INTRODUCTION

How to Use This Manual

The 92 CIVIC Shop Manual (Maintenance, Repair and Construction) is devided into two volumes (volume 1 and volume 2).
Make sure to refer both volumes when carrying out repair or maintenance of 92 CIVIC or when you want to know its construction.
This manual (volume 1) is divided into 8 sections. The first page of each section is marked with a black tab that lines up with its corresponding thumb index tab on this page. You can quickly find the first page of each section without looking through a full table of contents. The symbols printed at the top corner of each page can also be used as a quick reference system.

Each section includes:

1. A table of contents, or an exploded view index showing:
   - Parts disassembly sequence.
   - Bolt torques and thread sizes.
   - Page references to descriptions in text.
2. Disassembly/assembly procedures and tools.
3. Inspection.
4. Testing/troubleshooting.
5. Repair.
6. Adjustments.

Special Information

⚠WARNING Indicates a strong possibility of severe personal injury or loss of life if instructions are not followed.

CAUTION: Indicates a possibility of personal injury or equipment damage if instructions are not followed.

NOTE: Gives helpful information.

CAUTION: Detailed descriptions of *standard workshop* procedures, safety principles and service operations are not included. Please note that this manual contains warnings and cautions against some specific service methods which could cause PERSONAL INJURY, damage a vehicle or make it unsafe. Please understand that these warnings cannot cover all conceivable ways in which service, whether or not recommended by HONDA might be done, or of the possible hazardous consequences of every conceivable way, nor could HONDA investigate all such ways. Anyone using service procedures or tools, whether or not recommended by HONDA, *must satisfy himself thoroughly* that neither personal safety nor vehicle safety will be jeopardized.

First Edition 9/91 1514 pages

HONDA MOTOR CO., LTD.
Service Publication Office

▀ Sections below are in VOLUME 2.
As sections with * include SRS components, special precautions are required, when servicing.

General Information

Chassis and Engine Numbers
European Model (2-Door Hatchback)

Vehicle Identification Number

JHMEG33200S000001

Manufacturer, Code and Vehicle Type
- JHM: HONDA MOTOR CO., LTD., JAPAN
  HONDA Passenger car

Line/Engine and Body Type
- EG3: CIVIC 1300/2-Door Hatchback
- EG4: CIVIC 1500/2-Door Hatchback
- EG5: CIVIC 1600/2-Door Hatchback
- EG6: CIVIC 1600 VTi/2-Door Hatchback

Body and Transmission Type
- 3:2-Door Hatchback/5-speed Manual
- 4:2-Door Hatchback/4-speed Automatic

Vehicle Grade
- 2: DX (EG3: KG/KF/KS/KE)
- 4: DXi (EG4: KG)
- 5: LSi (EG4: KG/KF/KS/KE)
- 6: VEi (EG4: KG/KE)
- 8: ESi (EG5: KG/KF/KS/KE)
- 9: VTi (EG6: KG/KF/KE)

Fixed Code

Auxiliary Number

Factory Code
- S: Suzuka Factory in Japan

Model Year
- 0: 1992

Serial Number

Engine Number

B16A2-1000001

Engine Type
- B16A2: 1600 DOHC 16-valves Multi-point Fuel-injection VTEC Engine with CATA
- D13B2: 1300 SOHC 16-valves 1-carbureted Engine with CATA
- D15B2: 1500 SOHC 16-valves Dual-point Fuel-injection Engine with CATA
- D15Z1: 1500 SOHC 16-valves Multi-point Fuel-injection VTEC-E Engine with CATA
- D16Z6: 1600 SOHC 16-valves Multi-point Fuel-injection VTEC Engine with CATA
- D16Z7: 1600 SOHC 16-valves Multi-point Fuel-injection VTEC Engine with CATA for KG (Austria)

Serial Number
- B16A2: 1000001~
- D13B2: 2000001~
- D15B2: 5800001~
- D15Z1: 1700001~
- D16Z6: 1700001~
- D17Z7: 1000001~

Manual Transmission Number

S20-1000001

Transmission Type
- S20: For except B16A2
- Y21: For B16A2

Serial Number

Automatic Transmission Number

M24A-1000001

Transmission Type

Serial Number

European Model (4-Door Sedan)

Vehicle Identification Number (except KB)

JHMEG85400S000001

Manufacturer, Code and Vehicle Type
- JHM: HONDA MOTOR CO., LTD., JAPAN
  HONDA Passenger car

Line/Engine and Body Type
- EG8: CIVIC 1500/4-Door Sedan
- EH1: CIVIC 1600/4-Door Sedan 4WD
- EH9: CIVIC 1600/4-Door Sedan

Body and Transmission Type
- 5:4-Door Sedan/5-speed Manual
- 6:4-Door Sedan/4-speed Automatic

Vehicle Grade
- 4: DXi (EG8: KG/KS)
- 5: LSi (EG8: KG/KS/KE)
- 8: ESi (EH9: KG/KF/KS/KE)
- 8: RTSi (EH1: KG)
- 9: VTi (EH9: KG/KF/KE)

Fixed Code

Auxiliary Number

Factory Code
- S: Suzuka Factory in Japan

Model Year
- 0: 1992

Serial Number

Vehicle Identification Number (KB)

1HGEH554*NL700001

Manufacturer, Code and Vehicle Type
- 1HG: HONDA OF AMERICA MFG., INC. U.S.A.
  HONDA Passenger car

Line/Engine and Body Type
- EH5: CIVIC 1600/4-Door Sedan

Body and Transmission Type
- 5:4-Door Sedan/5-speed Manual
- 6:4-Door Sedan/4-speed Automatic

Vehicle Grade
- 4: DX (EH5: KB)
- 6: LX (EH5: KB)

Check Digit

Model Year
- **N: 1992**

Factory Code
- L: Ohio Factory in U.S.A. (East Liberty)

Serial Number

Engine Number (except KB)

B16A2-1000001

Engine Type
- B16A2: 1600 DOHC 16-valves Multi-point Fuel-injection VTEC Engine with CATA
- D15B2: 1500 SOHC 16-valves Dual-point Fuel-injection Engine with CATA
- D16Z6: 1600 SOHC 16-valves Multi-point Fuel-injection VTEC Engine with CATA
- D16Z7: 1600 SOHC 16-valves Multi-point Fuel-injection VTEC Engine with CATA for KG (Austria) and 4WD

Serial Number
- B16A2: 1000001~
- D15B2: 5800001~
- D16Z6: 1700001~
- D16Z7 for KG (Autria): 1000001~
- D16Z7 for 4WD: 1100001~

Engine Number (KB)

D16B7-5000001

Engine Type
- D16B7: 1600 SOHC 16-valves Multi-point Fuel-injection Engine without CATA

Serial Number

Manual Transmission Number

S20-1000001

Transmission Type
- S20: For except B16A2
- Y21: For B16A2
- S22: For 4WD

Serial Number

Automatic Transmission Number

M24A-1000001

Transmission Type
- M24A: For 2WD
- M25A: For 4WD

Serial Number

Chassis and Engine Numbers
Except European Model (2-Door Hatchback)

Vehicle Identification Number

JHMEG33100S000001

Manufacturer, Code and Vehicle Type
- JHM: HONDA MOTOR CO., LTD., JAPAN
  HONDA Passenger car

Line/Engine and Body Type
- EG3: CIVIC 1300/2-Door Hatchback
- EG4: CIVIC 1500/2-Door Hatchback
- EG5: CIVIC 1600/2-Door Hatchback

Body and Transmission Type
- 3:2-Door Hatchback/5-speed Manual
- 4:2-Door Hatchback/4-speed Automatic

Vehicle Grade
- 1: EL (EG3: KT), CX (EG3: KQ)
- 2: EX (EG4: KP/KT/KY)
- 3: GL (EG4: KQ)
- 7: Si (EG4: KQ/KP/KT)

Fixed Code

Auxiliary Number

Factory Code
- S: Suzuka Factory in Japan

Model Year
- 0: 1992

Serial Number

Engine Number

B13B2-2000001

Engine Type
- D13B2: 1300 SOHC 16-valves 1-carbureted Engine with CATA for KQ
- D13B3: 1300 SOHC 16-valves 1-carbureted Engine without CATA for KT
- D15B3: 1500 SOHC 16-valves 1-carbureted Engine without CATA for KP/KT/KY
- D15B4: 1500 SOHC 16-valves 2-carbureted Engine with CATA for KQ
- D16A8: 1600 SOHC 16-valves Multi-point Fuel-injection Engine with CATA for KQ
- D16A9: 1600 DOHC 16-valves Multi-point Fuel-injection Engine without CATA for KP/KT

Serial Number

Manual Transmission Number

S20-1000001

Transmission Type

Serial Number

Automatic Transmission Number

M24A-1000001

Transmission Type
- M24A: D16A8 (KQ)
- M48A: Except D16A8 (KQ)

Serial Number

Except European Model (4-Door Sedan)

Vehicle Identification Number

JHMEH85100S000001

Manufacturer, Code and Vehicle Type
- JHM: HONDA MOTOR CO., LTD., JAPAN
  HONDA Passenger car

Line/Engine and Body Type
- EH8: CIVIC 1200/4-Door Sedan
- EG7: CIVIC 1300/4-Door Sedan
- EG8: CIVIC 1500/4-Door Sedan
- EH9: CIVIC 1600/4-Door Sedan

Body and Transmission Type
- 5:4-Door Sedan/5-speed Manual
- 6:4-Door Sedan/4-speed Automatic

Vehicle Grade
- 1:1.2 EL (EH8: KT), EL (EG7: KP)
  1.5 EL (EG8: KP/KT/KU)
- 2:1.2 EX (EH8: KU), EX (EG8: KP/KT/KY)
- 3: GL (EG8: KQ)
- 7: Si (EH9: KQ/KP/KT/KY)

Fixed Code

Auxiliary Number

Factory Code
- S: Suzuka Factory in JAPAN

Model Year
- 0: 1992

Serial Number

Engine Number

B12B1-2000001

Engine Type
- D12B1: 1200 SOHC 16-valves 1-carbureted Engine without CATA
- D13B3: 1300 SOHC 16-valves 1-carbureted Engine without CATA
- D15B4: 1500 SOHC 16-valves 2-carbureted Engine without CATA
- D16A8: 1600 DOHC 16-valves Multi-point Fuel-injection Engine with CATA for KQ
- D16A9: 1600 DOHC 16-valves Multi-point Fuel-injection Engine without CATA for KP/KT

Serial Number

Manual Transmission Number

S20-1000001

Transmission Type

Serial Number

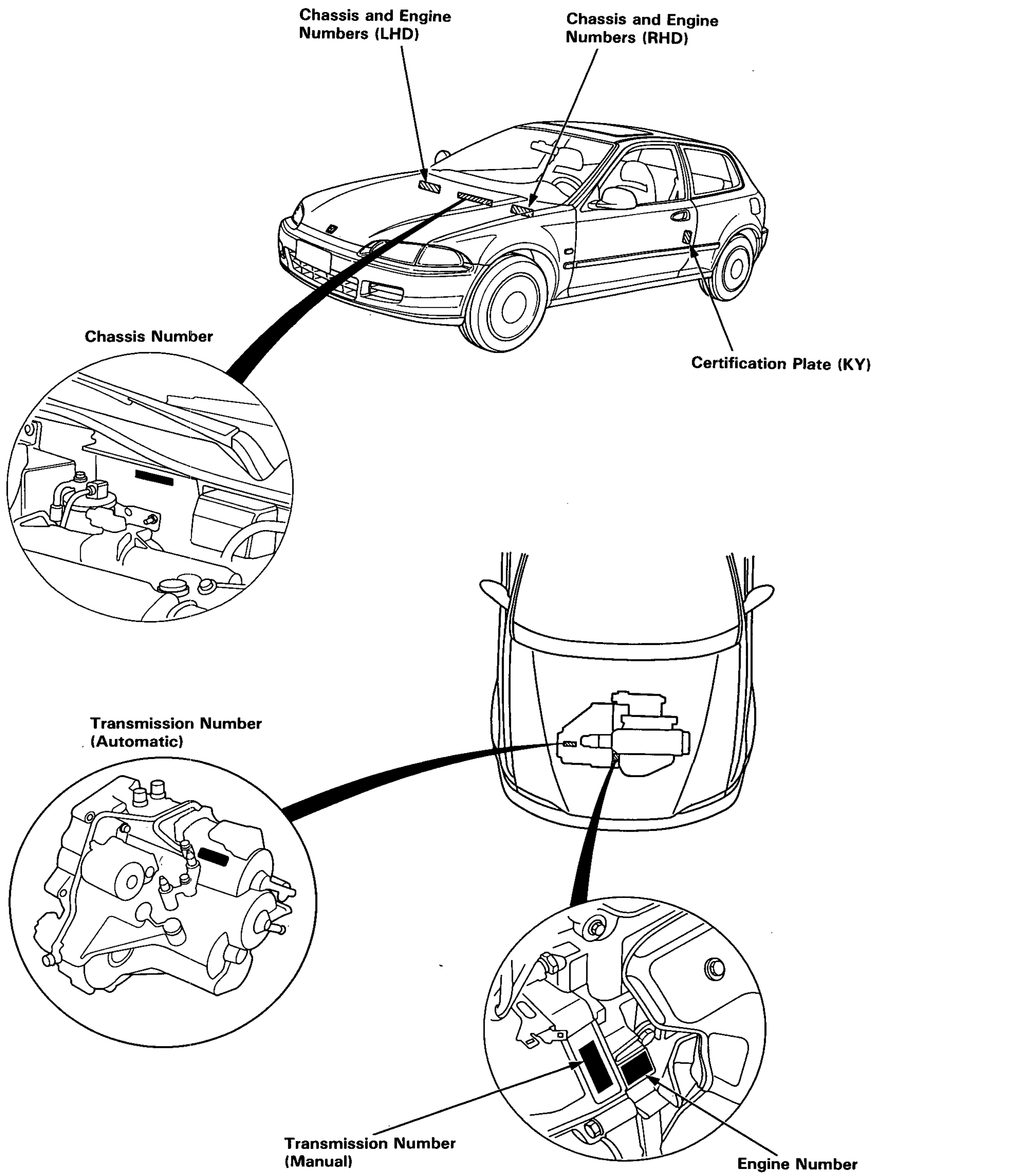
Automatic Transmission Number

M24A-1000001

Transmission Type
- M24A: D16A8 (KQ)
- M48A: Except D16A8 (KQ)

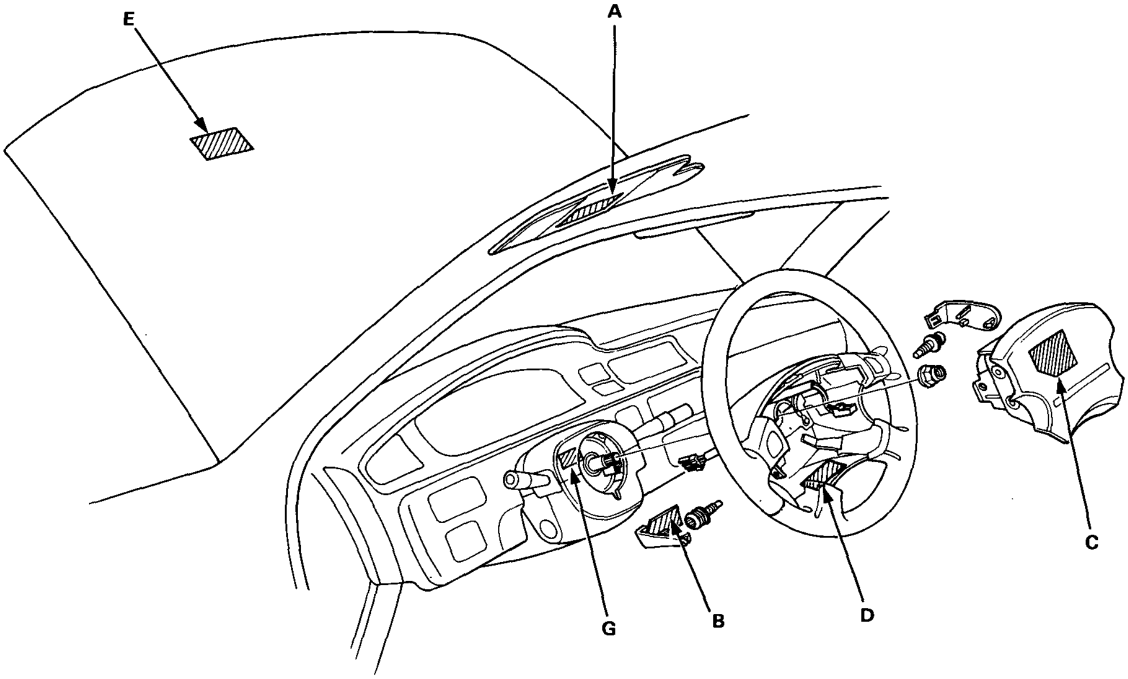
Serial Number

Identification Number Locations



Label Locations

Warning/Caution Labels



A: DRIVER INFORMATION

ALWAYS WEAR YOUR SEAT BELT SRS
- THIS CAR IS EQUIPPED WITH A DRIVER AIRBAG AS A SUPPLEMENTAL RESTRAINT SYSTEM (S.R.S.).
- IT IS DESIGNED TO SUPPLEMENT THE SEAT BELT.
- IF YOUR SRS INDICATOR LIGHTS WHILE DRIVING, SEE YOUR AUTHORIZED HONDA DEALER.

ATTACHEZ TOUJOURS VOTRE CEINTURE SRS
- CE VEHICULE EST EQUIPE D'UN COUSSIN D'AIR POUR LE CONDUCTEUR QUI CONSTITUE UN SYSTEME DE RETENUE COMPLEMENTAIRE (S.R.S.).
- CE COUSSIN D'AIR COMPLETE LA FONCTION DE LA CEINTURE DE SECURITE.
- SI LE TEMOIN SRS S'ALLUME PENDANT LA CONDUITE, ADRESSEZ-VOUS A VOTRE CONCESSIONNAIRE HONDA OFFICIEL.

SICHERHEITSGURTE
BEI JEDER FAHRT ANLEGEN SRS
- DIESES FAHRZEUG BESITZT EINEN FAHRER-AIRBAG ALS ZUSÄTZLICHES RÜCKHALTESYSTEM (S.R.S.).
- ES IST EINE ERGÄNZUNG ZUM SICHERHEITGURT.
- WENN DUE SRS-KONTROLLEUCHTE WAHREND DER FAHRT AUFLEUCHTET, UMGEHEND FINEN HONDA HÄNDLER AUFSUCHEN.

DRAAG ALTIJD UW VEILIGHEIDSGORDEL SRS
- DIT VOERTUIG IS UITGERUST MET EEN LUCHTKUSSEN AAN DE BESTUURDERSKANT ALTS EXTRA BESCHERMING (S.R.S.).
- DIT IS ONTWORPEN ALS EXTRA BESCHERMING BIJ DE VEILIGHEIDSGORDEL.
- ALS HEL SRS-WAARSCHUWINGSLAMPJE GAAT BRANDEN ONDER HET RIJDEN. NEEM DAN KONTAKT OP MET EEN HONDA DEALER.

B: MAINTENANCE LID CAUTION

CAUTION SRS
BEFORE MAINTENANCE, SWITCH OFF THE IGNITION.
ATTENTION
AVANT TOUT ENTRETIEN, COUPER LE CONTACT.
ACHTUNG
VOR WARTUNG ZÜNDUNG AUSSCHALTEN.
LET OP
ZET HET KONTAKTSLOT AF ALVORENS MET HET ONDERHOUD TE BEGINNEN.

(cont'd)

Label Locations

Warning/Caution Labels (cont'd)

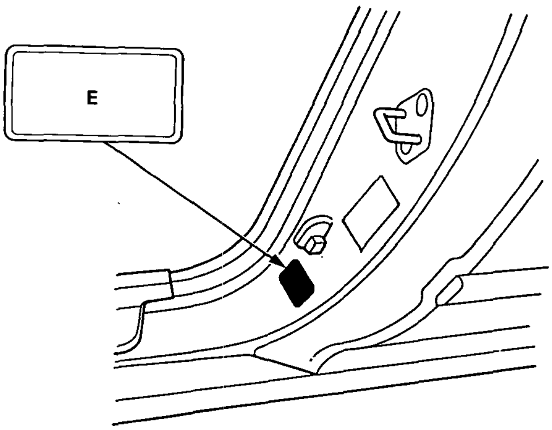
C: MONITOR CAUTION

CAUTION SRS
REFER TO THE SHOP MANUAL
ATTENTION
SE REPORTER AU MANUEL D'ATELIER
WAARSCHUWING
LEES HET WERKPLAATS HANDBOEK
ACHTUNG
- WERKSTATT HANDBUCH LESEN
- DER GASGENERATOR IN DIESEM GEHÄUSE DARF NUR FUR INSASSEN-RÜCKHALTESYSTEME MIT LUFTSACK IN KRAFTFAHRZEUGE MONTIERT WERDEN. DIE MONTAGE UND DEMONTAGE DES GASGENERATORS DARF NUR VON DAFÜR GESCHULTEM PERRSONAL VORGENCHMEN VERDEN.

D: COVER CAUTION

CAUTION SRS
ACHTUNG
- REFER TO THE SHOP MANUAL
- SE REPORTER AU MANUEL D'ATELIER.
- WERKSTATT HANDBUCH LESEN.
- LEES HET WERKPLAATSHANDBOEK.

E: LABEL AIRBAG

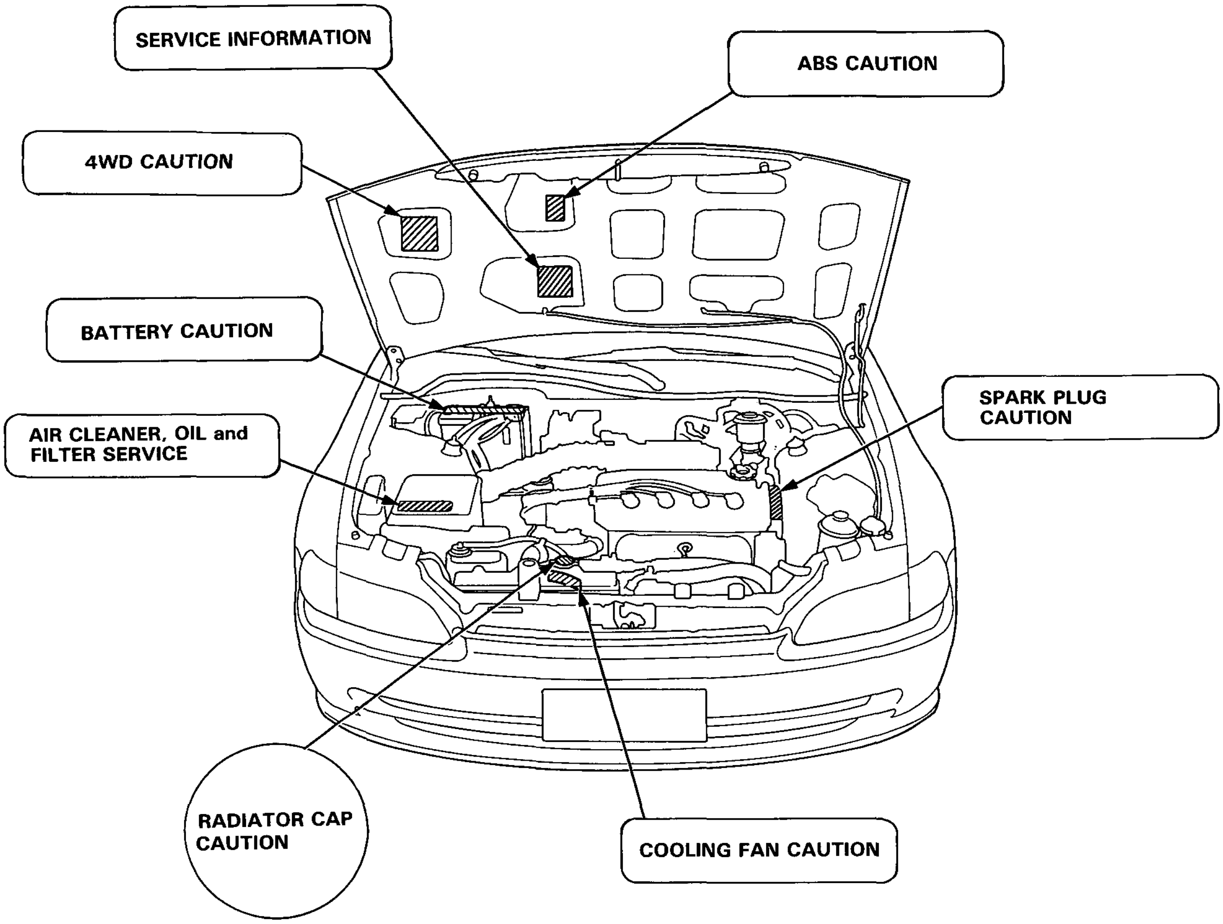


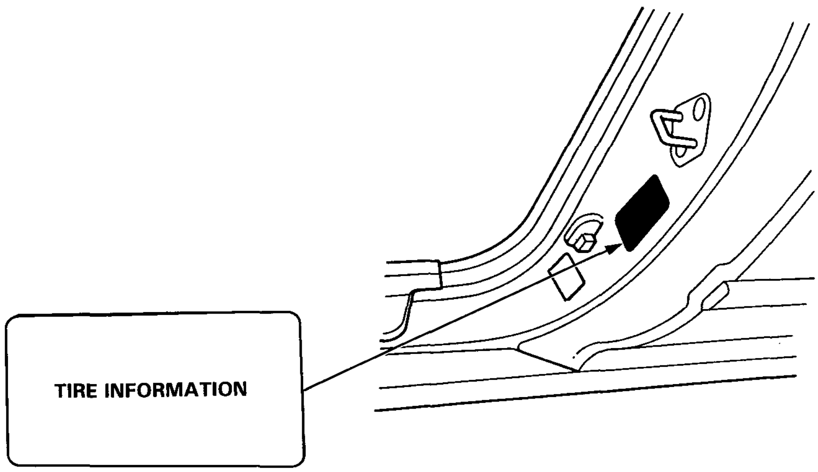
F: UNDER-HOOD WARNING

WARNING SRS
THIS VEHICLE IS EQUIPPED WITH A DRIVER AIRBAG AS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS).
ALL S.R.S. ELECTRICAL WIRING AND CONNECTORS ARE COLORED YELLOW. DO NOT USE ELECTRICAL TEST EQUIPMENT ON THESE CIRCUITS. TAMPERING WITH OR DISCONNECTING THE S.R.S. WIRING COULD RESULT IN ACCIDENTAL FIRING OF THE INFLATOR OR MAKE THE SYSTEM INOPERATIVE, WHICH MAY RESULT IN SERIOUS INJURY.
ATTENTION SRS
CE VEHICULE EST EQUIPE D'UN COUSSIN D'AIR DU COTE CONDUCTEUR QUI CONSTITUE UN SYSTEME DE RETENUE COMPLEMENTAIRE (S.R.S)
TOUS LES FILS ET CONNECTEURS ELECTRIQUES DU SYSTEME DE RETENUE COMPLEMENTAIRE (S.R.S.) SONT DE COULEUR JAUNE. N'UTILISEZ PAS UN EQUIPEMENT D'ESSAIS ELECTRIQUES SUR CES CIRCUITS. NE TOUCHEZ PAS ET NE DEBRANCHEZ PAS LES FILS DU SYSTEME S.R.S. CAR CECI POURRAIT DE TRADUIRE PAR LE DECLENCHEMENT ACCIDENTEL DU GONFLEUR OU RENDRE LE SYSTEME INOPERANT ET VOUS EXPOSER AINSI A DE GRAVES BLESSURES.
WARNUNG SRS
DIESES FAHRZEUG IST MIT EINEM FAHRER-AIRBAG (SRS) ALS ZUSÄTZLICHEM RÜCKHALTESYSTEM AUSGERÜSTET.
ALLE ELEKTRISCHEN KABEL, SOWIE DIE ZUGEHÖRIGEN STECKVERBINDER DES S.R.S. -SYSTEMS SIND IN GELBER FARBE AUSGEFÜHRT.
KEINE ELEKTRISCHEN PRÜGERÄTE AN DIE S.R.S. -VERKABELUNG ANSCHLIEBEN. VERÄNDERN ODER UNTERBRECHEN DER S.R.S -VERKABELUNG KANN UNKONTROLLIERTES ZÜNDEN DES GASGENERATORS AUSLÖSEN. ODER DAS SYSTEM AUBER FUNKTION SETZEN. WAS ZU ERNSTHAFTEN VERLETZUNGEN FÜHREN KANN.
WAARSCHUWING SRS
DIT VOERTUIG IS UITGERUST MET EEN LUCHTKUSSEN AAN DE BESTUURDERSKANT ALS EXTRA BESCHERMING (S.R.S.).
ALLE ELEKTRISCHE LEIDINGEN EN AANSLUITIGEN VAN DE S.R.S. ZIJN GEEL GEKLEURD. GEBRUIK GEEN ELEKTRISCHE TESTAPPARATUUR VOOR DEZE CIRCUITS. KNOEIEN MET OF LOSKOPPELEN VAN DE S.R.S. LEIDINGEN KAN LEIDEN TOT BRAND IN DE VULINRICHTING OF TOT UITSCHAKELEN VAN HET SYSTEEM DIT KAN TOT ERNSTIGE ONGELUKKEN LEIDEN.

G: SLIP RING CAUTION

CAUTION SRS
- NO SERVICEABLE PARTS INSIDE.
- DO NOT DISASSEMBLE OR TAMPER.
- DO NOT DROP.
- STORE IN A CLEAN, DRY AREA.


SERVICE INFORMATION
ABS CAUTION
4WD CAUTION
BATTERY CAUTION
SPARK PLUG CAUTION
AIR CLEANER, OIL and FILTER SERVICE
RADIATOR CAP CAUTION
COOLING FAN CAUTION


TIRE INFORMATION

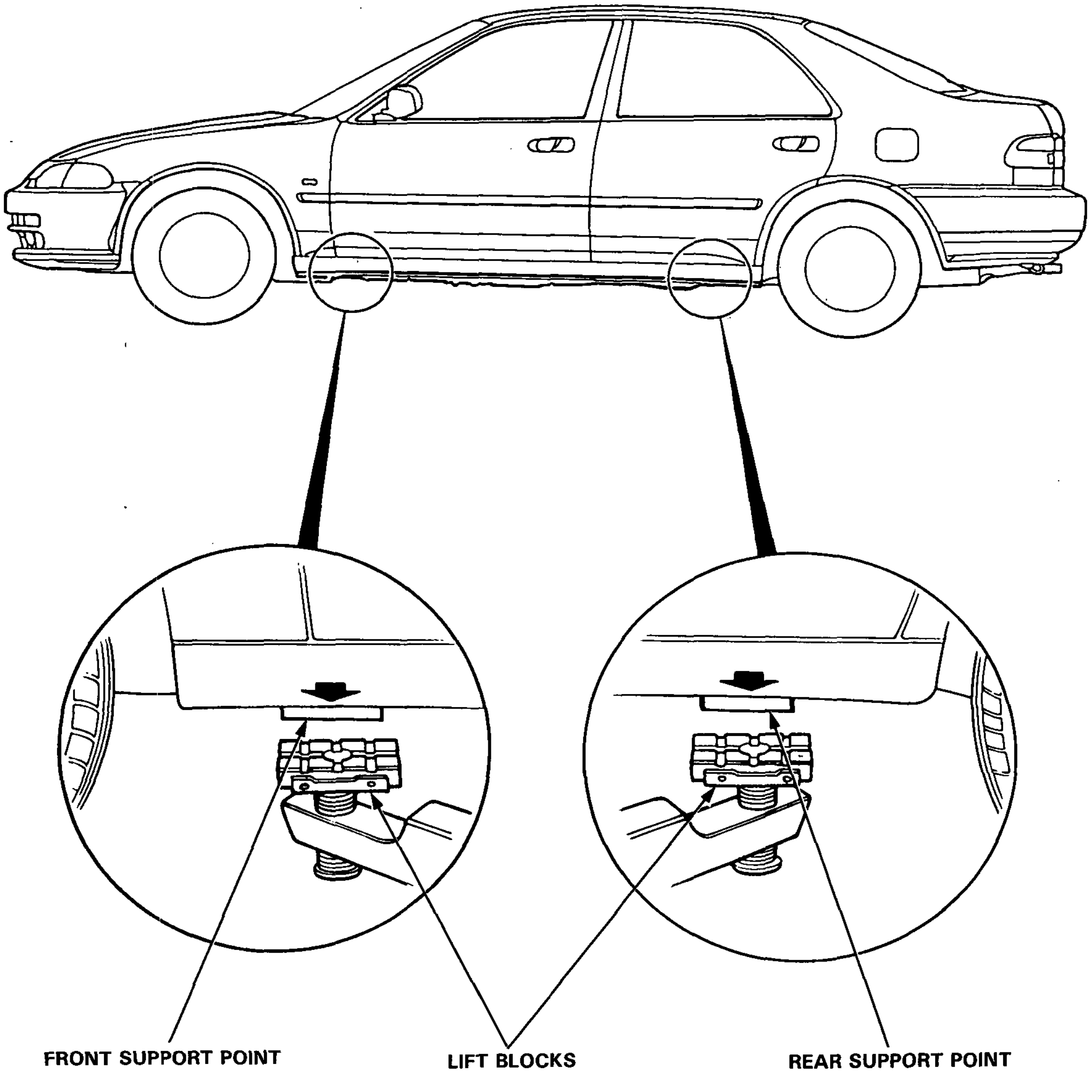
Lift and Support Points

Hoist

⚠WARNING When heavy rear components such as suspension, fuel tank, spare tire and hatch are to be removed, place additional weight in the luggage area before hoisting. When substantial weight is removed from the rear of the car, the canter of gravity may change and can cause the car to tip forward on the hoist.

NOTE: Since each tire/wheel assembly weighs approximately 14 kg (30 lbs), placing the front wheels in the trunk will assist with the weight transfer.

1. Place the lift blocks as shown.
2. Raise the hoist a few inches and rock the car to be sure it is firmly supported.
3. Raise the hoist to full height and inspect lift points for solid support.



Floor Jack

1. Set the parking brake and block the wheels that are not being lifted.

2. When lifting the rear of the car, put the gearshift lever in reverse (Automatic in PARK).

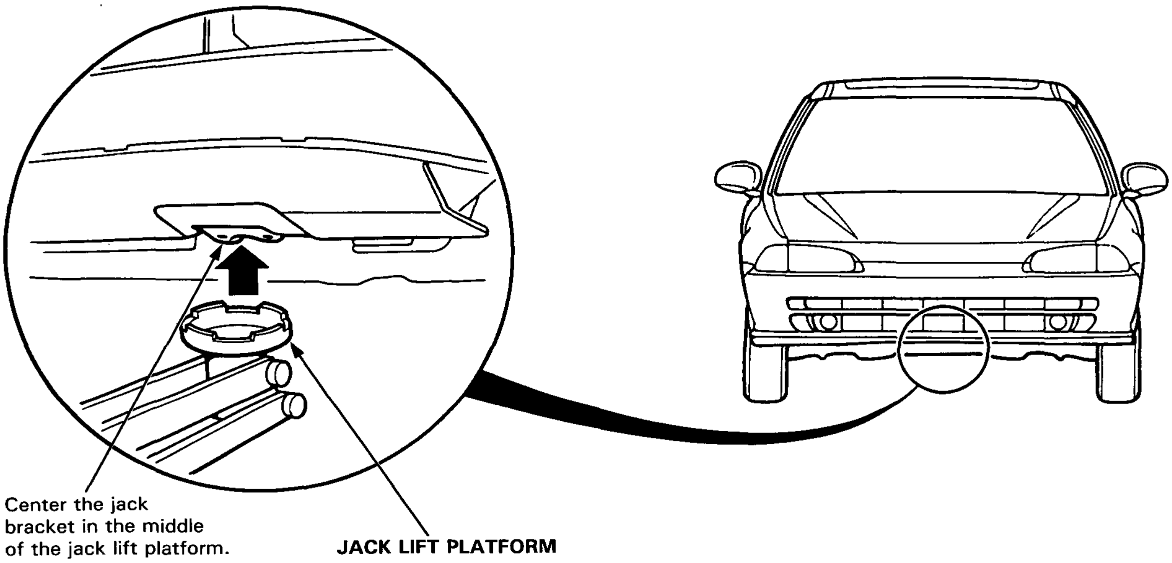
3. Raise the car high enough to insert the safety stands.

4. Adjust and place the safety stands as shown on page 1-10 so the car will be approximately level, then lower the car onto them.

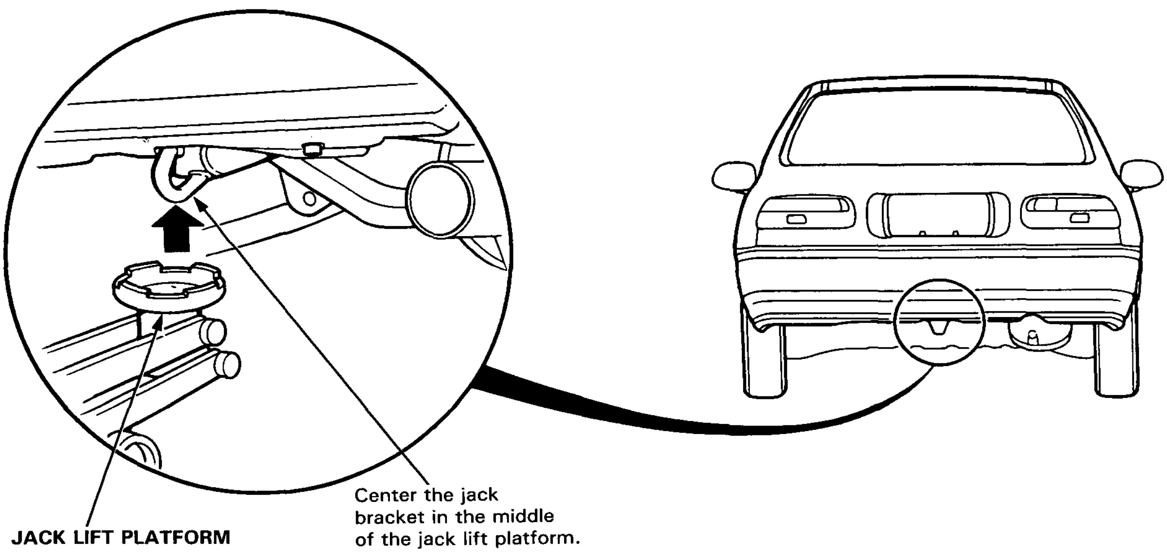
⚠WARNING

- **Always use safety stands when working on or under any vehicle that is supported by only a jack.**
- **Never attempt to use a bumper jack for lifting or *supporting the car.***

Front

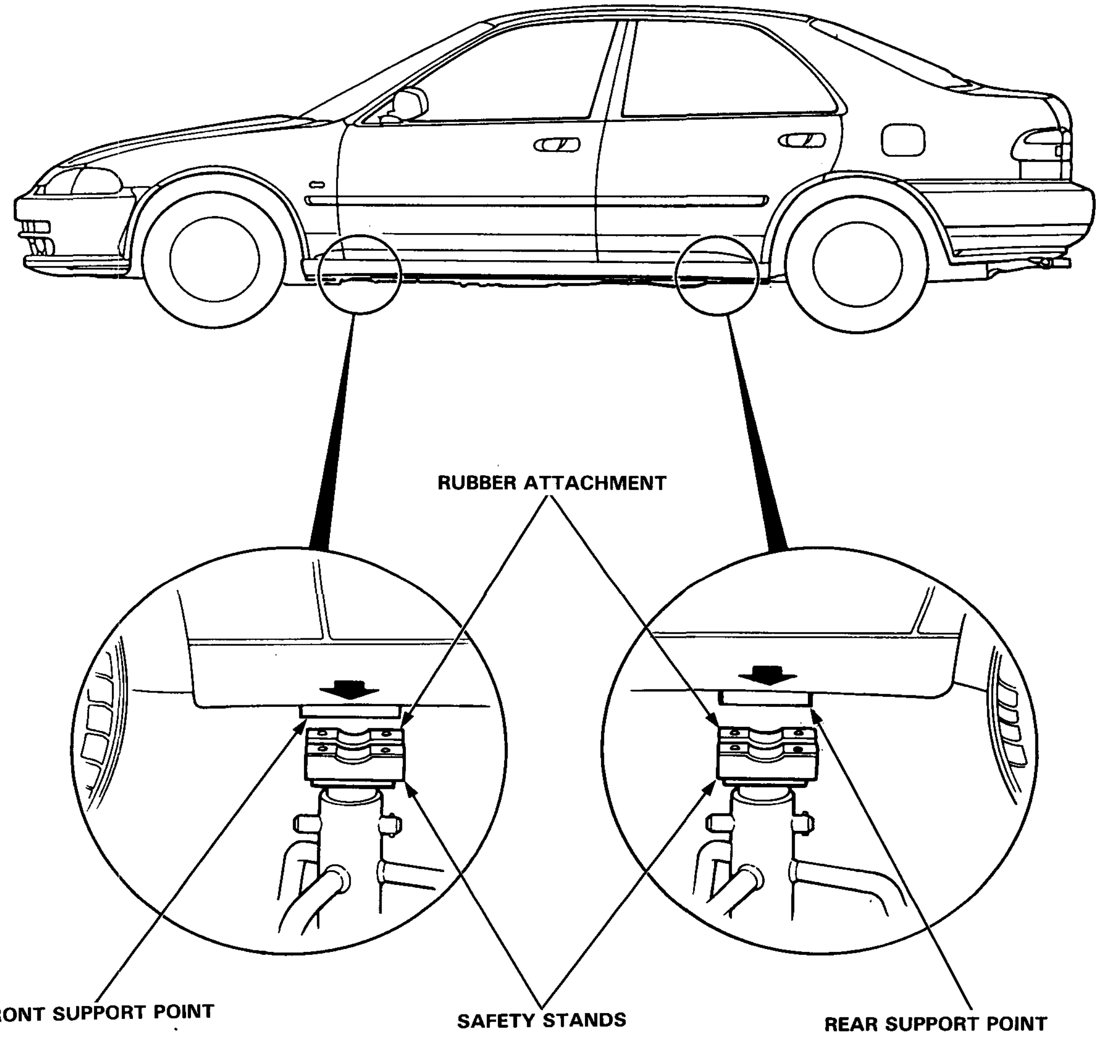


Rear



Lift and Support Points

Safety Stands



Service Precautions

Towing

For 4WD see also "4WD Disengagement".

If the car needs to be towed, call a professional towing service. Never tow the car behind another car with just a rope or chain. It is very dangerous.

Emergency Towing
There are three popular methods of towing a car:

Flat-bed Equipment—The operator loads the car on the back of a truck. This is the best way of towing the car.

Wheel Lift Equipment—The tow truck uses two pivoting arms which go under the tires (front or rear) and lifts them off the ground. The other two wheels remain on the ground.

Sling-type Equipment—The tow truck uses metal cables with hooks on the ends. These hooks go around parts of the frame or suspension and the cables lift that end of the car off the ground. The car's suspension and body can be seriously damaged if this method of towing is attempted.

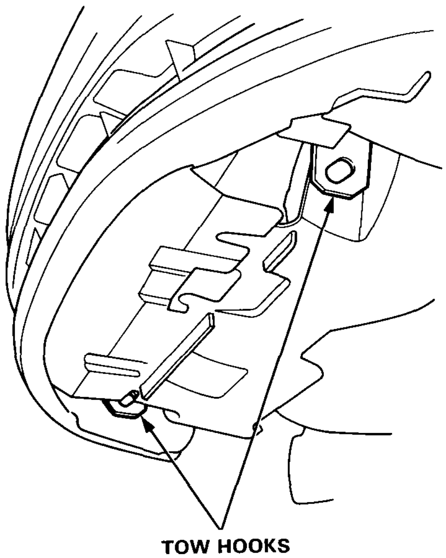
If the car cannot be transported by flat-bed, it should be towed with the front wheels off the ground. If due to damage, the car must be towed with the front wheels on the ground, do the following:

- Release the parking brake.
- Shift the transmission to Neutral (5-speed). If the car has an automatic transmission: Start the engine. Shift to D_4, then to Neutral. Shut the engine off.
  NOTICE: Improper towing preparation will damage the transmission. Follow the above procedure exactly. If you can not shift the transmission or start the engine (automatic transmission), the car must be transported on a flat-bed.
- It is best to tow the car no farther than 80 km (50 miles), and keep the speed below 55 km/h (35 mph).

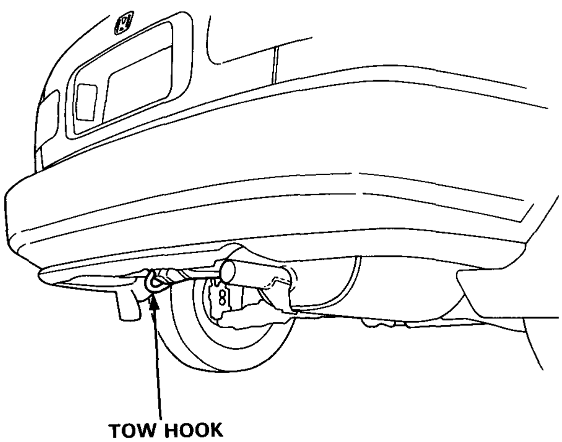
NOTICE: Trying to lift or tow the car by the bumpers will cause serious damge. The bumpers are not designed to support the car's weight.

Front:

CAUTION: On the car equipped with the front spoiler, remove the spoiler when towing.



Rear:



Service Precautions

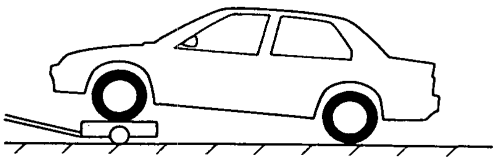
4WD Disengagement

The 4WD System shifts instantaneously and automatically from front wheel drive to four wheel drive when greater traction is needed.

⚠WARNING The 4WD system must be manually disengaged before performing service that requires only the front wheels or only the rear wheels to be turning. Disengaging the system will prevent sudden movement of the car, which may result in personal injury.

TOWING:

CAUTION: Before towing the car with either the front or rear wheels raised off the ground, place the transmission in neutral and manually disengage the 4WD system to prevent the raised wheels from turning.



If possible, always tow the car with the front wheels off the ground, and 4WD disengaged. Do not use the bumpers to lift the car or to support the car's weight while towing. Check local regulations for towing with a chain or frame-mounted tow bar. A chain may be attached to the hooks shown in the illustration. Do not attach a tow bar to either bumper.

If the car is to be towed with front wheels on the ground, observe the following precautions;

Manual Transmission

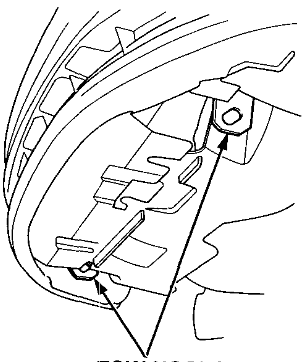
Shift the transmission to Neutral and turn the ignition key to the "I" position.

Automatic Transmission

First, check the automatic transmission fluid level (see Section 14). Start the engine and shift to D_4, then to N. Return the ignition key to the "I" position.

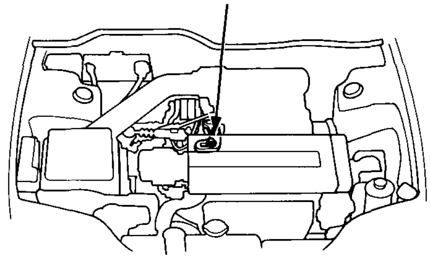
CAUTION:

- **Do not tow with front wheels on the grond when the automatic transmission fluid level is low or the transmission cannot be shifted with the engine running.**
- **Do not exceed 55 km/h (35 mph) or tow for distances of more than 80 km (50 miles.)**



4WD Disengagement
(For cars not equipped ABS)
Manual Transmission:

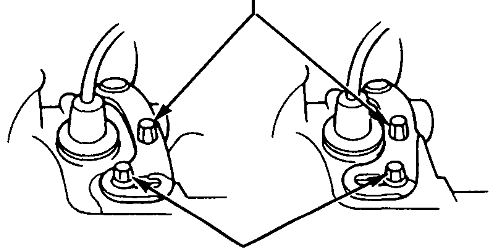
1. Located the orange disengagement lever at the rear of the engine compartment.



2. Loosen the lock at the slotted end of the lever.

   NOTE: For better accessibility, use a socket and a long extension bar.

   CAUTION: Do not loosen the lock bolt more than 5—7 turns.
   Replacement is extremely difficult.

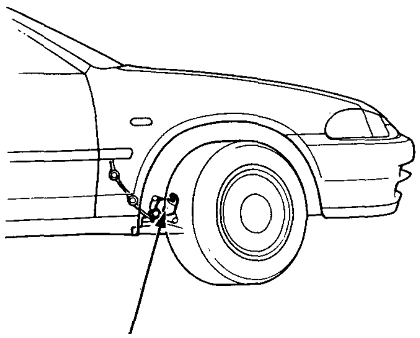


3. Move the lever by turning the middle bolt counterclockwise.
4. Tighten the lock bolt.

   NOTE: After service or towing is completed return the lever to the normal (4WD on) position and tighten the lock bolt.

Automatic transmission:

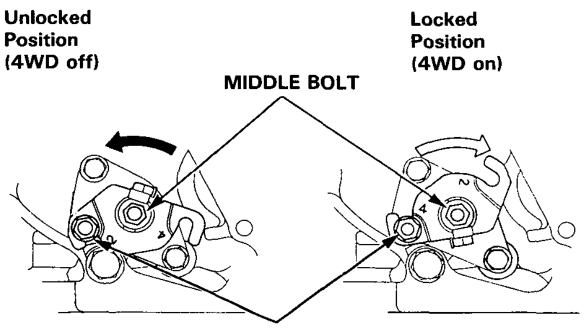
1. Locate the disengagement plate at the rear of the transmission case behind the right front wheel.



2. Loosen the lock bolt in the notch on the plate.

   NOTE: For better accessibility, use a socket and a long extension bar.

   CAUTION: Do not loosen the middle bolt more than 5—7 turns. Replacement is extremely difficult.

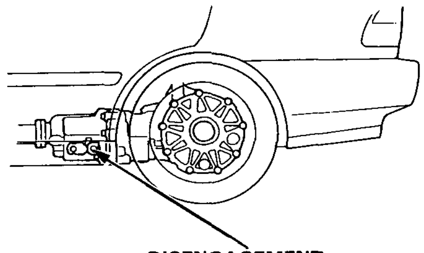


3. Turn the middle bolt counterclockwise until the plate rotates about 150° and is stopped by the lock bolt.
4. Tighten the lock bolt.

   NOTE: After service or towing is completed, return the plate to the normal (4WD on) position and tighten the lock bolt.

4WD Disengagement (For cars equipped with ABS)

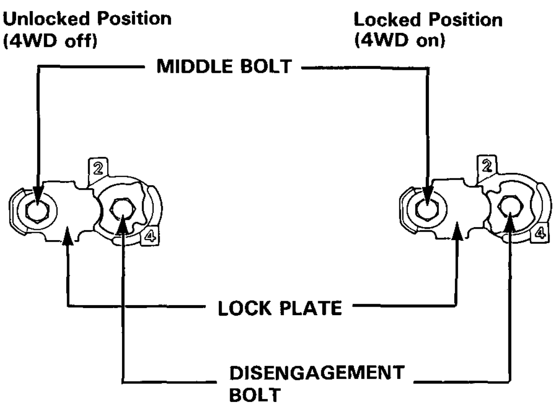
1. Locate the orange disengagement bolt at the front of the rear differential behind the left rear wheel.



2. Loosen the middle bolt fixing the lock plate.

   NOTE: For better accessibility, use a socket and a long extension bar.

   CAUTION: Do not loosen the iddle bolt more than 5—7 turns. Replacement is extremely difficult.



3. Turn the disengagement bolt counterclockwise until the disengagement bolt rotates about 180° and is stopped by the lock plate.
4. Tighten the middle bolt.

   NOTE: After service or towing is completed, return the plate to the normal (4WD on) position and tighten the middle bolt.

Special Tools

Individual tool lists are located at the front of each section.

Specifications

Standards and Service Limits

Cylinder Head/Valve Train — Section 6
D12B, D13B, D15B, D16A7 Engine

	MEASUREMENT			STANDARD (NEW)	SERVICE LIMIT
Com-pression	250 min^{-1} (rpm) and wide open throttle kPa (kg/cm^2, psi)	Nominal		1,300 (13.0,184)	
		Minimum		950 (9.5,135)	
		Maximum variation		200 (2,28)	
Cylinder head	Warpage			—	0.05 (0.002)
	Height			94.95–95.05 (3.738–3.742)	—
Camshaft	End play			0.05–0.15 (0.002–0.006)	0.5 (0.02)
	Oil clearance			0.050–0.089 (0.002–0.004)	0.15 (0.006)
	Runout			0.015 (0.0006) max.	0.03 (0.001)
	Cam lobe Height	D12B1, D13B2, D13B3	IN	35.472 (1.3965)	—
			EX	35.693 (1.4052)	—
		D15B3, D15B4	IN	36.603 (1.4411)	—
			EX	36.747 (1.4467)	—
		D15B2	IN	36.603 (1.4411)	—
			EX	36.750 (1.4468)	—
		D16A7	IN	36.782 (1.4481)	
			EX	36.947 (1.4546)	
Valve	Valve clearance		IN	0.18–0.22 (0.007–0.009)	—
			EX	0.23–0.27 (0.009–0.011)	—
	Valve stem O.D.		IN	5.48–5.49 (0.2157–0.2161)	5.45 (0.2183)
			EX	5.45–5.46 (0.2146–0.2150)	5.42 (0.2134)
	Stem-to-guide clearance		IN	0.02–0.05 (0.0008–0.0020)	0.08 (0.003)
			EX	0.05–0.08 (0.002–0.003)	0.11 (0.004)
Valve seat	Width		IN	0.85–1.15 (0.033–0.045)	1.6 (0.063)
			EX	1.25–1.55 (0.049–0.061)	2.0 (0.079)
	Stem installed height		IN	46.985–47.455 (1.8498–1.8683)	47.705 (1.8781)
			EX	48.965–49.435 (1.9278–1.9463)	49.685 (1.9561)
Valve spring	Free length	D12B1, D13B2, D13B3	IN	47.97 (1.889)	—
			EX	49.19 (1.937)	—
		D15B2, D15B3, D16A7	IN	48.58 (1.913)	—
			EX	49.19 (1.937)	—
		D15B4	IN	48.58 (1.913)	—
			EX	48.49 (1.909)	—
Valve guide	I.D.		IN	5.51–5.53 (0.217–0.218)	5.60 (0.220)
			EX	5.51–5.53 (0.217–0.218)	5.60 (0.220)
	Installed height		IN	15.95–16.45 (0.628–0.648)	—
			EX	15.95–16.45 (0.628–0.648)	—
Rocker arm	Arm-to-shaft clearance		IN	0.017–0.050 (0.0007–0.0020)	0.08 (0.003)
			EX	0.018–0.054 (0.0007–0.0021)	0.08 (0.003)

Unit of length: mm (in)

Cylinder Head/Valve Train — Section 6
D15Z, D16Z Engine

	MEASUREMENT				STANDARD (NEW)	SERVICE LIMIT
Com-pression	250 min⁻¹ (rpm) and wide open throttle kPa (kg/cm², psi)			Nominal	1,300 (13.0,184)	
				Minimum	1,150 (11.5,166)	
				Maximum variation	200 (2,28)	
Cylinder head	Warpage				——	0.05 (0.002)
	Height				92.95—93.05 (3.659—3.663)	——
Camshaft	End play				0.05—0.15 (0.002—0.006)	0.5 (0.02)
	Oil clearance				0.050—0.089 (0.002—0.004)	0.15 (0.006)
	Runout				0.015 (0.0006) max.	0.03 (0.001)
	Cam lobe Height	D15Z1	IN	Primary	38.427 (1.5129)	——
				Secondary	32.292 (1.2713)	——
			EX		37.997 (1.4959)	——
		D16Z6, D16Z7	IN	Primary	35.900 (1.4134)	——
				Mid	38.107 (1.5003)	——
				Secondary	36.195 (1.4250)	——
			EX		38.008 (1.4964)	——
Valve	Valve clearance		IN		0.18—0.22 (0.007—0.009)	——
			EX		0.23—0.27 (0.009—0.011)	——
	Valve stem O.D.		IN		5.48—5.49 (0.2157—0.2161)	5.45 (0.2183)
			EX		5.45—5.46 (0.2146—0.2150)	5.42 (0.2134)
	Stem-to-guide clearance		IN		0.02—0.05 (0.0008—0.0020)	0.08 (0.003)
			EX		0.05—0.08 (0.002—0.003)	0.12 (0.005)
Valve seat	Width		IN		0.85—1.15 (0.033—0.045)	1.6 (0.063)
			EX		1.25—1.55 (0.049—0.061)	2.0 (0.079)
	Stem installed height		IN		53.165—53.635 (2.0931—2.1116)	53.885 (2.1215)
			EX		53.165—53.635 (2.0931—2.1116)	53.885 (2.1215)
Valve spring	Free length	D15Z1	IN		54.78 (2.157)	——
			EX		58.23 (2.293) *1	——
					58.26 (2.294) *2	——
		D16Z6, D16Z7	IN		57.97 (2.282)	——
			EX		58.41 (2.300)	——
Valve guide	I.D.		IN		5.51—5.53 (0.217—0.218)	5.60 (0.220)
			EX		5.51—5.53 (0.217—0.218)	5.60 (0.220)
	Installed height		IN		17.85—18.35 (0.703—0.722)	——
			EX		18.65—19.15 (0.734—0.754)	——
Rocker arm	Arm-to-shaft clearance		IN		0.017—0.050 (0.0007—0.0020)	0.08 (0.003)
			EX		0.018—0.054 (0.0007—0.0021)	0.08 (0.003)

*1: NIPPON HATSUJO made, *2: CHUO HATSUJO made.

Standards and Service Limits

Cylinder Head/Valve Train — Section 6
D16A8, D16A9, Engine

	MEASUREMENT		STANDARD (NEW)	SERVICE LIMIT
Com-pression	250 min^{-1} (rpm) and wide open throttle kPa (kg/cm^2, psi)	Nominal	1,350 (13.5,192)	
		Minimum	950 (9.5,135)	
		Maximum variation	200 (2,28)	
Cylinder head	Warpage		——	0.05 (0.002)
	Height		131.95—132.05 (5.195—5.199)	——
Camshaft	End play		0.05—0.15 (0.002—0.006)	0.5 (0.02)
	Oil clearance		0.050—0.089 (0.002—0.004)	0.15 (0.006)
	Runout		0.015 (0.0006) max.	0.03 (0.001)
	Cam lobe Height	IN	32.983 (1.299)	——
		EX	32.382 (1.275)	——
Valve	Valve clearance	IN	0.21—0.25 (0.008—0.010)	——
		EX	0.24—0.28 (0.009—0.011)	——
	Valve stem O.D.	IN	6.58—6.59 (0.2591—0.2594)	6.55 (0.2579)
		EX	6.55—6.56 (0.2579—0.2583)	6.52 (0.2567)
	Stem-to-guide clearance	IN	0.02—0.05 (0.0008—0.0020)	0.08 (0.003)
		EX	0.05—0.08 (0.002—0.003)	0.12 (0.005)
Valve seat	Width	IN	1.25—1.55 (0.049—0.061)	2.0 (0.079)
		EX	1.25—1.55 (0.049—0.061)	2.0 (0.079)
	Stem installed height	IN	45.545—46.015 (1.793—1.812)	46.265 (1.821)
		EX	44.735—45.205 (1.761—1.780)	45.455 (1.790)
Valve spring	Free length	IN	47.49 (1.870)	——
		EX	46.89 (1.846)	——
	Squareness		——	1.6 (0.063)
Valve guide	I.D.	IN and EX	6.61—6.63 (0.260—0.261)	6.65 (0.262)

Unit of length: mm (in)

Cylinder Head/Valve Train — Section 6
B16A Engine

	MEASUREMENT			STANDARD (NEW)	SERVICE LIMIT
Compression	250 min^{-1} (rpm) and wide open throttle kPa (kg/cm^2, psi)		Nominal	1,300 (13.0,184)	
			Minimum	950 (9.5,135)	
			Maximum variation	200 (2,28)	
Cylinder head	Warpage			——	0.05 (0.002)
	Height			141.95–142.05 (5.589–5.593)	——
Camshaft	End play			0.05–0.15 (0.002–0.006)	0.5 (0.02)
	Oil clearance			0.050–0.089 (0.002–0.004)	0.15 (0.006)
	Runout			0.015 (0.0006) max.	0.03 (0.001)
	Cam lobe Height	IN	Primary	33.088 (1.303)	——
			Mid	36.267 (1.428)	——
			Secondary	34.978 (1.377)	——
		EX	Primary	32.785 (1.291)	——
			Mid	35.720 (1.406)	——
			Secondary	34.691 (1.366)	——
Valve	Valve clearance		IN	0.21–0.25 (0.008–0.009)	——
			EX	0.24–0.28 (0.009–0.011)	——
	Valve stem O.D.		IN	5.475–5.485 (0.2156–0.2159)	5.445 (0.2144)
			EX	5.45–5.46 (0.2146–0.2150)	5.42 (0.2134)
	Stem-to-guide clearance		IN	0.025–0.055 (0.0009–0.0022)	0.08 (0.003)
			EX	0.05–0.08 (0.002–0.003)	0.11 (0.004)
Valve seat	Width		IN	1.25–1.55 (0.049–0.061)	2.0 (0.079)
			EX	1.25–1.55 (0.049–0.061)	2.0 (0.079)
	Stem installed height		IN	37.465–37.935 (1.475–1.494)	38.185 (1.503)
			EX	37.165–37.635 (1.463–1.482)	37.885 (1.492)
Valve spring	Free length	IN	OUTER	40.92 (1.611) *1	——
				40.91 (1.610) *2	——
			INNER	36.71 (1.443)	——
		EX		41.96 (1.652)*1	——
				41.94 (1.651)*2	——
Valve guide	I.D.		IN	5.51–5.53 (0.217–0.218)	5.55 (0.219)
			EX	5.51–5.53 (0.217–0.218)	5.55 (0.219)
	Installed height		IN	12.55–13.05 (0.494–0.514)	——
			EX	12.55–13.05 (0.494–0.514)	——
Rocker arm	Arm-to-shaft clearance		IN	0.025–0.052 (0.0009–0.0020)	0.08 (0.003)
			EX	0.025–0.052 (0.0009–0.0020)	0.08 (0.003)

*1: NIPPON HATSUJO made, *2: CHUO HATSUJO made.

Standard and Service Limits

Engine Block — Section 7
D12B, D13B, D15B, D15Z, D16A, D16Z Engine

	MEASUREMENT			STANDARD (NEW)	SERVICE LIMIT
Cylinder block	Wapage of deck surface			0.07 (0.003) max.	0.10 (0.004)
	Bore diameter			75.00—75.02 (2.953—2.954)	75.07 (2.956)
	Bore taper			——	0.05 (0.002)
	Reboring limit			——	0.5 (0.02)
Piston	Skirt O.D.	At 15 mm (0.59 in) from bottom of shirt		74.98—74.99 (2.9520—2.9524)	74.97 (2.9516)
	Clearance in cylinder			0.01—0.04 (0.0004—0.0016)	0.05 (0.002)
	Groove width (for ring)	Top	D15Z1	1.02—1.03 (0.0402—0.0406)	1.05 (0.041)
			Except D15Z1	1.22—1.23 (0.0480—0.0484)	1.25 (0.049)
		Second	D15Z1	1.22—1.23 (0.0480—0.0484)	1.25 (0.049)
			Except D15Z1	1.52—1.53 (0.0598—0.0602)	1.55 (0.061)
		Oil		2.805—2.820 (0.1104—0.1110)	2.85 (0.112)
Piston ring	Ring-to-groove clearance	Top	D15Z1	0.030—0.055 (0.0012—0.0022)	0.13 (0.005)
			Except D15Z1	0.035—0.060 (0.0014—0.0024)	0.13 (0.005)
		Second		0.035—0.055 (0.0014—0.0022)	0.13 (0.005)
	Ring end gap		Top	0.15—0.30 (0.006—0.012)	0.60 (0.024)
			Second	0.30—0.45 (0.012—0.018)	0.70 (0.028)
			Oil	0.20—0.70 (0.008—0.028)	0.80 (0.031)
Piston Pin	O.D.			18.994—19.000 (0.7478—0.7480)	——
	Pin-to-piston clearance			0.010—0.022 (0.0004—0.0009)	——
Connecting rod	Pin-to-rod interference			0.014—0.040 (0.0006—0.0016)	——
	Small end bore diameter			18.96—18.98 (0.746—0.747)	——
	Large end bore diameter	Nominal	D12B, D13B	43.0 (1.69)	——
			D15B, D15Z	45.0 (1.77)	——
			D16A, D16Z	48.0 (1.89)	——
	End play installed on crankshaft			0.15—0.30 (0.006—0.012)	0.40 (0.016)
	Small end bore-to-large end bore parallelism			0.12 (0.005)/100 max.	0.15 (0.006/100
Crankshaft	Main journal diameter	D16A, D16Z		54.976—55.000 (2.1644—2.1654)	——
		D12B, D13B, D15B, D15Z		44.976—45.000 (1.7707—1.7717)	——
	Rod journal diameter	D12B, D13B		39.976—40.000 (1.574—1.575)	——
		D15B, D15Z		41.976—42.000 (1.653—1.654)	——
		D16A, D16Z		44.976—45.000 (1.771—1.772)	——
	Taper			0.0025 (0.0001) max.	0.01 (0.0004)
	Out-of round			0.0025 (0.0001) max.	0.01 (0.0004)
	End play			0.10—0.35 (0.004—0.014)	0.45 (0.018)
	Runout			0.015 (0.0006) max.	0.03 (0.0012)
Bearings	Main bearing-to-journal Oil clearance				
		D12B, D13B, D15B, D15Z			
		No. 1 and 5 journals		0.018—0.036 (0.0007—0.0014)	0.05 (0.002)
		No. 2, 3 and 4 journals		0.024—0.042 (0.0010—0.0017)	0.05 (0.002)
		D16A, D16Z			
		No. 1 and 5 journals		0.018—0.036 (0.0007—0.0014)	0.05 (0.002)
		No. 2 and 4 journals		0.024—0.042 (0.0010—0.0017)	0.05 (0.002)
		No. 3 journal		0.030—0.048 (0.0012—0.0019)	0.05 (0.002)
	Rod bearing-to-journal oil clearance			0.020—0.038 (0.0008—0.0014)	0.05 (0.002)

Unit of length: mm (in)

Engine Block — Section 7
B16A Engine

	MEASUREMENT		STANDARD (NEW)	SERVICE LIMIT
Cylinder block	Warpage of deck surface		0.05 (0.0020)	0.08 (0.031)
	Bore diameter	X	81.000–81.020 (3.1890–3.1898)	81.070 (3.1917)
		Y	81.000–81.015 (3.1890–3.1896)	
	Bore taper		——	0.25 (0.002)
	Reboring limit		——	0.25 (0.01)
Piston	Skirt O.D. At 15 mm (0.59 in) from bottom of skirt		80.98–80.99 (3.1882–3.1886)	80.97 (3.1879)
	Clearance in cylinder		0.01–0.035 (0.0004–0.0014)	0.05 (0.002)
	Ring groove width	Top	1.030–1.040 (0.0406–0.0409)	1.060 (0.0417)
		2nd	1.230–1.240 (0.0484–0.0488)	1.260 (0.0496)
		Oil	2.805–2.820 (0.1104–0.1110)	2.840 (0.1118)
Piston ring	Piston-to-ring clearance	Top	0.045–0.070 (0.0018–0.0028)	0.130 (0.0051)
		2nd	0.045–0.070 (0.0018–0.0028)*1	0.130 (0.0051)
			0.040–0.065 (0.0015–0.0026)*2	
	Ring end gap	Top	0.20–0.35 (0.0079–0.0138)	0.60
		2nd	0.40–0.55 (0.0157–0.0217)	0.70 (0.0276)
		Oil	0.20–0.45 (0.0079–0.0177)*1	0.80 (0.0315)
			0.20–0.50 (0.0079–0.0197)*2	
Piston pin	Diameter		20.994–21.000 (0.8265–0.8268)	——
	Pin-to-piston clearance		0.010–0.022 (0.0004–0.0009)	——
Connecting rod	Pin-to-rod interference		0.013–0.032 (0.0005–0.0013)	——
	Small end bore diameter		20.968–20.981 (0.8255–0.8260)	——
	Large end bore diameter	Nominal	48.0 (1.89)	——
	End play installed on crankshaft		0.15–0.30 (0.0059–0.0118)	0.40 (0.0157)
Crankshaft	Main journal diameter			
	No. 1, 2, 4 and 5 journals		54.976–55.000 (2.1644–2.1654)	——
	No. 3 journal		54.970–54.994 (2.1642–2.1651)	——
	Rod journal diameter		44.976–45.000 (1.7707–1.7717)	——
	Journal taper		0.005 (0.00020) max.	——
	Journal out of round		0.004 (0.00016) max.	0.006 (0.002)
	End play		0.10–0.35 (0.0039–0.0138)	0.045 (0.0018)
	Runout		0.020 (0.0008) max.	0.030 (0.0012)
Bearing	Main bearing-to-journal oil clearance			
	No. 1, 2, 4 and 5 journals		0.024–0.042 (0.0009–0.0017)	0.050 (0.0020)
	No. 3 journal		0.030–0.048 (0.0012–0.0019)	0.060 (0.0024)
	Rod bearing-to-journal oil clearance		0.032–0.050 (0.0013–0.0020)	0.060 (0.0024)

*1: TEIKOKU PISTON RING made
*2: RIKEN made

Standards and Service Limits

Engine Lubrication — Section 8
D12B, D13B, D15B, D15Z, D16A Engine

	MEASUREMENT		STANDARD (NEW)	SERVICE LIMIT
Engine oil	Capacity ℓ (US qt, Imp qt)	D12B, D13B, D15B, D15Z, D16A7	4.0 (4.2, 3.5) for engine overhaul 3.3 (3.5, 2.9) for oil change, including filter 3.0 (3.2, 2.6) for oil change, without filter	
		D16A8, D16A9	4.3 (4.5, 3.8) for engine overhaul 3.6 (3.8, 3.2) for oil change, including filter 3.3 (3.5, 2.9) for oil change, without filter	
Oil pump	Displacement ℓ (US gal, Imp gal)/ min @min^{-1} (rpm)	D12B, D13B, D15B, D15Z, D16A7	45 (12, 10) @6,300	
		D16A8, D16A9	63 (17, 14) @6,800	
	Inner-to-outer rotor clearance		0.02–0.14 (0.001–0.006)	0.2 (0.008)
	Pump body-to-outer rotor clearance		0.10–0.175 (0.004–0.007)	0.2 (0.008)
	Pump body-to-rotor axial clearance		0.03–0.08 (0.001–0.003)	0.15 (0.006)
Relief valve	Pressure setting 80°C (176°F) kPa (kg/cm^2, psi)	at idle	70 (0.7, 10) min.	
		at 3.000 min^{-1} (rpm)	350 (3.5, 50) min.	

Engine Lubrication — Section 8
B16A Engine

	MEASUREMENT		STANDARD (NEW)	SERVICE LIMIT
Engine oil	Capacity ℓ (US qt, Imp qt)		4.8 (5.1, 4.2) For engine disassembly 4.0 (4.2, 3.6) For oil change, including oil filter	
Oil pump	Displacement ℓ (US gal, Imp gal)/min@min^{-1} (rpm)		73 (19, 16) @7,800	
	inner-to-outer rotor radial clearance		0.04–0.16 (0.0016–0.0063)	0.2 (0.0079)
	Pump body-to-rotor radial clearance		0.10–0.19 (0.0039–0.0075)	0.2 (0.0079)
	Pump body-to-rotor side clearance		0.02–0.07 (0.0008–0.0026)	0.15 (0.0059)
Relief valve	Pressure setting 80°C (176°F) kPa (kg/cm^2)	at idle	70 (0.7, 10) min.	
		at 3.000 min^{-1} (rpm)	350 (3.5, 50) min.	

Unit of length: mm (in)

Cooling — Section 10

	MEASUREMENT	STANDARD (NEW)
Radiator	Coolant capacity ℓ (US gal, Imp gal) M/T including engine, heater, cooling line and reservoir reservoir capacity: 0.4 ℓ (0.42 US qt, 0.35 Imp qt)	B16A 4.8 (1.27, 1.06) for overhaul 3.9 (1.03, 0.86) for coolant change D12B, D13B, D15B, D16A, D16Z 4.5 (1.12, 0.99) for overhaul 3.6 (0.95, 0.79) for coolant change D15Z 4.4 (1.08, 0.97) for overhaul 3.5 (0.92, 0.77) for coolant change
	A/T	D12B, D15B 4.4 (1.08, 0.97) for overhaul 3.5 (0.92, 0.77) for coolant change D16A, D16Z 4.7 (1.16, 1.03) for overhaul 3.8 (1.00, 0.84) for coolant change
Radiator cap	Opening pressure kPa (kg-cm^2, psi)	95—125 (0.95—1.25, 13.5—17.8)
Thermostat	Start to opening °C (°F) D15Z1 Except D15Z1 Fully open °C (°F) D15Z1 Except D15Z1 Valve lift at fully open	80—84 (176—183) 76—80 (169—176) 95 (203) 90 (194) 8.0 (0.31) min.
Water pump	Displacement ℓ (US gal, Imp gal)/min @min^{-1} (rpm) D12B, D13B, D15B, D15Z, D16A7 D16Z8, D16A9 B16A	125 (33.0, 27.5) @6,000 112 (29.6, 24.6) @6,000 140 (37.0, 30.8) @6,000
Cooling fan	Thermoswitch "ON" temperature °C (°F) Thermoswitch "OFF" temperature °C (°F)	91.0—95.0 (196—203) Subtract 3—8 (5—15) from actual "ON" temperature.

Standards and Service Limits

Fuel and Emission (Carbureted Engine) — Section 11

	MEASUREMENT		STANDARD (NEW)	
Fuel pump	Displacement cc (US oz, Imp oz)/min Delivery pressure kPa (kg/cm², psi)		760 (25.7, 26.8) min. 9–14 (0.09–0.14, 1–2)	
Fuel tank	Capacity ℓ (US gal, Imp gal)		45 (11.9, 9.9)	
Engine	Idle speed min⁻¹ (rpm) with headlight and cooling fan off		M/T	A/T at [N]
		D12B, D15B3 D13B B15B4	800 800 650	1,000 —— 720
	Idle CO %		0.1 max.	

Fuel and Emission (PGM-FI Engine) — Section 11

	MEASUREMENT		STANDARD (NEW)	
Fuel pump	Displacement cc (US oz, Imp oz) in 10 seconds Relief valve opening pressure kPa (kg/cm², psi)		222 (7.5, 7.8) min. 450–600 (4.5–6.0, 64–85)	
Pressure regulator	Pressure with regulator vacuum hose disconnected kPa (kg/cm², psi)		280–330 (2.8–3.3, 40–47)	
Fuel tank	Capacity ℓ (US gal, Imp gal)		45 (11.9, 9.9)	
Engine	Idle speed min⁻¹ (rpm) with headlight and cooling fan off		M/T	A/T at [N]
		D15B2, D16A, D16Z D15Z B16A	750 600 750	750 —— ——
	Idle CO %		0.1 max.	

Clutch — Section 12

	MEASUREMENT		STANDARD (NEW)	SERVICE LIMIT
Clutch pedal	Pedal height	to floor	164 (6.4)	——
	Stroke		135 (5.3)	——
	Pedal play		12–21 (0.5–0.8)	——
	Disengagement height	to floor	83 (3.3)	——
		to carpet	55 (2.2) min. Reference	——
Flywheel	Clutch surface runout		0.05 (0.002) max.	0.15 (0.006)
Clutch disc	Rivet head depth		1.3 (0.06) max.	0.2 (0.008)
	Surface runout		0.8 (0.03) max.	1.0 (0.04)
	Thickness		8.1–8.8 (0.32–0.35)	5.7 (0.22)
Clutch cover	Pressure plate warpage		0.03 (0.001) max.	0.15 (0.006)

Unit of length: mm (in)

2WD Manual Transmission S20 — Section 13

	MEASUREMENT		STANDARD (NEW)	SERVICE LIMIT
Transmission oil	Capacity ℓ (U.S.qt., Imp.qt.)		1.8 (1.9, 1.6) at oil change 1.9 (2.0, 1.7) at assembly	
Mainshaft	End play		0.13—0.20 (0.005—0.008)	Adjust with shim
	Diameter of ball bearing contact area (clutch hosing side)		25.977—25.990 (1.0227—1.0232)	25.92 (1.020)
	Diameter of third gear contact area		33.984—34.000 (1.3380—1.3386)	33.93 (1.336)
	Diameter of 4th, 5th gear contact area		26.980—26.993 (1.0622—1.0627)	26.93 (1.060)
	Diameter of ball bearing contact area (transmission hosing side)		21.987—22.000 (0.8656—0.8661)	21.93 (0.863)
	Ronout		0.02 (0.0008) max.	0.05 (0.002)
Mainshaft third and fourth gears	I.D.		39.009—39.025 (1.5358—1.5364)	39.07 (1.538)
	End play	3rd	0.06—0.21 (0.0024—0.0083)	0.33 (0.013)
		4th	0.06—0.19 (0.0024—0.0075)	0.31 (0.012)
	Thickness	3rd	30.22—30.27 (1.1898—1.1917)	30.15 (1.187)
		4th	30.12—30.17 (1.1858—1.1878)	30.05 (1.183)
Mainshaft fifth gear	I.D.		37.009—37.025 (1.4570—1.4577)	37.07 (1.459)
	End play		0.06—0.19 (0.0024—0.0075)	0.31 (0.012)
	Thickness		28.42—28.47 (1.1189—1.1209)	28.35 (1.116)
Countershaft	End play		0.17—0.38 (0.0067—0.0150)	0.53 (0.021)
	Diameter of needle bearing contact area		30.000—30.015 (1.1811—1.1817)	29.95 (1.179)
	Diameter of ball bearing contact area		24.980—24.993 (0.9835—0.9840)	24.93 (0.981)
	Diameter of low gear contact area		35.984—36.000 (1.4167—1.4173)	35.93 (1.415)
	Runout		0.02 (0.0008) max.	0.05 (0.002)
Countershaft low gear	I.D.		41.009—41.025 (1.6145—1.6152)	41.07 (1.617)
	End play		0.03—0.10 (0.0012—0.0039)	0.22 (0.009)
	Thickness		30.41—30.44 (1.1972—1.1984)	30.36 (1.195)
Countershaft second gear	I.D.		44.009—44.025 (1.7326—1.7333)	44.07 (1.735)
	End play		0.03—0.11 (0.0012—0.0043)	0.23 (0.009)
	Thickness		31.92—31.97 (1.2567—1.2587)	31.85 (1.254)
Spacer collar (Countershaft second gear)	I.D.		32.988—32.998 (1.2987—1.2991)	33.04 (1.301)
	O.D.		38.989—39.000 (1.5350—1.5354)	38.93 (1.533)
	Length		32.03—32.06 (1.2610—1.2622)	32.01 (1.260)
Spacer collar (Mainshaft fourth and fifth gears)	I.D.		27.002—27.012 (1.0631—1.0635)	27.06 (1.065)
	O.D.	4th	33.989—34.000 (1.3381—1.3386)	33.93 (1.336)
		5th	31.989—32.000 (1.2594—1.2598)	31.93 (1.257)
	Length	4th	22.83—22.86 (0.8988—0.9000)	22.81 (0.898)
		5th	23.53—23.56 (0.9264—0.9276)	23.51 (0.926)
Reverse Idler gear	I.D.		15.016—15.043 (0.5911—0.5922)	15.08 (0.594)
	Gear-to-reverse gear shaft clearance		0.032—0.077 (0.0013—0.0030)	0.14 (0.006)
Synchro ring	Ring-to-gear clearance (ring pushed against gear)		0.73—1.18 (0.029—0.046)	0.4 (0.016)
Shift fork	Shift fork finger thickness		6.4—6.5 (0.252—0.255)	——
	Fork-to-synchro sleeve clearance		0.25—0.45 (0.0098—0.0177)	0.8 (0.03)
Reverse shift fork	Shift fork pawl groove width		12.7—13.0 (0.500—0.512)	——
	Fork-to-reverse idler gear clearance		0.5—1.1 (0.020—0.043)	1.8 (0.071)
	Groove width		7.05—7.25 (0.278—0.285)	——
	Fork-to-fifth/reverse shift piece pin clearance		0.05—0.35 (0.002—0.014)	0.5 (0.02)
Shift arm A	Diameter of shift rod contact area		13.005—13.130 (0.5120—0.5169)	——
	Shift arm A-to-shift rod clearance		0.005—0.230 (0.0002—0.0091)	0.35 (0.0138)
Shift arm B	Diameter of shift arm shaft contact area		13.973—14.000 (0.5501—0.5512)	——
	Shift arm B-to-shift arm shaft clearance		0.013—0.070 (0.0005—0.0028)	0.16 (0.0063)
	Shift arm B-to-shift piece clearance		0.2—0.5 (0.0079—0.0197)	0.62 (0.0244)
	Shift piece diameter of shift fork shaft contact area		12.9—13.0 (0.5079—0.5118)	12.78 (0.5031)

Standards and Service Limits

2WD Manual Transmission Y21 — Section 13

	MEASUREMENT		STANDARD (NEW)	SERVICE LIMIT
Transmission oil	Capacity ℓ (U.S.qt., Imp.qt.)		2.3 (2.4, 2.0) at oil change 2.4 (2.5, 2.1) at assembly	
Mainshaft	End play Diameter of ball bearing contact area (clutch hosing side) Diameter of third gear contact area Diameter of ball bearing contact area (transmission hosing side) Ronout		0.11–0.18 (0.004–0.007) 27.977–27.990 (1.101–1.102) 37.984–38.000 (1.495–1.496) 27.987–28.000 (1.1018–1.1024) 0.02 (0.0008) max.	Adjust with shim 27.93 (1.10) 37.93 (1.493) 27.94 (1.10) 0.05 (0.002)
Mainshaft third and fourth gears	I.D. End play Thickness	 3rd 4th	43.009–43.025 (1.6933–1.6939) 0.06–0.21 (0.0024–0.0083) 34.92–34.97 (1.3748–1.3768) 31.42–31.47 (1.2370–1.2390)	43.08 (1.696) 0.33 (0.013) 34.3 (1.350) 31.8 (1.252)
Mainshaft fifth gear	I.D. End play Thickness		43.009–43.025 (1.6933–1.6939) 0.06–0.21 (0.0024–0.0083) 31.42–31.47 (1.237–1.239)	43.08 (1.696) 0.3 (0.012) 31.3 (1.232)
Countershaft	Diameter of needle bearing contact area Diameter of ball bearing contact area Diameter of low gear contact area Runout		33.000–33.015 (1.299–1.300) 24.980–24.993 (0.9835–0.9840) 36.984–37.000 (1.4561–1.4567) 0.02 (0.0008) max.	32.95 (1.297) 24.93 (0.981) 36.93 (1.454) 0.05 (0.002)
Countershaft low gear	I.D. End play		42.009–42.025 (1.6539–1.6545) 0.04–0.12 (0.0016–0.0047)	42.08 (1.657) Adjust with shim
Countershaft second gear	I.D. End play Thickness		47.009–47.025 (1.8507–1.8514) 0.05–0.12 (0.0020–0.0047) 28.92–28.97 (1.1386–1.1405)	47.05 (1.852) Adjust with collar 28.8 (1.134)
Spacer collar (Countershaft second gear)	I.D. O.D. Length	 A B	36.521–36.531 (1.4378–1.4382) 41.989–42.000 (1.6531–1.6535) 29.02–29.04 (1.1425–1.1433) 29.07–29.09 (1.1444–1.1453)	36.541 (1.439) 41.94 (1.651) —— ——
Spacer collar (Mainshaft fourth and fifth gears)	I.D. O.D. Length		31.002–31.012 (1.2205–1.2209) 36.989–37.000 (1.4563–1.4567) 56.45–56.55 (2.2224–2.2264) 26.03–26.01	31.06 (1.223) 36.94 (1.454) ——

(cont'd)

Unit of length: mm (in)

2WD Manual Transmission Y21 (cont'd) — Section 13

	MEASUREMENT		STANDARD (NEW)	SERVICE LIMIT
Reverse Idle gear	I.D.		20.016—20.043 (0.7880—0.7891)	20.09 (0.7909)
	Gear-to-reverse gear shaft clearance		0.036—0.084 (0.0014—0.0033)	0.16 (0.006)
Synchro ring	Ring-to-gear clearance (ring pushed against gear)		0.85—1.10 (0.033—0.043)	0.4 (0.016)
Shift fork	Shift fork finger thickness		7.4—7.5 (0.291—0.295)	——
	Fork-to-synchro sleeve clearance		0.45—0.65 (0.018—0.026)	1.0 (0.039)
Reverse shift fork	Shift fork pawl groove width		13.0—13.3 (0.511—0.524)	——
	Fork-to-reverse idler gear clearance		0.5—1.1 (0.020—0.043)	1.8 (0.07)
	"L" groove width	at fifth gear side	7.40—7.70 (0.291—0.303)	——
		at reverse gear side	7.05—7.25 (0.278—0.285)	——
	Fork-to-fifth/reverse shift piece pin clearance			
		at fifth gear side	0.4—0.9 (0.016—0.035)	——
		at reverse gear side	0.05—0.45 (0.0020—0.018)	——
Shift rod guide	Groove width of shift arm contact area		11.8—12.0 (0.4646—0.4724)	——
	Shift rod guide-to-shift arm clearance		0.05—0.35 (0.002—0.014)	0.80 (0.031)
Shift guide	Groove width of shift arm contact area		7.9—8.0 (0.311—0.315)	——
	Shift rod guide-to-shift arm clearance		0.10—0.30 (0.004—0.012)	0.60 (0.024)
	I.D.		14.000—14.068 (0.551—0.554)	——
	Guide-to-shaft clearance		0.011—0.092 (0.0004—0.0036)	0.150 (0.0059)
	Diameter of shift fork contact area		11.90—12.00 (0.469—0.472)	——
	Guide-to-shift fork clearance		0.20—0.50 (0.008—0.020)	0.80 (0.032)
Selector arm	Diameter of shift rod guide contact area		11.90—12.00 (0.469—0.472)	——
	Arm-to-shift rod guide clearance		0.05—0.25 (0.002—0.010)	0.50 (0.020)
	Groove width of interlock contact area		9.9—10.0 (0.390—0.394)	——
	Arm-to-interlock clearance		0.05—0.25 (0.002—0.010)	0.50 (0.020)

Standards and Service Limits

4WD Manual Transmission S22 — Section 13

	MEASUREMENT	STANDARD (NEW)	SERVICE LIMIT
Transmis- sion oil	Capacity ℓ (U.S. qt., Imp. qt)	2.4 (2.5, 2.1) at assembly 2.3 (2.4, 2.0) at oil change	
Mainshaft	End play Diameter of needle bearing contact area Diameter of 3rd gear contact area Diameter of 63/28C ball bearing contact area Diameter of 6306/25 ball bearing contact area Runout	0.08—0.15 (0.003—0.006) 27.987—28.000 (1.1018—1.1024) 34.984—35.000 (1.3773—1.3780) 27.977—27.990 (1.1015—1.1020) 24.987—25.000 (0.9837—0.9843) 0.02 (0.001) max.	Adjust with shim 27.93 (1.100) 34.93 (1.375) 27.92 (1.099) 24.93 (0.981) 0.05 (0.002)
Mainshaft 3rd gear	I.D. End play Thickness	40.009—40.025 (1.5752—1.5758) 0.06—0.21 (0.002—0.008) 32.42—32.47 (1.276—1.278)	40.07 (1.578) 0.3 (0.01) 32.3 (1.27)
Mainshaft 4th gear	I.D. End play Thickness	40.009—40.025 (1.5752—1.5758) 0.06—0.21 (0.002—0.008) 30.92—30.97 (1.217—1.219)	40.07 (1.578) 0.3 (0.01) 30.8 (1.21)
Mainshaft 5th gear	I.D. End play Thickness	40.009—40.025 (1.5752—1.5758) 0.06—0.21 (0.002—0.008) 30.42—30.47 (1.198—1.200)	40.07 (1.578) 0.3 (0.01) 30.3 (1.19)
Counter- shaft	End play Diameter of needle bearing contact area Diameter of ball bearing contact area Diameter of super-low 3 gear contact area Runout	0.05—0.30 (0.002—0.012) 29.000—29.015 (1.1417—1.1423) 24.987—25.000 (0.9837—0.9843) 30.464—30.480 (1.1994—1.2000) 0.02 (0.001) max.	0.5 (0.02) 28.94 (1.139) 24.93 (0.981) 30.41 (1.197) 0.05 (0.002)
Counter- shaft low gear	I.D. End play Thickness	50.009—50.025 (1.9689—1.9695) 0.03—0.08 (0.001—0.003) 32.95—33.00 (1.297—1.299)	50.07 (1.971) 0.18 (0.007) 32.83 (1.293)
Counter- shaft 2nd gear	I.D. End play Thickness	50.009—50.025 (1.989—1.9695) 0.03—0.08 (0.001—0.003) 32.92—32.97 (1.296—1.298)	50.07 (1.971) 0.18 (0.007) 32.8 (1.29)
Mainshaft 4th gear & 5th gear distance collar	I.D. O.D. Length	28.002—28.012 (1.1024—1.1028) 34.989—35.000 (1.3775—1.3780) 26.03—26.08 (1.025—1.027)	28.06 (1.105) 34.93 (1.375) 26.01 (1.024)
Counter- shaft 2nd gear dis- tance collar	I.D. O.D. Length	36.48—36.49 (1.436—1.437) 43.989—44.000 (1.7318—1.7323) 28.96—29.40 (1.140—1.157)	36.54 (1.439) 43.93 (1.730) Adjust with collar.
Reverse idler gear	I.D. Gear to shaft clearance	20.016—20.043 (0.7880—0.7890) 0.036—0.084 (0.0014—0.0033)	20.08 (0.791) 0.14 (0.006)
Super-low 1st shaft	Distance of needle bearing contact area	23.984—23.993 (0.9443—0.9446)	23.93 (0.942)
Super-low 1st gear	I.D. Thickness	30.000—30.013 (1.1811—1.1816) 62.95—63.00 (2.478—2.480)	29.94 (1.179) 62.83 (2.474)
Super-low 2nd shaft	Diameter of needle bearing contact area End play Diameter of ball bearing contact area 62/28 6204U Runout	22.987—23.000 (0.9050—0.9055) 0.07—0.20 (0.003—0.008) 27.987—28.000 (1.1018—1.1024) 19.987—20.000 (0.7869—0.7874) 0.02 (0.001) max.	22.93 (0.903) Adjust with shim. 27.93 (1.100) 19.93 (0.785) 0.05 (0.002)

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4WD Manual Transmission S22 (cont'd)— Section 13

	MEASUREMENT		STANDARD (NEW)	SERVICE LIMIT
Super-low 2nd gear	I.D. End play Thickness		37.009–37.025 (1.4570–1.4577) 0.03–0.16 (0.001–0.006) 34.42–34.47 (1.355–1.357)	37.07 (1.459) 0.24 (0.009) 34.3 (1.35)
Super-low 3rd gear	Diameter of needle bearing contact area Width of needle bearing contact area		43.984–44.000 (1.7318–1.7323) 31.03–31.08 (1.222–1.224)	43.93 (1.730) 31.01 (1.221)
Super-low 2nd gear distance collar	I.D. O.D. Width		23.000–23.013 (0.9055–0.9060) 31.989–32.000 (1.2594–1.2598) 31.00–31.03 (1.220–1.222)	23.06 (0.908) 31.93 (1.257) 30.98 (1.220)
Transfer shaft	Diameter of needle bearing contact area Diameter of taper bearing contact area Width of transfer driven bevel gear contact area Diameter of drive bevel gear contact area Runout		27.987–28.000 (1.1018–1.1024) 16.989–17.000 (0.6689–0.6693) 45.01–45.05 (1.772–1.774) 35.002–35.018 (1.3780–1.3787) 0.02 (0.001) max.	27.93 (1.100) 16.93 (0.667) 45.17 (1.778) 34.95 (1.376) 0.05 (0.002)
Transfer driven gear	I.D. Diameter of needle bearing contact area End play Thickness		34.009–34.025 (1.3389–1.3396) 54.000–54.015 (2.1260–2.1266) 0.04–0.13 (0.002–0.005) 44.92–44.97 (1.690–1.770)	34.07 (1.341) 53.94 (2.124) 0.21 (0.008) 44.8 (1.76)
Transfer drive bevel gear	I.D. Diameter of taper bearing contact area		25.000–25.021 (0.9843–0.9851) 35.002–35.018 (1.3780–1.3787)	25.06 (0.987) 34.95 (1.376)
Transfer driven bevel gear	Backlash Diameter of taper bearng contact area	 32007 320/28	0.10–0.15 (0.004–0.006) 35.002–35.018 (1.3780–1.3787) 27.987–28.000 (1.1018–1.1024)	Adjust with shim. 34.95 (1.376) 27.93 (1.100)
Blocking ring	Ring-to-gear clearance		0.85–1.10 (0.033–0.043)	0.4 (0.02)
1st/2nd shift fork & 3rd/4th shift fork	Synchronizer sleeve groove width Shift fork-to-synchronizer sleeve clearance Fork shaft-to-shift fork clearance	 Thrust Radial	7.95–8.05 (0.313–0.317) 0.45–0.65 (0.018–0.026) 0.05–0.45 (0.002–0.018) 0.040–0.138 (0.0016–0.0054)	— 1.0 (0.04) 0.8 (0.03) —
5th shift fork	Synchronizer sleeve groove width Shift fork-to-synchronizer sleeve clearance Fork shaft-to-shift fork clearance 5th/Reverse shift fork shaft 1st/2nd shift fork shaft	 Thrust Radial	5.75–5.85 (0.226–0.230) 0.25–0.45 (0.010–0.018) 0.05–0.45 (0.002–0.018) 0.005–0.070 (0.0002–0.0028) 0.440–0.670 (0.0173–0.0264)	— 0.8 (0.03) 0.8 (0.03) — —
Reverse shift fork	Shift fork pawl thickness Shift fork-to-reverse idle gear clearance L-groove width Shift fork-to-5th/Reverse shift piece clearance		13.0–13.3 (0.51–0.52) 0.5–1.1 (0.02–0.04) 7.05–7.25 (0.278–0.285) 0.05–0.35 (0.002–0.014)	— 1.8 (0.07) — 0.5 (0.02)
SHift arm A	Diameter or shift piece contact area Shift arm-to-shift piece clearance I.D. Shift arm-to-shaft clearance		12.9–13.0 (0.508–0.512) 0.2–0.5 (0.01–0.02) 16.000–16.068 (0.6299–0.6326) 0.011–0.092 (0.0004–0.0036)	— 0.7 (0.03) — —

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Standards and Service Limits

4WD Manual Transmission S22 (cont'd)— Section 13

	MEASUREMENT	STANDARD (NEW)	SERVICE LIMIT
Shift arm	Diameter of shift arm A contact area Shift arm-to-shift arm A clearance	11.9—12.0 (0.469—0.472) 0.05—0.25 (0.002—0.010)	—— 0.5 (0.02)
Select arm	Diameter of shift arm A contact area Select arm-to-shift arm A clearance	7.95—8.00 (0.313—0.315) 0.10—0.25 (0.004—0.010)	—— 0.5 (0.02)
Super-low shift fork	Synchronizer sleeve groove width Shift fork-to-synchronizer sleeve clearance Thrust Radial	5.75—5.85 (0.226—0.230) 0.25—0.45 (0.010—0.018) 0.05—0.45 (0.002—0.018)	—— 0.8 (0.03) 0.8 (0.03)
Super-low shift piece A	Shift piece-to-fork shaft clearance Diameter of super-low shift lever contact area Shift piece-to-super-low shift lever clearance	0.040—0.138 (0.0016—0.0054) 10.1—10.2 (0.398—0.402) 0.1—0.3 (0.004—0.012)	—— —— ——
Super-low shift piece B	Diameter of super-low shift lever contact area Shift piece-to-super-low shift lever clearance	7.9—8.0 (0.311-0.315) 0.05—0.25 (0.002—0.010)	—— 0.5 (0.02)
Disengage-ment fork	Sleeve groove width Fork-to-sleeve clearance Thrust Radial	8.45—8.55 (0.333—0.337) 0.45—0.65 (0.018—0.026) 0.2—1.1 (0.01—0.04)	—— 1.0 (0.04) 1.5 (0.06)

Unit of length: mm (in)

2WD Automatic Transmission M48A— Section 14

	MEASUREMENT		STANDARD (NEW)	SERVICE LIMIT
Transmission fluid	Capacity ℓ (US qt, Imp qt)		5.4 (5.7, 4.8) for *overhaul* 2.4 (2.5, 2.1) for fluid change	
Hydraulic pressure kPa (kg/cm², psi) D12B1	Line pressure at 2,000 min⁻¹(rpm) N or P		800—850 (8.0—8.5, 114—121)	750 (7.5, 107)
	2nd clutch pressure at 2,000 min⁻¹(rpm) D_4		420 (4.2, 60) throttle fully closed | 800—850 (8.0—8.5, 114—121) throttle more than 1/4 opened	370 (3.7, 53) throttle fully closed | 750 (7.5, 107) throttle more than 1/4 opened
	3rd clutch pressure at 2,000 min⁻¹(rpm) D_4			
	4th clutch pressure at 2,000 min⁻¹(rpm) D_4			
	2nd clutch pressure at 2,000 min⁻¹(rpm) 2		800—850 (8.0—8.5, 114—121)	750 (7.5, 107)
	1st clutch pressure at 2,000 min⁻¹(rpm) D_4 or D_3		800—850 (8.0—8.5, 114—121)	750 (7.5, 107)
	Governor pressure at 37.5 mph (60 km/h)		151—161 (1.51—1.61, 21—23)	146 (1.46, 21)
	Throttle pressure B	Throttle fully closed Throttle fully open	0 800—850 (8.0—8.5, 114—121)	—— 750 (7.5, 107)
	Throttle pressure A	Throttle fully closed Throttle fully open	0—5 (0—0.05, 0—1) 515—530 (5.15—5.3, 73—75)	—— 510 (5.1, 73)
Hydraulic pressure kPa (kg/cm², psi) D15B4	Line pressure at 2,000 min⁻¹(rpm) N or P		850—900 (8.5—9.0, 121—128)	800 (8.0, 114)
	2nd clutch pressure at 2,000 min⁻¹(rpm) D_4		420 (4.2, 60) throttle fully closed | 850—900 (8.5—9.0, 121—128) throttle more than 1/4 opened	370 (3.7, 53) throttle fully closed | 800 (8.0, 114) throttle more than 1/4 opened
	3rd clutch pressure at 2,000 min⁻¹(rpm) D_4			
	4th clutch pressure at 2,000 min⁻¹(rpm) D_4			
	2nd clutch pressure at 2,000 min⁻¹(rpm) 2		850—900 (8.5—9.0, 121—128)	800 (8.0, 114)
	1st clutch pressure at 2,000 min⁻¹(rpm) D_4 or D_3		850—900 (8.5—9.0, 121—128)	800 (8.0, 114)
	Governor pressure at 37.5 mph (60 km/h)		151—161 (1.51—1.61, 21—23)	146 (1.46, 21)
	Throttle pressure B	Throttle fully closed Throttle fully open	0 850—900 (8.5—9.0, 121—128)	—— 800 (8.0, 114)
	Throttle pressure A	Throttle fully closed Throttle fully open	0—5 (0—0.05, 0—1) 515—530 (5.15—5.3, 73—75)	—— 510 (5.1, 73)

(cont'd)

Standards and Service Limits

2WD Automatic Transmission M48A (cont'd)— Section 14

	MEASUREMENT		STANDARD (NEW)	SERVICE LIMIT
Hydraulic pressure kPa (kg/cm^2, psi) D15B3	Line pressure at 2,000 min^{-1}(rpm) N or P		800—850 (8.0—8.5, 114—121)	750 (7.5, 107)
	2nd clutch pressure at 2,000 min^{-1}(rpm) D_4		420 (4.2, 60) throttle fully closed | 800—850 (8.0—8.5, 114—121) throttle more than 1/4 opened	370 (3.7, 53) throttle fully closed | 750 (7.5, 107) throttle more than 1/4 opened
	3rd clutch pressure at 2,000 min^{-1}(rpm) D_4			
	4th clutch pressure at 2,000 min^{-1}(rpm) D_4			
	2nd clutch pressure at 2,000 min^{-1}(rpm) 2		800—850 (8.0—8.5, 114—121)	750 (7.5, 107)
	1st clutch pressure at 2,000 min^{-1}(rpm) D_4 or D_3		800—850 (8.0—8.5, 114—121)	750 (7.5, 107)
	Governor pressure at 37.5 mph (60 km/h)		151—161 (1.51—1.61, 21—23)	146 (1.46, 21)
	Throttle pressure B	Throttle fully closed Throttle fully open	0 800—850 (8.0—8.5, 114—121)	—— 750 (7.5, 107)
	Throttle pressure A	Throttle fully closed Throttle fully open	0—5 (0—0.05, 0—1) 515—530 (5.15—5.3, 73—75)	—— 510 (5.1, 73)
Hydraulic pressure kPa (kg/cm^2, psi) D16A8, D16A9	Line pressure at 2,000 min^{-1}(rpm) N or P		800—850 (8.0—8.5, 114—121)	750 (77.5, 107)
	2nd clutch pressure at 2,000 min^{-1}(rpm) D_4		420 (4.2, 60) throttle fully closed | 800—850 (8.0—8.5, 114—121) throttle more than 1/4 opened	370 (3.7, 53) throttle fully closed | 750 (7.5, 107) throttle more than 1/4 opened
	3rd clutch pressure at 2,000 min^{-1}(rpm) D_4			
	4th clutch pressure at 2,000 min^{-1}(rpm) D_4			
	2nd clutch pressure at 2,000 min^{-1}(rpm) 2		800—850 (8.0—8.5, 114—121)	750 (7.5, 107)
	1st clutch pressure at 2,000 min^{-1}(rpm) D_4 or D_3		800—850 (8.0—8.5, 114—121)	750 (7.5, 107)
	Governor pressure at 37.5 mph (60 km/h)		151—161 (1.51—1.61, 21—23)	146 (1.46, 21)
	Throttle pressure B	Throttle fully closed Throttle fully open	0 800—850 (8.0—8.5, 114—121)	—— 750 (7.5, 107)
	Throttle pressure A	Throttle fully closed Throttle fully open	0—5 (0—0.05, 0—1) 495—510 (4.95—5.1, 70—73)	—— 490 (4.9, 70)
Stall speed min^{-1}(rpm) (check with car on level ground)			2,300—2,900	——
Clutch	Clutch initial clearance	1st, 2nd 3rd, 4th	0.65—0.85 (0.026—0.033) 0.40—0.60 (0.016—0.024)	—— ——
	Clutch return spring free length	1st 2nd, 3rd, 4th	31.0 (1.22) 30.5 (1.20)	29.0 (1.14) 28.5 (1.12)
	Clutch disc thickness		1.88—2.00 (0.074—0.079)	Until grooves worn out
	Clutch plate thickness	1st Except 1st	1.55—1.65 (0.061—0.065) 1.95—2.05 (0.077—0.081)	Discoloration Discoloration

(cont'd)

2WD Automatic Transmission M48A (cont'd)— Section 14

	MEASUREMENT		STANDARD (NEW)	SERVICE LIMIT
Clutch	Clutch end plate thickness D12B1, D15B3	MARK 1	2.2—2.3 (0.087—0.091)	Discoloration
		MARK 2	2.5—2.6 (0.098—0.102)	↑
		MARK 3	2.8—2.9 (0.110—0.114)	
		MARK 4	3.1—3.2 (0.122—0.126)	
		MARK 5	3.4—3.5 (0.134—0.138)	
		MARK 11	2.05—2.15 (0.081—0.085)	
		MARK 12	2.35—2.45 (0.093—0.096)	
		MARK 13	2.65—2.75 (0.104—0.108)	
		MARK 14	2.95—3.05 (0.116—0.120)	
		MARK 15	3.25—3.35 (0.128—0.132)	↓
		MARK 16	3.55—3.65 (0.140—0.144)	Discoloration
	Clutch end plate thickness D15B4, D16A8, D16A9	MARK 1	2.3—2.4 (0.091—0.094)	Discoloration
		MARK 2	2.4—2.5 (0.094—0.098)	↑
		MARK 3	2.5—2.6 (0.098—0.102)	
		MARK 4	2.6—2.7 (0.102—0.106)	
		MARK 5	2.7—2.8 (0.106—0.110)	
		MARK 6	2.8—2.9 (0.110—0.114)	
		MARK 7	2.9—3.0 (0.114—0.118)	
		MARK 8	3.0—3.1 (0.118—0.122)	
		MARK 9	3.1—3.2 (0.122—0.126)	
		MARK 10	3.2—3.3 (0.126—0.130)	
		MARK 11	2.0—2.1 (0.079—0.083)	
		MARK 12	2.1—2.2 (0.083—0.087)	↓
		MARK 13	2.2—2.3 (0.087—0.091)	Discoloration

(cont'd)

Standards and Service Limits

2WD Automatic Transmission M48A (cont'd)— Section 14

	MEASUREMENT	STANDARD (NEW)	SERVICE LIMIT
Trans-mission	Diameter of needle bearing contact area		
	On mainshaft and stator shaft	19.980—19.993 (0.7866—0.7871)	Wear or damage
	On mainshaft 2nd gear	35.975—35.991 (1.4163—1.4169)	
	On mainshaft 4th gear collar	31.975—31.991 (1.2589—1.2595)	
	On mainshaft 1st gear collar	27.975—27.995 (1.1014—1.1022)	
	On countershaft (L.side)	36.004—36.017 (1.4175—1.4180)	
	On countershaft 3rd gear distance collar	31.975—31.991 (1.2589—1.2595)	
	On countershaft 4th gear	27.980—27.993 (1.1016—1.1021)	
	On countershaft reverse gear collar	29.980—29.993 (1.1803—1.1808)	
	On countershaft 1st gear collar	29.980—29.993 (1.1803—1.1808)	
	On reverse idler gear shaft	13.990—14.000 (0.5508—0.5512)	
	On mainshaft 1st gear	33.000—33.016 (1.2992—1.3000)	Wear or damage
	Inside diameter of needle bearing contact area		
	On mainshaft 2nd gear	41.000—41.016 (1.6142—1.6148)	Wear or damage
	On mainshaft 4th gear	38.000—38.016 (1.4961—1.4967)	
	On countershaft 1st gear	35.000—35.016 (1.3780—1.3786)	
	On countershaft 3rd gear	38.000—38.016 (1.4961—1.6967)	
	On countershaft 4th gear	33.000—33.016 (1.2992—1.2998)	
	On countershaft reverse gear	36.000—36.016 (1.4173—1.4179)	
	On reverse idler gear	18.007—18.020 (0.7089—0.7094)	
	On stator shaft (R. side)	26.000—26.013 (1.0236—1.0241)	
	On stator shaft (stator side)	24.000—24.021 (0.9449—0.9457)	
	On reverse idler shaft holder	14.416—14.434 (0.5676—0.5683)	Wear or damage
	End play		
	Mainshaft 1st gear	0.08—0.24 (0.003—0.009)	—
	Mainshaft 2nd gear	0.07—0.15 (0.003—0.006)	—
	Mainshaft 4th gear	0.10—0.22 (0.004—0.009)	—
	Countershaft 1st gear	0.10—0.45 (0.004—0.018)	—
	Countershaft 3rd gear	0.07—0.15 (0.003—0.006)	—
	Countershaft 4th gear	0.07—0.15 (0.003—0.006)	—
	Reverse idler gear	0.05—0.18 (0.002—0.007)	—
	Countershaft reverse gear	0.10—0.45 (0.004—0.018)	—
	Selector hub O.D.	51.87—51.90 (2.042—2.043)	Wear or damage
	Mainshhaft 4th gear collar length	40.00—40.05 (1.5748—1.5768)	—
	Mainshaft 1st gear collar length	25.00—25.15 (0.9843—0.9902)	—
	Mainshaft 1st gear collar flange thickness	2.5—2.6 (2.098—2.102)	Wear or damage
	Countershaft distance collar length	38.97—39.00 (1.534—1.535)	—
		39.02—39.05 (1.536—1.537)	—
		39.07—39.10 (1.538—1.539)	—
		39.12—39.15 (1.540—1.541)	—
		39.17—39.20 (1.542—1.543)	—
		39.22—39.25 (1.544—1.545)	—
		39.27—39.30 (1.546—1.547)	—
		38.87—38.90 (1.530—1.531)	—
		38.92—38.95 (1.532—1.533)	—
	Countershaft reverse gear collar length	14.5—14.55 (0.571—0.573)	—
	Countershaft reverse gear collar flange thickness	2.45—2.55 (0.096—0.100)	Wear or damage
	Countershaft 1st gear collar length	14.50—14.55 (0.571—0.573)	—
	Countershaft 1st gear collar flange thickness	2.45—2.55 (0.096—0.100)	Wear or damage

(cont'd)

Unit of length: mm (in)

2WD Automatic Transmission M48A (cont'd)— Section 14

	MEASUREMENT		STANDARD (NEW)	SERVICE LIMIT
Transmission (cont'd)	Mainshaft 2nd gear thrust washer thickness		3.47–3.50 (0.137–0.138)	Wear or damage
			3.52–3.55 (0.139–0.140)	↑
			3.57–3.60 (0.141–0.142)	
			3.62–3.65 (0.143–0.144)	
			3.67–3.70 (0.145–0.146)	
			3.72–3.75 (0.147–0.148)	
			3.77–3.80 (0.148–0.150)	
			3.82–3.85 (0.151–0.152)	↓
			3.87–3.90 (0.153–0.154)	Wear or damage
	Thrust washer thickness			
	Mainshaft 4th gear		4.45–4.55 (0.175–0.179)	Wear or damage
	Mainshaft ball bearing L. side		2.95–3.05 (0.116–0.120)	↑
	Mainshaft 1st gear L. side		1.45–1.50 (0.057–0.057)	↓
	Mainshaft 1st gear R. side		2.43–2.50 (0.096–0.098)	Wear or damage
	Countershaft 3rd gear thrust washer thickness		2.87–2.90 (0.113–0.114)	Wear or damage
			2.92–2.95 (0.115–0.116)	↑
			2.97–3.00 (0.117–0.118)	
			3.02–3.05 (0.119–0.120)	
			3.07–3.10 (0.121–0.122)	
			3.12–3.15 (0.123–0.124)	
			3.17–3.20 (0.125–0.126)	
			3.22–3.25 (0.127–0.128)	
			3.27–3.30 (0.129–0.130)	
			3.32–3.35 (0.131–0.132)	↓
			3.37–3.40 (0.133–0.134)	Wear or damage
	Mainshaft 4th gear thrust washer thickness		2.93–3.00 (0.115–0.118)	Wear or damage
	One-way clutch contact area I.D.			↑
	Countershaft 1st gear		74.414–74.440 (2.930–2.931)	↓
	Parking gear		57.755–57.768 (2.2738–2.2743)	Wear or damage
	Mainshaft feed pipe A, O.D.		8.97–8.98 (0.353–0.354)	8.95 (0.352)
	Mainshaft feed pipe B, O.D.		5.97–5.98 (0.2350–0.2354)	5.95 (0.234)
	Countershaft feed pipe O.D		7.97–7.98 (0.3138–0.3142)	7.95 (9.313)
	Mainshaft sealing ring thickness		1.980–1.995 (0.0780–0.0785)	1.80 (0.071)
	Mainshaft bushing I.D.		6.018–6.030 (0.2369–0.2374)	6.045 (0.2380)
	Mainshaft bushing I.D.		9.000–9.015 (0.3543–0.3549)	9.030 (0.355)
	Countershaft bushing I.D.		8.000–8.015 (0.3150–0.3156)	8.030 (0.3161)
	Mainshaft sealing ring groove width		2.025–2.060 (0.0797–0.081)	2.080 (0.082)
Regulator valve body	Sealing ring contact I.D.		32.000–32.025 (1.260–1.261)	32.05 (1.262)
Shifting device and parking brake control	Reverse shift fork finger thickness		5.90–6.00 (0.232–0.236)	5.40 (0.213)
	Parking brake ratchet pawl		——	Wear or other defect
	Parking brake gear		——	
	Throttle cam stopper height		18.5–18.6 (0.728–0.732)	——
Servo body	Shift fork shaft bore I.D.	A	14.000–14.005 (0.5512–0.5514)	——
		B	14.006–14.010 (0.5514–0.5516)	——
		C	14.011–14.015 (0.5516–0.5518)	——
	Shift fork shaft valve bore I.D.		37.000–37.039 (1.4567–1.4582)	37.045 (1.4585)
Oil pump	Oil pump gear side clearance		0.03–0.05 (0.001–0.002)	0.07 (0.003)
	Oil pump gear-to-body clearance	Drive	0.240–0.266 (0.009–0.010)	——
		Driven	0.063–0.088 (0.002–0.003)	——
	Oil pump driven gear I.D.		14.016–14.034 (0.5518–0.5525)	Wear or damage
	Oil pump shaft O.D.		13.980–13.990 (0.5504–0.5508)	Wear or damage

(cont'd)

2WD Automatic Transmission M48A (cont'd)

	MEASUREMENT		STANDARD (New)			
			Wire Dia.	O.D.	Free Length	No. of Coils
Spring	Orifice control valve spring		0.9 (0.035)	6.6 (0.260)	44.0 (1.732)	22.0
	3-4 shift valve spring		0.7 (0.028)	9.6 (0.378)	32.9 (1.295)	6.4
	3-4 shift ball spring		0.45 (0.018)	4.5 (0.177)	12.0 (0.472)	6.7
	Cooler relief valve spring		1.1 (0.043)	8.4 (0.331)	36.4 (1.433)	12.0
	Relief valve spring		1.0 (0.039)	8.4 (0.331)	52.0 (2.047)	23.0
	2-3 shift valve spring		0.7 (0.028)	7.6 (0.299)	43.0 (1.693)	12.7
	2-3 shift ball spring		0.4 (0.016)	4.5 (0.177)	14.7 (0.579)	7.3
	1-2 shift valve spring		0.5 (0.020)	4.5 (0.177)	44.5 (1.752)	35.1
	1-2 shift ball spring		0.4 (0.016)	4.5 (0.177)	11.3 (0.445)	8.0
	Regulator valve spring A	D12B1 Others	1.8 (0.071) 1.8 (0.071)	14.7 (0.579) 14.7 (0.579)	86.5 (3.406) 88.1 (3.468)	16.5 16.5
	Regulator valve spring B		1.8 (0.071)	9.6 (0.378)	44.0 (1.732)	7.5
	Stator reaction spring		5.5 (0.217)	*26.4 (1.039)	30.3 (1.193)	2.1
	Lock-up control valve spring	D12B1/D15B3 D15B4/D16A8/D16A9	0.7 (0.028) 0.6 (0.024)	6.6 (0.260) 6.6 (0.260)	32.5 (1.280) 32.8 (1.291)	14.0 15.8
	Torque converter check valve spring		1.1 (0.043)	8.4 (0.331)	36.4 (1.433)	12.0
	Modulator valve spring	D12B1/D15B3	1.2 (0.047) 1.2 (0.047)	9.4 (0.370) 9.4 (0.370)	26.3 (1.035) 27.2 (1.071)	8.0 8.0
		D15B4/D16A8 D16A9	1.2 (0.047) 1.2 (0.047)	9.4 (0.370) 9.4 (0.370)	26.3 (1.035) 26.4 (1.039)	8.0 8.0
	Throttle valve A spring	D12B1/D15B3	1.1 (0.043) 1.1 (0.043) 1.0 (0.039) 1.0 (0.039)	8.5 (0.335) 8.5 (0.335) 8.5 (0.335) 8.5 (0.335)	22.3 (0.878) 22.3 (0.878) 22.2 (0.874) 22.1 (0.870)	8.1 7.6 6.0 5.5
		D15B4/D16A8 D16A9	1.0 (0.039) 1.0 (0.039) 1.0 (0.039) 1.0 (0.039)	8.5 (0.335) 8.5 (0.335) 8.5 (0.335) 8.5 (0.335)	22.2 (0.874) 22.1 (0.870) 22.5 (0.886) 22.3 (0.878)	6.0 5.5 7.3 6.6
	Throttle valve A adjusting spring		0.8 (0.031)	6.2 (0.244)	27.0 (1.063)	8.5
	Throttle valve B spring	D12B1/D15B3	1.4 (0.055) 1.4 (0.055) 1.6 (0.063)	8.5 (0.335) 8.5 (0.335) 8.5 (0.335)	41.4 (1.630) 41.4 (1.630) 41.3 (1.626)	8.4 7.8 13.9
		D15B4/D16A8 D16A9	1.6 (0.063) 1.6 (0.063) 1.6 (0.063)	8.5 (0.335) 8.5 (0.335) 8.5 (0.335)	41.3 (1.626) 41.4 (1.630) 41.3 (1.626)	13.9 11.7 15.0

*: Inside Diameter

Unit of length: mm (in)

2WD Automatic Transmission M48A (cont'd)

	MEASUREMENT	STANDARD (New)			
		Wire Dia.	O.D.	Free Length	No. of Coils
Spring	Throttle valve B adjusting spring	0.8 (0.031)	6.2 (0.244)	30.0 (1.181)	8.0
	3rd accumulator spring	2.9 (0.114)	15.5 (0.689)	79.5 (3.130)	15.0
	2nd accumulator spring	3.9 (0.154)	20.2 (0.795)	74.9 (2.949)	10.9
	4th accumulator spring	3.5 (0.138)	18.6 (0.732)	77.4 (3.047)	10.2
	Reverse timing valve spring	0.7 (0.028)	5.6 (0.220)	43.8 (1.724)	21.7
	Servo control valve spring	1.0 (0.039)	7.6 (0.299)	44.0 (1.732)	18.2
	Lock-up shift valve spring D12B1/D15B3 D15B4/D16A8/D16A9	0.7 (0.028) 1.1 (0.043)	8.1 (0.319) 8.1 (0.319)	39.0 (1.535) 51.8 (2.039)	15.4 22.3
	Lock-up timing valve spring	1.0 (0.039)	6.6 (0.260)	52.3 (2.059)	30.1
	Governor spring A	1.0 (0.039)	18.8 (0.740)	32.9 (1.295)	4.1
	Governor spring B	0.9 (0.035) 0.9 (0.035)	11.8 (0.465) 11.8 (0.465)	27.8 (1.094) 29.1 (1.146)	6.0 6.0
	1st-hold accumulator spring	4.0 (0.157)	21.5 (0.846)	71.7 (2.823)	8.3
	Kick-down valve spring	1.0 (0.039)	10.1 (0.398)	38.9 (1.531)	12.5
	Orifice control valve spring	0.9 (0.035)	6.1 (0.240)	35.9 (1.413)	20.0
	Shift timing valve spring	0.9 (0.035)	8.6 (0.339)	42.9 (1.689)	21.4
	4th exhaust valve spring	0.9 (0.035)	6.1 (0.240)	43.7 (1.720)	20.3
	Accumulator valve spring D12B1/D15B3 D15B4/D16A8/D16A9	1.2 (0.047) 1.2 (0.047)	7.7 (0.303) 7.7 (0.303)	45.1 (1.776) 45.6 (1.795)	19.8 21.8
	Lock-up cut valve spring	0.7 (0.028)	7.6 (0.299)	29.0 (1.412)	18.0
	Reverse control valve spring	0.7 (0.028)	7.6 (0.299)	37.2 (1.465)	15.3
	CPC (Clutch Pressure Control) valve spring	0.9 (0.035)	8.6 (0.339)	18.2 (0.717)	5.54
	Governor spring A	1.0 (0.039)	18.8 (0.740)	20.4 (0.803)	4.0
	Governor spring B	0.9 (0.035)	11.8 (0.465)	27.8 (1.094)	6.0
	1st accumulator one-way ball spring	0.29 (0.011)	4.0 (0.157)	14.0 (0.551)	13.0
	1st accumulator spring A	2.34 x 2.90 (0.092 x 0.114)	21.5 (0.846)	66.7 (2.626)	10.2
	1st accumulator spring B	2.8 (0.110)	13.1 (0.516)	40.0 (1.575)	8.8

Standards and Service Limits

2WD Automatic Transmission M24A — Section 14

	MEASUREMENT		STANDARD (NEW)	SERVICE LIMIT
Transmission fluid	Capacity ℓ (US qt, Imp qt)		5.9 (6.2, 5.2) for overhaul 2.7 (2.8, 2.4) for fluid change	
Hydraulic pressure kPa (kg/cm^2, psi) D16Z6, D16A8, D16A7	Line pressure at 2,000 min^{-1} (rpm) N or P		850—900 (8.5—9.0, 121—128)	800 (8.0, 114)
	2nd clutch pressure at 2,000 min^{-1} (rpm) D$_4$ 3rd clutch pressure at 2,000 min^{-1} (rpm) D$_4$ 4th clutch pressure at 2,000 min^{-1} (rpm) D$_4$		400 (4.0, 57) throttle fully closed 850—900 (8.5—9.0, 121—128) throttle more than 1/8 opened	350 (3.5, 50) throttle fully closed 800 (8.0, 114) throttle more than 1/8 opened
	2nd clutch pressure at 2,000 min^{-1} (rpm) 2		850—900 (8.5—9.0, 121—128)	800 (8.0, 114)
	1st clutch pressure at 2,000 min^{-1} (rpm) D$_4$ or 1		850—900 (8.5—9.0, 121—128)	800 (8.0, 114)
	Governor pressure at 37.5 mph (60 km/h)	D16Z6, D16A8 D16A7	180—190 (1.80—1.90, 26—27) 182—192 (1.82—1.92, 26—27)	175 (1.75, 25) 177 (1.77, 25)
	Throttle pressure B	Throttle fully closed Throttle fully open	0—15 (0—0.15, 0—2) 850—900 (8.5—9.0, 121—128)	—— 800 (8.0, 114)
	Throttle pressure A D16Z6	Throttle fully closed Throttle fully open	0—5 (0—0.05, 0—1) 505—520 (5.05—5.2, 72—74)	—— 500 (5.0, 71)
	Throttle pressure A D16A8	Throttle fully closed Throttle fully open	0—5 (0—0.05, 0—1) 535—550 (5.35—5.5, 76—78)	—— 530 (5.3, 75)
	Throttle pressure A D16A7	Throttle fully closed Throttle fully open	0—5 (0—0.05, 0—1) 515—530 (5.15—5.3, 73—75)	—— 510 (5.1, 73)
Hydraulic pressure kPa (kg/cm^2, psi) D15B2	Line pressure at 2,000 min^{-1} (rpm) N or P		800—850 (8.0—8.5, 114—121)	750 (7.5, 107)
	2nd clutch pressure at 2,000 min^{-1} (rpm) D$_4$ 3rd clutch pressure at 2,000 min^{-1} (rpm) D$_4$ 4th clutch pressure at 2,000 min^{-1} (rpm) D$_4$		400 (4.0, 57) throttle fully closed 800—850 (8.0—8.5, 114—121) throttle more than 1/8 opened	350 (3.5, 50) throttle fully closed 750 (7.5, 107) throttle more than 1/8 opened
	2nd clutch pressure at 2,000 min^{-1} (rpm) 2		800—850 (8.0—8.5, 114—121)	750 (7.5, 107)
	1st clutch pressure at 2,000 min^{-1} (rpm) D$_4$ or 1		800—850 (8.0—8.5, 114—121)	750 (7.5, 107)
	Governor pressure at 37.5 mph (60 km/h)		180—190 (1.80—1.90, 26—27)	175 (1.75, 25)
	Throttle pressure B	Throttle fully closed Throttle fully open	0—15 (0—0.15, 0—2) 800—850 (8.0—8.5, 114—121)	—— 750 (7.5, 107)
	Throttle pressure A	Throttle fully closed Throttle fully open	0—5 (0—0.05, 0—1) 505—520 (5.05—5.2, 72—74)	—— 500 (5.0, 71)
Stall speed min^{-1} (rpm) (check with car on level ground)			2,400—2,800	——

(cont'd)

Unit of length: mm (in)

2WD Automatic Transmission M24A (cont'd) — Section 14

	MEASUREMENT		STANDARD (NEW)	SERVICE LIMIT
Clutch	Clutch initial clearance	1st, 2nd	0.65—0.85 (0.026—0.033)	——
		3rd, 4th	0.40—0.60 (0.016—0.024)	——
		1st-hold	0.5—0.8 (0.02—0.03)	——
	Clutch return spring free length	1st	31.0 (1.22)	29.0 (1.14)
		2nd, 3rd, 4th	30.5 (1.20)	28.5 (1.12)
		1st-hold	34.6 (1.36)	32.6 (1.28)
	Clutch disc thickness		1.88—2.00 (0.074—0.079)	Until grooves worn out
	Clutch plate thickness	1st	1.55—1.65 (0.061—0.065)	Discoloration
		Except 1st	1.95—2.05 (0.077—0.081)	Discoloration
	Clutch end plate thickness (except 1st-hold)	MARK 1	2.3—2.4 (0.091—0.094)	Discoloration
		MARK 2	2.4—2.5 (0.094—0.098)	
		MARK 3	2.5—2.6 (0.098—0.102)	
		MARK 4	2.6—2.7 (0.102—0.106)	
		MARK 5	2.7—2.8 (0.106—0.110)	
		MARK 6	2.8—2.9 (0.110—0.114)	
		MARK 7	2.9—3.0 (0.114—0.118)	
		MARK 8	3.0—3.1 (0.118—0.122)	
		MARK 9	3.1—3.2 (0.122—0.126)	
		MARK 10	3.2—3.3 (0.126—0.130)	
		MARK 11	2.0—2.1 (0.079—0.083)	
		MARK 12	2.1—2.2 (0.083—0.087)	
		MARK 13	2.2—2.3 (0.087—0.091)	Discoloration
	Clutch end plate thickness (1st-hold)	MARK 1	2.05—2.10 (0.081—0.083)	Discoloration
		MARK 2	2.15—2.20 (0.085—0.087)	
		MARK 3	2.25—2.30 (0.089—0.091)	
		MARK 4	2.35—2.40 (0.093—0.094)	
		NO MARK	2.45—2.50 (0.096—0.098)	
		MARK 6	2.55—2.60 (0.100—0.102)	
		MARK 7	2.65—2.70 (0.104—0.106)	Discoloration

(cont'd)

Standards and Service Limits

2WD Automatic Transmission M24A (cont'd) — Section 14

	MEASUREMENT	STANDARD (NEW)	SERVICE LIMIT
Trans-mission	Diameter of needle bearing contact area		
	On mainshaft and stator shaft	22.980—22.993 (0.9047—0.9052)	Wear or damage
	On mainshaft 2nd gear	35.975—35.991 (1.4163—1.4169)	
	On mainshaft 4th gear collar	31.975—31.991 (1.2589—1.2595)	
	On mainshaft 1st gear collar	30.975—30.991 (1.2195—1.2201)	
	On countershaft (L. side)	36.004—36.017 (1.4175—1.4180)	
	On countershaft 3rd gear distance collar	31.975—31.991 (1.2589—1.2595)	
	On countershaft 4th gear	27.980—27.993 (1.1016—1.1021)	
	On countershaft reverse gear collar	31.975—31.991 (1.2589—1.2595)	
	On countershaft 1st gear collar	31.975—31.991 (1.2589—1.2595)	
	On subshaft (L. side)	25.991—26.000 (1.0233—1.0236)	
	On subshaft 4th gear collar	27.980—27.993 (1.1016—1.1021)	
	On reverse idler gear shaft	13.990—14.000 (0.5508—0.5512)	
	On mainshaft 1st gear	35.000—35.016 (1.3780—1.3786)	
	On mainshaft 2nd gear	41.000—41.016 (1.6142—1.6148)	
	On mainshaft 4th gear	38.000—38.016 (1.4961—1.4967)	
	On countershaft 1st gear	38.000—38.016 (1.4961—1.4967)	Wear or damage
	Inside diameter of needle bearing contact area		
	On countershaft 3rd gear	38.000—38.016 (1.4961—1.6967)	Wear or damage
	On countershaft 4th gear	33.000—33.016 (1.2992—1.2998)	
	On countershaft reverse gear	38.000—38.016 (1.4961—1.4967)	
	On subshaft 4th gear	32.000—32.016 (1.2598—1.2605)	
	On reverse idler gear	18.007—18.020 (0.7089—0.7094)	
	On stator shaft (R. side)	29.000—29.013 (1.1417—1.1422)	
	On stator shaft (stator side)	27.000—27.021 (1.0630—1.1638)	
	On reverse idler shaft holder	14.416—14.434 (0.5676—0.5683)	Wear or damage
	End play		
	Mainshaft 1st gear	0.08—0.24 (0.003—0.009)	——
	Mainshaft 2nd gear	0.05—0.13 (0.002—0.0051)	——
	Mainshaft 4th gear	0.05—0.135 (0.002—0.0053)	——
	Countershaft 1st gear	0.1—0.5 (0.004—0.020)	——
	Countershaft 3rd gear	0.05—0.13 (0.002—0.0051)	——
	Countershaft 4th gear	0.05—0.13 (0.002—0.0051)	——
	Subshaft 4th gear	0.05—0.17 (0.002—0.007)	——
	Reverse idler gear	0.05—0.18 (0.002—0.007)	——
	Countershaft reverse gear	0.10—0.25 (0.004—0.010)	——
	Selector hub O.D.	51.87—51.90 (2.042—2.043)	Wear or damage
	Mainshaft 4th gear collar length	45.00—45.03 (1.772—1.773)	——
	Mainshaft 1st gear collar length	27.00—27.15 (1.063—1.069)	——
	Mainshaft 1st gear collar flange thickness	2.5—2.6 (2.098—2.102)	Wear or damage
	Countershaft distance collar length	38.97—39.00 (1.534—1.535)	——
		39.02—39.05 (1.536—1.537)	——
		39.07—39.10 (1.538—1.539)	——
		39.12—39.15 (1.540—1.541)	——
		39.17—39.20 (1.542—1.543)	——
		39.22—39.25 (1.544—1.545)	——
		39.27—39.30 (1.546—1.547)	——
		38.87—38.90 (1.530—1.531)	——
		38.92—38.95 (1.532—1.533)	——
	Countershaft reverse gear collar length	14.5—14.6 (0.571—0.575)	——
	Countershaft reverse gear collar flange thickness	2.4—2.6 (0.094—0.102)	Wear or damage
	Countershaft 1st gear collar length	14.5—14.6 (0.571—0.575)	——
	Countershaft 1st gear collar flange thickness	2.4—2.6 (0.094—0.102)	Wear or damage
	Subshaft 4th gear collar length	24.0—24.1 (0.945—0.949)	Wear or damage
	Subshaft 4th gear collar flange thickness	3.00—3.15 (0.118—0.124)	Wear or damage

(cont'd)

Unit of length: mm (in)

2WD Automatic Transmission M24A (cont'd) — Section 14

	MEASUREMENT	STANDARD (NEW)	SERVICE LIMIT
Trans-mission (cont'd)	Mainshaft 2nd gear thrust washer thickness	3.47—3.50 (0.137—0.138)	Wear or damage
		3.52—3.55 (0.139—0.140)	
		3.57—3.60 (0.141—0.142)	
		3.62—3.65 (0.143—0.144)	
		3.67—3.70 (0.145—0.146)	
		3.72—3.75 (0.147—0.148)	
		3.77—3.80 (0.148—0.150)	
		3.82—3.85 (0.151—0.152)	
		3.87—3.90 (0.153—0.154)	Wear or damage
	Thrust washer thickness		
	Mainshaft 4th gear	4.45—4.55 (0.175—0.179)	Wear or damage
	Mainshaft ball bearing L. side	3.45—3.55 (0.136—0.140)	
	Mainshaft 1st gear L. side	1.45—1.50 (0.057—0.057)	
	Mainshaft 1st gear R. side	3.43—3.50 (0.135—0.138)	Wear or damage
	Countershaft 3rd gear thrust washer thickness	2.97—3.00 (0.117—0.118)	Wear or damage
		3.02—3.05 (0.119—0.120)	
		3.07—3.10 (0.121—0.122)	
		3.12—3.15 (0.123—0.124)	
		3.17—3.20 (0.125—0.126)	
		3.22—3.25 (0.127—0.128)	
		3.27—3.30 (0.129—0.130)	
		3.32—3.35 (0.131—0.132)	
		3.37—3.40 (0.133—0.134)	
		3.42—3.45 (0.135—0.136)	
		3.47—3.50 (0.137—0.138)	Wear or damage
	Mainshaft 4th gear thrust washer thickness	2.93—3.00 (0.115—0.118)	Wear or damage
	One-way clutch contact area I.D.		
	Countershaft 1st gear	83.339—83.365 (3.2810—3.2821)	
	Parking gear	66.685—66.698 (2.6254—2.6259)	Wear or damage
	Mainshaft feed pipe A, O.D.	8.97—8.98 (0.353—0.354)	8.95 (0.352)
	Mainshaft feed pipe B, O.D.	5.97—5.98 (0.2350—0.2354)	5.95 (0.234)
	Countershaft feed pipe O.D	7.97—7.98 (0.3138—0.3142)	7.95 (9.313)
	Subshaft feed pipe O.D.	7.97—7.98 (0.3138—0.3142)	7.95 (0.313)
	Mainshaft sealing ring thickness (29 mm and 35 mm)	1.980—1.995 (0.0780—0.0785)	1.80 (0.071)
	Mainshaft bushing I.D.	6.018—6.030 (0.2369—0.2374)	6.045 (0.2380)
	Mainshaft bushing I.D.	9.000—9.015 (0.3543—0.3549)	9.030 (0.355)
	Countershaft bushing I.D.	8.000—8.015 (0.3150—0.3156)	8.030 (0.3161)
	Subshaft bushing I.D.	8.000—8.015 (0.3150—0.3156)	8.030 (0.3161)
	Mainshaft sealing ring groove width	2.025—2.060 (0.0797—0.081)	2.080 (0.082)
Regulator valve body	Sealing ring contact I.D.	35.000—35.025 (1.3780—1.3782)	35.050 (1.3799)
Shifting device and parking brake control	Reverse shift fork finger thickness	5.90—6.00 (0.232—0.236)	5.40 (0.213)
	Parking brake ratchet pawl	——	Wear or other defect
	Parking brake gear	——	
	Throttle cam stopper height	27.0—27.1 (1.063—1.067)	——
Servo body	Shift fork shaft bore I.D.	14.000—14.010 (0.5512—0.5516)	——
	Shift fork shaft valve bore I.D.	37.000—37.039 (1.4567—1.4582)	37.045 (1.4585)
Oil pump	Oil pump gear side clearance	0.03—0.05 (0.001—0.002)	0.07 (0.003)
	Oil pump gear-to-body clearance Drive	0.210—0.265 (0.0083—0.0104)	——
	Driven	0.070—0.125 (0.0028—0.0049)	——
	Oil pump driven gear I.D.	14.016—14.034 (0.5518—0.5525)	Wear or damage
	Oil pump shaft O.D.	13.980—13.990 (0.5504—0.5508)	Wear or damage

(cont'd)

Standards and Service Limits

2WD Automatic Transmission M24A (cont'd) — Section 14

	MEASUREMENT	STANDARD (NEW)			
		Wire Dia.	O.D.	Free Length	No. of Coils
Springs D16Z6, D16A7, D15B2	Regulator valve spring A	1.8 (0.07)	14.7 (0.58)	88.6 (3.49)	16.5
	Regulator valve spring B	1.8 (0.07)	9.6 (0.38)	44.0 (1.73)	7.5
	Stator reaction spring	5.5 (0.22)	26.4 (1.04)	30.3 (1.19)	2.1
	Torque converter check valve spring	1.1 (0.04)	8.4 (0.33)	33.8 (1.33)	12.5
	Modulator valve spring	1.2 (0.05)	7.0 (0.28)	27.2 (1.07)	8.0
	Relief valve spring	1.1 (0.04)	8.6 0.34)	37.1 (1.46)	13.4
	Cooler check valve spring	1.1 (0.04)	8.4 (0.33)	33.8 (1.33)	12.5
	Governor spring A	1.0 (0.04)	18.8 (0.74)	32.9 (1.30)	4.1
	Governor spring B	0.9 (0.04)	11.8 (0.47)	27.8 (1.09)	6.0
		0.9 (0.04)	11.8 (0.47)	29.1 (1.15)	6.0
	2—3 orifice control valve spring	1.0 (0.04)	6.6 (0.26)	29.9 (1.18)	14.7
	4—3 kick-down valve spring	1.0 (0.04)	6.6 (0.26)	29.9 (1.18)	14.7
	2/3—4 orifice control valve spring	1.0 (0.04)	8.6 (0.34)	52.2 (2.06)	18.2
	Throttle valve spring A	1.0 (0.04)	8.5 (0.33)	22.2 (0.87)	6.0
	Throttle valve spring A	1.0 (0.04)	8.5 (0.33)	22.1 (0.87)	5.5
	Throttle valve spring A	1.1 (0.04)	8.5 (0.33)	22.3 (0.87)	8.1
	Throttle valve spring A	1.1 (0.04)	8.5 (0.33)	22.3 (0.87)	7.6
	Throttle valve adjust spring B	0.8 (0.03)	6.2 (0.24)	30 (1.18)	8
	Throttle valve adjust spring A	0.8 (0.03)	6.2 (0.24)	27 (1.06)	8.5
	Throttle valve spring B	1.4 (0.06)	8.5 (0.33)	41.5 (1.63)	10.5
	Throttle valve spring B	1.4 (0.06)	8.5 (0.33)	41.5 (1.63)	11.2
	Throttle valve spring B	1.4 (0.06)	8.5 (0.33)	41.6 (1.64)	12.4
	1—2 shift valve spring	0.45 (0.018)	5.1 (0.20)	52.8 (2.08)	29
	1—2 shift valve ball spring	0.45 (0.018)	4.5 (0.18)	10.7 (0.42)	12.7
	2—3 shift valve spring	0.9 (0.04)	7.1 (0.28)	64.7 (2.55)	32.1
	2—3 shift valve ball spring	0.4 (0.02)	4.5 (0.18)	14.7 (0.58)	7.3
	3—4 shift valve spring	0.9 (0.04)	9.6 (0.38)	32.5 (1.28)	10.3
	3—4 shift valve ball spring	0.5 (0.02)	4.5 (0.18)	11.3 (0.44)	7.4
	1st-hold accumulator spring	4.0 (0.16)	21.5 (0.85)	71.7 (2.82)	8.3
	1st accumulator spring	2.6 (0.10)	24.3 (0.96)	79.8 (3.14)	8.5
	2nd accumulator spring	3.5 (0.14)	22 (0.87)	75.4 (2.97)	8.7
	3rd accumulator spring	2.9 (0.11)	17.5 (0.69)	81.5 (3.21)	13.9
	4th accumulator spring	2.8 (0.11)	16 (0.63)	85.0 (3.35)	15.8
	Lock-up shift valve spring	0.9 (0.04)	7.6 (0.30)	73.7 (2.90)	32
	Lock-up timing valve spring	0.8 (0.03)	6.6 (0.26)	61.5 (2.42)	27.6
	Lock-up control valve spring C	0.8 (0.03)	6.6 (0.26)	50.6 (1.99)	24.6
	Lock-up control valve spring D	0.8 (0.03)	6.6 (0.26)	50.6 (1.99)	24.6
	Lock-up control valve spring E	0.8 (0.03)	6.6 (0.26)	50.6 (1.99)	24.6
	Governor cut valve spring	0.8 (0.03)	7.6 (0.30)	44.5 (1.75)	17
	CPC valve spring A	0.8 (0.03)	8.4 (0.33)	25.5 (1.00)	8.1
	CPC valve spring B	0.8 (0.03)	8.4 (0.33)	25.5 (1.00)	8.1
	Reverse control valve spring	0.7 (0.03)	7.1 (0.28)	40 (1.57)	20.8
	3—2 timing valve spring	1.2 (0.05)	8.6 (0.34)	46.9 (1.85)	15.2
	3—2 kick-down spring	1.3 (0.05)	8.6 (0.34)	45.6 (1.80)	17
	Servo control valve spring	0.9 (0.04)	6.4 (0.25)	34.1 (1.34)	17.5
	2—1 timing valve spring	0.7 (0.03)	5.6 (0.22)	33 (1.30)	21.7
	4th exhaust valve spring	0.9 (0.04)	6.6 (0.26)	43.3 (1.70)	22

(cont'd)

Unit of length: mm (in)

2WD Automatic Transmission M24A (cont'd) — Section 14

	MEASUREMENT	STANDARD (NEW)			
		Wire Dia.	O.D.	Free Length	No. of Coils
Springs D16A8	Regulator valve spring A	1.8 (0.07)	14.7 (0.58)	88.6 (3.49)	16.5
	Regulator valve spring B	1.8 (0.07)	9.6 (0.38)	44.0 (1.73)	7.5
	Stator reaction spring	5.5 (0.22)	26.4 (1.04)	30.3 (1.19)	2.1
	Torque converter check valve spring	1.1 (0.04)	8.4 (0.33)	33.8 (1.33)	12.5
	Modulator valve spring	1.2 (0.05)	7.0 (0.28)	27.6 (1.09)	7.7
	Relief valve spring	1.1 (0.04)	8.6 (0.34)	37.1 (1.46)	13.4
	Cooler check valve spring	1.1 (0.04)	8.4 (0.33)	33.8 (1.33)	12.5
	Governor spring A	1.0 (0.04)	18.8 (0.74)	18.0 (0.71)	4.0
	Governor spring B	0.8 (0.03)	11.8 (0.47)	30.0 (1.18)	6.3
		0.8 (0.03)	11.8 (0.47)	34.4 (1.35)	6.3
		0.8 (0.03)	11.8 (0.47)	30.9 (1.22)	6.0
	2—3 orifice control valve spring	1.0 (0.04)	6.6 (0.26)	29.9 (1.18)	14.7
	4—3 kick-down valve spring	1.0 (0.04)	6.6 (0.26)	29.9 (1.18)	14.7
	2/3—4 orifice control valve spring	1.0 (0.04)	8.6 (0.34)	52.2 (2.06)	18.2
	Throttle valve spring A	1.0 (0.04)	8.5 (0.33)	22.2 (0.87)	6.0
	Throttle valve spring A	1.0 (0.04)	8.5 (0.33)	22.1 (0.87)	5.5
	Throttle valve spring A	1.1 (0.04)	8.5 (0.33)	22.3 (0.87)	8.1
	Throttle valve spring A	1.0 (0.04)	8.5 (0.33)	22.3 (0.87)	6.2
	Throttle valve adjust spring B	0.8 (0.03)	6.2 (0.24)	30 (1.18)	8
	Throttle valve adjust spring A	0.8 (0.03)	6.2 (0.24)	27 (1.06)	8.5
	Throttle valve spring B	1.4 (0.06)	8.5 (0.33)	41.5 (1.63)	10.5
	Throttle valve spring B	1.4 (0.06)	8.5 (0.33)	41.5 (1.63)	11.2
	Throttle valve spring B	1.4 (0.06)	8.5 (0.33)	41.6 (1.64)	12.4
	1—2 shift valve spring	0.5 (0.02)	6.1 (0.24)	52.0 (2.05)	18.8
	1—2 shift valve ball spring	0.45 (0.018)	4.5 (0.18)	10.7 (0.42)	12.7
	2—3 shift valve spring	0.9 (0.04)	7.6 (0.30)	53.8 (2.12)	28.5
	2—3 shift valve ball spring	0.45 (0.018)	4.5 (0.18)	12.0 (0.47)	6.7
	3—4 shift valve spring	0.8 (0.03)	9.6 (0.38)	27.1 (1.07)	7.8
	3—4 shift valve ball spring	0.45 (0.018)	4.5 (0.18)	13.5 (0.53)	8.2
	1st-hold accumulator spring	4.0 (0.16)	21.5 (0.85)	71.7 (2.82)	8.3
	1st accumulator spring	2.6 (0.10)	24.3 (0.96)	79.8 (3.14)	8.5
	2nd accumulator spring	3.5 (0.14)	22 (0.87)	75.4 (2.97)	8.7
	3rd accumulator spring	2.9 (0.11)	17.5 (0.69)	81.5 (3.21)	13.9
	4th accumulator spring	2.8 (0.11)	16 (0.63)	85.0 (3.35)	15.8
	Lock-up shift valve spring	0.9 (0.04)	7.6 (0.30)	73.7 (2.90)	32
	Lock-up timing valve spring	0.7 (0.03)	6.6 (0.26)	64.3 (2.53)	22.4
	Lock-up control valve spring C	0.8 (0.03)	6.6 (0.26)	50.6 (1.99)	24.6
	Lock-up control valve spring D	0.8 (0.03)	6.6 (0.26)	50.6 (1.99)	24.6
	Lock-up control valve spring E	0.8 (0.03)	6.6 (0.26)	50.6 (1.99)	24.6
	Governor cut valve spring	0.8 (0.03)	7.6 (0.30)	44.5 (1.75)	17
	CPC valve spring A	0.8 (0.03)	8.4 (0.33)	25.5 (1.00)	8.1
	CPC valve spring B	0.8 (0.03)	8.4 (0.33)	25.5 (1.00)	8.1
	Reverse control valve spring	0.7 (0.03)	7.1 (0.28)	40 (1.57)	20.8
	3—2 timing valve spring	1.2 (0.05)	8.6 (0.34)	46.9 (1.85)	15.2
	3—2 kick-down spring	1.3 (0.05)	8.6 (0.34)	45.6 (1.80)	17
	Servo control valve spring	0.9 (0.04)	6.4 (0.25)	34.1 (1.34)	17.5
	2—1 timing valve spring	0.7 (0.03)	5.6 (0.22)	33 (1.30)	21.7
	4th exhaust valve spring	0.9 (0.04)	6.6 (0.26)	43.3 (1.70)	22

(cont'd)

Standards and Service Limits

4WD Automatic Transmission M25A— Section 14

	MEASUREMENT		STANDARD (NEW)	SERVICE LIMIT
Transmission fluid	Capacity ℓ (US qt, Imp qt)		6.4 (6.8, 5.6) for overhaul 3.2 (3.4, 2.8) for fluid change	
Hydraulic pressure kPa (kg/cm^2, psi)	Line pressure at 2,000 min^{-1} (rpm) N or P		850—900 (8.5—9.0, 121—128)	800 (8.0, 114)
	2nd clutch pressure at 2,000 min^{-1} (rpm) D_4 3rd clutch pressure at 2,000 min^{-1} (rpm) D_4 4th clutch pressure at 2,000 min^{-1} (rpm) D_4		500 (5.0, 71) *throttle fully closed* | 850—900 (8.5—9.0, 121—128) throttle more than 3/8 opened	450 (4.5, 61) throttle fully closed | 800 (8.0, 114) throttle more than 3/8 opened
	2nd clutch pressure at 2,000 min^{-1} (rpm) 2		850—900 (8.5—9.0, 121—128)	800 (8.0, 114)
	1st clutch pressure at 2,000 min^{-1} (rpm) D_4 or 1		850—900 (8.5—9.0, 121—128)	800 (8.0, 114)
	1st-hold clutch pressure at 2,000 min^{-1} (rpm) 1		850—900 (8.5—9.0, 121—128)	800 (8.0, 114)
	Throttle pressure B	Throttle fully closed Throttle fully open	0 850—900 (8.5—9.0, 121—128)	—— 800 (8.0, 114)
Stall speed min^{-1} (rpm) (check with car on level ground)			2,300—2,900	——
Clutch	Clutch initial clearance	1st, 2nd 3rd, 4th 1st-hold	0.65—0.85 (0.026—0.033) 0.40—0.60 (0.016—0.024) 0.5—0.8 (0.02—0.03)	—— —— ——
	Clutch return spring free length	1st 2nd, 3rd, 4th 1st-hold	31.0 (1.22) 30.5 (1.20) 34.6 (1.36)	29.0 (1.14) 28.5 (1.12) 32.6 (1.28)
	Clutch disc thickness		1.88—2.00 (0.074—0.079)	Until grooves worn out
	Clutch plate thickness	1st Except 1st	1.55—1.65 (0.061—0.065) 1.95—2.05 (0.077—0.081)	Discoloration Discoloration
	Clutch end plate thickness (except 1st-hold)	MARK 1 MARK 2 MARK 3 MARK 4 MARK 5 MARK 6 MARK 7 MARK 8 MARK 9 MARK 10 MARK 11 MARK 12 MARK 13	2.3—2.4 (0.091—0.094) 2.4—2.5 (0.094—0.098) 2.5—2.6 (0.098—0.102) 2.6—2.7 (0.102—0.106) 2.7—2.8 (0.106—0.110) 2.8—2.9 (0.110—0.114) 2.9—3.0 (0.114—0.118) 3.0—3.1 (0.118—0.122) 3.1—3.2 (0.122—0.126) 3.2—3.3 (0.126—0.130) 2.0—2.1 (0.079—0.083) 2.1—2.2 (0.083—0.087) 2.2—2.3 (0.087—0.091)	Discoloration ↕ Discoloration
	Clutch end plate thickness (1st-hold)	MARK 1 MARK 2 MARK 3 MARK 4 NO MARK MARK 6 MARK 7	2.05—2.10 (0.081—0.083) 2.15—2.20 (0.085—0.087) 2.25—2.30 (0.089—0.091) 2.35—2.40 (0.093—0.094) 2.45—2.50 (0.096—0.098) 2.55—2.60 (0.100—0.102) 2.65—2.70 (0.104—0.106)	Discoloration ↕ Discoloration

(cont'd)

Unit of length: mm (in)

4WD Automatic Transmission M25A (cont'd) — Section 14

	MEASUREMENT	STANDARD (NEW)	SERVICE LIMIT
Trans-mission	Diameter of needle bearing contact area		
	On mainshaft and stator shaft	19.980–19.993 (0.7866–0.7871)	Wear or damage
	On mainshaft 2nd gear	35.975–35.991 (1.4163–1.4169)	
	On mainshaft 4th gear collar	31.975–31.991 (1.2589–1.2595)	
	On mainshaft 1st gear collar	30.975–30.991 (1.2195–1.2201)	
	On countershaft (L. side)	36.004–36.017 (1.4175–1.4180)	
	On countershaft 3rd gear distance collar	31.975–31.991 (1.2589–1.2595)	
	On countershaft 4th gear	27.980–27.993 (1.1016–1.1021)	
	On countershaft reverse gear collar	29.980–29.993 (1.1803–1.1808)	
	On countershaft 1st gear collar	31.975–31.991 (1.2589–1.2595)	
	On subshaft (L. side)	27.991–28.000 (1.1020–1.1024)	
	On subshaft 4th gear collar	29.980–29.993 (1.1803–1.1808)	
	On reverse idler gear shaft	13.990–14.000 (0.5508–0.5512)	Wear or damage
	Inside diameter of needle bearing contact area		
	On mainshaft 1st gear	36.000–36.016 (1.4173–1.4179)	Wear or damage
	On mainshaft 2nd gear	41.000–41.016 (1.6142–1.6148)	
	On mainshaft 4th gear	38.000–38.016 (1.4961–1.4967)	
	On countershaft 1st gear	38.000–38.016 (1.4961–1.4967)	
	On countershaft 3rd gear	38.000–38.016 (1.4961–1.6967)	
	On countershaft 4th gear	33.000–33.016 (1.2992–1.2998)	
	On countershaft reverse gear	36.000–36.016 (1.4173–1.4179)	
	On subshaft 4th gear	35.000–35.016 (1.3780–1.3786)	
	On reverse idler gear	18.007–18.020 (0.7089–0.7094)	
	On stator shaft (R. side)	26.000–26.013 (1.0236–1.0241)	
	On stator shaft (stator side)	24.000–24.021 (0.9449–0.9457)	
	On reverse idler shaft holder	14.416–14.434 (0.5676–0.5683)	Wear or damage
	End play		
	Mainshaft 1st gear	0.08–0.24 (0.003–0.009)	—
	Mainshaft 2nd gear	0.07–0.15 (0.003–0.006)	—
	Mainshaft 4th gear	0–0.08 (0–0.003)	—
	Countershaft 1st gear	0.1–0.45 (0.004–0.018)	—
	Countershaft 3rd gear	0.07–0.15 (0.003–0.006)	—
	Countershaft 4th gear	0.07–0.15 (0.003–0.006)	—
	Reverse idler gear	0.05–0.18 (0.002–0.007)	—
	Countershaft reverse gear	0.1–0.45 (0.004–0.018)	—
	Selector hub O.D.	51.87–51.90 (2.042–2.043)	Wear or damage
	Mainshaft 4th gear collar length	46.50–46.53 (1.8307–1.8319)	—
	Mainshaft 1st gear collar length	24.50–24.55 (0.9646–0.9665)	—
	Mainshaft 1st gear collar flange thickness	2.5–2.6 (2.098–2.102)	Wear or damage
	Countershaft distance collar length	38.97–39.00 (1.534–1.535)	—
		39.02–39.05 (1.536–1.537)	—
		39.07–39.10 (1.538–1.539)	—
		39.12–39.15 (1.540–1.541)	—
		39.17–39.20 (1.542–1.543)	—
		39.22–39.25 (1.544–1.545)	—
		39.27–39.30 (1.546–1.547)	—
		38.87–38.90 (1.530–1.531)	—
		38.92–38.95 (1.532–1.533)	—
	Countershaft reverse gear collar length	14.5–14.55 (0.5709–0.5728)	—
	Countershaft reverse gear collar flange thickness	2.45–2.55 (0.096–0.100)	Wear or damage
	Countershaft 1st gear collar length	14.5–14.55 (0.5709–0.5728)	—
	Countershaft 1st gear collar flange thickness	2.45–2.55 (0.096–0.100)	Wear or damage
	Subshaft 4th gear collar length	24.0–24.1 (0.945–0.949)	Wear or damage
	Subshaft 4th gear collar length of needle bearing contact area	21.0–21.1 (0.8268–0.8307)	Wear or damage

(cont'd)

Standards and Service Limits

4WD Automatic Transmission M25A (cont'd) — Section 14

	MEASUREMENT	STANDARD (NEW)	SERVICE LIMIT
Trans-mission (cont'd)	Mainshaft 2nd gear thrust washer thickness	3.47–3.50 (0.137–0.138) 3.52–3.55 (0.139–0.140) 3.57–3.60 (0.141–0.142) 3.62–3.65 (0.143–0.144) 3.67–3.70 (0.145–0.146) 3.72–3.75 (0.147–0.148) 3.77–3.80 (0.148–0.150) 3.82–3.85 (0.151–0.152) 3.87–3.90 (0.153–0.154)	Wear or damage ↕ Wear or damage
	Thrust washer thickness Mainshaft 4th gear Mainshaft ball bearing L. side Mainshaft 1st gear L. side Mainshaft 1st gear R. side	 4.45–4.55 (0.175–0.179) 2.95–3.05 (0.1161–0.1201) 1.45–1.50 (0.057–0.057) 2.43–2.50 (0.096–0.098)	 Wear or damage ↕ Wear or damage
	Countershaft 3rd gear thrust washer thickness	2.87–2.90 (0.113–0.114) 2.92–2.95 (0.115–0.116) 2.97–3.00 (0.117–0.118) 3.02–3.05 (0.119–0.120) 3.07–3.10 (0.121–0.122) 3.12–3.15 (0.123–0.124) 3.17–3.20 (0.125–0.126) 3.22–3.25 (0.127–0.128) 3.27–3.30 (0.129–0.130) 3.32–3.35 (0.131–0.132) 3.37–3.40 (0.133–0.134)	Wear or damage ↕ Wear or damage
	Mainshaft 4th gear thrust washer thickness One-way clutch contact area I.D. Countershaft 1st gear Parking gear Mainshaft feed pipe A, O.D. Mainshaft feed pipe B, O.D. Countershaft feed pipe O.D Subshaft feed pipe O.D. Mainshaft sealing ring thickness Mainshaft bushing I.D. Mainshaft bushing I.D. Countershaft bushing I.D. Subshaft bushing I.D. Mainshaft sealing ring groove width	2.93–3.00 (0.115–0.118) 83.339–83.365 (3.2810–3.2821) 66.685–66.698 (2.6254–2.6259) 8.97–8.98 (0.353–0.354) 5.97–5.98 (0.2350–0.2354) 7.97–7.98 (0.3138–0.3142) 5.97–5.98 (0.2350–0.2354) 1.980–1.995 (0.0780–0.0785) 6.018–6.030 (0.2369–0.2374) 9.000–9.015 (0.3543–0.3549) 8.000–8.015 (0.3150–0.3156) 6.018–6.030 (0.2369–0.2374) 2.025–2.060 (0.0797–0.081)	Wear or damage ↕ Wear or damage 8.95 (0.352) 5.95 (0.234) 7.95 (9.313) 5.95 (0.2343) 1.80 (0.071) 6.045 (0.2380) 9.030 (0.355) 8.030 (0.3161) 6.045 (0.2380) 2.080 (0.082)
Regulator valve body	Sealing ring contact I.D.	35.000–35.025 (1.3780–1.3782) 32.000–32.025 (1.2598–1.2608)	35.050 (1.3799) 32.05 (1.262)
Shifting device and parking brake control	Reverse shift fork finger thickness Parking brake ratchet pawl Parking brake gear Throttle cam stopper height	5.90–6.00 (0.232–0.236) —— —— 27.0–27.1 (1.063–1.067)	5.40 (0.213) Wear or other defect ——
Servo body	Shift fork shaft bore I.D. A B C Shift fork shaft valve bore I.D.	14.000–14.005 (0.5512–0.5514) 14.006–14.010 (0.5514–0.5516) 14.011–14.015 (0.5516–0.5518) 37.000–37.039 (1.4567–1.4582)	—— 37.045 (1:4585)
Oil pump	Oil pump gear side clearance Oil pump gear-to-body clearance Drive Driven Oil pump driven gear I.D. Oil pump shaft O.D.	0.03–0.05 (0.001–0.002) 0.240–0.266 (0.009–0.010) 0.063–0.088 (0.002–0.003) 14.016–14.034 (0.5518–0.5525) 13.980–13.990 (0.5504–0.5508)	0.07 (0.003) —— —— Wear or damage Wear or damage

(cont'd)

Unit of length: mm (in)

4WD Automatic Transmission M25A (cont'd) — Section 14

	MEASUREMENT	STANDARD (NEW)			
		Wire Dia.	O.D.	Free Length	No. of Coils
Springs	Regulator valve spring A	1.8 (0.07)	14.7 (0.58)	86.5 (3.41)	16.5
	Regulator valve spring B	1.8 (0.07)	9.6 (0.38)	44.0 (1.73)	7.5
	Stator reaction spring	5.5 (0.22)	31.9 (1.26)	30.3 (1.19)	2.1
	Torque converter check valve spring	1.1 (0.04)	8.4 (0.33)	36.4 (1.43)	12
	Relief valve spring	1.0 (0.04)	8.4 (0.33)	52.0 (2.05)	23
	2nd orifice control valve spring	0.8 (0.03)	6.6 (0.26)	38.5 (1.52)	28
	Servo orifice control valve spring	0.9 (0.04)	6.1 (0.24)	35.9 (1.41)	20
	Throttle control valve B spring	1.6 (0.06)	8.5 (0.33)	41.3 (1.63)	13.9
	Throttle control valve B adjuster spring	0.8 (0.03)	6.2 (0.24)	30.0 (1.18)	8
	1—2 shift spring	0.9 (0.04)	8.6 (0.34)	40.4 (1.59)	14.5
	2—3 shift spring	0.8 (0.03)	8.6 (0.34)	35.8 (1.41)	10.6
	3—4 shift spring	0.8 (0.03)	7.6 (0.30)	59.7 (2.35)	22.7
	1st accumulator A spring	2.0 (0.08)	13.7 (0.54)	71.3 (2.81)	11.0 and 8.0
	1st accumulator B spring	3.2 (0.13)	24.3 (0.96)	59.5 (2.34)	5.8
	4th accumulator spring	3.5 (0.14)	18.6 (0.73)	77.0 (3.03)	11
	2nd accumulator spring	2.7 (0.11)	16.1 (0.63)	88.4 (3.48)	16.0
	3rd accumulator spring	2.8 (0.11)	15.5 (0.61)	78.7 (3.10)	15
	L/C control springs	0.8 (0.03)	6.6 (0.26)	47.9 (1.89)	25.1
	L/C timing valve B spring	0.9 (0.04)	5.6 (0.22)	43.6 (1.72)	30.1
	CPC valve spring	1.4 (0.06)	9.4 (0.37)	31.6 (1.24)	10.9
	L/C shift valve spring	1.1 (0.04)	8.1 (0.32)	51.0 (2.01)	21.3
	4—2 kick down valve spring	0.9 (0.04)	6.4 (0.25)	42.7 (1.68)	20.8
	Cooler relief valve spring	1.1 (0.04)	8.4 (0.33)	36.4 (1.43)	12
	Modulator valve springs A and B	0.9 (0.04)	8.6 (0.34)	18.2 (0.72)	5.54
	Servo control valve spring	1.0 (0.04)	8.1 (0.32)	42.0 (1.65)	16.5
	4th exhaust valve spring	0.9 (0.04)	6.6 (0.26)	37.0 (1.46)	18.7
	4—3 kick down valve spring	0.9 (0.04)	6.4 (0.25)	42.7 (1.68)	20.8

Standards and Service Limits

Differential 2WD M/T S20 — Section 15

		MEASUREMENT	STANDARD (NEW)	SERVICE LIMIT
Ring gear		Backlash	0.07—0.130 (0.0028—0.0051)	0.180 (0.0071)
Differential carrier		Pinion shaft bore diameter	18.000—18.018 (0.7087—0.7094)	——
		Carrier-to-pinion shaft clearance	0.013—0.047 (0.0005—0.0019)	0.095 (0.004)
		Drivershaft bore diameter	26.025—26.045 (1.0246—1.0254)	——
			28.025—28.045 (1.1033—1.1041)	——
		Carrier-to-driveshaft clearance	0.045—0.086 (0.0018—0.0034)	0.14 (0.006)
Differential pinion gear		Backlash	0.05—0.15 (0.002—0.006)	——
		Pinion gear bore diameter	18.042—18.066 (0.7103—0.7113)	——
		Pinion gear-to-pinion shaft clearance	0.055—0.095 (0.0021—0.0037)	0.150 (0.0059)
Set ring-to-bearing outer race			0—0.1 (0—0.004)	——

Differential 2WD M/T Y21 — Section 15

		MEASUREMENT	STANDARD (NEW)	SERVICE LIMIT
Ring gear		Backlash	0.085—0.142 (0.003—0.006)	0.200 (0.008)
Differential carrier		Pinion shaft bore diameter	18.000—18.016 (0.7087—0.7093)	——
		Carrier-to-pinion shaft clearance	0.017—0.045 (0.001—0.002)	0.100 (0.004)
		Drivershaft bore diameter	28.000—28.021 (1.102—1.103)	——
		Carrier-to-driveshaft clearance	0.020—0.062 (0.001—0.002)	0.120 (0.005)
Differential pinion gear		Backlash	0.05—0.15 (0.002—0.006)	——
		Pinion gear bore diameter	18.042—18.066 (0.710—0.711)	——
		Pinion gear-to-pinion shaft clearance	0.059—0.095 (0.002—0.004)	0.150 (0.006)
Set ring-to-bearing outer race			0—0.1 (0—0.004)	——

Differential 2WD A/T M48A — Section 15

		MEASUREMENT	STANDARD (NEW)	SERVICE LIMIT
Ring gear		Backlash	0.082—0.137 (0.0032—0.0054)	0.2 (0.0079)
Differential carrier		Pinion shaft bore diameter	15.000—15.018 (0.5906—0.5913)	——
		Carrier-to-pinion shaft clearance	0.016—0.052 (0.0006—0.0020)	0.1 (0.004)
		Drivershaft bore diameter	26.005—26.025 (1.0238—1.0246)	——
		Carrier-to-driveshaft clearance	0.025—0.063 (0.0010—0.0026)	0.12 (0.005)
Differential pinion gear		Backlash	0.05—0.15 (0.002—0.006)	——
		Pinion gear bore diameter	15.041—15.061 (0.5922—0.5930)	——
		Pinion gear-to-pinion shaft clearance	0.057—0.095 (0.0022—0.0037)	0.15 (0.006)
Set ring-to-bearing outer race			0—0.15 (0—0.006)	Adjust with shim

Unit of length: mm (in)

Differential 2WD A/T M24A — Section 15

	MEASUREMENT	STANDARD (NEW)	SERVICE LIMIT
Final driven gear	Backlash	0.071–0.129 (0.0028–0.0051)	——
Differential carrier	Pinion shaft contact area I.D. Carrier-to-pinion clearance Drivershaft contact area I.D. Carrier-to-driveshaft clearance Ball bearing contact area O.D.	18.000–18.018 (15.8382–15.8540) 0.016–0.052 (0.0006–0.0024) 28.005–28.025 (1.1026–1.1033) 0.025–0.066 (0.0010–0.0026) 40.002–40.018 (1.5749–1.5755)	—— 0.10 (0.004) —— 0.12 (0.005) ——
Differential pinion gear	Backlash I.D. Pinion gear-to-pinion shaft clearance	0.05–0.15 (0.002–0.006) 18.042–18.066 (0.7103–0.7113) 0.059–0.095 (0.0023–0.0037)	—— —— 0.15 (0.006)
Set ring-to-bearing outer race		0–0.15 (0–0.006)	Adjust with shim

Front Differential 4WD Transmission — Section 15

	MEASUREMENT	STANDARD (NEW)	SERVICE LIMIT
Ring gear	Backlash	0.071–0.129 (0.0030–0.0050)	——
Differential carrier	Pinion shaft bore diameter Carrier-to-pinion shaft clearance Drivershaft bore diameter Carrier-to-driveshaft clearance Ball bearing bore diameter	18.000–18.018 (0.7087–0.7094) 0.016–0.052 (0.0006–0.0020) 28.000–28.021 (1.1024–1.1032) 0.025–0.006 (0.0010–0.0026) 40.002–40.018 (1.5749–1.5755)	—— 0.1 (0.004) —— 0.12 (0.005) ——
Differential pinion gear	Backlash Pinion gear bore diamteter Pinion gear-to-pinion shaft clearance	0.05–0.15 (0.002–0.006) 18.042–18.066 (0.7103–0.7112) 0.059–0.095 (0.0023–0.0037)	Adjust with pinion washers —— 0.15 (0.006)

Rear Differential 4WD Transmission without ABS — Section 15

	MEASUREMENT	STANDARD (NEW)	SERVICE LIMIT
Differential carrier assembly	Oil capacity — Replace Disassemble	0.65 ℓ (0.69 US. qt., 0.57 Imp.qt) 0.70 ℓ (0.74 US. qt., 0.62 Imp. qt)	—— ——
Differential carrier	Diameter of taper bearing contact area Front drive pinion bearing Rear drive pinion bearing Side bearing	 57.979–58.009 (2.2826–2.2838) 71.979–72.009 (2.8338–2.8350) 68.000–68.030 (2.6772–2.6783)	 58.06 (2.286) 72.06 (2.837) 68.08 (2.680)
Differential case	Diameter of diff. pinion shaft contact area Case-to-diff. pinion shaft Diameter of drive shaft contact area Case-to-drive shaft clearance Diameter of taper bearing contact area	18.000–18.018 (0.7087–0.7094) 0.016–0.052 (0.0006–0.0020) 26.005–26.025 (1.0236–1.0246) 0.025–0.066 (0.0010–0.0026) 40.002–40.018 (1.5749–1.5755)	—— 0.1 (0.004) —— 0.12 (0.005) 39.95 (1.573)
Differential pinion gear	Backlash I.D. Gear-to-pinion shaft clearance	0.05–0.15 (0.002–0.006) 18.042–18.066 (0.7103–0.7113) 0.059–0.095 (0.0022–0.0037)	Adjust with washer —— 0.15 (0.006)
Hypoid drive pinion gear	Backlash Diameter of taper bearing contact area Front pinion bearing Rear pinion bearing	0.11–0.16 (0.004–0.006) 27.987–28.000 (1.1018–1.1024) 30.002–30.018 (1.1812–1.1818)	Adjust with a shim 27.93 (1.100) 29.95 (1.179)

Standards and Service Limits

Rear Differential 4WD Transmission with ABS — Section 15

	MEASUREMENT	STANDARD (NEW)	SERVICE LIMIT
Clutch housing	Fluid Capacity — *Disassembly*	0.31 ℓ (0.33 US. qt., 0.27 Imp. qt)	
Differential carrier assembly	Oil capacity — Replace Disassembly	0.93 ℓ (0.98 US. qt., 0.82 Imp. qt) 1.00 ℓ (1.06 US. qt., 0.88 Imp. qt)	—— ——
Hypoid drive pinion gear	Backlash	0.10—0.15 (0.004—0.006)	Adjust with shim
2-4 shift fork	Fork projection width for 2—4 sleeve groove	6.8—6.9 (0.268—0.272)	——
Clearance of clutch hub to clutch peace		0.05—0.25 (0.002—0.100) max	——
Preroad of hypoid drive pinion	N•m (kg-m, lb-ft)	98—160 (10.0—16.3, 22—36)	——
Total preroad of hypoid drive pinion and bisccous coupling unit	N•m (kg-m, lb-ft)	109—175 (11.1—17.8, 25—39)	——

Steering — Section 17

	MEASUREMENT	STANDARD (NEW)
Steering wheel	Play at steering wheel circumference Starting load at steering wheel circumference N (kg, lb) Manual steering Power steering — Engine running	0—10 (0—0.39) 13—18 (1.3—1.8, 2.87—3.97) 30 (3.0, 6.6) 25 (2.5, 5,5)
Gearbox	Angle of rack-huide-screw loosened from locked position — M/S P/S LHD RHD Preload at pinion gear shaft N•m (kg-cm, lb-in) — M/S P/S	50° ± 10° $20^{\circ}\,^{+5^{\circ}}_{-0^{\circ}}$ 25° max. 0.5—1.7 (5—17, 4.3—14.8) 0.6—1.1 (6—11, 5.21—9.55)
Pump	Pump pressure with valve closed (oil temp./speed: 40°C (105°F) min./idle. Do not run for more than 5 seconds). kPa (kg/cm², psi) — LHD RHD	8,000—9,000 (80—90, 1,138—1,280) 5,500—6,500 (55—65, 398—470)
Power steering fluid	Recommended power steering fluid Fluid capacity ℓ (US qt, Imp qt) — System LHD RHD Reservoir	HONDA Power Steering Fluid-V 1.1 (1.16, 0.97) 1.0 (1.06, 0.88) 0.4 (0.42, 0.35)
Power steering belt	Deflection with 100 N (10 kg, 22 lb) between pulleys Except D16A8, D16A9 D16A8, D16A9	8.0—12.0 (0.31—0.47) with used belt 6.0—9.5 (0.24—0.37) with new belt 5.5—9.0 (0.22—0.35) with new belt
	Tension measured with belt tension gauge N (kg, lb) Except D16A8, D16A9 D16A8, D16A9	350—500 (35—50, 77—110) with used belt 500—700 (50—70, 110—154) with new belt 550—750 (55—75, 121—165) with new belt

M/S: manual steering, P/S: Power steering.

Unit of length: mm (in)

Suspension — Section 18

	MEASUREMENT			STANDARD (NEW)	SERVICE LIMIT
Wheel alignment	B16A2	Camber	Front	$-0°05' \pm 1°$	——
			Rear	$-0°25' \pm 1°$	——
		Caster	Front	$1°10' \pm 1°$	——
		Total toe	Front	0 ± 3.0 (0 ± 0.12)	——
			Rear	2.0^{+2}_{-1}, $(0.08^{+0.08}_{-0.04})$	——
		Front wheel	Inward wheel	36°03′	——
		Turning angle	Outward wheel	30°37′	——
	Except B16A2 (2WD)	Camber schlou	Front	$0°00' \pm 1°$	——
			Rear	$-0°20' \pm 1°$	——
		Caster	Front	$1°10' \pm 1°$	——
		Total toe	Front	0 ± 3.0 (0 ± 0.12)	——
			Rear	2.0^{+2}_{-1} $(0.08^{+0.08}_{-0.04})$	——
		Front wheel	Inward wheel	40°22′	——
		Turning angle	Outward wheel	33°07′	——
	4WD	Camber	Front	$0°15' \pm 1°$	——
			Rear	$-0°25' \pm 1°$	——
		Caster	Front	$1°05' \pm 1°$	——
		Total toe	Front	0 ± 3.0 (0 ± 0.12)	——
			Rear		
			without ABS	2.0^{+2}_{-1} $(0.08^{+0.08}_{-0.04})$	——
			with ABS	0^{+1}_{-2} $(0^{+0.04}_{-0.08})$	——
		Front wheel	Inward wheel	40°53′	——
		Turning angle	Outward wheel	33°23′	——
Wheel	Rim runout	Aluminum wheel	Axial	0—0.7 (0—0.028)	——
			Radial	0—0.7 (0—0.028)	——
		Steel wheel	Axial	0—1.0 (0—0.039)	——
			Radial	0—1.0 (0—0.039)	——
Wheel bearing	End play		Front	0	0.05 (0.002)
			Rear	0	0.05 (0.002)

Standards and Service Limits

Brakes — Section 19

	MEASUREMENT			STANDARD (NEW)	SERVICE LIMIT
Parking brake lever	Play in stroke at 200 N (20 kg, 44 lb) lever force			To be locked when pulled 6—10 notches	——
Foot brake pedal	Pedal height (with floor mat removed)		A/T	160 (6.30)	——
			M/T	165 (6.50)	——
	Free play			1—5 (0.04—0.20)	——
Master cylinder	Piston-to-pushrod clearance			0—0.4 (0—0.016)	——
Disc brake	Disc thickness	Front		21.0 (0.83)	19.0 (0.75)
			D13B 3D except KQ	17.0 (0.67)	15.0 (0.59)
		Rear		9.0 (0.35)	8.0 (0.31)
	Disc runout	Front		——	0.10 (0.004)
		Rear		——	0.10 (0.004)
	Disc parallelism	Front and rear		——	0.015 (0.0006)
		Front	D13B 3D except KQ	9.5 (0.37)	1.6 (0.06)
			B16A2, D16Z7 (4WD)	10.0 (0.39)	1.6 (0.06)
			Others	9.0 (0.35)	1.6 (0.06)
		Rear		7.5 (0.03)	1.6 (0.06)
Rear brake drum	I.D.		4WD	200 (7.87)	201 (7.91)
			2WD	180 (7.09)	181 (7.13)
	Lining thickness		2WD	4.5 (0.18)	2.0 (0.08)
			4WD	4.0 (0.16)	2.0 (0.08)

	MEASUREMENT		Vacuum mmHg (inHg)	Line pressure kPa (kg/cm², psi)
Brake booster	Characteristics at 200 N (20 kg, 44 lb) pedal force.	D16Z7 (4WD) without ABS	0 (0)	131 (13.1, 186)
			300 (11.8)	546 (54.6, 776)
			500 (19.7)	830 (83.0, 1.180)
		B16A2 without ABS	0 (0)	131 (13.1, 186)
			300 (11.8)	546 (54.6, 776)
			500 (19.7)	765 (76.5, 1,088)
		D16Z7 (4WD) and B16A2 with ABS	0 (0)	92 (9.2, 131)
			300 (11.8)	557 (55.7, 792)
			500 (19.7)	874 (87.4, 1,243)
		D13B 3D	0 (0)	152 (15.2, 216)
			300 (11.8)	531 (53.1, 755)
			500 (19.7)	788 (78.8, 1,120)
		Others	0 (0)	152 (15.2, 216)
			300 (11.8)	638 (63.8, 907)
			500 (19.7)	887 (88.7, 1,261)

Unit of length: mm (in)

Air Conditioner — Section 22

	MEASUREMENT		STANDARD (NEW)		
			MATSUSHITA	NIPPONDENSO	SANDEN
Air conditioner system	Lubricant capacity cc (fl oz)	Condenser Evaprorator Line or hose Receiver	15 (1/2) 35 (1-1/6) 10 (1/3) 10 (1/3)	15 (1/2) 35 (1-1/6) 10 (1/3) 10 (1/3)	20 (2/3) 45 (1-1/2) 10 (1/3) 10 (1/3)
Compressor	Lubricant capacity cc(US oz, Imp oz)		140—150 (4.73—5.07, 4.93—5.28)	60—100 (2.03—3.38, 2.11—3.52)	120—140 (4.06—4.73, 4.22—4.93)
	Stator coil resistance at 20°C (68°F) Ω		3.16—3.50	3.4—3.8	2.65—2.95
	Pulley-to-pressure plate clearance		0.4—0.6 0.016—0.024)	0.35—0.65 (0.014—0.026)	0.35—0.65 (0.014—0.026)
Compressor belt	Deflection with 100 N (10 kg, 22 lb) between pulleys		6.5—10.5 (0.26—0.41) with used belt 5.0—7.0 (0.20—0.28) with new belt		
	Tension measured with belt tension gauge N (kg, lb)		350—500 (35—50, 77—110) with used belt 600—800 (60—80, 132—176) with new belt		

Standards and Service Limits

Electrical — Section 23

Unit of length: mm (in)

	MEASUREMENT	STANDARD (NEW)	
Ignition coil	Rated voltage V	12	
		D12B, D13B, D15B3, D15B4	D15B2, D15Z, D16Z, D16A, B16A
	Primary winding resistance Ω at 25°C (77°F) Secondary winding resistance kΩ at 25°C (77°F)	0.5—0.7 14.4—21.6	0.6—0.8 12.9—19.3
Spark plug	Type Gap	See Section 23 1.1 (0.43)	
Ignition timing	At idling ° BTDC	D12B1 (A/T): 22° (Red) BTDC D15B3 (A/T): 12° (Red) BTDC D13B, D15B3 (M/T), D15B4: 20° (Red) BTDC Others: 16° (Red) BTDC	
Alternator belt	Deflection with 100 N (10 kg, 22 lb) between pulleys Except B16A B16A2	7.0—10.5 (0.28—0.41) with used belt 5.5—8.0 (0.22—0.31) with new belt 5.0—7.0 (0.20—0.28) with new belt	
	Tension measured with belt tension gauge N (kg, lb) Except B16A B16A2	350—550 (35—50, 77—110) with used belt 550—750 (55—75, 121—165) with new belt 700—900 (79—90, 154—198) with new belt	
Alternator (NIPPON-DENSO)	Output 13.5 V at hot A Coil resistance (rotor) Ω Slip ring O.D. Brush length Brush spring tension g (oz)	70 2.9 14.4 (0.567) 10.5 (0.41) 330 (11.6)	—— 14.0 (0.551) 5.5 (0.22) ——
Alternator (MITSUBISHI)	Output 13.5 V at hot A Coil resistance (rotor) Ω Slip ring O.D. Brush length Brush spring tension g (oz)	70 3.4—3.8 22.7 (0.89) 22.0 (0.87) 300—450 (10.6—15.9)	—— 22.2 (0.87) 8.0 (0.31) ——
Alternator (NIPPON-DENSO)	Output 13.5 V at hot A Coil resistance (rotor) Ω Slip ring O.D. Brush length Brush spring tension g (oz)	80 2.8—3.0 14.4 (0.567) 10.5 (0.41) 300—360 (10.6—12.7)	—— 14.0 (0.551) 5.5 (0.22) ——
Starter motor (HITACHI 0.8 kW)	Type Mica depth Commutator runout Commutator O.D. Brush length Brush spring tension (new) N (kg, lb)	Direct drive 0.5—0.8 (0.020—0.031) 0—0.1 (0—0.004) 40.0 (1.574) 14.5—15.5 (0.57—0.61) 13 (1.3, 2.9)	0.2 (0.008) 0.4 (0.016) 39.0 (1.535) 11.0 (0.43) ——
Starter motor (MITSUBA) 1.0 kW, 1.2 kW, 1.4 kW)	Type Mica depth Commutator runout Commutator O.D. Brush length Brush spring tension (new) N (kg, lb) 1.0, 1.2 kW 1.4 kW	Gear reduction 0.4—0.5 (0.016—0.020) 0—0.02 (0—0.001) 28.0—28.1 (1.102—1.106) 14.3—14.7 (0.56—0.58) 18.5—23.5 (1.85—2.35, 4.1—5.2) 16—18 (1.6—1.8, 3.5—4.0)	0.15 (0.006) 0.05 (0.002) 27.5 (1.083) 9.3 (0.37) —— ——
Starter motor, (MIPPON-DENSO 1.0 kW, 1.2 KW)	Type Mica depth Commutator runout Commutator O.D. Brush length Brush spring tension (new) N (kg,lb) 1.0 kW 1.2 kW	Gear reduction 0.5—0.8 (0.020—0.031) 0—0.02 (0—0.001) 29.9—30.0 (1.177—1.181) 13.0—13.5 (0.51—0.53) 17.85—24.15 (1.5—2.415, 3.9—5.3) 14.0—20.0 (1.4—2.0, 3.1—4.4)	0.2 (0.008) 0.05 (0.002) 29.0 (1.14) 8.5 (0.33) —— ——

Design Specifications

	ITEMS			METRIC	ENGLISH	NOTES
DIMENSIONS 2D H/B	Overall length			4,080 mm	160.6 in	
				4,090 mm	161.0 in	For Finland only
				4,070 mm	160.2 in	KQ
				4,075 mm	160.4 in	KY
	Overall width			1,695 mm	66.7 in	
	Overall height			1,345 mm	53.0 in	
	Wheelbase			2,570 mm	101.2 in	
	Track	Front		1,475 mm	58.1 in	
		Rear		1,465 mm	57.8 in	
	Ground clearance			160 mm	6.3 in	
				150 mm	5.9 in	Models with CATA. except VEi
	Seating capacity	Except VTi		Five (5)		
			VTi	Four (4)		
DIMENSIONS 4D	Overall length			4,405 mm	173.4 in	
				4,415 mm	173.8 in	For Finnish model
				4,395 mm	173.0 in	KQ
	Overall width			1,695 mm	66.7 in	
	Overall height			1,375 mm	54.1 in	2WD
				1,395 mm	54.9 in	4WD
	Wheelbase			2,620 mm	103.1 in	
	Track	Front		1,475 mm	58.1 in	
		Rear	2WD	1,465 mm	57.8 in	
			4WD	1,455 mm	57.3 in	
	Ground clearance			160 mm	6.3 in	
				150 mm	5.9 in	Models with CATA.
	Seating capacity	Except VTi		Five (5)		
			VTi	Four (4)		

(cont'd)

Design Specifications

	ITEMS			METRIC	ENGLISH	NOTES
WEIGHT 2D H/B	Curb weight	DX	M/T	925 kg	2,039 lb	KG,KF,KE
				930 kg	2,050 lb	KS
		CX	M/T	970 kg	2,138 lb	KQ
		EX	M/T	940 kg	2,072 lb	KP
				1,008 kg	2,222 lb	KY
			A/T	960 kg	2,116 lb	KP
				1,028 kg	2,266 lb	KY
		GL	M/T	970 kg	2,138 lb	KQ
			A/T	1,001 kg	2,207 lb	KQ
		DXi	M/T	935 kg	2,061 lb	KG
			A/T	965 kg	2,127 lb	KG
		LSi	M/T	950 kg	2,094 lb	KG, KF, KE
				955 kg	2,105 lb	KS
			A/T	980 kg	2,161 lb	KG, KF, KE
				985 kg	2,172 lb	KS
		VEi	M/T	935 kg	2,061 lb	KG, KE
		ESi	M/T	985 kg	2,172 lb	KG, KF
				1,000 kg	2,205 lb	KE
				990 kg	2,183 lb	KS
			A/T	1,015 kg	2,238 lb	KG, KF
				1,030 kg	2,271 lb	KE
				1,020 kg	2,249 lb	KS
		Si	M/T	975 kg	2,150 lb	KP
				1,016 kg	2,340 lb	KQ
			A/T	1,041 kg	2,295 lb	KQ
		VTi	M/T	1,080 kg	2,381 lb	KG, KE
				1,085 kg	2,392 lb	KS
	Weight Distribution (Front/Rear)					
		DX	M/T	565/360 kg	1,246/794 lb	KG, KF, KE
				570/360 kg	1,257/794 lb	KS
		CX	M/T	599/371 kg	1,321/818 lb	KQ
		EX	M/T	580/360 kg	1,279/794 lb	KP
				624/384 kg	1,376/847 lb	KY
			A/T	600/360 kg	1,378/794 lb	KP
				648/380 kg	1,429/838 lb	KY
		GL	M/T	602/374 kg	1,327/825 lb	KQ
			A/T	627/374 kg	1,382/825 lb	KQ
		DXi	M/T	570/365 kg	1,257/805 lb	KG
			A/T	600/365 kg	1,328/805 lb	KG
		LSi	M/T	585/365 kg	1,290/805 lb	KG, KF, KE
				590/365 kg	1,301/805 lb	KS
			A/T	615/365 kg	1,356/805 lb	KG, KF, KE
				620/365 kg	1,367/805 lb	KS
		VEi	M/T	570/365 kg	1,257/805 lb	KG, KE
		ESi	M/T	605/380 kg	1,334/838 lb	KG, KF
				615/385 kg	1,356/849 lb	KE
				610/380 kg	1,345/838 lb	KS
			A/T	635/380 kg	1,400/838 lb	KG, KF
				645/385 kg	1,422/849 lb	KE
				640/380 kg	1,411/838 lb	KS
		Si	M/T	600/375 kg	1,323/827 lb	KP
				624/392 kg	1,376/864 lb	KQ
			A/T	649/392 kg	1,431/864 lb	KQ
		VTi	M/T	680/400 kg	1,499/882 lb	KG, KE
				685/400 kg	1,510/882 lb	KS
	Max. Permissible Weight (EC)					
		DX		1,370 kg	3,020 lb	
		EX, VEi, DXi, LSi, VTi		1,460 kg	3,219 lb	
		ESi, Si		1,500 kg	3,310 lb	

	ITEMS			METRIC	ENGLISH	NOTES
WEIGHT 4D	Curb weight	1.5 EL	M/T	970 kg	2,138 lb	KP
				1,017 kg	2,242 lb	KY
			A/T	990 kg	2,138 lb	KP
				1,037 kg	2,286 lb	KY
		1.5 EX	M/T	985 kg	2,171 lb	KP
				1,045 kg	2,304 lb	KY
			A/T	1,005 kg	2,216 lb	KP
				1,065 kg	2,348 lb	KY
		GL	M/T	1,012 kg	2,231 lb	KQ
			A/T	1,041 kg	2,295 lb	KQ
		DXi	M/T	980 kg	2,161 lb	KG
				985 kg	2,172 lb	KS
			A/T	1,010 kg	2,227 lb	KG
				1,015 kg	2,238 lb	KS
		LSi	M/T	995 kg	2,194 lb	KG, KE
				1,000 kg	2,205 lb	KS
			A/T	1,025 kg	2,260 lb	KG, KE
				1,030 kg	2,271 lb	KS
		DX	M/T	1,080 kg	2,381 lb	KB
			A/T	1,100 kg	2,425 lb	KB
		EX	M/T	1,090 kg	2,403 lb	KB
			A/T	1,110 kg	2,447 lb	KB
		ESi	M/T	1,030 kg	2,271 lb	KG, KF, KE
				1,035 kg	2,282 lb	KS
			A/T	1,060 kg	2,337 lb	KG, KF, KE
				1,065 kg	2,348 lb	KS
		Si	M/T	1,052 kg	2,319 lb	KQ
				1,090 kg	2,403 lb	KY
			A/T	1,077 kg	2,374 lb	KQ
				1,115 kg	2,458 lb	KY
		VTi	M/T	1,105 kg	2,436 lb	KG, KF
				1,120 kg	2,469 lb	KE
				1,110 kg	2,447 lb	KS
		RTSi	M/T	1,130 kg	2,491 lb	KG
			A/T	1,145 kg	2,524 lb	KG

(cont'd)

Design Specifications

	ITEM	METRIC	ENGLISH	NOTES
WEIGHT 4D	Weight Distribution (Front/Rear)			
	1.5 EL M/T	575/395 kg	1,268/871 lb	KP
		625/392 kg	1,378/864 lb	KY
	A/T	595/395 kg	1,312/871 lb	KP
		649/388 kg	1,431/855 lb	KY
	1.5 EX M/T	590/395 kg	1,301/871 lb	KP
		633/412 kg	1,396/908 lb	KY
	A/T	610/395 kg	1,345/871 lb	KP
		657/408 kg	1,448/899 lb	KY
	GL M/T	610/402 kg	1,345/886 lb	KQ
	A/T	635/406 kg	1,400/895 lb	KQ
	DXi M/T	580/400 kg	1,279/882 lb	KG
		585/400 kg	1,290/882 lb	KS
	A/T	610/400 kg	1,345/882 lb	KG
		615/400 kg	1,356/882 lb	KS
	LSi M/T	595/400 kg	1,312/882 lb	KG, KE
		600/400 kg	1,323/882 lb	KS
	A/T	625/400 kg	1,378/882 lb	KG, KE
		630/400 kg	1,390/882 lb	KS
	DX M/T	655/425 kg	1,444/937 lb	KB
	A/T	680/420 kg	1,499/926 lb	KB
	EX M/T	660/430 kg	1,455/948 lb	KB
	A/T	685/425 kg	1,510/937 lb	KB
	ESi M/T	615/415 kg	1,356/915 lb	KG, KF, KE
		620/415 kg	1,367/915 lb	KS
	A/T	645/415 kg	1,422/915 lb	KG, KF, KE
		650/415 kg	1,433/915 lb	KS
	Si M/T	635/417 kg	1,400/919 lb	KQ
		649/441 kg	1,431/972 lb	KY
	A/T	660/417 kg	1,455/919 lb	KQ
		680/435 kg	1,499/959 lb	KY
	VTi M/T	675/430 kg	1,488/948 lb	KG, KF
		685/435 kg	1,510/959 lb	KE
		680/430 kg	1,499/948 lb	KS
	RTSi M/T	665/465 kg	1,466/1,025 lb	KG
	A/T	680/465 kg	1,499/1,025 lb	KG
	Max. Permissible Weight (EC)			
	1.5EL, 1.5EX, DXi, LSi	1,500 kg	3,310 lb	
	DX, EX, ESi, VTi	1,520 kg	3,351 lb	
	RTSi	1,640 kg	3,616 lb	

	ITEM		METRIC	ENGLISH	NOTES
ENGINE	Type		Water-cooled, 4-stroke SOHC gasoline engine Water-cooled, 4-stroke DOHC gasoline engine		
	Cylinder Arrangement		In-line 4-cylinder, transverse mount		
	Bore and Stroke	D12B	75.0 x 67.5 mm	2.95 x 2.66 in	
		D13B	75.0 x 76.0 mm	2.95 x 2.99 in	
		D15B, D15Z	75.0 x 84.5 mm	2.95 x 3.33 in	
		D16A, D16Z	75.0 x 90.0 mm	2.95 x 3.54 in	
		B16A	81.0 x 77.4 mm	3.19 x 3.05 in	
	Displacement	D12B	1,193 cm^3	73.0 cu-in	
		D13B	1,343 cm^3	82.0 cu-in	
		D15B, D15Z	1,493 cm^3	91.0 cu-in	
		D16A, D16Z	1,590 cm^3	97.0 cu-in	
		B16A	1,595 cm^3	97.3 cu-in	
	Compression Ratio	D12B	8.6		
		D13B	9.0		
		D15B	9.2		
		D15Z	9.3		
		D16A7	9.1		
		D16Z	9.2		
		D16A8, D16A9	9.5		
		B16A	10.2		
	Valve Train		Belt driven, SOHC Belt driven, DOHC		
	Lubrication System		Forced and wet sump		
	Fuel Required	D12B1	Leaded gasoline with 85 R.O.N or higher*1		*1 Unleaded gasoline with 91 R.O.N. or higher may also be used.
		D13B3, D15B3	Leaded gasoline with 91 R.O.N or higher*1		
		D13B2, D15B2, D15B4 D15Z1, D16A8	Unleaded gasoline with 91 R.O.N or higher		
		D16Z6, D16Z7, B16A2	Premium unleaded gasoline 95 R.O.N or higher		*2 Premium unleaded gasoline with 95 R.O.N. or higher may also be used.
		D16A9, D16A7	Premium leaded gasoline 98 R.O.N or higher*2		
STARTER	Makes/Type		HITACHI/Direct drive, 0.8 kW MITSUBA/Gear reduction, 1.0 kW, 1.2 kW and 1.4 kW NIPPONDENSO/Gear reduction, 1.0 kW and 1.2 kW		
	Normal Output		0.8 kW, 1.0 kW, 1.2 kW, 1.4 kW		
	Nominal Voltage		12 V		
	Hour Rating		30 seconds		
	Direction of Rotation		Clockwise as viewed from gear end		
	Weight HITACHI 0.8 kW		3.7 kg	8.2 lb	
	MITSUBA 1.0, 1.2 kW		3.4 kg	7.5 lb	
	1.4 kW		3.5 kg	7.7 lb	
	NIPPONDENSO 1.0 kW		3.85 kg	8.49 lb	
	1.2 kW		3.4 kg	7.5 lb	

(cont'd)

Design Specifications

	ITEM		METRIC	ENGLISH	NOTES
CLUTCH	Clutch Type	M/T	Single plate dry, diaphragm spring		
		A/T	Torque converter		
	Clutch Facing Area	M/T	176 cm^2	27 sq in	
TRANS-MISSION	Transmission	M/T	Synchronized 5-speed forward, 1 reverse		
		A/T 2WD	4-speed automtic with lock-up clutch, 1 reverse		
		4WD	Electronically controlled 4-speed automatic, 1 reverse		
	Primary Reduction		Direct 1 : 1		

Type		Manual				
		D12B D13B D15B D16A	D15Z1	D16Z	D16Z7 4WD	B16A
Gear Ratio	SL	——	——	——	4.512	——
	1st	3.250	3.250	3.250	3.384	3.230
	2nd	1.900	1.900	1.900	1.952	2.105
	3rd	1.250	1.250	1.250	1.266	1.458
	4th	0.909	0.909	0.937	0.942	1.107
	5th	0.750	0.750	0.771	0.789	0.875
	Reverse	3.153	3.153	3.153	3.000	3.000
Final Reduction	Gear ratio	4.250	3.722	4.250	4.428	4.266
	Gear type	Single helical gear				

Type		Automatic						
		D12B, D15B3	D15B2, D16Z6	D15B4	D16A8	D16A9	D16A7	D16Z7 4WD
Gear Ratio	1st	2.722	2.600	2.720	2.600	2.722	2.600	2.526
	2nd	1.555	1.393	1.500	1.393	1.500	1.468	1.428
	3rd	1.027	0.975	1.027	0.926	1.027	0.975	0.974
	4th	0.780	0.772	0.780	0.673	0.780	0.673	0.733
	Reverse	1.954	1.954	1.954	1.954	1.954	1.954	1.954
Final Reduction	Gear ratio	3.937	4.333	3.937	4.333	3.937	4.333	4.333
	Gear type	Single helical gear						

	ITEM		METRIC	ENGLISH	NOTES
AIR CONDITIONER	Cooling Capacity		3,730 Kca/h	14,800 BTU/h	
	— Conditions:				
	Compressor Speed		2,200 rpm		
	Outside Air Temperature		35 → 25 → 20°C	95 → 77 → 68°F	
	Outside Air Humidity		80% → 30%		
	Condenser Air Velocity		3.5 m/sec	11.5 ft/sec	
	Blower Capacity		430 m^3/h	15,188 cu ft/h	at 12 V
	Compressor	Type/Makes	Scroll type/SANDEN		D15Z, D16A, D16Z
		No. of Cylinder	——		
		Capacity	85.6 cc/rev	5.22 cy ub/rev	
		Max. Speed	10,000 min^{-1} (rpm)		
		Lubricant Capacity	120 cc	4.06 US oz, 4.22 Imp oz	
	Compressor	Type/Make	Vane rotary type/MATSUSHITA		D12B, D13B, D15B
		No. of Cylinder	3		
		Capacity	150 cc/rev	9.15 cu in/rev	
		Max. Speed	8,000 min^{-1} (rpm)		
		Lubricant Capacity	140 cc	4.73 US oz. 4.93 Imp oz	
	Compressor	Type/Make	Swash-plate type/NIPPONDENSO		B16A2
		No. of Cylinder	10		
		Capacity	155.3 cc/rev	9.47 cu in/rev	
		Max. Speed	7,600 min^{-1} (rpm)		
		Lubricant Capacity	60—100 cc	2.03—3.38 US oz. 2.11—3.52 Imp oz	
	Condenser	Type	Corrugated fin type		
	Evaporator	Type	Corrugated fin type		
	Blower	Type	Sirocco fan		
		Motor Input	200 W/12 V		
		Speed Control	4-speed variable		
		Max. Capacity	430 m^3/h	15,188 cu ft/h	at 12 V
AIR CONDITIONER (cont'd)	Temp. Control		Air-mix type		
	Comp. Clutch	Type	Dry, single plate, poly-V-belt drive		
		Power Consumption	42 W max./12 V		
	Refrigerant	Type	R12		
		Quantity	$650 {}^{+0}_{-50}$ g	$22.9 {}^{+0}_{-1.8}$ oz	

(cont'd)

Design Specifications

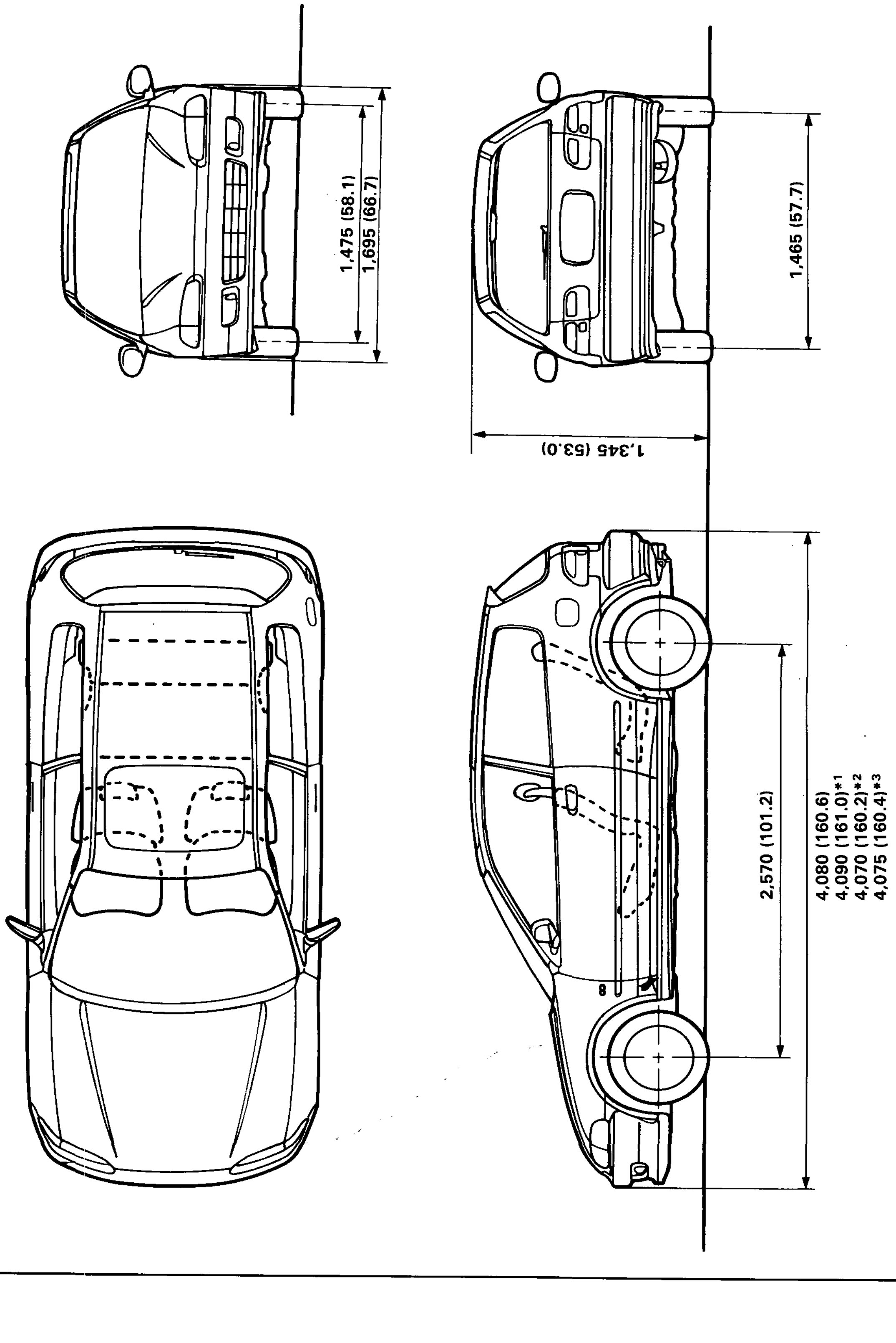
	ITEM	METRIC	ENGLISH	NOTES
STEERING SYSTEM	Type P/S	Power assisted, rack and pinion		
	M/S	rack and pinion		
	Overall Ratio VTi P/S	LHD: 17.5	RHD: 17.6	
	Except VTi P/S	LHD: 17.5	RHD: 17.0	
	M/S	LHD: 19.0	RHD: 19.0	
	Turns, Lock-to-lock VTi P/S	LHD: 3.3	RHD: 3.1	
	Except VTi P/S	LHD: 3.6	RHD: 3.5	
	M/S	LHD: 3.9	RHD: 3.9	
	Steering WHeel Dia. Except VEi and VTi	375 mm	14.8 in	
	VEi	380 mm	15.0 in	
	VTi	377 mm	14.8 in	
SUS-PENSION	Type, Front and Rear	Independent double wishbone, coil spring		
	Shock Absorber, Front and Rear	Telescopic, hydraulic nitrogen gas-filled		
WHEEL ALIGNME-NT	Camber			
	Front VTi	$-0°05' \pm 1°$		
	2WD except VTi	$0°00' \pm 1°$		
	4WD	$0°15' \pm 1°$		
	Rear VTi	$-0°25' \pm 1°$		
	2WD except VTi	$-0°20' \pm 1°$		
	4WD	$-0°25' \pm 1°$		
	Caster			
	Front 2WD	$1°10' \pm 1°$		
	4WD	$1°05' \pm 1°$		
	Toe			
	Front	0 mm	0 in	
	Rear	In 2.0 mm	In 0.08 in	
BRAKE SYSTEM	Type, Front	Power-assisted self-adjusting ventilated disc		
	Rear	Power-assisted self-adjusting solid disc or drum		
	Pad and Lining Surface Area: Front	$35.8\ cm^2 \times 2$	5.5 sq in x 2	Disc, 190 mm dia.
		$43.2\ cm^2 \times 2$	6.7 sq in x 2	Disc, 191 mm dia.
		$51.5\ cm^2 \times 2$	8.0 sq in x 2	Disc, 211 mm dia.
	Rear	$21.0\ cm^2 \times 2$	3.26 sq in x 2	Disc
		$50.2\ cm^2 \times 2$	7.8 sq in x 2	Drum
	Parking Brake Kind and Type	Mechanical actuating, rear two wheel brakes		
TIRE	Size	175/70R13 82H		
		155R13 78S		
		185/60R14 82H		
		195/55 R15 84V		
	Spare tire VTi (2D H/B)	T135/70D15		

	ITEM	METRIC	ENGLISH	NOTES
ELEC-TRICAL	Battery	12 V—47 AH, 36 AH, 38 AH/5 HR		
	Starter	12 V—0.8 kW, 12 V—1.0 kW, 12 V—1.2 kW, 12 V—1.4 kW		
	Alternator	12 V—70 A, 80 A		
	Fuses			
	In The Under-Dash Fuse Box	7.5 A, 10 A, 15 A, 20 A, 30 A		
	In The Under-Hood Fuse/Relay Box	7.5 A, 10 A, 15 A, 20 A, 30 A, 40 A, 50 A, 80 A		
	In The Under-Hood ABS Fuse/Relay Box	7.5 A, 15 A, 20 A, 50 A		
	Headlights High/Low	12 V—60/55 W		
	Front Turn Signal Lights	12 V—21 W		
	Rear Turn Signal Lights	12 V—21 W		
	Brake/Tail Lights	12 V—21/5 W		
	High Mount Brake Light	12 V—21 CP		KQ and KY model
	Back-up Lights	12 V—21 W		
	License Plate Lights	12 V—5 W		
	Ceiling Lights	12 V—8 W 12 V—5 W		
	Trunk/luggage Lights	12 V—3.4 W		
	Gauge Lights	12 V—3.0 W		
	Indicator Lights	12 V—1.12 W, 1.4 W		
	Illumination and Pilot Lights	12 V—1.4 W, 1.12 W, 0.84 W 12 V—0.91 W, 0.56 W, LED		
	Heater Illumination Lights	12 V—1.4 W		
	Rear Fog light	12 V—21 W		European and KP model

Body Specifications

2-Door Hatchback:

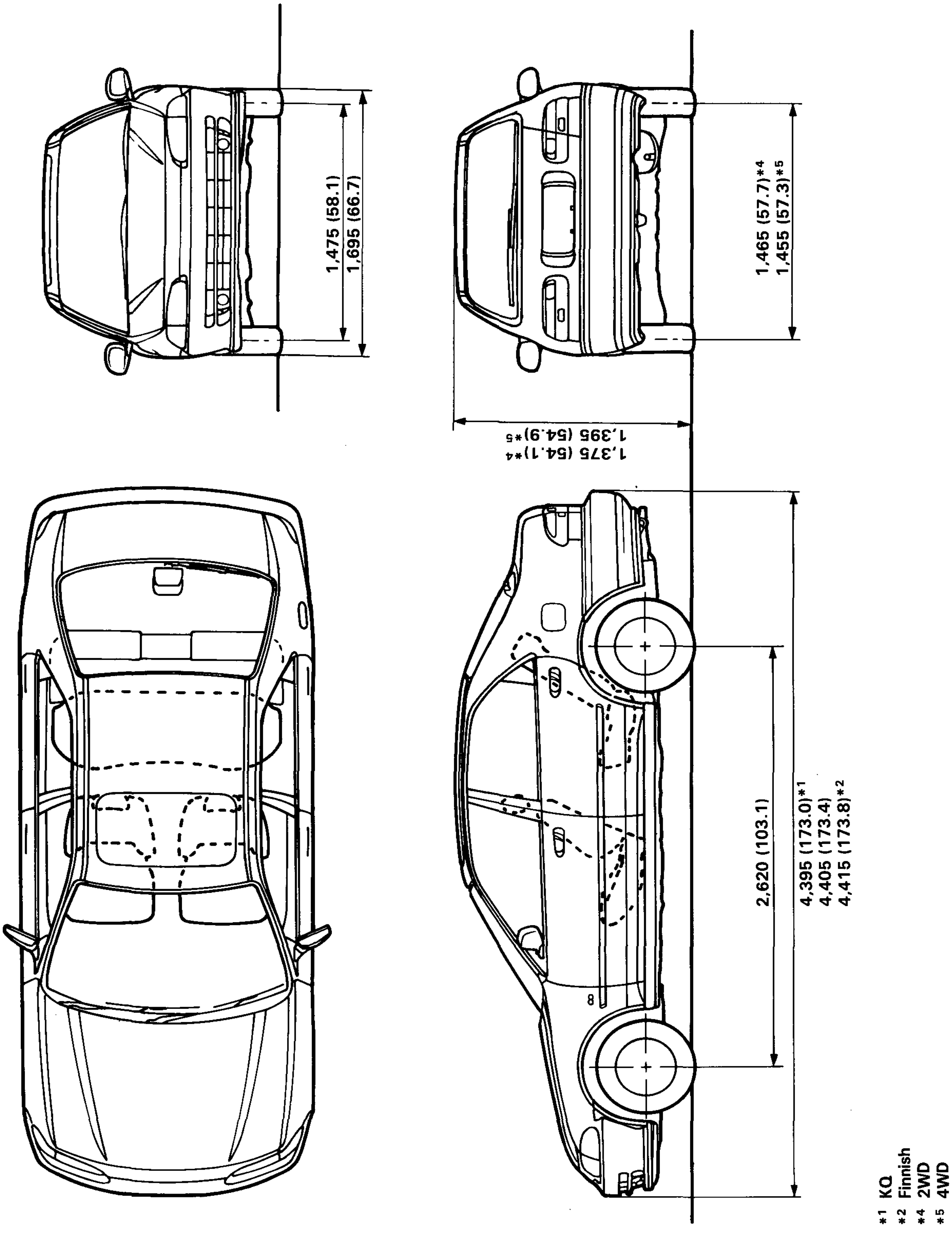
Unit: mm (in)



*1 Finnish model, *2 KQ, *3 KY

4-Door Sedan:

Unit: mm (in)



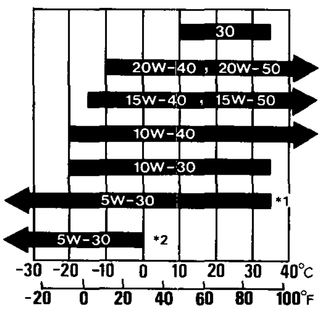
Maintenance

Lubrication Points

For the details of lubrication points and types of lubricants to be applied, refer to the Illustrated Index and various work procedures (such as Assembly/Reassembly, Replacement, Overhaul, Installation, etc.) contained in each section.

No.	LUBRICATION POINTS		LUBRICANT
1	Engine		API Service Grade: SG or SF fuel efficient oil
2	Transmission	Manual	API Service Grade: SF or SG SAE Viscosity: See chart below.
		Automatic	Honda Premium Formula or DEXRON® II Automatic transmission fluid
3	Brake Line		Brake fluid DOT3 or DOT4
4	Clutch Line		Brake fluid DOT3 or DOT4
5	Power steering gearbox		Steering grease P/N 08733–B070E
6	Shift lever pivots (Manual)		Silicone grease with molybdenum disulfide
7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	Release fork (Manual) Steering boots Steering column bushings Steering ball joints Select lever (Automatic) Pedal linkage Brake master cylinder pushrod Trunk hinges and latch (4-Door Sedan) Door hinges upper and lower Door opening detents Fuel filler lid Engine hood hinges and engine hood latch Clutch master cylinder pushrod Throttle cable end Rear brake shoe linkages Tailgate hinges and latches (2-Door Hatchback)		Multi-purpose grease
23	Caliper	Piston seal, Dust seal, Caliper pin, Piston	Silicone grease
24	Power steering system		Honda power steering fluid-V
25	Rear Differential (4WD only)		Hypoid Gear oil (API GL5) above −18°C (12°F) SAE90, below −18°C (12°F) SAE 80

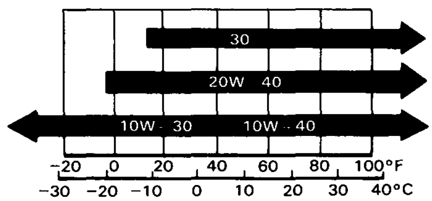
Recommended Engine Oil
API Service Grade: SG or SF fuel efficient oil. Select the oil for the car according to this chart.



Ambient temperature ranges

*1: Except 1.6 ℓ models
*2: 1.6 ℓ models

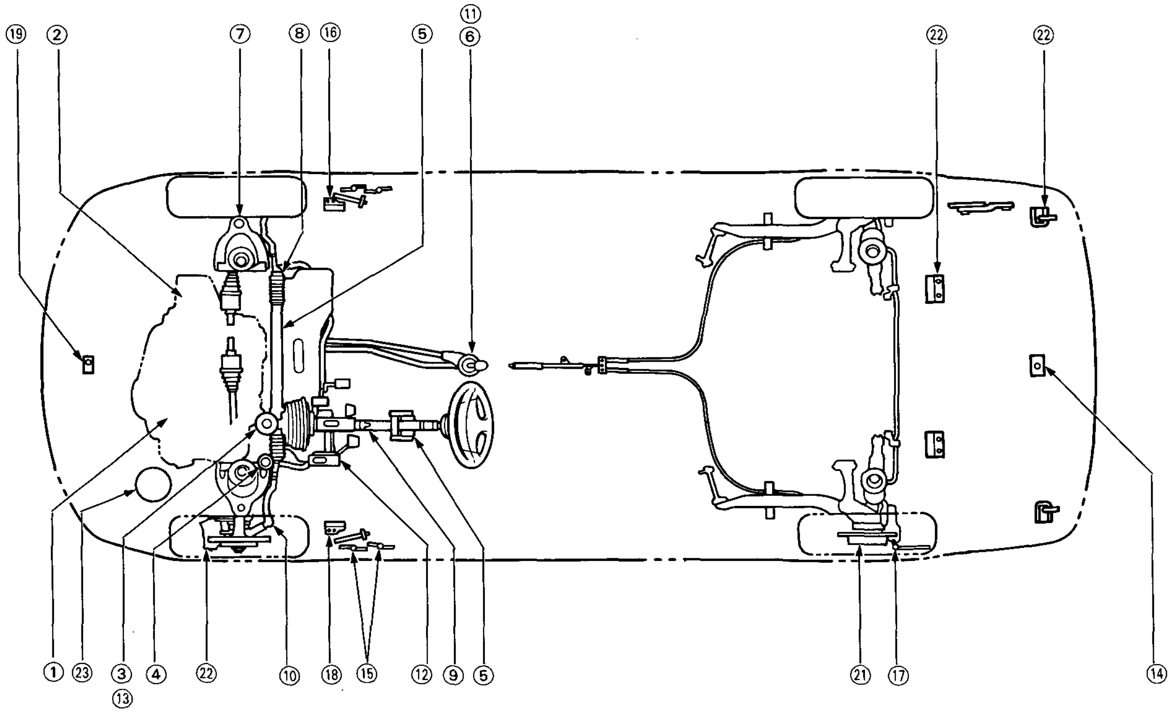
Recommended Manual Transmission Oil
API Service Grade: SF or SG



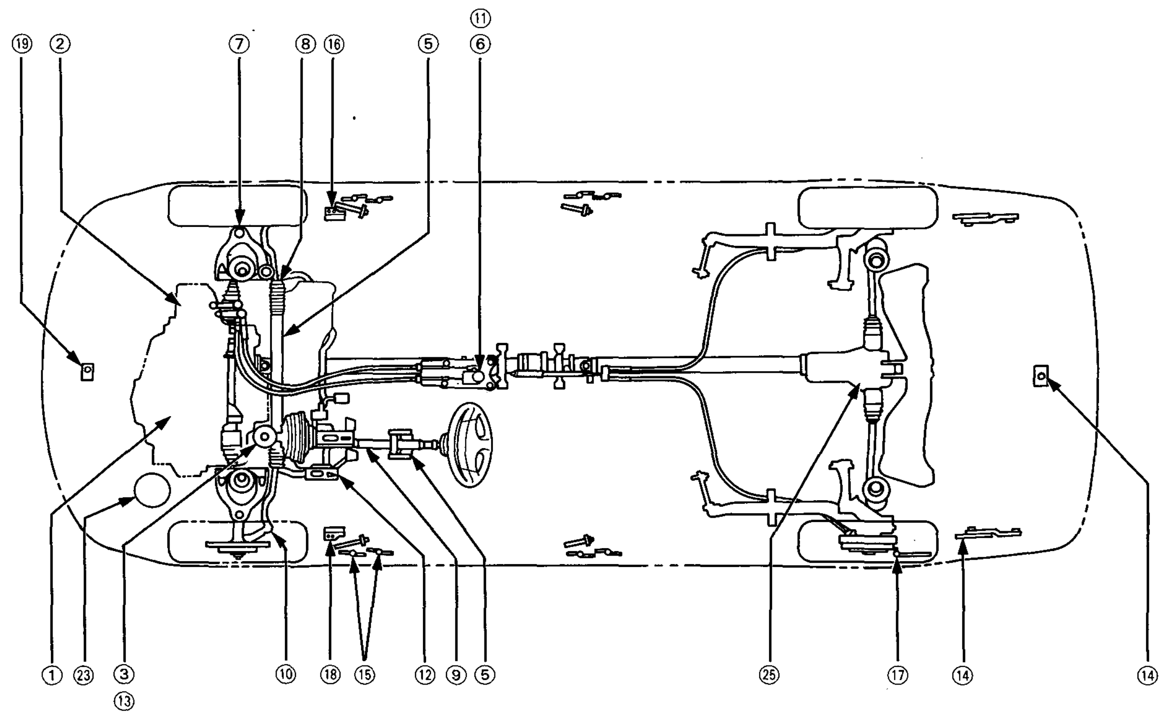
Ambient temperature ranges

CAUTION: Used engine oil may cause skin cancer if repeatedly left in contact with the skin for prolonged periods. Although this is unlikely unless you handle used oil on a daily basis, it is still advisable to thoroughly wash your hands with soap and water as soon as possible after handling used oil.

2-Door Hatchback:



4-Door Sedan 4WD:



R—Replace C—Clean I—Inspect After inspection, clean, adjust, repair or replace if necessary.

Service at the interval listed x 1,000 km (or miles) or after that number of months, whichever comes first.		x 1,000 km	10	20	30	40	50	60	70	80	90	100
		x 1,000 miles	6	12	18	24	30	36	42	48	54	60
		months	6	12	18	24	30	36	42	48	54	60
Emission Related												
□ Air Cleaner Element	For European and Australian model					R				R		
	Except for European and Australian model			R		R		R		R		R
Idle speed and idle CO	Except for Switzerland and KS model*2			I		I		I		I		I
	For Switzerland and KS model*2											I
E.G.R. System (for cars using leaded gasoline)												I
Evaporative emission control system												I
Ignition timing and control system	Except for Switzerland and KS model*2					I				I		
	For Switzerland and KS model*2											I
Positive crankcase ventilation valve	Except for Switzerland and KS model*2					I				I		
	For Switzerland and KS model*2											I
Blow-by filter	For carburetor types					I				I		
Intake air temperature control system	For carburetor types										I	
Throttle control system	Except for KS model*2 *3					I				I		
	For KS model*2 *3										I	
Choke opener operation	For automatic choke types*3											I
Valve clearance				I		I		I		I		I
Fuel filter (Inchuding aux. filter)						R				R		
Tank, fuel line and connections						I				I		
Spark plugs	For cars with catalytic converter					R*1				R*1		
	For cars without catalytic converter			R		R		R		R		R
Distributor cap and rotor	Except for Switzerland and KS model*2					I				I		
	For Switzerland and KS model*2											I
Ignition wiring	Except for Switzerland and KS model*2					I				I		
	For Switzerland and KS model*2											I
▣ Engine oil and oil filter			R	R	R	R	R	R	R	R	R	R
Alternator drive belt						I				I		
Power steering pump belt (For cars with power steering system)						I				I		
Cooling system hoses and connections						I				I		
• Radiator coolant										R*1		
□ Transmission oil						R				R		
Rear differential oil (For cars with 4WD)						R				R		

- Day to day care (engine oil, ATF and coolant level) should be done practically according to the owner's manual by the customer.

□ Under severe driving conditions, service these items more often.

*1 For KS model, replace every 2 years or 40,000 km (24,000 miles), whichever comes first after 30,000 km (18,000 miles).

*2 KS model-Sales Country: Sweden, Norway and Finland

*3 For carburetor types

R—Replace C—Clean I—Inspect After inspection, clean, adjust, repair or replace if necessary.

Service at the interval listed x 1,000 km (or miles) or after that number of months, whichever comes first.											
	x 1,000 km	10	20	30	40	50	60	70	80	90	100
	x 1,000 miles	6	12	18	24	30	36	42	48	54	60
	months	6	12	18	24	30	36	42	48	54	60
Engine (Non-Emission Related)											
Timing Belt											R
Water pump											I
Exhaust pipe and muffler			I		I		I		I		I
Catalytic converter heat shield (For cars with catalytic converter)											I
Brakes (Non-Emission Related)											
Front brake pad		I	I	I	I	I	I	I	I	I	I
☐ Front brake discs and calipers			I		I		I		I		I
☐ Rear brake discs, calipers and pad			I		I		I		I		I
Rear brake drums, wheel cylinders and linings					I				I		
Brake hoses and lines (including Anti-lock brake system*2)			I		I		I		I		I
Parking brake			I		I				I		
Brake fluid (including Anti-lock brake system*2)					R				R		
Anti-lock brake system high pressure hose*2									R		
Anti-lock brake system operation*2			I		I				I		
Steering, suspension and transaxle (Non-Emission Related)											
Front wheel alignment			I		I		I		I		I
Steering operation, tie rod ends, steering gear box and boots			I		I				I		
Suspension mounting bolts			I		I		I		I		I
☐ Power steering system (For cars with power steering system)			I		I		I		I		I
Rear differential clutch operation*2 (For cars with 4WD)			I		I				I		

- Day to day care (engine oil, ATF and coolant level) should be done practically according to the owner's manual by the customer.

☐ Under severe driving conditions, service these items more often.

*1 Thereafter, replace every 2 years or 40,000 km (24,000 miles), whichever comes first.

*2 For cars with Anti-lock brake system.

Severe Driving Conditions
Items with a ☐ in the chart will need service more often, if you drive in some severe conditions.

The conditions are:
A. *Repeated* short distance driving.
B. Dusty conditions.
C. Severe cold weather.
D. Areas with road salt or other corrosive materials.
E. Rough or muddy roads.
F. Towing a trailer.

The services are:
— Replace engine oil and oil filter every 5,000 km (3,000 miles) or 3 months under condition A, B or F.
— Replace the air filter (air cleaner element) every 20,000 km (12,000 miles) or 12 months for European and Australian model under condition B or E.
— Replace the air filter (air cleaner element) every 10,000 km (6,000 miles) or 6 months for other than European and Australian model under condition B or E.
— Replace transmission oil every 20,000 km (12,000 miles) or 12 months under condition F.
— Inspect the front brake discs and calipers every 10,000 km (6,000 miles) or 6 months under condition A, B, D, E or F.
— Inspect the rear brake discs, calipers and pads every 20,000 km (12,000 miles) or 12 months under condition A, B, D, E or F.
— Inspect power steering system every 10,000 km (6,000 miles) or 6 months under condition B, C or E.

Engine

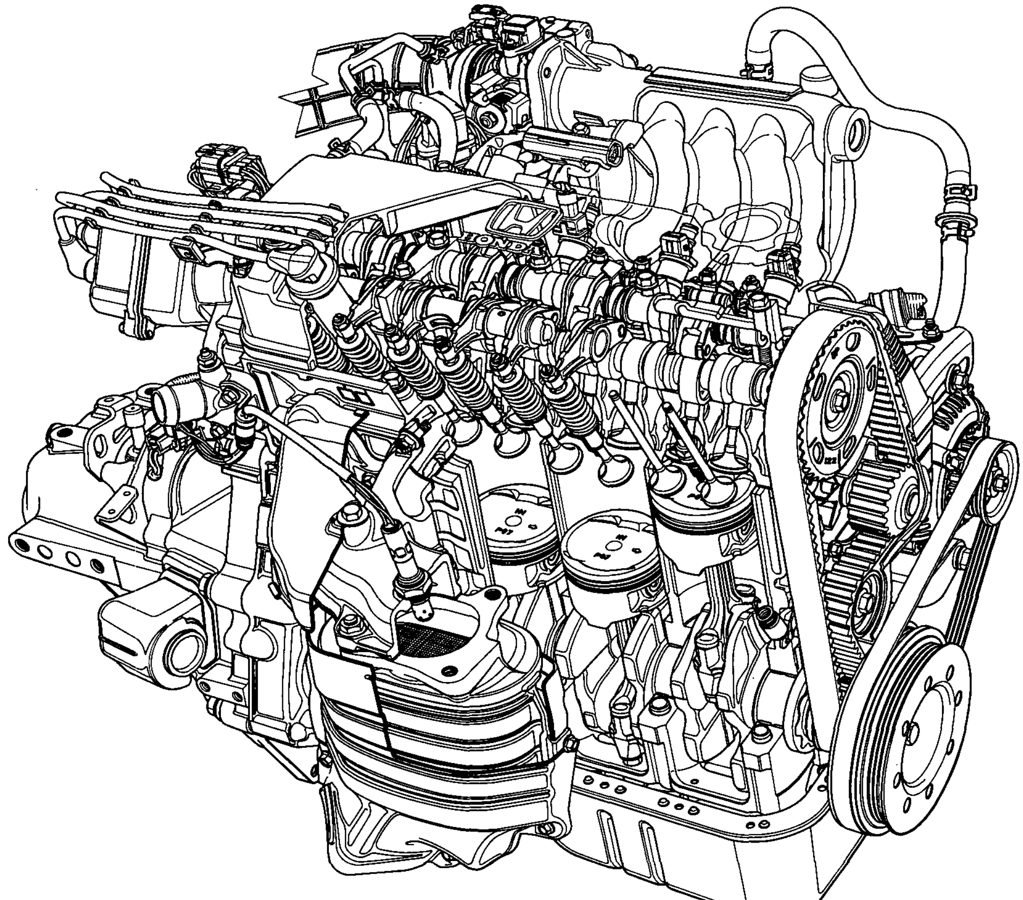
Design and Operation

Outline

Description

D15Z1 engine: VTEC-E, 1493 cc
D16Z6 engine: VTEC, 1590 cc
Both engines are SOHC, inline 4 cylinder, water cooled, and multi-point injected.
These engines use the Honda Variable Valve Timing and Lift Electronic Control System (VTEC-E or VTEC) which allows the timing and lift of the intake valves to be changed simultaneously.

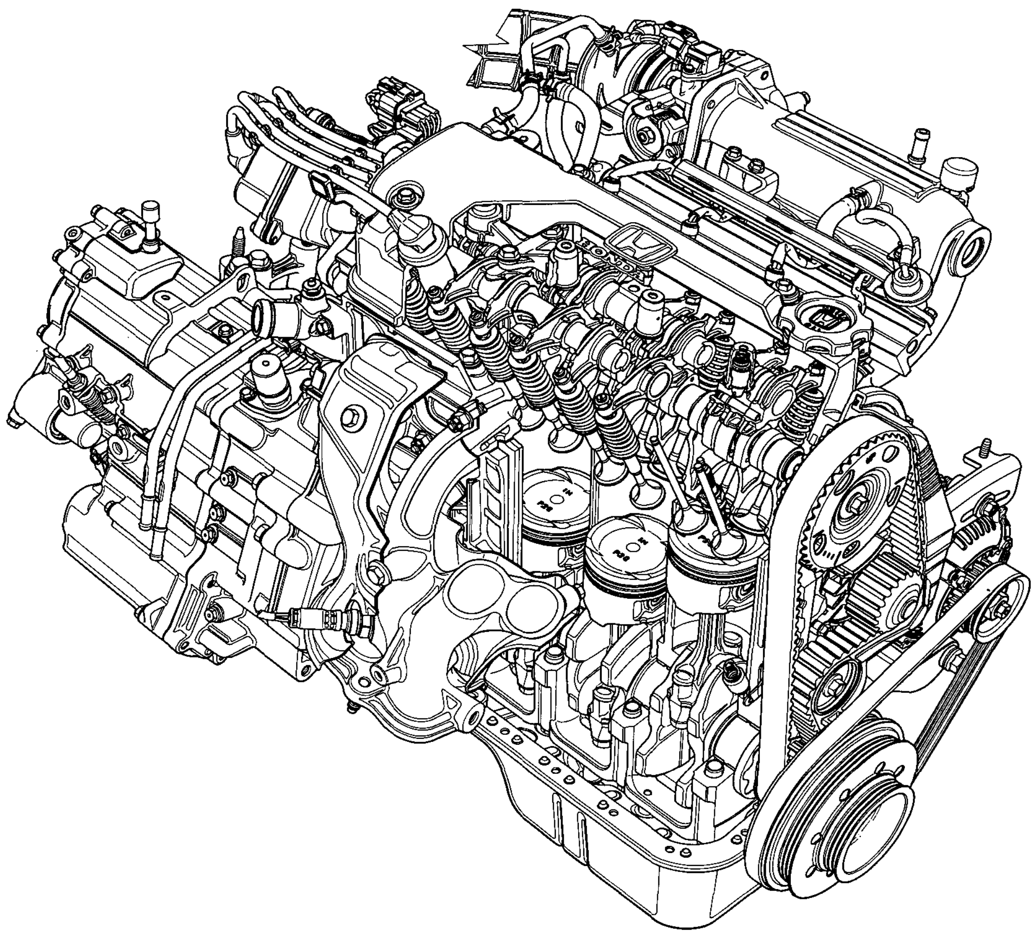
D15Z1 engine (VTEC-E):



Major Specifications:

	D15Z1 engine (VTEC-E)	D16Z6 engine (VTEC)
Type	Water-cooled, inline 4-cylinder, cross-flow	
Displacement	1,493 cm^3 (91.1 cu in)	1,590 cm^3 (91.1 cu in)
Bore x Stroke	75.0 x 84.5 mm (2.95 x 3.33 in)	75.0 x 90.0 mm (2.95 x 3.54 in)
Compression Ratio	9.3	9.2
Cam and Valve Mechanism	SOHC, VTEC-E	SOHC, VTEC
Valve Train	Belt Driven	
Fuel Supply System	PGM-FI (Multi-Point Injection)	

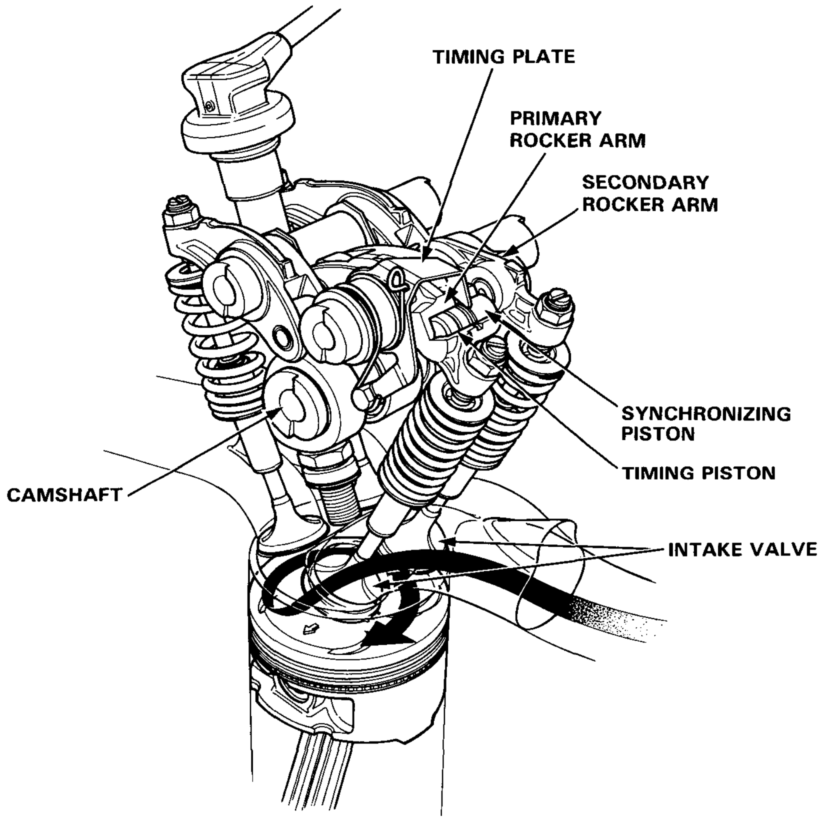
D16Z6 engine (VTEC):



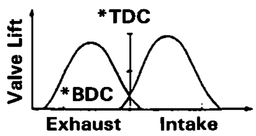
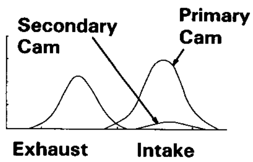
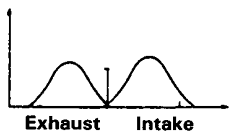
Cam and Valve Mechanism

Variable Valve Timing and Lift Electronic Control System (D15Z1 engine, VTEC-E)

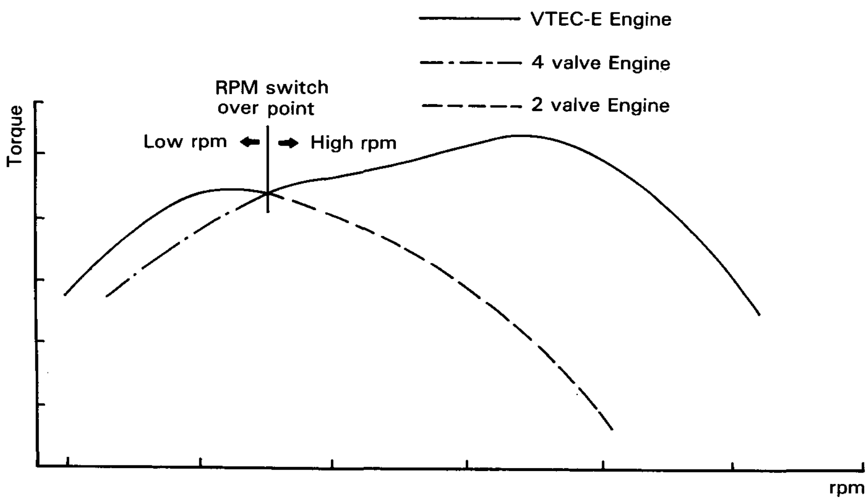
This engine has a normal 4 valve per cylinder valve arrangement. At low RPM, the primary intake valve operates at normal lift while the secondary intake valve opens only slightly to prevent fuel accumulation in the intake port. At high RPM, the secondary intake valve rocker arm is connected to the primay intake valve rocker arm to allow normal valve lift. A synchronizing piston connects/disconnects the two intake valve rocker arms. Hydraulic pressure against a timing piston moves the synchronizing piston one direction, while a stopper piston and return spring moves the synchronizing piston back when hydiaulic pressure is released.



A variable valve timing and lift mechanism is used so the engine achieves both low fuel consumption and high output. With this system, a very lean fuel/air is efficiently burned to achieve high torque characteristics and low fuel consumption in the low rpm range, while in the high rpm range, high output, equivalent to that of a conventional 4-valve engine, is achieved.

	High Power Engine	Variable Timing & Lift Engine	2 valve Engine
Valve Timing (exhaust/intake) Valve Lift			
Max. Power	O	O	
Low rpm Torque		O	O
Idling Stability		O	O
Fuel consumption	×	O	

*TDC = Top Dead Center *BDC = Bottom Dead Center
O = Optimum Characteristic
× = Worst Characteristic

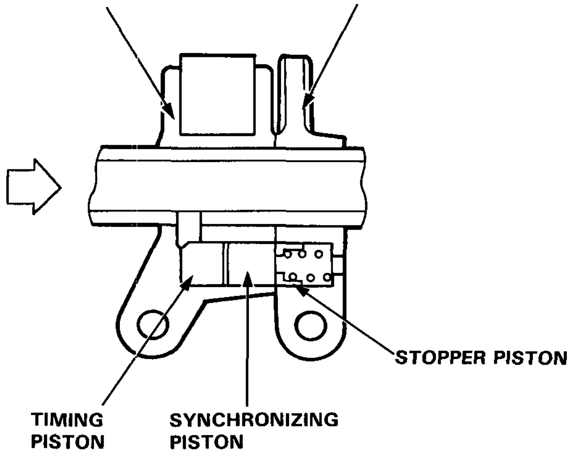


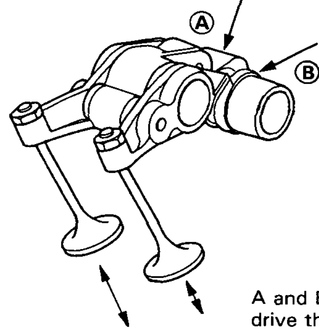
Cam and Valve Mechanism

Variable Valve Timing and Lift Electronic Control System (D15Z1 engine VTEC-E)

Mechanism:

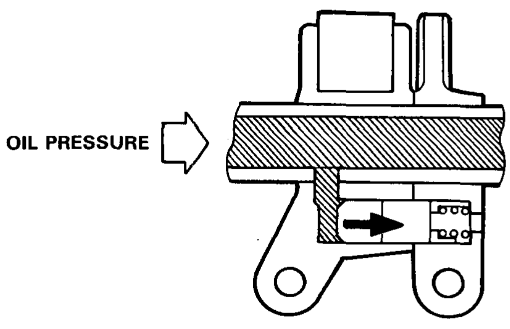
At Low Speed:
The primary rocker arm and secondary rocker arm are separated. Since both cam lobes, A and B, have different valve timing and lift, the lift of the secondary rocker arm is then small, so that one intake valve barely opens (one-valve control).

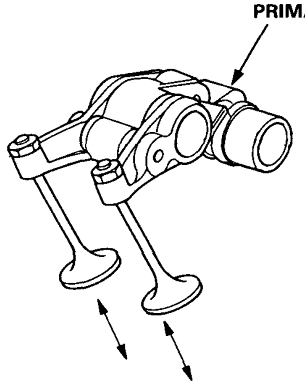




A and B cam lobes drive the rocker arms separately.

At High Speed:
The timing piston inside the primary rocker arm is shifted by hydraulic pressure in the direction shown. Both rocker arms, primary and secondary, are then connected by the synchronizing piston. The secondary rocker arm is driven at the same lift as the primary rocker arm, so that valve operation becomes the same as an ordinary 4-valve engine.

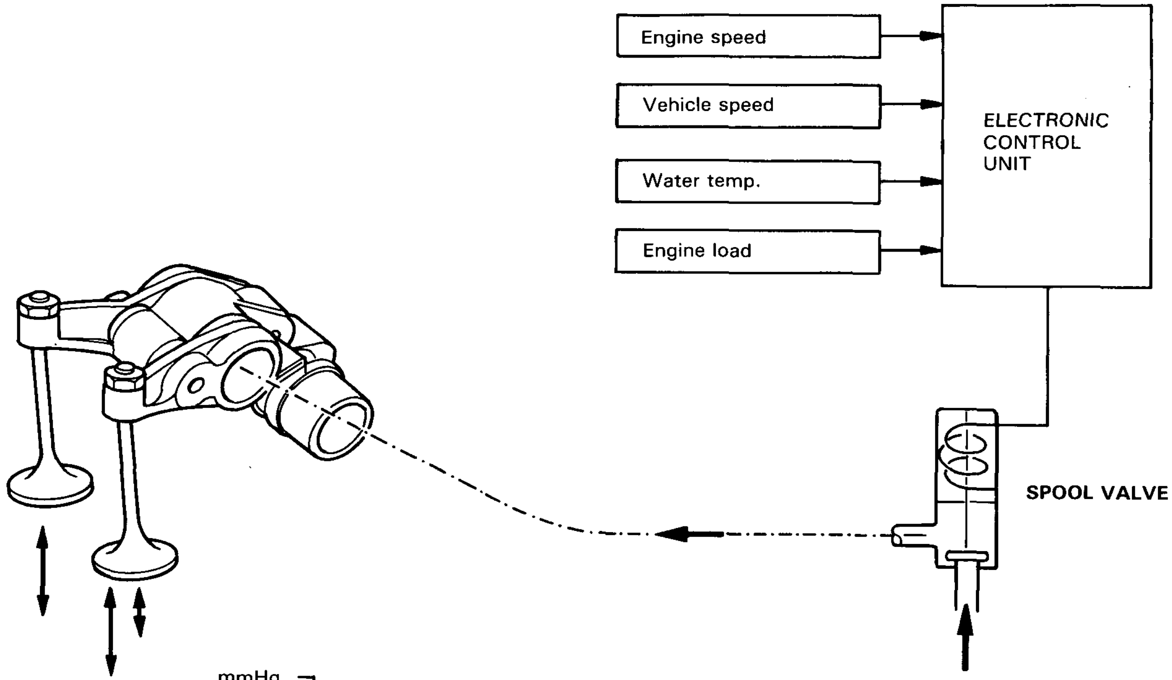


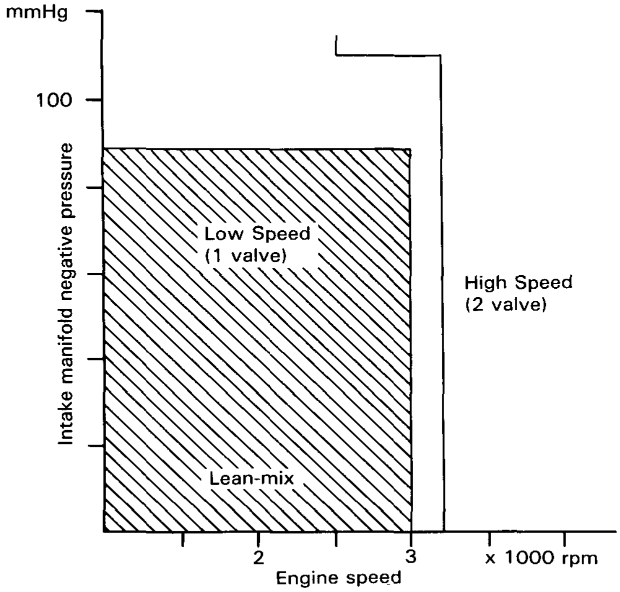


Connected by hydraulic piston, and driven only by the primary cam.

Control System:
The control system for this mechanism constantly monitors the changes in engine status such us load, rpm and vehicle speed. This information is transmitted to the PGM-FI ECU (Electronic Control Unit) to achieve optimum drivability under all conditions.

Valve Timing Change Conditions:
Engine Speed: 2,500 min^{-1} (rpm).
Vehicle Speed: 5 km/h (3 mph) min.
Water Temperature: −5.3°C (22.5°F) min.
Engine Load: Judged by intake manifold negative pressure

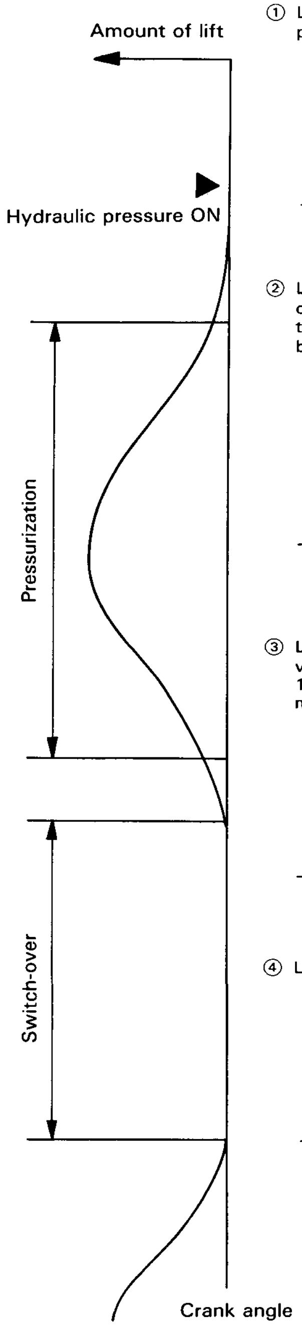




Cam and Valve Mechanism

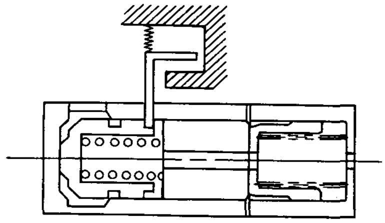
Variable Valve Timing and Lift Electronic Control System (D15Z1 engine VTEC-E)

Explanation of Timing Mechanism Operation:
The variable valve timing and lift mechanism switches intake valve operation between single valve operation and two valve operation depending upon engine speed. To help achieve switch-over, a timing plate is installed on the primary rocker arm.

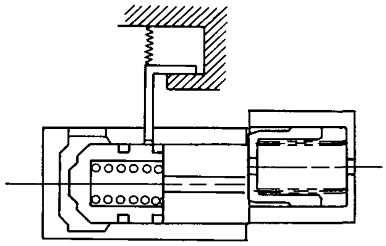


Hydraulic Pressure ON

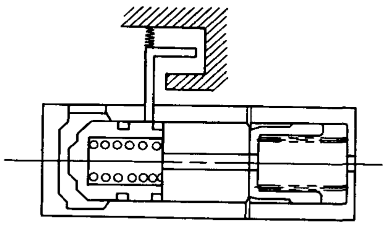
① Lift 0: Switch-over is impossible as the timing plate is into the timing piston.



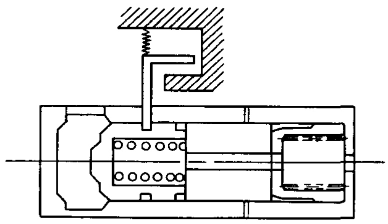
② Lift process begins: The timing plate is desengaged, and the timing piston starts shifting. The synchronizing piston does not move because of the lift.



③ Lift 0: Since the timing plate is pulled out, the valve operating mode starts to change from 1-valve operation to 2-valve operation from the moment when the lift became zero.

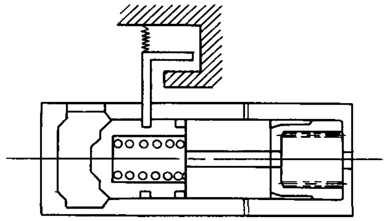


④ Lift 0: Switch-over is completed.

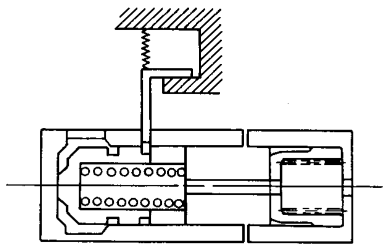


Hydraulic pressure OFF

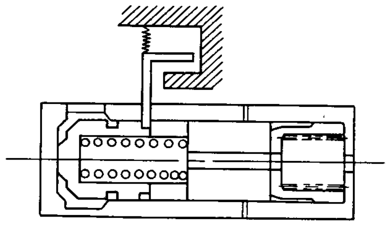
① Lift 0: Switch-over is impossible as the timing is inserted into the timing piston.



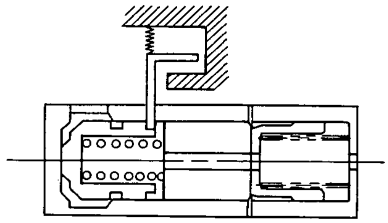
② Lift process begins: The timing plate alone starts shifting. The synchronizing piston does not move, because of the load imposed.



③ Lift 0: The synchronizing piston is pushed back by the return spring and the valve operation mode starts to change from 2-valve operation to 1-valve operation from the moment when the lift becomes zero.

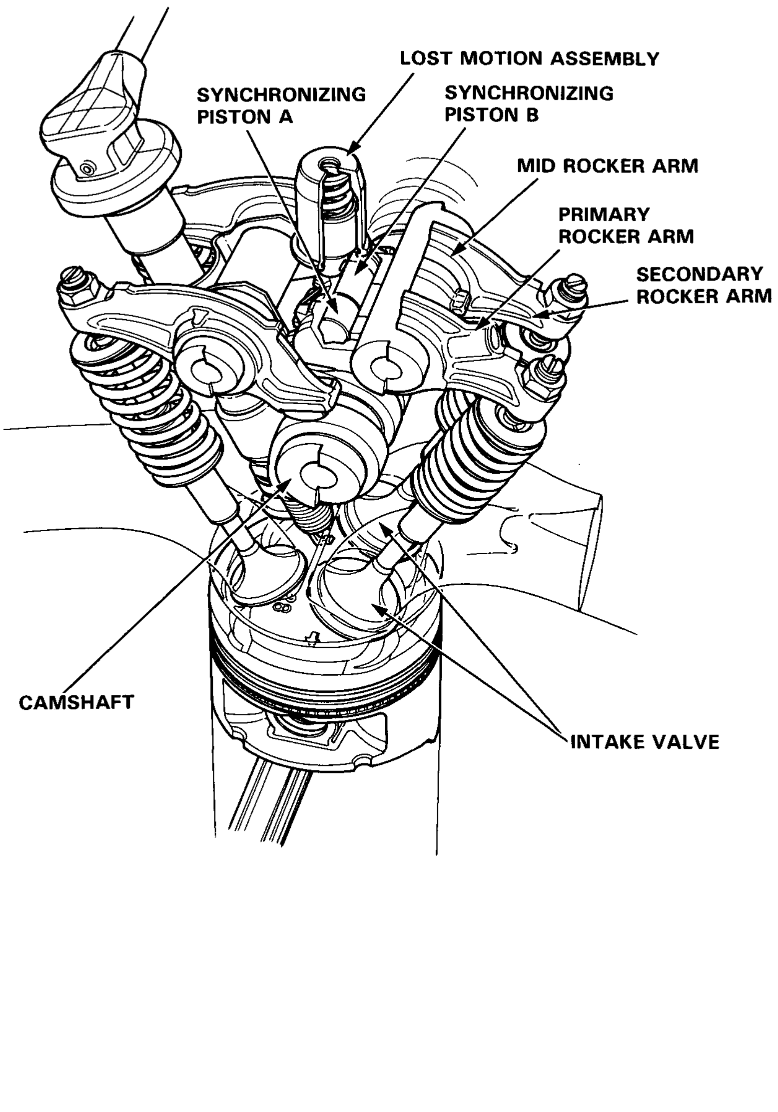


④ Lift 0: Switch-over is completed.



Variable Valve Timing and Lift Electronic Control System (D16Z6 engine VTEC)

The engine is equipped with multiple cam lobes per cylinder, providing one valve timing and lift profile at low speed and a different profile at high speed. Switch-over from one profile to the other is controlled electronially, and is selected by monitoring current engine speed and load.

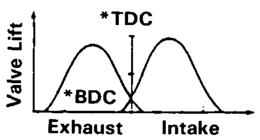
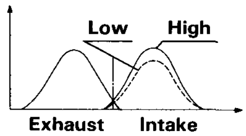
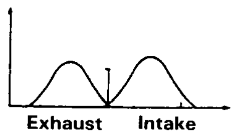


Cam and Valve Mechanism

Variable Valve Timing and Lift Electronic Control System (D16Z6 engine VTEC)

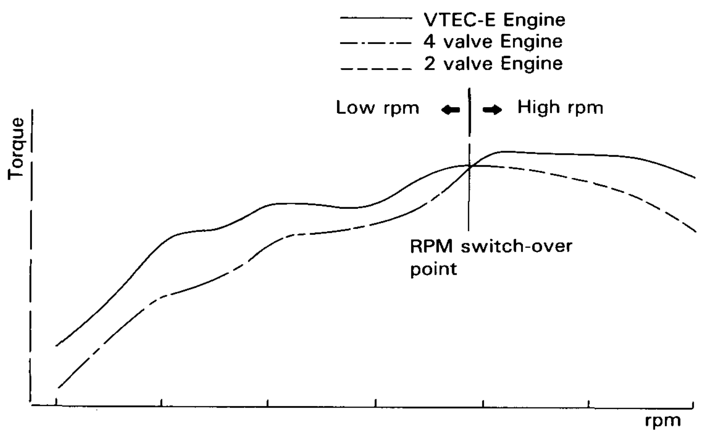
In general, it would be ideal if the high rpm performance of a racing engine and the low rpm performance of a standard passenger car engine could be combined in a single engine. This would result in a maximum performance engine with a wide power band. Two of the major differences between racing engines and standard engines are the timing of the intake/exhaust/valves and the degree of valve lift. Racing engines have longer intake/exhaust timing and a higher valve lift than standard engines. The Honda Variable Valve Timing and Lift Electronic Control System takes this into account. When vlave actuation is adjusted for low rpm timing and lift, low rpm torque is better than in a standard engine. When valve actuation is then adjusted for high rpm timing and lift. output improves to the level that a racing engine can offer.Until now. few variable valve timing systems have been commercialized. In those that have, only the time that both valves are open (intake/exhaust overlap) could be changed. Honda's system is the first in the world in which the intake valve timing and the degree of valve lift can be changed as needed, making it the most advanced valve train mechanism available.

Comparison of Valve Lift of Racing Engines vs. Mass Produced Engines

	Racing Engine	Variable Timing & Lift Engine	Standard Engine
Valve Timing (exhaust/intake) Valve Lift			
Max. Power	○	○	
Low rpm Torque		○	○
Idling Stability		○	○

*TDC = Top Dead Center *BDC = Bottom Dead Center
○ = Optimum Characteristic

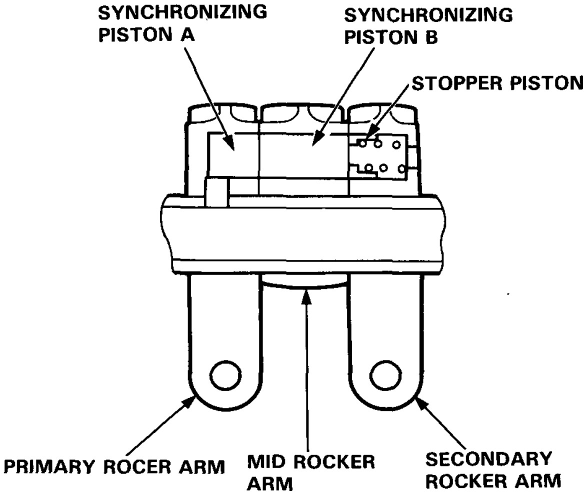
The engine is equipped with two valve timing and lift settings which change according to driving conditions.

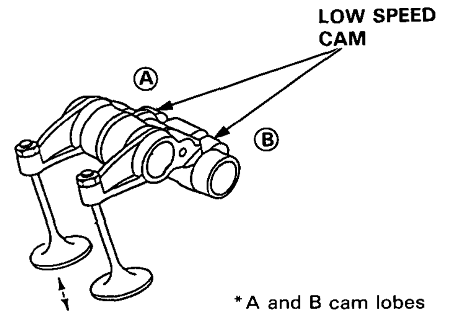


Mechanism:

At low rpm:
As shown, the primary and secondary rocker arms located on both sides are not connected to the mid rocker arm, but are driven separately by cam lobes A and B at different timing and lift. Although the mid rocer arm is following the center cam lobe with the lost-motion assembly, it has no effect on the opening and closing of the valves in the low rpm range.

At Low rpm:

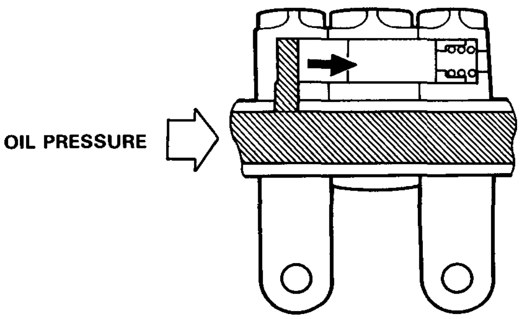


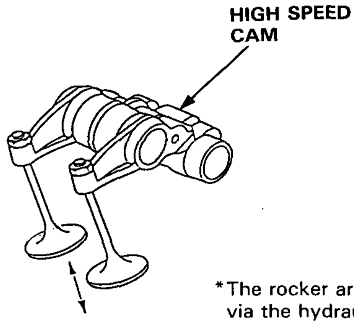


*A and B cam lobes drive the rocker arms separately.

At High rpm:
When driving at high rpm, the built-in piston moves in the direction shown by the arrow in the figure below. As a result, the primary, secondary, and mid rocker arms are linked by 2 hydraulic pistons (like a skewer) and the 3 rocker arms move as a single unit. In this state, all the rocker arms are driven by cam lobe C opening and closing the valves at the valve timing and lift set for high operation.

At High rpm:





*The rocker arms are linked via the hydraulic piston. Cam lobe C drives the rocker arms.

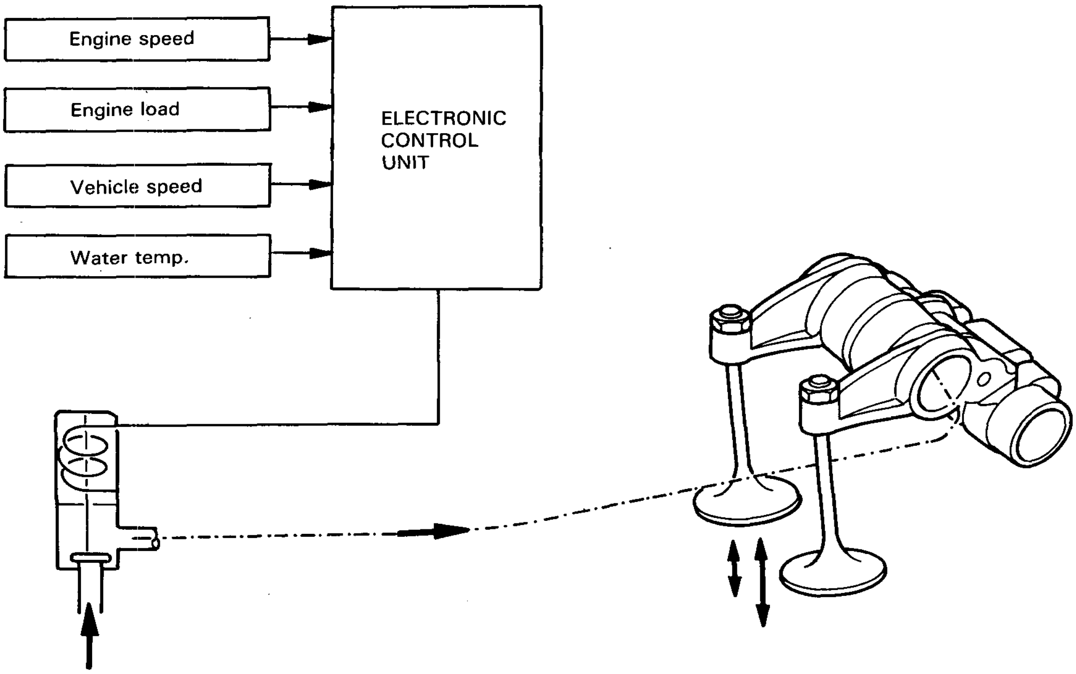
Cam and Valve Mechanism

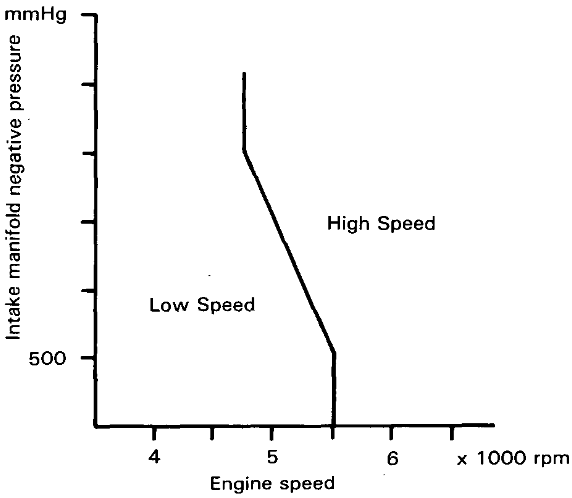
Variable Valve Timing and Lift Electronic Control System (D16Z6 engine VTEC)

Controls:

The control system for this mechanism, as shown below, constantly monitors the changes in engine status such as load, rpm and vehicle speed. This information is transmitted to the Control Unit.

Valve Timing Change Conditions
Engine RPM: 4,800 min^{-1} (rpm).
Vehicle Speed: M/T: 20 km/h (13 MPH), A/T: 5 km/h (3 MPH) min.
Water Temperature: 60°C (140°F) min.
Engine Load: Judged by intake manifold negative pressure

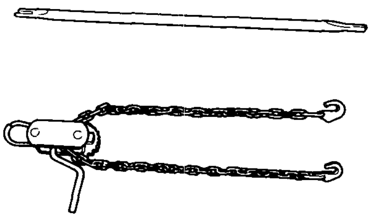




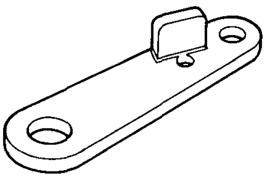
Engine Removal/Installation

Special Tools

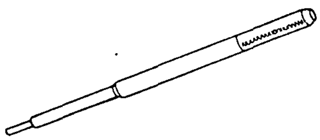
Ref. No.	Tool Number	Description	Qty	Page Reference
①	07KAK–SJ40101	Engine Tilt Hanger Set	1	5-23
②	07MAK–PY30100	Engine Sub Hanger Stay	1	5-23
③	07744–0010600	Pin Driver, 8.0 mm	1	5-22



①



②



③

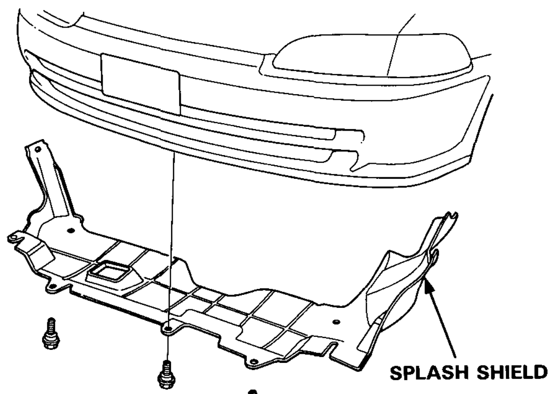
⚠WARNING
- **Make sure jacks and safety stands are placed properly and hoist brackets are attached to the correct positions on the engine.**
- **Make sure the car will not roll off stands and fall while you are working under it.**

CAUTION:
- **Use fender covers to avoid damaging painted surfaces.**
- **Unspecified items are common.**
- **Unplug the wiring connectors carefully while holding the connector portion to avoid damage.**
- **Mark all wiring and hoses to avoid misconnection. Also, be sure that they do not contact other wiring or hoses or interfere with other parts.**

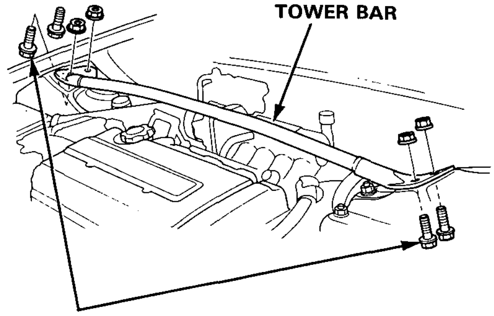
1. Disconnect the battery negative terminal first, then the positive terminal.
2. Remove the radiator cap.

   ⚠WARNING Use care when removing the radiator cap to avoid scalding by hot coolant or steam.

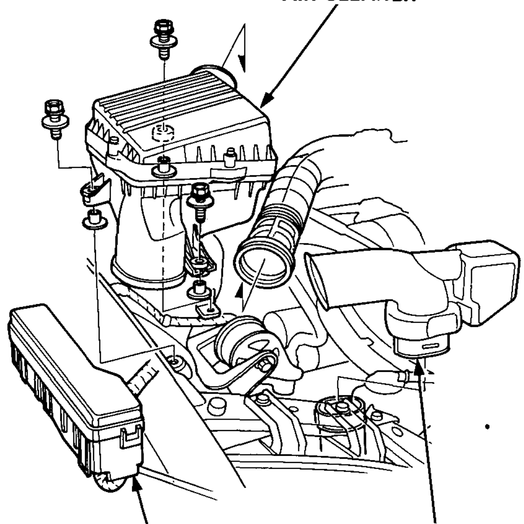
3. Raise the hoist to full height.
4. Remove the front tires/wheels and the engine splash shield.



5. Drain the coolant (see Section 10).
   - Loosen the drain plug from the radiator lower tank.
6. Drain the transmission oil/fluid. Use a 10 mm (3/8") drive socket wrench to remove the drain plug. Reinstall the drain plug using a new washer.
7. Drain the engine oil. Reinstall the drain plug using a new washer.
8. Lower the hoist. Secure the hood as far open as possible.
9. Remove the tower bar (B16A2 engine).



10. Remove the under-hood ABS fuse/relay box (LHD).
11. Remove the air intake hose, the resonator and the air cleaner assembly.



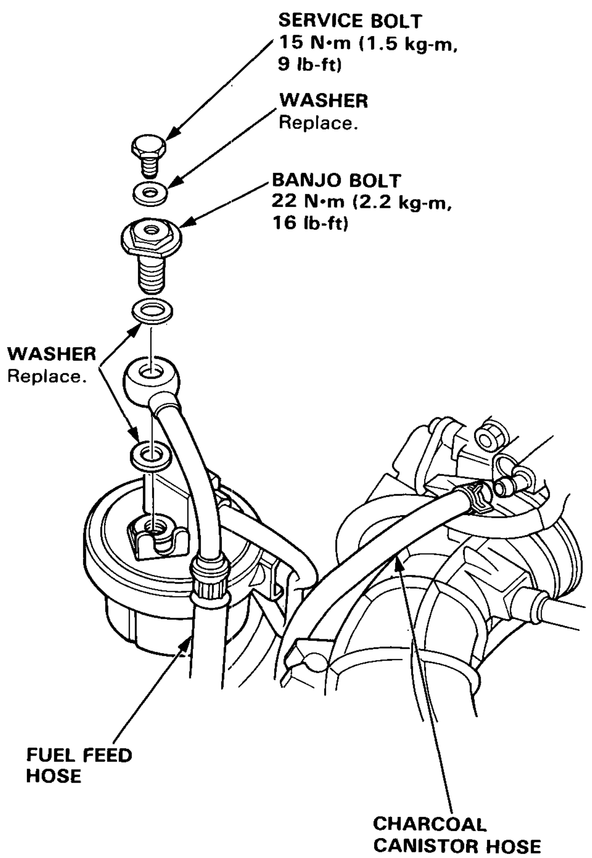
(cont'd)

12. Relieve fuel pressure by slowly loosening the service bolt on the fuel filter about one turn (see Section 11).

⚠WARNING Do not smoke while workig on the fuel system. Keep open flame away from work area. Drain fuel only into an approved container.

CAUTION:
- **Before disconnecting any fuel line, the fuel pressure should be relieved as described above.**
- **Place a shop towel over the fuel filter to prevent pressurized fuel from spraying over the engine.**

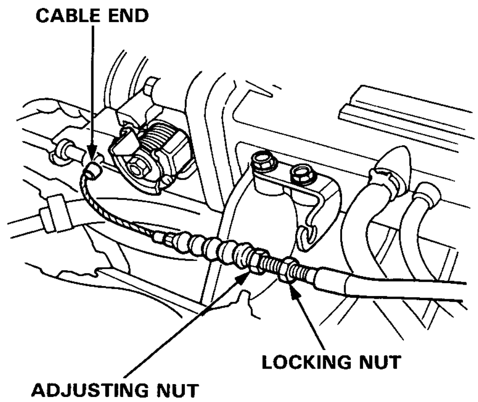
13. Remove the fuel feed hose and charcoal canister hose from the intake manifold.



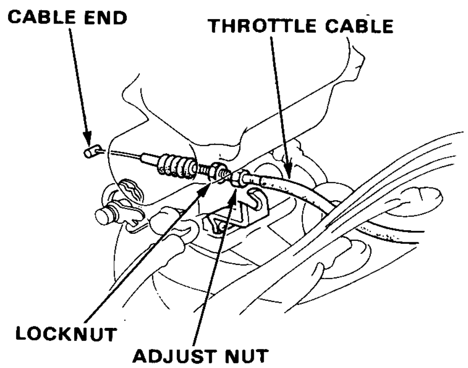
14. Remove the throttle cable by loosening the locking-nut, then slip the cable end out of the accelerator linkage.

NOTE:
- Take care not to bend the cable when removing it. Always replace any kinked cable with a new one.
- Adjust the throttle cable when installing (see Section 11).

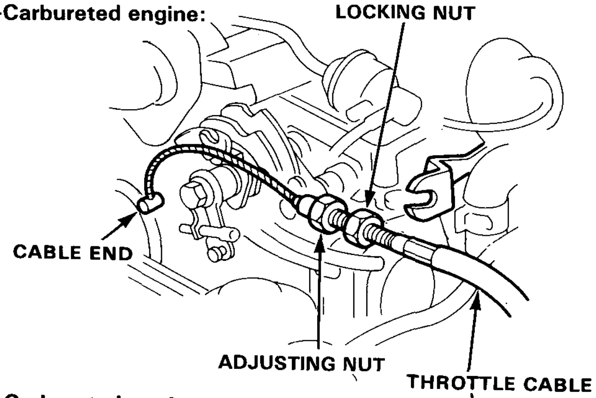
PGM-FI (except D15B2) engine:



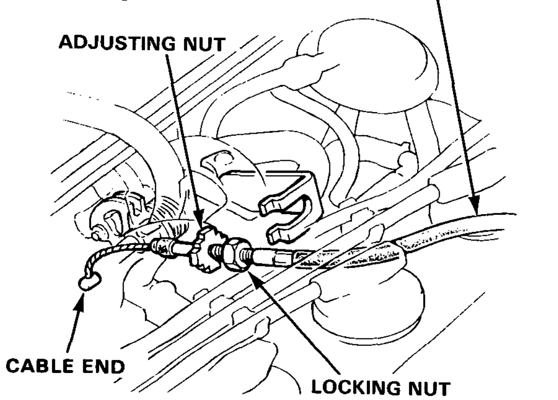
PGM-FI (D15B2) engine:



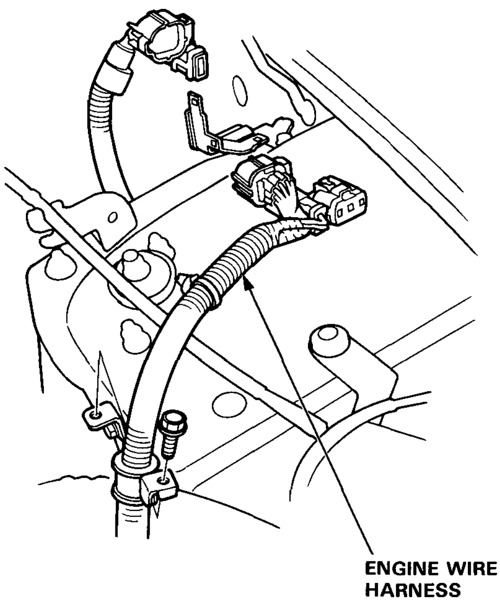
1-Carbureted engine:



2-Carbureted engine:

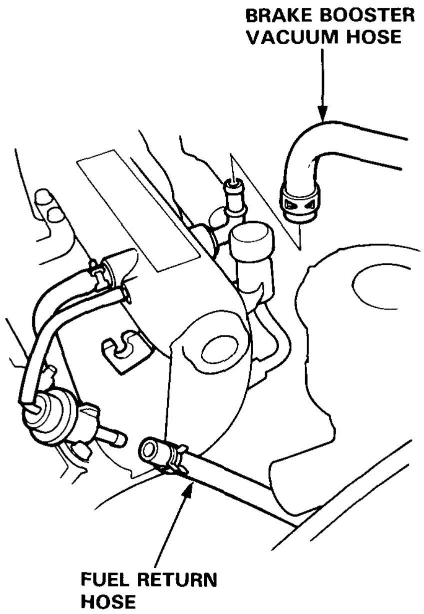


15. Remove the engine wire harness connectors on the left side of engine compartment.

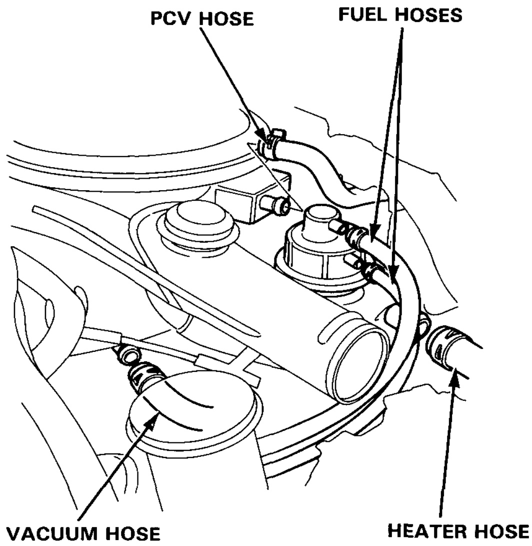


16. Remove the fuel return hose and brake booster vacuum hose.

PGM-FI engine:



1-Carbureted engine:



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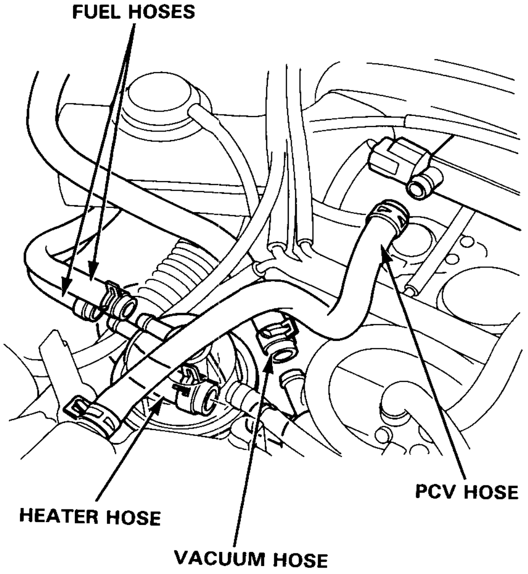
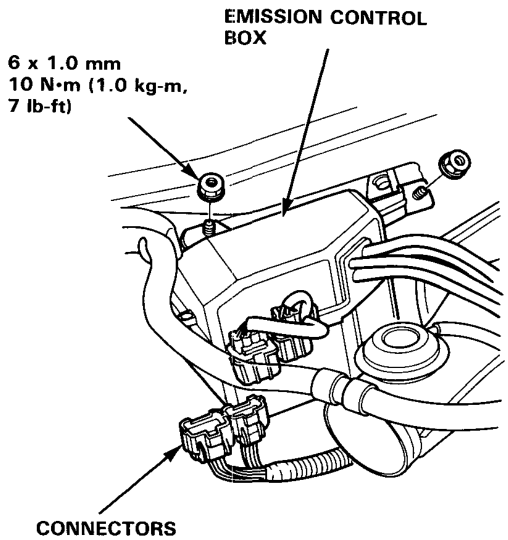
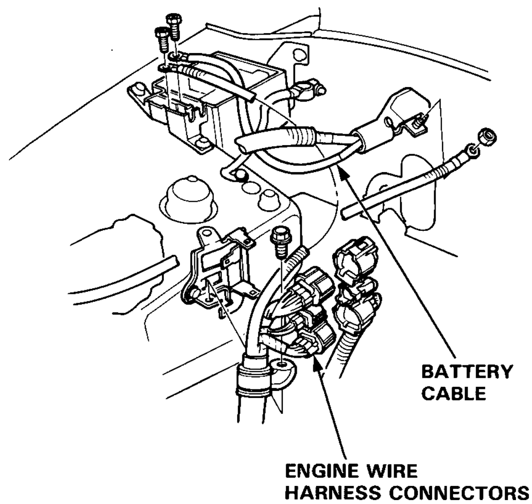
2-Carbureted engine:



17. Disconnect the connectors, then remove the fuel emission control box (carbureted engine).

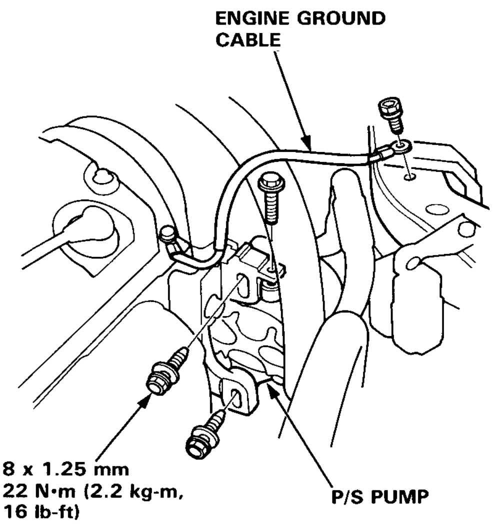


18. Remove the engine wire harness connectors, terminal and clamps on the right side of engine compartment.
19. Remove the battery cable/starter cable from the under-hood fuse/relay box and ABS power cable from battery terminal.

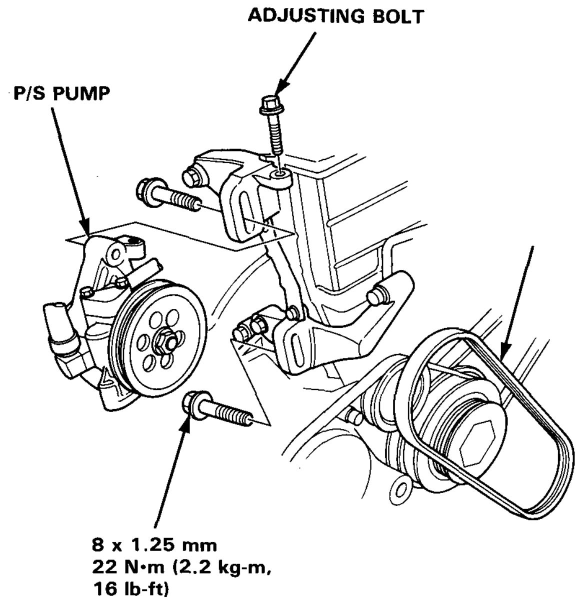


20. Remove the engine ground cable on the cylinder head.
21. Remove the P/S belt and pump.
    - Do not disconnect the P/S hoses.

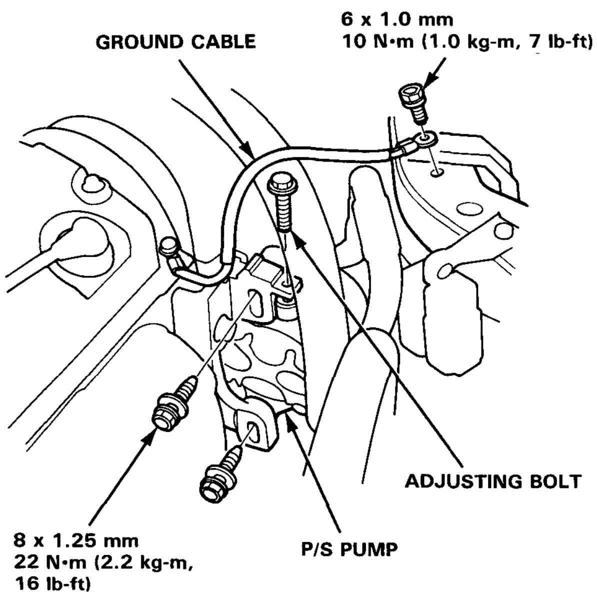
SOHC engine:



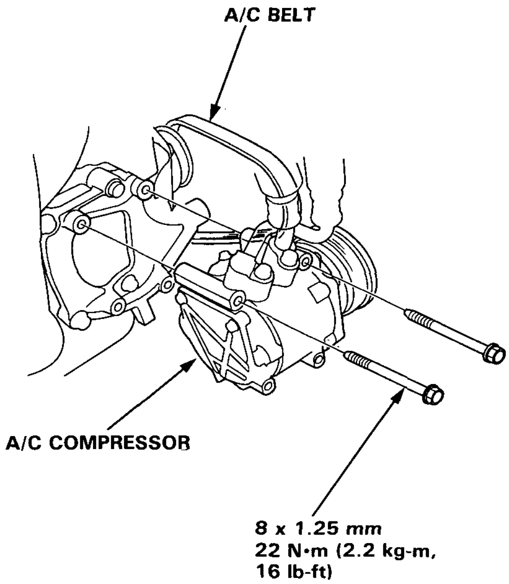
D16A7/D16A8 (DOHC) engine:



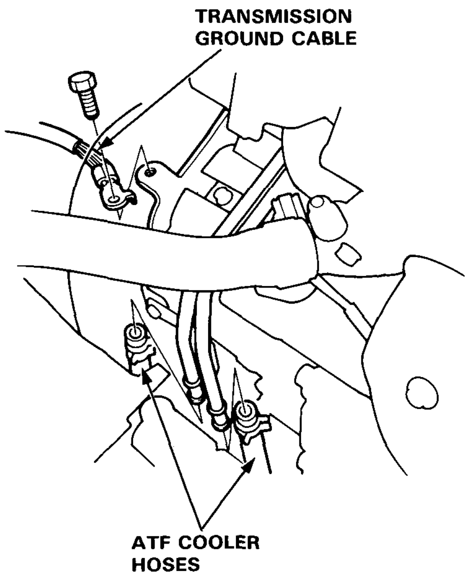
B16A2 (DOHC VTEC) engine:



22. Remove the A/C belt and compressor.
    - Do not disconnect the A/C hoses.
    - Disconnect the connector.



23. Remove the transmission ground cable and the ATF cooler hoses (A/T).



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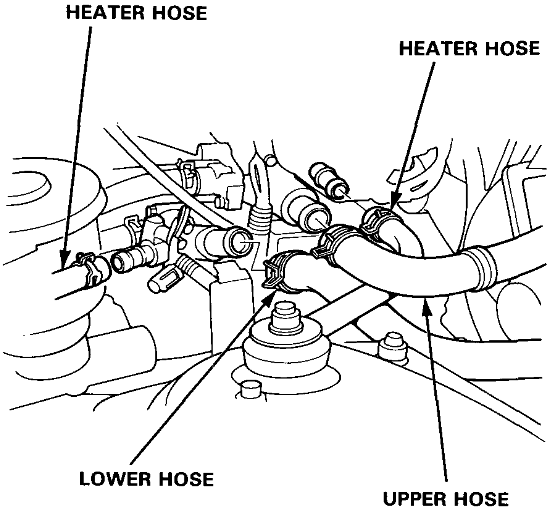
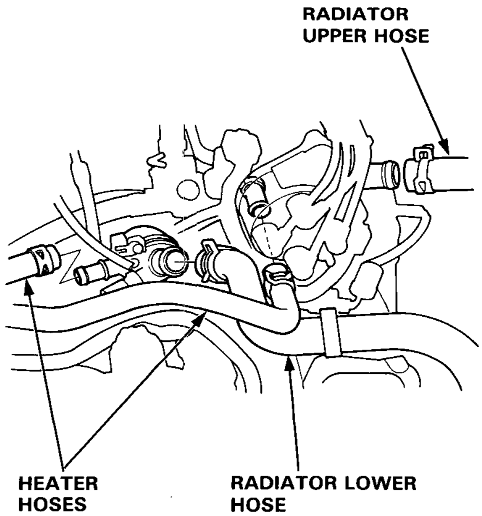
24. Remove the upper and lower radiator hoses and the heater hoses.

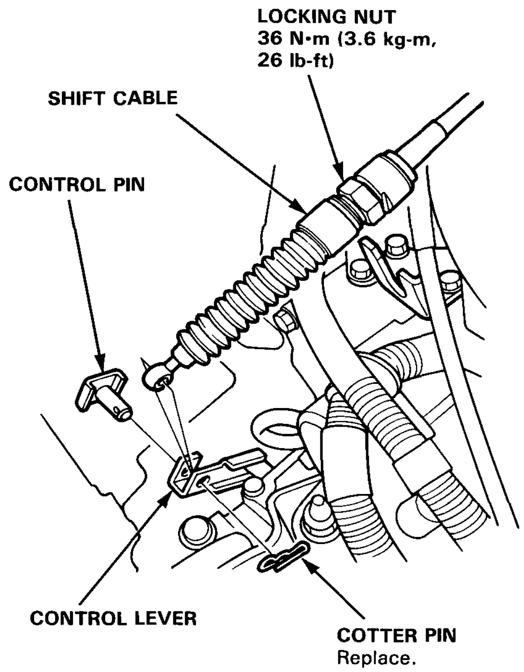
B16A2 engine:



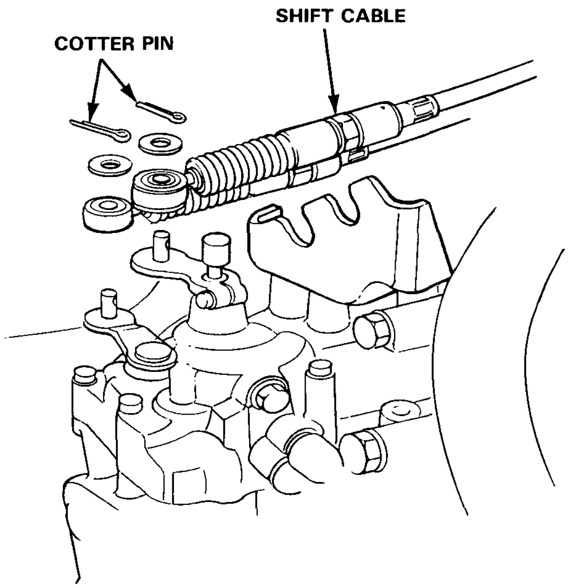
Except B16A2 engine:



25. Remove the A/T shift cable.



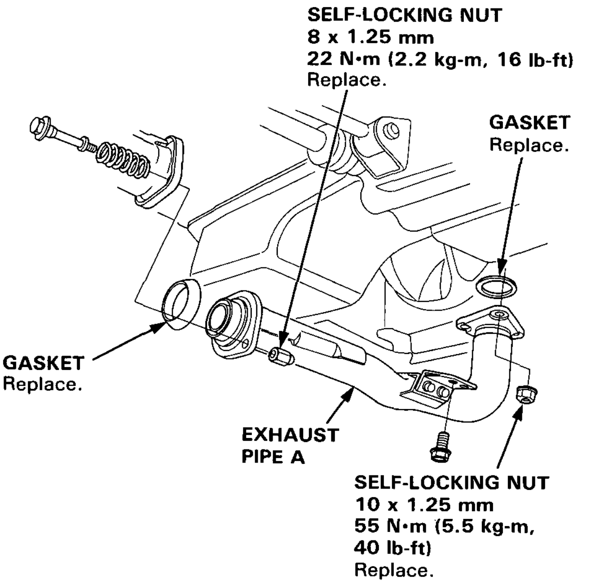
26. Remove the shift cable and select cable (M/T 4WD).



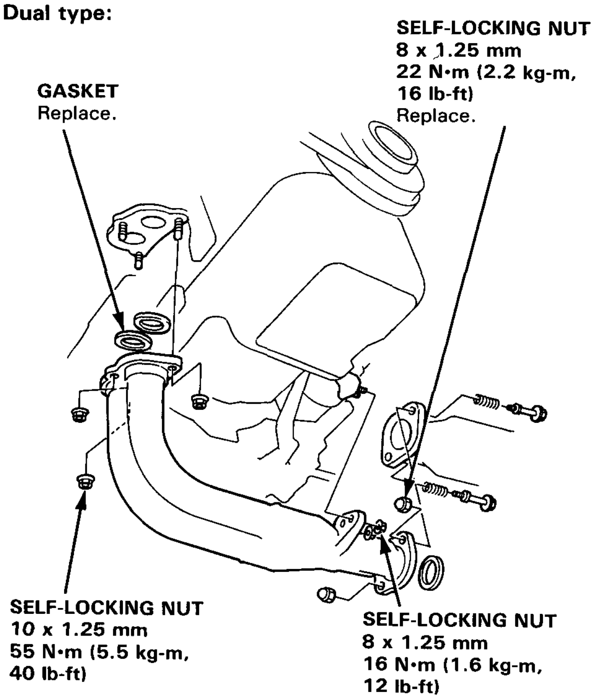
27. Raise the hoist to full height.

28. Remove the exhaust pipe and stay.

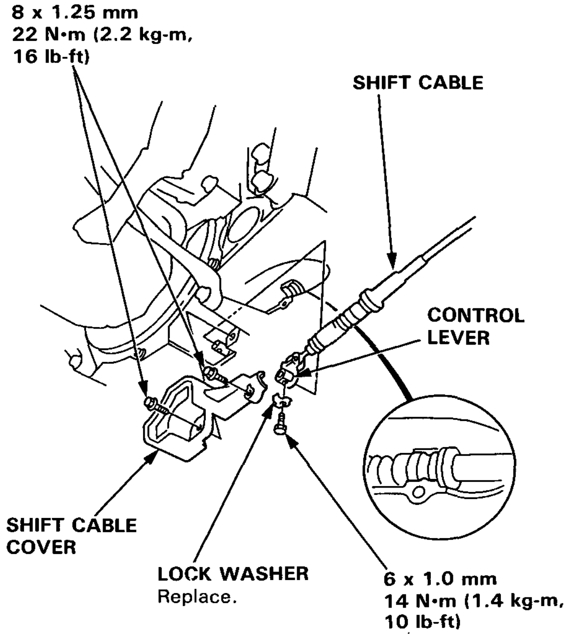
Single type:



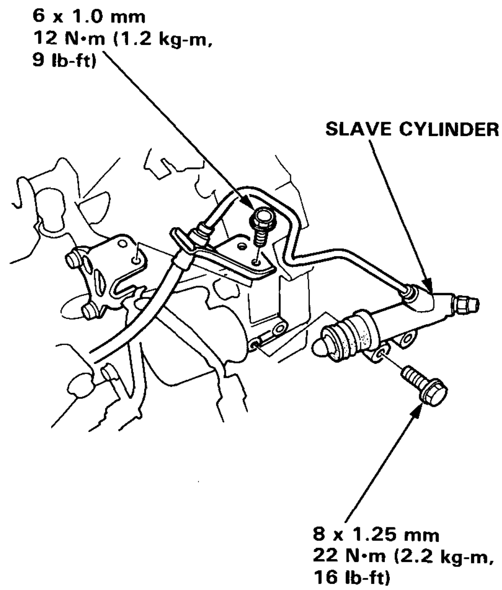
Dual type:



29. Remove the A/T shift cable (A/T).

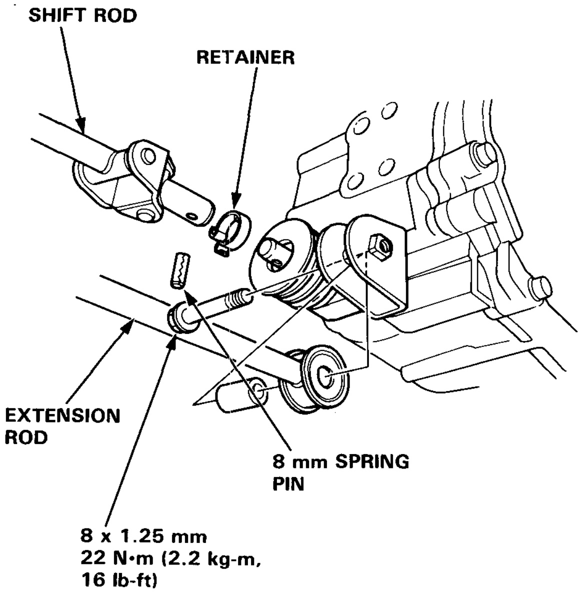


30. Remove the clutch slave cylinder and pipe/hose assembly (M/T).
   - Do not disconnect the pipe/hose assembly.

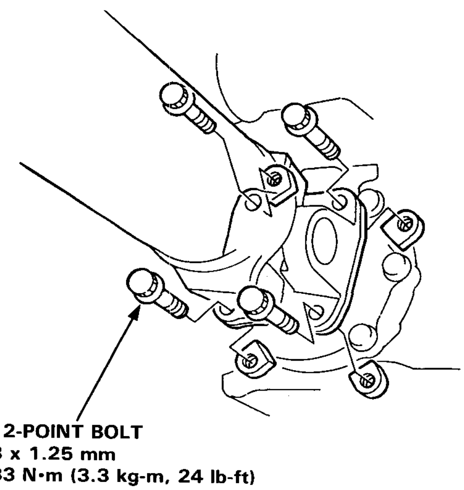


(cont'd)

31. Remove the shift rod and the extension rod (M/T).



32. Remove the No. 1 propeller shaft by disconnect the V-joint (4WD).

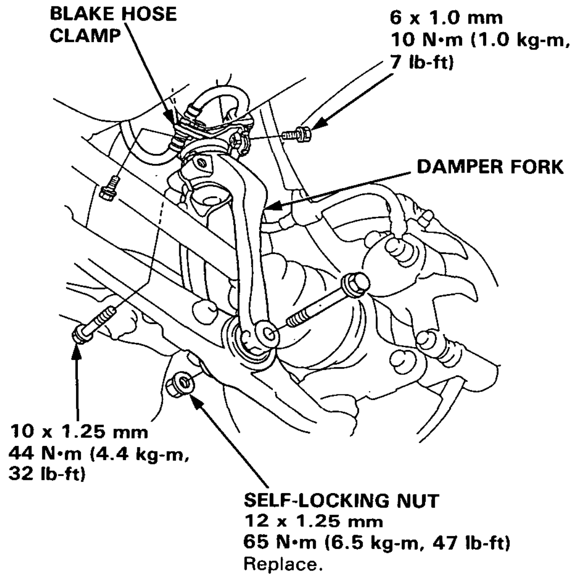


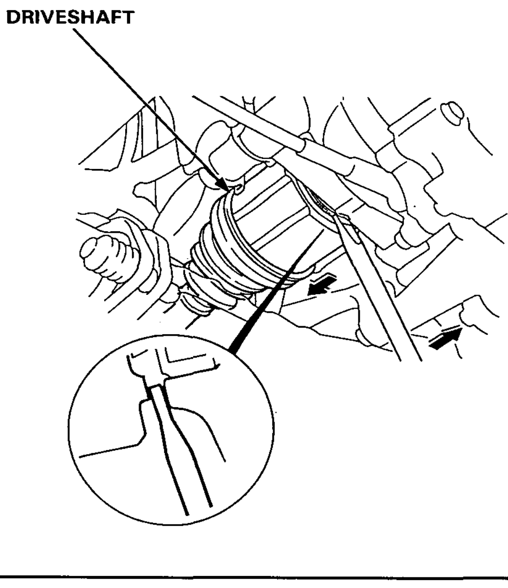
33. Remove the damper fork.

34. Disconnect the suspension lower arm ball joint with the special tool. Refer to section 18 for proper procedure.

35. Remove the driveshafts.

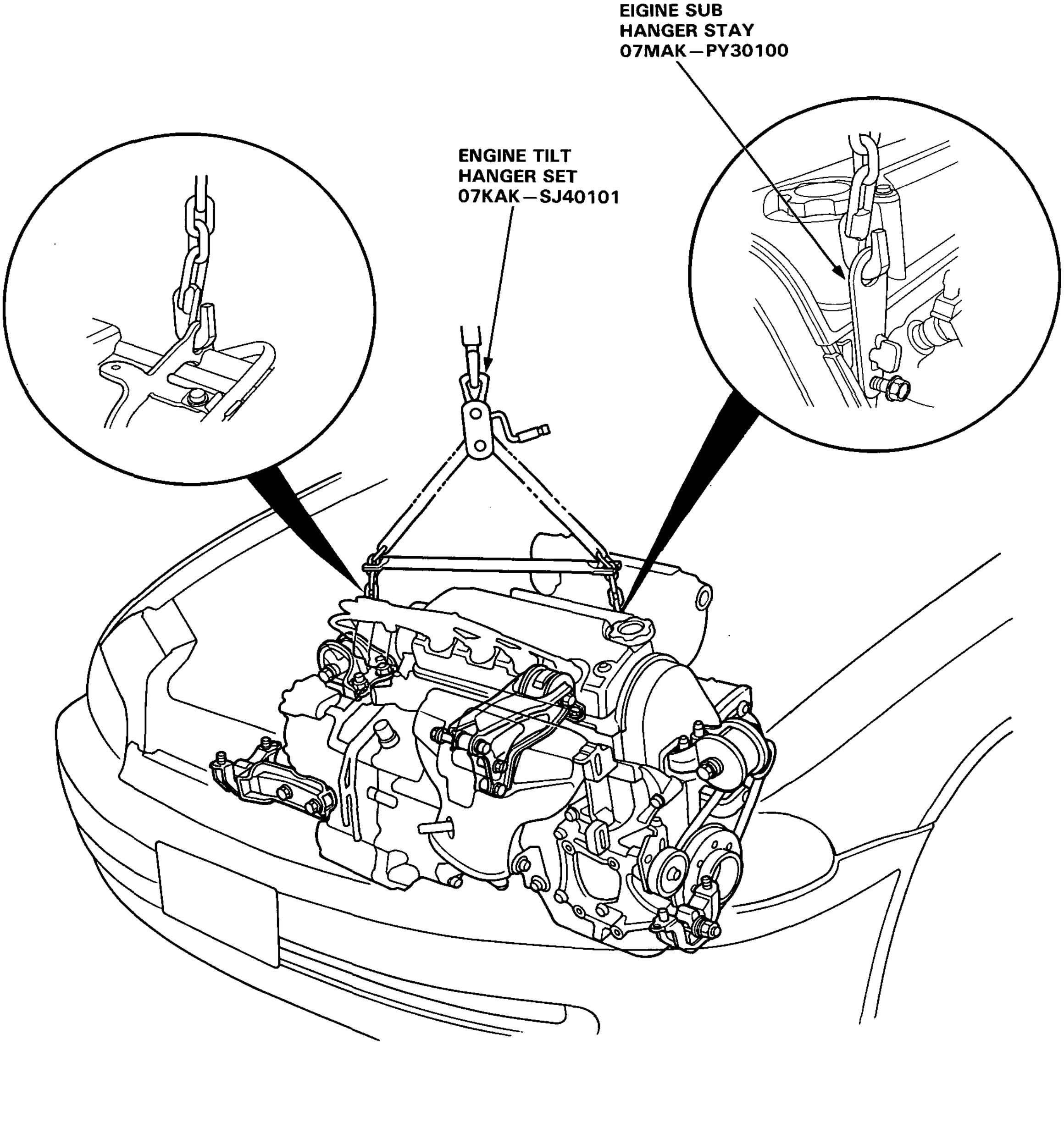
NOTE:
- Coat all precision-finished surfaces with clean engine oil or grease.
- Tie plastic bags over the driveshaft end.





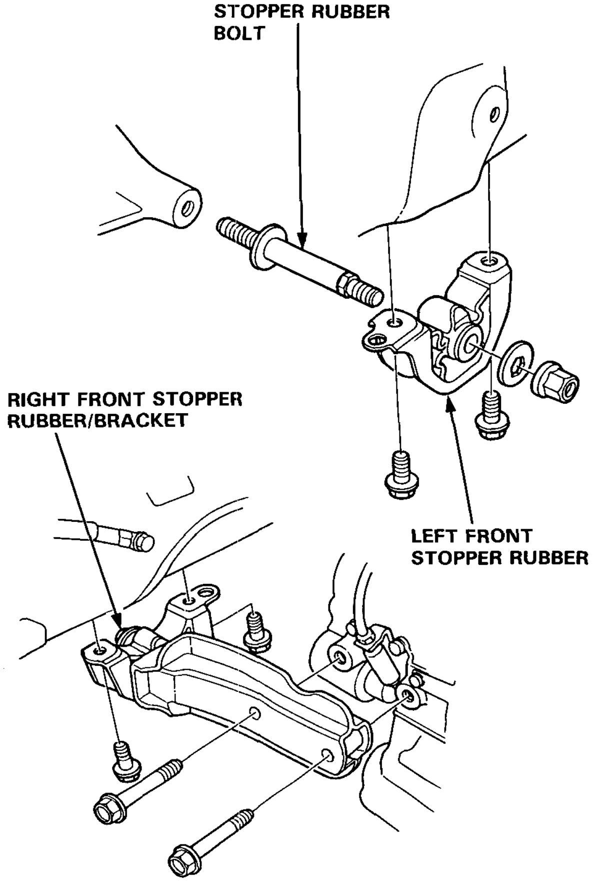
36. Lower the hoist.

37. Attach the chain hoist to the engine.

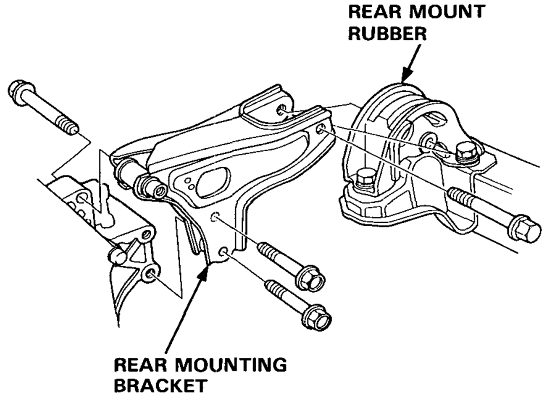


(cont'd)

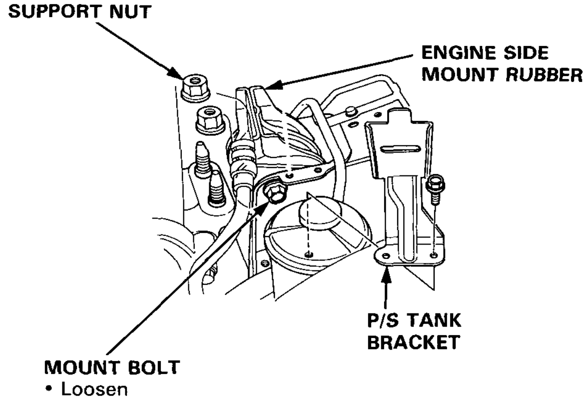
38. Remove the left and right front stopper rubbers and stopper brackets.



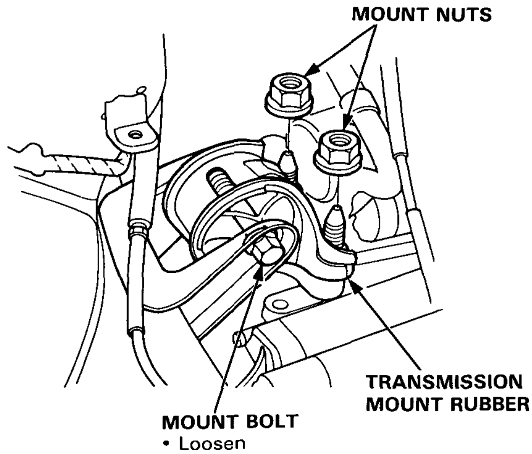
39. Remove the rear engine mounting bracket.



40. Remove the engine support nuts. Loosen the mount bolt and pivot the engine side mount out of the way.



41. Remove the transmission mount nuts. Loosen the mount bolt and pivot the transmission side mount out of the way.



42. Raise the chain hoist to remove all slack from the chain.

43. Check that the engine is completely free of vacuum hoses, fuel and coolant hoses, and electric wires.

44. Slowly raise the engine approximately 150 mm (6'').
    Check once again that all hoses and wires have been disconnected from the engine.

45. Raise the engine all the way and remove it from the car.

46. Install the engine in the reverse order of removal.

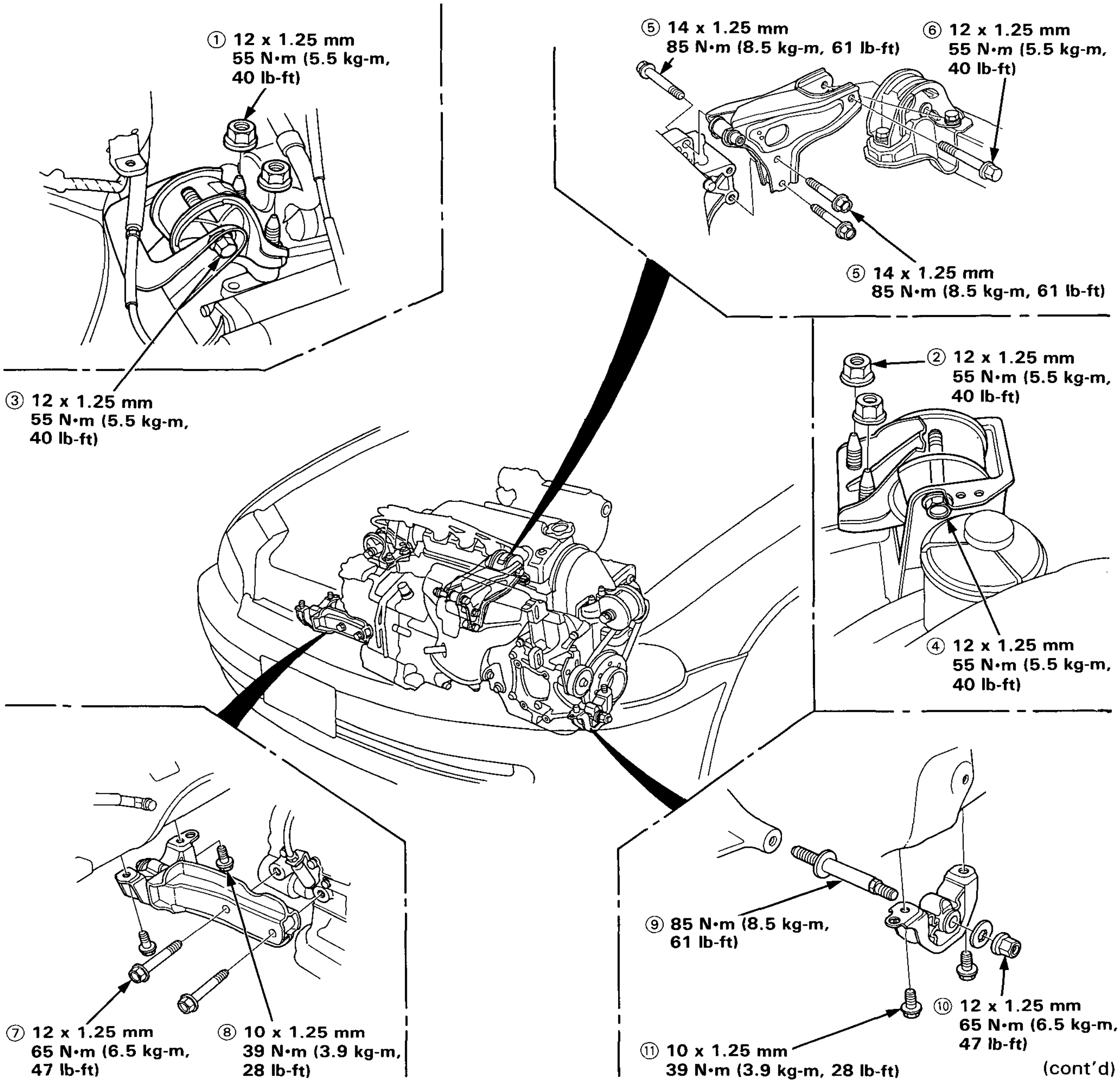
NOTE:
After the engine is in place:
- Torque the engine mounting bolts in sequence shown below.

CAUTION: Failure to tighten the bolts in the proper sequence can cause excessive noise and vibration, and reduce bushing life; check that the bushings are not twisted or offset.

- Check that the spring clip on the end of each driveshaft clicks in to place.

CAUTION: Use new spring clips on installation.

- Bleed air from the cooling system at the bleed bolt with the heater valve open.
- Adjust the throttle cable tension.
- Check the clutch pedal free play (M/T).
- Check that the transmission shifts into gear smoothly.

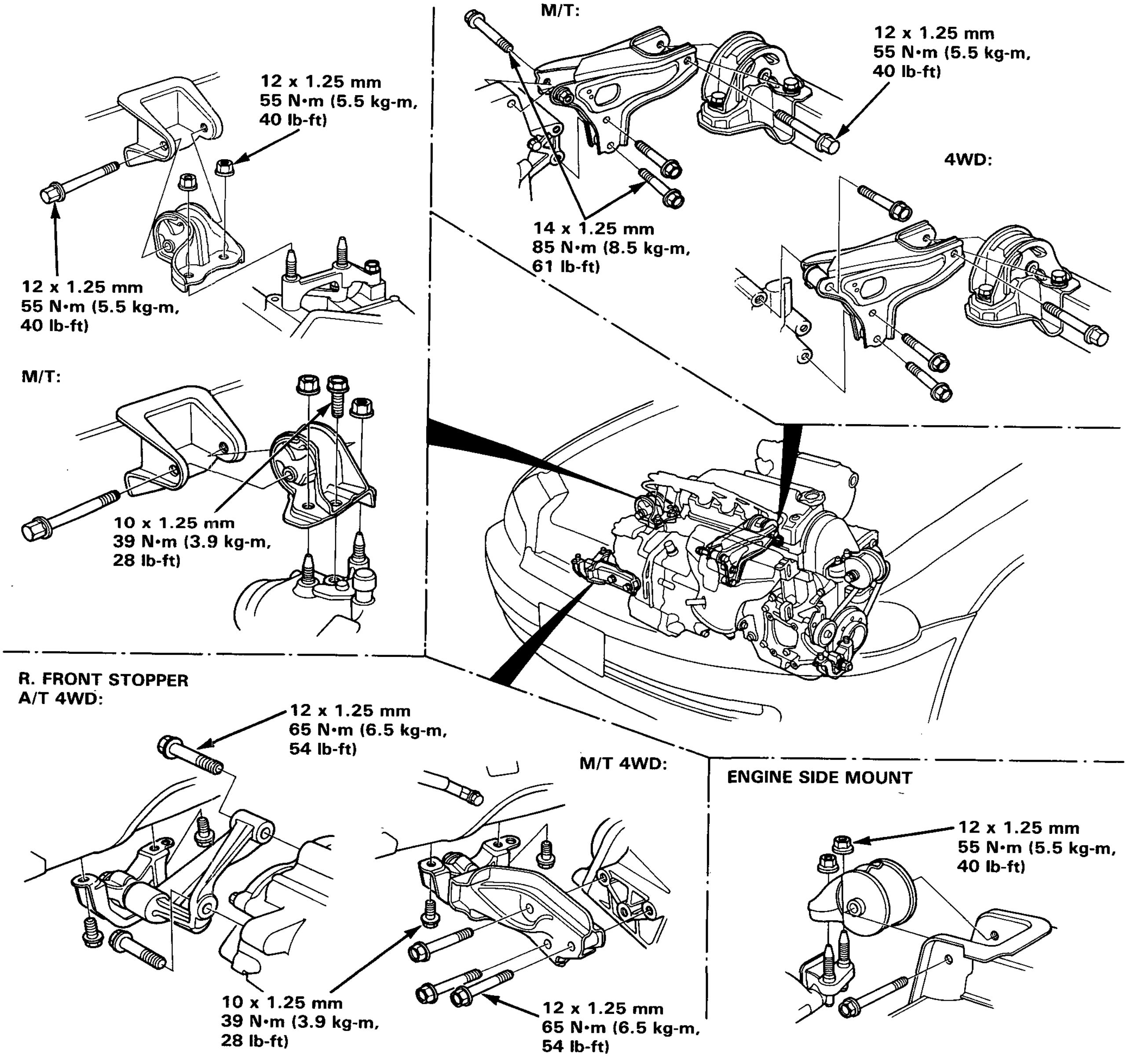


(cont'd)

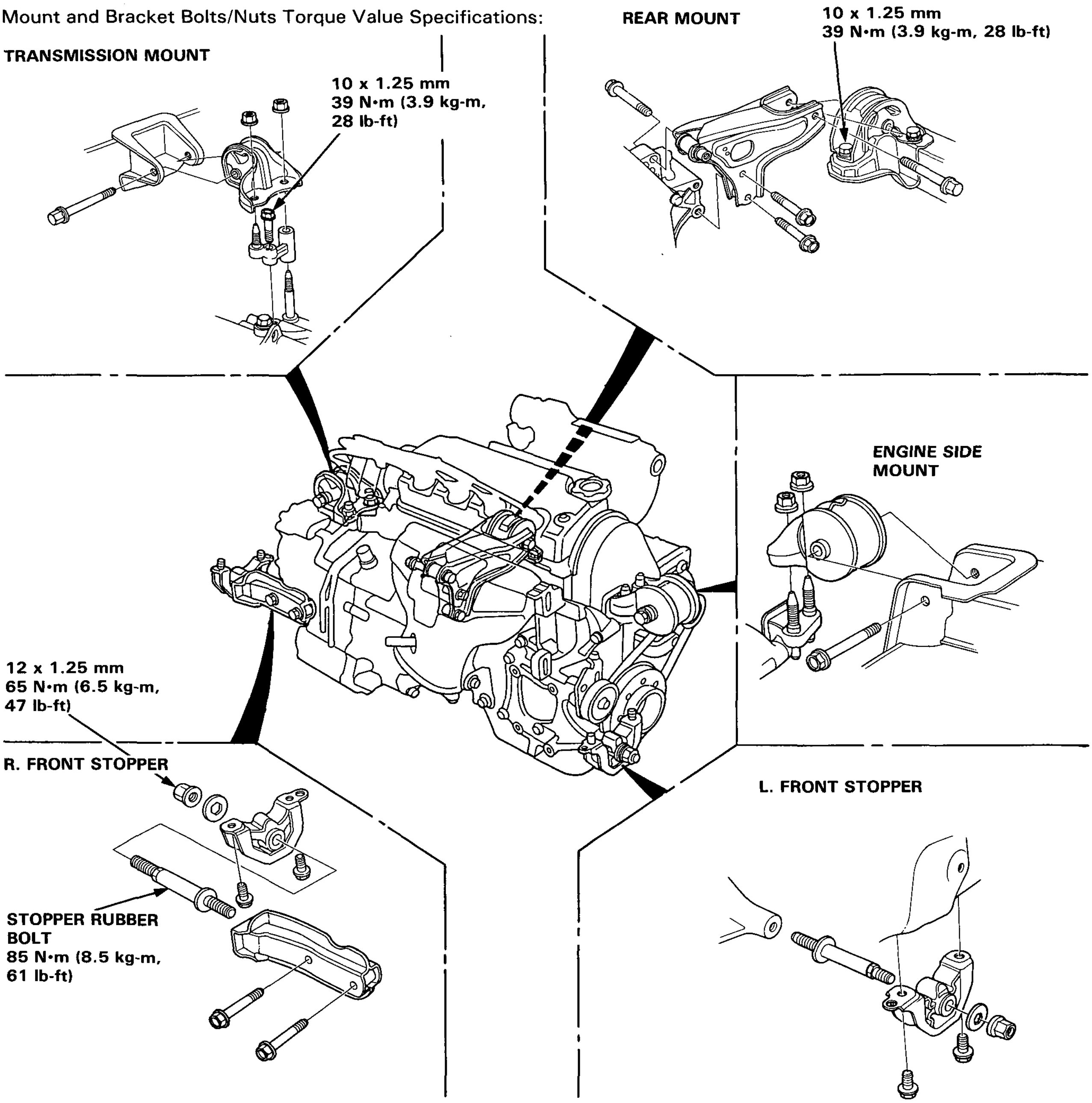
Engine Removal/Installation

(cont'd)

- Adjust the tension of the following drive belts.
  Alternator belt (Section 23).
  Power steering pump belt (Section 17).
  Air conditioner compressor belt (Section 22).
- Clean battery posts and cable terminals with sandpaper, assemble, then apply grease to prevent corrosion.
- Inspect for fuel leakage.
  After assembling fuel line parts, turn on the ignition switch (do not operate the starter) so that the fuel pump operates for approximately two seconds and the fuel is pressurized. Repeat this operation two or three times and check whether any fuel leakage has occurred at any point in the fuel line.



Mount and Bracket Bolts/Nuts Torque Value Specifications:



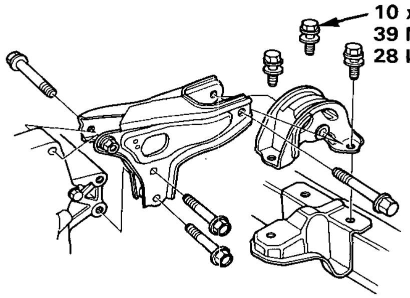
(cont'd)

Engine Removal/Installation

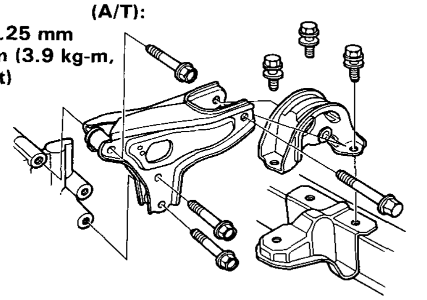
(cont'd)

Mount and Bracket Bolts/Nuts Torque Value Specifications:

REAR MOUNT
D16Z6 (A/T), B16A2 (A/T):

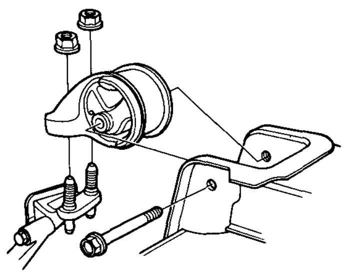


Except D16Z6 (A/T), B16A2 (A/T):



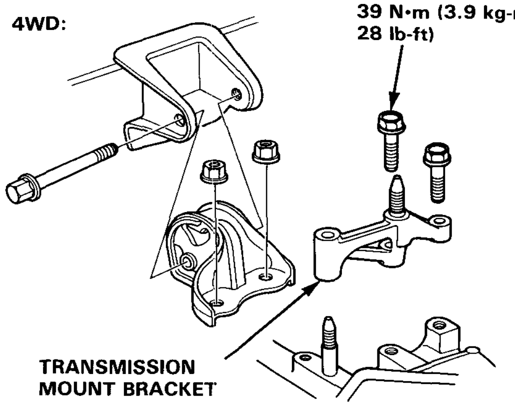
ENGINE SIDE MOUNT

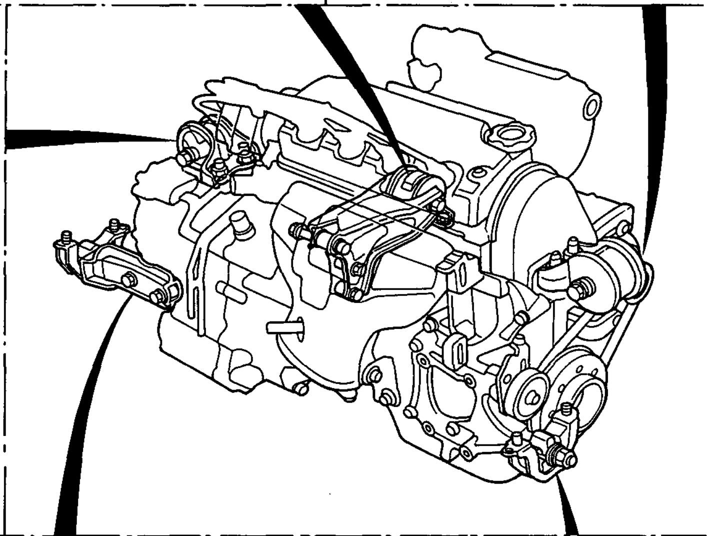
B16A2:



TRANSMISSION MOUNT

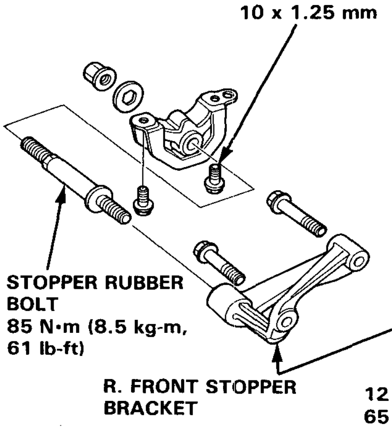
4WD:



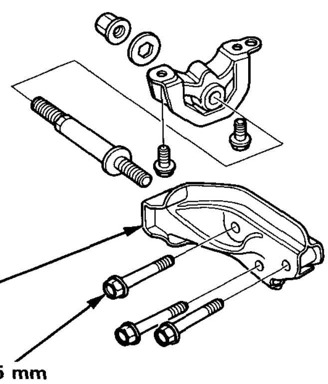


R. FRONT STOPPER

4WD:

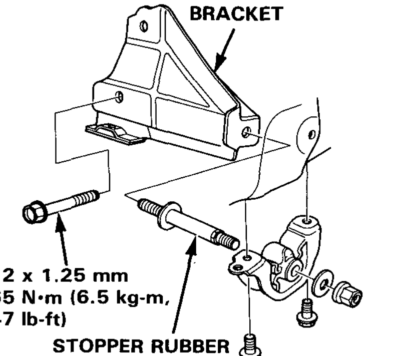


M/T:

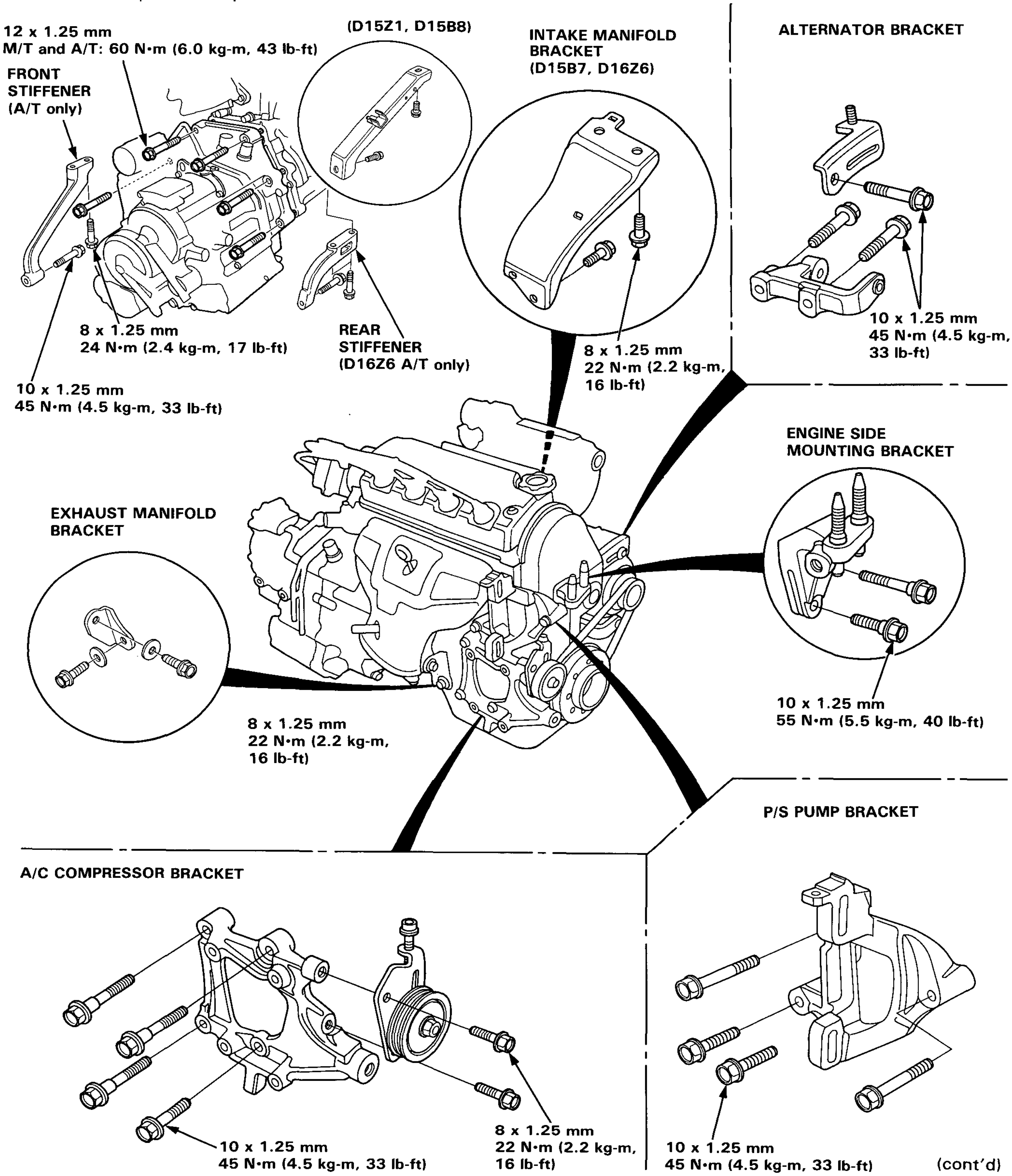


L. FRONT STOPPER

CARS NOT EQUIPPED A/C:



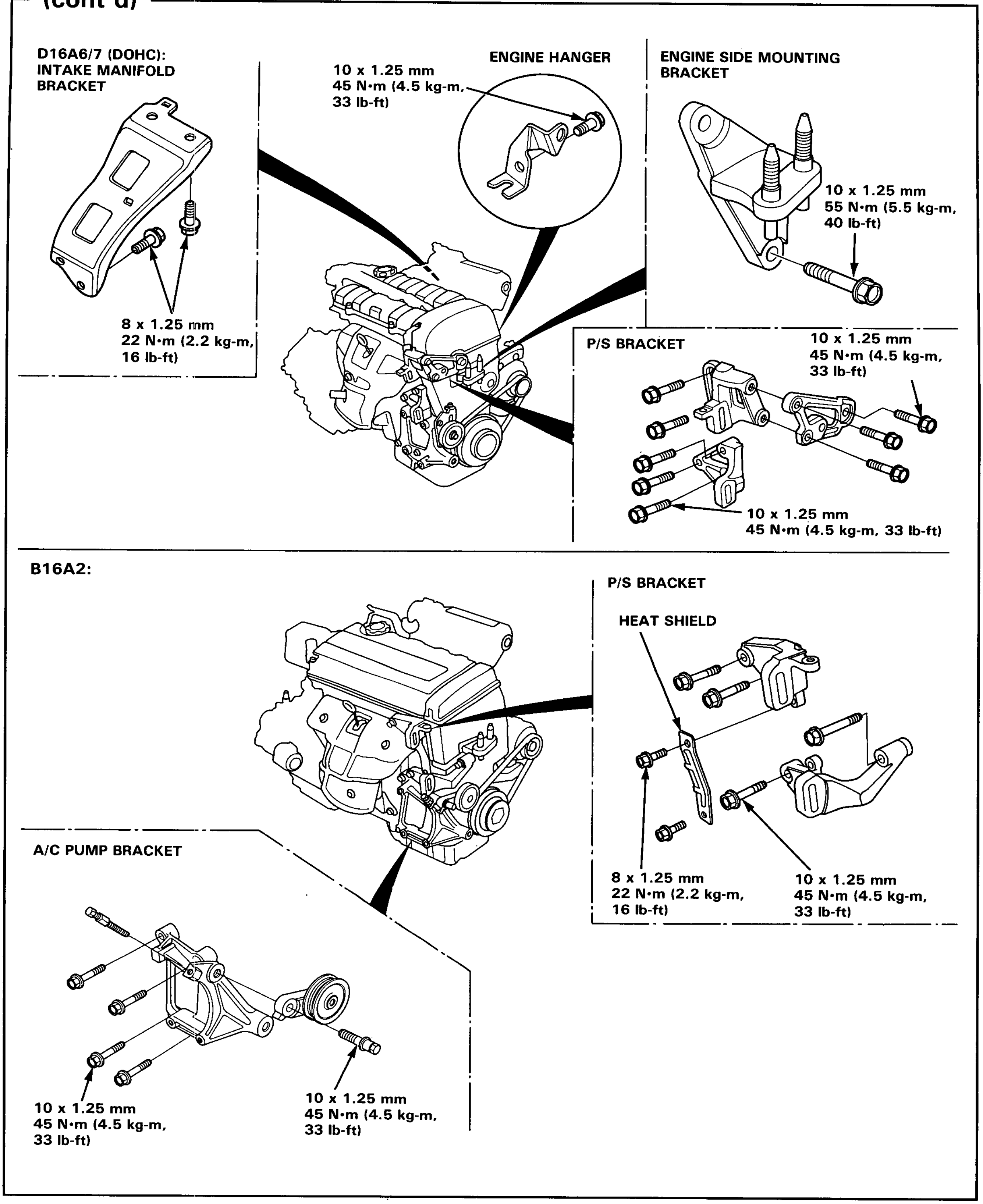
Additional Torque Value Specifications:



(cont'd)

Engine Removal/Installation

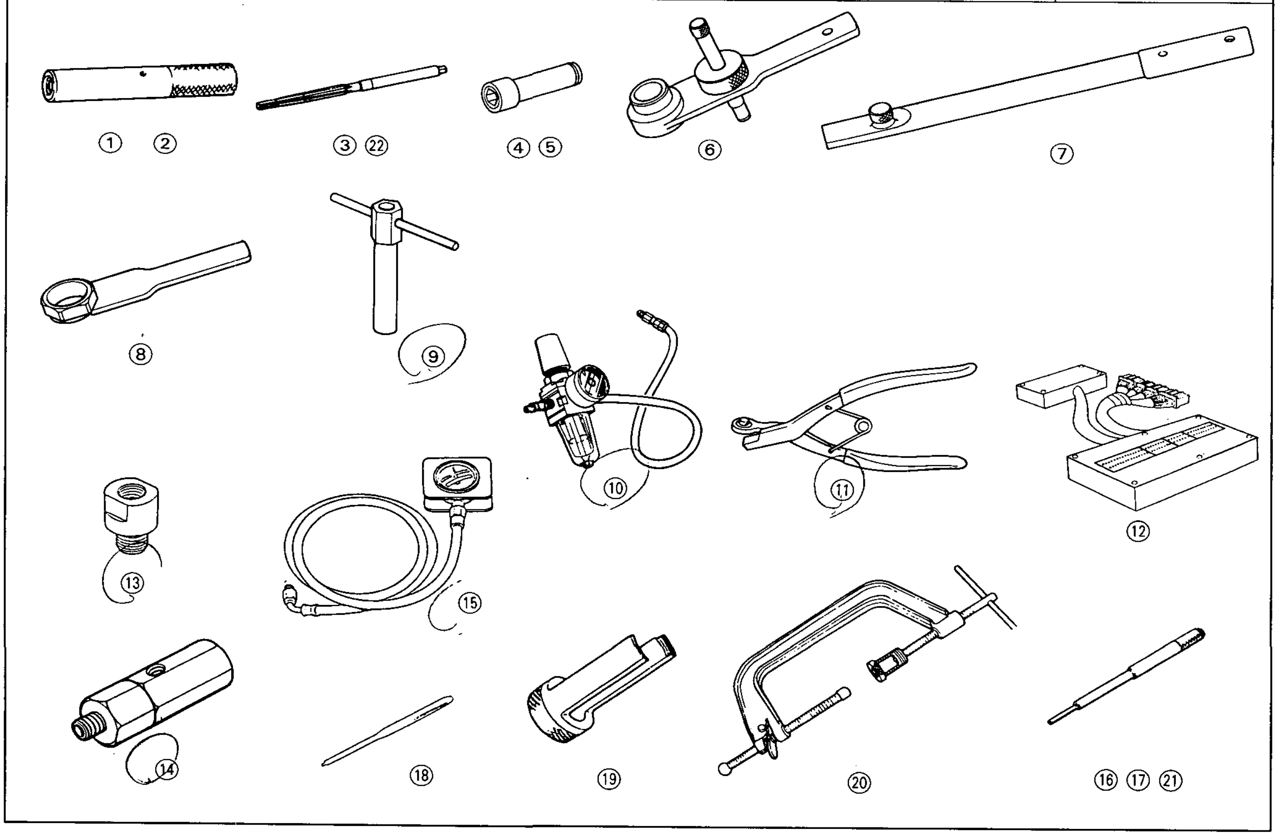
(cont'd)



Cylinder Head/Valve Train

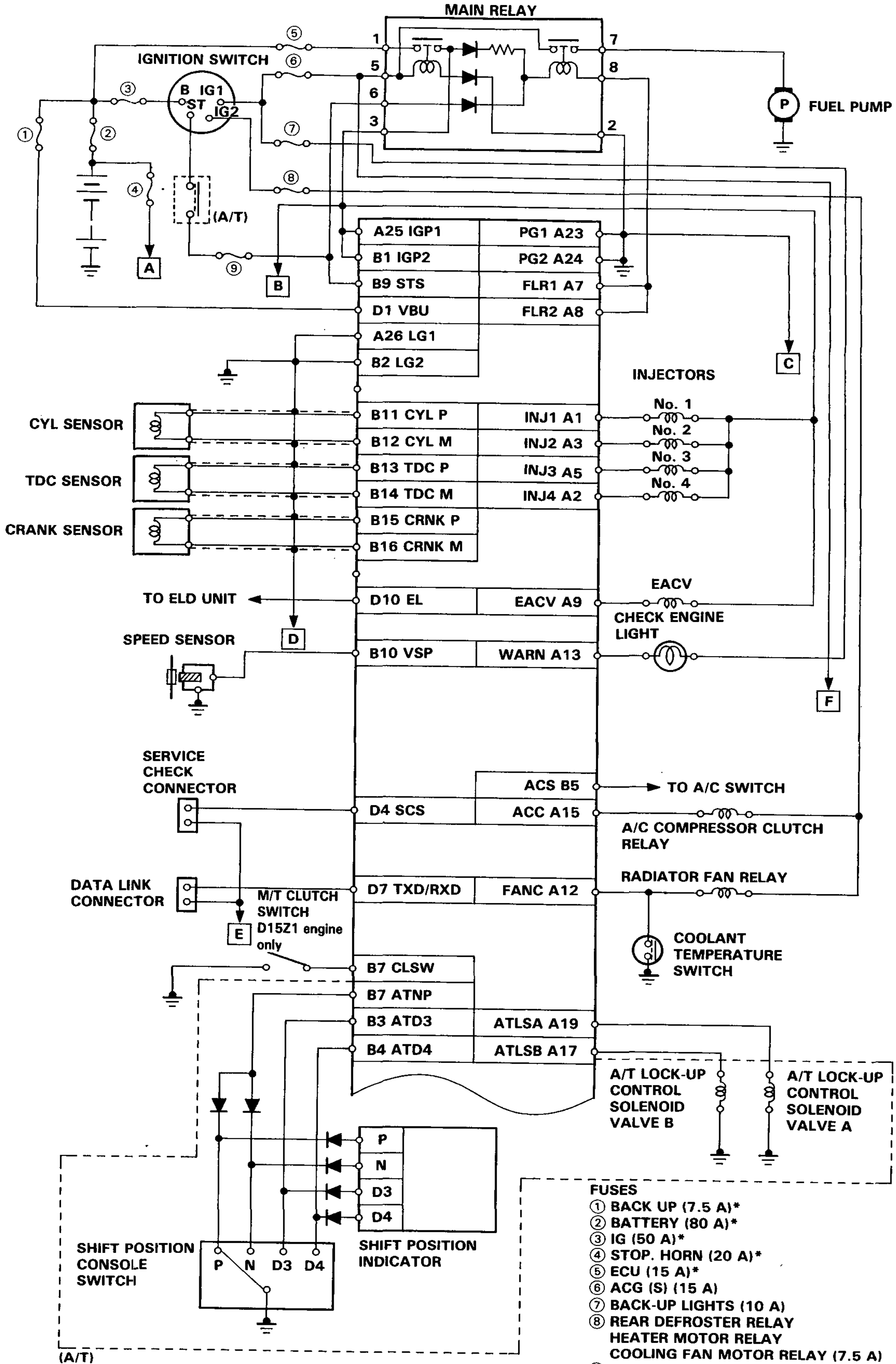
Special Tools

Ref. No.	Tool Number	Description	Q'ty	Page Reference
①	07GAD–PH70100	Stem Seal driver	1	6-81
②	07HAH–PJ70200	Stem Seal driver	1	6-44
③	07HAH–PJ70100	Valve Guide Reamer, 5.5 mm	1	6-43, 111
④	07JAA–0010100	Socket Wrench, 17 mm	1	6-56, 89
⑤	07JAA–0010200	Socket Wrench, 19 mm	1	6-89, 120
⑥	07JAB–0010100	Pulley Holder Attachment	1	6-56, 89
⑦	07JAB–0010200	Handle	1	6-56, 89, 120
⑧	07JAB–0010400	Pulley Holder Attachment HEX 50 mm	1	6-89, 120
⑨	07LAA–PR30100	Tappet Adjuster Wrench	1	6-126
⑩	07LAJ–PR30100	Valve Inspection Set	1	6-61, 63, 124
⑪	07LAJ–PR30200	Air Stopper	1	6-61, 63, 124
⑫	07LAJ–PT30100 or 07LAJ–PT3010A	Test Harness	1	6-9
⑬	07LAK–PR30100	Gauge Joint Adaptor	1	6-15, 16
⑭	07NAJ–P070100	VTEC Pressure Gauge Attachment	1	6-15, 16
⑮	07406–0070000	Low Pressure Gauge	1	6-15, 16
⑯	07742–0010100	Valve Guide Driver, 5.5 mm	1	6-42, 43, 111
⑰	07742–0010200	Valve Guide Driver, 6.6 mm	1	6-80
⑱	07744–0010400	Pin Driver, 5.5 mm	1	6-76
⑲	07757–PJ10100	Valve Spring Compressor Attachment	1	6-106
⑳	07757–0010000	Valve Spring Compressor	1	6-38, 78, 106
㉑	07942–8920000	Valve Guide Driver	1	6-111
㉒	07984–6570101	Valve Guide Reamer	1	6-81

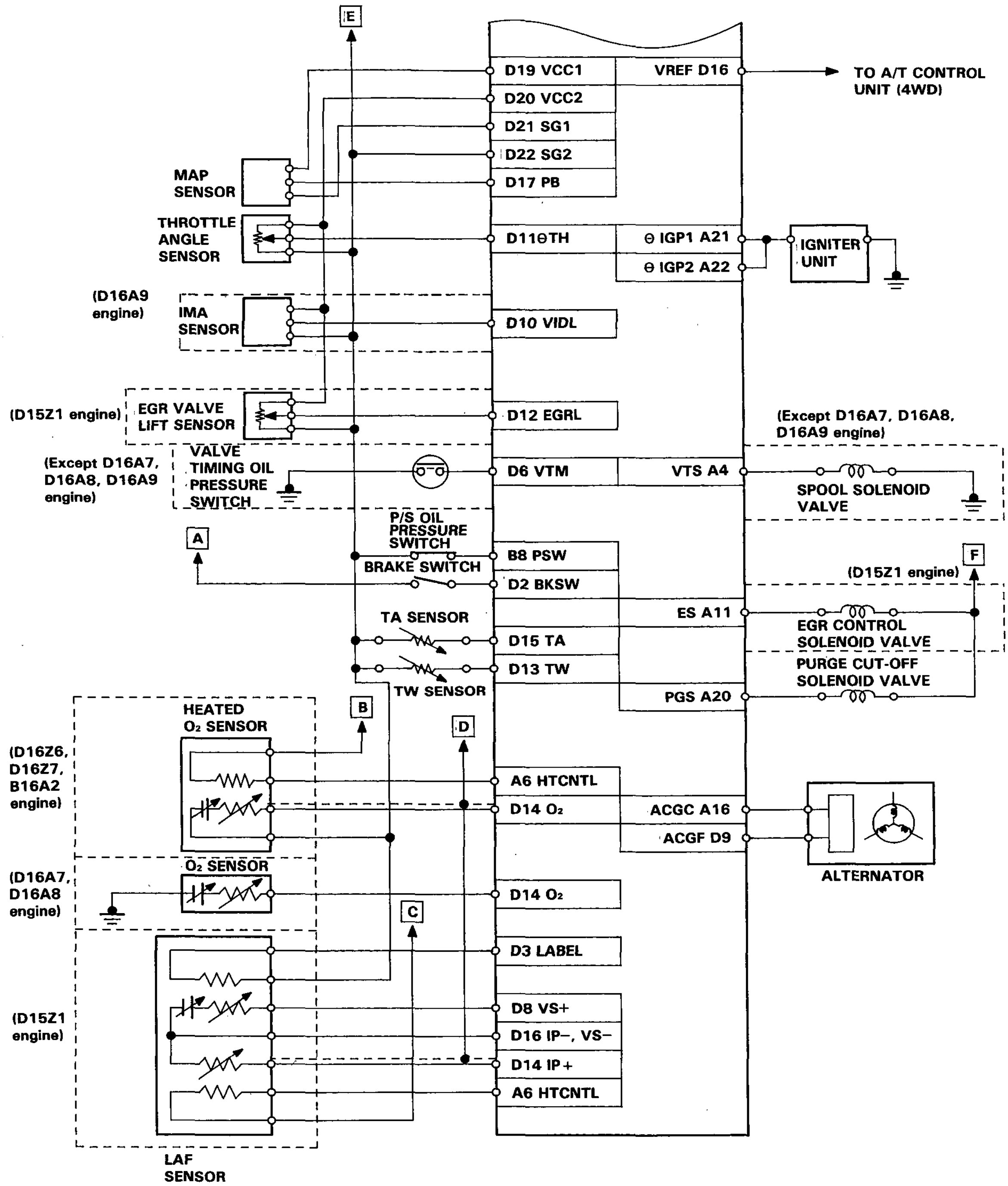


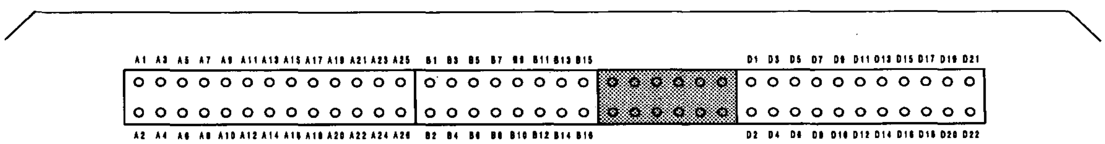
Cylinder Head/Valve Train
D12B/D13B/D15B/D15Z/D16A7/D16Z engine

Electrical Connectors



FUSES
① BACK UP (7.5 A)*
② BATTERY (80 A)*
③ IG (50 A)*
④ STOP. HORN (20 A)*
⑤ ECU (15 A)*
⑥ ACG (S) (15 A)
⑦ BACK-UP LIGHTS (10 A)
⑧ REAR DEFROSTER RELAY
HEATER MOTOR RELAY
COOLING FAN MOTOR RELAY (7.5 A)
⑨ STARTER SIGNAL (7.5 A)
*: UNDER-HOOD FUSE/RELAY BOX



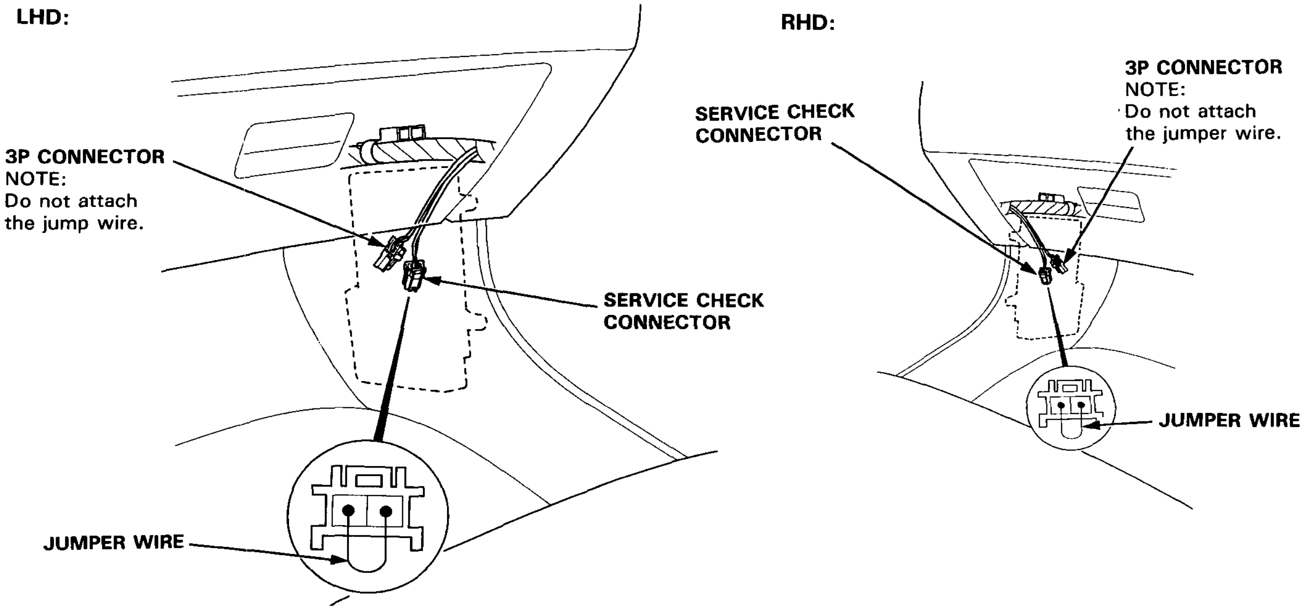


TERMINAL LOCATION

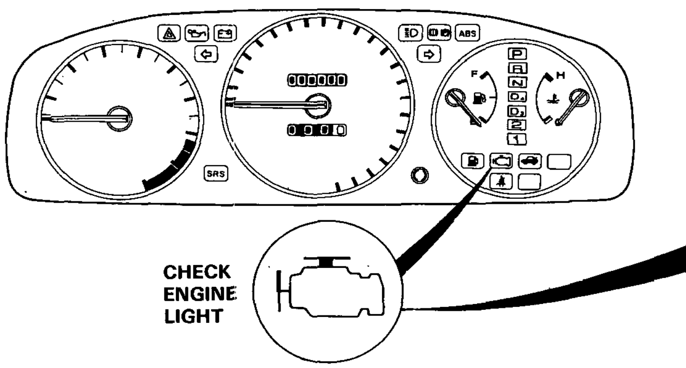
Troubleshooting—Self-diagnostic Procedures

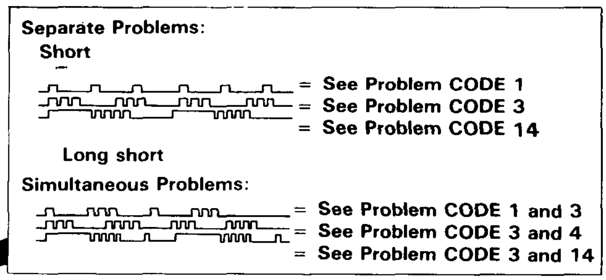
I. When the Check Engine light has been reported on, do the following:

1. Connect the Servuce Check Connector terminals with a jumper wire as shown (The 2P Service Check Connector is located under the dash on the passenger side of the car). Turn the ignition switch on.



2. Note the CODE: the Check Engine light indicates a failure code by the length and number of blinks. The Check Engine light can indicate simultaneous component problems by blinking separate codes, one after another. Problem codes 1 through 9 are indicated by individual short blinks. Problem codes 10 through 48 are indicated by a series of long and short blinks. The number of long blinks equals the first digit, the number of short blinks equals the second digit.



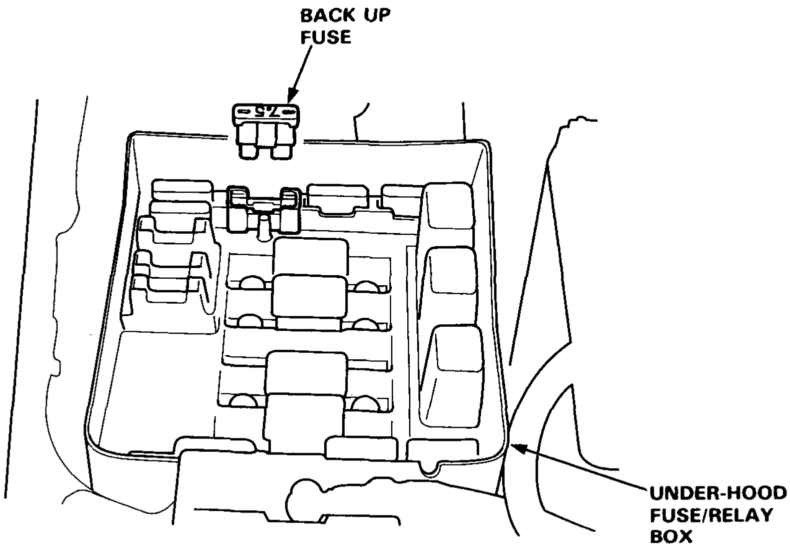


II. ECU Reset Procedure

1. Turn the ignition switch off.

2. Remove the BACK UP fuse (7.5 A) from the under-hood fuse/relay box for 10 seconds to reset the ECU.

   NOTE: Disconnecting the BACK UP fuse also cancels the radio preset stations and the clock setting. Make note of the radio presets before removing the fuse so you reset them.



III. Final Procedure (this procedure must be done after any troubleshooting)

1. Remove the Jumper Wire.

   NOTE: If the Service Check Connector is jumped, the Check Engine light will stay on.

2. Do the ECU Reset Procedure.

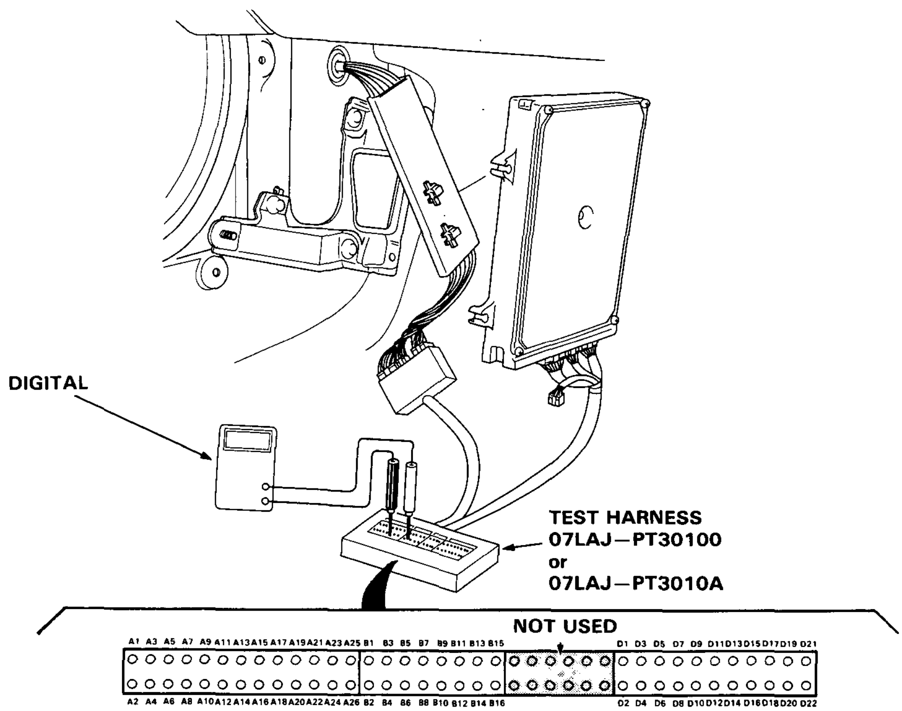
3. Set the radio preset stations and the clock setting.

(cont'd)

Troubleshooting—Self-diagnostic Procedures (cont'd)

SELF-DIAGNOSIS INDICATOR BLINKS	SYSTEM INDICATED	PAGE (Except D15B2 engine)	PAGE (D15B2 engine)
0	ECU	11-219	11-270
1	OXYGEN SENSOR (Except D16A9 engine)	11-223, 225	11-274
3	MANIFOLD ABSOLUTE PRESSURE (MAP SENSOR)	11-242	11-276
5		11-246	11-280
4	CRANK ANGLE (CRANK SENSOR)	11-250	11-282
6	COOLANT TEMPERATURE (TW SENSOR)	11-252	11-284
7	THROTTLE ANGLE	11-254	11-286
8	TDC POSITION (TDC SENSOR)	11-250	11-282
9	No. 1 CYLINDER POSITION (CYL SENSOR)	11-250	—
10	INTAKE AIR TEMPERATURE (TA SENSOR)	11-256	11-288
11	IMA SENSOR (D16A9 engine)	11-258	—
12	EXHAUST GAS RECIRCULATION SYSTEM (EGR)	11-386	—
14	ELECTRONIC AIR CONTRL (EACV)	11-300	11-316
15	IGNITION OUTPUT SIGNAL	11-260	11-290
16	FUEL INJECTOR (D15B2 engine)	—	11-338
17	VEHICLE SPEED SENSOR	11-262	11-292
19	A/T LOCK-UP CONTROL SOLENOID VALVE A/B	11-264	11-294
20	ELECTRONIC LOAD DETECTOR (ELD)	11-266	—
21	SPOOL SOLENOID VALVE	6-12	—
22	VALVE TIMING OIL PRESSURE SWITCH	6-14	—
41	OXYGEN SENSOR HEATER (D16Z6, D16Z7, B16A2 engine)	11-230	—
41	LAF SENSOR HEATER (D15Z1 engine)	11-236	—
43	FUEL SUPPLY SYSTEM (D16Z6, D16Z7, B16Z2 engine)	11-240	—
48	LAF SENSOR (D15Z1 engine)	11-226	—

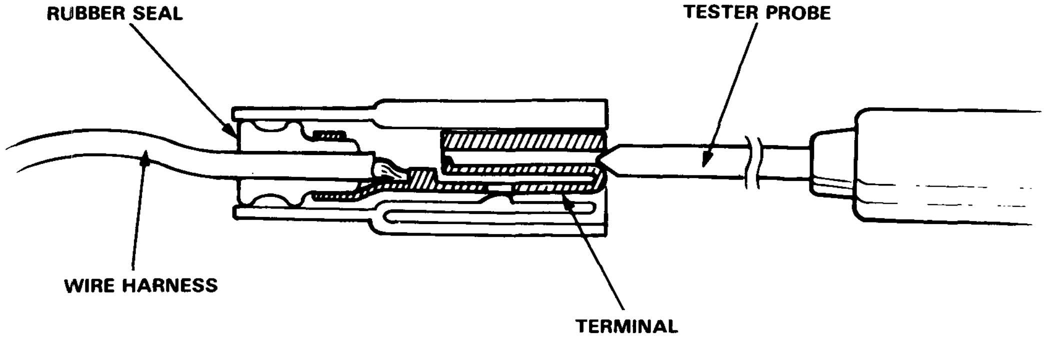
- If codes other than those listed above are indicated, verify the code. If the code indicated is not listed above, replace the ECU.
- The Check Engine light may come on, indicating a system problem when, in fact, there is a poor or intermittent electrical connection. First, check the electrical connections, clean or repair connections if necessary.
- The Check Engine light and D_4 indicator light may light simultaneously when the self-diagnosis indicator blinks 6, 7 and 17 Check the PGM-FI system according to the PGM-FI control system troubleshooting, then recheck the D_4 indicator light. If it lights, see page 14-316.
- The Check Engine light does not come on when there is a malfunctionn in the Electric Load Detector circuits. However, it will indicate the codes when the Service Check Connector is jumped.



TERMINAL LOCATION

Troubleshooting—Self-diagnostic Procedures (cont'd)

CAUTION:
- Puncturing the insulation on a wire can cause poor or intermittent electrical connections.
- For testing at connectors other than the test harness, bring the tester probe into contact with the terminal from the connector side of wire harness connectors in the engine compartment. For female connectors, just touch lightly with the tester probe and do not insert the probe.



How To Read Flowcharts

A flowchart is designed to be used from start to final repair. It's like a map showing you the shortest distance. But beware: if you go off the ''map'' anywhere but a ''stop'' symbol, you can easily get lost.

START (bold type) — Describes the conditions or situation to start a troubleshooting flowchart.

ACTION — Asks you to do something; perform a test, set up a condition etc.

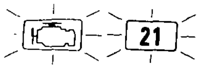
⟨DECISION⟩ — Asks you about the result of an action, then sends you in the appropriate troubleshooting direction.

STOP (bold type) — The end of a series of actions and decisions, describes a final repair action and sometimes directs you to an earlier part of the flowchart to confirm you repair.

NOTE:

- the term ''Intermittent Failure'' is used in these charts. It simÿ means a system may have had a failure, but it checks out OK at this time. If the Check engine light on the dash does not come on, check for poor connections or loose wires at all connections related to the ciricuit that you are troubleshooting.
- Most of the troubleshooting flowcharts have you reset the ECU and try to duplicate the problem code. If the problem is intermittent and you can't duplicate the code, do not continue through the flowchart. To do so will only result in confusion and, possibly, a needlessly replaced ECU.
- ''Open'' and ''Short'' are common electrical terms. An open is a break in a wire or at a connection. A short is an accidental connection of a wire to ground or to another wire. In simple electronics, this usually means something won't work at all. In complex electronics (like ECU's), this can sometimes mean something works, but not the way it's supposed to.
- If the electrical readings are not as specified when using the test harness, check the test harness connections before proceeding.

Troubleshooting Flowchart—Spool Valve



Self-diagnosis Check Engine light indicates code 21: A problem in the Spool Valve circuit.

— Engine is running.
— Check Engine light has been reported on.
— With service check connector jumped (page 6-6), CODE 21 is indicated.

↓

Do the ECU Reset Procedures (page 6-7).

↓

Start the engine.

↓

Is Check Engine light on and does it indicate CODE 21?

NO → **Intermittent failure, system is OK at this time (test drive may be necessary). Check for poor connections or loose wires at spool valve and ECU.**

YES ↓

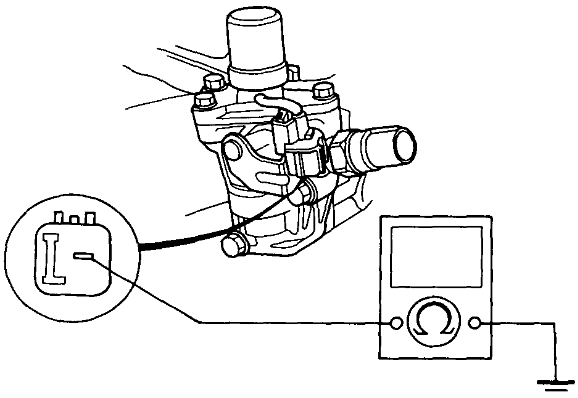
Turn the ignition switch OFF.

↓

Disconnect the 1P connector from the spool valve.

↓

Check for continuity between 1P connector terminal and body ground.



↓

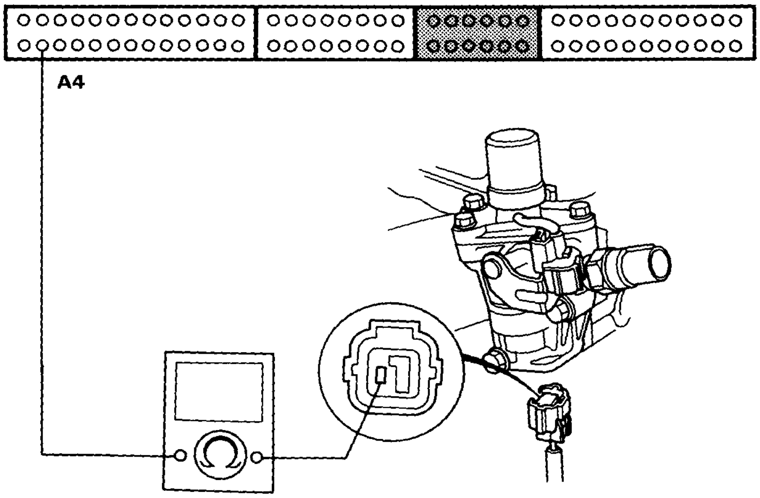
Is there 14—30 Ω?

NO → **Replace the spool valve.**

YES ↓

To page 6-13

From page 6-12



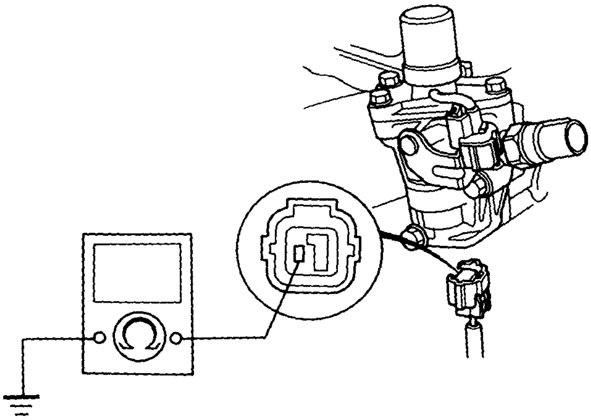
Connect the ECU test harness.

Check for continuity between 1P connector terminal and A4 terminal.

Does continuity exist?

NO → **Repair open in wire between ECU and spool valve connector.**

YES



Check for continuity between 1P connector terminal (harness side) and body ground.

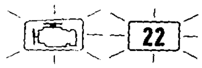
Does continuity exist?

YES → **Repair short in wire between ECU and spool valve connector.**

NO

Substitute a known-good ECU and recheck. If symptom/indication goes away replace the original ECU.

Troubleshooting Flowchart—Oil Pressure Switch



Self-diagnosis Check Engine light indicates code 22: A problem in the Oil Pressure Switch circuit.

— Engine is running.
— Check Engine light has been reported on.
— With service check connector jumped (page 6-6), CODE 22 is indicated.

↓

Do the ECU Reset Procedures (page 6-7).

↓

Turn the ignition switch ON.

↓

Is Check Engine light on and does it indicate CODE 22?

- NO → **Intermittent failure, system is OK at this time (test drive may be necessary). Check for poor connections or loose wires at oil pressure switch and ECU.**
- YES ↓

Turn the ignition switch OFF.

↓

Disconnect the 2P connector from the oil pressure switch.

↓

Check for continuity between BLK terminal and body ground.

↓

Does continuity exist?

- NO → **Repair open in BLK wire between 2P connector and body ground.**
- YES ↓

Connect the ECU test harness.

↓

Check for continuity between BLU/BLK terminal and D6 terminal.

↓

Does continuity exist?

- NO → **Repair open in BLU/BLK wire between ECU and 2P connector.**
- YES ↓

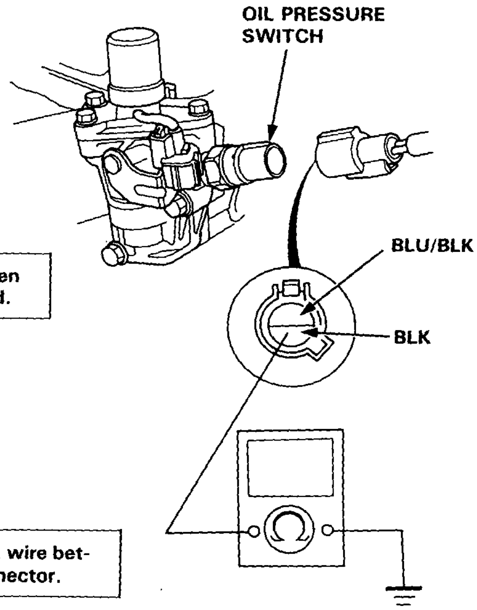
Check for continuity between D6 terminal and body ground.

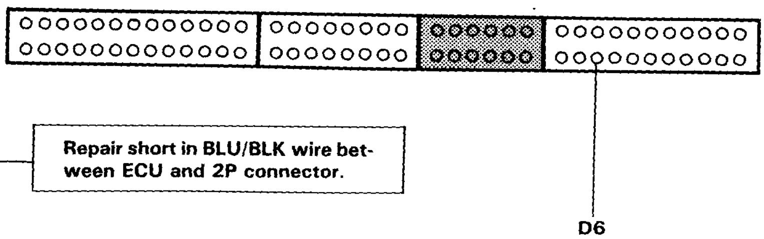
↓

Does continuity exist?

- YES → **Repair short in BLU/BLK wire between ECU and 2P connector.**
- NO ↓

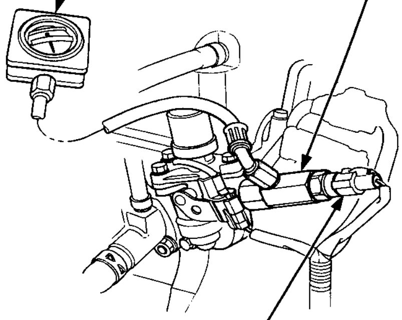
To page 6-15

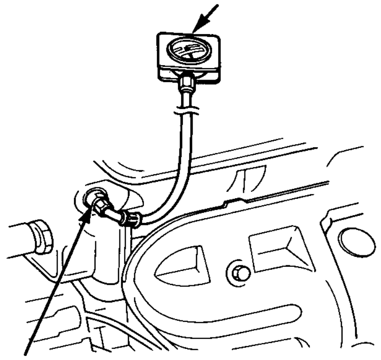




From page 6-14

D15Z1, D16Z6 engine:
Remove the oil pressure switch, install the special tools, the reinstall the oil pressure switch.
B16A2 engine:
Remove 10 mm sealing bolt and connect oil pressure gauge.





Connect a tachometer (Section 11).

Start the engine and warm it up to normal operating temperature.

Check oil pressure at engine speeds of 1,000, 3,000 and 5,000 min^{-1} (rpm), D15Z1: 1,000 and 3,000 min^{-1} (rpm).

NOTE:
Keep measuring time as short as possible because engine is running with no load (within one minute).

Is pressure below 50 kPa (0.5 kg/cm^2, 7 psi)? — NO → **Inspect the spool valve.**

YES

Check for continuity between the 2 terminals on the oil pressure switch.

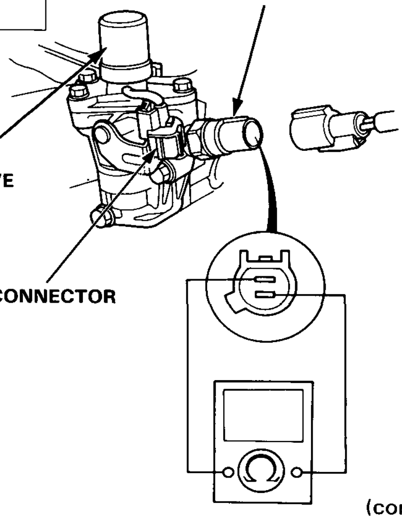
Does continuity exist? — NO → **Replace oil pressure switch.**

YES

Disconnect the 1P connector from the spool valve.

Attach the battery positive terminal to the GRN/WHT terminal.

To page 6-16

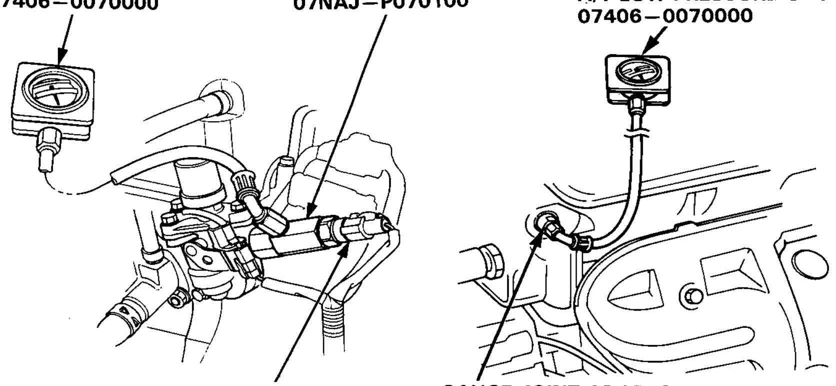


(cont'd)

Troubleshooting Flowchart—Oil Pressure Switch (cont'd)

From page 6-15

Start the engine and check oil pressure at engine speeds of 5,000 min^{-1} (rpm), D15Z1 engine: 3,000 min^{-1} (rpm).



NOTE:
Keep measuring time as short as possible because engine is running with no load (within one minute).

Is pressure above 400 kPa (4 kg/cm^2, 57 psi), D15Z1 engine: above 250 kPa (2.5 kg/cm^2, 36 psi).

NO → **Inspect the spool valve.**

YES ↓

Check for continuity between the 2 terminals on the oil pressure switch under above condition.

Does continuity exist?

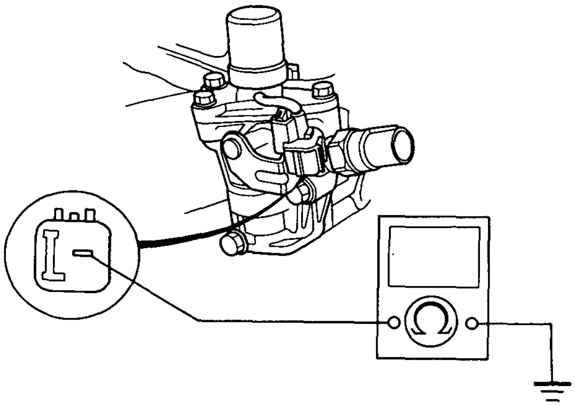
NO → **Replace oil pressure switch.**

YES ↓

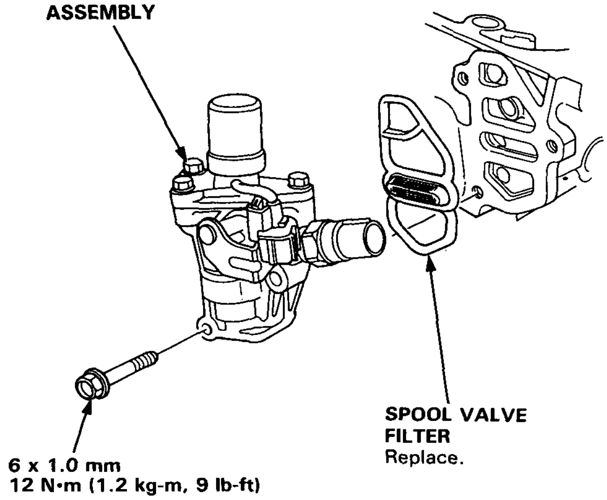
Substitute a known-good ECU and recheck. If symptom/indication goes away replace the original ECU.

Spool Valve Inspection

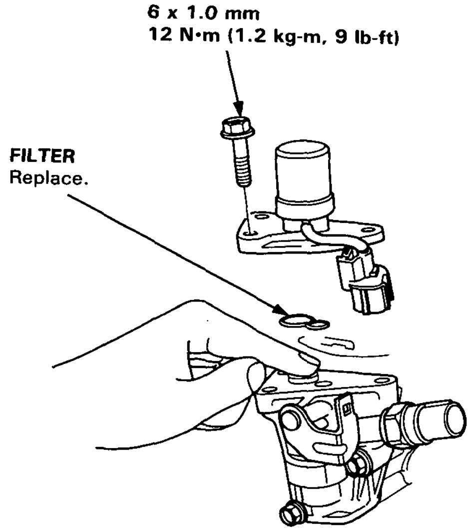
1. Disconnect the 1P connector from the spool valve.
2. *Measure resistance between the terminal and body ground.*
   Resistance: approx 14—30 ohms



3. If the resistance is within specifications, remove the spool valve assembly from the cylinder head, and check the spool valve filter for clogging.
   - If there is cologging, replace the engine oil filter and the engine oil.



4. *If filters are normal, push the spool valve with your finger and check its movement.*
   - If spool valve is normal, check the engine oil pressure.

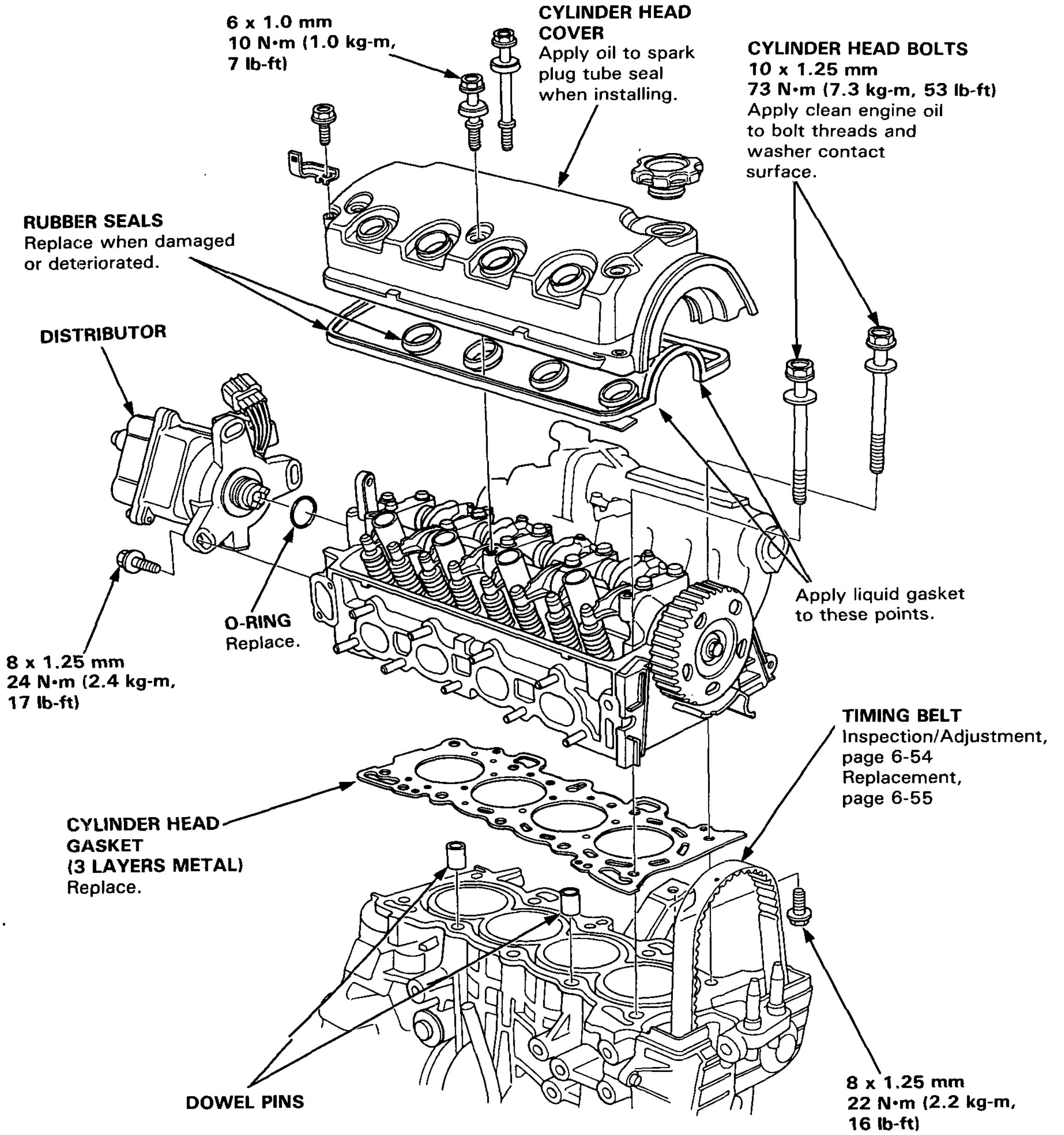


Illustrated Index

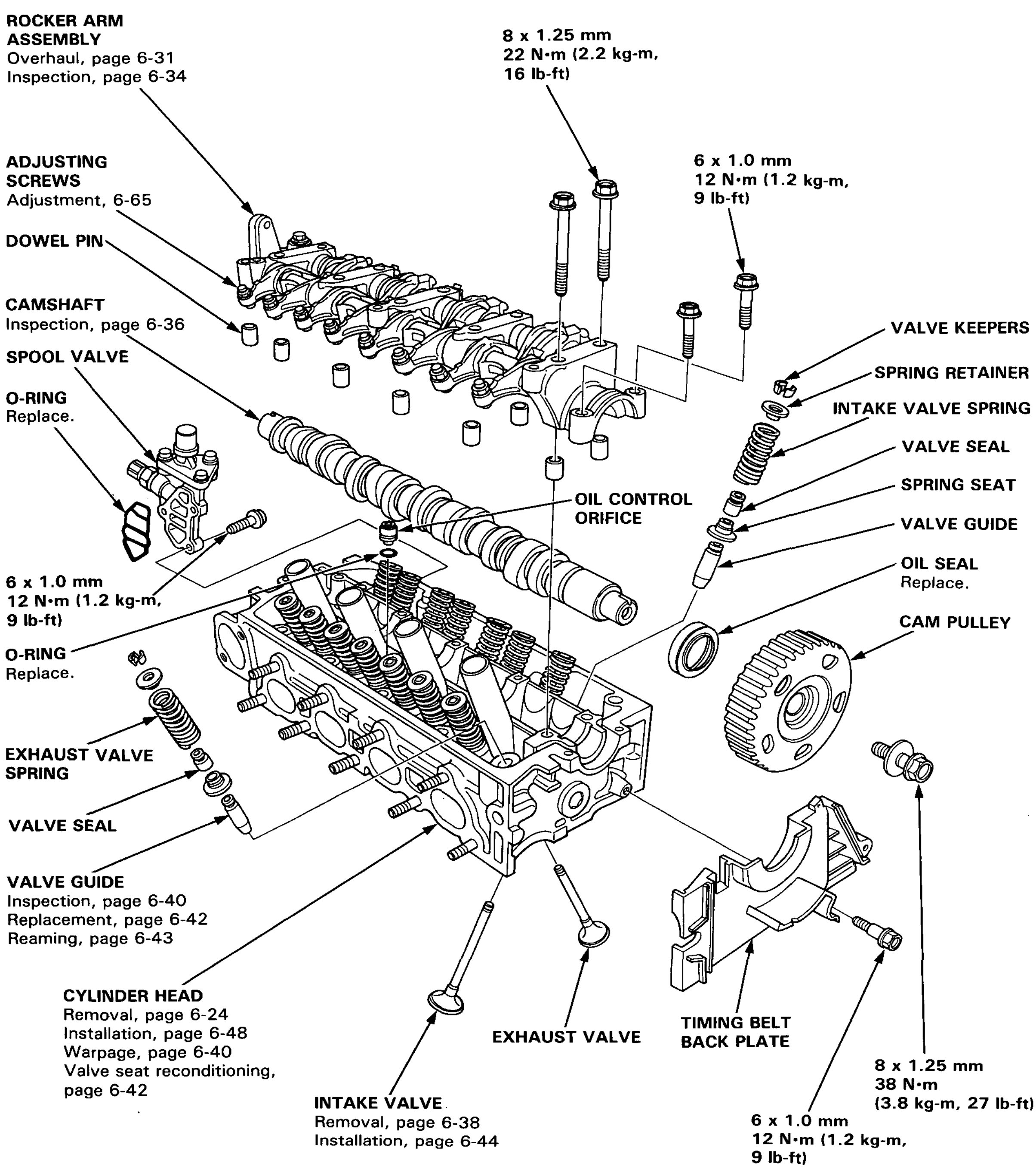
D15Z engine:

CAUTION: To avoid damaging the cylinder head, wait until the coolant temperature drops below 38°C (100°F) before removing it.

NOTE:
- Use new O-rings and gaskets when reassembling.
- Use liquid gasket, Part No. 0Y740–99968.
- Prior to reassembling, clean all the parts in solvent, dry them, and apply lubricant to any contact parts.



NOTE: Use new O-rings and gaskets when reassembling.
Prior to reassembling, clean all the parts in solvent, dry them, and apply lubricant to any contact parts.

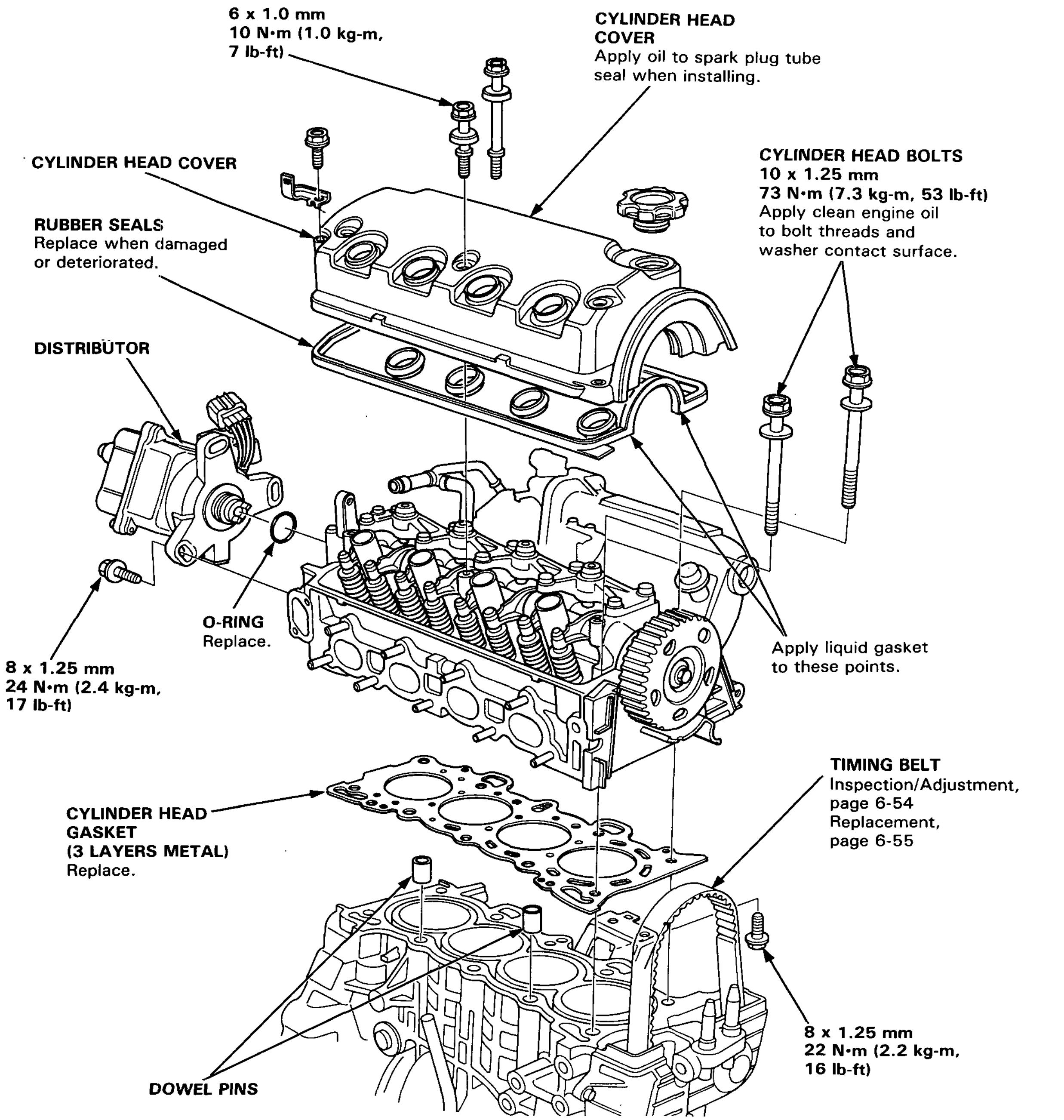


Illustrated Index

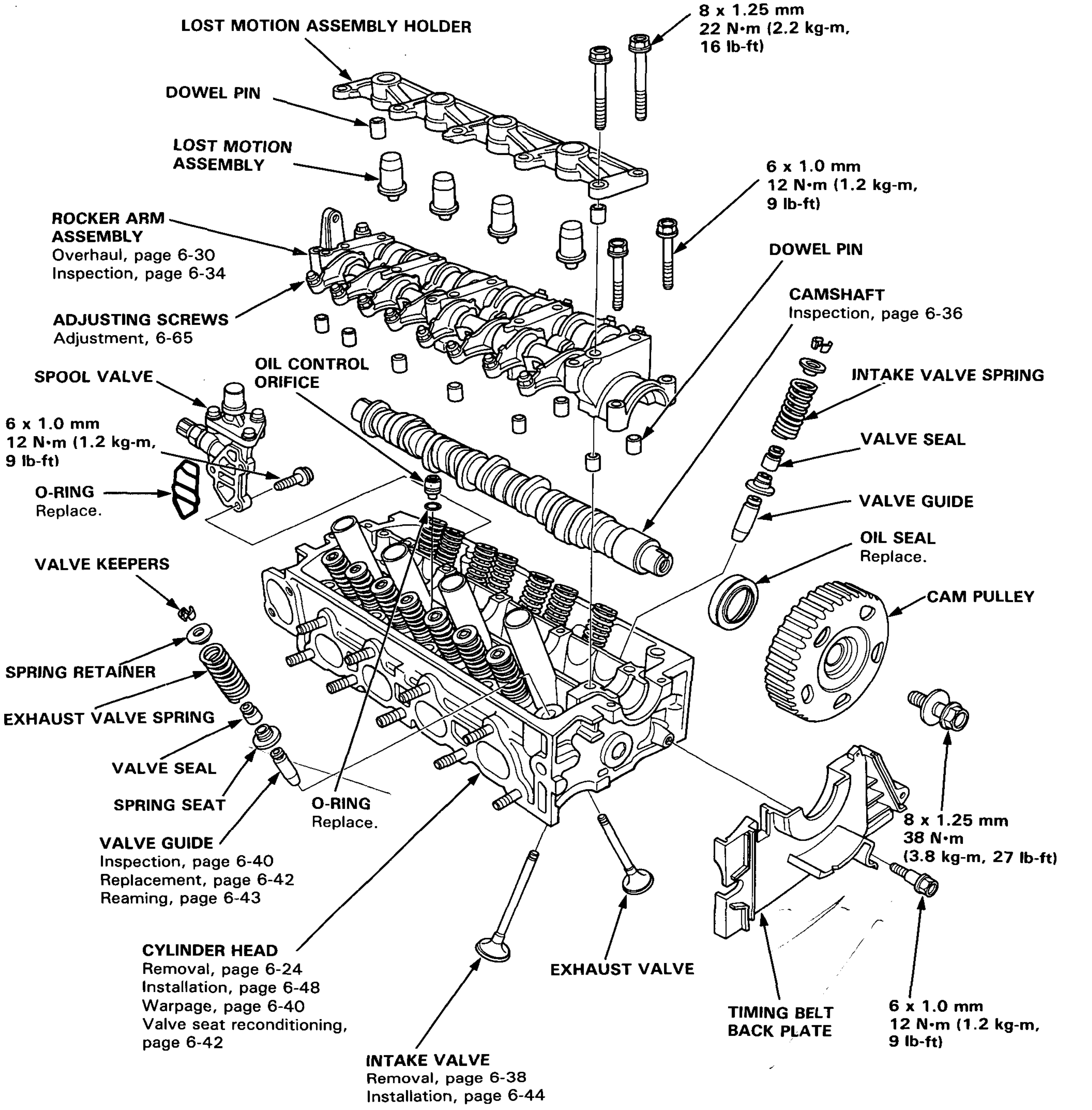
D16Z6 engine:

CAUTION: To avoid damaging the cylinder head, wait until the coolant temperature drops below 38°C (100°F) before removing it.

NOTE:
- Use new O-rings and gaskets when reassembling.
- Use liquid gasket, Part No. 0Y740–99968.
- Prior to reassembling, clean all the parts in solvent, dry them, and apply lubricant to any contact parts.



NOTE: Use new O-rings and gaskets when reassembling.
Prior to reassembling, clean all the parts in solvent, dry them, and apply lubricant to any contact parts.



(cont'd)

Cylinder Head/Valve Train

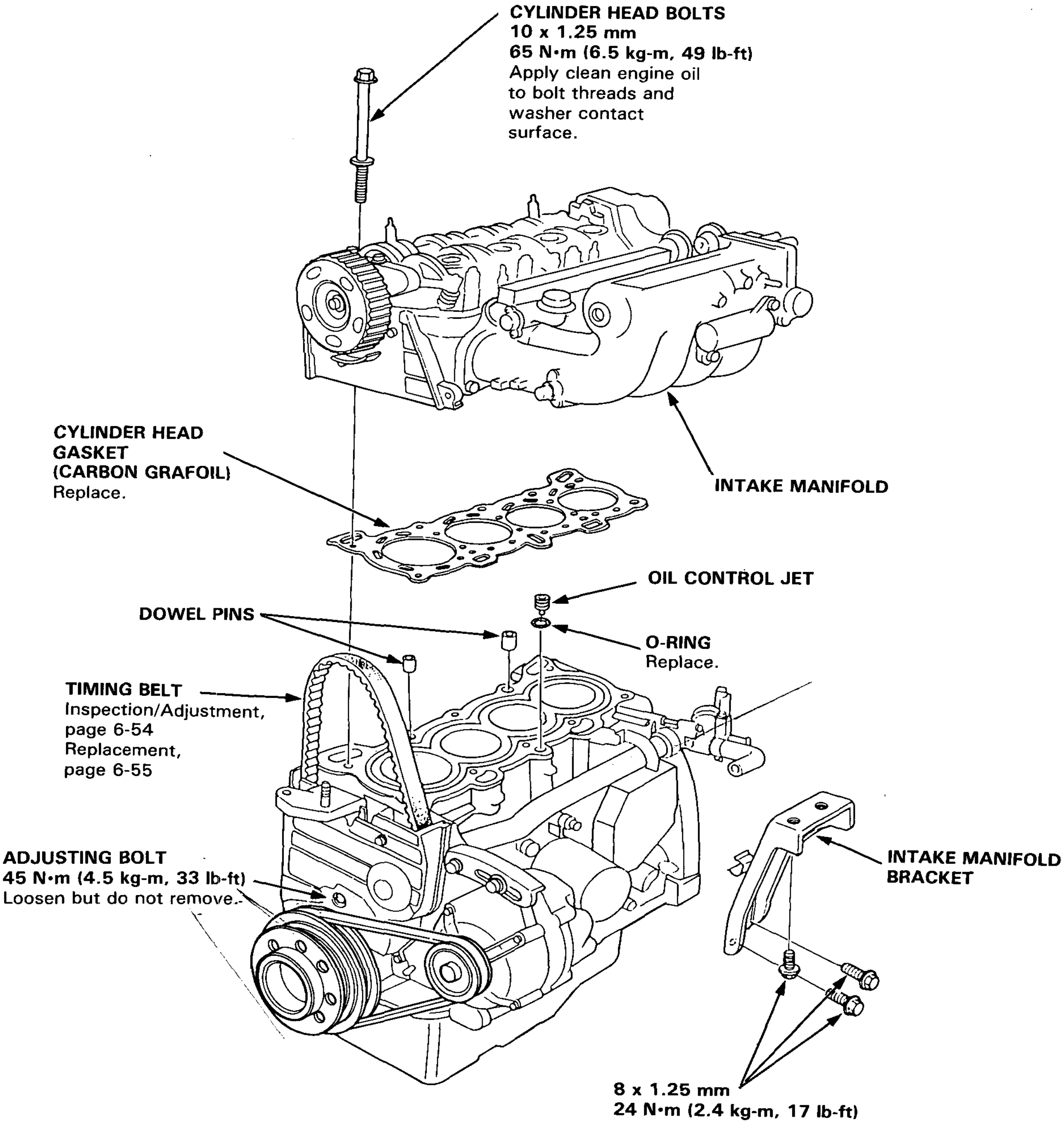
Illustrated Index

D12B, D13B, D15B, D16A7 engine:
Illustrated: D16A7 engine

CAUTION: To avoid damaging the cylinder head, wait until the coolant temperature drops below 38°C (100°F) before removing it.

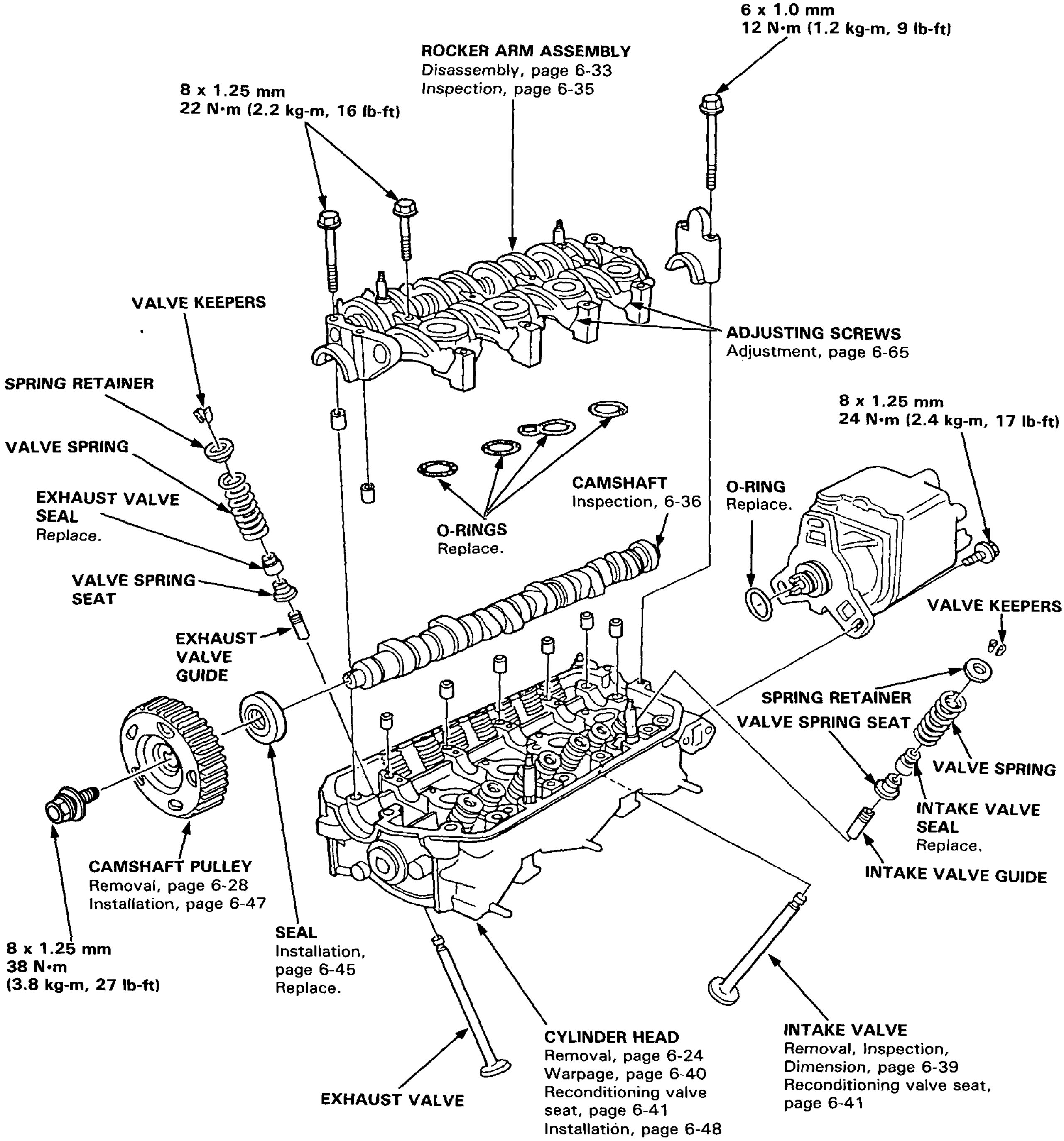
NOTE:
- Use new O-rings and gaskets when reassembling.
- Use liquid gasket, Part No. 0Y740–99968.

Prior to reassembling, clean all the parts in solvent, dry them, and apply lubricant to any contact parts.



(cont'd)

NOTE: Use only new O-rings and new gaskets when reassembling.
Prior to reassembling, clean all the parts in solvent, dry then, and apply lubricant to any contact parts.



Cylinder Head

Removal

Engine removal is not required for this procedure.

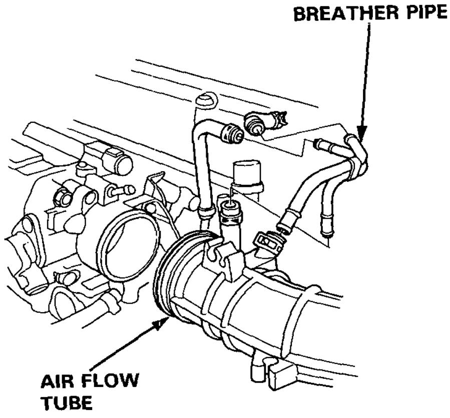
CAUTION: To avoid damaging the cylinder head, wait until the coolant temperature drops below 38°C (100° F) before loosening the retaining bolts.

NOTE:
- Inspect the timing belt before removing the cylinder head.
- Turn the crankshaft pulley so that the No. 1 piston is at top-dead-center (page 6-58).
- Mark all emissions hoses before disconnecting them.

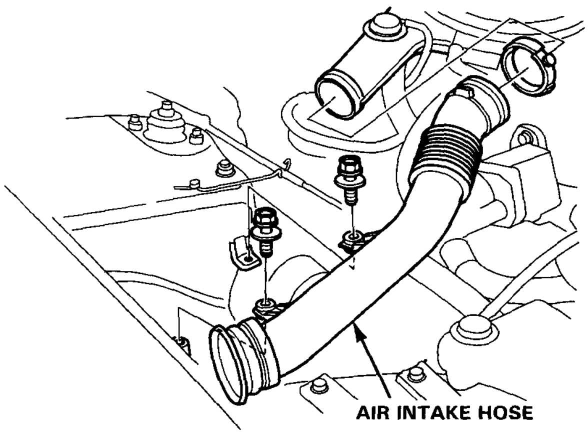
1. Disconnect the negative terminal from the battery.
2. Drain the coolant (See section 10).
   - Remove the radiator cap to speed draining.
3. Relieve fuel pressure.

   WARNING Do not smoke while working on fuel system, keep open flame or spark away from work area. Drain fuel only into an approved container.
4. Remove the air flow tube.
5. Remove the fuel feed hose and charcoal canister hose from the intake manifold.

D16A7 engine:

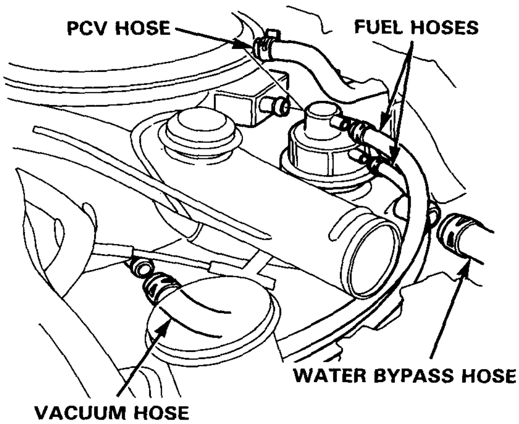


D12B, D13B, D15B3 engine:

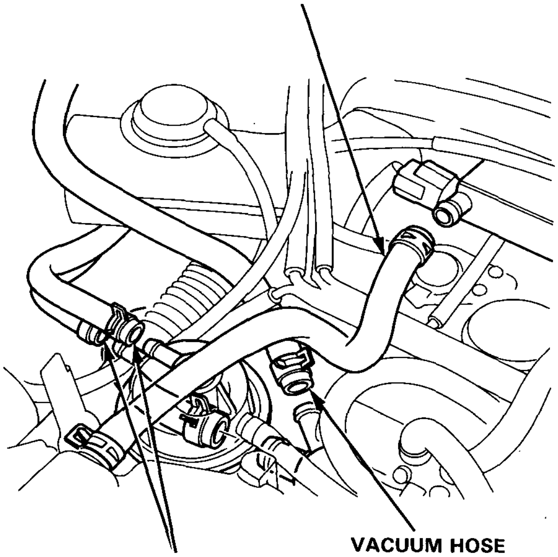


6. Remove the PCV hose, fuel hoses vacuum hose and water bypass hose.

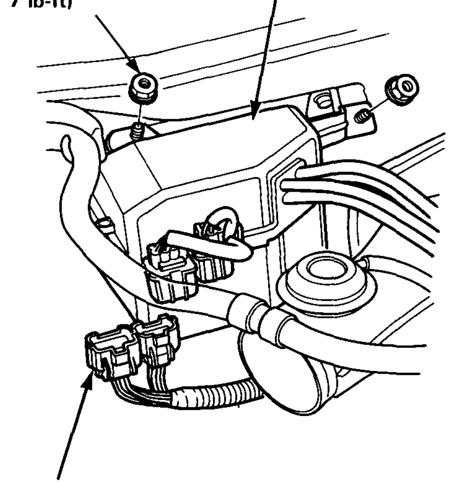
D12B, D13B, D15B3 engine:



D15B4 engine.

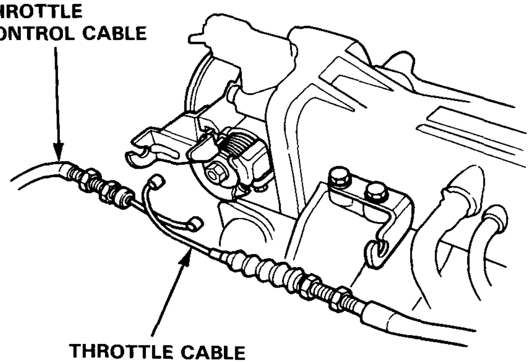


7. Disconnect two connectors, then remove the fuel emission control box.
   • Do not remove the vacuum tubes.



8. Remove the throttle cable and the throttle control cable (A/T) from the throttle body.

   NOTE:
   - *Take care not to bend the cable when removing* it. Always replace any kinked cable with a new one.
   - Adjust the throttle cable when installing (See section 11).



9. Remove the engine wire harness connectors and wire harness clamps from the cylinder head and the intake manifold.
   - Four injector connectors
   - TA sensor connector
   - EACV connector
   - Throttle sensor connector
   - MAP sensor connector
   - Ground terminal (at thermostat cover)
   - TW switch connector (for cooling fan)
   - Oxygen sensor connector
   - TW sensor connector (for emission)
   - Temperature unit connector
   - Spool valve connector (D16Z, D15Z engine)
   - Oil pressure switch connector (D16Z, D15Z engine)
   - EGR lift sensor connector (D15Z engine)

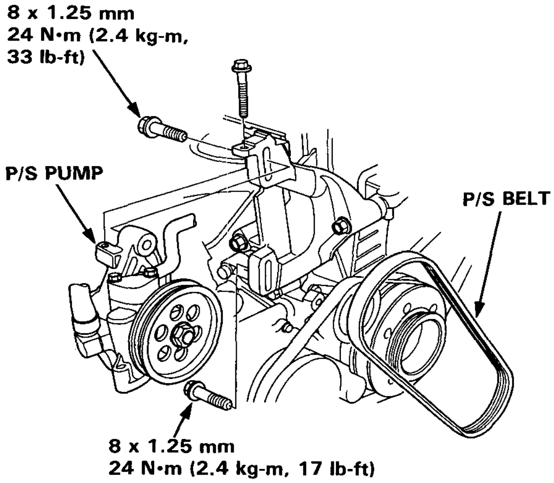
(cont'd)

Removal (cont'd)

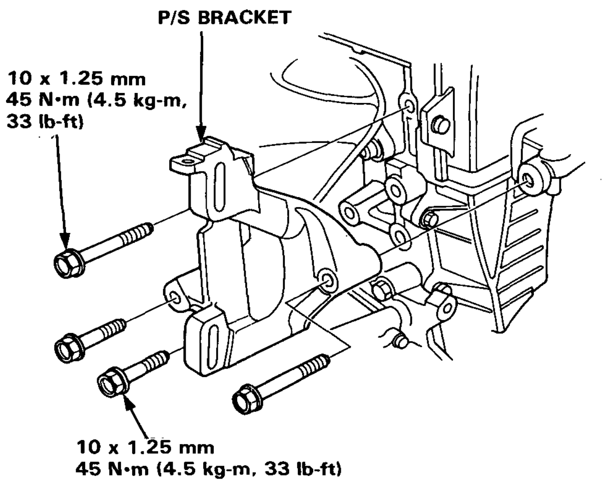
10. Disconnect spark plug wire at spark plugs. Remove the distributor.

11. Remove the engine ground cable on the cylinder head cover.

12. Remove the P/S belt and pump.
    - Do not disconnect the P/S hoses.



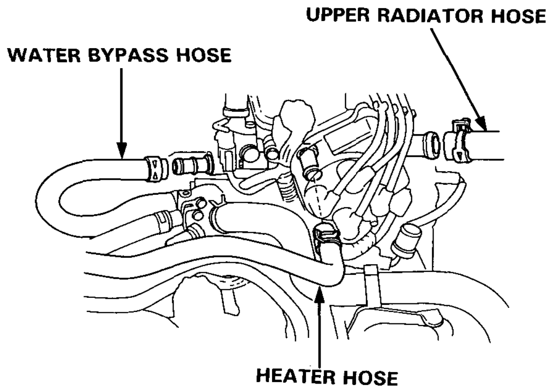
13. Remove the P/S bracket.



14. Remove the emission vacuum hoses and water bypass hoses from the intake manifold assembly.

15. Remove the radiator upper hose and heater hose from the cylinder head.

16. Remove the water bypass hose from intake manifold.



17. Remove the intake manifold bracket.

18. Remove the self-locking nuts and disconnect the exhaust manifold and exhaust pipe A.

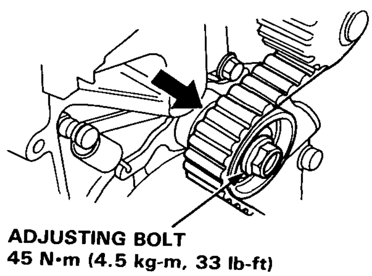
19. Remove the exhaust manifold bracket.

20. Remove the PCV hose, then remove the cylinder head cover.

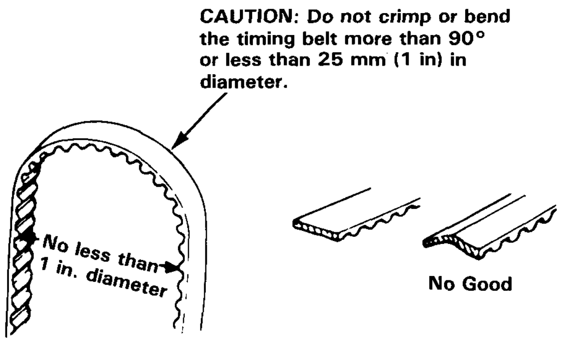
21. Remove the timing belt upper cover.

22. Loosen the timing belt adjusting bolt 180° to release the belt tension.

23. Push the tensioner to release tension from the timing belt, then retighten the adjusting bolt.



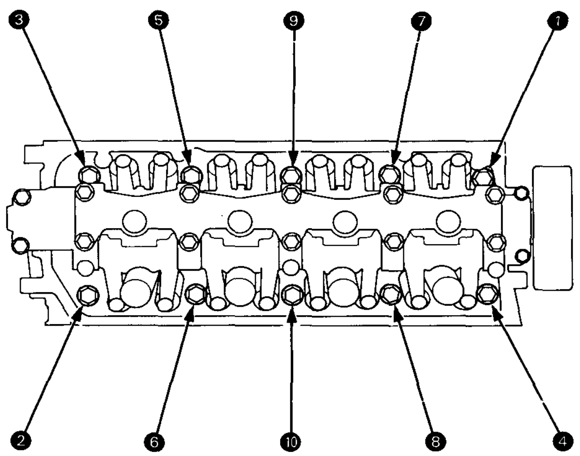
24. Remove the belt from the cam pulley.



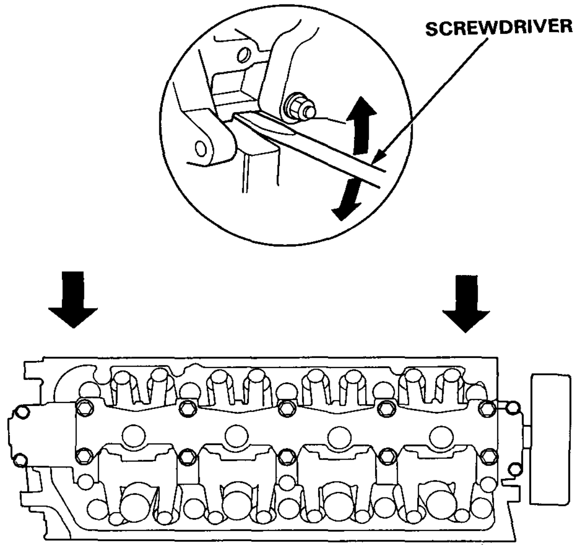
25. Remove the cylinder head bolts, then remove the cylinder head.

CAUTION: To prevent warpage, unscrew the bolts in sequence 1/3 turn at a time; repeat until all bolts are loosened.

CYLINDER HEAD BOLT LOOSENING SEQUENCE



NOTE: Separate the cylinder head from the block with a flat blade screwdriver as shown.



26. Remove the intake manifold and exhaust manifold from the cylinder head.

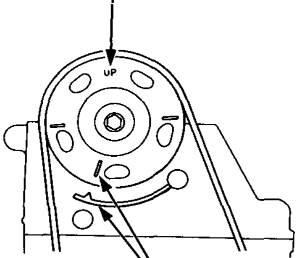
Cam Pulley

Removal

1. To ease reassembly, turn the pulley until the "UP" mark faces up, and the front timing mark is aligned as shown below.

D16A7, D16Z engine:

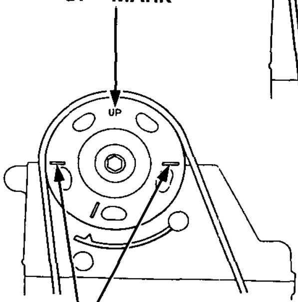
"UP" MARK



TDC mark aligned with the pointer on cylinder head back cover.

D12B, D13B, D15B engine:

"UP" MARK



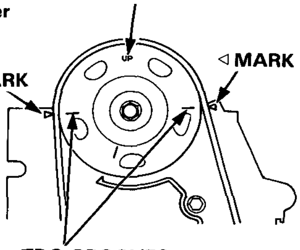
TDC GROOVES
Align front timing mark on pulley with the valve cover surface.

D15Z engine:

"UP" MARK

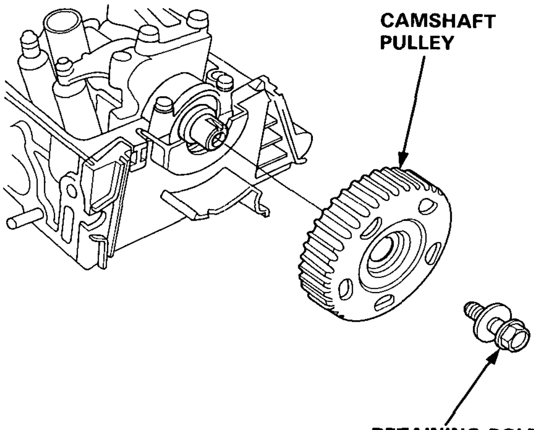
▷ MARK

◁ MARK



TDC GROOVES
Align with triangle mark (▷ ◁) on cylinder head back cover.

2. Remove the retaining bolt and the cam pulley.



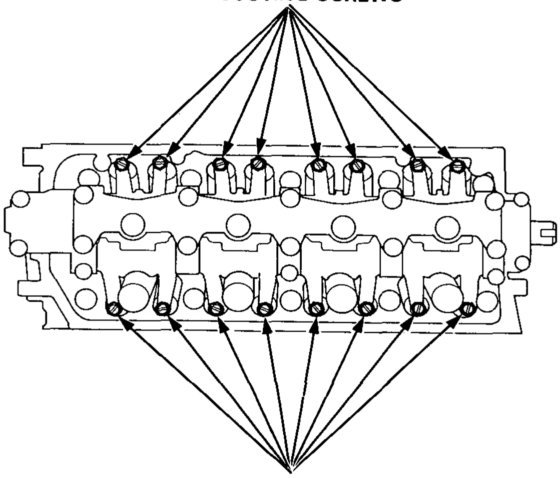
Rocker Arms

Removal

1. Loosen the adjusting screws.

D16Z engine:

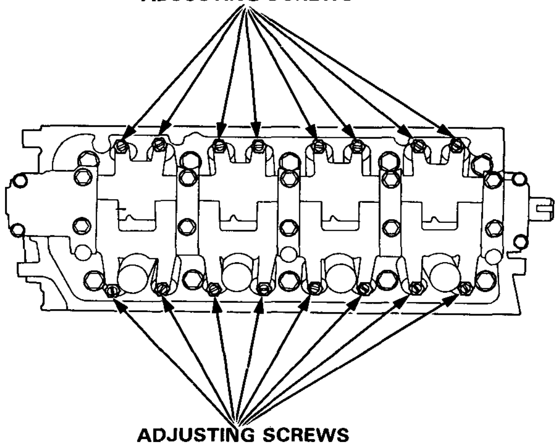
ADJUSTING SCREWS



ADJUSTING SCREWS

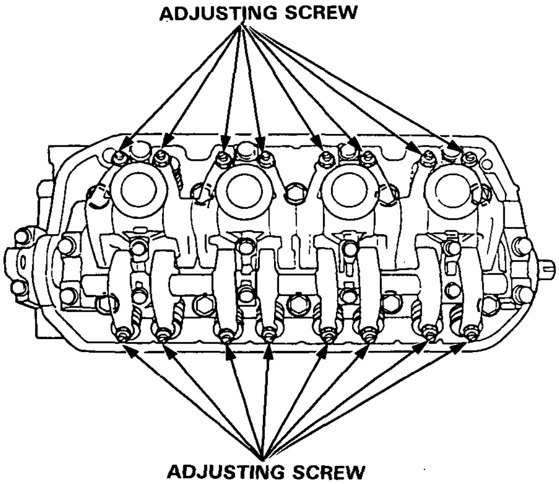
D15Z engine:

ADJUSTING SCREWS



ADJUSTING SCREWS

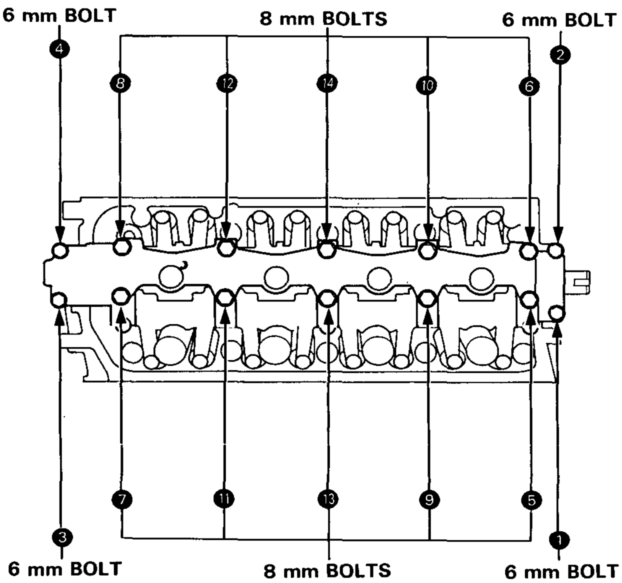
D12B, D13B, D15B, D16A7 engine:



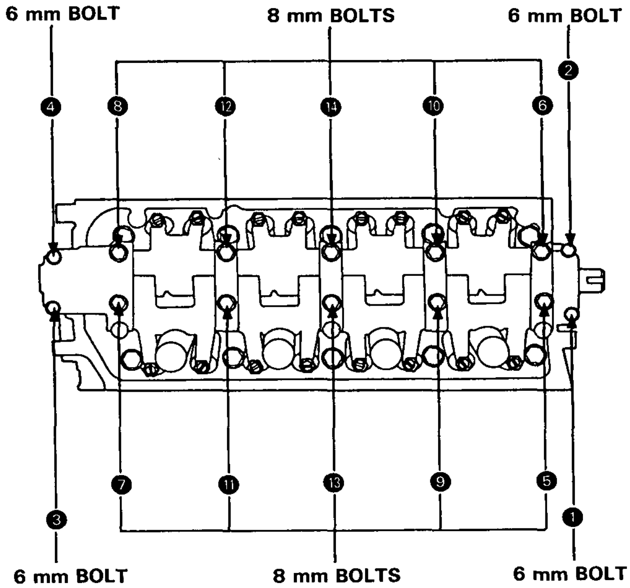
2. Unscrew the cam holder bolts, then remove the rocker arm assembly.

   NOTE:
   - Unscrew the cam holder bolts two turns at a time, in a criss-cross pattern, to prevent damaging the valves or rocker arm assembly.
   - When removing the rocker arm assembly, do not remove the cam holder bolts. The bolts will keep the cam holders, the springs and the rocker arms on the shaft.

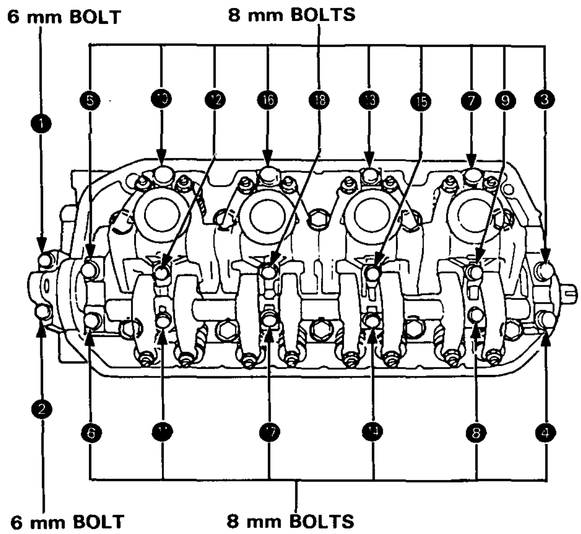
D16Z engine:



D15Z engine:



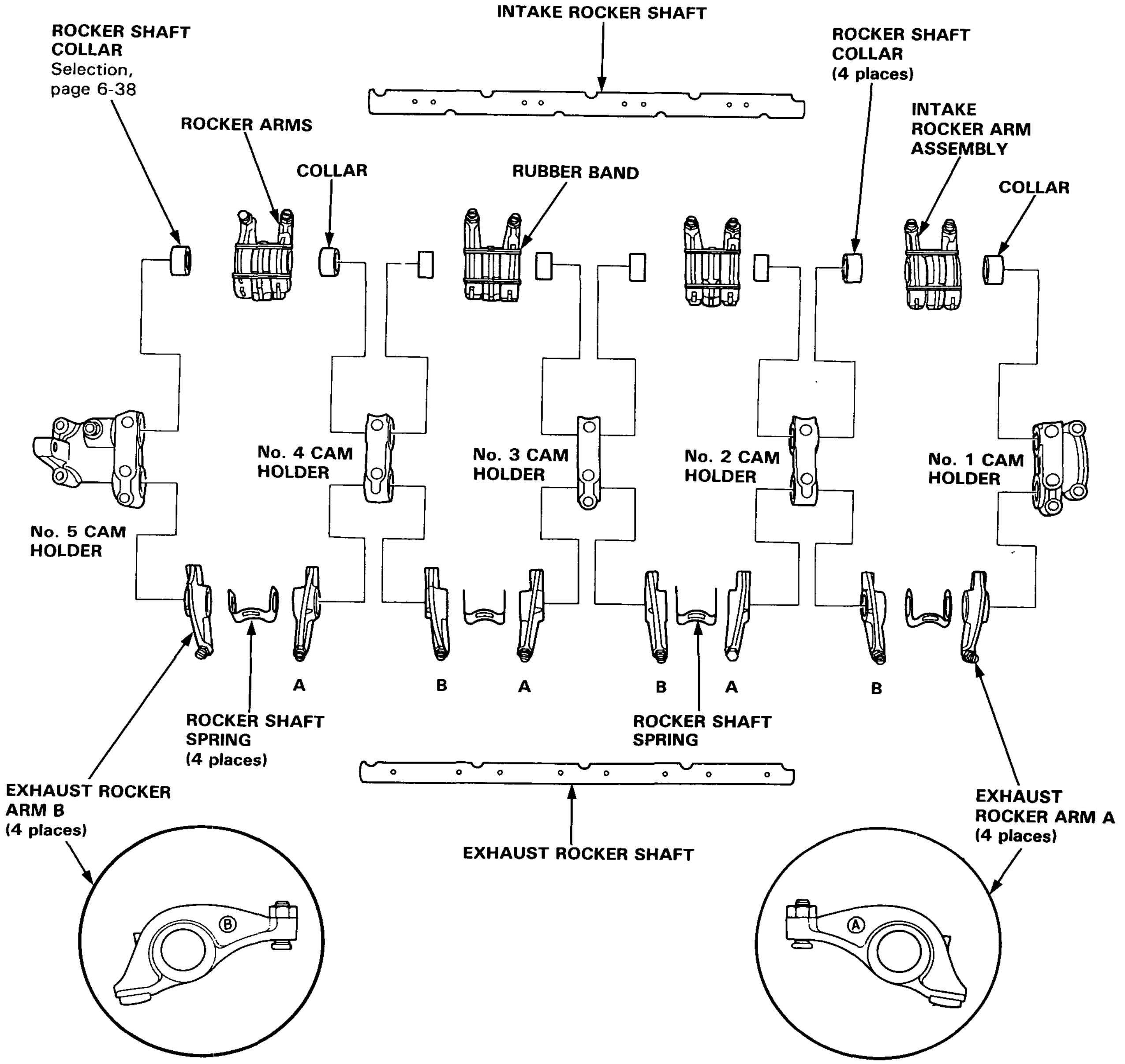
D12B, D13B, D15B, D16A7 engine:



Overhaul

NOTE:
- Identify parts as they are removed to ensure reinstallation in original locations.
- Inspect rocker shafts and rocker arms (page 6-34).
- Rocker arms must be installed in the same position if reused.
- When removing or installing rocker arm assembly, do not remove bearing cap bolts. The bolts will keep the holders, springs and rocker arms on the shaft.

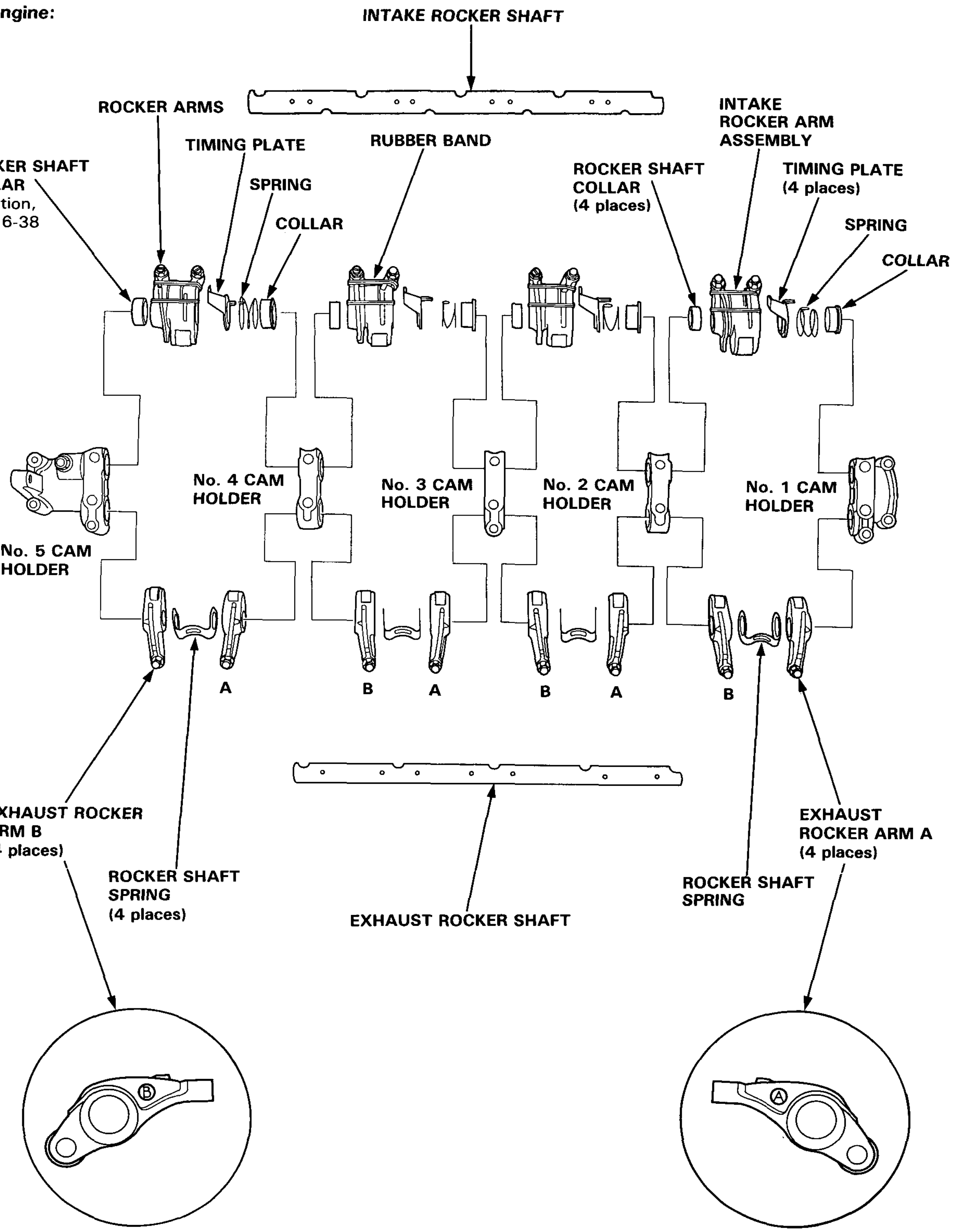
D16Z engine:



Letter "B" is stamped on rocker arm.

Letter "A" is stamped on rocker arm.

D15Z engine:



Letter "B" is stamped on rocker arm.

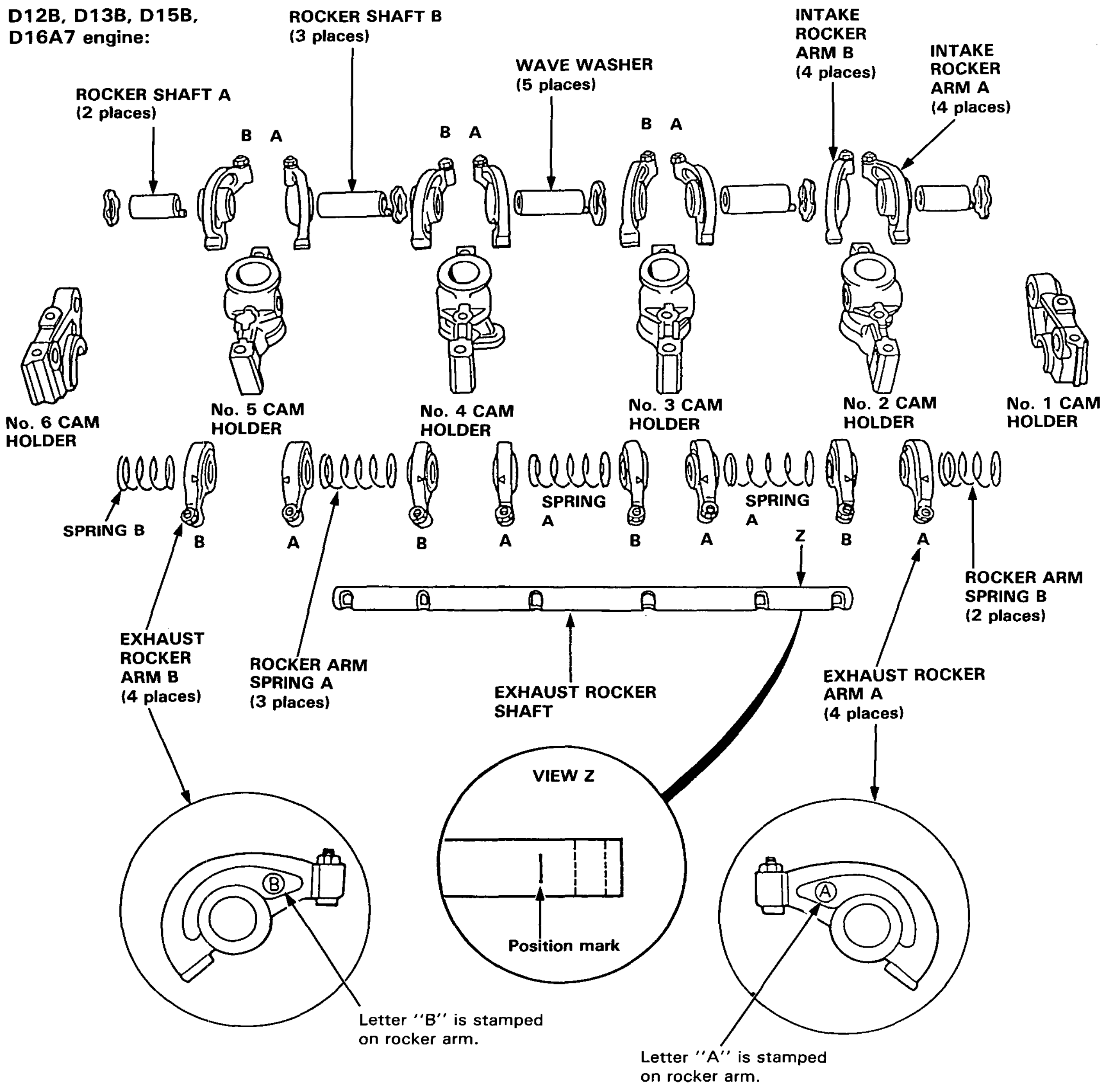
Letter "A" is stamped on rocker arm.

(cont'd)

Overhaul (cont'd)

NOTE:
- Identify parts as they are removed to ensure reinstallation in original locations.
- Inspect rocker shafts and rocker arms (page 6-35).
- Rocker arms must be installed in the same position if reused.
- When removing or installing rocker arm assembly, do not remove bearing cap bolts. The bolts will keep the holders, springs and rocker arms on the shaft.

D12B, D13B, D15B, D16A7 engine:



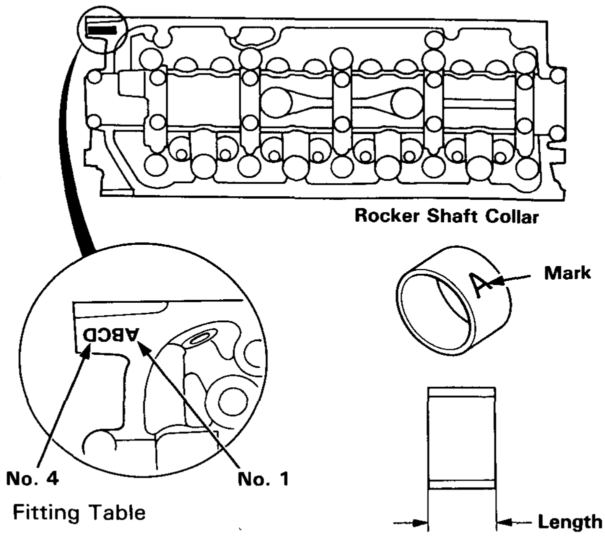
Rocker Shaft Collars

Selection (D16Z engine)

CAUTION: If the codes are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

Cam Holder Distance Code Location (Marks)

Marks have been stamped on the upper face end of the cylinder head as a code for the distance of each cam holder.
Use them, and the marks stamped on the rocker shaft collar (code for collar length), to choose the correct rocker shaft collars from the table below.



Fitting Table

Head Marks	A	B	C	D	E	F
Collar Marks	A	B	C	D	E	F

Rocker Shaft Collar

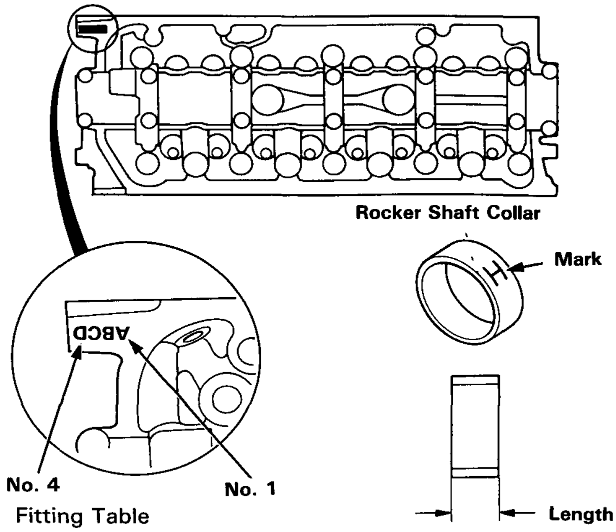
Marks	Part Number	Length mm (in)
A	14651–P08–000	12.325–12.375 (0.4852–0.4872)
B	14652–P08–000	12.275–12.325 (0.4833–0.4852)
C	14653–P08–000	12.225–12.275 (0.4813–0.4833)
D	14654–P08–000	12.175–12.225 (0.4793–0.4813)
E	14655–P08–000	12.125–12.175 (0.4774–0.4793)
F	14656–P08–000	12.075–12.125 (0.4754–0.4774)

Selection (D15Z engine)

CAUTION: If the codes are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

Cam Holder Distance Code Location (Marks)

Marks have been stamped on the upper face end of the cylinder head as a code for the distance of each cam holder.
Use them, and the marks stamped on the rocker shaft collar (code for collar length), to choose the correct rocker shaft collars from the table below.



Fitting Table

Head Marks	A	B	C	D	E	F
Collar Marks	H	I	J	K	L	M

Rocker Shaft Collar

Marks	Part Number	Length mm (in)
H	14651–P07–000	8.975–9.025 (0.3533–0.3553)
I	14652–P07–000	8.925–8.975 (0.3513–0.3533)
J	14653–P07–000	8.875–8.925 (0.3494–0.3513)
K	14654–P07–000	8.825–8.875 (0.3474–0.3494)
L	14655–P07–000	8.775–8.825 (0.3455–0.3474)
M	14656–P07–000	8.725–8.775 (0.3435–0.3455)

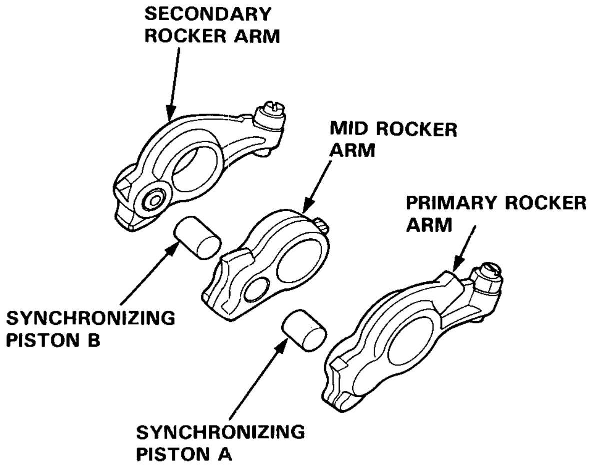
Rocker Arms and Lost Motion Assemblies

Inspection (D16Z, D15Z engine)

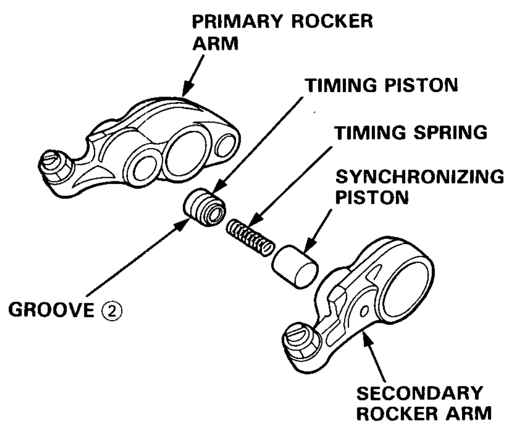
NOTE: When reassembling the primary rocker arm, carefully apply air pressure to oil passage of the rocker arm.

1. Inspect the rocker arm piston. Push it manually.
   — If it does not move smoothly, replace the rocker arm assembly.

D16Z6 engine:



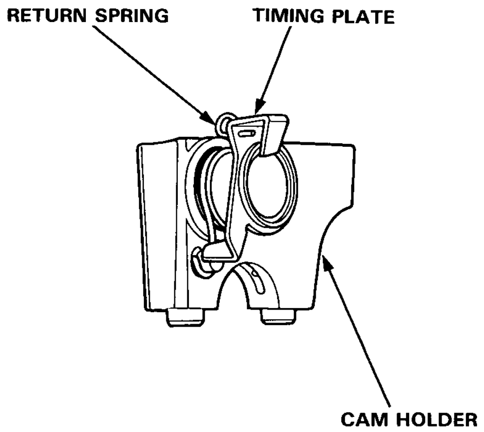
D15Z1 engine:



NOTE:
- Apply oil to the pistons when reassembling.
- Bundle the rocker arms with a band to prevent them from separating.

D15Z1 engine:

NOTE: Set the timing plate and return spring as shown below.



D16Z6 engine only:

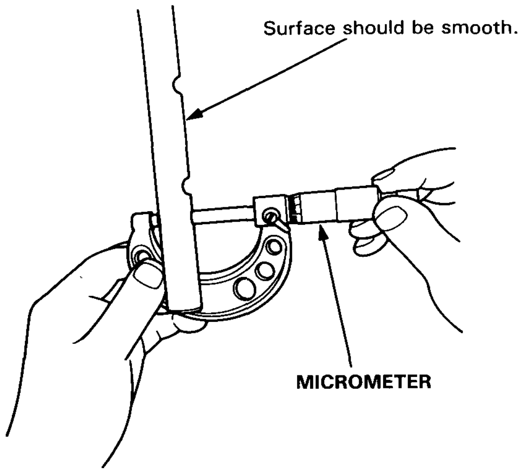
2. Pushing the rocker arm top gently with the finger will cause it to sink slightly. Increasing the force on it will cause it to sink deeper.
   — If the lost motion assembly does not move smoothly, replace it.

Rocker Arms and Shafts

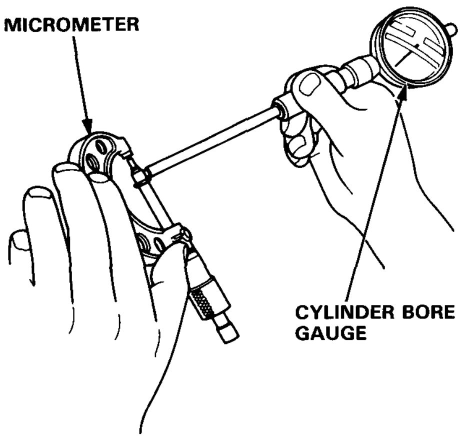
Clearance

Measure both the intake rocker shaft and exhaust rocker shaft.

1. Measure the diameter of shaft at the first rocker location.

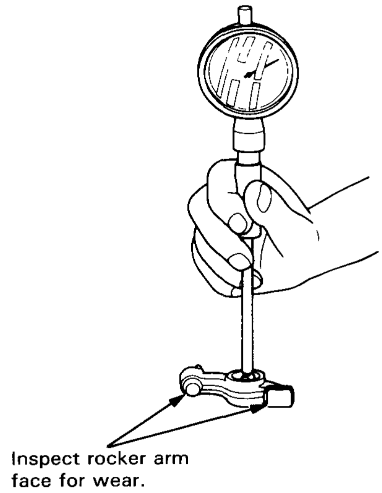


2. Zero the gauge to the shaft diameter.



3. Measure inside diameter of rocker arm and check for out-of-round condition.

Rocker Arm Radial Clearance:
Service Limit: 0.08 mm (0.003 in)



4. Repeat for all the rockers.
   — If the clearance is over the service limit, replace the rocker shaft and all over-tolerance rocker arms.

Camshaft

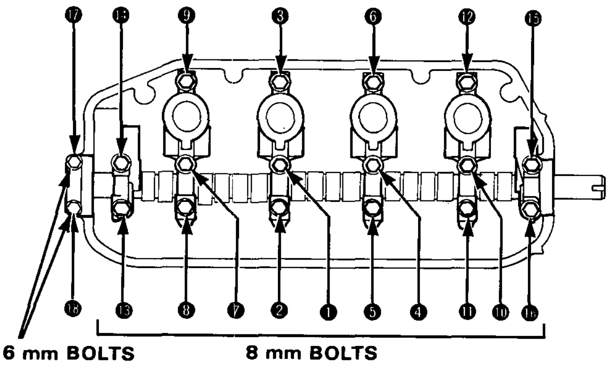
Inspection

NOTE:
- Do not rotate the camshaft during inspection.
- Remove the rocker arms and rocker shafts.

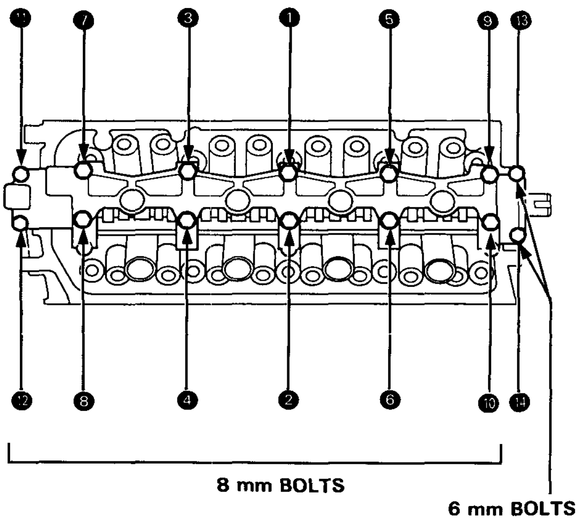
1. Put the camshaft and the cam holders on the cylinder head, then tighten the bolts to the specified torque.

   Specified torque:
   8 mm bolts: 22 N·m (2.2 kg-m, 16 lb-ft)
   6 mm bolts: 12 N·m (1.2 kg-m, 9 lb-ft)

D12B, D13B, D15B, D16A7 engine:



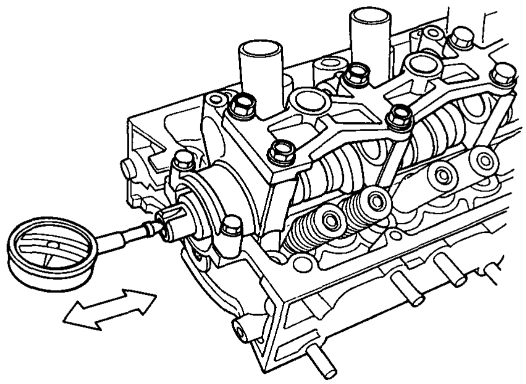
D16Z6, D15Z1 engine:



2. Seat the camshaft by pushing it toward the rear of the cylinder head.

3. Zero the dial indicator against the end of the camshaft. Push the camshaft back and forth, and read the end play.

   Camshaft End Play:
   Standard (New): 0.05–0.15 mm (0.002–0.006 in)
   Service Limit: 0.5 mm (0.02 in)



4. Remove the bolts, then remove the cam holders from the cylinder head.
   – Lift camshaft out of cylinder head, wipe clean, then inspect lift ramps. Replace camshaft if lobes are pitted, scored, or excessively worn.
   – Clean the camshaft bearing surfaces in the cylinder head, then set camshaft back in place.
   – Insert plastigage strip across each journal.

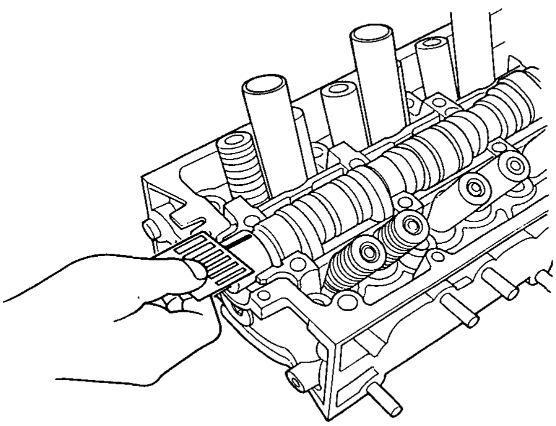
5. Install the cam holders and tighten the bolts to the specified torque.

(cont'd)

Inspection (cont'd)

6. Remove the cam holders, then measure the widest portion of the plastigage on each journal.

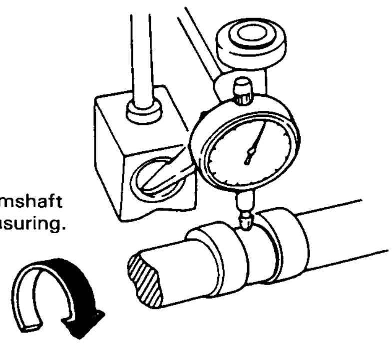
Camshaft Bearing Radial Clearance:
Standard (New): 0.050–0.089 mm (0.002–0.004 in)
Service Limit: 0.15 mm (0.006 in)



7. If the camshaft bearing radial clearance is out of tolerance:
   - And the camshaft has already been replaced, you must replace the cylinder head.
   - If the camshaft has not been replaced, first check the total runout with the camshaft supported on V-blocks.

Camshaft Total Runout:
Standard (New): 0.015 mm (0.0006 in)
Service Limit: 0.030 mm (0.0010 in)

Rotate camshaft while measuring.



- If the total runout of the camshaft is within tolerance, replace the cylinder head.
- If the total runout is out of tolerance, replace the camshaft and recheck. If the bearing clearance is still out of tolerance, replace the cylinder head.

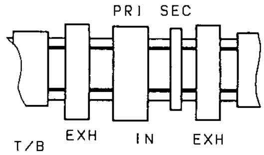
8. Check the cam lobe height wear.

Cam lobe height standard (New)

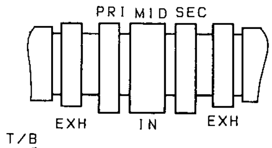
Unit mm (in)

		INTAKE	EXHAUST
D12B, D13B engine		35.458 (1.3960)	35.693 (1.4052)
D15B2 engine		36.603 (1.4411)	36.750 (1.4468)
D15B3, D15B4 engine		36.603 (1.4411)	36.747 (1.4467)
D16A7 engine		36.782 (1.4481)	36.947 (1.4546)
D15Z engine	PRI	38.427 (1.5129)	37.997 (1.4960)
	SEC	32.292 (1.2713)	
D16Z engine	PRI	35.900 (1.4134)	38.008 (1.4960)
	SEC	36.195 (1.4251)	
	MID	38.107 (1.5003)	

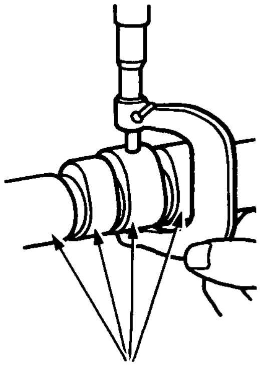
PRI: Primary cam lobe, SEC: Secondary cam lobe.
MID: Mid cam lobe, T/B: Timing belt.



D15Z engine



D16Z engine

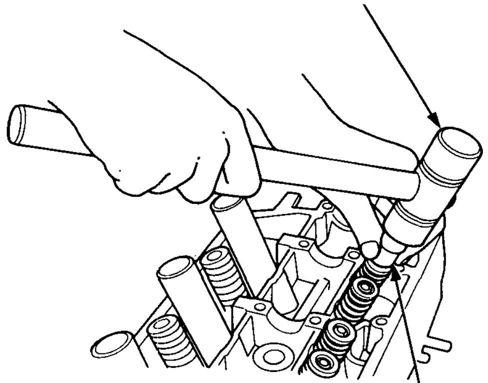


Check this area for wear.

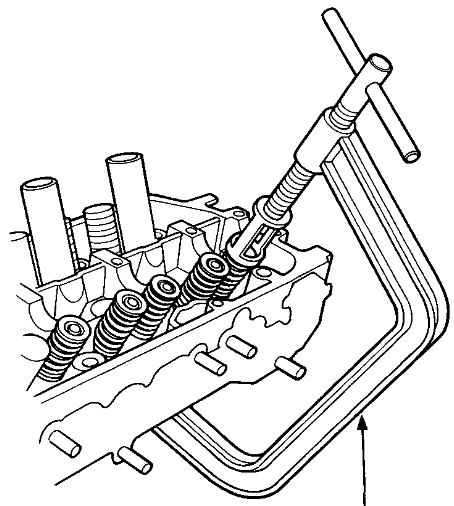
Replacement

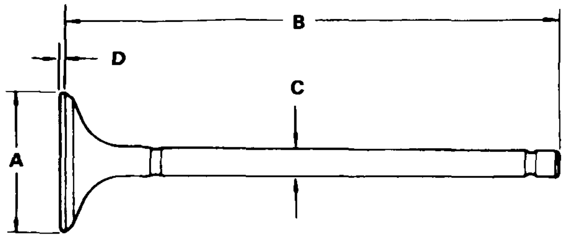
NOTE: Identify valves and valve springs as the are removed so that each item can be reinstalled in its original position.

1. Using an appropriate-sized socket and plastic mallet, lightly tap the valve retainer to loosen the valve keepers before installing the valve spring compressor.



2. Install the spring compressor. Compress the spring and remove the valve keeper.





D16Z engine:
Intake Valve Dimensions
A Standard (New): 29.9–30.1 mm (1.18–1.19 in)
B Standard (New): 117.42–117.72 mm (4.623–4.635 in)
C Standard (New): 5.48–5.49 mm (0.2157–0.2161 in)
C Service Limit: 5.45 mm (0.215 in)
D Standard (New): 0.85–1.15 mm (0.033–0.045 in)
D Service Limit: 0.65 mm (0.026 in)

Exhaust Valve Dimensions
A Standard (New): 25.9–26.1 mm (1.02–1.03 in)
B Standard (New): 114.60–114.90 mm (4.512–4.524 in)
C Standard (New): 5.45–5.46 mm (0.2146–0.2150 in)
C Service Limit: 5.42 mm (0.213 in)
D Standard (New): 1.05–1.35 mm (0.041–0.053 in)
D Service Limit: 0.95 mm (0.037 in)

D15Z *engine:*
Intake Valve Dimensions
A Standard (New): 27.4–27.6 mm (1.08–1.09 in)
B Standard (New): 118.82–119.12 mm (4.678–4.690 in)
C Standard (New): 5.48–5.49 mm (0.2157–0.2161 in)
C Service Limit: 5.45 mm (0.215 in)
D Standard (New): 0.85–1.15 mm (0.033–0.045 in)
D Service Limit: 0.65 mm (0.026 in)

Exhaust Valve Dimensions
A Standard (New): 23.4–23.6 mm (0.92–0.93 in)
B Standard (New): 116.20–116.50 mm (4.575–4.587 in)
C Standard (New): 5.45–5.46 mm (0.2146–0.2150 in)
C Service Limit: 5.42 mm (0.213 in)
D Standard (New): 1.05–1.35 mm (0.041–0.053 in)
D Service Limit: 0.95 mm (0.037 in)

D12B, D13B, D15B, D16A7 engine:
Intake Valve Dimensions
A Standard (New): 28.9–29.1 mm (1.14–1.15 in)
B Standard (New): 113.82–114.12 mm (4.481–4.493 in)
C Standard (New): 5.48–5.49 mm (0.2157–0.2161 in)
C Service Limit: 5.45 mm (0.215 in)
D Standard (New): 0.85–1.15 mm (0.033–0.045 in)
D Service Limit: 0.65 mm (0.026 in)

Exhaust Valve Dimensions
A Standard (New): 24.9–25.1 mm (0.98–0.99 in)
B Standard (New): 117.40–117.70 mm (4.622–4.634 in)
C Standard (New): 5.45–5.46 mm (0.2146–0.2150 in)
C Service Limit: 5.42 mm (0.213 in)
D Standard (New): 1.05–1.35 mm (0.041–0.053 in)
D Service Limit: 0.95 mm (0.037 in)

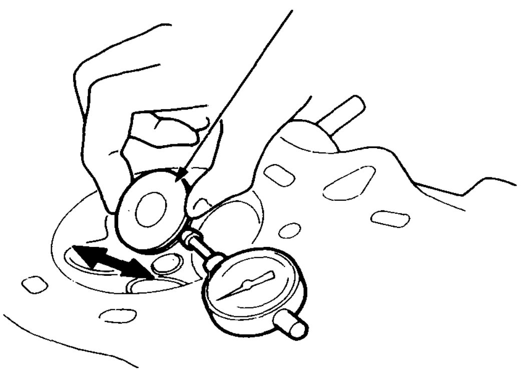
Valves

Valve Movement

Measure the guide-to-stem clearance with a dial indicator while rocking the stem in the direction of normal thrust (wobble method).

Intake Valve Stem-to-Guide Clearance:
Standard (New): 0.04–0.10 mm (0.002–0.004 in)
Service Limit: 0.16 mm (0.006 in)

Exhaust Valve Stem-to-Guide Clearance:
Standard (New): 0.10–0.16 mm (0.004–0.006 in)
Service Limit: 0.22 mm (0.009 in)



- If measurement exceeds the service limit, recheck using a new valve.
- If measurement is now within the service limit, reassemble using a new valve.
- If measurement still exceeds limit, recheck using alternate method below, then replace valve and guide, if necessary.

NOTE: An alternate method of checking guide to stem clearance is to subtract the O.D. of the valve stem, measured with a micrometer, from the I.D. of the valve guide, measured with an inside micrometer or ball gauge. Take the measurements in three places along the valve stem and three places inside the valve guide. The difference between the largest guide measurement and the smallest stem measurement should not exceed the service limit.

Intake Valve Stem-to-Guide Clearance:
Standard (New): 0.020–0.050 mm (0.001–0.002 in)
Service Limit: 0.080 mm (0.003 in)

Exhaust Valve Stem-to-Guide Clearance:
Standard (New): 0.05–0.08 mm (0.002–0.003 in)
Service Limit: 0.11 mm (0.004 in)

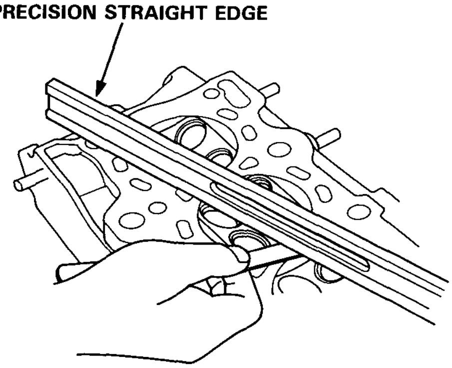
Cylinder Head

Warpage

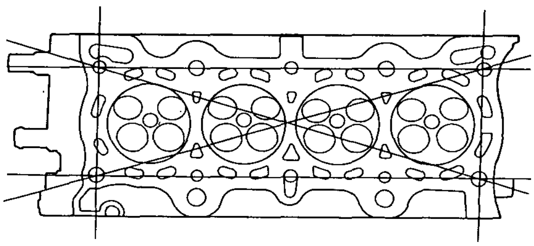
NOTE: If the camshaft bearing clearances (page 6-41) are not within specification, the head cannot be resurfaced.

If the camshaft bearing radial clearances are within specifications, check the head for warpage.

- If warpage is less than 0.05 mm (0.002 in) cylinder head resurfacing is not required.
- If warpage is between 0.05 mm (0.002 in) and 0.2 mm (0.008 in), resurface cylinder head.
- Maximum resurface limit is 0.2 mm (0.008 in) based on a height of 93 mm (3.66 in).



Measure along edges, and 3 ways across center.



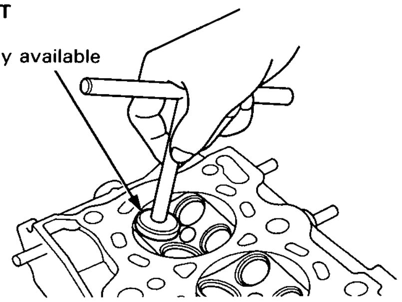
Cylinder Head Height:
D15Z, D16Z engine:
Standard (New): 92.95–93.05 mm (3.6594–3.6634 in)
Service Limit: 0.05 mm (0.002 in)
D12B, D13B, D15B, D16A7 engine:
Standard (New): 94.95–95.05 mm (3.7382–3.7421 in)
Service Limit: 0.05 mm (0.002 in)

Valve Seats

Reconditioning

1. Renew the valve seats in the cylinder head using a valve seat cutter.

   NOTE: If the guides are worn (page 6-40), replace them (page 6-42) before cutting the valve seats.

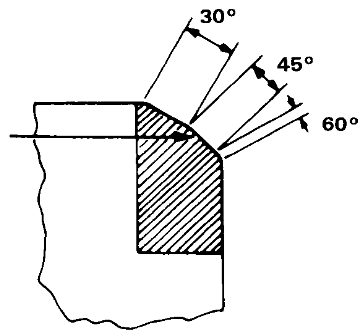


2. Carefully cut a 45° seat, removing only enough material to ensure a smooth and concentric seat.

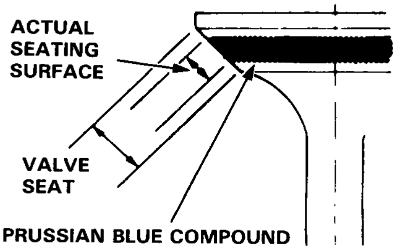
3. Bevel the upper edge of the seat with the 30° cutter and the lower edge of the seat with the 60° cutter. Check the width of seat and adjust accordingly.

4. Make one more very light pass with the 45° cutter to remove any possible burrs caused by the other cutters.

   Valve Seat Width:
   Standard (New):
   Intake: 0.85–1.15 mm (0.033–0.045 in)
   Exhaust: 1.25–1.55 mm (0.049–0.061 in)
   Service Limit:
   Intake: 1.6 mm (0.06 in)
   Exhaust: 2.0 mm (0.08 in)



5. After resurfacing the seat, inspect for even valve seating: Apply Prussian Blue compound to the valve face, and insert the valve in its original location in the head, then lift and snap it closed against the seat several times.



6. The actual valve seating surface, as shown by the blue compound, should be centered on the seat.
   - If it is too high (closer to the valve stem), you must make a second cut with the 60° cutter to move it down, then one more cut with the 45° cutter to restore seat width.
   - If it is too low (closer to the valve edge), you must make a second cut with the 30° cutter to move it up, then one more cut with the 45° cutter to restore seat width.

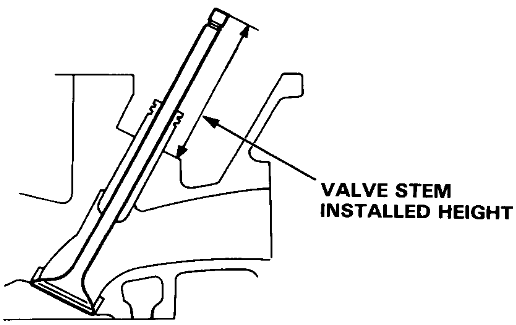
   NOTE: The final cut should always be made with the 45° cutter.

7. Insert the intake and exhaust valves in the head and measure the valve stem installed height.

   D12B, D13B, D15B, D16A7 engine:
   Intake Valve Stem Installed Height:
   Standard (New): 46.99–47.46 mm (1.850–1.868 in)
   Service Limit: 47.71 mm (1.878 in)
   Exhaust Valve Stem Installed Height:
   Standard (New): 48.97–49.44 mm (1.9278–1.946 in)
   Service Limit: 49.69 mm (1.956 in)

   D15Z, D16Z engine:
   Intake, Exhaust Stem Installed Height:
   Standard (New): 53.17–53.64 mm (2.0931–2.112 in)
   Service Limit: 53.89 mm (2.122 in)

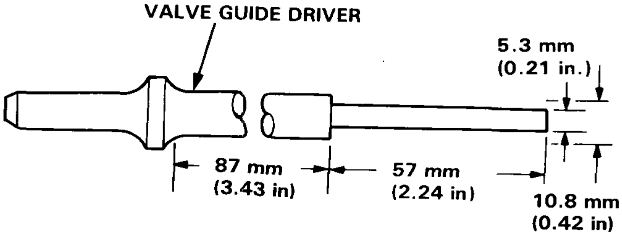
8. If the valve stem installed height is over the service limit, replace the valve and recheck. If its still over the service limit, replace the cylinder head; the valve seat in the head is too deep.



Valve Guides

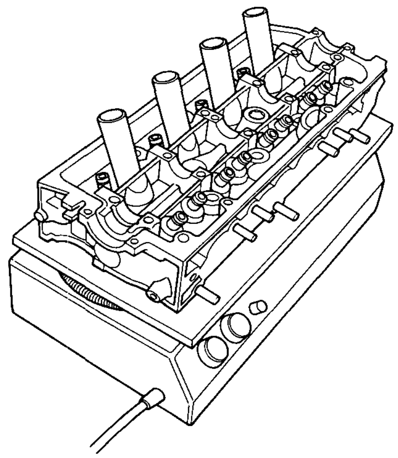
Replacement

1. As illustrated in the removal steps of this procedure use a commercially-available air-impact driver attachment which may need to be modified to fit the diameter of the valve guides. In most cases, the same procedure can be done using Valve Guide Drivers and a conventional hammer. Tool numbers are included in the procedure.



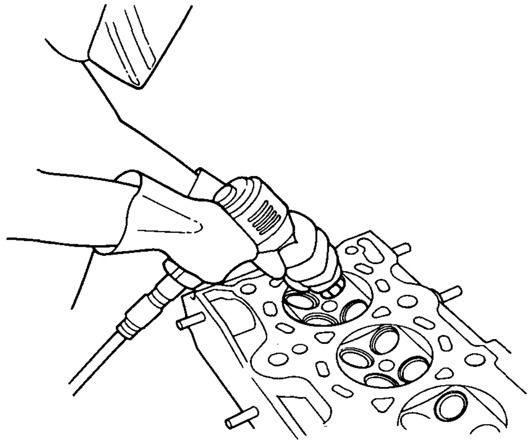
2. Select the proper replacement guides and chill them in the freezer section of a refrigerator for about an hour.

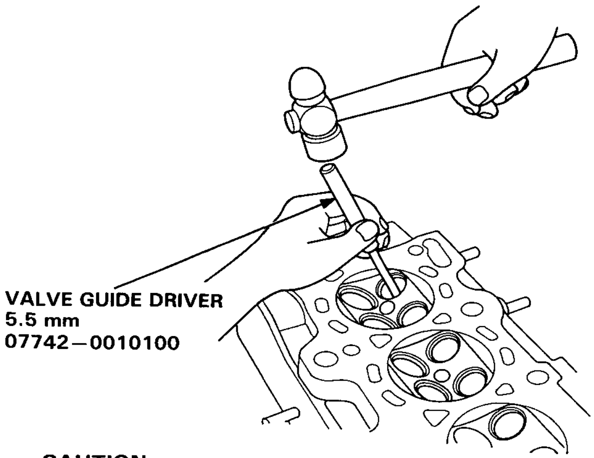
3. *Use a hot plate or oven to evenly heat the cylinder* head to 150°C (300°F). Monitor the temperature with a cooking thermometer.



CAUTION:
- **Do not use a torch; it may warp the head.**
- **Do not get the head hotter than 150°C (300°F); excessive heat may loosen the valve seats.**
- **To avoid burns, use heavy gloves when handling the heated cylinder head.**

4. Working from the camshaft side, use the driver and an air hammer to drive the guide about 2 mm towards the combustion chamber. This will knock off some of the carbon and make removal easier.





CAUTION:
- **Always wear safety goggles or a face shield when using the air hammer.**
- **Hold the air hammer directly in line with the valve guide to prevent damaging the driver.**

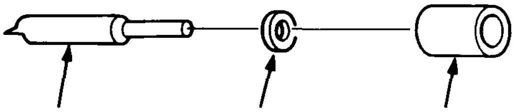
5. Turn the head over and drive the guide out toward the camshaft side of head.

   If a valve guide still won't move, drill it out with a 5/16 inch bit, then try again.

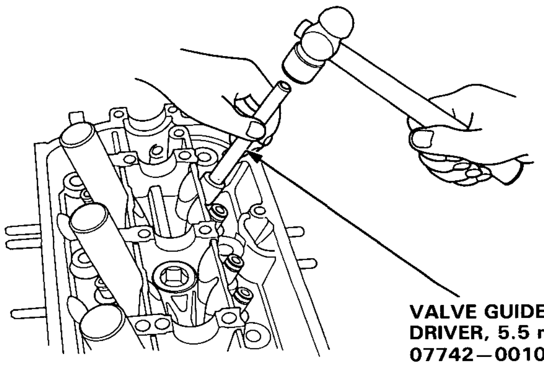
   CAUTION: Drill guides only in extreme cases; you could damage the cylinder head if the guide breaks.

6. Remove the new guides from the refrigerator, one at a time, as you need them.

7. Slip a 6 mm steel washer and the correct driver attachment over the end of the driver. (The washer will absorb some of the impact and extend the life of the driver).



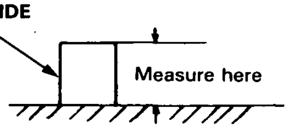
8. Install the new guide(s) from the camshaft side of the cylinder head; drive each one in until the attachment bottoms on the head. If you have all sixteen guides to do, you may have to reheat the head one or two more times.



NOTE: Valve guide replacement can be performed with this special tool.

Valve Guide Installed Height:
D16Z, D15Z engine:
Intake: 17.85–18.35 mm (0.703–0.722 in)
Exhaust: 18.65–19.15 mm (0.734–0.754 in)

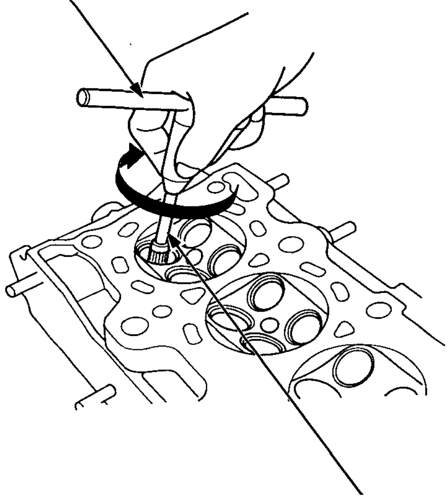
D12B, D13B, D15B, D16A7 engine:
Intake: 15.95–16.45 mm (0.628–0.648 in)
Exhaust: 15.95–16.45 mm (0.628–0.648 in)



Valve Guide Reaming

NOTE: For new valve guides only.

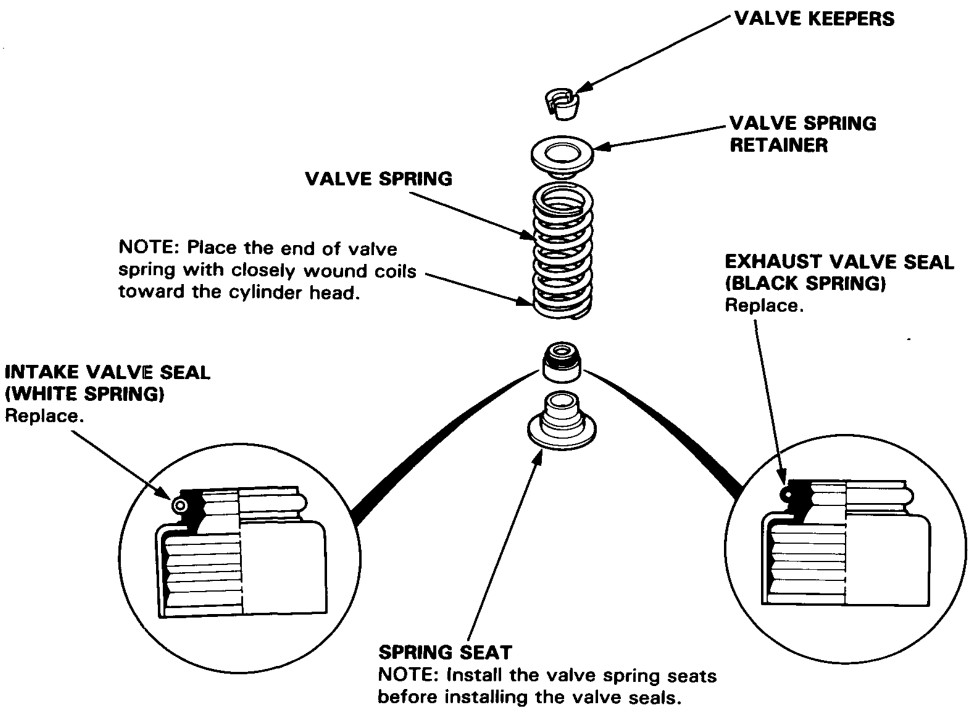
1. Coat both the reamer and valve guide with cutting oil.
2. Rotate the reamer clockwise the full length of the valve guide bore.
3. Continue to rotate the reamer clockwise while removing it from the bore.
4. Thoroughly wash the guide in detergent and water to remove any cutting residue.
5. Check the clearance with a valve (page 6-40).
   – Verify that the valve slides in the valve guide without exerting pressure.

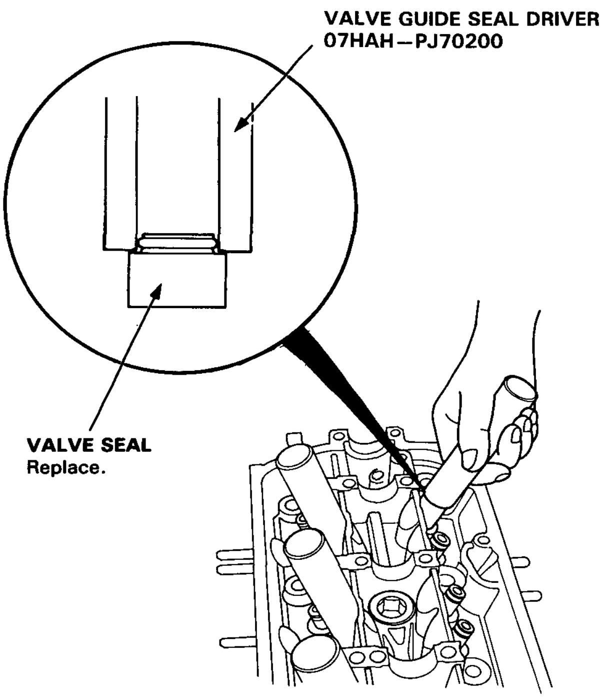


Valve Springs and Valves

Valve Spring and Valve Seal Installation Sequence

NOTE: Exhaust and intake valve seals are NOT interchangeable.



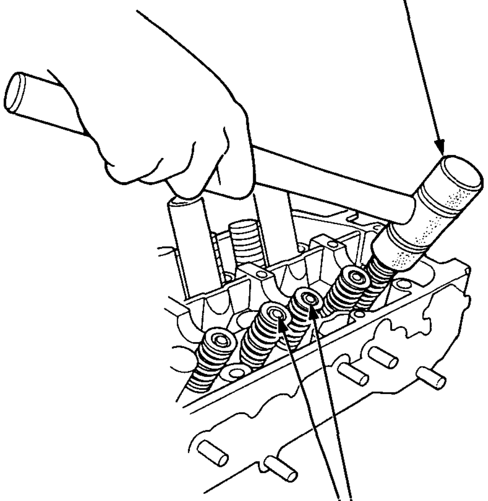


Valve Springs and Valves

Valve Installation

CAUTION: When tapping the valve stems tap it at a right angle to the stem end so as not to bend the stem.

- When installing the valves in the cylinder head, coat the valve stems with oil before inserting them into valve guides, and make sure the valves move up and down smoothly.
- When the valves and springs are in place, lightly tap the end of each valve stem two or three times to ensure proper seating of the valve and valve keepers.



Camshaft/Seal and Rocker Arms

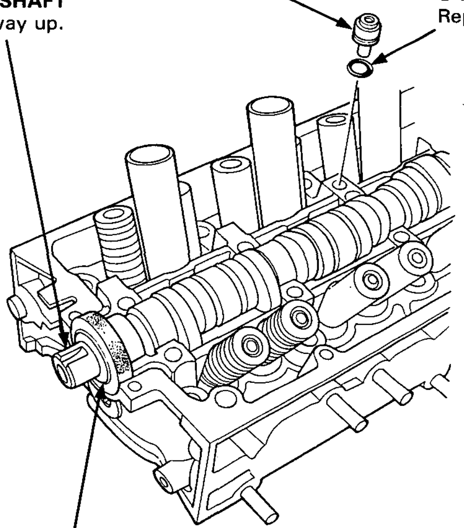
Installation

CAUTION:
- **Make sure that all the rockers are in alignment with the valves when torquing the rocker assembly bolts.**
- **To prevent the rocker arm assembly from coming apart, leave the cam holder holding bolts in the holes.**

1. After wiping down the cam and journals in the cylinder head, lubricate both surfaces and install the camshaft.
2. Set the camshaft and camshaft seal as shown below.
3. Install the camshaft seal with the open side (spring) facing in.

OIL Lubricate the cam lobes after reassembly.

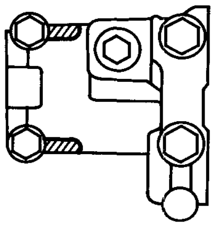
4. Install the oil control orifice as shown.
   - Use a new O-ring when installing.



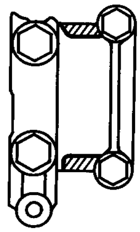
(cont'd)

Installation (cont'd)

4. Apply liquid gasket to the head mating surface of the No. 1 and No. 5 or No. 6 cam holders.
   — Apply liquid gasket to the shaded areas.

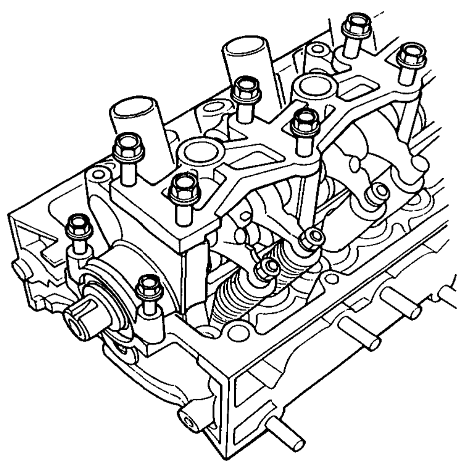


No. 5



No. 1

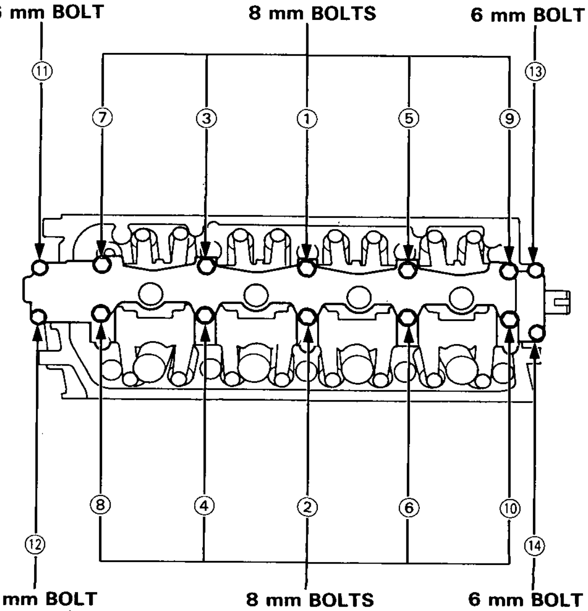
5. Set the rocker arm assembly in place and loosely install the bolts.
   — Make sure that the rocker arms are properly positioned on the valve stems.



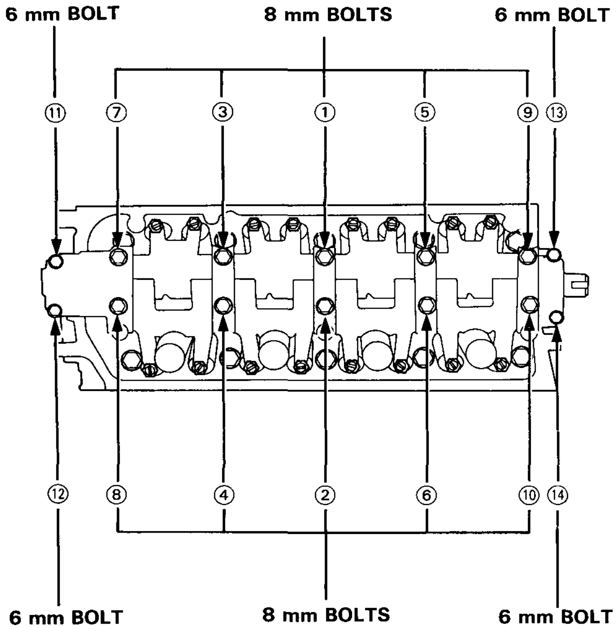
6. Tighten each bolt two turns at a time, in the sequence shown below, to ensure that the rockers do not bind the valves.

Specified torque:
8 mm bolts: 22 N·m (2.2 kg-m, 16 lb-ft)
6 mm bolts: 12 N·m (1.2 kg-m, 9 lb-ft)

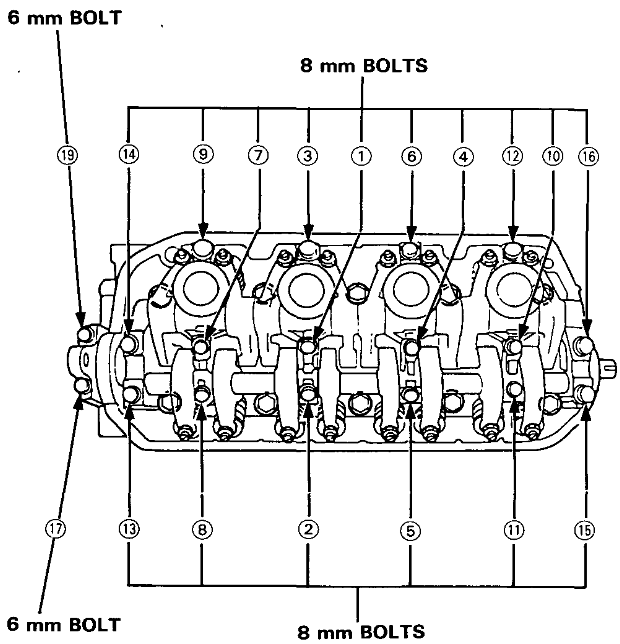
D16Z engine:



D15Z engine:

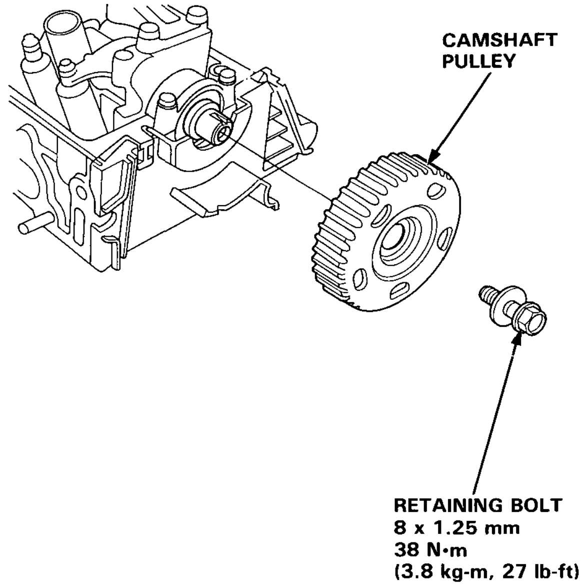


D12B, D13B, D15B, D16A7 engine:



7. Install the timing belt back cover.

8. Install the cam pulley.



Cylinder Head

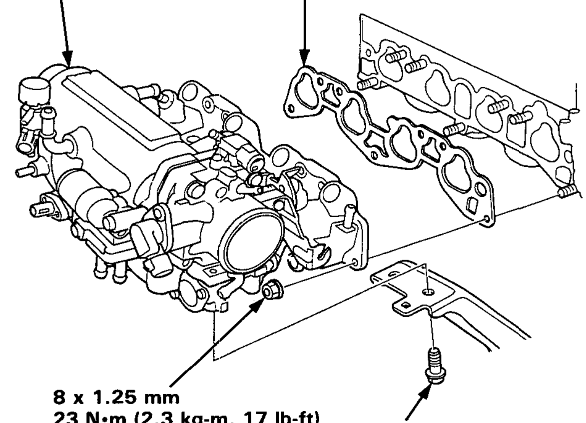
Installation

Install the cylinder head in the reverse order of removal:

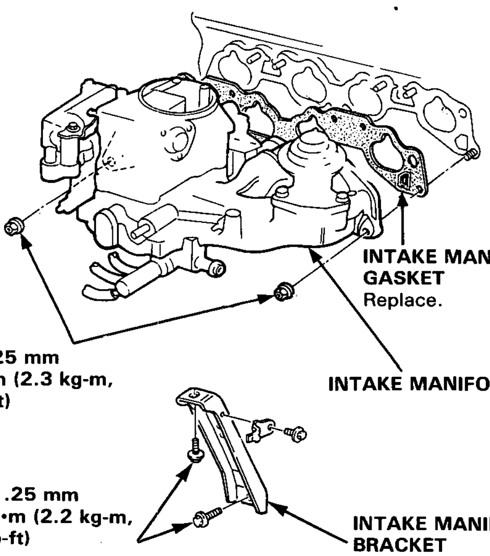
NOTE:
- Always use a new head gasket.
- Cylinder head and engine block surface must be clean.
- Turn the crankshaft so that No. 1 piston is at TDC (page 6-59).

1. Install the intake manifold and tighten the nuts in a criss-cross pattern in 2 or 3 steps, beginning with the inner nuts.

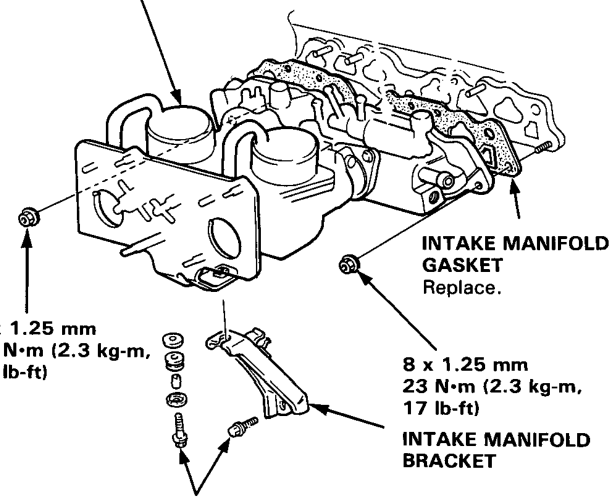
D15Z, D16A7, D16Z engine:



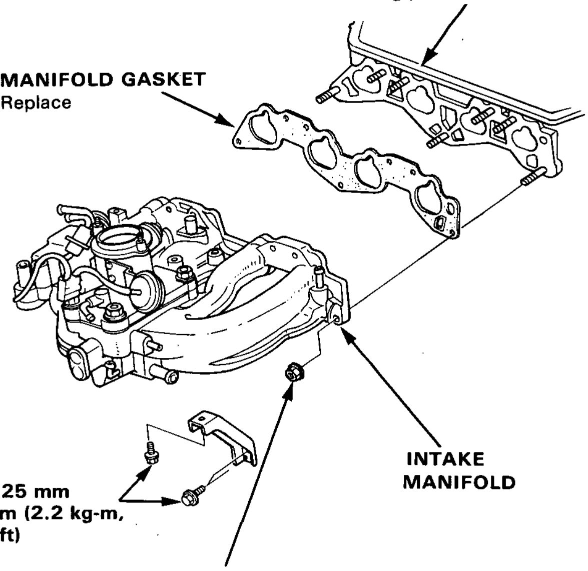
D12B, D13B, D15B3 engine:



D15B4 engine:

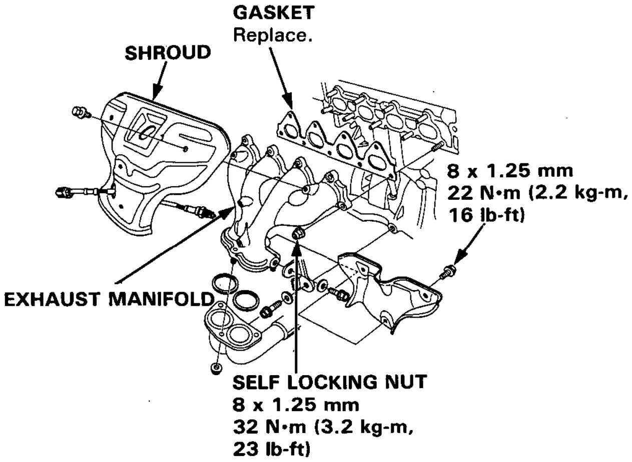


D15B2:

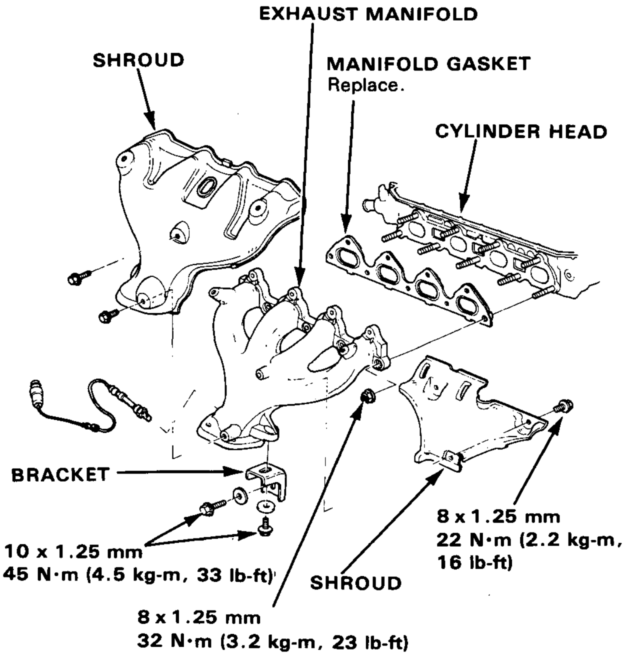


2. Install the exhaust manifold and tighten the nuts in a criss-cross pattern in 2 or 3 steps, beginning with the inner nut.

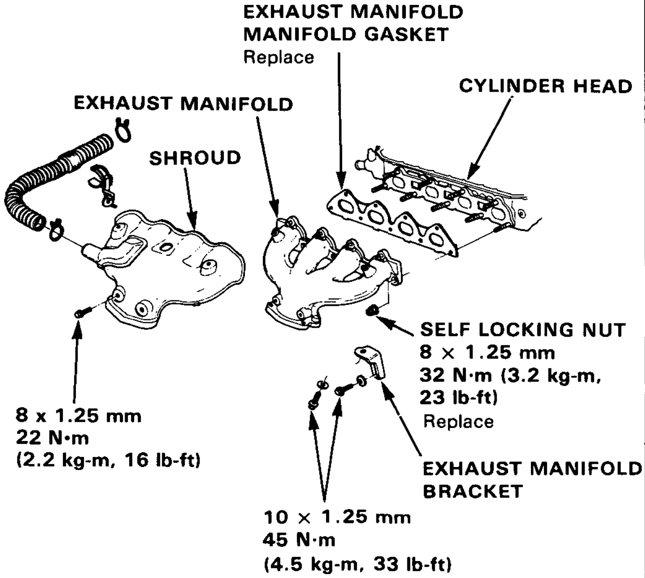
D16A7, D16Z engine:



D15B engine:

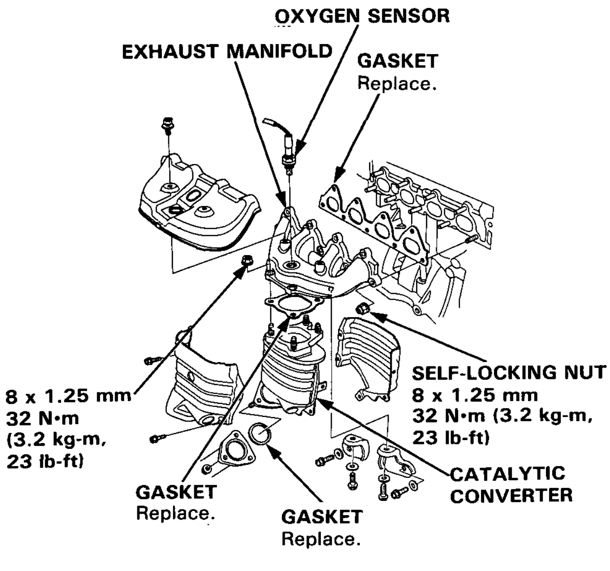


D12B, D13B engine:



3. Install the catalytic converter on the exhaust manifold, then install the exhaust manifold assembly.

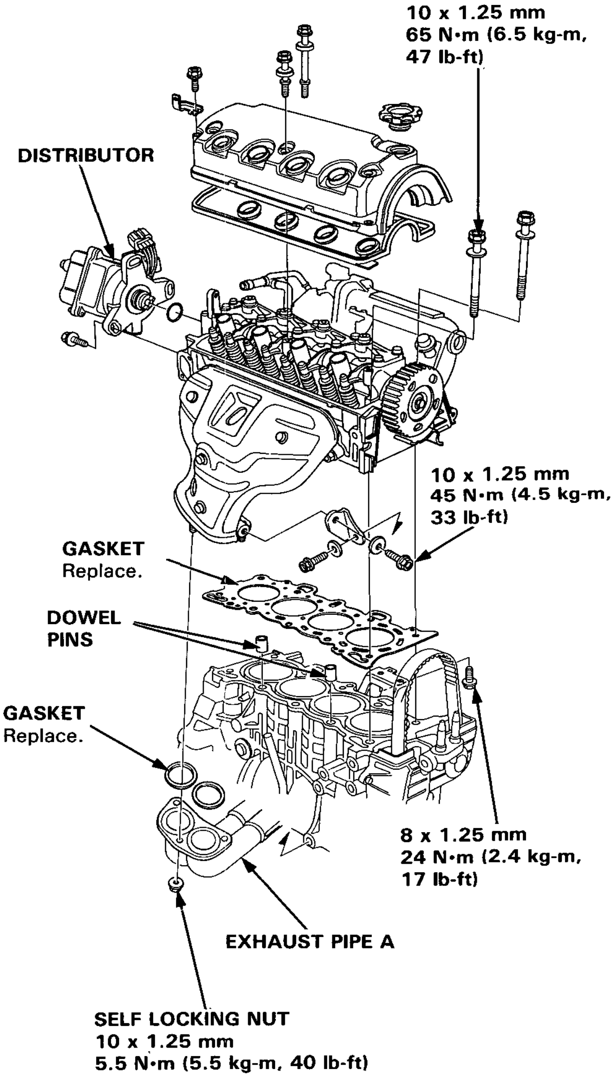
D15Z engine:



Installation (cont'd)

4. Install two dowel pins, head gasket, and cylinder head.

NOTE:
- Apply clean engine oil on the bolt threads and washer contact surface.
- Always use a new cylinder head gasket.
- Turn the cam pulley to TDC before installing.

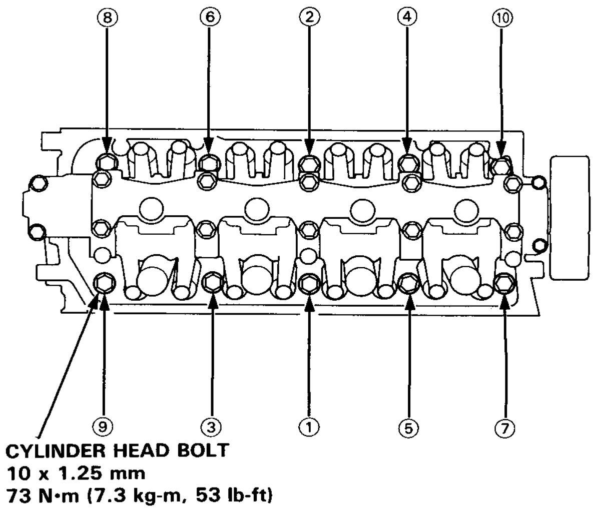


5. Install the bolts that secure the intake manifold to its bracket, but do not tighten them yet.

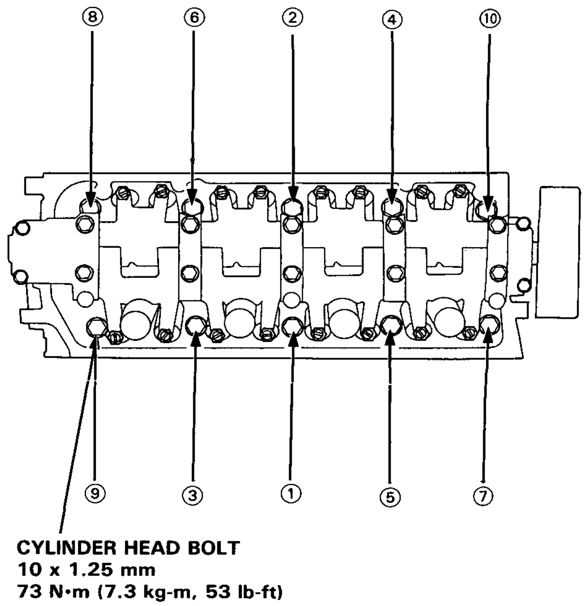
6. Tighten the cylinder head bolts in two steps.
   1st step: 30 N·m (3.0 kg-m, 22 lb-ft)
   2nd step:
   D16Z, D15Z engine:
   73 N·m (7.3 kg-m, 53 lb-ft)
   D12B, D13B, D15B, D16A7 engine:
   65 N·m (6.5 kg-m, 47 lb-ft)

CYLINDER HEAD BOLTS TIGHTENING SEQUENCE

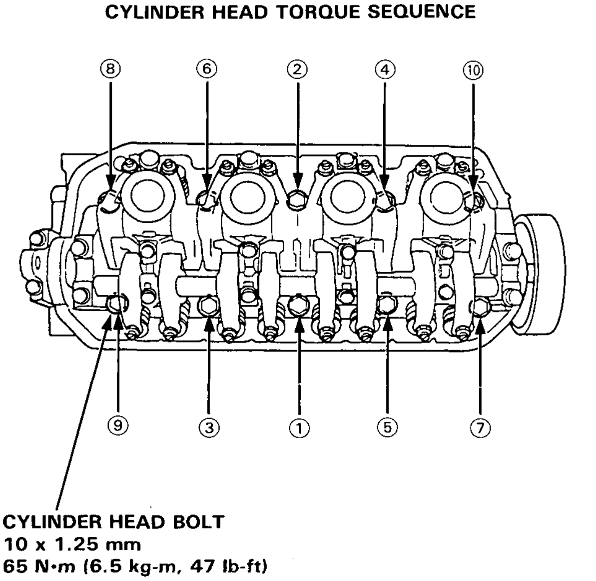
D16Z engine:



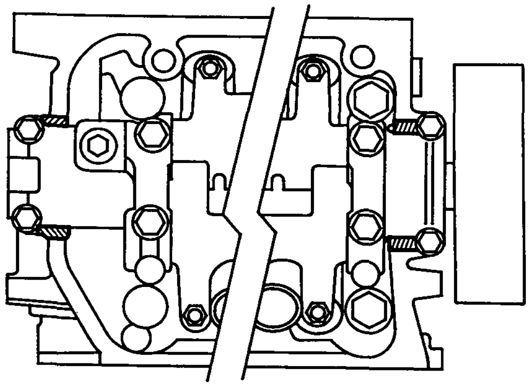
D15Z engine:



D12B, D13B, D15B, D16A7 engine:

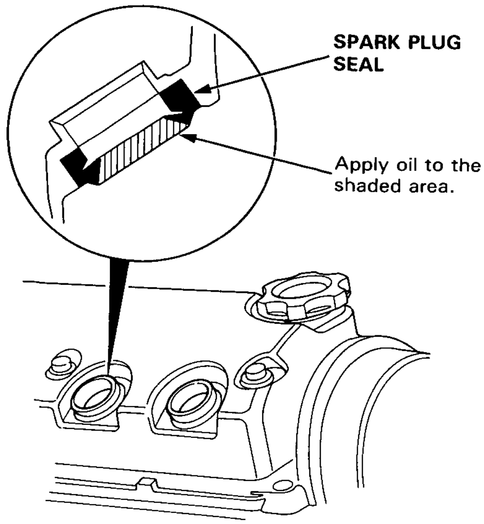


7. Install the exhaust pipe A on the exhaust manifold.
8. Tighten the bolts for intake manifold bracket.
9. Install the exhaust pipe A on its bracket.
10. After the installation, check that the tubes, hoses and connectors are installed correctly.
11. Adjust the valve timing (page 6-63).
12. Apply liquid gasket to the head mating surface of the No. 1 and No. 5 or No. 6 cam holders, then install the cylinder head cover.



D16Z, D15Z engine:

NOTE:
- Carefully apply oil with your finger to the shaded area when installing the cylinder head cover.
- Visually check the spark plug seal for damage.



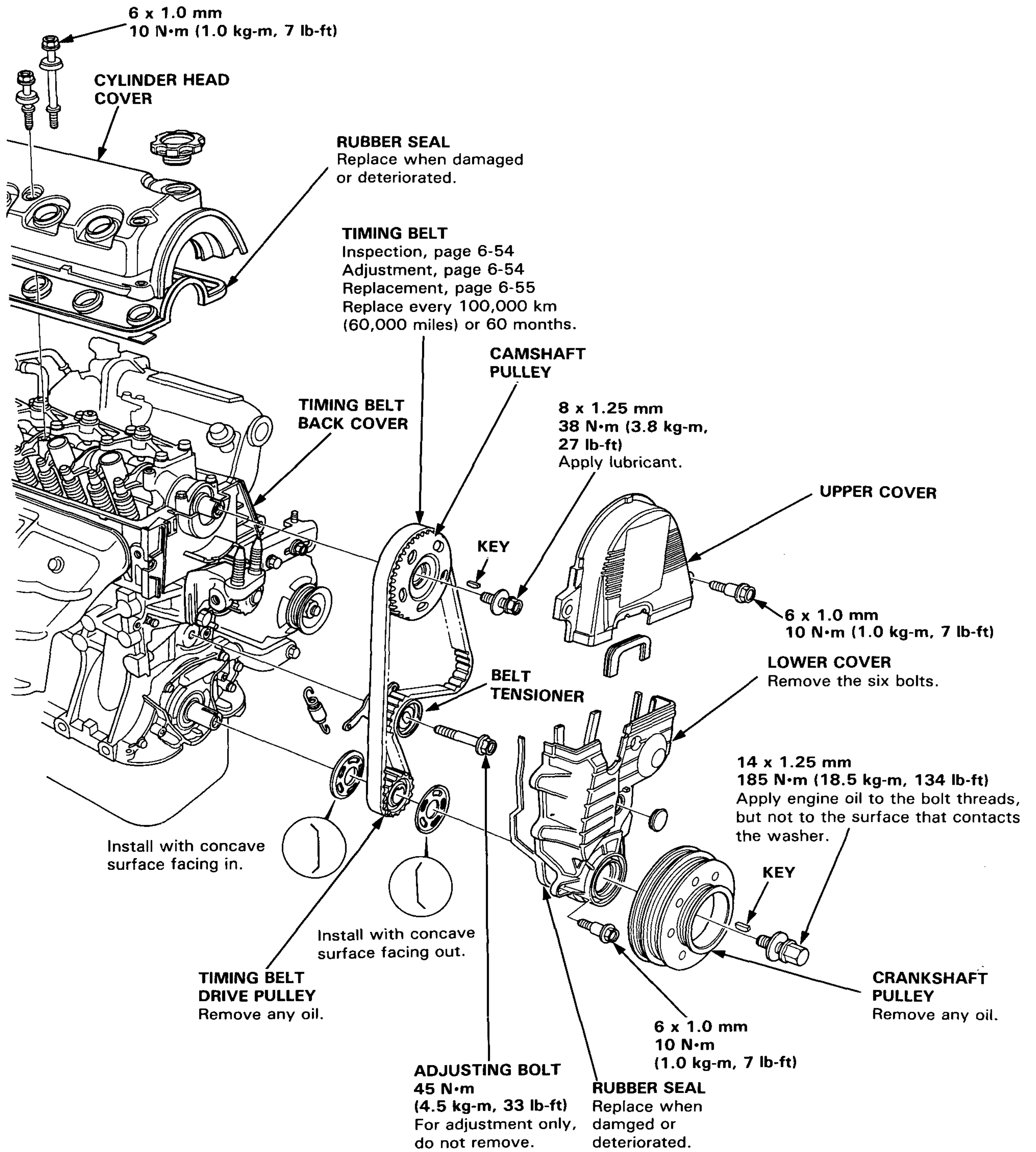
Timing Belt

Illustrated Index

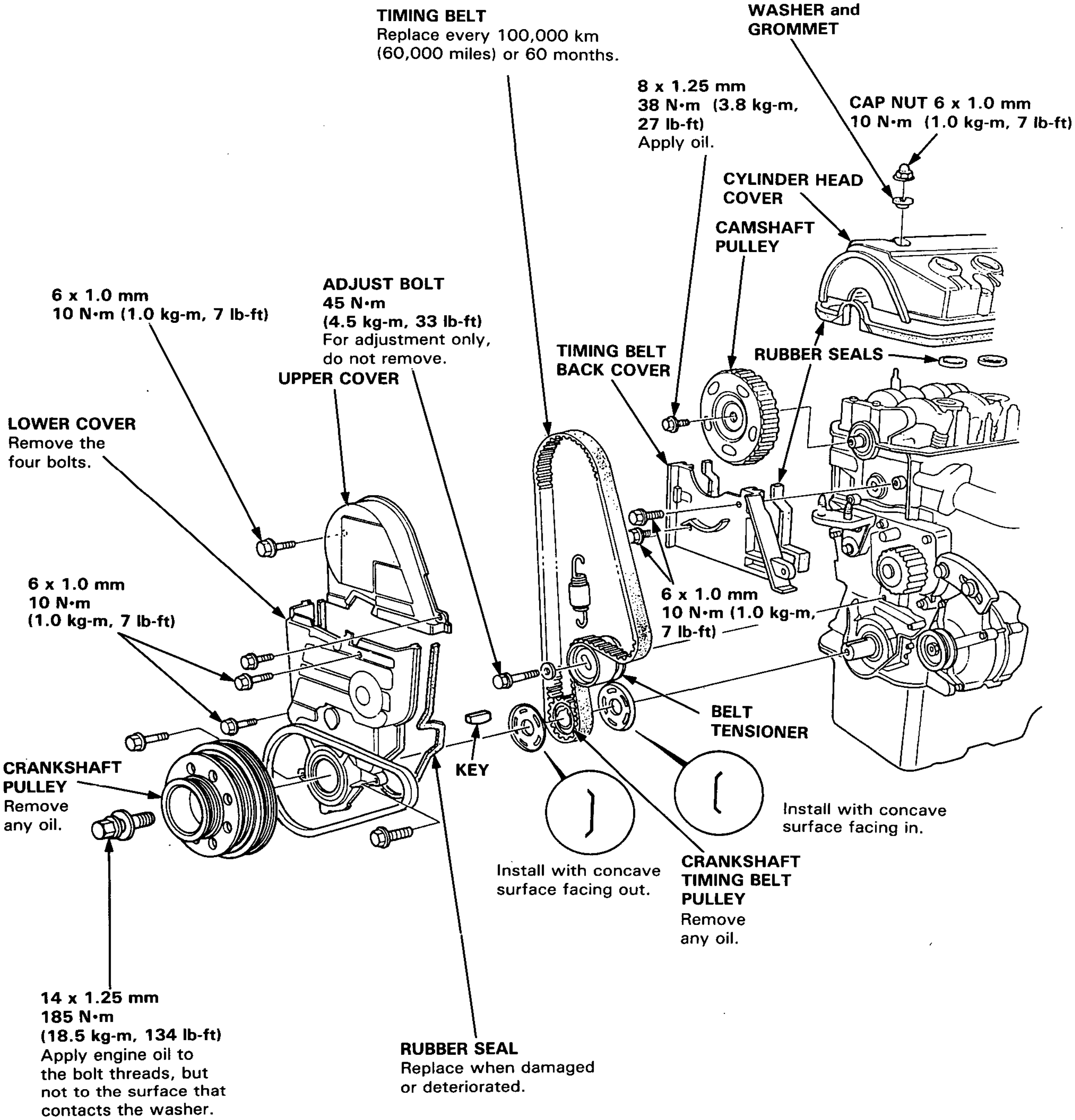
D16Z, D15Z engine:

NOTE:

- Refer to Section 23, for alternator belt adjustment.
- Refer to Section 22, for A/C compressor belt adjustment.
- Refer to Section 17, for P/S pump belt adjustment.
- Before removing, mark direction of rotation.



D12A, D13B, D15B, D16A7 engine:

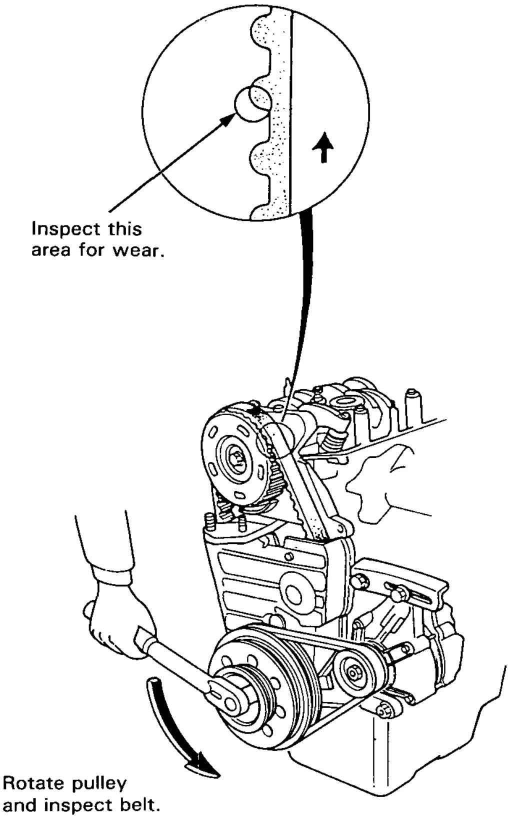


Timing Belt

Inspection

NOTE:
- Replace the belt if oil soaked.
- Remove any oil or solvent that gets on the belt.

1. Remove the cylinder head cover.
2. Remove the timing belt upper cover.
3. Inspect the timing belt for cracks and oil soaking.



4. If the pulley bolt loosens while turning the crank, tighten it to specified torque.

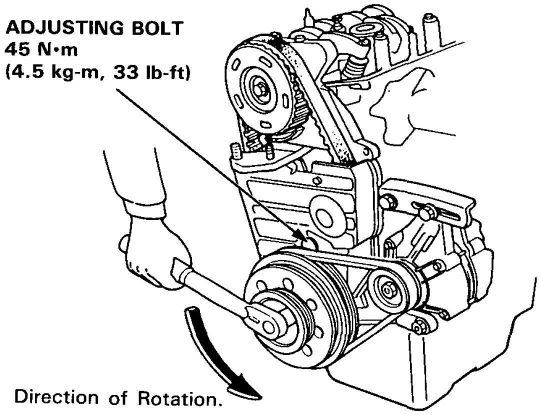
   Specified Torque:
   185 N·m (18.5 kg-m, 134 lb-ft)

Tension Adjustment

CAUTION: Always adjust the timing belt tension with the engine cold.

NOTE:
- The tensioner is spring-loaded to apply proper tension to the belt automatically after making the following adjustment.
- Always rotate the crankshaft counterclockwise when viewed from the pulley side.
  Rotating it clockwise may result in improper adjustment of the belt tension.

1. Remove the cylinder head cover.
2. Remove the timing belt upper cover.
3. Set the No. 1 piston at TDC (page 6-60).
4. Loosen the adjusting bolt 180°.



5. Rotate the crankshaft counterclockwise 3-teeth on the camshaft pulley to create tension on the timing belt.
6. Make sure the timing belt and the cam pulley are engaged securely.
7. Torque the adjusting bolt to 45 N·m (4.5 kg-m, 33 lb-ft).
8. If the pulley bolt loosens while turning the crank, tighten it to specified torque.

   Specified Torque:
   185 N·m (18.5 kg-m, 134 lb-ft)

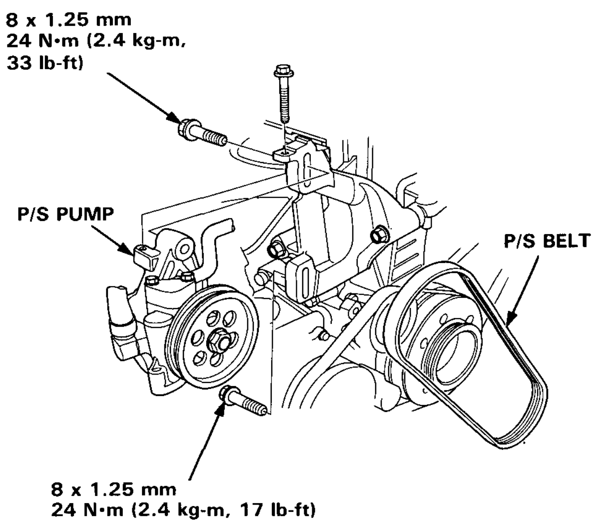
Removal

CAUTION: Inspect the water pump when replacing the timing belt (page 10-16).

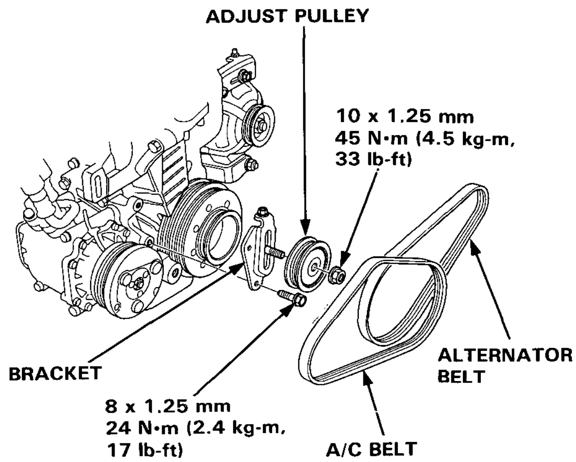
NOTE:
- Turn the crankshaft so that No. 1 piston is at top-dead-center (page 6-53 and 54).
- Before removing the timing belt, mark its direction of rotation if it to be reused.

1. Remove the splash shield.

2. Remove the power steering pump.
   - Do not disconnect the P/S hoses.

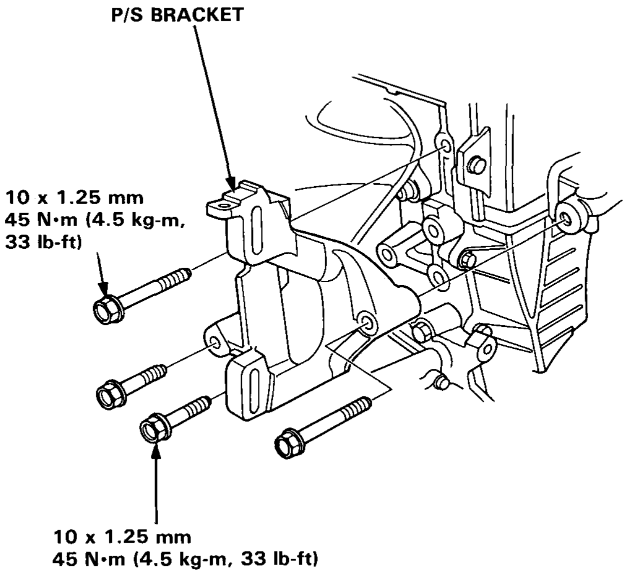


3. Remove the A/C compressor adjust pulley with bracket and the belt (with A/C), then remove the alternator belt.



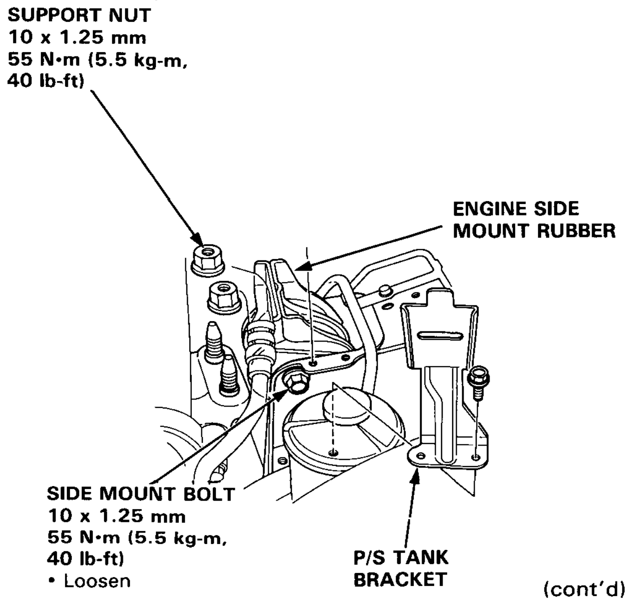
4. Remove the P/S bracket.

5. Loosen the alternator adjusting bolt and pivot nut, then remove the belt.



6. Remove the cruise control actuator and the P/S tank bracket.

7. Remove the engine support nuts. Loosen the mount bolt and pivot the engine side mount rubber out of the way.



(cont'd)

Removal (cont'd)

8. Remove the cylinder head cover.

9. Remove the timing belt upper cover.

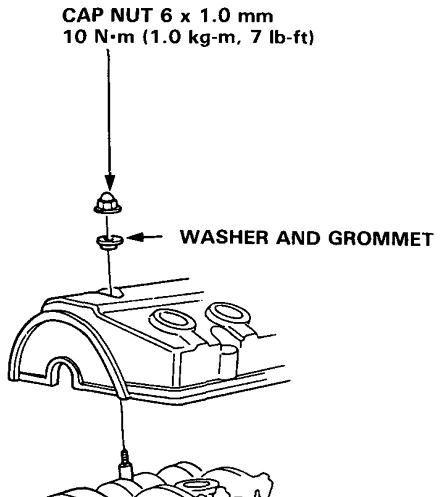
10. Remove the special bolt and crankshaft pulley.

11. Remove the timing belt upper cover and the lower cover.

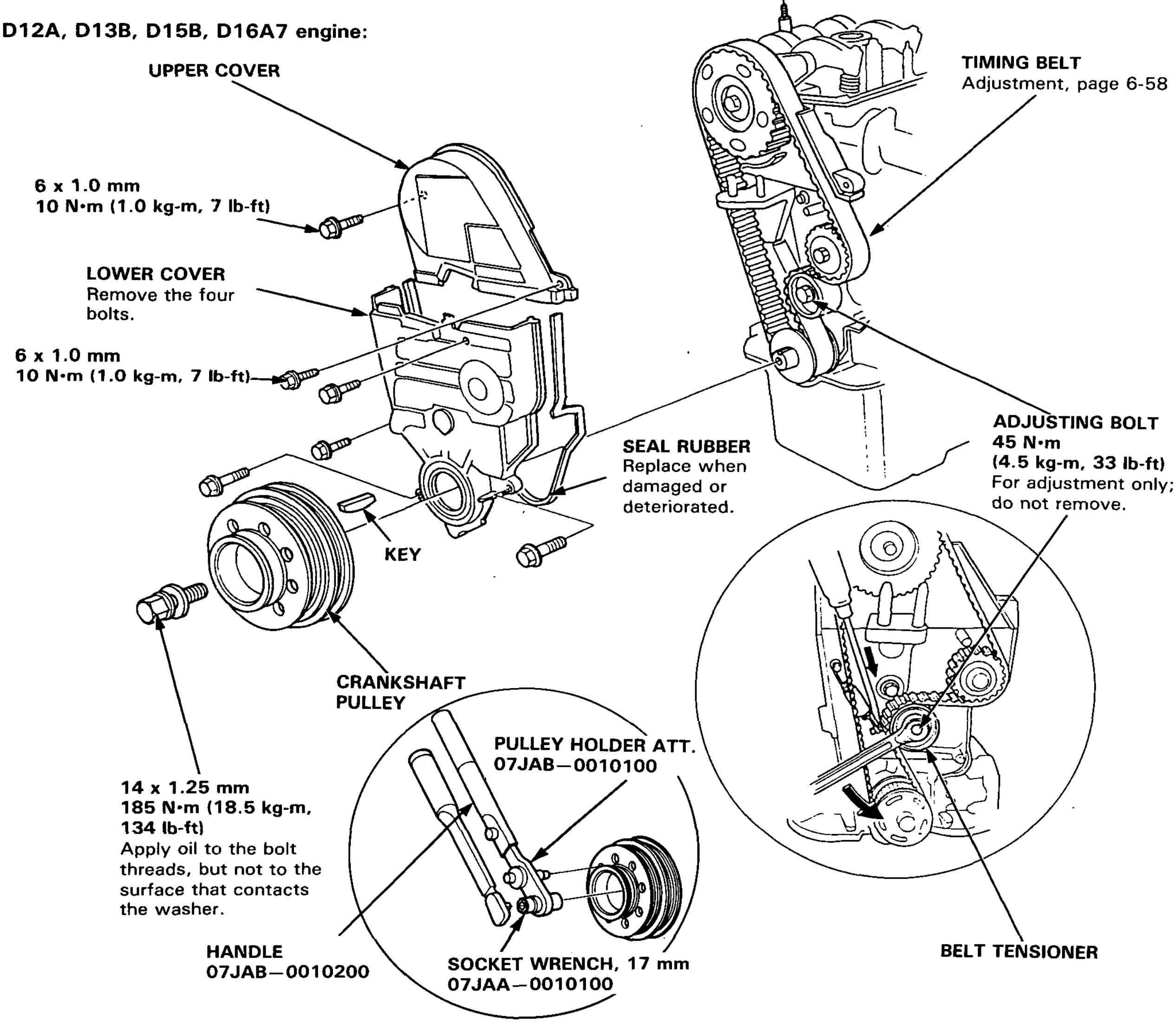
12. Loosen the timing belt adjusting bolt 180° to release the belt tension.

13. Push the tensioner to release tension from the belt, then retighten the adjusting bolt.

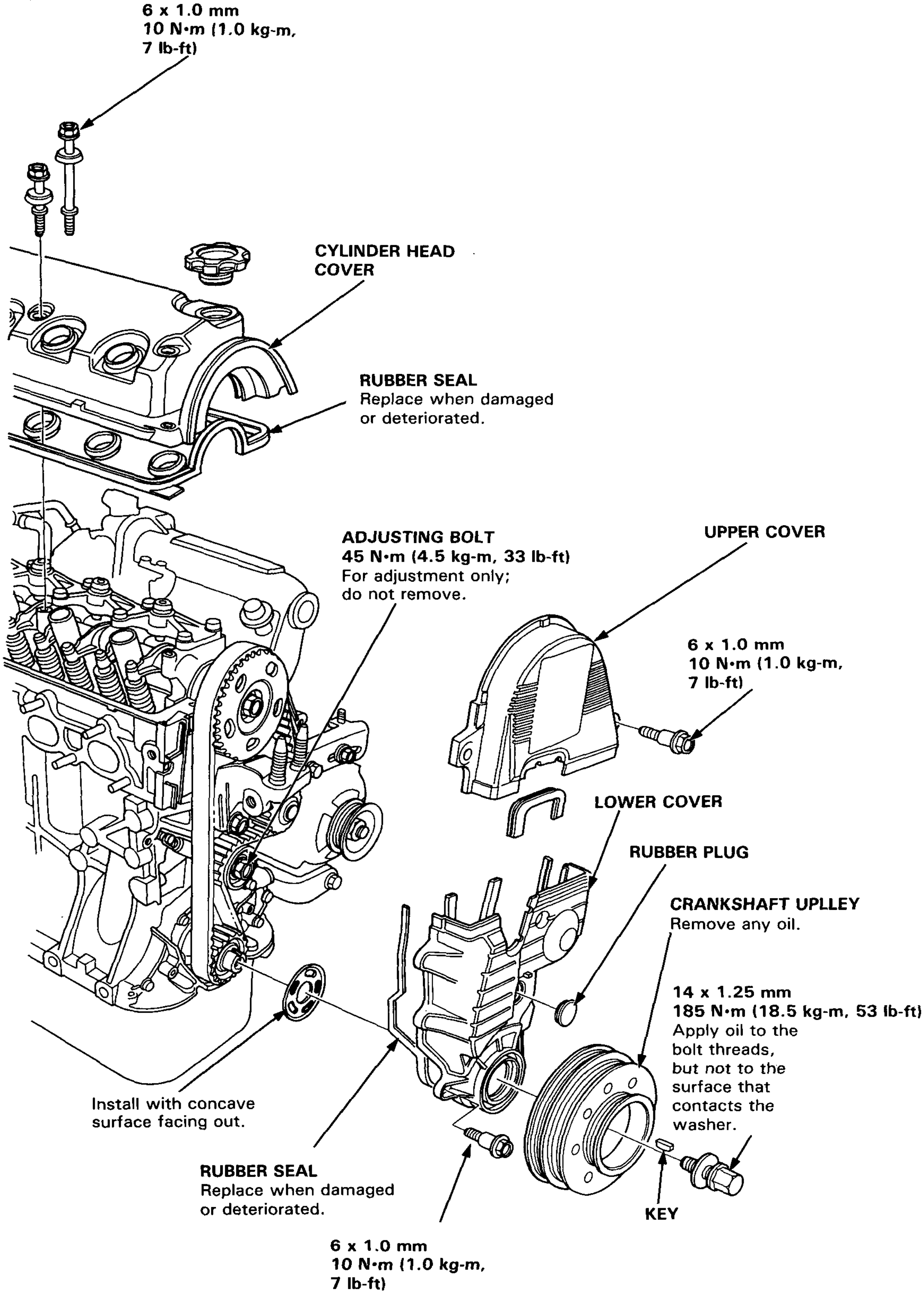
14. Remove the timing belt from the pulleys.



D12A, D13B, D15B, D16A7 engine:



D16Z, D15Z engine:



Installation

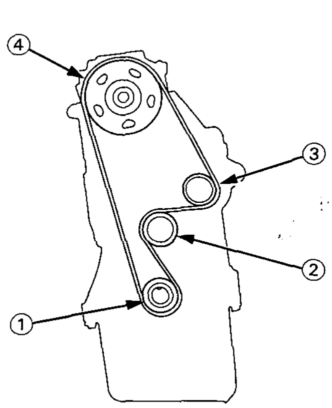
1. Install the timing belt in the reverse order of removal;
   Only key points are described here.

2. Position the crankshaft and the cam pulleys as shown before installing the timing belt.

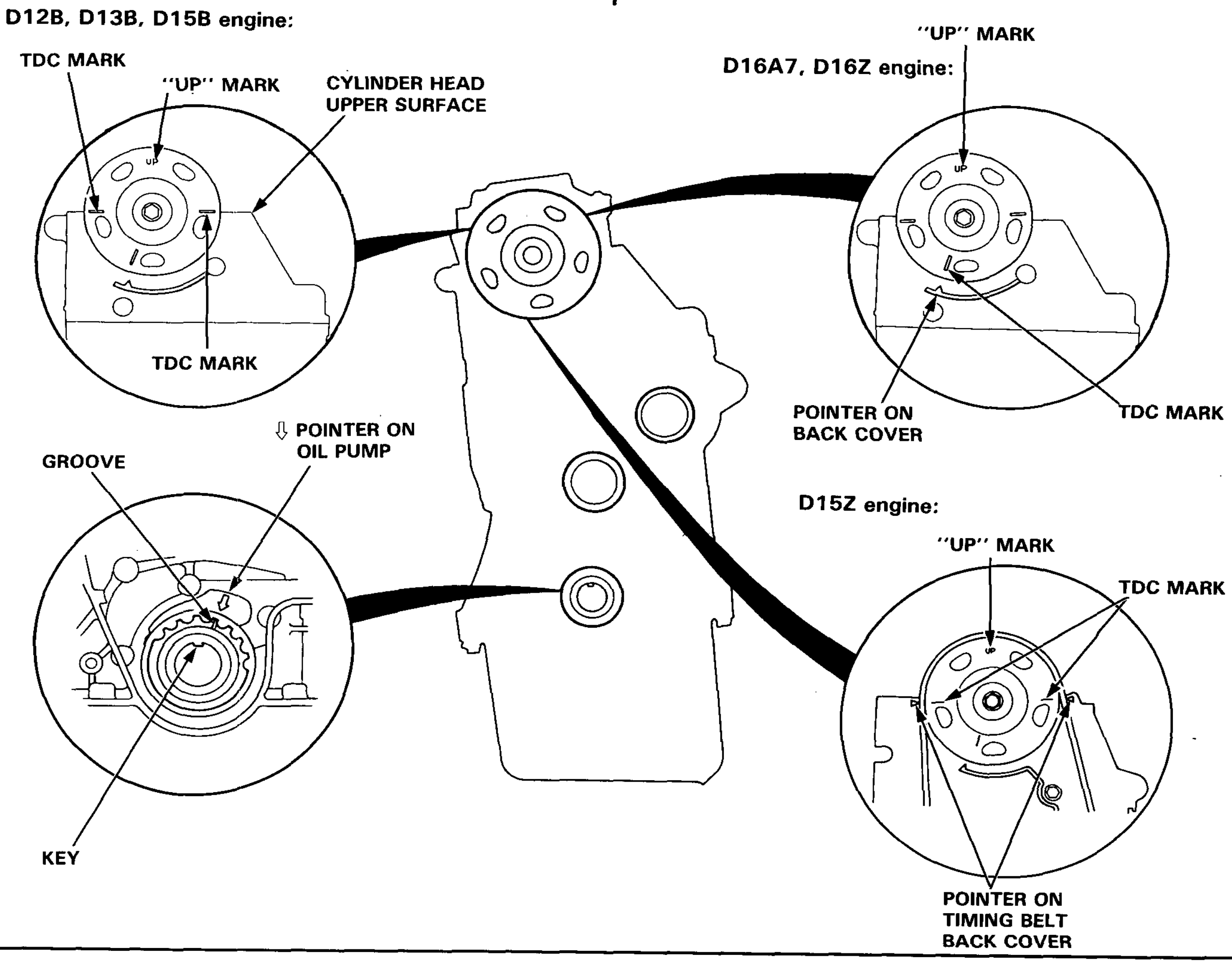
   A Set the crankshaft so that the No. 1 piston is at top-dead-center (TDC).

   NOTE: Align the groove on the teeth side of the timing belt drive pulley to the ⇩ pointer on the oil pump.

   B D12B, D13B, D15B engine: Align the TDC marks on the cam pulley with the cylinder head upper surface.
   D16A7, D16Z engine: Align the TDC mark on the cam pulley with pointer on the back cover.
   D15Z engine: Align the TDC marks on the cam pulley with pointers (triangle marks) on the back cover.



3. Install the timing belt tightly in the sequence shown.
   ① Timing belt drive pulley (crankshaft) → ② Adjusting pulley → ③ Water pump pulley → ④ camshaft pulley.



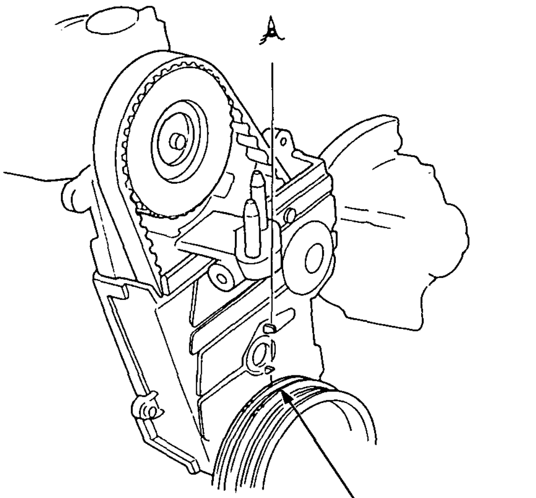
4. Loosen the adjusting bolt, and retighten it after tensioning the belt.

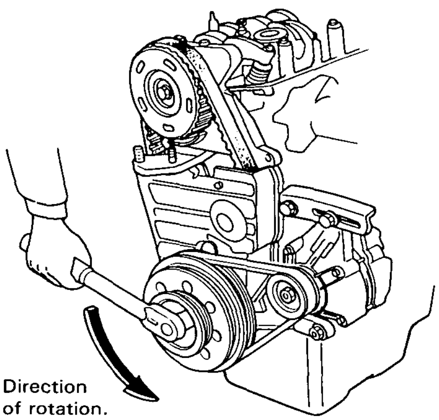
5. Rotate the crankshaft *about 4 or 6 turns clockwise* so that the belt may fit in position on the pulleys.

6. Adjust the timing belt tension (page 6-54).

7. Check the crankshaft pulley and the cam pulley at TDC.

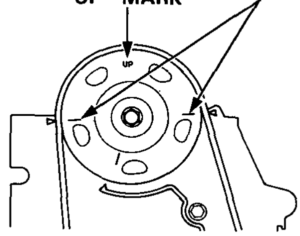
CRANKSHAFT PULLEY:



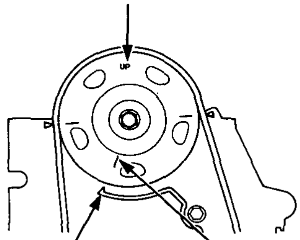


CAM PULLEY:

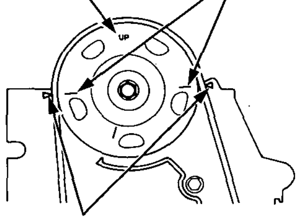
D12B, D13B, D15B engine:



D16A7, D16Z engine:



D15Z engine:



8. If the cam pulley is not positioned at TDC, remove the timing belt and adjust the positioning following the procedure on page 6-58, then reinstall the timing belt.

   NOTE: *Refer to page 6-55 for timing belt removal.*

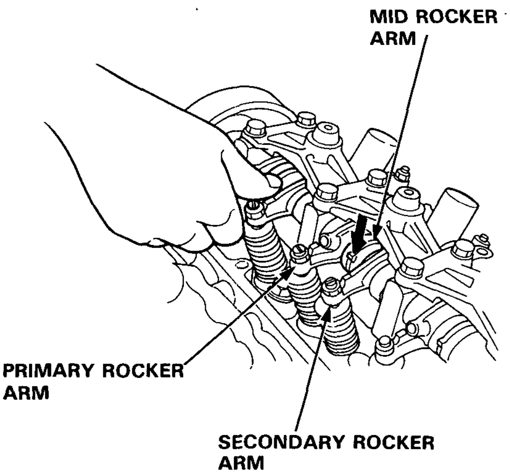
   After installation, adjust the tension of each belt.
   - See section 23 for alternator belt tension adjustment.
   - See section 22 for A/C compressor belt tension adjustment.
   - See section 17 for P/S pump belt tension adjustment.

Rocker Arms

Manual Inspection (D16Z engine)

1. Set the No. 1 piston at TDC.
2. Remove the cylinder head cover.

   NOTE: Apply oil to spark plug tube oil seal with your finger when installing cylinder head cover.
3. Push the intake mid rocker arm on the No. 1 cylinder manually.
4. Check that the intake mid rocker arm moves independently of the primary and secondary intake rocker arms.

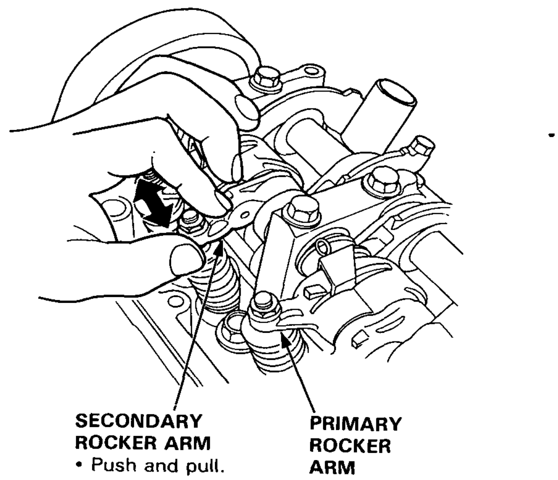


5. Check the intake mid rocker arm of each cylinder at TDC.
   - If the intake mid rocker arm does not move, remove the mid, primary and secondary intake rocker arms as an assembly and check that the pistons in the mid and primary rocker arms move smoothly.
   - Replace the intake rocker arms as an assembly if there is any abnormality.

Manual Inspection (D15Z engine)

1. Set the No. 1 piston at TDC.
2. Remove the cylinder head cover.

   NOTE: Apply oil to spark plug tube oil seal with your finger when installing cylinder head cover.
3. Move the intake secondary rocker arm on the No. 1 cylinder manually.
4. Check that the intake secondary rocker arms move independently of the primary intake rocker arm.

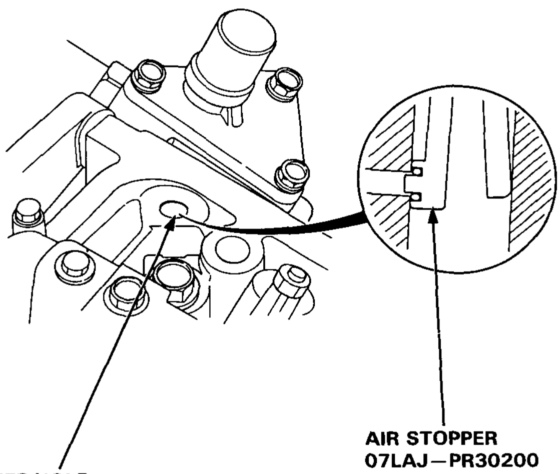


5. Check the intake secondary rocker arm of each cylinder at TDC.
   - If the intake secondary rocker arm does not move, remove the primary and secondary intake rocker arms as an assembly and check that the pistons in the secondary and primary rocker arms move smoothly.
   - Replace the intake rocker arms as an assembly if there is any abnormality.

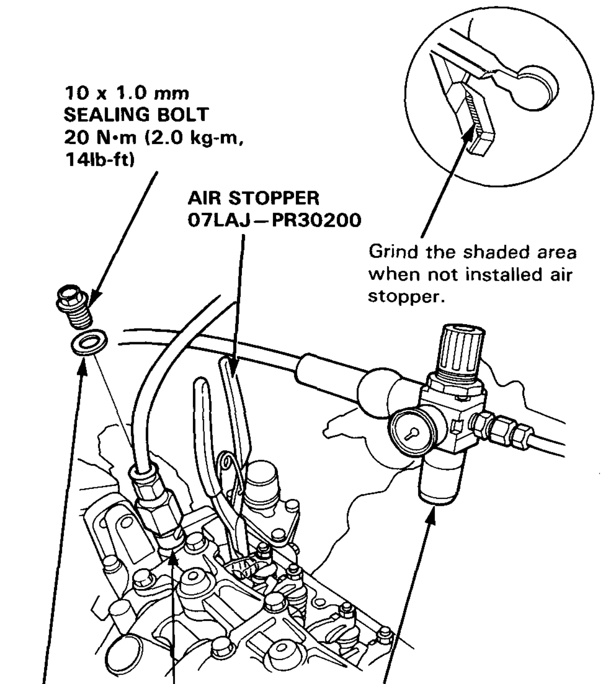
Inspection Using Special Tools (D16Z engine)

CAUTION:
- **Before using the Valve Inspection Tool, make sure that the air pressure gauge on the air compressor indicates over 250 kPa (2.5 kg/cm², 36 psi).**
- **Inspection the valve clearance before rocker arm inspection.**
- **Cover the timing belt with a shop towel to protect the belt.**
- **Check the intake mid rocker arm of each cylinder at TDC.**

1. Remove the cylinder head cover.
2. Plug the relief hole with the special tool (Air Stopper).



3. Remove the sealing bolt and washer from the inspection hole and connect the Valve Inspection Tool.



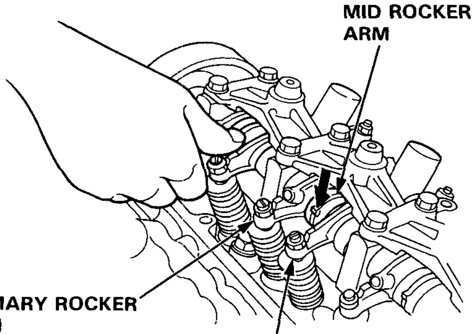
(cont'd)

Inspection Using Special Tools (D16Z engine, cont'd)

4. Apply specified air pressure to the rocker arm synchronizing piston A/B, after loosening the regulator valve on the valve inspection set.

   Specified Air Pressure:
   250 kPa (2.5 kg/cm², 36 psi)

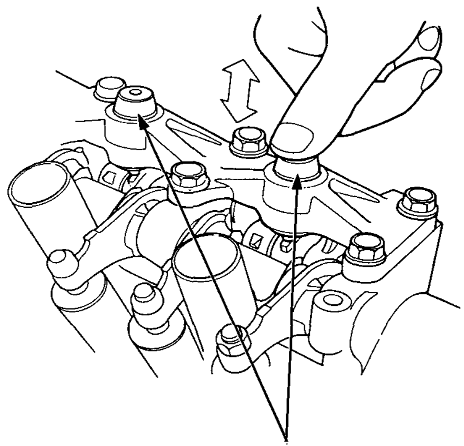
5. Make sure that the intake primary and secondary rocker arms are mechanically connected by piston and that the mid rocker arm does not move when pushed manually.



- If the intake mid rocker arms move independently of the primary and secondary rocker arms, replace the rocker arms as a set.

6. Remove the special tools.

7. Check for smooth operation of the lost motion assembly. It is compressed slightly when the intake mid rocker arm is lightly pushed and compressed deeply when the mid rocker arm is strongly pushed.
   - Replace the lost motion assembly if it does not move smoothly.

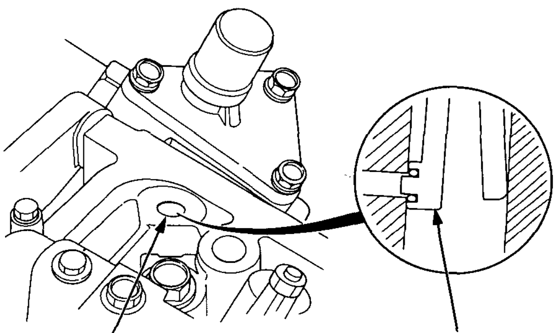


8. After inspection, check that the Check Engine light does not come on.

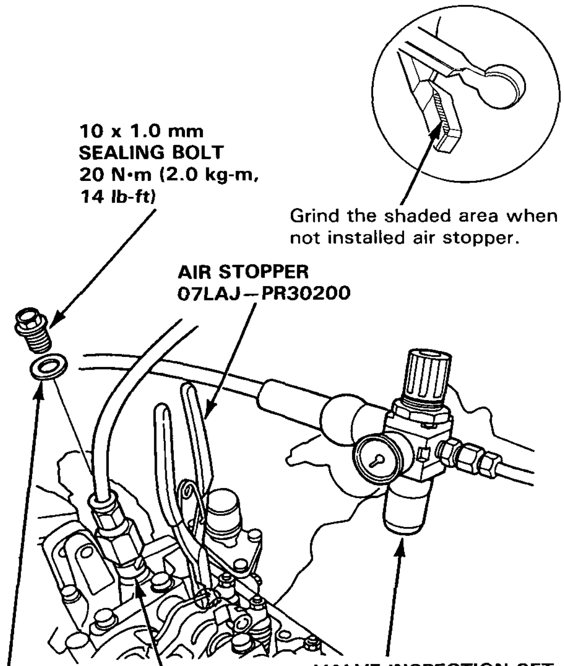
Inspection Using Special Tools (D15Z engine)

CAUTION:
- **Before using the Valve Inspection Tool, make sure that the air pressure gauge on the air compressor indicates over 250 kPa (2.5 kg/cm², 36 psi).**
- **Inspect the valve clearance before rocker arm inspection.**
- **Cover the timing belt with a shop towel to protect the belt.**
- **Check the intake mid rocker arm of each cylinder at TDC.**

1. Remove the cylinder head cover.
2. Plug the relief hole with the special tool (Air Stopper).



3. Remove the sealing bolt and washer from the inspection hole and connect the Valve Inspection Tool.



4. Apply specified air pressure to the intake rocker arm timing piston, after loosening the regulator valve on the valve inspection set.

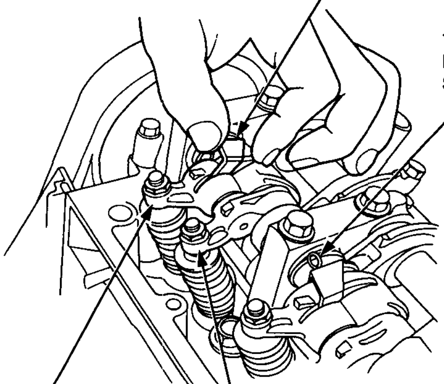
   Specified Air Pressure:
   250 kPa (2.5 kg/cm², 36 psi)

(cont'd)

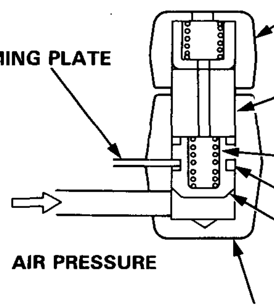
Inspection Using Special Tools (D15Z engine, cont'd)

5. With the specified air pressure applied, push up the timing plate; the synchronizing piston will pop out and engage the intake secondary rocker arm. Visually check the engagement of the synchronizing piston.

   NOTE:
   - The synchronizing piston can be seen in the gap between the secondary and primary rocker arms.
   - When the timing plate is engaged in the groove A on the timing piston, the piston will be locked in the pushed out position.



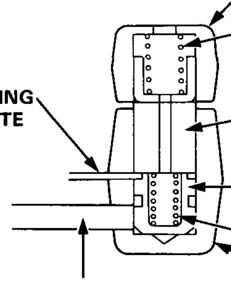
At Hight RPM:



6. Stop applying air pressure and push up the timing plate; the synchronizing piston will return to its original position with a click. Visually check the disengagement of the synchronizing pistons.

   NOTE:
   - When the timing plate is pushed up, it will disengage the timing piston letting the synchronizing piston return to its original position by the return spring.
   - Replace the intake rocker arms as an assembly if there is any abnormality.

At Low RPM:



7. Remove the special tools.

8. After inspection, check that the Check Engine light does not come on.

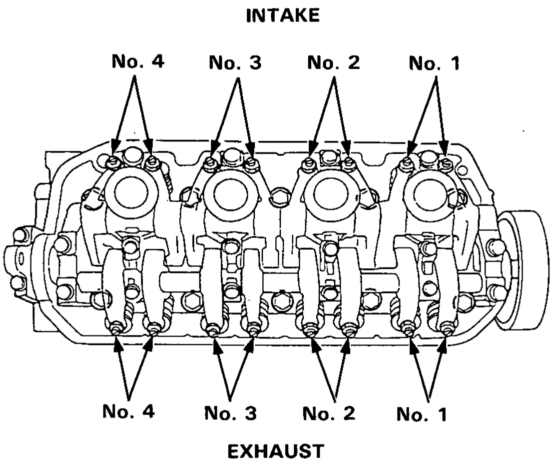
Adjustment

NOTE:
- Valves should be adjusted cold when the cylinder head temperature is less than 38°C (100° F). Adjustment is the same for intake and exhaust valves.
- If the pulley bolt loosens while turning crank, tighten it to specified torque.

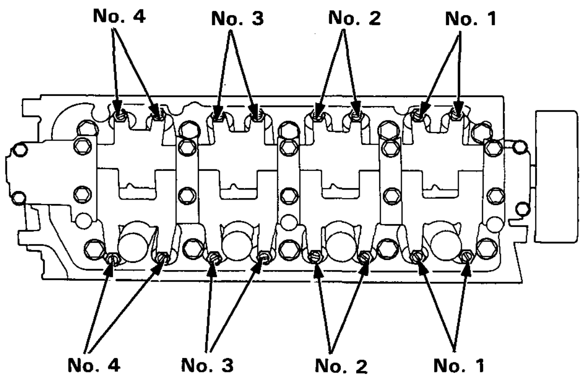
Specified Torque:
185 N·m (18.5 kg-m, 134 lb-ft)

1. Remove the cylinder head cover.

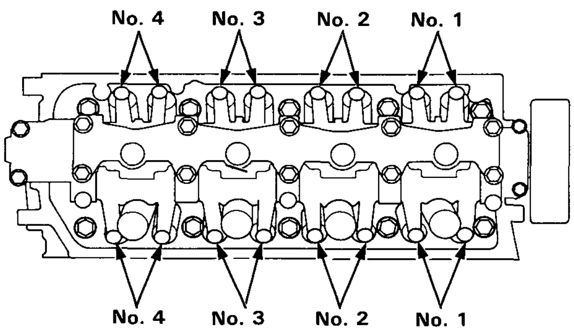
D12B, D13B, D15B, D16B7 engine:



D15Z engine:



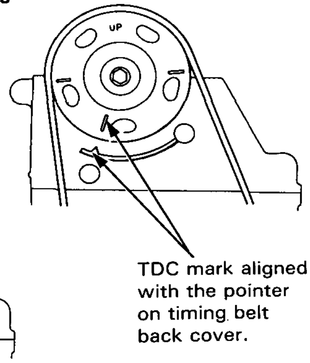
D16Z engine:



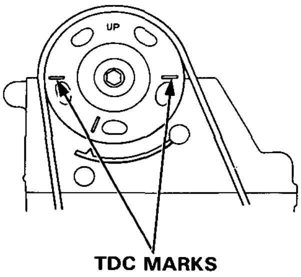
2. Set No. 1 piston at TDC. "UP" mark on the pulley should be at top, and TDC marks should align with cylinder head upper surface (D12B, D13B, D15B engine) or TDC groove should align with pointer(s) on the timing belt back cover (D16A7, D16Z, D15Z engine). The crankshaft pulley should be at TDC.

   Number 1 piston at TDC:

D16A7, D16Z engine:



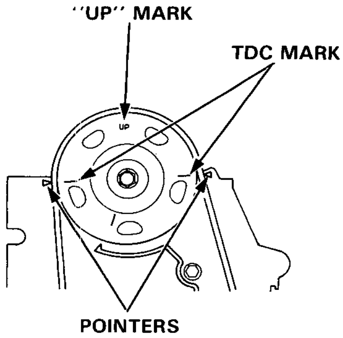
D12B, D13B, D15B engine:



(cont'd)

Adjustment (cont'd)

D15Z engine:



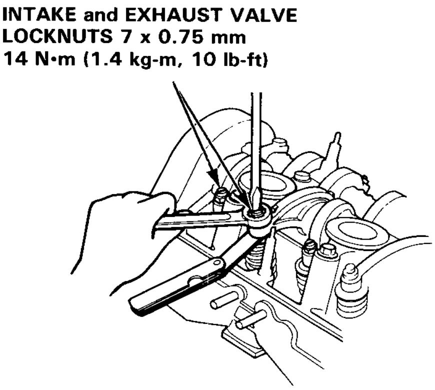
3. Adjust valves on No. 1 cylinder.

   Intake: 0.18–0.22 mm (0.007–0.009 in)
   Exhaust: 0.23–0.27 mm (0.009–0.011 in)

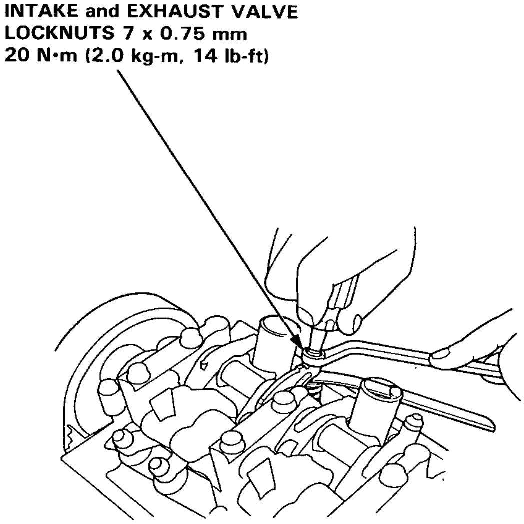
4. Loosen locknut and turn adjustment screw until feeler gauge slides back and forth with slight amount of drag.

   D12B, D13B, D15B, D16A7 engine:

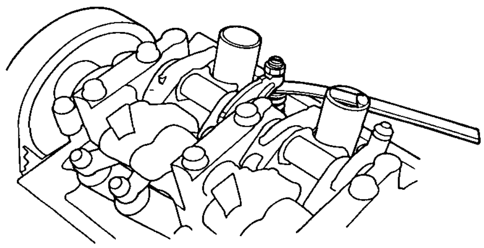
   CAUTION: Do not overtighten the locknuts, for the rocker arms are made of aluminum.



D16Z, D15Z engine:



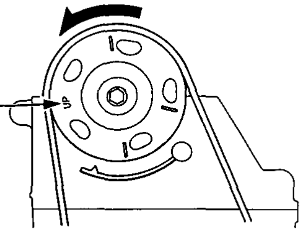
5. Tighten locknut and check clearance again. Repeat adjustment if necessary.



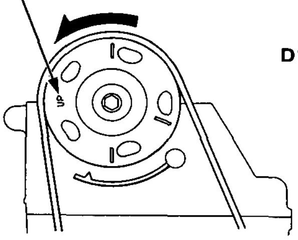
6. Rotate crankshaft 180° counterclockwise (cam pulley turns 90°). The "UP" mark should be at exhaust side. Distributor rotor should point to No. 3 plug wire. Adjust valve on No. 3 cylinder.

Number 3 piston at TDC:

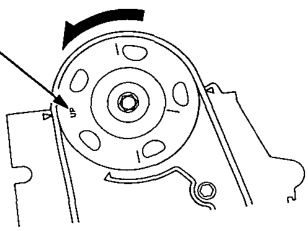
D16A7, D16Z engine:



D12B, D13B, D15B engine:



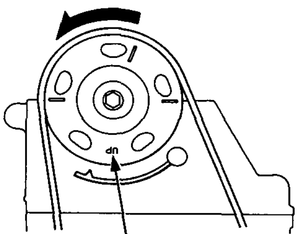
D15Z engine:



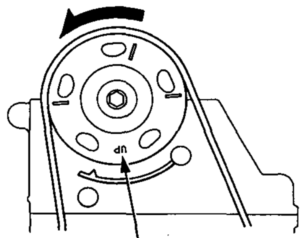
7. Rotate crankshaft 180° counterclockwise to bring No. 4 piston to TDC. Both TDC grooves are once again visible and distributor rotor should point to No. 4 plug wire. Adjust valves on No. 4 cylinder.

Number 4 piston at TDC:

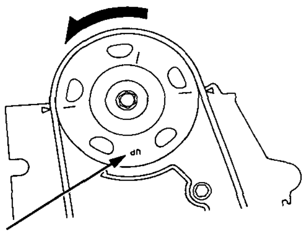
D16A7, D16Z engine:



D12B, D13B, D15B engine:



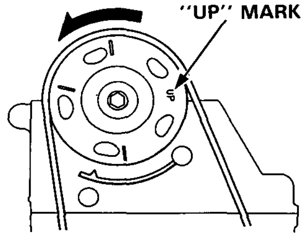
D15Z engine:



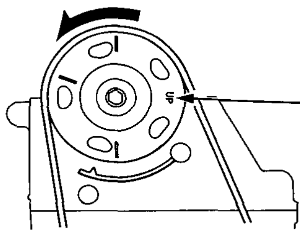
8. Rotate crankshaft 180° counterclockwise to bring No. 2 piston to TDC. The "UP" mark should be at intake side. Distributor rotor should point to No. 2 plug wire. Adjust valves on No. 4 cylinder.

Number 2 piston at TDC:

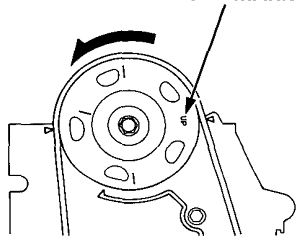
D16A7, D16Z engine:



D12B, D13B, D15B engine:



D15Z engine:



Cylinder Head/Valve Train
D16A8/D16A9 engine

Cylinder Head/Valve Train

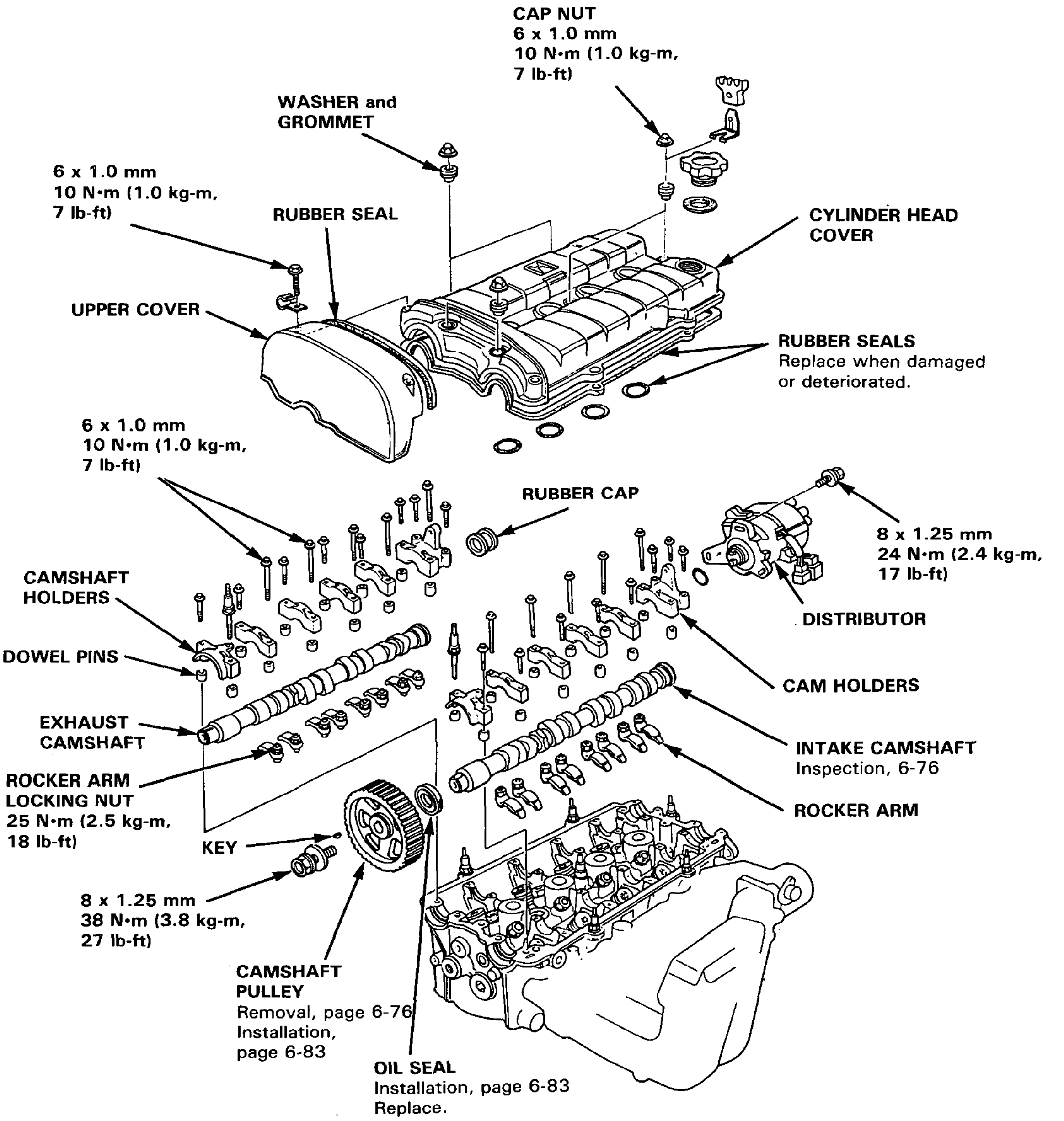
Illustrated Index

D16A8, D16A9 engine:

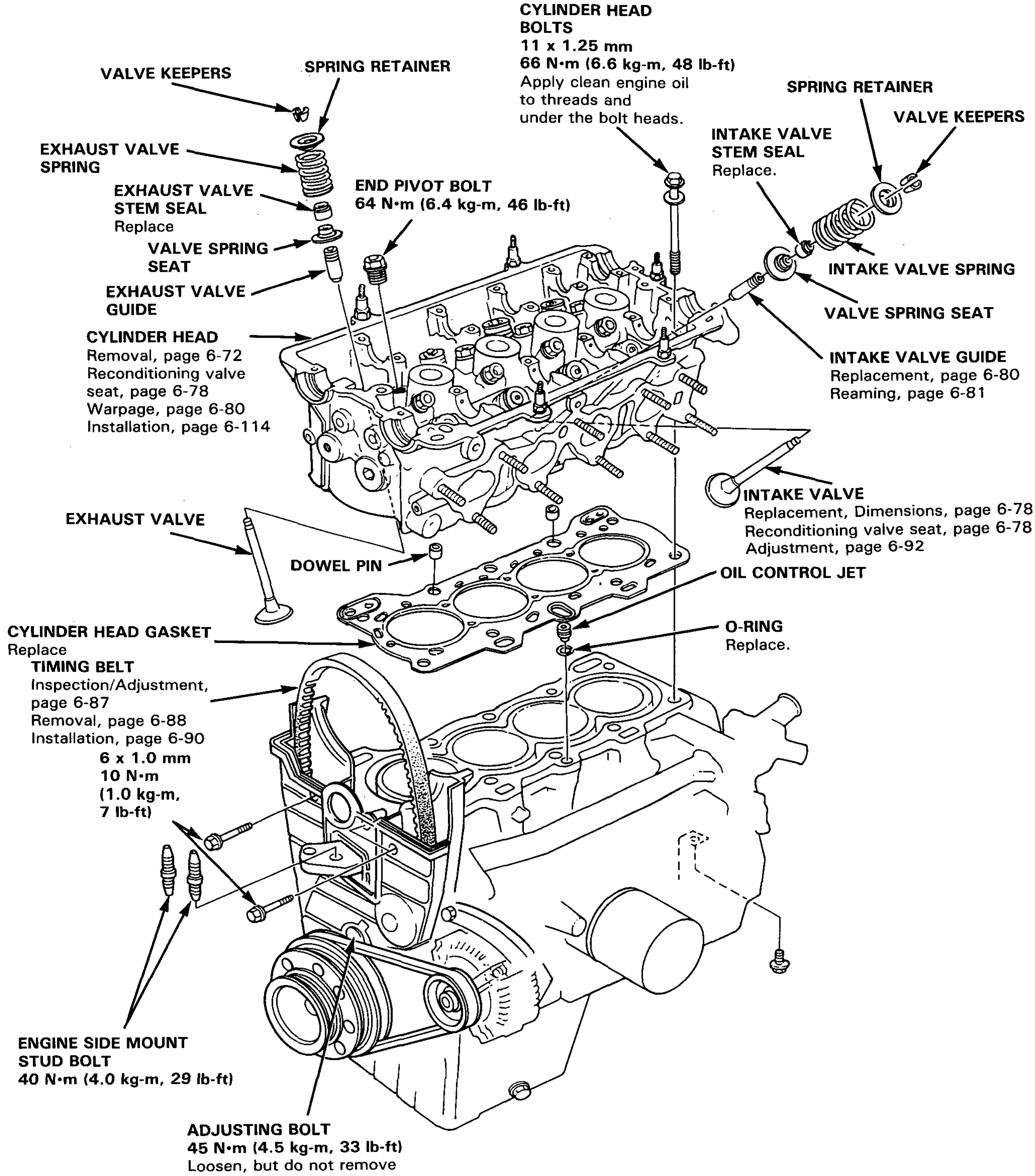
CAUTION: To avoid damaging the cylinder head, wait until the coolant temperature drops below 38°C (100°F) before removing it.

NOTE:
- Use new O-rings and gaskets when reassembling.
- Use liquid gasket, Part No. 0Y740−99968.

Prior to reassembling, clean all the parts in solvent, dry them, and apply lubricant to any contact parts.



NOTE: Use new O-rings and gaskets when reassembling.
Prior to reassembling, clean all the parts in solvent, dry them, and apply lubricant to any contact parts.



Cylinder Head

Removal

Engine removal is not required for this procedure.

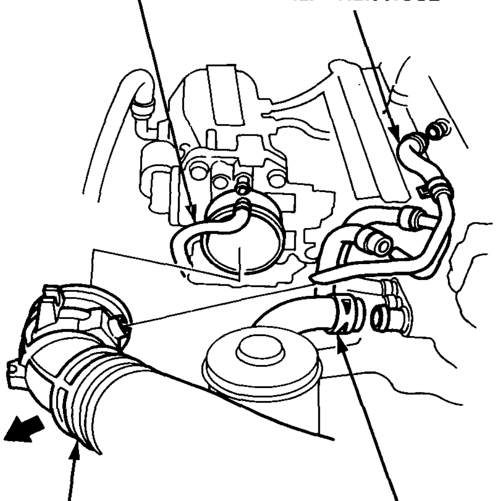
CAUTION: To avoid damaging the cylinder head, wait until the coolant temperature drops below 38°C (100°F) before loosening the retaining bolts.

NOTE:
- Inspect the timing belt before removing the cylinder head.
- Turn the crankshaft pulley so that the No. 1 piston is at top-dead-center (page 6-91).
- Mark all emissions hoses before disconnecting them.

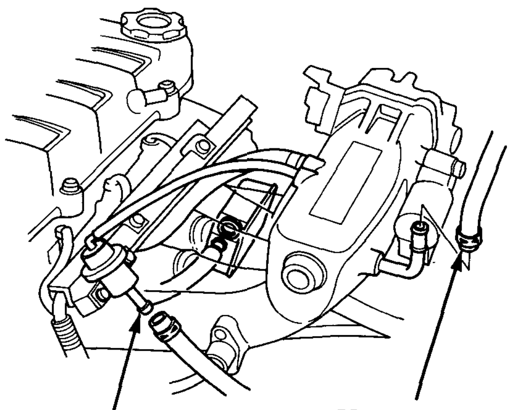
1. Disconnect the negative terminal from the battery.
2. Drain the coolant (see Section 10).
3. Relieve fuel pressure.

   ⚠WARNING Do not smoke while working on fuel system, keep open flame or spark away from work area. Drain fuel only into an approved container.

4. Remove the air flow tube.
5. Remove the fuel feed hose and charcoal canister hose from the intake manifold.

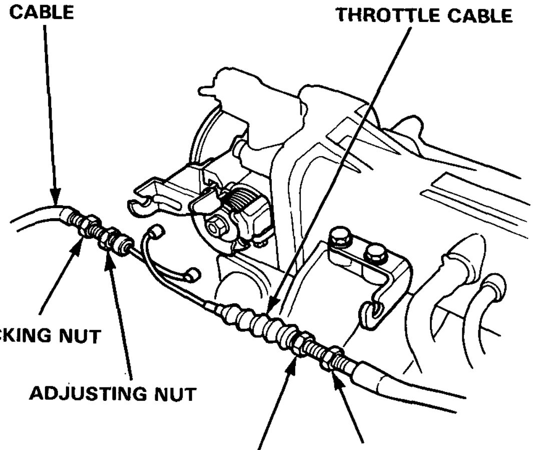


6. Remove the fuel return hose and brake booster vacuum hose.



7. Remove the throttle cable and throttle control cable (A/T).

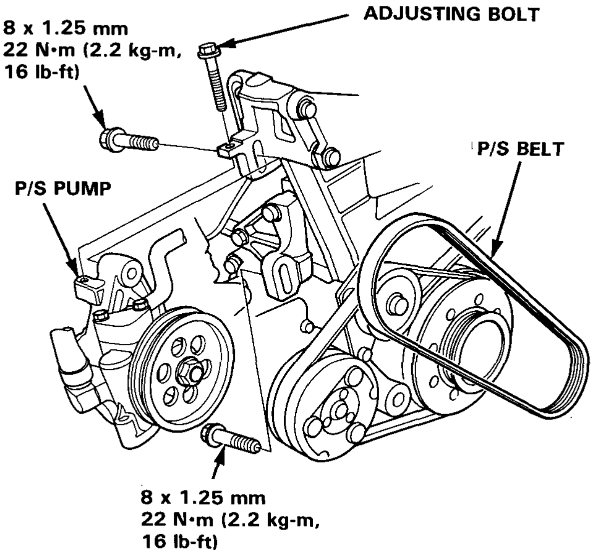
   NOTE:
   - Take care not to bend the cable when removing it. Always replace any kinked cable with a new one.
   - Adjust the throttle cable when installing (see Section 11).



9. Remove the engine wire harness connectors and wire harness clamps from the cylinder head and the intake manifold.
   - Four injector connectors
   - TA sensor connector
   - EACV connector
   - Throttle sensor connector
   - MAP sensor connector
   - *Ground terminal (at thermostat cover)*
   - TW switch connector (for cooling fan)
   - Oxygen sensor connector
   - TW sensor connector (for emission)
   - *Temperature unit connector*
   - TDC/CRANK/CYL sensor connector

10. Remove ground cable from the cylinder head.

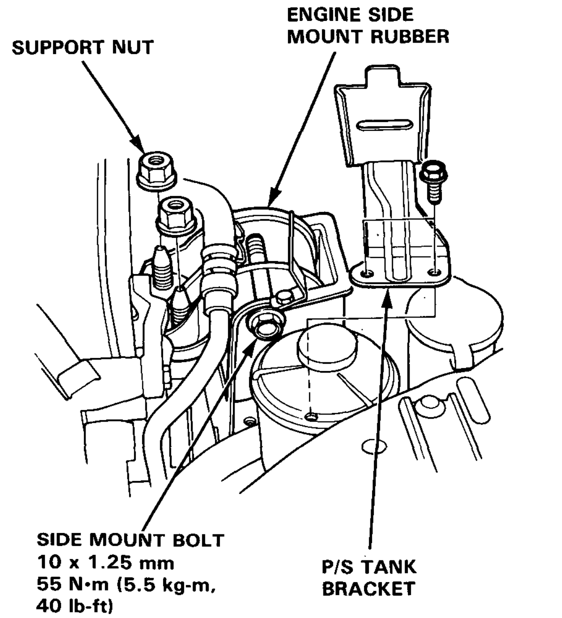
11. Remove the P/S belt, then remove the P/S pump.



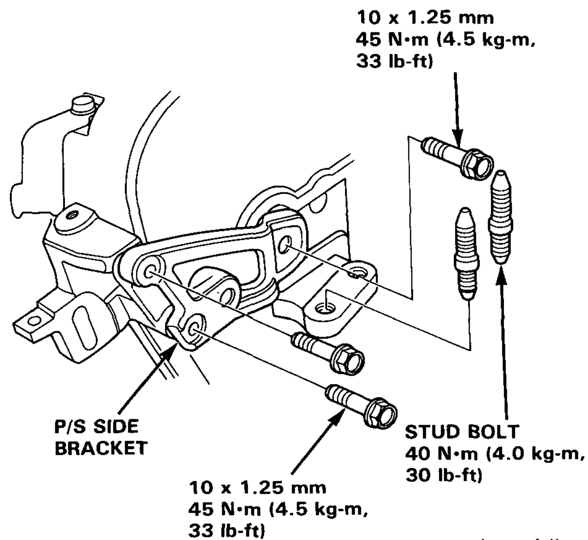
12. Remove the P/S bracket.

13. Remove the P/S tank bracket.

14. Remove the engine support nuts. Loosen the mount bolt and pivot the engine mount rubber out of the way.



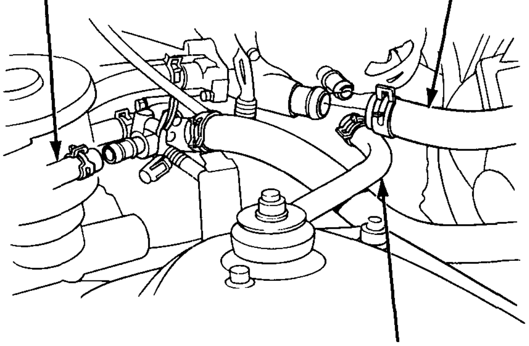
15. Remove two stud bolts from the side mounting bracket then remove the P/S side bracket.



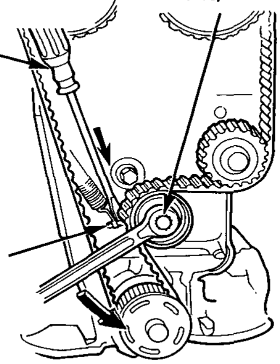
(cont'd)

Removal (cont'd)

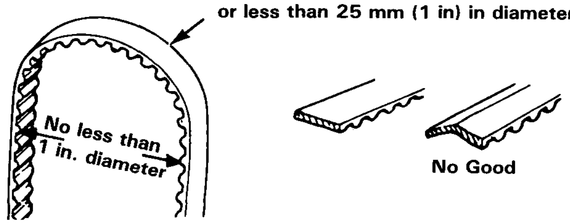
16. Remove two timing belt lower cover bolts and a back cover mount bolt.
17. Remove the radiator upper hose and heater hose from the cylinder head.
18. Remove the water bypass hose from intake manifold.



19. Remove the intake manifold bracket.
20. Remove the self-locking nuts and disconnect the exhaust manifold and exhaust pipe A.
21. Remove the exhaust manifold bracket.
22. Remove the PCV hose from the cylinder head cover.
23. Remove the timing belt upper cover.
24. Loosen the timing belt adjusting bolt 180° to release the belt tension.
25. Push the tensioner to release tension from the timing belt, then retighten the adjusting bolt.

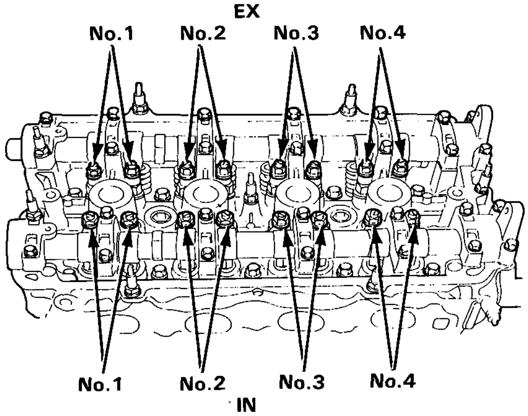


26. Remove the belt from the cam pulley.



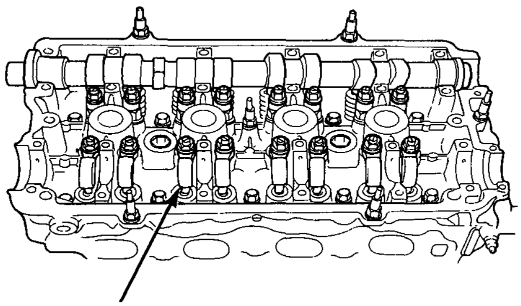
27. Remove the camshaft pulleys.

28. Loosen the rocker arm locknuts, then remove the camholders.



29. Remove the rocker arm.

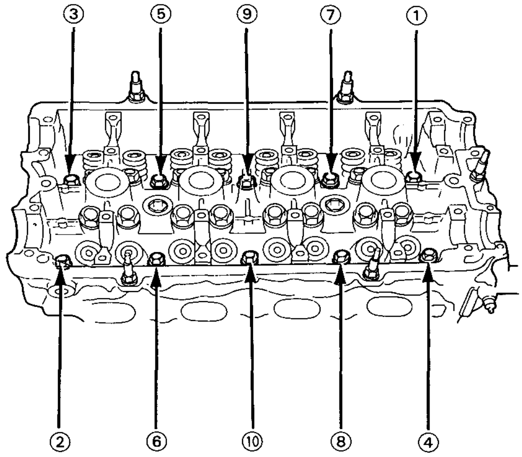
NOTE: Rocker arms must be installed in the same possition if reused.



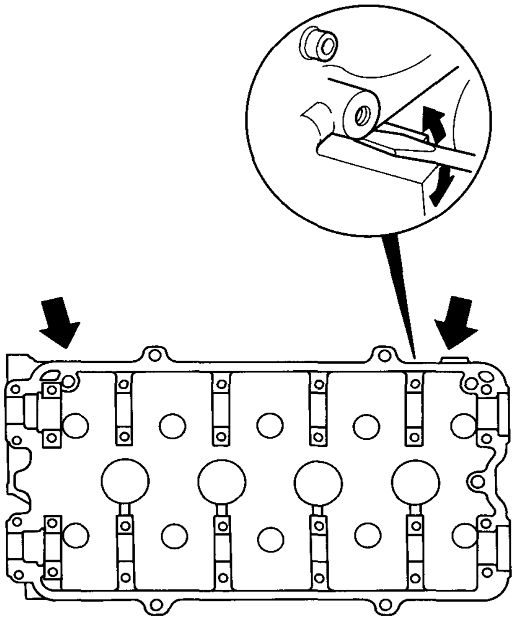
30. Remove the cylinder head bolts, then remove the cylinder head.

CAUTION: To prevent warpage, unscrew the bolts in sequence 1/3 turn at a time; repeat until all bolts are loosened.

CYLINDER HEAD BOLT LOOSENING SEQUENCE



NOTE: Separate the cylinder head from the block with a flat blade screwdriver as shown.

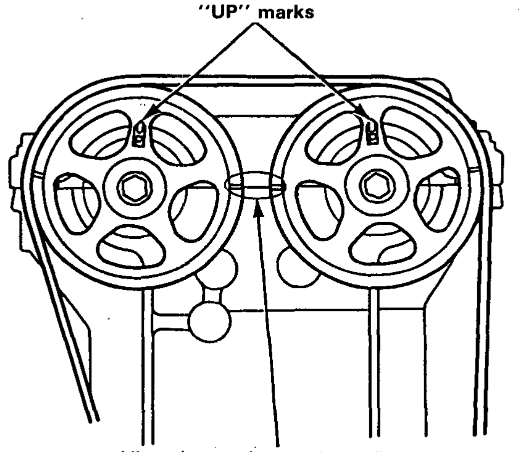


31. Remove the intake manifold and exhaust manifold from the cylinder head.

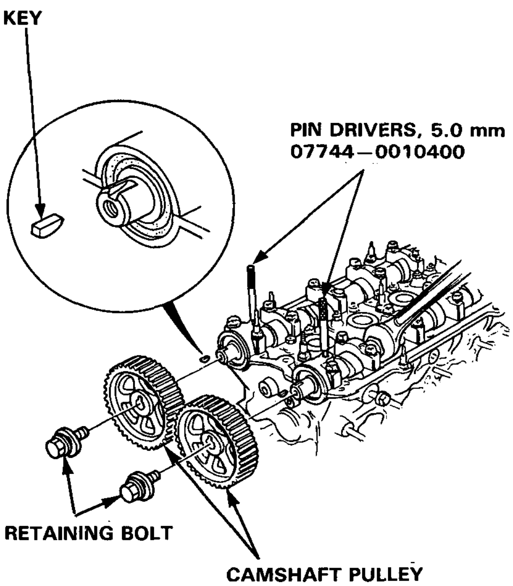
Camshaft Pulleys

Removal

1. To ease reassembly, turn the pulley until the "UP" marks faces up, and the front timing marks are aligned with the both mark on the pulleys.



2. Remove the pulley retaining bolts and washers, then remove the pulleys.



NOTE: Before removing camshafts assembly, check camshaft end play.

Camshafts

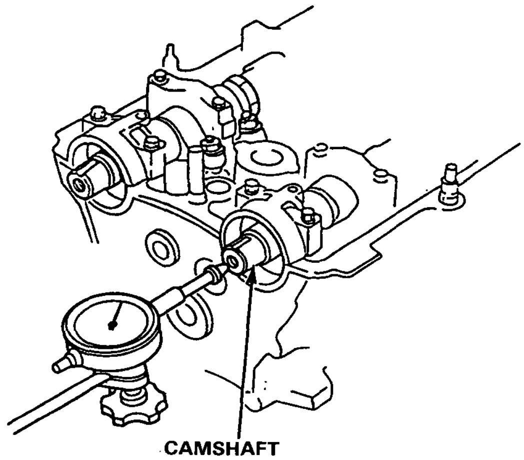
Inspection

NOTE:
- Do not rotate camshaft during inspection; loosen the adjust screws before starting.
- Remove the rocker arms before inspection.

1. Seat camshafts by pushing them toward distributor end of cylinder head.

2. Zero dial indicator against end of distributor drive, then push camshafts back and forth, and read the end play.

Camshaft End Play:
Standard (New): 0.05–0.15 mm (0.002–0.006 in.)
Service Limit: 0.5 mm (0.02 in.)



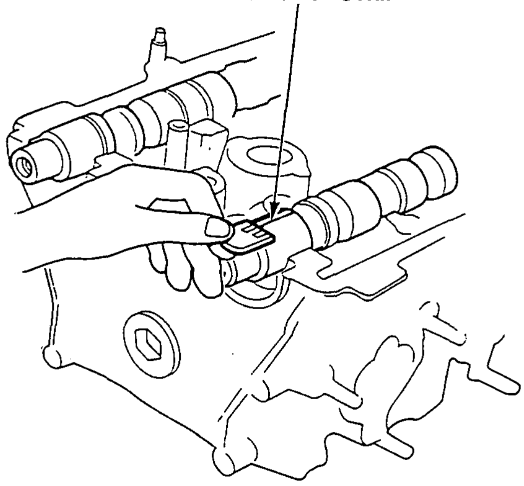
3. Remove the camshaft holder bolts from the cylinder head.

NOTE: Unscrew the camshaft holder bolts, two turns at a time, in a crisscross pattern, to prevent damaging valves or rocker arms.

- Lift camshaft out of cylinder head, wipe clean, then inspect lift ramps. Replace camshaft if lobes are pitted, scored, or excessively worn.
- Clean the camshaft bearing surfaces in the cylinder head, then set camshaft back in place.
- Insert plastigage strip across each journal.
- Install the camshaft holders and torque bolts to values and in sequence shown on page 6-84.

4. Measure widest portion of plastigage on each journal.

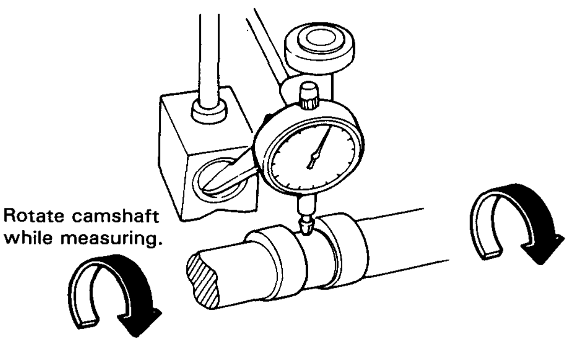
Camshaft Bearing Radial Clearance:
Standard (New): 0.050—0.089 mm (0.002—0.004 in.)
Service Limit: 0.15 mm (0.006 in.)



5. If camshaft bearing radial clearance is out of tolerance:

- And camshaft has already been replaced, you must replace the cylinder head.
- If camshaft has not been replaced, first check total runout with the camshaft supported on V-blocks.

Camshaft Total Runout:
Standard (New): 0.003 mm (0.001 in.)
Service Limit: 0.06 mm (0.002 in.)

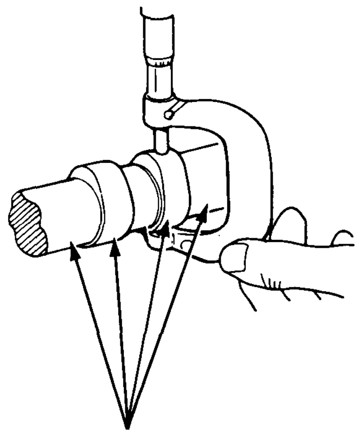


— If the total runout of the camshaft is within tolerance, replace the cylinder head.

— If the total runout is out of tolerance, replace the camshaft and recheck. If the bearing clearance is still out of tolerance, replace the cylinder head.

6. Measure camshaft height.

Intake Standard: 32.983 mm (1.2985 in.)
Exhaust Standard: 32.382 mm (1.2749 in.)

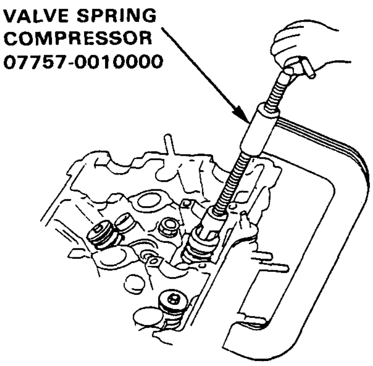


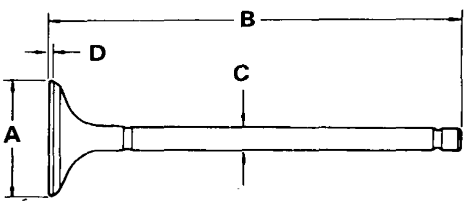
Valves

Replacement

NOTE: Identify valves and valve springs as they are removed so that each item can be reinstalled in its original position.

1. Tap each valve stem with a plastic mallet to loosen valve keepers before installing spring compressor.
2. Install spring compressor. Compress spring and remove valve keeper.





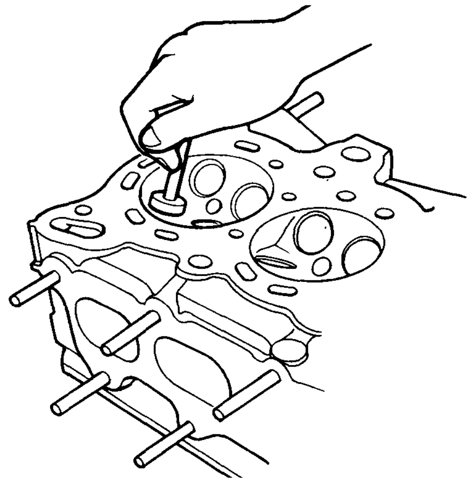
Intake Valve Dimensions
A Standard (New): 29.9–30.1 mm (1.177–1.185 in.)
B Standard (New): 103.98–104.28 mm (4.0937–4.1055 in.)
C Standard (New): 6.58–6.59 mm (0.2591–0.2594 in.)
C Service Limit: 6.55 mm (0.258 in.)
D Standard (New): 1.05–1.35 mm (0.041–0.053 in.)
D Service Limit: 1.00 mm (0.039 in.)
Exhaust Valve Dimensions
A Standard (New): 26.9–27.1 mm (1.059–1.067 in.)
B Standard (New): 102.67–102.97 mm (4.0421–4.0539 in.)
C Standard (New): 6.55–6.56 mm (0.2579–0.2583 in.)
C Service Limit: 6.52 mm (0.257 in.)
D Standard (New): 1.65–1.95 mm (0.065–0.077 in.)
D Service Limit: 1.45 mm (0.057 in.)

Valve Seats

Reconditioning

1. Renew the valve seats in the cylinder head using valve seat cutters.

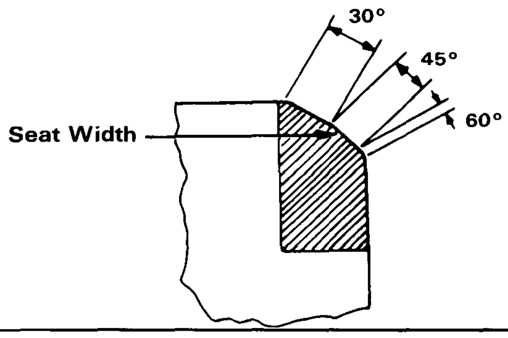
   NOTE: If guides are worn, replace them (page 6-80) before cutting valve seats.



CUTTER	INTAKE	EXHAUST
45°	07780–0010800	07780–0010300
30°	07780–0012900	07780–0012200
60°	07780–0014000	07780–0014000
HOLDER	07781–0010201 and 07781–0010301	

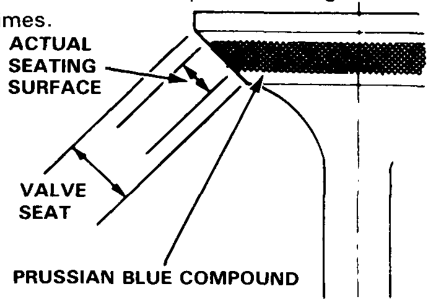
2. Carefully cut a 45° seat, removing only enough material to ensure a smooth and concentric seat.
3. Bevel the upper edge of seat with the 30° cutter and the lower edge of seat with 60° cutter. Check width of seat and adjust accordingly.
4. Make one more very light pass with the 45° cutter to remove any possible burrs caused by the other cutters.

Valve Seat Width:
Standard: 1.25–1.55 mm (0.049–0.061 in.)
Service Limit: 2.0 mm (0.08 in.)



Valve Movement

5. After resurfacing seat, inspect for even valve seating: Apply Prussian blue compound to valve face, and insert valve in original location in head, then lift it and snap it closed against seat several times.

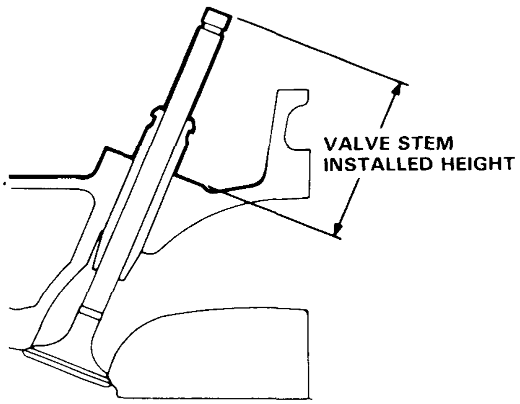


6. The actual valve seating surface, as shown by the blue compound, should be centered on the seat.
   - If it is too high (closer to the valve stem), you must make a second cut with the 60° cutter to move it down, then one more cut with the 45° cutter to restore seat width.
   - If it is too low (closer to valve edge), you must make a second cut with the 30° cutter to move it up, then one more cut with the 45° cutter to restore seat width.

   NOTE: The final cut should always be made with the 45° cutter.

7. Insert intake and exhaust valves in head and measure valve stem installed height.

   Intake Valve Stem Installed Height:
   Standard (New): 45.780 mm (1.802 in.)
   Service Limit: 46.265 mm (1.822 in.)
   Exhaust Valve Stem Installed Height:
   Standard (New): 44.970 mm (1.771 in.)
   Service Limit: 45.455 mm (1.790 in.)

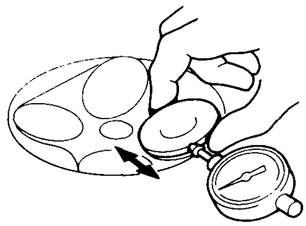


8. If valve stem installed height is over service limit, replace valve and recheck. If still over service limit, replace cylinder head; the valve seat in the head is too deep.

1. Measure the valve movement with a dial indicator while rocking the stem in the direction of normal thrust (Wobble Method).

   Intake Valve Movement
   Standard (New): 0.04–0.10 mm (0.0016–0.004 in.)
   Service Limit: 0.16 mm (0.006 in.)
   Exhaust Valve Movement
   Standard (New): 0.10–0.16 mm (0.004–0.006 in.)
   Service Limit: 0.22 mm (0.009 in.)

Valve extended 10 mm out from seat.



- If measurement exceeds the service limit, recheck using new valve.
- If measurement is now within service limit, reassemble using new valve.
- If measurement still exceeds limit, recheck using alternate method below, then replace valve and guide, if necessary.

NOTE: An alternate method of checking guide to stem clearance is to subtract the O.D. of the valve stem, measured with a micrometer, from the I.D. of the valve guide, measured with an inside micrometer or ball gauge.
Take the measurements in three places along the valve stem and three places inside the valve guide. The difference between the largest guide measurement and the smallest stem measurement should not exceed the service limit.

Intake Valve Stem-to-Guide Clearance
Standard (New): 0.02–0.05 mm (0.001–0.002 in.)
Service Limit: 0.08 mm (0.003 in.)
Exhaust Valve Stem-to-Guide Clearance
Standard (New): 0.05–0.08 mm (0.002–0.003 in.)
Service Limit: 0.11 mm (0.004 in.)

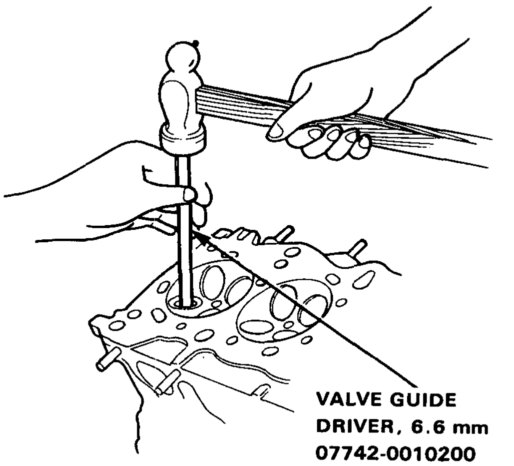
Valves Guides

Replacement

NOTE:
- For best results, heat cylinder head to 150°C (300°F) before removing or installing guides.
- It may be necessary to use an air hammer to remove some valve guides.

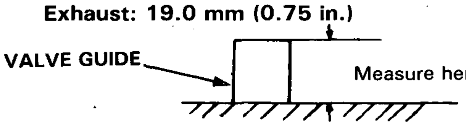
CAUTION: To avoid burns, use heavy gloves when handling heated cylinder head.

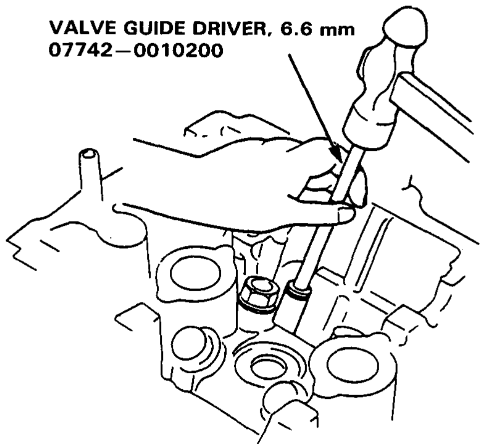
1. Drive the valve guide out from the bottom of the cylinder head.



2. Drive in a vew valve guide to the specified depth little by little.

Intake: 19.4 mm (0.76 in.)
Exhaust: 19.0 mm (0.75 in.)





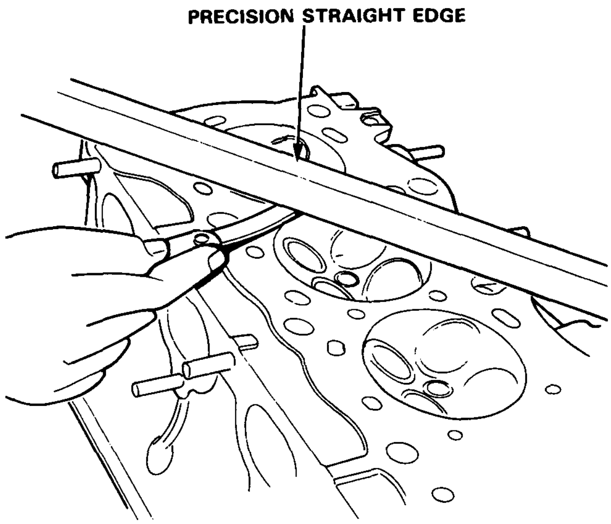
Cylinder Head

Warpage

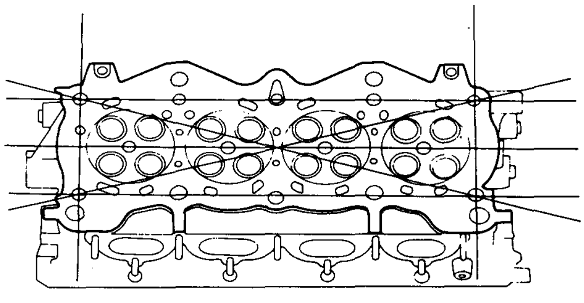
NOTE: If camshaft bearing clearances are not within specification, the head can not be resurfaced (page 6-76).

If camshaft bearing radial clearances are within specifications, check head for warpage.

- If warpage is less than 0.05 mm (0.002 in.) cylinder head resurfacing is not required.
- If warpage is between 0.05 mm (0.002 in.) and 0.2 mm (0.008 in.), resurface cylinder head.
- Maximum resurface limit is 0.2 mm (0.008 in.) based on height of 131.8 mm (5.19 in.).



Measure along edges, and 3 ways across center.



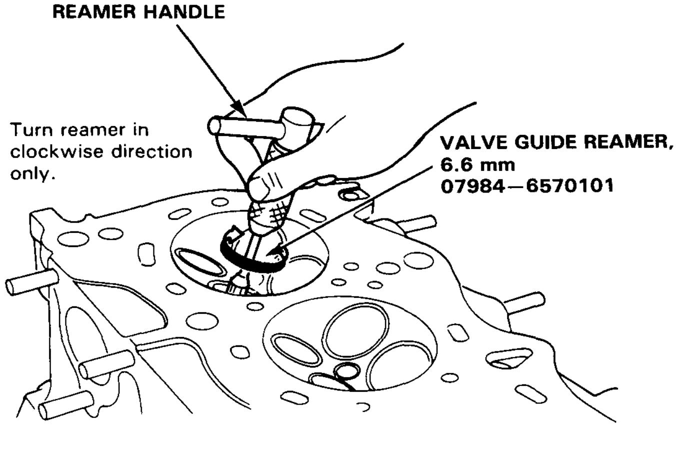
Cylinder Head Height:
Standard New: 132.0 mm (5.20 in.)

Valve Guides and Valve Springs/Valve Seals

Valve Guides Reaming

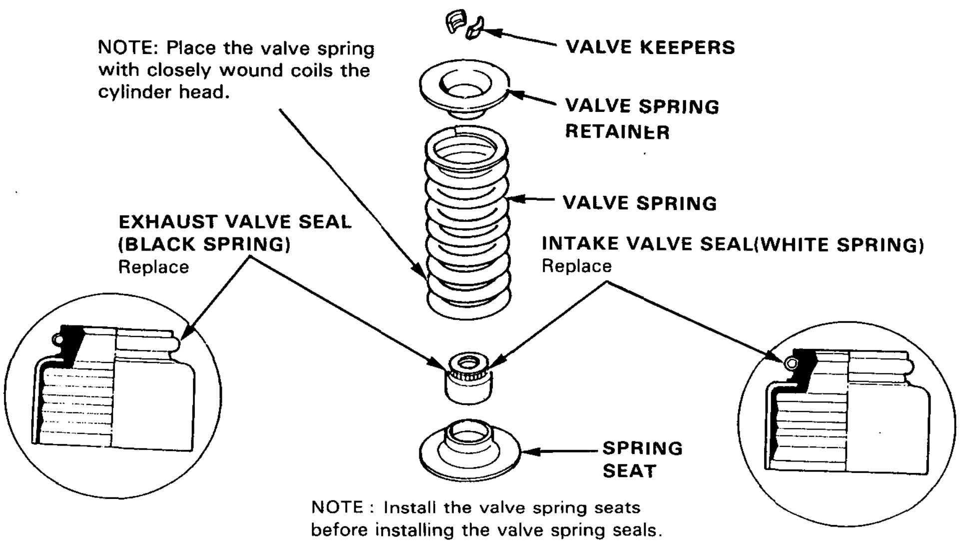
NOTE: For new valve guides only.

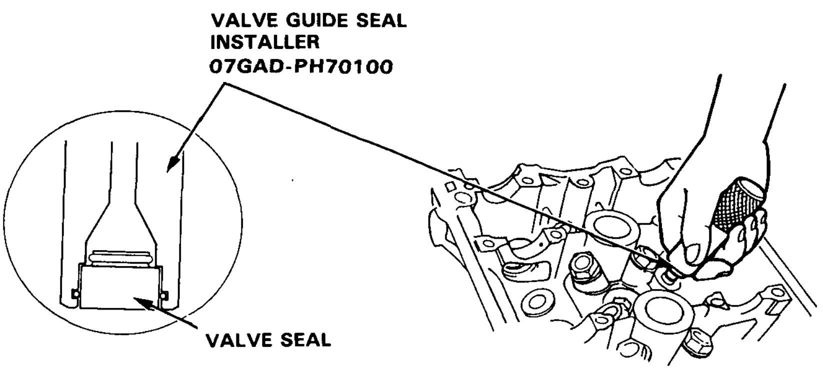
1. Coat reamer and valve guide with cutting oil.
2. Rotate reamer clockwise the full length of the valve guide bore.
3. Continue to rotate reamer clockwise while removing.
4. Throughly wash the guide in detergent and water to remove any cutting residue.
5. Check clearance with valve.



Valve Springs/Valve Seals Installation Sequence

NOTE : Exhaust and intake valve seals are NOT interchangeable.



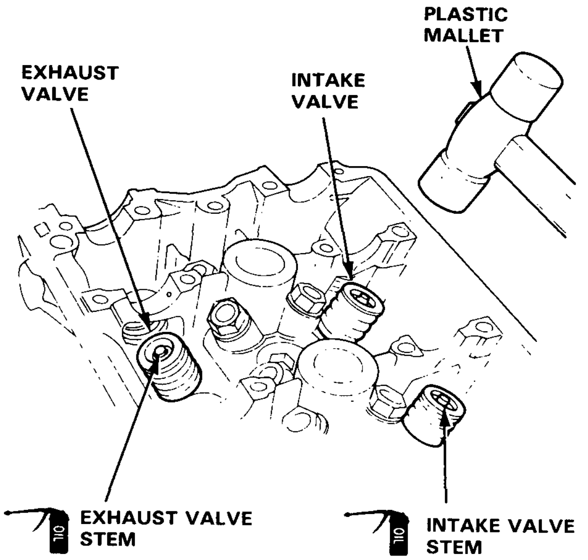


Valves

Installation

When installing valves in cylinder head, coat valve stems with oil before inserting into valve guides, and make sure valves move up and down smoothly.

When valves and springs are in place, lightly tap the end of each valve stem two or three times to ensure proper seating of valve and valve keepers (use plastic mallet).



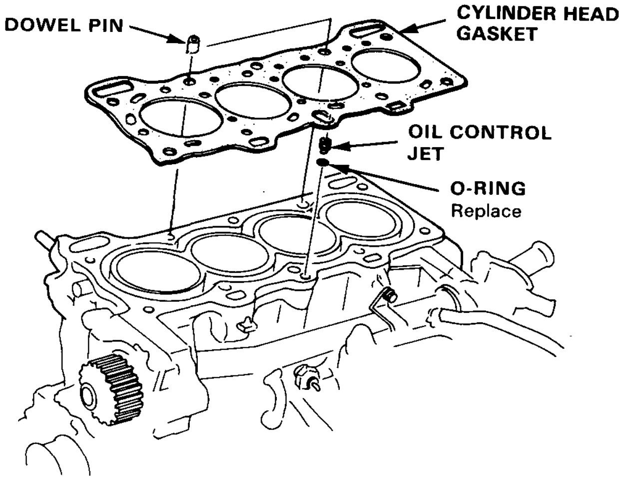
Cylinder Head

Installation

1. Install the cylinder head in reverse order of removal:

   - Always use a new head gasket.
   - Cylinder head and engine block durface must be clean.
   - "UP" mark on timing belt pulley should be at the top.

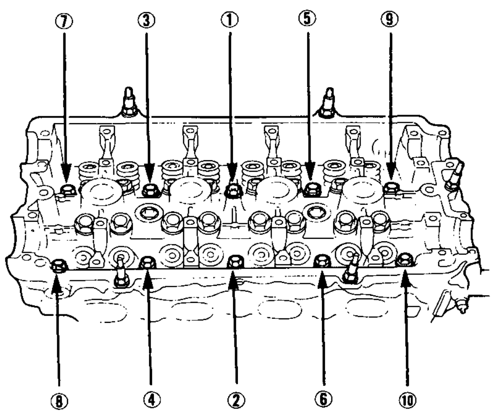
   NOTE: Cylinder head dowel pins and oil control jet must be aligned.



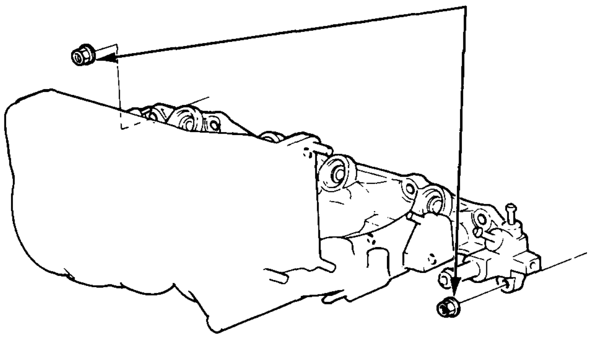
2. Tighten cylinder head bolts in two steps. In the first step tighten all bolts, in sequence, to about 30 N•m (3.0 kg-m, 22 lb-ft); in the final step tighten, in same sequence, to 66 N•m (6.6 kg-m, 47 lb-ft)

   NOTE:
   - Apply engine oil to the cylinder head bolts and the washers.
   - Use the longer bolts at the position No. 1 and No. 2 as shown.

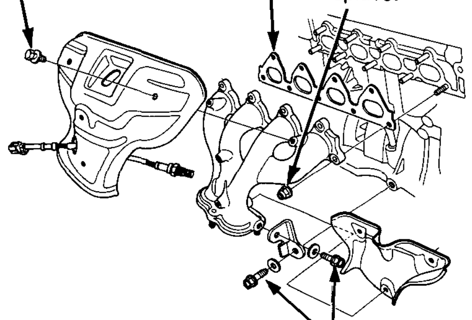
CYLINDER HEAD BOLTS TORQUE SEQUENCE



3. Install the intake manifold and tighten the nuts in a crisscross pattern in 2 or 3 steps, beginning with the inner nuts.



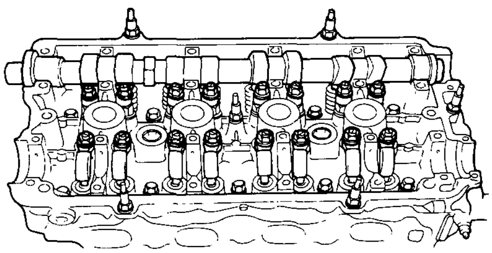
4. Install the exhaust manifold and bracket.



Installation

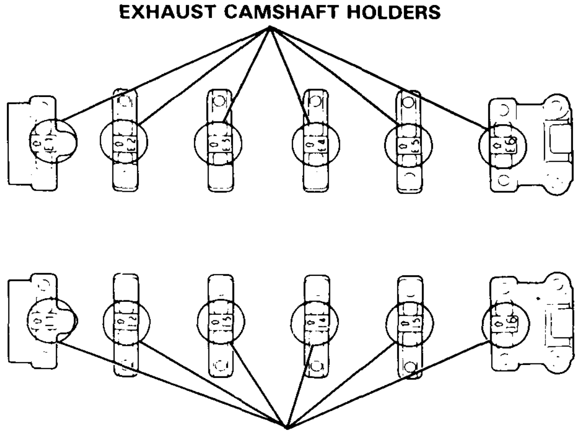
CAUTION:
- **Make sure that the keyways on the camshafts are facing up. (No. 1 cylinder TDC).**
- **Valve locknuts should be loosened and adjust screws backed off before installation.**
- **Replace the rocker arms in these original positions.**

1. Place the rocker arms on the pivot bolts and the valve stems.



2. Install the camshafts and the camshaft seals with the open side (spring) facing in.

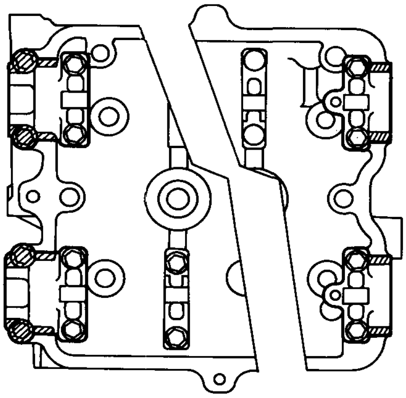
NOTE:
- "I" or "E" marks are stamped on the camshaft holders.
- Do not apply oil to the holder mating surface of camshaft seals.



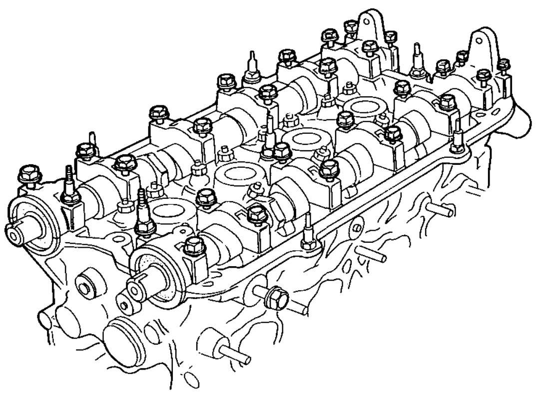
(cont'd)

Installation (cont'd)

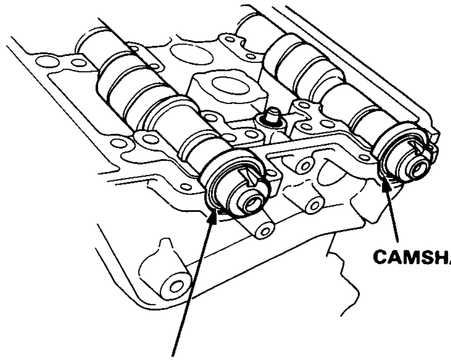
3. Apply liquid gasket to the head mating surfaces of the No. 1 and No. 6 camshaft holders, then install them, along with the No. 2. 3. 4 and 5.



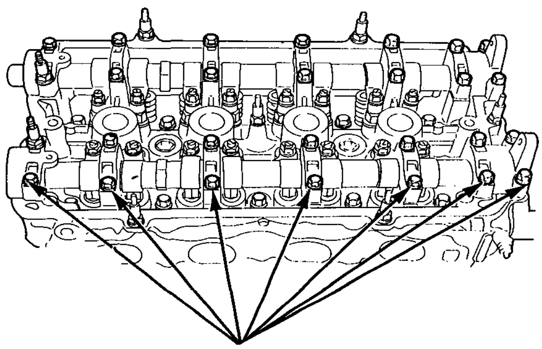
4. Tighten the camshaft holders temporarily.
   - Make sure that the rocker arms are properly positioned on the valve stems.



5. Set the camshaft seal as shown below.

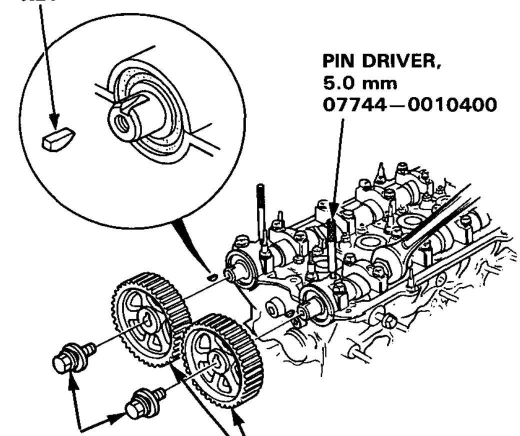


6. Tighten each bolt two turns at a time in the sequence shown below to insure that the rockers do not bind on the valves.



7. Install the timing belt back cover.

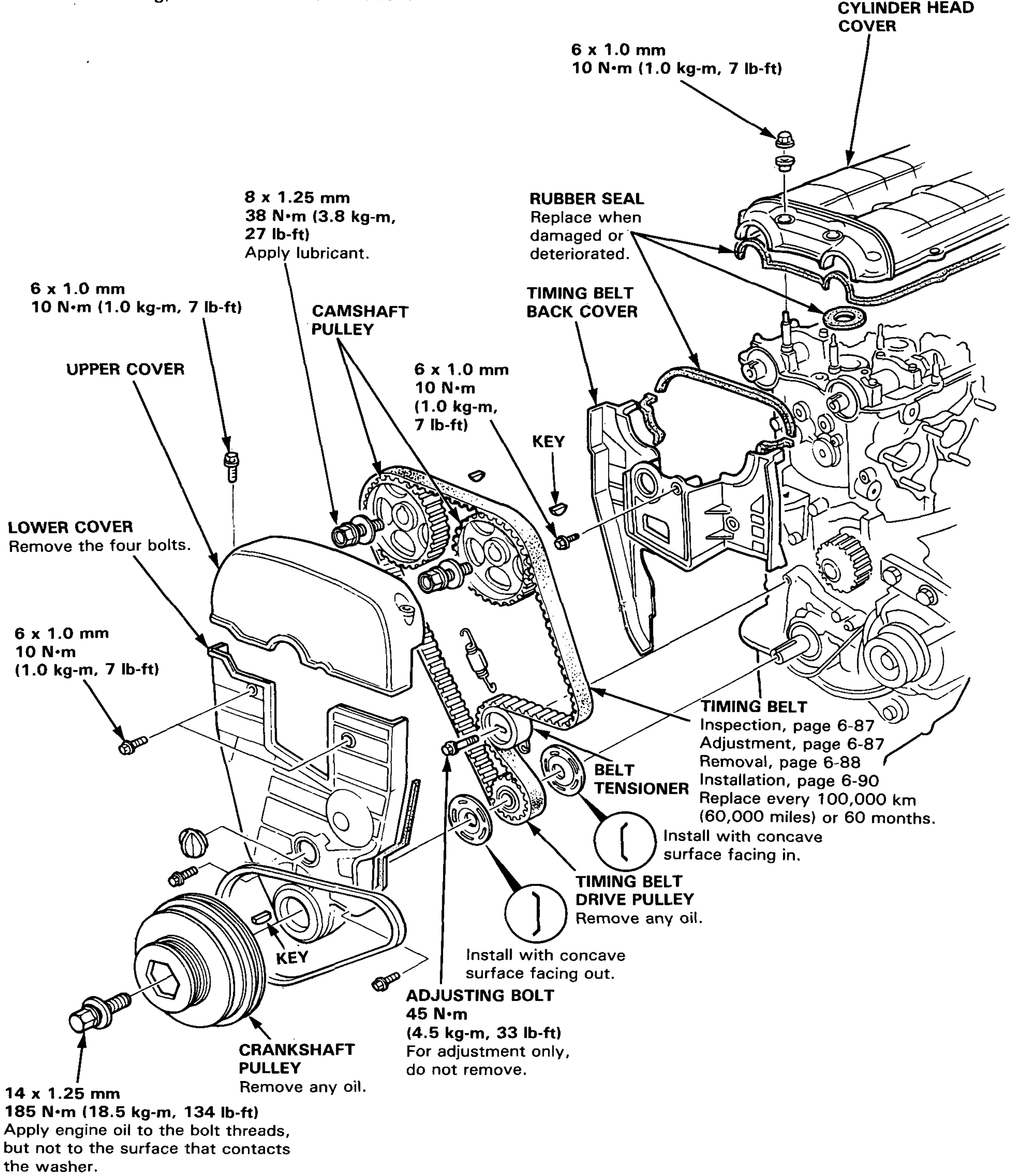
8. Install the camshaft pulleys.



Timing Belt

Illustrated Index

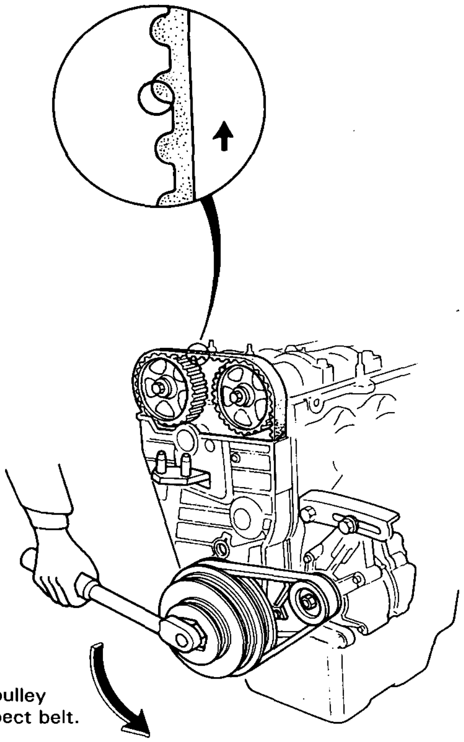
NOTE:
- Refer to Section 23, for alternator belt adjustment.
- Refer to Section 22, for A/C compressor belt adjustment.
- Refer to Section 17, for P/S pump belt adjustment.
- Before removing, mark direction of rotation.



Inspection

NOTE:
- Replace the belt if oil soaked.
- Remove any oil or solvent that gets on the belt.

1. Remove the timing belt upper cover.
2. Remove the cylinder head cover.
3. Inspect the timing belt for cracks and oil soaking.



Rotate pulley and inspect belt.

4. If the pulley bolt loosens while turning the crank, tighten it to specified torque.

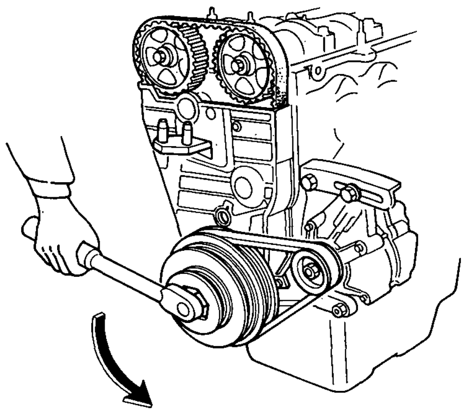
   Specified Torque:
   185 N·m (18.5 kg-m, 134 lb-ft)

Tension Adjustment

CAUTION: Always adjust the timing belt tension with the engine cold.

NOTE:
- The tensioner is spring-loaded to apply proper tension to the belt automatically after making the following adjustment.
- Always rotate the crankshaft counterclockwise when viewed form the pulley side.
  Rotating it clockwise may result in improper adjustment of the belt tension.

1. Remove the timing belt upper cover.
2. Remove the cylinder head cover.
3. Set the No. 1 piston at TDC (page 6-90).
4. Loosen the adjusting bolt 180°.



Direction of Rotation.

5. Rotate the crankshaft counterclockwise 3-teeth on the camshaft pulley to create tension on the timing belt.
6. Make sure the timing belt and the cam pulley are engaged securely.
7. Torque the adjusting bolt to 45 N·m (4.5 kg-m, 33 lb-ft).
8. If the pulley bolt loosens while turning the crank, tighten it to specified torque.

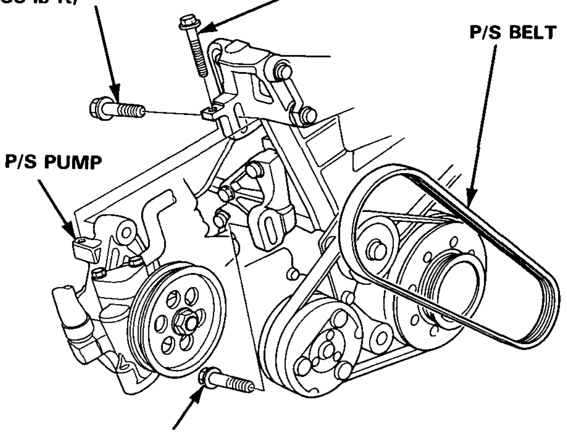
   Specified Torque:
   185 N·m (18.5 kg-m, 134 lb-ft)

Removal

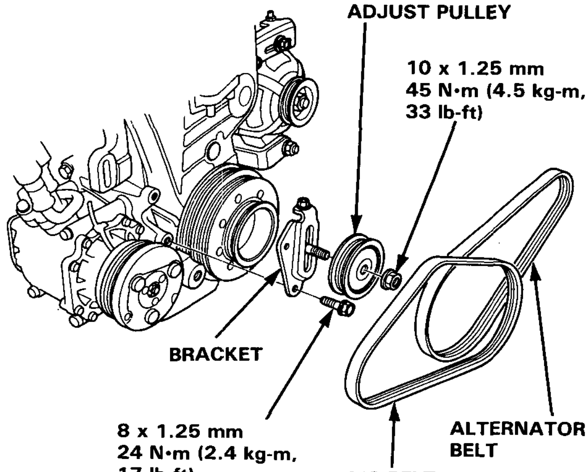
CAUTION: Inspect the water pump when replacing the timing belt.

NOTE:
- Turn the crankshaft so that No. 1 piston is at top-dead center (page 6-90 and 91).
- Before removing the timing belt, mark its direction of rotation if it to be reused.

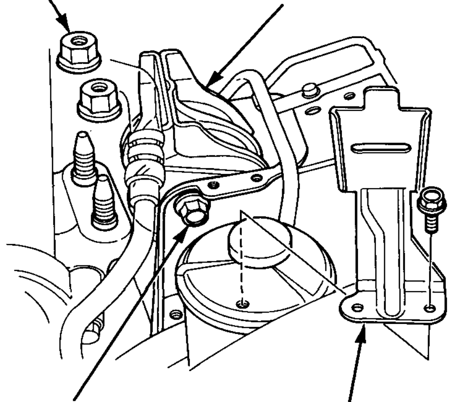
1. Remove the splash shield.
2. Remove the power steering pump.
   - Do not disconnect the P/S hoses.



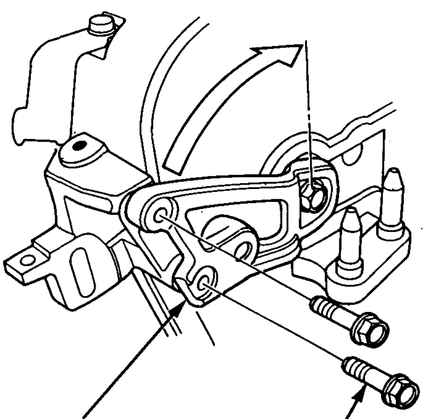
3. Remove the A/C compressor adjust pulley with bracket and the belt (with A/C), then remove the alternator belt.



4. Remove the P/S tank bracket.
5. Remove the engine support nuts. Loosen the mount bolt and pivot the engine side mount rubber out of the way.



6. Loosen P/S bracket bolt, then turn up the side bracket as shown.



7. Remove the timing belt upper cover.

8. Remove the valve cover.

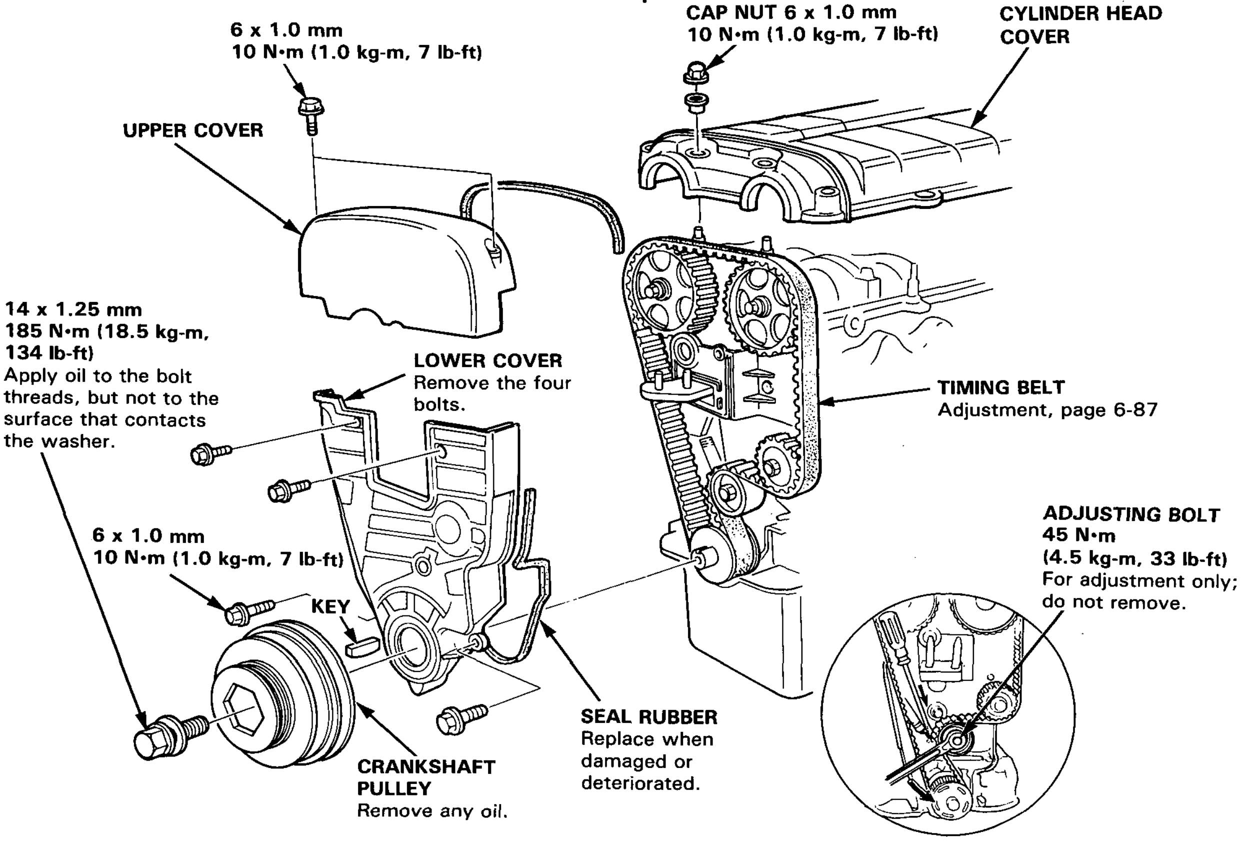
9. Remove the special bolt with special tools, then *remove crankshaft pulley*.

10. Remove the timing belt lower cover.

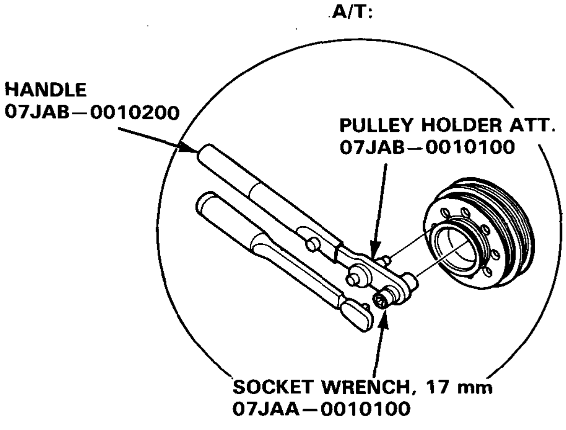
11. Loosen the timing belt adjusting bolt 180° to release the belt tension.

12. Push the tensioner to release tension from the belt, then retighten the adjusting bolt.

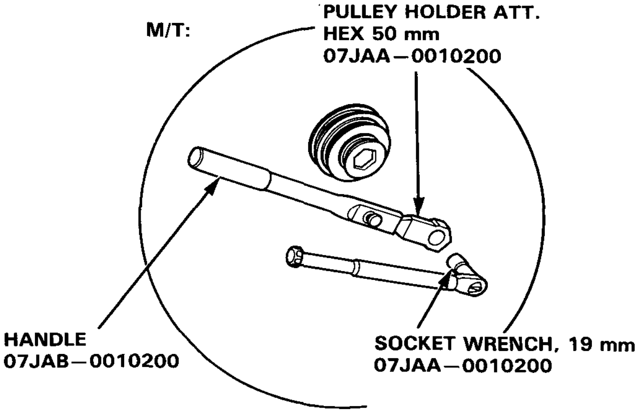
13. Remove the timing belt from the pulleys.



A/T:



M/T:



Timing Belt

Installation

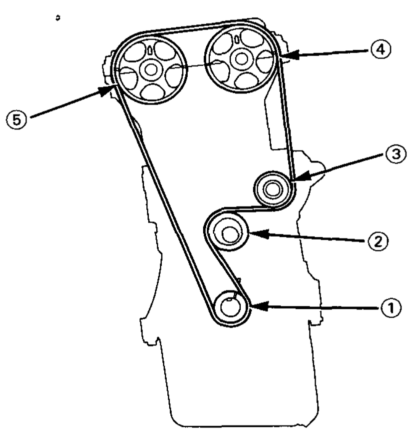
1. Install the timing belt in the reverse order of removal;
   Only key points are described here.

2. Position the crankshaft and the cam pulleys as shown before installing the timing belt.

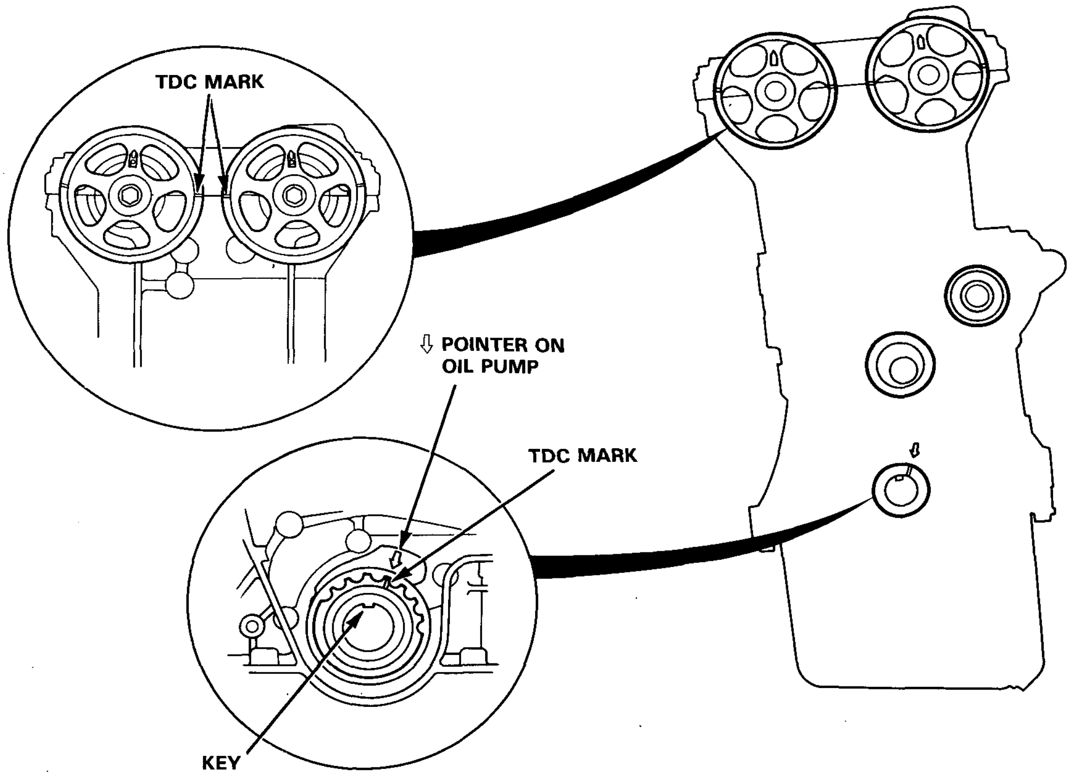
   A Set the crankshaft so that the No. 1 piston is at top-dead-center (TDC).

   NOTE: Align the groove on the teeth side of the timing belt drive pulley to the ⇩ pointer on the oil pump.

   Align the TDC mark on the cam pulley with pointer on the back cover.

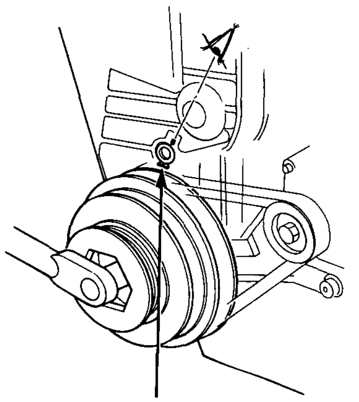


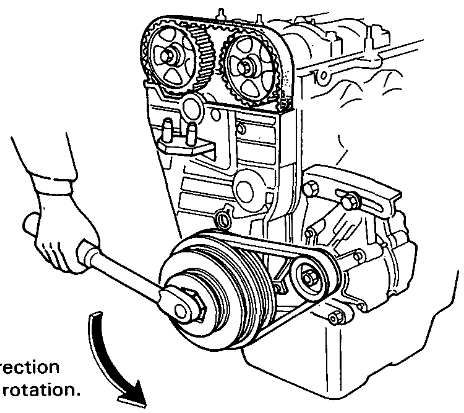
3. Install the timing belt tightly in the sequence shown.
   ① Timing belt drive pulley (crankshaft) → ② Adjusting pulley → ③ Water pump pulley → ④ Intake camshaft pulley → ⑤ Exhaust camshaft pulley.



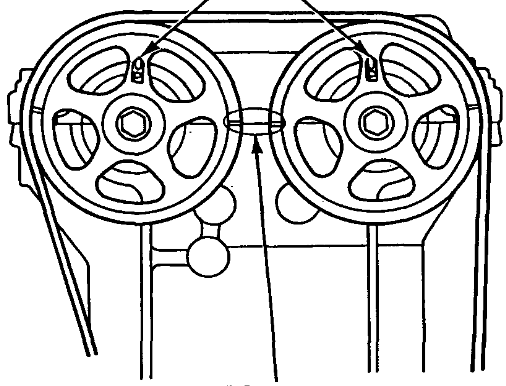
4. Loosen the adjusting bolt, and retighten it after tensioning the belt.
5. *Rotate the crankshaft about 4 or 6 turns clockwise* so that the belt may fit in position on the pulleys.
6. Adjust the timing belt tension (page 6-87).
7. Check the cranshaft pulley and the cam pulley at TDC.

CRANKSHAFT PULLEY:


TDC MARK
(Painted white)


Direction of rotation.

CAMSHAFT PULLEY:



8. If the cam pulley is not positioned at TDC, remove the timing belt and adjust the positioning following the procedure on page 6-90, then reinstall the timing belt.

   NOTE: Refer to page 6-88 for timing belt removal.

   After installation, adjust the tension of each belt.
   - *See section 23 for alternator belt tension adjustment.*
   - See section 22 for A/C compressor belt tension adjustment.
   - See section 17 for P/S pump belt tension adjustment.

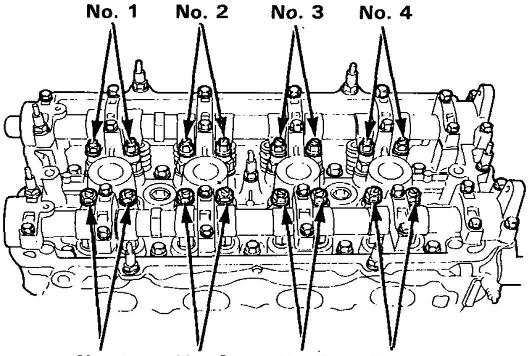
Valve Clearance

Adjustment

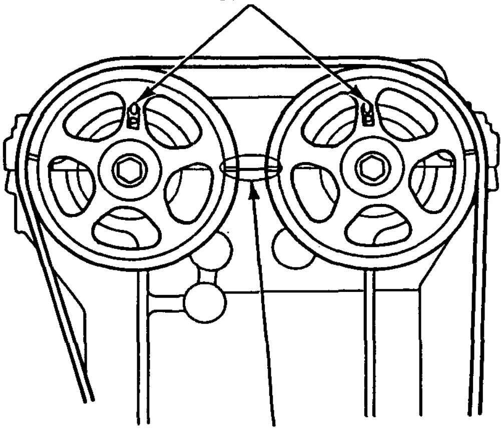
NOTE:
- Valves should be adjusted cold when the cylinder head temperature is less than 38°C (100°F). Adjustment is the same for intake and exhaust valves.
- If the pulley bolt loosens while turning crank, tighten it to specified torque.

Specified Torque:
185 N·m (18.5 kg-m, 134 lb-ft)

1. Remove the cylinder head cover.



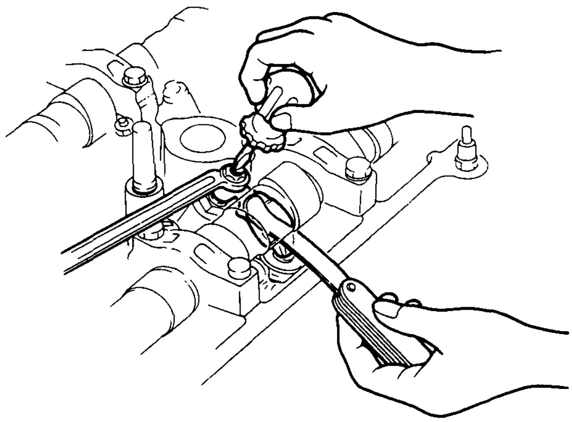
2. Set No. 1 piston at TDC. "UP"mark on the pulleys should be at top, and TDC marks should align with intake and exhaust pulleys.



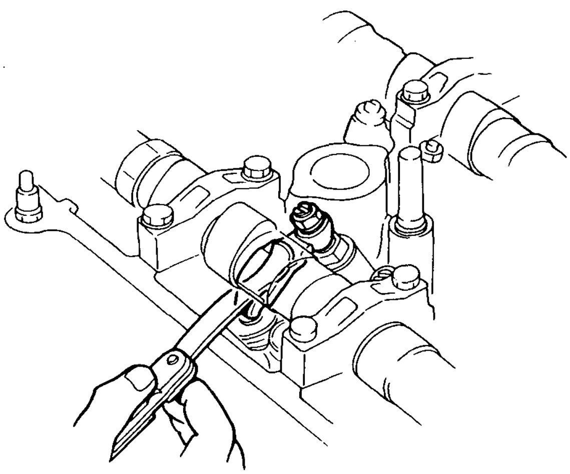
3. Adjust valves on No. 1 cylinder.

Intake: 0.13–0.17 mm (0.005–0.007 in)
Exhaust: 0.15–0.19 mm (0.006–0.008 in)

4. Loosen locknut and turn adjustment screw until feeler gauge slides back and forth with slight amount of drag.

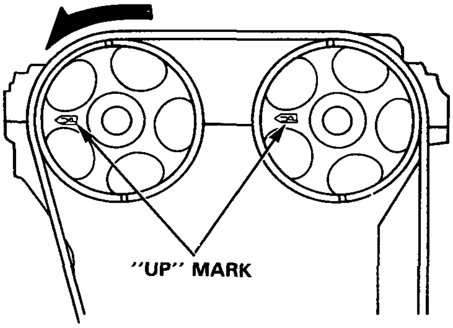


5. Tighten locknut and check clearance again. Repeat adjustment if necessary.



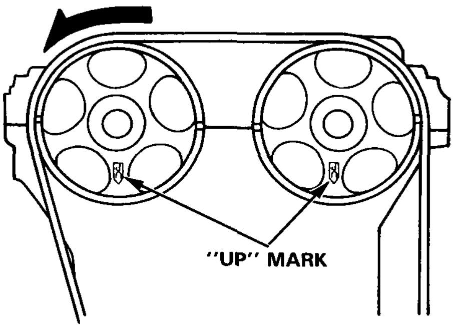
6. Rotate crankshaft 180° counterclockwise (cam pulley turns 90°). The "UP" mark should be at exhaust side. Distributor rotor should point to No. 3 plug wire. Adjust valve on No. 3 cylinder.

Number 3 piston at TDC:

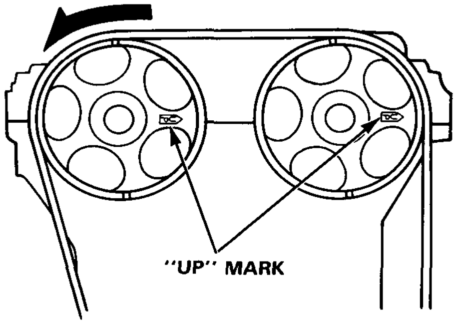


7. Rotate cranshaft 180° counterclockwise to bring No. 4 piston to TDC. Both TDC grooves are once again visible and distributor rotor should point to No. 4 plug wire. Adjust valves on No. 4 cylinder.

Number 4 piston at TDC:



8. Rotate crankshaft 180° counterclockwise to bring No. 2 piston to TDC. The "UP" mark should be at intake side. Distributor rotor should point to No. 2 plug wire. Adjust valves on No. 4 cylinder.



Cylinder Head/Valve Train
B16A engine

Cylinder Head/Valve Train

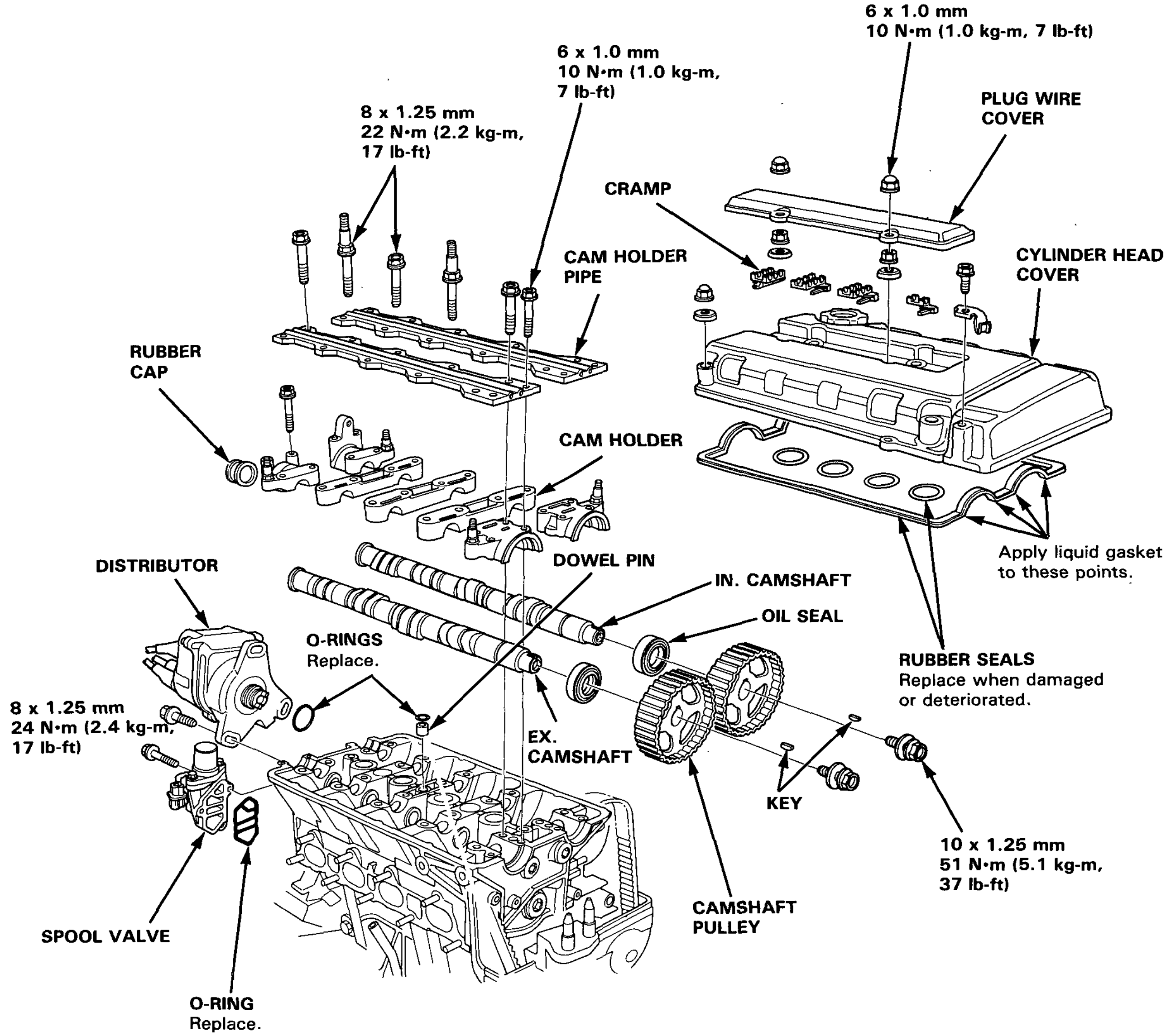
Illustrated Index

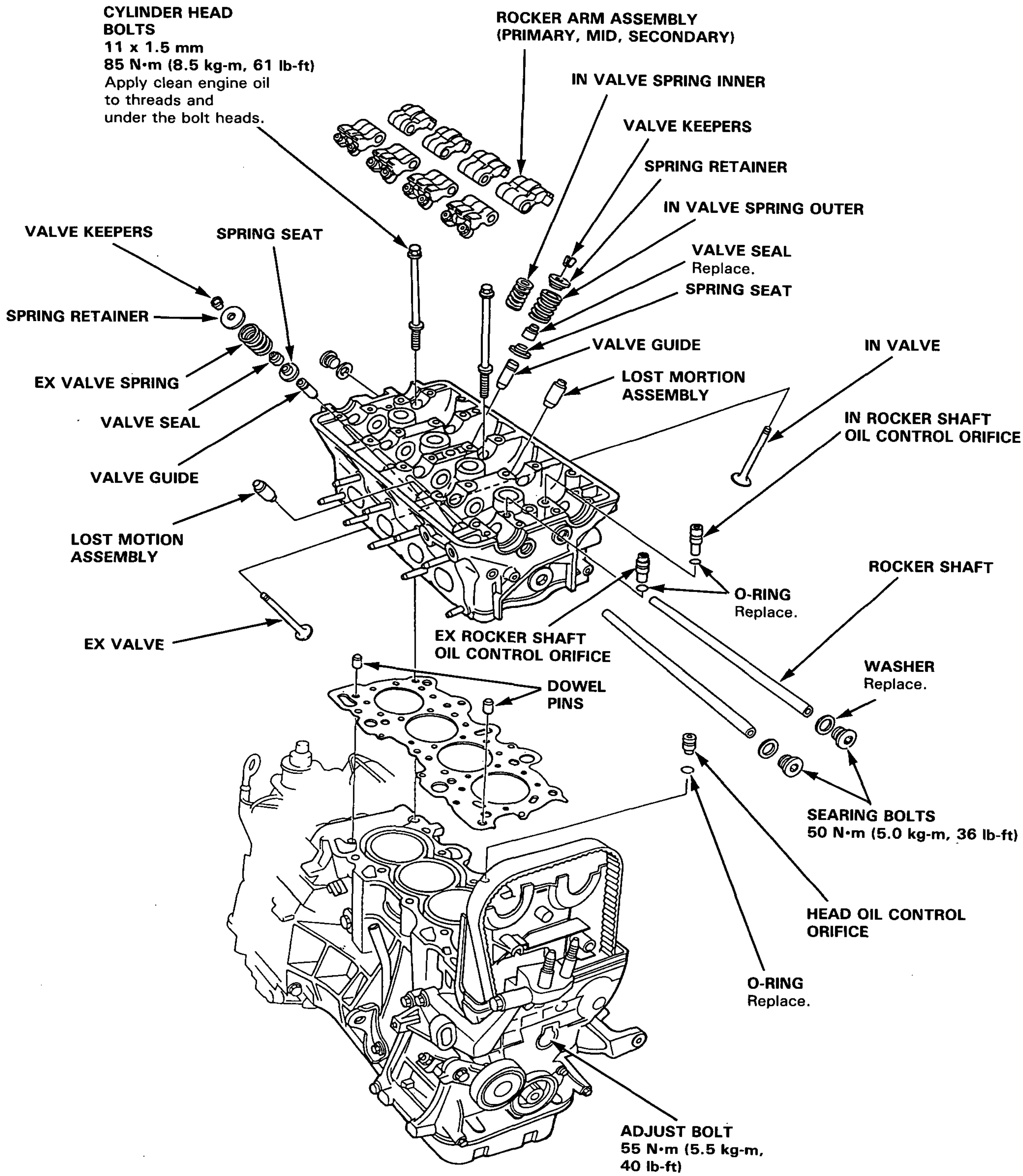
B16A engine:

CAUTION: To avoid damaging the cylinder head, wait until the coolant temperature drops below 38°C (100°F) before removing it.

NOTE:
- Use new O-rings and gaskets when reassembling.
- Use liquid gasket, Part No. 0Y740−99968.

Prior to reassembling, clean all the parts in solvent, dry them, and apply lubricant to any contact parts.




CYLINDER HEAD
BOLTS
11 x 1.5 mm
85 N•m (8.5 kg-m, 61 lb-ft)
Apply clean engine oil
to threads and
under the bolt heads.
ROCKER ARM ASSEMBLY
(PRIMARY, MID, SECONDARY)
IN VALVE SPRING INNER
VALVE KEEPERS
SPRING RETAINER
IN VALVE SPRING OUTER
VALVE SEAL
Replace.
SPRING SEAT
VALVE KEEPERS
SPRING SEAT
SPRING RETAINER
EX VALVE SPRING
VALVE SEAL
VALVE GUIDE
VALVE GUIDE
IN VALVE
LOST MORTION
ASSEMBLY
IN ROCKER SHAFT
OIL CONTROL ORIFICE
LOST MOTION
ASSEMBLY
ROCKER SHAFT
O-RING
Replace.
EX VALVE
EX ROCKER SHAFT
OIL CONTROL ORIFICE
DOWEL
PINS
WASHER
Replace.
SEARING BOLTS
50 N•m (5.0 kg-m, 36 lb-ft)
HEAD OIL CONTROL
ORIFICE
O-RING
Replace.
ADJUST BOLT
55 N•m (5.5 kg-m,
40 lb-ft)

Removal

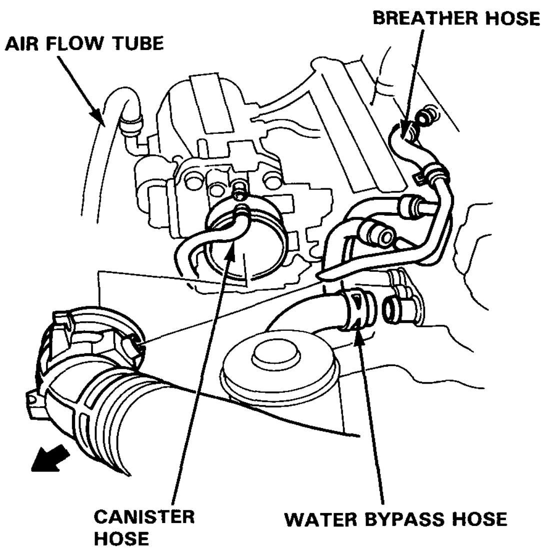
Engine removal is not required for this procedure.

CAUTION: To avoid damaging the cylinder head, wait until the coolant temperature drops below 38°C (100°F) before loosening the retaining bolts.

NOTE:
- Inspect the timing belt before removing the cylinder head.
- Turn the crankshaft pulley so that the No. 1 piston is at top-dead-center (page 6-121).
- Mark all emissions hoses before disconnecting them.

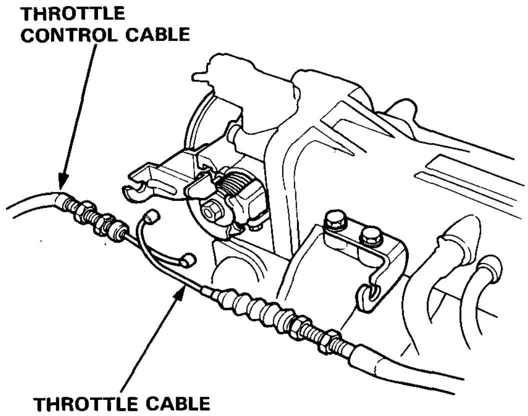
1. Disconnect the negative terminal from the battery.
2. Drain the coolant (see Section 10).
   - Remove the radiator cap to speed draining.
3. Relieve fuel pressure.

   ⚠WARNING Do not smoke while working on fuel system, keep open flame or spark away from work area. Drain fuel only into an approved container.
4. Remove the air flow tube.
5. Remove the fuel feed hose and charcoal canister hose form the intake manifold.

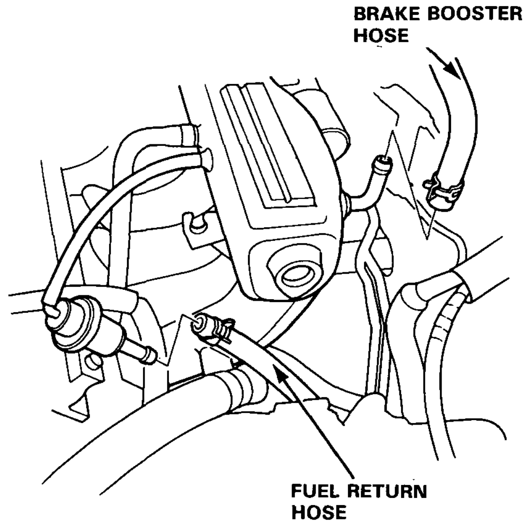


6. Remove the throttle cable at the throttle body.
7. Remove the throttle control cable form the throttle body (A/T only).

   NOTE:
   - Take care not to bend the cable when removing it. Always replace any kinked cable with a new one.
   - Adjust the throttle cable when installing (See Section 11).

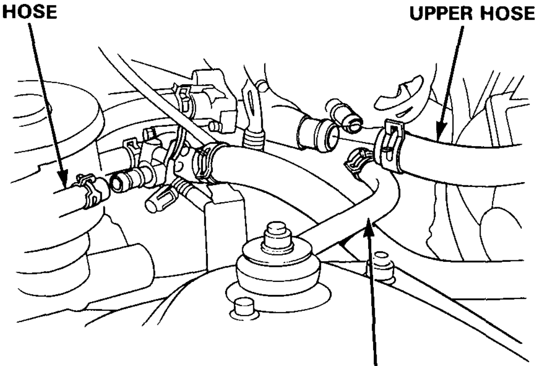


8. Remove the fuel return hose and brake booster vacuum hose.



9. Remove the engine wire harness connectors and wire harness clamps from the cylinder head and the intake manifold.
   - Four injector connectors
   - TA sensor connector
   - EACV connector
   - Throttle sensor connector
   - Ground terminal (at thermostat cover)
   - TW switch connector (for cooling fan)
   - Oxygen sensor connector
   - TW sensor connector (for emission)
   - Temperature unit connector
   - Spool valve connector
   - Oil pressure switch connector

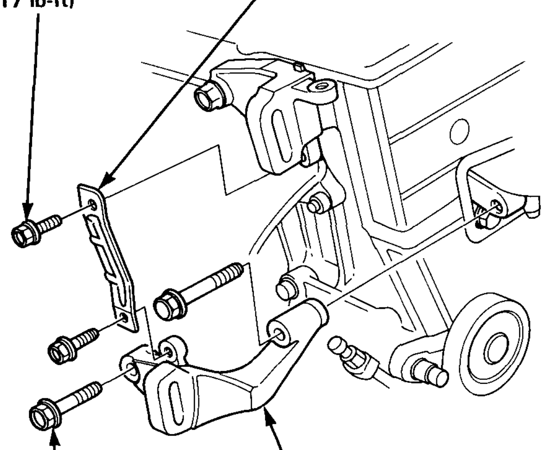
10. Remove the radiator upper hose and heater hose.



11. Remove the engine ground cable on the cylinder head cover.

12. Remove the P/S belt and pump.
    - Do not disconnect the P/S hoses.

13. Remove the P/S lower bracket and heat shield.



17. Remove the intake manifold bracket.

18. Remove the self-locking nuts and disconnect the exhaust manifold and exhaust pipe A.

19. Remove the exhaust manifold bracket.

20. Remove the PCV hose, then remove the cylinder head cover.

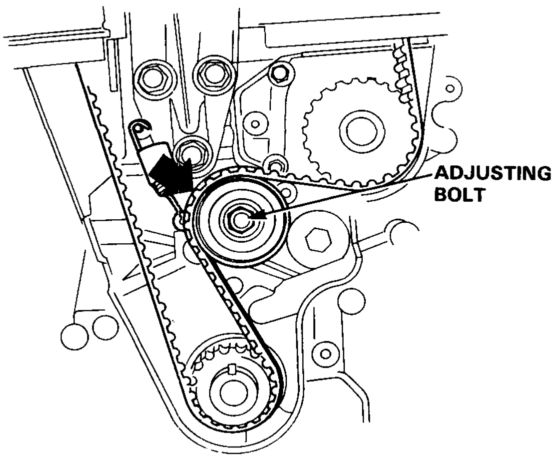
21. Remove the timing belt upper cover.

(cont'd)

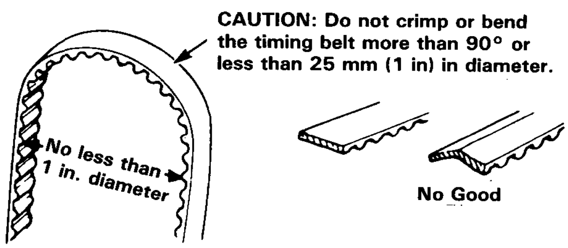
Removal (cont'd)

22. Loosen the timing belt adjusting bolt 180° to release the belt tension.

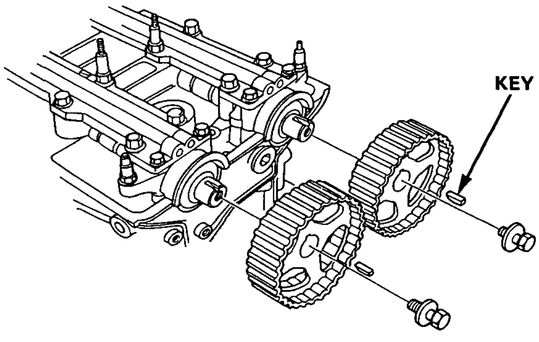
23. Push the tensioner to release tension from the timing belt, then retighten the adjusting bolt.



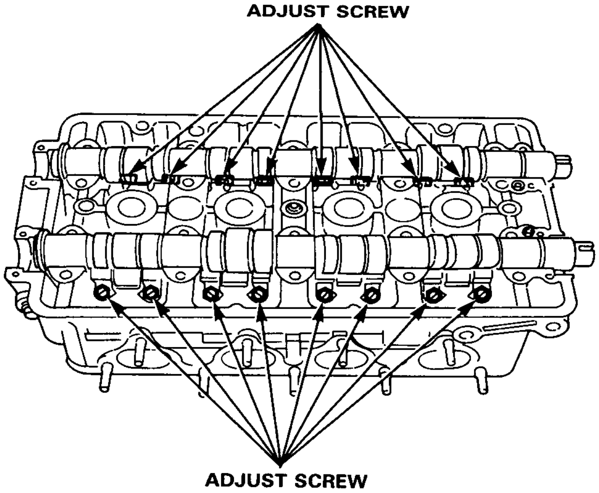
24. Remove the belt from the cam pulley.



25. Remove the camshaft pulleys.



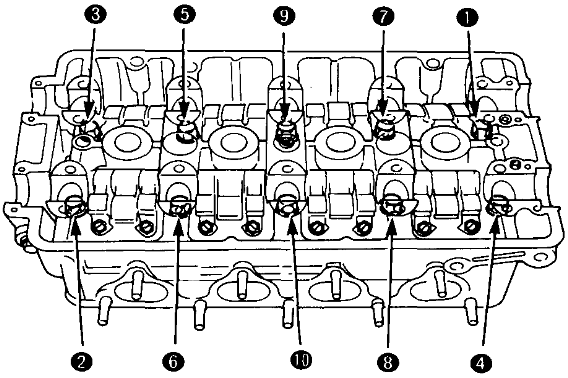
26. Loosen the adjust screw and camshaft holders, then remove the camshaft and rocker arms.



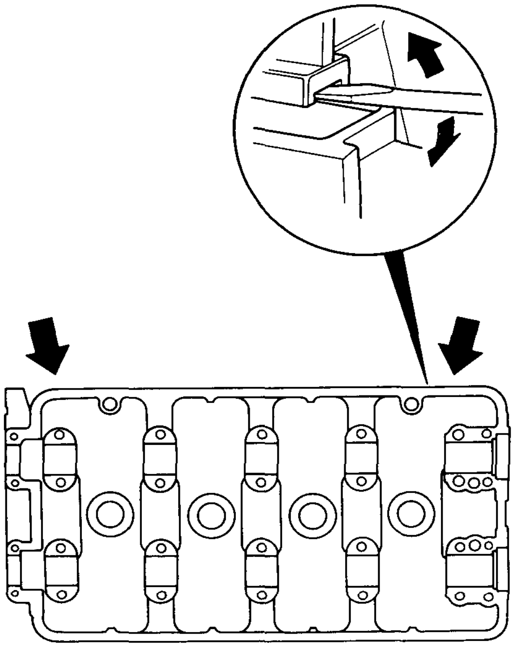
25. Remove the cylinder head bolts, then remove the cylinder head.

CAUTION: To prevent warpage, unscrew the bolts in sequence 1/3 turn at a time; repeat until all bolts are loosened.

CYLINDER HEAD BOLT LOOSENING SEQUENCE



NOTE: Separate the cylinder head from the block with a flat blade screwdriver as shown.

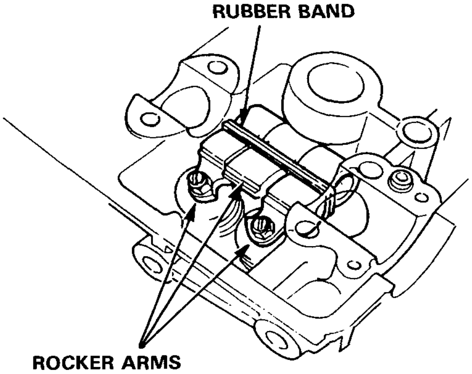


26. Remove the intake manifold and exhaust manifold from the cylinder head.

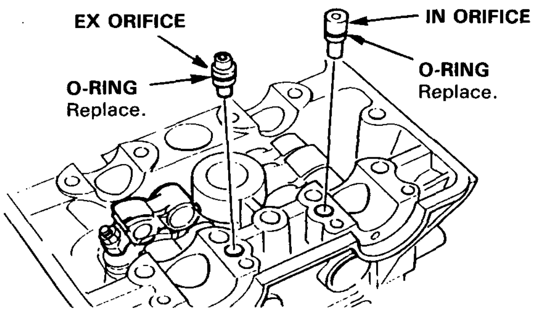
Rocker Arms

Removal

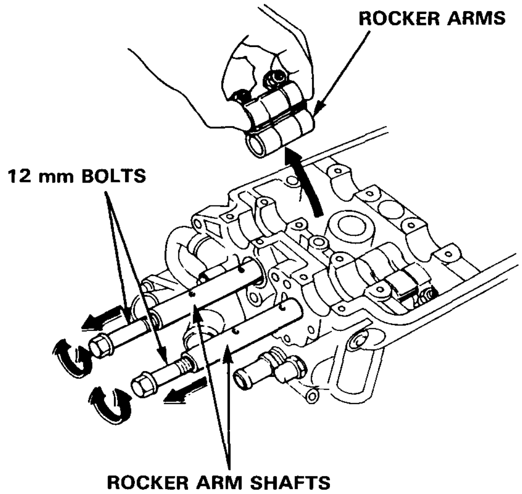
1. Hold the rocker arms together with a rubber band to prevent them from separating.



2. Remove the intake and exhaust rocker shaft oil control orifice, then remove the spool valve and the sealing bolts.
NOTE: The shapes of the oil control orifice of the intake and exhaust are different. Identify the parts as they are removed to ensure reinstallation in the original locations.



3. Screw 12 mm bolts into the rocker arm shafts. Remove each rocker arm while slowly pulling out of in take and exhaust rocker arm shafts.

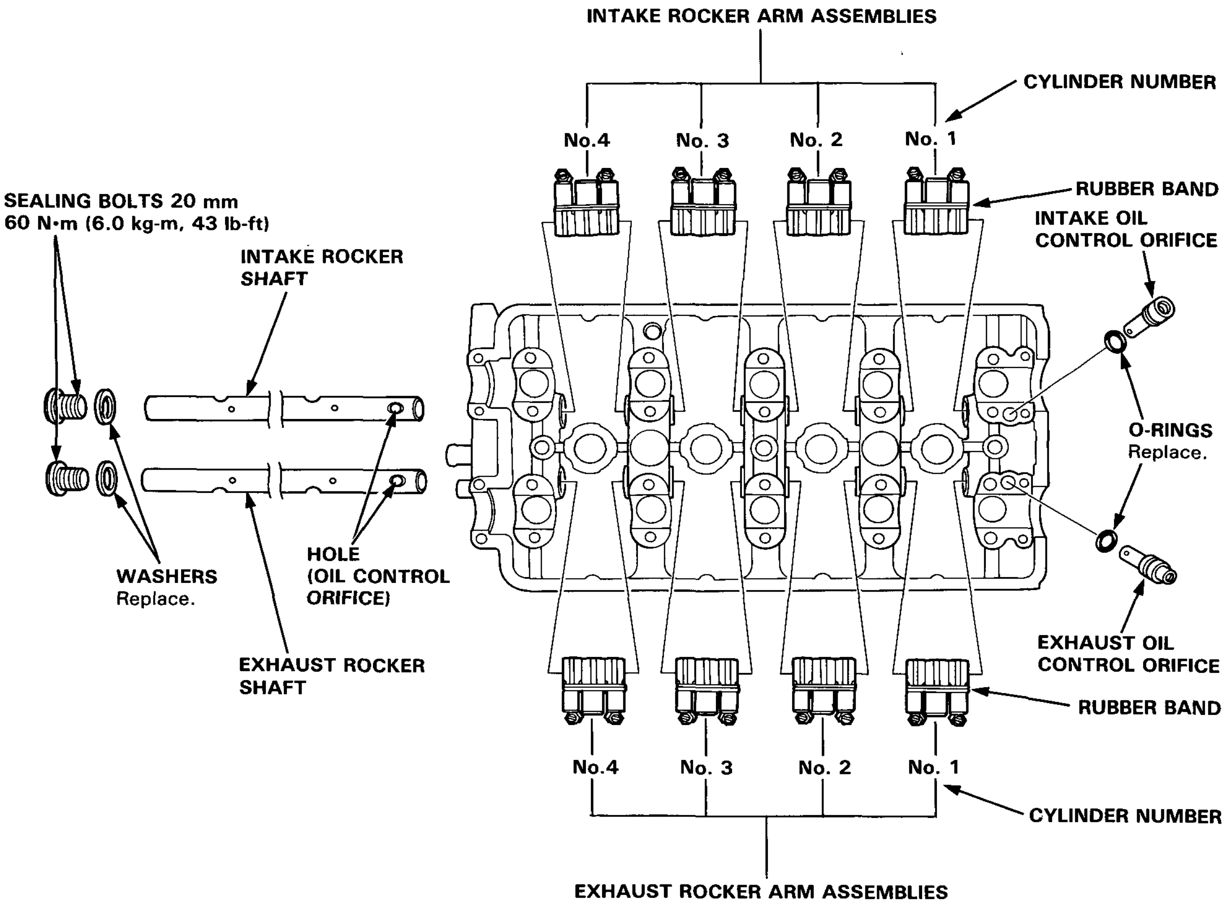


Locations

CAUTION: After installing the locker shaft orifice, try to turn the rocker shaft to make sure that the orifice has been inserted in the hole of rocker shaft correctly. If the orifice is in place, it should not turn.

NOTE:
- Identify parts as they are removed to ensure reinstallation in original locations.
- Inspect rocker shafts and rocker arms (pages 6-104 and 105).
- Rocker arms must be installed in the same position if reused.

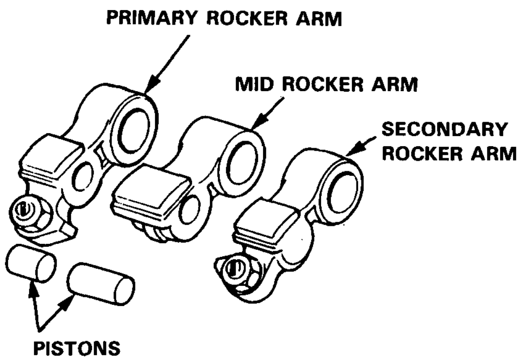
Prior to reinstalling, clean all the parts in solvent, dry them and apply lubricant to any contact surfaces.



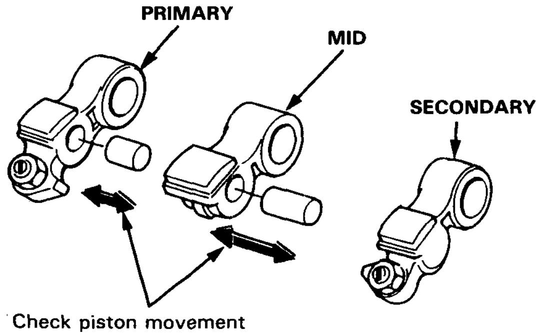
Rocker Arms and Lost Motion Assemblies

Inspection

NOTE: When reassembling the primary rocker arm, carefully apply air pressure to the oil passage of the rocker arm.

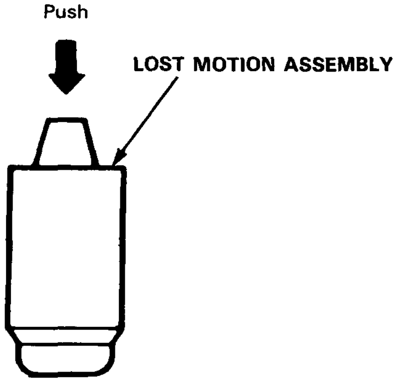


1. Inspect the rocker arm piston. Push it manually.
   — If it does not move smoothly, replace the rocker arm assembly.



NOTE:
- Apply oil to the pistons when reassembling.
- Bundle the rocker arms with a rubber band to prevent them from separating.

2. Remove the lost motion assembly from the cylinder head and inspect it. Pushing it gently with the finger will cause it to sink slightly. Increasing the force on it will cause it to sink deeper.
   — If the lost motion assembly does not move smoothly, replace it.

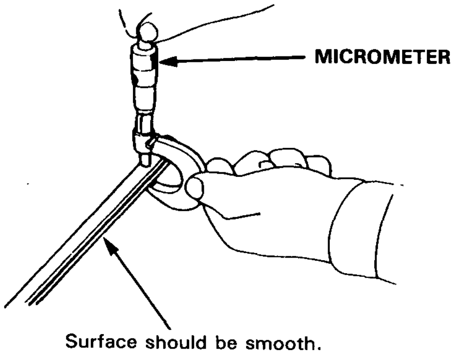


Rocker Arms and Shafts

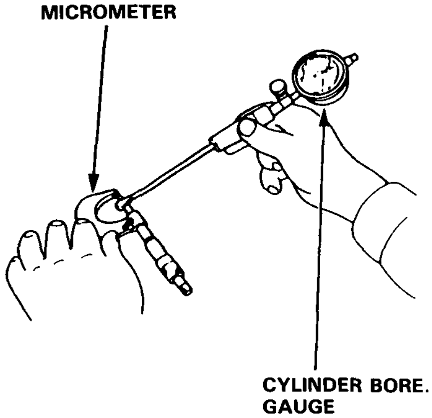
Clearance

Measure both the intake rocker shafts and exhaust rocker shafts.

1. Measure diameter of shaft at first rocker location.

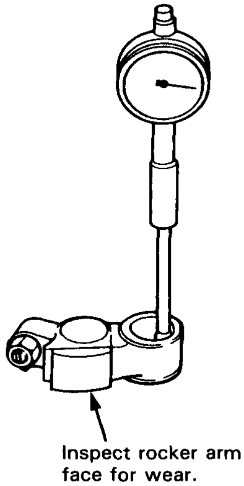


2. Zero gauge to shaft diameter.



3. Measure inside diameter of rocker arm and check for out-of-round condition.

Rocker Arm Radial Clearance:
Service Limit: 0.08 mm (0.003 in.)



Repeat for all rockers.
— If over limit, replace rocker shaft and all over-tolerance rocker arms.

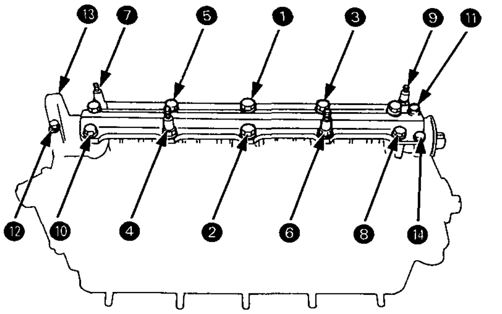
NOTE: If any rocker arm needs replacement, replace all three rocker arms in that set (primary, mid, and secondary).

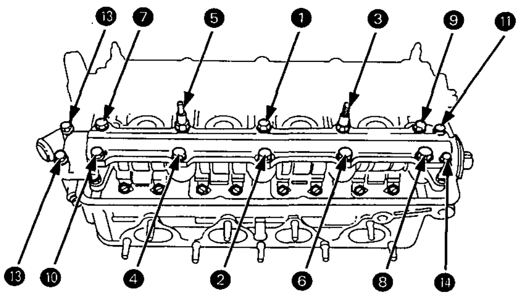
Inspection

NOTE:
- Do not rotate the camshaft during inspection.
- Remove the rocker arms and rocker shafts.

1. Put the camshaft and cam holders on the cylinder head, and then tighten the bolts to the specified torque.

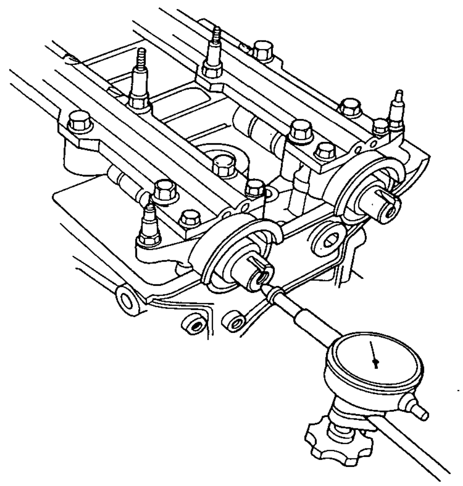
   Specified Torque:
   ❶—❿: 8 mm bolts 22 N·m (2.2 kg-m, 16 lb-ft)
   ⓫—⓮: 6 mm bolts 11 N·m (1.1 kg-m, 8 lb-ft)





2. Seat the camshaft by pushing it toward distributor end of cylinder head.
3. Zero the dial indicator against end of distributor drive, then push the camshaft back and borth, and read the end play.

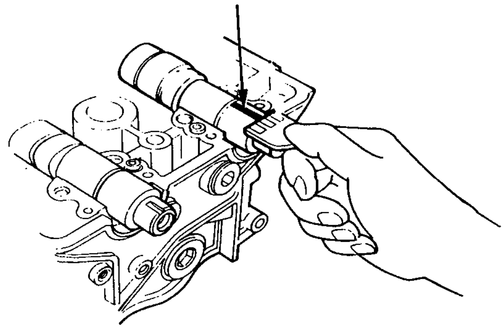
   Camshaft End Play:
   Standard (New): 0.05—0.15 mm (0.002—0.006 in.)
   Service limit: 0.5 mm (0.02 in.)



4. Remove the bolts, then remove the cam holders from the cylinder head.
   — Lift camshaft out of cylinder head, wipe clean, then inspect lift ramps. Replace camshaft if lobes are pitted, scored, or excessively worn.
   — Clean the camshaft bearing surfaces in the cylinder head, then set camshaft back in place.
   — Insert plastigage strip across each journal.
5. Put the camshaft on the cylinder head, then install the cam holders, and then tighten the bolts to the specified torque, as shown in the left column on this page.
6. Measure widest portion of plastigage on each journal.

   Camshaft Bearing Radial Clearance:
   Standard (New): 0.050—0.089 mm (0.002—0.004 in.)
   Service Limit: 0.15 mm (0.006 in.)

PLASTIGAGE STRIP

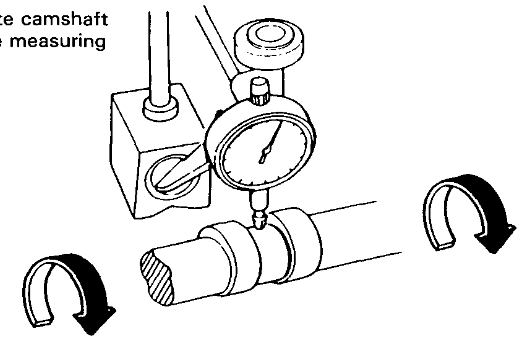


7. If camshaft bearing radial clearance is out of tolerance:

   — And camshaft has already been replaced, you *must replace the cylinder head.*

   — If camshaft has not been replaced, first check total runout with the camshaft supported on V-blocks.

   Camshaft Total Runout:
   Standard (New): 0.15 mm (0.0006 in)
   Service Limit: 0.030 mm (0.0012 in)

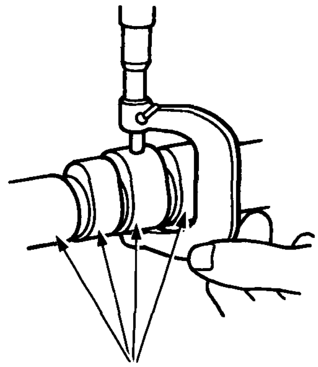


   — If the total runout of the camshaft is within tolerance, replace the cylinder head.
   — If the total runout is out of tolerance, replace the camshaft and recheck. If the bearing clearance is still out of tolerance, replace the cylinder head.

8. Check the wear of the cam lobe height.

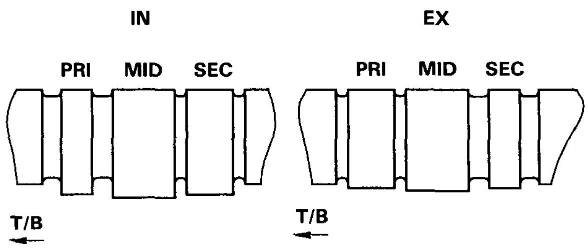
Cam lobe height standard (New):

	INTAKE	EXHAUST
PRIMARY	33.088 mm (1.3027 in)	32.785 mm (1.2907 in)
MID	36.267 mm (1.4278 in)	35.720 mm (1.4063 in)
SECONDARY	34.978 mm (1.3774 in)	34.691 mm (1.3658 in)



Check this area for wear.

Cam Position



T/B: TIMING BELT
PRI: PRIMARY
MID: MID
SEC: SECONDARY

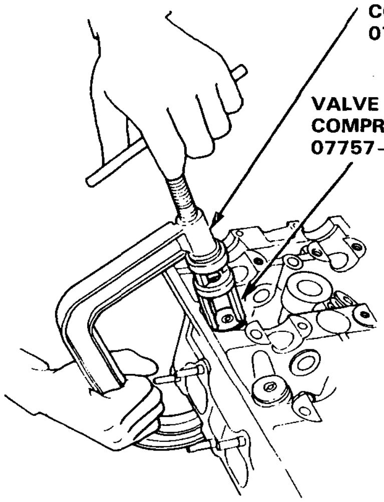
Replacement

NOTE: Identify valves and valve springs as they are removed so that each item can be reinstalled in its original position.

1. Tap each valve stem end perpendicularly with a hammer gripe bottom (refer to page 6-113) to loosen valve keepers before installing spring compressor.

   CAUTION: When tapping, care should be taken not to bend the valve stem.

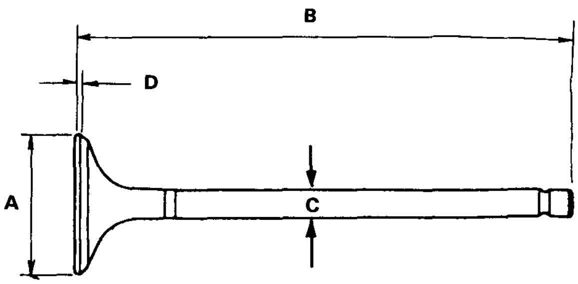
2. Install spring compressor. Compress spring and remove valve keeper.



3. Install the special tool as shown.

4. Remove the valve guide seal.

Valve Demensions



Intake Valve

A Standard (New): 32.90–33.10 mm (1.2953–1.3031 in)
B Standard (New): 101.00–101.30 mm (3.9764–3.9882 in)
C Standard (New): 5.475 –5.485 mm (0.2156–0.2159 in)
C Service Limit: 5.445 (0.2144 in)
D Standard (New): 1.05–1.35 mm (0.0413–0.0531 in)
D Service Limit: 0.85 mm (0.0335 in)

Exhaust Valve

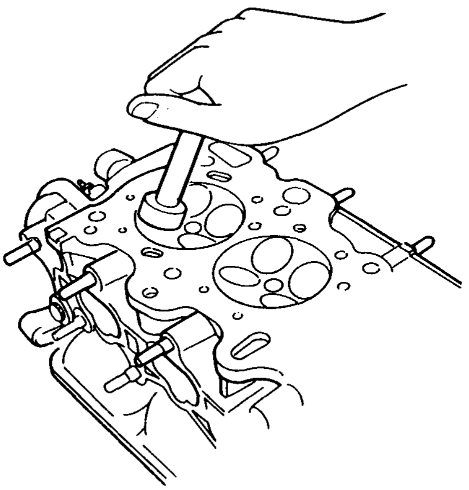
A Standard (New): 27.90–28.10 mm (1.0984–1.1063 in)
B Standard (New): 100.60–100.90 mm (3.9606–3.9724 in)
C Standard (New): 5.450 –5.460 mm (0.2146–0.2150 in)
C Service Limit: 5.420 (0.2134 in)
D Standard (New): 1.65–1.95 mm (0.0650–0.0768 in)
D Service Limit: 1.45 mm (0.0571 in)

Valve Seats

Reconditioning

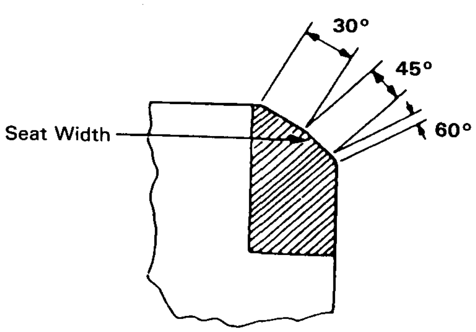
1. Renew the valve seats in the cylinder head using a valve seat cutters.

   NOTE: If guides are worn, replace them before cutting the valve seats.

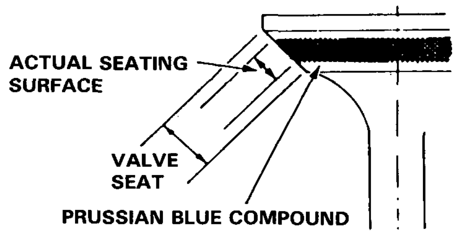


2. Carefully cut a 45° seat, removing only enough material to ensure a smooth and concentric seat.
3. Bevel the upper edge of the seat with the 30° cutter and the lower edge of the seat with the 60° cutter. Check width of seat and adjust accordingly.
4. Make one more very light pass with the 45° cutter to remove any possible burrs caused by the other cutters.

   Valve Seat Width:
   Standard: 1.25—1.55 mm (0.049—0.061 in.)
   Service Limit: 2.0 mm (0.079 in.)



5. After resufacing the seat, inspect for even valve seating: Apply Prussian Blue Compound to the valve face, and insert valve in original location in the head, then lift it and snap it closed against the seat several times.

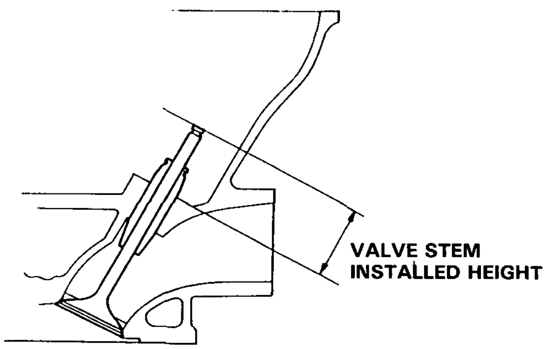


6. The actual valve seating surface, as shown by the blue compound, should be centered on the seat.
   - If it is too high (closer to the valve stem), you must make a second cut with the 60° cutter to move it down, then one more cut with the 45° cutter to restore seat width.
   - If it is too low (closer to the valve edge), you must make a second cut with the 30° cutter to move it up, then one more cut with the 45° cutter to restore seat width.

   NOTE: The final cut should always be made with the 45° cutter.

7. Insert intake and exhaust valves in the head and measure valve stem installed height.

   Intake Valve Stem Installed Height:
   Standard (New): 37.465—37.935 mm (1.4750—1.4935 in)
   Service Limit: 38.185 mm (1.5033 in)
   Exhaust Valve Stem Installed Height:
   Standard (New): 37.165—37.635 mm (1.4632—1.4817 in)
   Service Limit: 37.885 (1.4915 in)



8. If valve stem installed height is over the service limit, replace valve and recheck. If still over the service limit, replace cylinder head; the valve seat in the head is too deep.

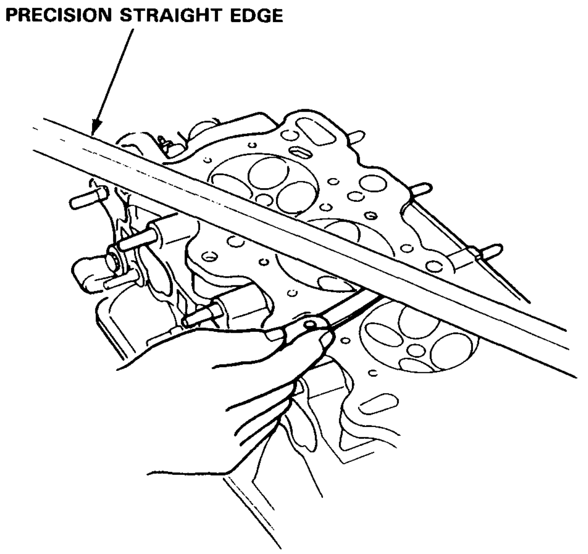
Cylinder Head

Warpage

NOTE: If camshaft bearing clearances (page 6-106) are not within specification, the head cannot be resurfaced.

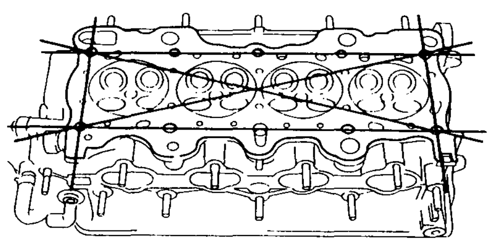
If camshaft bearing radial clearance are within specifications, check the head for warpage.

- If warpage is less than 0.05 mm (0.002 in.) cylinder head resurfacing is not required.
- If warpage is between 0.05 mm (0.002 in.) and 0.2 mm (0.008 in.), resurface cylinder head.
- Maximum resurface limit is 0.2 mm (0.008 in.) based on a height of 142 mm (5.59 in.).



Cylinder Head Height:
Standard (New): 141.95–142.05 mm
(5.5886–5.5925 in)

Measure along edges, and 3 ways across center.



Valves

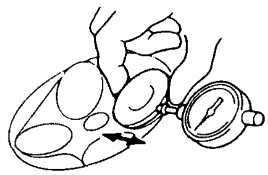
Valve Movement

Measure the guide-to-stem clearance with a dial indicator while rocking the stem in the direction of normal thrust (wobble method).

Intake Valve Stem-to-Guide Clearance:
Standard (New): 0.05–0.11 mm
(0.0020–0.0043 in)
Service Limit: 0.15 mm (0.0059 in)

Exhaust Valve Stem-to-Guide Clearance:
Standard (New): 0.10–0.16 mm
(0.0039–0.0063 in)
Service Limit: 0.24 (0.0094 in)

Valve extended 10 mm out from seat.



- If measurement exceeds the service limit, recheck using a new valve.
- If measurement is now within the service limit, reassemble using a new valve.
- If measurement still exceeds limit, recheck using alternate method below, then replace valve and guide, if necessary.

NOTE: An alternate method of checking guide to stem clearance is to subtract the O.D. of the valve stem, measured with a micrometer, from the I.D. of the valve guide, measured with an inside micrometer or ball gauge.
Take the measurements in three places along the valve stem and three places inside the valve guide. The difference between the largest guide measurement and the smallest stem measurement should not exceed the service limit.

Intake Valve Stem-to-Guide Clearance:
Standard (New): 0.025–0.055 mm
(0.0010–0.0022 in)
Service Limit: 0.080 mm (0.0031 in)

Exhaust Valve Stem-to-Guide Clearance:
Standard (New): 0.050–0.080 mm
(0.0020–0.0031 in)
Service Limit: 0.110 mm (0.0043 in)

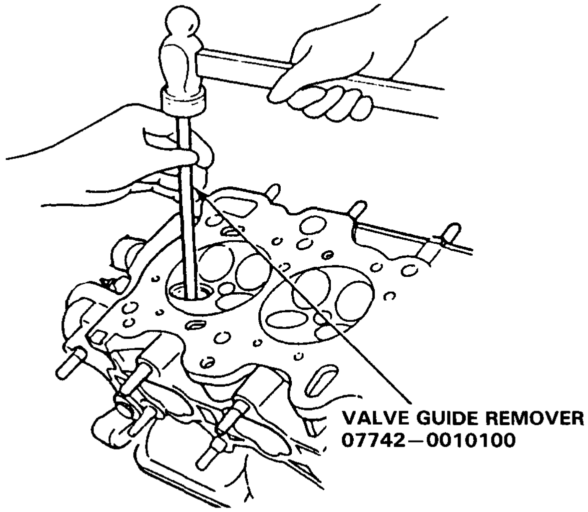
Valve Guides

Replacement

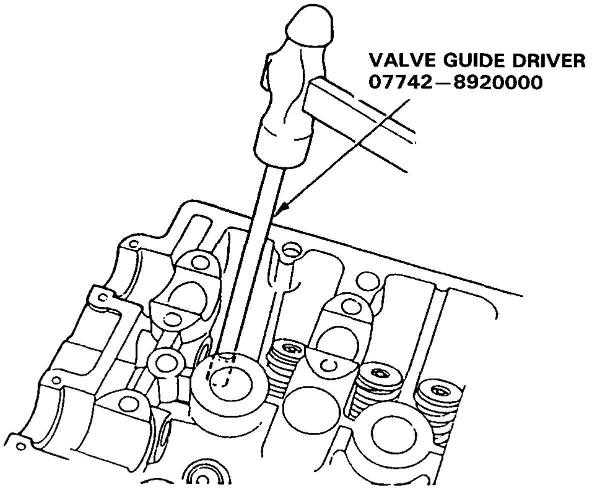
NOTE:
- For best results, heat cylinder head to 150°C (300°F) before removing or installing guides.
- It may be necessary to use an air hammer to remove some valve guides.

CAUTION: To avoid burns, use heavy gloves when handling heated cylinder head.

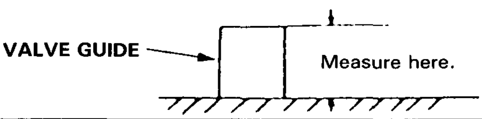
1. Drive the valve guide out from the bottom of the cylinder head.



2. Drive in a new valve guide to the specified depth.



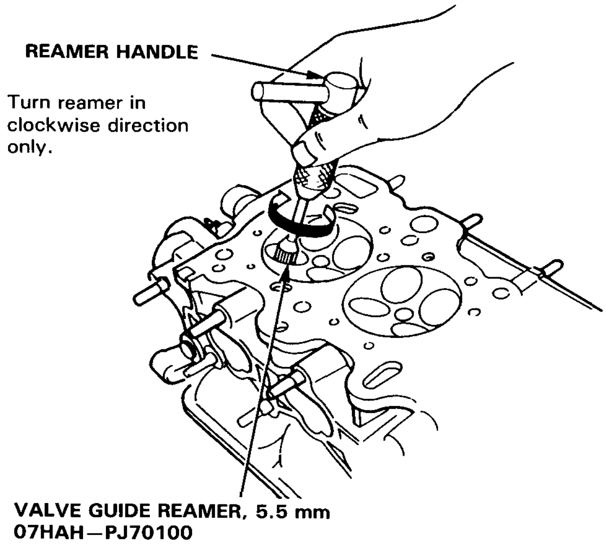
Valve Guide Installed Height:
Intake: 12.55–13.05 mm (0.4941–0.5138 in)
Exhaust: 12.55–13.05 mm (0.4941–0.5138 in)



Valve Guide Reaming

NOTE: For new valve guides only.

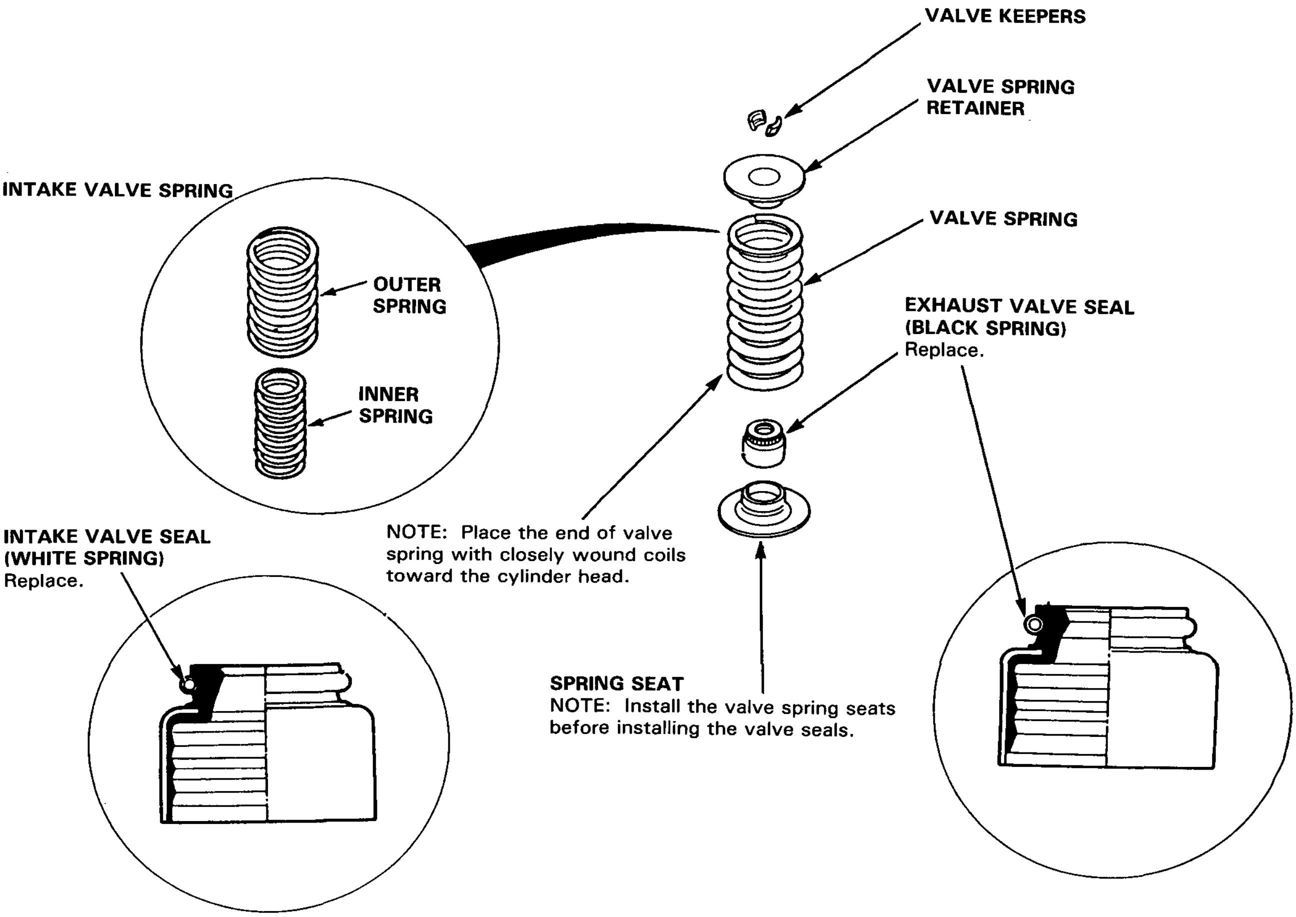
1. Coat both reamer and valve guide with cutting oil.
2. Rotate the reamer clockwise the full length of the valve guide bore.
3. Continue to rotate the reamer clockwise while removing it from the bore.
4. Thoroughly wash the guide in detergent and water to remove any cutting residue.
5. Check clearance with a valve (page 6-110).
   - Verify that the valve slides in the IN, EX valve guides without exerting pressure.

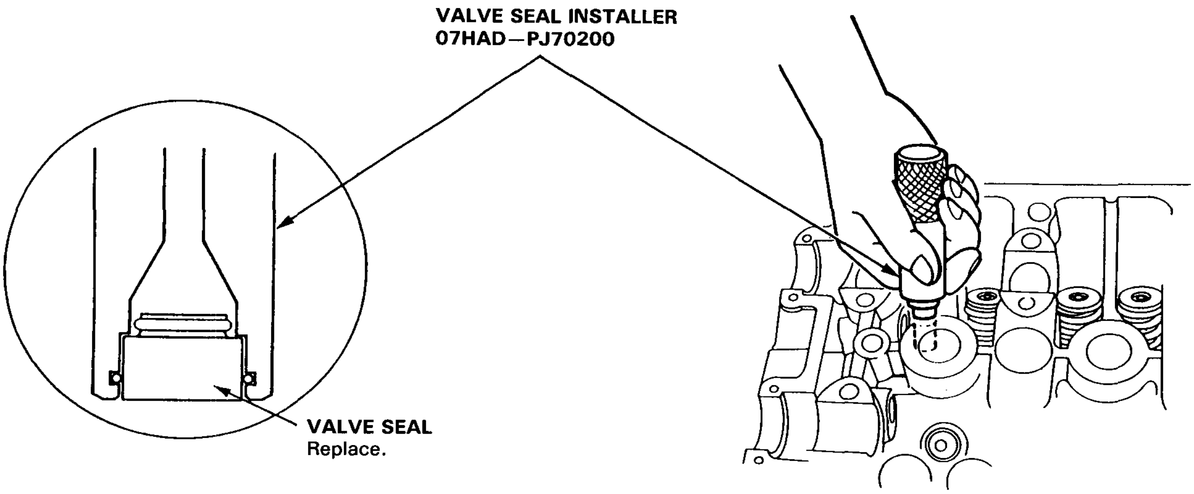


Valve Springs and Valve Seals

Valve Spring and Valve Seal Installation Sequence

NOTE: Exhaust and intake valve seals are NOT interchangeable.

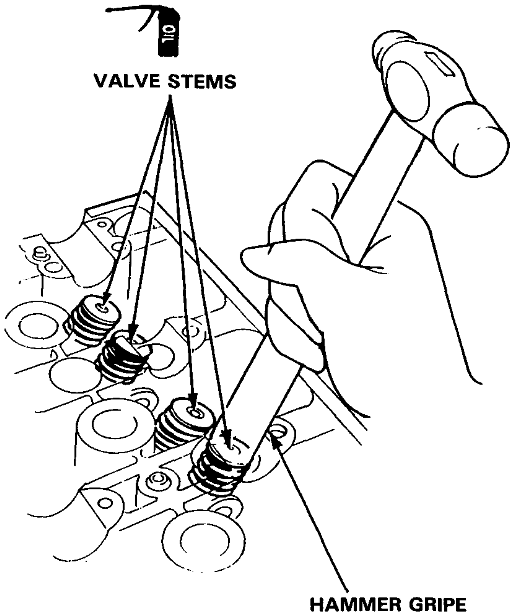




Rocker Arms

Valve Installation

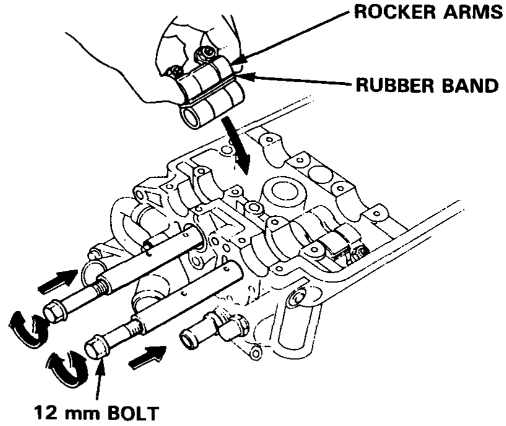
- When installing valves in cylinder head, coat valve stems with oil before inseting into valve guides, and make sure valves move up and down smoothly.
- When valves and springs are in place, lightly tap the end of each valve stem two or three times to ensure proper seating of valve and valve keepers (use hammer gripe bottom).



Installation

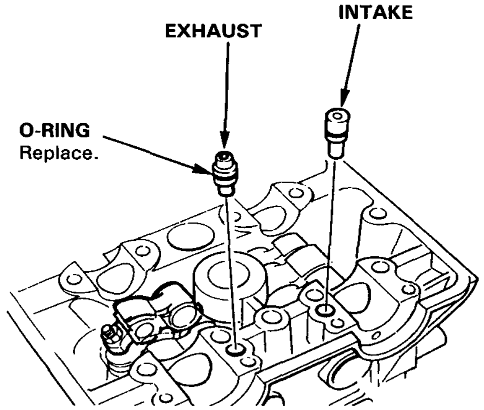
1. Install the rocker arms in the reverse order of removal:
   - Valve adjusting locknuts should be loosened and adjusting screw backed off before instllation.
   - The component parts must be reinstalled in the original locations.
2. Install the lost motion assembly.
3. Install the rocker arms while passsing the rocker arm shaft through the cylinder head.

   NOTE: Remove the rubber band after installing the rocker arms.



4. Install the orifices. If the holes in the rocker arm shaft and cylinder head are not in line each other, mount a 12 mm bolt on the rocker arm shaft and rotate the shaft.

   NOTE: The shapes of the orifices for the intake and exhaust are different. The orifices must be installed in the original locations.

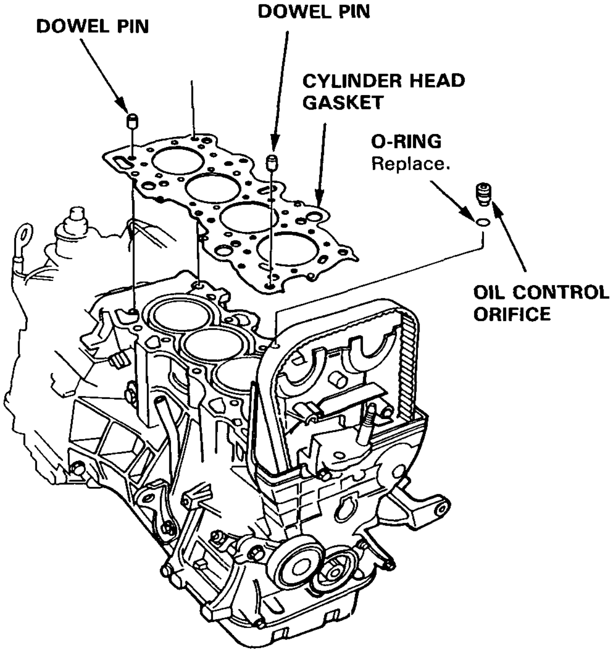


Cylinder Head

Installation

1. Install the cylinder head in the reverse order of removal:
   - Always use a new head and manifold gasket.
   - The cylinder head gasket is a metal gasket. Take care not to bend it.
   - Rotate the crankshaft, set the No. 1 piston at TDC (page 6-121).

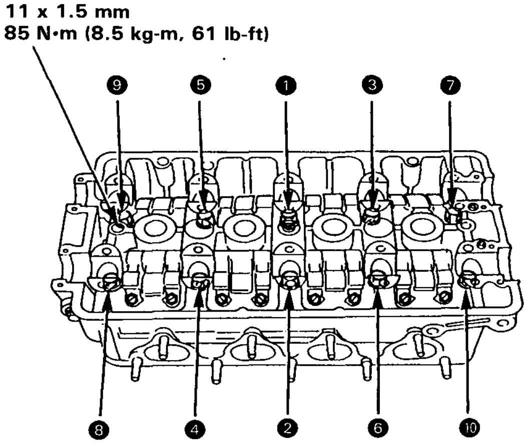
2. Install the cylinder head gasket, dowel pins and the head oil control orifice on the cylinder head.



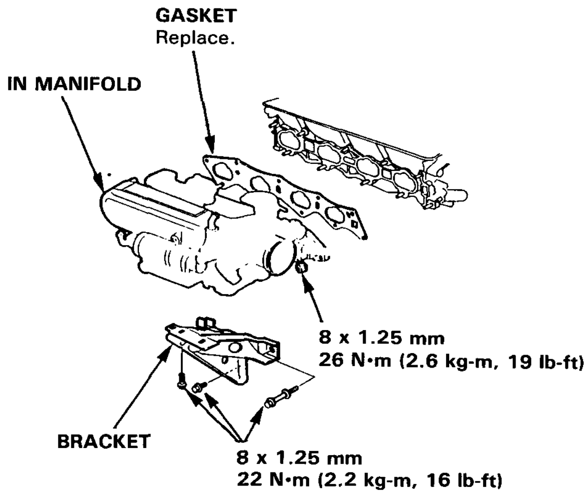
3. Tighten cylinder head bolts in two steps. In the first step, tighten all bolts in sequence, to about 30 N•m (3.0 kg-m, 22 lb-ft). In the final step, tighten in same sequence to 85 N•m (8.5 kg-m, 61 lb-ft).

   NOTE: Apply clean engine oil to the bolt threads and under the bolt head.

CYLINDER HEAD BOLT TORQUE SEQUENCE

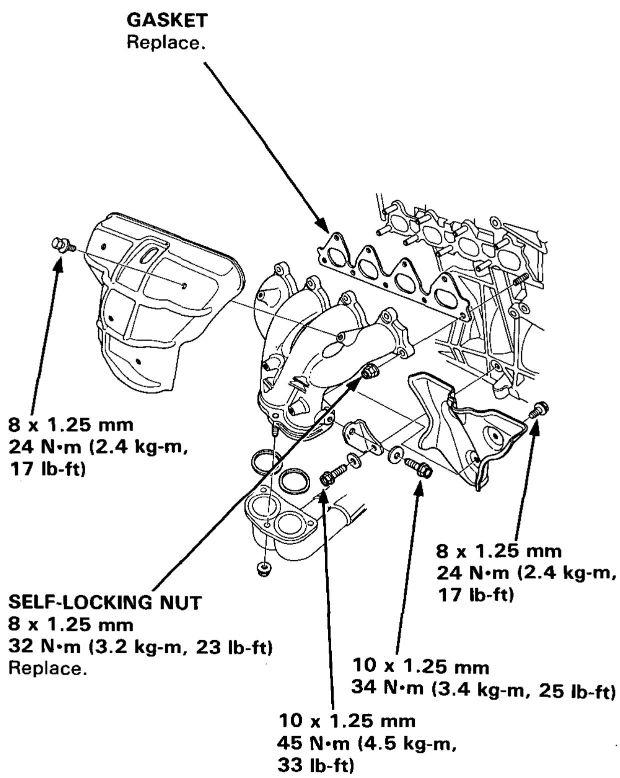


4. Install the intake manifold and tighten the nuts in a criss-cross pattern in two or three steps, beginning with the inner nuts.



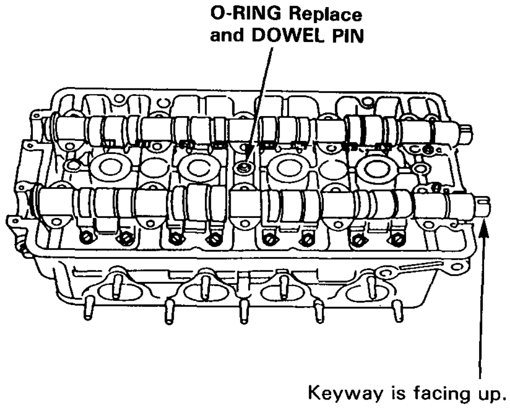
Installation

5. Install the exhaust manifold and tighten the new self-locking nuts in a criss-cross pattern in two or three steps, beginning with the inner nuts.



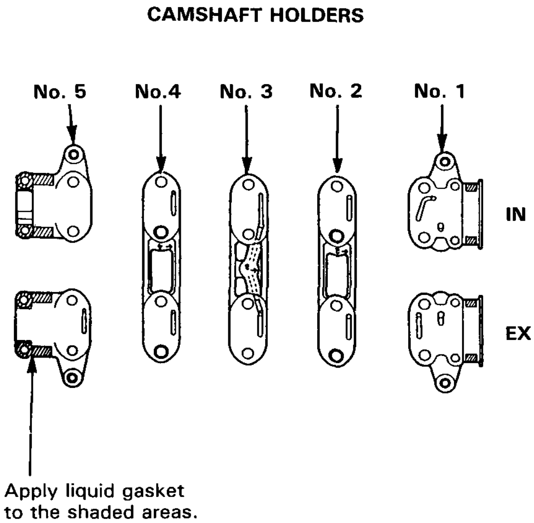
1. Install the camshafts and camshaft oil seals.

   NOTE:
   - Install the camshafts with keyway facing up.
   - Install the oil seal with the spring side face in.
   - The oil seal housing surface should be dry.
   - Set the O-ring and dowel pin in the oil passage of the No. 3 camshaft holder.



2. Apply liquid gasket to the head mating surface of the No. 1 and No. 5 camshaft holders on both the intake and exhaust side. Confirm that the camshaft keyway are face up, then place the holders, together with the No. 2, No. 3 and No. 4 camshaft holders, on the cylinder head.

   NOTE: *The arrows marked on the camshaft holders shoud point to the timing belt.*



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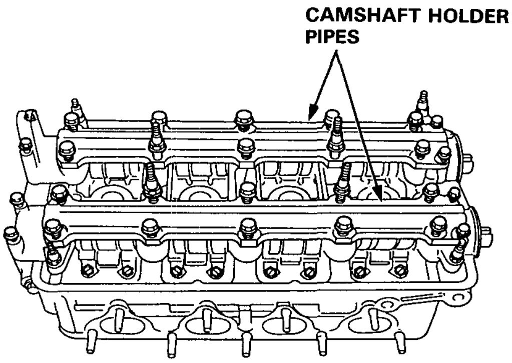
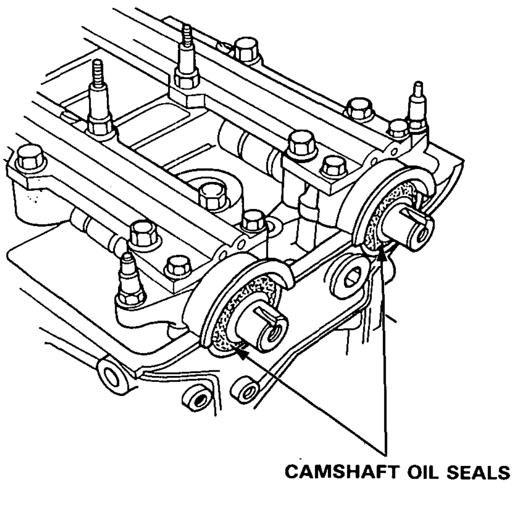
Camshafts

Installation (cont'd)

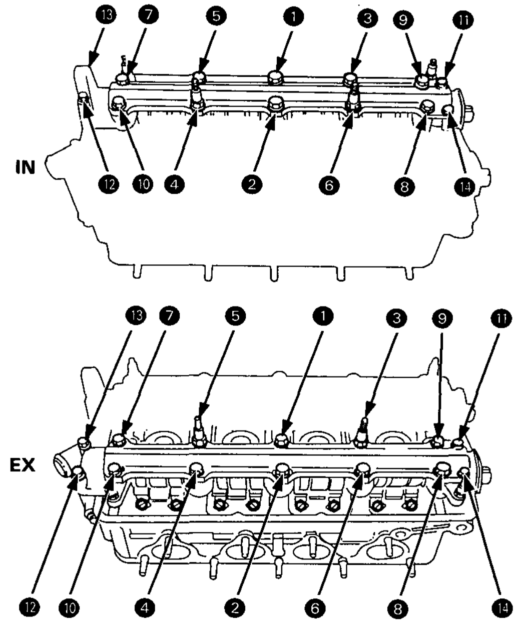
3. Temporarily tighten the bolts of the camshaft holders and the comshaft holder pipes.



4. Push the camshaft oil seal securely against the base of the camshaft holder.



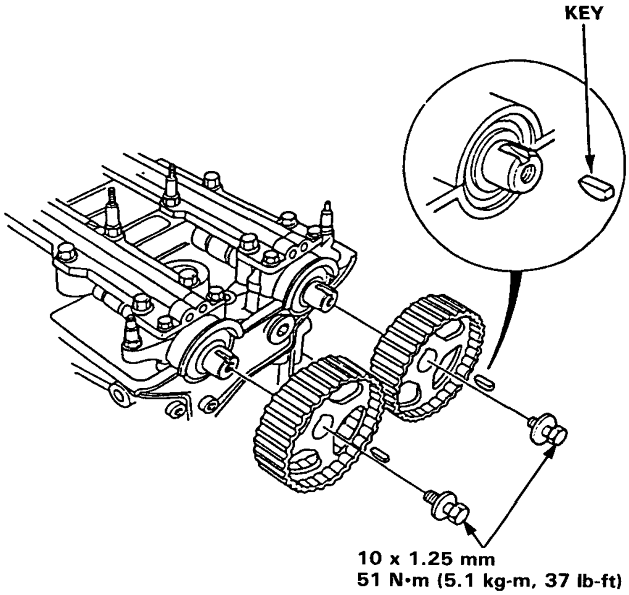
5. Tighten the bolts in the sequence shown below.



❶—❿: 8 x 1.25 mm 22 N•m (2.2 kg-m, 16 lb-ft)
❿—⓮: 6 x 1.0 mm 11 N•m (1.1 kg-m, 8 lb-ft)

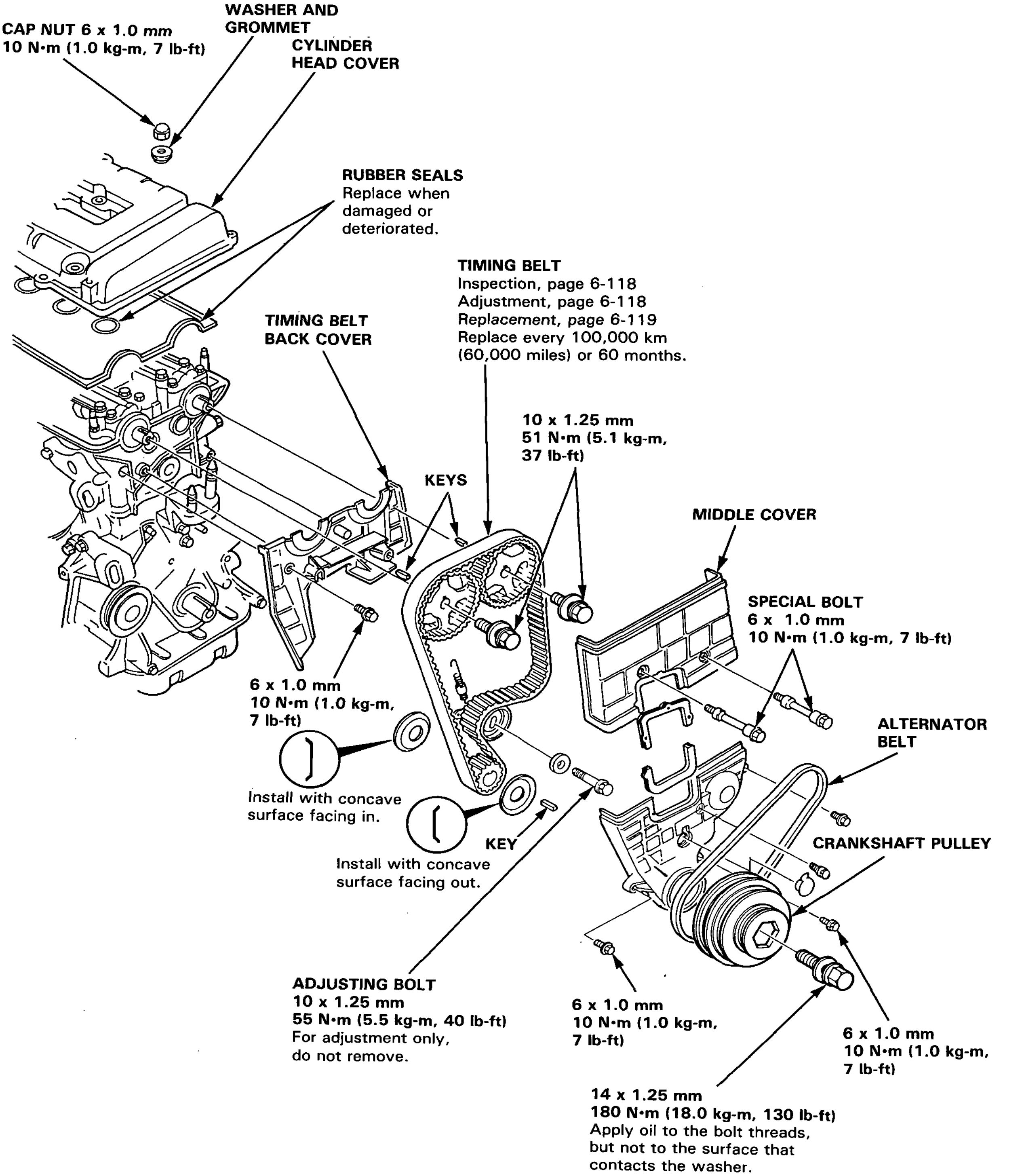
6. Install the back cover of the timing belt.

7. Install the camshaft pulleys.



Illustrated Index

NOTE:
- Refer to section 23 for alternator belt adjustment.
- Refer to section 22 for A/C compressor belt adjustment.
- Refer to section 17 for P/C pump belt adjustment.
- Mark direction of rotation before removing.

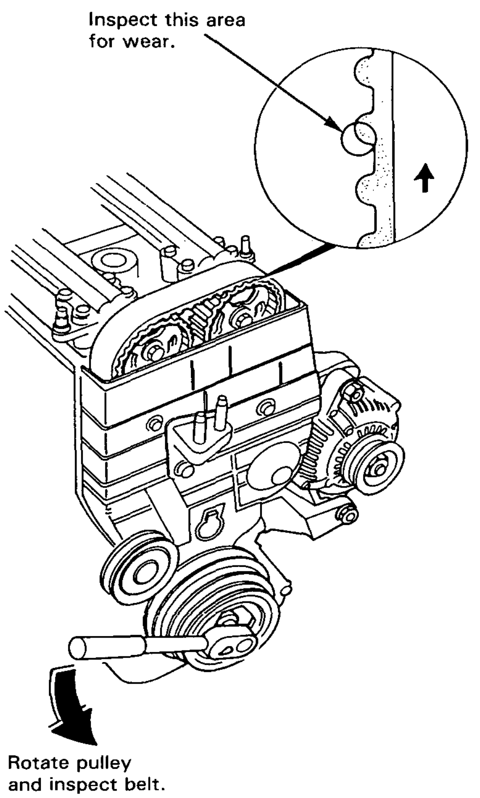


Timing Belt

Inspection

NOTE:
- Replace the belt if oil soaked.
- Remove any oil or solvent that gets on the belt.

1. Remove the cylinder head cover.
2. Inspect the timing belt for cracks and oil soaking.



3. If the pulley bolt loosens while turning the crank, tighten it to specified torque.

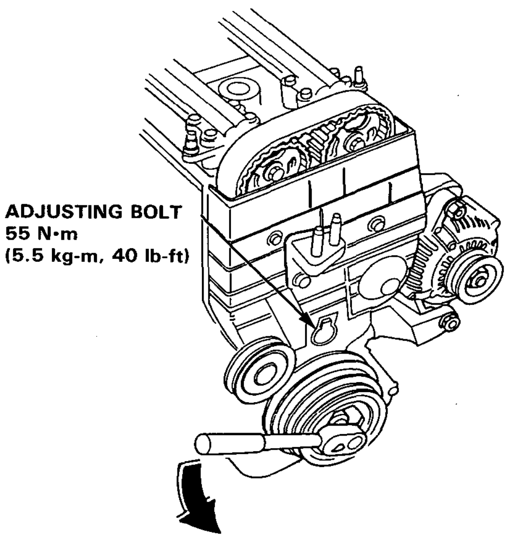
Specified Torque:
180 N•m (18.0 kg-m, 130 lb-ft)

Tension Adjustment

CAUTION: Always adjust the timing belt tension with the engine cold.

NOTE:
- The tensioner is spring-loaded to apply proper tension to the belt automatically after making the following adjustment.
- Always rotate the crankshaft counterclockwise when viewed from the pulley side.
  Rotating it clockwise may result in improper adjustment of the belt tension.

1. Remove the cylinder head cover.
2. Set the No. 1 piston at TDC (page 6-121).
3. Loosen the adjusting bolt 180°.



4. Rotate the crankshaft counterclockwise 3-teeth on the camshaft pulley to create tension on the timing belt.
5. Make sure the timing belt and the cam pulley are engaged securely.
6. Torque the adjusting bolt to 55 N•m (5.5 kg-m, 40 lb-ft).
7. If the pulley bolt loosens while turning the crank, tighten it to specified torque.

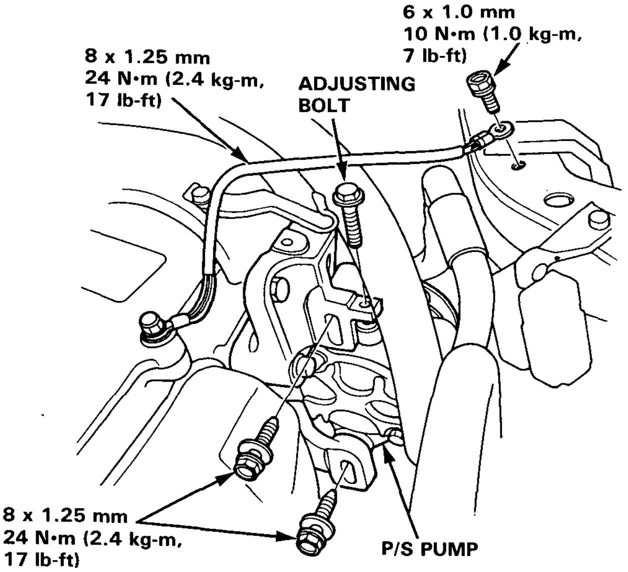
Specified Torque:
180 N•m (18.0 kg-m, 130 lb-ft)

Removal

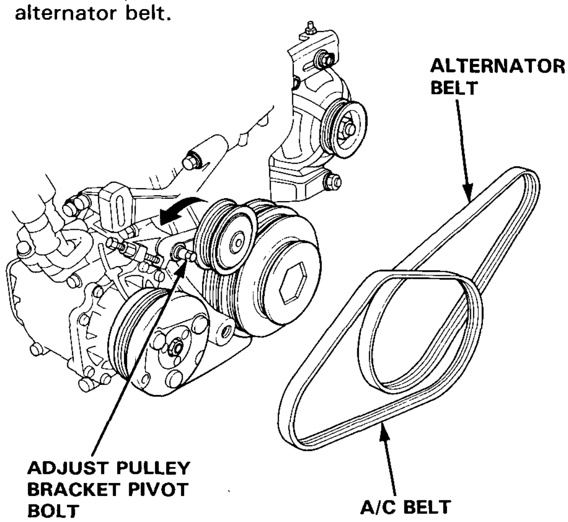
CAUTION: Inspect the water pump when replacing the timing belt.

NOTE:
- Turn the crankshaft so that No. 1 piston is at top-dead-center (page 6-121).
- Before removing the timing belt, mark its direction of rotation if it to be reused.

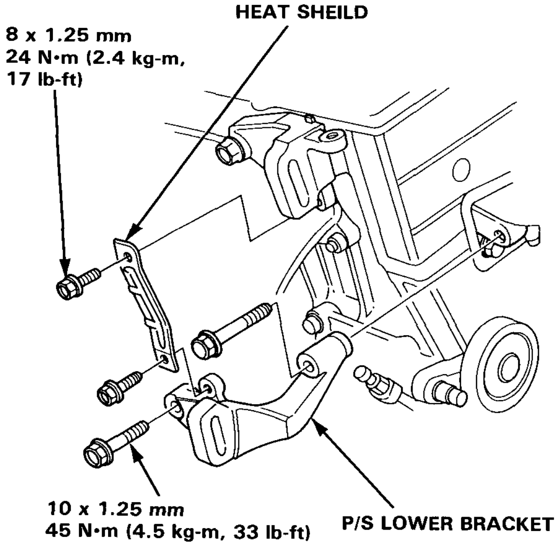
1. Remove the splash shield.
2. Remove the power steering pump.
   - Do not disconnect the P/S hoses.



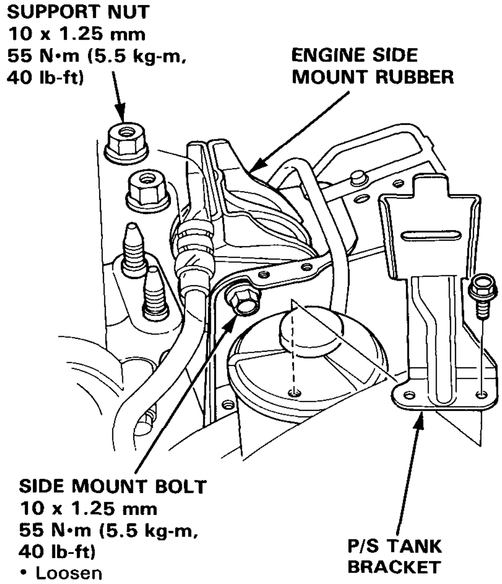
3. Remove the A/C compressor adjust pulley with bracket and the belt (with A/C), then remove the alternator belt.



4. Remove the P/S lower bracket and heat shield.
5. Loosen the alternator adjusting bolt and pivot nut, then remove the belt.



6. Remove the P/S tank bracket.
7. Remove the engine support nuts. Loosen the mount bolt and pivot the engine side mount rubber out of the way.



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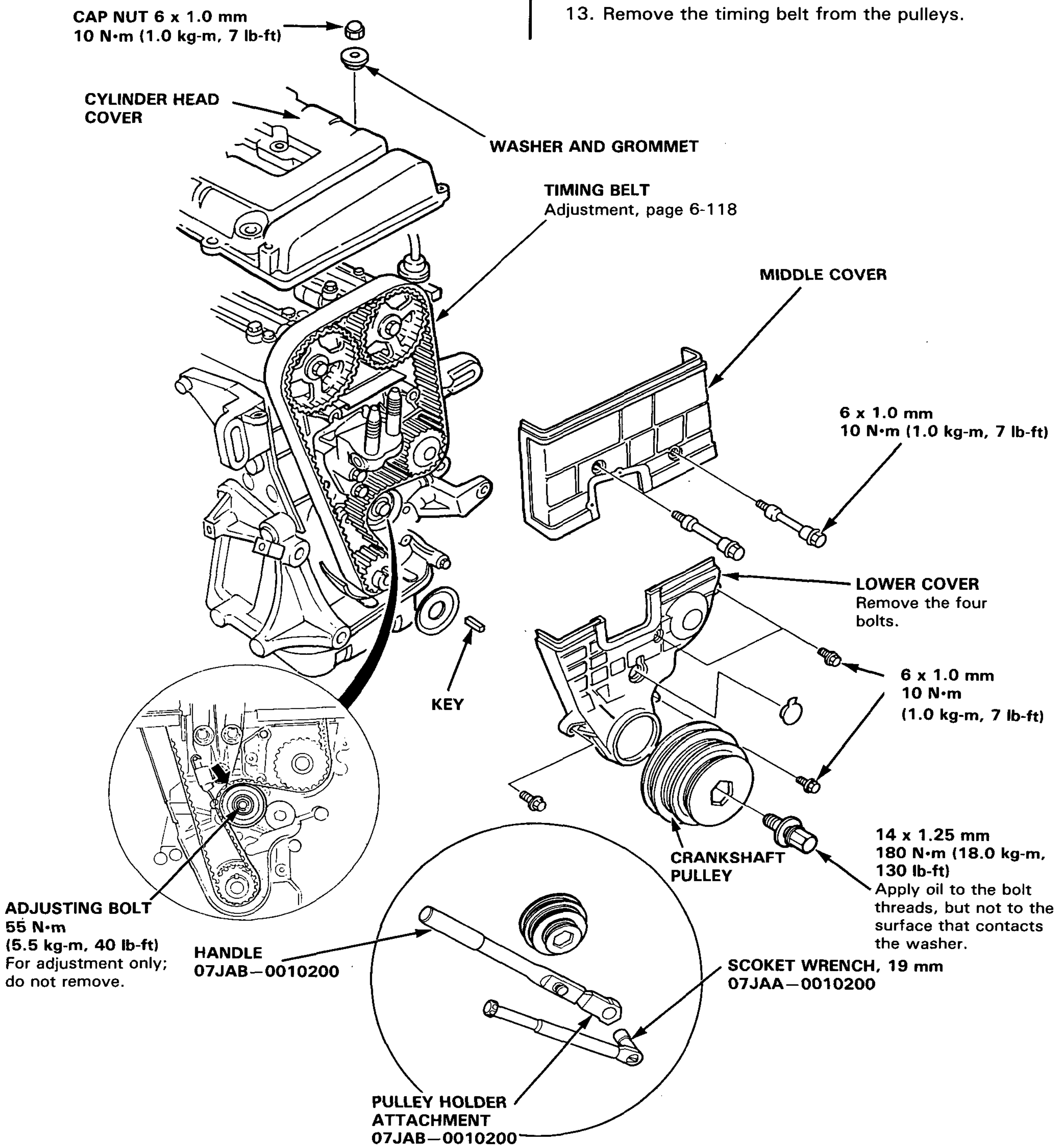
Removal (cont'd)

8. Remove the cylinder head cover.
9. Remove the special bolt and crankshaft pulley.
10. Remove the timing belt middle cover and the lower cover.
11. Loosen the timing belt adjusting bolt 180° to release the belt tension.
12. Push the tensioner to release tension from the belt, then retighten the adjusting bolt.
13. Remove the timing belt from the pulleys.



Installation

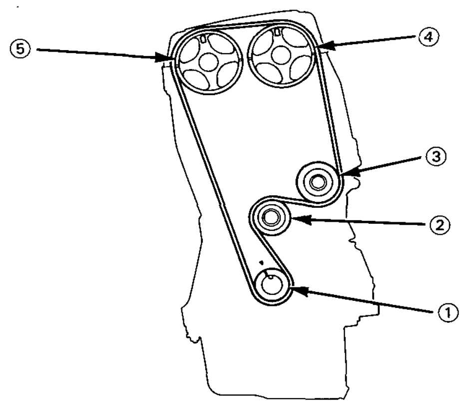
1. Install the timing belt in the reverse order of removal;
   Only key points are described here.

2. Position the crankshaft and the cam pulleys as shown before installing the timing belt.

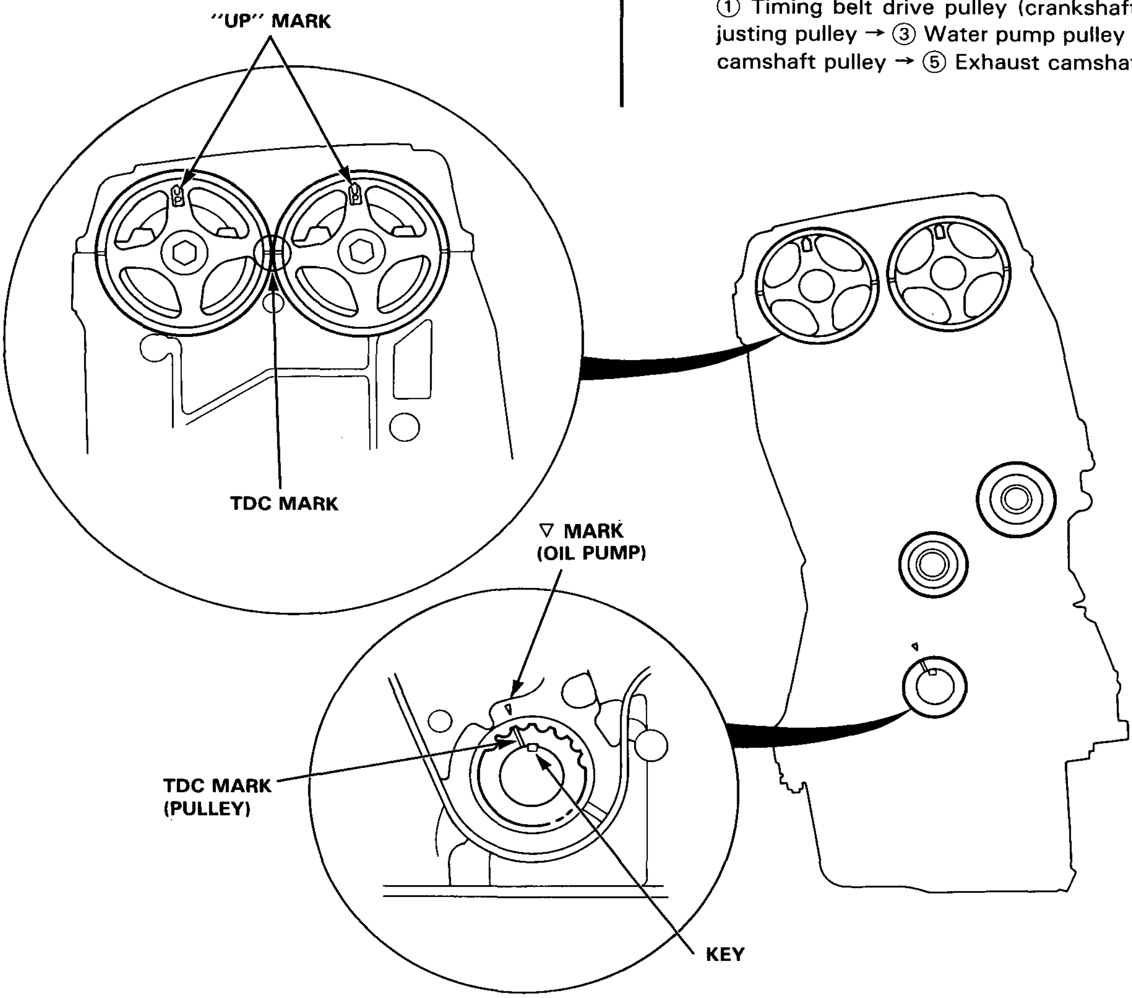
   A Set the crankshaft so that the No. 1 piston is at top-dead-center (TDC).

   NOTE: Align the groove on the teeth side of the timing belt drive pulley to the ▽ pointer on the oil pump.

   B Align the TDC marks of intake and exhaust pulleys.



3. Install the timing belt tightly in the sequence shown.
   ① Timing belt drive pulley (crankshaft) → ② Adjusting pulley → ③ Water pump pulley → ④ Intake camshaft pulley → ⑤ Exhaust camshaft pulley.



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Installation (cont'd)

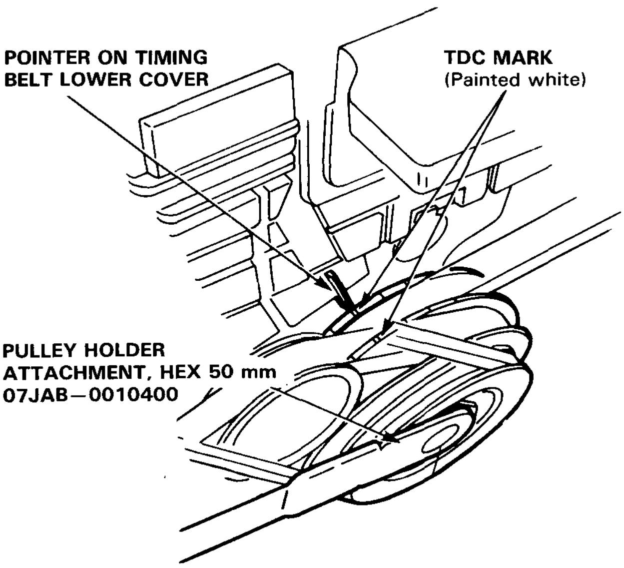
4. Loosen the adjusting bolt, and retighten it after tensioning the belt.

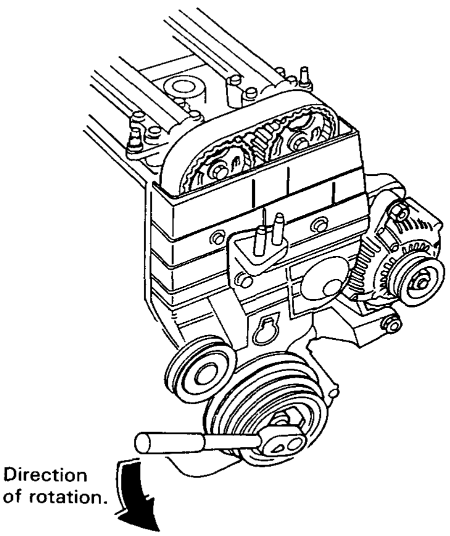
5. Rotate the crankshaft about 4 or 6 turns clockwise so that the belt may fit in position on the pulleys.

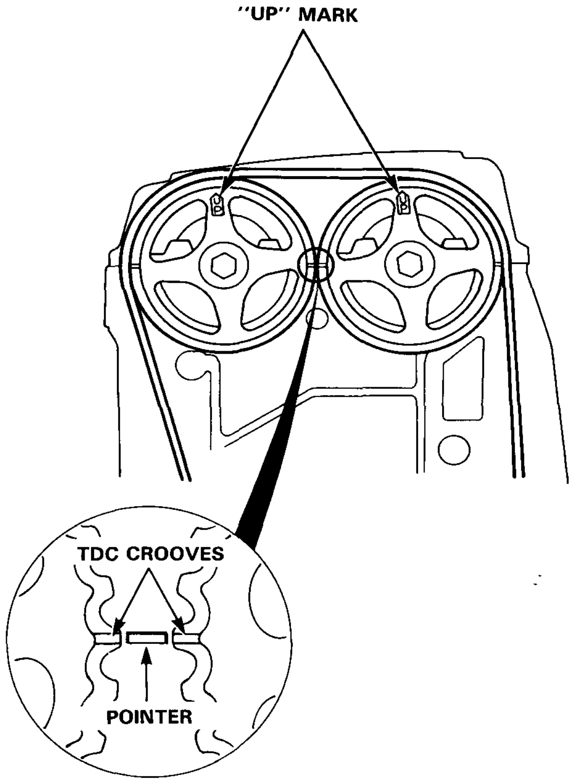
6. Adjust the timing belt tension (page 6-118).

7. Check the crankshaft pulley and the cam pulley at TDC.

   CRANKSHAFT PULLEY:







8. If the cam pulley is not positioned at TDC, remove the timing belt and adjust the positioning following the procedure on page 6-122, then reinstall the timing belt.

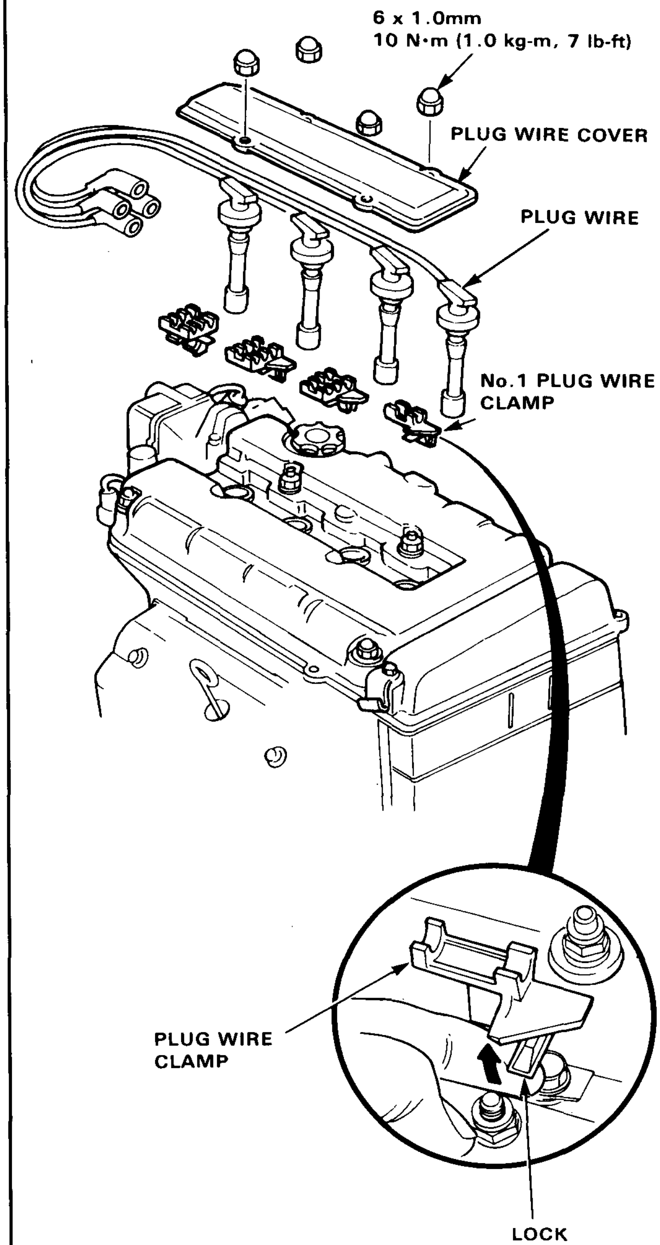
   NOTE: Refer to page 6-119 for timing belt removal.

   After installation, adjust the tension of each belt.
   - See section 23 for alternator belt tension adjustment.
   - See section 22 for A/C compressor belt tension adjustment.
   - See section 17 for P/S pump belt tension adjustment.

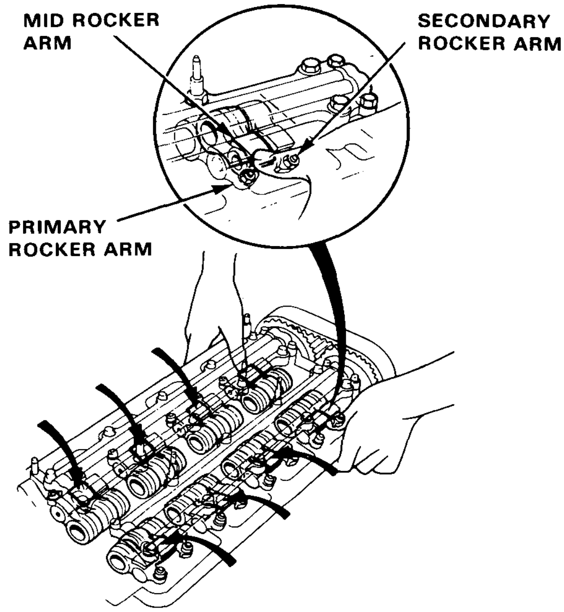
Rocker Arms

Manual Inspection

1. Set the No. 1 cylinder at TDC.
2. Remove the plug wire cover and the plug wires.
3. Remove the plug clamps while pulling up on the lock.



4. Remove the valve cover.
5. Push the mid rocker arm on the No. 1 cylinder manually.
6. Check that the mid rocker arm moves independently of the primary and secondary intake rocker arms.



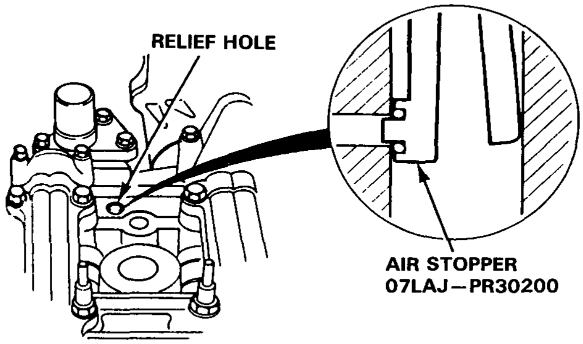
7. Check the mid rocker arm of each cylinder at TDC.
   - If the mid rocker arm does not move, remove the mid primary and secondary rocker arms as an assembly and check that the pistons in the mid and primary rocker arms move smoothly.
   - Replace the rocker arms as an assembly if there is any abnormality.

(cont'd)

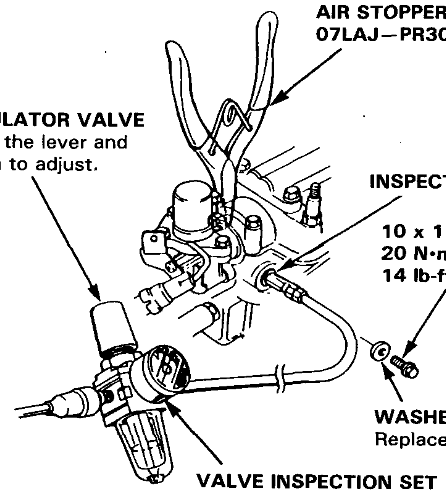
Inspection Using Special Tools

CAUTION:
- **Before using the special tool (Valve Inspection Set), make sure that the air pressure gauge on the air compressor indicates over 250 kPa (2.5 kg/cm², 36 psi).**
- **Inspect the valve clearance before rocker arm inspection.**
- **Cover the timing belt with shop towel to prevent the belt.**
- **Check the mid rocker arm of each cylinder at TDC.**

1. Remove the cylinder head cover.
2. Plug the relief hole with the special tool (Air Stopper).



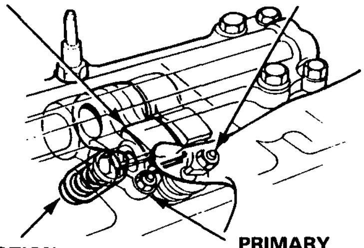
3. Remove the bolt and washer from the inspection hole and connect the special tool (Valve Inspection Set).



4. Apply specified air pressure to the rocker arm pistons after loosening the regulator valve on the valve inspection set.

   Specified Air Pressure:
   250 kPa (2.5 kg/cm², 36 psi)
   — 500 kPa (5.0 kg/cm², 71 psi)

5. Make sure that the intake primary and secondary rocker arms are mechanically connected by pistons and that the mid rocker arms do not move when pushed manually.



   - If the mid rocker arms independently of the primary and secondary rocker arms, replace the rocker arms, as a set.

6. Remove the special tools.

7. Check for smooth operation of the lost motion assembly. It is compressed slightly when the mid rocker arm is lightly pushed and compressed deeply when the mid rocker arm is strongly pushed.
   - Replace the lost motion assembly if it does not move smoothly.

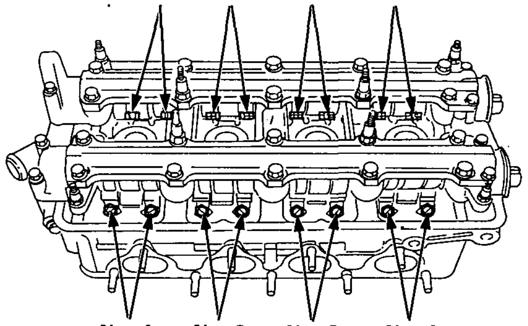
8. After inspection, check that the ECU does not come on.

Valve Clearance

Adjustment

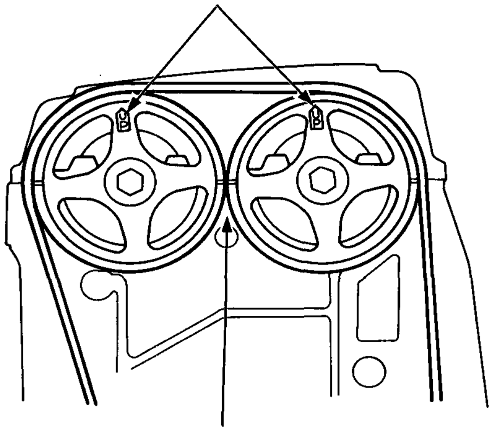
NOTE:
- Valves should be adjusted when the cylinder head temperature is less than 38°C (100° F). Adjustment is the same for intake and exhaust valves.
- If the pulley bolt loosens while turning crank, retorque it to 120 N•m (12.0 kg-m, 87 lb-ft).

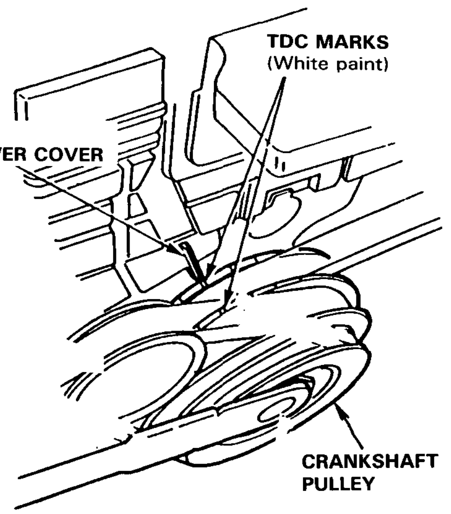
1. Remove cylinder head cover.



2. Set No. 1 piston at TDC. "UP" mark on the pulley should be at top, and TDC grooves on the pulley should align with the pointer on timing belt back cover. TDC grooves (white paint) on the crankshaft pulley should align with pointer on the timing belt lower cover.

Number 1 piston at TDC

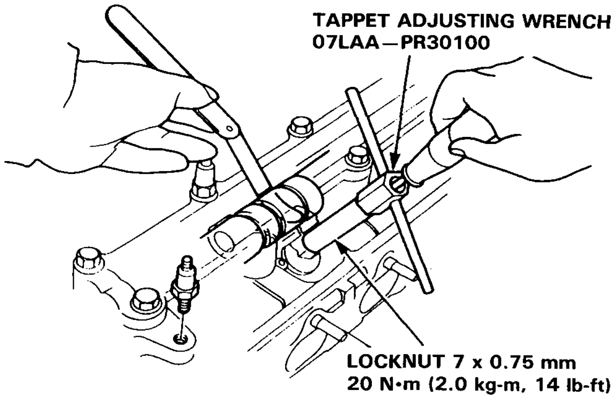




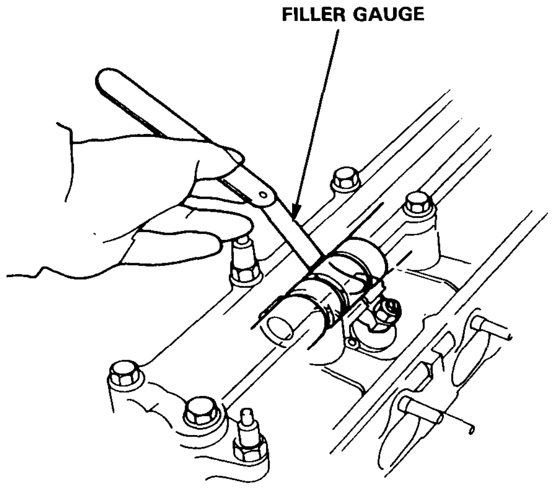
3. Adjust valve clearance on No. 1 cylinder.

   Intake: 0.15—0.19 mm (0.006—0.007 in.)
   Exhaust: 0.17—0.21 mm (0.007—0.008 in.)

4. Loosen the locknut and turn the adjustment screw until feeler gauge slides back and forth with a *slight* amount of drag.

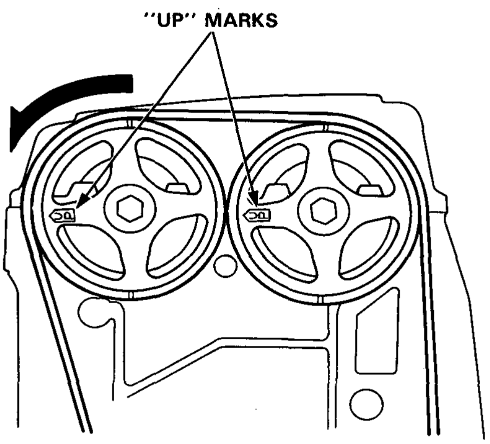


5. Tighten locknut and recheck clearance again. Repeat adjustment if necessary.



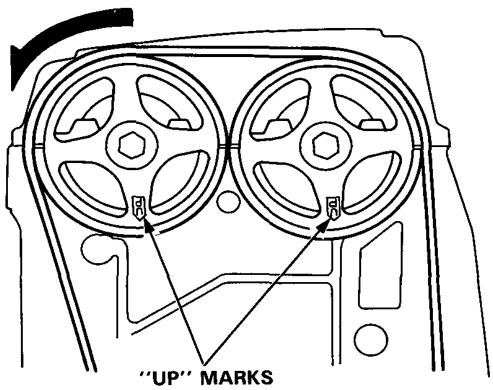
6. Rotate the crankshaft 180° counterclockwise (cam pulley turns 90°). The "UP" mark should be on the exhaust side. Adjust valve on No. 3 cylinder.

Number 3 piston at TDC



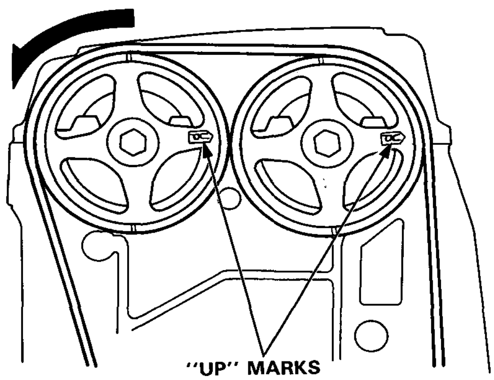
7. Rotate crankshaft 180° counterclockwise to bring No. 4 piston to TDC. Both TDC grooves are once again visible. Adjust valves on No. 4 cylinder.

Number 4 piston at TDC



8. Rotate crankshaft 180° counterclockwise to bring No. 2 piston to TDC. The "UP" marks should be on the intake side. Adjust valves on No. 2 cylinder.

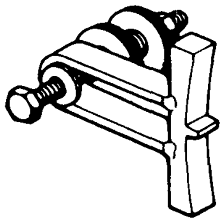
Number 2 piston at TDC



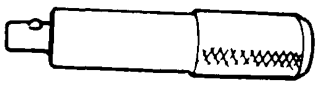
Engine Block

Special Tools

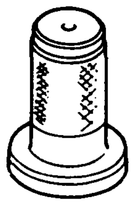
Ref. No.	Tool Number	Description	Qty	Page Reference
①	07LAB–PV00100 or 07924–PD20003	Ring Gear Holder	1	7-6
②	07749–0010000	Driver	1	7-23, 27
③	07947–SB00200	Seal Driver	1	7-23
④	07948–SB00101	Driver Attachment	1	7-23, 27
⑤	07973–PE00200	Pilot Collar	1	7-17, 19
⑥	07LAF–PR30100	Pilot Collar	1	7-17, 20
⑦	07973–PE00310	Piston Pin Driver Shaft	1	7-17, 19, 20
⑧	07973–PE00320	Piston Pin Driver Head	1	7-17, 19, 20
⑨	07973–PE00400	Piston Pin Base Insert	1	7-17, 19
⑩	07GAF–PH60300	Piston Pin Base Insert	1	7-17, 20
⑪	07973–SB00100	Piston Base Head	1	7-17, 19
⑫	07HAF–PL20102	Piston Base Head	1	7-17, 20
⑬	07973–6570500	Piston Base	1	7-17, 20
⑭	07973–6570600	Piston Base Spring	1	7-17



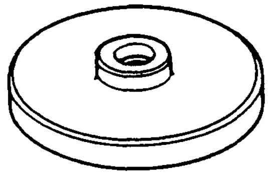
①



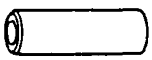
②



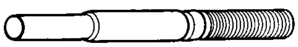
③



④



⑤ ⑥



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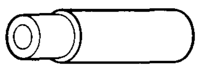

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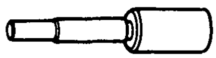
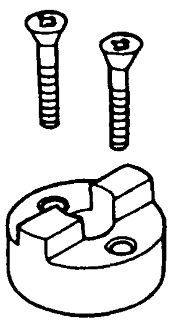
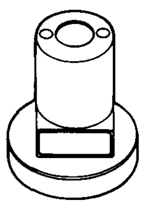


⑨ ⑩



⑪ ⑫



⑬

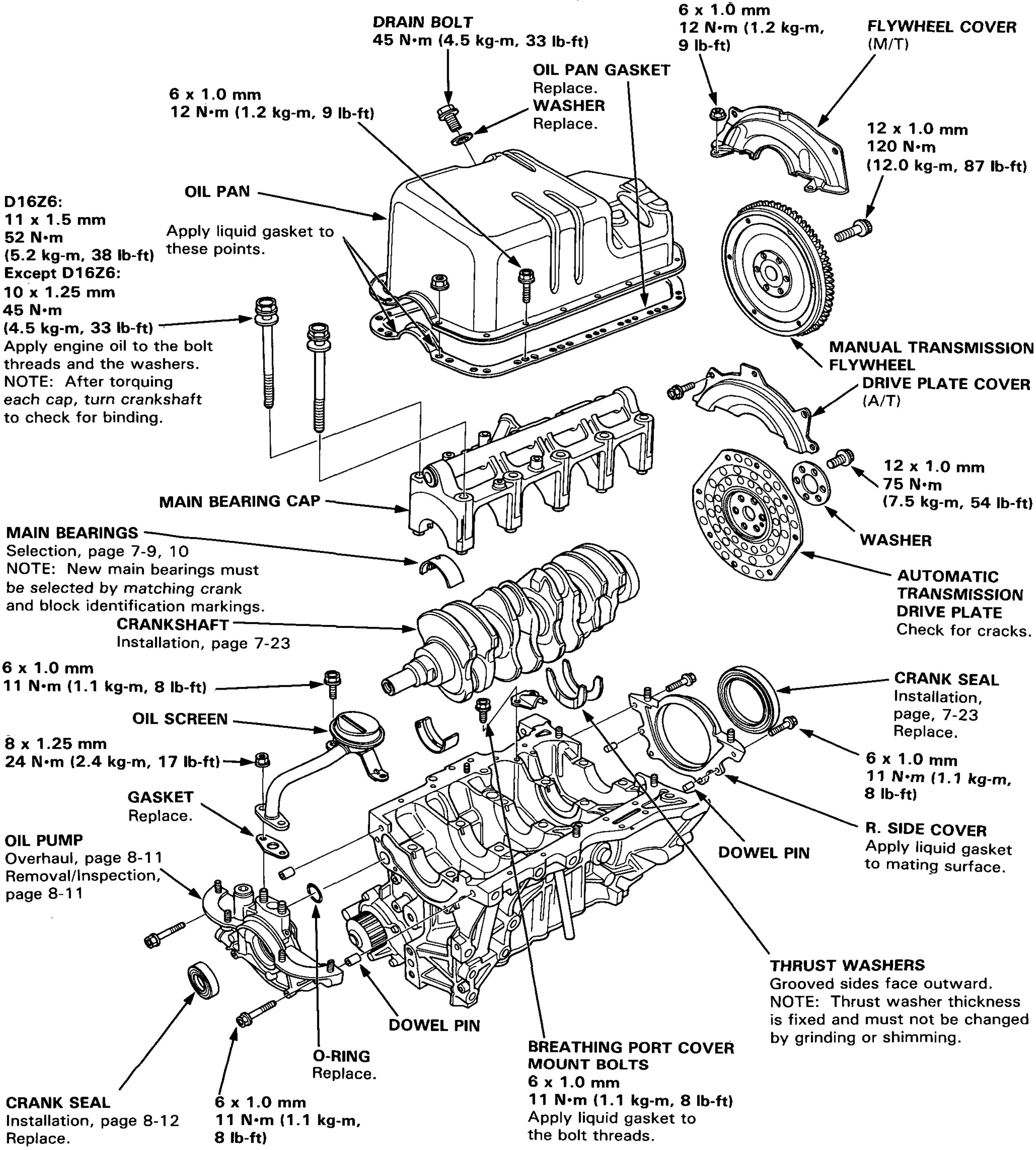
⑭

Engine Block

Illustrated Index/Except B16A

Lubricate all internal parts with engine oil during reassembly.

NOTE:
- Apply liquid gasket to the mating surfaces of the R. side cover and oil pump case before installing them.
- Use liquid gasket, part No. 0Y740−99986.
- D12B, D13B, D15B, D15Z, D16A, D16Z engine is shown, they are similar.

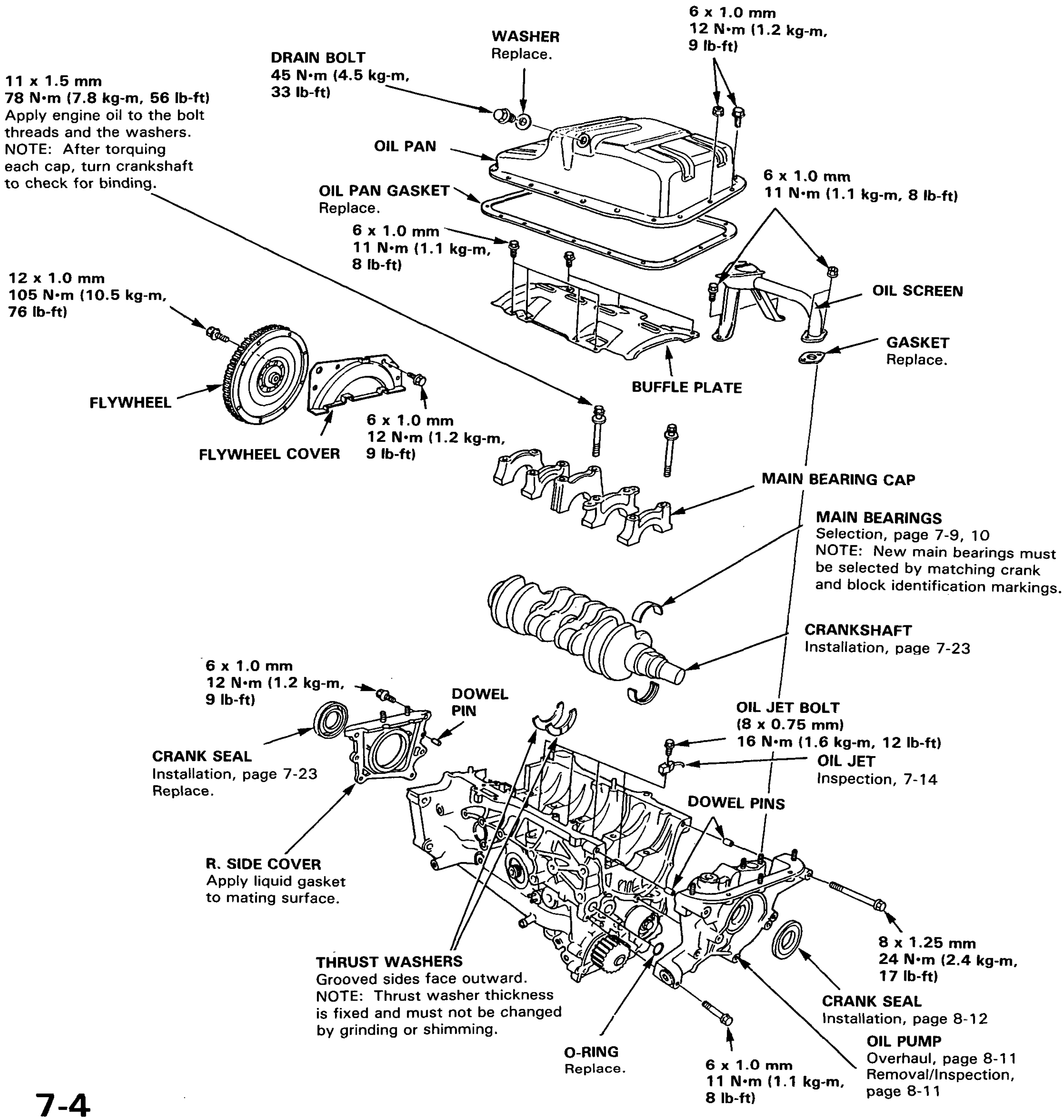


Engine Block

Illustrated Index/B16A

Lubricate all internal parts with engine oil during reassembly.

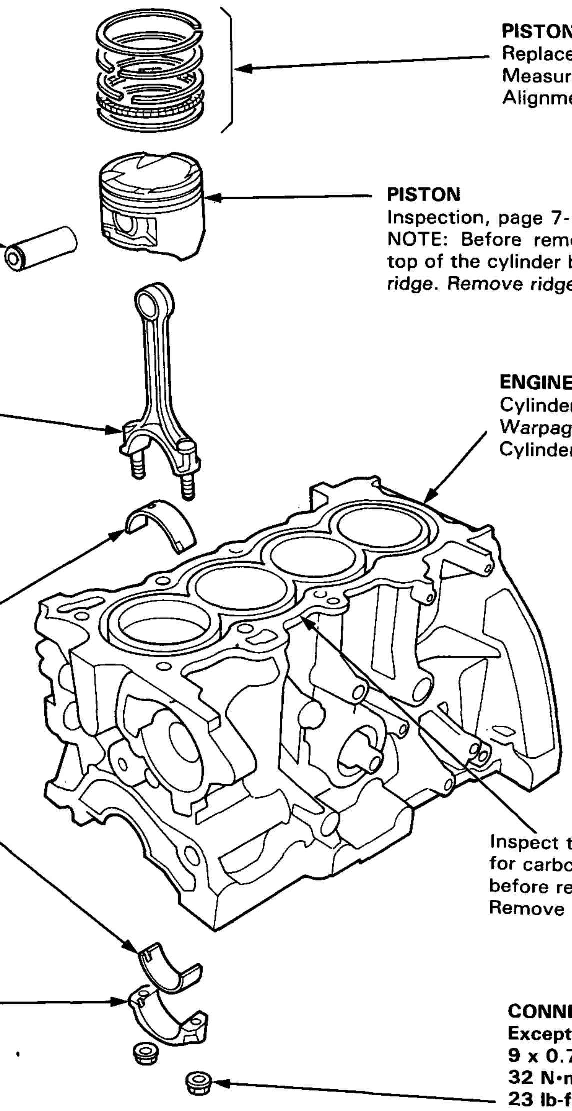
NOTE:
- Apply liquid gasket to the mating surfaces of the R. side cover and oil pump case before installing them.
- Use liquid gasket, part No. 0Y740—99986.



Illustrated Index

NOTE: New rod bearings must be selected by matching connecting rod assembly and crankshaft identification markings (page 7-10).

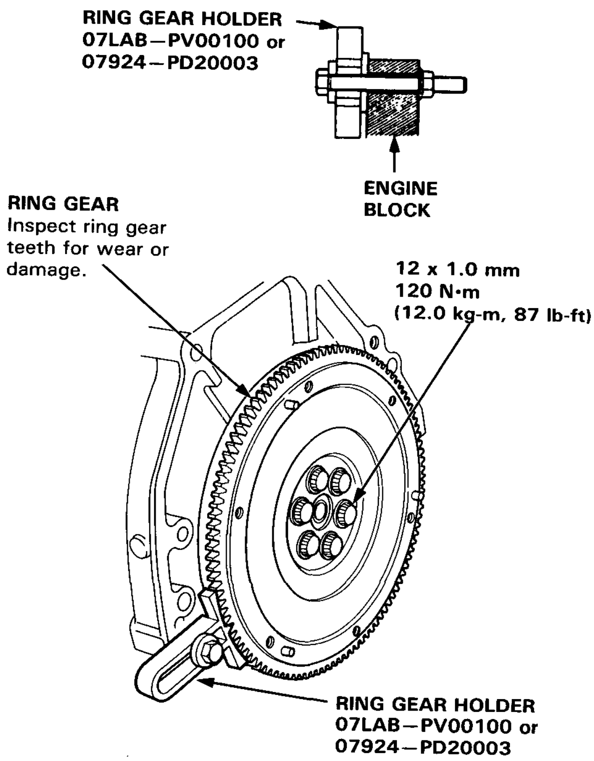
Lubricate all internal parts with engine oil during reassembly.



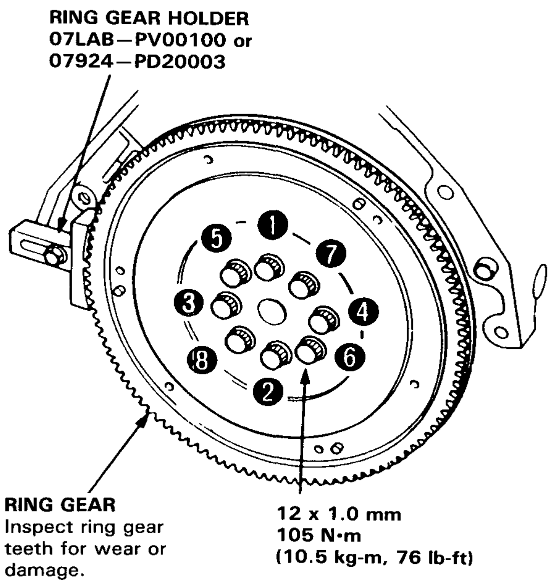
Flywheel and Drive Plate

Replacement

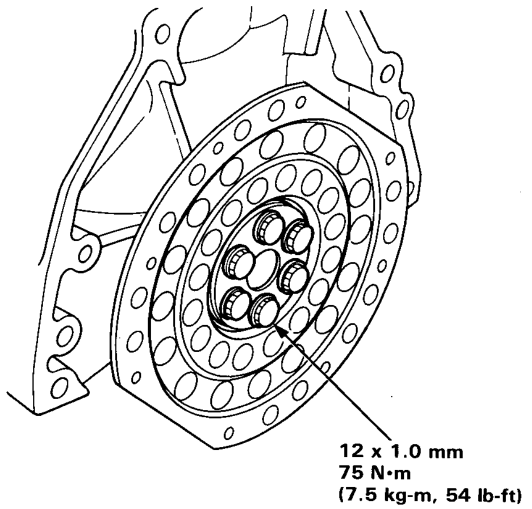
Manual Transmission:
Except B16A:
Remove the six flywheel bolts, then separate the flywheel from the crankshaft flange. After installation, tighten the bolts in the criss-cross pattern.



B16A:



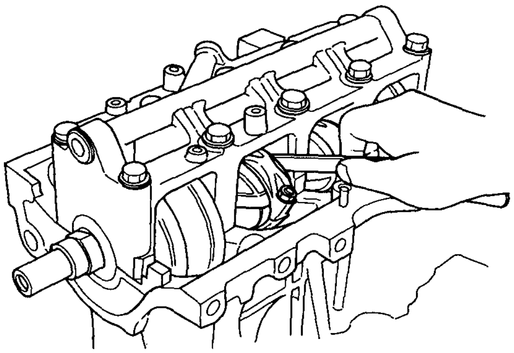
Automatic Transmission:
Remove the six drive plate bolts, then separate the drive plate from the crankshaft flange. After installation, tighten the bolts in the criss-cross pattern.



Connecting Rod and Crankshaft

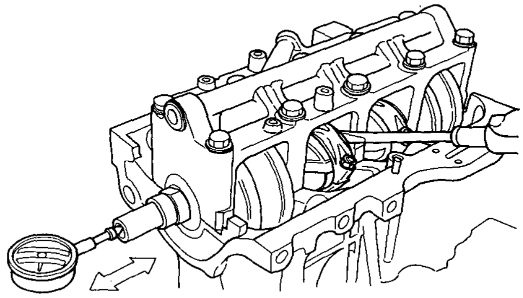
End Play

Connecting Rod End Play:
Standard (New): **0.15–0.30 mm (0.006–0.012 in.)**
Service Limit: **0.40 mm (0.016 in.)**



- If out-of-tolerance, install a new connecting rod.
- If still out-of-tolerance, replace the crankshaft (pages 7-11 and 7-23).

Push the crank firmly away from the dial indicator, and zero the dial against the end of the crank. Then pull the crank firmly back toward the indicator; dial reading should not exceed service limit.



Crankshaft End Play:
Standard (New): **0.10–0.35 mm (0.004–0.014 in.)**
Service Limit: **0.45 mm (0.018 in.)**

- If end play is excessive, inspect the thrust washers and thrust surface on the crankshaft. Replace parts as necessary.

NOTE: Thrust washer thickness is fixed and must not be changed either by grinding or shimming. Thrust washers are installed with grooved side facing outward.

Main Bearings

Clearance

1. To check main bearing clearance, remove the main caps and bearing halves.

2. Clean each main journal and bearing half with a clean shop rag.

3. Place one strip of plastigage across each main journal.

   NOTE: If the engine is still in the car when you bolt the main cap down to check clearance, the weight of the crank and flywheel will flatten the plastigage further than just the torque on the cap bolt, and give you an incorrect reading. For an accurate reading, support the crank with a jack under the counterweights and check only one bearing at a time.

4. Reinstall the bearing and cap, then torque the bolts.

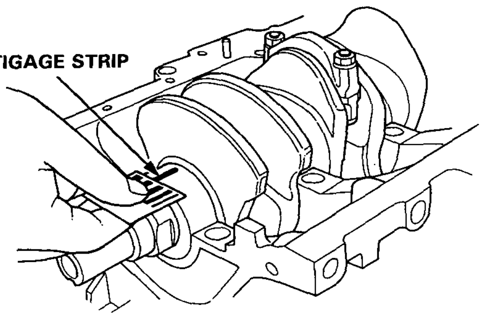
   1st step: 25 N·m (2.5 kg-m, 18 lb-ft)
   Final step:
   D12B, D13B, D15B, D15Z, D16A:
   45 N·m (4.5 kg-m, 33 lb-ft)
   D16Z6: 52 N·m (5.2 kg-m, 38 lb-ft)
   B16A: 78N·m (7.8 kg-m, 66 lb-ft)

   NOTE: Do not rotate the crank during inspection.

5. Remove the cap and bearing again, and measure the widest part of the plastigage.

   Main Bearing Clearance:
   D12B, D13B, D15B, D15Z
   Standard (New):
   No. 1, 5 Journals:
   0.018–0.036 mm (0.0007–0.0014 in.)
   No. 2, 3, 4 Journals:
   0.024–0.042 mm (0.0010–0.0017 in.)
   Service Limit: 0.05 mm (0.002 in.)

   D16A, D16Z
   Standard (New):
   No. 1, 5 Journals:
   0.018–0.036 mm (0.0007–0.0014 in.)
   No. 2, 4 Journals:
   0.024–0.042 mm (0.0010–0.0017 in.)
   No. 3 Journals:
   0.030–0.048 mm (0.0012–0.0019 in.)
   B16A
   Standard (New):
   No. 1, 2, 4, 5 Journals:
   0.024–0.042 mm (0.0010–0.0017 in.)
   No. 3 Journals:
   0.030–0.048 mm (0.0012–0.0019 in.)
   Service Limit: 0.06 mm (0.002 in.)



6. If the plastigage measures too wide or too narrow, (remove the engine if it's still in the car), remove the crank, and remove the upper half of the bearing. Install a new, complete bearing with the same color code (select the color as shown on the next page), and recheck the clearance.

   CAUTION: Do not file, shim, or scrape the bearings or the caps to adjust clearance.

7. If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check again.

   NOTE: If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crank and start over.

Rod Bearings

Clearance

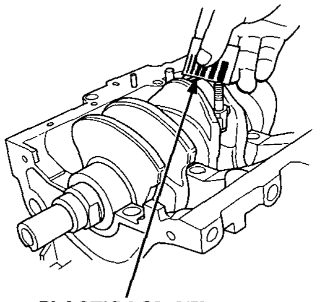
1. Remove the connecting rod cap and bearing half.
2. Clean the crankshaft rod journal and bearing half with a clean shop rag.
3. Place the plastigage across the rod journal.
4. Reinstall the bearing half and cap, and torque the nuts.

   Torque
   Except B16A: 32 N·m (3.2 kg-m, 23 lb-ft)
   B16A: 41 N·m (4.1 kg-m, 30 lb-ft)

   NOTE: Do not rotate the crank during inspection.

5. Remove the rod cap and bearing half and measure the widest part of the plastigage.

   Connecting Rod Bearing Clearance:
   Except B16A
   Standard (New): 0.020–0.038 mm (0.0008–0.0015 in.)
   Service Limit: 0.05 mm (0.002 in.)
   B16A engine
   Standard (New): 0.032–0.050 mm (0.0013–0.0020 in.)
   Service Limit: 0.06 mm (0.0024 in.)



6. If the plastigage measures too wide or too narrow, remove the upper half of the bearing, install a new, complete bearing with the same color code (select the color as shown on the next page), and recheck the clearance.

   CAUTION: Do not file, shim, or scrape the bearings or the caps to adjust clearance.

7. If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check clearance again.

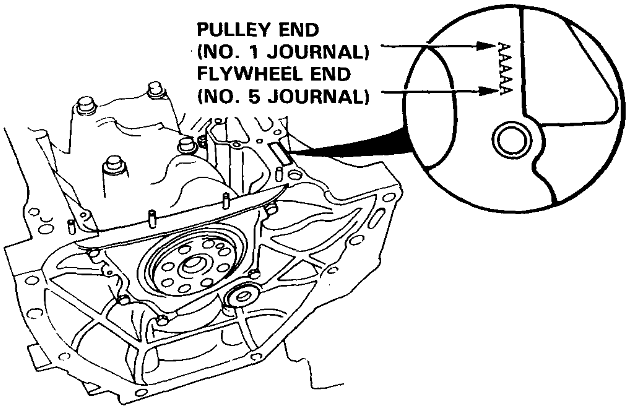
   NOTE: If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crank and start over.

Main Bearing

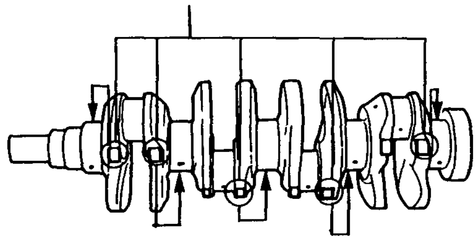
Selection

B16A
Crank Bore Code Location (Marks)

Marks have been stamped on the end of the block as a code for the size of each of the 5 main journal bores. Use then, and the numbers stamped on the crank (codes for main journal size), to choose the correct bearings.



Main Journal Code Locations (Numbers)



Bearing Identification

Color code is on the edge of the bearing → Larger crank bore

→ Smaller bearing (thicker)

↓ Smaller main journal ↓ Smaller bearing (thicker)

	A or I	B or II	C or III	D or IIII
1 or I	Red	Pink	Yellow	Green
2 or II	Pink	Yellow	Green	Brown
3 or III	Yellow	Green	Brown	Black
4 or IIII	Green	Brown	Black	Blue

(cont'd)

Main Bearings

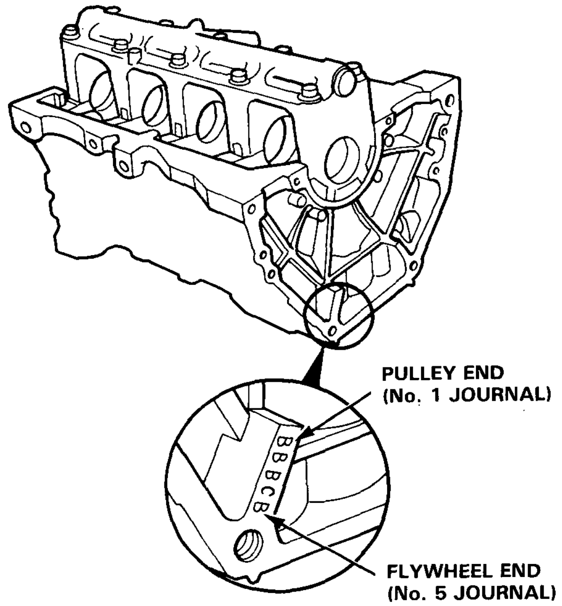
Selection (cont'd)

Except B16A

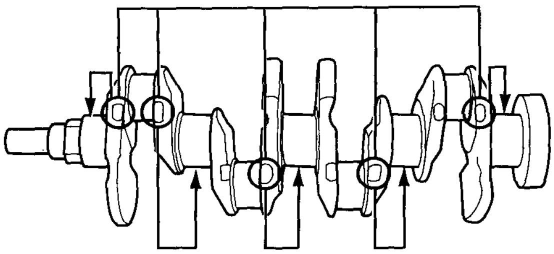
Crank Bore Code Location (Marks)

Marks have been stamped on the end of the block as a code for the size of each of the 5 main journal bores. Use them, and the numbers stamped on the crank (codes for main journal size), to choose the correct bearings.

CAUTION: If the codes are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.



Main Journal Code Location (Numbers)



Bearing Identification

Color code is on the edge of the bearing.

Larger crank bore → (A, B, C, D)

Smaller main journal ↓ (1, 2, 3, 4)

Smaller bearing (thicker) → and ↓

	A	B	C	D
1	Red	Pink	Yellow	Green
2	Pink	Yellow	Green	Brown
3	Yellow	Green	Brown	Black
4	Green	Brown	Black	Blue

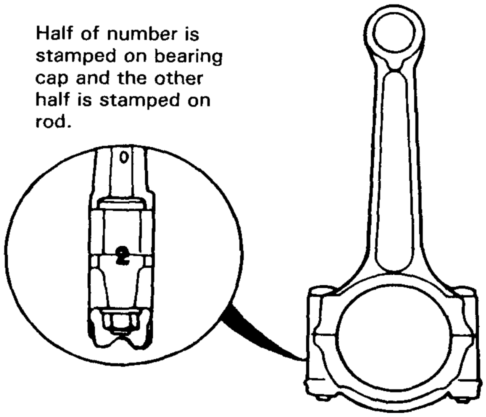
Rod Bearings

Selection

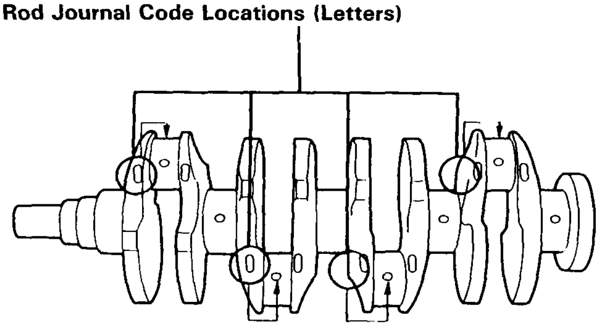
Rod Code Location (Numbers)

Numbers have been stamped on the side of each connecting rod as a code for the size of the big end. Use them, and the letters stamped on the crank (codes for rod journal size), to choose the correct bearings.

CAUTION: If the codes are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.



Rod Journal Code Locations (Letters)



Bearing Identification

Color code is on the edge of the bearing.

Larger big end bore → (1, 2, 3, 4)

Smaller rod journal ↓ (A or I, B or II, C or III, D or IIII)

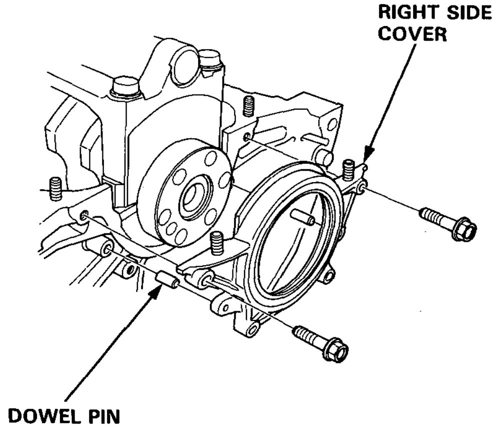
Smaller bearing (thicker) → and ↓

	1	2	3	4
A or I	Red	Pink	Yellow	Green
B or II	Pink	Yellow	Green	Brown
C or III	Yellow	Green	Brown	Black
D or IIII	Green	Brown	Black	Blue

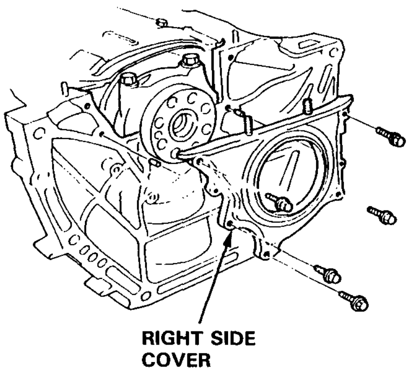
Removal

1. Remove the oil pan assembly.
2. Remove the right side cover.

Except B16A:

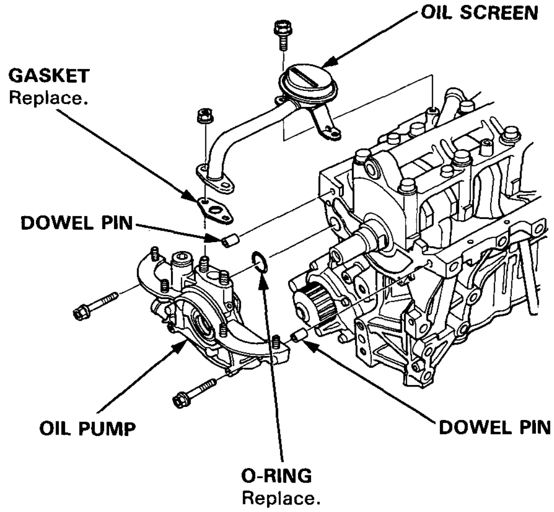


B16A:

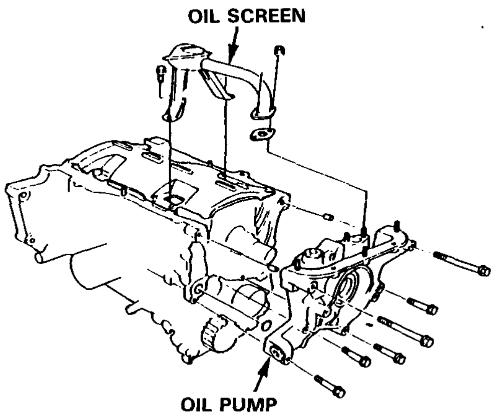


3. Remove the oil screen.
4. Remove the oil pump.

Except B16A:



B16A:



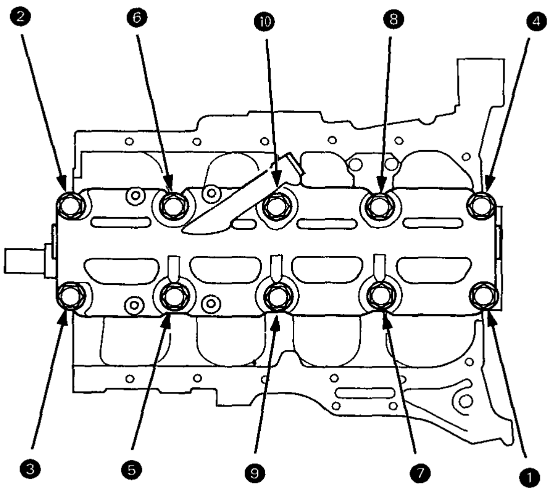
(cont'd)

Removal (cont'd)

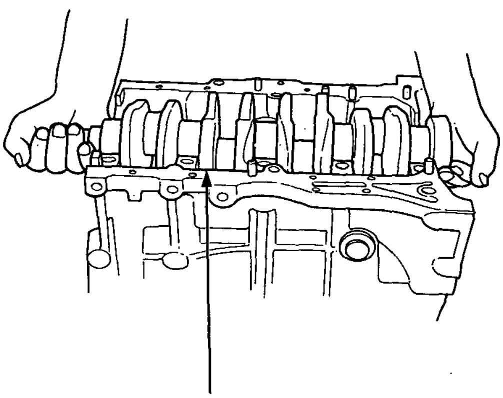
5. Remove the bolts and the bearing cap.

   CAUTION: To prevent warpage, unscrew the bolts in sequence 1/3 turn at a time; repeat the sequence until all bolts are loosened.

MAIN BEARING CAP BOLTS LOOSENING SEQUENCE

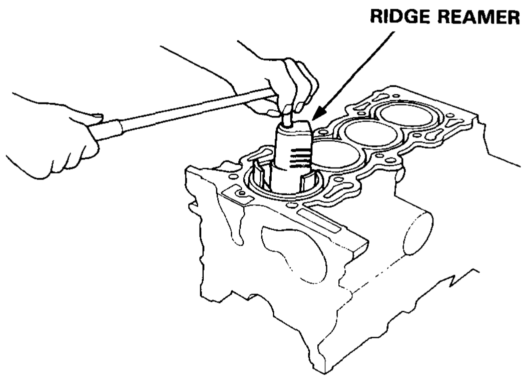


6. Remove the rod caps/bearings and main caps/bearings. Keep all caps/bearings in order.
7. Lift the crankshaft out of the engine, being careful not to damage journals.

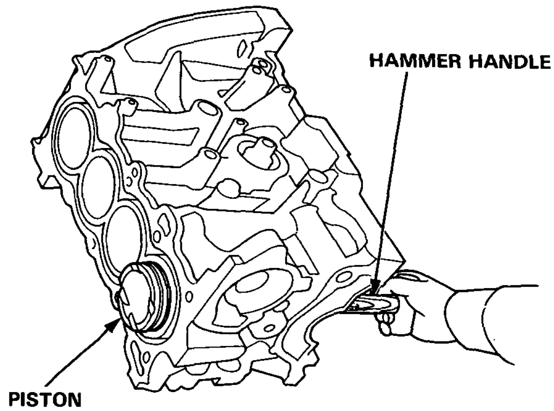


8. Remove the upper bearing halves from the connecting rods and set them aside with their respective caps.
9. Reinstall the main caps and bearings on the engine in proper order.
10. If you can feel a ridge of metal or hard carbon around the top of each cylinder, remove it with a ridge reamer. Follow the reamer manufacturer's instructions.

    CAUTION: If the ridge is not removed, it may damage the pistons as they are pushed out.



11. Use the wooden handle of a hammer to drive the pistons out.



12. Reinstall the rod bearings and caps after removing each piston/connecting rod assembly.
13. Mark each piston/connecting rod assembly with its cylinder number to avoid mixup on reassembly.

    NOTE: The existing number on the connecting rod does not indicate its position in the engine, it indicates the rod bore size.

Crankshaft

Inspection

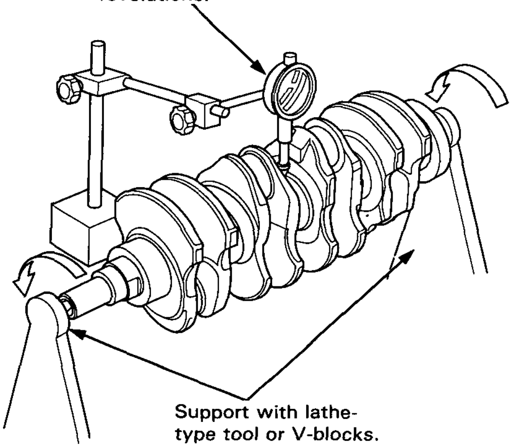
- Clean the crankshaft oil passages with pipe cleaners or a suitable brush.
- Check the keyway and threads.

Alignment

- Measure runout on all main journals to make sure the crank is not bent.
- The difference between measurements on each journal must not be more than the service limit.

Crankshaft Total Indicated Runout:
Except B16A:
Standard (New): **0.015 mm (0.0006 in.) max.**
Service Limit: **0.030 mm (0.0012 in.)**

B16A:
Standard (New): **0.02 mm (0.0008 in.) max.**
Service Limit: **0.03 mm (0.0012 in.)**

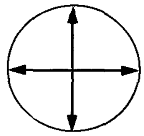


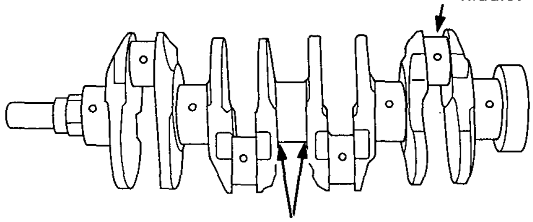
Out-of-Round and Taper

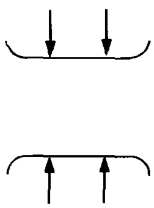
- Measure out-of-round at the middle of each rod and main journal in two places.
- The difference between measurements on each journal must not be more than the service limit.

Journal Out-of-Round:
Except B16A:
Standard (New): **0.0025 mm (0.0001 in.) max.**
Service Limit: **0.010 mm (0.0004 in.)**

B16A:
Standard (New): **0.004 mm (0.0002 in.) max.**
Service Limit: **0.006 mm (0.0002 in.)**







- Measure taper at edges of each rod and main journal.
- The difference between measurements on each journal must not be more than the service limit.

Journal Taper:
Standard (New): **0.005 mm (0.0002 in.) max.**
Service Limit: **0.010 mm (0.0004 in.)**

Oil Jet

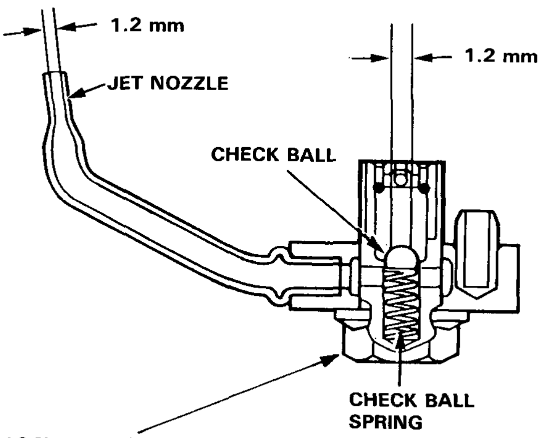
Inspection

NOTE: Inspection for B16A engine.

1. Remove the oil jet and carry out the inspection as follows.

   - Make sure that a drill of 1.1 mm dia can go through the nozzle hole (1.2 mm dia.).
   - Insert the other end of the drill (1.1 mm dia.) from the oil intake (1.2 mm dia.) and check if the check ball moves smoothly and it has a stroke of approximately 4 mm.
   - Confirm that the check ball does not activate by the air pressure of less than 196 kPa (2.0 kg/cm², 28 psi). (Reserve of idle oil pressure).

   NOTE: Replace the assembly if the oil jet nozzle is damaged or bent.



2. When installing, the torque must be ocntrolled accurately.

   Torque: 16 N·m (1.6 kg-m, 12 lb-ft)

Pistons

Inspection

1. Check the piston for distortion or cracks.

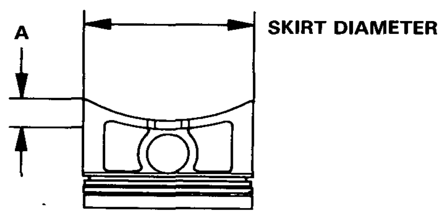
   NOTE: If cylinder is bored, an oversized piston must be used.

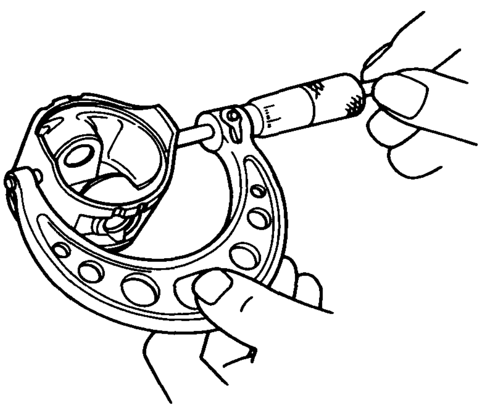
2. Measure piston diameter at a point A from bottom of skirt.

   A: 15 mm (0.59 in.)

   Piston Diameter:
   Except B16A:
   Standard (New): 74.98–74.99 mm (2.9520–2.9524 in.)
   Service Limit: 74.97 mm (2.9516 in.)

   B16A:
   Standard (New): 80.98–80.99 mm (3.1882–3.1886 in.)
   Service Limit: 80.97 mm (3.1879 in.)

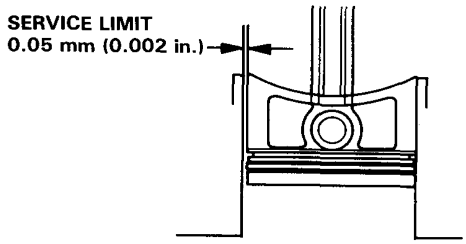




3. Calculate difference between cylinder bore diameter on page 7-15 and piston diameter.

Piston-to-Block Clearance
Except B16A:
Standard (New): 0.01—0.04 mm (0.0004—0.0016 in.)
Service Limit: 0.05 mm (0.002 in.)

B16A:
Standard (New): 0.010—0.035 mm (0.0004—0.0014 in.)
Service Limit: 0.05 mm (0.002 in.)



Oversize Piston Diameter
Except B16A:
0.25: 75.23—75.24 mm (2.9618—2.9622 in.)
0.50: 75.48—75.49 mm (2.9716—2.9720 in.)

B16A:
0.25: 81.23—81.24 mm (3.1980—3.1984 in.)

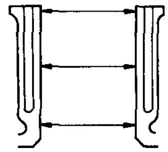
4. Check the piston pin-to-piston clearance. Coat the piston pin with engine oil.
It should then be possible to push the piston pin into the piston hole with thumb pressure.

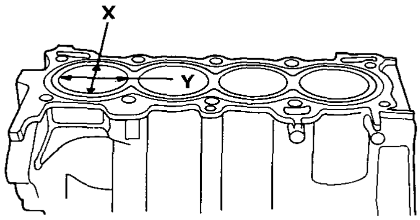
Piston Pin-to-Piston Clearance:
Except B16A:
Service Limit: 0.010—0.022 mm (0.0004—0.0009 in.)

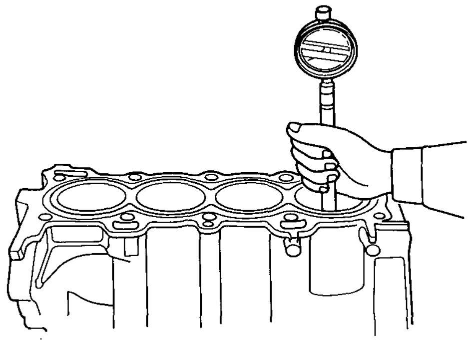
B16A:
Service Limit: 0.010—0.022 mm (0.0004—0.0009 in.)

Inspection

1. Measure wear and taper in directions X and Y at three levels in each cylinder as shown.







Cylinder Bore Size: Except B16A
Standard (New): 75.00—75.02 mm (2.9528—2.9535 in.)
Service Limit: 75.07 mm (2.9555 in.)

Oversize
0.25: 75.25—75.27 mm (2.9626—2.9634 in.)
0.50: 75.50—75.52 mm (2.9724—2.9732 in.)

Bore Taper
Limit: (Difference between first and third measurement) 0.05 mm (0.002 in.)

Cylinder Bore Size: B16A
Standard (New):
X: 81.000—81.020 mm (3.1890—3.1898 in.)
Y: 81.000—81.015 mm (3.1890—3.1896 in.)
Y Measure Point: 50—55 mm (1.97—2.17 in.) from block top surface.
Service Limit: 81.070 mm (3.1917 in.)

Oversize
0.25: 81.25—81.45 mm (3.1988—3.2067 in.)

Bore Taper
Limit: (Difference between first and third measurement) 0.05 mm (0.002 in.)

(cont'd)

Cylinder Block

Inspection (cont'd)

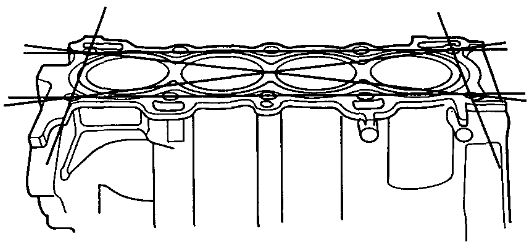
- If measurements in any cylinder are beyond Oversize Bore Service Limit, replace the block.
- If block is to be rebored, refer to Piston Clearance Inspection (page 7-14 and 15) after reboring.

NOTE: Scored or scratched cylinder bores must be honed.

Reboring Limit: 0.50 mm (0.020 in.)

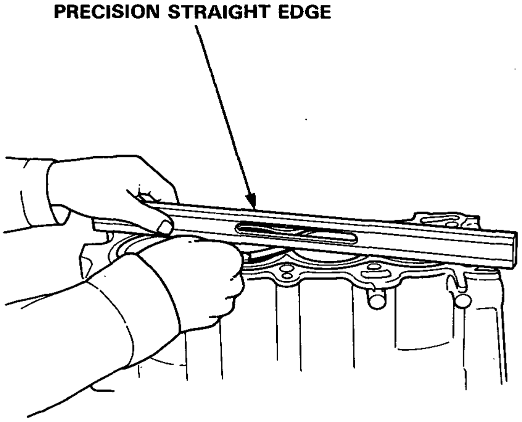
2. Check the top of the block for warpage. Measure along the edges and across the center as shown.

SURFACES TO BE MEASURED



Engine Block Warpage:
Except B16A:
Standard (New): 0.07 mm (0.003 in.) max.
Service Limit: 0.10 mm (0.004 in.)

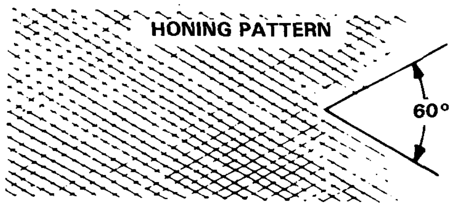
B16A:
Standard (New): 0.05 mm (0.0020 in.)
Service Limit: 0.08 mm (0.0031 in.)



Bore Honing

1. Measure cylinder bores as shown on page 7-15. If the block is to be re-used, hone the cylinders and remeasure the bores.
2. Hone cylinder bores with honing oil and a fine (400 grit) stone in a 60 degree cross-hatch pattern.

NOTE:
- Use only a rigid hone with 400 grit or finer stone such as Sunnen, Ammco, or equivalent.
- Do not use stones that are worn or broken.

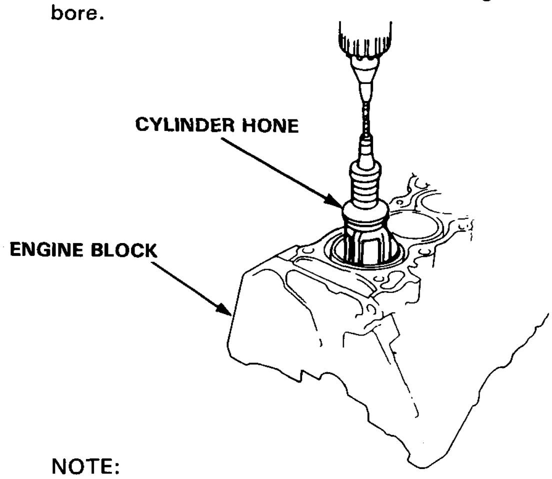


3. When honing is complete, thoroughly clean the engine block of all metal particles. Wash the cylinder bores with hot soapy water, then dry and oil immediately to prevent rusting.

NOTE: Never use solvent, it will only redistribute the grit on the cylinder walls.

4. If scoring or scratches are still present in cylinder bores after honing to service limit, rebore the engine block.

NOTE: Some light vertical scoring and scratching is acceptable if it is not deep enough to catch your fingernail and does not run the full length of the bore.

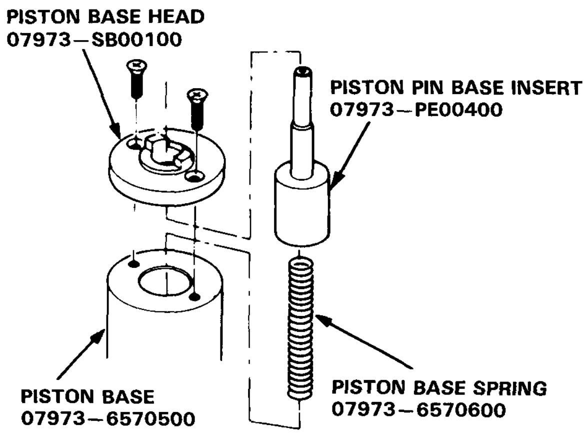


NOTE:
- After honing, clean the cylinder thoroughly with soapy water.
- Only scored or scratched cylinder bores must be honed.

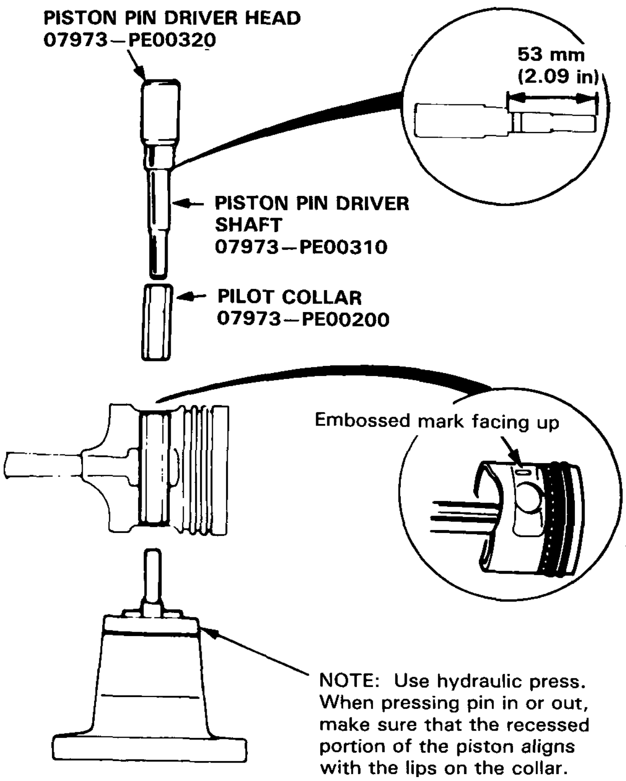
Piston Pins

Removal/Except B16A

1. Assemble the special tools as shown.



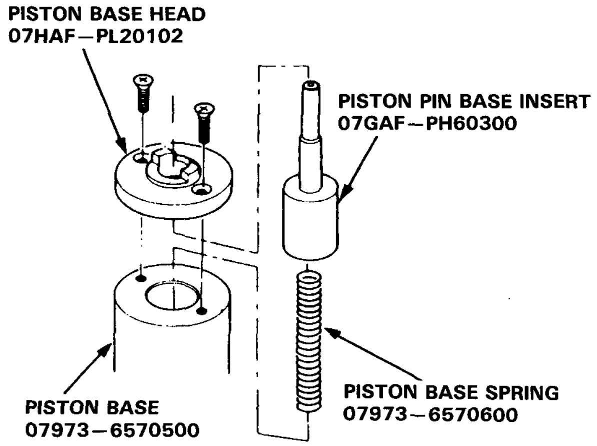
2. Adjust the length of piston pin driver to 53 mm (2.09 in) as shown.



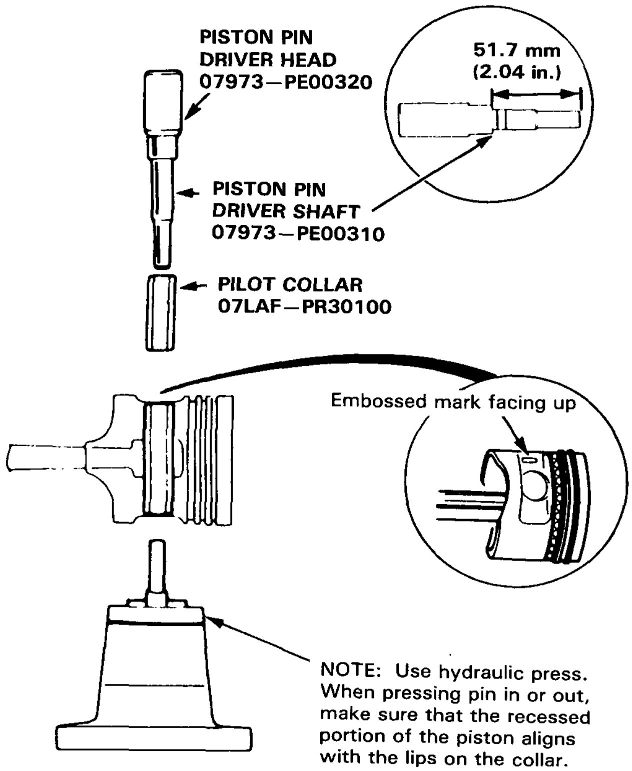
3. Place the piston on the special tool and press the pin out with a hydraulic press.

Removal/B16A

1. Assemble the special tools as shown.



2. Adjust the length of piston pin driver to 51.7 mm (2.04 in) as shown.



3. Place the piston on the special tool and press the pin out with a hydraulic press.

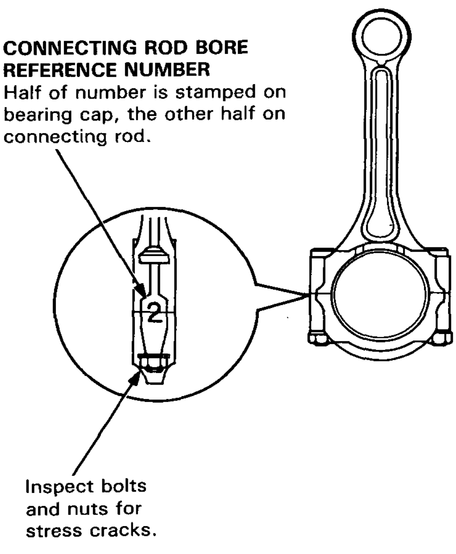
Connecting Rods

Selection

Each rod is sorted into one of four tolerance ranges (from 0 to 0.024 mm, in 0.006 mm increments) depending on the size of its big end bore. It's then stamped with a number (1, 2, 3 or 4) indicating that tolerance. You may find any combination of 1, 2, 3 or 4 in any engine.

Normal Bore Size: D12B, D13B: 43 mm (1.69 in)
D15B, D15Z: 45 mm (1.77 in)
D16A, D16Z, B16B: 48 mm (1.89 in)

NOTE:
- Reference numbers are for big end bore size and do NOT indicate the position of rod in engine.
- Inspect connecting rod for cracks and heat damage.



Piston Pins

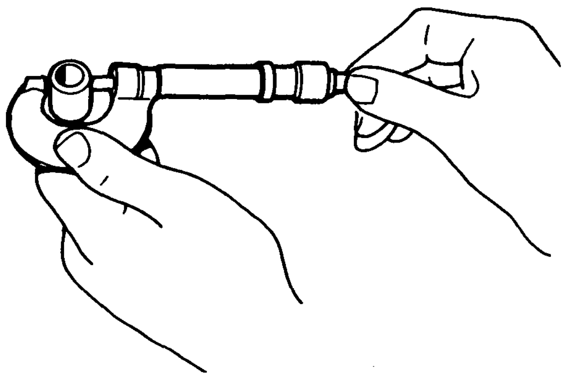
Inspection

1. Measure the diameter of the piston pin.

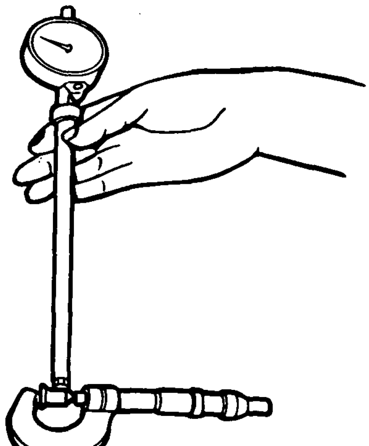
Piston Pin Diameter:
Except B16A:
Standard (New): 18.994–19.000 mm (0.7478–0.7480 in)
Oversize: 18.997–19.003 mm (0.7479–0.7481 in)

B16A:
20.994–21.000 mm (0.8265–0.8268 in)
Oversize: 20.997–21.003 mm (0.8267–0.8269 in)

NOTE: All replacement piston pins are oversize.



2. Zero the dial indicator to the piston pin diameter.

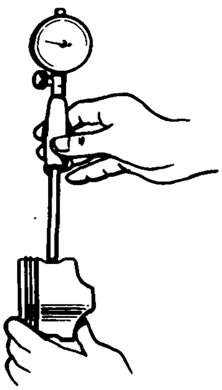


3. Measure the piston pin-to-piston clearance.

   NOTE: Check the piston for distortion or cracks.

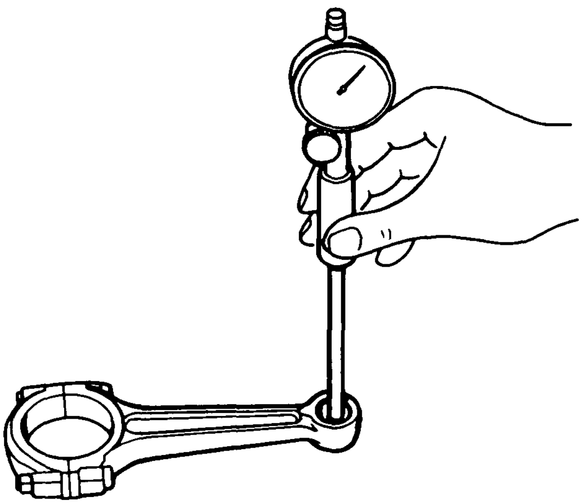
   If the piston pin clearance is greater than 0.024 mm (0.0009 in), remeasure using an oversize piston pin.

   Piston Pin-to-Piston Clearance:
   Service Limit: 0.010–0.022 mm
   (0.0004–0.0009 in)



4. Check the difference between piston pin diameter and connecting rod small end diameter.

   Piston Pin-to-Connecting Rod Interference:
   Except B16A:
   Standard (New): 0.014–0.040 mm
   (0.0006–0.0016 in)
   B16A:
   Standard (New): 0.013–0.032 mm
   (0.0005–0.0013 in.)

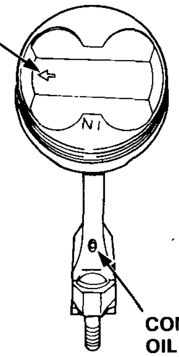


Installation/Except B16A

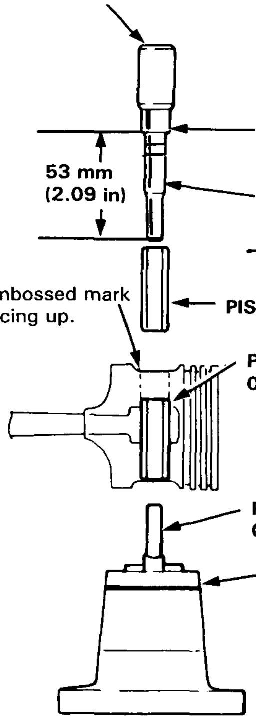
1. Use a hydraulic press for installation.

   - When pressing pin in or out, be sure you position *the recessed flat on the piston against the lugs* on the base attachment.

The arrow must face the timing belt side of the engine and the connecting rod oil hole must face the rear of the engine.



2. Adjust the length of piston pindriver to 53 mm (2.09 in) as shown.

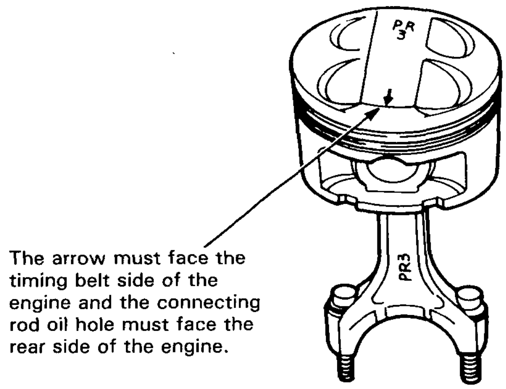


NOTE: Install the assembled piston and rod with the oil hole facing the rear of the engine.

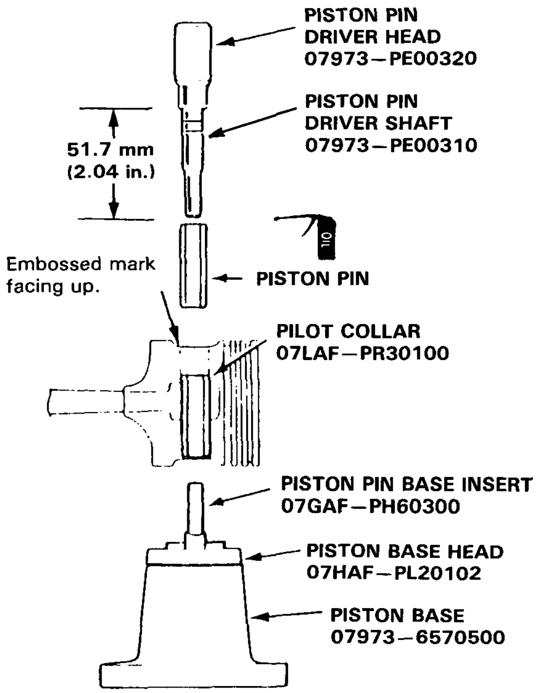
Piston Pins

Installation/B16A

1. Use a hydraulic press for installation.
   - When pressing pin in or out, be sure you position the recessed flat on the piston against the lugs on the base attachment.



2. Adjust the length of piston pin driver to 51.7 mm (2.04 in) as shown.



NOTE: Install the assembled piston and rod with the oil hole facing the rear of the engine.

Piston Rings

End Gap

1. Using a piston, push a new ring into the cylinder bore 15–20 mm (0.6–0.8 in.) from the bottom.
2. Measure the piston ring end-gap with a feeler gauge:
   - If the gap is too small, check to see if you have the proper rings for your engine.
   - If the gap is too large, recheck the cylinder bore diameter against the wear limits on page 7-15. If the bore is over limit, the engine block must be rebored.

Piston Ring End-Gap: Except B16A

Top Ring
Standard (New): 0.15–0.30 mm (0.006–0.012 in.)
Service Limit: 0.60 mm (0.024 in.)

Second Ring
Standard (New): 0.30–0.45 mm (0.012–0.018 in.)
Service Limit: 0.70 mm (0.028 in.)

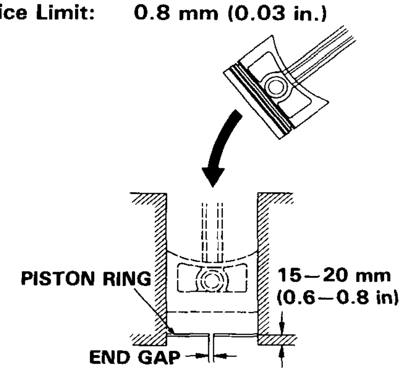
Oil Ring
Standard (New): 0.2–0.7 mm (0.008–0.028 in.)
Service Limit: 0.80 mm (0.032 in.)

Piston Ring End-Gap: B16A

Top Ring
Standard (New): 0.20–0.35 mm (0.008–0.014 in.)
Service Limit: 0.6 mm (0.02 in.)

Second Ring
Standard (New): 0.40–0.55 mm (0.016–0.022 in.)
Service Limit: 0.7 mm (0.03 in.)

Oil Ring
Standard (New): 0.20–0.45 mm (0.008–0.018 in.) TEIKOKU PISTON RING made
0.20–0.50 mm (0.008–0.020 in.) RIKEN made
Service Limit: 0.8 mm (0.03 in.)



Replacement

1. Using a ring expander, remove the old piston rings.
2. Clean all ring grooves thoroughly.

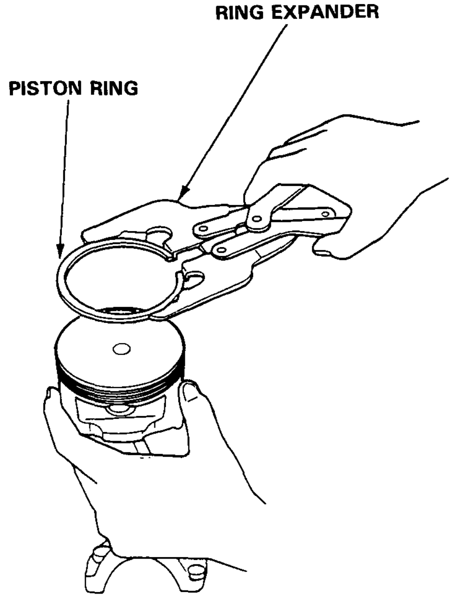
   NOTE:
   - Use a squared-off broken ring or ring groove cleaner with blade to fit piston grooves.
   - Top ring groove is 1.0 mm (0.039 in.) wide (D15Z1 and B16A) or 1.2 mm (0.047 in.) wide (except D15Z1 and B16A).
   - Second ring groove is 1.2 mm (0.047 in.) wide (D15Z1 and B16A) or 1.5 mm (0.059 in.) wide (except D15Z1 and B16A).
   - Oil ring groove is 2.8 mm (0.11 in.) wide.
   - File down blade if necessary.

   CAUTION: Do not use a wire brush to clean ring lands, or cut ring lands deeper with cleaning tool.

   NOTE: If piston is to be separated from connecting rod, do not install new rings yet.

3. Install new rings in proper sequence and position (page 7-22).

   NOTE: Do not reuse old piston rings.

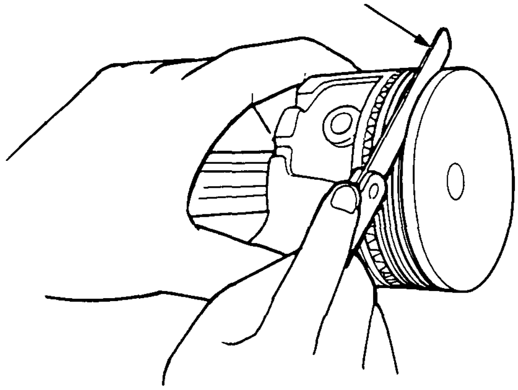


Land Clearances

After installing a new set of rings, measure ring-to-land clearances:

Top Ring Clearance
Standard (New):
D15Z1: 0.030–0.055 mm (0.001–0.002 in.)
B16A: 0.045–0.070 mm (0.0018–0.0028 in.)
Except D15Z1 and B16A:
0.035–0.060 mm (0.001–0.002 in.)
Service Limit: 0.13 mm (0.005 in.)

Second Ring Clearance
Standard (New):
Except B16A:
0.035–0.055 mm (0.001–0.002 in.)
B16A: 0.045–0.070 mm (0.0018–0.00281 in.)
TEIKOKU PISTON RING made
0.040–0.065 mm (0.0015–0.0026 in.)
RIKEN made
Service Limit: 0.13 mm (0.005 in.)

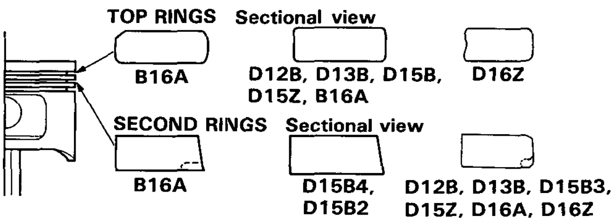


Piston Rings

Alignment

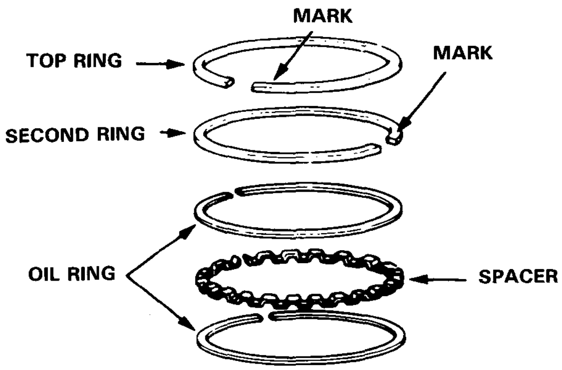
1. Install the rings as shown.

   Identify top and second rings by the chamfer on the edge, and make sure they are in proper grooves on piston.

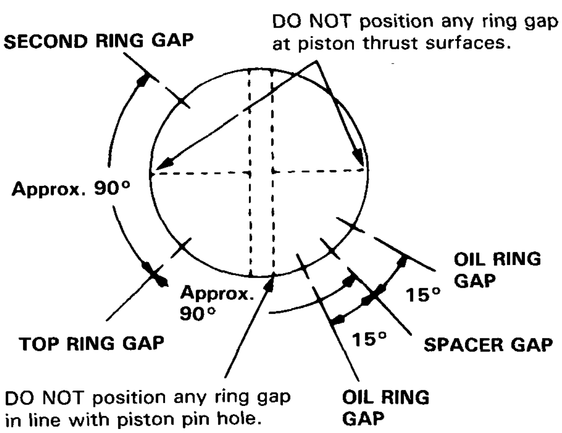


2. Rotate the rings in grooves to make sure they do not bind.

3. The manufacturing marks must be facing upward.



4. Position the ring end gaps as shown:



Pistons

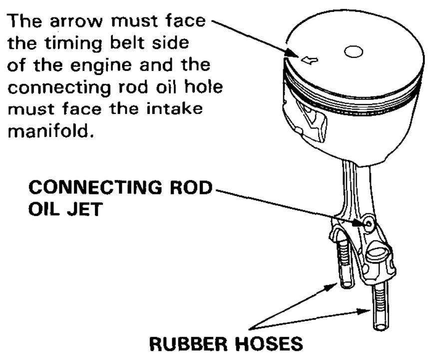
Installation

Before installing the piston, apply a coat of engine oil to the ring grooves and cylinder bores.

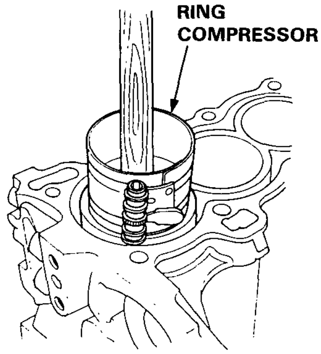
1. If the crankshaft is already installed:
   - Remove the connecting rod caps and slip short sections of rubber hose over the threaded ends of the connecting rod bolts.
   - Install the ring compressor, check that the bearing is securely in place, then position the piston in the cylinder and drive it in using the wooden handle of a hammer.
   - Stop after the ring compressor pops free and check the connecting rod-to-crank journal alignment before driving piston into place.
   - Install the rod caps with bearings, and torque the nuts.

   Torque:
   Except B16A: 33 N·m (3.3 kg-m, 23 lb-ft)
   B16A: 41 N·m (4.1 kg-m, 30 lb-ft)

2. If the crankshaft is not installed:
   - Remove the rod caps and bearings, install the ring compressor, then position the piston in the cylinder and drive it in using the wooden handle of a hammer.
   - Position all pistons at top dead center.



NOTE: Maintain downward force on the ring compressor to prevent rings from expanding before entering the cylinder bore.

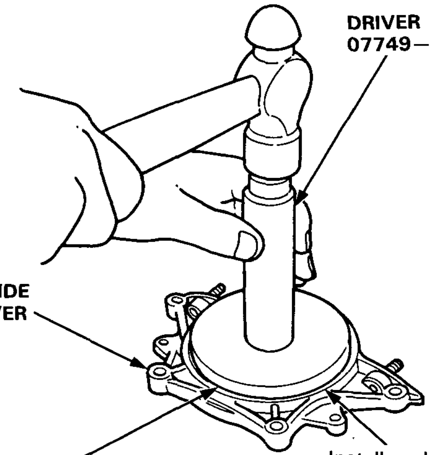


Oil Seal

Installation

The seal surface on the block should be dry.
Apply a light coat of oil to the crankshaft and to the lip of seal.

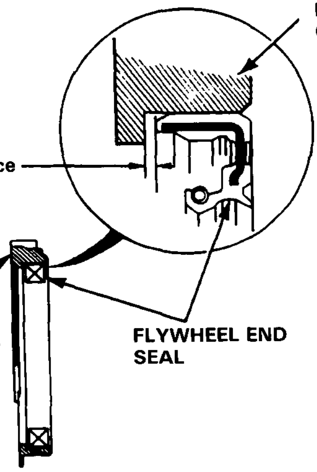
1. Using the special tool, drive flywheel-end seal into the right side cover.



2. Confirm clearance is equal all the way around with a feeler gauge.

   Clearance: Except B16A:
   0.2–0.8 mm (0.01–0.03 in.)

   B16A: 0.5–0.8 mm (0.02–0.03 in.)



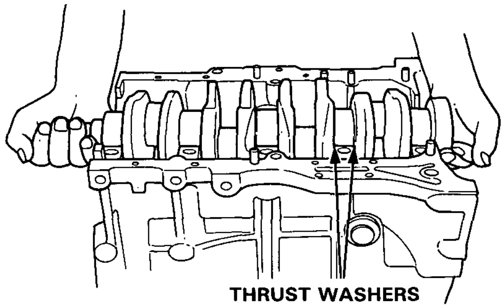
NOTE: Refer to page 8-13 for installation of the oil pump side oil seal.

Crankshaft

Installation

Before installing the crankshaft, apply a coat of engine oil to the main bearings and rod bearings.

1. Insert bearing halves in the engine block and connecting rods.
2. Hold the crankshaft so rod journals for cylinders No. 2 and No. 3 are straight down.
3. Lower the crankshaft into the block, seating the rod journals into connecting rods No. 2 and No. 3, and install the rod caps and nuts finger-tight.



4. Rotate the crankshaft clockwise, seat journals into connecting rods No. 1 and No. 4, and install the rod caps and nuts finger-tight.

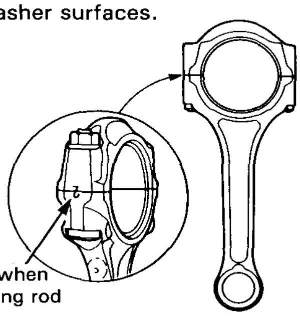
   NOTE: Install caps so the bearing recess is on the same side as the recess in the rod.

5. Check rod bearing clearance with plastigage (page 7-7), then torque the capnuts.

   Torque:
   Except B16A:
   32 N·m (3.2 kg-m, 23 lb-ft)
   B16A: 41 N·m (4.1 kg-m, 30 lb-ft)

   NOTE: Reference numbers on connecting rod are for big-end bore tolerance and do not indicate the position of piston in the engine.

6. Install the thrust washers on the No. 4 journal. Oil the thrust washer surfaces.



(cont'd)

Installation (cont'd)

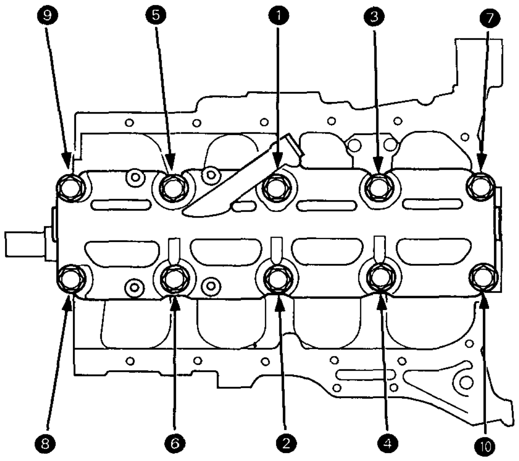
7. Install the main bearing caps.
   Check clearance with plastigage (page 7-9), then tighten the bearing cap bolts in 2 steps.

   First step: 25 N·m (2.5 kg-m, 18 lb-ft)
   Second step: Except D16Z6 and B16A
   45 N·m (4.5 kg-m, 33 lb-ft)
   D16Z6: 52 N·m (5.2 kg-m, 38 lb-ft)
   B16A: 78 N·m (7.8 kg-m, 56 lb-ft)

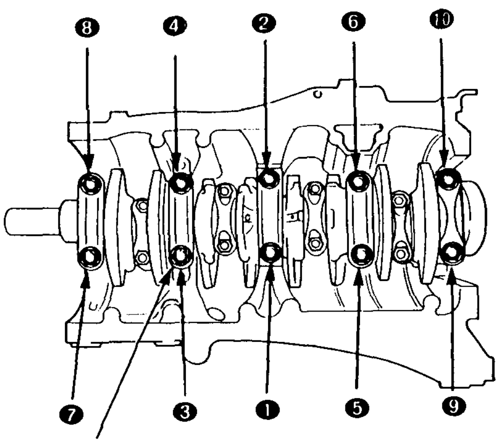
   NOTE: Coat the thrust washer surfaces and bolt threads with oil.

MAIN BEARING CAP BOLTS TIGHTENING SEQUENCE

Except B16A:



B16A:



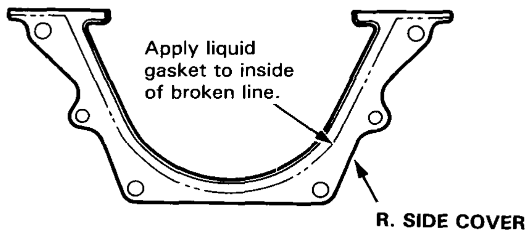
NOTE: The No.3 bearing bolts are longer bolts.

8. Install the baffle plate.
   (B16A only)

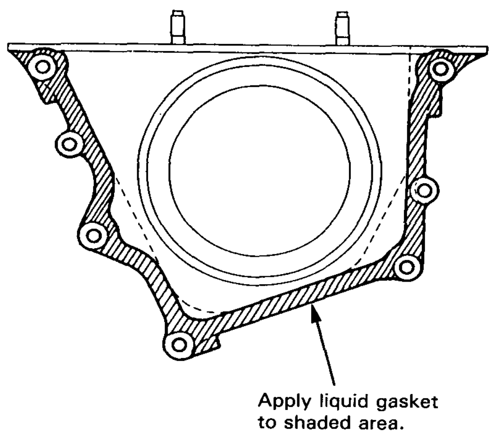
9. Apply liquid gasket to the block mating surface of the right side cover.

   NOTE:
   - Use liquid gasket, Part No. 0Y740−99986.
   - Check that the mating surfaces are clean and dry before applying liquid gasket.
   - Apply liquid gasket by starting with an even band, centered between edges of the mating surface.
   - To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
   - Do not apply liquid gasket to O-ring grooves.
   - Do not install the parts if 20 minutes or more have elapsed since applying liquid gasket. Instead, reapply liquid gasket after removing old residue.
   - After assembly, wait at least 30 minutes before filling the engine with oil.
   - Apply a light coat of oil to the crankshaft and to the lip of seal.
   - Use a new O-ring and apply oil when installing it.

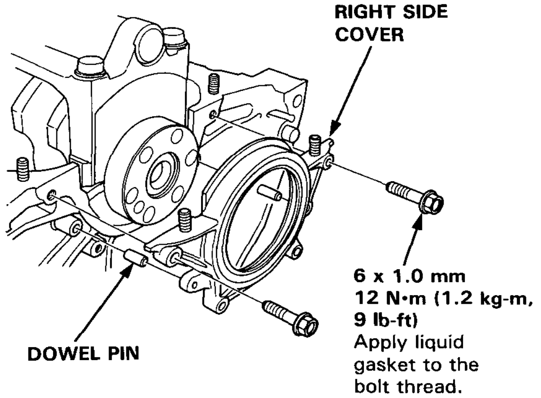
Except B16A:



B16A:



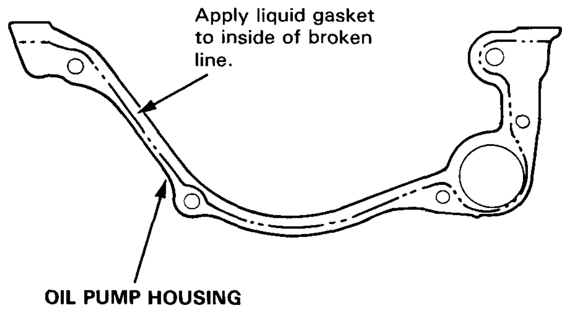
10. Install the R. side cover on the engine block.



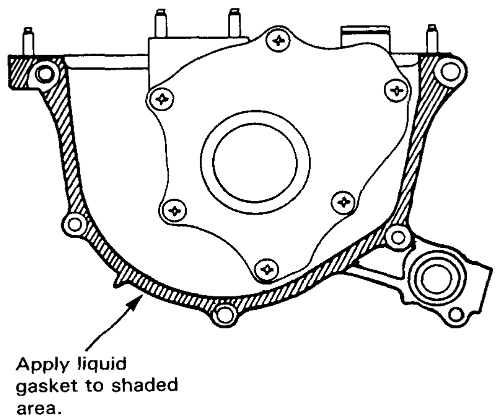
11. Apply liquid gasket to the block mating surface of the oil pump, then install it on the engine block.

    NOTE: Do not apply liquid gasket to O-ring grooves.

Except B16A:



B16A:

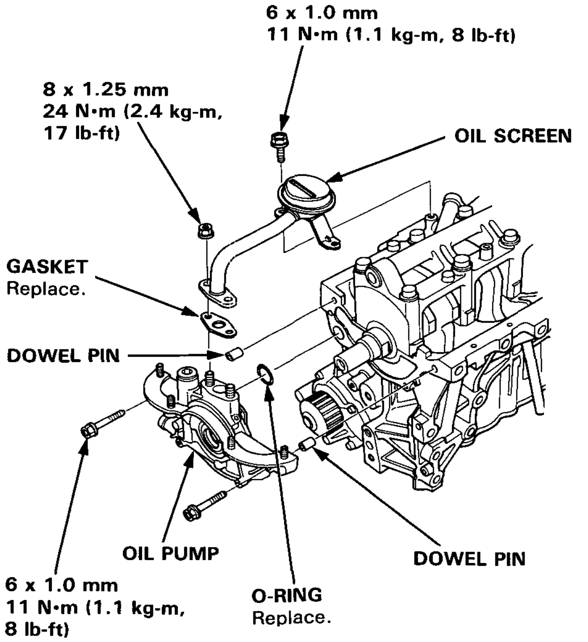


(cont'd)

Installation (cont'd)

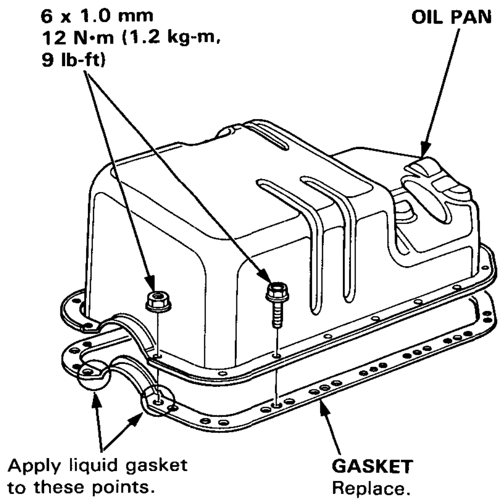
NOTE:
- Apply a light coat of oil to the crankshaft and to the lip of seal.
- Use new O-rings and apply oil when installing them.

12. Install the oil screen.



13. Install the oil pan gasket and the oil pan.

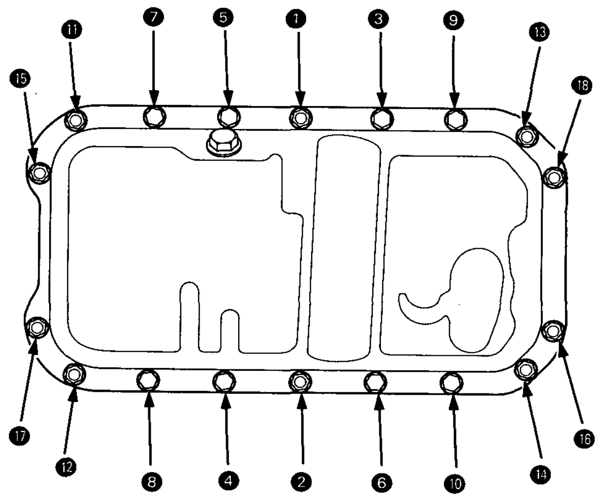
 NOTE: Use a new oil pan gasket.



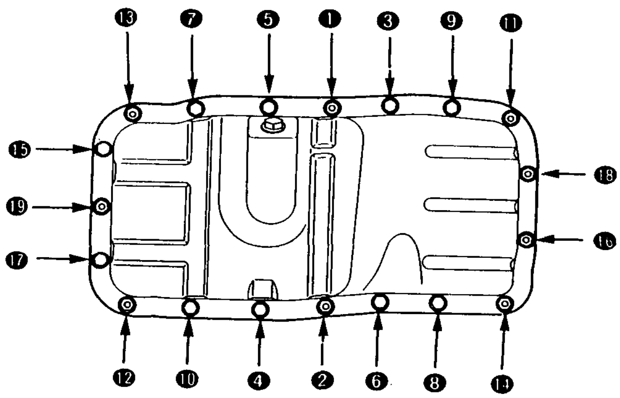
14. Tighten the oil pan bolts and nuts as shown.

OIL PAN BOLTS/NUTS TORQUE SEQUENCE
6 x 1.0 mm
12 N·m (1.2 kg-m, 9 lb-ft)

Except B16A:



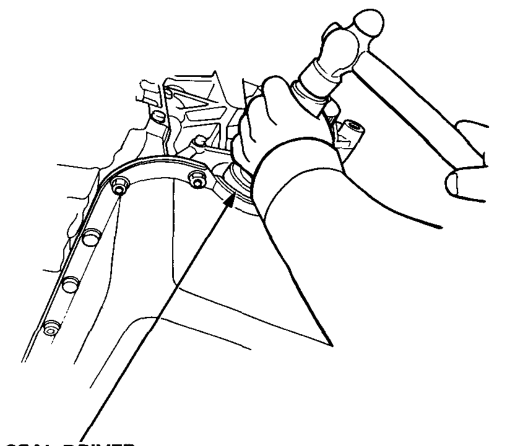
B16A:



Installation

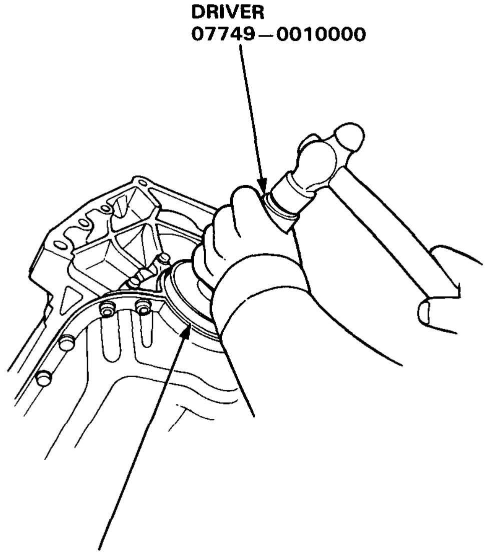
NOTE:
- Engine removal is not required.
- The seal surface on the block should be dry.
  Apply a light coat of grease to the crankshaft and to the lips of the seals.

1. Using the special tool, drive in the timing pulley-end seal until the driver bottoms against the oil pump. When the seal is in place, clean any excess grease off the crankshaft and check that the oil seal lip is not distorted.



2. Measure the flywheel-end seal thickness and the oil seal housing depth. Using special tool, drive the flywheel-end seal into the rear cover to the point where the clearance between the bottom of the oil seal and the rear cover is 0.2–0.8 mm (0.01–0.03 in) (page 7-18).

   NOTE: *Align the hole in the driver attachment with* the pin on the crankshaft.



Oil Pan

Replacement (4WD)

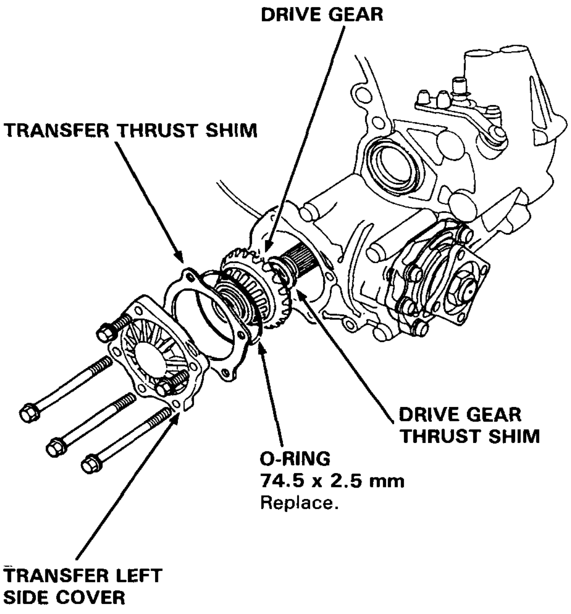
WARNING

- **Make sure jacks and safety stands are placed properly and hoist brackets are attached to correct positions on the engine. (See Section 1)**
- **Apply parking brake and block rear wheels, so car will not roll off stands and fall on you while working under it.**

Removal:

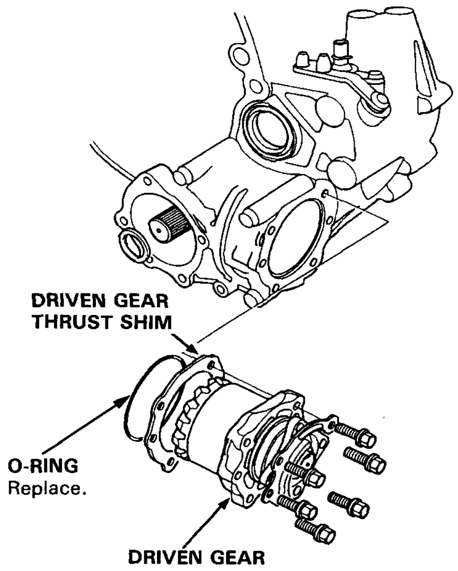
1. Remove the engine splash shield (page 5-15).
2. Drain the engine oil.
3. Drain the transmission oil/fluid.
4. Remove the exhaust pipe A (page 5-21).
5. Disconnect the propeller shaft at the transmission (page 5-8).
6. Remove the L. side cover protector. (A/T only)
7. Remove the transfer left side cover from the transfer housing.

   NOTE: Be careful not to damage the thrust shim and mating surface.



8. Remove the driven gear from the transfer case.

   NOTE: Be careful not to damage the thrust sim and mating surface.

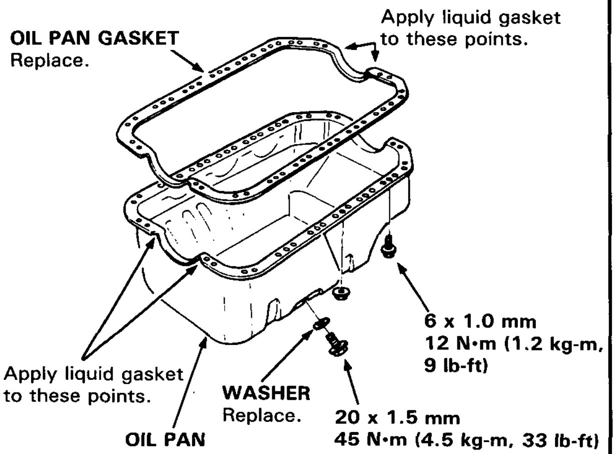


9. Remove the transfer case from the clutch housing.
10. Remove the clutch case cover.
11. Remove the oil pan by removing the bolts and nuts.

Installation:

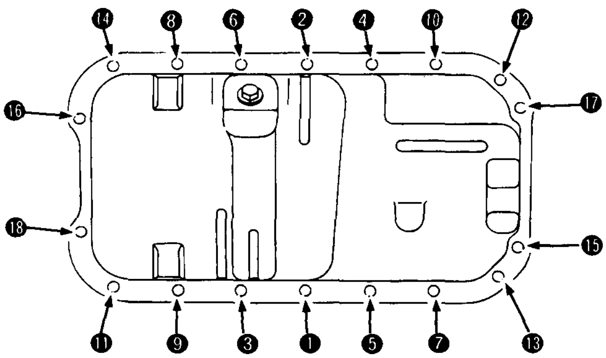
Installation in the reverse order of removal.

1. Thoroughly clean the mating surface of the oil pan and engine case. Apply liquid gasket to both surface of the gasket.



NOTE:
- Replace gaskets and O-rings at disassembly.
- Use liquid gasket, Part No. 0Y740−99986.
- Check that the mating surfaces are clean and dry before applying liquid gasket.
- Apply liquid gasket evenly, in a narrow bead centered on the mating surface.
- To prevent leakage of oil, apply liquid gasket to the inner threads of oil, apply liquid gasket to the inner threads of the bolt holes.
- *Do not install the parts if 20 minutes or more* have passed after applying liquid gasket. Instead reapply liquid gasket after removing old one.
- Fill the case with clean engine oil 30 minutes after assembly.

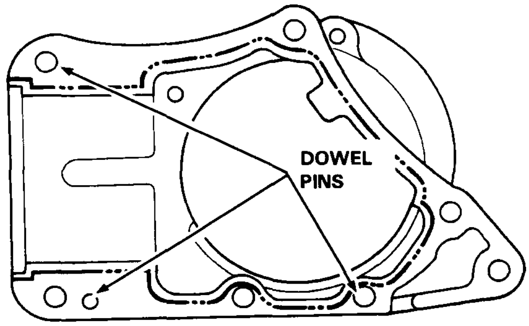
2. Tighte the bolts as shown below.
Torque: 12 N·m (1.2 kg-m , 9 lb-ft)



NOTE: Tighten bolts and nuts in two steps and torque the bolts in a criss-cross pattern.

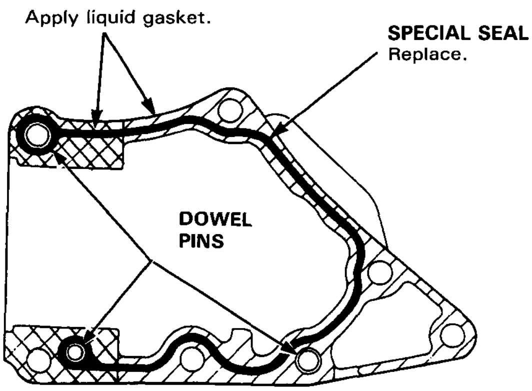
3. Apply liquid gasket to the clutch housing (M/T) or torque converter housing (A/T) mating surface of the transfer case.
Use liquid gasket Part No. 0Y740−99986.

M/T



A/T

NOTE: Install the special seal as shown.

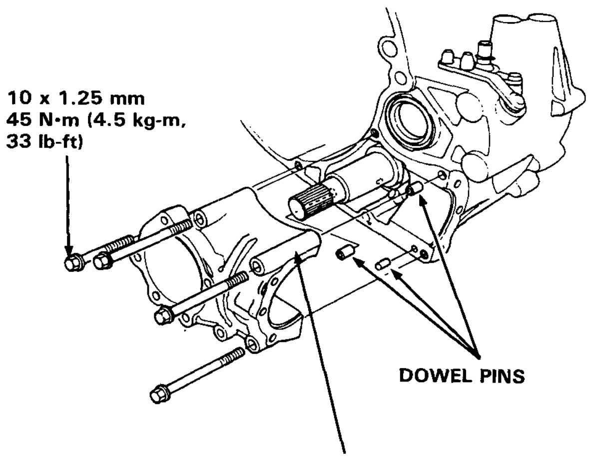


(cont'd)

Replacement (4WD) (cont'd)

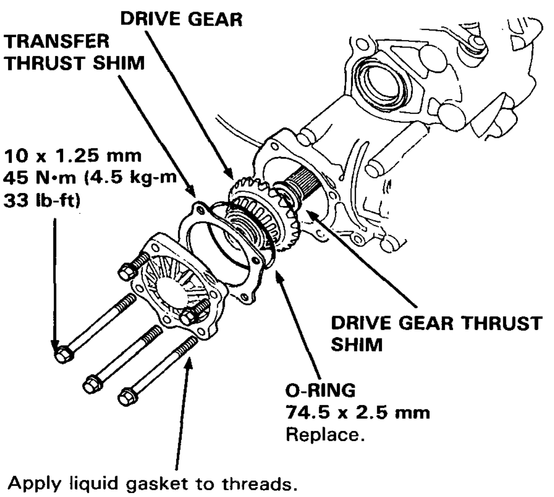
4. Install the transfer housing on the clutch or torque converter housing.

   NOTE: Be careful not to damage the thrust shim and mating surface, and keep them clean.



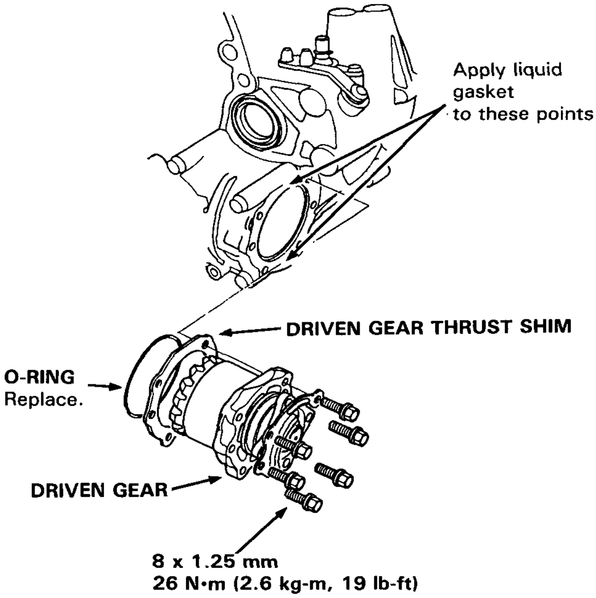
5. Install the following parts on and in the transfer shaft and transfer housing.
   - Drive gear thrust shim
   - Drive gear (lubricate with oil)
   - Transfer thrust shim
   - Transfer left side cover.

   NOTE: Be careful not to damage the thrust shim and mating surface, and keep them clean.



6. Install the following parts in the transfer housing.
   - Driven gear thrust shim
   - Driven gear

   NOTE: Be careful not to damage the thrust shim and mating surface, and keep them clean.



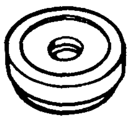
7. Install the L. side cover protector (A/T only).

8. If necessary, perform the following inspections (See Section 13 or 14).
   - Tooth contact between the transfer driven and drive gears.
   - The backlash at the companion flange.
   - The transfer driven gear preload.
   - The total preload.

Engine Lubrication

Special Tools

Ref. No.	Tool Number	Description	Qty	Page Reference
①	07746–0010400	Attachment, 52 x 55 mm	1	8-12
②	07749–0010000	Driver	1	8-12
③	07942–6110001	Oil Filter Socket	1	8-7



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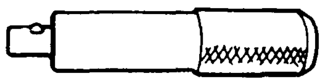
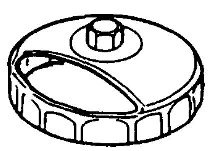


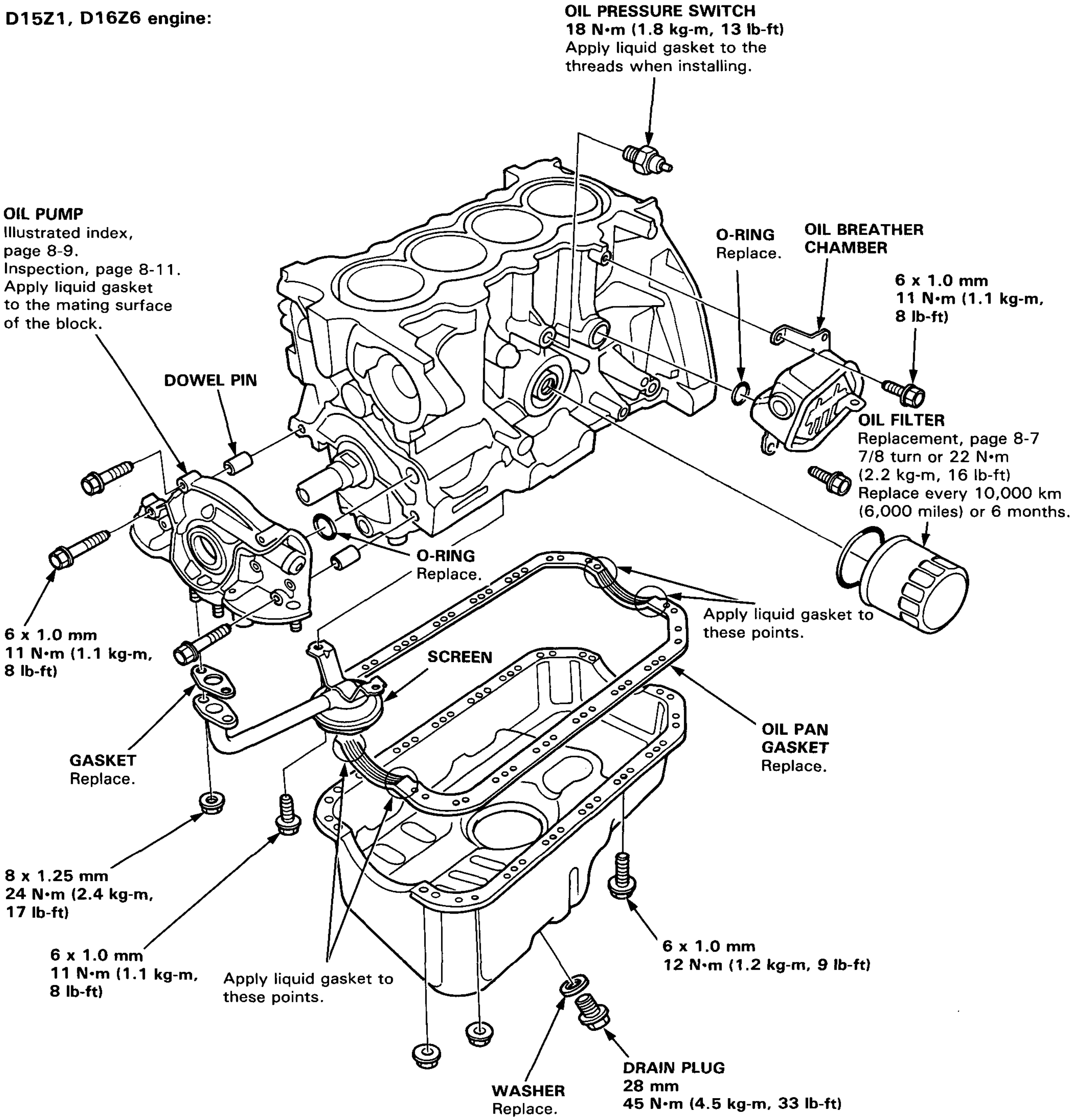
②



③

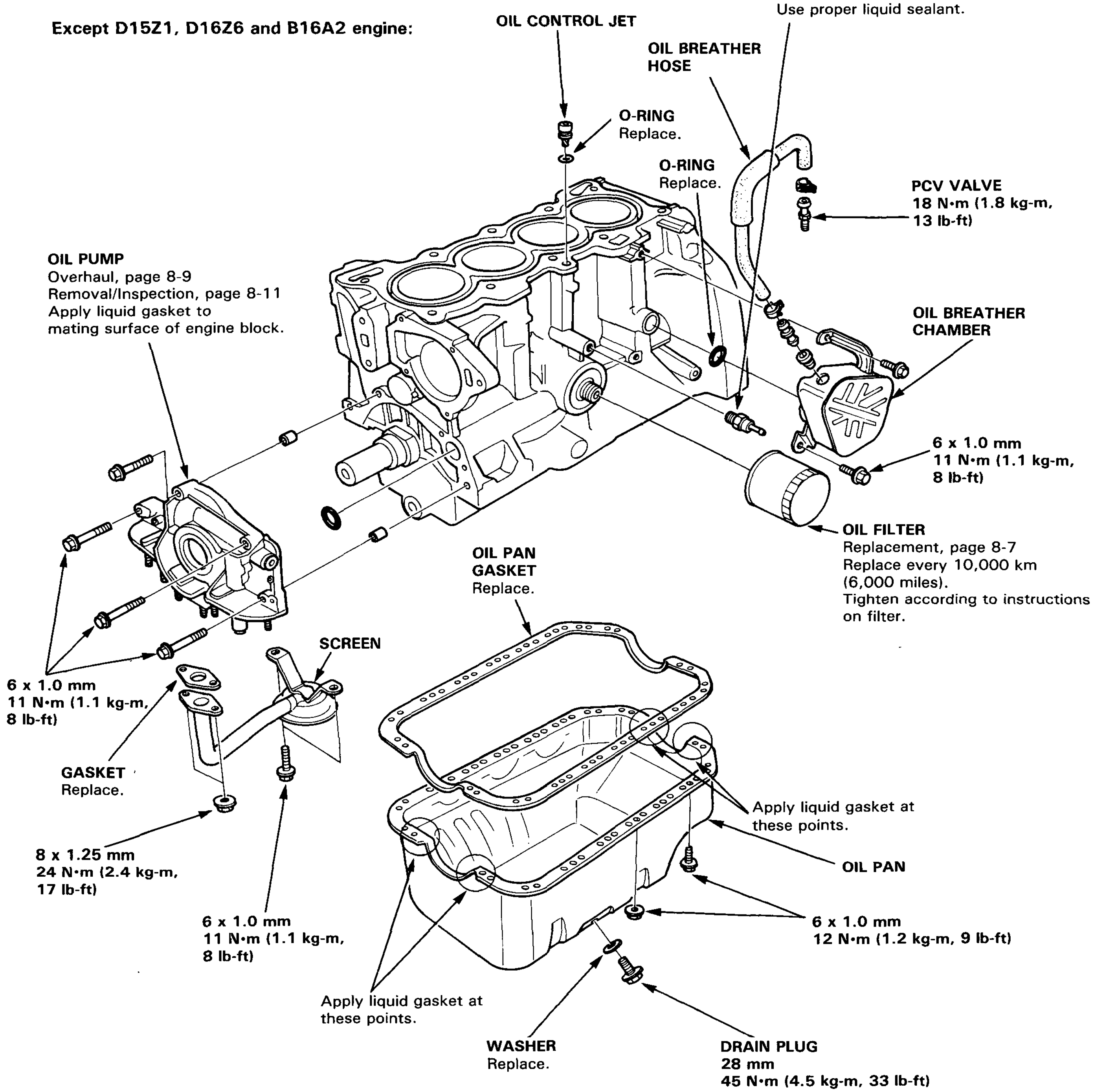
NOTE:
- Use new O-rings when reassembling.
- Apply oil to O-rings before installation.
- Use liquid gasket, Part No. 08740−99968.

D15Z1, D16Z6 engine:



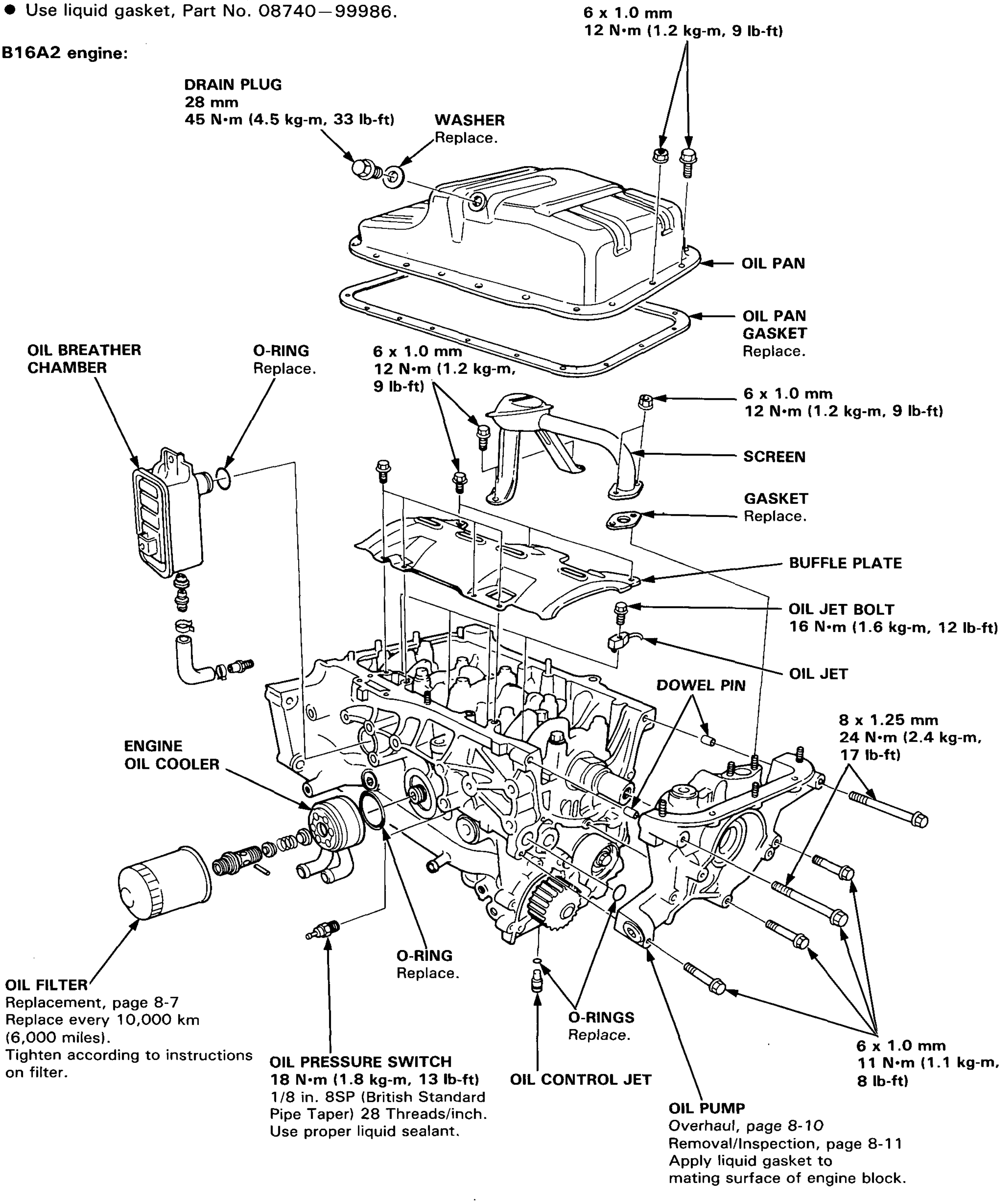
NOTE:
- Use new O-rings whenever reassembling.
- Apply oil to O-rings before installation.
- Use liquid gasket, Part No. 08740—99968.

Except D15Z1, D16Z6 and B16A2 engine:



NOTE:
- Use new O-rings whenever reassembling.
- Apply oil to O-rings before installation.
- Use liquid gasket, Part No. 08740−99986.

B16A2 engine:

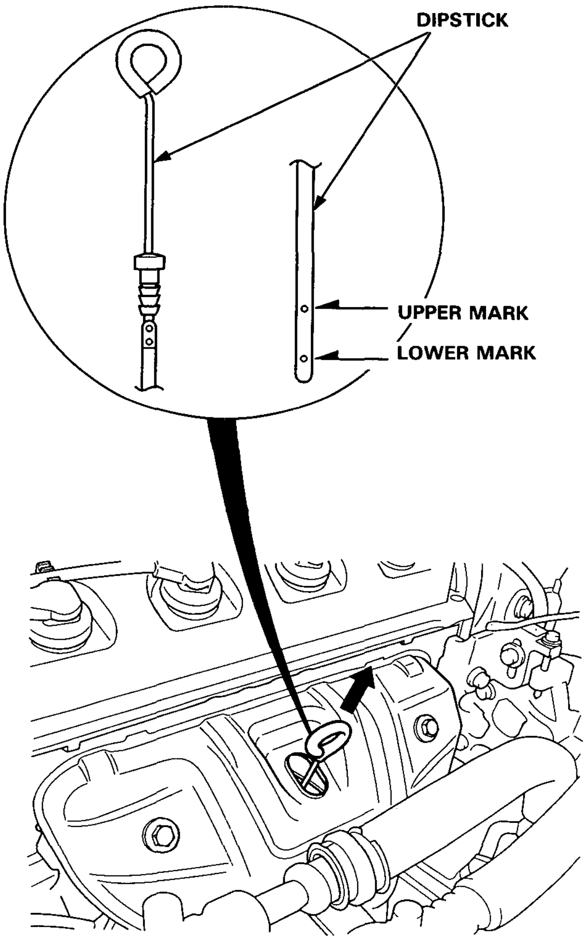


Oil Level

Inspection

1. Check engine oil with the engine off and the car parked on level ground.
2. Make certain that the oil level indicated on the dipstick is between the upper and lower marks.
3. If the level has dropped close to the lower mark, add oil until it reaches the upper mark.

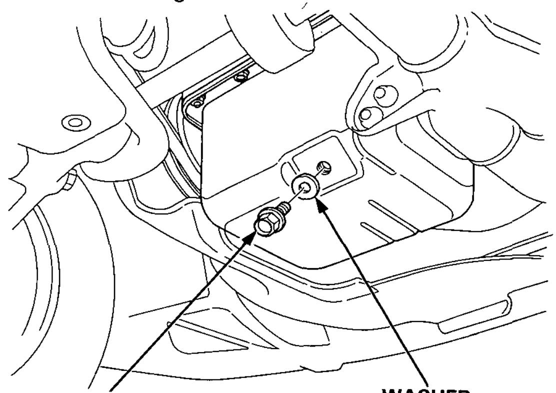
   CAUTION: Insert the dipstick carefully to avoid bending it.



Engine Oil

Replacement

1. Warm up the engine.
2. Drain the engine oil.



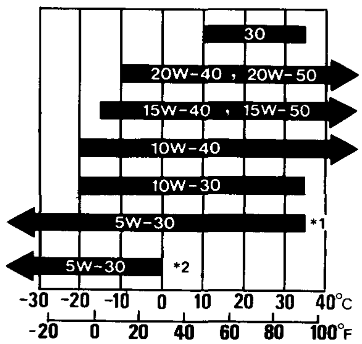
3. Reinstall the drain plug with a new washer, and refill with the recommended oil.

Requirement	API Service Grade: SG or SF
Change	Every 10,000 km (6,000 miles) or 6 months.

Capacity ℓ (US qt, Imp qt)

Engine type	After engine overhaul	At change including filter
D16A8, D16A9 engine	4.3 (4.5, 3.8)	3.6 (3.8, 3.2)
B16A2 engine	4.8 (5.1, 4.2)	4.0 (4.2, 3.5)
Except D16A8, D16A9, B16A2 engine	4.0 (4.2, 3.5)	3.3 (3.5, 2.9)

Engine Oil Viscosity for Outside Temperature Ranges.



Ambient temperature ranges

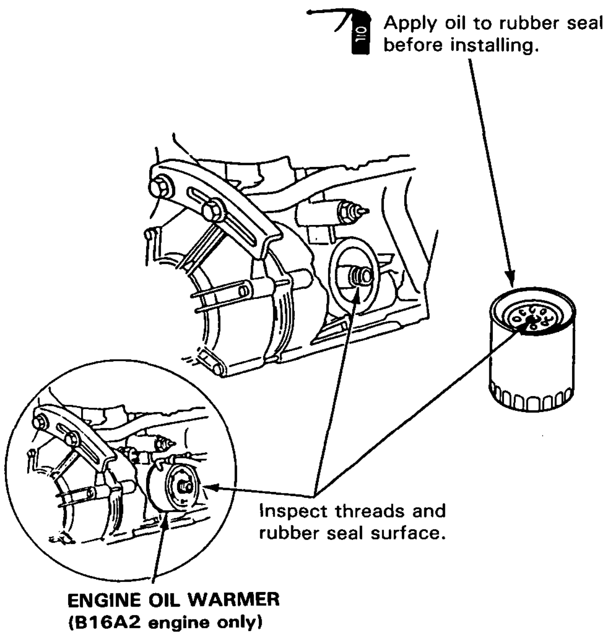
***1: Exeept 1.6 ℓ engine**
***2: 1.6 ℓ engine**

Replacement

CAUTION: After the engine has been run, the exhaust pipes will be hot; be careful when working around the exhaust manifold.

1. Remove the oil filter with the special oil filter socket.
2. Inspect the threads and rubber seal on the new filter.
   Wipe off seat on engine block, then apply a light coat of oil to the filter rubber seal.

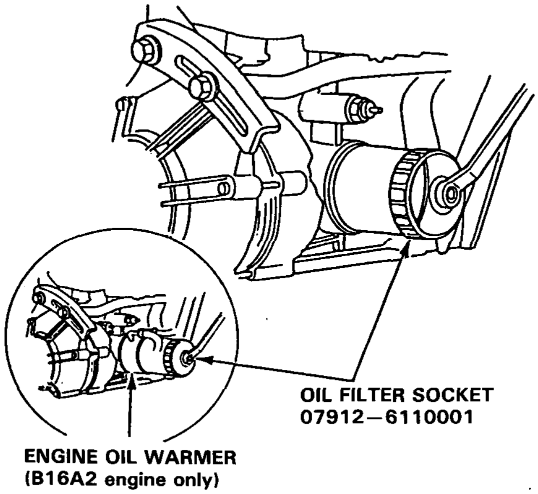
   NOTE: Use only filters with a built-in bypass system.



3. Install the oil filter by hand.
4. After the rubber seal is seated, tighten the oil filter clockwise with the special tool.

   Tighten: 7/8 turn clockwise.
   ***Tightening torque:* 22 N·m (2.2 kg-m, 16 lb-ft)**

   CAUTION: Installation using other than the above procedure could result in serious engine defects due to oil leakage.



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Filter

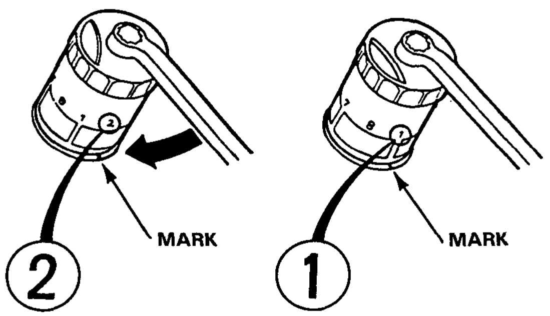
Replacement (cont'd)

Eight numbers (1 to 8) are printed on the surface of the filter.

The following explains the procedure for tightening filters using these numbers.

1) Make a mark on the cylinder block under the number that shows at the bottom of the filter when the rubber seal is seated.

2) Tighten the filter by turning it clockwise seven numbers from the marked point. For example, if a mark is made under the number 2 when the rubber seal is seated, the filter should be tightened until the number 1 comes up to the marked point.



Number when rubber seal is seated.

Number after tightening.

Number when rubber seal is seated	1	2	3	4	5	6	7	8
Number after tightening	8	1	2	3	4	5	6	7

5. After installation, fill the engine with oil up to the specified level, run the engine for more than 3 minutes, then check for oil leakage.

Oil Pressure

Test

If the oil pressure warning light stays on with the engine running, check the engine oil level. If the oil level is correct:

1. Connect a tachometer.

2. Remove the oil pressure sender and install an oil pressure gauge.

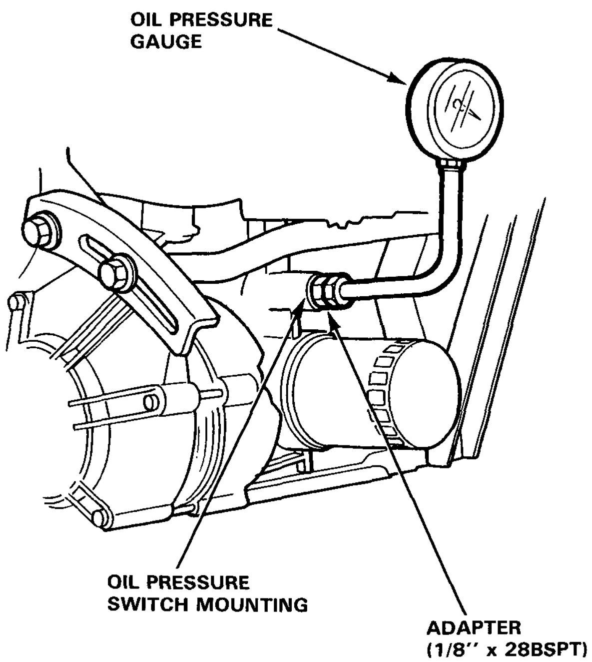
3. Start the engine and allow it to reach operating temperature (fan comes on at least twice).

4. Pressure should be:

   Engine Oil Pressure: 80°C (176°F)

At Idle:	**70 kPa (0.7 kg/cm², 10 psi) minimum**
At 3,000 min^{-1} (rpm):	**350 kPa (3.5 kg/cm², 50 psi) minimum**

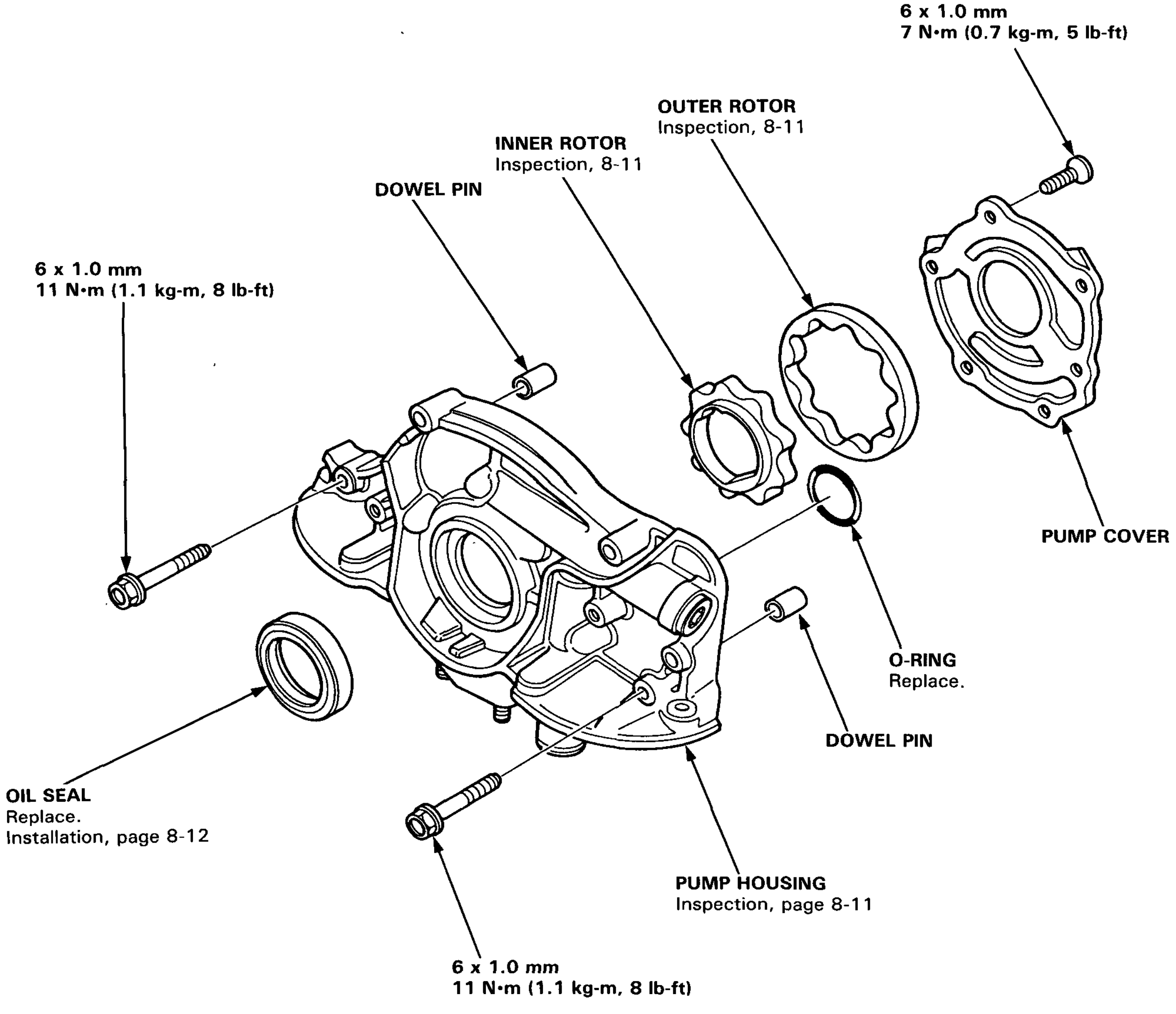
   - If oil pressure is within specifications, replace the oil pressure sender and recheck.
   - If oil pressure is NOT within specifications, inspect the oil pump (pages 8-11 and 12).



Illustrated Index

NOTE:
- Use new O-rings when reassembling.
- Apply oil to O-rings before installation.

Except B16A2 engine:

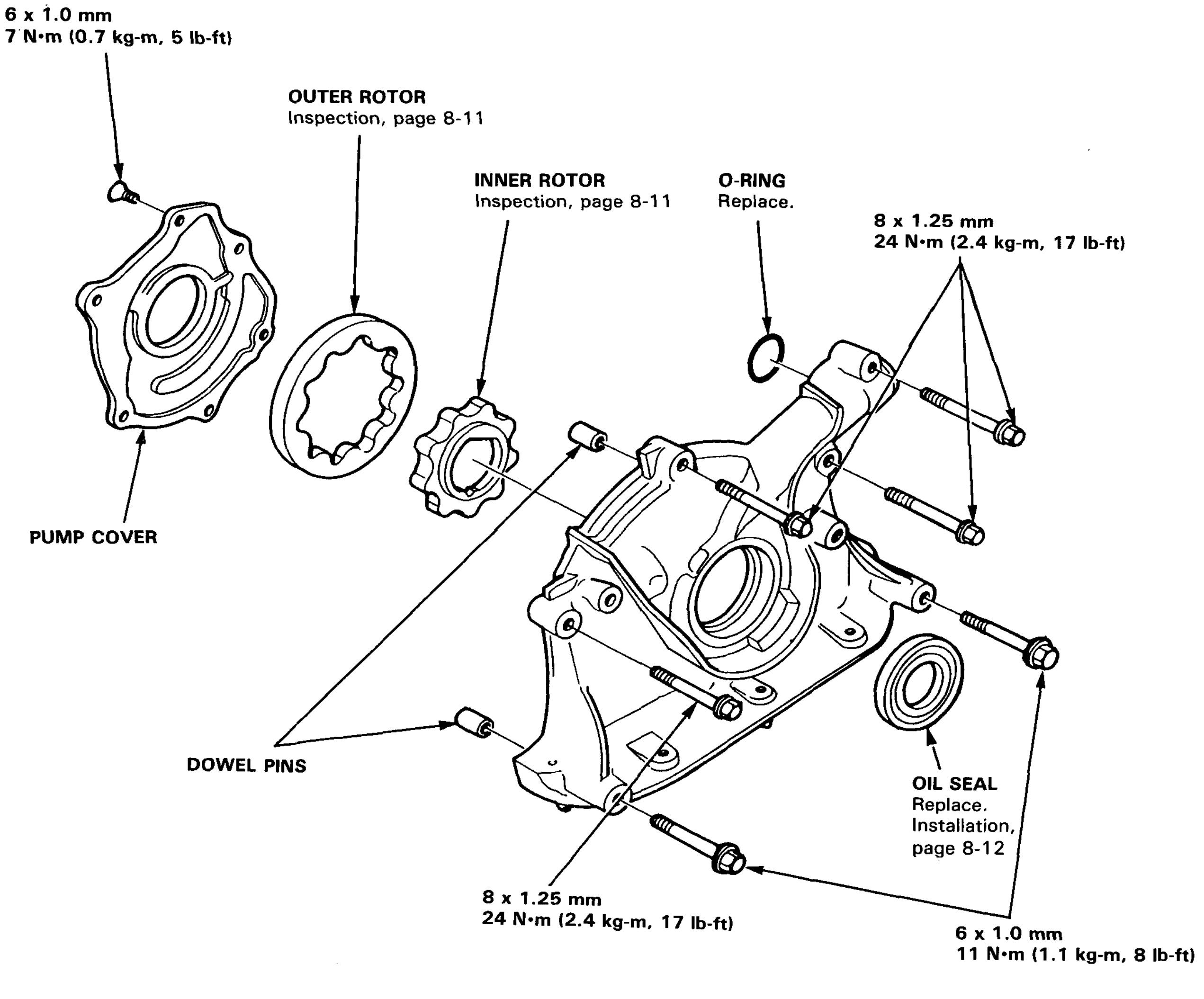


(cont'd)

Illustrated Index (cont'd)

NOTE:
- Use new O-rings when reassembling.
- Apply oil to O-rings before installation.

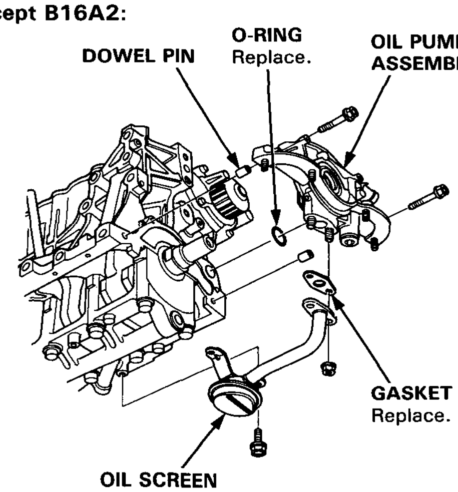
B16A2:



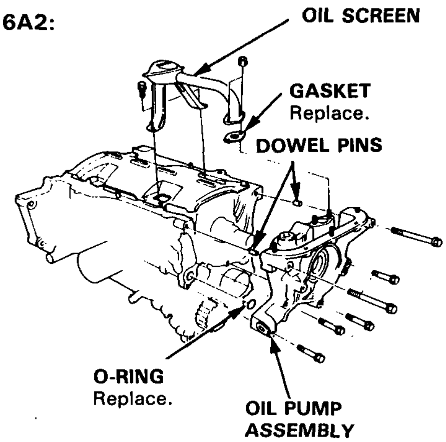
Removal/Inspection

1. Drain the engine oil.
2. Turn the crankshaft and align the white groove on the crankshaft pulley with the pointer on the timing belt cover.
3. Remove the valve cover and timing belt upper cover.
4. Remove the alternator belt.
5. Remove the crankshaft pulley and remove the timing belt lower cover.
6. Remove the timing belt and drive pulley.
7. Remove the oil pan.
8. Remove the oil screen.
9. Remove the mount bolts and the oil pump assembly.

Except B16A2:



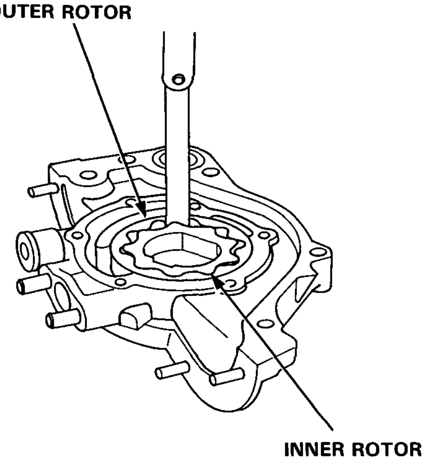
B16A2:



10. Remove the screws from the pump housing, then separate the housing and cover.
11. Check the radial clearance on the pump rotor.

Inner Rotor-to-Outer Rotor Clearance
Standard (New):

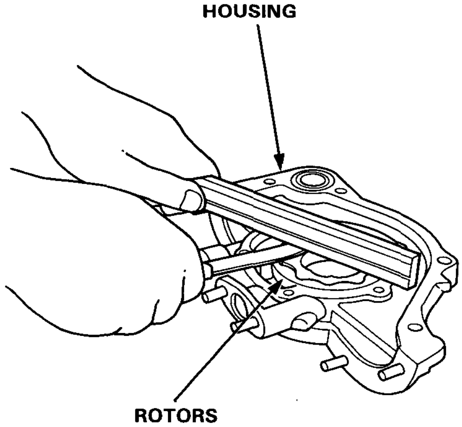
Except B16A2 engine:	**0.02–0.04 mm (0.001–0.002 in)**
B16A2 engine:	**0.04–0.16 mm (0.002–0.006 in)**
Service Limit:	**0.2 mm (0.008 in)**



12. Check the axial clearance on the pump rotor.

Housing-to-Rotor Axial Clearance
Standard (New):

Except B16A2 engine:	**0.03–0.08 mm (0.001–0.003 in)**
B16A2 engine:	**0.02–0.07 mm (0.001–0.003 in)**
Service Limit:	**0.15 mm (0.006 in)**



(cont'd)

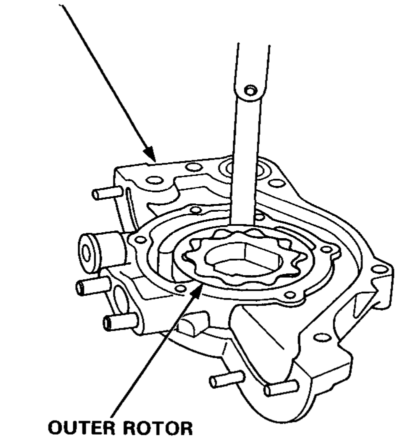
Oil Pump

Removal/Inspection (cont'd)

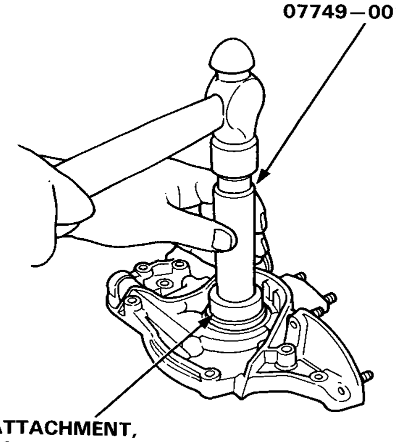
13. Check the radial clearance between the housing and the outer rotor.

Housing-to-Outer Rotor Clearance
Standard (New):

Except B16A2 engine:	**0.10–0.18 mm (0.004–0.007 in)**
B16A2 engine:	**0.04–0.16 mm (0.002–0.006 in)**
Service Limit:	**0.20 mm (0.008 in)**



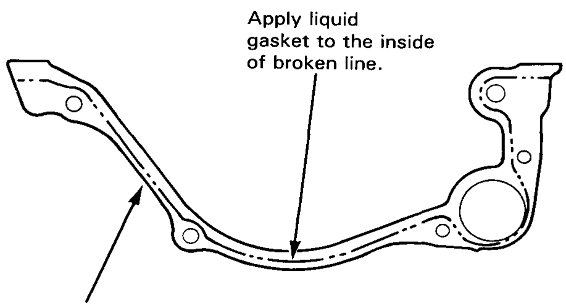
14. Inspect both rotors and pump housing for scoring or other damage. Replace parts if necessary.
15. Remove the old oil seal from the oil pump.
16. Gently tap in the new oil seal until the tool bottoms on the pump using the special tools.



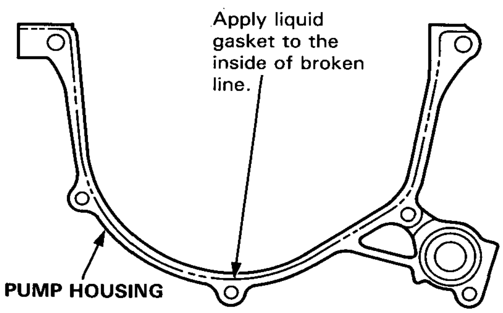
17. Reassemble the oil pump, applying liquid gasket to the pump housing screws.
18. Check that the oil pump turns freely.
19. Apply a light coat of oil to the seal lip.
20. Install the two dowel pins and new O-ring on the cylinder block.
21. Apply liquid gasket to the cylinder block mating surface of the oil pump.

NOTE:
- Use liquid gasket, Part No. 08740–99968.
- Check that the mating surfaces are clean and dry before applying liquid gasket.
- Apply liquid gasket evenly, in a narrow bead centered on the mating surface.
- Do not apply liquid gasket to the O-ring grooves.
- To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.

OIL PUMP HOUSING
Except B16A2 engine:



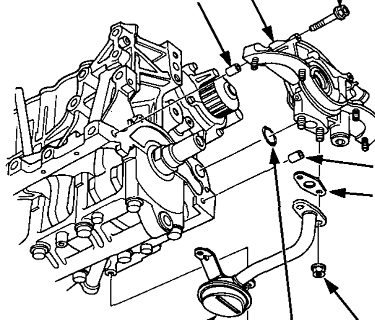
B16A2 engine:



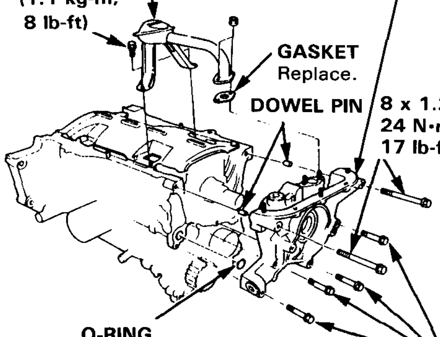
- Do not install the parts if 20 minutes or more have elapsed since applying liquid gasket. Instead, reapply liquid gasket after removing old residue.
- After assembly, wait at least 30 minutes before filling the engine with oil.

22. *Install the oil pump assembly to the engine block.*

Except B16A2 engine



B16A2 engine



23. *Install the screen.*

24. Install the oil pan (see Section 7).

25. Install the timing belt (see Section 6).

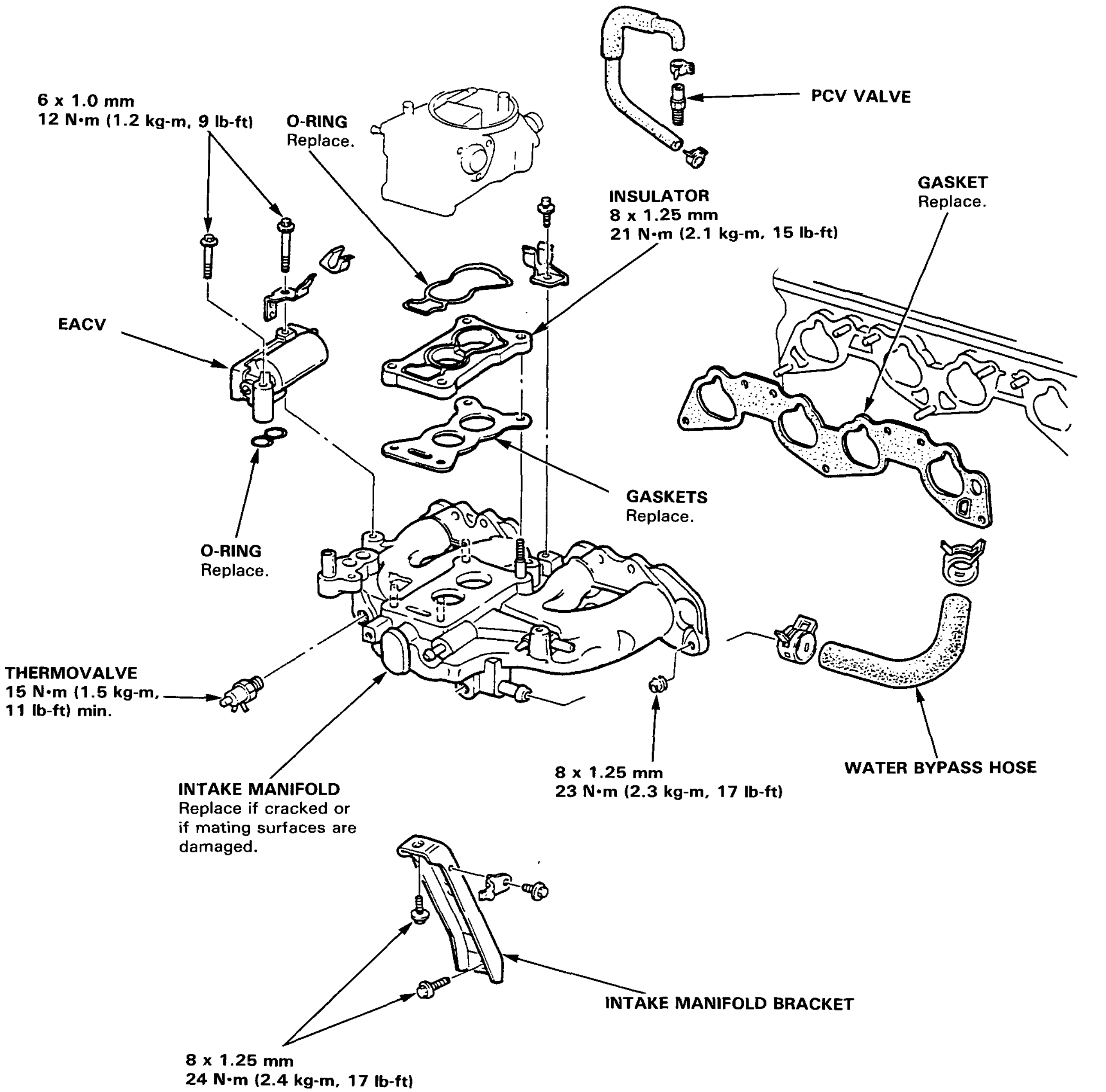
Intake Manifold/Exhaust System

Intake Manifold

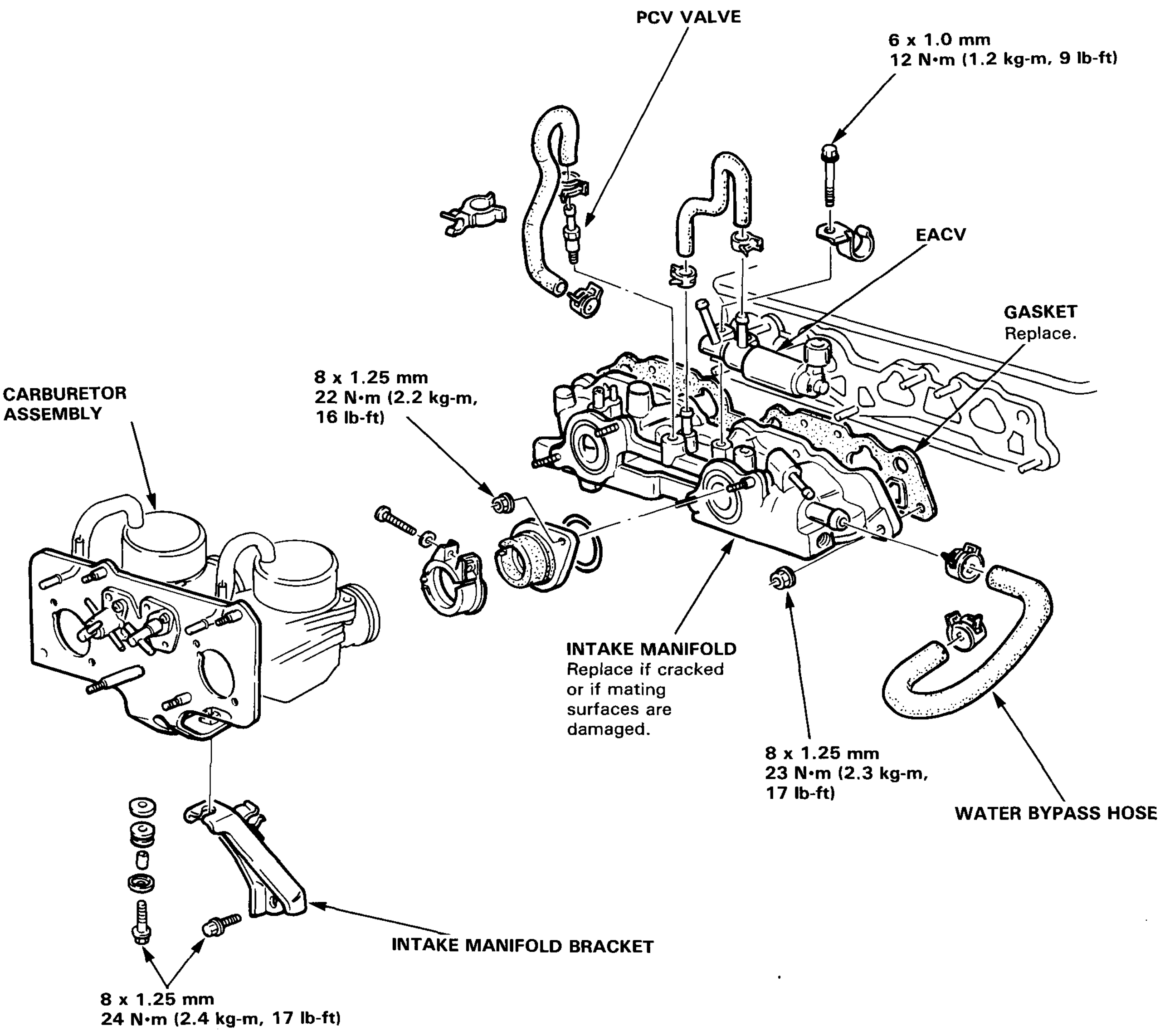
Replacement

NOTE: Use new O-rings and gaskets whenever reassembling.

D12B1, D13B2, D13B3, D15B3 engine:



D15B4 engine:



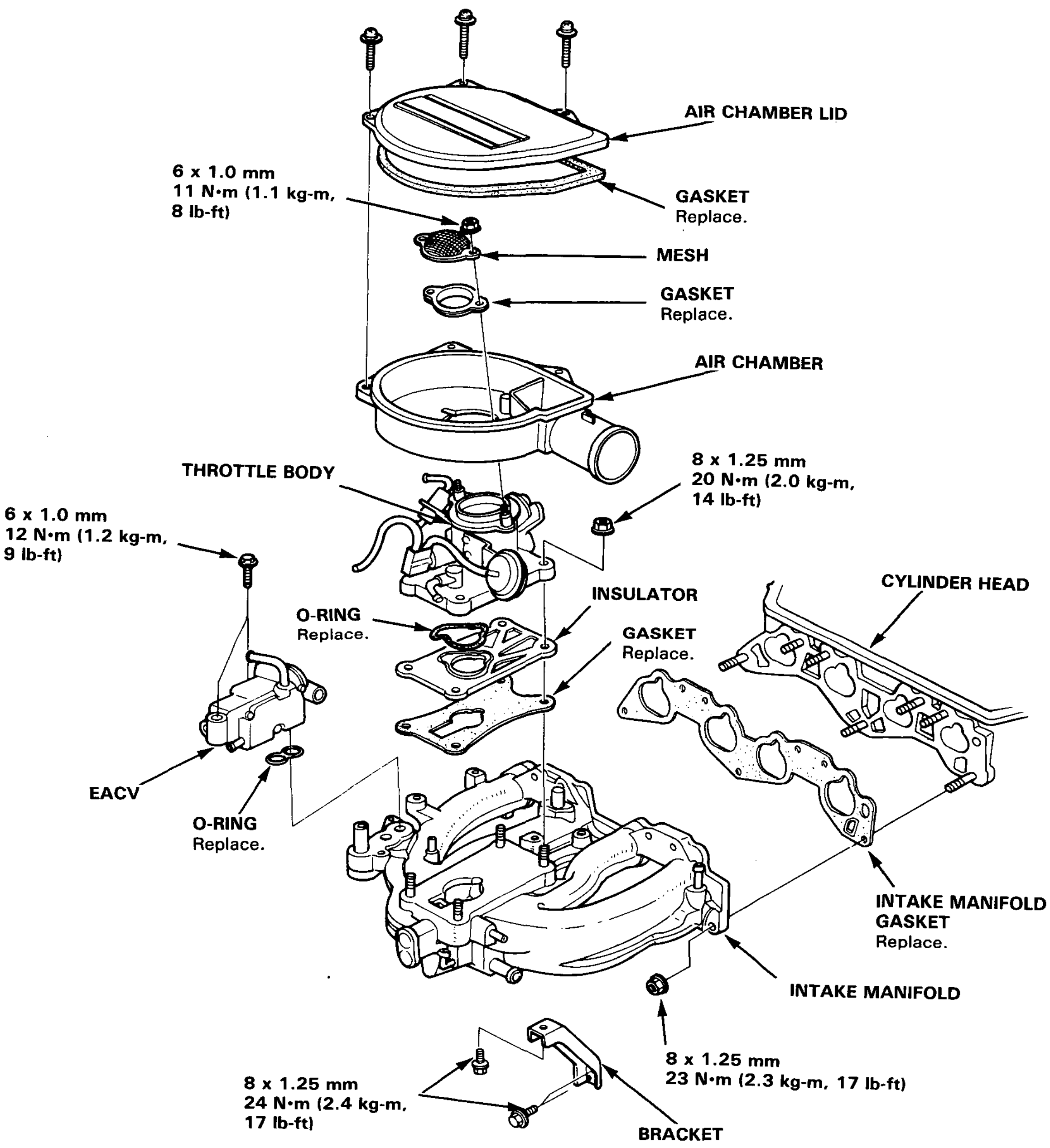
(cont'd)

Intake Manifold

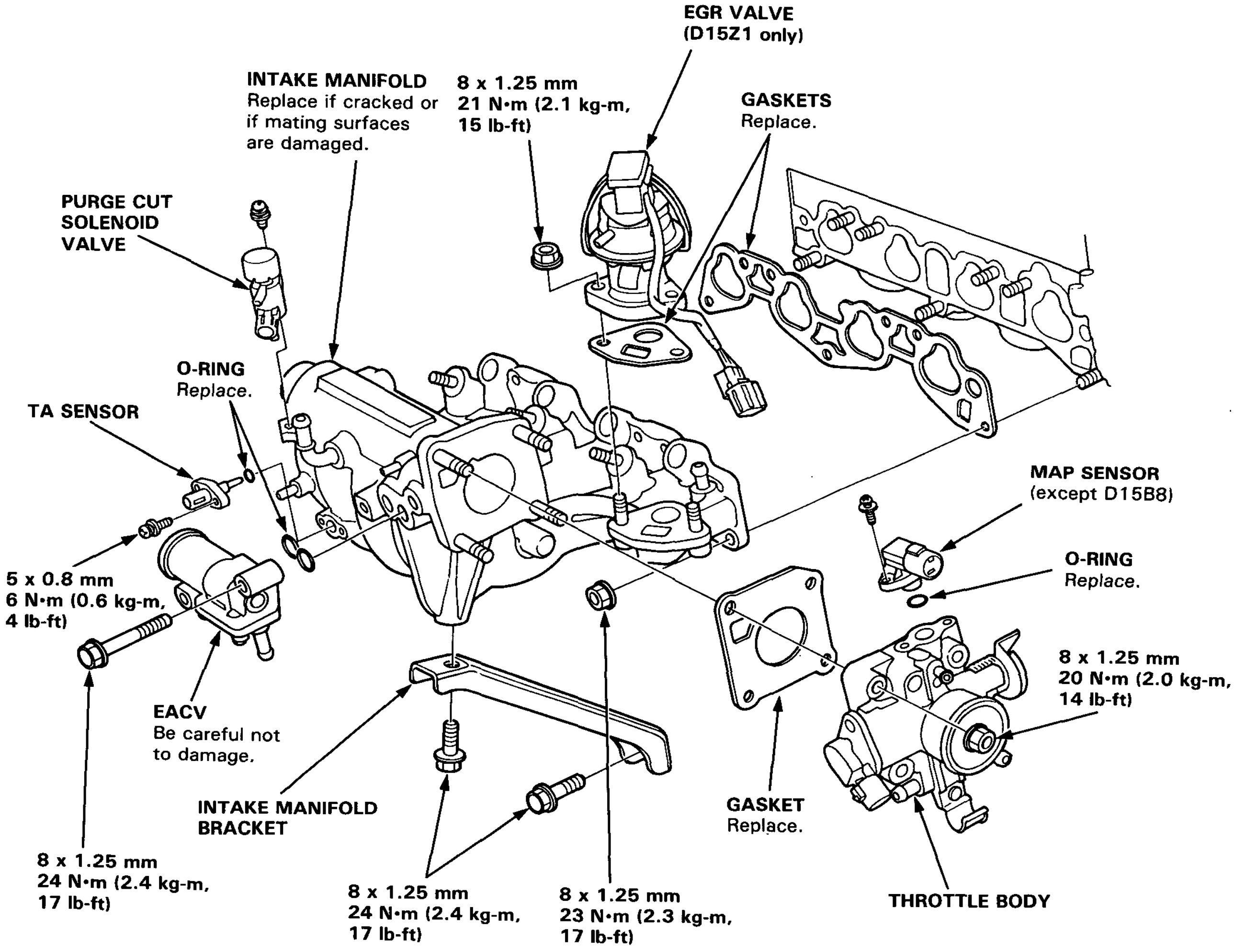
Replacement (cont'd)

NOTE: Use new O-rings and gaskets whenever reassembling.

D15B2 engine:



D15Z1 engine:



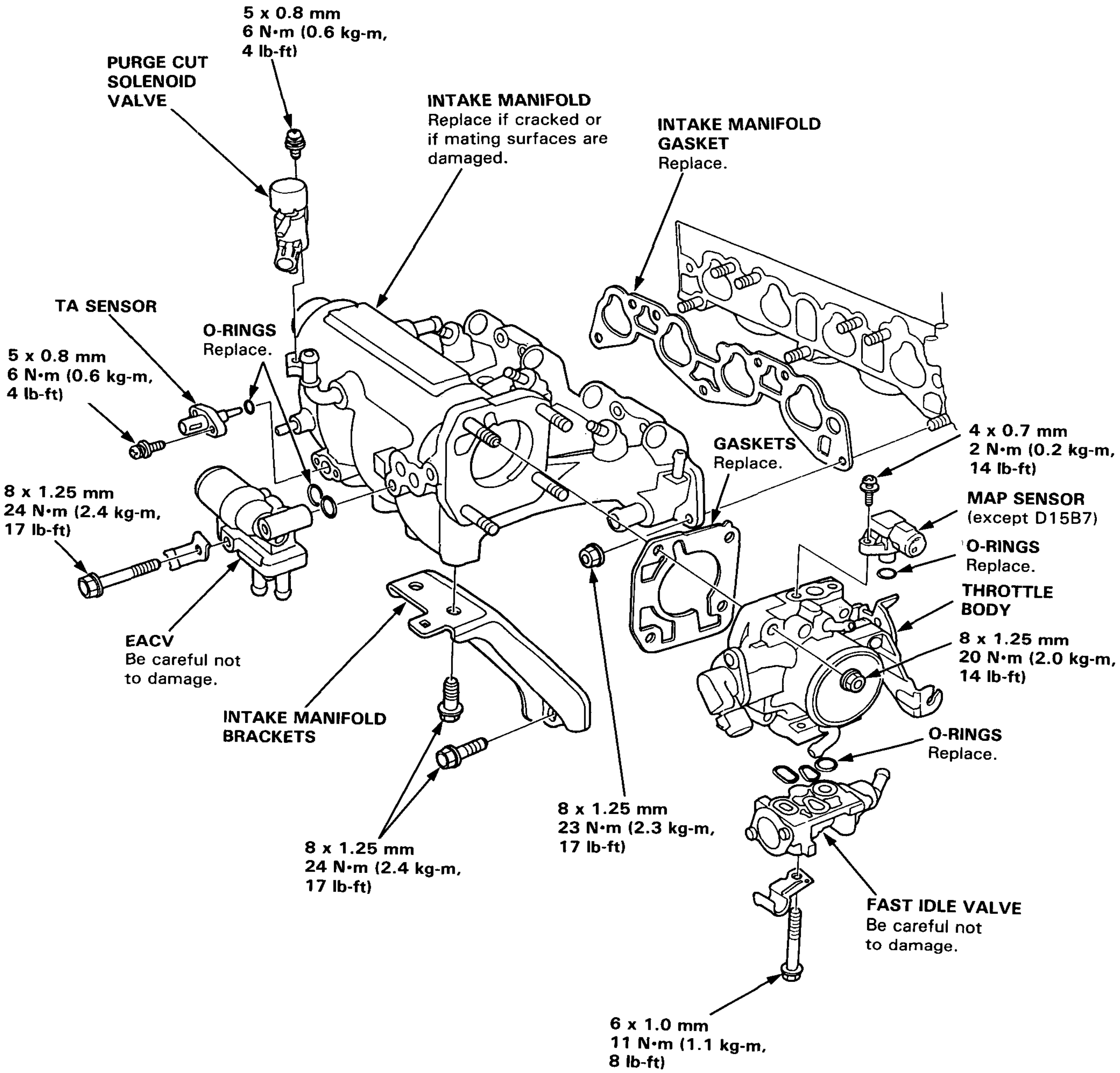
(cont'd)

Intake Manifold

Replacement (cont'd)

NOTE: Use new gaskets and O-rings when reassembling.

D16A2, D16A7, D16A8, D16A9, D16Z6, D16Z7 engine:

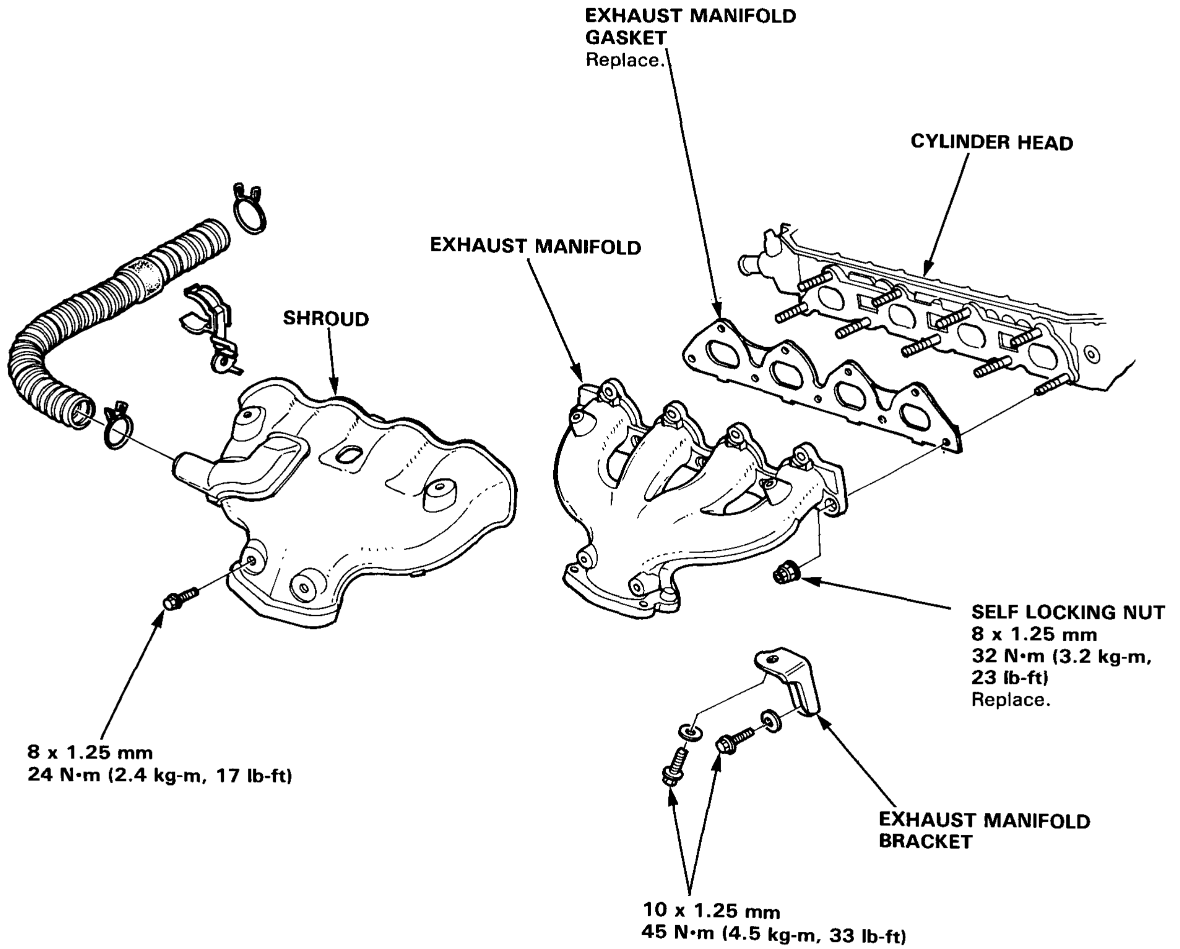


Exhaust Manifold

Replacement

NOTE: Use new gaskets whenever reassembling.

D12B1, D13B2, D13B3 engine:



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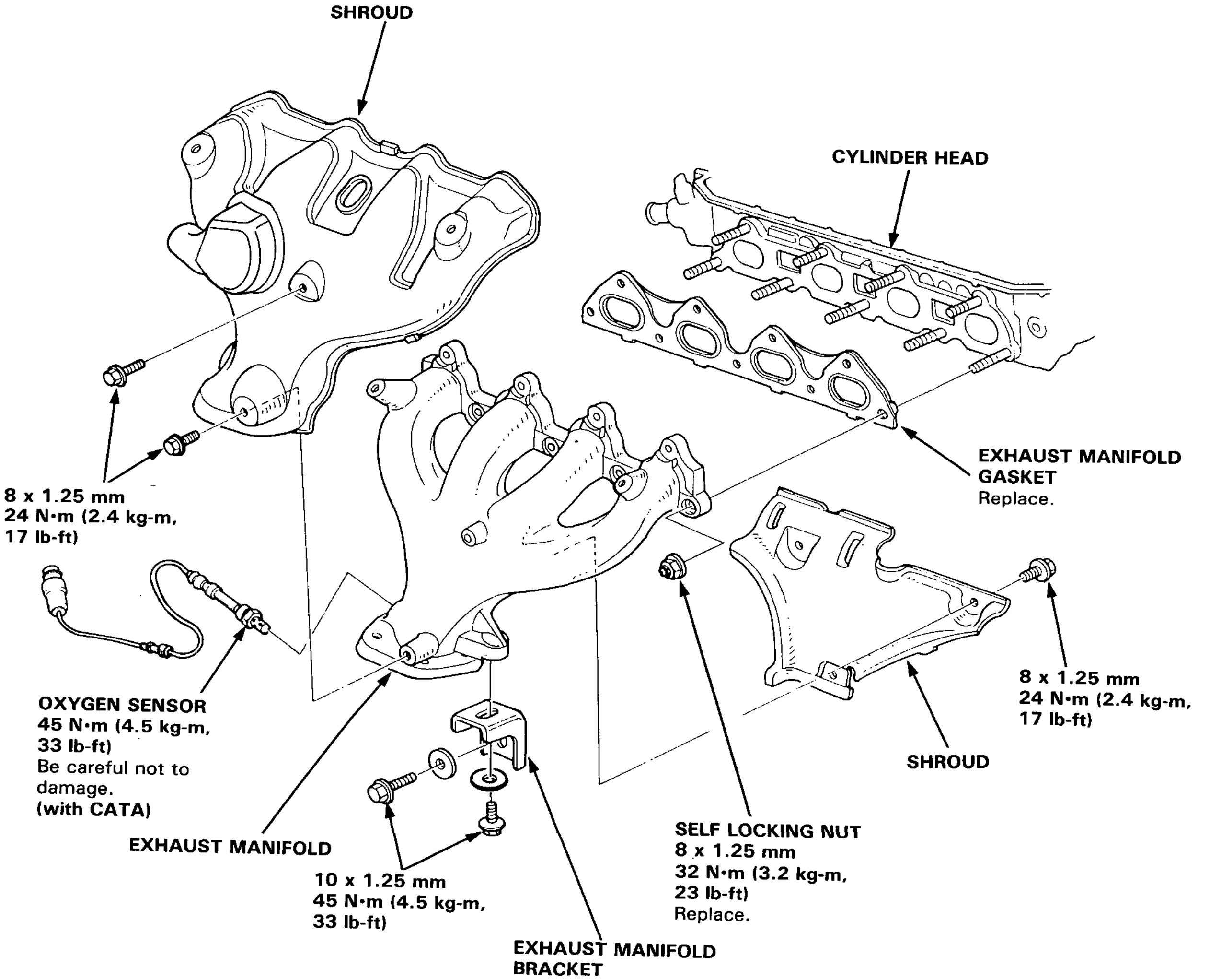
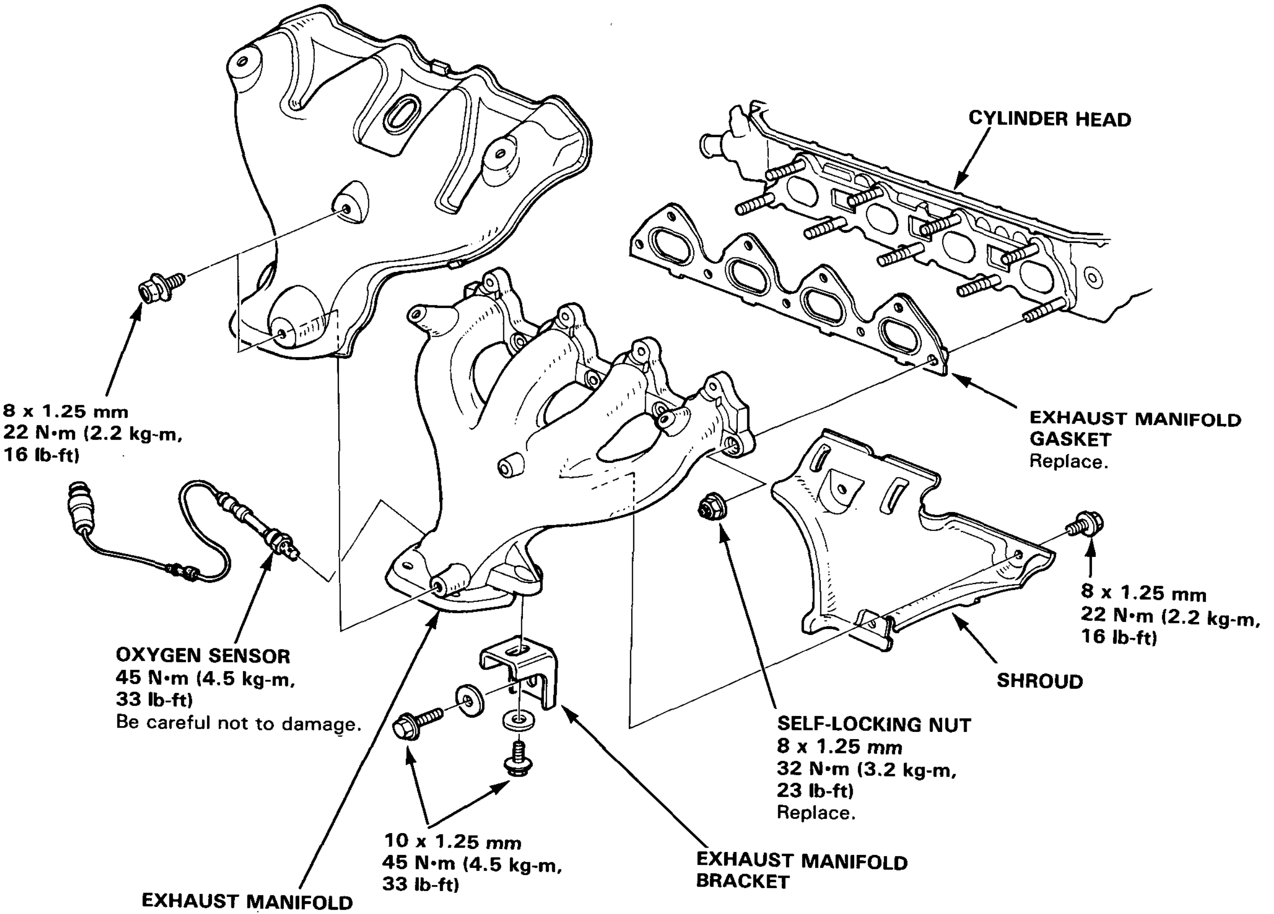
Replacement (cont'd)

NOTE: Use new gaskets whenever reassembling.

D15B3, D15B4 engine:



D15B2 engine:



(cont'd)

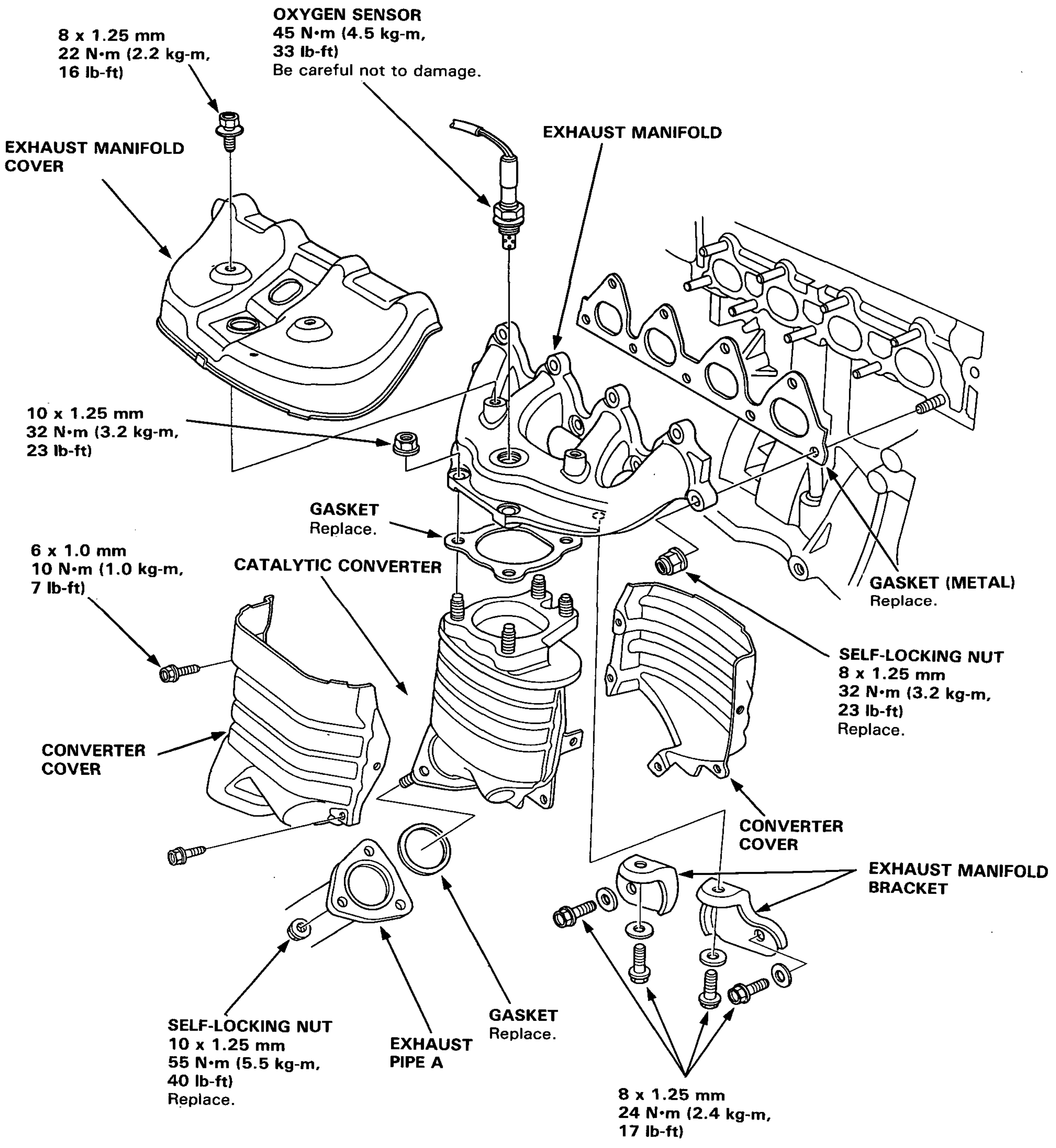
Exhaust Manifold

Replacement (cont'd)

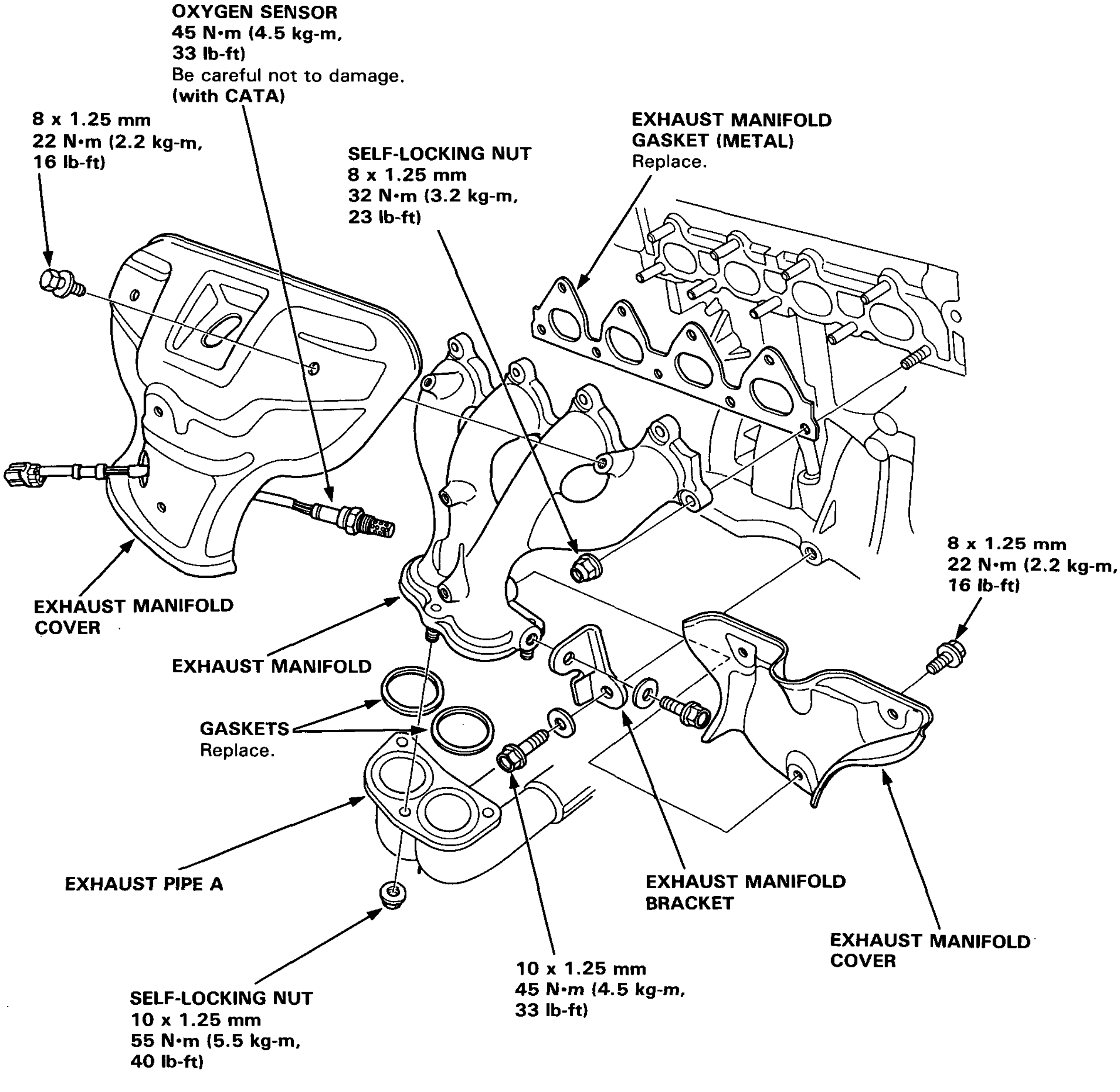
NOTE: Use new gaskets and new self-locking nuts when reassembling.

CAUTION: In handling a metal gasket, care should be taken not to bend it or damage the contact surface of the gasket.

D15Z1 engine:



D16A, D16Z engine:



(cont'd)

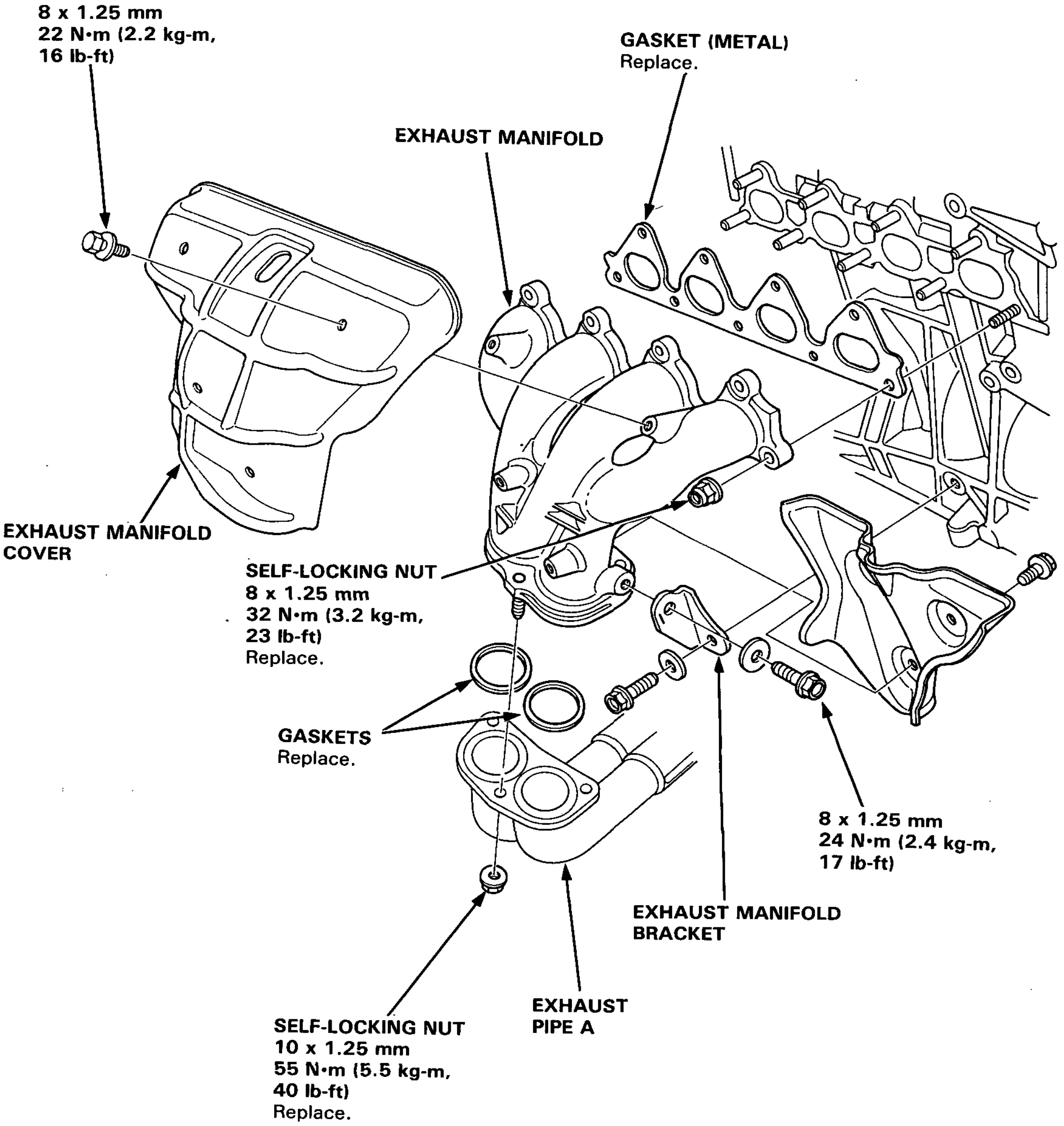
Exhaust Manifold

Replacement (cont'd)

NOTE: Use new gaskets and new self-locking nuts when reassembling.

CAUTION: In handling a metal gasket, care should be taken not to bend it or damage the contact surface of the gasket.

B16A engine:

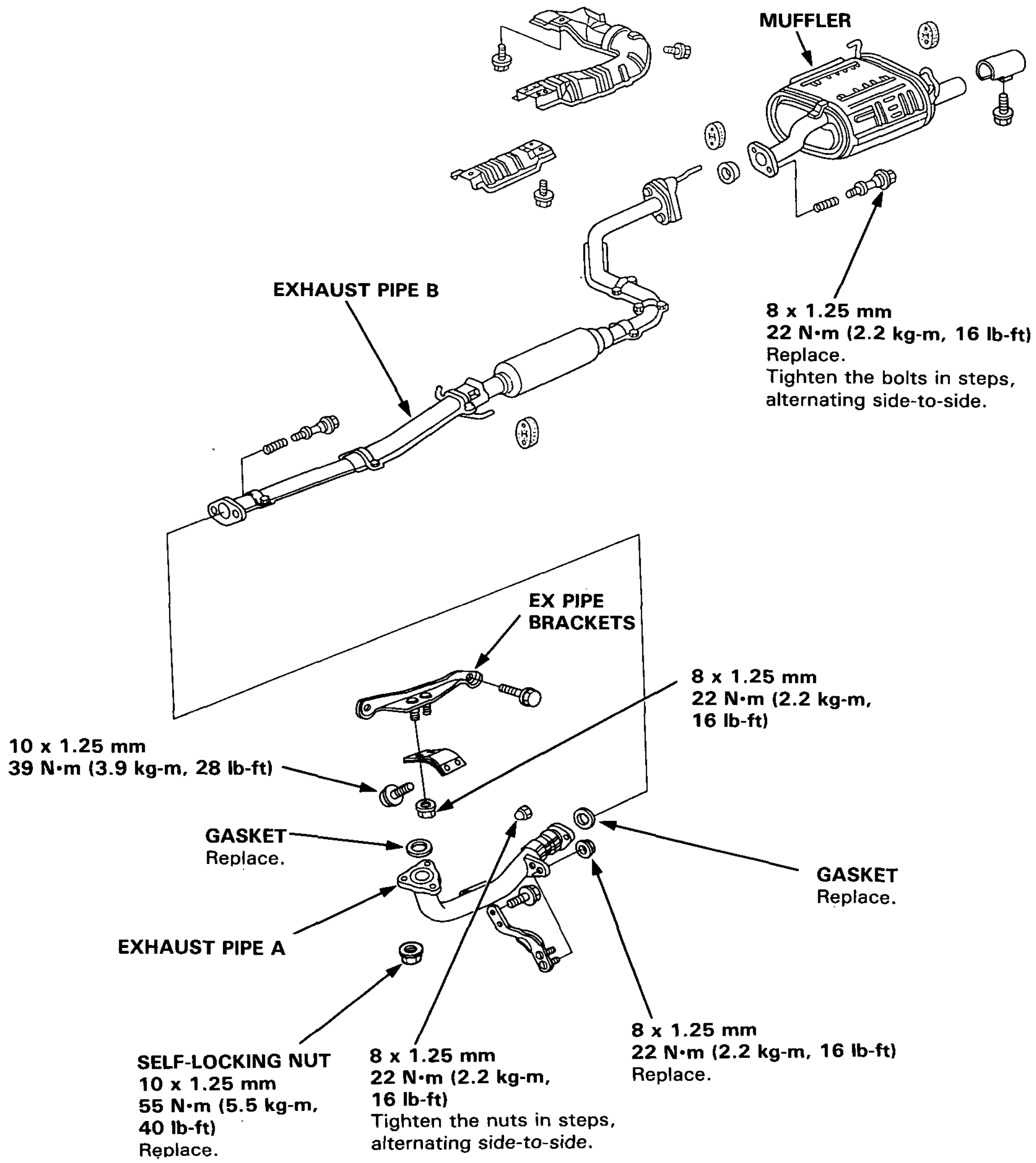


Exhaust Pipe and Maffler

Replacement

NOTE: Use new gaskets and self-locking nuts when reassembling.

D12B, D13B3, D15B3, D15Z engine:



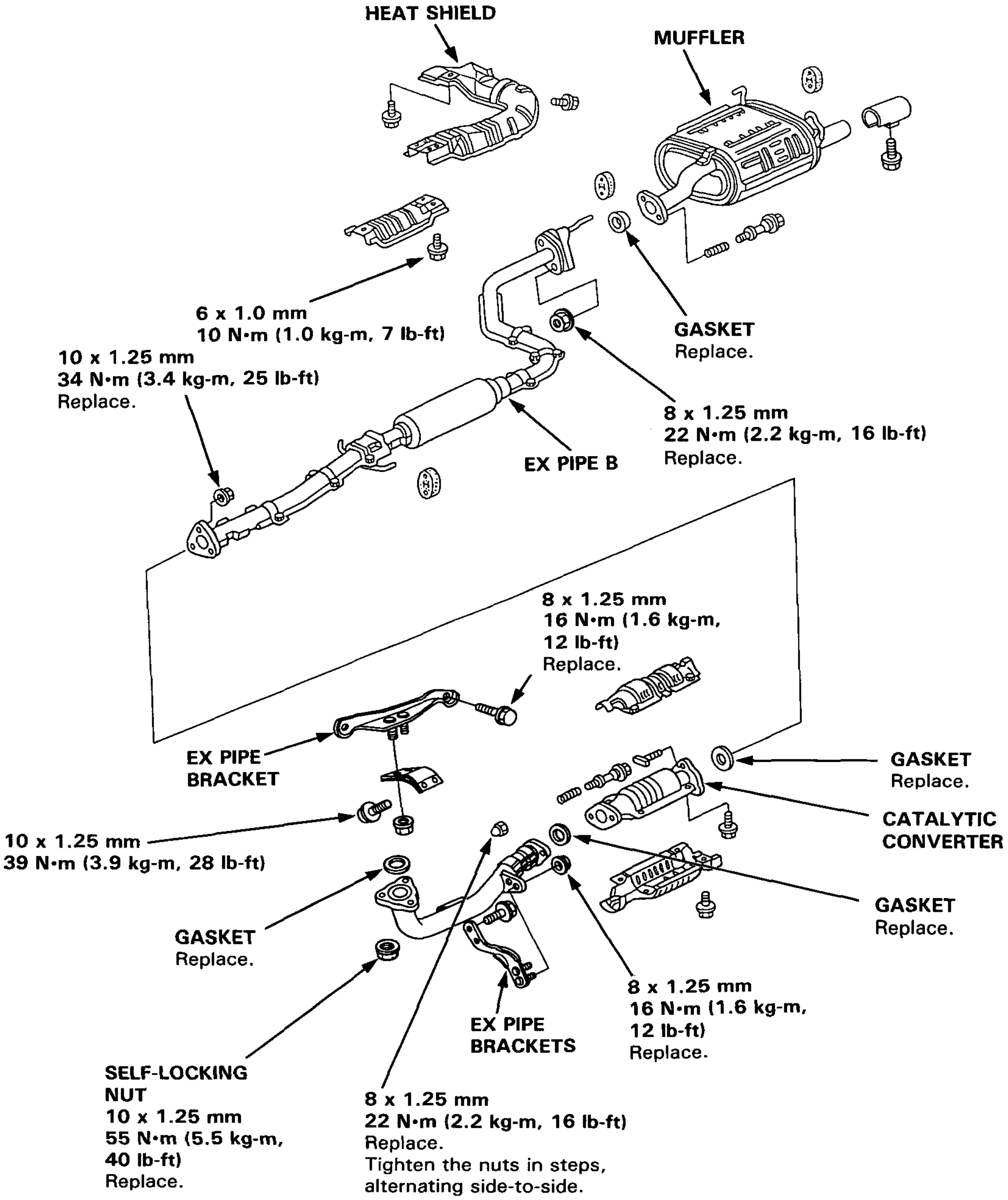
(cont'd)

Exhaust Pipe and Muffler

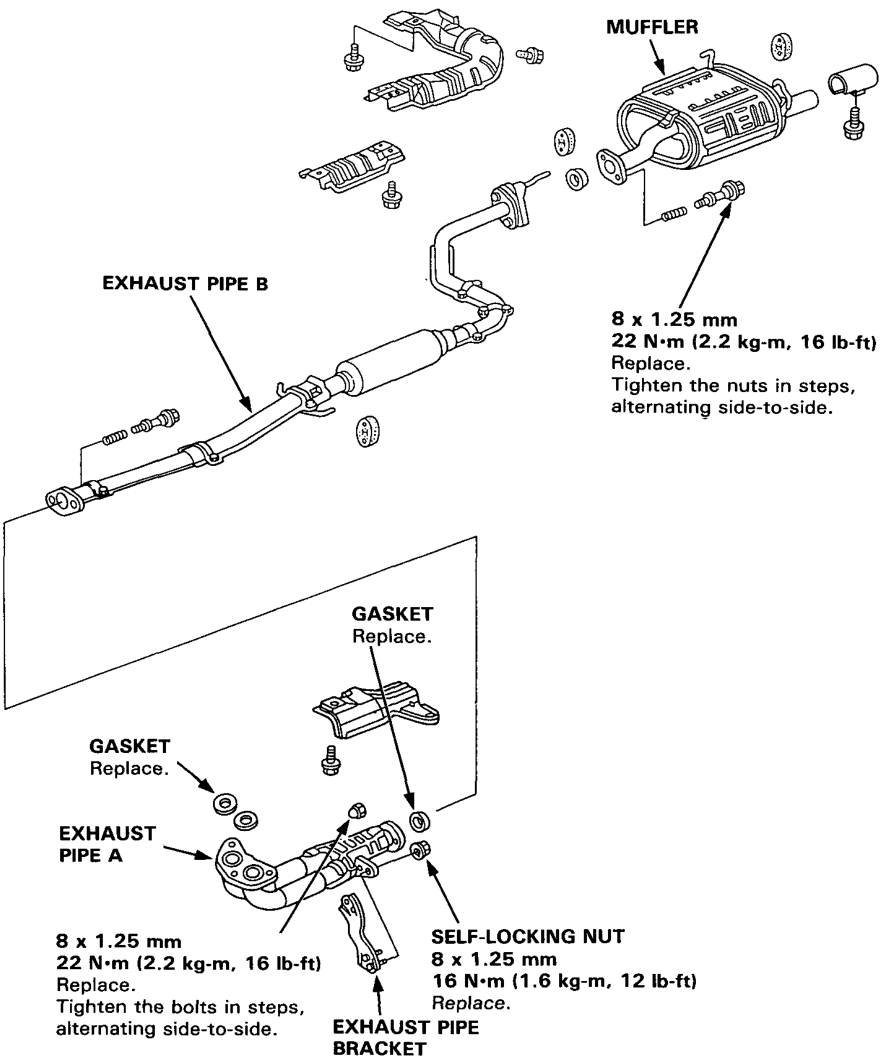
Replacement (cont'd)

NOTE: Use new gaskets and self-locking nuts when reassembling.

D13B2, D15B2, D15B4 engine:



D16A7, D16A9 engine:



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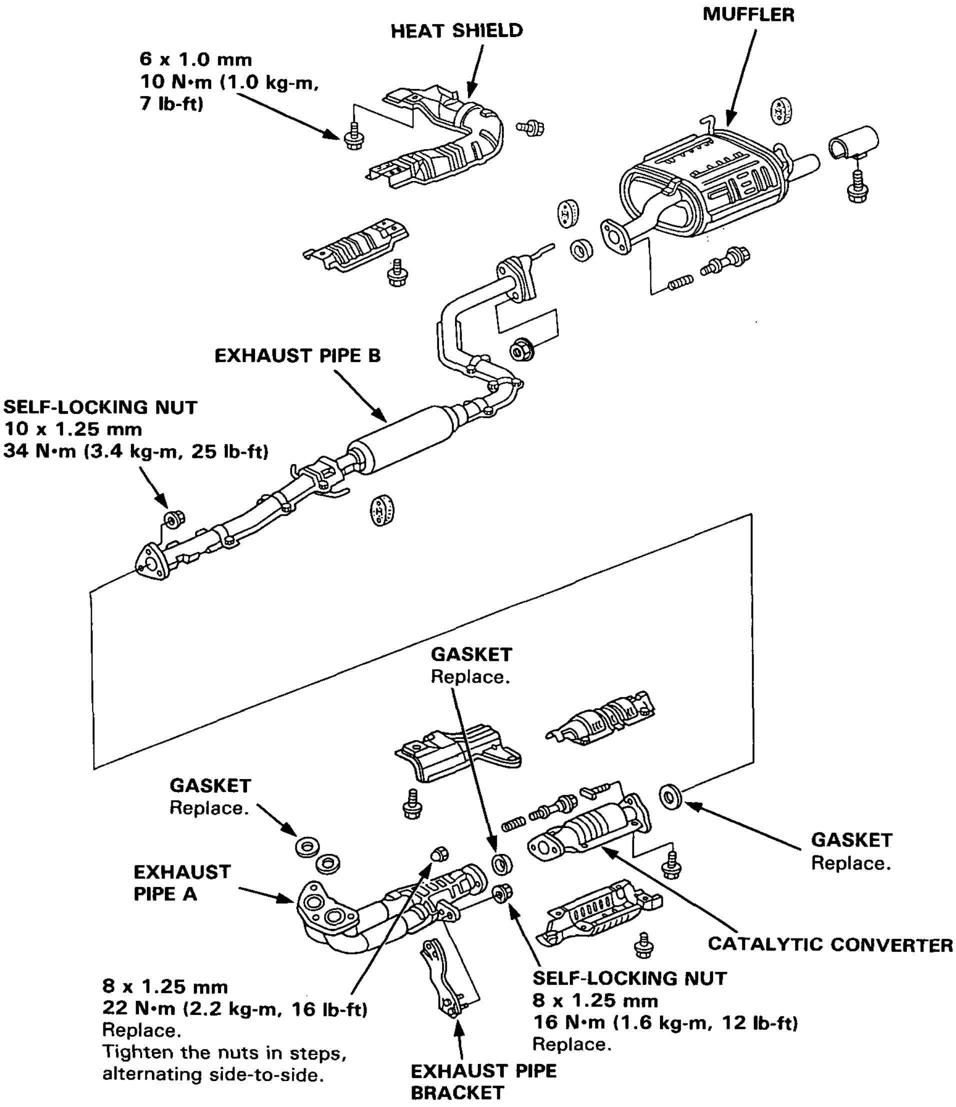
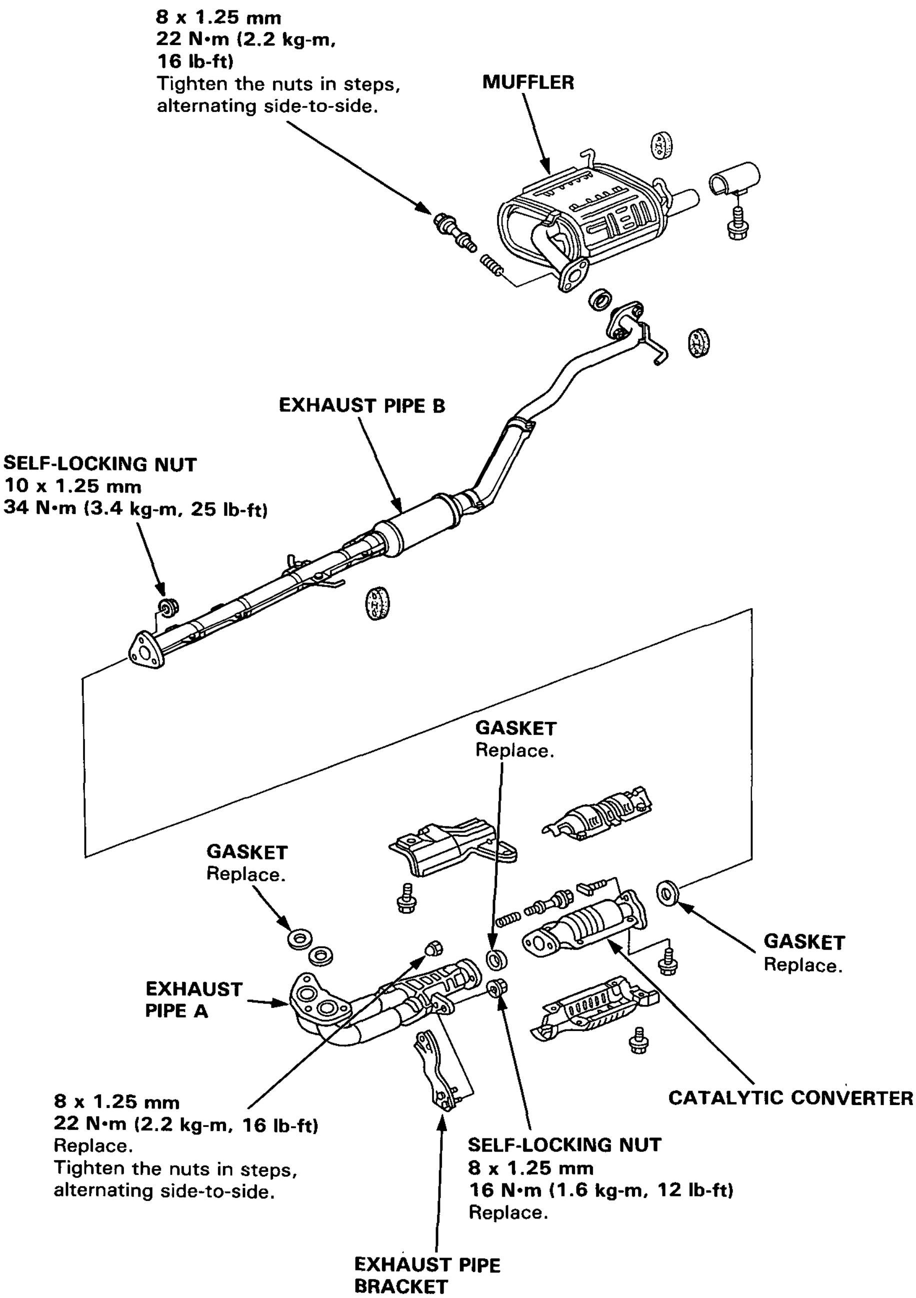
Replacement (cont'd)

NOTE: Use new gaskets and self-locking nuts when reassembling.

B16A2, D16A8, D16Z6 engine:



D16Z7 engine (4WD):



Cooling

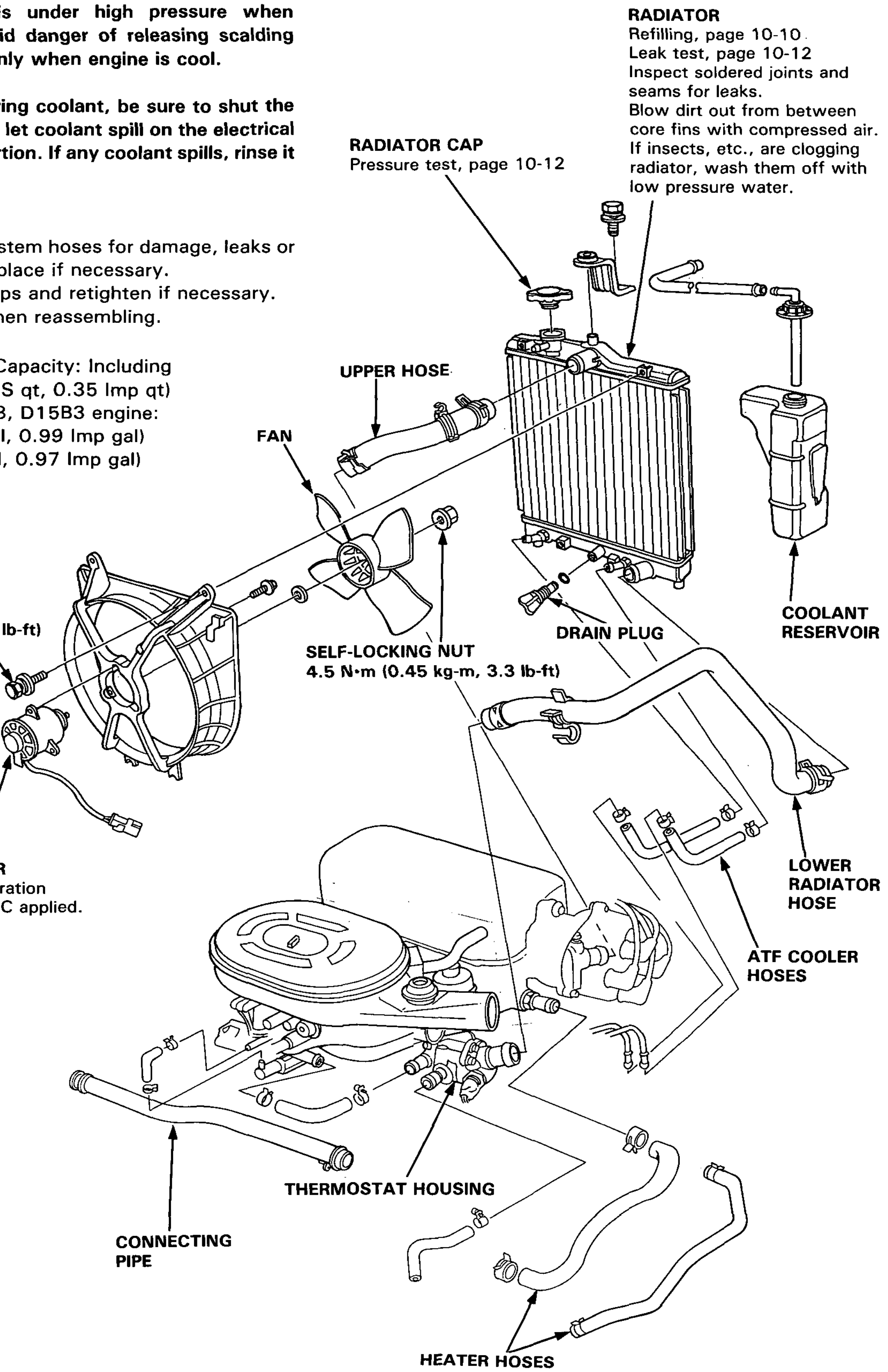
Illustrated Index

⚠WARNING System is under high pressure when engine is hot. To avoid danger of releasing scalding coolant, remove cap only when engine is cool.

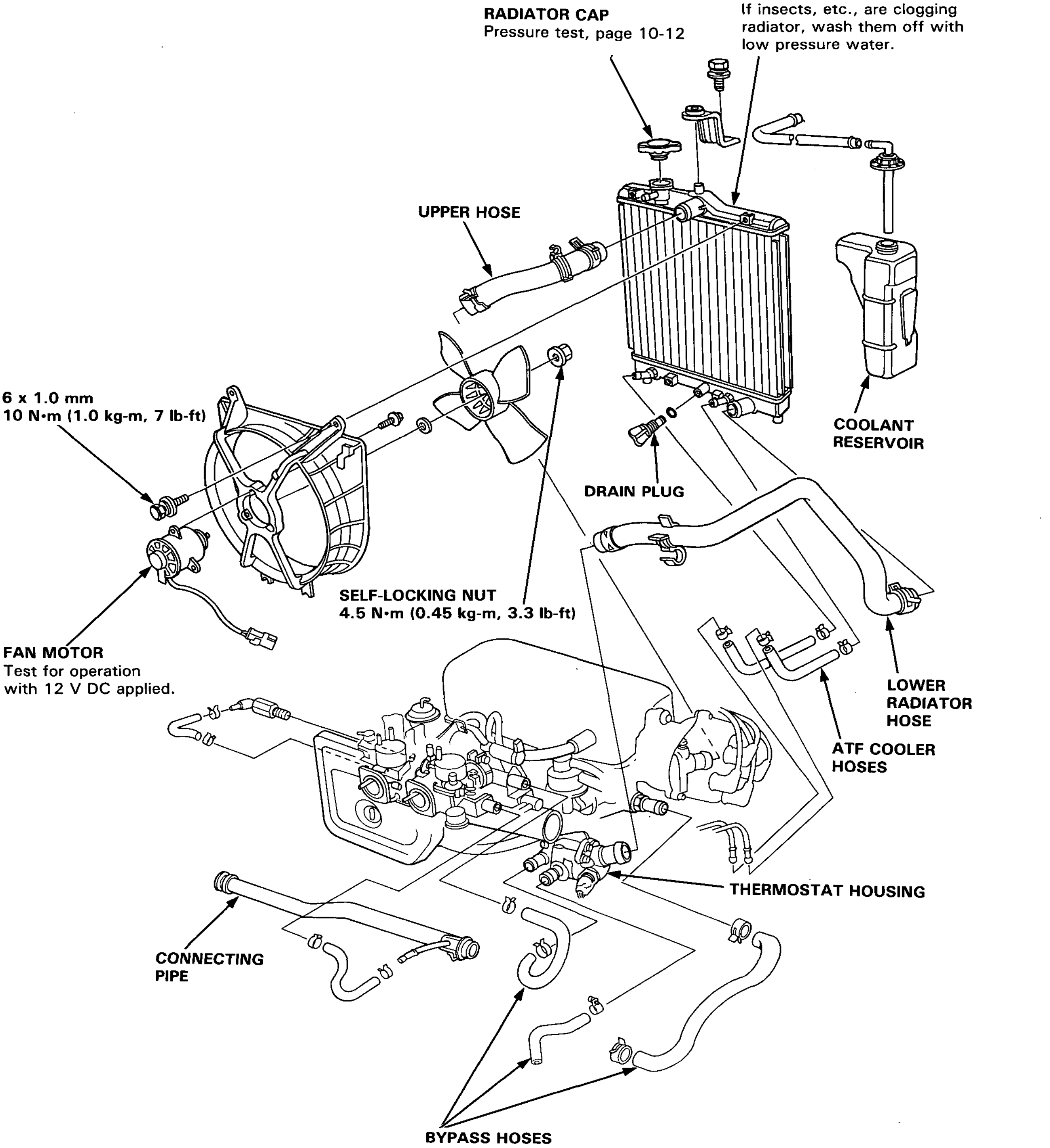
CAUTION: When pouring coolant, be sure to shut the relay box lid and not to let coolant spill on the electrical parts or the painted portion. If any coolant spills, rinse it off immediately.

NOTE:
- Check all cooling system hoses for damage, leaks or deterioration and replace if necessary.
- Check all hose clamps and retighten if necessary.
- Use new O-rings when reassembling.

Total Cooling System Capacity: Including reservoir 0.4 ℓ (0.42 US qt, 0.35 Imp qt)
D12BL, D13B2, D13B3, D15B3 engine:
M/T 4.5 ℓ (1.19 US gal, 0.99 Imp gal)
A/T 4.4 ℓ (1.16 US gal, 0.97 Imp gal)



Total Cooling System Capacity: Including reservoir 0.4 ℓ (0.42 US qt, 0.35 Imp qt)
D15B4 engine:
M/T 4.5 ℓ (1.19 US gal, 0.99 Imp gal)
A/T 4.4 ℓ (1.16 US gal, 0.97 Imp gal)



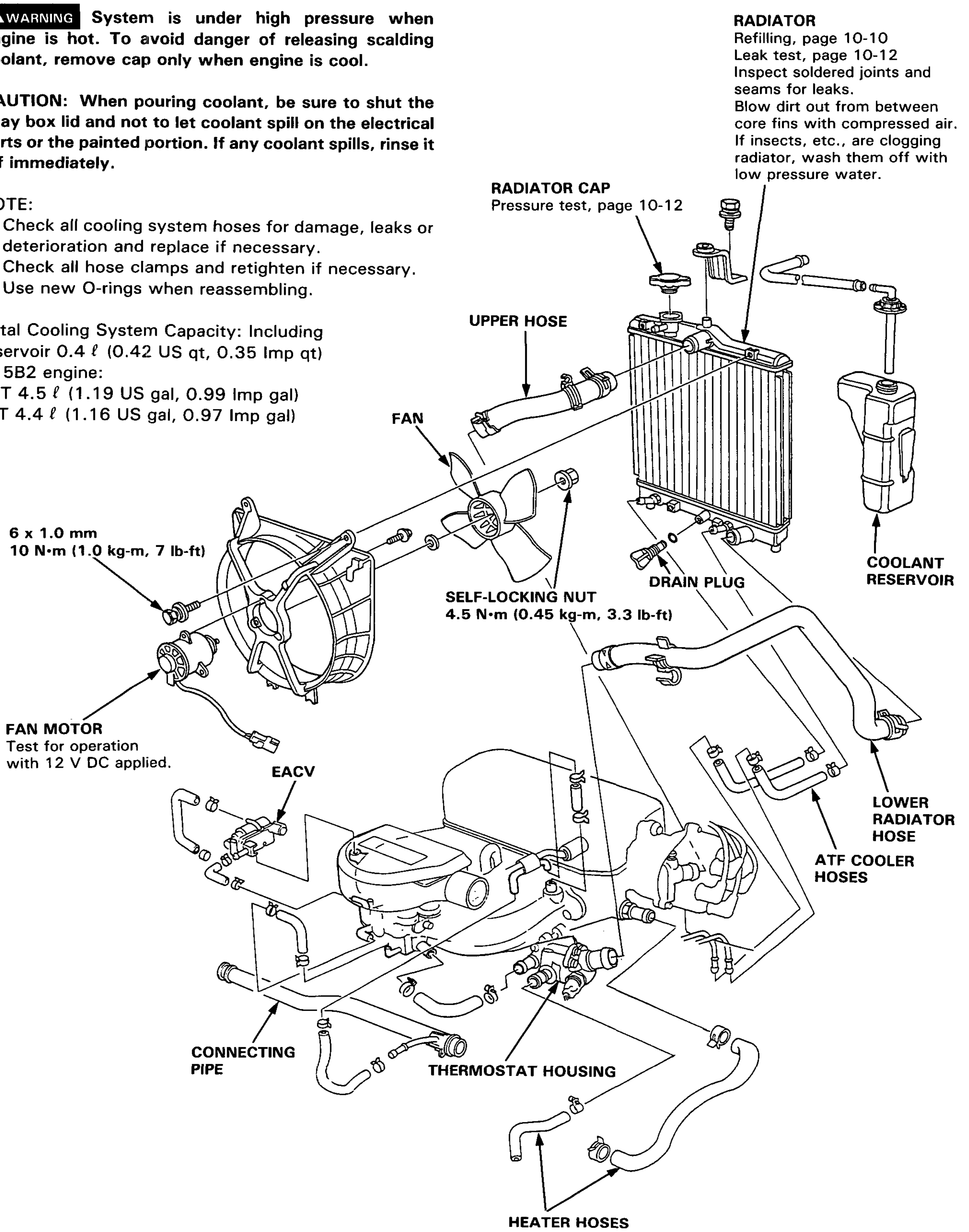
Illustrated Index

⚠WARNING System is under high pressure when engine is hot. To avoid danger of releasing scalding coolant, remove cap only when engine is cool.

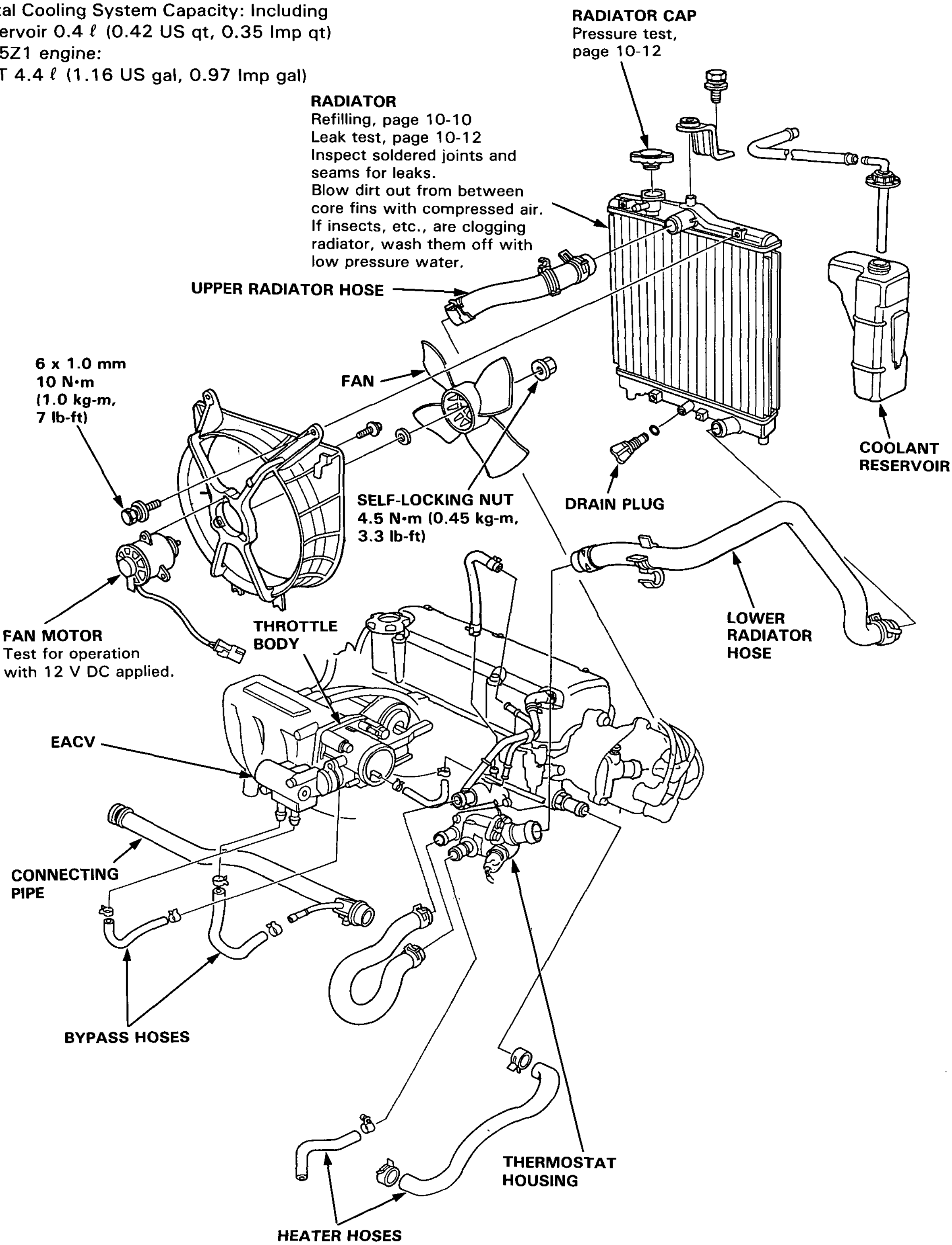
CAUTION: When pouring coolant, be sure to shut the relay box lid and not to let coolant spill on the electrical parts or the painted portion. If any coolant spills, rinse it off immediately.

NOTE:
- Check all cooling system hoses for damage, leaks or deterioration and replace if necessary.
- Check all hose clamps and retighten if necessary.
- Use new O-rings when reassembling.

Total Cooling System Capacity: Including reservoir 0.4 ℓ (0.42 US qt, 0.35 Imp qt)
D15B2 engine:
M/T 4.5 ℓ (1.19 US gal, 0.99 Imp gal)
A/T 4.4 ℓ (1.16 US gal, 0.97 Imp gal)



Total Cooling System Capacity: Including reservoir 0.4 ℓ (0.42 US qt, 0.35 Imp qt)
D15Z1 engine:
M/T 4.4 ℓ (1.16 US gal, 0.97 Imp gal)



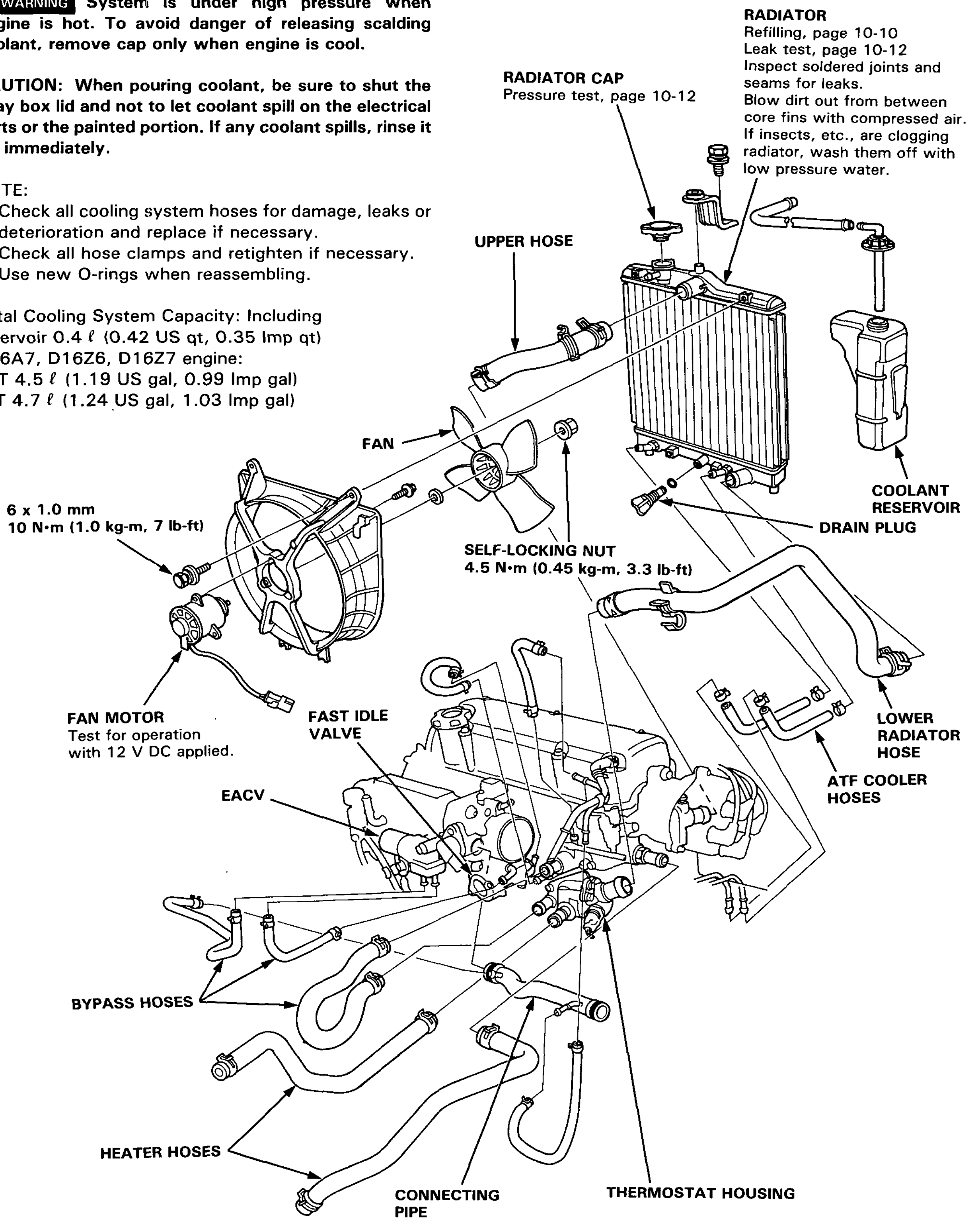
Illustrated Index

⚠WARNING System is under high pressure when engine is hot. To avoid danger of releasing scalding coolant, remove cap only when engine is cool.

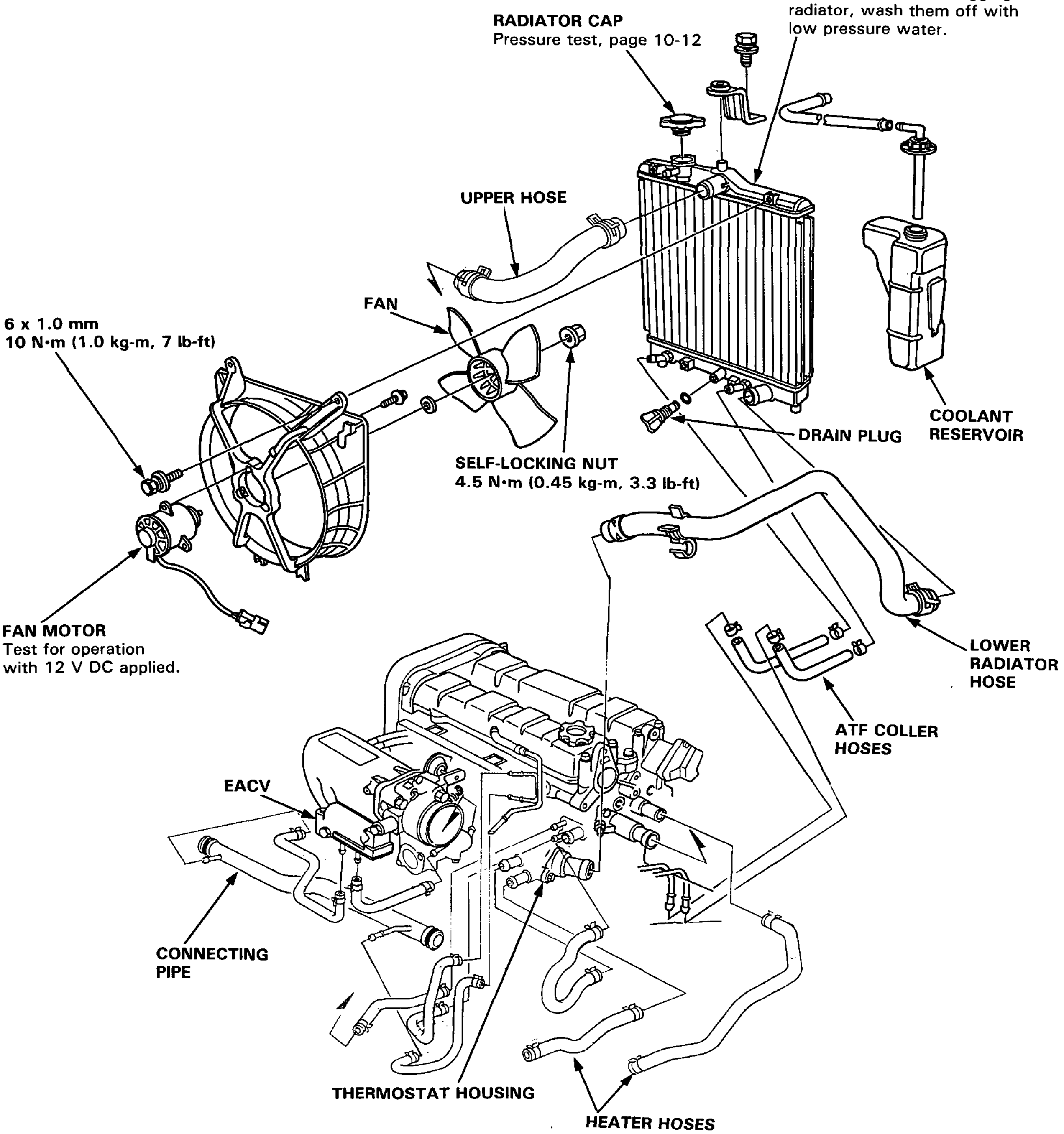
CAUTION: When pouring coolant, be sure to shut the relay box lid and not to let coolant spill on the electrical parts or the painted portion. If any coolant spills, rinse it off immediately.

NOTE:
- Check all cooling system hoses for damage, leaks or deterioration and replace if necessary.
- Check all hose clamps and retighten if necessary.
- Use new O-rings when reassembling.

Total Cooling System Capacity: Including reservoir 0.4 ℓ (0.42 US qt, 0.35 Imp qt)
D16A7, D16Z6, D16Z7 engine:
M/T 4.5 ℓ (1.19 US gal, 0.99 Imp gal)
A/T 4.7 ℓ (1.24 US gal, 1.03 Imp gal)



Total Cooling System Capacity: Including reservoir 0.4 ℓ (0.42 US qt, 0.35 Imp qt)
D16A8, D16A9 engine:
M/T 4.5 ℓ (1.19 US gal, 0.99 Imp gal)
A/T 4.7 ℓ (1.24 US gal, 1.03 Imp gal)



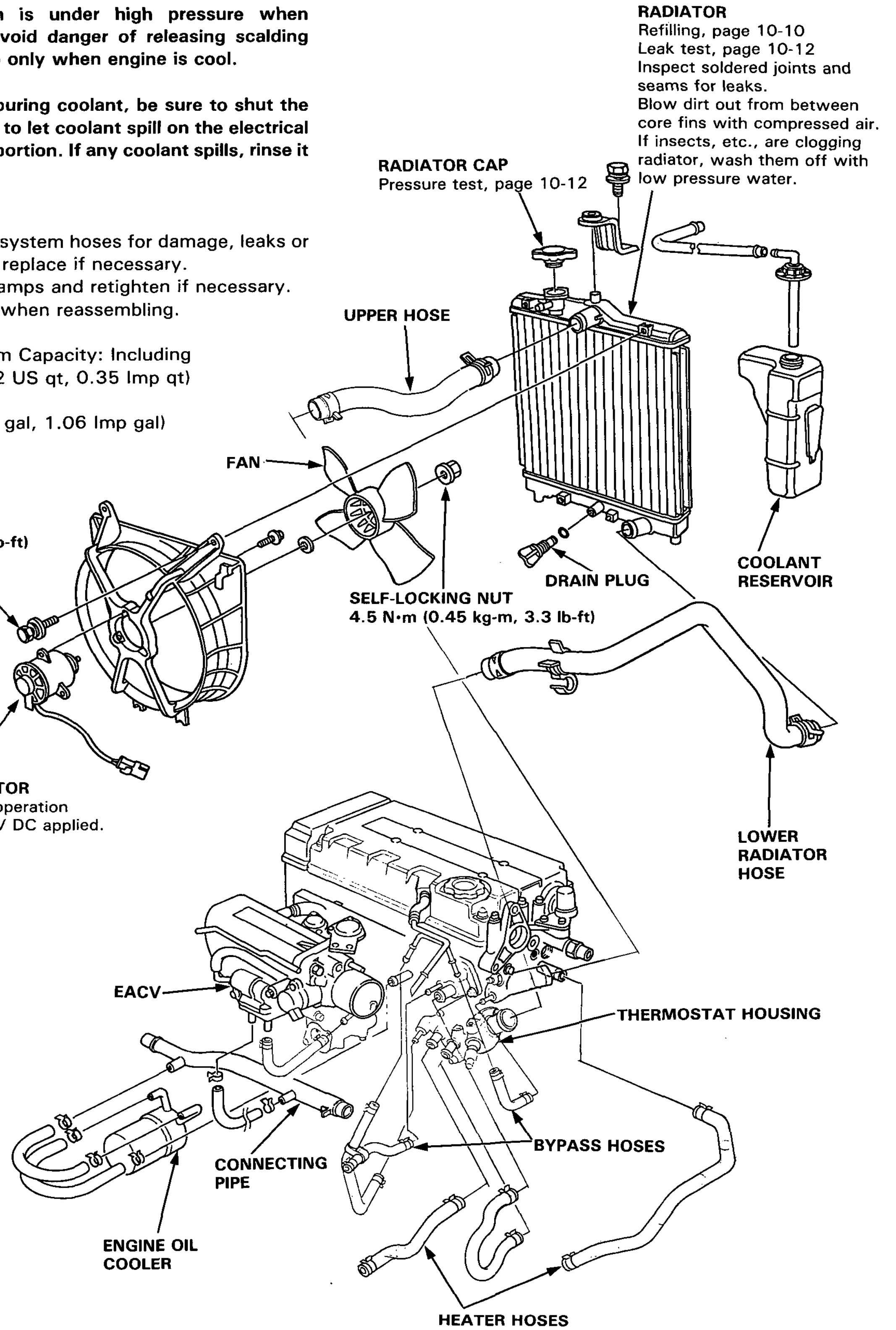
Illustrated Index

⚠WARNING System is under high pressure when engine is hot. To avoid danger of releasing scalding coolant, remove cap only when engine is cool.

CAUTION: When pouring coolant, be sure to shut the relay box lid and not to let coolant spill on the electrical parts or the painted portion. If any coolant spills, rinse it off immediately.

NOTE:
- Check all cooling system hoses for damage, leaks or deterioration and replace if necessary.
- Check all hose clamps and retighten if necessary.
- Use new O-rings when reassembling.

Total Cooling System Capacity: Including reservoir 0.4 ℓ (0.42 US qt, 0.35 Imp qt)
B16A2 engine:
M/T 4.8 ℓ (1.27 US gal, 1.06 Imp gal)



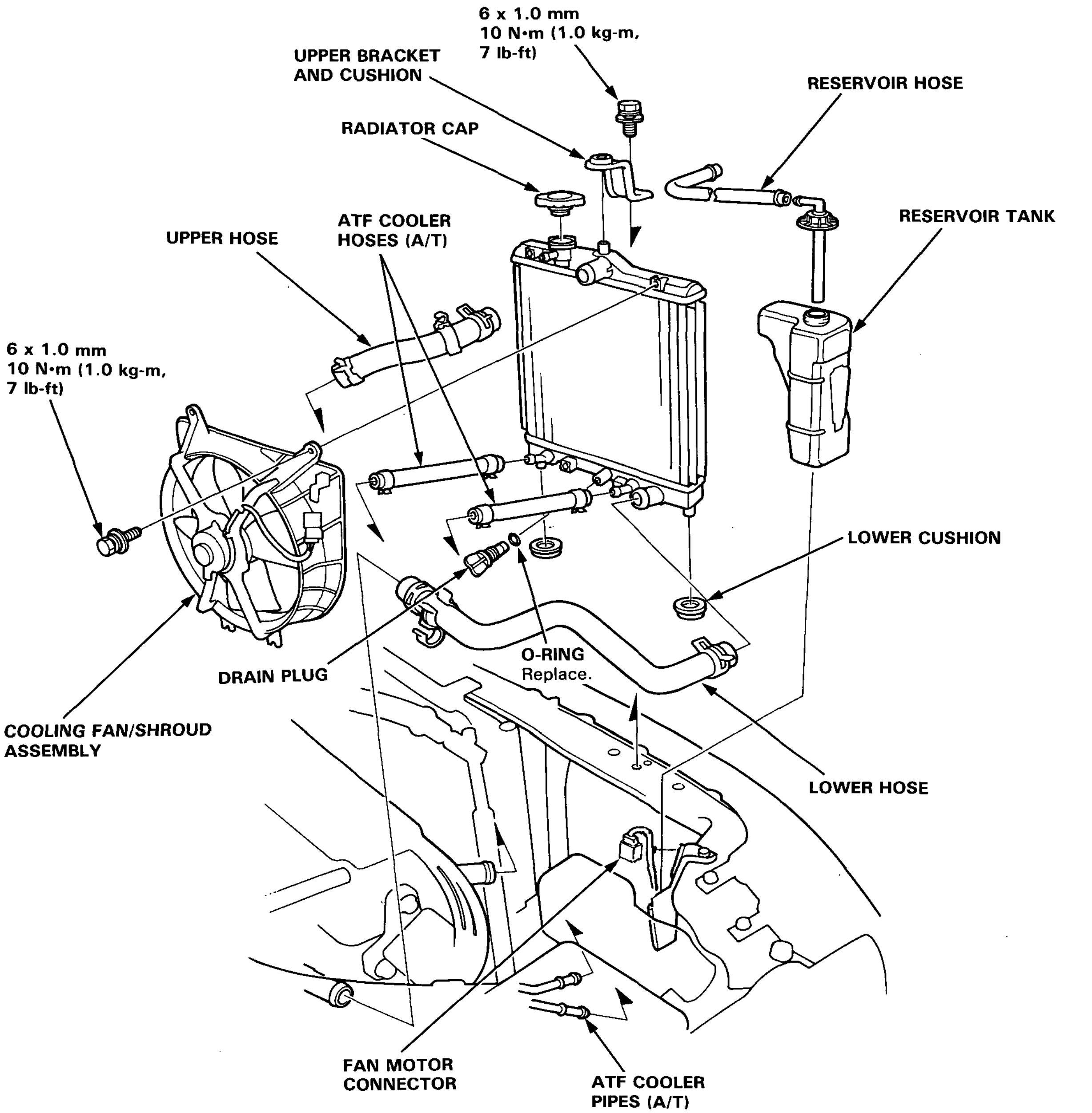
Radiator

Replacement

1. Drain the radiator coolant.
2. Remove the upper and lower radiator hoses, and ATF cooler hoses.
3. Disconnect the fan motor connector.
4. Remove the radiator upper brackets, then pull up the radiator.
5. Remove the fan shroud assemblies and other parts from radiator.

Install the radiator in the reverse order of removal:

NOTE:
- Set the upper and lower cushions securely.
- Fill the radiator and bleed the air.



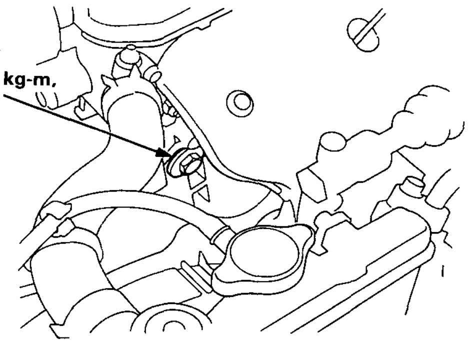
Radiator

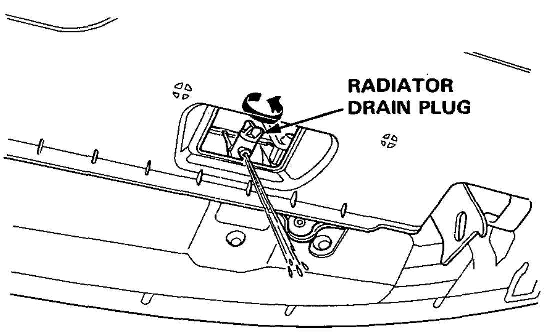
Refilling and Bleeding

⚠WARNING Removing the radiator cap while the engine is hot can cause the coolant to spray out, seriously scalding you. Always let the engine and radiator cool down before removing the radiator cap.

CAUTION: When pouring coolant, be sure to shut the relay box lid and not let coolant spill on the electrical parts or the paint. If any coolant spills, rinse it off immediately.

1. Start the engine. Slide the heater temperature control lever to maximum heat and turn off the engine. Make sure the engine and radiator are cool to the touch.
2. Remove the radiator cap.
3. Loosen the drain plug on the bottom of the radiator and remove the drain bolt on the engine block. Let the coolant drain out.





4. Remove the reservoir from its holder by pulling it straight up. Drain the coolant, then put the reservoir back in its holder.
5. When the coolant stops draining, apply liquid gasket to the drain bolt threads, then reinstall the bolt with a new washer. Tighten it securely.
6. Tighten the radiator drain plug securely.
7. Mix the recommended antifreeze/coolant with an equal amount of water in a clean container.

NOTE:
- Use only HONDA-RECOMMENDED antifreeze/coolant.
- For best corrosion protection, the coolant concentrations must be maintained year-round at 50% MINIMUM. Coolant concentrations less than 50% may not provide sufficient protection against corrosion or freezing.

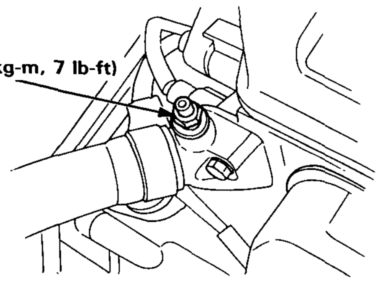
CAUTION:
- **Do not mix different brands of antifreeze/coolant.**
- **Do not use additional rust inhibitors or anti-rust products; they may not be compatible with the recommended coolant.**

Radiator Coolant Refill Capacity: Including reservoir 0.4 ℓ (0.42 US qt, 0.35 Imp qt)

ENGINE TYPE	M/T	A/T
	ℓ (US gal, Imp gal)	
D12B ☒	3.6 (0.95, 0.79)	3.5 (0.92, 0.77)
D13B ☒	3.6 (0.95, 0,79)	3.5 (0.92, 0.77)
D15B ☒	3.6 (0.95, 0.79)	3.5 (0.92, 0.77)
D15Z ☒	3.5 (0.92, 0.77)	——
D16A ☒	3.6 (0.95, 0.79)	3.8 (1.00, 0.84)
D16Z ☒	3.6 (0.95, 0.79)	3.8 (1.00, 0.84)
B16A ☒	3.9 (1.03, 0.86)	——

8. Pour coolant into the radiator up to the base of the filler neck.

9. Loosen the bleed bolt on top of the engine. Tighten it again when coolant comes out in a steady stream with no bubbles.



10. Refill the radiator to the base of the filler neck. Put the cap on the radiator, and tighten it only to the first stop. Start the engine and let it run until it warms up (the radiator cooling fan comes on at least twice).

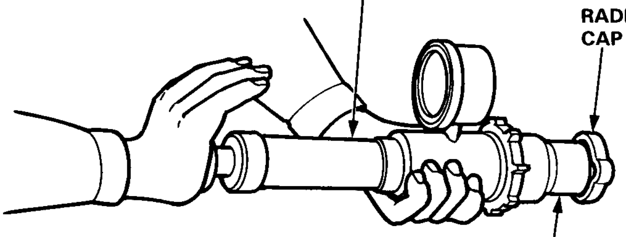
11. Turn off the engine. Check the level in the radiator, add coolant if needed. Install the radiator cap, and tighten it fully.

12. Fill the reservoir to the MAX mark. Install the reservoir cap.

Radiator

Cap Testing

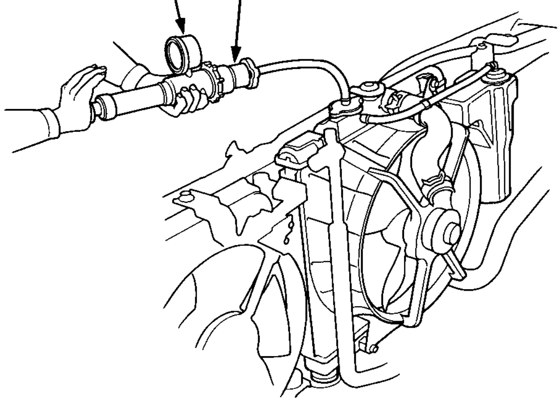
1. Remove the radiator cap, wet its seal with coolant, then install it on the pressure tester.
2. Apply a pressure of 95—125 kPa (0.95—1.25 kg/cm^2, 14—18 psi).
3. Check for a drop in pressure.



Pressure Testing

1. Wait until the engine is cool, then carefully remove the radiator cap and fill the radiator with coolant to the top of the filler neck.
2. Attach the pressure tester to the radiator and apply a pressure of 95—125 kPa (0.95—1.25 kg/cm^2, 14—18 psi).
3. Inspect for coolant leaks and a drop in pressure.
4. Remove the tester and reinstall the radiator cap.

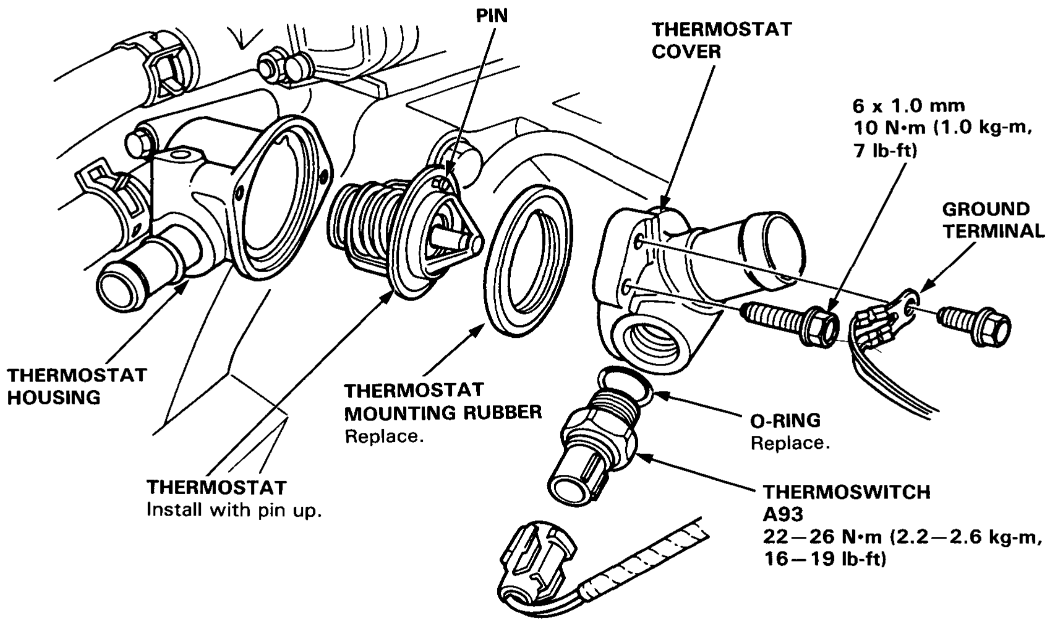
NOTE:
- Check for engine oil in the coolant and/or coolant in the engine oil.
- Check for ATF in the coolant and/or coolant in the ATF (A/T).



Thermostat

Replacement

NOTE: Use new gaskets and O-rings when reassembling.



Testing

Replace thermostat if it is open at room temperature.

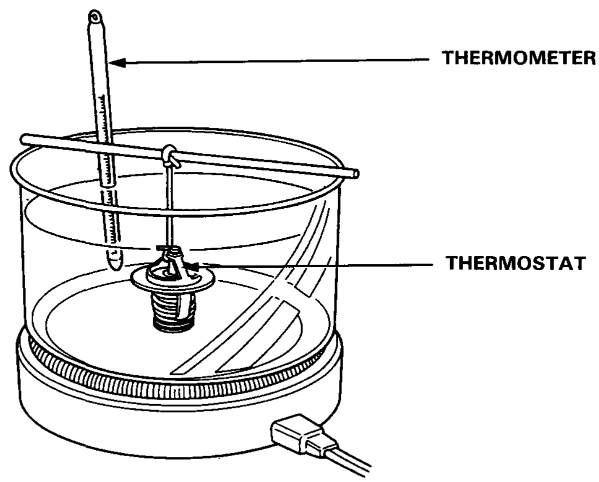
To test a closed thermostat:

1. *Suspend the thermostat in a container of water as shown.*
2. Heat the water and check the temperature with a thermometer. Check the temperature at which the thermostat first opens and at full lift.

   CAUTION: Do not let the thermometer touch the bottom of the hot container.

3. Measure the lift height of the thermostat when it's full open.

   STANDARD THERMOSTAT
   Starts opening:
   D15Z1: 82±2°C (180±4°F)
   Others: 78±2°C (172±4°F)
   Fully open:
   D15Z1: 95°C (203°F)
   Others: 90°C (194°F)
   Lift height: 8.0 mm (0.31 in)



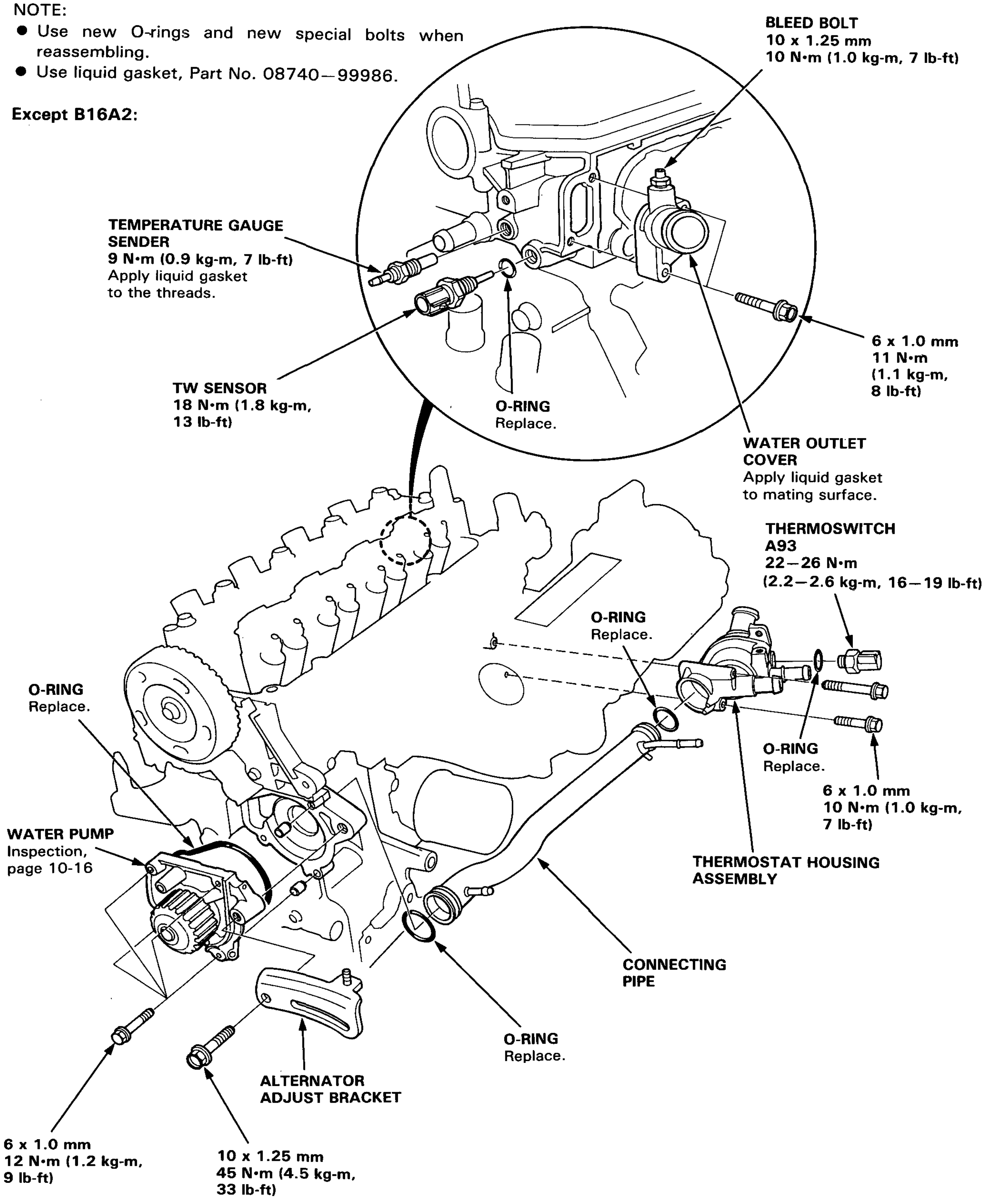
Water Pump

Illustrated Index

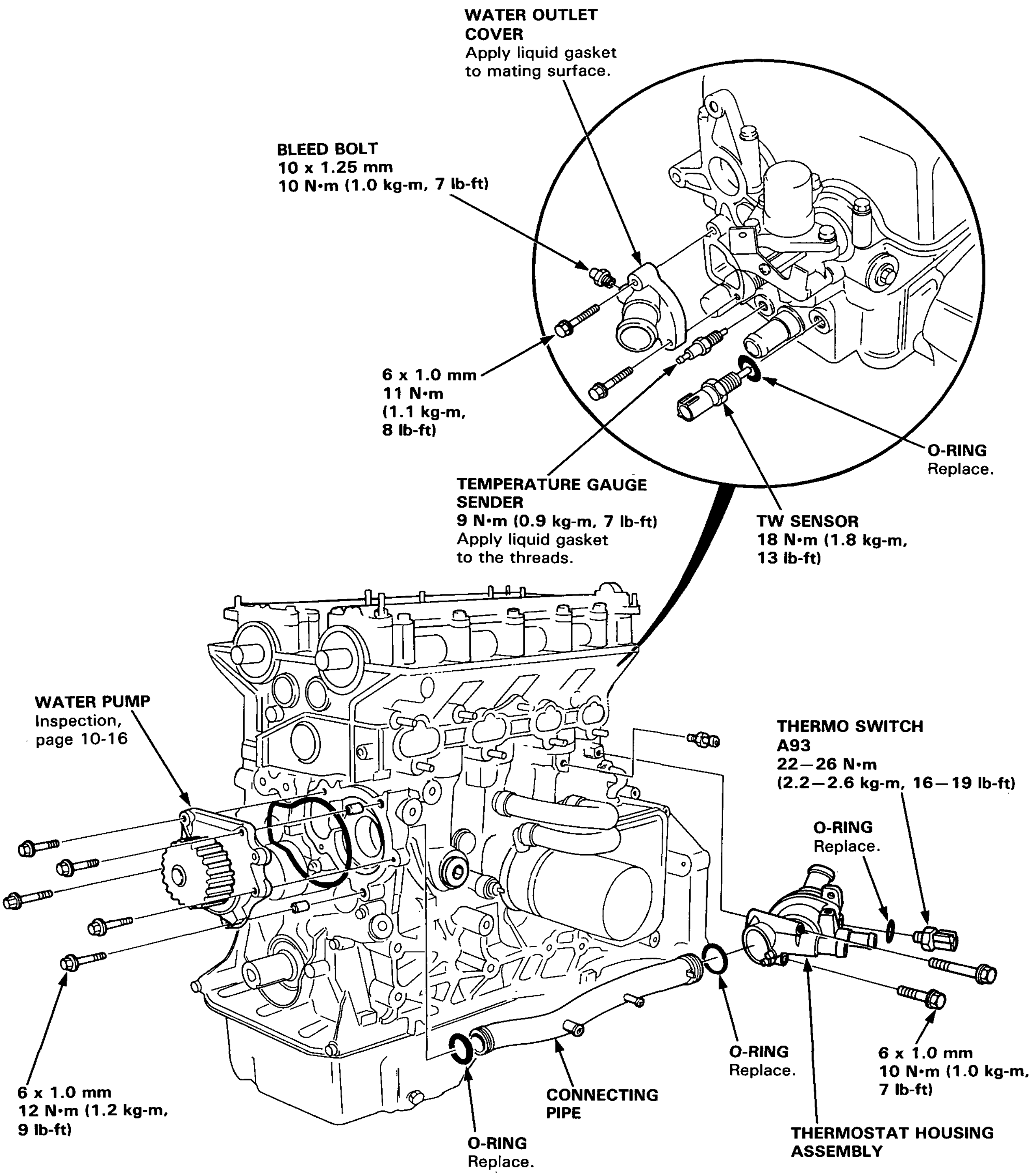
NOTE:

- Use new O-rings and new special bolts when reassembling.
- Use liquid gasket, Part No. 08740–99986.

Except B16A2:



B16A2:


WATER OUTLET COVER
Apply liquid gasket to mating surface.
BLEED BOLT
10 x 1.25 mm
10 N•m (1.0 kg-m, 7 lb-ft)
6 x 1.0 mm
11 N•m
(1.1 kg-m,
8 lb-ft)
O-RING
Replace.
TEMPERATURE GAUGE SENDER
9 N•m (0.9 kg-m, 7 lb-ft)
Apply liquid gasket to the threads.
TW SENSOR
18 N•m (1.8 kg-m,
13 lb-ft)
WATER PUMP
Inspection,
page 10-16
THERMO SWITCH
A93
22—26 N•m
(2.2—2.6 kg-m, 16—19 lb-ft)
O-RING
Replace.
6 x 1.0 mm
12 N•m (1.2 kg-m,
9 lb-ft)
O-RING
Replace.
6 x 1.0 mm
10 N•m (1.0 kg-m,
7 lb-ft)
CONNECTING PIPE
O-RING
Replace.
THERMOSTAT HOUSING ASSEMBLY

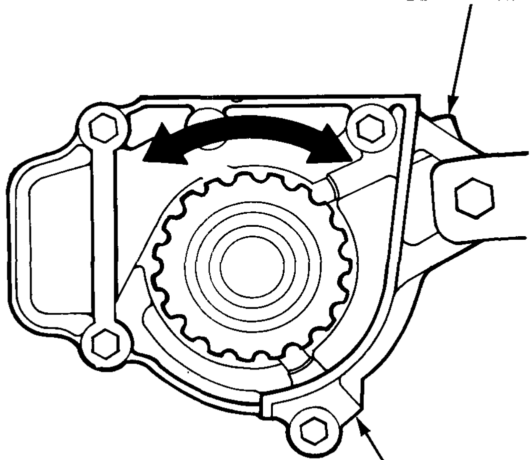
Water Pump

Inspection

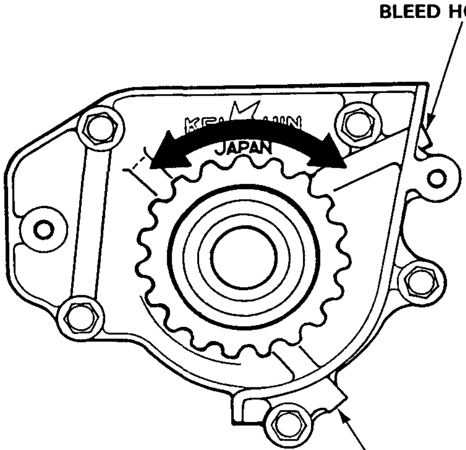
1. *Remove the timing belt (page 6-59).*
2. Check that the water pump pulley turns freely.
3. Check for signs of seal leakage.

   NOTE: A small amount of "weeping" from the bleed hole is normal.

Except B16A2:

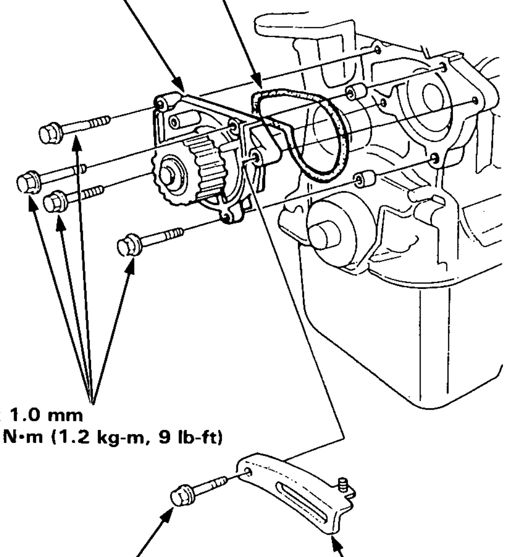


B16A2:



Replacement

1. Remove the timing belt (SOHC: page 6-55, *DOHC*: page 6-88, B16A2: page 6-119).
2. Remove the water pump by removing five bolts.



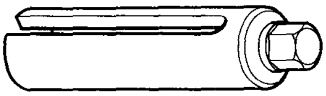
3. Install the water pump in the reverse order of removal.

Fuel and Emissions

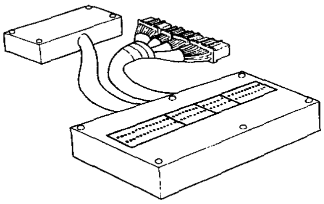
Fuel and Emissions (Carbureted Engine)

Special Tools

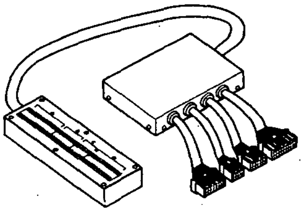
Ref. NO.	Tool Number	Description	Qty	Remarks
①	07LAA–PT50101	O_2 Sensor Socket Wrench	1	
②	07LAJ–PT30100	Test Harness	1	
	or			
	07LAJ–PT3010A	Test Harness	1	
③	07LAJ–PT30200	Test Harness	1	
④	07411–0020000	Digital Circuit Tester	1	
⑤	07614–0050100	Fuel Line Clamp	1	



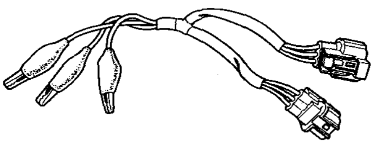
①



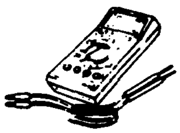
②



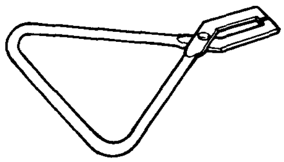
②



③

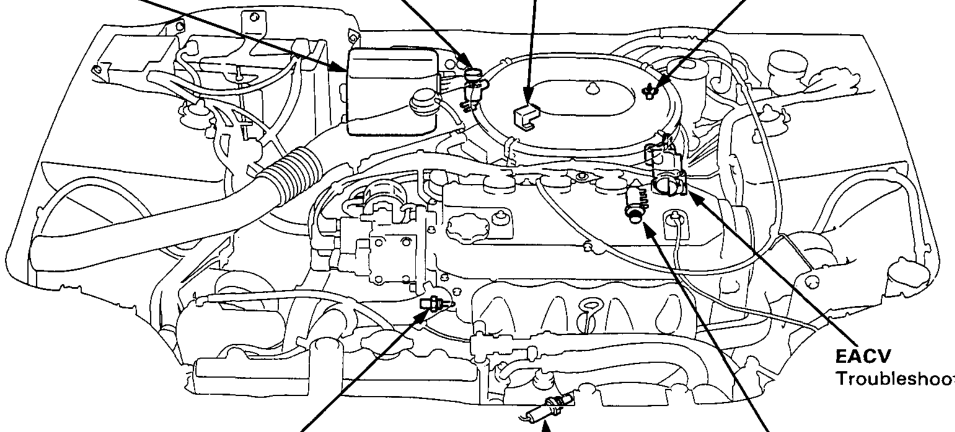


④

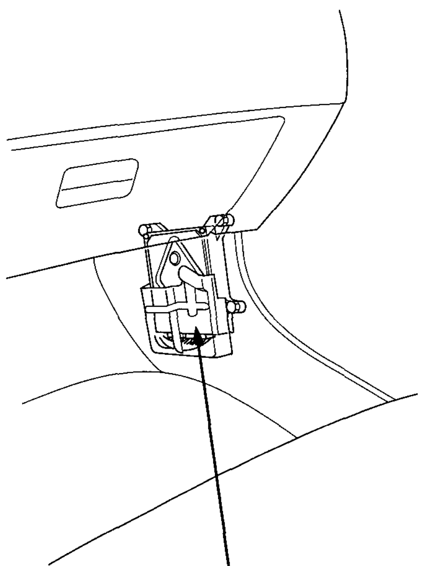


⑤

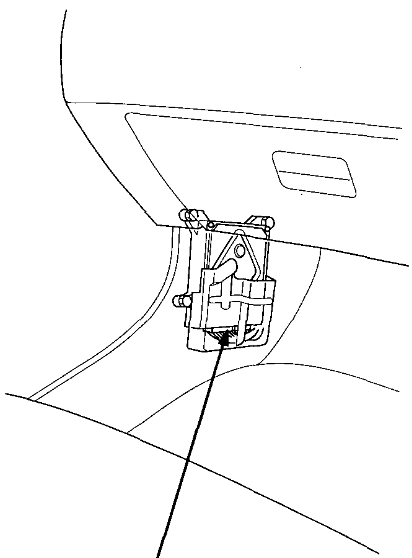
[D13B2 EUROPE & KQ Engine]



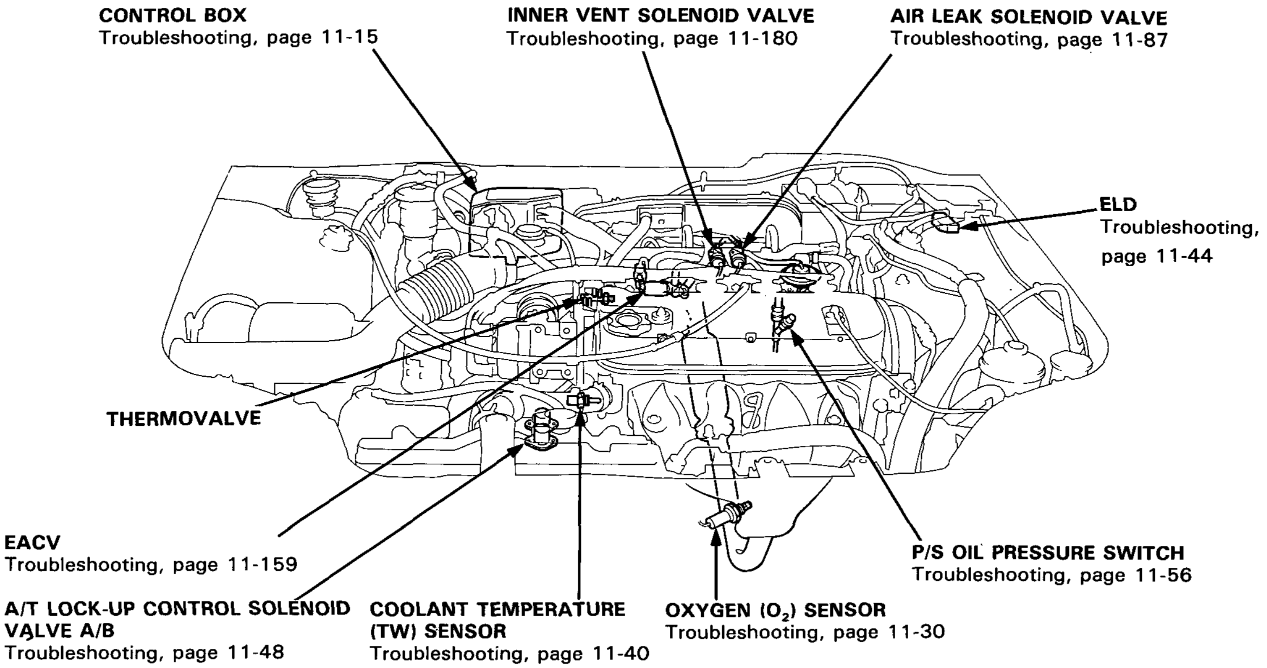
(KG, KS, KF)

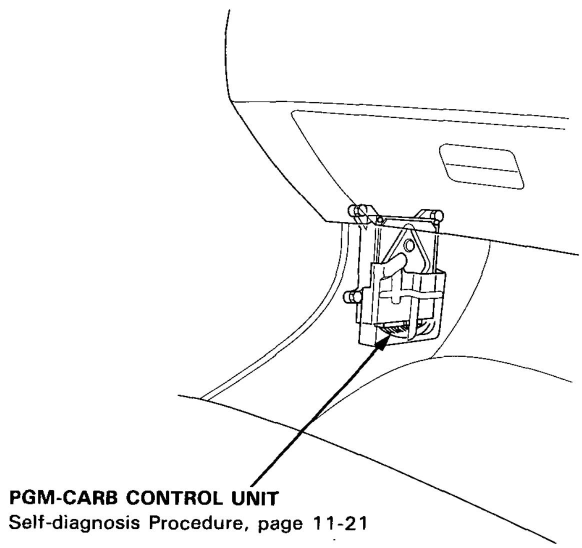


(KE, KQ)

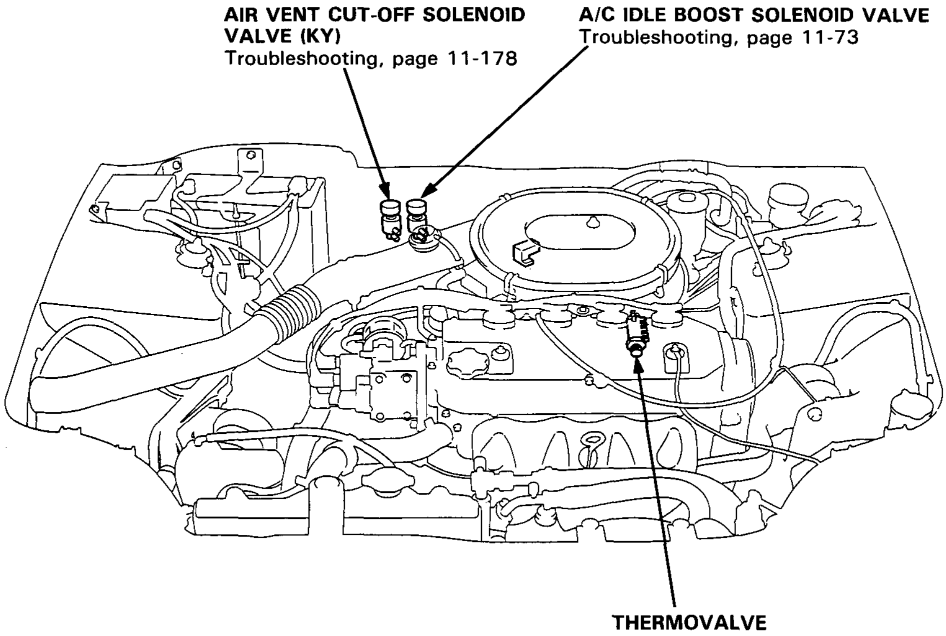


[D15B4 (KQ CARB) Engine]





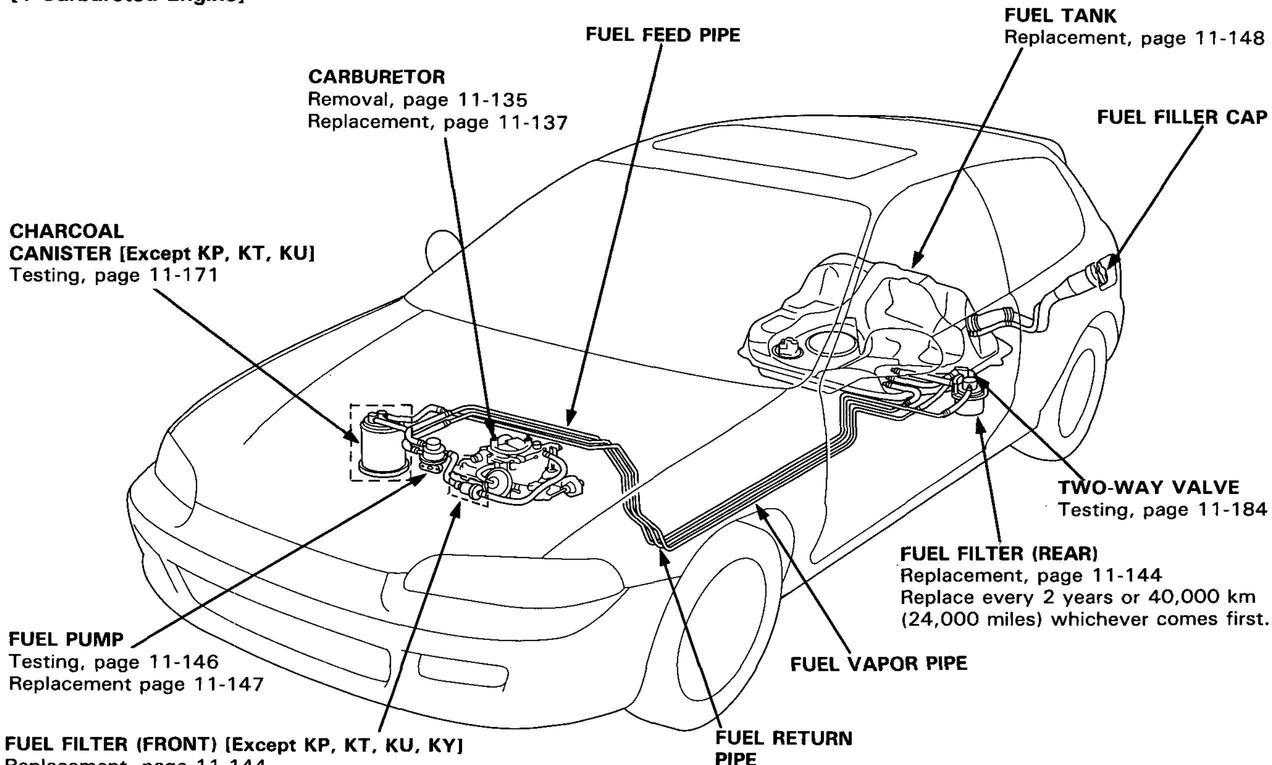
[D12B1, D13B3 EXCEPT EUROPE and D15B3 Engine]



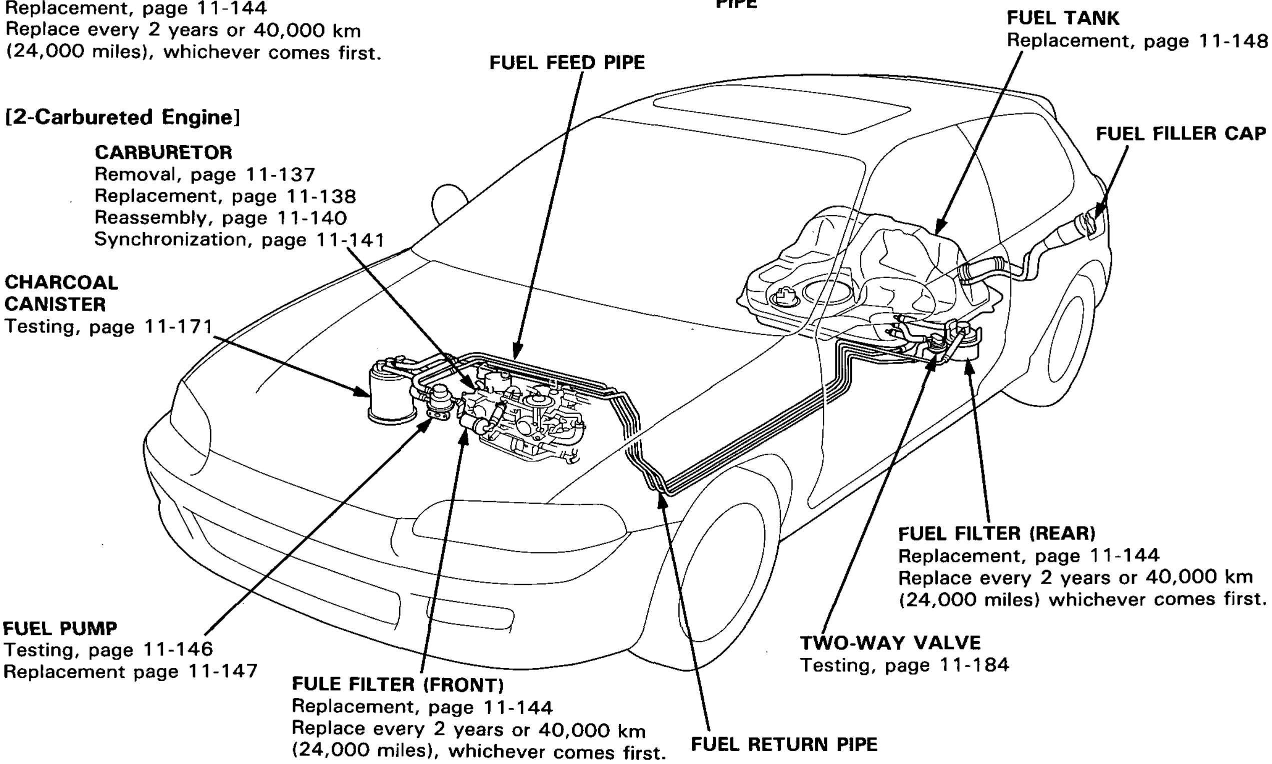
Component Locations

Index

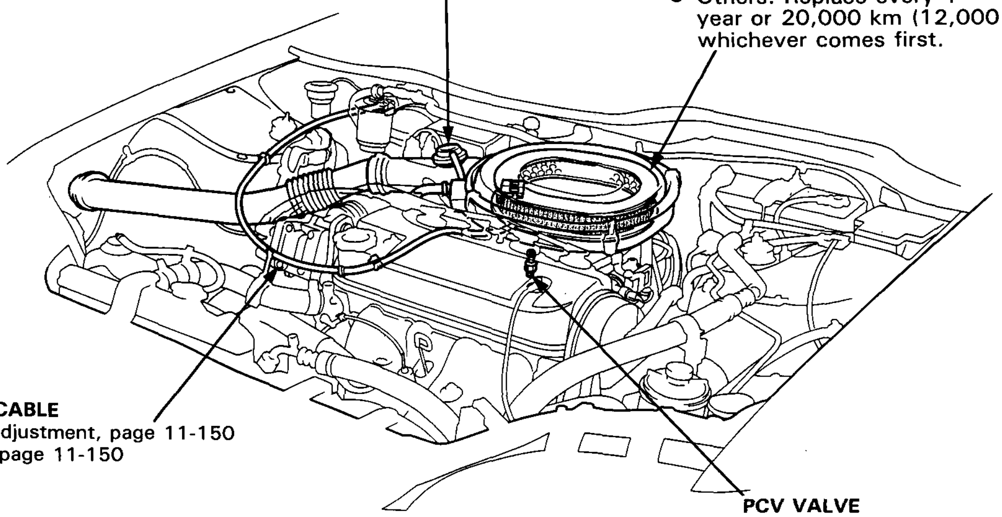
[1-Carbureted Engine]



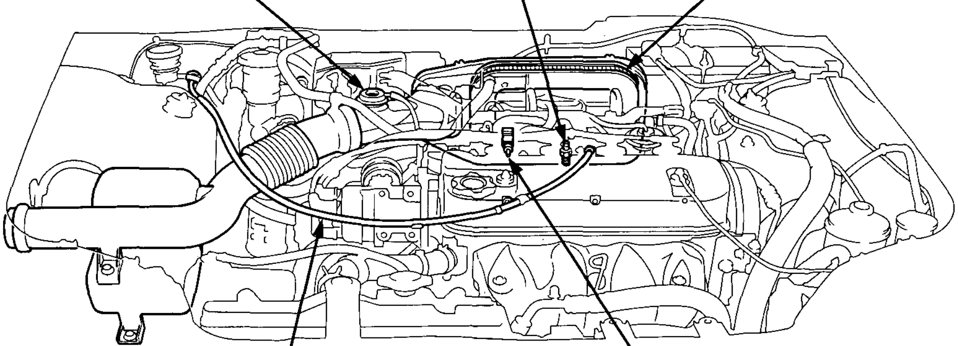
[2-Carbureted Engine]



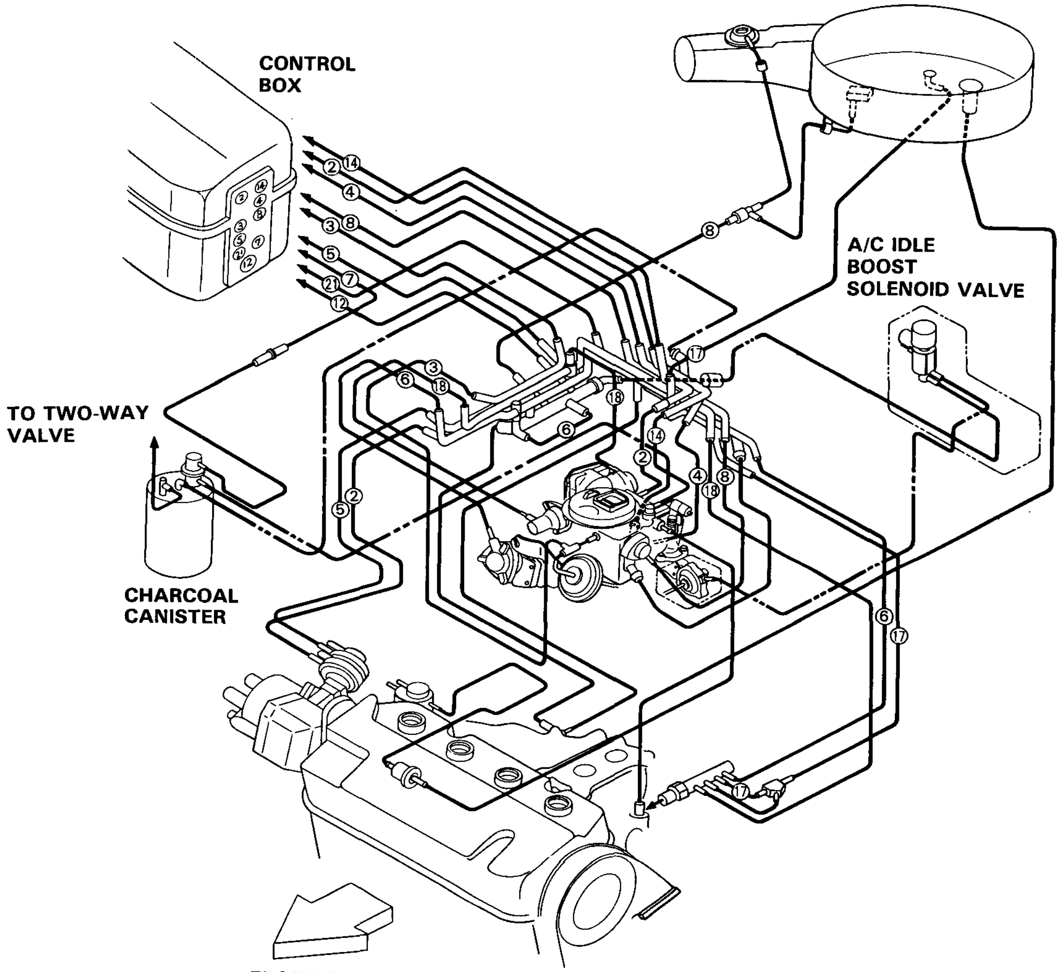
[1-Carbureted Engine]



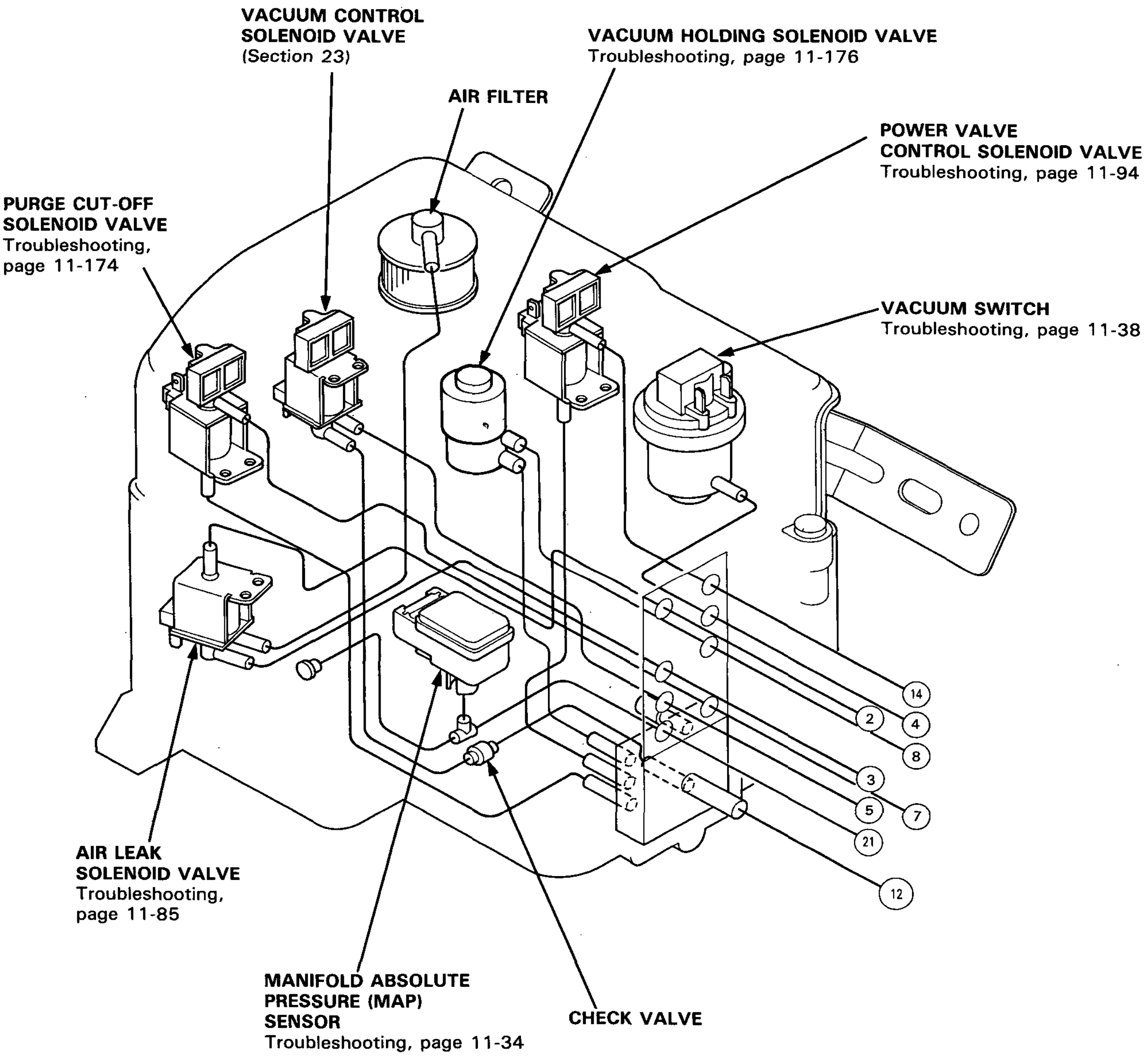
[2-Carbureted Engine]



[D13B2 EUROPE & KQ Engine]



Control Box



VACUUM CONTROL
SOLENOID VALVE
(Section 23)
VACUUM HOLDING SOLENOID VALVE
Troubleshooting, page 11-176
AIR FILTER
POWER VALVE
CONTROL SOLENOID VALVE
Troubleshooting, page 11-94
PURGE CUT-OFF
SOLENOID VALVE
Troubleshooting,
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VACUUM SWITCH
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AIR LEAK
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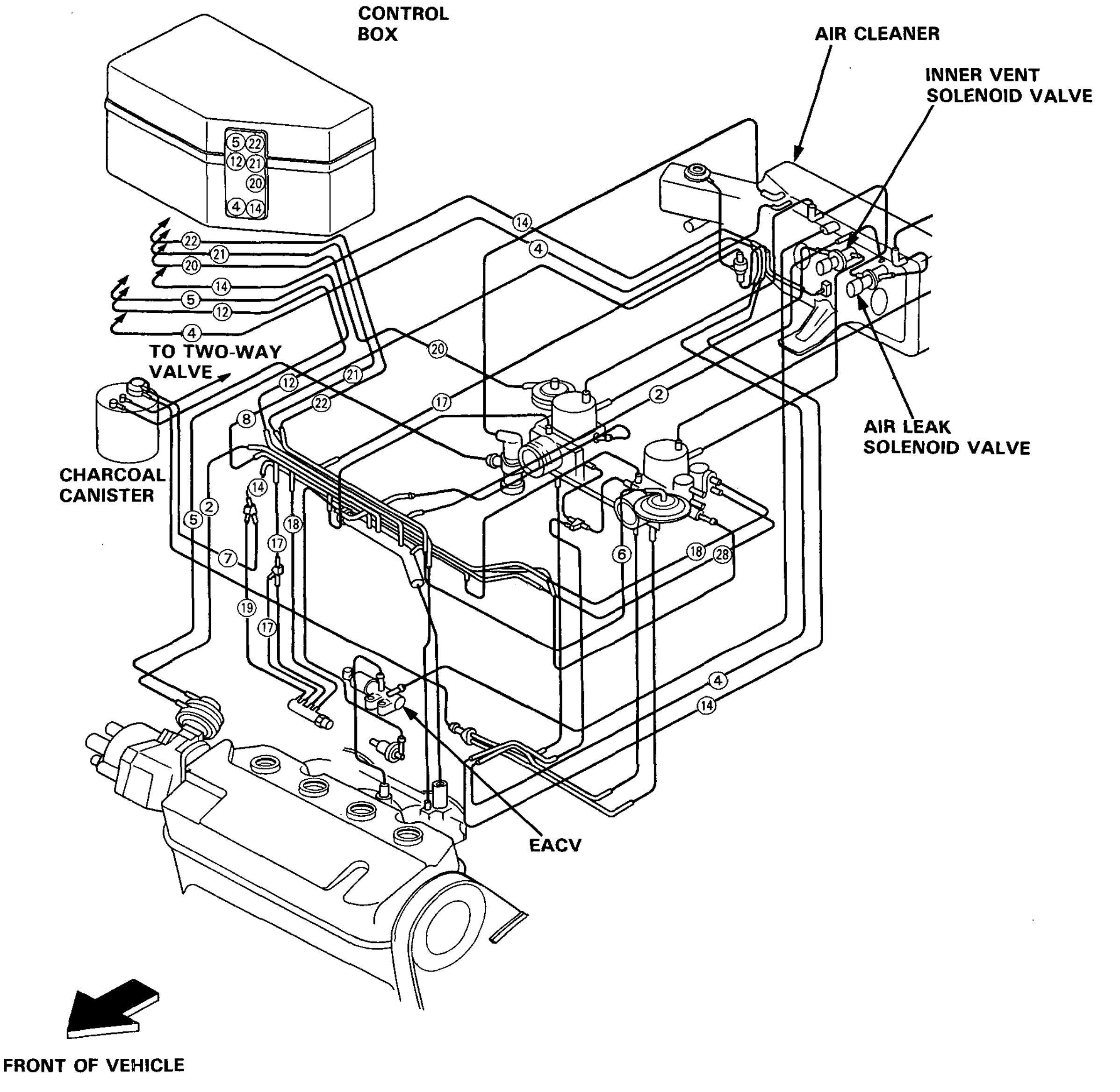
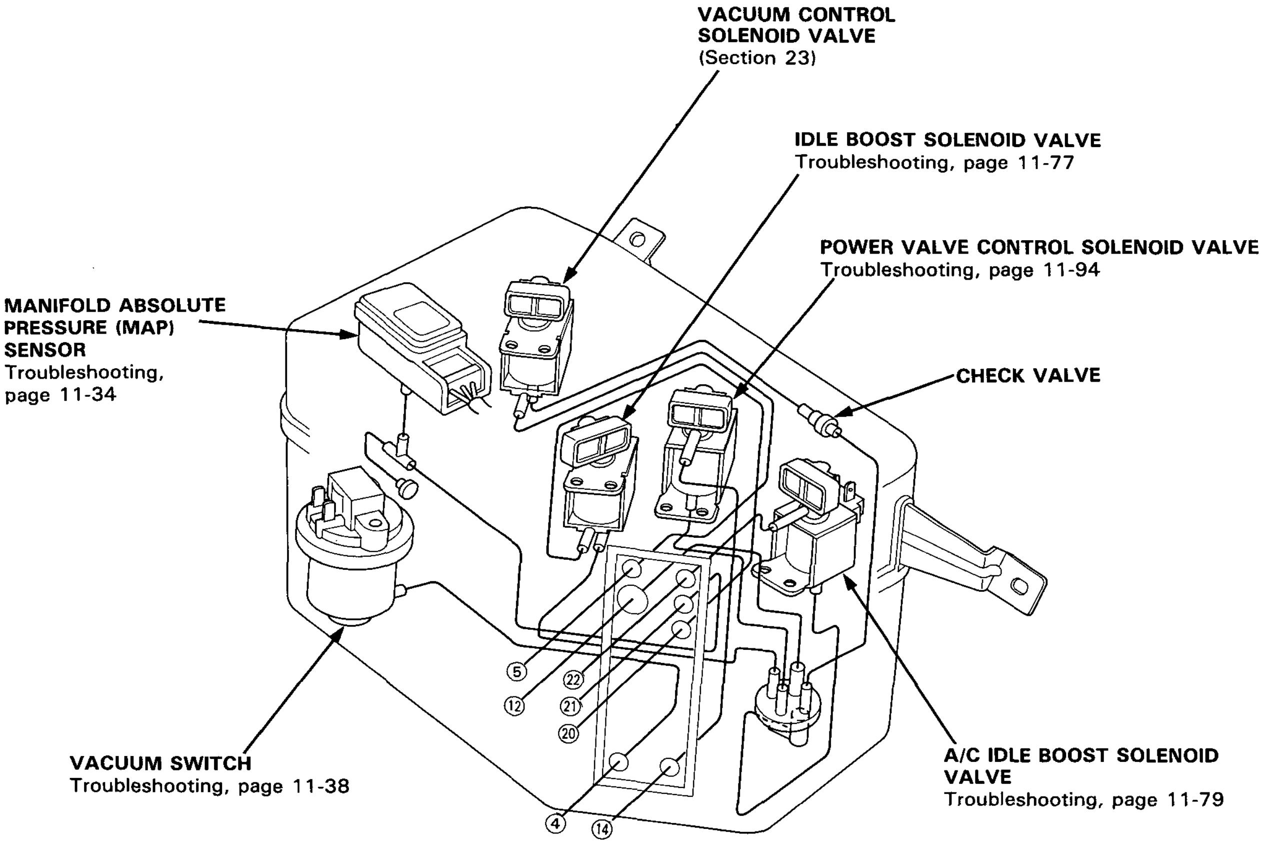
MANIFOLD ABSOLUTE
PRESSURE (MAP)
SENSOR
Troubleshooting, page 11-34
CHECK VALVE

Vacuum Connection

[D15B4 (KQ CARB) Engine]



Control Box



VACUUM CONTROL SOLENOID VALVE
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IDLE BOOST SOLENOID VALVE
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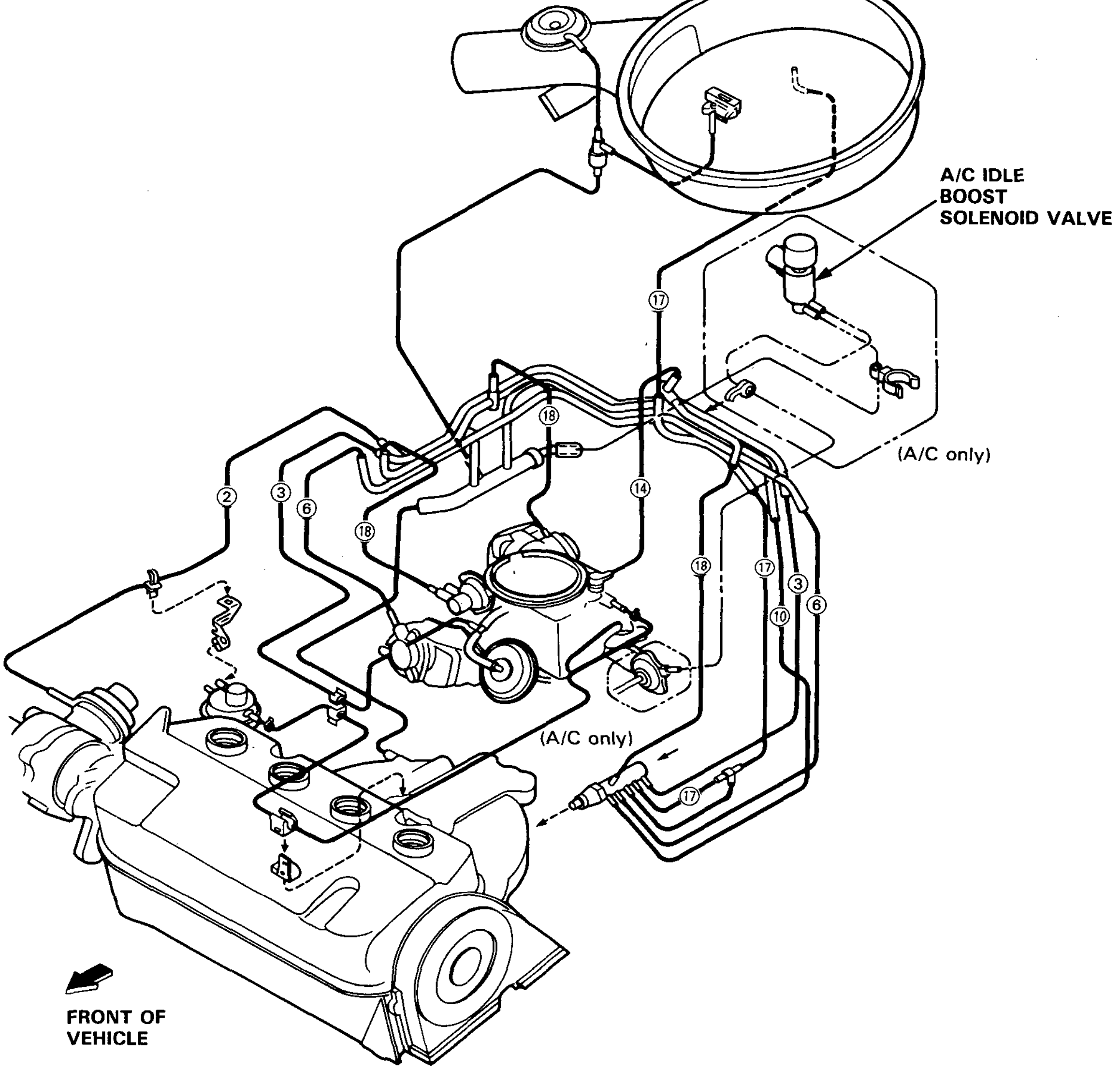
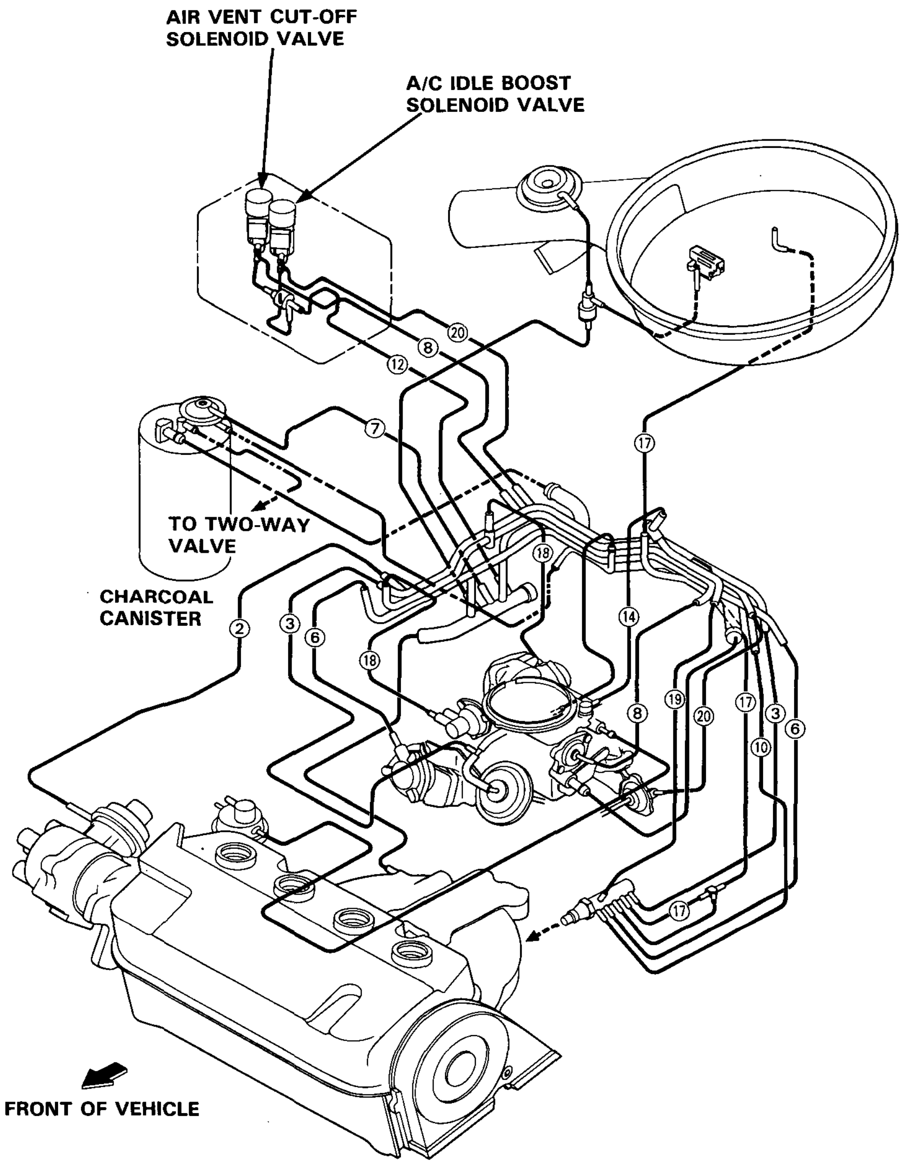
Troubleshooting, page 11-79

Vacuum Connection

[D12B1, D13B3 EXCEPT EUROPE and D15B3 (EXCEPT KY) Engine]



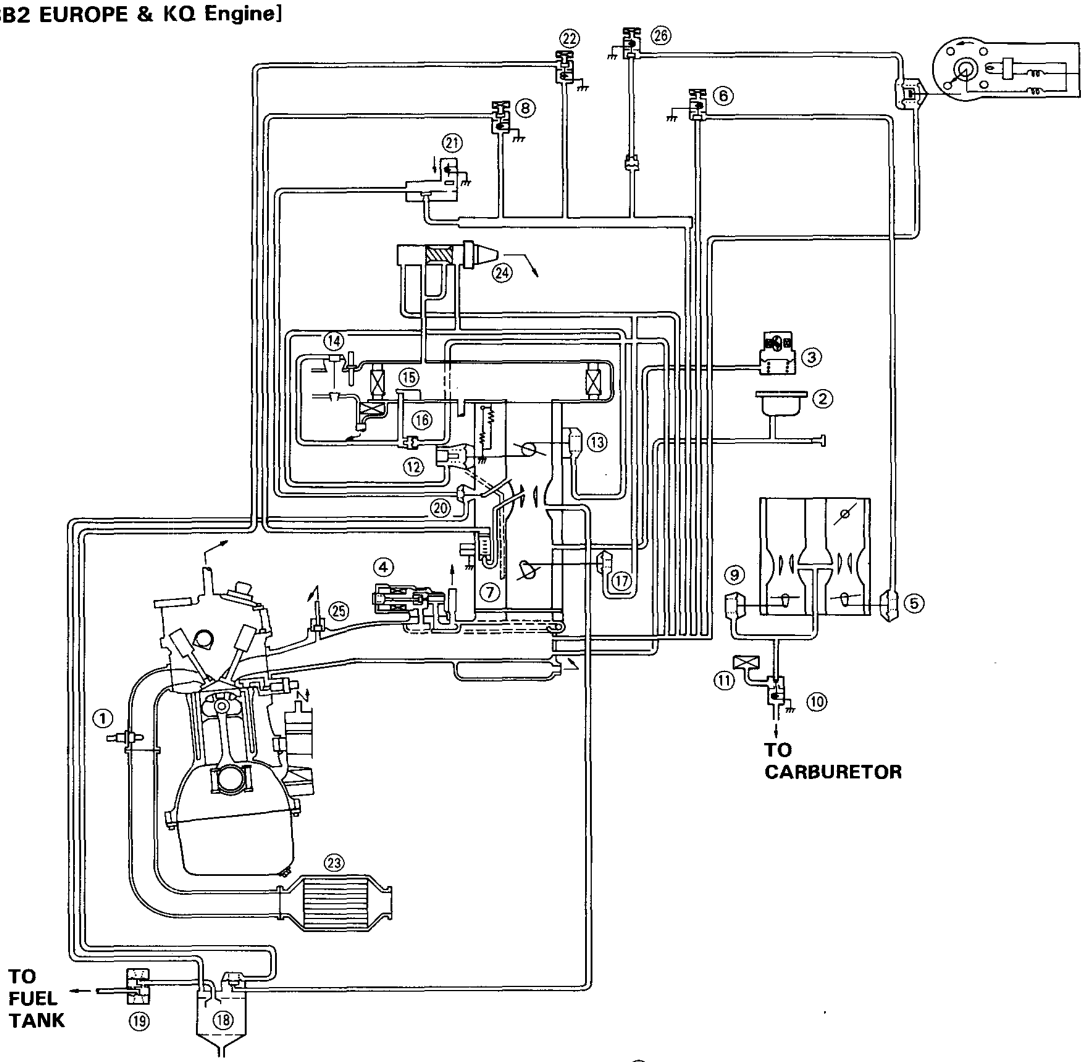
[D15B3 (KY) Engine]



System Description

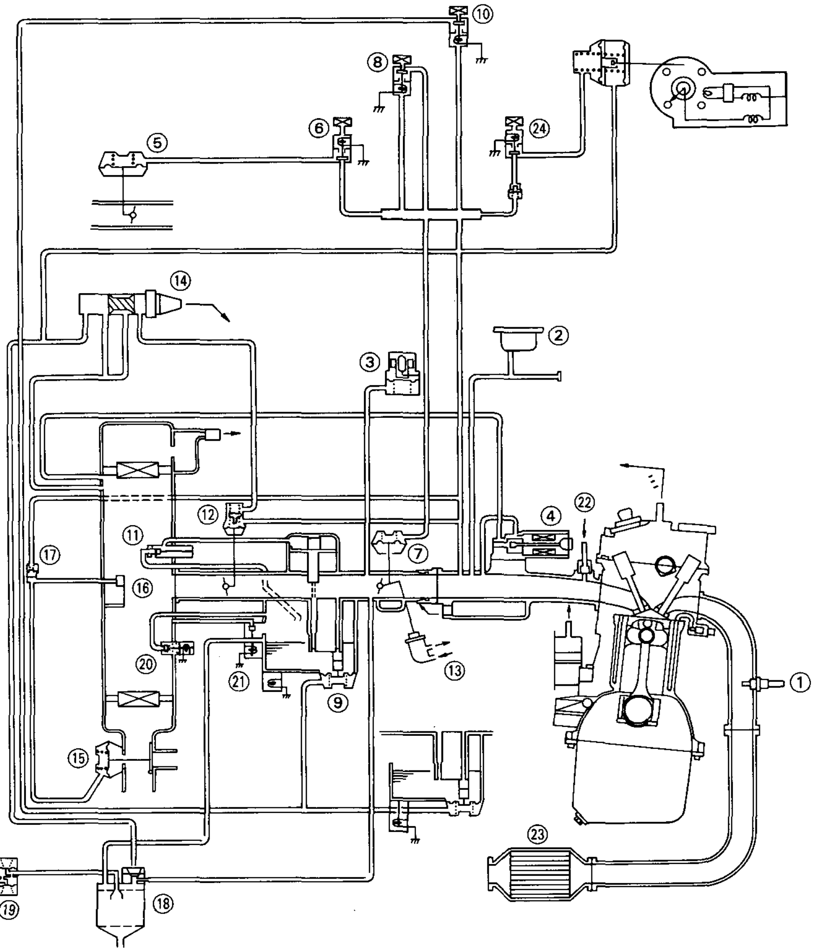
Vacuum Connection

[D13B2 EUROPE & KQ Engine]



① OXYGEN (O_2) SENSOR
② MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR
③ VACUUM SWITCH
④ ELECTRONIC AIR CONTROL VALVE (EACV)
⑤ A/C IDLE BOOST THROTTLE CONTROLLER
⑥ A/C IDLE BOOST SOLENOID VALVE
⑦ POWER VALVE
⑧ POWER VALVE CONTROL SOLENOID VALVE
⑨ SECONDARY DIAPHRAGM
⑩ AIR LEAK SOLENOID VALVE
⑪ AIR FILTER
⑫ CHOKE OPENER
⑬ FAST IDLE UNLOADER
⑭ AIR CONTROL DIAPHRAGM
⑮ AIR BLEED VALVE
⑯ CHECK VALVE
⑰ THROTTLE CONTROLLER
⑱ CHARCOAL CANISTER
⑲ TWO-WAY VALVE
⑳ AIR VENT CUT-OFF DIAPHRAGM
㉑ VACUUM HOLDING SOLENOID VALVE
㉒ PURGE CUT-OFF SOLENOID VALVE
㉓ CATLYTIC CONVERTER
㉔ THERMOVALVE
㉕ PCV VALVE
㉖ VACUUM CONTROL SOLENOID VALVE

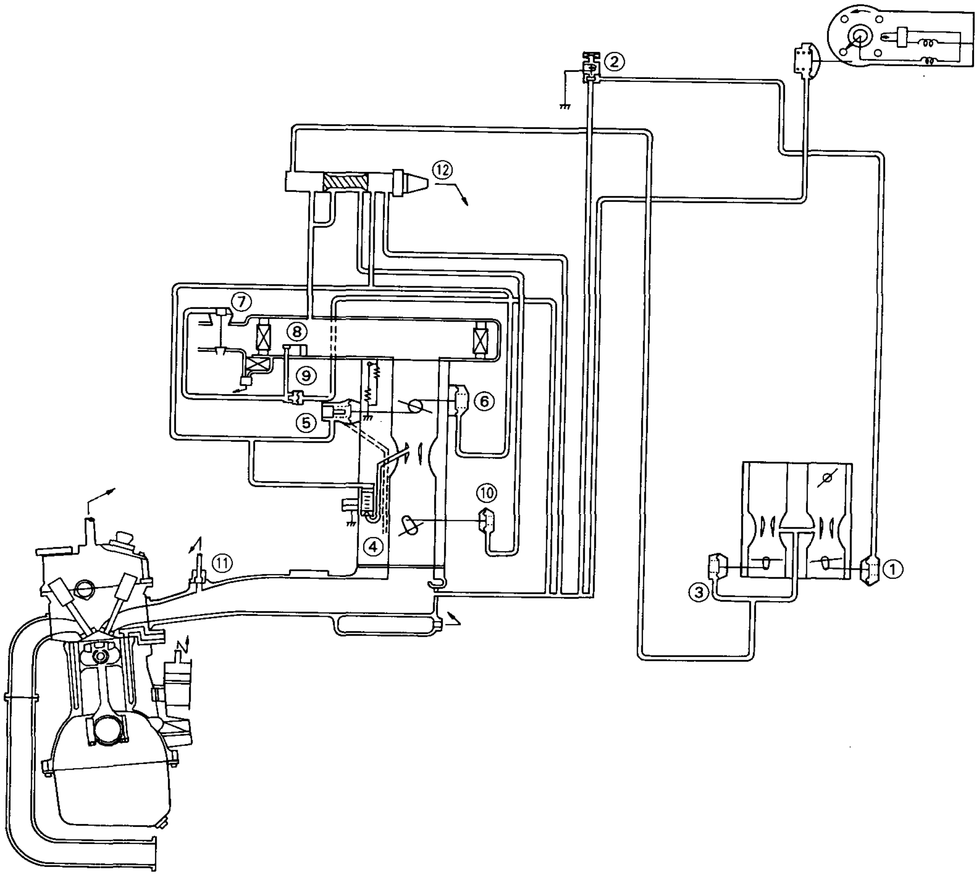
[D15B4 (KQ CARB) Engine]



① OXYGEN (O_2) SENSOR
② MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR
③ VACUUM SWITCH
④ ELECTRONIC AIR CONTROL VALVE (EACV)
⑤ IDLE BOOST THROTTLE CONTROLLER
⑥ IDLE BOOST SOLENOID VALVE
⑦ THROTTLE CONTROLLER
⑧ A/C IDLE BOOST SOLENOID VALVE
⑨ POWER VALVE
⑩ POWER VALVE CONTROL SOLENOID VALVE
⑪ AIR LEAK SOLENOID VALVE
⑫ CHOKE OPENER
⑬ THERMOWAX VALVE
⑭ THERMOVALVE
⑮ AIR CONTROL DIAPHRAGM
⑯ AIR BLEED VALVE
⑰ CHECK VALVE
⑱ CHARCOAL CANISTER
⑲ TWO-WAY VALVE
⑳ INNER VENT SOLENOID VALVE
㉑ AIR VENT CUT-OFF SOLENOID VALVE
㉒ PCV VALVE
㉓ CATALYTIC CONVERTER
㉔ VACUUM CONTROL SOLENOID VALVE

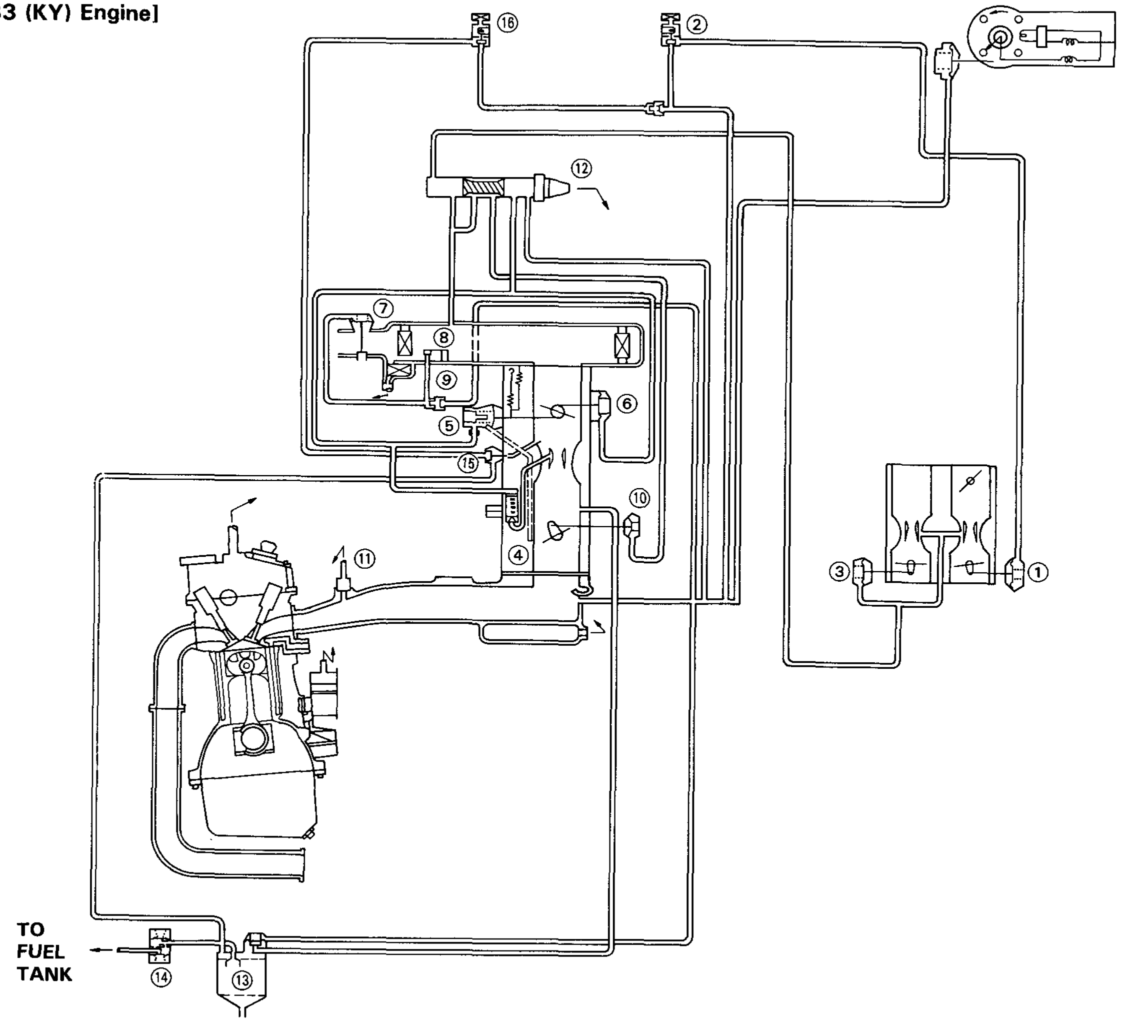
Vacuum Connection

[D12B1, D13B3 EXCEPT EUROPE and D15B3 (Except KY) Engine]



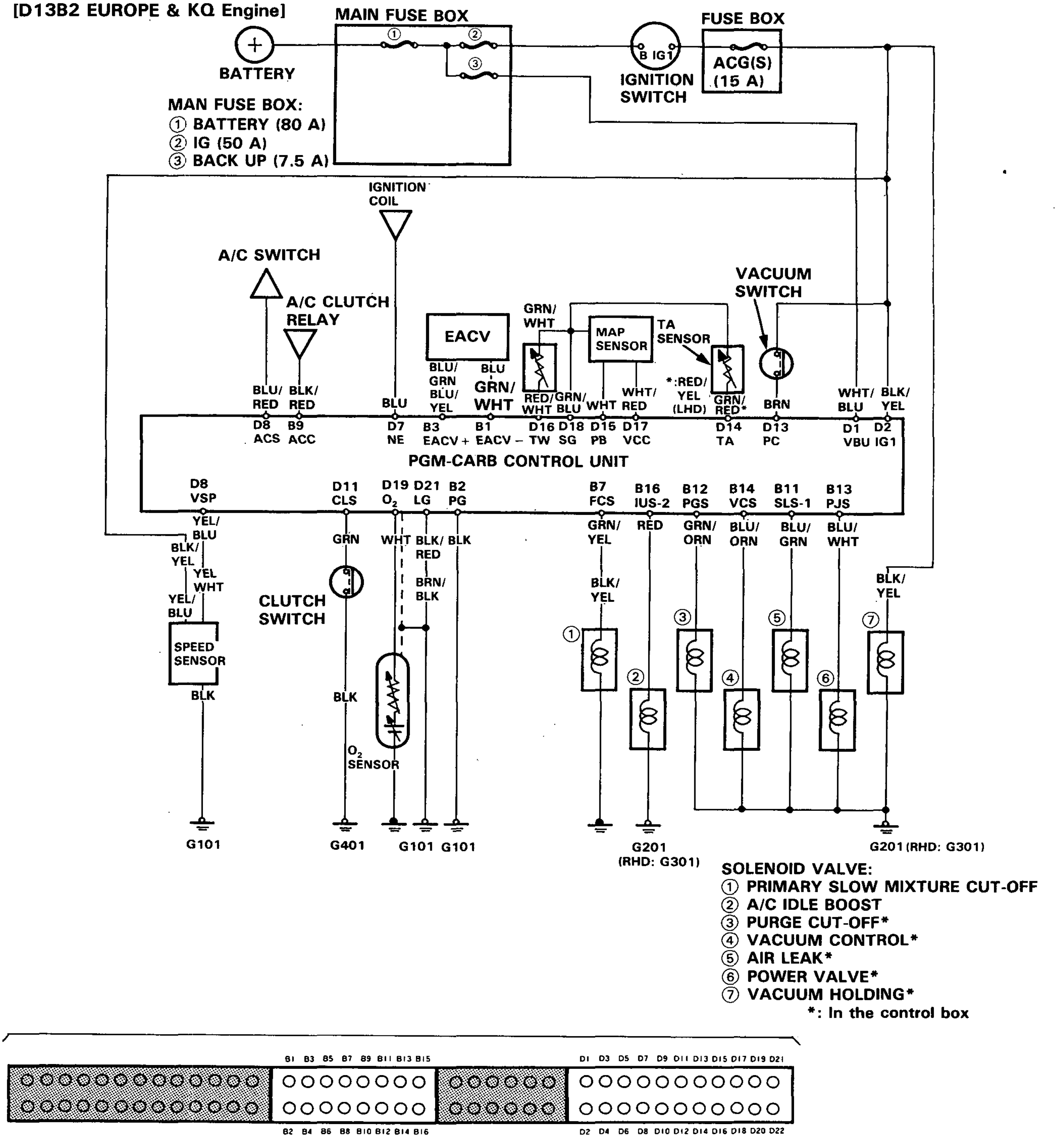
① A/C IDLE BOOST THROTTLE CONTROLLER
② A/C IDLE BOOST SOLENOID VALVE
③ SECONDARY DIAPHRAGM
④ POWER VALVE
⑤ CHOKE OPENER
⑥ FAST IDLE UNLOADER
⑦ AIR CONTROL DIAPHRAGM
⑧ AIR BLEED VALVE
⑨ CHECK VALVE
⑩ THROTTLE CONTROLLER
⑪ PCV VALVE
⑫ THERMOVALVE

[D15B3 (KY) Engine]



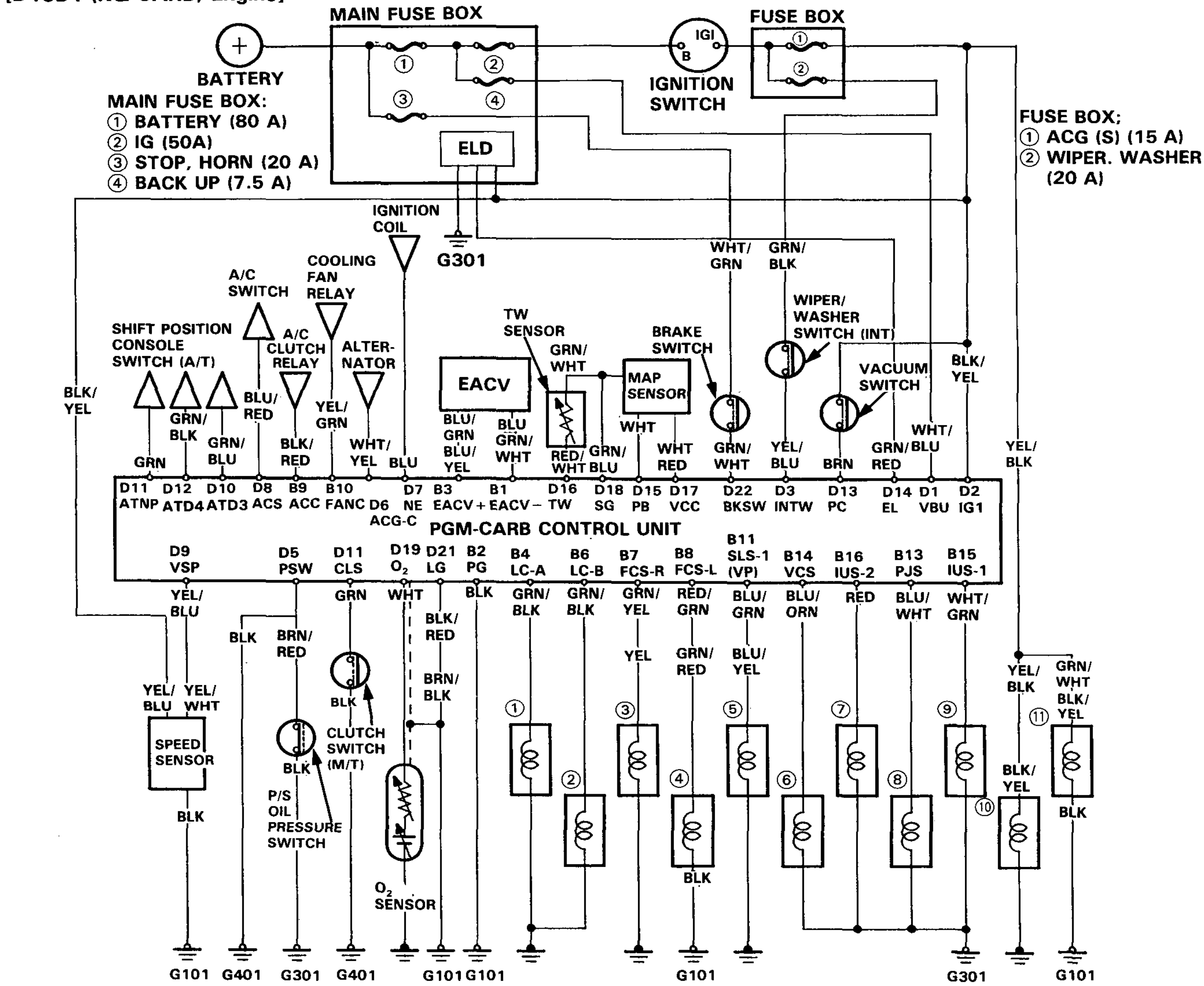
① A/C IDLE BOOST THROTTLE CONTROLLER
② A/C IDLE BOOST SOLENOID VALVE
③ SECONDARY DIAPHRAGM
④ POWER VALVE
⑤ CHOKE OPENER
⑥ FAST IDLE UNLOADER
⑦ AIR CONTROL DIAPHRAGM
⑧ AIR BLEED VALVE
⑨ CHECK VALVE
⑩ THROTTLE CONTROLLER
⑪ PCV VALVE
⑫ THERMOVALVE
⑬ CHARCOAL CANISTER
⑭ TWO-WAY VALVE
⑮ AIR VENT CUT-OFF DIAPHRAGM
⑯ AIR VENT CUT-OFF SOLENOID VALVE

[D13B2 EUROPE & KQ Engine]



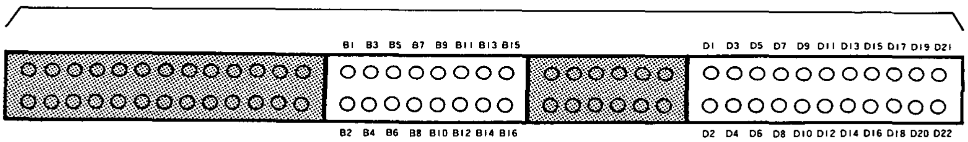
SOLENOID VALVE:
① PRIMARY SLOW MIXTURE CUT-OFF
② A/C IDLE BOOST
③ PURGE CUT-OFF*
④ VACUUM CONTROL*
⑤ AIR LEAK*
⑥ POWER VALVE*
⑦ VACUUM HOLDING*
*: In the control box

[D15B4 (KQ CARB) Engine]



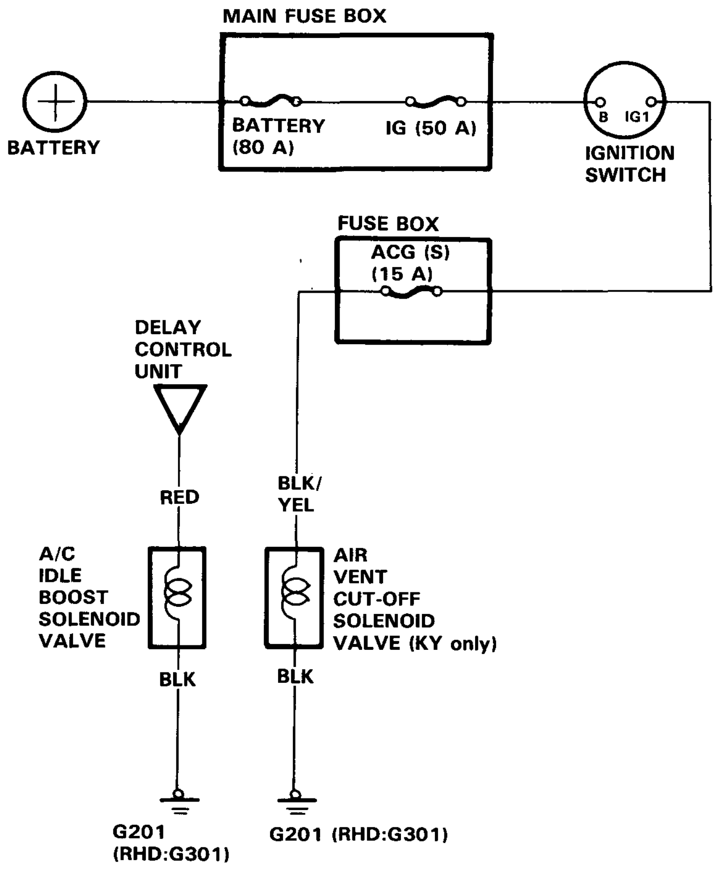
SOLENOID VALVE:
① A/T LOCK-UP CONTROL (A)
② A/T LOCK-UP CONTROL (B)
③ PRIMARY SLOW MIXTURE CUT-OFF (RIGHT)
④ PRIMARY SLOW MIXTURE CUT-OFF (LEFT)
⑤ AIR LEAK
⑥ VACUUM CONTROL*
⑦ A/C IDLE BOOST*
⑧ POWER VALVE*
⑨ IDLE BOOST*
⑩ AIR VENT CUT-OFF
⑪ INNER VENT

*: *In the control box*



Electrical Connection

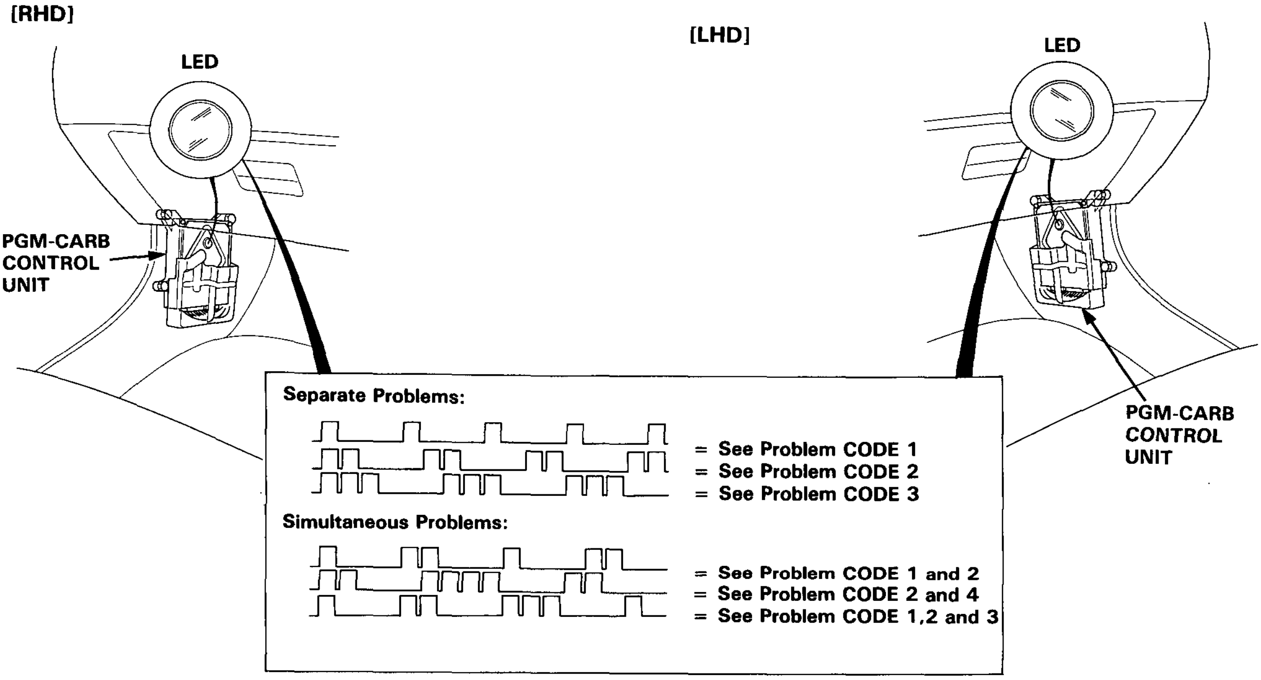
[D12B1, D13B3 EXCEPT EUROPE and D15B3 Engine]



Self-Diagnostic Procedure

[D13B2 EUROPE & KQ and D15B4 (KQ CARB) Engine]

Turn the ignition on, remove the door sill molding and pull the carpet back to expose the control unit, and observe the LED on the control unit. The LED indicates a system failure code by its blinking frequency.
The control unit LED can indicate any number of simultaneous component problems by blinking separate codes, one after another.



SELF-DIAGNOSIS INDICATOR BLINKS	SYSTEM INDICATED	PAGE
1	OXYGEN CONTENT	11-30
2	VEHICLE SPEED PULSER	11-32
3	MANIFOLD ABSOLUTE PRESSURE	11-34
4	VACUUM SWITCH SIGNAL	11-38
5	MANIFOLD ABSOLUTE PRESSURE	11-36
6	COOLANT TEMPERATURE	11-40
8	IGNITION COIL SIGNAL	11-42
9	ELECTRIC LOAD DETECTOR (ELD)*	11-44
10	INTAKE AIR TEMPERATURE**	11-46
11	A/T LOCK-UP CONTROL SOLENOID VALVE A/B*	11-48
14	ELECTRONIC AIR CONTROL	11-160

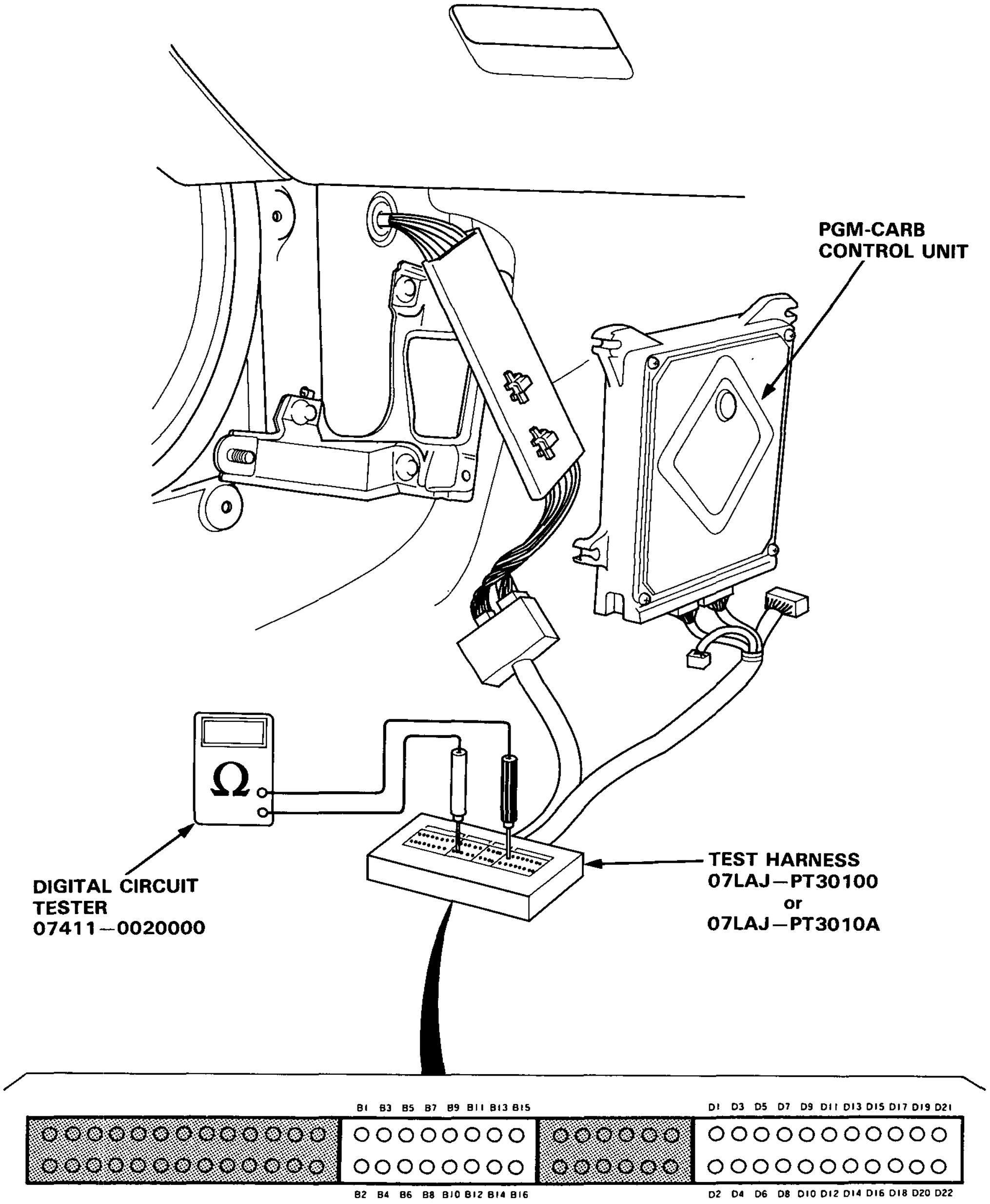
*: D15B4 (KQ CARB) Engine
**: D13B2 EUROPE & KQ

If CODE 7, 12, 13 (or more than 14), count the number of blinks again; if the indicator is in fact blinking these codes, substitute a known-good control unit and recheck. If the indication goes away, replace the original control unit. The control unit LED may come on, indicating a system problem, when, in fact, there is a poor or intermittent electrical connection. First, check the electrical connections, clean or repair connections if necessary.

(cont'd)

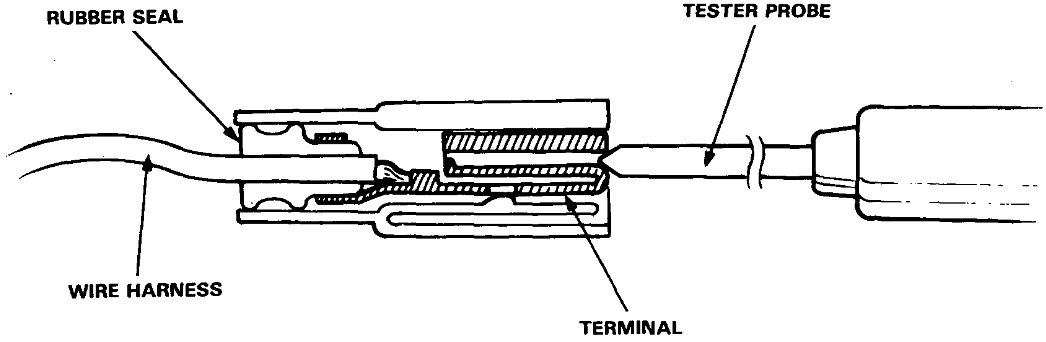
Self-Diagnosis Procedure (cont'd)

If the inspection for a particular failure code requires the test harness, remove the left door (LHD: right door) sill molding and pull the carpet back to expose the control unit. Unbolt the ECU bracket. Connect the test harness. Check the system according to the procedure described for the appropriate code(s) listed on the following pages.



CAUTION:

- Puncturing the insulation on a wire can cause poor or intermittent electrical connections.
- For testing at connectors other than the test harness, bring the tester probe into contact with the terminal from the connector side of wire harness connectors in the engine compartment. For female connectors, just touch lightly with the tester probe and do not insert the probe.



Troubleshooting

How to Read Flowcharts

A flowchart is designed to be used from start to final repair. It's like a map showing you the shortest distance. But beware: if you go off the "map" anywhere but a "stop" symbol, you can easily get lost.

START (bold type)	Describes the conditions or situation to start a troubleshooting flowchart.
ACTION	Asks you to do something; perform a test, set up a codition etc.
DECISION	Asks you about the result of an action, then sends you in the appropriate troubleshooting direction.
STOP (bold type)	The end of a series of actions and decisions, describes a final repair actiona and sometimes directs you to an earlier part of the flowchart to confirm your repair.

NOTE:

- The term "Intermittent Failure" is used in these charts. It simply means a system may have had a failure, but it checks out OK through all your tests. You may need to road test the car to reproduce the failure or, if the problem was a loose connection, you may have unknowingly solved it while doing the tests. In any event, if the LED on the control unit does not come on, check for poor connections or loose wires at all connectors related to the circuit that you are troubleshooting.
- Most of the troubleshooting flowcharts have you reset the control unit and try to duplicate the problem code. If the problem is intermittent and you can't duplicate the code, do not continue through the flowchart. To do so will only result in confusion and, possibly, a needlessly replaced control unit.
- "Open" and "Short" are common electrical terms. An open is a break in a wire or at a connection. A short is an accidental connection of a wire to ground or to another wire. In simple electronics, this usually means something won't work at all. In complex electronics (like control unit's), this can sometimes mean something works, but not the way it's supposed to.
- If the electrical readings are not as specified when using the test harness, check the test harness connections before proceeding.

PGM-CARB Control Unit

System Description

[D13B2 EUROPE & KQ and D15B4 (KQ CARB) Engine]

The Control Unit contains logic circuits that sense the inputs and apply outputs as required to control emissions and effect smooth engine performance.

INPUTS	CONTROL UNIT	OUTPUTS
Oxygen Sensor Vehicle Speed Signal MAP Sensor Vacuum Switch TW Sensor Electric Load Detector* TA Sensor** Ignition Coil Signal A/C Switch Signal A/T Shift Position Signal Clutch Switch Signal Battery Voltage (IGN. 1) Battery Voltage (Bat) P/S Oil Pressure Switch Signal* Brake Switch Signal* Wiper/Washer Switch (INT) Signal*	Idle Function Feedback Function Fuel Cut-off Evaporative Function Back-up Function	EACV Primary Slow Mixture Cut-off Solenoid Valve Idle Boost Solenoid Valve* A/C Idle Boost Solenoid Valve Air Leak Solenoid Valve Power Valve Control Solenoid Valve Vacuum Control Solenoid Valve Purge Cut-off Solenoid Valve** A/T Lock-up Control Solenoid Valve A/B*

*: D15B4 (KQ CARB) Engine
**: D13B2 EUROPE & KQ Engine

Control Unit Back-up Functions

1. Fail-Safe Function
   When an abnormality occurs in signal from a sensor, the control unit ignores that signal and assumes a preprogrammed value that allows the engine to continue to run.

2. Back-up Function
   When an abnormality occurs in the control unit itself, a back-up circuit independent of the system permits minimal driving.

3. Self-diagnosis Function (LED indicator).
   When an abnormality occurs in a signal from a sensor, the control unit indicates the LED on the control unit, stores the failure code in erasable memory and indicates the code with a LED on the control unit anytime the ignition is on.

Symptom-to System Chart

[D13B2 EUROPE & KQ Engine]

NOTE: Across each row in the chart, the systems that could be sources of a symptom are ranked in the order the should be inspected starting with ①. Find the symptom in the left column, read across to the most likely source, then refer to the page listed at the top of that column. If inspection shows the system is OK, try the next most likely system ②, etc.

SYMPTOM \ SYSTEM		PGM-CARB CONTROL SYSTEM						
		PGM-CARB CONTROL UNIT	OXYGEN SENSOR	VEHICLE SPEED PULSER	MANIFOLD ABSOLUTE PRESSURE SENSOR	VACUUM SWITCH	COOLANT TEMPERA-TURE SENSOR	IGNITION COIL SIGNAI
PAGE		50	30	32	34,36	38	40	42
SELF-DIAGNOSIS INDICATOR (LED) BLINKS		0 or *	1	2	3 or 5	4	6	8
ENGINE WON'T START								
DIFFICULT TO START ENGINE WHEN COLD		(BU)						
IRREGULAR IDLING	WHEN COLD FAST IDLE OUT OF SPECIFIC	(BU)						
	ROUGH IDLE	(BU)	③		②			
	WHEN WARM ENGINE SPEED TOO HIGH	(BU)						
	WHEN WARM ENGINE SPEED TOO LOW	(BU)						
FREQUENT STALLING	WHILE WARMING UP	(BU)			②		③	
	AFTER WARMING UP	(BU)			②			
POOR PERFOR-MANCE	MISFIRE OR ROUGH RUNNING	(BU)	③	③	②			
	FAILS EMISSION TEST	(BU)	②		①			
	LOSS OF POWER	(BU)			③			

* CODE 7, 9, 11, 12, 13, or exceeds 14: count the number of blinks again. If the indicator is in fact blinking these codes, substitute a known-good control unit and recheck. If the indication goes away, replace the original control unit.

(BU): When the self-diagnosis indicator is on, the back-up system is in operation.
Substitute a known-good control unit and recheck. If the indication goes away, replace the original control unit.

PGM-CARB CONTROL SYSTEM							EMISSION CONTROL	
INTAKE AIR TEMPERA-TURE SENSOR	A/T SHIFT POSITION SIGNAL	CLUTCH SWITCH SIGNAL	A/C SIGNAL	CARBURETOR	FUEL SUPPLY	AIR INTAKE	ELECTRONIC AIR CONTROL VALVE	OTHER EMISSION CONTROL
46	52	54	58	64	142	149	160	154
⑩							⑭	
				②	①			
				①				
③				①				③
③				①			③	③
			③	①				
				①				
				①			③	
				①			①	
				①	②			
				②		③	③	③
				③	②	①		②

Symptom-to System Chart

[D15B4 (KQ CARB) Engine]

NOTE: Across each row in the chart, the systems that could be sources of a symptom are ranked in the order they should be inspected starting with ①. Find the symptom in the left column, read across to the most likely source, then refer to the page listed at the top of that column. If inspection shows the system is OK, try the next most likely system ②, etc.

SYMPTOM		SYSTEM: PGM-CARB CONTROL SYSTEM							
		PGM-CARB CONTROL UNIT	OXYGEN SENSOR	VEHICLE SPEED PULSER	MANIFOLD ABSOLUTE PRESSURE SENSOR	VACUUM SWITCH	COOLANT TEMPERA-TURE SENSOR	IGNITION COIL SIGNAl	ELECTRIC LOAD DETECTOR
PAGE		50	30	32	34,36	38	40	42	44
SELF-DIAGNOSIS INDICATOR (LED) BLINKS		0 or *	1	2	3 or 5	4	6	8	9
ENGINE WON'T START									
DIFFICULT TO START ENGINE WHEN COLD		BU							
IRREGULAR IDLING	WHEN COLD FAST IDLE OUT OF SPECIFIC	BU							
	ROUGH IDLE	BU	③		②				
	WHEN WARM ENGINE SPEED TOO HIGH	BU							③
	WHEN WARM ENGINE SPEED TOO LOW	BU							
FREQUENT STALLING	WHILE WARMING UP	BU			②		③		
	AFTER WARMING UP	BU			②				
POOR PERFORMANCE	MISFIRE OR ROUGH RUNNING	BU	③	③	②				
	FAILS EMISSION TEST	BU	②		①				
	LOSS OF POWER	BU			③				

* CODE 7, 12, 13, or exceeds 14: count the number of blinks again. If the indicator is in fact blinking these codes, substitute a known-good control unit and recheck. If the indication goes away, replace the original control unit.

BU: When the self-diagnosis indicator is on, the back-up system is in operation.
Substitute a known-good control unit and recheck. If the indication goes away, replace the original control unit.

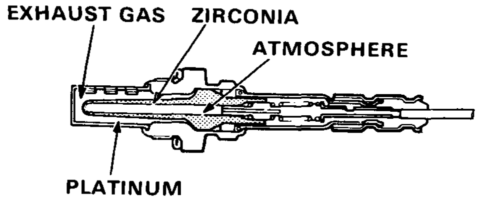
PGM-CARB CONTROL SYSTEM							CAR-BURETOR	FUEL SUPPLY	AIR INTAKE	EMISSION CONTROL	
LOCK-UP CONTROL SOLENOID VALVE	A/T SHIFT POSITION SIGNAL	CLUTCH SWITCH SIGNAL	P/S OIL PRESSURE SWITCH	A/C SIGNAL	BRAKE SWITCH SIGNAL	WIPER/ WASHER SWITCH SIGNAL				ELEC-TRONIC AIR CONTROL VALVE	OTHER EMISSION CONTROL
48	52	54	56	58	60	62	60	142	149	160	154
⑪										⑭	
							②	①			
							①				
							①				③
							①			③	③
			③	③			①				
							①				
							①			③	
							①			①	
							①	②			
							②		③	③	③
							③	②	①		②

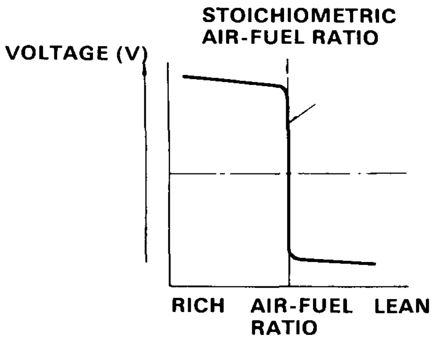
PGM-CARB Control System

Troubleshooting Flowchart — Oxygen Sensor

(1) Self-diagnosis LED indicator indicates CODE 1: A problem in the Oxygen (O_2) Sensor circuit.

The oxygen sensor, detects the oxygen content in the exhaust gas, and inputs the control unit. In operation, the control unit receives the signals from the sensor and varies the duration during which fuel is injected. The oxygen sensor is installed on the exhaust manifold.





LED indicates CODE 1.

Turn the ignition switch OFF.

Remove BACK UP fuse in the under-hood relay box for 10 seconds to reset control unit.

Warm up engine to normal operating temperature (the cooling fan comes on).

Does LED indicate CODE 1 ?
- NO → **Intermittent failure (test drive may be necessary).**
- YES ↓

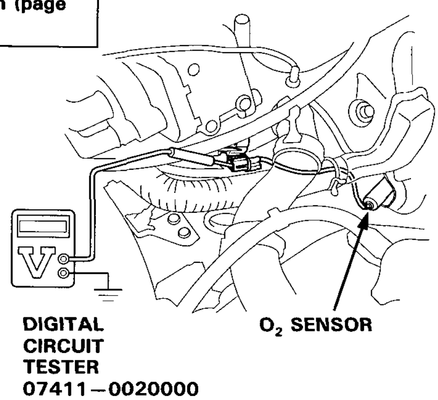
Inspect fuel pressure at the fuel filter.

Is pressure as specified ?
- NO → **Repair fuel supply system (page 11-142)**
- YES ↓

Disconnect wire harness from indicated O_2 sensor.

Warm up engine to normal operating temperature again, then open the throttle wide open then close it.

(To page 11-31)

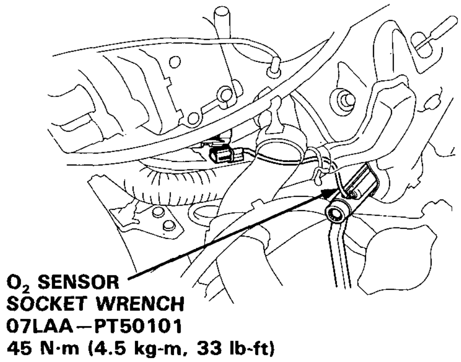


(From page 11-30)

Measure voltage between the connector terminal and body ground.

Is voltage above 0.6 V at wide open throttle and below 0.4 V when the throttle is quickly released ?

NO → **Replace O_2 sensor.**



YES

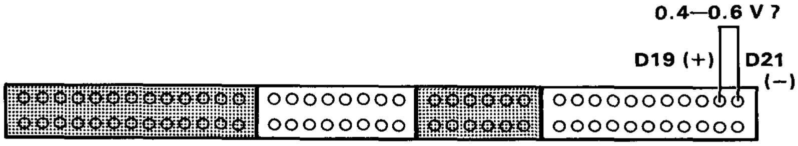
Stop engine.

Reconnect O_2 sensor.

Connect the test harness between the control unit and connector (page 11-22).

Restart and warm up engine to normal operating temperature, then open the throttle wide open then close it.

Measure voltage between D19 (+) terminal and D21 (−) terminal.



Is voltage above 0.6 V at wide open throttle and below 0.4 V when the throttle is quickly released ?

NO → **Repair open or short in WHT wire between control unit (D19) and the O_2 sensor.**

YES

Substitute a known-good control unit and recheck. If symptom/indication goes away, replace the original control unit.

PGM-CARB Control System

Troubleshooting Flowchart — Vehicle Speed Sensor

(2) Self-diagnosis LED indicator indicates CODE 2: A problem in the Vehicle Speed circuit.

The signal generated by the speed sensor, produces pulses when the front wheels turn.

LED indicates CODE 2.

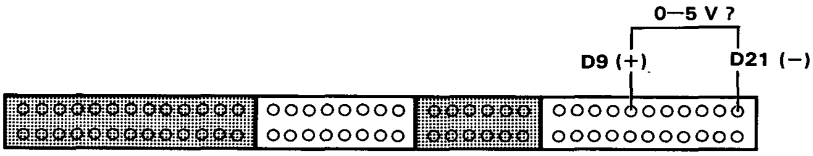
Connect the test harness between the control unti and connector (page 11-22).

Block rear wheels and set the parking brake. Jack up the front of the car and support with safety stands.

WARNING **Block rear wheels before jacking up front of car.**

Turn the ignition switch ON.

Slowly rotate front wheel and measure voltage between D9 (+) terminal and D21 (−) terminal.



Does voltage pulse 0 V and 5 V ?

YES → **Substitute a known-good control unit and recheck. If prescribed voltage in now available replace the original control unit.**

NO → Turn the ignition switch OFF.

Disconnect D connector from the control unit only, not the wire harness.

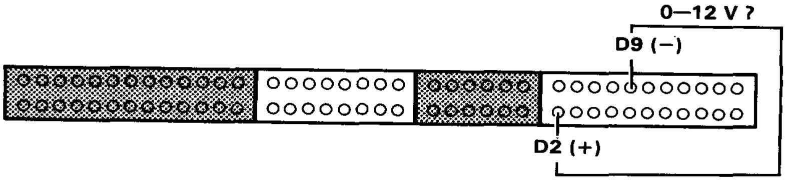
Turn the ignition switch ON.

Slowly rotate front wheel and measure voltage between D2 (+) terminal and D9 (−) terminal.

Does voltage pulse 0 V and 12 V ?

YES → **Substitute a known-good control unit and recheck. If prescribed voltage is now available replace the original control unit.**

NO →
- **Repair open or short in YEL/RED, YEL/WHT wire between control unit (D9) and the speed sensor.**
- **Faulty speed sensor.**

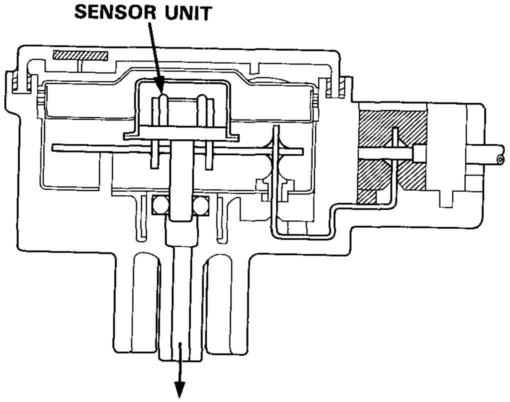


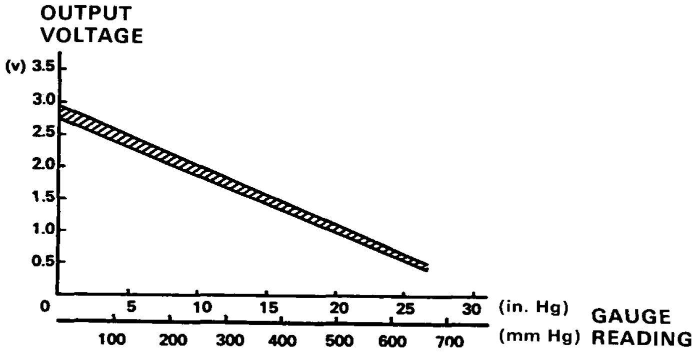
Troubleshooting Flowchart — MAP Sensor

(3) Self-daignosis LED indicator indicates CODE 3: Most likely an electrical problem in the Manifold Absolute Pressure (MAP) Sensor system.

(5) Self-diagnosis LED indicator indicates CODE 5: Most likely a mechanical problem (broken hose) in the Manifold Absolute Pressure (MAP) Sensor system.

The MAP sensor converts manifold absolute pressure into electrical signals and inputs the control unit.





(3)

—Engine is warm and running.
—LED indicates CODE 3.

Turn the ignition switch OFF.

Remove BACK UP fuse in the under-hood relay box for 10 seconds to reset control unit.

Start the engine and allow to idle.

Does LED indicate CODE 3 ?

NO → Intermittent failure (test drive may be necessary).

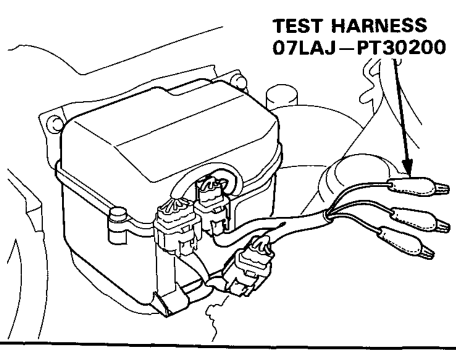
YES

Turn the ignition switch OFF.

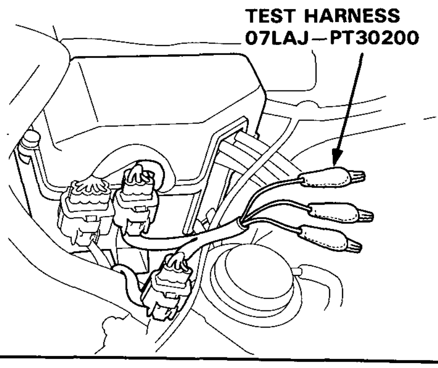
Connect the test harness between the MAP sensor and wire harness.

(To page 11-35)

[D13B2 EUROPE & KQ Engine]



[D15B4 (KQ CARB) Engine]



(From page 11-34)

Turn the ignition switch ON.

Measure voltage between RED (+) terminal and GRN (−) terminal.

Is there approx. 5 V ?

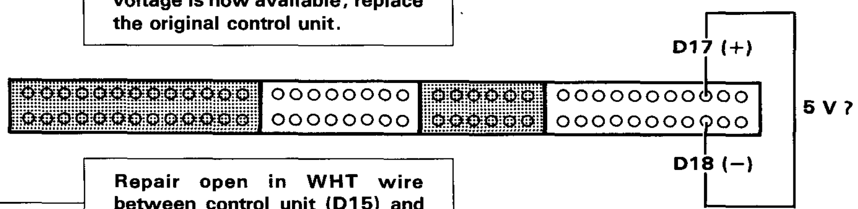
NO → Measure voltage between RED (+) terminal and body ground.

- Is there approx. 5 V ?
  - YES → **Repair open in GRN/BLU wire between control unit (D18) and MAP sensor.**
  - NO → Turn the ignition switch OFF.

    Connect the test harness between the control unit and connector (page 11-22).

    Measure voltage between D17 (+) terminal and D18 (−) terminal with the ignition switch on.

    Is there approx. 5 V ?
    - YES → **Repair open in WHT/RED wire between control unit (D17) and MAP sensor.**
    - NO → **Substitute a known-good control unit and recheck. If prescribed voltage is now available, replace the original control unit.**



YES → Measure voltage between WHT (+) terminal and GRN (−) terminal.

Is there approx. 3 V ?

NO →
- **Replace MAP sensor.**
- **Repair short in WHT wire between control unit (D15) and MAP sensor.**

YES → Turn the ignition switch OFF.

Connect the test harness between the control unit and connector (page 11-22).

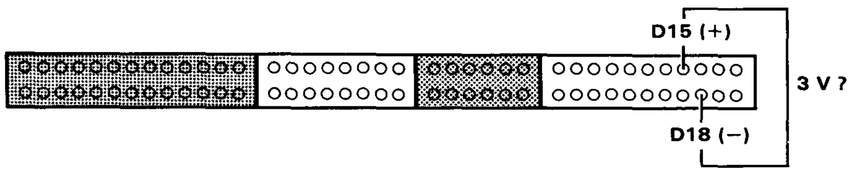
Turn the ignition switch ON.

Measure voltage between D15 (+) terminal and D18 (−) terminal.

Is there approx. 3 V ?

NO → **Repair open in WHT wire between control unit (D15) and MAP sensor.**

YES → **Substitute a known-good control unit and recheck. If symptom/indication goes away, replace the original control unit.**



(cont'd)

(5)

LED indicates CODE 5.

Turn the ignition switch OFF.

Remove BACK UP fuse in the under-hood relay box for 10 seconds to reset control unit.

Start engine and keep engine speed at idle.

Does LED indicate CODE 5 ?

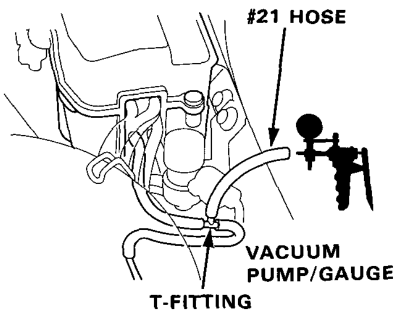
- NO → **Intermittent failure (test drive may be necessary).**
- YES ↓

Stop engine.

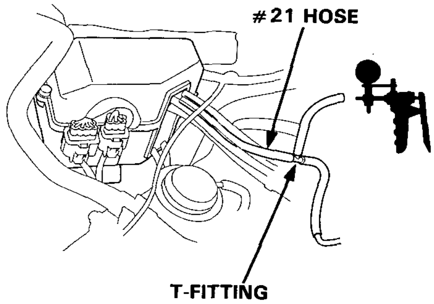
Remove #21 hose from the vacuum hose manifold and connect a T-fitting from a vacuum gauge between the vacuum hose manifold and the MAP sensor.

Start engine.

[D13B2 EUROPE & KQ Engine]



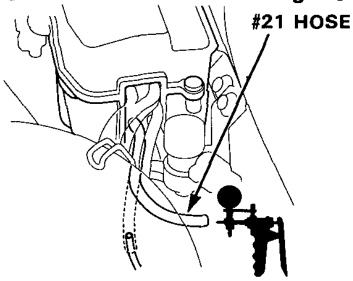
[D15B4 (KQ CARB) Engine]



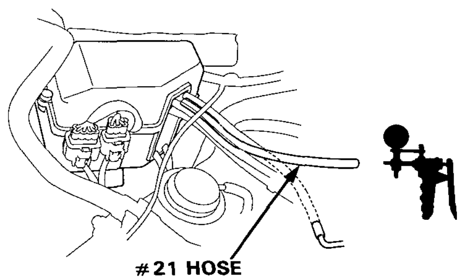
Is there vacuum ?

- NO → **Repair as necessary.**
- YES ↓

[D13B2 EUROPE & KQ Engine]



[D15B4 (KQ CARB) Engine]



Connect a vacuum pump to #21 hose and apply vacuum.

Does it hold vacuum ?

- NO → **Replace #21 hose.**
- YES ↓

(To page 11-37)

(From page 11-36)

Stop engine.

Connect the test harness between the MAP sensor and wire harness.

Turn the ignition switch ON.

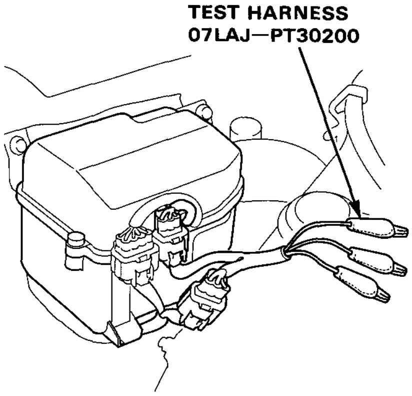
Measure voltage between WHT (+) terminal and GRN (−) terminal.

Is there approx. 3 V ?

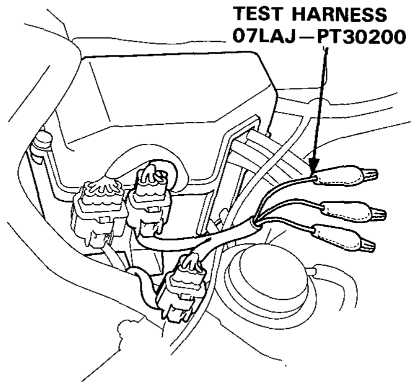
NO → **Replace MAP sensor.**

YES → **Substitute a known-good control unit and recheck. If symptom/indication goes away, replace the original control unit.**

[D13B2 EUROPE & KQ Engine]



[D15B4 (KQ CARB) Engine]



Troubleshooting Flowchart—Vacuum Switch

(4) Self-diagnosis LED indicator indicates CODE 4: A problem in the vacuum switch.

The vacuum switch converts carburetor ported vacuum into electrical signals and inputs the control unit.

—Engine is warm running.
—LED indicates CODE 4.

Turn the ignition switch OFF.

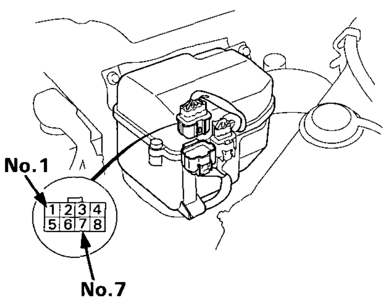
Remove BACK UP fuse in the under-hood relay box for 10 seconds to reset control unit.

Disconnect the 8P connector on the control box.

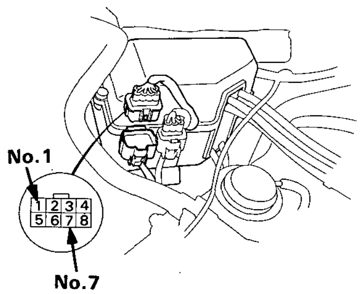
Start the engine.

Measure resistance between No.1 terminal and No.7 terminal on the control box.

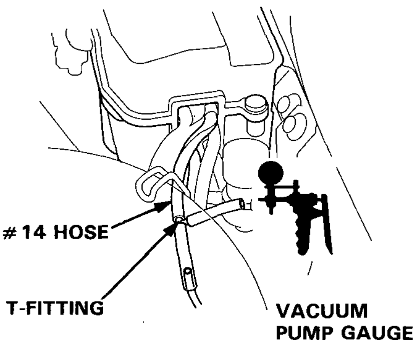
[D13B2 EUROPE & KQ Engine]



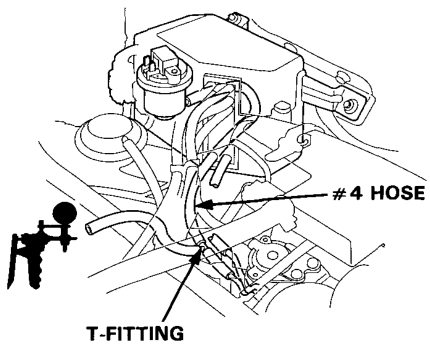
[D15B4 (KQ CARB) Engine]



[D13B2 EUROPE & KQ Engine]



[D15B4 (KQ CARB) Engine]



Does continuity exist ?

YES → Remove #4 hose from the vacuum hose manifold and connect a T-fitting from a vacuum gauge between the vacuum hose manifold and the vacuum switch.

Is there more than 30 mmHg of vacuum ?

NO → **—Replace vacuum switch.**
—Repair open BLK/YEL or BRN wire in the control box.

YES → **Check routing of #4 hose.**

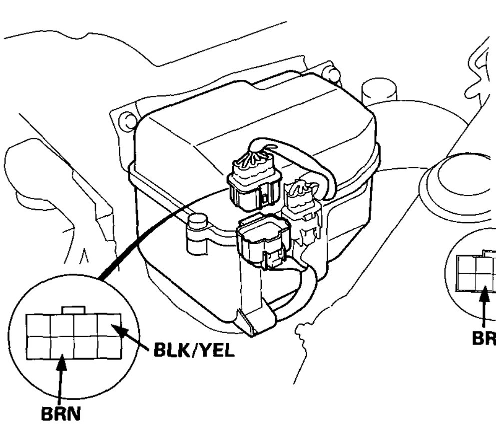
NO → (To page 11-39)

(From page 11-38)

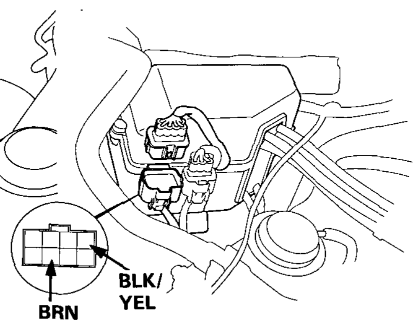
Turn the ignition switch ON.

Measure voltage between BLK/YEL terminal and body ground on the wire harness.

[D13B2 EUROPE & KQ Engine]



[D15B4 (KQ CARB) Engine]



Is there battery voltage ?

NO → **Repair open in BLK/YEL wire between connector and ACG(S) fuse.**

YES

Turn the ignition switch OFF.

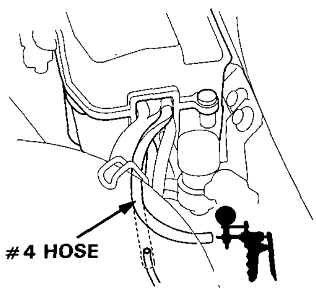
Reconnect the connector to the control box.

Connect the test harness between the control unit and connector (page 11-22).

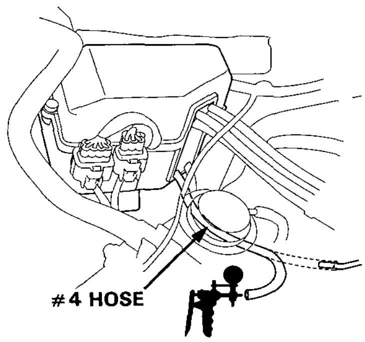
Turn the ignition switch ON.

Remove #4 hose from the vacuum hose manifold and connect a vacuum pump.

[D13B2 EUROPE & KQ Engine]

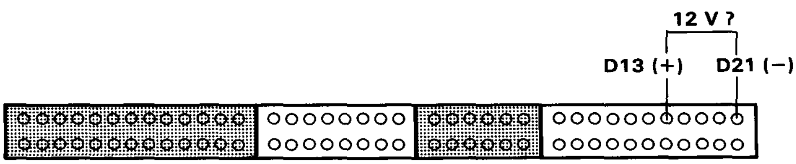


[D15B4 (KQ CARB) Engine]



Apply vacuum.

Measure voltage between D13 (+) terminal and D21 (−) terminal.



Is there battery voltage ?

NO → **Repair open in BRN wire between control unit (D13) and vacuum switch.**

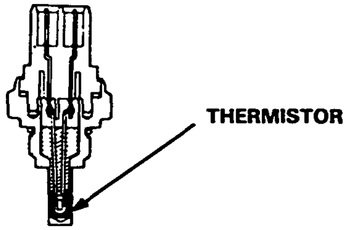
YES

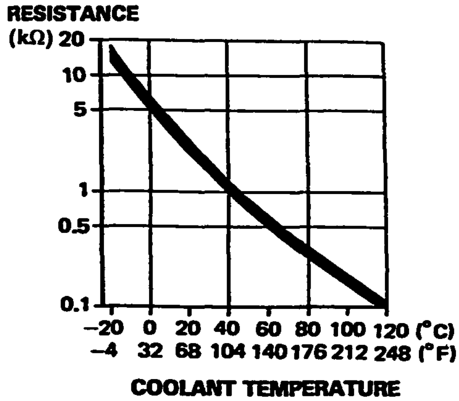
Substitute a known-good control unit and recheck. If symptom/indication goes away, replace the original control unit.

Troubleshooting Flow Chart—TW Sensor

(6) Self-diagnosis LED indicator indicates CODE 6: Most likely a problem in the Coolant Temperature (TW) *Sensor circuit.*

The TW sensor is a temperature dependant resistor (thermistor). The resistance of the thermistor decreases as the coolant temperature increases as shown below.





LED indicates CODE 6.

Turn the ignition switch OFF.

Remove BACK UP fuse in the under-hood relay box for 10 seconds to reset control unit.

Turn the ignition switch ON.

Does LED indicates CODE 6 ?

- NO → **Intermittent failure (test drive may be necessary).**
- YES ↓

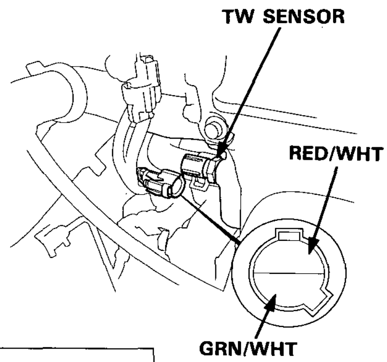
Warm up engine to normal operating temperature (the cooling fan comes on).

Disconnect the 2P connector on the TW sensor.

Measure resistance between the 2 terminals on the TW sensor.

Is there 200−400 Ω ?

- NO → **Replace TW sensor.**
- YES ↓



(To page 11-41)

(From page 11-40)

Measure voltage between RED/WHT (+) terminal and body ground.

Is there approx. 5 V ?

YES

Measure voltage between RED/WHT (+) terminal and GRN/WHT (−) terminal.

Is there approx. 5 V ?

YES

Substitute a known-good control unit and recheck. If symptom/indication goes away, replace the original control unit.

NO

Repair open in GRN/WHT, GRN/BLU wire between control unit (D18) and TW sensor.

NO

Turn the ignition switch OFF.

Connect the test harness between the control unit and connector (page 11-22).

Turn the ignition switch ON.

Measure voltage between D16 (+) terminal and D18 (−) terminal.

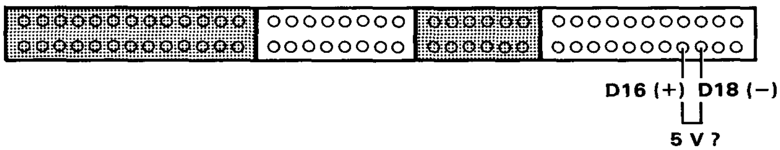
Is there approx. 5 V ?

YES

Repair open in RED/WHT wire between control unit (D16) and TW sensor.

NO

—Substitute a known-good control unit and recheck. If prescribed voltage is now available, replace the original control unit.
—Repair short in RED/WHT wire between control unit (D16) and TW sensor.



Troubleshooting Flowchart—Ignition Coil Signal

(8) Self-diagnosis LED indicator indicates CODE 8: A problem in the ignition coil signal circuit.

This signal allows the control unit to monitor the engine.

LED indicates CODE 8.

Turn the ignition switch OFF.

Remove BACK UP fuse in the under-hood relay box for 10 seconds to reset control unit.

Turn the ignition switch ON.

Does LED indicates CODE 8 ?

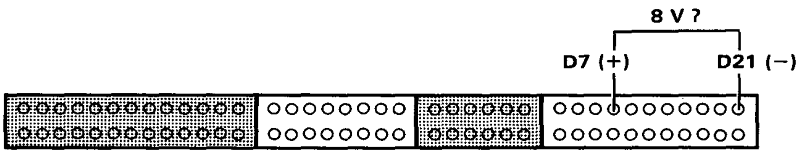
NO → **Intermittent failure (test drive may be necessary).**

YES ↓

Start the engine.

Connect the test harness between the control unit and connector (page 11-22).

Measure voltage between D7 (+) terminal and D21 (−) terminal.



Is voltage above approx. 8 V ?

NO → **Repair short or open BLU wire between control unit (D7) and ignition coil.**

YES ↓

Substitute a known-good control unit and recheck. If symptom/indication goes away, replace the original control unit.

PGM-CARB Control System

Troubleshooting Flowchart—Electric Load Detector [D15B4 (KQ CARB) Engine]

(9) Self-diagnosis LED indicator indicates CODE 9: A problem in the Electric Load Detector circuit.

LED indicates CODE 9.

Start engine and keep engine speed at idle.
Turn on headlights.

Does LED indicates CODE 9 ?

NO → **Intermittent failure, system is OK at this time (test drive may be necessary).**

YES ↓

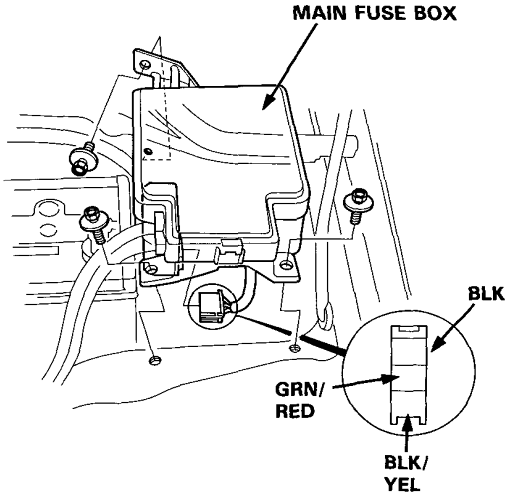
Turn the ignition switch OFF.

Remove the main fuse box.

Disconnect the 3P connector from the electric load detector.

Turn the ignition switch ON.

Measure voltage between BLK/YEL (+) terminal and BLK (−) terminal.



Is there battery voltage ?

NO → Measure voltage between BLK/YEL (+) terminal and body ground.

Is there battery voltage ?

YES → **Repair open in BLK wire between the 3P connector and G301.**

NO → **Repair open in BLK/YEL wire between ACG (S) (15 A) and the 3P connector.**

YES ↓

(To page 11-45)

(From page 11-44)

Measure voltage between GRN/RED terminal and body ground.

Is there 4.5—5 V ?

NO → Repair open or short in GRN/RED wire between control unit (D14) and the 3 P connector. If wire is OK, substitute a known good control unit and recheck.

YES ↓

Turn the ignition switch OFF.

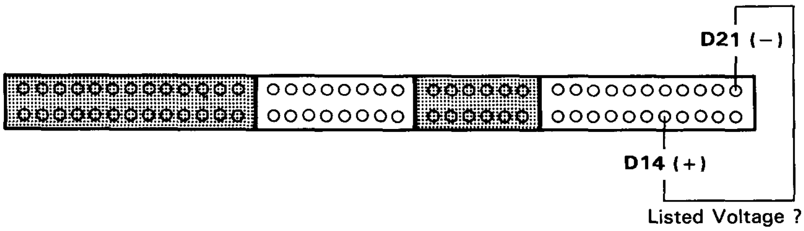
Connect the 3 P connector to the electric load detector.

Connect the test harness between the control unit and connector (page 11-22).

Turn the ignition switch on.

Under the conditions listed in the chart to the right, measure voltage between D14 (+) terminal and D21 (−) terminal.

Condition	Voltage
Headlight switch, first position(●)	2.9—3.1 V
Headlight switch, second position (●)	1.9—2.2 V
Ignition switch ON	3.4—3.5 V



Is the voltage listed in the chart available ?

NO → **Faulty electric load detector.**

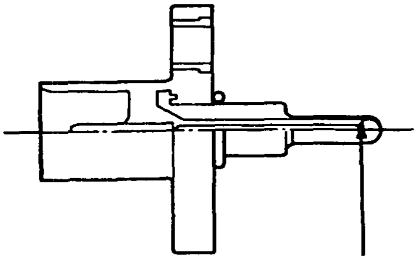
YES ↓

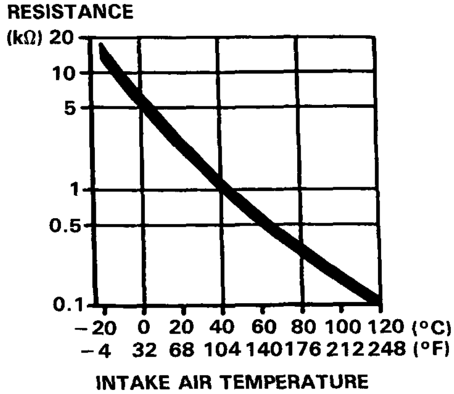
Substitute a known-good control unit and recheck. If symptom/indication goes away, replace the original control unit.

Troubleshooting Flowchart—TA Sensor [D13B2 EUROPE & KQ Engine]

(10) Self-diagnosis LED indicator indicates CODE 10: Most likely a problem in the Intake Air Temperature (TA) Sensor circuit.

The TA sensor is a temperature dependant resistor (thermistor). The resistance of the thermistor decreases as the intake air temperature increases as shown below.





LED indicates CODE 10.

↓

Turn the ignition switch OFF.

↓

Remove BACK UP fuse in the under-hood relay box for 10 seconds to reset control unit.

↓

Turn the ignition switch ON.

↓

Does LED indicates CODE 10 ?

- NO → **Intermittent failure (test drive may be necessary).**
- YES ↓

Disconnect the 2P connector on the TA sensor.

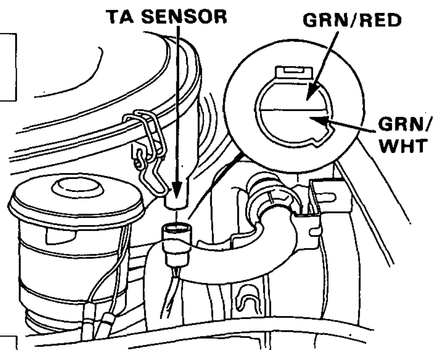
↓

Measure resistance between the 2 terminals on the TA sensor.

↓

Is there 1−4 kΩ ?

- NO → **Replace TA sensor.**
- YES ↓



(To page 11-47)

(From page 11-46)

Measure voltage between GRN/RED (+) terminal and body ground.

Is there approx. 5 V ?

NO → Turn the ignition switch OFF.

Connect the test harness between the control unit and connector (page 11-22).

Turn the ignition switch ON.

Measure voltage between D14 (+) terminal and D18 (−) terminal.

Is there approx. 5 V ?

YES → **Repair open in GRN/RED, (LHD: RED/YEL, GRN/RED) wire between control unit (D14) and TA sensor.**

NO →

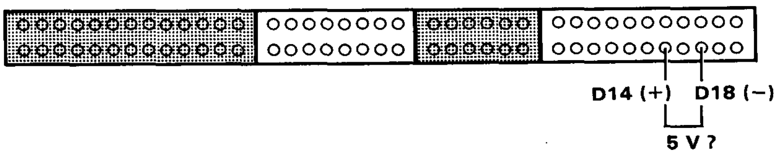
- **Substitute a known-good control unit and recheck. If prescribed voltage is now available, replace the original control unit.**
- **Repair short in GRN/RED (LHD: RED/YEL, GRN/RED) wire between control unit (D14) and TA sensor.**

YES → Measure voltage between GRN/RED (+) terminal and GRN/WHT (−) terminal.

Is there approx. 5 V ?

NO → **Repair open in GRN/WHT, GRN/BLU wire between control unit (D18) and TA sensor.**

YES → **Substitute a known-good control unit and recheck. If symptom/indication goes away, replace the original control unit.**



Troubleshooting Flowchart—A/T Lock-up Control Solenoid Valve A/B [D15B4 (KQ CARB) Engine] A/T only)

(11) Self-diagnosis LED indicator indicates CODE 11: A problem in the A/T Lock-up Control Solenoid Valve A (or B) circuit.

LED indicates CODE 11.

Turn the ignition switch OFF.

Remove BACK UP fuse in the under-hood relay box for 10 seconds to reset control unit.

Test drive necessary.
Drive the car for several miles so that the transmission upshifts and downshifts several times.

Does LED indicates CODE 11 ?

NO → **Intermittent failure (test drive may be necessary).**

YES ↓

Turn the ignition switch OFF.

Connect the test harness to the main harness only, not to the control unit (page 11-22).

Disconnect the 2P connector from the lock-up control solenoid valve.

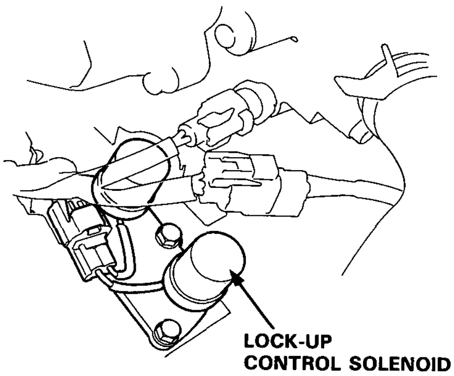
Check for continuity between B4 or B6* and body groun.

Does continuity exist ?

YES → **Repair short in YEL or GRN/BLK* wire between control unit (B4 or B6*) and the 2P connector.**

NO ↓

(To page 11-49)

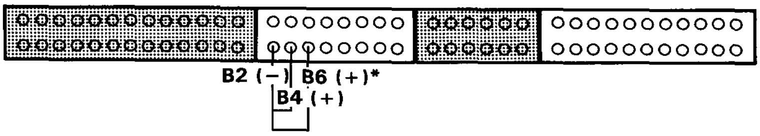


*: Lock-up Control Solenoid Valve B

(To page 11-48)

Reconnect the 2P connector.

Measure resistance between B4 or B6* terminal and B2 terminal.



Is there 15-22 Ω ?

NO

Check for continuity in YEL or GRN/BLK* wire between control unit (B4 or B6*) and the 2P connector.

Does continuity exist ?

YES

Faulty lock-up control solenoid valve (section 14).

NO

Repair open in YEL or GRN/BLK* wire between control unit (B4 or B6*) and the 2P connector.

YES

Substitute a known-good control unit and recheck. If symptom/indication goes away, replace the original control unit.

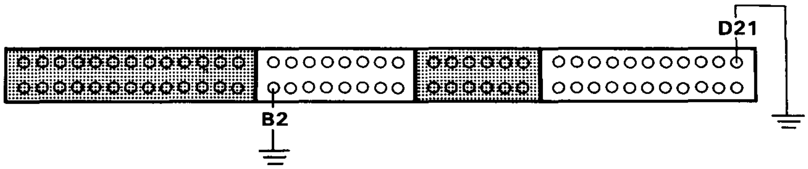
PGM-CARB Control System

Input Troubleshooting Flowchart—Power Source (IG1, Bat) and Ground

Inspection of Power Source (IG1, Bat) and Ground.

Connect the test harness between the control unit and connector (page 11-22).

Check for continuity between the body ground and the following terminals individually: ● B2, ● D21.

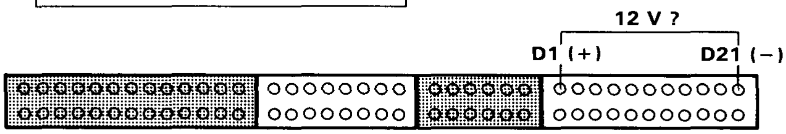


Does continuity exist ?

NO →
— Repair open in BLK/RED, BRN/BLK wire between control unit (D21) and G101.
— Repair open in BLK wire between control unit (B2) and G101.

YES ↓

Measure voltage between D1 (+) terminal and D21 (−) terminal.



Is there battery voltage ?

NO → Inspect BACK UP fuse.

Is BACK UP fuse OK ?

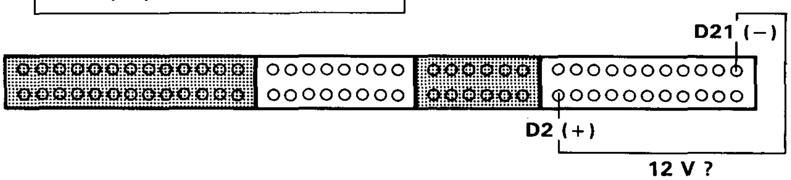
NO → **Replace fuse.**

YES → **Repair open in WHT/BLU wire between BACK UP fuse and control unit (D1).**

YES ↓

Turn the ignition switch ON.

Measure voltage between D2 (+) terminal and D21 (−) terminal.



Is there battery voltage ?

NO → Turn the ignition switch OFF.

Inspect ACG (S) (15 A) fuse

Is ACG (S) (15 A) fuse OK ?

NO → **Replace fuse.**

YES → **Repair open in BLK/YEL wire between ACG (S) (15 A) fuse and control unit (D2)**

YES ↓

Power Source (IG1, Bat) and Ground are OK.

PGM-CARB Control System

Input Troubleshooting Flowchart — A/T Shift Position Signal (A/T only)

This signals the control unit when the transmission is in $\boxed{N}$, $\boxed{P}$, $\boxed{D_3}$ or $\boxed{D_4}$.

Inspection of A/T Shift Position Signal.

Turn the ignition switch ON.

Observe the A/T shift indicator and select each position separately.

Does the indicator light properly ?

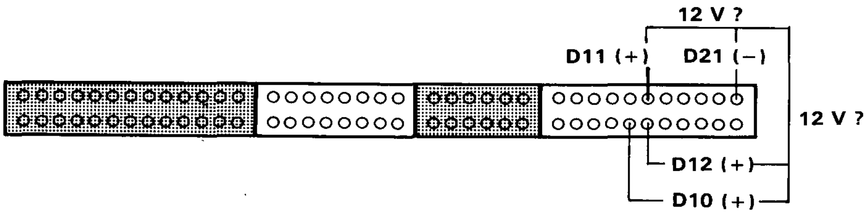
- NO → **See A/T shift position indicator inspection (section 23).**
- YES ↓

Turn the ignition switch OFF.

Connect the test harness between the control unit and connector. But disconnect D connector from the wire harness only, not the control unti (page 11-22).

Turn the ignition switch ON.

Measure voltage between D12 (+), D11 (+), D10 (+) terminal and D21 (−) terminal.

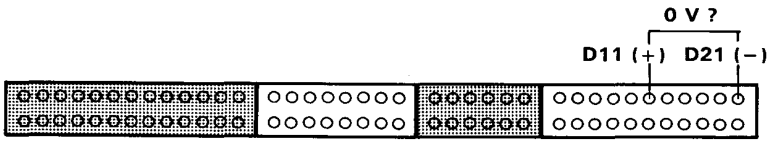


Is there battery voltage ?

- NO → **Substitute known-good control unit and recheck. If prescribed voltage is now available, replace the original control unit.**
- YES ↓

Reconnect D connector to the wire harness.

Measure voltage between D11 (+) terminal and D21 (−) terminal in $\boxed{N}$ or $\boxed{P}$.



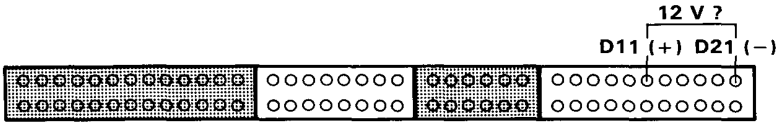
Is there voltage ?

- YES → **Repair open in GRN wire between control unit (D11) and combination meter.**
- NO ↓

(To page 11-53)

(To page 11-52)

Measure voltage between D11 (+) terminal and D21 (−) terminal in all other shift positions except [N] or [P].

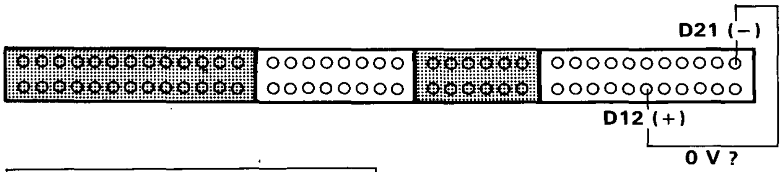


Is there battery voltage ?

NO → **Repair short in GRN wire between combination meter and control unit (D11).**

YES ↓

Measure voltage between D12 (+) terminal and D21 (−) terminal in [D4].

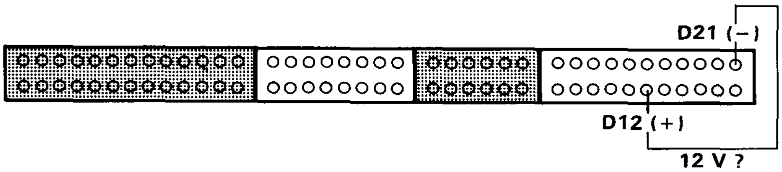


Is there voltage ?

YES → **Repair open in GRN/BLK wire between control unit (D12) and combination meter.**

NO ↓

Measure voltage between D12 (+) terminal and D21 (−) terminal in all other shift positions except [D4].

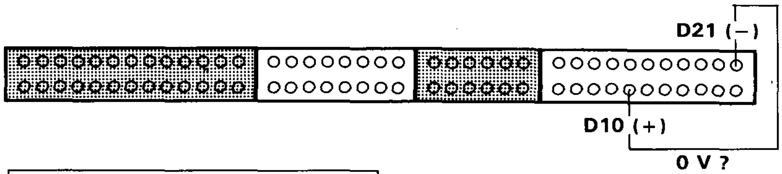


Is there battery voltage ?

NO → **Repair short in GRN/BLK wire between combination meter and control unit (D12).**

YES ↓

Measure voltage between D10 (+) terminal and d21 (−) terminal in [D_3].

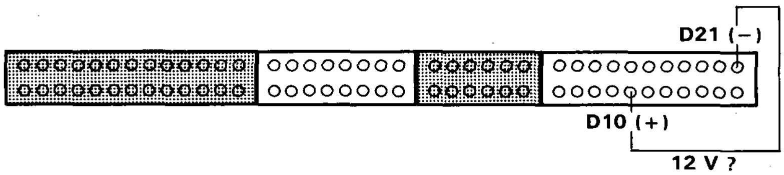


Is there voltage ?

YES → **Repair open in GRN/BLU wire between control unit (D10) and combination meter.**

NO ↓

Measure voltage between D10 (+) terminal and D21 (−) terminal in all other shift positions except [D_3].



Is there battery voltage ?

NO → **Repair short in GRN/BLU wire between combination meter and control unit (D10).**

YES ↓

A/T Shift Position Signal is OK.

Input Troubleshooting Flowchart — Clutch Switch Signal (M/T only)

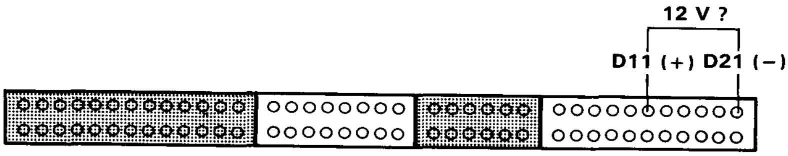
This signals the control unit when the clutch is engaged.

Inspection of Clutch Switch Signal.

Connect the test harness between the control unit and connector (page 11-22).

Turn the ignition switch ON.

Measure voltage between D11 (+) terminal and D21 (−) terminal.

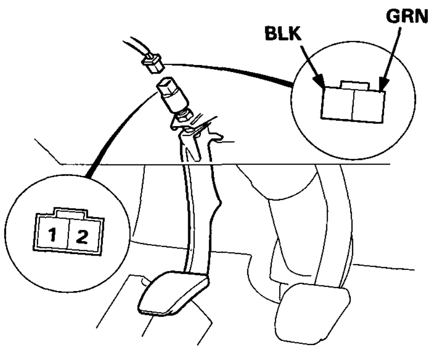


Is there battery voltage ?

NO → Turn the ignition switch OFF.

Disconnect the 2P connector on the clutch switch.

Check for continuity between the 2 terminals on the clutch switch.



Does continuity exist ?

YES → **Replace the clutch switch.**

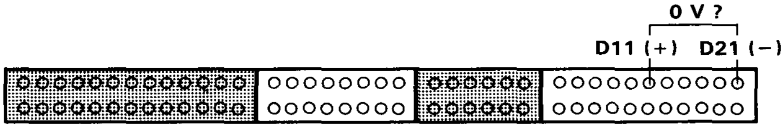
NO →

- **Repair short in GRN wire between control unit (D11) and clutch switch.**
- **Substitute a known-good control unit and recheck. If prescribed voltage is now available, replace the original control unit.**

YES → Depress the clutch pedal.

(To page 11-55)

(From page 11-54)



Is there voltage ?

YES → Turn the ignition switch OFF.

Disconnect the 2P connector on the clutch switch.

Connect GRN terminal to BLK terminal.

Turn the ignition switch ON.

Is there voltage ?

NO → **Replace the clutch switch.**

YES →

- **Repair open in GRN wire between control unit (D11) and clutch switch.**
- **Repair open in BLK wire between clutch switch and G401.**

NO → **Clutch Switch Signal is OK.**

Input Troubleshooting Flowchart — P/S Oil Pressure Switch Signal [D15B4 (KQ CARB) Engine]

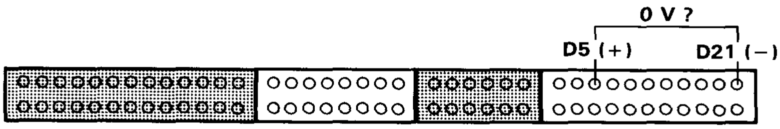
The signals the control unti when the power steering load is high.

Inspection of P/S Oil Pressure Switch Signal.

Connect the test harness between the control unit and connector (page 11-22).

Turn the ignition switch ON.

Measure voltage between D5 (+) terminal and D21 (−) terminal.



Is there voltage ?

YES → Turn the ignition switch OFF.

Disconnect the 2P connector on the P/S oil pressure switch.

Connect BRN/RED terminal to BLK terminal.

Turn the ignition switch ON.

Is there voltage ?

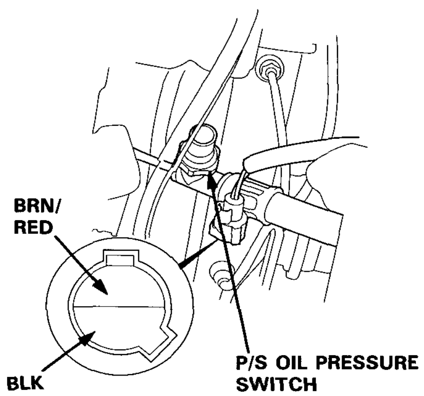
NO → **Replace the P/S oil pressure switch.**

YES →

- **Repair open in BRN/RED wire between control unit (D5) and P/S oil pressure swtich.**
- **Repair open in BLK wire between P/S oil pressure switch and G301.**

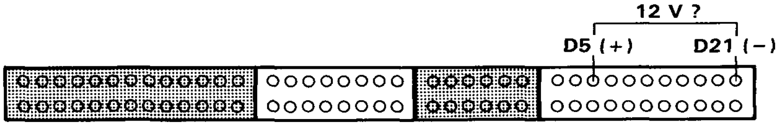
NO → Turn steering wheel slowly.

(To page 11-57)



(From page 11-56)

Measure voltage between D5 (+) terminal and D21 (−) terminal while steering wheel is turning.



Is there battery voltage ?

NO → Turn the ignition switch OFF.

Disconnect the 2P connector on the P/S oil pressure switch.

Check for continuity between the 2 terminals on the P/S oil pressure switch.

Does continuity exist ?

YES → **Replace the P/S oil pressure switch.**

NO →

- **Repair short in BRN/RED wire between control unit (D5) and P/S oil pressure switch.**
- **Substitute a known-good control unit and recheck. If prescribed voltage in now available, replace the original control unit.**

YES →

P/S Oil Pressure Switch Signal is OK.

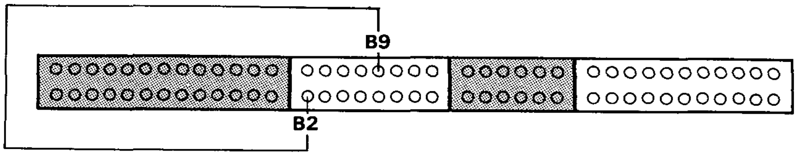
Input Troubleshooting Flowchart — Air Conditioning Signal

This signals the control unit when the A/C switch is on.

Inspection of Air Conditioning Signal.

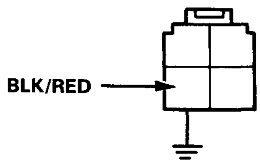
Connect the test harness between the control unit and connector (page 11-22).

Connect B9 terminal to B2 terminal.



Does A/C operate ?

NO → Connect the BLK/RED terminal of the 4P connector on the A/C clutch relay to body ground.



Does A/C operate ?

NO → **See Air conditioner inspection (section 22).**

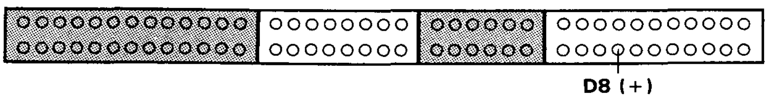
YES → **Repair open in BLK/RED wire between control unit (B9) and A/C clutch relay.**

YES ↓

Start engine.

Blower switch ON.

A/C switch ON.



Does A/C operate ?

YES → **Air Conditioning Signal is OK.**

NO → Measure voltage between D8 (+) terminal and D21 (−) terminal.

Is voltage below 3 V ?

NO → **Repair open in BLU/RED wire between ECU (D8) and A/C switch.**

YES → **Substitute a known-good control unit and recheck. If prescribed voltage is now available, replace the original control unit.**

PGM-CARB Control System

Input Troubleshooting Flowchart — Brake Switch Signal [D15B4 (KQ CARB) Engine]

This signals the control unit when the brake pedal is depressed

Inspection of Brake Switch Signal.

↓

Are the brake lights on without depressing the brake pedal ?
- YES → **Inspect the brake switch (section 19).**
- NO ↓

Depress the brake pedal.

↓

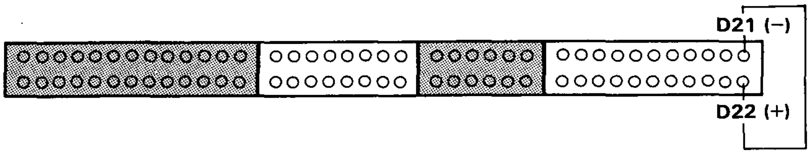
Do the brake lights come on ?
- NO → Inspect STOP, HORN (20 A) fuse (main fuse box).
  - ↓ Is fuse OK ?
    - NO → **Replace fuse.**
    - YES → **Inspect the brake switch (section 19).**
- YES ↓

Connect the test harness between the control unti and connector (page 11-22).

↓

(To page 11-61)

(To page 11-60)



Measure voltage between D22 (+) terminal and D21 (−) terminal.

Is there battery voltage ?

NO → **Repair open in GRN/WHT wire between the brake switch and control unit (D22)**

YES → **Brake switch signal is OK.**

Input Troubleshooting Flowchart WIPER/WASHER Switch Signal ("INT") [D15B4 (KQ CARB) Engine]

This signal the control unit when the wiper/washer switch (INT) is ON.

Inspection of Wiper/Washer Switch Signal (INT).

Does the wiper/washer switch (INT) operate properly ?

- NO → **See the wiper/washer switch inspection (section 23).**
- YES ↓

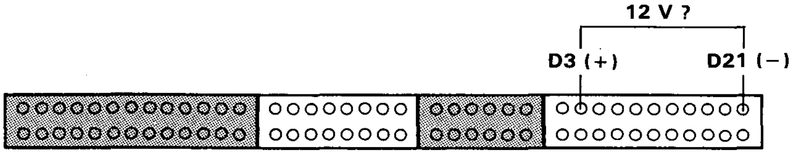
Turn the ignition switch OFF.

Connect the test harness between the control unit and connector (page 11-22).

Turn the ignition switch ON.

Turn the wiper/washer switch "INT".

Measure voltage between D3 (+) terminal and D21 (−) terminal.



Is there battery voltage ?

- NO → **Repair open in YEL/BLU wire between the wiper/washer switch and control unit (D3).**
- YES ↓

Wiper/Washer Switch Signal is OK.

Carburetor

Symptom-to-Sub System Chart

[1-Carbureted Engine]

NOTE:
- Across each row in the chart, the sub systems that could be sources of a symptom are ranked in the order they should be inspected, starting with ①. Find the symptom in the left column, read across to the most likely source, then refer to the page listed at the top of that column. If inspection shows the system is OK, try the next system ②, etc.
- Before starting inspection, check that other items that affect engine performance are within specification. Check the self-diagnosis indicator (PGM-CARB), valve clearance, air cleaner, and PCV valve. In addition, check the ignition timing, function of the vacuum and centrifugal advance, and the condition of the spak plugs. If those items are all within specifications, begin with the troubleshooting listed in pages 11-64 and 11-65.

SYMPTOM \ SYSTEM		IDLE SPEED/ MIXTURE	IDLE BOOST	AUTOMATIC CHOKE/ FAST IDLE SYSTEM	AIR VENT CUT-OFF DIAPHRAGM / FLOAT LEVEL
PAGE		104	70	119	115,173
ENGINE WON'T START					①
DIFFICULT TO START ENGINE	WHEN COLD			①	②
	WHEN WARM				②
IRREGULAR IDLING	WHEN COLD FAST IDLE OUT OF SPECIFICATION		②	①	
	WHEN WARM ENGINE SPEED TOO HIGH	①	②	③	
	WHEN WARM ENGINE SPEED TOO LOW	①	①		
	ROUGH IDLE/ FLUCTUATION	①	③		②
FREQUENT STALLING	WHILE WARMING UP		②	①	
	AFTER WARMING UP	①	②		②
POOR PERFORMANCE	MISFIRE OR ROUGH RUNNING			①	①
	LOSS OFF POWER				②
	AFTERBURN	①			
	HESITATION/SURGE				

POWER VALVE	PRIMARY SLOW MIXTURE CUT-OFF SOLENOID VALVE	SLOW AIR JET CONTROL	VACUUM CONTROLLED SECONDARY	ACCELE-RATOR PUMP
89	96	84	81	112
	②	②		
	①			②
	①	②		
②	②			
		②		
		②		
		③	②	
②	①			
	①	①		
			②	
③			①	③
②				①

Symptom-to-Sub System Chart

[2-Carbureted Engine]

NOTE:

- Across each row in the chart, the sub systems that could be sources of a symptom are ranked in the order they should be inspected, starting with ①. Find the symptom in the left column, read across to the most likely source, then refer to the page listed at the top of that column. If inspection shows the system is OK, try the next system ②, etc.
- Before starting inspection, check that other items that affect engine performance are within specification. Check the self-diagnosis indicator, valve clearance, air cleaner, and PCV valve. In addition, check the ignition timing, function of the vacuum and centrifugal advance, and the condition of the spark plugs. If those items are all within specifications, begin with the troubleshooting listed in pages 11-66 and 11-67.

SYMPTOM	SYSTEM	CARBURETOR			
		IDLE SPEED/ MIXTURE	A/C IDLE BOOST	AUTOMATIC CHOKE/ FAST IDLE SYSTEM	AIR VENT CUT-OFF (INNER VENT) SOLENDID VALVE
PAGE		104	70	128	180,182
ENGINE WON'T START					①
DIFFICULT TO START ENGINE	WHEN COLD			①	②
	WHEN WARM				②
IRREGULAR IDLING	WHEN COLD FAST IDLE OUT OF SPECIFICATION			①	
	WHEN WARM ENGINE SPEED TOO HIGH	①	②	③	
	WHEN WARM ENGINE SPEED TOO LOW	①	①		
	ROUGH IDLE/ FLUCTUATION	①	③		②
FREQUENT STALLING	WHILE WARMING UP		②	①	
	AFTER WARMING UP	①	②		②
POOR PERFORMANCE	MISFIRE OR ROUGH RUNNING			②	①
	LOSS OFF POWER				②
	AFTERBURN	②			
	HESITATION/SURGE				

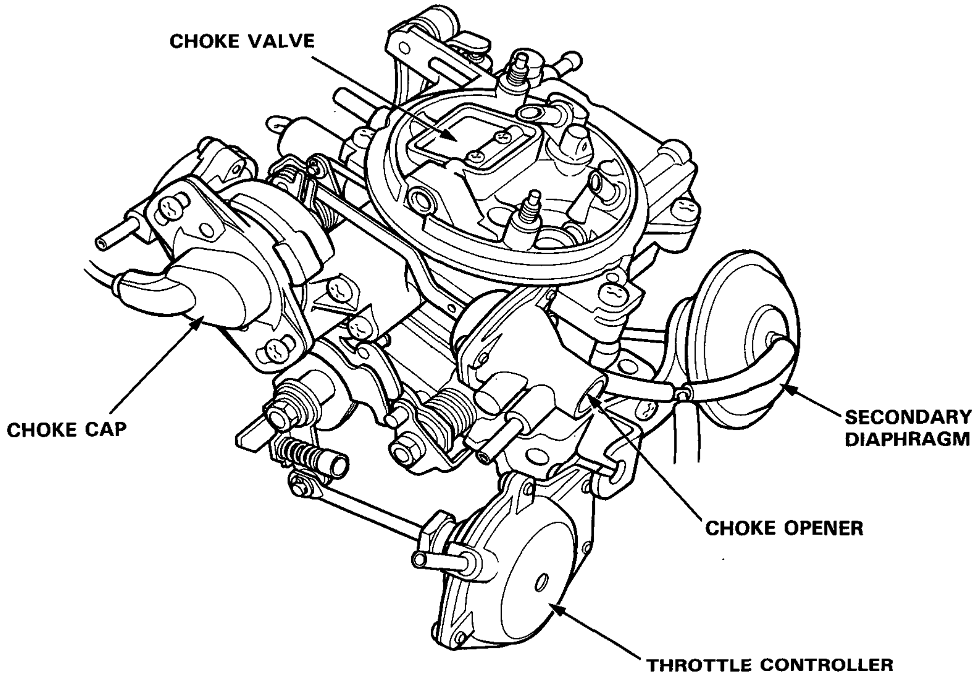
CARBURETOR				
POWER VALVE	PRIMARY SLOW MIXTURE CUT-OFF SOLENOID VALVE	SLOW AIR JET CONTROL	VACUUM PISTON CONTROL	ACCELER-ATOR PUMP
89	96	84	84	114
	2	2		
	1			2
	1	2		
	2			
		2		
		3		
	1			
	1	1		
			2	
3			1	3
				1

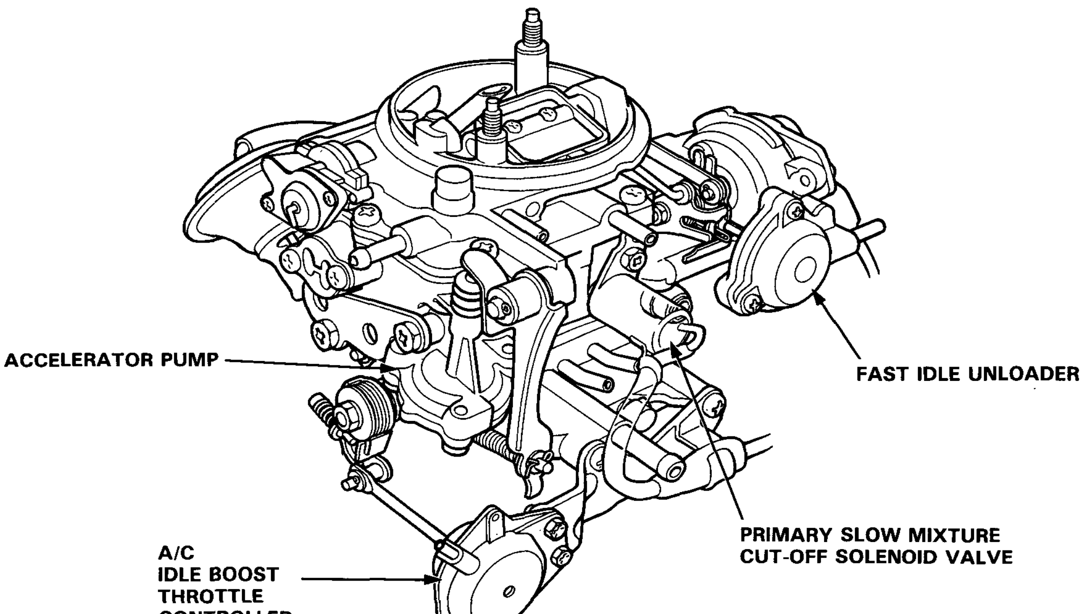
Carburetor

System Description [1-Carbureted Engine]

The carburetor is a fixed venturi type of compact 2-barrel down draft with excellent fuel atomization characteristic. It has primary and secondary throttle bores, and fuel is supplied through the primary bore at normal driving speed while it is supplied through both the primary and secondary bores at high driving speed.

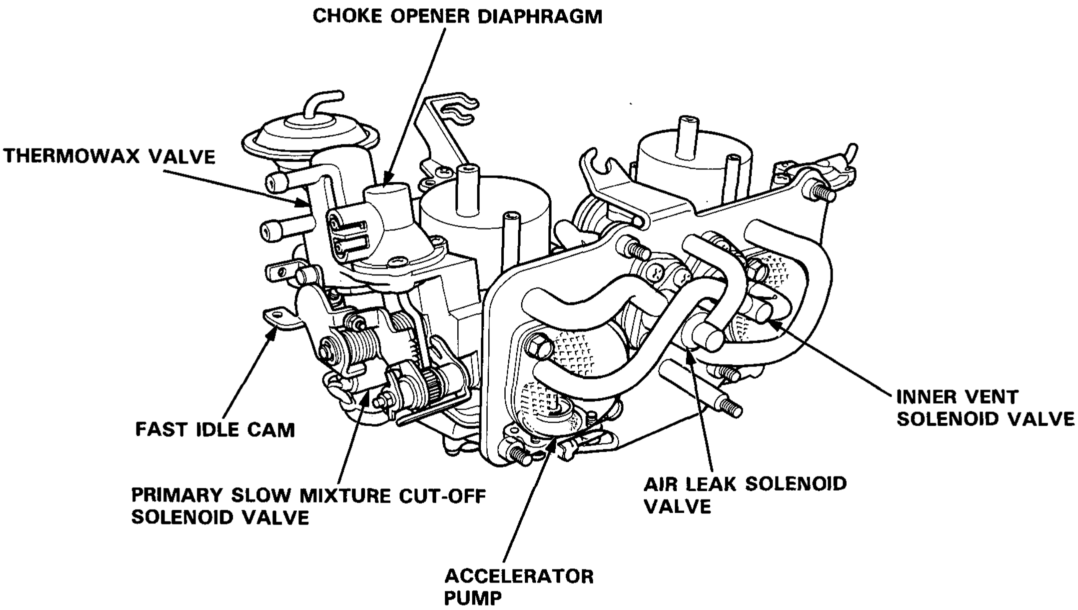
This carburetor has three stories structure: choke valve is attached to air horn body of the upper side, venturi, float chamber and accelerator pump, choke housing are attached to mixing body of the middle, and primary and secondary throttle valve, secondary diaphragm and pilot screw are attached to throttle body of the lower side.

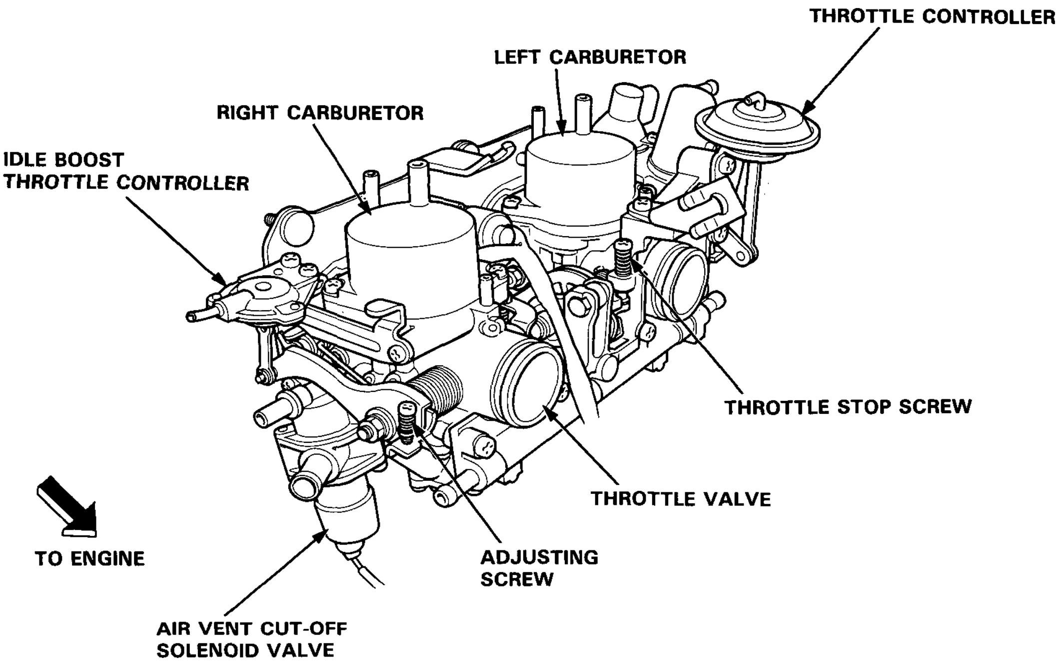




System Description [2-Carbureted Engine]

This carburetor assembly consists of two side-draft carburetors, each of which has a variable venturi.
The variable venturi carburetors allow a smooth increase of engine speed and engine output due to the change in venturi area in proportion to carburetor intake air flow rate.





Idle Control System

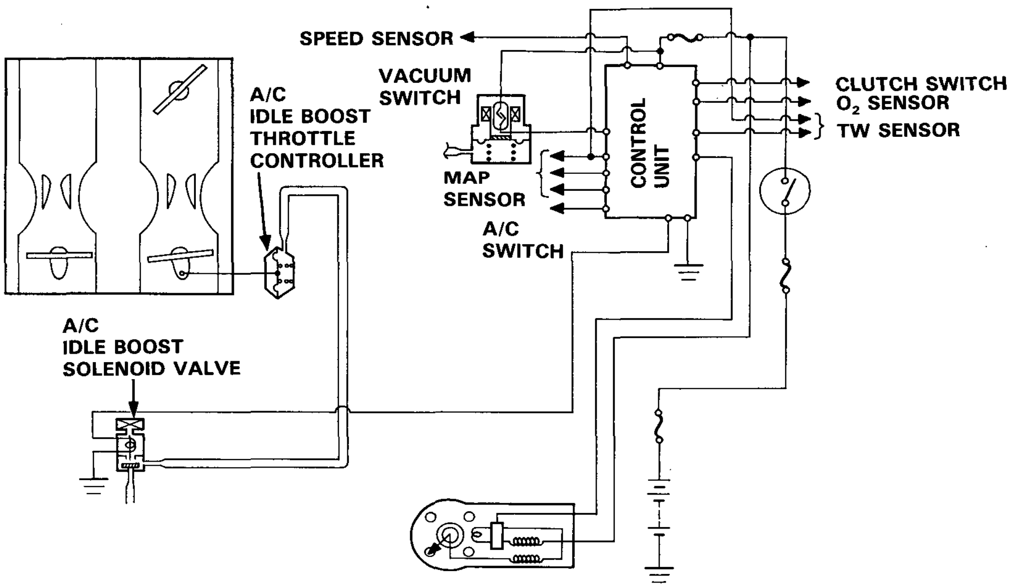
Description

This system maintains a stable idle speed under different engine loads.
1-Carbureted Engine:
Idle control is accomplished using the A/C idle boost throttle controller.
2-Carbureted Engine:
Idle control is accomplished using two throttle controllers, the idle boost throttle controller and throttle controller.
The control unit monitors the inputs shown and directs voltage to the solenoid valves.

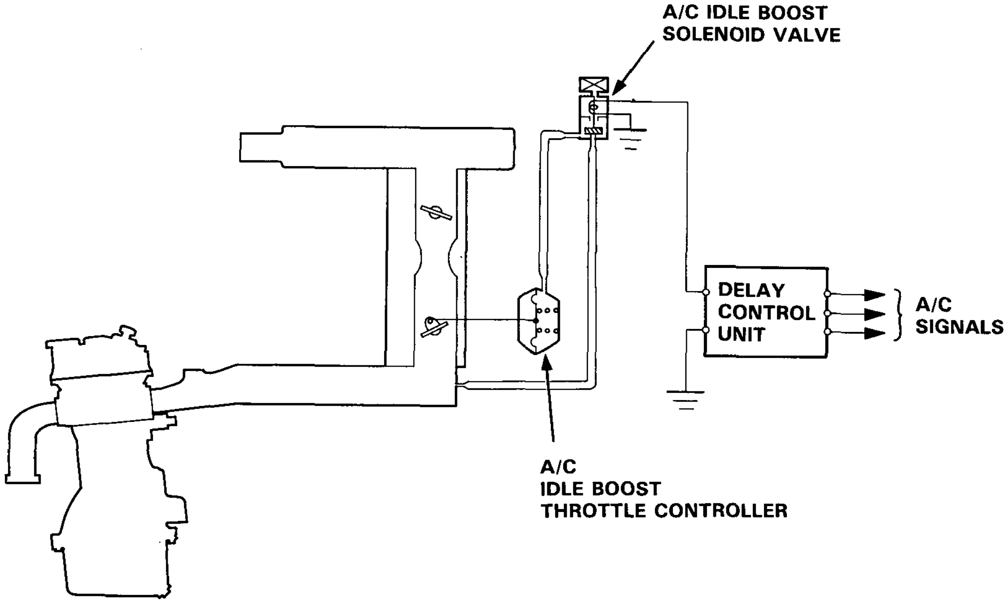
The A/C idle boost solenoid valve is energized
1-Carbureted Engine:
when the A/C compressor is energized, applying vacuum to the A/C idle boost throttle controller.
2-Carbureted Engine:
when the A/C compressor is energized, releasing vacuum to the throttle controler.

The idle boost solenoid valve is energized (2-Carbureted Engine only)
when the headlights and blower switch is on, applying vacuum to the idle boost throttle controller.

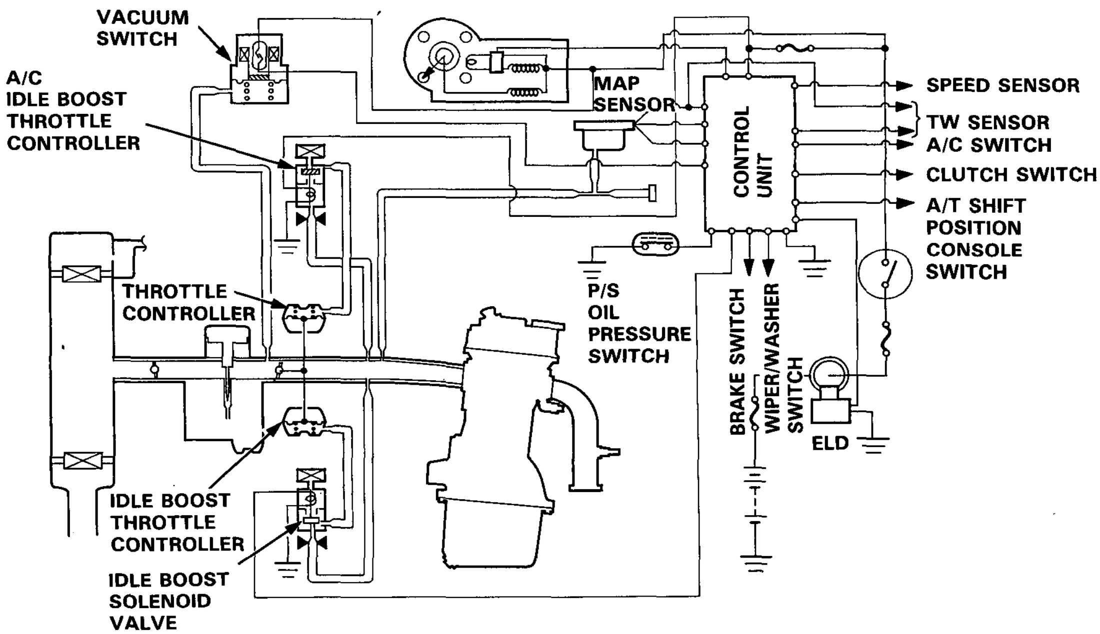
[D13B2 EUROPE & KQ Engine]



[D12B1, D13B3 EXCEPT EUROPE and D15B3 Engine]



[D15B4 (KQ CARB) Engine]



Idle Control System [1-Carbureted Engine]

Testing

1. Start the engine and warm up to normal operating temperature (the cooling fan comes on).

2. Check the idle speed with headlights, heater blower, rear window defogger, cooling fan and air conditioner off.

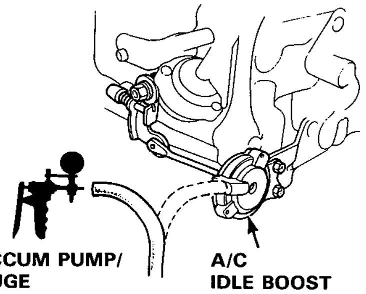
   Idle speed should be:

Manual	800 ±50 min^{-1} (rpm)
Automatic	1,000 ±50 min^{-1} (rpm) (N or P)

- If OK, go to step 4.
- If not, got to step 3.

3. Disconnect the vacuum hose (KY: #20) from the A/C idle boost throttle controller and check the vacuum.

   There should be no vacuum.



- If there is no vacuum, check the throttle valve shaft for binding or sticking and replace the A/C idle boost throttle controller.
- If there is vacuum, go to A/C idle boost solenoid valve troubleshooting (page 11-73).

4. Check the idle speed with the A/C on.

   Idle speed should be:

Manual	800 ±50 min^{-1} (rpm)
Automatic	1,000 ±50 min^{-1} (rpm) (N or P)

- If not, disconnect the vacuum hose (KY: #20) from the A/C idle boost throttle controller and check the vacuum.

There should be vacuum.

— If there is vacuum, check the throttle valve shaft for binding or sticking and replace the A/C idle boost throttle controller.

— If there is no vacuum, go to A/C idle boost solenoid valve troubleshooting (page 11-73).

Troubleshooting Flowchart A/C Idle Boost Sole- noid Valve

The A/C idle boost solenoid valve is energized when the A/C compressor is energized, applying vacuum to the diaphragm of the idle boost throttle controller. This increases the idle speed when the A/C compressor is on.

Inspection of A/C Idle Boost Sole- noid Valve

↓

Disconnect the lower vacuum hose of the solenoid valve from the joint and connect a vacuum pump.

↓

Disconnect vacuum hose (KY: #20) of the solenoid valve from the vacuum hose manifold and connect a vacuum gauge.

↓

Start the engine.

↓

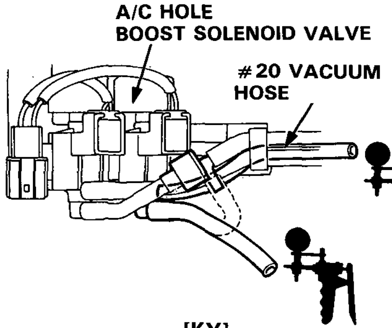
Apply vacuum.

↓

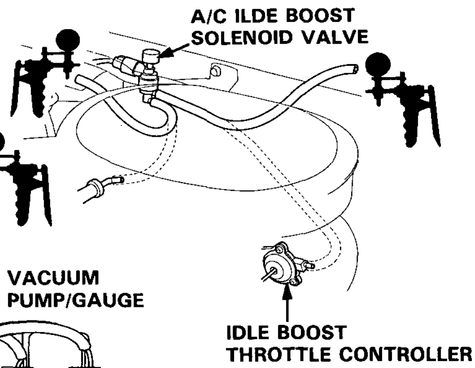
Is vacuum indicated on the gauge?

- YES → Turn the ignition switch OFF.
  ↓
  Disconnect the connector on the solenoid valve.
  ↓
  Start the engine.
  ↓
  Measure voltage between RED (+) terminal and BLK (−) terminal.
  ↓
  Is there voltage ?
  - YES → **[D13B2 EUROPE & KQ Engine] Check the self-diagnosis indicator (page 11-21). If OK, check the input trouble-shooting (page 11-26). [D12B1, D13B3 EXCEPT EUROPE and D15B3 Engine] See Air Conditioner inspection (section 21).**
  - NO → **Replace the solenoid valve.**
- NO → Blower switch ON.
  ↓
  Turn the A/C switch ON.
  ↓
  (To page 11-74)

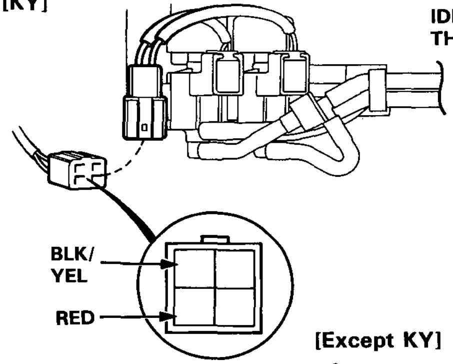
[KY]



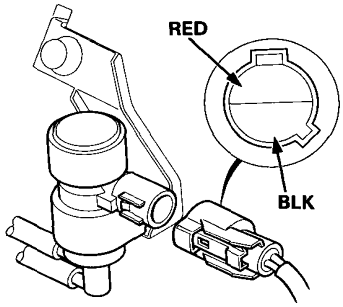
[Except KY]



[KY]



[Except KY]



(cont'd)

Idle Control System [1-Carbureted Engine] (cont'd)

(From page 11-73)

Is vacuum indicated on the gauge?

YES

A/C Idle Boost Solenoid Valve is OK.

NO

Turn the ignition switch OFF.

Disconnect the connector on the control box.

Start the engine.

Blower switch ON.

Turn the A/C switch ON.

Measure voltage between RED (+) terminal and BLK (−) terminal.

Is there battery voltage ?

YES

Replace the solenoid valve.

NO

Measure voltage between RED (+) terminal and body ground.

Is there battery voltage?

YES

Repair open in BLK wire between the solenoid valve and G201 (RHD: G301).

NO

[D12B1, D13B3 EXCEPT EUROPE and D15B3 Engine]
Inspect open in RED wire between the solenoid valve and delay control unit.
If OK, see Air Conditioner inspection (section 21).
[D13B2 EUROPE & KQ Engine]
Check the self-diagnosis indicator (page 11-21). If OK, inspect open in RED wire between the solenoid valve and control unit (B16).

Idle Control System [2-Carburated Engine]

Testing

1. Start the engine and warm up to normal operating temperature (the cooling fan comes on).

2. Check the idle speed with headlights, heater blower, rear window defogger, cooling fan and air conditioner off.

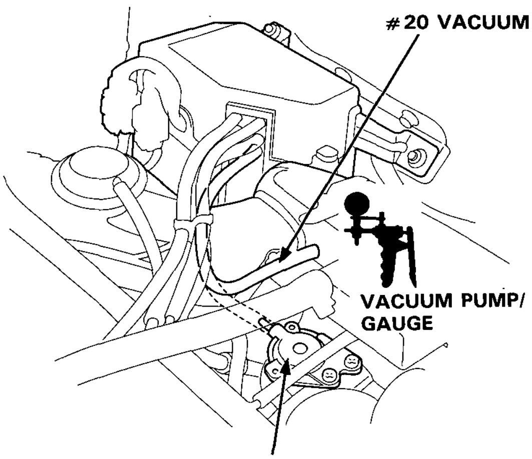
   Idle speed should be:

Manual	650 ±50 min⁻¹ (rpm)
Automatic	720 ±50 min⁻ (rpm) (N or P)

- If OK, go to step 5.
- If not, go to step 3.

3. Disconnect the #20 vacuum hose at idle boost throttle controller and check vacuum.

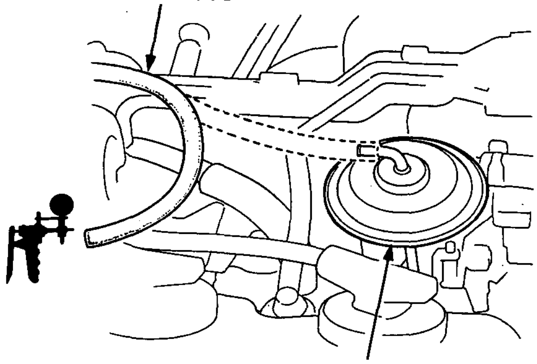
   There should be no vacuum



- If there is no vacuum, check the throttle valve shaft for binding or sticking and replace the idle boost throttle controller.
- If there is vacuum, go to idle boost solenoid valve (pag 11-77).

4. Disconnect the #6 vacuum hose at throttle controller and check vacuum.

   There should be vacuum.



- If there is vacuum, check the throttle valve shaft for bidning or sticking and replace the throttle controller.
- If there is no vacuum, check the #6, #22 and #12 vacuum line for proper connection, cracks, blockage or disconnected hose. If OK, go to the A/C idle boost solenoid valve troubleshooting (page 11-79).

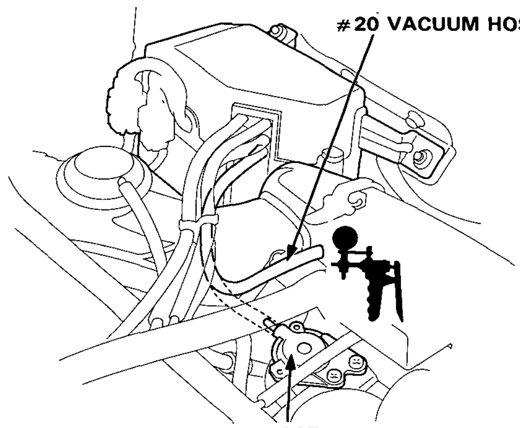
5. *Check the idle speed with headlights and heater blower on.*

   Idle speed should be:

Manual	700 ±50 min⁻¹ (rpm)
Automatic	850 ±50 min⁻¹ (rpm) (N or P)

- If OK, go to step 7.
- If not, go to step 6.

6. Disconnect the #20 vacuum hose at idle boost throttle controller and check vacuum.
   There should be vacuum.



(cont'd)

Carburetor

- If there is vacuum, check the throttle valve shaft for binding or sticking and replace the idle boost throttle controller.
- If there is no vacuum, check the #20 and #12 vacuum line for proper connection, cracks, blockage or disconnected hose. If OK, go to the idle boost solenoid valve troubleshooting (page 11-77).

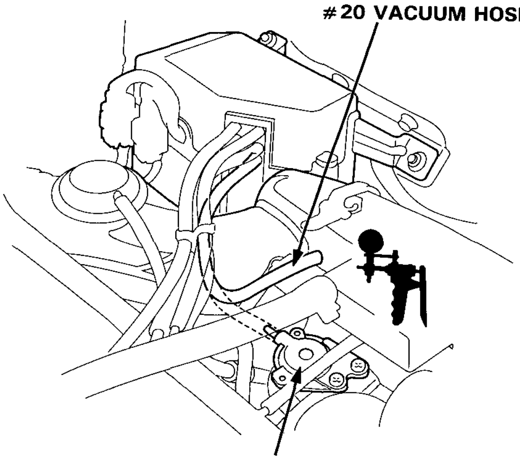
7. Check the idle speed with the A/C on.

Idle speed should be:

Manual	780 ±50 min^{-1} (rpm)
Automatic	1,000 ±50 min^{-1} (rpm) ($\boxed{N}$ or $\boxed{P}$)

- If not, go to step 8.

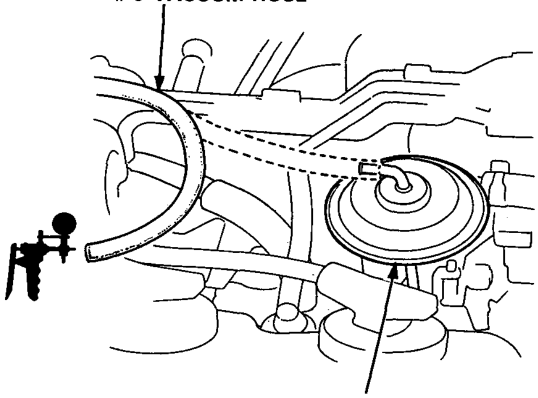
8. Disconnect the #20 vacuum hose at idle boost throttle controller and check vacuum.
There should be vacuum.



- If there is vacuum, check the throttle valve shaft for binding or sticking and replace the idle boost throttle controller.
- If there is no vacuum, check the #20 and #12 vacuum line for proper connection, cracks, blockage or disconnected hose. If OK, go to the idle boost solenoid valve troubleshooting (page 11-77).

9. Disconnect the #6 vacuum hose at throttle controller and check vacuum.

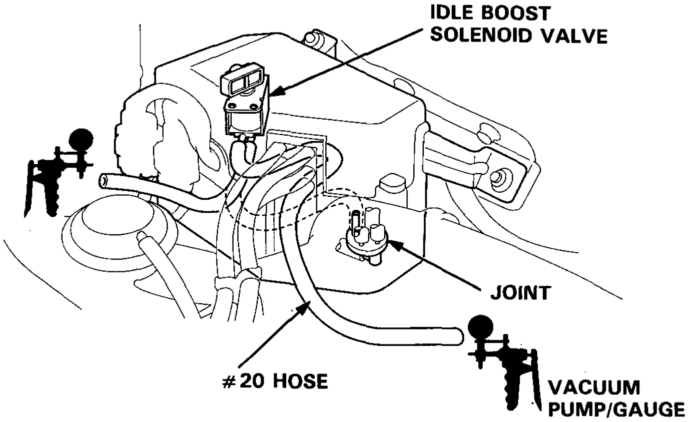
There should be no vacuum.



- If there is no vacuum, check the throttle valve shaft for binding or sticking and replace the throttle controller.
- If there is vacuum, go to A/C idle boost solenoid valve (page 11-79).

Troubleshooting Flowchart — Idle Boost Solenoid Valve

The idle boost solenoid valve is energized when there is electric load on the engine, applying vacuum to the diaphragm of the idle boost throttle controller. This increases the idle speed when the headlights and blower switch is on.



Inspection of Idle Boost Solenoid Valve.

Open the control box.

Disconnect the lower vacuum hose of the solenoid valve from the joint and connect a vacuum pump.

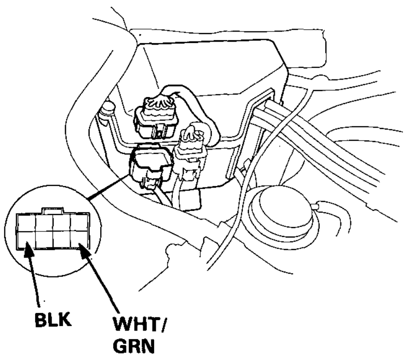
Disconnect #20 vacuum hose of the solenoid valve from the vacuum hose manifold and connect a vacuum gauge.

Start the engine.

Apply vacuum.

Is vacuum indicated on the gauge?

- YES → Turn the ignition switch OFF.
  - Disconnect the connector on the control box.
  - Start the engine.
  - Measure voltage between WHT/GRN (+) terminal and BLK (−) terminal.
  - Is there voltage ?
    - YES → **Check the self-diagnosis indicator (page 11-21). If OK, check the input troubleshooting (page 11-28).**
    - NO → **Replace the solenoid valve.**
- NO → Headlights and blower switch ON.
  - Apply vacuum.
  - (To page 11-78)



(cont'd)

Idle Control System [2-Carbureted Engine]

(From page 11-77)

Is vacuum indicated on the gauge?

YES → **Idle Boost Solenoid Valve is OK.**

NO → Turn the ignition switch OFF.

Disconnect the connector on the control box.

Start the engine.

Headlights and blower switch ON.

Measure voltage between WHT/GRN (+) terminal and BLK (−) terminal.

Is there battery voltage ?

YES → **Replace the solenoid valve.**

NO → Measure voltage between WHT/GRN (+) terminal and body ground.

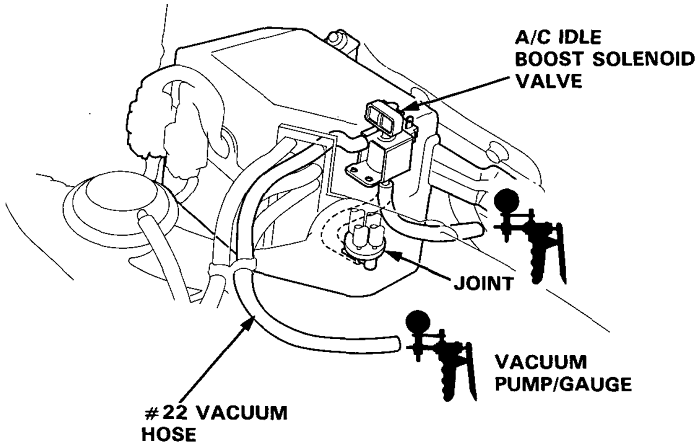
Is there battery voltage?

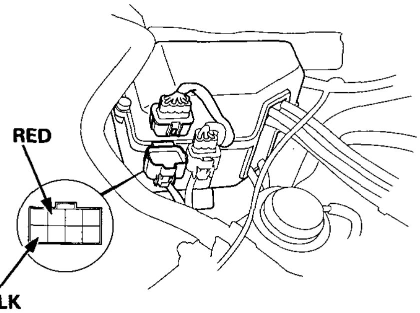
YES → **Repair open in BLK wire between the solenoid valve and G301.**

NO → **Check the self-diagnosis indicator (page 11-21). If OK, inspect open in WHT/GRN wire between the solenoid valve and control unit (B15).**

Troubleshooting Flowchart — A/C Idle Boost Solenoid Valve

The A/C idle boost solenoid valve is energized when the A/C compressor is energized, applying vacuum to the diaphragm of the throttle controller. This increases the idle speed when the A/C compressor is on.





Inspection of A/C Idle Boost Solenoid Valve

1. Open the control box.
2. Disconnect the lower vacuum hose of the solenoid valve from the joint and connect a vacuum pump.
3. Disconnect #22 vacuum hose of the solenoid valve from the vacuum hose manifold and connect a vacuum gauge.
4. Start the engine.
5. Apply vacuum.

Is vacuum indicated on the gauge?

- **YES** →
  - Blower switch ON.
  - Turn the A/C switch ON.
  - (To page 11-80)
- **NO** →
  - Turn the ignition switch OFF.
  - Disconnect the connector on the control box.
  - Start the engine.
  - Measure voltage between RED (+) terminal and BLK (−) terminal.
  - **Is there voltage ?**
    - **YES** → **Check the self-diagnosis indicator (page 11-21). If OK, check the input troubleshooting (page 11-28).**
    - **NO** → **Replace the solenoid valve.**

(cont'd)

Idle Control System [2-Carbureted Engine] (cont'd)

(From page 11-79)

Is vacuum indicated on the gauge ?

- NO: **A/C Idle Boost Solenoid Valve is OK.**
- YES: Turn the ignition switch OFF.

Disconnect the connector on the control box.

Start the engine.

Blower switch ON.

Turn the A/C switch ON.

Measure voltage between RED (+) terminal and BLK (−) terminal on the control box.

Is there battery voltage ?

- YES: **Replace the solenoid valve.**
- NO: Measure voltage between RED (+) terminal and body ground.

Is there battery voltage ?

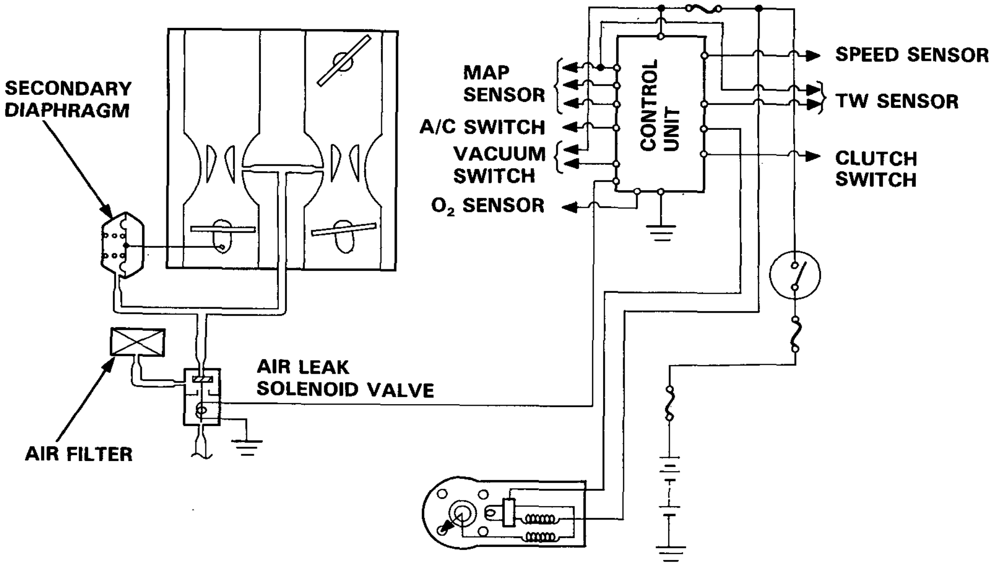
- YES: **Repair open in BLK wire between the solenoid valve and G301.**
- NO: **Check the self-diagnosis indicator (page 11-21). If OK, inspect open in RED wire between the solenoid valve and control unit (B16).**

Vacuum Controlled Secondary [1-Carbureted Engine]

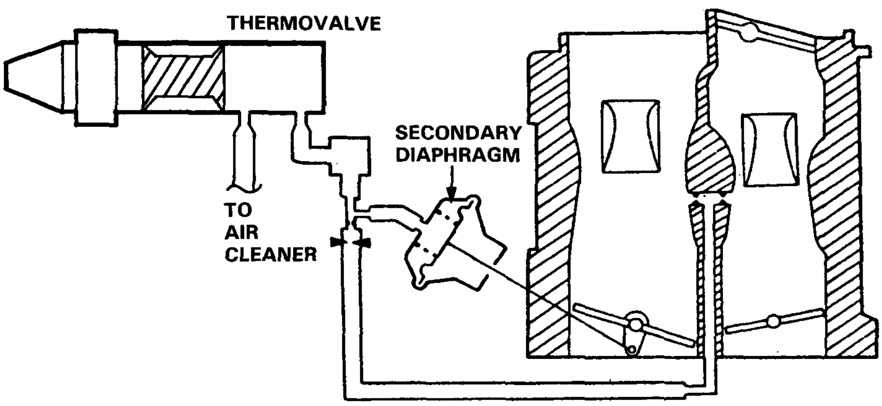
Description

This system is designed to control vacuum bypass into the air cleaner to keep the secondary throttle valve closed in order to improve drivability when the engine is cold.

[D13B2 EUROPE & KQ Engine]



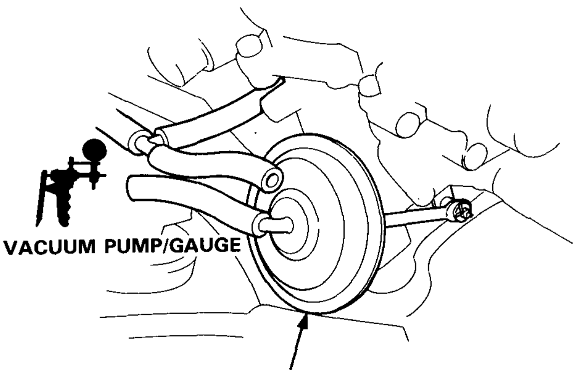
[D12B1, D13B3 EXCEPT EUROPE and D15B3 Engine]



Vacuum Controlled Secondary [1-Carbureted Engine] (cont'd)

Testing
[D12B1, D13B3 EXCEPT EUROPE and D15B3 Engine]

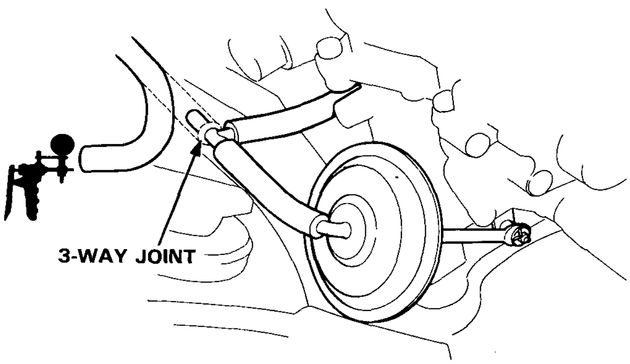
1. Disconnect the secondary diaphragm vacuum hose and attach a spare piece of hose between the diaphragm and a vacuum pump.
2. Open the throttle valve fully and apply a vacuum. Check the diaphragm rod moves as vacuum is applied and that the vacuum then remains steady.



- If the vacuum does not hold or the rod does not move, first check the hose for proper connection and condition, then replace the diaphragm and recheck.

3. Disconnect the vacuum hose from the 3-way joint, connect a vacuum pump and apply vacuum.
NOTE: The engine coolant temperature must be below 60°C (140°F).

It should not hold vacuum.

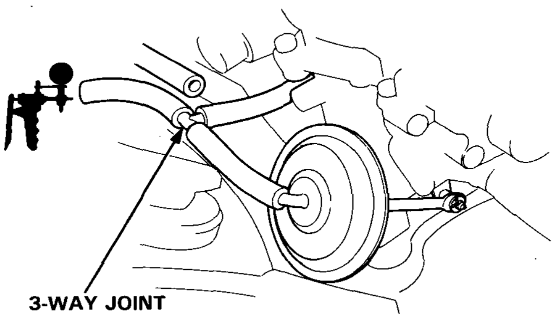


- If it holds vacuum, check the vacuum line for proper connection or cracks. If OK, replace the thermovalve.

4. Start the engine and warm up to normal operating temperature (the cooling fan comes on).
5. Apply vacuum.
It should hold vacuum.

- If it does not hold vacuum, check the vacuum line for proper connection, blockage or disconnected hose. If OK, replace the thermovalve.

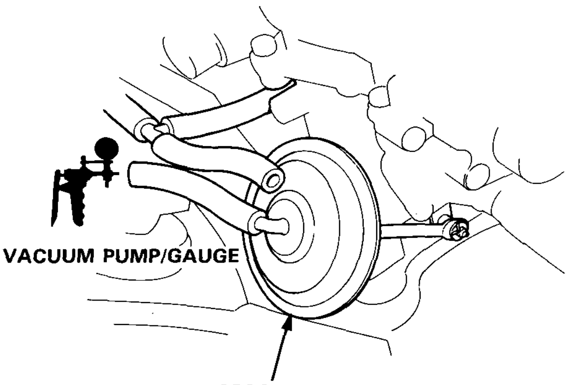
6. Disconnect the vacuum hose from the 3-way joint and connect to a vacuum pump/gauge.
Apply a vacuum.
It should not hold vacuum.



- If vacuum does not hold, test is complete.
- If vacuum is held, check the hose, the 3-way joint and clean the vacuum port.

Testing
[D13B2 EUROPE & KQ Engine]

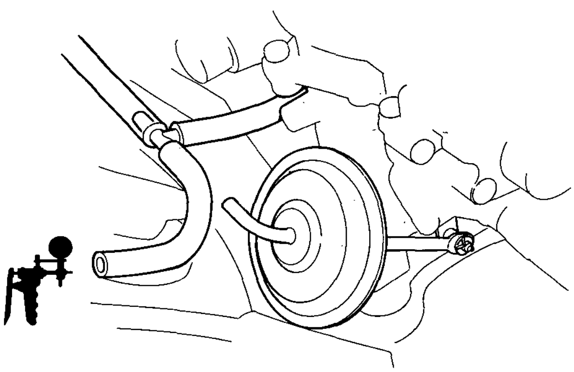
1. Disconnect the secondary diaphragm vacuum hose and attach a spare piece of hose between the diaphragm and a vacuum pump.
2. Open the throttle valve fully and apply a vacuum. Check the diaphragm rod moves as vacuum is applied and that the vacuum then remains steady.



- If the vacuum does not hold or the rod does not move, first check the hose for proper connection and condition, then replace the diaphragm and recheck.

3. Disconnect the secondary diaphragm vacuum hose and connect a vacuum pump. Check vacuum.
NOTE: *The engine coolant temperature must be below 65°C (149°F)*

There should be no vacuum.



- If there is vacuum, check the vacuum line (air filter and 3-way joint) proper connection or blockage. If OK, go to the air leak solenoid valve troubleshooting (page 11-85).

4. Start the engine and warm up to normal operating temperature (the cooling fan comes on).
5. Reconnect the vacuum hose to the secondary diaphragm.
6. Raise the engine speed to 5,000 min^{-1} (rpm), then close the throttle suddenly.
And then check the secondary diaphragm for smooth movement.

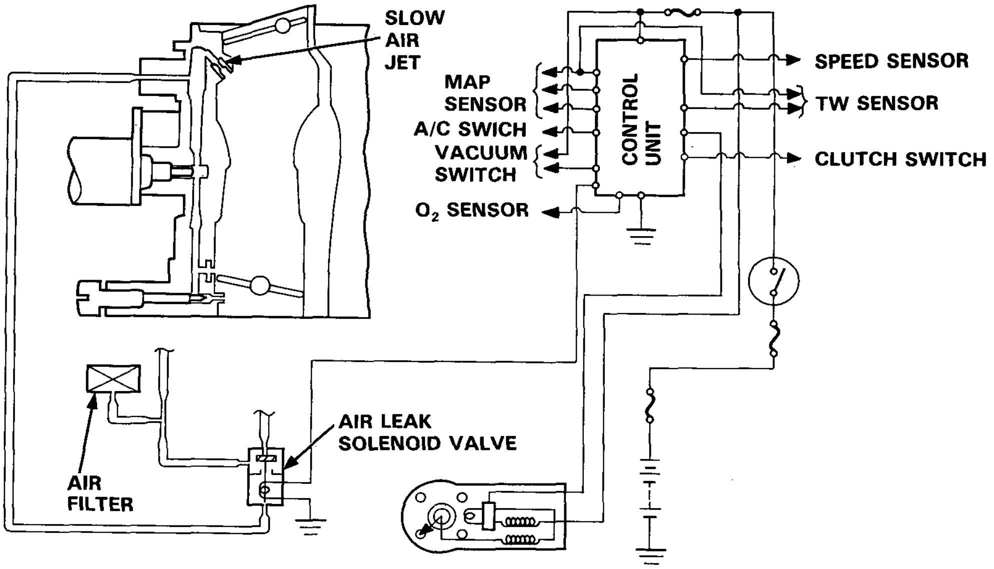
- If not, check the vacuum line for proper connection, cracks or disconnected hose. If OK, go to the air leak solenoid valve troubleshooting (page 11-85).

Slow Air Jet Control System

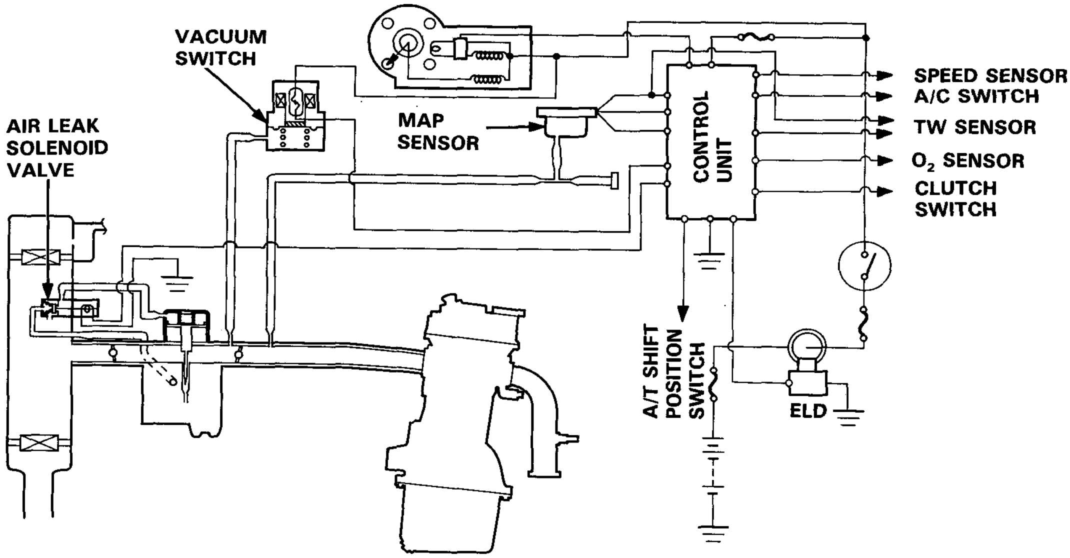
Description

To maintain optimum air-fuel ratio, the slow air jet control system controls air flow into the primary jets of the carburetor throats. When the car is being started, or running in the power mode, the control unit energizes the air leak solenoid valve [D15B4 (KQ CARB) Engine: in the air cleaner] to close the extra air passage, increasing fuel flow.

[D13B2 EUROPE & KQ Engine]



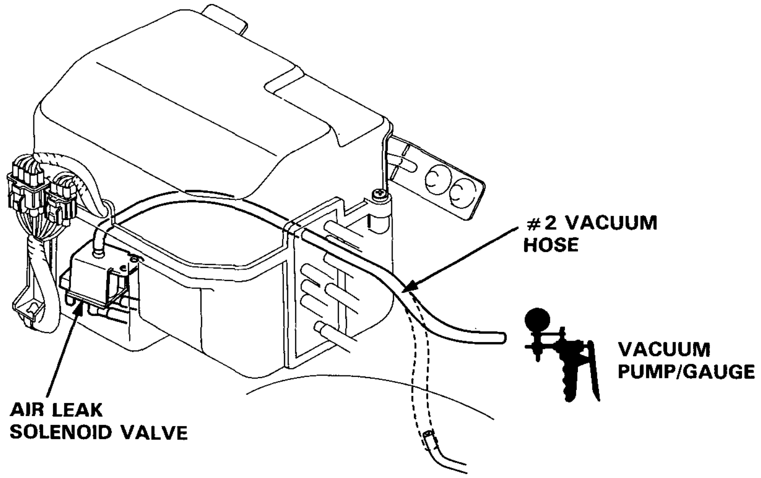
[D15B4 (KQ CARB) Engine]

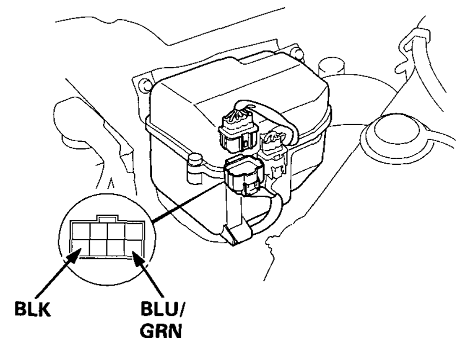


Troubleshooting Flow Chart — Air Leak Solenoid Valve

The air leak solenoid valve is energized when the car is being started, or running in the power mode, to close the extra air passage, increasing fuel flow.

[D13B2 EUROPE & KQ Engine]





Inspection of Air Leak Solenoid Valve.

↓

Disconnect the #2 vacuum hose from the carburetor and connect a vacuum pump, then cap the carburetor.

↓

Disconnect the #21 vacuum hose from the vacuum hose manifold and connect a vacuum pump, then cap the vacuum hose manifold.

↓

Start the engine and apply vacuum to the #21 vacuum hose within 10 seconds.

↓

Start the engine and warm up to normal operating temperature (the cooling fan comes on).

↓

Apply 100 mm Hg (4 in. Hg) vacuum to the #2 hose.

↓

Does solenoid valve hold vacuum when release the vacuum #21 hose ?

- YES → (To page 11-86)
- NO → Turn the ignition switch OFF.

  ↓

  Disconnect the connector on the control box.

  ↓

  Start the engine and apply vacuum to the #21 hose within 10 seconds.

  ↓

  Measure voltage between BLU/GRN (+) temrinal and BLK (−) terminal.

  ↓

  (To page 11-86)

(cont'd)

Slow Air Jet Control System (cont'd)

(From page 11-85)

Apply vacuum to the #21 hose.

Apply 100 mmHg (4 in.Hg) vacuum to the hose.

Does solenoid valve hold vacuum?

- YES → Turn the ignition switch OFF.
- NO → **Air Leak Solenoid Valve is OK.**

(From page 11-85)

Is there battery voltage when release the vacuum #21 hose ?

- YES → **Replace the solenoid valve.**
- NO → Measure voltage between BLU/GRN (+) terminal and body ground.

Is there battery voltage when release the vacuum #21 hose ?

- YES → **Repair open in BLK wire between the solenoid valve and G201 (RHD: G301).**
- NO → **Check the self-diagnosis indicator (page 11-21). If OK, inspect open in BLU/GRN wire between the solenoid valve and control unti (B11).**

Turn the ignition switch OFF.

Disconnect the connector on the control box.

Start the engine and apply vacuum to the #21 vacuum hose within 10 seconds.

Measure voltage between BLU/GRN (+) terminal and BLK (−) terminal.

Is there voltage ?

- YES → **Check the self-diagnosis indicator (page 11-21). If OK, check the input troubleshooting (page 11-26).**
- NO → **Replace the solenoid valve.**

Troubleshooting Flow Chart **Air Leak Solenoid Valve**

The air leak solenoid valve is energized when the car is being started, or running in the power mode, to close the extra air passage, increasing fuel flow.

[D15B4 EUROPE (KQ CARB) Engine]

Inspection of Air Leak Solenoid Valve.

Disconnect the #2 vacuum hose from the carburetor and connect a vacuum pump, then cap the carburetor.

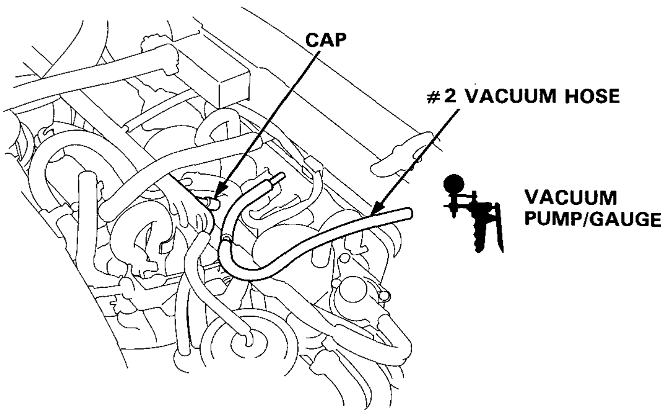
Disconnect the #21 vacuum hose from the vacuum hose manifold and connect a vacuum pump, then cap the vacuum hose manifold.

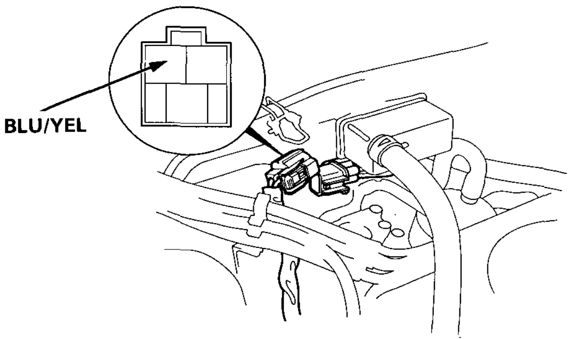
Start the engine and apply vacuum to the #21 vacuum hose within 10 seconds.

Start the engine and warm up to normal operating temperature (the cooling fan comes on).

Hold engine of 2,000 min^{-1} (rpm).

Apply 100 mm Hg (4 in.Hg) vacuum to the #2 hose.





Does solenoid valve hold vacuum ?

YES — (To page 11-88)

NO —

Turn the ignition switch OFF.

Disconnect the 3P connector near the air cleaner.

Start the engine and apply vacuum to the #21 hose within 10 seconds.

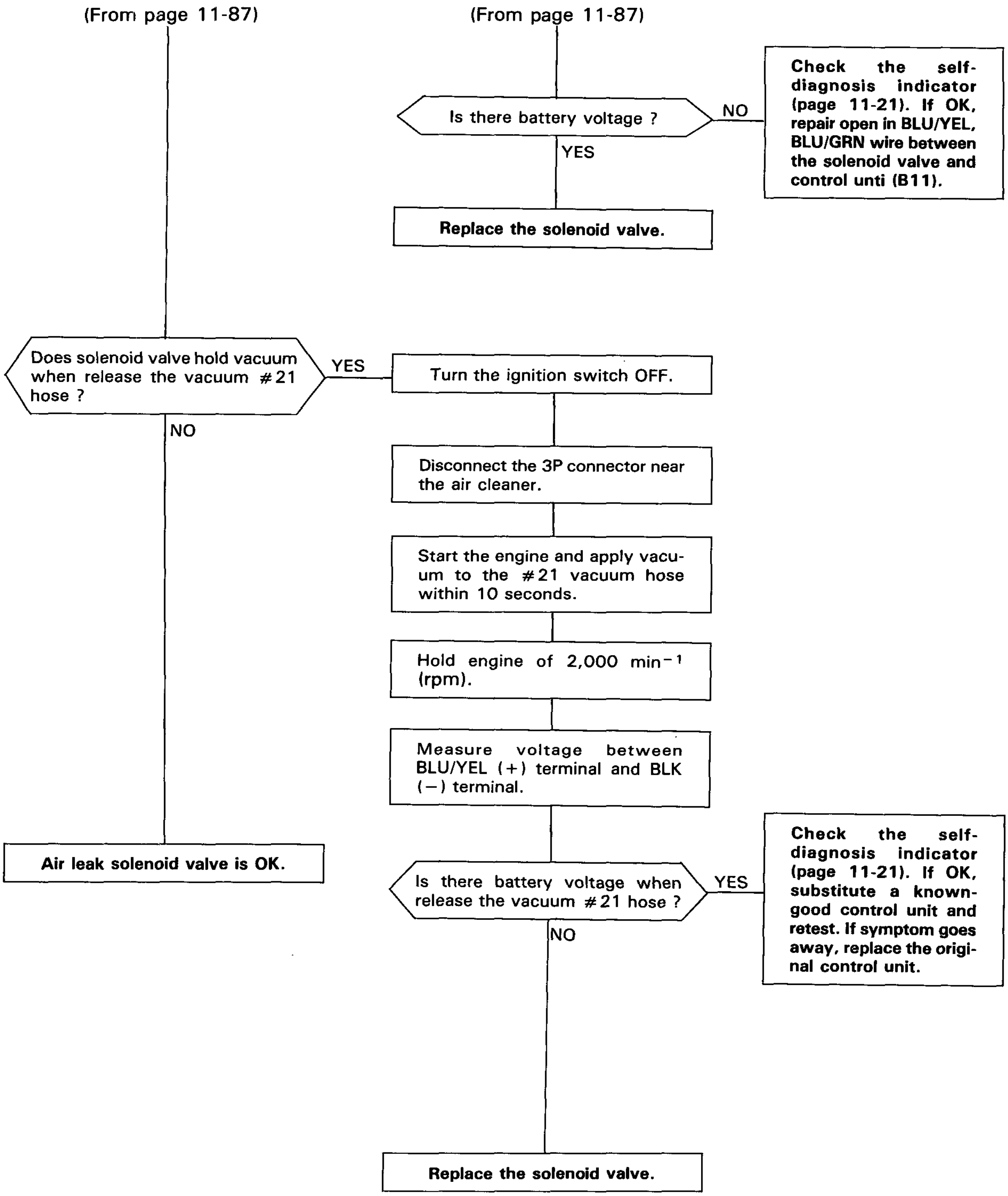
Hold engine at 2,000 min^{-1} (rpm).

Measure voltage between BLU/YEL (+) terminal and body ground.

(To page 11-88)

(cont'd)

Slow Air Jet Control System (cont'd)



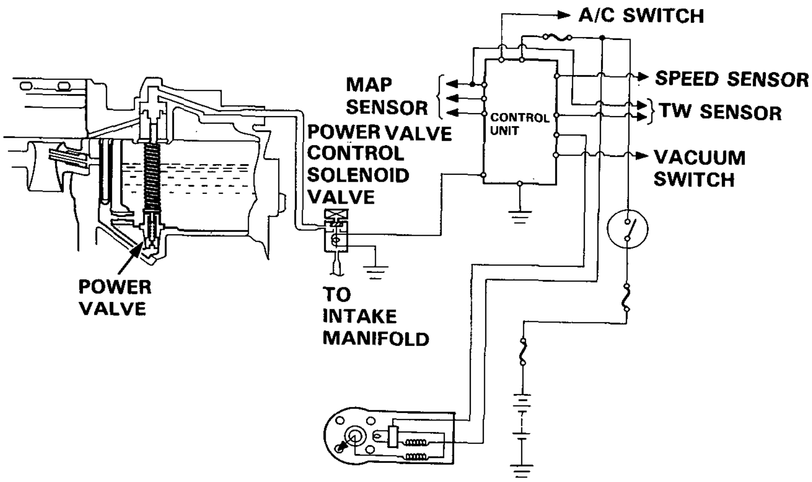
Description

This system is provided to supply supplementary fuel into the primary main fuel passage when the vehicle is operated in the power mode.

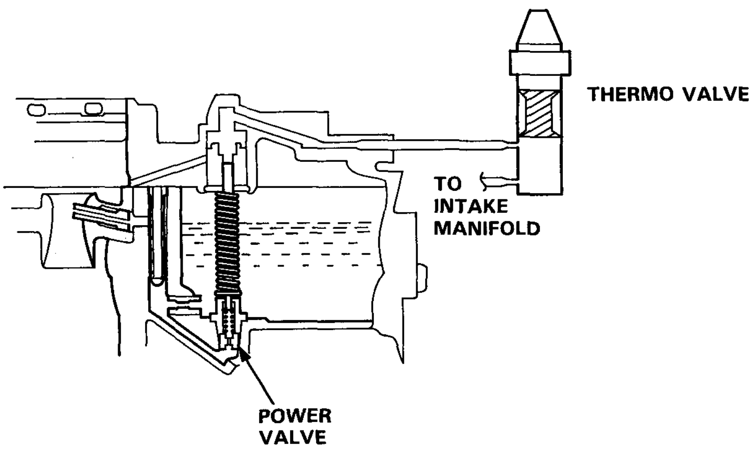
In normal driving modes other than acceleration, manifold vacuum is applied on the diaphragm of the power valve and the valve is closed. When the throttle valve is suddenly opened to accelerate the vehicle, the power valve opens because of the decreased manifold vacuum and supplies additional fuel to the primary main fuel passage through the power jet, providing smooth acceleration performance.

[D13B2 EUROPE & KQ and D15B4 (KQ CARB) Engine]
When the power valve control solenoid valve is activated by the control unit, the power valve is opened because the solenoid valve does not allow vacuum to act on the power valve.

[D13B2 EUROPE & KQ Engine]



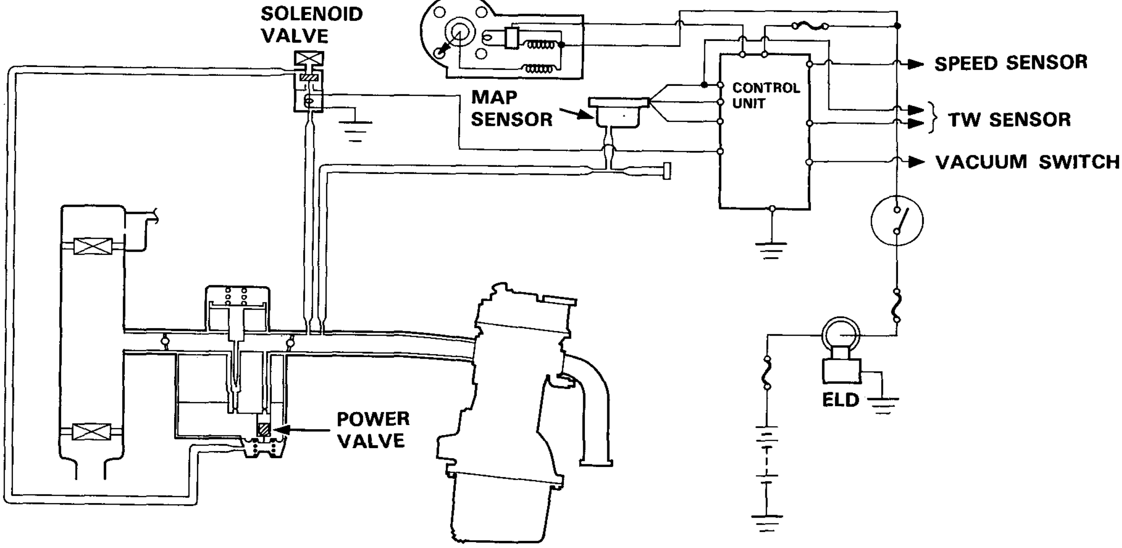
[D12B1, D13B3 EXCEPT EUROPE and D15B3 Engine]

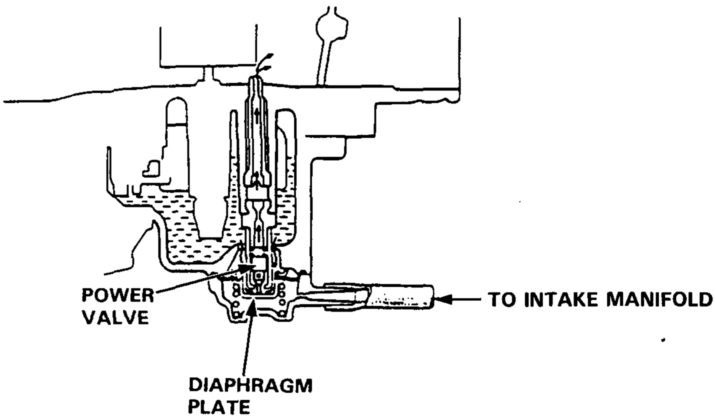


(cont'd)

Power Valve (cont'd)

[D15B4 (KQ CARB) Engine]

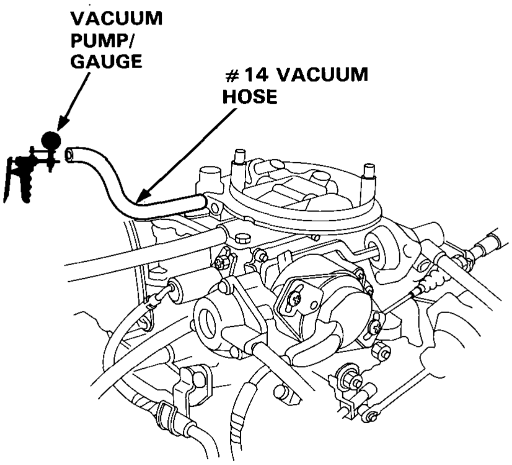




Power Valve [1-Carbureted Engine]

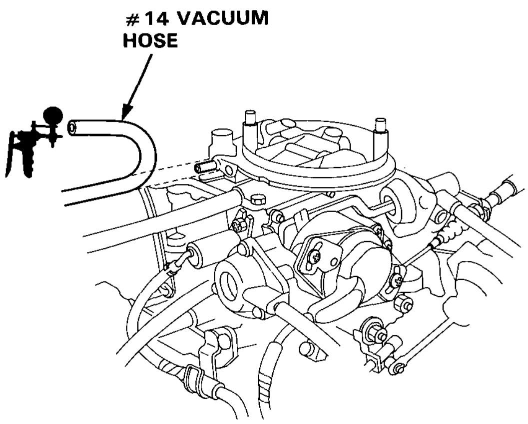
Testing
[D13B2 EUROPE & KQ Engine]

1. Disconnect the #14 vacuum hose from the vacuum hose manifold and connect a vacuum pump. Apply vacuum and listen for a clicking noise from the power valve.



- If a clicking sound is heard, go on to step 2.
- If no sound is heard, replace the power valve and retest.

2. Disconnect the #14 vacuum hose from the carburetor and connect a vacuum gauge to the hose.



3. Start the engine and check the vacuum.
   There should be no vacuum for about 3 seconds after the engine is started. And there should be vacuum within 15 seconds after the engine is started.

   NOTE: The engine coolant temperature must be below 30°C (86°F)

   - If not, check the #14 and #12 vacuum line for proper connection, cracks, blockage or disconnected hose. If OK, go to the power valve control solenoid valve troubleshooting (page 11-94).

4. Warm up to normal operating temperature (the cooling fan comes on).

5. Check the vacuum.
   There should be vacuum.

   - If not, check the #14 and #12 vacuum line for proper connection, cracks, blockage or disconnected hose. If OK, go to the power valve control solenoid valve troubleshooting (page 11-90).

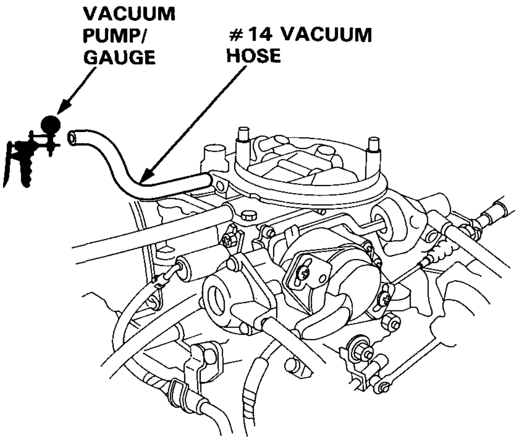
(cont'd)

Power Valve [1-Carbureted Engine] (cont'd)

Testing

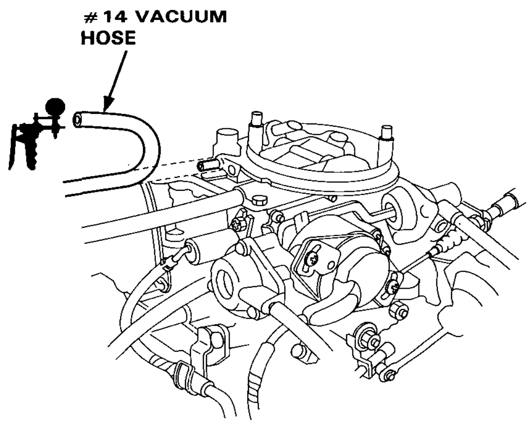
[D12B1, D13B3 EXCEPT EUROPE and D15B3 Engine]

1. Disconnect the #14 vacuum hose from the vacuum hose manifold and connect a vacuum pump. Apply vacuum and listen for a clicking noise from the power valve.



- If a clicking sound is heard, go on to step 2.
- If no sound is heard, replace the power valve and retest.

2. Disconnect the #14 vacuum hose from the carburetor and connect a vacuum gauge to the hose.



3. Start the engine and check the vacuum.

   NOTE: The engine coolant temperature must be below 30°C (86°F)

   There should be no vacuum.

   - If there is vacuum, check the vacuum hose for proper connection. If OK, replace the thermovalve.

4. Warm up to normal operating temperature (the cooling fan comes on).

5. Check the vacuum.

   There should be vacuum.

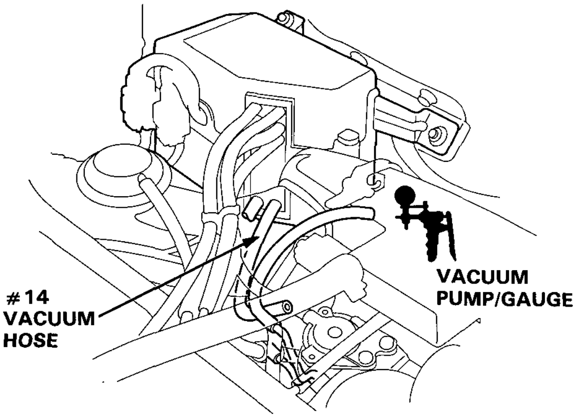
   - If there in no vacuum, check the #14 and #18 vacuum line for proper connection, cracks, blockage or disconnected hose. If OK, replace the thermovalve.

Power Valve [2-Carbureted Engine]

Testing

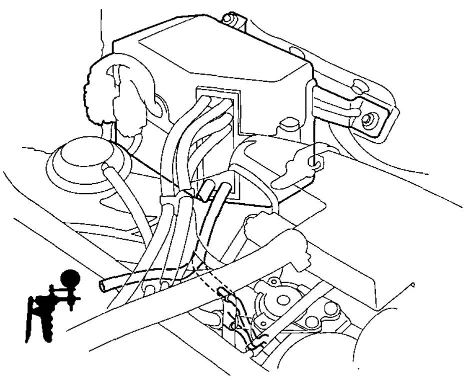
1. Disconnect the #14 vacuum hose from the vacuum hose manifold and connect a vacuum pump. Apply vacuum.

   It should hold vacuum.



   - If it does not hold vacuum, replace the diaphragm and retest (page 11-133).

2. Disconnect the #14 vacuum hose from the vacuum hose manifold, and connect a vacuum pump/gauge to the manifold.



3. Start the engine and check the vacuum.
   There should be no vacuum for about 3 seconds after the engine is started. And there should be vacuum within 15 seconds after the engine is started.

   NOTE: The engine coolant temperature must be below 30°C (86°F).

   - If not, check the #14 and #12 vacuum line for proper connection, cracks, blockage or disconnected hose. If OK, go to the power valve control solenoid valve troubleshooting (page 11-94).

4. Warm up to normal operating temperature (the cooling fan comes on).

5. Check the vacuum.

   There should be vacuum.

   - If not, check the #14 and #12 vacuum line for proper connection, cracks, blockage or disconnected hose. If OK, go to the power valve control solenoid valve troubleshooting (page 11-94).

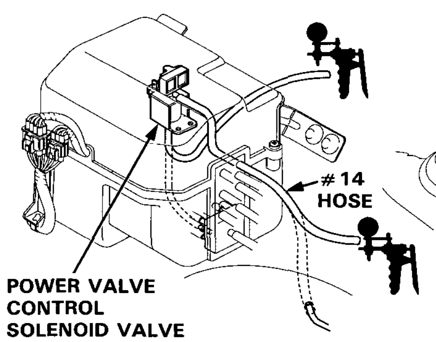
(cont'd)

Power Valve (cont'd)

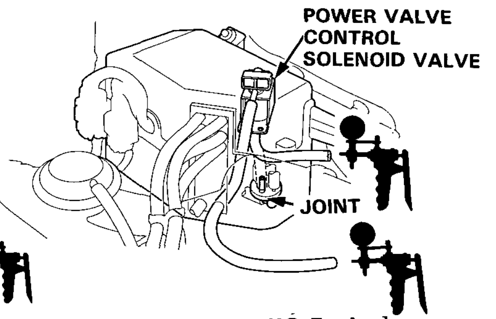
Troubleshooting Flowchart **Power Valve Control Solenoid Valve**

The power valve control solenoid valve is energized when the car is being started or engine coolant temperature is cold.

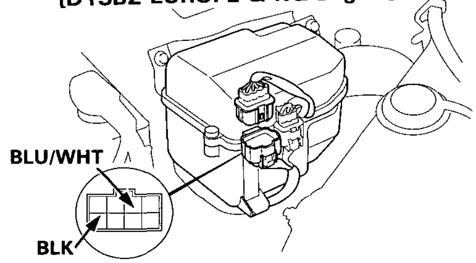
[D13B2 EUROPE & KQ Engine]



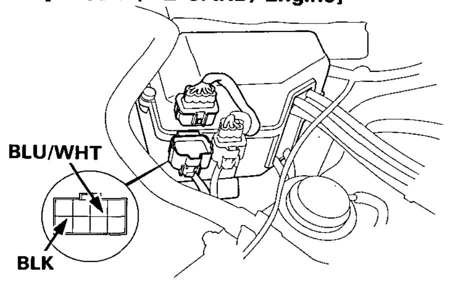
[D15B4 (KQ CARB) Engine]



[D13B2 EUROPE & KQ Engine]



[D15B4 (KQ CARB) Engine]



Inspection of Power Valve Control Solenoid Valve.

- Open the control box.
- Disconnect the lower vacuum hose of the solenoid valve from the joint and connect a vacuum pump.
- Disconnect #14 vacuum hose of the solenoid valve from the vacuum hose manifold and connect a vacuum gauge.
- Start engine.
- Apply vacuum for about 3 seconds after the engine is started.
- Is vacuum indicated on the gauge ?
  - NO → Warm up engine to normal operating temperature (cooling fan comes on). (To page 11-95)
  - YES → Turn the ignition switch OFF.
    - Disconnect the connector on the control box.
    - Measure voltage between BLU/WHT (+) terminal and BLK (−) terminal for about 3 seconds after the engine is started.
    - Is there battery voltage ?
      - YES → **Replace the solenoid valve.**
      - NO → Measure voltage between BLU/WHT (+) terminal and body ground.
        - Is there battery voltage ?
          - YES → **Repair open in BLK wire between the solenoid valve and G201 (RHD: G301).**
          - NO → **Check the self-diagnosis indicator (page 11-21). If OK, inspect open in BLU/WHT wire between the solenoid valve and control unit (B13).**

(From page 11-94)

Is vacuum indicated on the gauge ?

YES → **Power Valve Control Solenoid Vale is OK.**

NO → Turn the ignition switch OFF.

Disconnect the connector on the control box.

Start the engine.

Measure voltage between BLU/WHT (+) terminal and BLK (−) terminal.

Is there voltage ?

YES → **Check the self-diagnosis indicator (page 11-21). If OK, substitute a known-good control unit and retest. If symptom goes away, replace the original control unit.**

NO → **Replace the solenoid valve.**

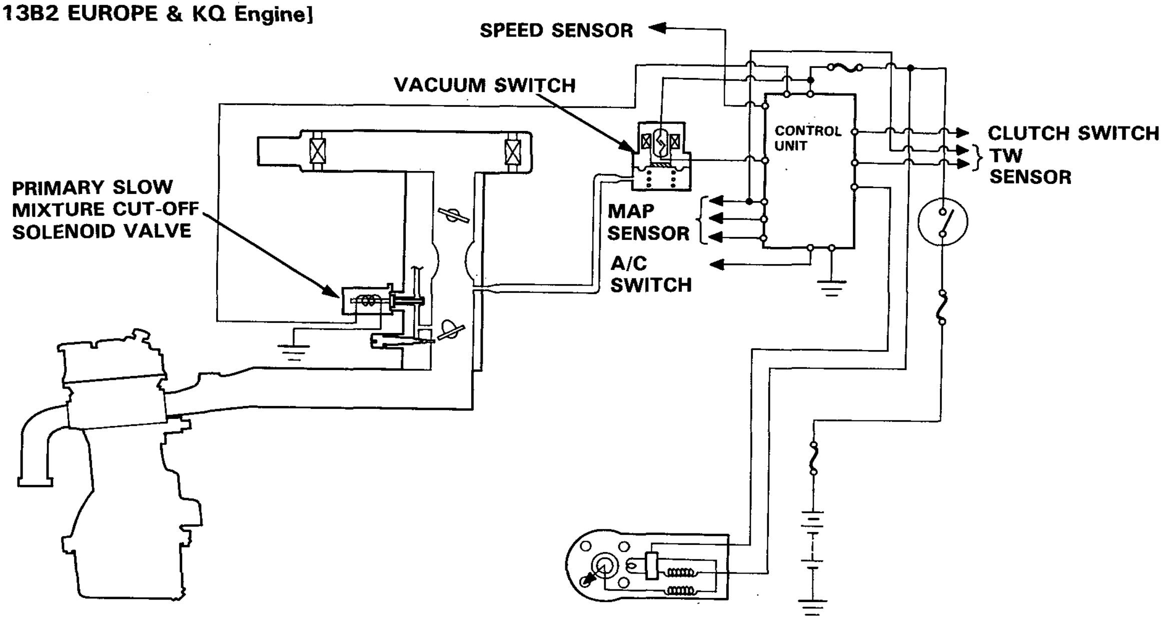
Primary Slow Mixture Cut-off Solenoid Valve

Description

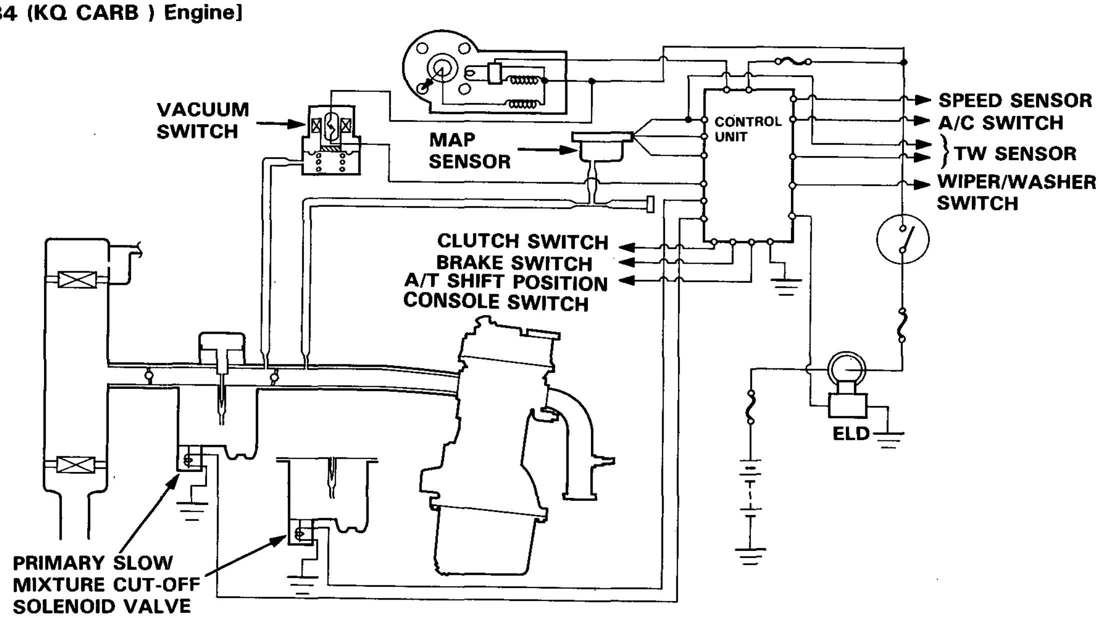
This system is designed for fuel economy and to prevent the catalytic converter from over-heating caused by unburned fuel when decelerating the vehicle.

The primary slow mixture cut-off solenoid valve is provided to cut-off the idle mixture passage upstream of the bypass port to prevent the engine from running on after the ignition switch is turned off.
This solenoid valve also functions to stop the mixture flow from the slow fuel system during vehicle deceleration in order to save the fuel consumption. When the vehicle is decelerating, the control unit identifies the condition and deactivates the solenoid valve to close the mixture passage.

[D13B2 EUROPE & KQ Engine]



[D15B4 (KQ CARB) Engine]



Primary Slow Mixture Cut-off Solenoid Valve [1-Carbureted Engine]

Troubleshooting Flowchart **Primary slow Mixture Cut-off Solenoid Valve**

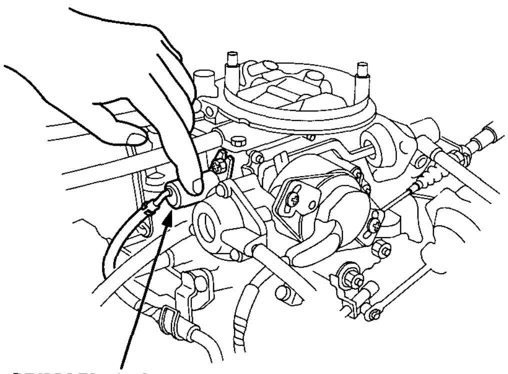
The primary slow mixture cut-off solenoid valve is provided to cut-off the idle mixture passage between the fuel/air passage and bypass port for preventing run-on when the ignition switch is turned off.
The solenoid valve also functions to cut-off the mixture flow under deceleration.

[D13B2 EUROPE & KQ Engine]

Inspection of Primary Slow Mixture Cut-off Solenoid Valve.

Turn the ignition switch ON.

Check the clicking sound of solenoid valve.



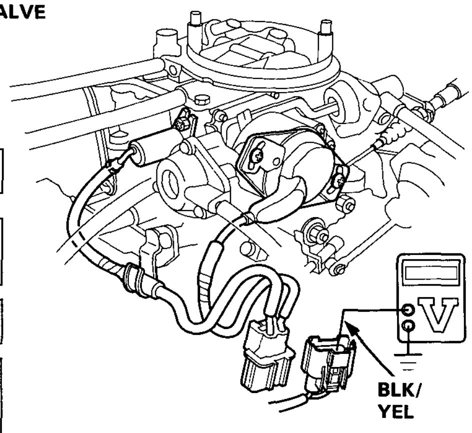
Does the solenoid valve click ?

NO → Turn the ignition switch OFF.

Disconnect the 2P connector.

Turn the ignition switch ON.

Measure voltage between BLK/YEL (+) terminal and body ground.



Is there battery voltage ?

YES → **Replace the solenoid valve.**

NO →

- **Repair open in BLK/YEL, GRN/YEL wire between the solenoid valve and control unit (B7).**
- **Check the self-diagnosis indicator (page 11-21). If OK, check the input troubleshooting (page 11-26).**

YES (Does the solenoid valve click ?) →

Start the engine and warm up to normal operating temperature (the cooling fan comes on).

(To page 11-98)

(cont'd)

Primary Slow Mixture Cut-off Solenoid Valve [1-Carbureted Engine] (cont'd)

(From page 11-97)

Raise engine speed to 5,000 min^{-1} (rpm) and close the throttle suddenly.

Does the solenoid valve click ?

- YES → **Primary Slow Mixture Cut-off Solenoid Valve is OK.**
- NO → Turn the ignition switch OFF.

Disconnect the 2P connector.

Start the engine.

Raise engine speed to 5,000 min^{-1} (rpm) and close the throttle suddenly.

Measure voltage between BLK/YEL (+) terminal and body ground.

Is there no voltage for a moment ?

- YES → **Replace the solenoid valve.**
- NO → **Check the self-diagnosis indicator (page 11-21). If OK, check the input troubleshooting (page 11-26).**

Troubleshooting Flowchart — Primary Slow Mixture Cut-off Solenoid Valve

[D12B1, D13B3 EXCEPT EUROPE and D15B3 Engine]

Inspection of Primary Slow Mixture Cut-off Solenoid Valve.

↓

Turn the ignition switch ON.

↓

Check the clicking sound of solenoid valve.

↓

Does the solenoid valve click ?

- YES → **Primary Slow Mixture Cut-off Solenoid Valve is OK.**
- NO → Turn the ignition switch OFF.

  ↓

  Disconnect the 2P connector.

  ↓

  Turn the ignition switch ON.

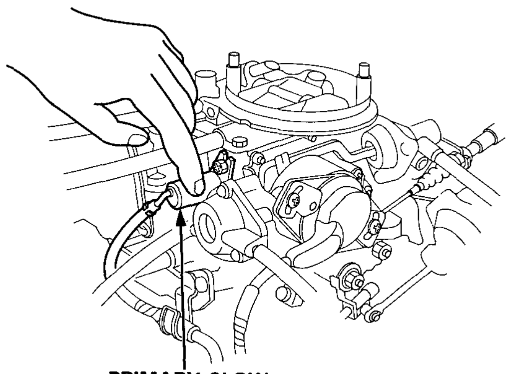
  ↓

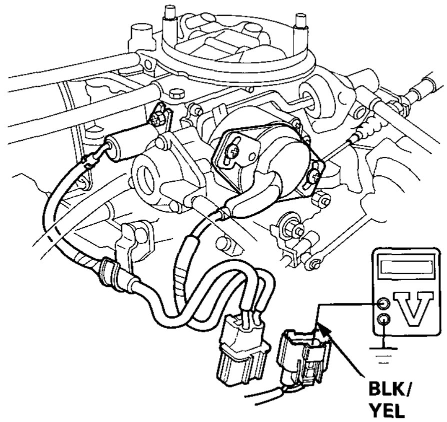
  Measure voltage between BLK/YEL (+) terminal and body ground.

  ↓

  Is there battery voltage ?

  - YES → **Replace the solenoid valve.**
  - NO → **Repair open or short in BLK/YEL wire between the 2P connector and the ignition switch as well as ACG(S) fuse.**





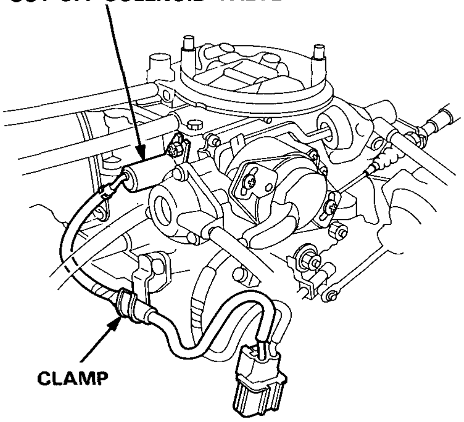
(cont'd)

Primary Slow Mixture Cut-off Solenoid Valve [1-Carbureted Engine] (cont'd)

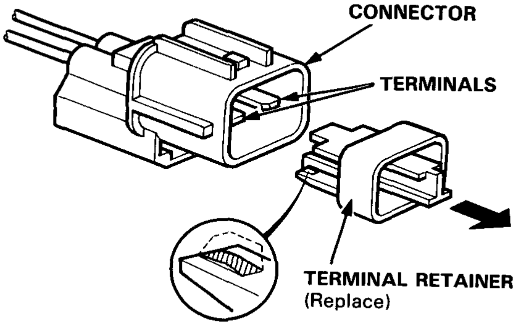
Replacement

1. Remove the 2P connector, and open the harness clamp on the idle controller bracket. Disconnect the solenoid valve harness from the clamp.

   CAUTION: Take care not to apply excessive force on the clamp at it is broken easily.

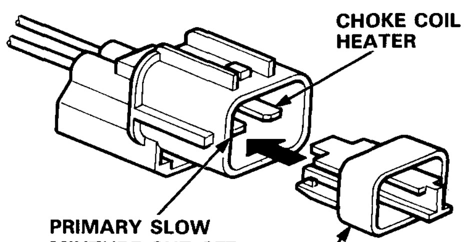


2. Disconnect the terminal retainer from the connector and remove the two terminals.

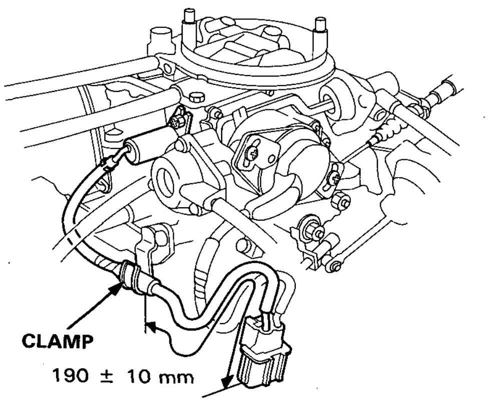


3. Replace the solenoid valve.

4. Connect the respective terminals to a new connector and install a new terminal retainer.
   NOTE:
   - Be sure to connect the terminal before installing the terminal retainer.
   - Replace the connector and terminal retainer with the new ones.
   - Note the location of the terminal.



5. Secure the harness with the clamp as shown in the drawing.

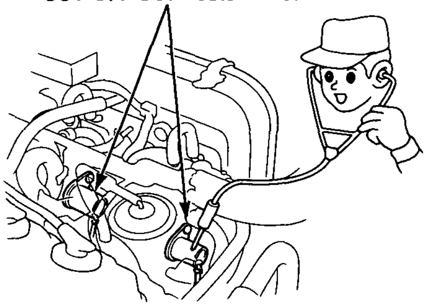


Primary Slow Mixture Cut-off Solenoid Valve [2-Carbureted Engine]

Troubleshooting Flow Chart **Primary Slow Mixture Cut-off Solenoid Valve**

The primary slow mixture cut-off solenoid valve is provided to cut-off the idle mixture passage between the fuel/air passage and bypass port for preventing run- on when the ignition switch is turned off.
The solenoid valve also functions to cut-off the mixture flow under deceleration.

PRIMARY SLOW MIXTURE CUT-OFF SOLENOID VALVE



Inspection of Primary Slow Mixture Cut-off Solenoid Valve

Turn the ignition switch ON.

Check the clicking sound of each solenoid valve by means of a stethoscope.

Does the solenoid valve click ?

YES

Start the engine and warm up to normal operating temperature (the cooling fan comes on).

(To page 11-102)

NO

Turn the ignition switch OFF.

Connect the test harness B between the control unit and connector (page 11-22).

Turn the ignition switch ON.

Right solenoid valve: Measure voltage between B7 (+) terminal and B2 (−) terminal.
Left solenoid vavle: Measure voltage between B8 (+) terminal and B2 (−) terminal.

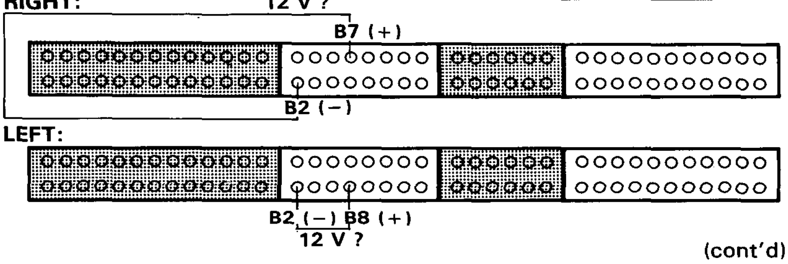
Is there battery voltage ?

YES

Right solenoid valve: Repair open or short in YEL, GRN/YEL wire between the solenoid valve and control unit (B7). If OK, replace the solenoid valve.
***Left solenoid valve:* Repair open or short in GRN/RED RED/GRN, wire between the solenoid valve and control unit (B8). If OK, inspect open in BLK wire between the solenoid valve and G101, and replace the solenoid valve.**

NO

Check the self-diagnosis indicator (page 11-21). If OK, check the input troubleshooting (page 11-28).



(cont'd)

Primary Slow Mixture Cut-off Solenoid Valve [2-Carbureted Engine] (cont'd)

(From page 11-101)

Raise engine speed to 5,000 min^{-1} (rpm) and close the throttle suddenly.

Does the solenoid valve click ?

YES → **Primary Slow Mixture Cut-off Solenoid Valve is OK.**

NO → Turn the ignition switch OFF.

Connect the test harness B between the control unit and connector (page 11-22).

Start the engine.

Raise engine speed to 5,000 min^{-1} (rpm) and close the throttle suddenly.

Right solenoid valve: Measure voltage between B7 (+) terminal and B2 (−) terminal.
Left solenoid valve: Measure voltage between B8 (+) terminal and B2 (−) terminal.

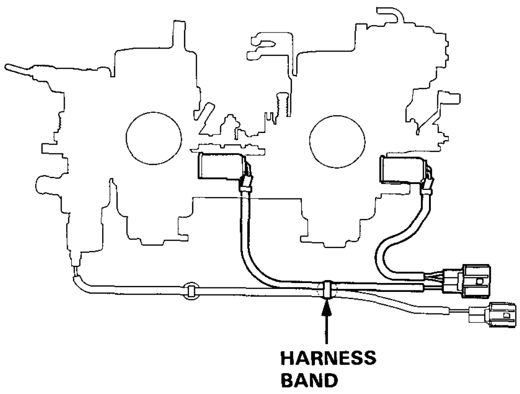
Is there no voltage for a moment ?

NO → **Check the self-diagnosis indicator (page 11-21). If OK, check the input troubleshooting (page 11-28).**

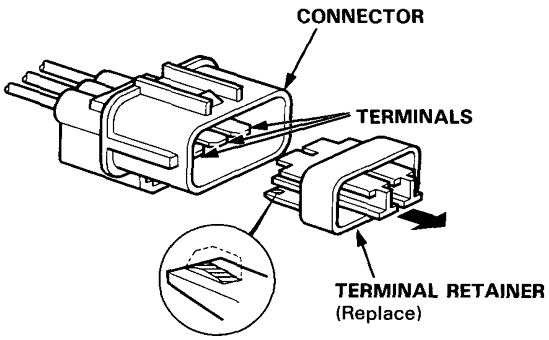
YES → **Replace the solenoid valve.**

Replacement

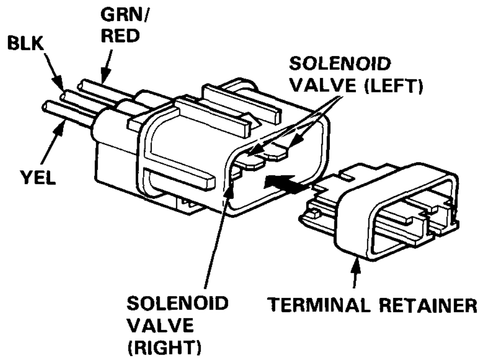
1. Remove the 3P connector and cut the harness band.



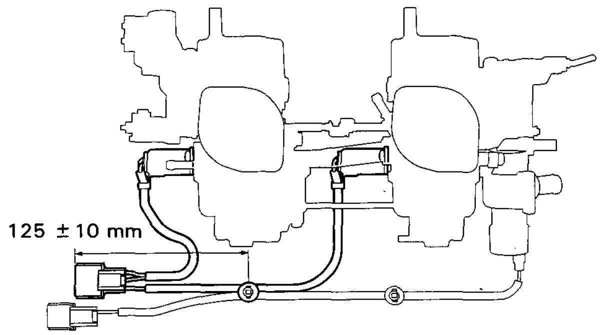
2. Remove the carburetor (page 11-137).
3. Disconnect the terminal retainer from the connector and remove the terminals.



4. Replace the solenoid valve.
5. Connect the respective terminals to a new connector and install a new terminal retainer.
   NOTE:
   - Be sure to connect the terminal before installing the terminal retainer.
   - Replace the connector and terminal retainer with the new ones.
   - Note the location of the terminal.



6. Secure the harness with the calmp as shown in the drawing and use the harness band to hold the two harnesses together.



Idle Speed/Mixture

[D13B2 Engine (KS)]

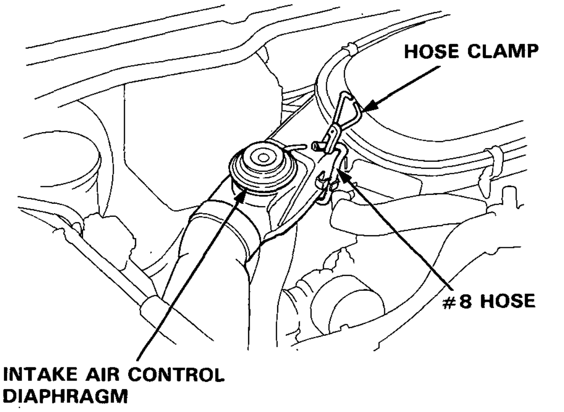
Inspection/Adjustment

Propane Enrichment Method

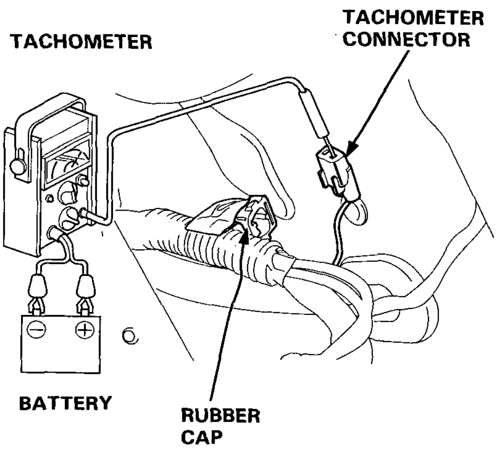
⚠WARNING Do not smoke during this procedure. Keep any open flame away from your work area.

NOTE:
- This procedure requires a propane enrichment kit.
- Check that the self diagnosis indicator before making idle speed and mixture inspections.

1. Start the engine and warm up to normal operating temperature (the cooling fan comes twice).
2. Disconnect the #8 vacuum hose from the intake air control diaphragm and clamp the hose end.

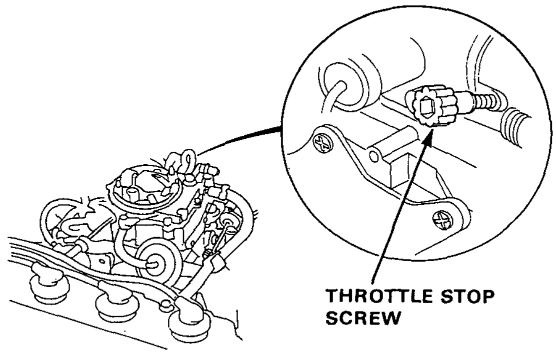


3. Connect a tachometer.



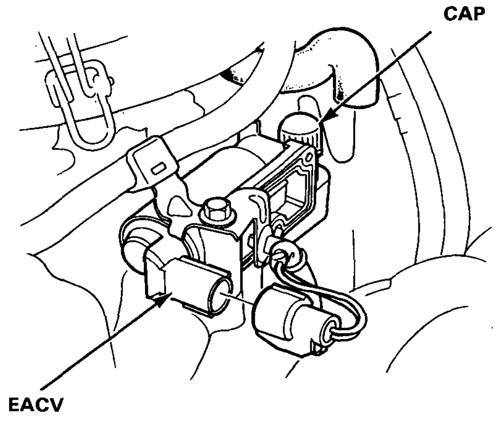
4. Turn the ignition switch OFF. Restart the engine and hold engine at idle for 2 minutes. And hold engine at 3,000—3,500 min^{-1} (rpm) for 1 minute.
   Check idle speed with the headlights, heater blower, rear window defogger, cooling fan and air conditioner off.

   Idle speed should be: 800 ±50 min^{-1} (rpm)

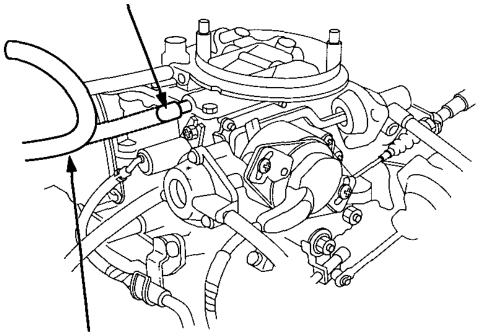


   Adjust the idle speed, if necessary, by turning the throttle stop screw.
   NOTE: If the idle speed is excessively high, check the throttle control system (page 11-163).

5. Disconnect the 2P connector from the EACV and disconnect the hose from the EACV, then cap the EACV.



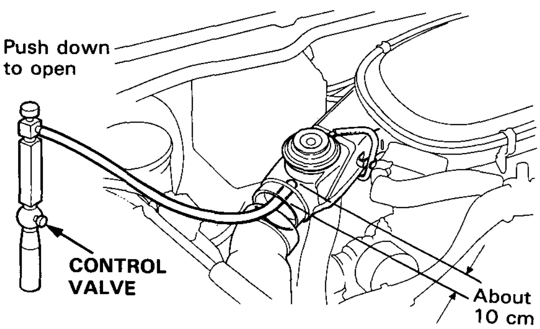
6. Disconnect the #2 vacuum hose from the carburetor, then cap the carburetor.



7. Disconnect air cleaner intake tube from air intake duct.

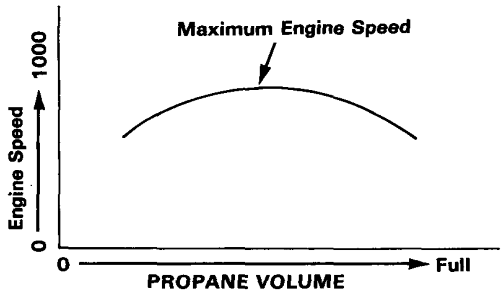
8. Insert the hose of the propane enrichment kit into the intake tube about 10 cm.

   NOTE: Check that propane bottle has adequate gas before beginning test.



9. With engine idling, depress push button on top of propane device, then slowly open the propane control valve to obtain maximum engine speed. Engine speed should increase as percentage of propane injected goes up.

   NOTE: Open the propane control valve slowly; a sudden burst of propane may stall the engine.

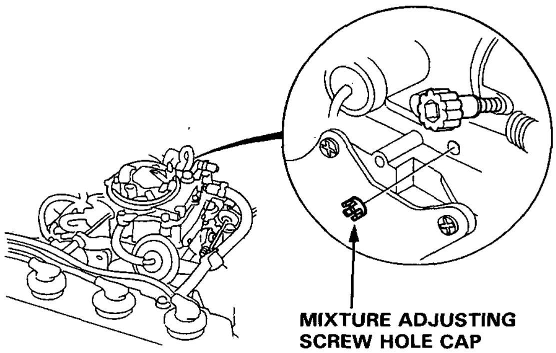


Engine speed increase should be: 20 ± 10 min^{-1} (rpm)

- If engine speed does not increase per specification, mixture is improperly adjusted. Go to step 10.
- If engine speed increases per specification, go to step 14.

10. Remove the air cleaner and close the propane control valve.

11. Remove the mixture adjusting screw hole cap.



(cont'd)

Idle Speed/Mixture (cont'd)

12. Start engine and warm up to normal operating temperature; the cooling fan will come on.

13. Reinstall the propane enrichment kit and recheck maximum propane enriched engine speed.

    - If the propane enriched speed is too low, mixture is too rich: turn the mixture screw 1/4-turn clockwise and recheck.
    - If the propane enriched speed is too high, mixture is to lean: turn the mixture screw 1/4-turn counterclockwise and recheck.

14. Close the propane control valve speed and remove the BACK UP fuse for 10 seconds to reset control unit. Recheck idle speed.

    Idle speed should be: 800 ±50 min^{-1} (rpm)

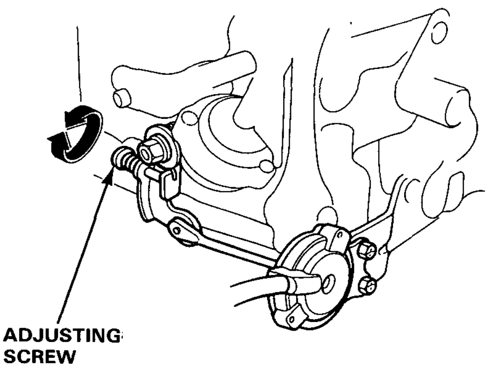
    - If idle speed is as specified (step 4), go to step 15.
    - If idle speed is not as specified, adjust by turning throttle stop screw, then repeat steps 13 and 14.

15. Remove propane enrichment kit and reconnect air cleaner intake tube on the air intake duct.

16. Reinstall the mixture adjusting screw hole cap.

17. If equipped with air conditioner, check the idle speed with the A/C on.

    Idle speed should be: 800 ±50 min^{-1} (rpm)



Adjust the idle speed, if necessary, by turning the adjusting screw.

[D12B1, D13B3 EXCEPT EUROPE, D13B2 EUROPE & KQ (Except KS) and D15B3 Engine]

CO Meter Method

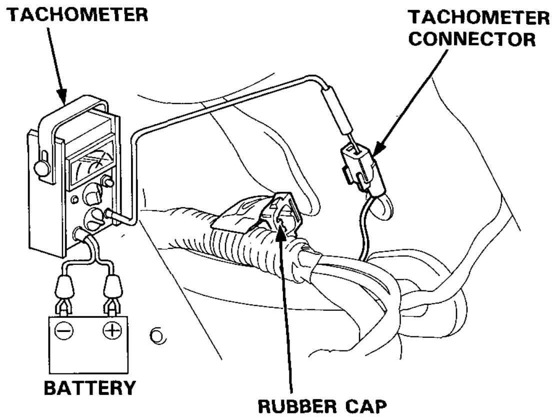
WARNING Do not smoke during this procedure. Keep any open flame away from your work area.

NOTE: Check that the self-diagnosis indicator before making idle speed and mixture inspections [D13B2 EUROPE & KQ (Except KS) Engine].

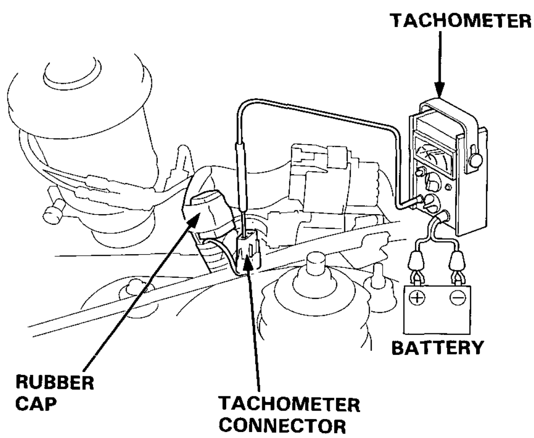
1. Start the engine and warm it up to normal operating temperature (the cooling fan comes twice).

2. Connect a tachometer.

[LHD]



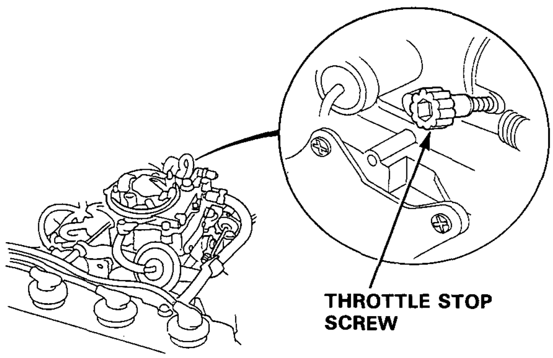
[RHD]



3. Turn the ignition switch OFF. Restart the engine and hold engine at idle for 2 minutes. And hold engine at 3,000—3,500 min^{-1} (rpm) for 1 minute.
Check idle speed with the headlights, heater blower, rear window defogger, cooling fan and air conditioner off.

Idle speed should be:

Manual	800 ±50 min^{-1} (rpm)
Automatic	1,000 ±50 min^{-1} (rpm) (N or P)



Adjust the idle speed, if necessary, by turning the throttle stop screw.
NOTE: If the idle speed is excessively high, check the throttle control system (page 11-163).

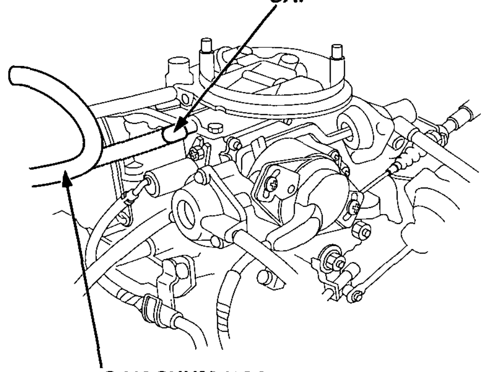
4. Calibrate the NDIR CO Meter in accordance with the manufacturer's recommended procedures.
Insert exhaust gas sampling probe into the tailpipe at least 40 cm.

5. Turn the ignition switch OFF. Restart the engine and hold engine at idle for 2 minutes. And hold engine at 3,000—3,500 min^{-1} (rpm) for 1 minute.
Check specification for idle CO with cooling fan, air conditioner OFF and headlights OFF.

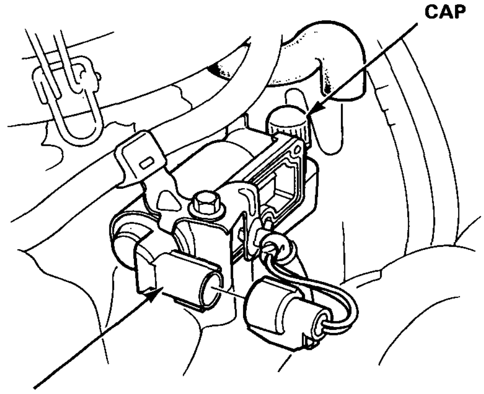
Specified CO%: below 0,2%

- If idle CO is as specified, go to step 13.
- If not, go to step 6 through 12.

6. [D13B2 EUROPE & KQ (Except KS) Engine]
Disconnect the #2 vacuum hose from the carburetor, then cap the carburetor.



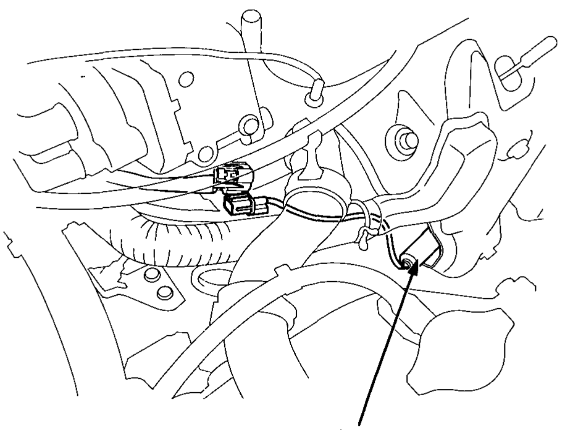
7. [D13B2 EUROPE & KQ (Except KS) Engine]
Disconnect the 2P connector from the EACV and disconnect the hose from the EACV, then cap the EACV.



(cont'd)

Idle Speed/Mixture (cont'd)

8. **[D13B2 EUROPE & KQ (Except KS) Engine]**
Disconnect the wire harness from the O^2 sensor.



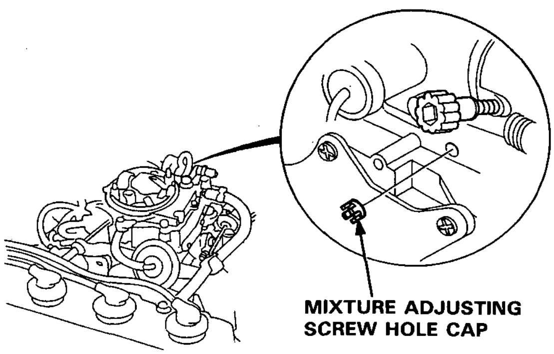
9. **[D13B2 EUROPE & KQ (Except KS) Engine]**
Turn the ignition switch OFF. Restart the engine and hold engine at idle for 2 minutes. and hold engine at 3,000—3,500 min^{-1} (rpm) for 1 minute.
Check specification for idle CO.

Specified CO%: 2.5 ± 0.5%

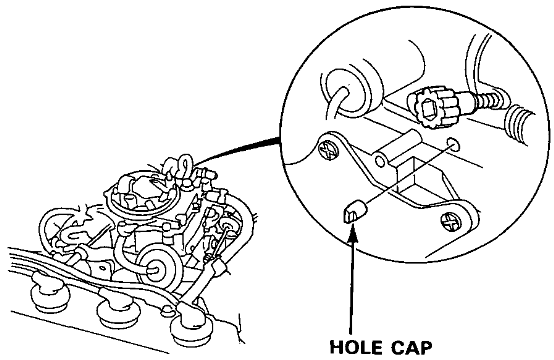
- If not, specification, go to step 10.

10. Remove mixture adjusting screw hole plug and adjust by turning mixture adjusting screw to obtain proper CO reading.

[D13B2 EUROPE & KQ (Except KS) Engine]



[D12B1, D13B3 EXCEPT EUROPE and D15B3 Engine]



— Turning mixture adjusting screw

clockwise: CO reading decreases
counterclockwise: CO reading increases

Readjust idle speed if necessary, and recheck idle CO.

11. **[D13B2 EUROPE & KQ (Except KS) Engine]**
Reconnect the connector and hose.
Remove BACK UP fuse for 10 seconds to reset control unti.

12. **[D13B2 EUROPE & KQ (Except KS) Engine]**
Turn the ignition switch OFF. Restart the engine and hold engine at idle for 2 minutes. And hold engine at 3,000—3,500 min^{-1} (rpm) for 1 minute.
Recheck idle CO.

Specified CO%: 0.2%

- If idle CO is as specified, go to step 13.
- If not, check the self-diagnosis indicator (page 11-21). If not, inspect the EACV (page 11-159) and the catalytic converter (page 11-156), then repeat step 6.

13. Recheck idle speed.

Idle speed should be:

Manula	800 ±50 min^{-1} (rpm)
Automatic	1,000 ±50 min^{-1} (rpm) ($\boxed{N}$ or $\boxed{P}$)

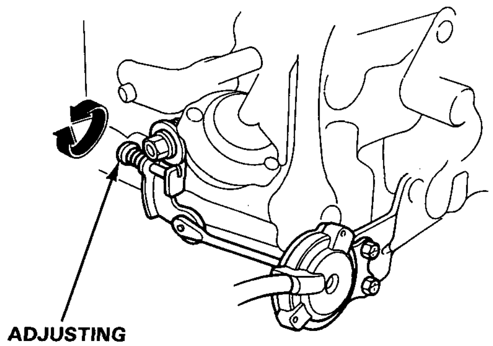
- If idle speed is as specified, go to step 14.
- If idle speed is not as specified, adjust by turning throttle stop screw, then repeat step 4.

14. Reinstall the mixture adjusting screw hoel cap.

15. If equipped with air conditioner, check the idle speed with the A/C on.

Idle speed should be:

Manual	800 ±50 min^{-1} (rpm)
Automatic	1,000 ±50 min^{-1} (rpm) (N or P)



Adjust the idle speed, if necessary, by turning the adjusting screw

[D15B4 (KQ CARB) Engine]

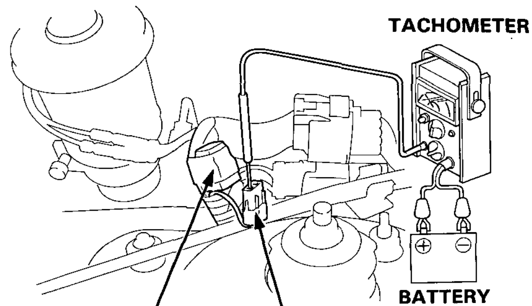
CO Meter Method

⚠WARNING Do not smoke during this procedure. Keep any open flame away from your work area.

NOTE: Check that the self-diagnosis indicator before making idle speed and mixture inspections

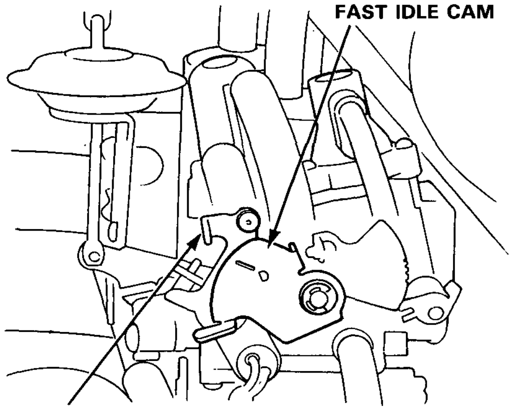
1. Start the engine and warm it up to normal operating temperature (the cooling fan comes twice).

2. Connect a tachometer.



3. Check the fast idle lever.

   Fast idle lever should not be seated against fast idle cam.



- If not, replace the left carburetor (page 11-137)

(cont'd)

Idle Speed/Mixture (cont'd)

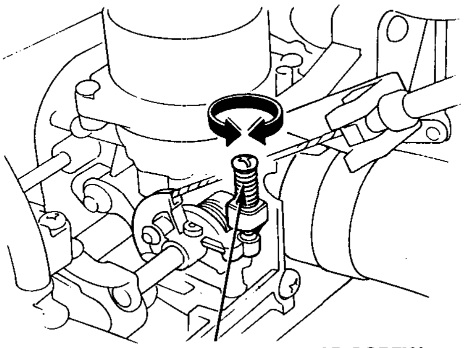
4. Check idle speed with the headlights, heater blower, rear window defogger, cooling fan and air conditioner off.

Idle speed should be:

Manual	650 ±50 min^{-1} (rpm)
Automatic	720 ±50 min^{-1} (rpm) ($\boxed{N}$ or $\boxed{P}$)

Adjust the idle speed, if necessary, by turning the throttle stop screw.

NOTE: If the idle speed is excessively high, check the throttle control (page 11-159).



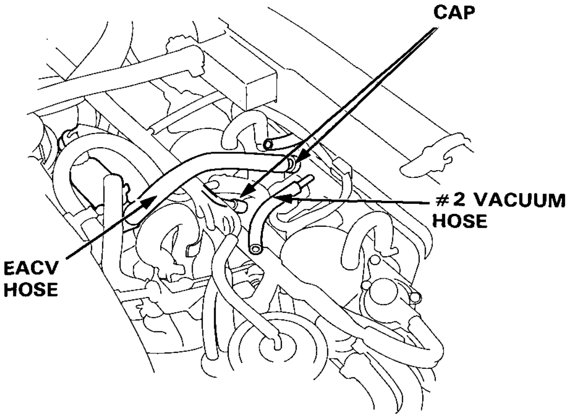
5. Calibrate the NDIR CO Meter in accordance with the manufacturer's recommended procedures.
Insert exhaust gas sampling probe into the tailpipe at least 40 cm.

6. Turn the ignition switch OFF. Restart the engine and hold engine at idle for 2 minutes. And hold engine at 3,000–3,500 min^{-1} (rpm) for 1 minute.
Check specification for idle CO with cooling fan, air conditioner OFF and headlights OFF.

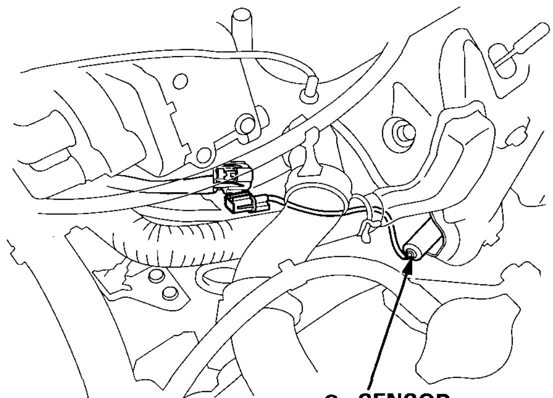
Specified CO%: 0.5%

- If idle CO is as specified, go to step 15.
- If not, go to step 7 through 13.

7. Disconnect the 2P connector from the EACV and disconnect the hose from vacuum hose manifold, then cap the hose end.
Disconnect #2 vacuum hose from vacuum hose manifold, then cap the hose end.



8. Disconnect the wire harness from the O_2 sensor.

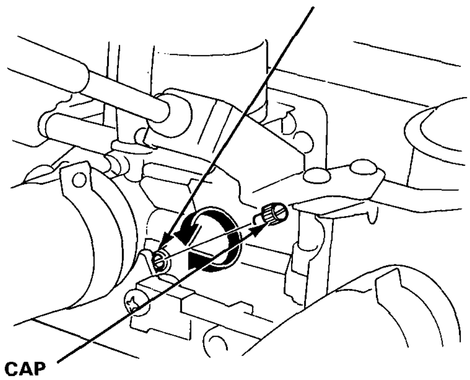


10. Turn the ignition switch OFF. Restart the engine and hold engine at idle for 2 minutes. And hold engine at 3,000–3,500 min^{-1} (rpm) for 1 minute. minute.
Check specification for idle CO.

Specified CO%: 2.5±0.5%

- If not, specification, go to step 11.

11. If not within specification, remove mixture adjusting screw hole caps and adjust by turning mixture adjusting screws to obtain proper CO reading.



Turning mixture adjusting screw
clockwise: CO reading decreases
counterclockwise: CO reading increases

- Readjust idle speed if necessary, and recheck idle CO.

12. Turn the ignition switch OFF. Reconnect the connector and hose.

13. Remove BACK UP fuse for 10 seconds to reset control unit and recheck idle speed.

Idle speed should be:

Manual	650 ±50 min^{-1} (rpm)
Automatic	720 ±50 min^{-1} (rpm) (N or P)

Specified CO%: 0.5%

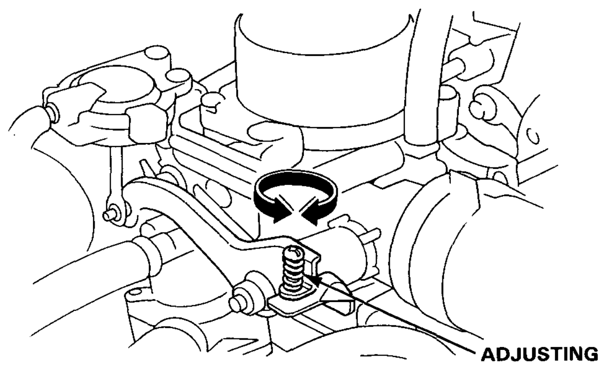
- If idle speed is not as specified, adjust by turning throttle stop screw, then repeat step 5.

14. Reinstall the mixture adjusting screw hole caps.

15. Check the idle speed with the headlights and blower switch ON.

Idle speed should be:

Manula	700 ±50 min^{-1} (rpm)
Automatic	850 ±50 min^{-1} (rpm) (N or P)

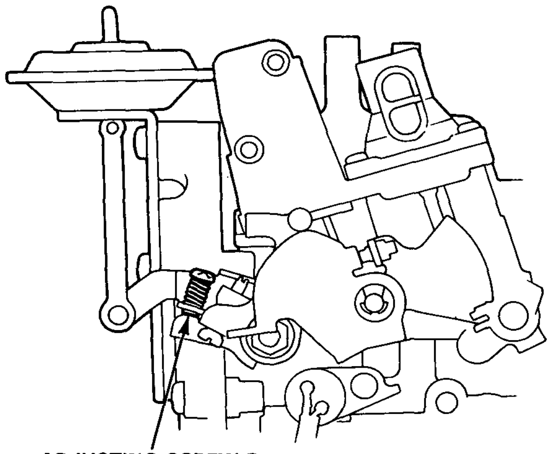


Adjust the idle speed, if necessary, by turning the adjusting screw A.

16. If equipped with air conditioner, check the idle speed with the A/C on.

Idle speed should be:

Manual	780 ±50 min^{-1} (rpm)
Automatic	1,000 ±50 min^{-1} (rpm) (N or P)



Adjusting the idle speed, if necessary, by turning the adjusting screw B.

Accelerator Pump [1-Carbureted Engine]

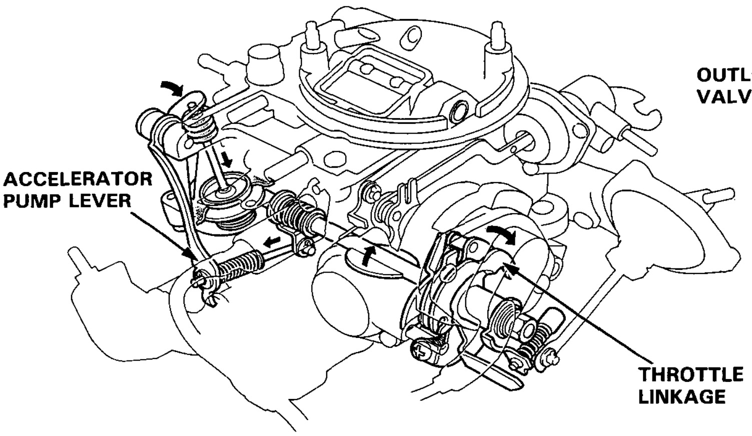
Description

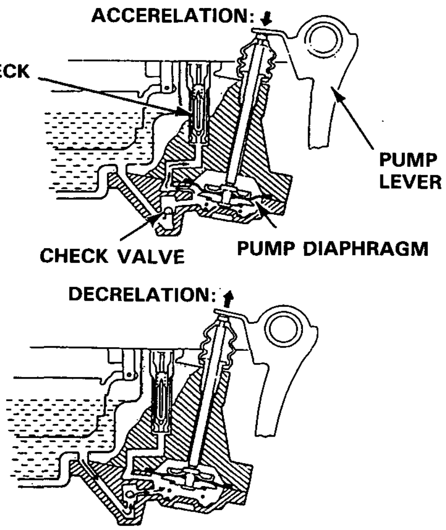
The fuel flow from the accelerator pump is further regulated by the temperature-sensitive bypass valve in the carburetor. is depressed suddenly at low engine speeds.

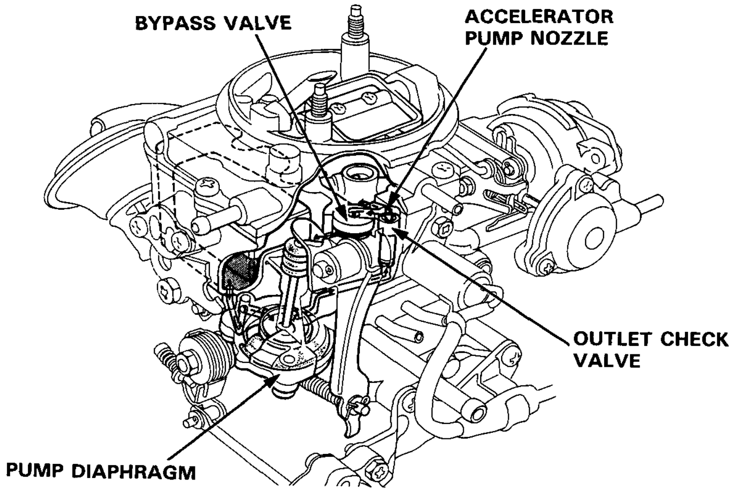
When the accelerator pedal is depressed, the pump rod, which is connected to the throttle lever, pushes down on the accelerator pump diaphragm. This opens the outlet check valve and allows fuel to be pumped up to the accelerator pump nozzle, where it is sprayed into the carburetor's primary throat.

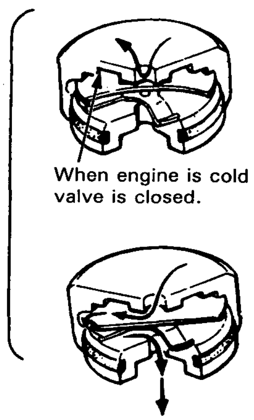
When the accelerator pedal is released, the accelerator pump diaphragm is pushed up by its spring and this closes the outlet check valve. Fuel, from the float chamber, flows into the accelerator pump chamber through the inlet check valve so that the pump will be ready when the accelerator pedal is again depressed suddenly.

The fuel flow from the accelerator pump is further regulated by the temperature-sensitive bypass valve in the carburetor. When the engine is cold, the bypass portion of the valve is closed so that the accelerator pump nozzle will get the maximum of fuel available. When the engine warms up to its normal operating temperature, the bypass valve opens and this allows some of the fuel, which would ordinarily be routed to the nozzle, to be bled back into the float chamber of the carburetor.







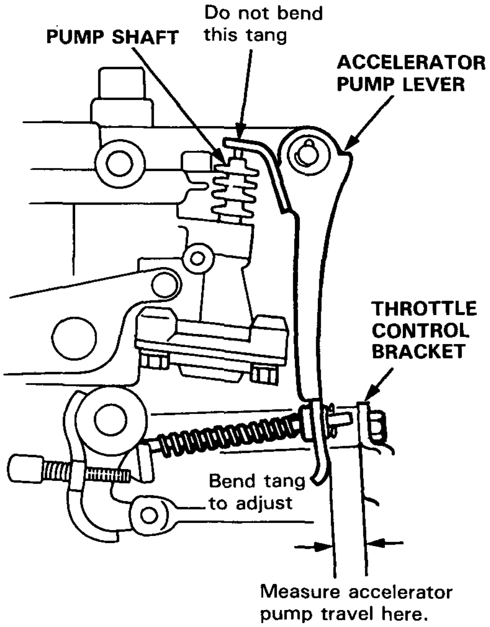


When engine is cold valve is closed.

When engine is hot, valve is open.

Inspection

1. Before measuring the accelerator pump linkage travel, make sure the pump shaft travels freely throughout the pump stroke. Make sure the pump lever is in contact with the pump shaft.



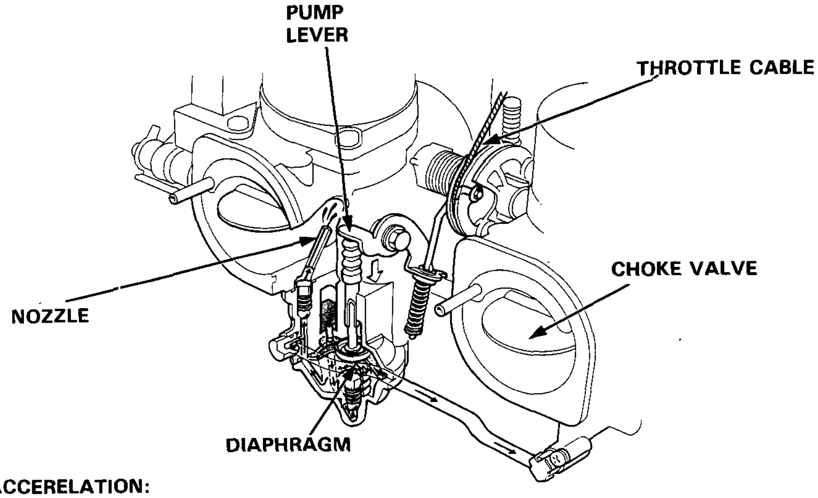
2. To check linkage travel, measure gap between bottom end of pump lever (tang) and stop as shown.
Limits: 16.5 ± 16.9 mm (0.65—0.67 in.)

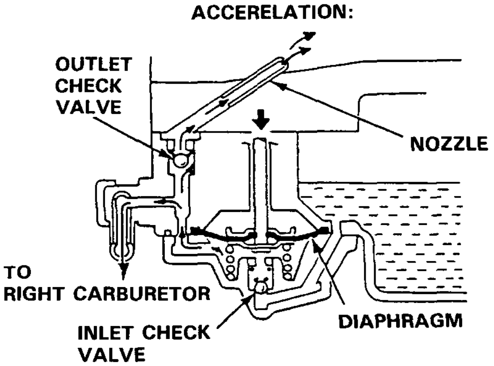
Carburetor

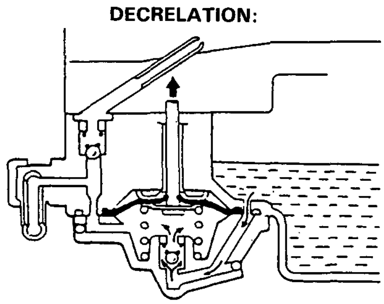
Accelerator Pump [2-Carbureted Engine]

Description

To prevent the temperary delay of the air/fuel mixture flow at acceleration, the accelerator pump is provided to supply additional fuel to the left/right-side carburetor.







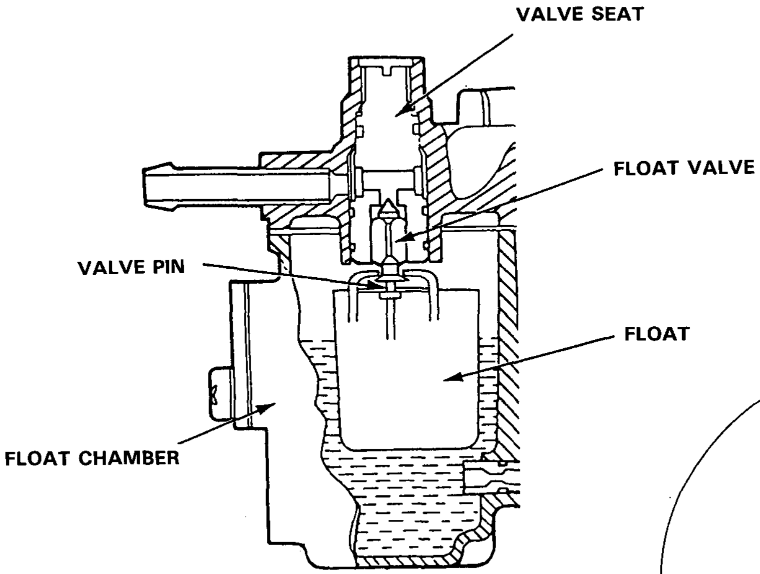
When the acceleration pedal is down, the accelerator pump diaphragm gets down through the pump lever connected with the throttle lever. At this time, since the inlet check valve is closed, the diaphragm chamber is pressurized and pushes up the outlet check valve, so that fuel is injected from the acceleration nozzle. The fuel pressurized in the diaphragm chamber also flows into the right-side carburetor and is injected from the acceleration nozzle as in the left-side carburetor. When the accelerator pedal is up, the acceleration pump diaphragm returns by the working of the spring, and the inlet check valve opens, so that the fuel in the float chamber flows into the diaphragm. At this time, since the outlet check valve is closed, the air intake from the nozzle side does not occur.

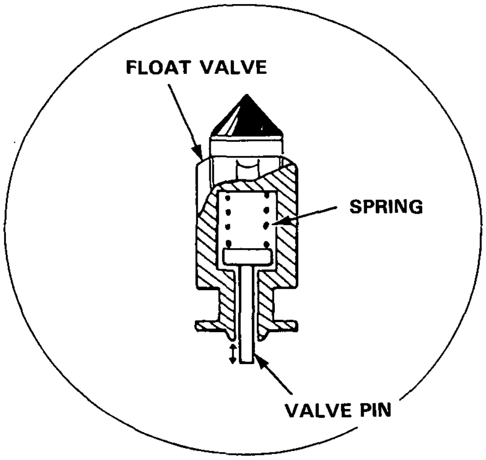
Float Level [1-Carbureted Engine]

Description

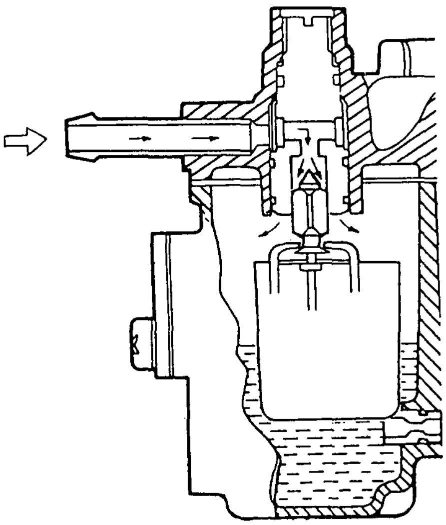
The float system consist of float, float chamber, float valve and valve seat. When the fuel level in the float chamber drops as fuel is consumed, the float and float valve move downward and fuel is pumped into the float chamber. When the fuel level in the float chamber rises, the float moves upward until the float valve reaches the valve seat, and fuel pump stops. The float system repeats this movement at drive so that constant fuel level is maintained in the carburetor at every time.
In addition, a valve pin is attached to the float valve so that the movement of the float is absorbed at car tilting or vibration and constant fuel level is maintained at every time.

FLOAT VALVE CLOSED





FLOAT VALVE OPEN



(cont'd)

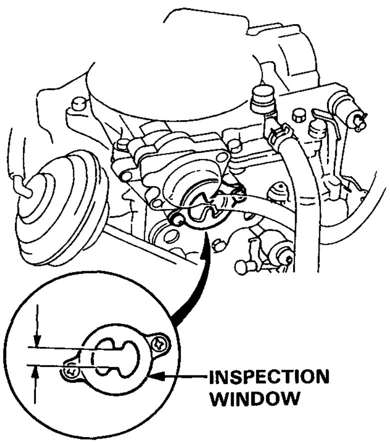
Float Level [1-Carbureted Engine]

Adjustment

[D13B2 EUROPE & KQ Engine]

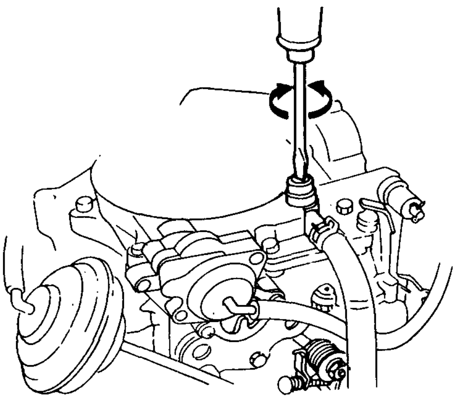
⚠WARNING Do not smoke while working on fuel system. Keep open flame away from work area.

1. Place the car on level ground.
2. Start and warm up the engine, snap the throttle between idle and 3,000 min^{-1} (rpm) several times then allow it to idle.
3. When the fuel level stabilizes, check that it is centered in the inspection window.



4. If the fuel level is not centered, adjust it by slowly turning the adjusting screw.
5. Paint the adjustment screw with white paint after adjustment.

   NOTE: Do not turn the adjusting screw more than 1/8-turn every 15-seconds.

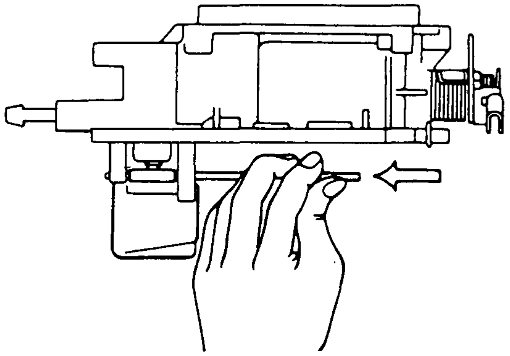


[D12B1, D13B3 EXCEPT EUROPE and D15B3 Engine]

⚠WARNING Do not smoke during this procedure. Keep any open flame away from your work area.

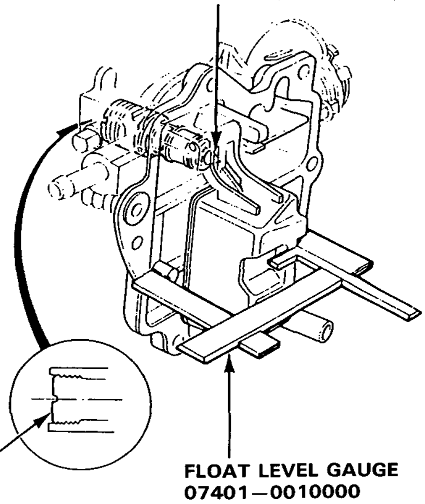
1. Remove float arm pin by lightly tapping it with a slender pin from long leg side as shwon, then remove float.

   NOTE: Never tap the float leg.



2. Reassemble float in reverse order.
3. Measure float level by attaching a float level gauge to the center of float.

   Float Level (from Gasket):
   34.5–36.5 mm (1.36–1.44 in.)



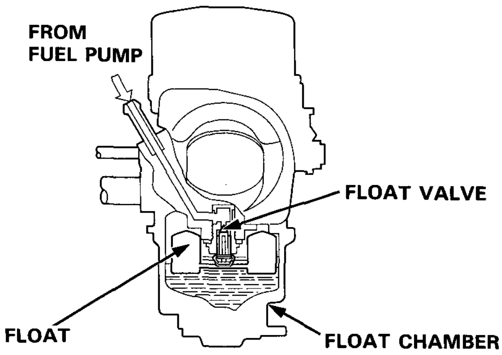
4. Adjust level by turning adjusting screw in or out if necessary.
5. Paint adjusting screw after adjustment.

Float Level [2-Carbureted Engine]

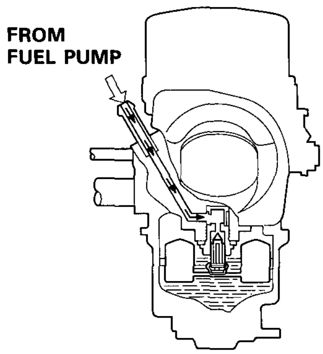
Description

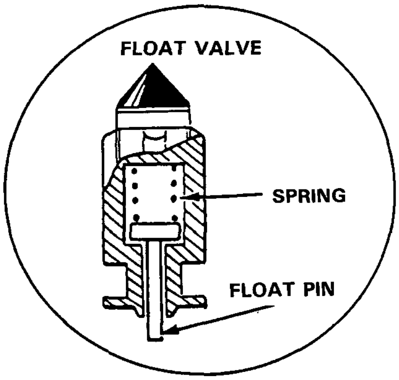
The float system consists of a float, a float chamber, a float valve and a valve seat. When the fuel level in the chamber decreases with the fuel consumption, the float and the float valve go down, and fuel flows into the chamber. When the fuel level in the chamber increases, the float valve goes up, and the float valve reaches the valve seat, so that fuel stops flowing into the chamber. The float system repeats this movement during driving to maintain a certain quantity of fuel in the carburetor.
In addition, the valve pin is equipped with the float valve so that the movement of the float can be absorbed at the time of car tilting and vibrating and stable fuel level can be obtained.

Float Valve Closed



Float Valve Open





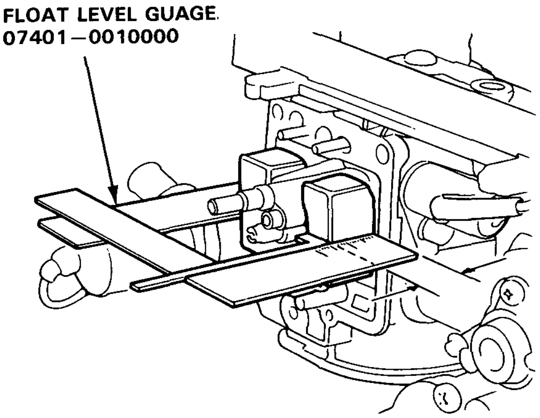
(cont'd)

Float Level [2-Carbureted Engine] (cont'd)

Adjustment

1. Remove the carburetors (page 11-137).
2. Remove the float chambers.
3. Using the float level gauge, measure the float level with the float tip lightly contacting the float valve and the carburetor float chamber surface inclined about 30° from vertical.

   Float Level: 16 ± 1 mm (0.6 ± 0.04 in.)



Automatic Choke [1-Carbureted Engine]

Description

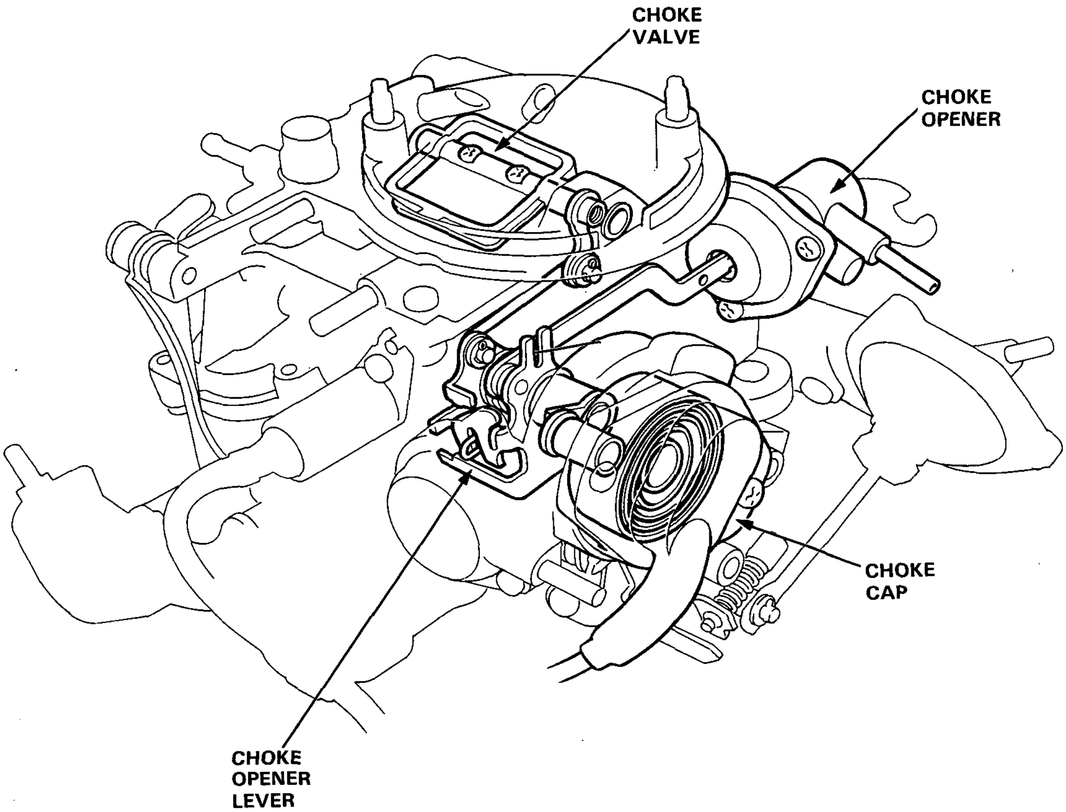
This system provides easy engine starting under a wide range of air temperatures.

The system consists of the following:

a) The choke valve and its linkage system
b) The choke heater electrical circuit
c) The choke opener
d) The fast idle and fast idle unloader system

The choke valve is located in the primary throttle bore of the carburetor. When the engine is not running, the choke valve angle is determined by the bimetallic coil spring acting against the choke return spring. When the engine is running, the choke opener also affects the choke valve angle.

When the engine is started, electric current supplied to the main choke heater causes the bimetallic coil spring to open the choke valve. As the air temperature in the choke cap rises, the thermal switch turns on and electric current is also directed to the secondary choke heater. This speeds the opening of the choke valve during its final stages. The combination of heater and thermistor keeps the bimetallic coil spring at a constant high temperature.

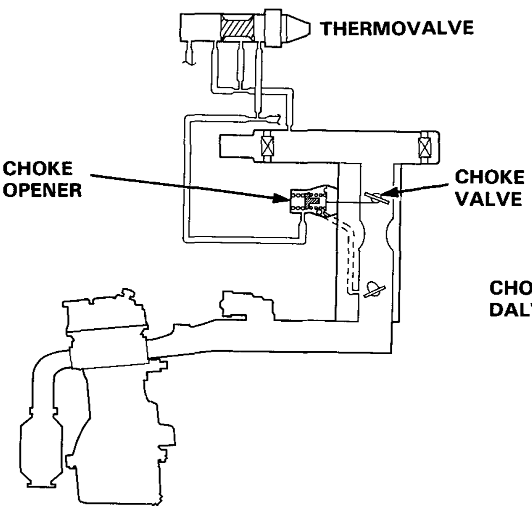


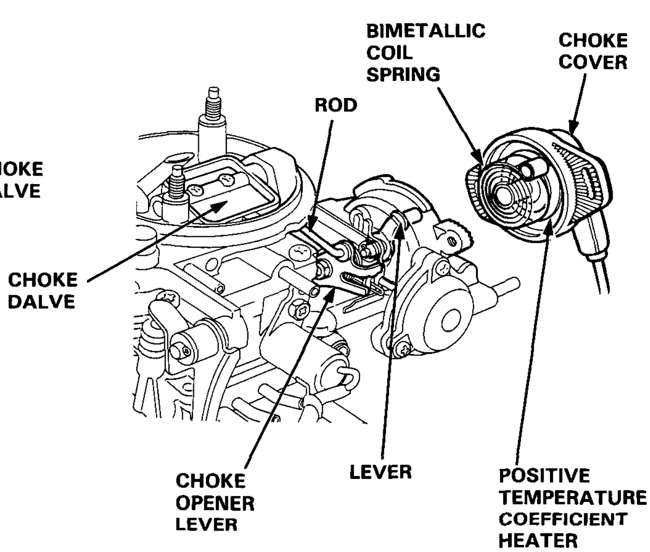
Choke Opener [1-Carbureted Engine]

Description

The fast idle cam is engaged and disengaged by depressing the accelerator pedal, and is also disengaged by the fast idle unloading mechanism.

The unloading mechanism consists of a fast idle unloader, and thermovalve. When the coolant temperature reaches the set temperature of thermovalve, it closes to shut off the vacuum bleed. This allows the diaphragm of the unloader to retract by manifold vacuum.





Choke Opener

This system is designed to promote easy starting. When starting the engine, manifold vacuum is transmitted to the choke opener; thus the choke valve is opened a fixed amount.

Thermovalve works to open the choke valve in response to engine coolant temperature. When the engine coolant temperature is below the set temperature of thermovalve, it opens and manifold vacuum is bled from the valve. In this situation the choke opener diaphragm is retracted to an intermediate position because of the balance between the vacuum and the spring force of the choke opener.

When the engine coolant temperature exceeds the set temperature of thermovalve, it closes to shut off the vacuum bleed and this allows the choke opener to retract fully and pull the choke valve open.

Testing

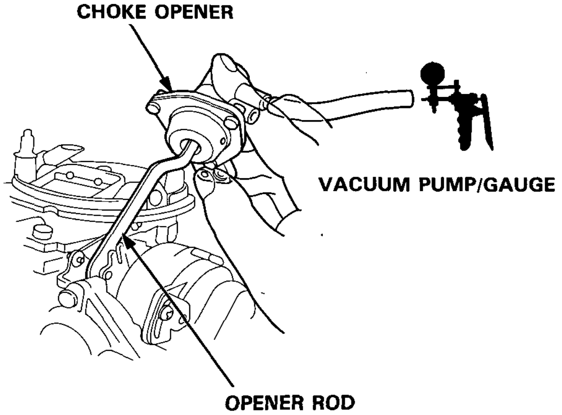
1. Disconnect the 2P connector of the choke coil heater.

2. Open and close the throttle fully to let the choke close.

3. *Start the engine.*

   The choke valve should partially open.

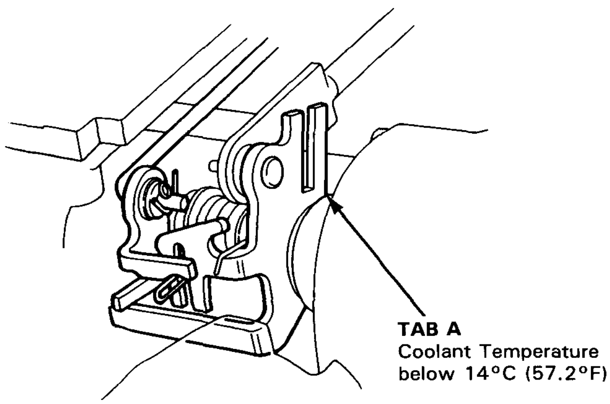
   - If the choke partially opens, go on to step 4 or step 5, depending on coolant temperature.
   - If the choke does not open partially, check the linkage for free movement, repair as necessary, and retest.
   - If the choke valve still does not open partially, check the choke opener diaphragm: Remove the choke opener, and connect a vacuum pump. Block the orifice in the opener while you apply enough vacuum to pull the opener rod all the way in, the stop.



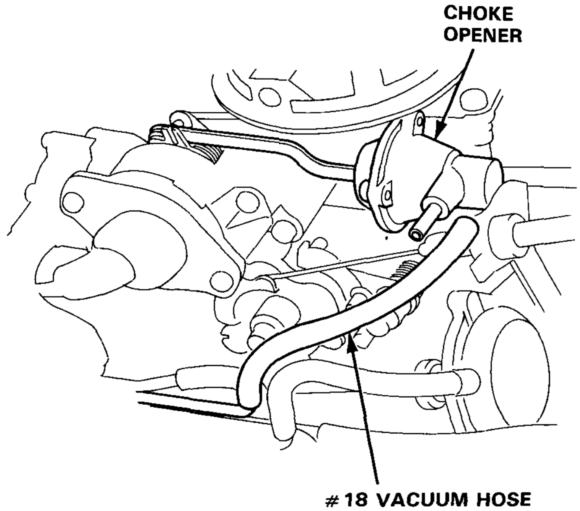
   – If the rod will not stay in, replace the opener.
   – If the rod stays in, check the vacuum port in the carburetor for blockage.

NOTE: After replacing or reinstalling the choke opener, retest it, then adjust it if necessary (page 11-123).

4. If coolant temperature is below about 14°C (57.2°F), Tab A on the choke opener lever should not be seated against the carburetor.



   - If Tab A is not seated, go on to step 5.
   - If Tab A is seated, disconnect the #18 vacuum hose from the choke opener.

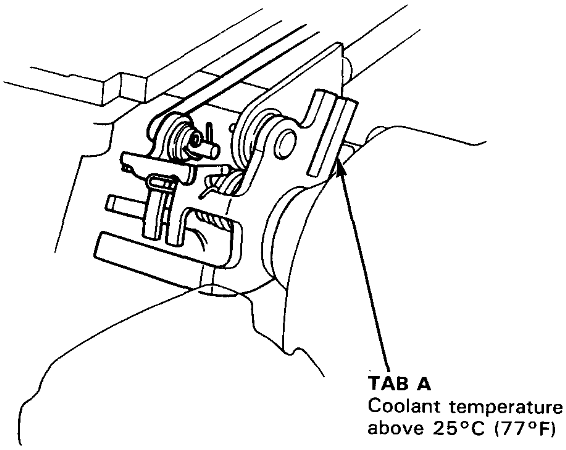


   – If Tab A comes off its seat, check the #18 vacuum line for proper connection or disconnected hose. If OK, replace the thermovalve.

(cont'd)

Choke Opener [1-Carbureted Engine] (cont'd)

5. If coolant temperature is above about 25°C (77°F), Tab A on the choke opener lever should be seated against the carburetor.



- If Tab A is not seated, check the #18 vacuum line for proper connection, cracks, blockage or disconnected hose. If OK, replace the thermovalve.

Choke Coil Tension and linkage [1-Carbureted Engine]

Inspection (COLD ENGINE)

1. Remove the air cleaner.

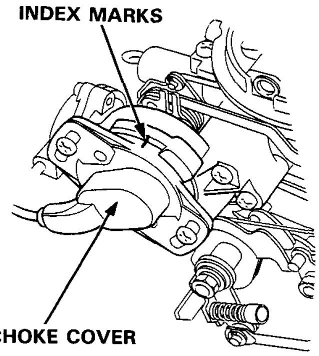
2. Open and close the throttle fully to let the choke close.

   The choke valve should close completely.

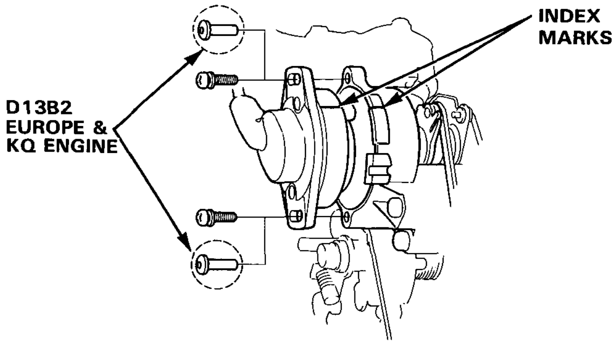
   NOTE: Above about 28°C (82°F) the choke will not close completely, but should still close to less than 3 mm (1/8 in.).

   - If the choke closes properly, go on to the fast idle unloader test on page 11-127.
   - If the choke does not close properly, spray its linkage with carburetor cleaner, and check the linkage for sings of mechanical binding (use a spray can with an extension on the nozzle to reach the linkage).

   CAUTION: Carburetor cleaner is very caustic; always wear safety goggles or a face shield when spraying.



- If the choke still does not close properly, remove the choke cover (page 11-120) and inspect the linkage for free movement. Repair or replace parts as necessary. Then reinstall the cover and adjust it so the index marks line up, and retest.
- If the choke still does not close properly, replace the cover (page 11-124).

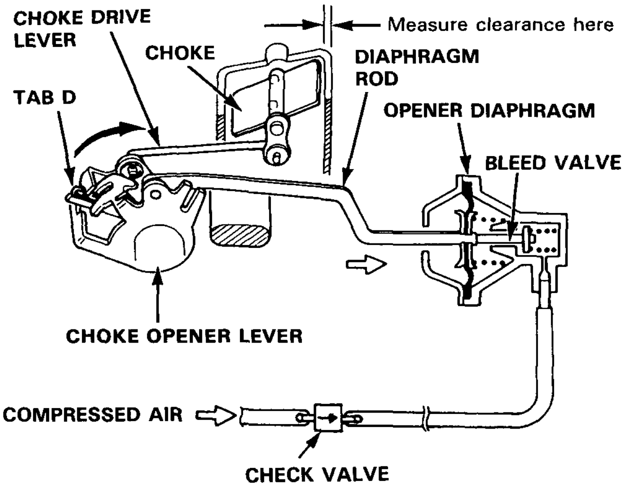


Choke Linkage [1-Carbureted Engine]

Adjustment

NOTE:
- This check is not necessary unless the linkage has been bent, choke opener has been replaced, or the car has poor cold starting.
- This check can be made with the engine HOT or COLD.

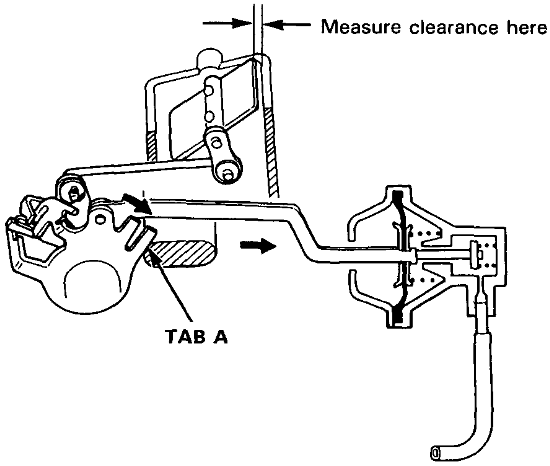
1. Remove the choke cover (page 11-120).
2. While holding the choke valve closed, open and close the throttle fully to engage the choke and fast idle linkage.
3. Disconnect the choke opener hose from the vacuum hose manifold, and attach a check valve to it as shown. Then pressurize the choke opener with low pressure compressed air, 103–586 kPa (15–85 psi) is OK, to hold the bleed valve in it closed.



4. Gently push the choke opener lever towards the opener until is stops (until you feel the opener rod seat against the pressurized bleed valve), then pull the choke drive lever down against the opener lever (to take all free play out of the linkage), and measure the clearance between the choke blade and casting:

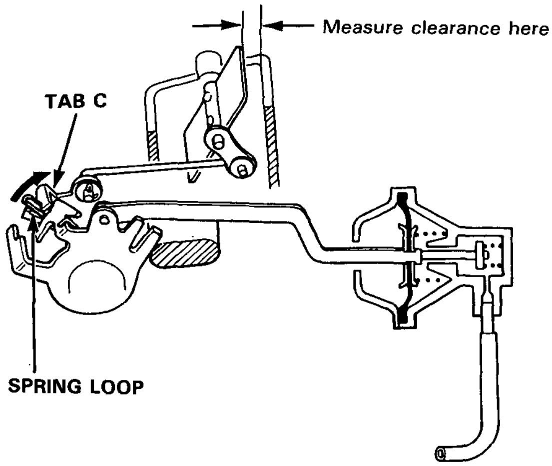
   1st Stage Clearance
   0.88 ± 0.07 mm (0.035 ± 0.003 in.)
   Adjust clearance by bending Tab D.

5. Remove the check valve, and reconnect the choke opener hose.
6. Hold both levers together, then push them toward the diaphragm again until they stop (Tab A on the opener lever seats against the carburetor), and measure the clearance at the choke valve.



   2nd Stage Clearance:
   2.9 ± 0.09 mm (0.114 ± 0.0035 in.)
   Adjust clearance by bending Tab A.

7. While still holding opener lever Tab A against its seat, release the choke drive lever, and meassure the clearance at the choke valve (Tab C on the drive lever should stay seated against the spring loop; if not, repeat step 2 and recheck):



   3rd Stage Clearance:
   5.25 ± 0.20 mm (0.206 ± 0.008 in.)

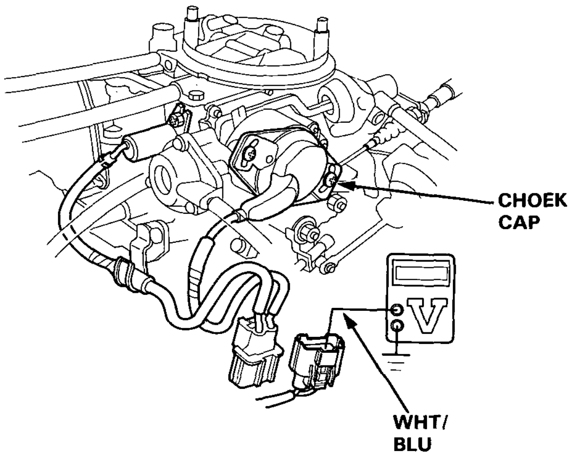
Choke Coil Heater [1-Carbureted Engine]

Testing

Start the engine and let it run. As the engine reaches normal operating temperature, the choke valve should fully open:

- If it does, go on to the fast idle unloaded test on page.
- If it doesn't inspect the linkage, and clean or repair it as necessary (page 11-122).
- If the choke still does not open all the way, disconnect the connector, and measure voltage between WHT/BLU (+) terminal and body ground.

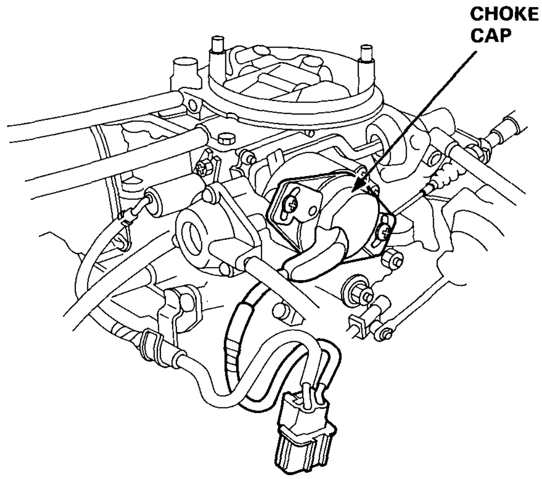
  There should be battery voltage with the engine running.



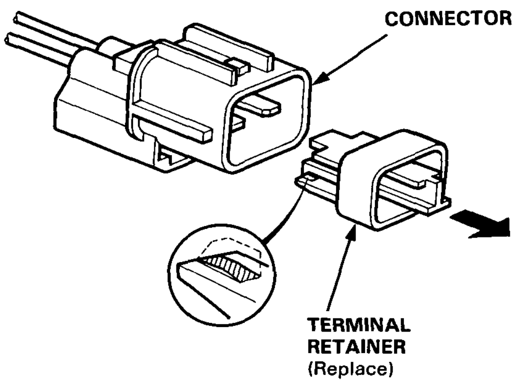
— If there is no voltage, inspect open in WHT/BLU wire between the connector and the alternator. If OK, inspect the alternator (section 23).

Replacement

1. Remove the air cleaner.
2. Remove the 2P connector.



3. Disconnect the terminal retainer from the connector and remove the two terminals.

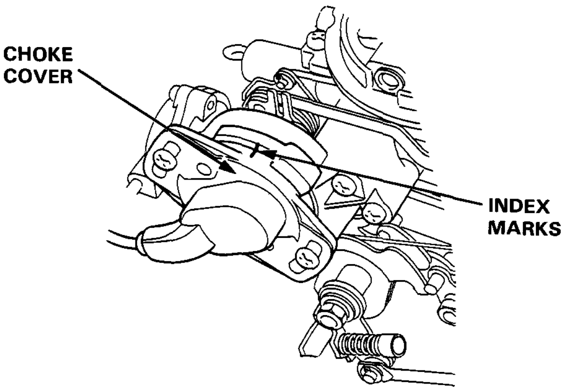


4. **[D13B2 EUROPE & KQ Engine]**
   Using a 5/32" or 4.1 mm diameter drill, drill out the rivets and remove the choke cover.

   CAUTION: Cover the carburetor with a clean shop rag to prevent chips from falling into the carburetor throat.

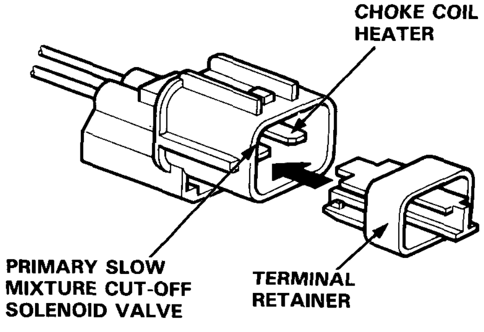
   [D12B1, D13B3 EXCEPT EUROPE and D15B3 Engine]
   Remove the screws and remove the choke cover.

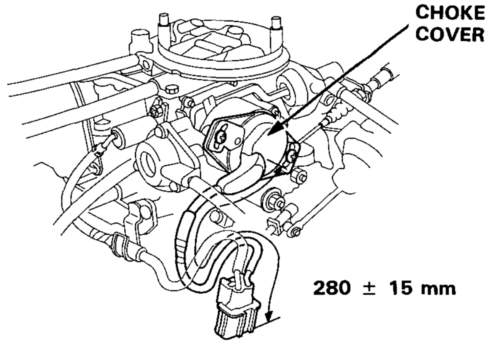
5. *Reinstall the cover and adjust it so that index marks align (D13B2 EUROPE & KQ Engine:, then secure it with rivets).*



6. Connect the respective terminals to a new connector and install a new terminal retainer.

   NOTE:
   - Be sure to connect the terminal before installing the terminal retainer.
   - Replace the connector and terminal retainer with the new ones.
   - Note the location of the terminal.



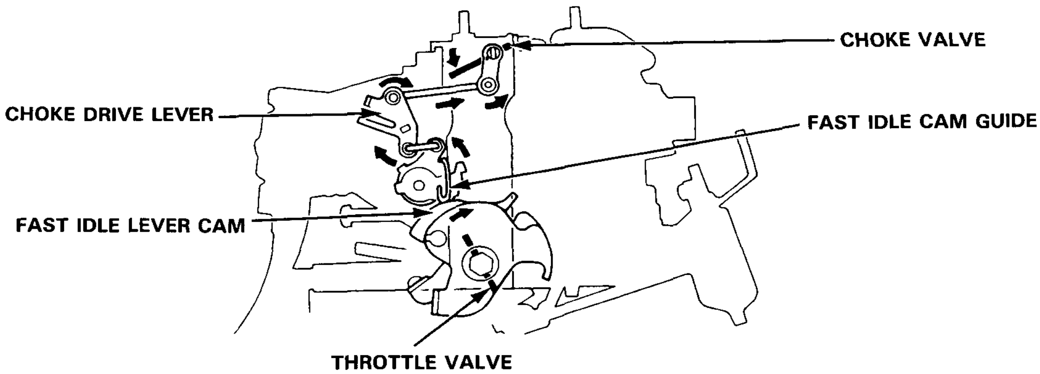


7. Reconnect the connector and reinstall the air cleaner.

Fast Idle [1-Carbureted Engine]

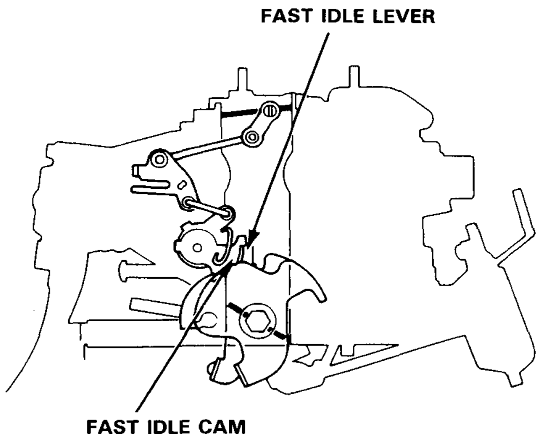
Description

Unloader mechanism
When a cold engine is started, the closed choke valve is opened a fixed amount by the linkage whenever the accelerator pedal is depressed beyond a certain point. This mechanism prevents the air fuel mixture from becoming excessively rich when additional acceleration is required.

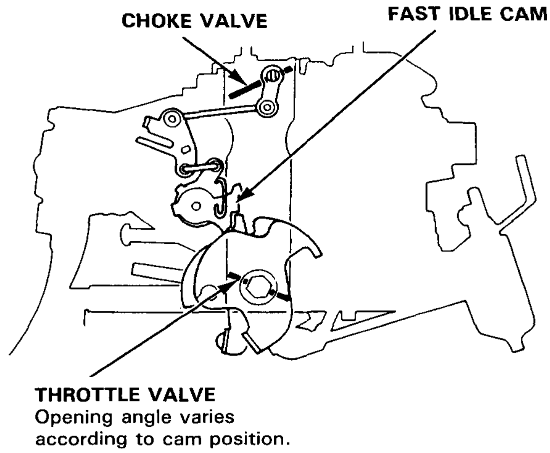


Fast idle mechanism
Before starting the cold engine, it is necessary to depress the accelerator pedal once in order to disengage the fast idle cam from the fast idle lever. When the accelerator pedal is released slowly, the fast idle cam is initially positioned by the bimetallic coil spring according to the ambient temperature.
As the choke heater warms the bimetallic coil spring, the lever rotates clockwise, opening the choke valve. The fast idle cam and lever will remain where originally set unless the throttle is depressed to wide open.
When the engine runs smoothly, the idle speed can be reduced by slowly depressing the accelerator pedal.

Before Starting

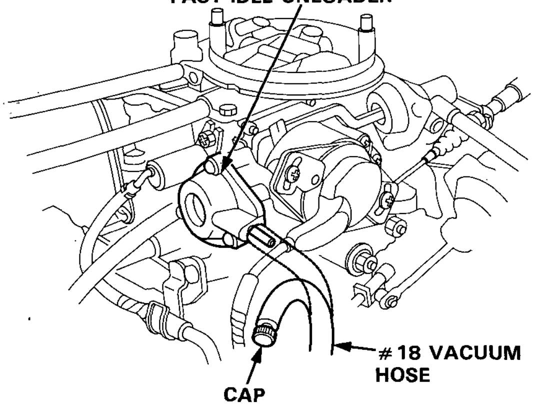


During Warming up

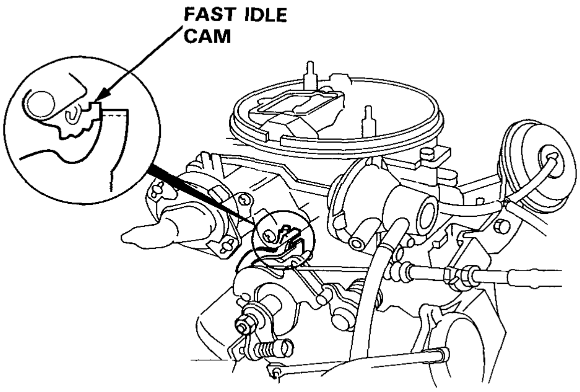


Testing

1. Disconnect the # 18 hose from the fast idle unloader.



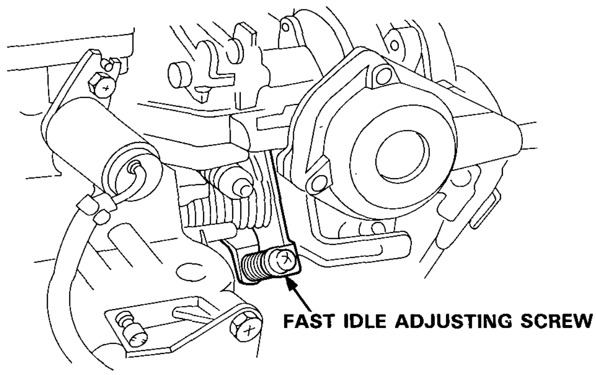
2. Open and close the throttle fully to engage the fast idle cam.



3. Start the engine.

   Fast idle should be 3,200 ± 500 min^{-1} (rpm)

   Adjust the fast idle speed, if necessary, by turning the fast idle adjusting screw.

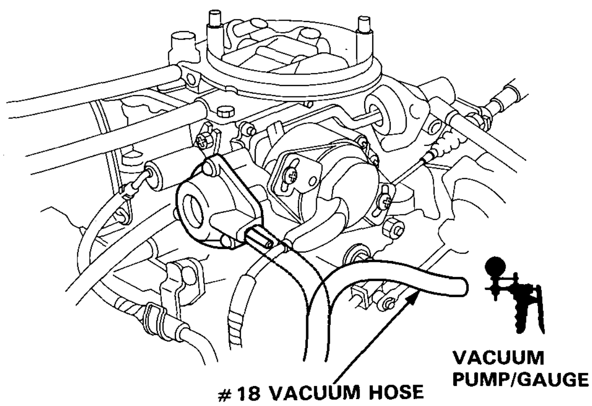


5. Reconnect the hose.

6. Warm up to normal operating temperature (the cooling fan comes on).

   When the engine warms up, it speed should drop below 1,400 min^{-1} (rpm) as the unloader pulls the internal choke linkage off the fast idle cam.

   - If fast idle does not drop below 1,400 min^{-1} (rpm), disconnect the # 18 hose, and check the vacuum.



   - If there is no vacuum, check the # 18 vacuum line for proper connection, cracks, blockage or disconnected hose. If OK, replace the thermovalve.
   - If there is vacuum, replace the fast idle unloader, and then inspect the choke coil tension and linkage (page 11-122).

Automatic Choke and Fast Idle [2-Carbureted Engine]

Description

This system provides easy engine starting under a wide range of air temperatures.

The system consists of the following:

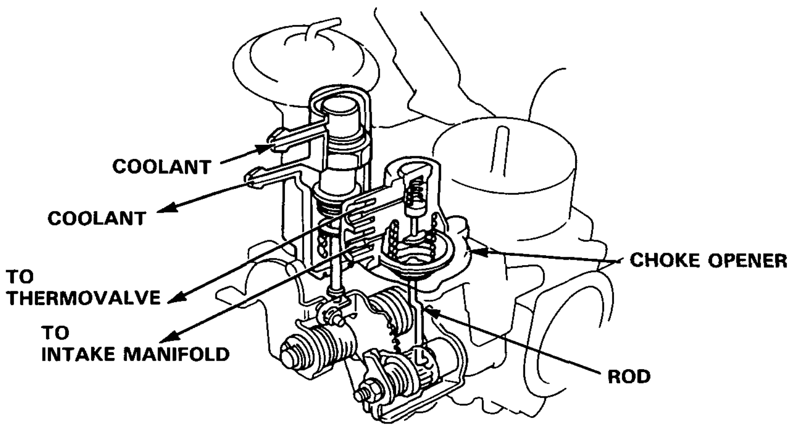
a) The choke valve and its linkage system
b) The choke opener (page 11-130).
c) The fast idle system (page 11-133).

The choke valves are located in the air intakes of the carburetors. When the engine is not running, the choke valve angle is determined by the thermowax valve. When the engine is running, the choke opener also affects the choke valve angle.

The choke opener adjusts the choke valve for increased air flow once the engine begins to fire. It operates in two steps according to coolant temperature.

The automatic choke system is controlled by the thermowax valve; as coolant temperature rises, the valve's piston extends which causes the fast idle cam to gradually rotate and decrease idle speed.

Engine coolant is fed through a passage in the carburetor's cast front bracket to prevent carburetor icing and to improve cold driveability by improving vaporization of the air/fuel mixture. Since excessive heat can cause fuel percolation, a thermovalve is used to shut off the coolant flow at temperatures above the thermovalve set temperature.

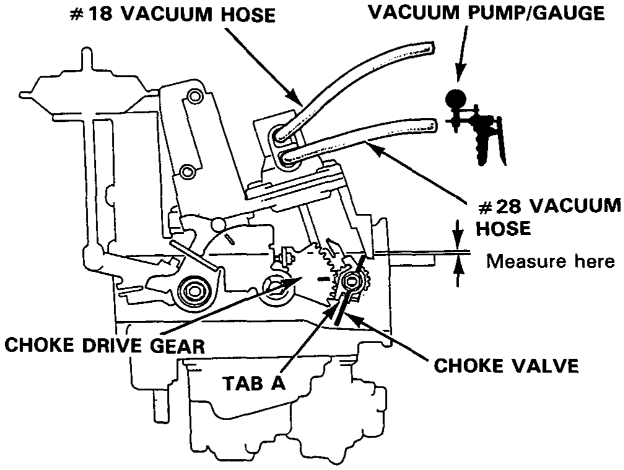


Choke Linkage [2-Carbureted Engine]

Adjustment

1. Remove the carburetor (page 11-137).
2. *Disconnect the #18 vacuum hose* from the choke opener and leave open to atmosphere. Disconnect the #28 vacuum hose and connect a vacuum pump. Apply at least 200 mm Hg (*8 in. Hg*)

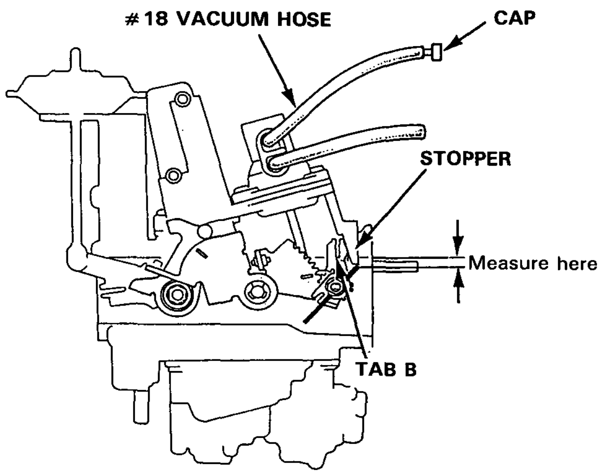
   NOTE: If vacuum drops below 200 mm Hg (8 in. Hg), slowly reapply vacuum until you can maintain the highest level without losing vacuum.
3. Turn the choke drive gear clockwise and measure the clearance between the choke valve and the casting.



1st Stage Clearance:
M/T: 1.65±0.15 mm (0.065±0.006 in.)
A/T: 1.75±0.15 mm (0.69±0.006 in.)

Adjust clearance by bending Tab A.

4. Cap the end of the #18 vacuum hose and apply vacuum.
5. Turn the choke drive lever clockwise until Tab B *seats against the stopper, and measure clearance be*tween the choke valve and casting.



2nd Stage Clearance:
M/T: 3.85±0.2 mm (0.152±0.008 in.)
A/T: 4.05±0.2 mm (0.159±0.008 in.)

Adjust clearance by bending Tab B

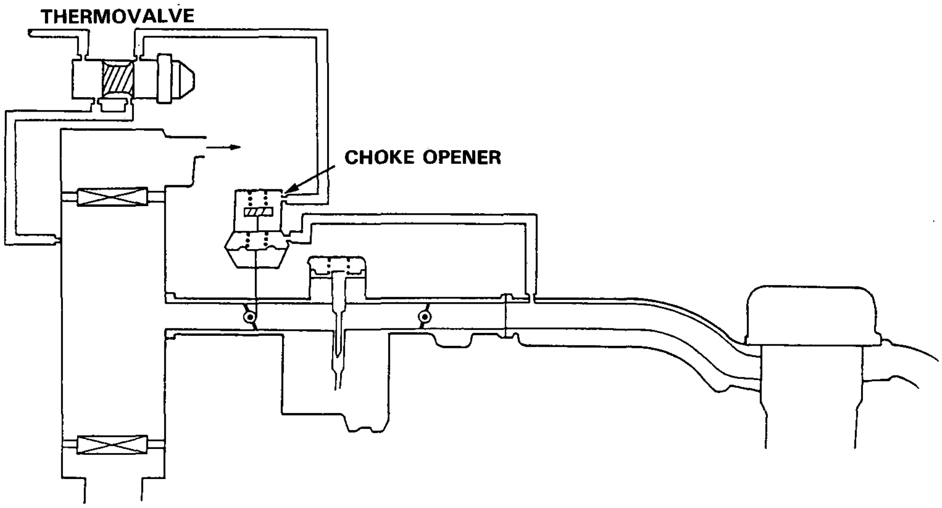
If the clearance can not adjust, replace the left carburetor (page 11-137).

Choke Opener [2-Carbureted Engine]

Description

Thermovalve operates to open the choke valve in response to engine coolant temperature. When the engine coolant temperature is below the set temperature of thermovalve (15°C), it opens and manifold vacuum is bled from the opener. In this situation the choke opener diaphragm is retracted to an intermediate position because of the balance between the vacuum and the spring force of the choke opener.

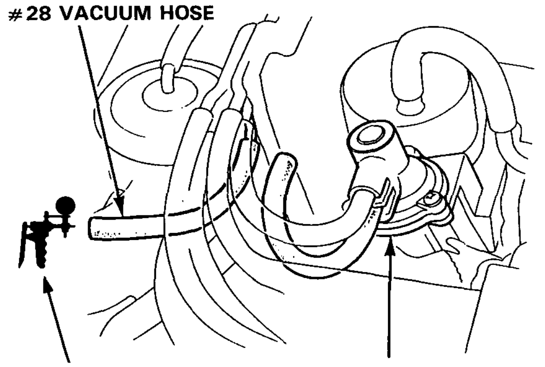
When the engine coolant temperature exceeds the set temperature of thermovalve (15°C), it closes to shut off the vacuum bleed and allows the choke opener to retract fully and pull the choke valve open.



Testing (COLD ENGINE)

NOTE: Engine coolant temperature must be below 15°C (59°F)

1. Disconnect the #28 vacuum hose from the choke opener and connect a vacuum pump.

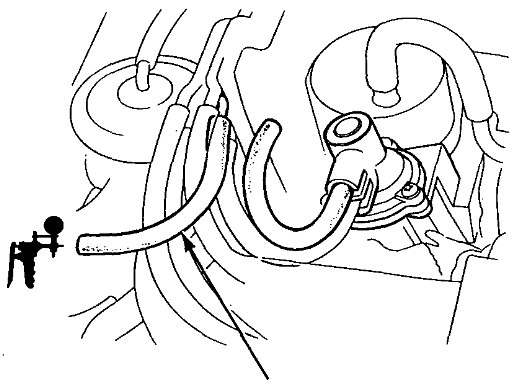


2. Start the engine and check the vacuum.

   There should be vacuum.

   - If there is no vacuum, check the #28 vacuum hose for proper connection, cracks, brockage or disconnected hose.

3. Disconnect the #18 vacuum hose from the choke opener, the connect a vacuum pump.



   It should not hold vacuum.

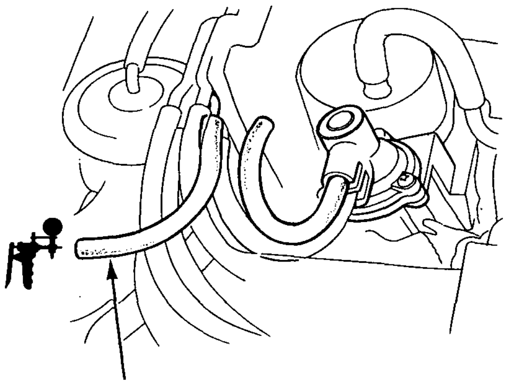
   - If it holds vacuum, check the #18 vacuum hose for proper connection, cracks, blockage or disconnected hose. If OK, replace the thermovalve and retest.

Testing (HOT ENGINE)

1. Start the engine and warm up to normal operating temperature (the cooling fan comes on).

2. Disconnect the #18 vacuum hose from the choke opener and connect a vacuum pump.

   It should hold vacumm



   - If it does not hold vacuum, check the #18 vacuum hose for proper connection, cracks, blockage or disconnected hose. If OK, replace the thermovalve and retest.

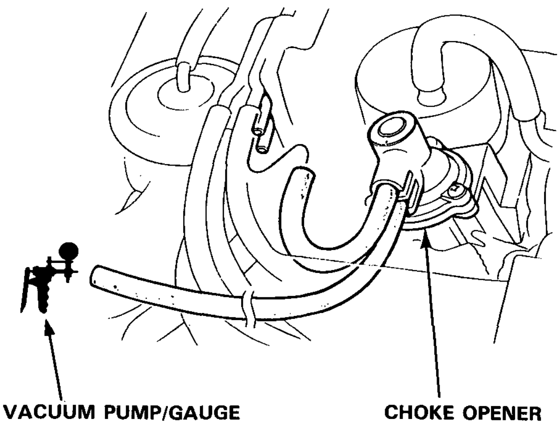
(cont'd)

Choke Opener [2-Carbureted Engine] (cont'd)

Choke Opener Diaphragm Testing

1. Disconnect the #18 vacuum hose from the vacuum hose manifold.

2. Disconnect the #28 vacuum hose from the vacuum hose manifold and connect a vacuum pump.



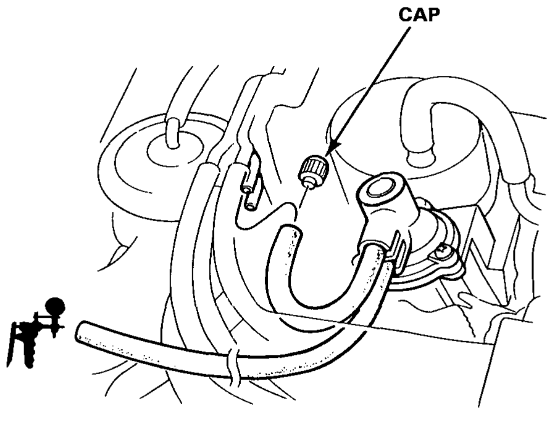
3. Apply vacuum.

   Vacuum should stabilize at 100 to 200 mm Hg (4 to 8 in. Hg) and it should pull the opener rod.

   - If not, check the linkage for signs of mechanical binding and replace the left carburetor (page 11-137).

4. Cap the end of the #18 vacuum hose and apply vacuum.

   It should pull the opener rod.



   - If not, replace the left carburetor (page 11-137).

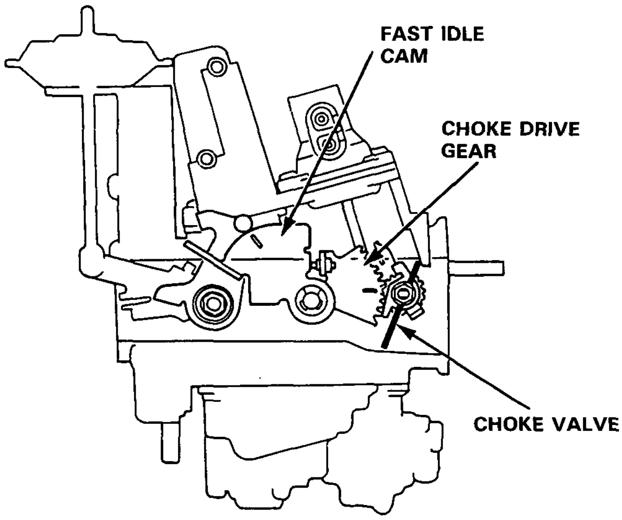
Fast Idle [2-Carbureted Engine]

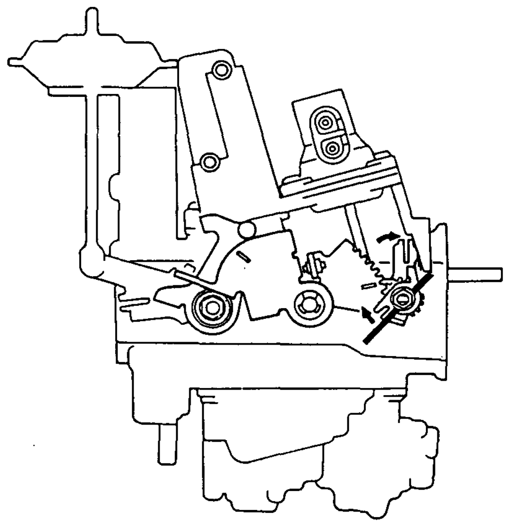
Description

Fast Idle Mechanism
The choke valves are located in the air intakes of the carburetors. When the engine is not running, the choke valve angle is determined by the thermowax valve. When the engine is running, the choke opener also affects the choke valve angle.

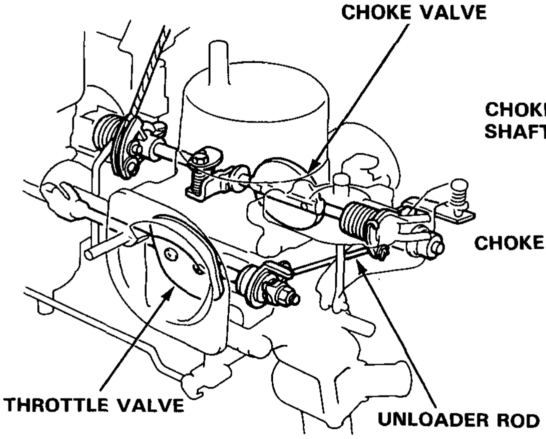
The choke opener adjusts the choke valve for increased air flow once the engine beings to fire. It operates in two steps according to coolant temperature.

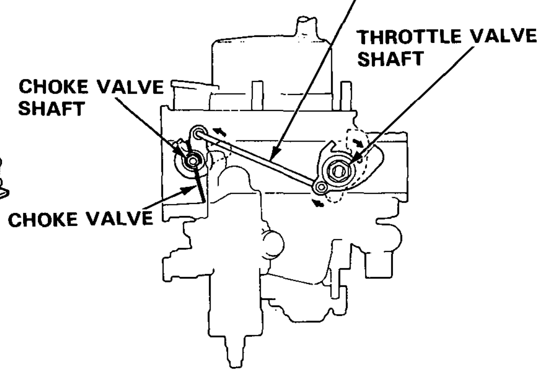
The automatic choke system is controlled by the thermowax valve; as coolant temperature rises, the valve's piston extends which causes the fast idle cam to gradually rotate and decrease idle speed.

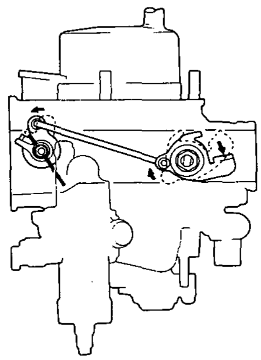




Fast Idle Unloader Mechanism
When a cold engine is started, the closed choke valve is opened a fixed amount by the linkage whenever the accelerator pedal is depressed beyond a certain point. This mechanism prevents the air fuel mixture from becoming excessively rich when additional acceleration is required.





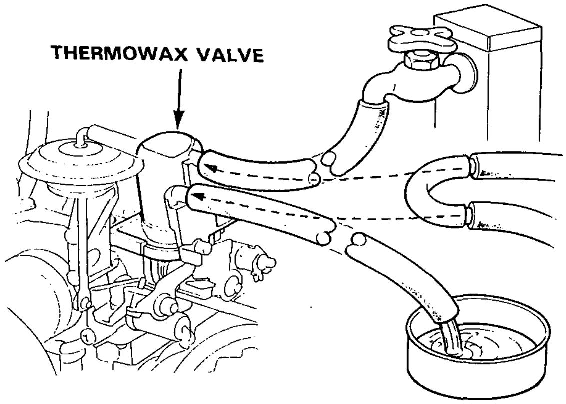


(cont'd)

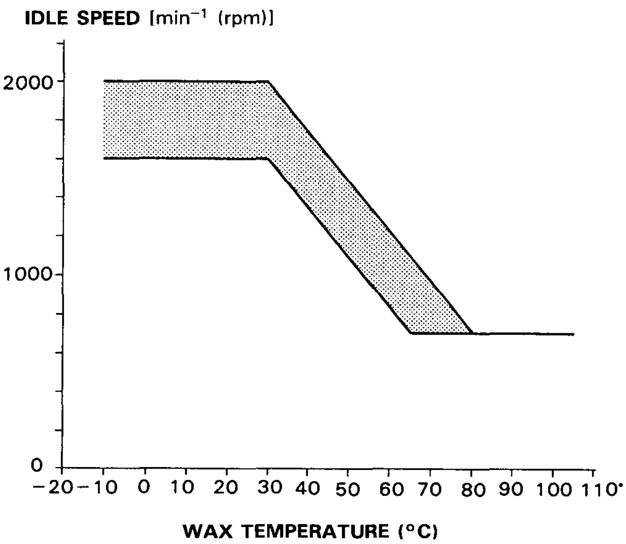
Fast Idle [2-Carbureted Engine] (cont'd)

Inspection/Adjustment

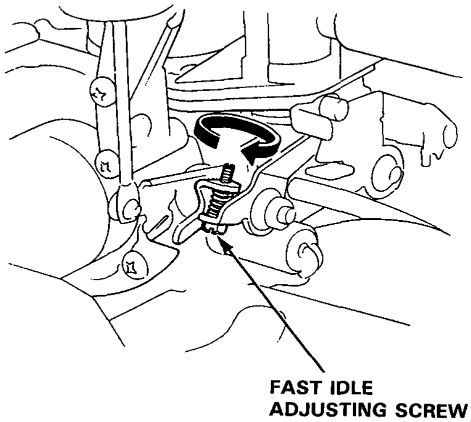
1. Start the engine and warm up to normal operating temperature (the cooling fan comes on).
2. Stop the engine.
3. Disconnect both coolant hoses from the thermowax valve and cap the end of hoses.
4. Apply cold water and cool down the wax.



5. Connect a tachometer and check the idle speed.



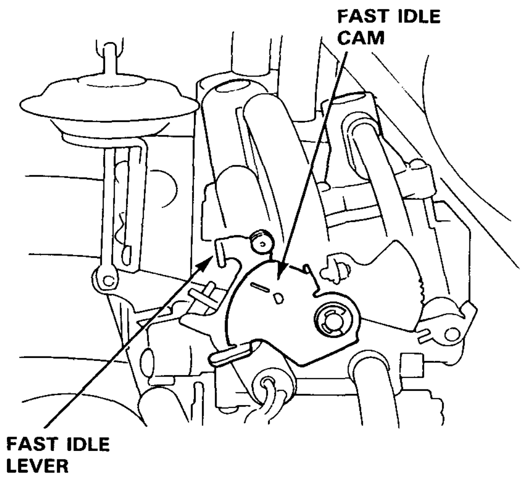
Adjust the idle speed, if necessary, by turning the fast idle adjusting screw.



- If not, replace the left carburetor (page 11-137).

6. Reinstall both coolant hose.
7. Start the engine and warm up to normal operating temperature (the cooling fan comes on).
8. Check the fast idle lever.

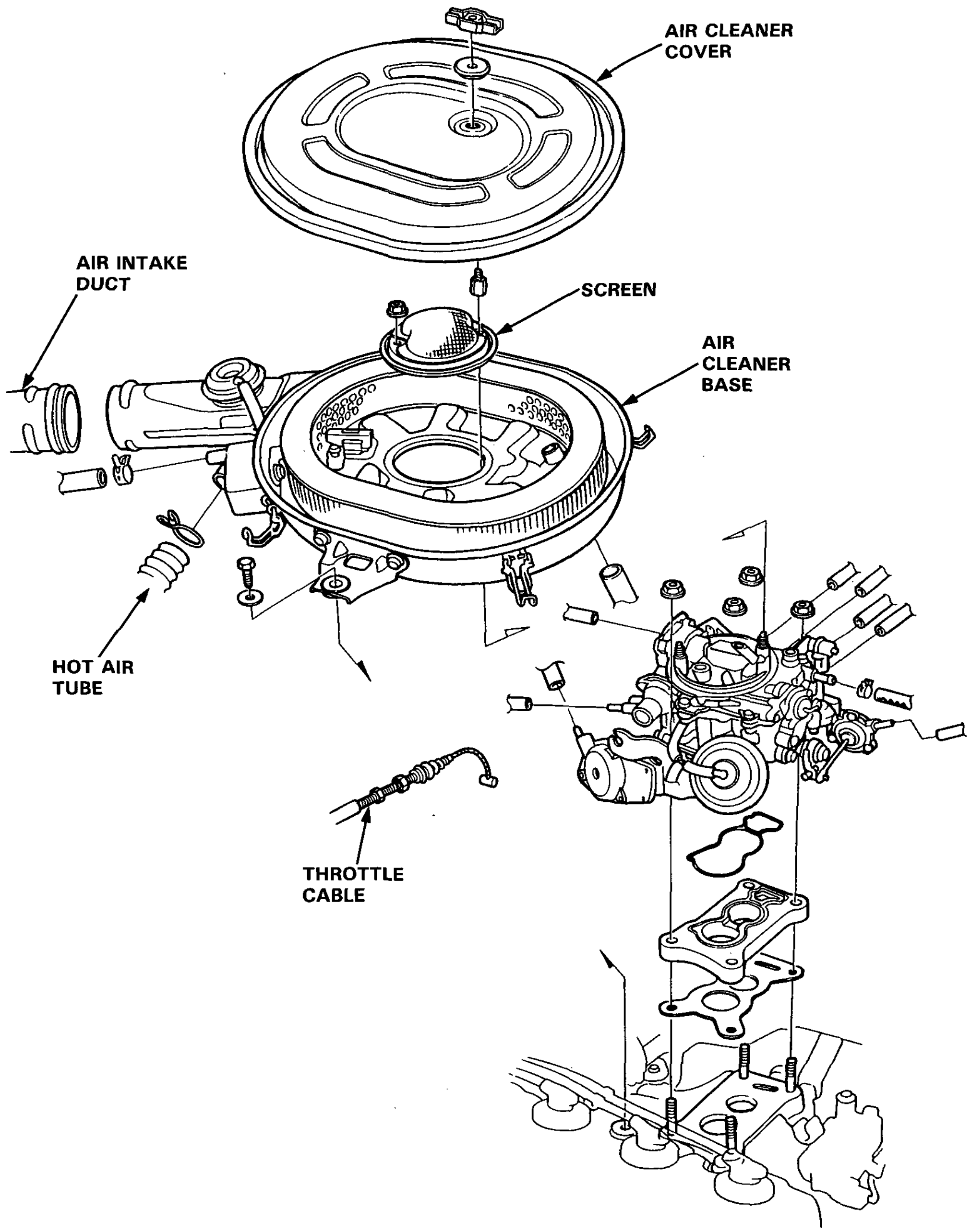
   Fast idle lever should not be seated against fast idle cam.



- If not, replace the left carburetor (page 11-137).

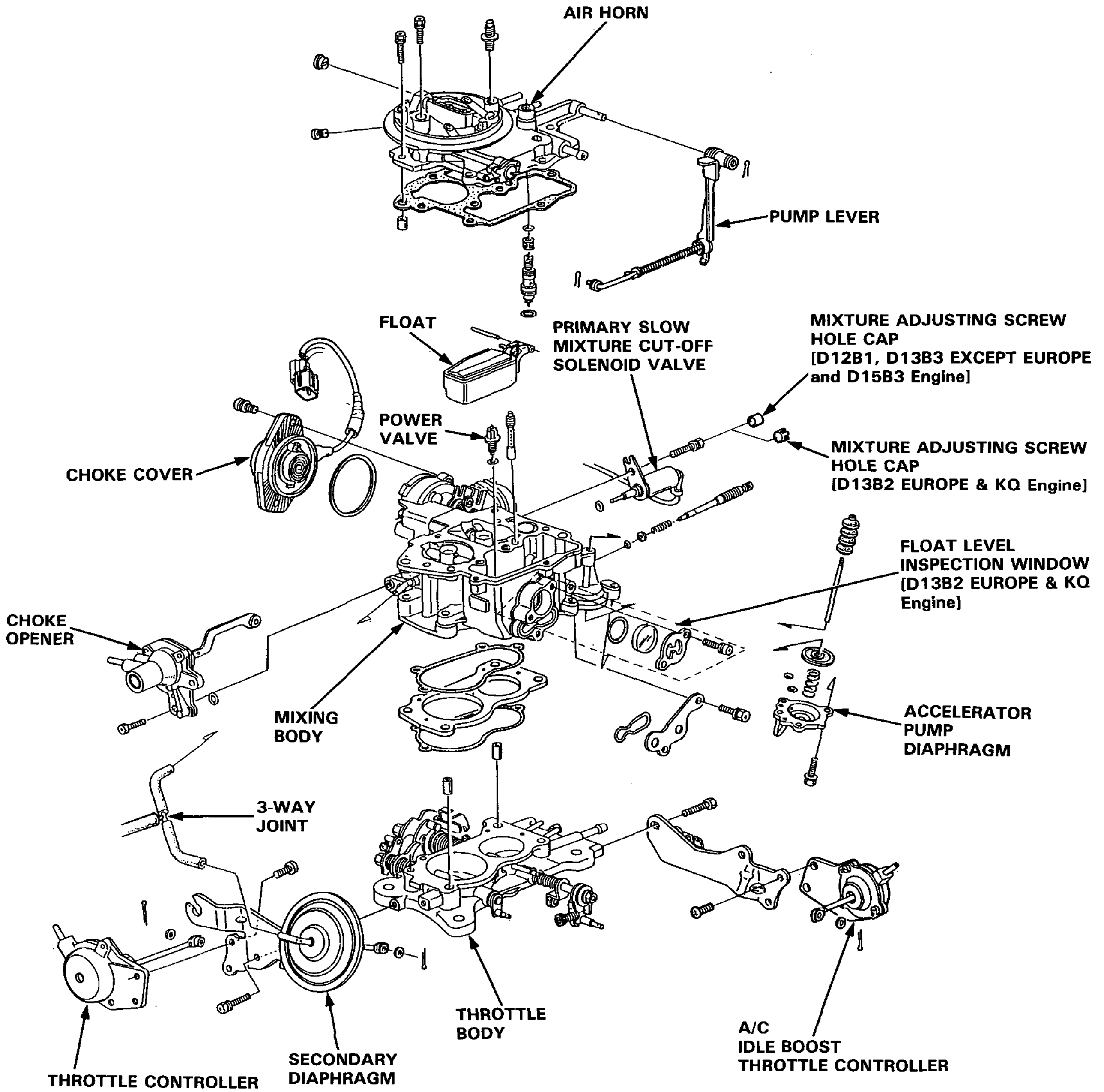
Removal [1-Carbureted Engine]

⚠WARNING Do not smoke while working on fuel system. Keep any open flame away from you work area. Drain fuel in to an approved container.



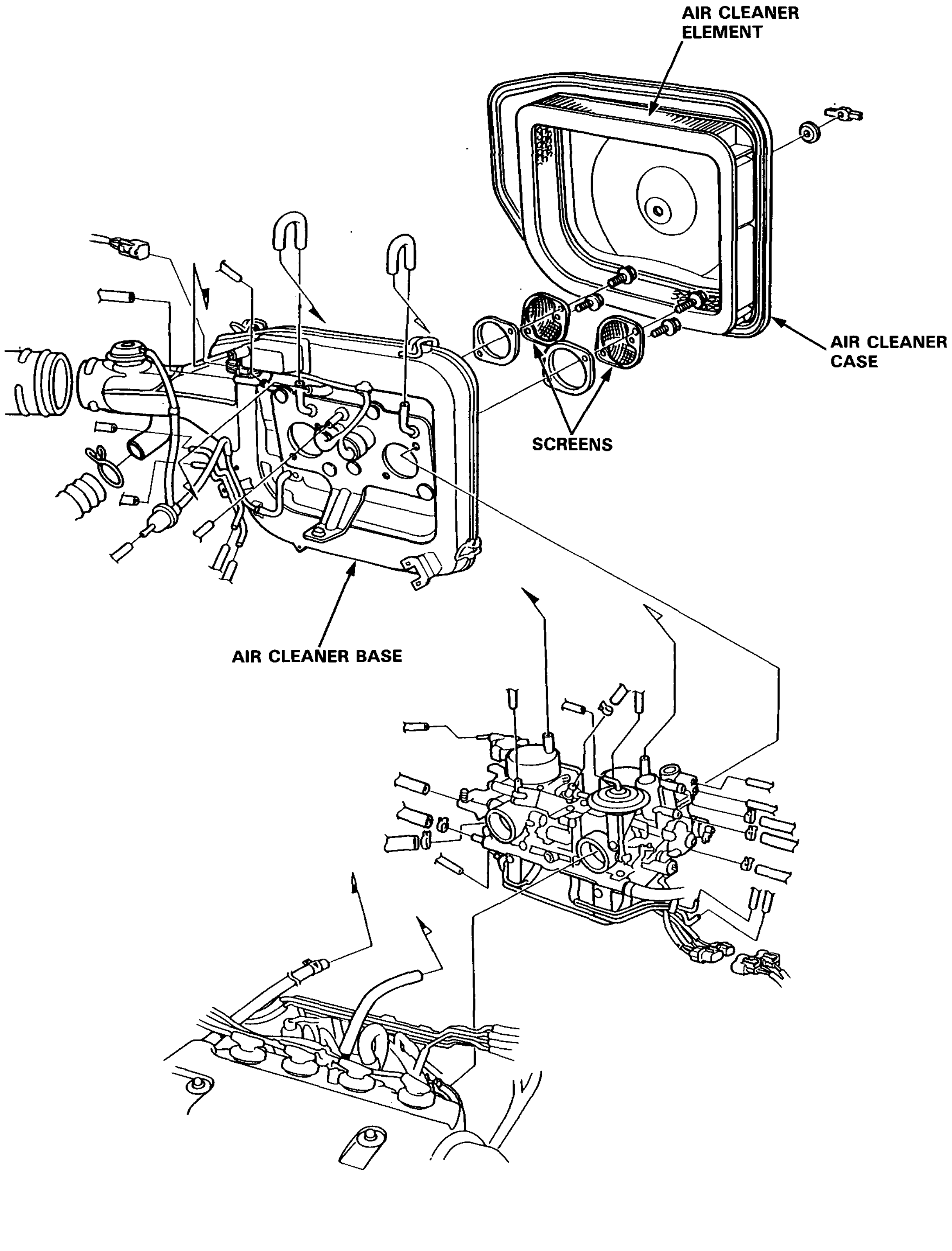
Carburetor

Replacement [1-Carbureted Engine]

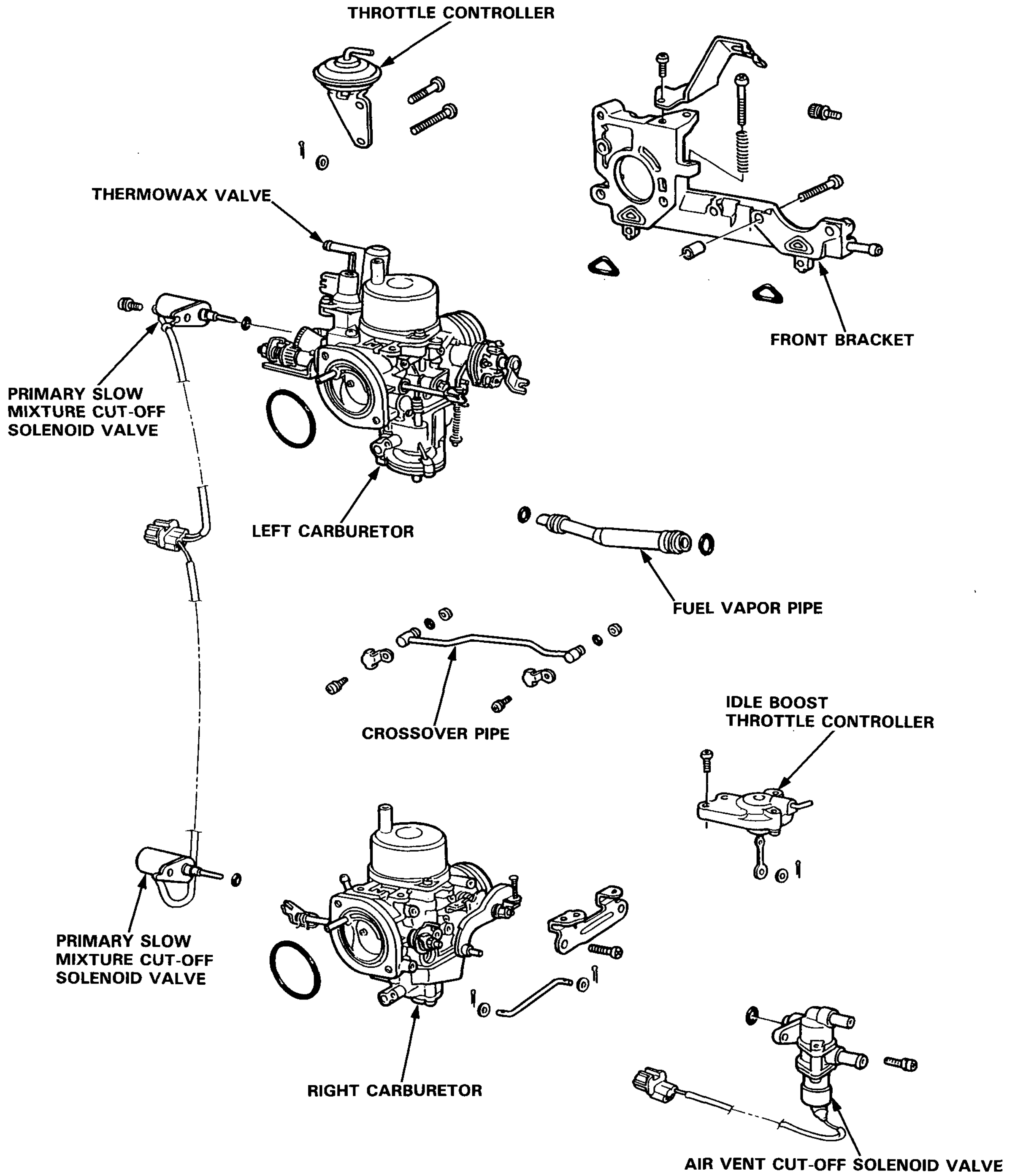


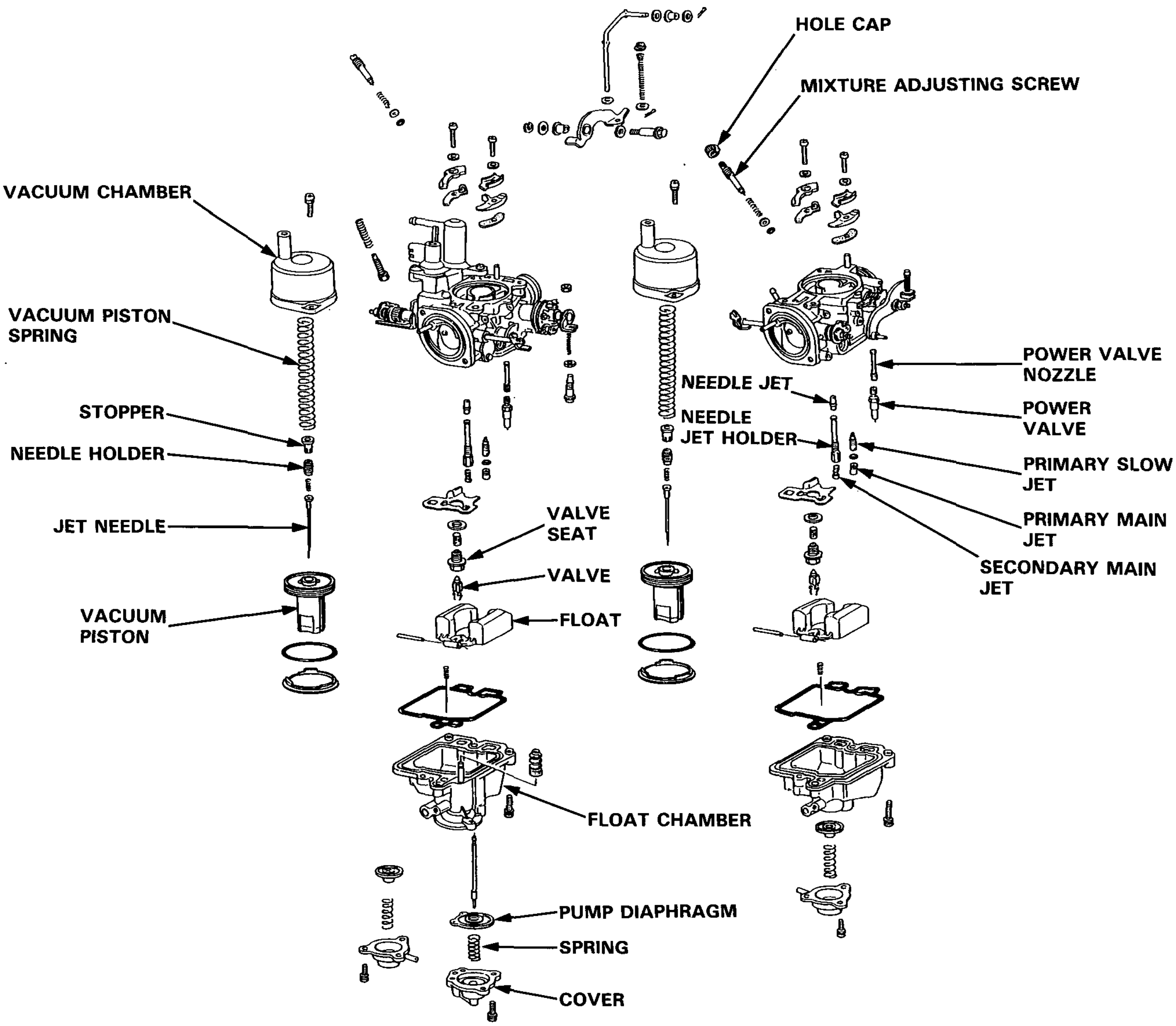
Removal [2-Carbureted Engine]

⚠WARNING Do not smoke while working on fuel system. Keep and open flame away from you work area. Drain fuel in to an approved container.



Replacement [2-Carbureted Engine]



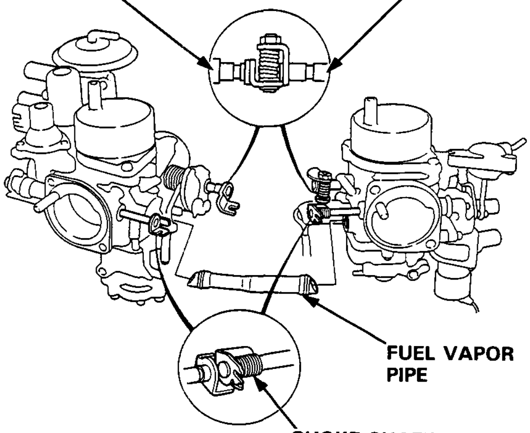

HOLE CAP
MIXTURE ADJUSTING SCREW
VACUUM CHAMBER
VACUUM PISTON SPRING
STOPPER
NEEDLE HOLDER
JET NEEDLE
VACUUM PISTON
VALVE SEAT
VALVE
FLOAT
NEEDLE JET
NEEDLE JET HOLDER
POWER VALVE NOZZLE
POWER VALVE
PRIMARY SLOW JET
PRIMARY MAIN JET
SECONDARY MAIN JET
FLOAT CHAMBER
PUMP DIAPHRAGM
SPRING
COVER

Reassembly [2-Carbureted Engine]

1. Insert the left carburetor's throttle shaft end (forked), between the washers on the right carburetor's throttle shaft end.

2. Install new O-rings on the fuel vapor pipe, then install it.

3. Set the left and right carburetors up.



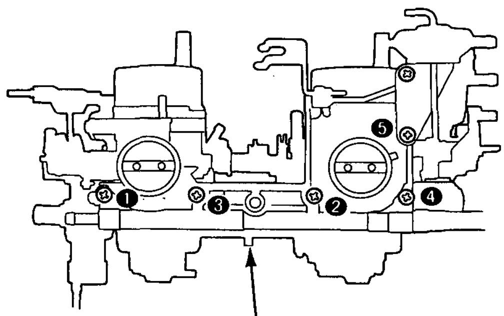
4. Connect the choke shaft spring.

5. Install the front braket, with new gaskets, but don't tighten its screws yet.

   CAUTION: Make sure the screw length is correct or you may damage the carburetors.

6. Check that the choke and throttle shafts move smoothly without binding.

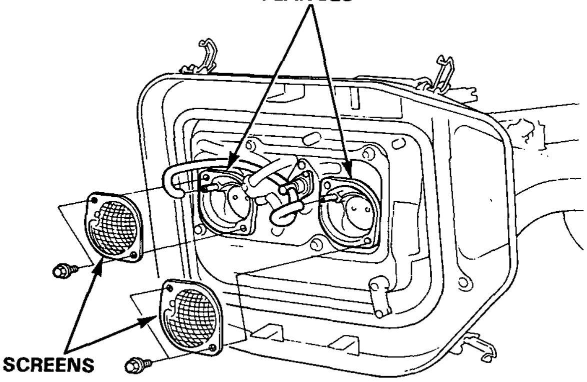
7. Tighten the screws in the sequence shown.



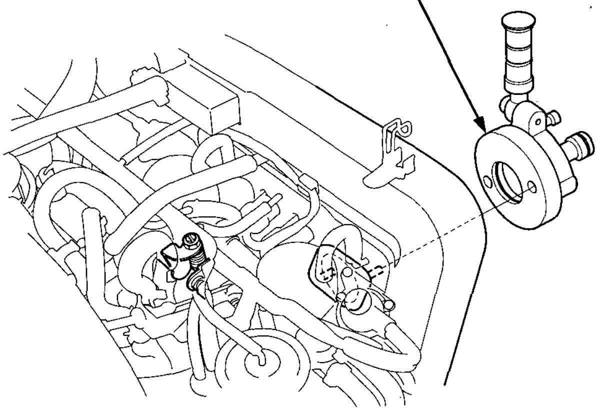
Synchronization [2-Carbureted Engine]

1. Remove the air cleaner cover and element.

2. Remove the air intake screens and air intake flanges.



3. Install the carburetor synchronizer.

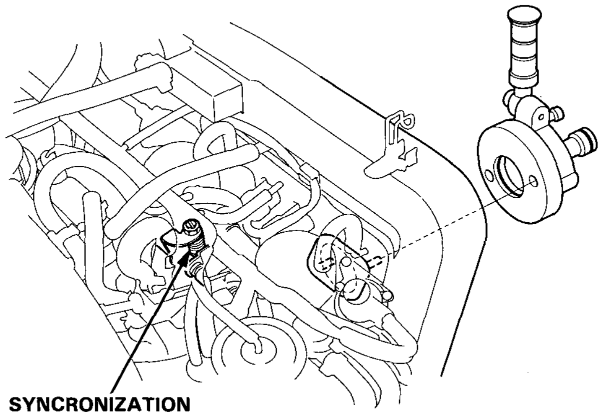


4. Connect a tachometer, start the engine and allow it to reach its normal operating temperature; the cooling fan will come on.

5. Measure the air flow using the carburetor synchronizer.

   – If the flow rates are identical, remove the synchronizer and reinstall the remaining parts in the reverse order of disassembly.

   – If the air flow rates are different, loosen the adjusting screw lock nut and adjust as necessary. The adjusting screw only affects the right carburetor; turning the screw clockwise decreases air flow and counterclockwise increases air flow. If the flow rates can't be balanced, check for air leaks or carbon build-up on a throttle valve.



6. Tighten the adjusting screw lock nut and recheck the flow rates. Adjust as necessary.

7. Remove the carburetor synchronizer and reinstall the remaiing parts in the reverse order of disassembly.

Symptom-to-sub System Chart

NOTE:
- Across each row in the chart, the sub systems that could be sources of a symptom are ranked in the order they should be inspected, starting with ①. Find the symptom in the left column, read across to the most likely source, then refer to the page listed at the top of that column. If inspection shows the system is OK, try the next system ②, etc.
- Before starting inspection, check that other items that affect engine performance are within specification. Check the self-diagnosis indicator (PGM-CARB), valve clearance, air cleaner, and PCV valve. In addition, check the ignition timing, function of the vacuum and centrifugal advance, and the condition of the spark plugs. If those items are *all* within specifications, begin with the troubleshooting listed in this page.

SYMPTOM \ SYSTEM		FUEL FILTERS	FUEL PUMP	FUEL TANK	CONTAMINATED FUEL
PAGE		144	145	147	*
ENGINE WON'T START		③	①		②
POOR PERFORMANCE	MISFIRE OR ROUGH RUNNING	①			①
	LOSS OF POWER	①			①

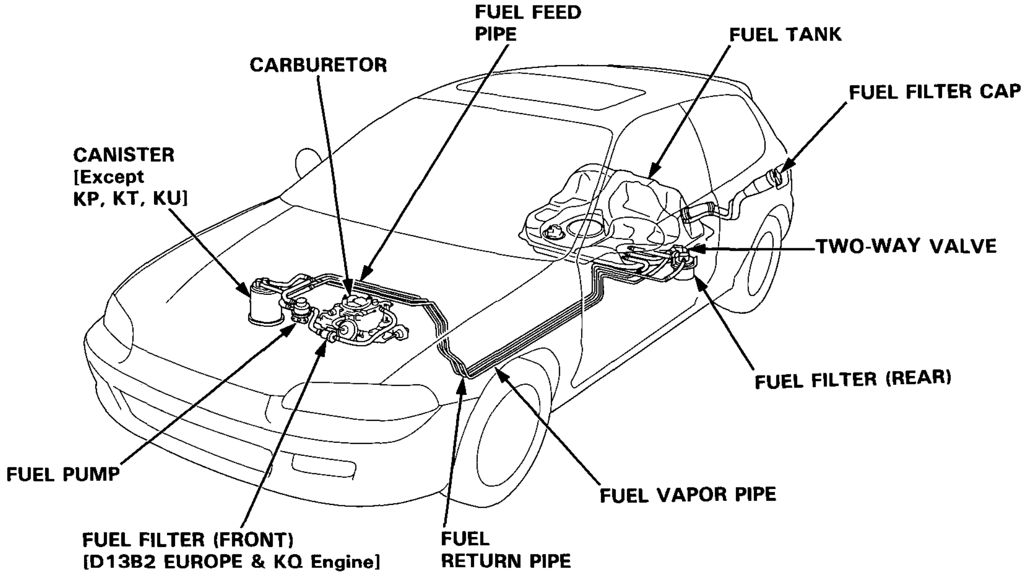
* Fuel with dirt, water or a high percentage of alcohol is considered contaminated.

System Description

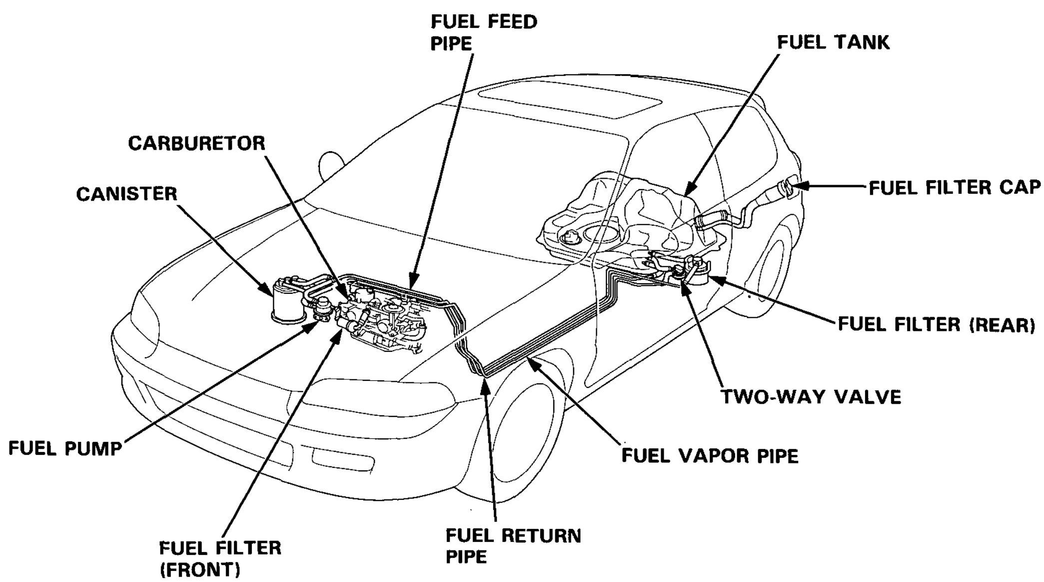
The fuel supply system consists of the fuel tank, fuel filter, fuel pump, carburetor and fuel lines.
The combinations of the carburetor and engine valiations are:

- Down-draft, two barrel type single carburetor
- Cross-flow CV constant vacuum type twin carburetor

[1-Carbureted Engine]



[2-Carbureted Engine]



Fuel Supply System

Fuel Filters

Replacement

Replace both front and rear filters at every 2 years or 40,000 km (24,000 miles) whichever comes first.

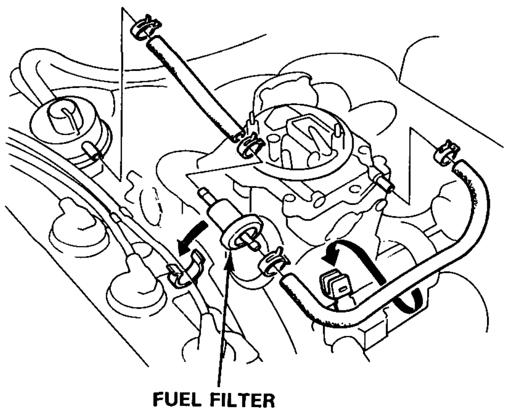
⚠WARNING Do not smoke while working on the fuel system. Keep open flame away from work area.

Front

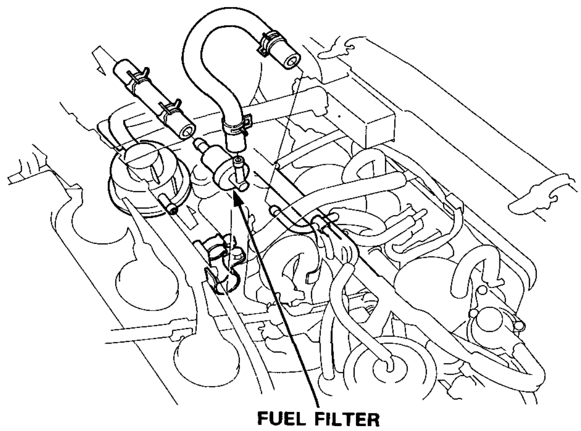
1. Use fuel line clamps to pinch off the fuel lines.
2. Disconnect the fuel lines and remove the fuel filter.

   CAUTION: When disconnecting the fuel lines, slide back the clamps then twist the lines as you pull, to avoid damaging them.
3. Install the new fuel filter.
4. Remove the fuel line clamps.

[D13B2 EUROPE & KQ Engine]



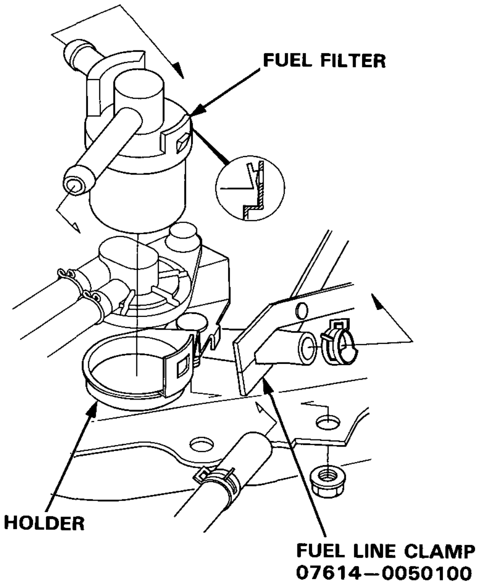
[D15B4 (KQ CARB) Engine]



Rear

1. Block front wheels. Jack up the rear of the car and support with jackstands.
2. Push in the tab of the fuel filter to release the holder, then remove the filter from its bracket.
3. Attach fuel line clamps to the fuel lines and disconnect the lines from the filter.

   CAUTION: To avoid damaging the fuel lines when disconnecting, slide back the clamps then twist the lines as you pull.
4. Install in the reverse order of removal.



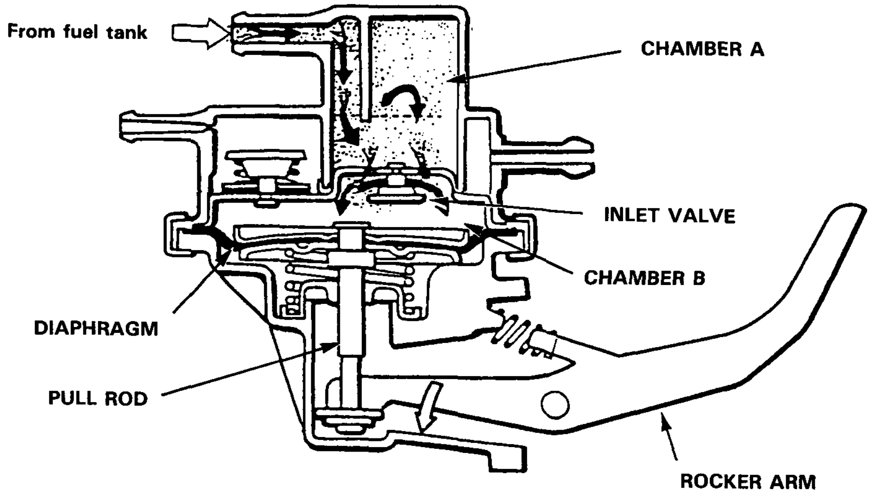
Fuel Pump

Description

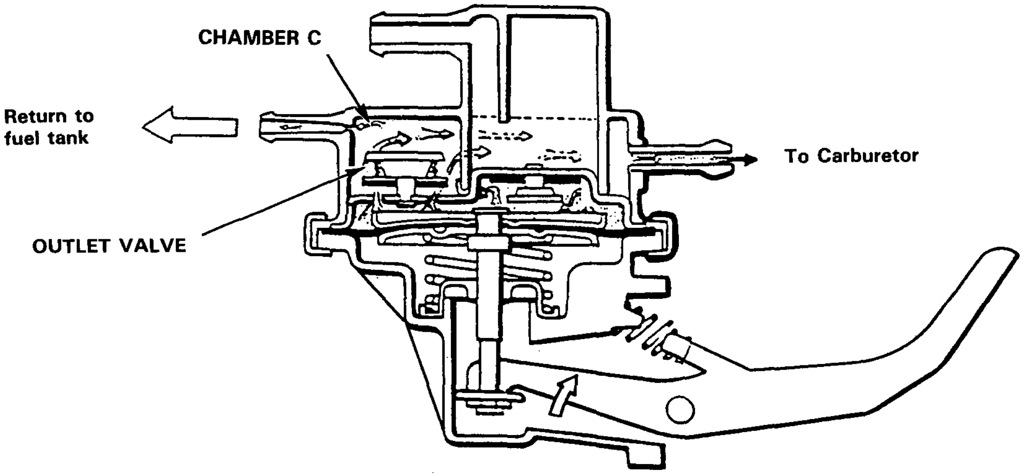
The simple mechanical fuel pump is driven by an eccentric cam on the camshaft. The pump is installed on the distributor mounting through a thick bakelite insulator to prevent heat transmission from the cylinder head.

As the camshaft rotates, the eccentric cam causes the pump rocker arm to rise and fall. When the rocker arm pulls the diaphragm down against the spring force, the inlet valve opens and allows fuel to enter from chamber A into chamber B. When the diaphragm is released by the return movement of the rocker arm, the spring forces the diaphragm upward, producing pressure in the space above the diaphragm. This pressure closes the inlet valve and opens the outlet valve. Now fuel is forced from chamber B to chamber C. The fuel from the fuel pump enters the carburetor through a float valve in the float chamber. If the chamber is full, the float valve closes to that no fuel can enter. When this happens, the fuel is forced from chamber C to the fuel tank through the fuel return line.

SUCTION



DELIVERY



(cont'd)

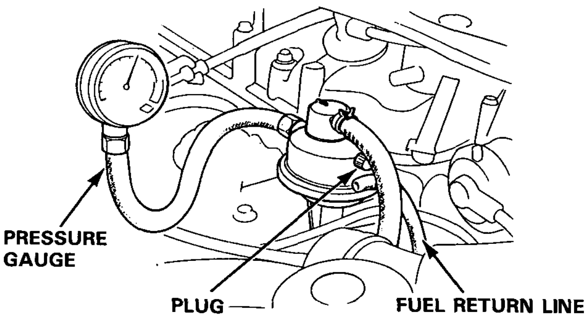
Fuel Pump (cont'd)

Testing

WARNING Do not smoke during the test. Keep any open flame away from your work area.

NOTE: Check for a clogged fuel filter and/or fuel line before checking fuel pump pressure.

1. Disconnect the fuel line at the fuel filter in the engine compartment, and connect a pressure gauge to it as shown.
2. Disconnect the fuel return line at the fuel pump and plug the return fitting with a plug.



3. Start the engine, and allow it to idle until pressure stabilizes, then stop engine.

   Pressure should be:
   6.8—22.6 kPa
   (0.07—0.23 kg/cm², 1.0—3.2 psi)

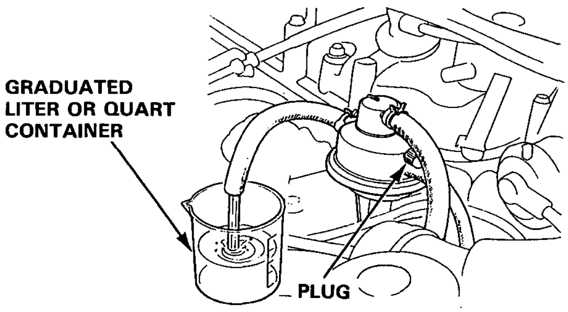
   - If gauge shows at least 6.8 kPa (0.07 kg/cm², 1.0 psi), go on to step 4.
   - If gauge shows less than 6.8 kPa (0.07 kg/cm², 1.0 psi), replace pump and re-test.

4. Remove pressure gauge and hold a graduated container under the hose.
5. Start the engine, and allow it to idle for 60 seconds, then stop the engine.

   Fuel volume should be 833.3 cm³ (27.9 oz).

   - If fuel volume is less than specified, replace the fuel pump and re-test.

   NOTE: Check for a clogged fuel filter and/or fuel line before replacing pump.



6. Remove the plug from fuel pump return fitting and reconnect return line.

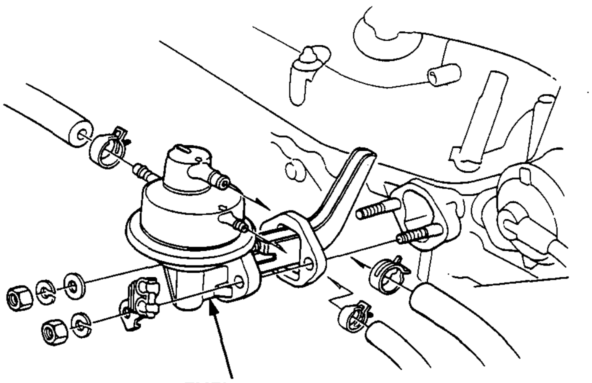
Replacement

WARNING Do not smoke while working on fuel system. Keep open flame away from work area.

1. Attach fuel line clamps to fuel pump lines.

2. Disconnect fuel lines at fuel pump.

   CAUTION: When disconnecting fuel lines, slide back clamps then twist lines as you pull, to avoid damaging them.



FUEL PUMP

3. Remove fuel pump.

4. Install in the reverse order of removal.

CAUTION: Make sure that the fuel lines are connected properly and securely.

Fuel Tank

Replacement

WARNING Do not smoke while working on fuel system. Keep open flame away from area.

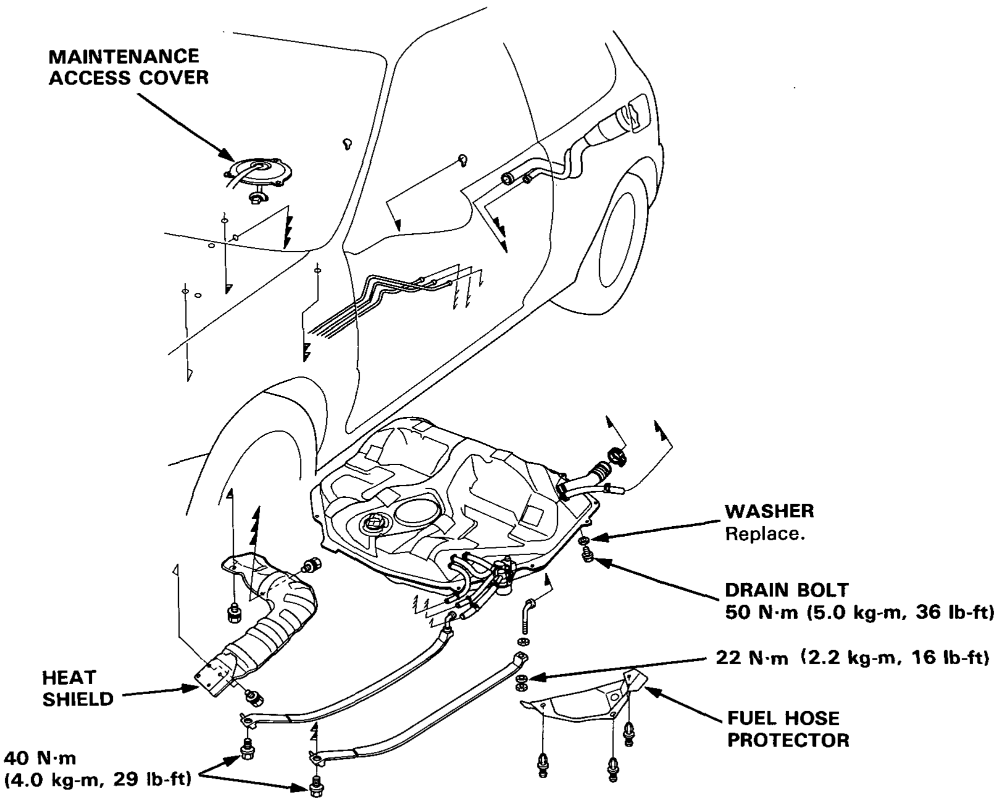
1. Block front wheels. Jack up the rear of the car and support with jackstands.
2. Remove the drain bolt and drain the fuel into an approved container.
3. Remove the rear seat (section 20).
4. Disconnect the fuel gauge sending unit connector.
5. Remove the fuel hose protector.
6. Remove the heat shield.
7. Disconnect the hoses.

   CAUTION: When disconnecting the hoses, slide back the clamps, then twist hoses as you pull, to avoid damaging them.

8. Place a jack, or other support, under the tank.
9. Remove the strap nuts and let the straps fall free.
10. Remove the fuel tank.

    NOTE: The tank may stick on the undercoat applied to its mount. To remove, carefully pry it off the mount.

11. Install a new washer on the drain bolt, then install parts in the reverse order of removal.



Air Intake System

Symptom-to-sub System Chart

NOTE:

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- Before starting inspection, check that other items that affect engine performance are within specification. Check the self-diagnosis indicator (PGM-CARB), valve clearance, air cleaner, PCV valve. In addition, check the ignition timing, function of the vacuum and centrifugal advance, and the condition of the spark plugs. If those items are all within specifications, begin with the troubleshooting listed in this page.

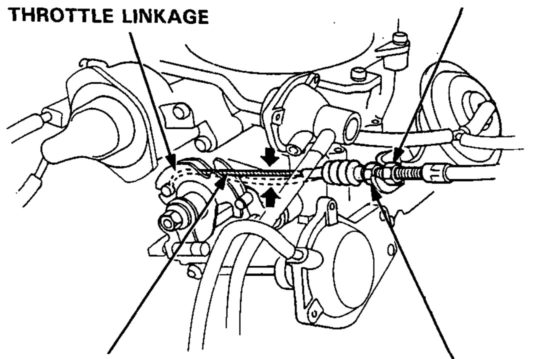
SYSTEM	THROTTLE CABLE	AIR INTAKE CONTROL
PAGE / SYMPTOM	150	152
LOSS OF POWER		①
AFTERBURN		①
HESITATION/SURGE		①

Throttle Cable

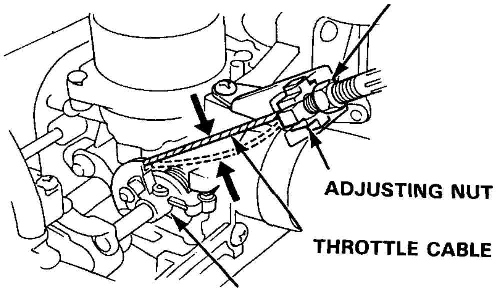
Inspection/Adjustment

1. Warm up the engine to normal operating temperature (the cooling fan comes on).
2. Check that throttle cable operates smoothly with no binding or sticking. Repair as necessary.
3. Start the engine and check cable free-play at throttle linkage at idle. Cable deflection should be 4—10 mm (3/16—3/8 in.)

[1-Carbureted Engine]



[2-Carbureted Engine]



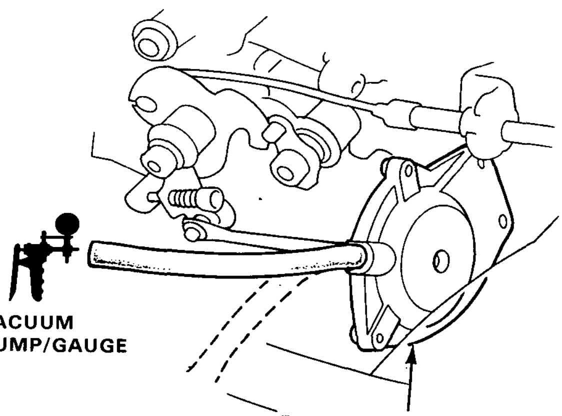
4. If deflection is not within specs, loosen locknut and turn adjusting nut until you can deflect cable as specified. Then tighten locknut.
5. With cable properly adjusted, check throttle valve to be sure it opens fully when you push accelerator pedal to the floor.

CAUTION: Check throttle valve to be sure it returns to idle position whenever you release accelerator.

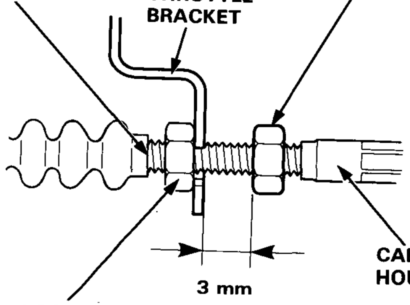
Installation

[1-Carbureted Engine]

1. Disconnect the hose from the throttle controller and connect a vacuum pump to the controller, then apply vacuum.



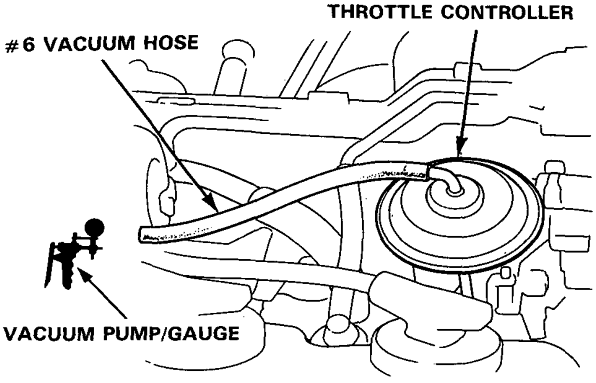
2. Fully open the throttle and choke valves, then close the throttle valve. Now, release the choke valve; the throttle linkage will be off the fast idle cam.
3. Install the throttle cable in the throttle linkage.



4. Turn the adjusting nut until it is 3 mm (1/8 in.) away from the cable bracket.
Tighten the locknut.
5. Disconnect the vacuum pump and reconnect the throttle controller hose.

[2-Carbureted Engine]

1. Disconnect the #6 vacuum hose from the throttle controller and connect a vacuum pump to the controller, the apply vacuum.

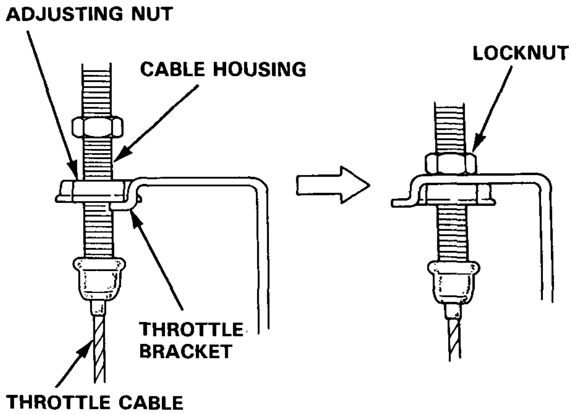


2. Fully open the throttle valve, then install the throttle cable in the throttle linkage and install the cable housing in the throttle bracket.

3. Warm up the engine to normal operating temperature (the cooling fan comes on).

4. Remove the cable housing from the throttle bracket, set the adjusting nut on the throttle bracket. Adjust the adjusting nut so that its free play is 0 mm.

5. Remove the cable housing from the throttle bracket, reset the adjusting nut and tighten the locknut.



6. Disconnect the vacuum pump and connect the #6 vacuum hose.

Air Intake System

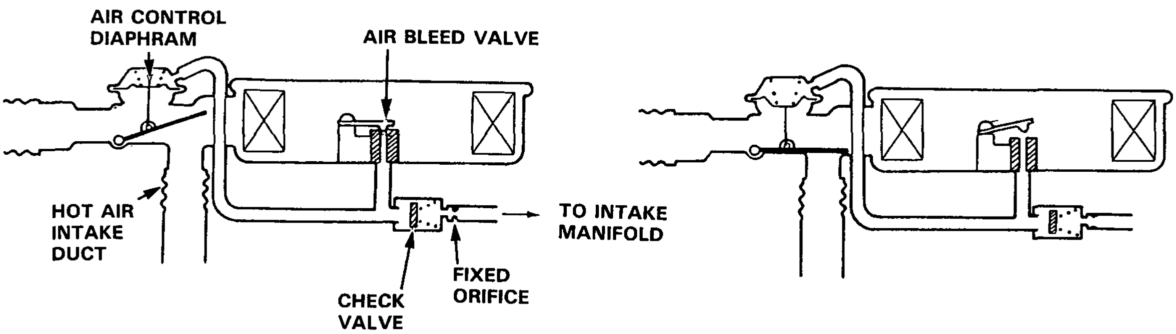
Intake Air Control System

Description

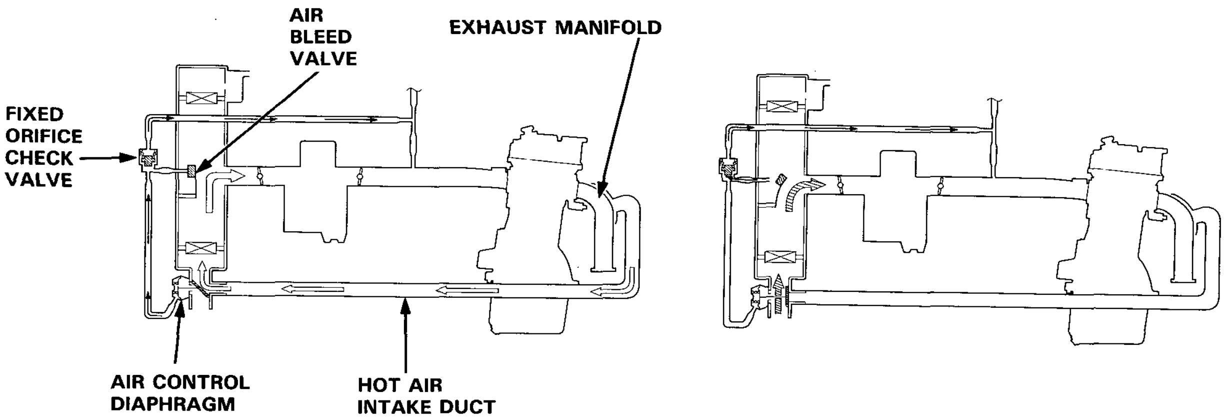
The air intake system supplies filtered, temperature-controlled air to the carburetor. It consists of the air cleaner, air intake pipe, carburetor, intake manifold and intake air control system.
The intake air control system maintains uniform air temperature inside the air cleaner (approximately 25°C, 77°F). The carburetor receives fresh air, controlled within a narrow temperature range, regardless of outside temperature.

CONDITION / PART	COLD — Below 25°C (77°F) (approx.)	HOT — Above 25°C (77°F) (approx.)
Bleed Valve	— closed, manifold vacuum builds.	— open, manifold vacuum bleeds off.
Diaphragm	— vacuum pulls up on control door.	— internal spring pushes down on control door.
Air Control Door	— rises, pre-heated air enters (outside air blocked).	— falls, outside air enters (heated air blocked).
Check Valve	— prevents vacuum loss from air control diaphragm at wide-open throttle.	
Fixed Orifice	— prevents rapid pressure changes. Allows smooth operation of control door.	

[1-Carbureted Engine]



[2-Carbureted Engine]

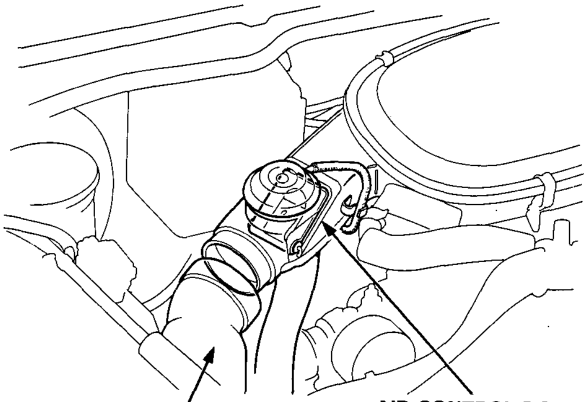


Testing (COLD ENGINE)

NOTE: Intake air temperature must be below 25°C (77°F)

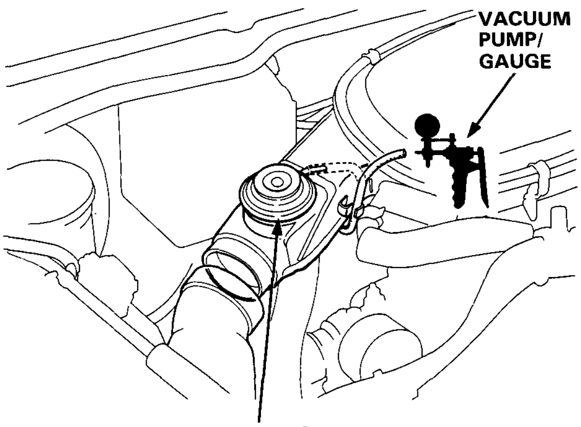
1. Disconnect the air intake duct and start the engine.

   The air control door should rise.



- If not, disconnect the vacuum hose from the air control diaphragm, and connect a vacuum pump.

  There should be vacuum.

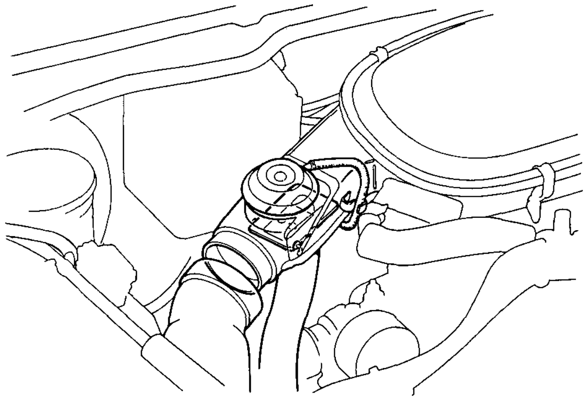


- If there is vacuum, replace the air control diaphragm and retest.
- If there is no vacuum, check the vacuum hose for proper connection, cracks, blockage or disconnected hose, and replace the air bleed valve.

Testing (HOT ENGINE)

1. Start the engine and warm up to normal operating temperature (the cooling fan comes on).

   The air control door should be down.



- If not, disconnect the vacuum hose from the air control diaphragm, and connect a vacuum pump.

  There should be no vacuum.

- If there is no vacuum, replace the air control diaphragm and retest.
- If there is vacuum, replace the air bleed valve and retest.

Emission Control System

Sympton-to-sub System Chart

NOTE:

- Across each row in the chart, the sub systems that could be sources of a symptom are ranked in the order they should be inspected, starting with ①. Find the symptom in the left column, read across to the most likely source, then refer to the page listed at the top of that column. If inspection shows the system is OK, try the next system ②, etc.
- Before starting inspection, check that other items that affect engine performance are within specification. Check the self-diagnosis indicator (PGM-CARB), valve clearance, air cleaner, and PCV valve. In addition, check the ignition timing, function of the vacuum and centrifugal advance, and the condition of the spark plugs. If those items are all within specifications, begin with the troubleshooting listed in this page.

SYSTEM / SYMPTOM		FEEDBACK CONTROL	THROTTLE CONTROL	EVAPORATIVE CONTROL
PAGE		157	162	168
ENGINE WON'T START		①		
DIFFICULT TO START ENGINE	WHEN COLD	①		
	WHEN WARM	①	②	
IRREGULAR IDLING	WHEN COLD FAST IDLE OUT OF SPECIFICATION	①	②	
	WHEN WARM ENGINE SPEED TOO HIGH		①	
	WHEN WARM ENGINE SPEED TOO LOW	①		
	ROUGH IDLE/ FLUCTUATION	①		
FREQUENT STALLING	WHILE WARMING UP	①		
	AFTER WARMING UP	①		
POOR PERFORMANCE	MISFIRE OR ROUGH RUNNING			
	LOSS OFF POWER	①		
	AFTERBURN	①	②	
	HESITATION/SURGE	①		

System Description

[D13B2 EUROPE & KQ and D15B4 (KQ CARB) Engine]
The emission control system includes the feedback control system, catalytic converter, throttle control system, positive crankcase ventilation system and evaporative control system.

[D12B1, D13B3 EXCEPT EUROPE and D15B3 Engine]
The emission control system includes the throttle control system, positive crankcase ventilation system and * evaporative control system. *: KY only

The emission control systems are designed to meet federal and state emission standards.

Tailpipe Emissions

Inspection

NOTE: It is not possible to use a CO meter to adjust the idle mixture; the effect of the catalytic converter prevents accurate tracking of such small changes in air-fuel ratio.

WARNING **Do not smoke during this procedure. Keep any open flame away from your work area.**

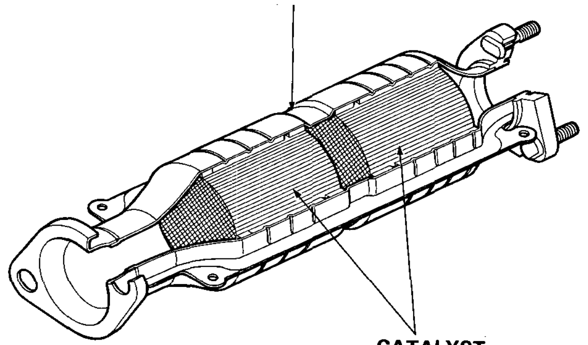
1. Follow steps the propane enrichment method (KS only).
2. Warm up and calibrate the CO meter according to the meter manufacture's instructions.
3. Check idle CO with the headlights, heater blower, rear window defogger, cooling fan, and air conditioner off.

   Specified CO%
   KQ: 0.5%
   Ex. KQ Others: 0.2%

Catalytic Converter [D13B2 EUROPE & KQ and D15B4 (KQ CARB) Engine]

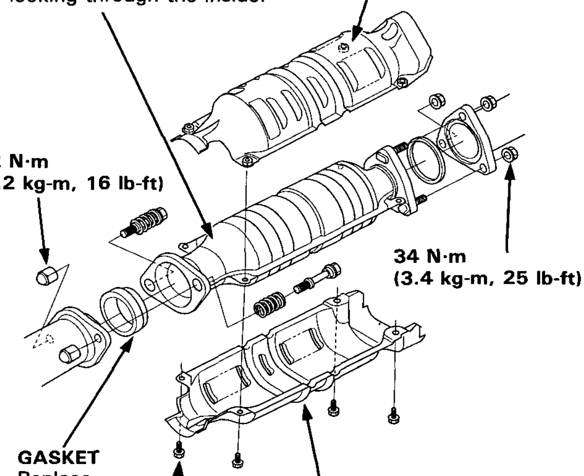
Description

The 3-way catalytic converter is used to convert hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx) in the exhaust gas, to carbon dioxide (CO_2), dinitrogen (N_2) and water vapor.



Inspection

If excessive exhaust system back-pressure is suspected, remove the catalytic converter from the car and make a visual check for plugging, melting or cracking of the catalyst. Replace the catalytic converter if any of the visible area is damaged or plugged.



Feedback Control [D13B2 EUROPE & KQ and D15B4 (KQ CARB) Engine]

Description

Air-fuel mixture ratio feedback on this vehicle is performed using the oxygen sensor, the EACV and the control unit. The oxygen sensor, sends the signal to the control unit on order to judge whether the air-fuel ratio is richer or leaner than the stoichiometric air-fuel ratio. The control unit receives other signals from speed sensor, TW sensor, vacuum switch, ignition coil, MAP sensor and TA sensor, and sends the electric current to the EACV.

The EACV opens the air passage from the air cleaner case to the intake manifold in proportion to the intensity of the electric current received from the control unit.

This feedback system has four functions:

1. air-fuel ratio control
2. shot air control
3. deceleration air supply
4. hot engine start control

1. Air-fuel ratio control

   The system is designed to achieve a stoichiometric air-fuel mixture ratio making the most of the three-way catalyst performance to give a simultaneous reduction of hydrocarbons, carbon monoxide and oxides of nitrogen. The carburetor air-fuel mixture is basically calibrated on the richer side of the stoichiometric ratio, and the air supply through the EACV dilutes the mixture for controlling the mixture close to the stoichiometric.

   The system performs feedback function in most of the driving conditions based on the output from the oxygen sensor. However, the system stops this feedback function when the engine needs richer or leaner mixture for the operating condition, such as when the vehicle is in a power mode, or when the engine is warming up.

2. Shot air control

   The system provides air into the intake manifold to improve emissions performance and prevent afterburning due to the over-rich mixture during short deceleration.

   The control unit receives signals of vehicle speed, engine coolant temperature, intake manifold vacuum and engine speed. And shot air is induced from the EACV when the manifold vacuum increases suddenly except when the vehicle is moving at a very low speed with the engine coolant temperature below the normal operating level.

   The amount of air supplied into the intake manifold depends on the amount of the manifold vacuum increase.

(cont'd)

Feedback Control [D13B2 EUROPE & KQ and D15B4 (KQ CARB) Engine]—(cont'd)

3. Deceleration air supply

This system is designed to improve emission performance by supplying air into the intake manifold during deceleration in relatively high engine speed.

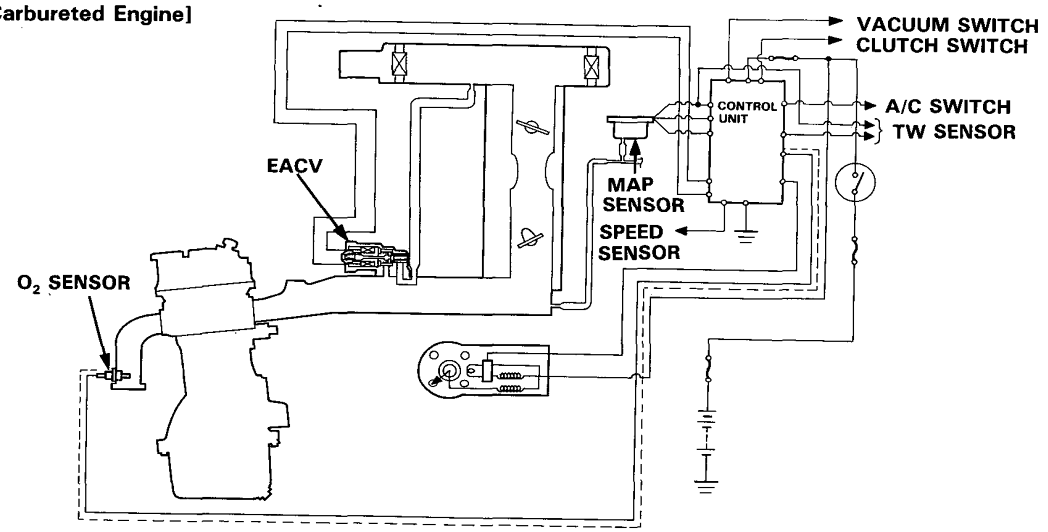
The control unit receives signals from the MAP sensor, TW sensor, speed sensor, vacuum switch, gear position switch and ignition coil, and identifies driving conditions for deceleration air supply. The control unit transmits the electric current to the EACV which opens and supplies air into the intake manifold.

4. Hot engine start control

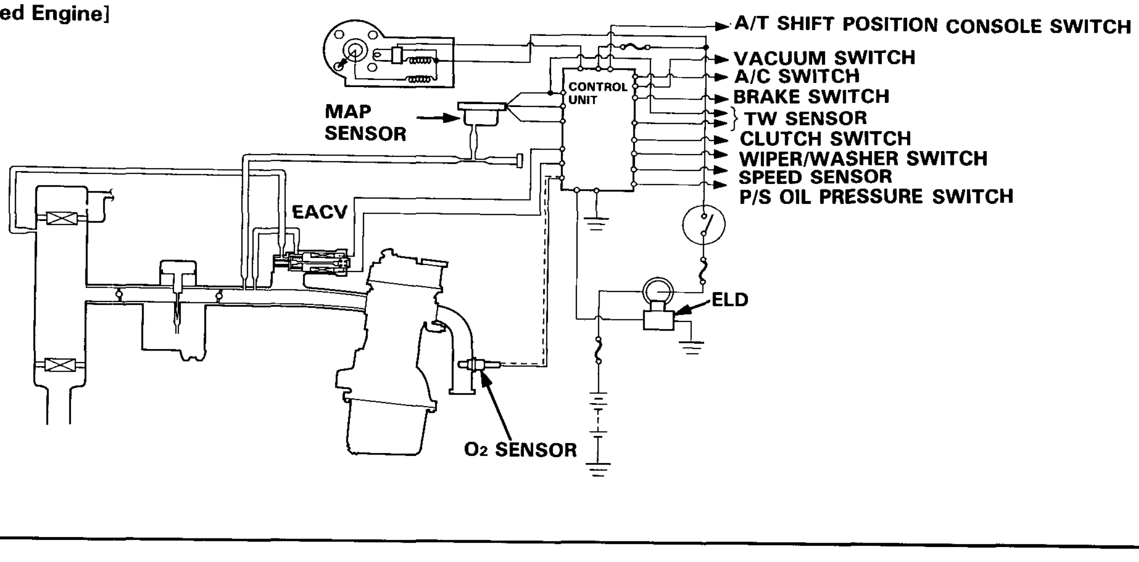
This system is designed to provide air into the intake manifold for engine starting when engine coolant temperature is very high.

The control unit receives the signal of engine coolant temperature. When it is higher than the normal temperature, the EACV is activated to supply air into the intake manifold before the vehicle speed exceeds the set speed.

[1-Carbureted Engine]



[2-Carbureted Engine]



Troubleshooting Flow Chart EACV

Inspection of EACV.

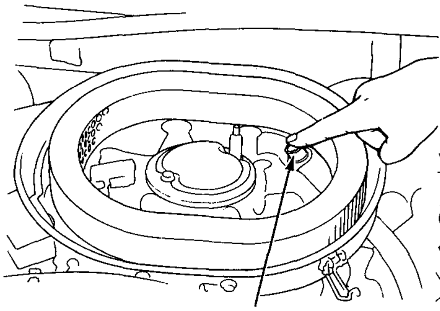
↓

Start the engine and warm up to *normal operating temperature* (the cooling fan comes on).

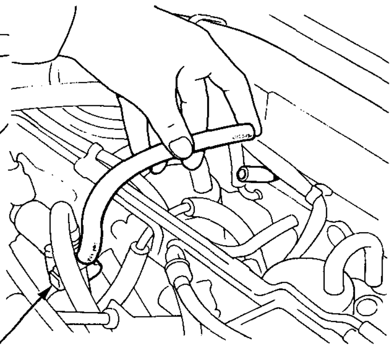
↓

[D13B2 EUROPE & KQ Engine]:
Remove the air cleaner cover.
[D15B4 (KQ CARB) Engine]:
Disconnect the EACV hose from the air cleaner.

[D13B2 EUROPE & KQ Engine]



[D15B4 (KQ CARB) Engine]



↓

Raise the engine speed to 5,000 min^{-1} (rpm)

↓

Is there vacuum ?

- YES → **Check the self-diagnosis indicator (page 11-21). If OK, replace the EACV *and retest*.**
- NO ↓

Raise the engine speed to 5,000 min^{-1} (rpm), then close the throttle suddenly.

↓

Is there vacuum ?

- NO → Check the self-diagnosis indicator (page 11-21).
  - ↓ Does LED indicate code 14 ?
    - YES → **Go to EACV trouble-shooting flowchart (page 11-160).**
    - NO → **Check the hose for proper connection, cracks, brockage or disconnected hose. If OK, replace the EACV and retest.**
- YES ↓

EACV is OK.

(cont'd)

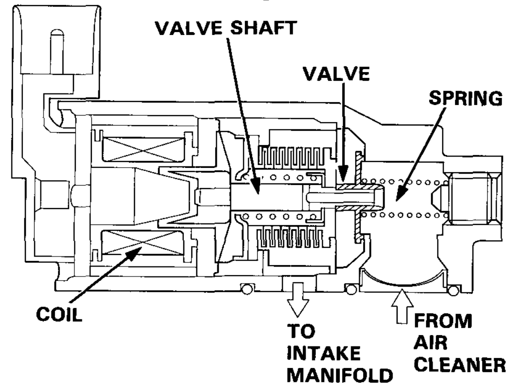
Feedback Control [D13B2 EUROPE & KQ and D15B4 (KQ CARB) Engine] — (cont'd)

Troubleshooting Flowchart EACV

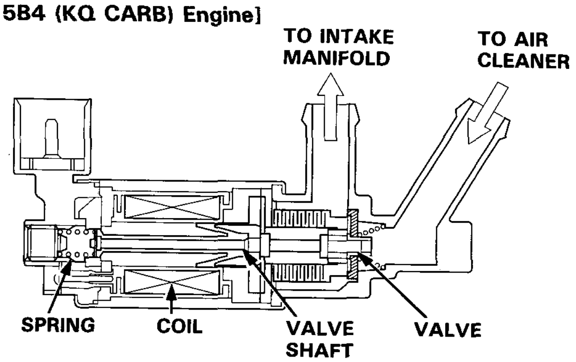
(14) Self-diagnosis LED indicator indicates CODE 14: A problem in the Electronic Air Control Valve (EACV) circuit.

The EACV opens the air passage from the air cleaner case to the intake manifold in proportion to the intensity of the electric current received from the control unit.

[D13B2 EUROPE & KQ Engine]



[D15B4 (KQ CARB) Engine]



—Engine is running.
—LED indicates CODE 14.

↓

Turn the ignition switch OFF.

↓

Remove BACK UP fuse in the under-hood relay box for 10 seconds to reset control unit.

↓

Start engine.

↓

Does LED indicates CODE 14 ?

- NO → **Intermittent failure (test driving may be necessary).**
- YES ↓

Stop engine.

↓

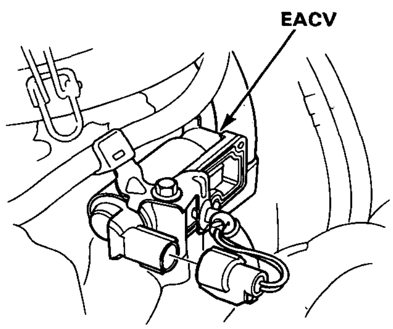
Disconnect the 2P connector on the EACV.

↓

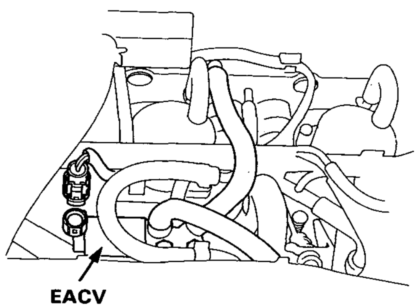
Measure resistance between the 2 terminals on the EACV.

(To page 11-161)

[D13B2 EUROPE & KQ Engine]



[D15B4 (KQ CARB) Engine]



(From page 11-160)

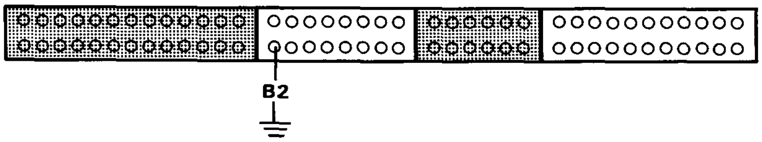
Is there 6—20 Ω ?
- NO → **Replace EACV.**
- YES ↓

Check for continuity to body ground on each terminal on the EACV.

Does continuity exist ?
- YES → **Replace EACV.**
- NO ↓

Reconnect the 2P connector to EACV.

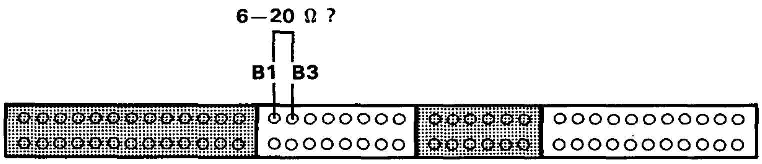
Connect the test harness between the control unit and connector. Disconnect "B" connector from the main wire harness only, not the control unit (page 11-22).



Check for continuity between B2 terminal and the body ground.

Does continuity exist ?
- NO → **Repair open in BLK wire between control unit (B2) and G101.**
- YES ↓

Measure resistance between B1 (+) terminal and B3 (−) terminal.



Is there 6—20 Ω ?
- NO → **Repair open in GRN/WHT, BLU wire between control unit (B1) and EACV or BLU/YEL, BLU/GRN wire between control unit (B3) and EACV.**
- YES ↓

Substitute a known-good control unit and recheck. If prescribed voltage is now available replace the original control unit.

Throttle Control System

Description

The throttle controller functions as a dashpot and a cranking opener. The dashpot is provided to control hydrocarbon emissions during vehicle deceleration or during shifting gears by preventing the throttle valve from shutting rapidly.

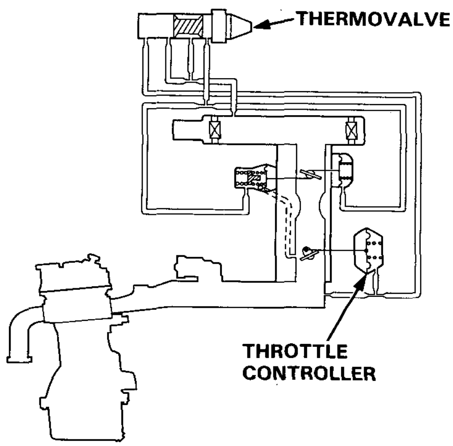
When the engine is at idle, intake manifold vacuum is applied on the diaphragm of the throttle controller through the orifice of the install pipe or solenoid valve and pulls up the diaphragm rod, so that the throttle valve is in the idle position.

After the vehicle starts to run, and as the intake manifold vacuum decreases the vacuum stored in the throttle controller leaks through the orifice of the install pipe or solenoid valve and throttle controller ceases to pull the diaphragm rod.

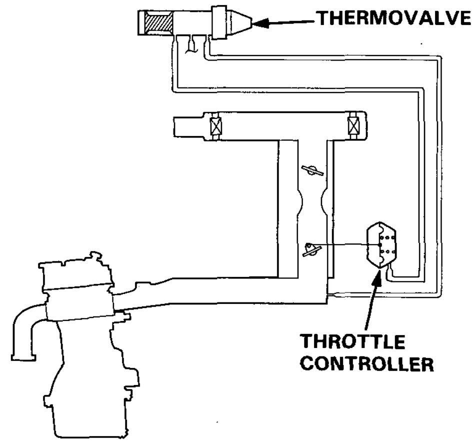
When the vehicle deceralates or when the manual transmission is shifted, the throttle valve closes rapidly to the position where the throttle valve lever is stopped with the diaphragm rod, and gradually returns to the idle position as high intake manifold vacuum slowly reaches the diaphragm of throttle controller through the orifice of install pipe or solenoid valve.

During cranking with the starter, the spring in the throttle controller pushes the throttle valve open a certain amount for assisting engine starting.

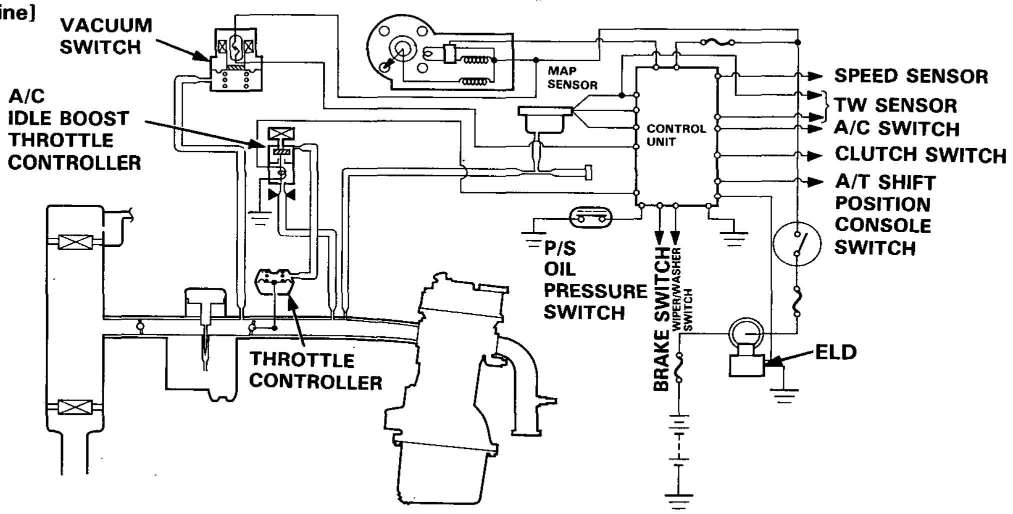
[D13B2 ERUOPE & KQ Engine]



[D12B1, D13B3 EXCEPT EUROPE and D15B3 Engine]



[D15B4 (KQ CARB) Engine]



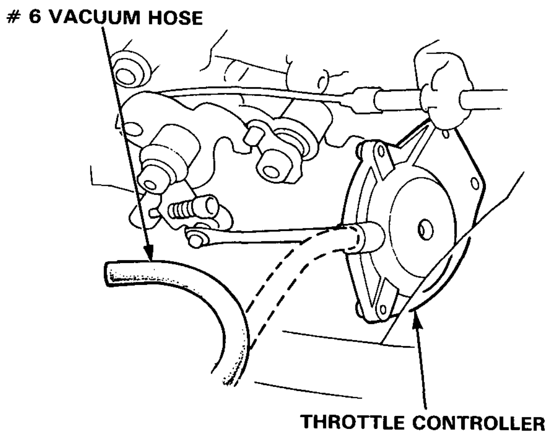
Testing (HOT ENGINE)

1. Start the engine and warm up to normal operating temperature (the cooling fan comes on).
2. Disconnect the #6 vacuum hose from the throttle controller and check the engine speed.

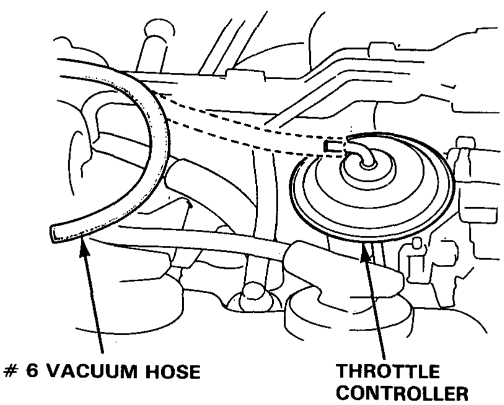
   Engine speed should be:

Manual	2,200 ± 500 min^{-1} (rpm)
Automatic	1,900 ± 500 min^{-1} (rpm)

[1-Carbureted Engine]

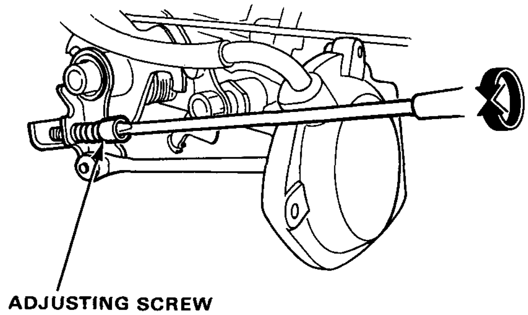


[2-Carbureted Engine]

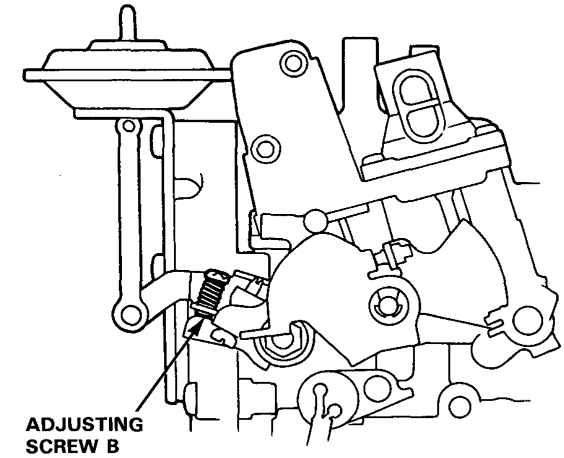


- If the engine speed is excessively high, adjust by turning the adjusting.

[1-Carbureted Engine]



[2-Carbureted Engine]



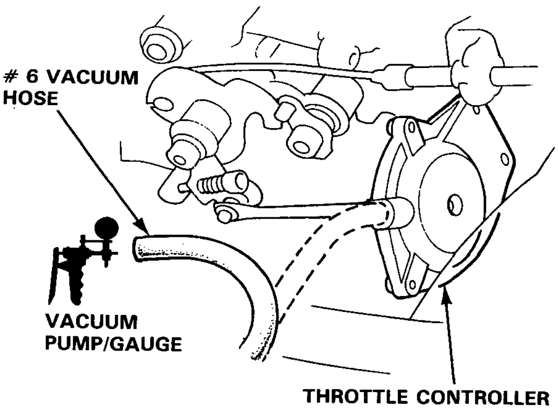
- If the engine speed does not change, connect a vacuum pump to the #6 vacuum hose and check vacuum.

  There should be vacuum.

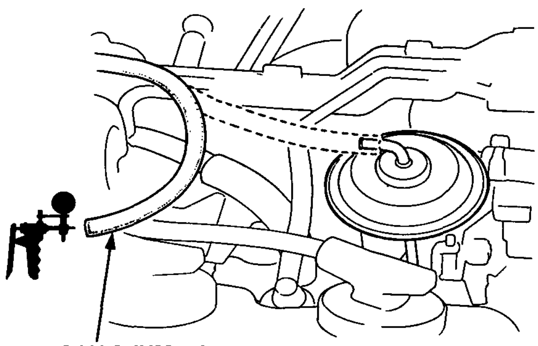
(cont'd)

Throttle Control System (cont'd)

[1-Carbureted Engine]



[2-Carbureted Engine]



- If there is no vacuum;
  1-Carbureted Engine:
  check the #6 vacuum hose for proper connection, cracks, blockage or disconnected hose and replace the thermovalve.
  2-Carbureted Engine:
  check the #6, #12 vacuum hose for proper connection, cracks, blockage or disconnected hose. If OK, go to A/C idle boost solenoid valve troubleshooting (page 11-79).
- If there is vacuum, replace the throttle controller and retest.

3. Reconnect the #6 vacuum hose and check the idle speed.

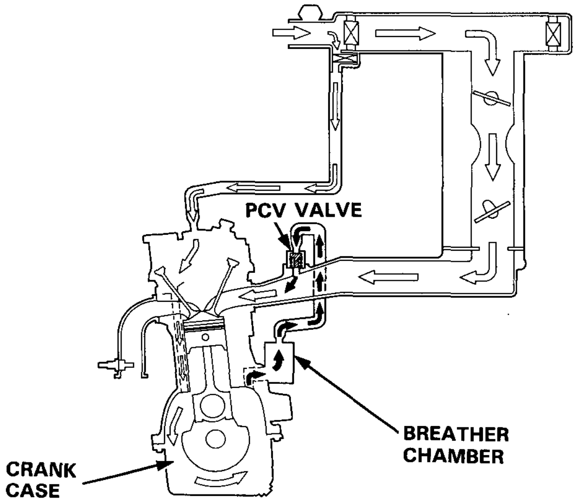
   Idle speed should be within specification (page 11-104).

Positive Crankcase Ventilation

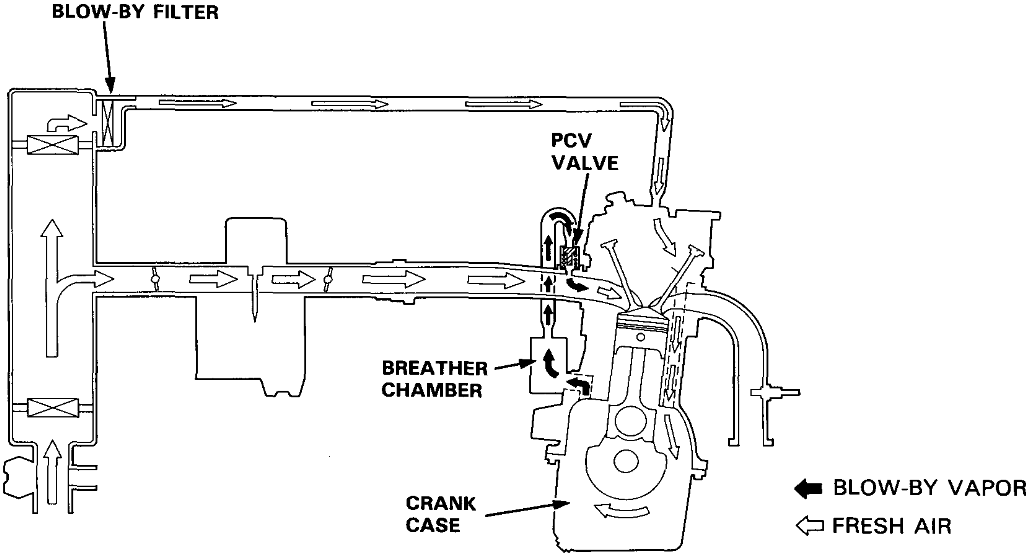
Description

A positive crankcase ventilation (P.C.V.) system is used to vent oil-contaminating blow-by gas from the crankcase back through the air intake system. A baffled chamber separates oil particles from the blow-by gas, to prevent the intake system from being soiled or contaminated.
In proportion to the negative pressure on the intake manifold, the P.C.V. valve installed at the exit part of the breather chamber is lifted and the blow-by gas is sucked directly into the manifold.

[1-Carbureted Engine]



[2-Carbureted Engine]



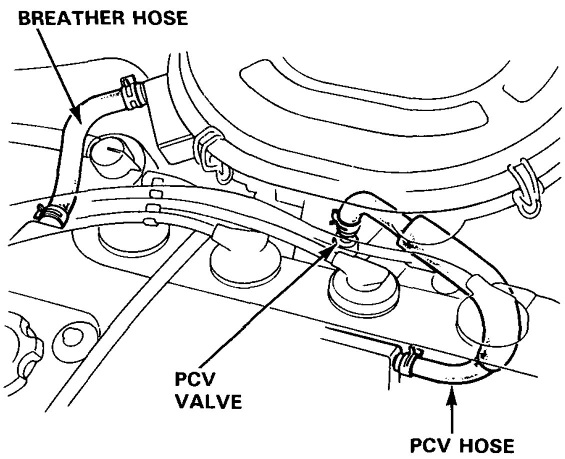
(cont'd)

Positive Crankcase Ventilation (cont'd)

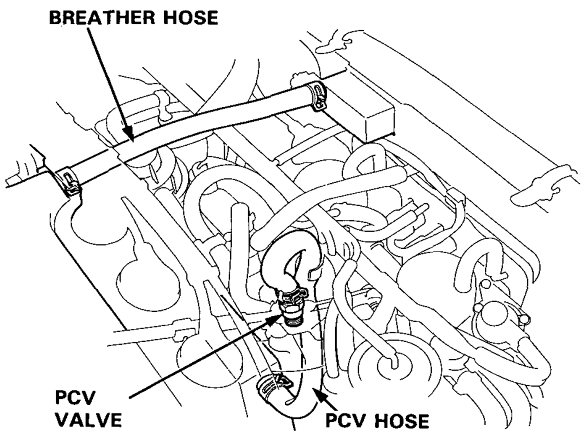
PCV Valve Test

1. Check the crankcase ventilation hoses and connections for leaks and clogging.

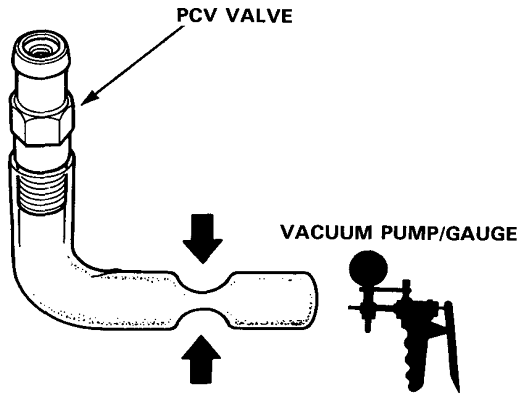
[1-Carbureted Engine]



[2-Carbureted Engine]



2. Remove the PCV valve from the intake mainfold and connect a vacuum pump.



3. Pinch the hose as illustrated above, apply 400—500 mmHg (16—20 in. Hg) of vacuum, unpinch the hose and promptly check for a clicking sound at the PCV valve.

   - If no clicking sound is heard, replace PCV valve and recheck.

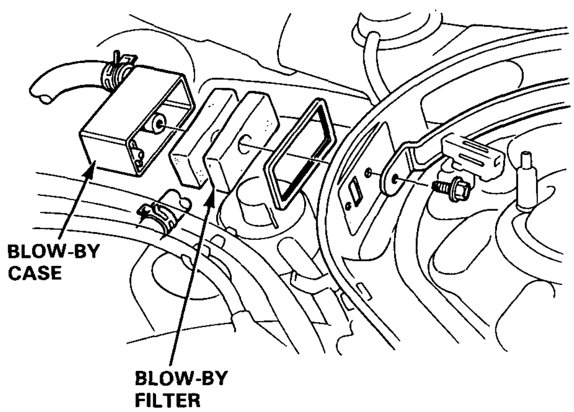
Blow-by Filter Test

Inspect the condition of the blow-by filter.

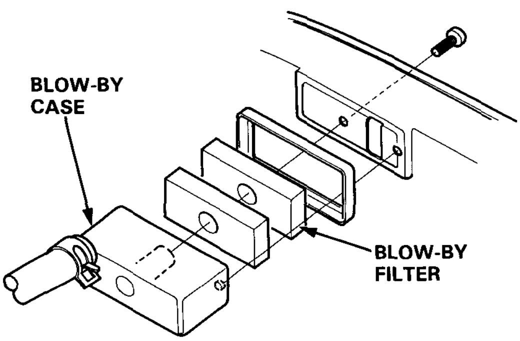
- Replace the filter in the following instances:

— When the filter is stuck fast and oil is dripping or seeping through.
— When the filter is covered with dust and dirt so that clogging is evident.

[1-Carbureted Engine]



[2-Carbureted Engine]



Evaporative Emission Control [D13B2 EUROPE & KQ, D15B3 (KY) and D15B4 (KQ CARB) Engine]

Description

[1-Carbureted Engine]

The evaporative controls are designed to minimize the amount of fuel vapor escaping to the atmosphere. The system consists of the following components.

A. Charcoal Canister

A canister for the temporary storage of fuel vapor until the fuel vapor can be purged from the canister into the engine and burned.

B. Vapor Purge Control System

Canister purging is accomplished by drawing fresh air through the canister and into the carburetor. The ported vacuum is controlled by the purge control diaphragm valve and the *purge cut-off solenoid valve.

*: D13B2 EUROPE & KQ Engine

C. Fuel Tank Vapor Control System

The Fuel Cut-Off Valve and Liquid Vapor Separator prohibit liquid fuel entering the two-way valve. When fuel vapor pressure in the fuel tank is higher than the set value of the two-way valve, the valve opens and regulates the flow of fuel vapor to the canister.

D. Air Vent Cut-Off Diaphragm

When the engine is not running, the air vent passage in the float chamber is cut-off by the valve attached to the diaphragm so that fuel vapor in the float chamber can be vented into the charcoal canister. When the engine is running, manifold vacuum holds the cut-off diaphragm open. * The vacuum holding solenoid valve stabilizes the manifold vacuum at the diaphragm.
** The air vent cut-off solenoid valve controls the manifold vacuum of the diaphragm.

*: D13B2 EUROPE & KQ Engine
**: D15B3 (KY) Engine

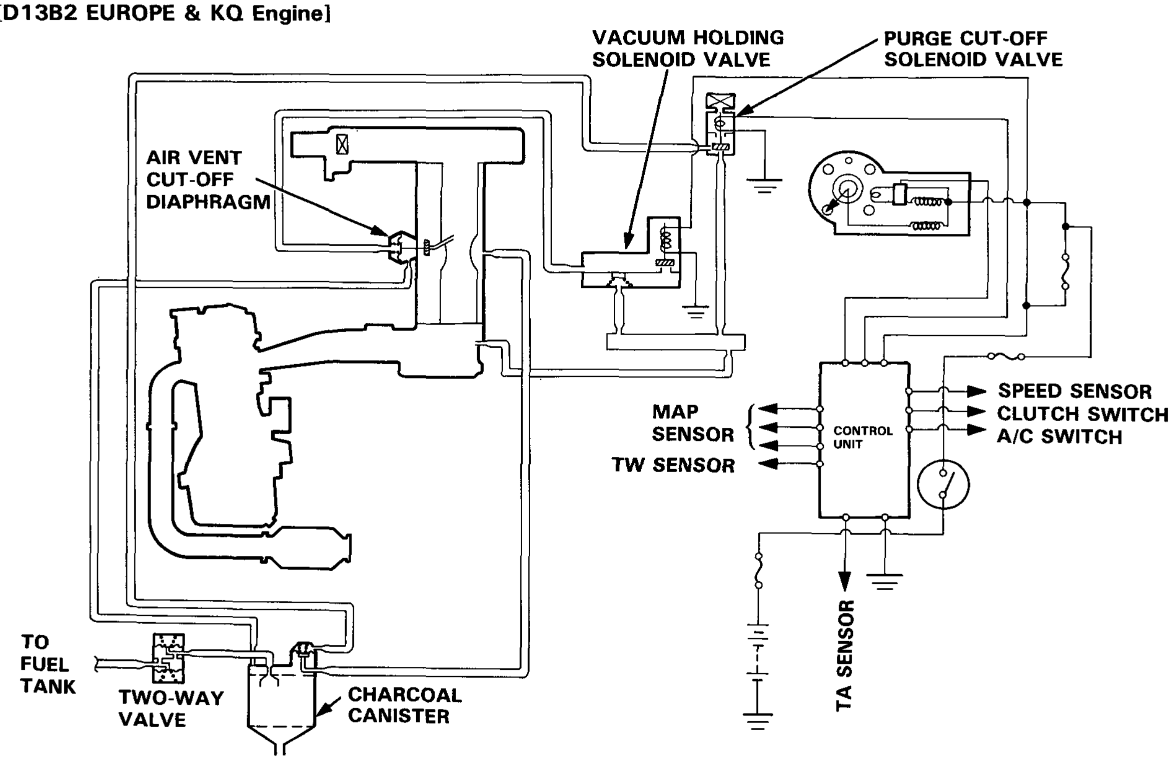
E. Fuel Filler Cap

A two-way valve in the fuel filter cap acts as a safety device if the evaporative control system malfunctions.

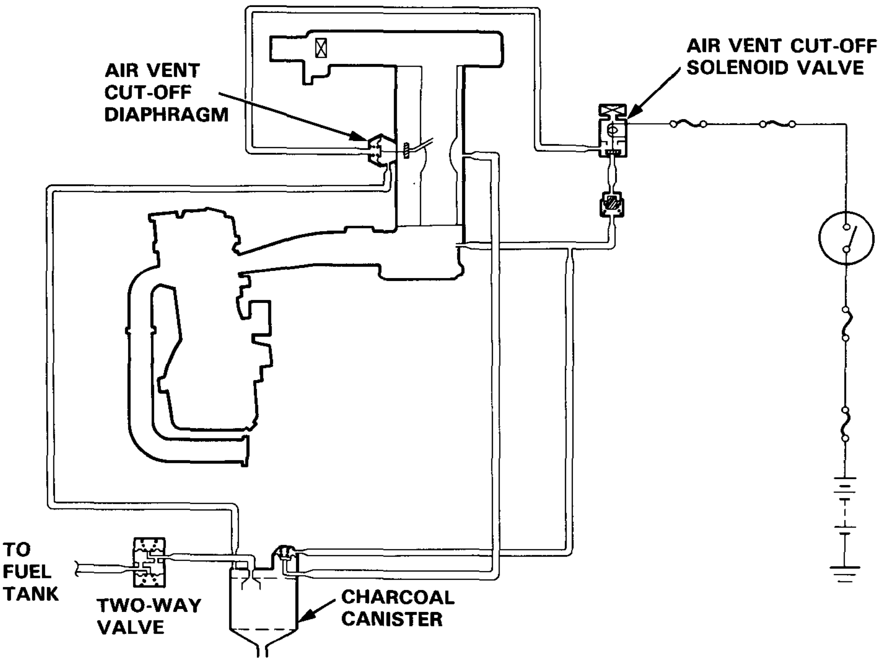
F. Carburetor Fuel Cut-Off

When the engine is not running, the fuel passages for the slow primary fuel metering system are cut-off by a solenoid valve so that fuel in the float chamber cannot enter the carburetor bore.

[D13B2 EUROPE & KQ Engine]



[D15B3 (KY) Engine]



(cont'd)

Evaporative Emission Control [D13B2 EUROPE & KQ, D15B3 (KY) and D15B4 (KQ CARB) Engine] (cont'd)

[2-Carbureted Engine]

The evaporative controls are designed to minimize the amount of fuel vapor escaping to the atmosphere. The system consists of the following components.

A. Charcoal Canister

A canister for the temporary storage of fuel vapor until the fuel vapor can be purged from the canister into the engine and burned.

B. Vapor Purge Control System

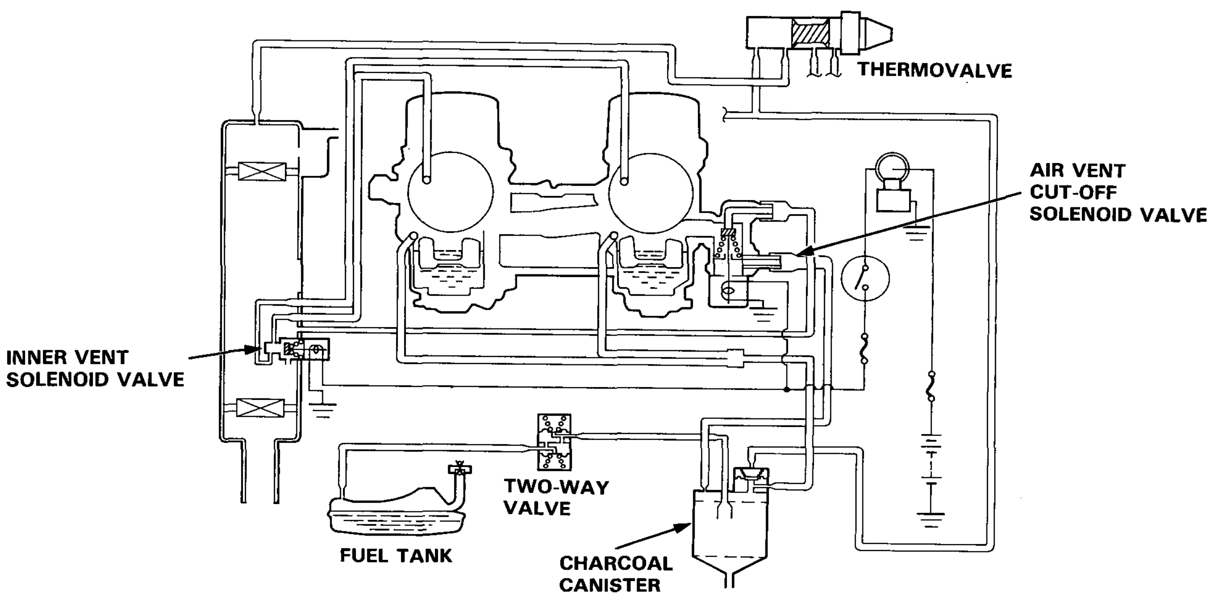
Canister purging is accomplished by drawing fresh air through the canister and into a port on the throttle body. The ported vacuum is controlled by the Purge Control Diaphragm Valve.
When the coolant temperature is above 55°C the thermovalve directs manifold vacuum to the purge control diaphragm valve.
When the coolant temperature is below 55°C the thermovalve does not provide manifold vacuum to the purge control diaphragm valve.

C. Fuel Tank Vapor Control System

The Fuel Cut-Off Valve and Liquid Vapor Separator prohibit liquid fuel entering the two-way valve.
When fuel vapor pressure in the fuel tank is higher than the set value of the two-way valve, the valve opens and regulates the flow of fuel vapor to the canister.

D. Carburetor Vapor Control System

The air vent cut-off solenoid valve regulates air flow to the carburetor float bowls. When the ignition switch is turned OFF the outer air vent passage opens, so that fuel vapor in the float bowls can be vented into the charcoal canister.
When the ignition switch is turned ON the air vent cut-off solenoid valve opens the inner air vent passage, so that fuel vapor in the float bowls can be vented into the air cleaner.
There is also an inner vent solenoid valve to control air flow to the carburetor float bowls. When the ignition switch is turned ON the inner vent solenoid valve normaly opens the sub inner air vent passage, but will only allow fuel vapor to be vented to the air cleaner.

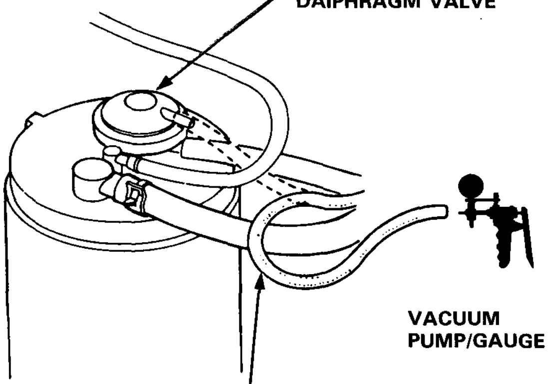


Testing (COLD ENGINE)

[D13B2 EUROPE & KQ and D15B4 (KQ CARB) Engine]

NOTE: Engine coolant temperature most be below 55°C (131°F).

1. Disconnect the #7 vacuum hose at purge control diaphragm valve and connect vacuum pump/gauge to the hose.



2. Start the engine and allow to idle.

   There should be no vacuum.

   - If there is no vacuum, go to hot engine test (next column).
   - If there is vacuum;

     [D13B2 EUROPE & KQ Engine]:

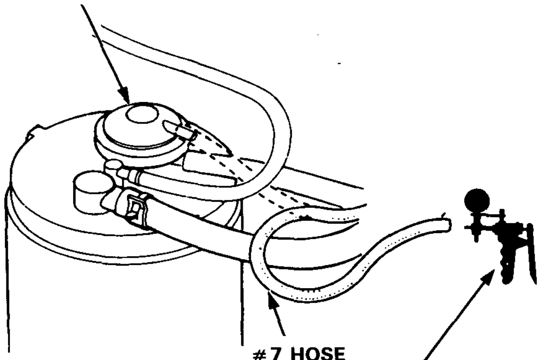
     go to purge cut-off solenoid valve trouble-shooting (page 11-174).

     [D15B4 (KQ CARB) Engine]:

     replace the thermovalve and retest.

Testing (HOT ENGINE)

1. Disconnect the #7 vacuum hose at the purge control diaphragm valve and connect a vacuum pump/gauge to the hose.



2. Start the engine and warm up to normal operating temperature (the cooling fan comes on).

   There should be vacuum.

   - If there is vacuum, go to step 3.
   - If there is no vacuum;

     [D13B2 EUROPE & KQ Engine]:

     go to purge cut-off solenoid valve trouble-shooting (page 11-174).

     [D15B3 (KY) Engine]:

     check the # 7 vacuum hose for proper connection, cracks, brockage or disconnected hose.

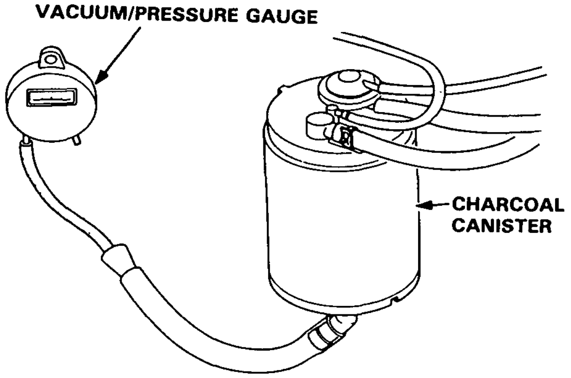
     [D15B4 (KQ CARB) Engine]:

     replace the thermovalve and retest.

(cont'd)

Evaporative Emission Controls [D13B2 EUROPE & KQ, D15B3 (KY) and D15B4 (KQ CARB) Engine] (cont'd)

3. Disconnect a vacuum pump/gauge and reconnect hose.
4. Remove fuel filter cap.
5. Remove the canister purge air hose from frame and connect hose to a vacuum gauge as shown.



6. Raise engine speed to 3,500 min^{-1} (rpm).

   Vacuum should appear on the gauge within 1 minute.

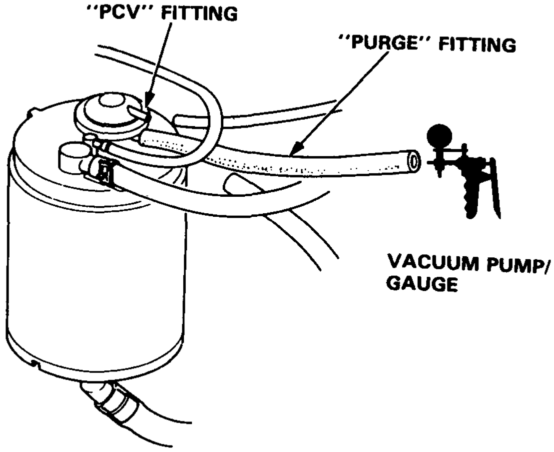
   - If vacuum appears on the gauge in 1 minute, remove the gauge and go on to step 8.
   - If no vacuum, disconnect the vacuum gauge and reinstall the fuel filler cap.

7. Remove the charcoal canister and check for signs of damage.

   - If damaged, replace the canister.
   - If OK, go on to step 8.

8. Stop the engine. Disconnect the hose from the canister PCV fitting.
   Connect a vacuum pump to the canister PURGE fitting as shown, and apply vacuum.

   Vacuum should remain steady.



   - If vacuum remains steady, go on to step 7.
   - If vacuum drops, replace the canister and retest.

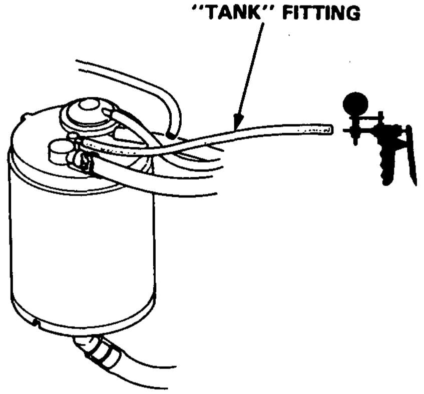
9. Restart the engine. Reconnect the hose to the canister PCV fitting.

   PURGE side vacuum should drop to zero.

   - If PURGE side vacuum does not drop to zero, replace the canister and retest.

10. Connect a vacuum pump to TANK fitting as shown, and apply vacuum.

    If should not hold vacuum.

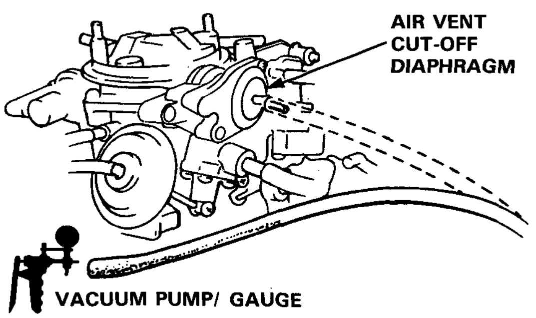


- If it does not hold vacuum, reinstall fuel filler cap and canister; test is complete.
- If it holds vacuum, replace canister and retest.

Air Vent Cut-off Diaphragm

[D13B2 EUROPE & KQ and D15B3 (KY) Engine]

1. Disconnect the #8 vacuum hose at the air vent cut-off diaphragm and install a vacuum pump/gauge to the hose.



2. Apply vacuum. Vacuum should not be held.
3. Turn ignition switch on.
4. Apply vacuum. Vacuum should remain steady.
   - If vacuum holds go no to step 5.
   - If vacuum does not hold, check the #8, #12 vacuum line for proper connection, cracks or disconnected hose.

     [D13B2 EUROPE & KQ Engine]:

     If OK, go to the air vent cut-off solenoid valve troubleshooting (page 11-176).

     [D15B3 (KY) Engine]:

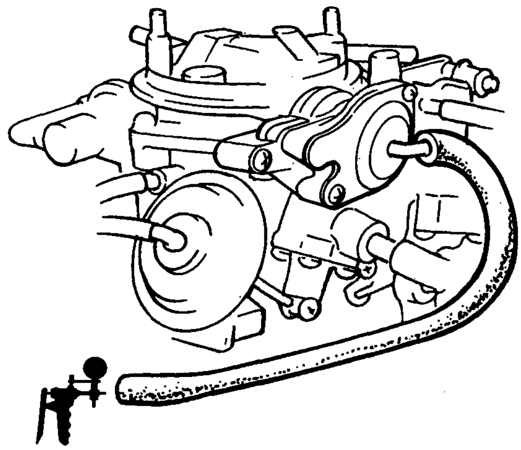
     If OK, go to the vacuum holding solenoid valve troubleshooting (page 11-178).
5. Start engine allow to idle and check for vacuum. Vacuum should be available.
   - If vacuum is available, go to step 6.
   - If vacuum is not available, check the #8, #12 vacuum line for proper connection, crocks or disconnected hose.

     [D13B2 EUROPE & KQ Engine]:

     If OK, go to the air vent cut-off solenoid valve troubleshooting (page 11-176).

     [D15B3 (KY) Engine]:

     If OK, go to the vacuum holding solenoid valve troubleshooting (page 11-178).
6. Turn ignition off. Vacuum should drop to zero.
7. Disconnect the vacuum pump from vacuum holding solenoid valve hose and connect to air vent cut-off diaphragm. Apply vacuum.



Vacuum should remain steady.

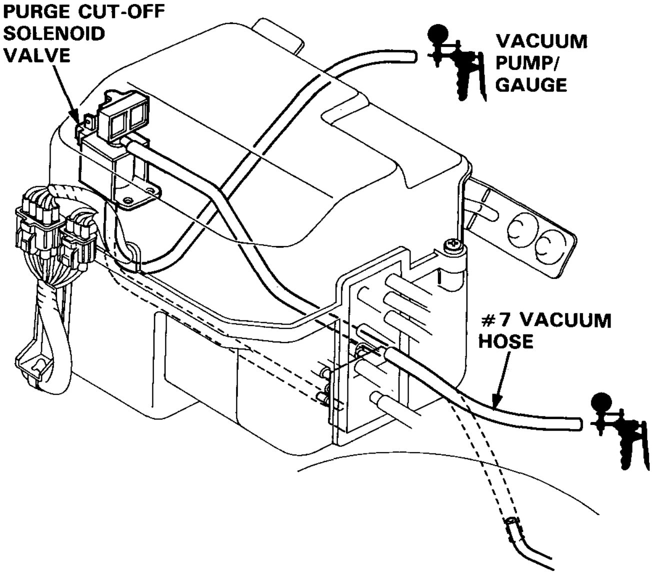
- If vacuum remains stable, diaphragm is OK.
- If vacuum decrease, replace diaphragm and retest.

Evaporative Emission Controls [D13B2 EUROPE & KQ, D15B3 (KY) and D15B4 (KQ CARB) Engine] (cont'd)

Troubleshooting Flowchart **Purge Cut-off Solenoid Valve**

When the engine coolant temperature is above the set temperature of the TW sensor, the purge cut-off solenoid valve is activated by the control unit receiving signals from each sensor.

[D13B2 EUROPE & KQ Engine]



Inspection of Purge Cut-off Solenoid valve.

Open the control box.

Disconnect the lower vacuum hose of the solenoid valve from the joint and connected a vacuum pump.

Disconnect the #7 vacuum hose from the joint and connect a vacuum gauge.

Start the engine.

Apply vacuum.

NOTE: Engine coolant temperature must be below 55°C (131°F).

Is vacuum indicated on the gauge?

YES → Turn the ignition switch OFF.

Disconnect the connector on the control box.

Start the engine.

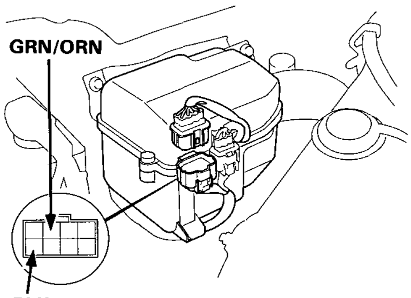
Measure voltage GRN/ORN (+) terminal and BLK terminal.

Is there battery voltage ?

YES → **Replace the solenoid valve.**

NO → Measure voltage GRN/ORN (+) terminal and body ground.

(To page 11-175)



NO (Is vacuum indicated on the gauge?) → Warm up to normal operating temperature (the cooling fan comes on).

(To page 11-175)

(From page 11-174)

(From page 11-174)

Is there battery voltage?

YES → **Repair open in BLK wire between the solenoid valve and G201 (RHD: G301)**

NO → **Check the self-diagnosis indicator (page 11-21). If OK, inspect open in GRN/ORN wire between the solenoid valve and control unit (B12).**

Is vacuum indicated on the gauge?

YES → **Purge Cut-off Solenoid Valve is OK.**

NO ↓

Turn the ignition switch OFF.

Disconnect the connector on the control box.

Start the engine.

Measure voltage between GRN/ORN (+) terminal and BLK (−) terminal.

Is there voltage ?

YES → **Check the self-diagnosis indicator (page 11-21). If OK, substitute a known-good control unit and retest. If symptom goes away, replace the original control unit.**

NO → **Replace the solenoid valve.**

(cont'd)

Evaporative Emission Controls [D13B2 EUROPE & KQ, D15B3 (KY) and D15B4 (KQ CARB) Engine] (cont'd)

Troubleshooting Flow Chart **Vacuum Holding Solenoid Valve**

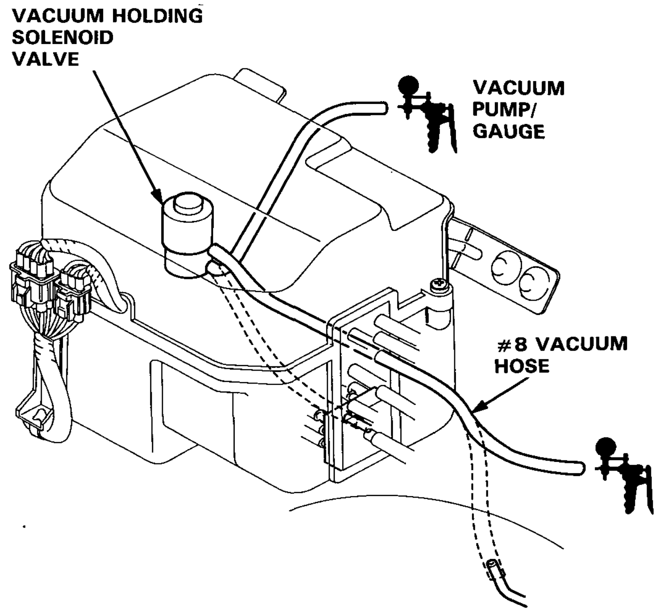
When the engine is not running, the air vent passage in the float chamber is cut-off by the valve attached to the diaphragm so that fuel vapor in the float chamber can be vented into the charcoal canister. When the engine is running, manifold vacuum holds the cut-off diaphragm open. The vacuum holding solenoid valve stabilizes the manifold vacuum at the diaphragm.

[D13B2 EUROPE & KQ Engine]

Inspection of Vacuum Holding Solenoid Valve.

Disconnect the #8 vacuum hose from the vacuum hose manifold and connect a vacuum pump.

Disconnect the lower hose of the solenoid valve from the joint.



Apply 100 mmHg (4 in. Hg) vacuum to the hose.

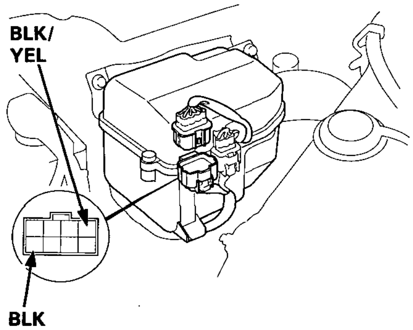
Does solenoid valve hold vacuum?
- YES → **Replace the solenoid valve.**
- NO ↓

Turn the ignition switch ON.

Does solenoid valve hold vacuum?
- YES → **Vacuum Holding Solenoid Valve is OK.**
- NO ↓

Turn the ignition switch OFF.

Disconnect the 8P connector on the control box.



Measure voltage between BLK/YEL (+) terminal and BLK (−) terminal.

Is there battery voltage?
- YES → **Replace the solenoid valve.**
- NO ↓

(To page 11-177)

(From page 11-176)

Measure voltage between BLK/YEL (+) terminal and body ground.

Is there battery voltage?

NO → **Repair open in BLK/YEL wire between the ignition switch and the connector as well as ACG(S) fuse.**

YES → **Repair open in BLK wire between the solenoid valve and G201 (RHD: G301).**

(cont'd)

Emission Control System

Evaporative Emission Controls [D13B2 EUROPE & KQ, D15B3 (KY) and D15B4 (KQ CARB) Engine] (cont'd)

Troubleshooting Flow Chart **Air Vent Cut-off Solenoid Valve**

When the engine is not running, the air vent passage in the float chamber is cut-off by the valve attached to the diaphragm so that fuel vapor in the float chamber can be vented into the charcoal canister. When the engine is running, manifold vacuum holds the cut-off diaphragm open. The air vent cut-off solenoid valve controls the manifold vacuum at the diaphragm.

[D15B3 (KY) Engine]

Inspection of Air Vent Cut-off Solenoid Valve.

↓

Disconnect the #8 vacuum hose from the vacuum hose manifold and connect a vacuum gauge.

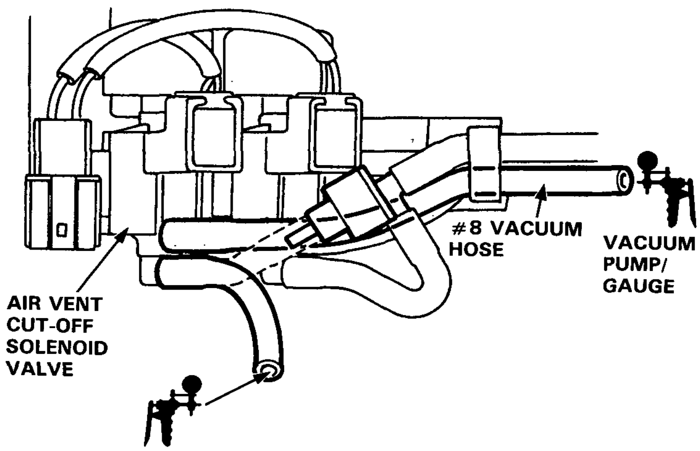
↓

Disconnect the #12 vacuum hose from the joint and connect a vacuum pump.

↓

Apply 100 mmHg (4 in. Hg) vacuum to the hose.

↓



Is vacuum indicated on the gauge?

- YES → **Replace the solenoid valve.**
- NO ↓

Turn the ignition switch ON.

↓

Apply 100 mmHg (4 in.Hg) vacuum to the hose.

↓

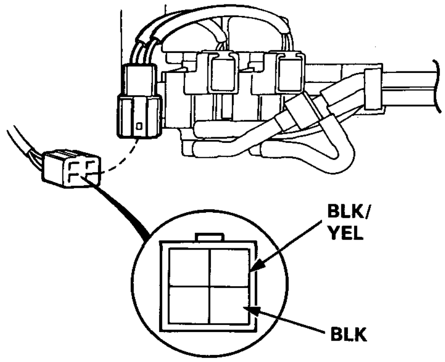
Is vacuum indicated on the gauge?

- YES → **Air Vent Cut-off Solenoid Valve is OK.**
- NO → Turn the ignition switch OFF.

↓

Disconnect the 4P connector of the solenoid valve.

↓



Measure voltage between BLK/YEL (+) terminal and BLK (−) terminal.

↓

Is there battery voltage ?

- YES → **Replace the solenoid valve.**
- NO ↓

(To page 11-179)

(From page 11-178)

Measure voltage between BLK/YEL (+) terminal and body ground.

Is there battery voltage ?

NO — **Repair open in BLK/YEL wire between the ignition switch and the connector as well as ACG(S) fuse.**

YES — **Repair open in BLK wire between the solenoid valve and G201 (RHD:G301)**

(cont'd)

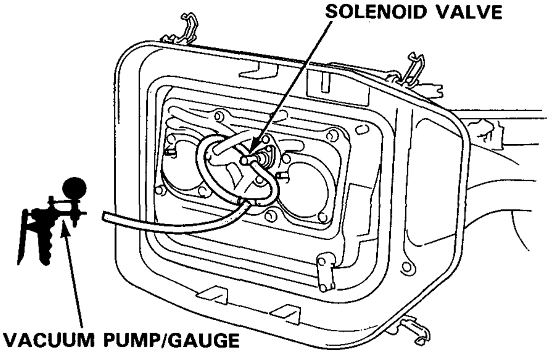
Evaporative Emission Controls [D13B2 EUROPE & KQ, D15B3 (KY) and D15B4 (KQ CARB) Engine] (cont'd)

Troubleshooting Flow Chart **Inner Vent Solenoid Valve**

The inner vent solenoid valve remains closed during engine cranking in order to facilitate engine startability by preventing fuel vapor in the float chamber from drawing into carburetor.

When the engine starts to run, the inner vent solenoid valve is activated to open the passage from air cleaner case.

[D15B4 (KQ CARB) Engine]



Inspection of Inner Solenoid Valve.

↓

Remove the air cleaner cover and filter element.

↓

Disconnect two vacuum hose from the carburetor and connect a vacuum pump.

↓

Apply vacuum.

↓

Does solenoid valve hold vacuum?

- NO → **Replace the solenoid valve.**
- YES ↓

Start the engine.

↓

Apply vacuum.

↓

Does solenoid valve hold vacuum?

- NO → **Inner Vent Solenoid Valve is OK.**
- YES ↓

Turn the ignition switch OFF.

↓

Disconnect the 3P connector near the air cleaner.

↓

Start the engine.

↓

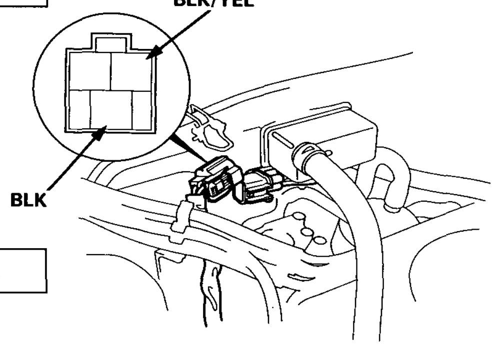
Measure voltage between BLK/YEL (+) terminal and BLK (−) terminal.

↓

Is there voltage ?

- YES → **Replace the solenoid valve.**
- NO ↓

(To page 11-181)



(From page 11-180)

Measure voltage between BLK/YEL (+) terminal and body ground.

Is there battery voltage ?

YES: **Repair open in BLK wire between the solenoid valve and G101.**

NO: **Check the BLK/YEL wire between the ignition switch and the solenoid valve as well as No. ACG(S) fuse.**

(cont'd)

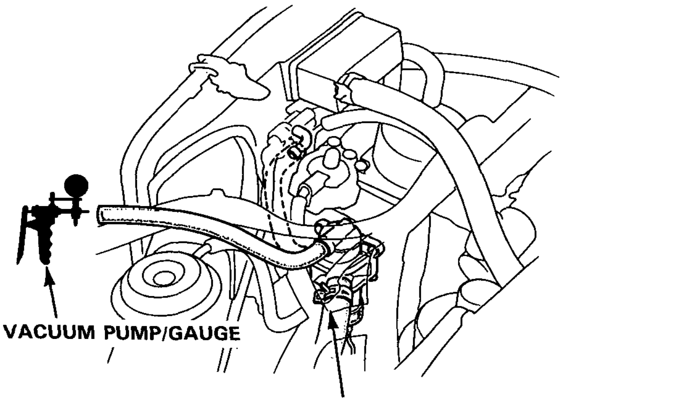
Evaporative Emission Controls [D13B2 EUROPE & KQ, D15B3 (KY) and D15B4 (KQ CARB) Engine] (cont'd)

Troubleshooting Flow Chart   Air Vent Cut-off Solenoid Valve

The air vent cut-off solenoid valve remains closed during engine cranking in order to facilitate engine startability by preventing fuel vapor in the float chamber from drawing into carburetor.

When the engine starts to run, air vent cut-off solenoid valve is activated to open the passage from air cleaner case.

[D15B4 (KQ CARB) Engine]



Inspection of Air Vent Cut-off Solenoid Valve.

↓

Disconnect the upper hose of the solenoid valve from the air cleaner and connect a vacuum pump.

↓

Disconnect the lower hose of the solenoid valve.

↓

Apply vacuum.

↓

Does solenoid valve hold vacuum?

- NO → **Replace the solenoid valve.**
- YES ↓

Start the engine.

↓

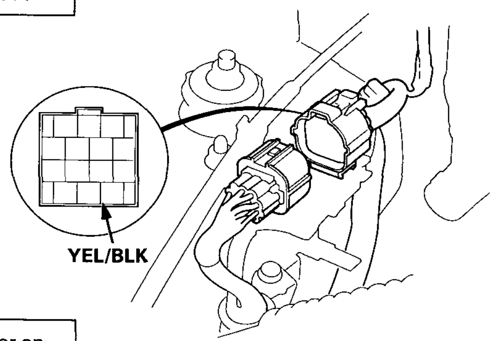
Apply vacuum.

↓

Does solenoid valve hold vacuum?

- NO → **Air Vent Cut-off Solenoid Valve is OK.**
- YES → Turn the ignition switch OFF.

↓



Disconnect the 14P connector on the air vent cut-off solenoid valve.

↓

Start the engine.

↓

(To page 11-183)

(From page 11-182)

Measure voltage between YEL/BLK (+) terminal and body ground at the 14P connector.

Is there battery voltage?

YES → **Repair open or short in BLK/YEL wire between the solenoid valve and the 14P connector.**
If OK, replace the solenoid valve.

NO → **Repair open or short in YEL/BLK, BLK/YEL wire between the ignition switch and the 14P connector *as well as* No. ACG (S) *fuse*.**

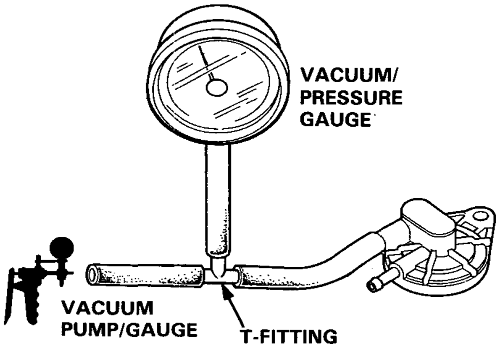
(cont'd)

Evaporative Emission Controls [D13B2 EUROPE & KQ, D15B3 (KY) and D15B4 (KQ CARB) Engine] (cont'd)

Two-Way Valve

1. Remove the filler cap.

2. Remove vapor line from the fuel tank and connect a T-fitting from a vacuum gauge and vacuum pump as shown.



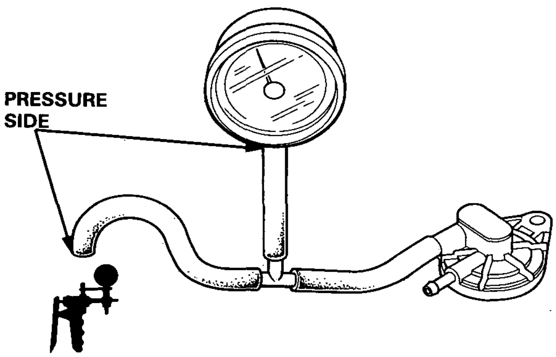
3. Slowly draw a vacuum while watching the gauge.

   Vacuum should stabilize at 5 to 15 mmHg (02. to 0.6 in.Hg).

   - If vacuum stabilizes momentarily (two-way valve opens) between 5 and 15 mmHg (0.2 and 0.6 in. Hg), go on to Step 4.

   - If vacuum stabilizes (valve opens) below 5 mmHg (0.2 in.Hg) or above 15 mmHg (0.6 in.Hg), install new valve and retest.

4. Move hand pump hose from vacuum to pressure fitting, and move vacuum gauge hose from vacuum to pressure side as shown.



5. Slowly pressurize the vapor line-while watching the gauge.

   Pressure should stbilize at 10 to 35 mmHg (0.4 to 1.4 in.Hg).

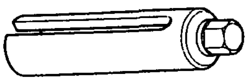
   - If pressure momentarily stabilizes (valve opens) at 10 to 35 mmHg (0.4 to 1.4 in.Hg), the valve is OK.

   - If pressure stabilizes below 10 mmHg (0.4 in. Hg) or above 35 mmHg (1.4 in.Hg), install a new valve and retest.

Fuel and Emission (Fuel-Injected Engine)

Special Tools

Ref. No.	Tool Number	Description	Q'ty	Remarks
①	07LAA–PT50101	O_2 Sensor Socket Wrench	1	
②	07LAJ–PT30100 or 07LAJ–PT3010A	Test Harness	1 1	
③	07406–0040001	Fuel Pressure Gauge Set	1	
③-1	07406–0040100	Pressure Gauge	(1)	Component Tools
③-2	07406–0040201	Hose Assy	(1)	
④	07999–PD6000A	Test Harness	1	
⑤	07411–0020000	Digital Circuit Tester	1	



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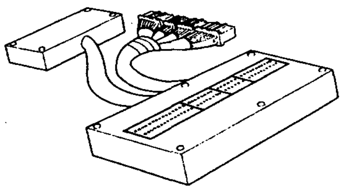

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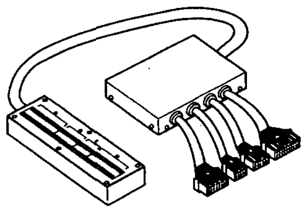

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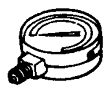
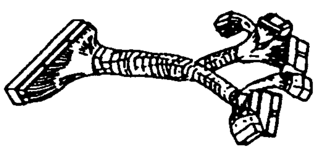
③



③-1

③-2



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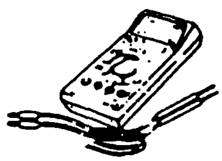

⑤

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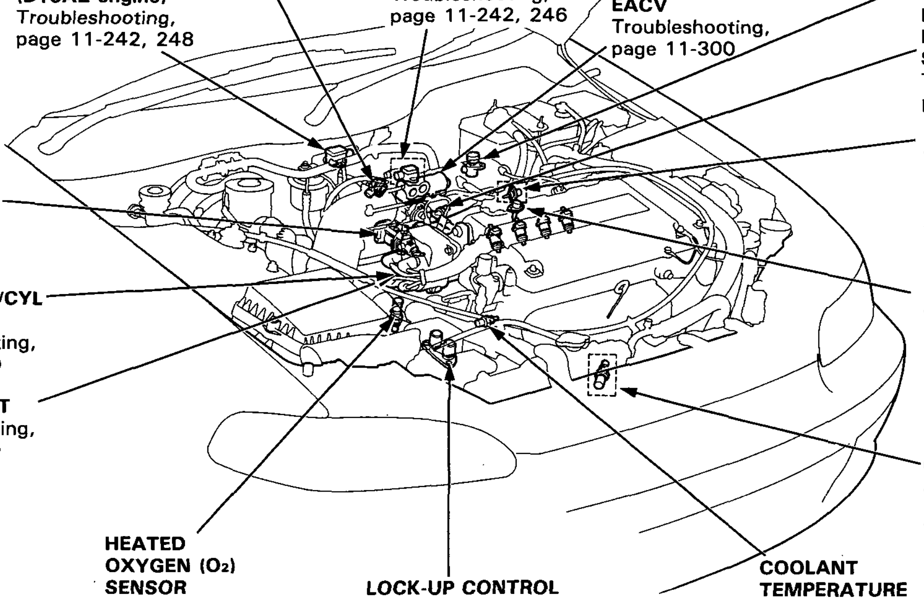
B16A2, D16A8, D16A9 engine:



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THROTTLE ANGLE SENSOR
Troubleshooting, page 11-254

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR (D16A8, D16A9 engine)
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INTAKE AIR TEMPERATURE (TA) SENSOR (B16A2 engine)
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OXYGEN (O_2) SENSOR (D16A8 engine)
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TDC/CRANK/CYL SENSOR
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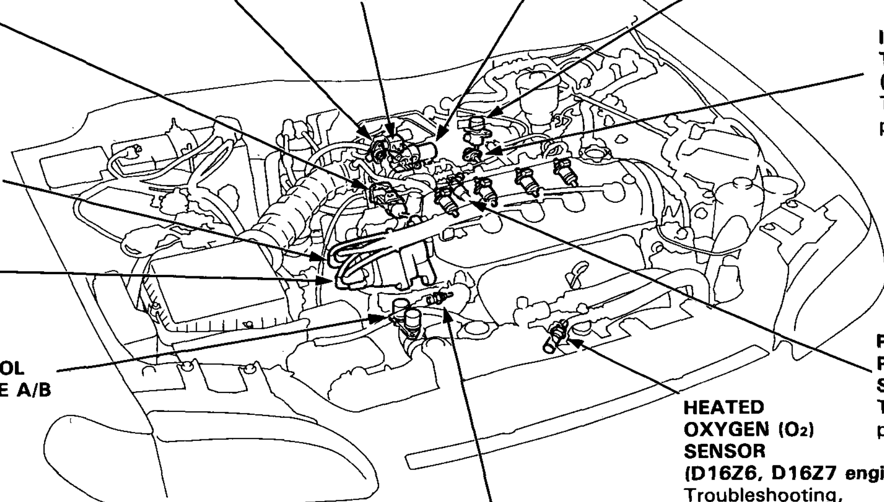

FAST IDLE VALVE
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MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR
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OXYGEN (O_2) SENSOR (D16A7, D16A8 engine)
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COOLANT TEMPERATURE (TW) SENSOR
Troubleshooting, page 11-252

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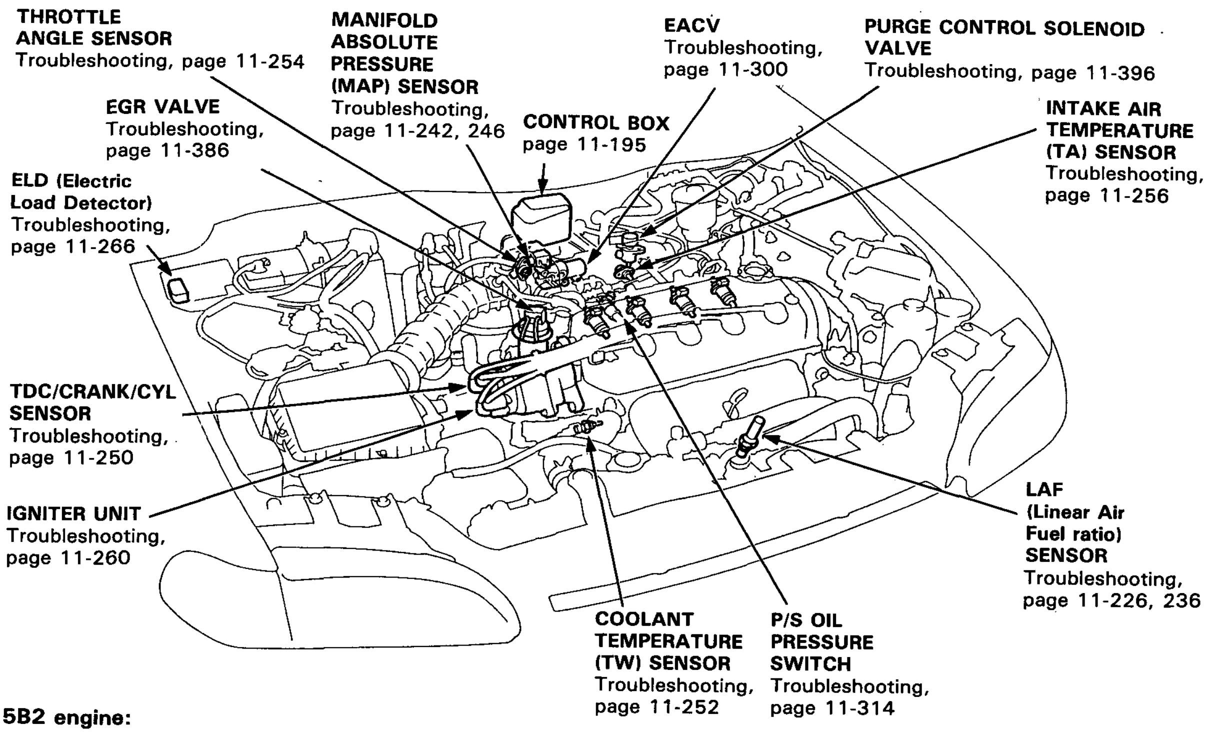
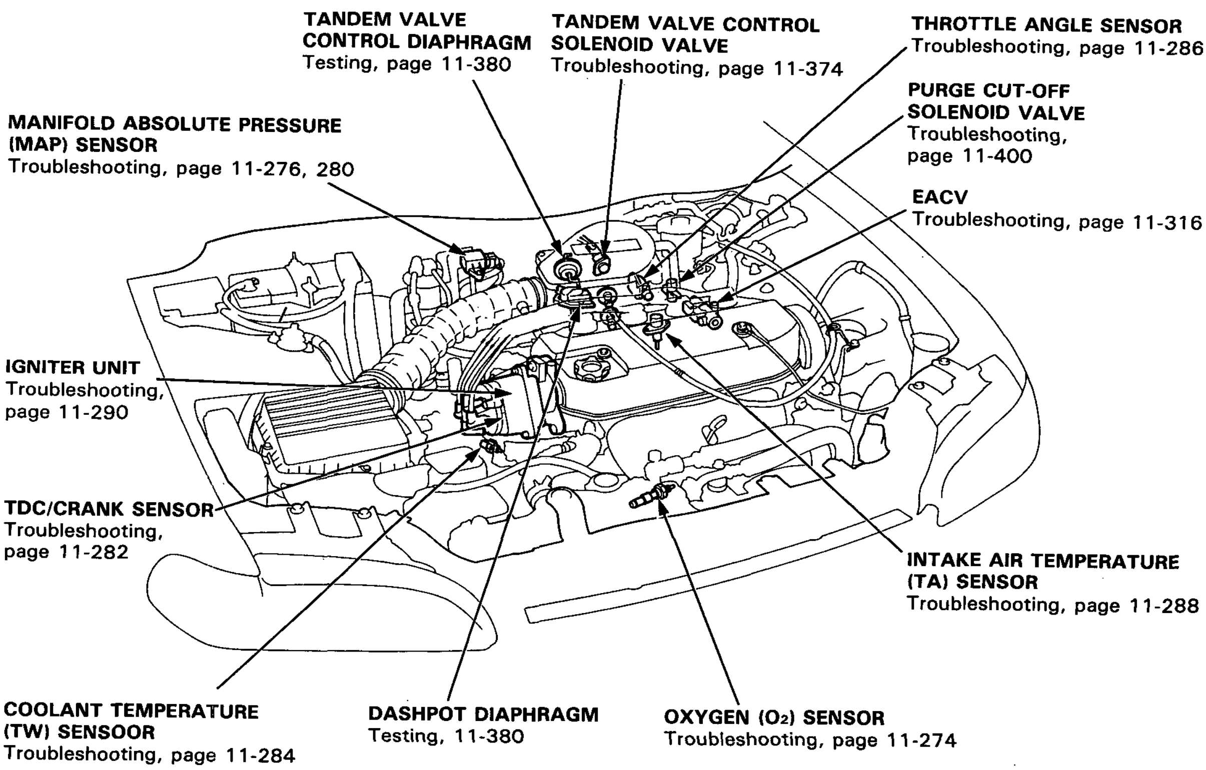
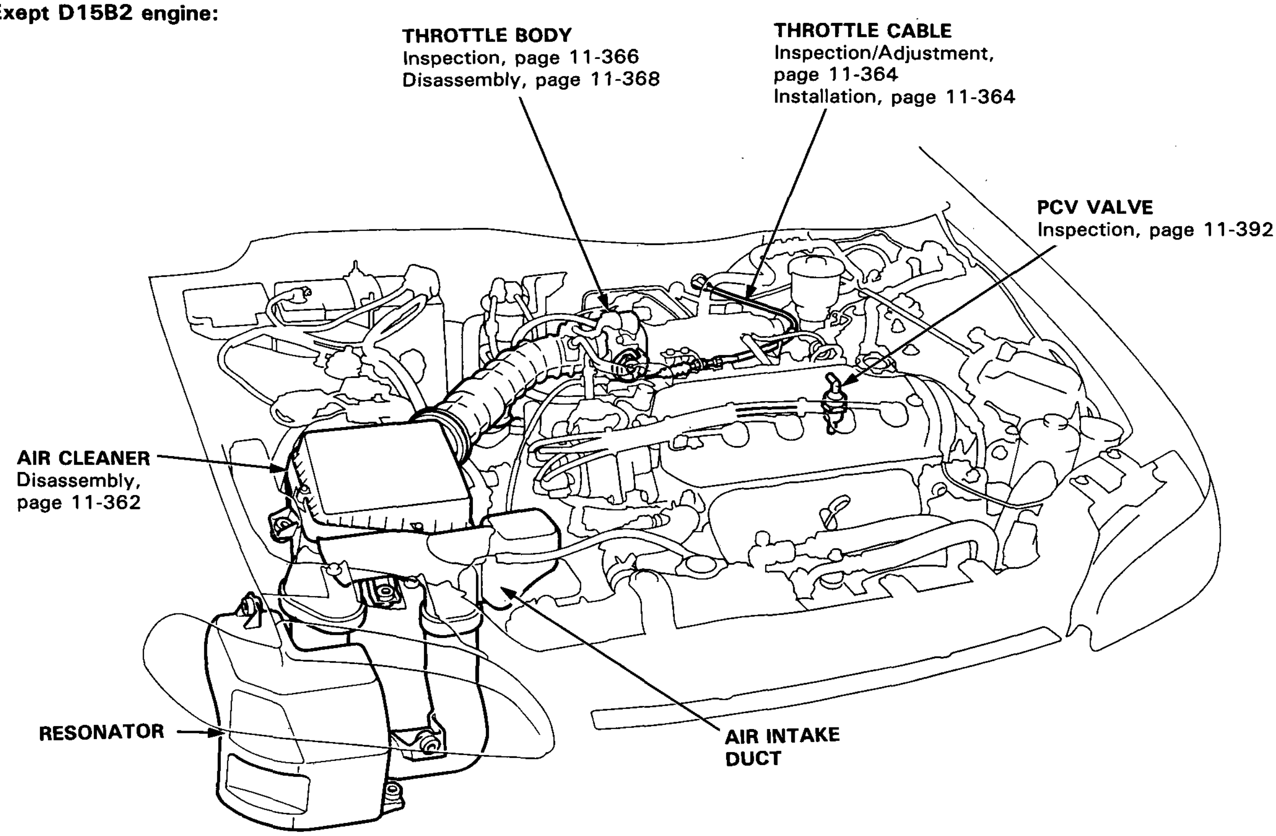
D15Z1 engine:



D15B2 engine:



Exept D15B2 engine:



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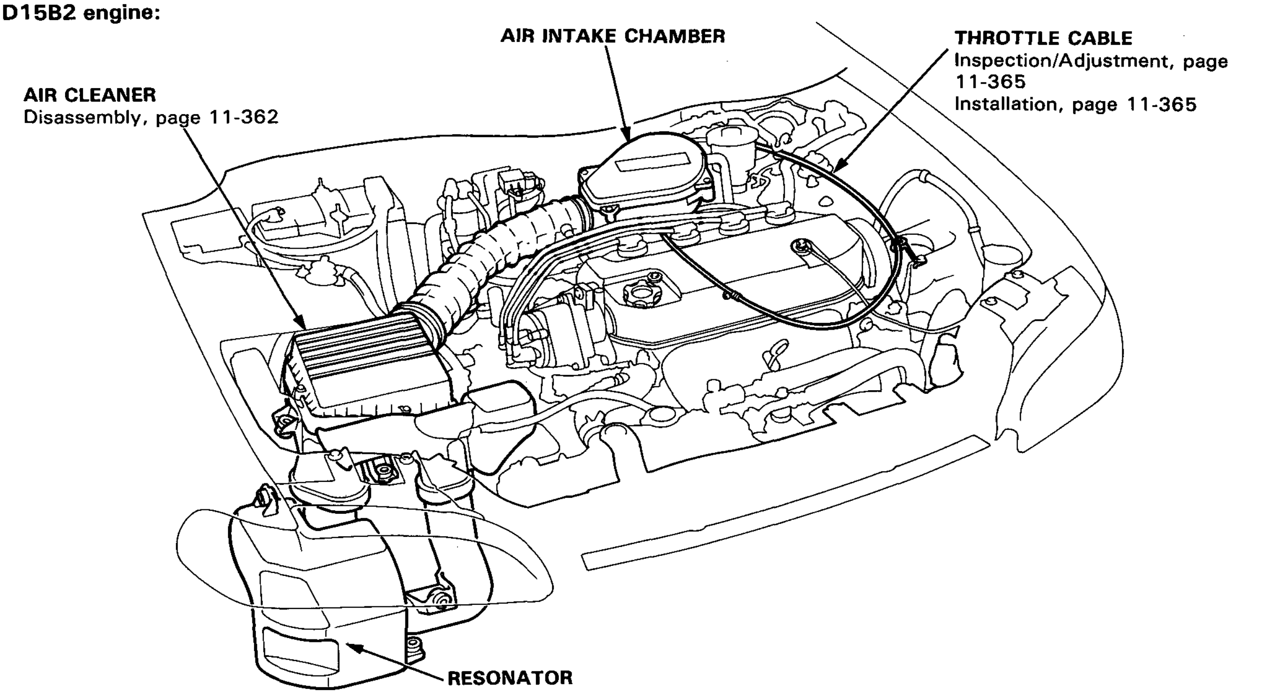

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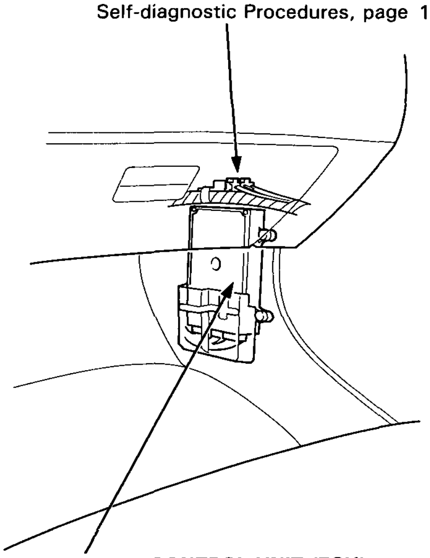
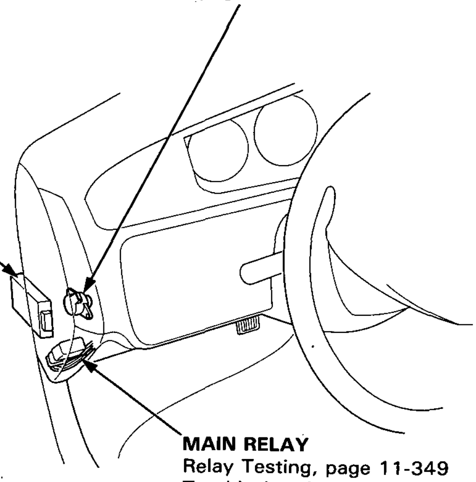
LHD:





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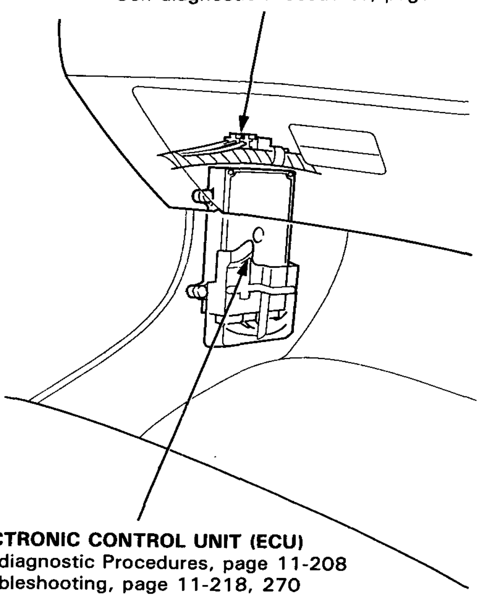
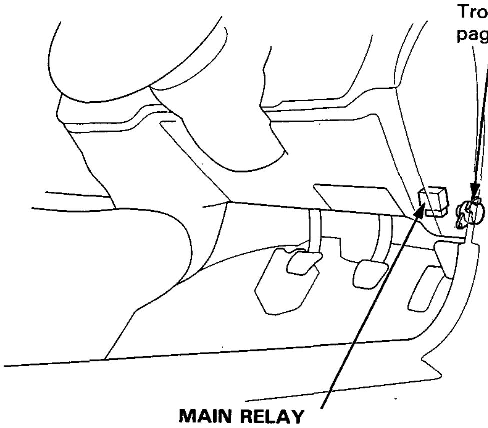
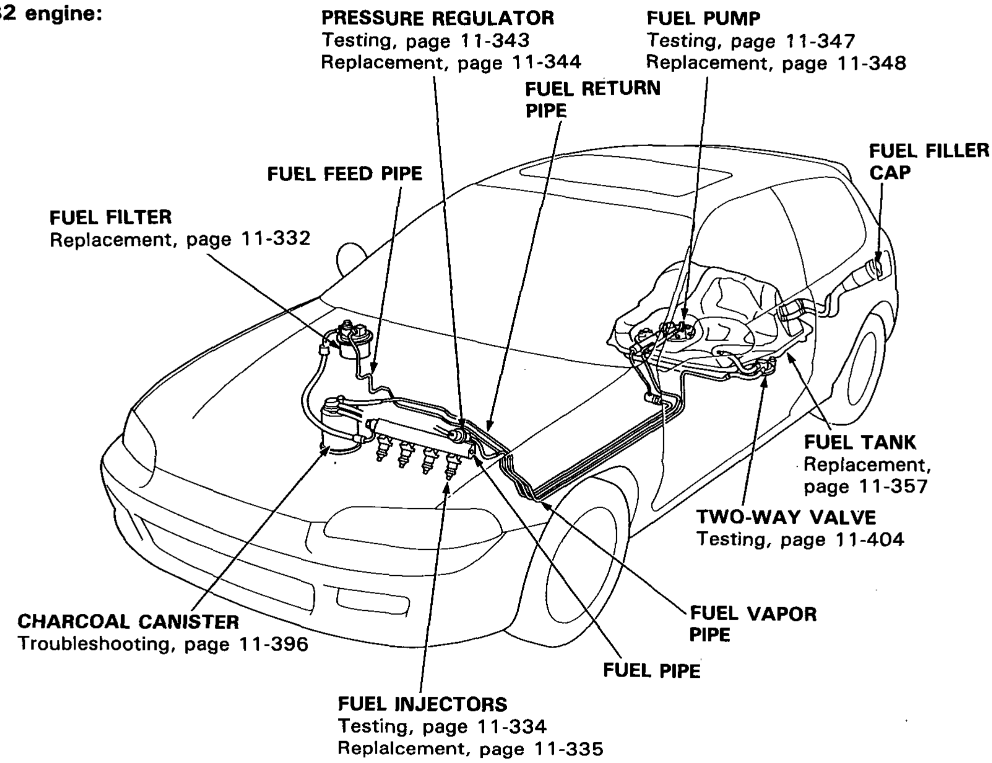
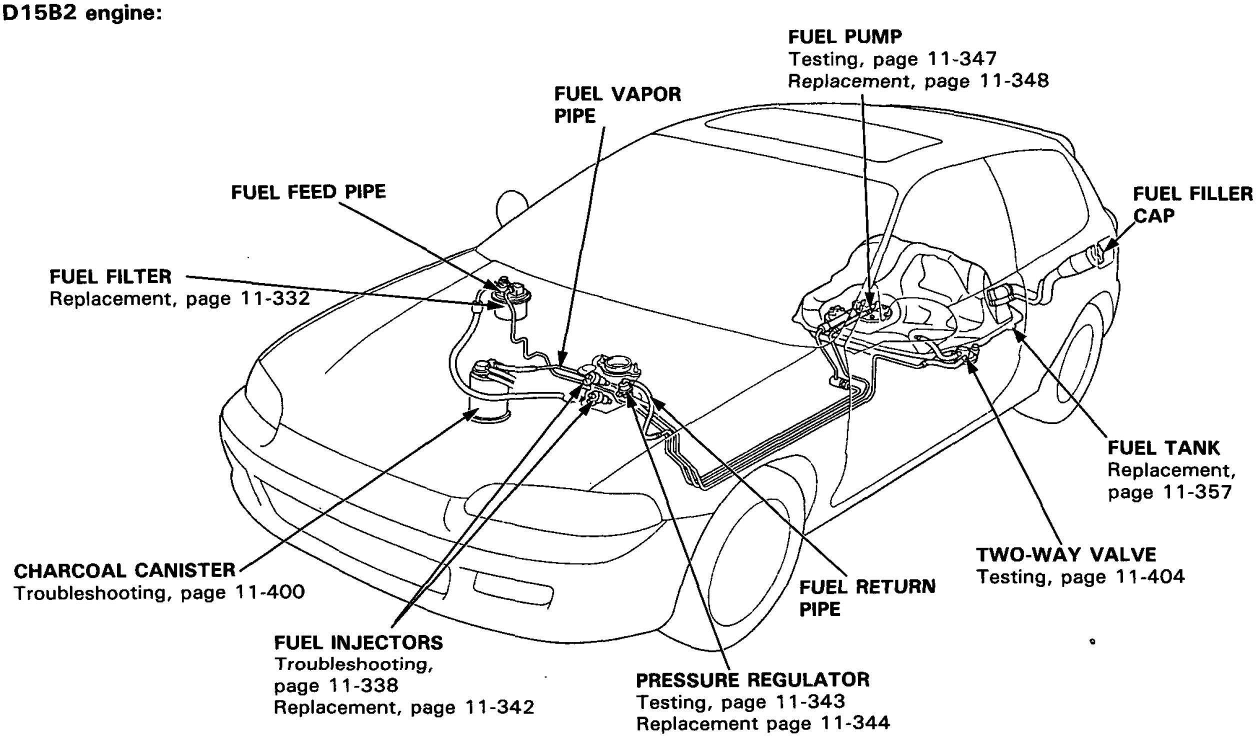




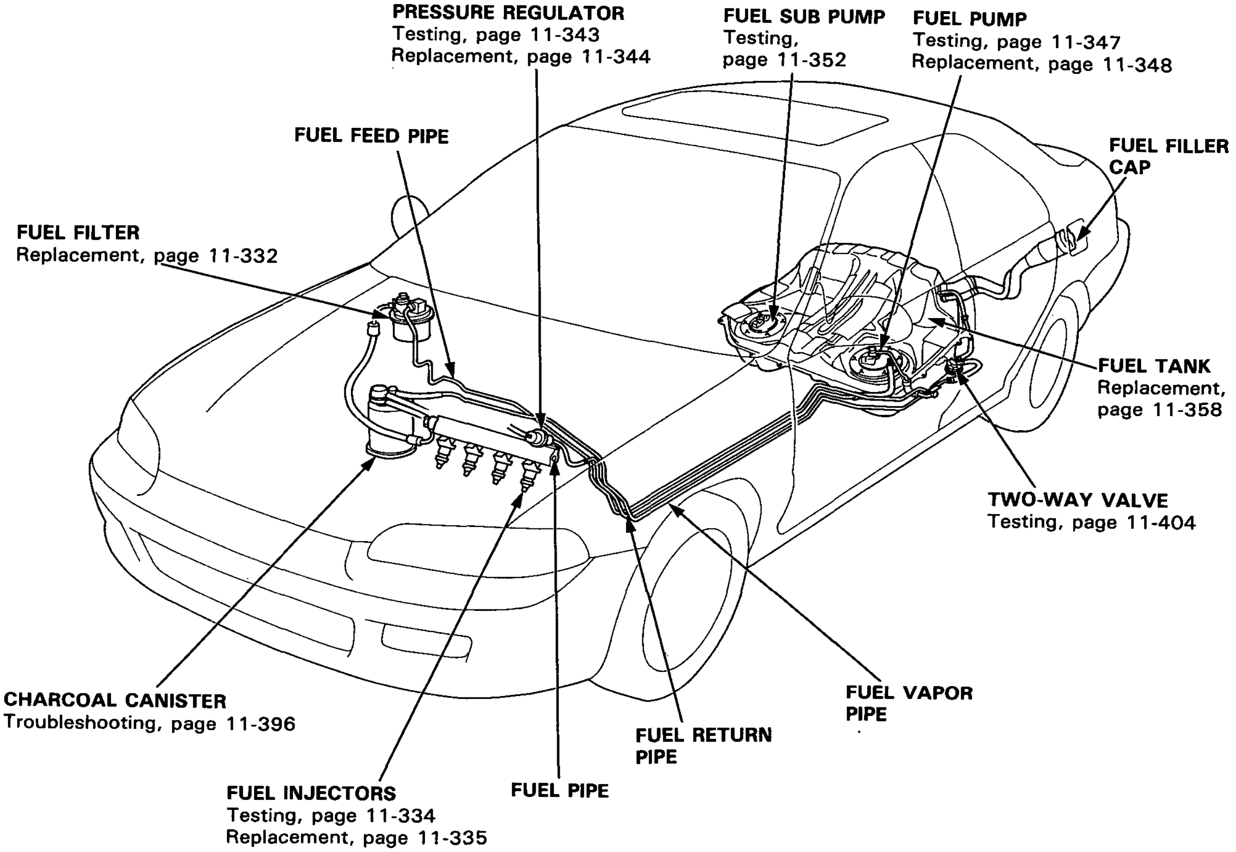
Exept D15B2 engine:



D15B2 engine:



4WD:



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page 11-352
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FUEL FILTER
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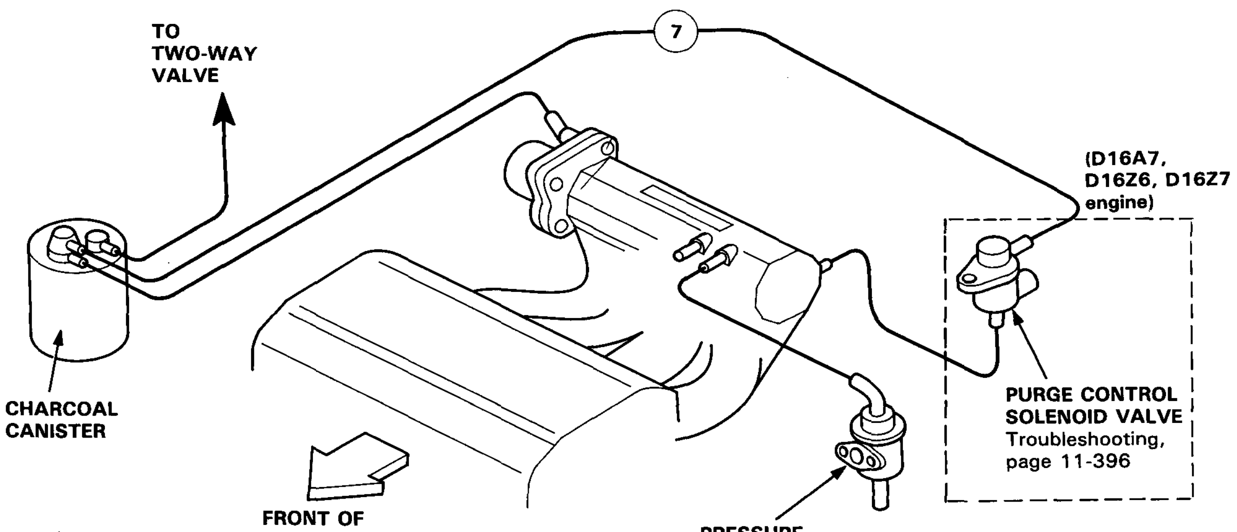
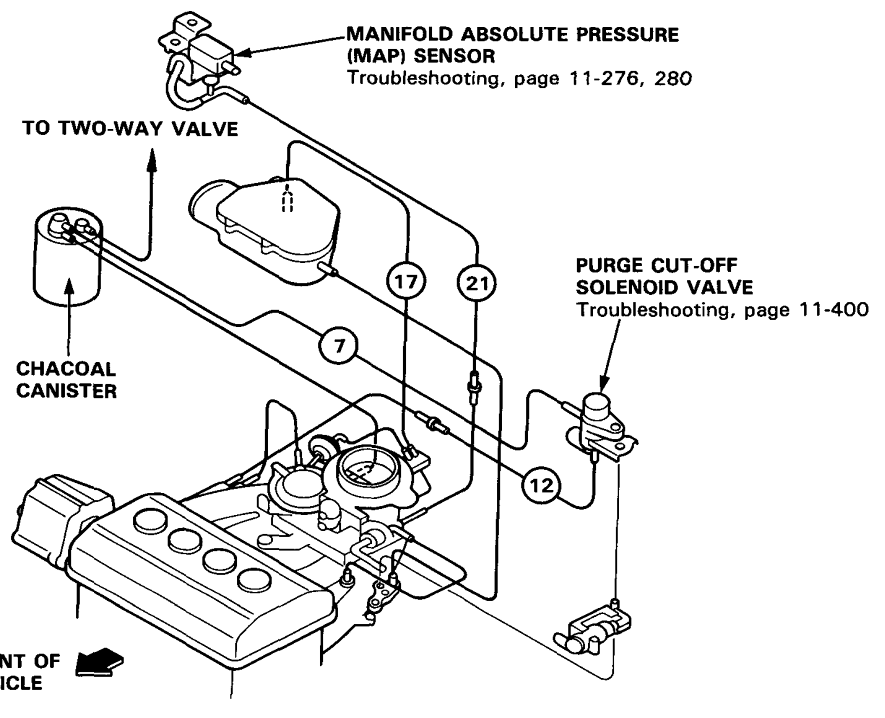
FUEL PIPE

Vacuum Connections

D16A7, D16Z6, D16Z7
D16A8, D16A9 engine:



D15B2 engine:

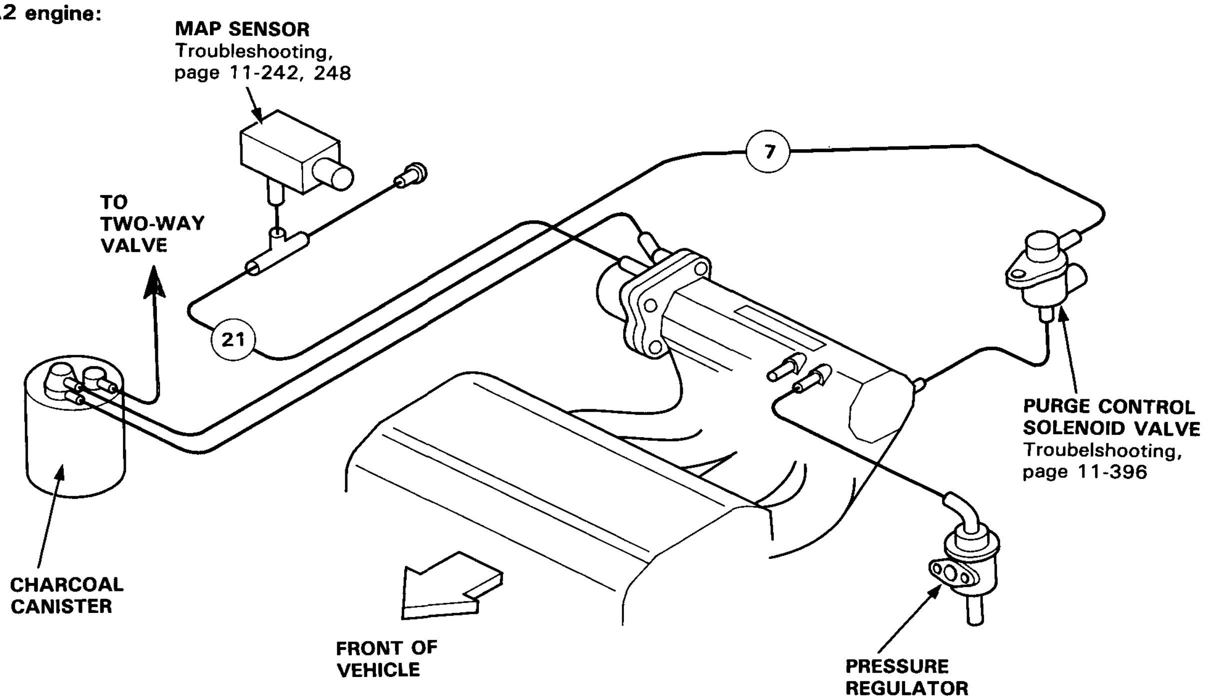


(cont'd)

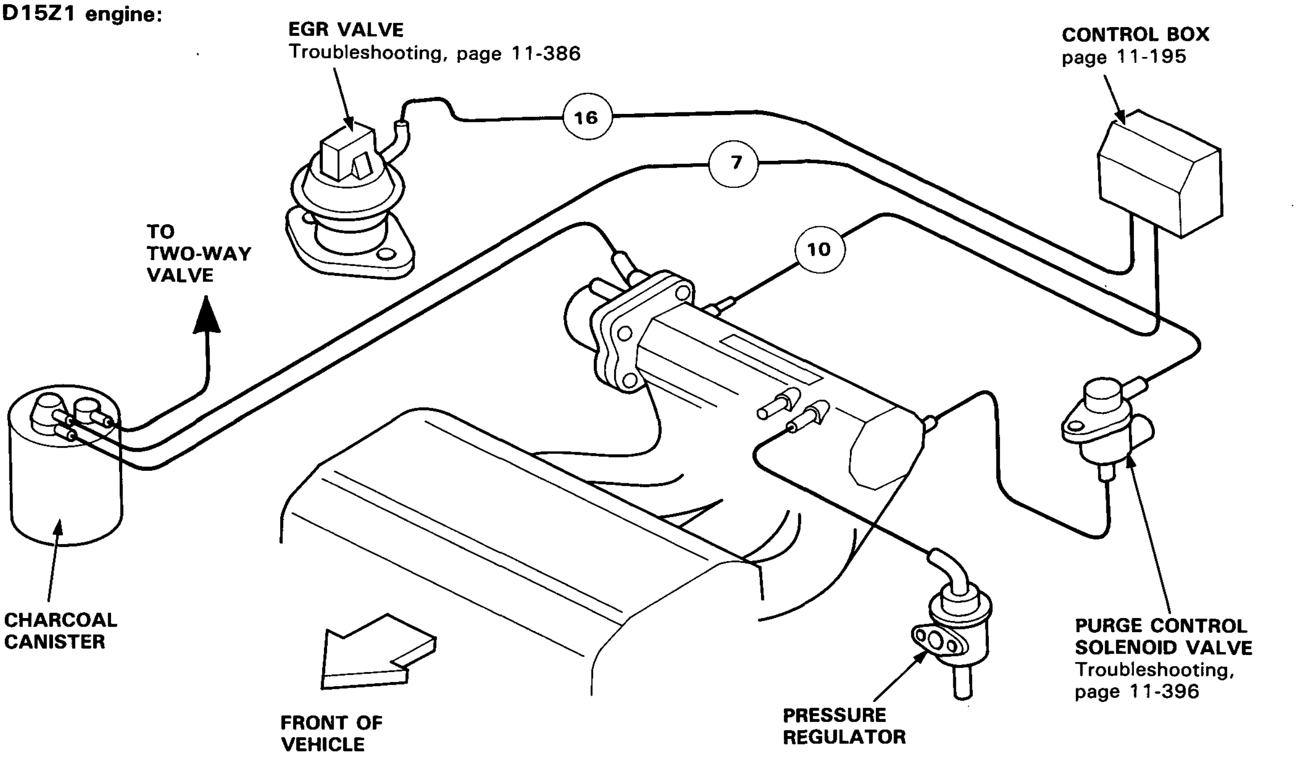
System Description

Vacuum Connections (cont'd)

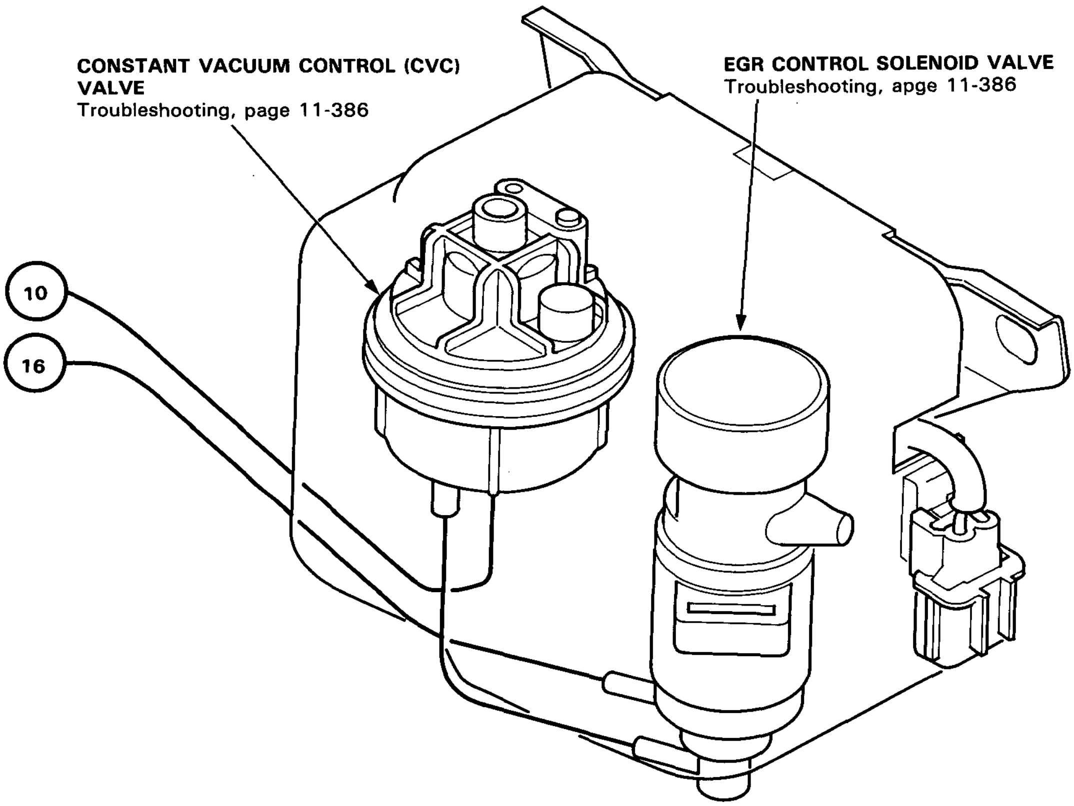
B16A2 engine:



D15Z1 engine:



Control Box
(D15Z1 engine only)



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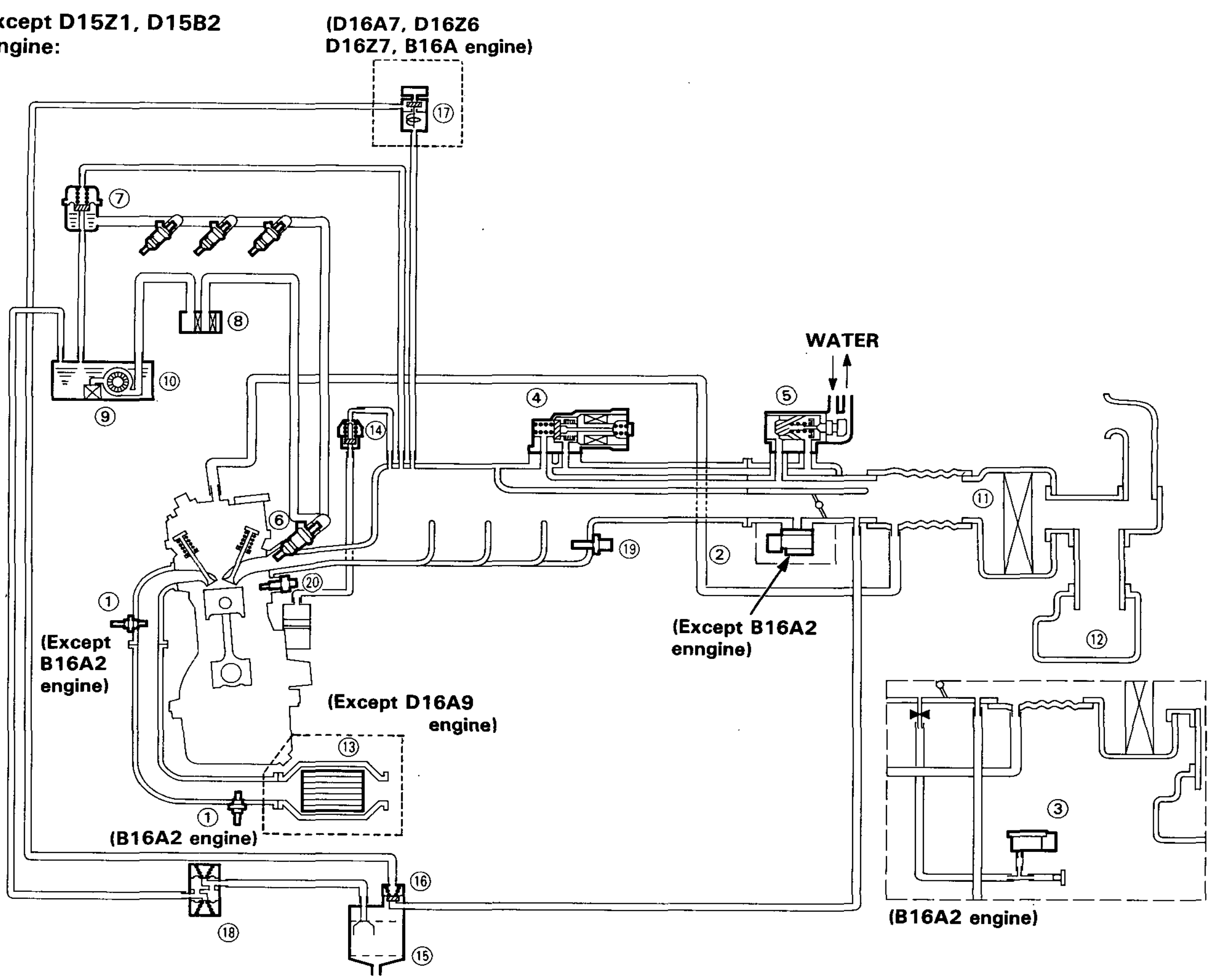
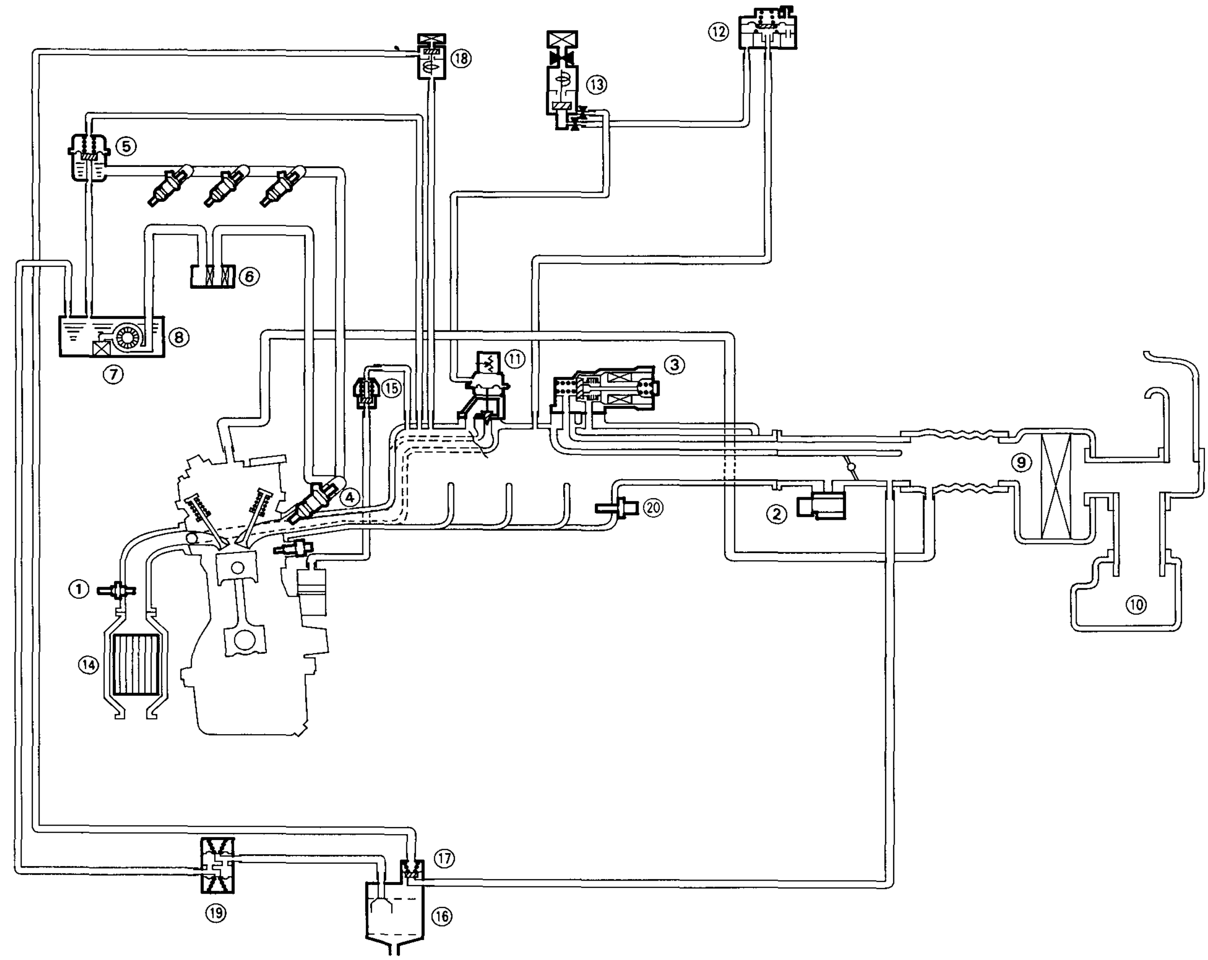
Vacuum Connections (cont'd)



① OXYGEN (O_2) SENSOR
② MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR (Except B16A2 engine)
③ MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR (B16A2 engine)
④ ELECTRONIC AIR CONTROL VALVE (EACV)
⑤ FAST IDLE VALVE
⑥ FUEL INJECTOR
⑦ PRESSURE REGULATOR
⑧ FUEL FILTER
⑨ FUEL PUMP
⑩ FUEL TANK
⑪ AIR CLEANER
⑫ RESONATOR
⑬ CATALYTIC CONVERTER
⑭ PCV VALVE
⑮ CHARCOAL CANISTER
⑯ PURGE CONTROL DIAPHRAGM VALVE
⑰ PURGE CONTROL SOLENOID VALVE
⑱ TWO-WAY VALE

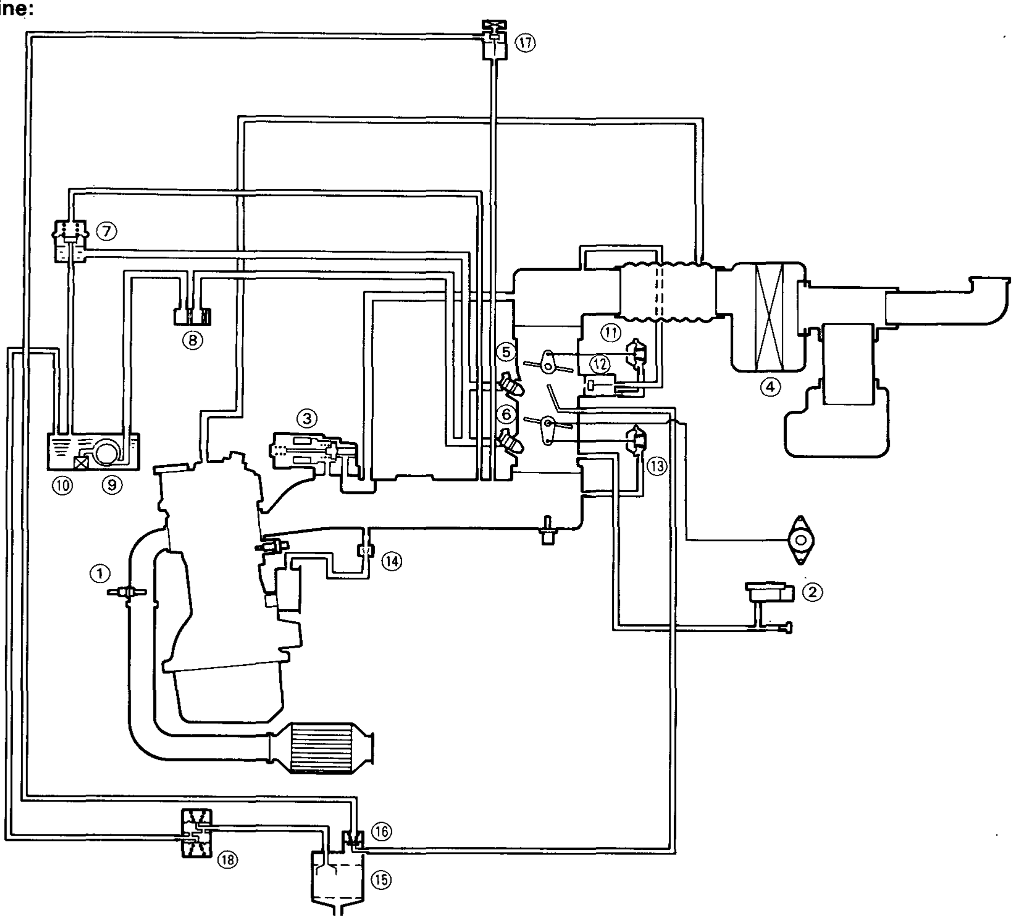
D15Z1 engine:



① OXYGEN (O_2) SENSOR
② MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR
③ ELECTRONIC AIR CONTROL VALVE (EACV)
④ FUEL INJECTOR
⑤ PRESSURE REGULATOR
⑥ FUEL FILTER
⑦ FUEL PUMP
⑧ FUEL TANK
⑨ AIR CLEANER
⑩ RESONNATOR
⑪ EGR VALVE
⑫ CONSTANT VACUUM CONTROL (CVC) VALVE
⑬ EGR CONTROL SOLENOID VALVE
⑭ CATALYTIC CONVERTER
⑮ PCV VALVE
⑯ CHARCOAL CANISTER
⑰ PURGE CONTROL DIAPHRAGM VALVE
⑱ PURGE CONTROL SOLENOID VALVE
⑲ TWO-WAY VALVE

(cont'd)

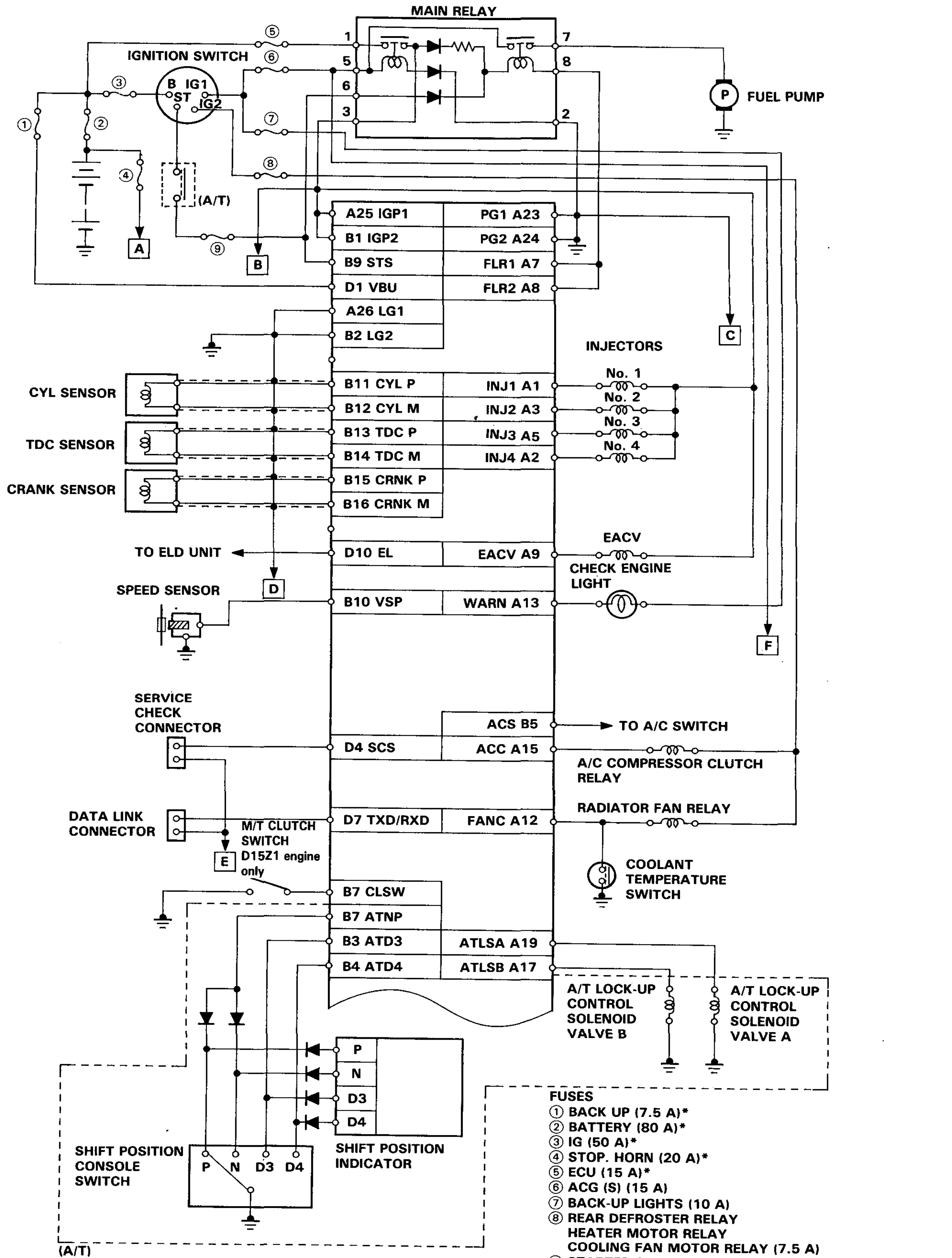
D15B2 engine:



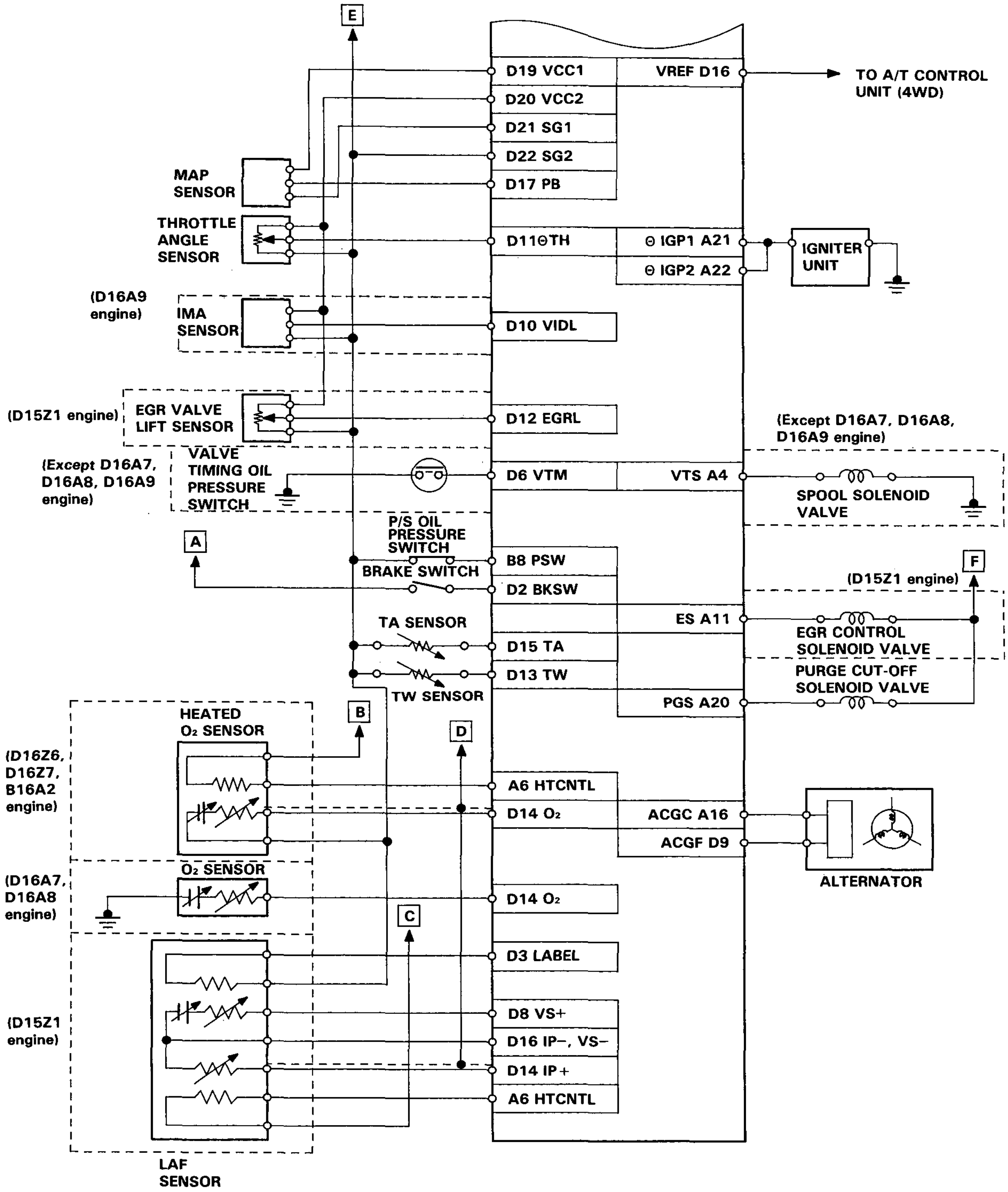
① OXYGEN (O_2) SENSOR
② MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR
③ ELECTRONIC AIR CONTROL VALVE (EACV)
④ AIR CLEANER
⑤ MAIN INJECTOR
⑥ AUX. INJECTOR
⑦ PRESSURE REGULATOR
⑧ FUEL FILTER
⑨ FUEL PUMP
⑩ FUEL TANK
⑪ TANDEM VALVE CONTROL DIAPHRGM
⑫ TANDEM VALVE CONTROL SOLENOID VALVE
⑬ DASHPOT DIAPHRAGM
⑭ PCV VALVE
⑮ CHARCOAL CANISTER
⑯ PURGE CONTROL DIAPHRAGM VALVE
⑰ PURGE CUT-OFF SOLENOID VALVE
⑱ TWO-WAY VALVE

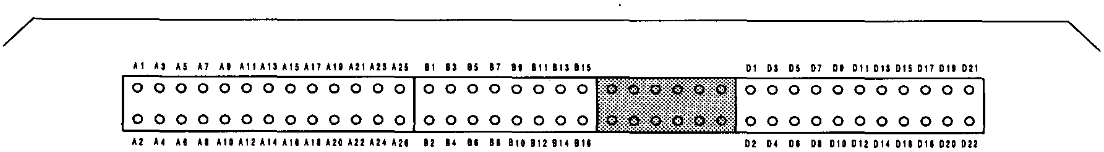
System Description

Electrical Connections Except D15B2 engine]



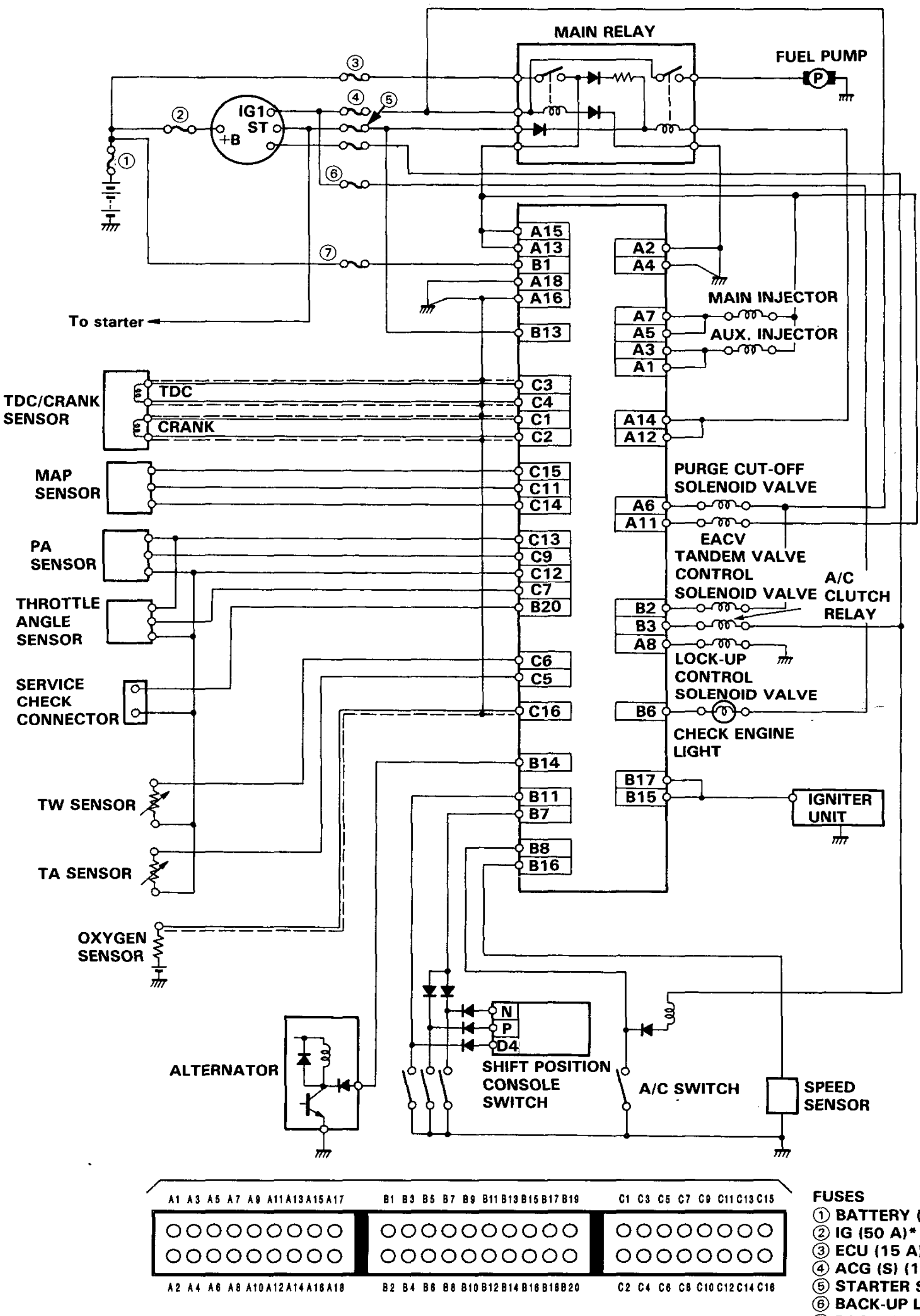
FUSES
① BACK UP (7.5 A)*
② BATTERY (80 A)*
③ IG (50 A)*
④ STOP, HORN (20 A)*
⑤ ECU (15 A)*
⑥ ACG (S) (15 A)
⑦ BACK-UP LIGHTS (10 A)
⑧ REAR DEFROSTER RELAY
HEATER MOTOR RELAY
COOLING FAN MOTOR RELAY (7.5 A)
⑨ STARTER SIGNAL (7.5 A)
*: UNDER-HOOD FUSE/RELAY BOX





TERMINAL LOCATION

Electrical Connections [D15B2 engine]



TERMINAL LOCATION

FUSES
① BATTERY (80 A)*
② IG (50 A)*
③ ECU (15 A)*
④ ACG (S) (15 A)
⑤ STARTER SIGNAL (7.5 A)
⑥ BACK-UP LIGHTS (10 A)
⑦ BACK-UP (7.5 A)*
*: UNDER-HOOD FUSE/RELAY BOX

Troubleshooting

Troubleshooting Guide [Except D15B2 engine]

NOTE: Across each row in the chart, the systems that could be sources of a symptom are ranked in the order they should be inspected starting with ①. Find the symptom in the left column, read across to the most likely source, then refer to the page listed at the top of that column. If inspection shows the system is OK, try the next most likely system ②, etc.

SYSTEM		PGM-FI									
		ECU	OXYGEN (D15Z1 engine: LAF)* SENSOR	MANIFOLD ABSOLUTE PRESSURE SENSOR	TDC/CRANK/CYL SENSOR	COOLANT TEMPERATURE SENSOR	THROTTLE ANGLE SENSOR	INTAKE AIR TEMPERATURE SENSOR	IMA SENSOR (D16A9 engine)	IGNITION OUTPUT SIGNAL	VEHICLE SPEED SENSOR
SYMPTOM	PAGE	218	223, 225, 226, 230, 236	242, 246	250	252	254	256	258	260	262
CHECK ENGINE LIGHT** TURNS ON		or									
CHECK ENGINE LIGHT BLINKS		0 or *	1 or 41 or 43 or 48 *	3 or 5	4 or 8 or 9	6	7	10	11	15	17
ENGINE WON'T START		①			③					③	
DIFFICULT TO START ENGINE WHEN COLD		BU		③	②	①					
IRREGULAR IDLING	WHEN COLD FAST IDLE OUT OF SPEC	BU				③					
IRREGULAR IDLING	ROUGH IDLE	BU		③							
IRREGULAR IDLING	WHEN WARM RPM TOO HIGH	BU									
IRREGULAR IDLING	WHEN WARM RPM TOO LOW	BU									
FREQUENT STALLING	WHILE WARMING UP	BU				③					
FREQUENT STALLING	AFTER WARMING UP	BU									
POOR PERFORMANCE	MISFIRE OR ROUGH RUNNING	BU		②	③						
POOR PERFORMANCE	FAILS EMISSION TEST	BU	③	②							
POOR PERFORMANCE	LOSS OF POWER	BU		③			②				

* If codes other than those listed above are indicted, count the number of blinks again. If the indicator is in fact blinking these codes, substitute a known-good ECU and recheck. If the indication goes away, replace the original ECU.
If the Check Engine light is on while the engine is running, jump the service check connector. If no code is displayed (Check Engine light stays on steady), the back-up system is in operation.
Substitute a known-good ECU and recheck. If the indication goes away, replace the original ECU.

PGM-FI				IDLE CONTROL		FUEL SUPPLY			EMISSION CONTROL	
LOCK-UP CONTROL SOLENOID VALVE	ELECTRIC LOAD DETECTOR	SPOOL SOLENOID VALVE	VALVE TIMING OIL PRESSURE SWITCH	ELECTRONIC AIR CONTROL VALVE	OTHER IDLE CONTROLS	FUEL INJECTOR	OTHER FUEL SUPPLY	AIR INTAKE	EGR CONTROL SYSTEM	OTHER EMISSION CONTROLS
264	266	6-12	6-14	300	296	334	331	360	386	381
19	20	21	22	14					12	
							②			
				①	②					
			②	①		②			③	
				①	②					
③				①		②				
				①	②		③			
				③			①		②	
						①			③	
										①
		③	③			③	①	③		

Troubleshooting Guide [D15B2 engine]

NOTE:
Across each row in the chart, the systems that could be sources of a symptom are ranked in the order they should be inspected starting with ①. Find the symptom in the left column, read across to the most likely source, then refer to the page listed at the top of that column. If inspection shows the system is OK, try the next most likely system ②, etc.

SYSTEM / SYMPTOM		PGM-FI						
		ECU	OXYGEN SENSOR	MANIFOLD ABSOLUTE PRESSURE SENSOR	TDC/CRANK SENSOR	COOLANT TEMPERA-TURE SENSOR	THROTTLE ANGLE SENSOR	INTAKE AIR TEMPERA-TURE SENSOR
PAGE		270	274	276, 280	282	284	286	288
CHECK ENGINE LIGHT TURNS ON		or						
SELF-DIAGNOSIS INDICATOR (LED) BLINKS		0 or *	1	3 or 5	4 or 8	6	7	10
ENGINE WON'T START		③						
DIFFICULT TO START ENGINE WHEN COLD		BU		③		①		
IRREGULAR IDLING	WHEN COLD FAST IDLE OUT OF SPEC	BU				③		
	ROUGH IDLE	BU		③				
	WHEN WARM RPM TOO HIGH	BU						
	WHEN WARM RPM TOO LOW	BU						
FREQUENT STALLING	WHILE WARMING UP	BU				③		
	AFTER WARMING UP	BU						
POOR PERFORM-ANCE	MISFIRE OR ROUGH RUNNING	BU		②	③			
	FAILS EMISSION TEST	BU	③	②				
	LOSS OF POWER	BU		③			②	

* If codes other than those listed above are indicted, count the number of blinks again. If the indicator is in fact blinking these codes, substitute a known-good ECU and recheck. If the indication goes away, replace the original ECU.
If the Check Engine light is on while the engine is running, jump the service check connector. If no code is displayed (Check Engine light stays on steady), the back-up system is in operation.
Substitute a known-good ECU and recheck. If the indication goes away, replace the original ECU.

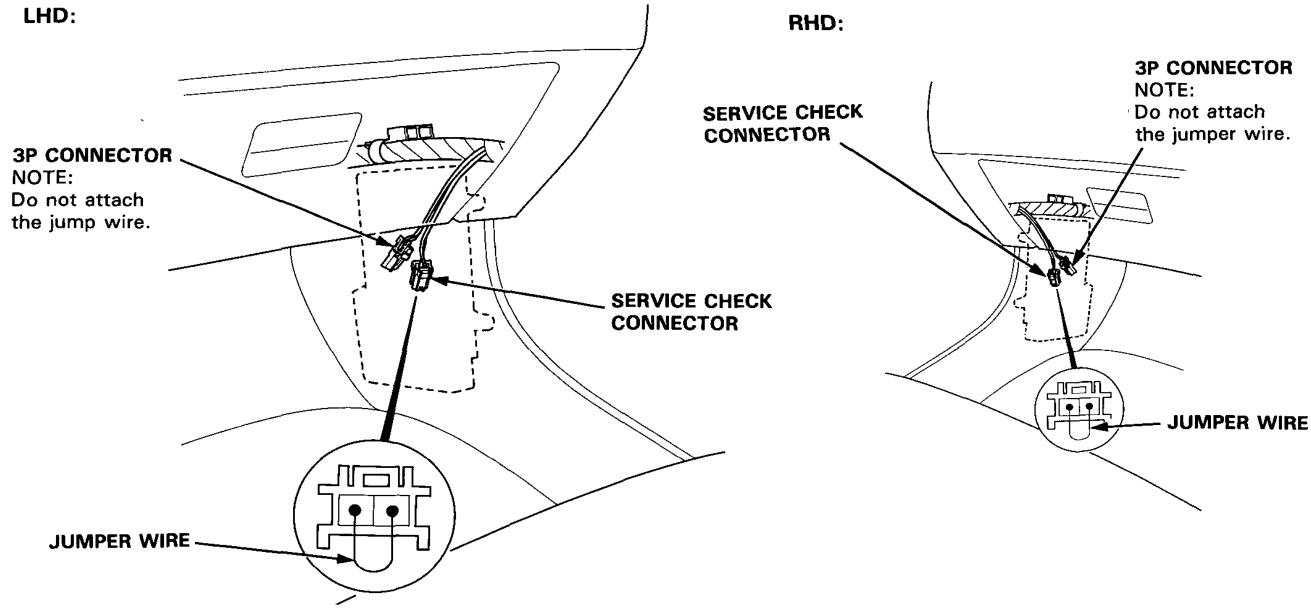
PGM-FI			IDLE CONTROL		FUEL SUPPLY			EMISSION CONTROL
EGNITION OUTPUT SIGNAL	VEHICLE SPEED SENSOR	LOCK-UP CONTROL SOLENOID VALVE	ELECTRONIC AIR CONTROL VALVE	OTHER IDLE CONTROLS	FUEL INJECTOR	OTHER FUEL SUPPLY	AIR INTAKE	OTHER EMISSION CONTROLS
290	292	294	316	296	338	331	360	381
15	17	19	14		16			
					2	1		
			2					
			1	2				
			2		1			
			2	1				
			1		2			
2			1					
			1		2	3		
			3		1	2		
						1		
					3	1		

Troubleshooting

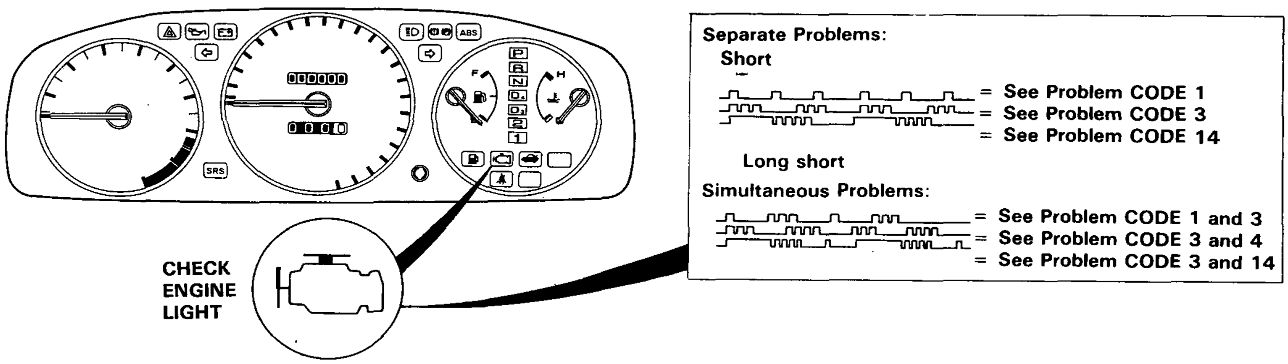
Self-diagnostic Procedures

I. When the Check Engine light has been reported on, do the following:

1. Connect the Servuce Check Connector terminals with a jumper wire as shown (The 2P Service Check Connector is located under the dash on the passenger side of the car). Turn the ignition switch on.



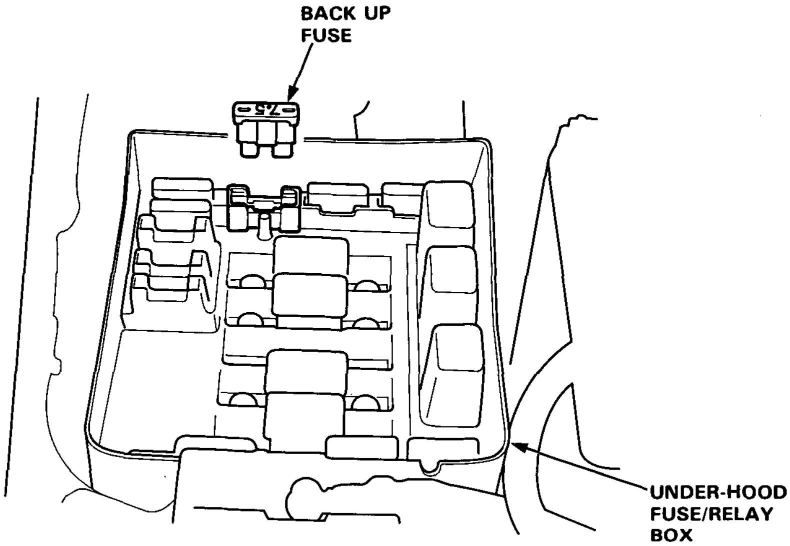
2. Note the CODE: the Check Engine light indicates a failure code by the length and number of blinks. The Check Engine light can indicate simultaneous component problems by blinking separate codes, one after another. Problem codes 1 through 9 are indicated by individual short blinks. Problem codes 10 through 48 are indicated by a series of long and short blinks. The number of long blinks equals the first digit, the number of short blinks equals the second digit.



II. ECU Reset Procedure

1. Turn the ignition switch off.
2. Remove the BACK UP fuse (7.5 A) from the under-hood fuse/relay box for 10 seconds to reset the ECU.

   NOTE: Disconnecting the BACK UP fuse also cancels the radio preset stations and the clock setting. Make note of the radio presets before removing the fuse so you reset them.



III. Final Procedure (this procedure must be done after any troubleshooting)

1. Remove the Jumper Wire.

   NOTE: If the Service Check Connector is jumped, the Check Engine light will stay on.

2. Do the ECU Reset Procedure.
3. Set the radio preset stations and the clock setting.

(cont'd)

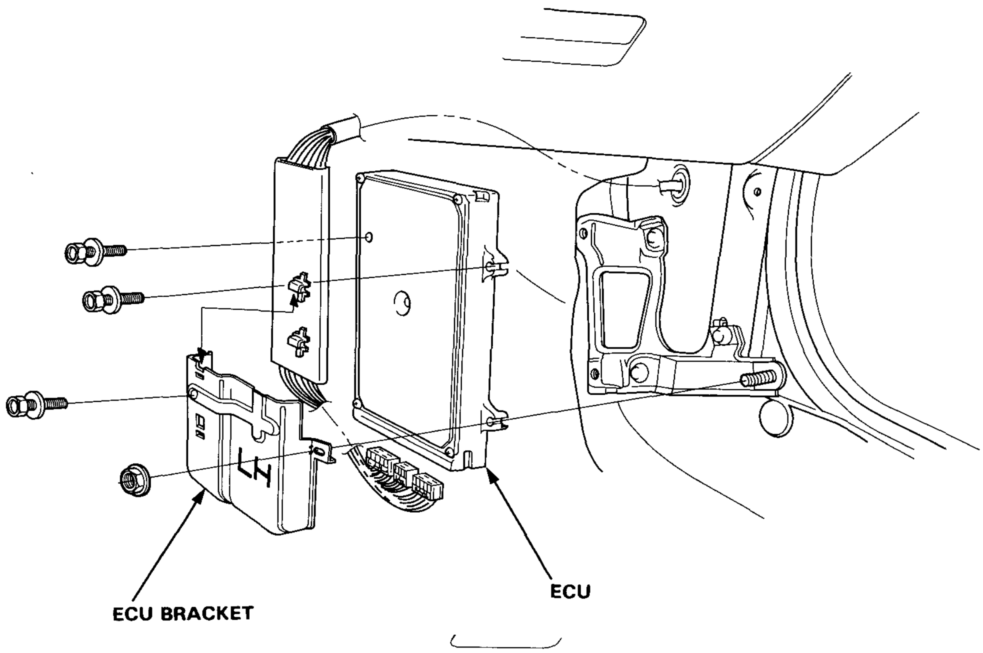
Self-diagnostic Procedures (cont'd)

SELF-DIAGNOSIS INDICATOR BLINKS	SYSTEM INDICATED	PAGE (Except D15B2 engine)	PAGE (D15B2 engine)
0	ECU	11-219	11-270
1	OXYGEN SENSOR (Except D16A9 engine)	11-223, 225	11-274
3	MANIFOLD ABSOLUTE PRESSURE (MAP SENSOR)	11-242	11-276
5		11-246	11-280
4	CRANK ANGLE (CRANK SENSOR)	11-250	11-282
6	COOLANT TEMPERATURE (TW SENSOR)	11-252	11-284
7	THROTTLE ANGLE	11-254	11-286
8	TDC POSITION (TDC SENSOR)	11-250	11-282
9	No. 1 CYLINDER POSITION (CYL SENSOR)	11-250	—
10	INTAKE AIR TEMPERATURE (TA SENSOR)	11-256	11-288
11	IMA SENSOR (D16A9 engine)	11-258	—
12	EXHAUST GAS RECIRCULATION SYSTEM (EGR)	11-386	—
14	ELECTRONIC AIR CONTRL (EACV)	11-300	11-316
15	IGNITION OUTPUT SIGNAL	11-260	11-290
16	FUEL INJECTOR (D15B2 engine)	—	11-338
17	VEHICLE SPEED SENSOR	11-262	11-292
19	A/T LOCK-UP CONTROL SOLENOID VALVE A/B	11-264	11-294
~~20~~	~~ELECTRONIC LOAD DETECTOR (ELD)~~	~~11-266~~	~~—~~
21	SPOOL SOLENOID VALVE	6-12	—
22	VALVE TIMING OIL PRESSURE SWITCH	6-14	—
41	OXYGEN SENSOR HEATER (D16Z6, D16Z7, B16A2 engine)	11-230	—
~~41~~	~~LAF~~ SENSOR ~~HEATER (D15Z1 engine)~~	11-236	~~—~~
43	FUEL SUPPLY SYSTEM (D16Z6, D16Z7, B16Z2 engine)	11-240	—
~~48~~	~~LAF~~ SENSOR (D15~~Z1 engine~~)	11-226	~~—~~

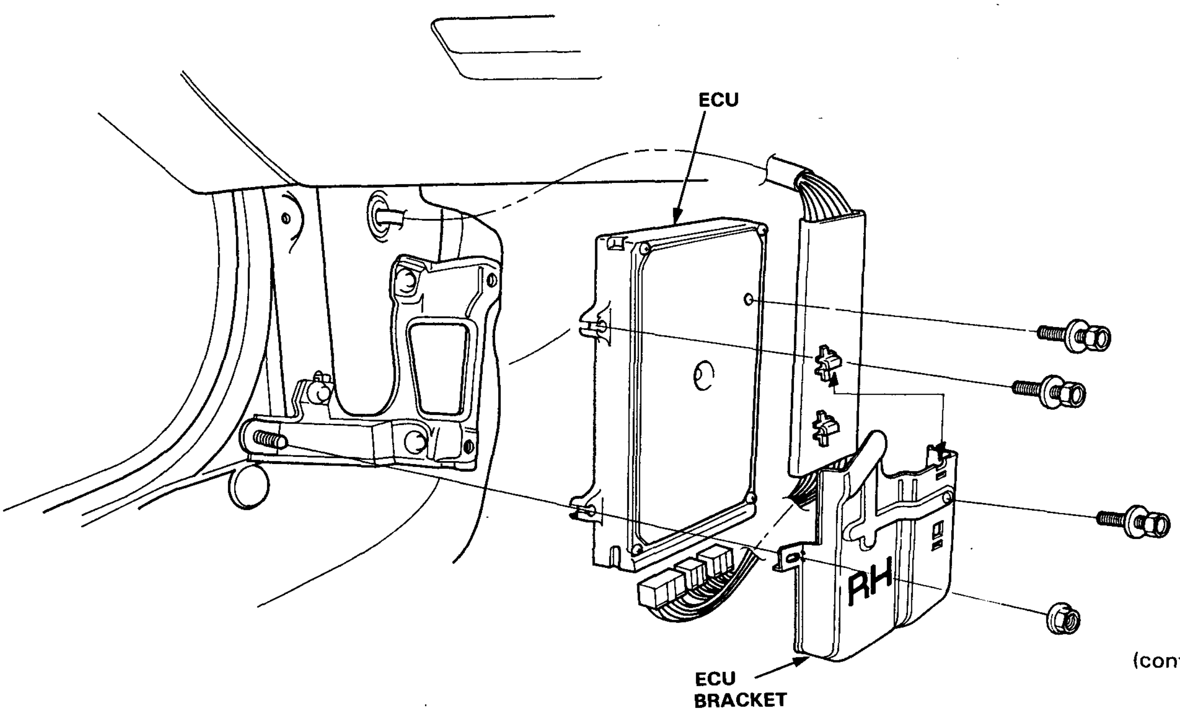
- If codes other than those listed above are indicated, verify the code. If the code indicated is not listed above, replace the ECU.
- The Check Engine light may come on, indicating a system problem when, in fact, there is a poor or intermittent electrical connection. First, check the electrical connections, clean or repair connections if necessary.
- The Check Engine light and D_4 indicator light may light simultaneously when the self-diagnosis indicator blinks 6, 7 and 17 Check the PGM-FI system according to the PGM-FI control system troubleshooting, then recheck the D_4 indicator light. If it lights, see page 14-316.
- The Check Engine light does not come on when there is a malfunctionn in the Electric Load Detector circuits. However, it will indicate the codes when the Service Check Connector is jumped.

If the inspection for a particular failure code requires the test harness, remove the right door sill molding and pull the carpet back to expose the ECU. Unbolt the ECU bracket: Turn the ignition switch off and connect the test harness. Check the system according to the procedure described for the appropriate code(s) listed on the following pages.

LHD:



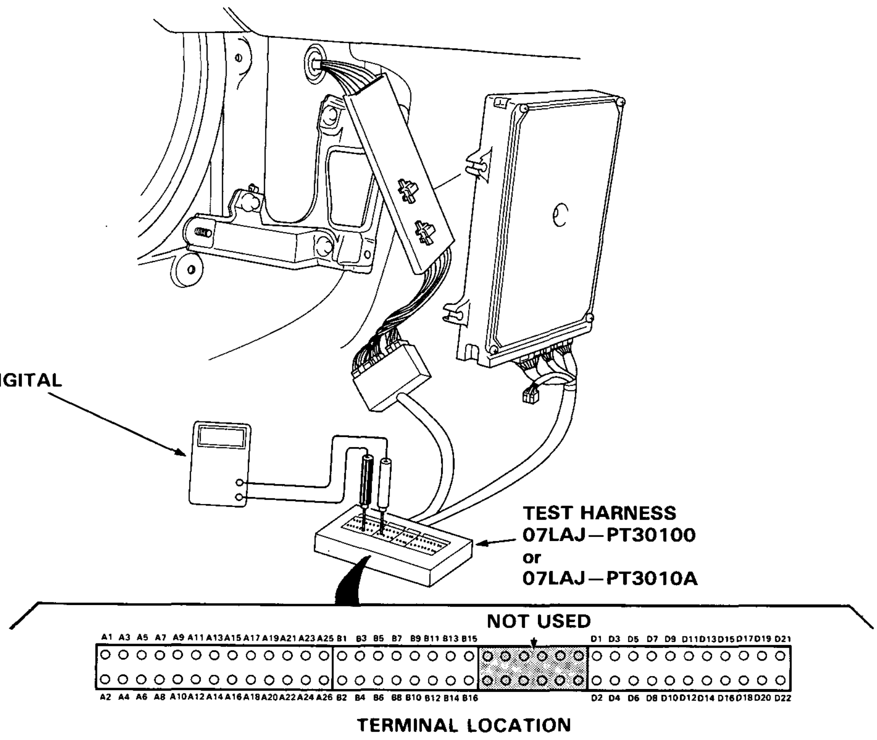
RHD:



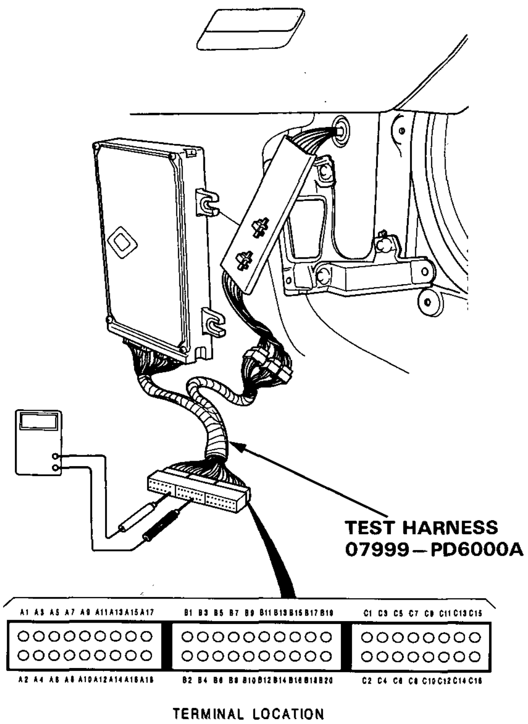
(cont'd)

Self-diagnostic Procedures (cont'd)

Except D15B2 engine:

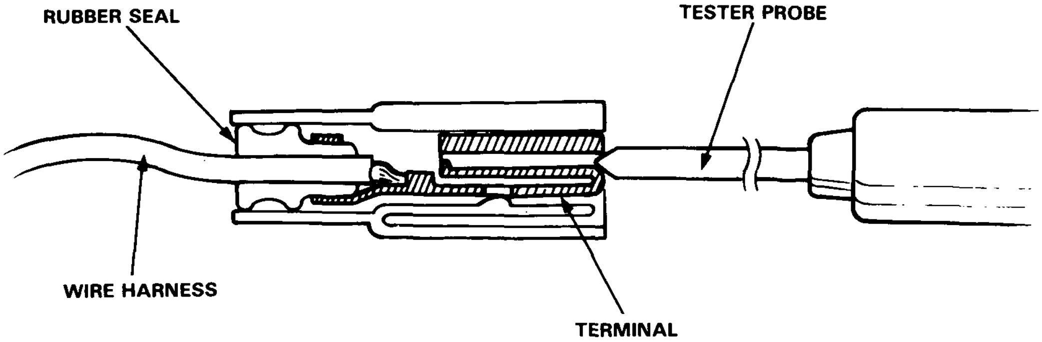


D15B2 engine:



CAUTION:

- Puncturing the insulation on a wire can cause poor or intermittent electrical connections.
- For testing at connectors other than the test harness, bring the tester probe into contact with the terminal from the connector side of wire harness connectors in the engine compartment. For female connectors, just touch lightly with the tester probe and do not insert the probe.



Troubleshooting

How to Read Flowcharts

A flowchart is designed to be used from start to final repair. It's like a map showing you the shortest distance. But beware: if you go off the ''map'' anywhere but a ''stop'' symbol, you can easily get lost.

START (bold type)	Describes the conditions or situation to start a troubleshooting flowchart.
ACTION	Asks you to do something; perform a test, set up a condition etc.
⟨DECISION⟩	Asks you about the result of an action, then sends you in the appropriate troubleshooting direction.
STOP (bold type)	The end of a series of actions and decisions, describes a final repair action and sometimes directs you to an earlier part of the flowchart to confirm you repair.

NOTE:

- the term ''Intermittent Failure'' is used in these charts. It simỹ means a system may have had a failure, but it checks out OK at this time. If the Check engine light on the dash does not come on, check for poor connections or loose wires at all connections related to the ciricuit that you are troubleshooting.
- Most of the troubleshooting flowcharts have you reset the ECU and try to duplicate the problem code. If the problem is intermittent and you can't duplicate the code, do not continue through the flowchart. To do so will only result in confusion and, possibly, a needlessly replaced ECU.
- ''Open'' and ''Short'' are common electrical terms. An open is a break in a wire or at a connection. A short is an accidental connection of a wire to ground or to another wire. In simple electronics, this usually means something won't work at all. In complex electronics (like ECU's), this can sometimes mean something works, but not the way it's supposed to.
- If the electrical readings are not as specified when using the test harness, check the test harness connections before proceeding.

System Description

INPUTS

- TDC/CRANK/CYL Sensors
- MAP Sensor
- TW Sensor
- TA Sensor
- Throttle Angle Sensor
- Oxygen Sensor
- LAF Sensor
- EGR Valve Lift Sensor
- Vehicle Speed Sensor
- IMA Sensor
- Starter Signal
- Alternator FR Signal
- Air conditioning Signal
- A/T Shift Position signal
- Battery Voltage (IGN. 1)
- M/T Clutch Switch Signal
- Brake Switch Signal
- P/S Oil Pressure Switch Signal
- Electic Load Detector
- Valve timing Oil Pressure Switch

ELECTRONIC CONTROL UNIT

- Injector Timing and Duration
- Electronic Idle Control
- Other Control Functions
- ECU Back-up Functions

OUTPUTS

- Injectors
- Main Relay (Fuel Pump)
- Check Engine Light
- EACV
- A/C Compressor Clutch Relay
- Igniter Unit
- Purge Control Solenoid Valve
- EGR Control Solenoid Valve
- Oxygen (LAF) Sensor Heater
- Alternator
- A/T Lock-up Solenoid Valve A/B
- Spool Solenoid Valve
- Tandem Valve Control (D15 B2 engine)

Injector Timing and Duration
The ECU contains memories for the basic discharge durations at various engine speeds and manifold pressures. The basic discharge duration, after being read out from the memory, is further modified by signals sent from various sensors to obtain the final discharge duration.

Electronic Air Control
Electronic Air Control valve (EACV)
When the engine is cold, the A/C compressor is on, the transmission is in gear (A/T only) or the alternator is charging, the ECU controls current to the EACV to maintain correct idle speed.

Ignition Timing Control
- The ECU contains memories for basic ignition timing at various engine speeds and manifold pressures. Ignition timing is also adjusted for coolant temperature.

Other Control Functions
1. Starting Control
   When the engine is started, the ECU provides a rich mixture.
2. Fuel Pump Control
   - When the ignition switch is initially turned on, the ECU supplies ground to the main relay that supplies current to the fuel pump for two seconds to pressurize the fuel system.
   - When the engine is running, the ECU supplies ground tothe main relay that suppleis current to the fuel pump.
   - When the engine is not running and the ignition is on, the ECU cuts ground to the main relay which cuts current to the fuel pump.

3. Fuel Cut-off Control
   - During deceleration with the throttle valve closed, current tothe injectors is cut off to improve fuel economy at speeds over following rpm:
     - D15B2 engine: 1300 min^{-1} (rpm)
     - D15Z1 engine: 850 min^{-1} (rpm)
     - D16A7 engine: 990 min^{-1} (rpm)
     - D16Z6,
       D16Z7 engine: M/T 1000 min^{-1} (rpm)
       A/T 990 min^{-1} (rpm)
     - D16A8,
       D16A9 engine: 990 min^{-1} (rpm)
     - B16A2 engine: 990 min^{-1} (rpm)
   - Fuel cut-off action also takes place when engine speed exceeds, D15B2 engine: 6800 min^{-1} (rpm), D15Z1 engine: 6300 min^{-1} (rpm), D16A7 engine: 7250 min^{-1} (rpm), D16Z6, D16Z7, D16A8, D16A9 engine: 7400 min^{-1} (rpm), B16A2 engine: 8100 min^{-1} (rpm) regardless of the position of the throttle valve, to protect the engine from overrevving.

4. A/C Compressor Clutch Relay
   When the ECU receives a demand for cooling from the air conditioning system (compressor control unit), it delays the compressor from being energized, and enriches the mixture to assure smooth transition to the A/C mode.

5. Purge Control Solenoid Valve
   When the coolant temperature is below D15Z1 engine: 75°C (167°F), D15B2 engine: 80°C (176°F) Others: 70°C (158°F) the ECU supplies a ground to the purge control solenoid valve which cuts vacuum to the purge control valve.

6. EGR Control Solenoid Valve (EGR CSV)
   When the EGR is required for control of oxides of nitrogen (NOx) emissions, the ECU supplies ground tot he EGR CSV which supplies regulated vacuum to the EGR valve.

7. Alternator Control
   The system controls the voltage generated at the alternator in accordance with the electric load and drive mode, and reduces the engine load to improve the fuel economy.

8. Tandem Valve Control Solenoid Valve
   Depending on coolant temperature and engine speed, the ECU supplies ground tothe tandem valve control solenoid valve which opens the tandem valve. The opening and closing of the tandem valve maintains good atomization of the fuel injected by the main fuel injector.

9. Lock-up Control Solenoid Valve (A/T)
   The speed and throttle angle sensor inputs to the ECU are sued to send an on/off voltage signal to the lock-up control solenoid valve for precise timing of the torque converter lock-up system.

ECU Back-up Functions

1. Fail-Safe Function
   When an abnormality occurs in a signal from a sensor, the ECU ignores that signal and assumes a pre-programmed valve that allows the engine to continue to run.

2. Back-up Function
   When an abnormality occurs in the ECU itself, the inejctors are controlled by a back-up circuit independent of the system in order to permit minimal driving.

3. Self-diagnosis Function (Check Engine light)
   When an abnormality occurs in a signal from a sensor, the ECU lights the Check Engine light and stores the failure code in erasable memory. When the ignition is initially turned on, the ECU supplies ground for the Check Engine light for two seconds.

Troubleshooting Flowchart — Engine Will Not Start

Engine will not start.

Watch the Check Engine light and turn the ignition switch ON

Did the Check Engine light come on at all?

- NO → **Perform troubleshooting on page 11-219.**
- YES ↓

Did the Check Engine light go off after two seconds?

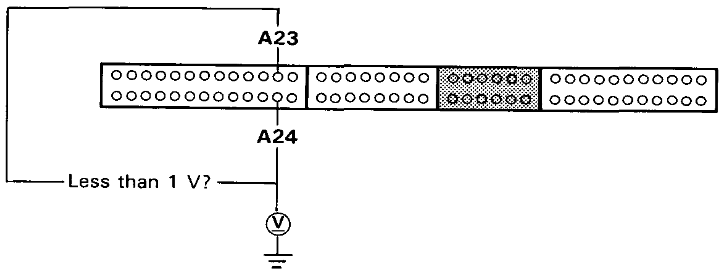
- NO → **Perform troubleshooting on page 11-220.**
- YES ↓

Turn the ignition switch OFF.

Connect the test harness between the ECU and connector (page 11-212).

Turn the ignition switch ON.

Measure voltage between body ground and the following terminals individually: A23, A24



Is there less than 1 V?

- NO → **Repair open in wire between ECU and G101 on wire that more than 1 V.**
- YES ↓

Inspect Fuel Pressure (page 11-332).

Is fuel pressure OK?

- NO → **Repair as necessary.**
- YES ↓

Perform ignition system check (section 23).

Troubleshooting Flowchart — ECU

Check Engine light never comes on (even for two seconds) after ignition is turned on.

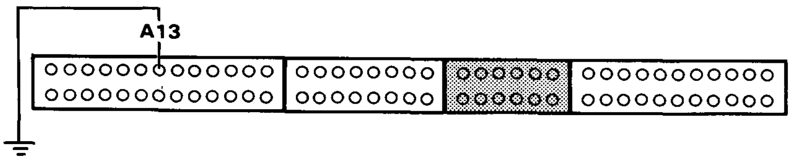
Is the oil pressure light on?

- NO → Inspect BACK UP LIGHT fuse.
  - Is BACK UP LIGHT fuse OK?
    - NO → **Replace fuse.**
    - YES → **Repair open in YEL between BACK UP LIGHT and gauge assembly.**
- YES ↓

Turn the ignition switch OFF.

Connect the test harness between the ECU and connector (page 11-212).

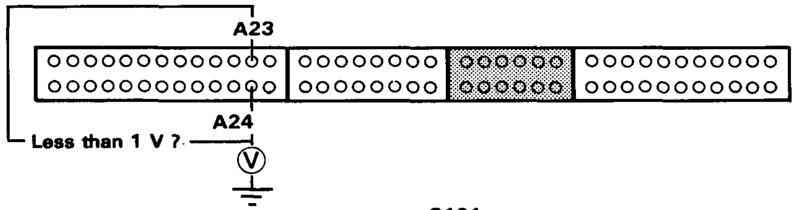
Connect A13 terminal to body ground.



Turn the ignition switch ON.

Is Check Engine light on?

- NO →
  - **Replace the light bulb.**
  - **Repair open in GRN/ORN wire between ECU (A13) and gauge assembly.**
- YES ↓

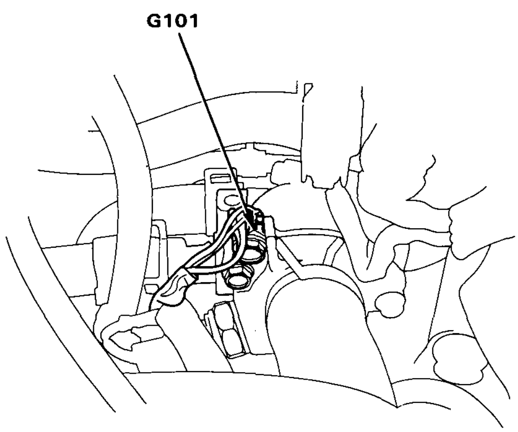


Measure voltage between body ground and the following terminals individually: •A23, •A24.

Is there less than 1V?

- NO → **Repair open in wire between ECU and G101 that had more than 1 V.**
- YES ↓

Substitute a known-good ECU and recheck. If symptom/ indication goes away, replace the original ECU.



(cont'd)

NOTE: When there is no code stored, the Check Engine light will stay on if the service check connector is jumped.

Check Engine light stays on or comes on after two seconds.

Turn the ignition switch ON.

Connect the service check connector with a jumper wire (page 11-208).

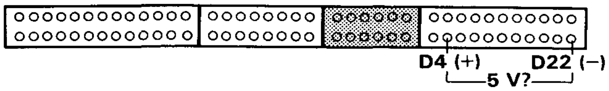
Does Check Engine light indicate any CODE?

- YES → **Go to self-diagnostic procedures (page 11-210).**
- NO → Remove the jumper wire from the service check connector.

Try to start the engine.

Did the engine start?

- NO → Remove and inspect the ECU (15 A) fuse in the under-hood fuse/relay box.
  - Is the fuse OK?
    - NO → **Replace the fuse.**
    - YES → (To page 11-221)
- YES → Turn the ignition switch OFF.



Connect the test harness between the ECU and connector (page 11-212).

Turn the ignition switch ON.

Measure voltage between D4 (+) terminal and D22 (−) terminal.

Is there approx. 5V?

- NO → **Repair short to body ground in BRN wire between the ECU (D4) and service check connector.**
- YES → Connect the service check connector with a jumper wire.

Measure voltage between D4 (+) terminal and D22 (−) terminal.

Is there approx. 5V?

- YES → *
  - **Repair open in BRN wire between ECU (D4) and service check connector.**
  - **Repair open in GRN/WHT wire between service check connector and ECU (D22).**
- NO → Remove the jumper wire from the service check connector.
  - (To page 11-221)

*NOTE: After repair, disconnect the service check connector jumper wire, test drive the car, and recheck the Check Engine light for a code.

(From page 11-220)

Inspect the ACG (S) (15 A) fuse in the under-dash fuse box.

Is the fuse OK?

NO — **Replace the fuse.**

YES

Turn the ignition switch ON.

Disconnect the 3P connector of each sensor one at a time:

- MAP sensor
- EGR valve lift sensor (D15Z1 engine)
- Throttle angle sensor

Does Check Engine light remain ON?

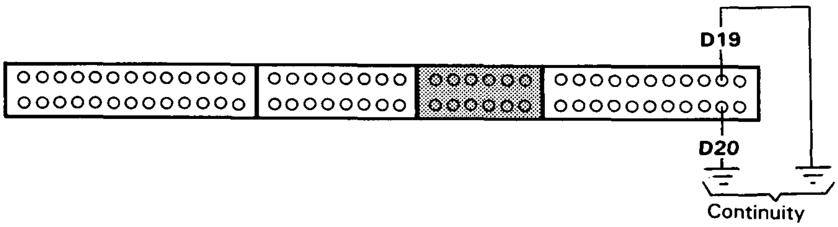
NO — **Replace the sensor that caused the light to go out.**

YES

Turn the ignition switch OFF.

Connect the test harness. Disconnect the "D" connector from the ECU only, not the main wire harness. (page 11-212).

Check for continuity between body ground terminals D19, D20.



Does continuity exist?

YES —

– Repair short to body ground in YEL/GRN* wire between ECU (D19) and MAP sensor.
– Repair short to body ground in YEL/WHT wire between ECU (D20) and throttle angle sensor or EGR valve lift sensor (D15Z1 engine).

*: B16A2 engine
Except B16A2 engine (YEL/RED)

NO

Reconnect all the sensor connectors.
Reconnect the "D" connector to the ECU.

Turn the ignition switch ON.

(To page 11-222)

(From page 11-220)

Turn the ignition switch OFF.

Disconnect "A" connector from the ECU.

Turn the ignition switch ON.

Is the Check Engine light ON?

NO — **Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.**

YES

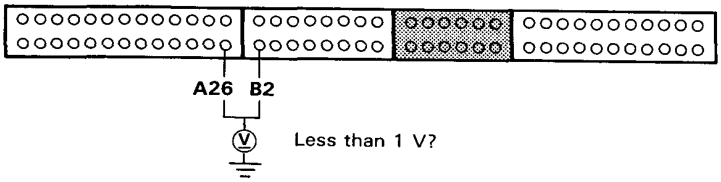
Repair short to body ground in GRN/ORN wire between the ECU (A13) and Check Engine light.

(cont'd)

Troubleshooting Flowchart — ECU (cont'd)

(From page 11-221)

Measure voltage between body ground and the following terminal individually: •A26, •B2.



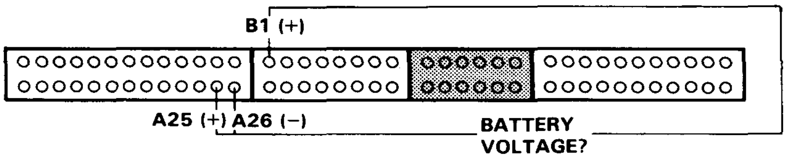
Is there less than 1 V?

NO → **Repair open in BLK/RED (A26) or BRN/BLK (B2) and G101.**

YES

Measure voltage between A26 (−) and the following: B1 (+) and A25 (+).

Measure voltage between A26 (−) and the following: B1 (+) and A25 (+).

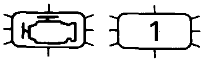


Is there battery voltage?

NO →
- **Repair open in YEL/BLK wire between ECU (A25, B1) and main relay.**
- **Check main relay and wiring connectors at main relay.**

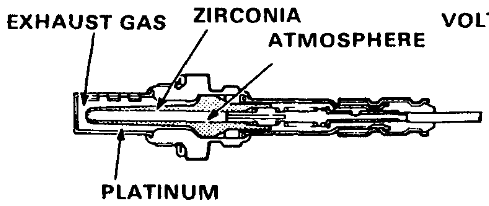
YES

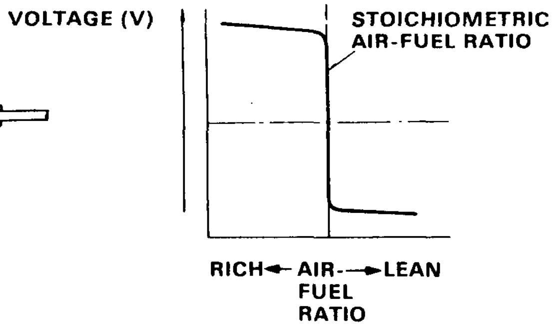
Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.

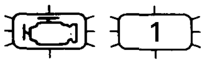


Self-diagnosis Check Engine light indicates code 1: A problem in the Oxygen (O_2) Sensor circuit.

The Oxygen sensor detects the oxygen content in the exhaust gas, and inputs the ECU. In operation, the ECU receives the signals from the sensor and varies the duration during which fuel is injected. The oxygen sensor is installed on the exhaust manifold.







— Check Engine light has been reported on.
— With service check connector jumped (page 11-208), CODE 1 is indicated.

↓

Do the ECU Reset Procedure (page 11-209).

↓

Inspect pressure regulator (page 11-343).

↓

Is it normal?

- NO → **Replace the pressure regulator (page 11-344)**
- YES ↓

Warm up engine to normal operating temperature (cooling fan comes on).

↓

Starting at 1600 min^{-1} (rpm), accelerate using wide open throttle for at least 5 seconds. Then decelerate for at least 5 seconds with the throttle completely closed.

↓

Is Check Engine warning light on and does LED indicate CODE 1.

- NO → ***Intermittent failure, system is OK at this time.* Check for poor connections or loose wires at O_2 sensor and ECU.**
- YES ↓

(To page 11-224)

(cont'd)

Troubleshooting Flowchart — Oxygen Sensor [D16A7, D16A8 engine] (cont'd)

(From page 11-223)

Disconnect engine wire harness from the O2 sensor.

Warm up engine to normal operating temperature again, then open the throttle wide open, then quickly release it.

Measure voltage between the connector terminal and body ground.

Is voltage above 0.6 V at wide open throttle and below 0.4 V when the throttle is quickly released ?

NO → **Replace O2 sensor.**

YES

Stop engine.

Reconnect the oxygen sensor.

Connect the test harness between the ECU and connector (page 11-212).

Restart and warm up engine to normal operating temperature, then open the throttle wide open, then quickly release it.

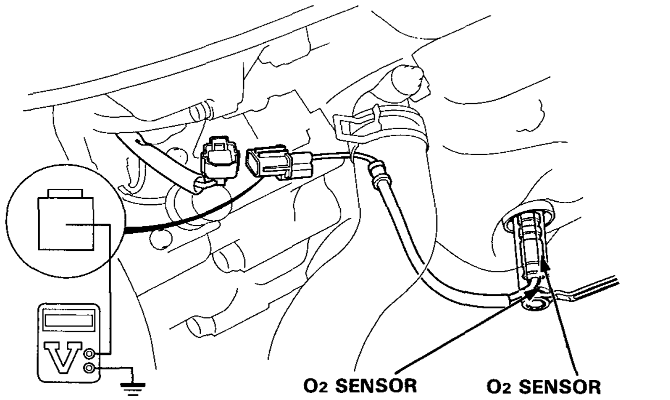
Measure voltage between D14 (+) terminal and D22 (−) terminal.

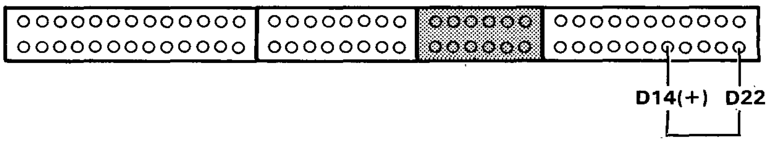
Is voltage above 0.6 V at wide open throttle and below 0.4 V when the throttle is quickly released ?

NO → **Repair short or open in WHT wire between ECU (D14) and O2 sensor.**

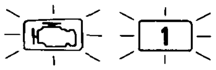
YES

Substitute a known-good ECU and recheck. If symptom/ indication goes away, replace the original ECU.



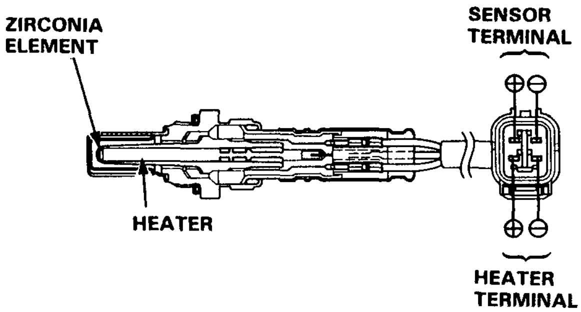


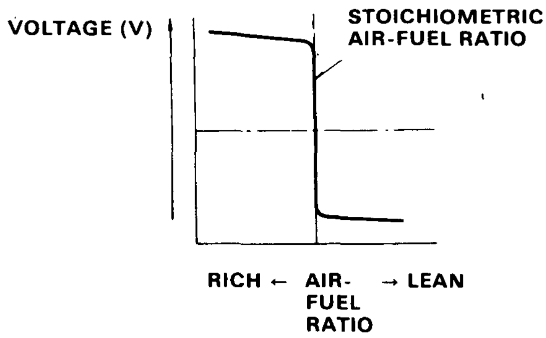
Troubleshooting Flowchart — Oxygen Sensor [D16Z6, D16Z7, B16A2 engine]

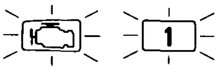


Self-diagnosis Check Engine light indicates code 1: A problem in the Oxygen (O_2) Sensor circuit.

The Oxygen sensor detects the oxygen content in the exhaust gas and signals the ECU. In operation, the ECU receives the signals from the sensor and varies the duration during which fuel is injected. The oxygen sensor has an internal heater. The heater stabilizes the sensor's output. The oxygen sensor is installed in the exhaust manifold.







- Check Engine light has been reported on.
- With service check connector jumpled (page 11-208), CODE 1 is indicated.

↓

Do the ECU Reset Procedure (page 11-209).

↓

Warm up engine to normal operating temperature (cooling fan comes on).

↓

Run engine for 60 seconds.

↓

Road test with the transmission in 2nd gear (M/T: 4th gear). Starting at 1600 min^{-1} (rpm), accelerate using wide open throttle for at least 5 seconds. Then decelerate for at least 5 seconds with the throttle completely closed.

↓

Is Check Engine light on and does it indicate CODE 1?

NO → **Intermittent failure, system is OK at this time. Check for poor connections or loose wires at O_2 sensor and ECU.**

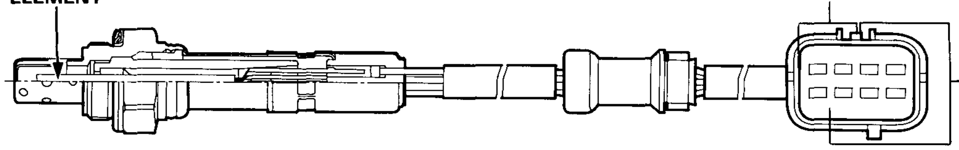
YES ↓

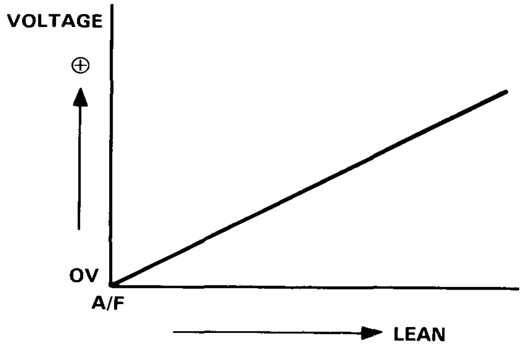
Go to page and perform test for CODE 43 (page 11-240)

Troubleshooting Flowchart — LAF Sensor [D15Z1 engine]

Self-diagnosis Check Engine light indicates code 48: A problem in the Linear Air Fuel ratio (LAF) Sensor circuit.

The LAF sensor operates over a wide air/fuel range.





- Engine is running.
- Check Engine light has been reported on. With service check connector jumped (page 11-208), CODE 48 is indicated.

Do the ECU Reset Procedure (page 11-209).

Start the engine.

Is Check Engine light on and does it indicate CODE 48?

YES — (To page 11-227)

NO — Road test with the transmission in 3rd gear. Hold the engine speed 1500 min^{-1} (rpm).

Is Check Engine light on and does it indicate CODE 48?

NO — **Intermittent failure, system is OK at this time (test drive may be necessary). Check for poor connections or loose wires at LAF sensor and ECU.**

YES — Turn the ignition switch OFF.

Connect the test harness between the ECU and connector (page 11-212).

NOTE: Use DIGITAL CIRCUIT TESTER

(Go to wire harness open check: ECU (D14) terminal and LAF sensor (page 11-230).)

(From page 11-226)

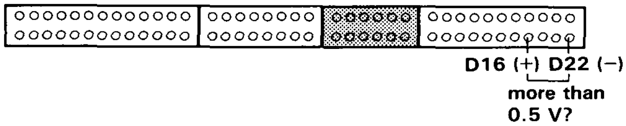
Turn the ignition switch OFF.

Connect the test harness between the ECU and connector (apge 11-212)

With the ignition switch OFF, wait for at least two minutes.

Turn the ignition switch ON.

Measure voltage between D16 (+) terminal and D22 (−) terminal.

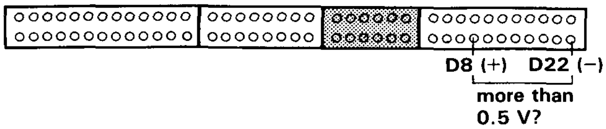


Is there more than 0.5 V?

NO → (Go to wire harness open or short check: ECU (D16) terminal and LAF sensor (page 11-230).)

YES ↓

Measure voltage between D8 (+) terminal and D22 (−) terminal.



Is there more than 0.5 V?

NO → (Go to wire harness open or short check: ECU (D8) terminal and LAF sensor (page 11-230).)

YES ↓

Is there more than 5.0 V?

NO → Disconnect the 8P connector from the LAF sensor.

(To page 11-228)

YES ↓

(To page 11-228)

(cont'd)

Troubleshooting Flowchart — LAF Sensor [D15Z1 engine] (cont'd)

(From page 11-227)

Measure voltage between D8 (+) terminal and D22 –) terminal.

Is there more than 5.0 V?

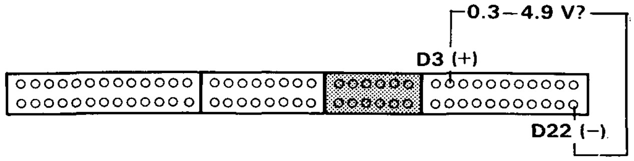
YES → **Replace LAF sensor.**

NO ↓

Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.

(From page 11-227)

Measure voltage between D3 (+) terminal and D22 (–) terminal.



Is there 0.3–4.9 V?

NO → Is there more than 4.9 V?

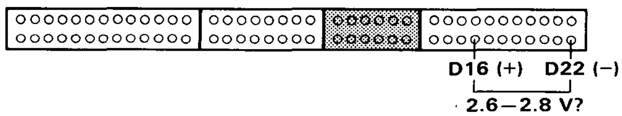
- NO → (Go to wire harness open check: ECU (D3) terminal and LAF sensor (page 11-230).)
- YES → (Go to wire harness short check: ECU (D3) terminal and LAF sensor (page 11-230).)

YES ↓

Warm up engine to normal operating temperature (cooling fan comes on).

↓

Measure voltage between D16 (+) terminal and D22 (–) terminal.

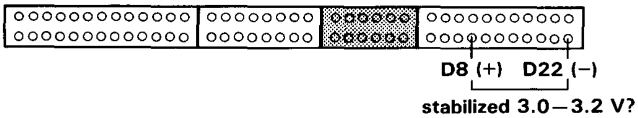


(To page 11-229)

(From page 11-228)

Is there 2.6—2.8 V?

NO → Measure voltage between D8 (+) terminal and D22 (–) terminal.

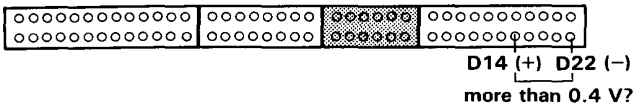


Is there less than 2.8 V?

NO → **Replace LAF sensor.**

YES → **Substitute a known-good ECU and recheck. If symptom/indicaton goes away, replace the original ECU.**

YES → Measure voltage between D14 (+) terminal and D22 (–) terminal.



Is there more than 0.4 V?

NO → Go to wire harness short check: ECU (D14) terminal and LAF sensor (page 11-230).

YES → **Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.**

(cont'd)

Troubleshooting Flowchart—LAF Sensor [D15Z1 engine] (cont'd)

Wire harness short check:

Turn the ignition switch OFF.

Disconnect "D" connector from the ECU only, not the main wire harness (page 11-212).

Check for continuity to body ground on indicated terminals.
* see table

Does continuity exist?

NO → **Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.**

YES → Disconnect the 8p connector from the LAF sensor.

Check for continuity to body ground on indicated terminals.
* see table

Does continuity exist?

YES → **Repair short in the indicated sensor wires.**
*** see table**

NO → **Replace LAF sensor.**

* Table:

CODE	ECU TERMINAL	WIRE COLOR	
		MAIN WIRE HARNESS	ENGINE WIRE HARNESS
41 (page, 11-48)	A6 (HTCNTL)	ORN/BLK	YEL/BLK
	A23 (PG1)	BLK	←
48	D22 (SG2)	GRN/WHT	←
	D3 (LABEL)	BLU/YEL	WHT
	D8 (VS +)	WHT/BLU	←
	D14 (IP +)	ORN/BLU	←
	D16 (IP −, VS −)	BLU/GRN	ORN

Wire harness open check:

Turn the ignition switch OFF.

Disconnect "D" connector from the ECU only, not the main wire harness (page 11-212).

Disconnect the 8p connector from the LAF sensor.

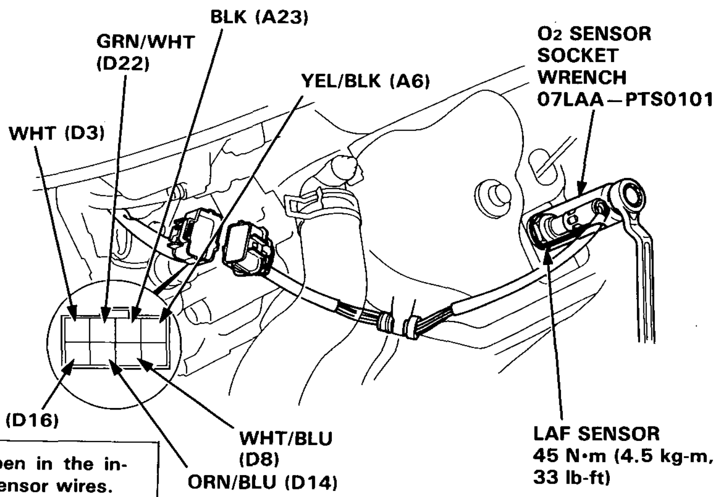
Check for continuity between indicated terminals and wire harness.
* see table

Does continuity exist?

NO → **Repair open in the indicated sensor wires.**
*** see table**

YES → **Inspect for poor terminal to terminal contact at LAF sensor connector and ECU.**
If terminal contact is OK, replace LAF sensor.

WIRE COLOR (ENGINE WIRE HARNESS SIDE):



Troubleshooting Flowchart — Oxygen Sensor Heater [D16Z6, D16Z7, B16A2 engine]

41 Self-diagnosis Check Engine light indicates code 41: A problem in the Oxygen (O_2) Sensor Heater circuit.

41

- Engine is running.
- Check Engine light has been reported on. With service check connector jumped (page 11-208), CODE 41 is indicated.

Do the ECU Reset Procedure (page 11-209).

Start the engine.

Is Check Engine light on and does it indicate CODE 41?

NO → **Intermittent failure, system is OK at this time (test drive may be necessary). Check for poor connections or loose wires at O_2 sensor and ECU.**

YES

Stop the engine

Disconnect the 4P connector from the O_2 sensor.

Measure resistance between terminals C and D on the O_2 sensor.

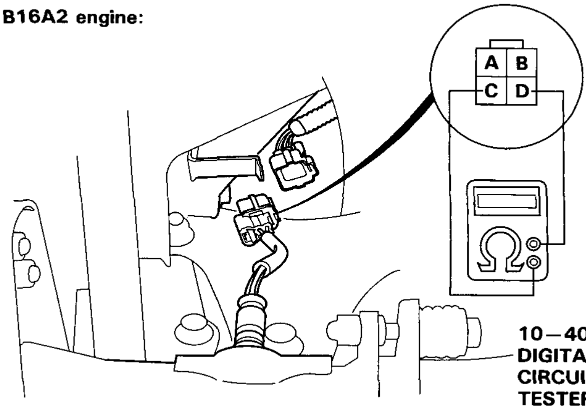
Is there 10—40 Ω

NO → **Replace O_2 sensor.**

YES

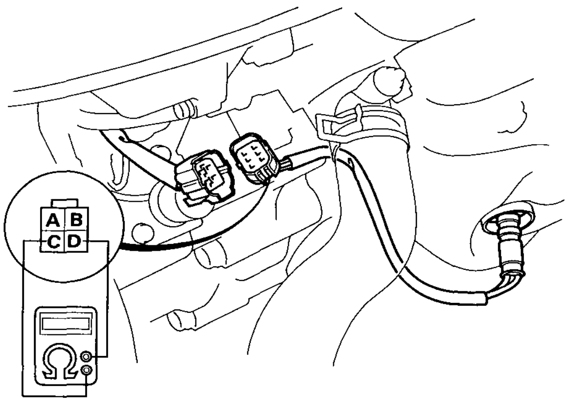
(To page 11-233)

B16A2 engine:



10—40 Ω DIGITAL CIRCUIT TESTER 07411—002000

D16Z6, D16Z7 engine:



10—40 Ω DIGITAL CIRCUIT TESTER 07411—002000

(From page 11-232)

Check for continuity to body ground on terminals C and D of the O_2 sensor.

Does continuity exist?

YES → **Replace O_2 sensor.**

NO ↓

Check for continuity between terminal D and terminals A and B individually.

Does continuity exist?

YES → **Replace O_2 sensor.**

NO ↓

Turn the ignition switch ON.

At O_2 sensor harness, measure voltage between YEL/BLK (+) terminal and ORN / BLK (−) terminal.

Is there battery voltage?

YES → Disconnect the "A" connector from the ECU.

At O_2 sensor harness, measure voltage between YEL/BLK (+) terminal and ORN / BLK (−) terminal.

Is there battery voltage?

YES → **Repair short in ORN / BLK wire between ECU (A6) and O_2 sensor.**

NO ↓

Reconnect the O_2 sensor connector.

(To page 11-234)

NO (from first "Is there battery voltage?") ↓

Measure voltage between YEL/BLK (+) terminal and body ground.

Is there battery voltage?

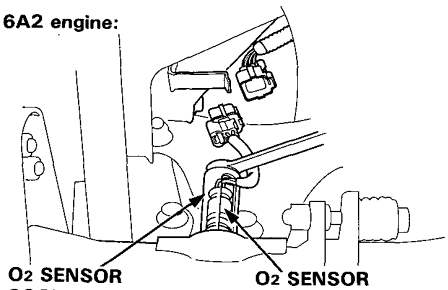
NO → **Repair open in YEL/BLK wire between O_2 sensor and main relay.**

YES ↓

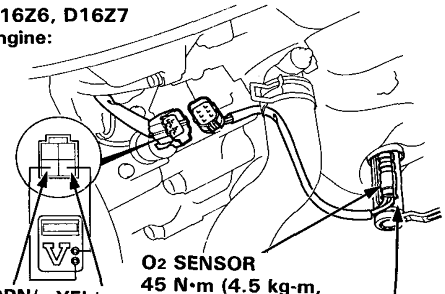
Turn the ignition switch OFF.

(To page 11-234)

B16A2 engine:



D16Z6, D16Z7 engine:



(cont'd)

Troubleshooting Flowchart — Oxygen Sensor Heater [D16Z6, D16Z7, B16A2 engine] (cont'd)

(From page 11-233)

Connect the test harness "A" connector to the main wire harness only, not the ECU (page 11-212).

Connect an ammeter between terminals A6 (+) and A26 (−).

Is the current less than 0.1 A? *

* Monitor over a 5 minutes period.

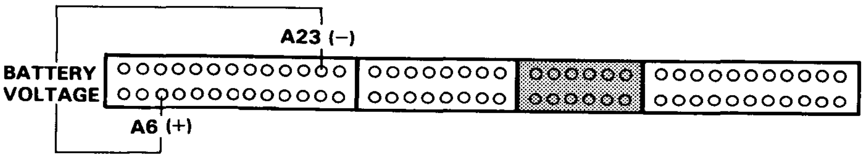
YES → **Replace O2 sensor.**

NO → **Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.**

(From page 11-233)

Reconnect the 4P connector to O2 sensor.

Connect the test harness "A" connector to the main wire harness only, not the ECU (page 11-212).



Turn the ignition switch ON.

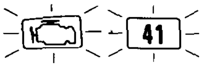
Measure voltage between A6 (+) terminal and A23 (−) terminal.

Is there battery voltage?

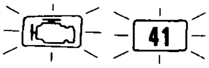
NO → **Repair open ORN / BLK wire between ECU (A6) and O2 sensor.**

YES → **Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.**

Troubleshooting Flowchart — LAF Sensor Heater [D15Z1 engine]



Self-diagnosis Check Engine light indicates code 41: A problem in the Linear Air Fuel ratio (LAF) Sensor Heater circuit.



— Engine is running.
— Check Engine light has been reported on. With service check connector jumped (page 11-208), CODE 41 indicated.

↓

Do the ECU Reset Procedure (page 11-209).

↓

Start the engine.

↓

Is Check Engine light on and does it indicate CODE 41?

- NO → **Intermittent failure, system is OK at this time (test drive may be necessary). Check for poor connections or loose wires at LAF sensor and ECU.**
- YES ↓

Stop the engine

↓

Disconnect the 8P connector from the LAF sensor.

↓

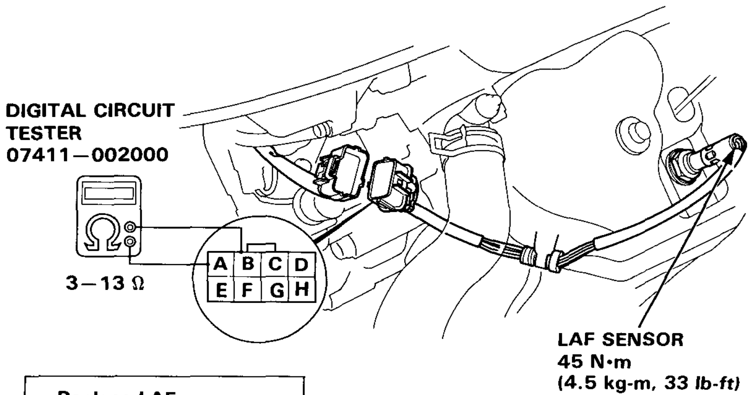
Measure resistance between terminals A and B on the LAF sensor.

↓

Is there 3—13 Ω ?

- NO → **Replace LAF sensor.**
- YES ↓

(To page 11-237)



(From page 11-236)

Check for continuity to body ground on each terminal on the LAF sensor.

Does continuity exist?

YES — **Replace LAF sensor.**

NO

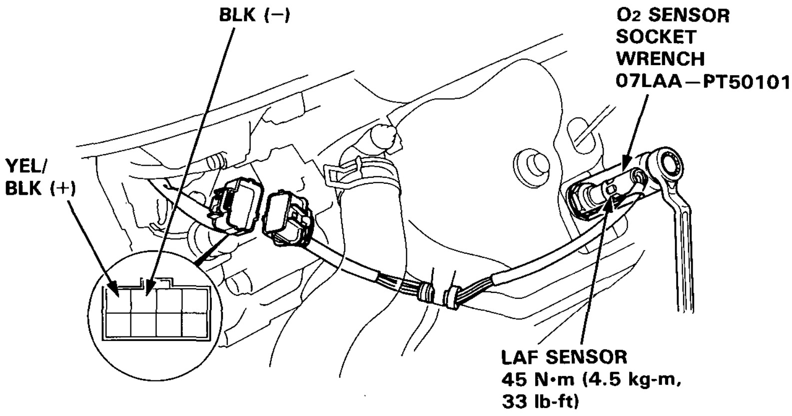
Check for continuity between terminal A and terminals C—H individually.

Does continuity exist?

YES — **Replace LAF sensor.**

NO

Start engine and keep engine rpm at idle.



Measure voltage between YEL/BLK (+) terminal and body ground.

Is there approx. 7 V?

YES — Measure voltage YEL/BLK (+) terminal and BLK (−) terminal.

Is there battery voltage?

NO — **Repair open in BLK wire between LAF sensor and G101.**

YES — **Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.**

NO (approx. 7 V?)

Turn the ignition switch OFF.

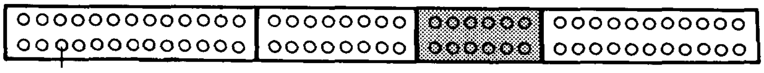
(To page 11-238)

(cont'd)

Troubleshooting Flowchart—LAF Sensor Heater [D15Z1 engine] (cont'd)

(From page 11-237)

Connect the test harness between the ECU and connector. Disconnect "A" connector from the ECU only, not main wire harness (page 11-212).



Check for continuity between A6 terminal and body ground.

Does continuity exist?

- YES → **Repair short in ORN/BLK, YEL/BLK wire between ECU (A6) and LAF sensor.**
- NO ↓

Disconnect the 8P connector from the LAF sensor.

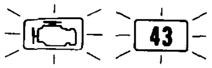
Check for continuity ORN/BLK, YEL/BLK wire between ECU (A6) and LAF sensor.

Does continuity exist?

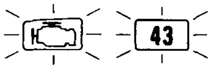
- YES → **Repair open in ORN/BLK, YEL/BLK wire between ECU (A6) and LAF sensor.**
- NO ↓

Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.

Troubleshooting Flowchart — Fuel Supply System [D16Z6, D16Z7 B16A2 engine]



Self-diagnosis Check Engine light indicates code 43: Most likely a problem in the Oxygen (O_2) Sensor circuit or a problem in the Fuel Supply System.



— Check Engine light has been reported on.
— With service check connector jumped (page 11-208), CODE 43 is indicated.
— or continued from code 1.

Is the 43 code accompanied by the Check Engine light and poor driveability?

YES → **Go to Fuel Supply System (page 11-331).**

NO ↓

Do the ECU Reset Procedure (page 11-209).

Warm up engine to normal operating temperature (cooling fan comes on).

Hold engine at 3,000 min^{-1} (rpm) for two minutes. (A/T: Transmission in $\boxed{N}$ or $\boxed{P}$.)

Is the Check Engine light on and does it indicate CODE 43?

NO → **Intermittent failure, system is OK at this time (test drive may be necessary). Check for poor connections or loose wires at O_2 sensor and ECU.**

YES ↓

Turn the ignition switch OFF.

Connect the test harness between the ECU and connector (page 11-212).

With the ignition switch OFF, wait for at least two minutes.

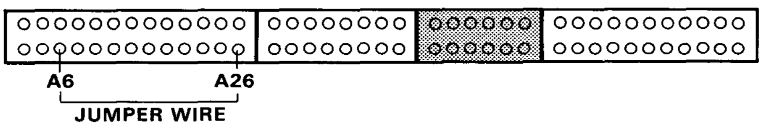
Install a jumper wire on the test harness between A6 and A26.

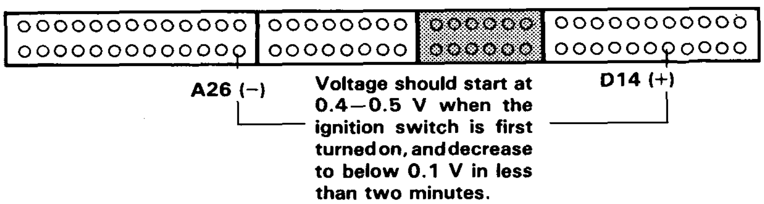
Turn the ignition switch ON.

Measure voltage between D14 (+) terminal and A26 (–) terminal as soon as the ignition switch is turned on.

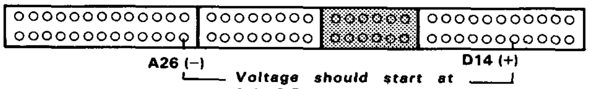
(To page 11-241).

NOTE:
- Use DIGITAL CIRCUIT TESTER
- Use 2 Volt range.





(From page 11-240)



Voltage should start at 0.4−0.5 V when the ignition switch is first turned on, and decrease to below 0.1 V in less than two minutes.

Is there 0.1 V or less when the ignition switch is first turned on?

YES → Disconnect the 4P connector from the O2 sensor.

Measure voltage between D14 (+) terminal and A26 (−) terminal.

Is there more than 0.1 V?

YES → **Replace O2 sensor.**

NO → Disconnect the "D" connector from the main wire harness.

Measure voltage between D14 (+) terminal and A26 (−) terminal.

Is there more than 0.1 V?

YES → **Repair short in WHT wire between ECU (D14) and O2 sensor.**

NO → **Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.**

NO → Disconnect the 4P connector from the O2 sensor.

Measure voltage at the engine wire harness side of the O2 sensor connector between GRN/WHT (−) and WHT (+).

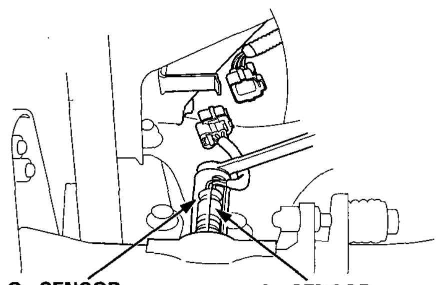
Is there more than 0.1 V?

YES → **Replace O2 sensor.**

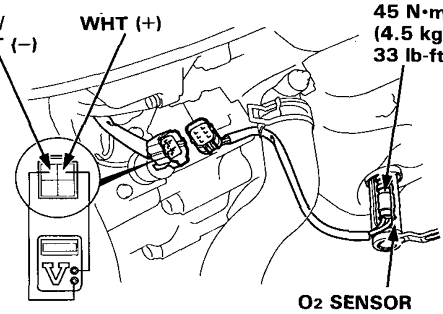
NO → **Repair open in WHT wire between ECU (D14) and O2 sensor.**

If wire is OK, check for open in GRN/WHT wire between ECU (D22) and O2 sensor.

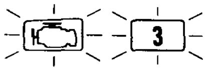
B16A2 engine:



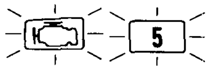
D16Z6, D16Z7 engine:



Troubleshooting Flowchart — MAP Sensor



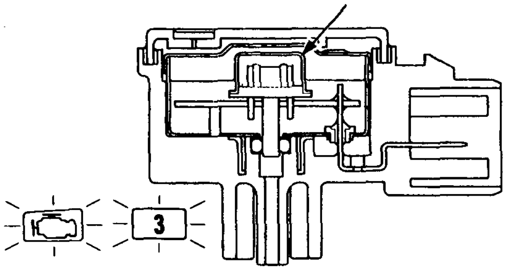
Self-diagnosis Check Engine light indicates code 3: An electrical problem in the Manifold Absolute Pressure (MAP) Sensor system.



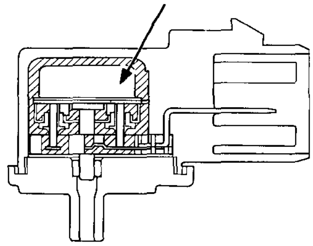
Self-diagnosis Check Engine light indicates code 45: Most likely a problem in the Fuel Metering System. Pressure (MAP) Sensor system.

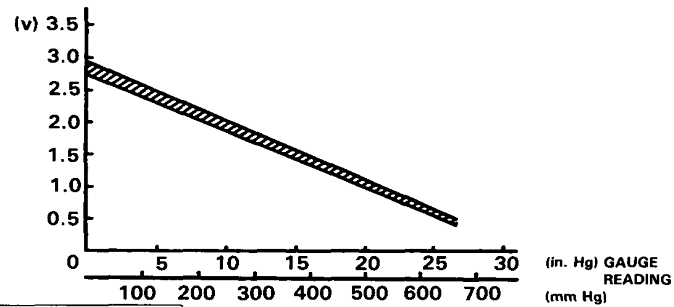
The MAP sensor converts manifold absolute pressure into electrical signals and inputs the ECU.

B16A2 engine:



Except B16A2 engine:





— Engine is warm and running.
— Check Engine light has been reported on.
— With service check connector jumped (page 11-208), CODE 3 is indicated.

Do the ECU Reset Procedure (page 11-209).

Start the engine and allow it to idle.

Is Check Engine light on and does it indicate CODE 3?

NO → **Intermittent failure, system is OK at this time (test drive may be necessary). Check for poor connection or loose wires at MAP sensor and ECU.**

YES

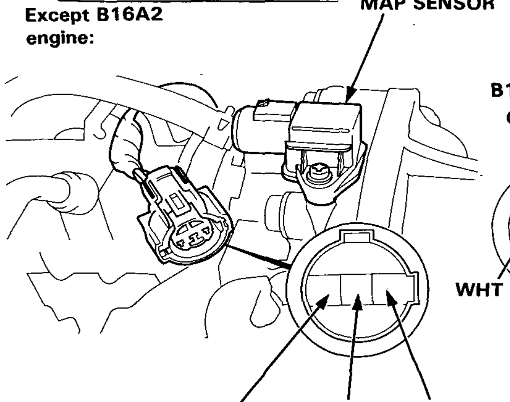
Turn the ignition switch OFF.

Disconnect the 3P connector from the MAP sensor.

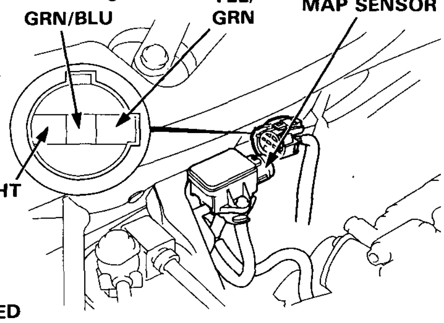
Turn the ignition switch ON.

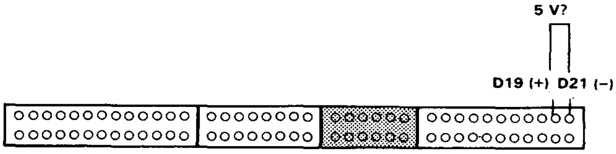
(To page 11-243)

Except B16A2 engine:



B16A2 engine:





*: B16A2 engine

(From page 11-242)

Measure voltage between YEL/RED (YEL/GRN)* (+) terminal and body ground.

Is there approx. 5V?

YES → Measure voltage between YEL/RED (YEL/GRN)* (+) terminal and GRN/WHT (GRN/BLU)* (−) terminal.

Is there approx. 5V?

NO → Repair open in GRN/WHT, GRN/BLU (GRN/BLU)* wire between ECU (D21) and MAP sensor.

YES

Measure voltage between WHT (+) terminal and GRN/WHT (GRN/BLU)* (−) terminal.

Is there approx. 5V?

NO → (To page 11-244)

YES

Turn the ignition switch OFF.

Reconnect the 3P connector to the MAP sensor.

Connect the test harness between the ECU and connector (page 11-212).

Turn the ignition switch ON.

(To page 11-244)

NO (from first "Is there approx. 5V?")

Connect the test harness "D" connector to the ECU only, not to the main wire harness (page 11-212).

Measure voltage between D19 (+) terminal and D21 (−) terminal.

*: B16A2 engine

Is there approx. 5 V?

YES → Repair open in YEL/RED YEL/GRN (YEL/GRN)* wire between ECU (D19) and MAP sensor.

NO → Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.

(cont'd)

Troubleshooting Flowchart — MAP Sensor (cont'd)

(From page 11-243)

Connect the test harness "D" connector to the ECU only, not to the main wire harness (page 11-212).

Measure voltage between D17 (+) terminal and D21 (−) terminal.

Is there approx. 5 V?

YES →

- Repair short in WHT wire between ECU (D17). and MAP sensor.
- Repair open in WHT wire between ECU (D17) and MAP sensor.

NO →

Substitute a known-good ECU and recheck. If prescribed voltage is now available, replace the original ECU.

(From page 11-243)

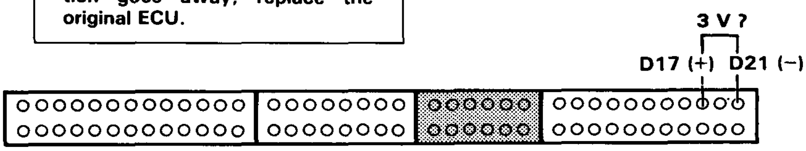
Measure voltage between D17 (+) terminal and D21 (−) terminal.

Is there approx. 3 V ?

NO → **Replace MAP sensor.**

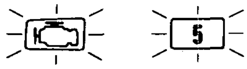
YES →

Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.



(cont'd)

Troubleshooting Flowchart—MAP Sensor [Except B16A2 engine] (cont'd)



- **Check Engine light has been reported on.**
- **With service check connector jumped (page 11-208), CODE 5 is indicated.**

↓

Do the ECU Reset Procedure (page 11-209).

↓

Start the engine and keep engine rpm at 2000 for one minute.

↓

Is Check Engine light on and does it indicate CODE 5?

NO →
- **Intermittent failure, system is OK at this time (test drive may be necessary).**
- **Check vacuum hoses, pipes and connections.**
- **Make sure all connectors are secure.**

YES ↓

Stop the engine.

↓

Remove the MAP sensor from throttle body.

↓

Connect a vacuum pump to the MAP sensor and apply vacuum.

↓

Does it hold vacuum?

NO → **Replace MAP sensor.**

YES ↓

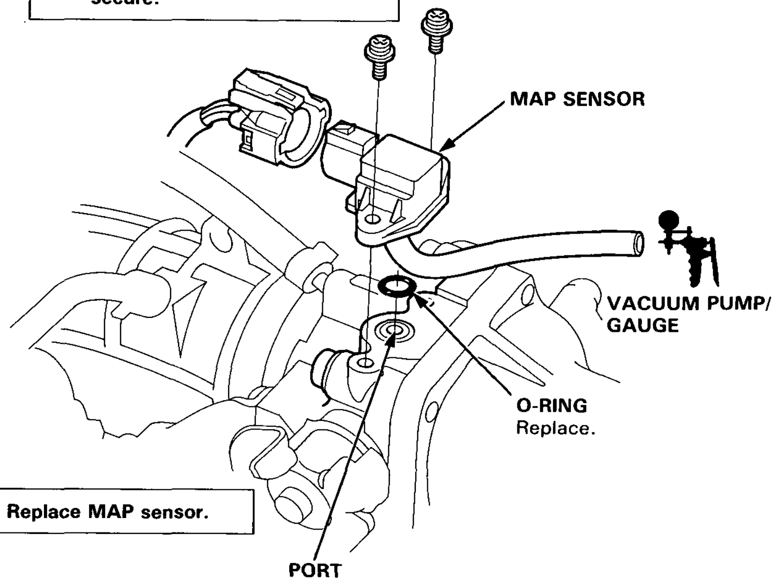
Start the engine.

↓

Put your finger over the MAP port on throttle body.

↓

(To page 11-247)



(From page 11-246)

Is there manifold vacuum?

NO → Remove restriction from throttle body.

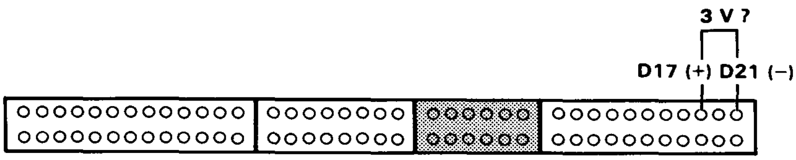
YES

Stop the engine.

Connect the test harness between the ECU and connector (page 11-212).

Turn the ignition switch ON.

Measure voltage between D17 (+) terminal and D21 (−) terminal.



Is there approx. 3 V ?

NO → **Replace MAP sensor.**

YES

Start the engine and allow it to idle.

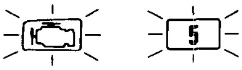
Is there approx. 1 V?

NO → **Replace MAP sensor.**

YES

Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.

Troubleshooting Flowchart—MAP Sensor [B16A2 engine]



- Check Engine light has been reported on.
- With service check connector jumped (page 11-208), CODE 5 is indicated.

Do the ECU Reset Procedure (page 11-209).

Start the engine and keep engine rpm at 2000 for one minute.

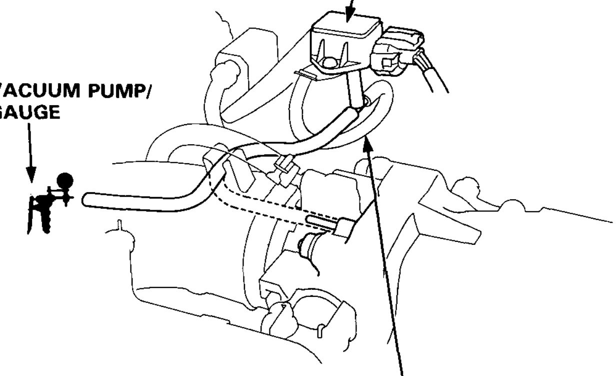
Is Check Engine light on and does it indicate CODE 5?

NO →
- Intermittent failure, system is OK at this time (test drive may be necessary).
- Check vacuum hoses, pipes and connections.
- Make sure all connectors are secure.

YES ↓

Stop the engine.

Disconnect #21 hose from the throttle body, connect vacuum pump to the hose and apply vacuum.



Does it hold vacuum?

NO → Connect a vacuum pump to the MAP sensor and apply vacuum.

Does it hold vacuum?

NO → **Replace MAP sensor.**

YES → **Repair vacuum leak in hose routing between MAP sensor and intake manifold.**

YES ↓

Connect a T-fitting from a vacuum gauge between the throttle body base and #21 hose.

(From page 11-249)

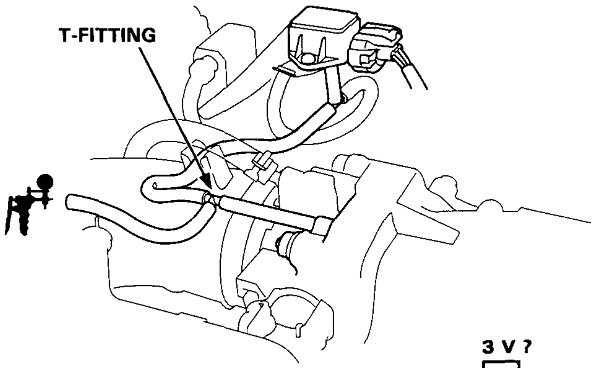
(From page 11-248)

Start the engine.

Is there manifold vacuum?

NO → **Remove restriction from throttle body.**

YES

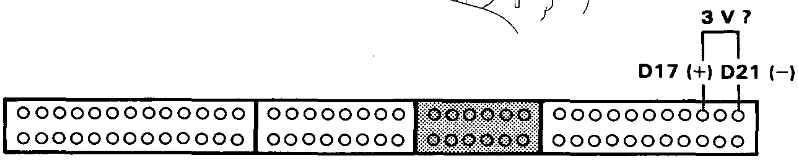


Stop the engine.

Connect the test harness between the ECU and connector (page 11-212).

Turn the ignition switch ON.

Measure voltage between D17 (+) terminal and D21 (–) terminal.



Is there approx. 3 V ?

NO → **Replace MAP sensor.**

YES

Start the engine and allow it to idle.

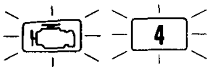
Is there approx. 1 V?

NO → **Replace MAP sensor.**

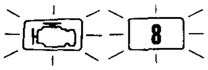
YES

Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.

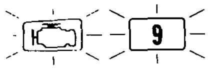
Troubleshooting Flowchart —— TDC/CRANK/CYL Sensor



Self-diagnosis Check Engine light indicates code 4: A problem in the CRANK Sensor *circuit*.

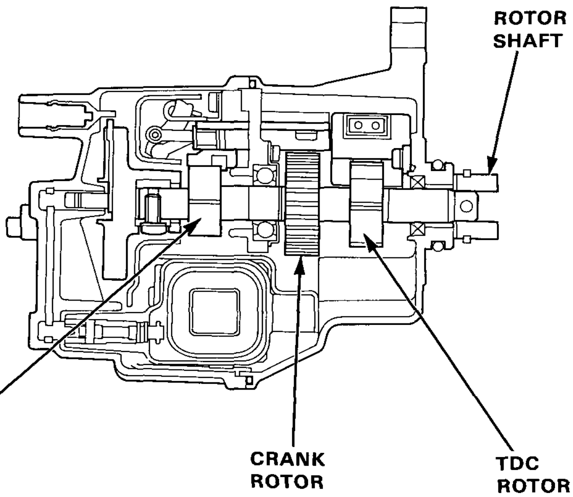


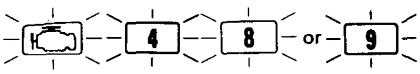
Self-diagnosis Check Engine light indicated code 8: A problem in the TDC Sensor circuit.



Self-diagnosis Check Engine light indicates code 9: A problem in the CYL Sensor circuit.

The CRANK sensor determines timing for fuel injection and ignition of each cylinder and also detects engine RPM. The TDC sensor determines ignition timing at start-up (cranking) and when crank angle is abnormal. The CYL sensor detects the position of No.1 cylinder for sequential fuel injection to each cylinder.





— Check Engine light has been reported on.
— With service check connector jumped (page 11-208), CODE 4, 8 and/or 9 are indicated.

Do the ECU Reset Procedure (apge 11-209).

Start the engine.

Is Check Engine light on and does it indicate CODE 4, 8 or 9?

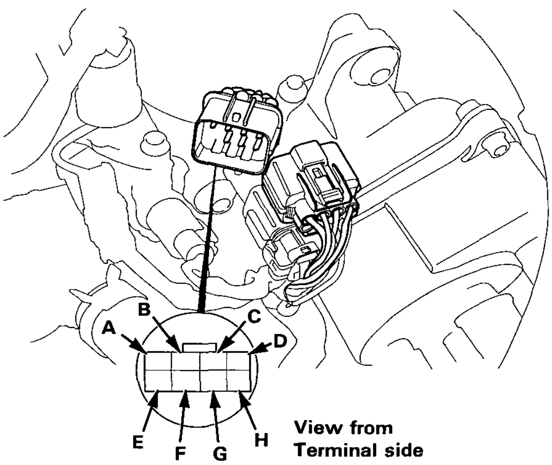
NO → **Intermittent failure, system is OK at this time (test drive may be necessary). Check for poor connections or loose wires at TPC/CRANK/CYL sensor and ECU.**

YES ↓

Stop the engine.

Disconnect the 8P connector from the TDC/CRANK/CYL sensor.

(To page 11-251)



(From page 11-250)

Measure resistance between terminals of the indicated sensor.
*see table

Is there 350–700Ω?

NO → Replace the distributor sub-assembly (Section 23).

YES

Check for continuity to body ground on both terminals of the indicated sensor.

Does continuity exist?

YES → Replace the distributor sub-assembly (Section 23).

NO

Reconnect the connector.

Connect the test harness to the main wire harness only, not to the ECU (page 11-212).

Measure resistance between terminals of the indicated sensor on test harness.
*see table

Is there 350–700Ω?

NO → **Repair open in the indicated sensor wires.**
***see table**

YES

Check for continuity to body ground on B15, B13 and B11 terminals.

Does continuity exist?

YES → **Repair short to body ground in the indicated sensor wires.**
***see table**

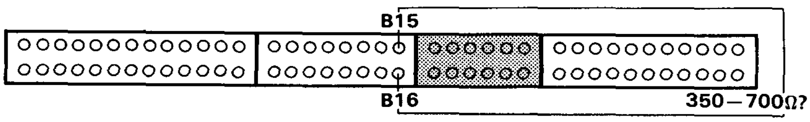
NO

Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.

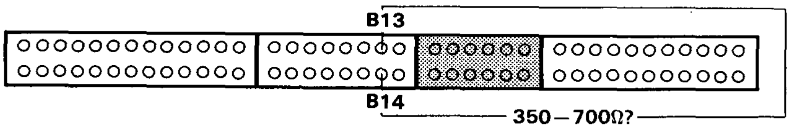
*:

SENSOR	CODE	SENSOR TERMINAL	ECU TERMINAL	WIRE COLOR
CRANK	4	B	B15	BLU/GRN
		F	B16	BLU/YEL
TDC	8	C	B13	ORN/BLU
		G	B14	WHT/BLU
CYL	9	D	B11	ORN
		H	B12	WHT

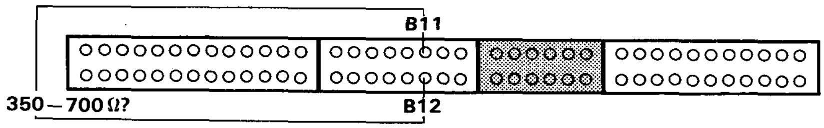
CRANK:



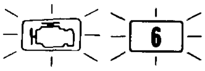
TDC:



CYL:

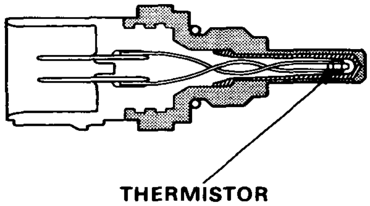


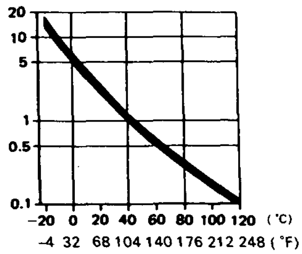
Troubleshooting Flowchart —— TW Sensor

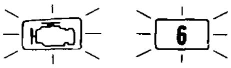


Self-diagnosis Check Engine light indicates code 6: A problem in the Coolant Temperature (TW) *Sensor* circuit.

The TW sensor is a temperature dependant resistor (thermistor). The resistance of the thermistor decreases as the coolant temperature increases as shown below.







- **Check Engine light has been reported on.**
- **With service check connector jumped (page 11-208), CODE 6 is indicated.**

↓

Do the ECU Reset Procedure (page 11-209).

↓

Turn the ignition switch ON.

↓

Is Check Engine light on and does it indicate CODE 6?

- NO → **Intermittent failure, system is OK at this time (test drive may be necessary). Check for poor connections or loose wires at TW sensor and ECU.**
- YES ↓

Warm up engine to normal operating temperature (cooling fan comes on).

↓

Turn the ignition switch OFF.

↓

Disconnect the 2P connector from the TW sensor.

↓

Measure resistance between the 2 terminals on the TW sensor.

↓

Is there 200—400 Ω?

- NO → **Replace TW sensor.**
- YES ↓

(To page 11-253)

(From page 11-252)

Turn the ignition switch ON.

Measure voltage between RED/WHT and body ground.

Is there approx. 5V ?

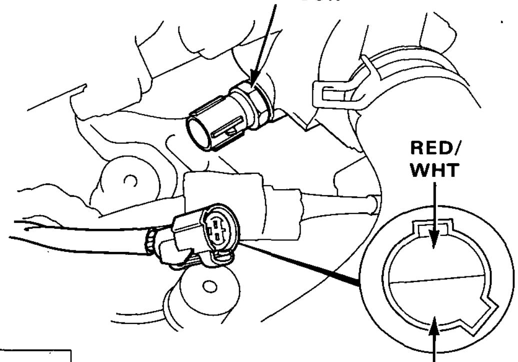
YES → Measure voltage between RED/WHT (+) terminal and GRN/WHT (−) terminal.

Is there approx. 5V ?

NO → Repair open in GRN/WHT wire between ECU (D22) and TW sensor.

YES → **Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.**

NO ↓



D16A7, D16Z6 and D16Z7 engine shown;
Others engine:
TW sensor located under distributor.

A/T (D16Z7 engine only)

Disconnect the 22P connector from the A/T control unit.

Is there approx. 5 V?

YES → **Replace the A/T control unit.**

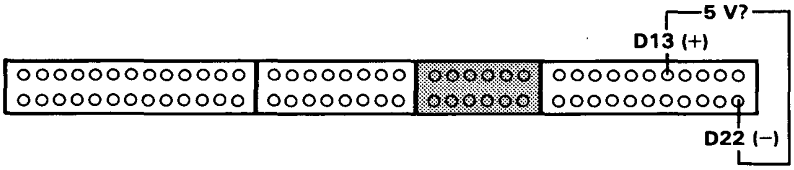
NO ↓

Turn the ignition switch OFF.

Connect the test harness "D" connector to the ECU only, not to the main wire harness (page 11-212).

Turn the ignition switch ON.

Measure voltage between D13 (+) terminal and D22 (−) terminal.

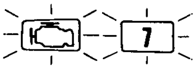


Is there approx. 5V?

YES → **Repair open or short in RED/WHT wire between ECU (D13) and sensor.**

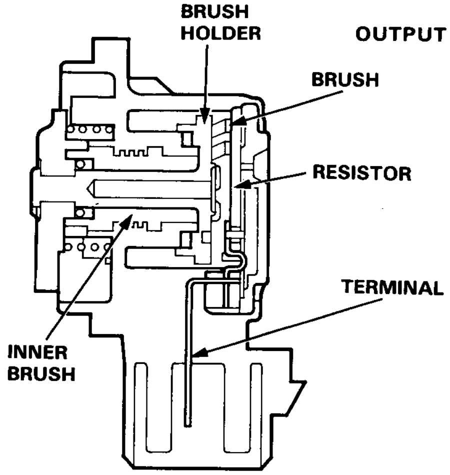
NO → **Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.**

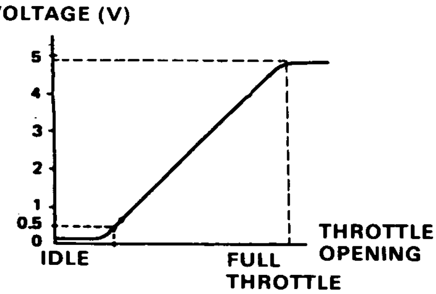
Troubleshooting Flowchart — Throttle Angle Sensor

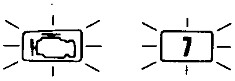


Self-diagnosis Check Engine light indicates code 7: A problem in the Throttle Angle Sensor circuit.

The throttle angle sensor is a potentiometer. It is connected to the throttle valve shaft. As the throttle angle changes, the throttle angle sensor varies the voltage signal to the ECU.







- Engine is running.
- Check Engine light has been reported on.
- With service check connector jumped (page 11-208), CODE 7 is indicated.

↓

Do the ECU Reset Procedure (page 11-209).

↓

Start the engine.

↓

Is Check Engine light on and does it indicate CODE 7?

- NO → **Intermittent failure, system is OK at this time (test drive may be necessary). Check for poor connections or loose wires at throttle angle sensor and ECU.**
- YES ↓

Turn the ignition switch OFF.

↓

Disconnect the 3P connector from the throttle angle sensor.

↓

Turn the ignition switch ON.

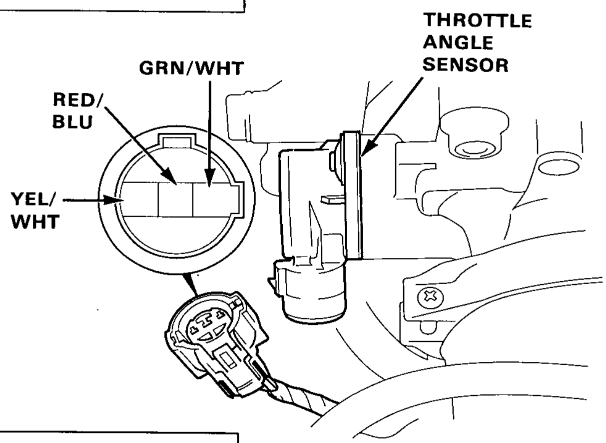
↓

Measure voltage between YEL/WHT (+) terminal and GRN/WHT (−) terminal.

↓

Is there approx. 5V ?

- NO → Measure voltage between YEL/WHT (+) terminal and body ground.
  - (To page 11-255)
- YES ↓ (To page 11-255)



(From page 11-254)

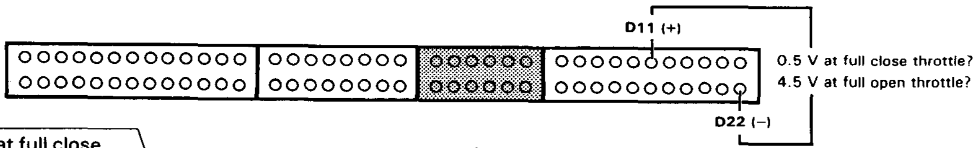
Turn the ignition switch OFF.

Reconnect the 3P connector.

Connect the test harness between the ECU and connector (page 11-212).

Turn the ignition switch ON.

Measure voltage between D11(+) terminal and D22 (−) terminal.



Is voltage 0.5 V at full close throttle, and approx. 4.5 V at full open throttle?
NOTE: There should be a smooth transition from 0.5 V to approx. 4.5 V as the throttle is depressed.

YES → **Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.**

NO → A/T (D16Z7 engine only)

Disconnect the 22P connector from the A/T control unit.

Is voltage 0.5 V at full close throttle,a nd 4.8 V at full open throttle?
NOTE: There should be a smooth transition from 0.5 V to 4.8 V as the throttle is despressed.

YES → **Replace the A/T control unit.**

NO →
- **Replace throttle angle sensor.**
- **Repair open or short in RED/BLU or LT GRN wire between ECU (D11), and throttle angle sensor.**

(From page 11-254)

Is there approx. 5V ?

YES → **Repair open in GRN/WHT wire between ECU (D22) and throttle angle sensor.**

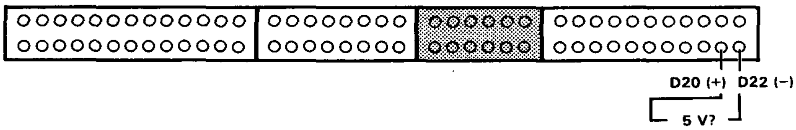
NO

Turn the ignition switch OFF.

Connect the test harness between the ECU and connector (page 11-212).

Turn the ignition switch ON.

Measure voltage between D20 (+) terinal and D22 (−) terminal.

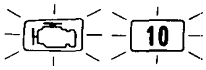


Is there approx. 5V ?

YES → **Repair open in YEL/WHT wire between ECU (D20) and throttle angle sensor.**

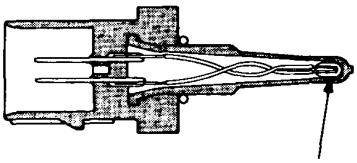
NO → **Substitute a known-good ECU and recheck. If prescribed voltage is now available, replace the original ECU.**

Troubleshooting Flowchart — TA Sensor

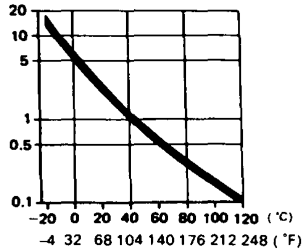


Self-diagnosis Check Engine light indicates code 10: A problem in the Intake Air Temperature (TA) Sensor circuit.

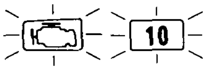
The TA sensor is a temperature dependant resistor (thermistor). The resistance of the thermistor decreases as the intake air temperature increases as shown below.



RESISTANCE (kΩ)



INTAKE AIR TEMPERATURE



- **Check Engine light has been reported on.**
- **With service check connector jumped (page 11-208), CODE 10 is indicated.**

↓

Do the ECU Reset Procedures (page 11-209)

↓

Turn the ignition switch ON.

↓

Is Check Engine light on and does it indicate CODE 10?

- NO → **Intermittent failure, system is OK at this time (test drive may be necessary). Check for poor connections or loose wires at TA Sensor and ECU.**
- YES ↓

Turn the ignition switch OFF.

↓

Disconnect the 2P connector from the TA sensor.

↓

Measure resistance between the 2 terminals on the TA sensor.

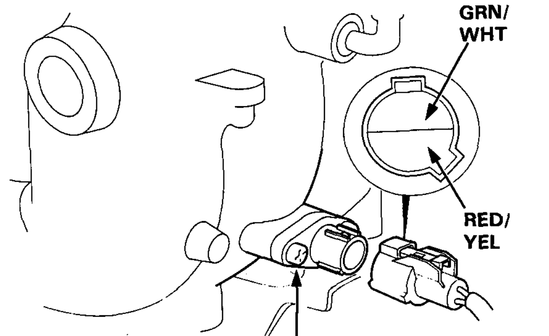
↓

Is there 0.4 – 4.0 kΩ?

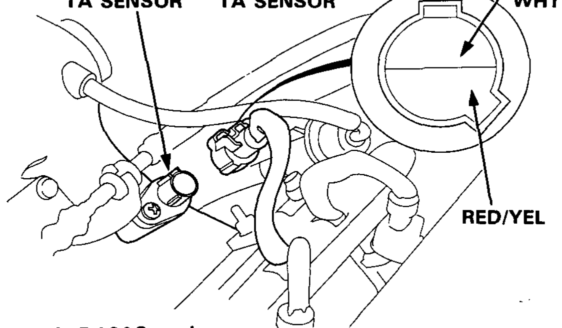
- NO → **Replace TA sensor.**
- YES ↓

(To page 11-257)

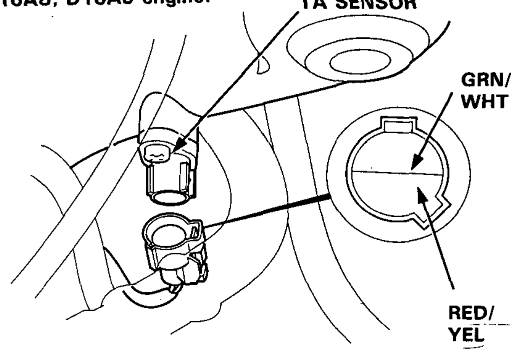
D15Z1, D16A7, D16Z6, D16Z7 engine:



B16A2 engine:



D16A8, D16A9 engine:



(From page 11-256)

Turn the ignition switch ON.

Measure voltage between RED/YEL (+) terminal and body ground.

Is there approx. 5 V ?

YES → Measure voltage between RED/YEL (+) terminal and GRN/WHT (−) terminal.

Is there approx. 5 V ?

NO → **Repair open in GRN/WHT wire between ECU (D22) and TA sensor.**

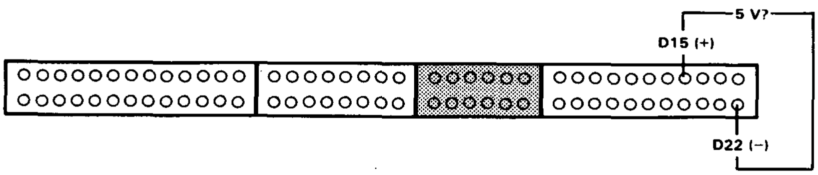
YES → **Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.**

NO → Turn the ignition switch OFF.

Connect the test harness "D" connector to the ECU only, not to the main wire harness (page 11-212).

Turn the ignition switch ON.

Measure voltage between D15 (+) terminal and D22 (−) terminal.



Is there approx. 5V?

YES → **Repair open or short in RED/YEL wire between ECU (D15) and TA sensor.**

NO → **Substitute a known-good ECU and recheck. If prescribed voltage is now available, replace the original ECU.**

Troubleshooting Flowchart — IMA Sensor [D16A9 engine only]

11 Self-diagnosis Check Engine light indicates code 11: A problem in the IMA Sensor circuit.

11

- Check Engine light has been reported on.
- With service check connector jumped (page 11-208), CODE 11 is indicated.

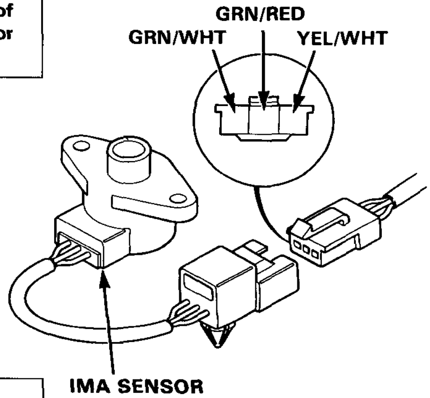
Do the ECU Reset Procedure (page 11-209).

Turn the ignition switch ON.

Is check Engine warning light on ? and does LED indicate CODE 11 ?

NO → **Intermittent failure, system is OK at this time (test drive may be necessary). Check for poor connections of loose wires at the IMA sensor connector.**

YES



Turn the ignition switch OFF.

Disconnect the 3P connector from the IMA sensor.

Measure resistance between A terminal and C terminal on IMA sensor harness.

Is there 4—6 kΩ ?

NO → **Replace IMA sensor.**

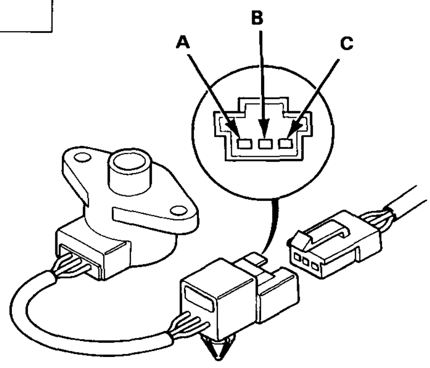
YES

Measure resistance between A and B terminals and between C and B terminals.

Does the sum of the two resistance checks equal 4—6 kΩ ?

NO → **Replace IMA sensor.**

YES



Turn the ignition switch ON.

Measure voltage between YEL/WHT (+) terminal and GRN/WHT (−) terminal on the wire harness.

(To page 6-259)

(From page 6-258)

Is there approx. 5 V ?

NO → Measure voltage between YEL/WHT (+) terminal and body ground.

Is there approx. 5 V ?

YES → **Repair open in GRN/WHT wire between ECU. (D22) and IMA sensor.**

NO ↓

Turn the ignition switch OFF.

Connect the test harness between the ECU and connector (page 6-212).

Turn the ignition switch ON.

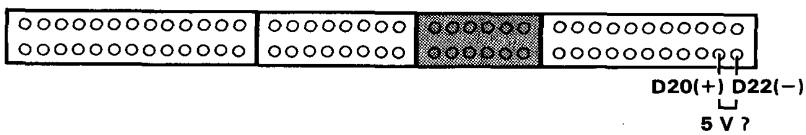
Measure voltage between D20 (+) terminal and D22 (−) terminal.

Is there approx. 5 V ?

YES → **Repair open in YEL/WHT wire between ECU (D20) and IMA sensor.**

NO ↓

Substitute a known-good ECU and recheck. If prescribed voltage is now available, replace the original ECU.



YES ↓

Turn the ignition switch OFF.

Connect the test harness between the ECU and connector (page 6-212)

Turn the ignition switch ON.

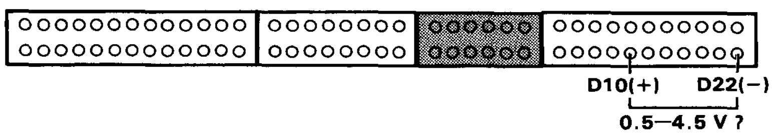
Measure voltage between D10 (+) terminal and D22 (−) terminal.

Is voltage 0.5—4.5 V ?

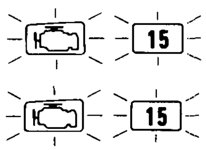
NO → **Repair open or short in GRN/RED wire between ECU (D10) and IMA sensor.**

YES ↓

Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.



Troubleshooting Flowchart — Ignition Output Signal



Self-diagnosis Check Engine light indicates code 15: A problem in the Ignition Output Signal circuit.

- Check Engine light has been reported on.
- With service check connector jumped (see page 11-208), CODE 15 is indicated.

Do the ECU Reset Procedure (page 11-209).

Start the engine.

NOTE: If the engine won't start, it may take 20 seconds of cranking to set the code.

Is Check Engine light on and does it indicate CODE 15?

NO → Intermittent failure, system is OK at this time (test drive may be necessary). Check for poor connections or loose wires at igniter unit and ECU.

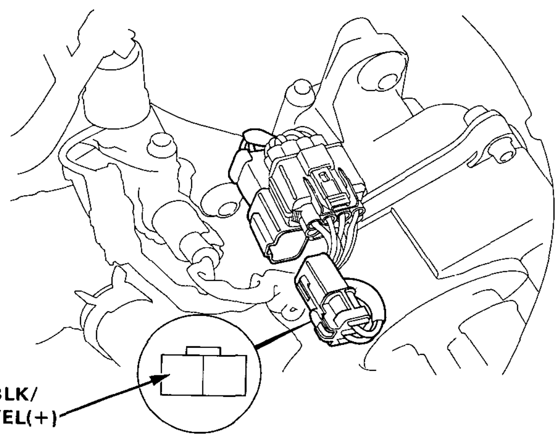
YES ↓

Turn the ignition switch OFF.

Disconnect the 2P connector from the distributor

Turn the ignition switch ON.

Measure voltage between BLK / YEL (+) terminal and body ground.



BLK/
YEL(+)

Is there battery voltage ?

NO → Repair open in BLK/YEL wire between the 2P connector and ignition switch.

YES ↓

(To page 11-261)

(From page 11-260)

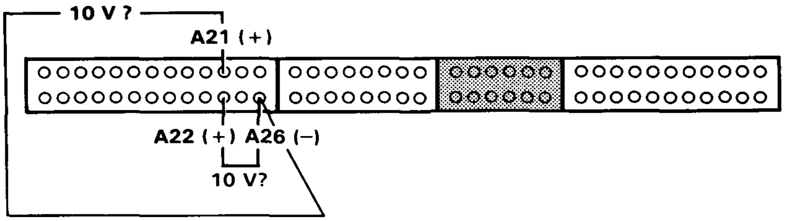
Turn the ignition switch OFF.

Reconnect the 2P connector.

Connect the test harness between the ECU and connector (page 11-212).

Turn the ignition switch ON.

Measure voltage individually between A21 (+), A22 (+) terminals and A26 (−) terminal.



Is there approx. 10 V?

NO:

- **Replace the igniter unit.**
- **Repair open or short in YEL/GRN wire between igniter unit and ECU (A21 or A22).**

NOTE: If the YEL/GRN wire was shorted, the igniter may be damaged.

YES:

Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.

Troubleshooting Flowchart — Vehicle Speed Sensor

17 Self-diagnosis Check Engine light indicates code 17: A problem in the Vehicle Speed Sensor circuit.

The signal generated by the speed sensor produces pulses when the front wheels turn.

17

- **Check Engine light has been reported on.**
- **With service check connector jumped (page 11-208), CODE 17 is indicated.**

↓

Do the ECU Reset Procedure (page 11-209)

↓

Road test necessary.
In 2nd gear accelerate to 4,000 min^{-1} (rpm) then decelerate to 1,500 min^{-1} (rpm) with throttle fully closed.

↓

Is Check Engine light on and does it indicate CODE 17?

NO → **Intermittent failure, system is OK at this time. Check for poor connections or loose wires at speed sensor and ECU.**

YES ↓

Block rear wheels and set the parking brake. Jack up the front of the car and support with safety stands.

⚠WARNING Block rear wheels before jacking up front of car.

↓

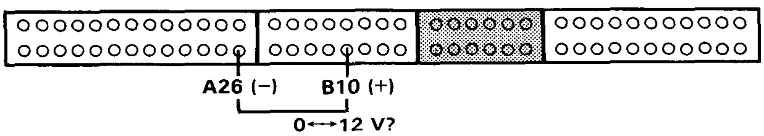
Connect the test harness between the ECU and connector (page 11-212)

↓

Turn the ignition switch ON.

↓

Block the right front wheel and slowly rotate left front wheel and measure voltage between B10 (+) terminal and A26 (−) terminal.



↓

Does voltage pulse 0 V and 12 V?

NO → Turn the ignition switch OFF.

(To page 11-263)

YES ↓

Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.

(From page 11-262)

Disconnect the B connector from the ECU only, not the main wire harness.

Turn the ignition switch ON.

Block the right front wheel and slowly rotate left front wheel and measure voltage between B10 (+) terminal and A26 (−) terminal.

Does voltage pulse 0 V and 12 V?

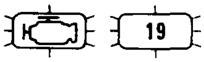
NO

- **Repair short in YEL/BLU wire between ECU (B10) and the speed sensor, speedometer, cruise control unit or A/T control unit (D16Z7 engine only).**
- **Repair open in YEL/BLU wire between ECU (B10) and speed sensor.**
- **If wire is OK, test the speed sensor (Section 23).**

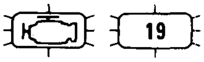
YES

Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.

Troubleshooting Flowchart — A/T Lock-up Control Solenoid Valve



Self-diagnosis Check Engine light indicates code 19: A problem in the Lock-up Control Solenoid Valve A (or B) circuit.



- **Check Eingine light has been reported on.**
- **With service check connector jumped (page 11-208), CODE 19 is indicated.**

Do the ECU Reset Procedure (page 11-209)

Test drive necessary.
Drive the car for several miles so that the transmission upshfts and downshifts several times.

Does Check Engine light indicate CODE 19?

NO → **Intermittent failure, system is OK at this time. Check for poor connections or loose wires at lock-up Control Solenoid Valves and ECU.**

YES ↓

Turn the ignition switch OFF.

Connect the test harness to the main harness only, not to the ECU (page 11-212)

Disconnect the 2P connector from the lock-up control solenoid valve.

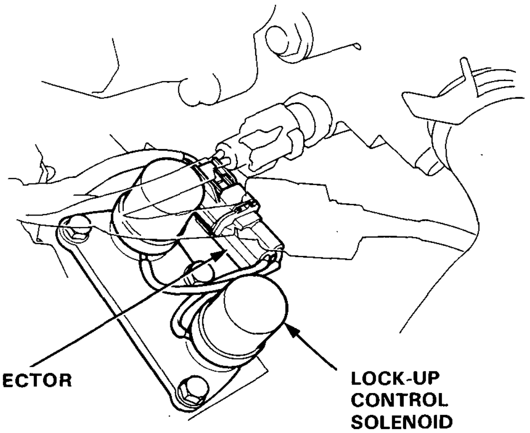
Check for continuity between A19 or A17* and body ground.

Does continuity exist?

YES → **Repair short in YEL or GRN/BLK* wire between ECU (A19 or A17*) and the 2P connector.**

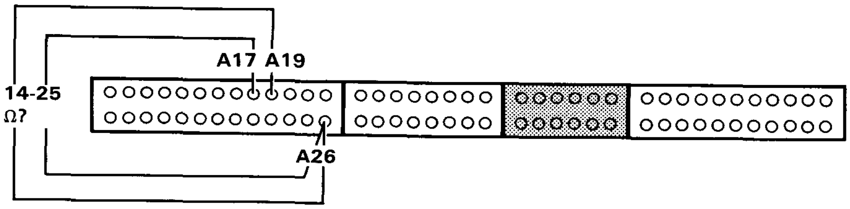
NO ↓

(To page 11-265)



* : Lock-up Control Solenoid Valve B

(From page page 11-264)



Reconnect the 2P connector.

Measure resistance between A19 or A17* terminal and A26 terminal.

Is there 14-25 Ω ?

NO → Check for continuity in YEL or GRN/BLK wire between ECU (A19 or A17*) and the 2P connector.

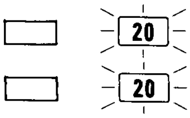
Does continuity exist?

YES → **Faulty lock-up control solenoid valve (page 11-14).**

NO → **Repair open in YEL or GRN/BLK* wire between ECU (A19 or A17*) and the 2P connector.**

YES → **Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.**

Troubleshooting Flowchart — Electric Load Detector [D15Z1 engine]



Self-diagnosis Check Engine light indicates code 20: A problem in the Electric Load Detector circuit.

With service check connector jumped (page 11-208), CODE 20 is indicated.

↓

Do the ECU Reset Procedure (page 11-209)

↓

Start engine and keep engine rpm at idle.
Turn on headlights.

↓

Does Check Engine light indicate CODE 20?

- NO → **Intermittent failure, system is OK at this time (test drive may be necessary). Check for poor connections or loose wires at C202 (ELD) and ECU.**
- YES ↓

Turn the ignition switch OFF.

↓

Remove the under-hood fuse/relay box and remove the fuse/relay box lower cover.

↓

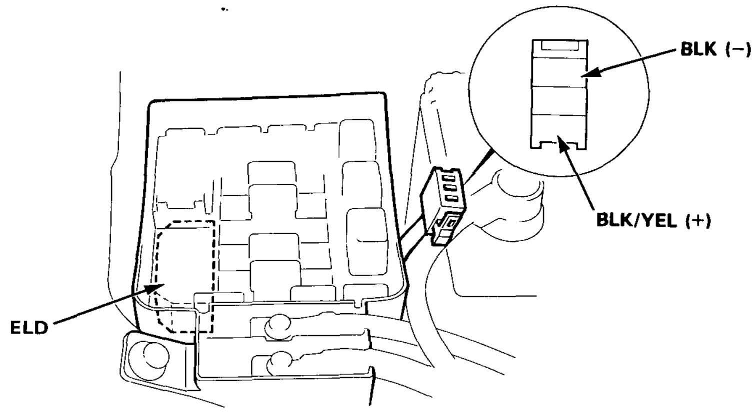
Disconnect the 3P connector from the electric load detector.

↓

Turn the ignition switch ON.

↓

Measure voltage between BLK/YEL (+) terminal and BLK (–) terminal.



↓

Is there battery voltage?

- NO → Measure voltage between BLK/YEL (+) terminal and body ground.
  - Is there battery voltage?
    - YES → **Repair open in BLK wire between the 3P connector and G201.**
    - NO → **Repair open in BLK/YEL wire between ACG (S) (15A) and the 3P connector.**
- YES ↓

(To page 11-267)

(From page 11-266)

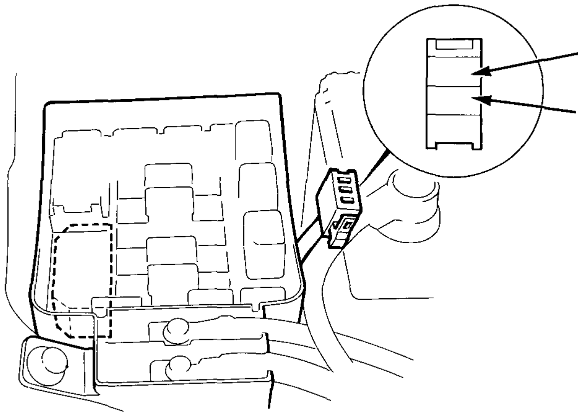
Measure voltage between GRN/RED terminal and body ground.

Is there 4.5—5 V?

NO

Repair open or short in GRN/RED wire between ECU (D10) and the 3P connector.
If wire is OK, substitute a known-good ECU and recheck.

YES



Turn the ignition switch OFF.

Connect the 3P connector to the electric load detector.

Connect the test harness between the ECU and connector (page 11-212).

(To page 11-268)

(cont'd)

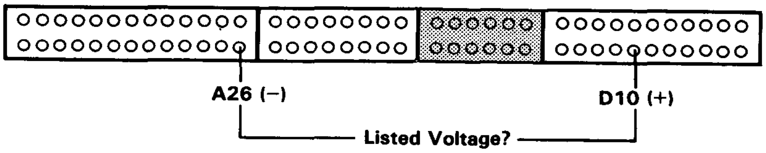
Troubleshooting Flowchart—Electric Load Detector [D15Z1 engine] (cont'd)

(From page 11-267)

Condition	Voltage
Headlight switch, first position (•)	2.5—3.5 V
Headlight switch, second position (●)	1.5—2.5 V

Start the engine and allow it to idle.

Under the conditions listed in the chart to the right, measure voltage between D10 (+) terminal and A26 (−) terminal.



Is the voltage listed in the chart available?

NO — **Faulty electric load detector.**

YES

Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.

Troubleshooting Flowchart — ECU [D15B2 engine]

Check Engine light never comes on (even for two seconds) after ignition is turned on.

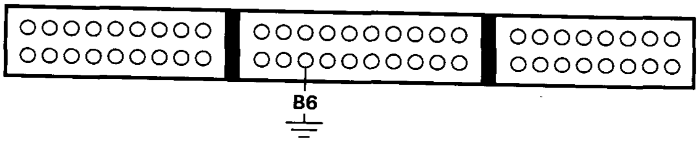
Is the oil pressure light on?

NO → Inspect BACK UP LIGHT fuse.

Is BACK UP LIGHT fuse OK?

NO → **Replace fuse.**

YES → **Repair open in YEL between BACK UP LIGHT and gauge assembly.**



YES (oil pressure light on) ↓

Turn the ignition switch OFF.

Connect the test harness between the ECU and connector (page 11-212)

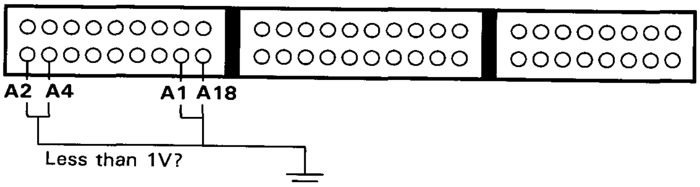
Connect B6 terminal to body ground.

Turn the ignition switch ON.

Is Check Engine light on?

NO →
- **Replace the light bulb.**
- **Repair open in GRN/ORN wire between ECU (B6) and gauge assembly.**

YES ↓



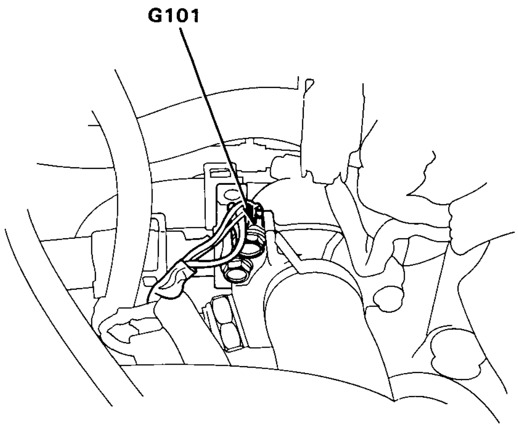
Measure voltage between body ground and the following terminals individually: •A2, •A4, •A16, •A18.

Is there less than 1V?

NO → **Repair open in wire between ECU and G101 that had more than 1 V.**

YES ↓

Substitute a known-good ECU and recheck. If symptom/ indication goes away, replace the original ECU.



NOTE: When there is no code stored, the Check Engine light will stay on if the service check connector is jumped.

Check Engine light stays on or comes on after two seconds.

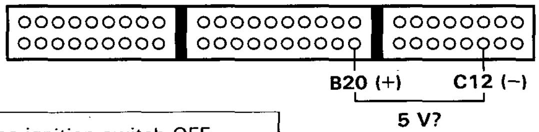
Turn the ignition switch ON.

Connect the service check connector with a jumper wire (page 11-208).

Does Check Engine light indicate any CODE?

YES → **Go to self-diagnostic procedures (page 11-210)**

NO ↓



Remove the jumper wire from the service check connector.

Try to start the engine.

Did the engine start?

YES →

Turn the ignition switch OFF.

Connect the test harness between the ECU and connector.

Turn the ignition switch ON.

Measure voltage between B20 terminal and C12 (−) terminal.

Is there approx. 5V?

NO → **Repair short to body ground in BRN wire between the eCU (B20) and service check connector.**

YES →

Connect the service check connector with a jumper wire.

Measure voltage between B20 (+) terminal and C12 (−) terminal.

Is there approx. 5V?

YES → *

- **Repair open in BRN wire between ECU (B20) and service check connector.**
- **Repair open in GRN/WHT wire between service check connector and ECU (C12).**

NO ↓

Remove the jumper wire from the service check connector.

(To page 11-272)

Did the engine start? NO ↓

Remove and inspect the ECU (15 A) fuse in the under-hood fuse/relay box.

Is the fuse OK?

NO → **Replace the fuse.**

YES ↓

(To page 11-272)

*NOTE: After repair, disconnect the service check connector jumper wire, test drive the car, and recheck the Check Engine light for a code.

(cont'd)

Troubleshooting Flowchart — ECU [D15B2 engine] (cont'd)

(From page 11-271)

Inspect the ACG (S) (15 A) fuse in the under-dash fuse box.

Is the fuse OK?

NO → **Replace the fuse.**

YES

Turn the ignition switch ON.

Disconnect the 3P connector of each sensor one at a time:
- MAP sensor
- Throttle angle sensor

Does Check Engine light remain ON?

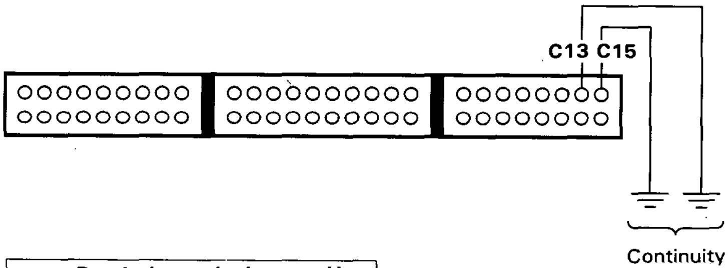
NO → **Replace the sensor that caused the light to go out.**

YES

Turn the ignition switch OFF.

Connect the test harness. Disconnect the "C" connector from the ECU only, not the main wire harness. (page 11-212).

Check for continuity between body ground terminals C13, C15.



Does continuity exist?

YES →
- **Repair short to body ground in YEL/GRN wire between ECU (C15) and MAP sensor.**
- **Repair short to body ground in YEL/WHT wire between ECU (C13) and throttle angle sensor.**

NO

Reconnect all the sensor connectors.
Reconnect the "C" connector to the ECU.

Turn the ignition switch ON.

(To page 11-273)

(From page 11-271)

Turn the ignition switch OFF.

Disconnect "A" connector from the ECU.

Turn the ignition switch ON.

Is the Check Engine light ON?

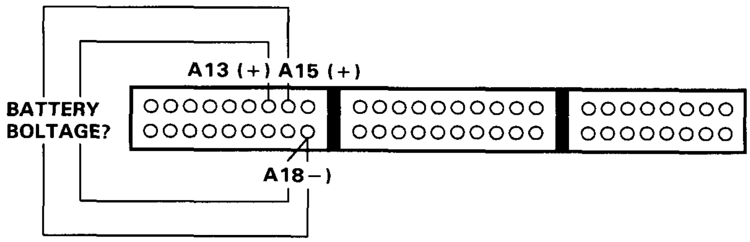
NO → **Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.**

YES

Repair short to body ground in GRN/ORN wire between the ECU (B6) and Check Engine light.

(From page 11-272)

Measure voltage between A18 (−) and the following: A13 (+) and A15 (+).



Is there battery voltage?

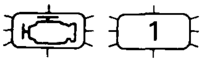
NO

— Repair open in YEL/BLK wire between ECU (A13, A15) and main relay.
— Check main relay and wiring connectors at main relay.

YES

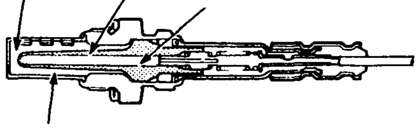
Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.

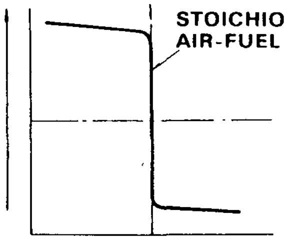
Troubleshooting Flowchart– Oxygen Senser [D15B2 engine]

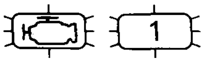


Self-diagnosis Check Engine light indicates code 1: A problem in the Oxygen (O_2) Sensor circuit.

The Oxygen sensor detects the oxygen content in the exhaust gas, and inputs the ECU. In operation, the ECU receives the signals from the sensor and varies the duration during which fuel is injected. The oxygen sensor is installed on the exhaust manifold.







- Check Engine light has been reported on.
- With service check connector jumped (page 11-208), CODE 1 is indicated.

↓

Do the ECU Reset Procedure (page 11-209).

↓

Inspect pressure regulator (page 11-343).

↓

Is it normal?

- NO → **Replace the pressure regulator (page 11-344)**
- YES ↓

Warm up engine to normal operating temperature (cooling fan comes on).

↓

Road test with the transmission in 2nd gear (M/T: 4th gear). Starting at 1400 min^{-1} (rpm), accelerate using ide open throttle for at least 5 seconds. Then decelerate for at least 5 seconds with the throttle completely closed.

↓

Is Check Engine warning light on and does LED indicate CODE 1.

- NO → **Intermittent failure, system is OK at this time. Check for poor connections or loose wires at O_2 sensor and ECU.**
- YES ↓

(To page 11-275)

(From page 11-274)

Disconnect engine wire harness from the O_2 sensor.

↓

Warm up engine to normal operating temperature again, then open the throttle wide open, then quickly release it.

↓

Measure voltage between the connector terminal and body ground.

↓

Is voltage above 0.6 V at wide open throttle and below 0.4 V when the throttle is quickly released ?

- NO → **Replace O_2 sensor.**
- YES ↓

Stop engine.

↓

Reconnect the oxygen sensor.

↓

Connect the test harness between the ECU and connector (From page 11-212)

↓

Restart and warm up engine to normal operating temperature, then open the throttle wide open, then quickly release it.

↓

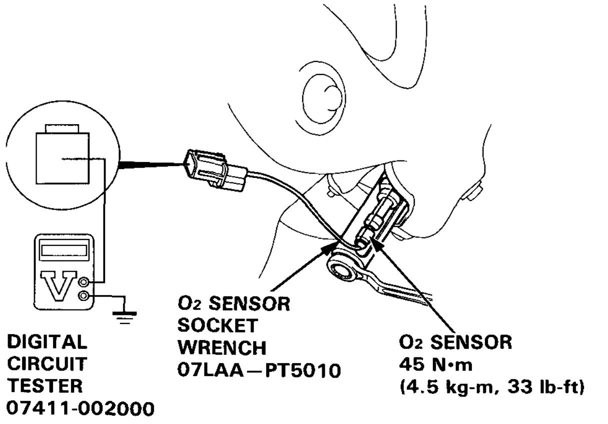
Measure voltage between C16 (+) terminal and A18 (−) terminal.

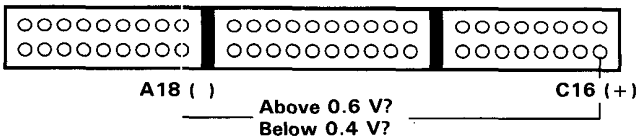
↓

Is voltage above 0.6 V at wide open throttle and below 0.4 V when the throttle is quickly released ?

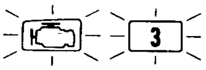
- NO → **Repair short or open in WHT wire between ECU (C16) and O_2 sensor.**
- YES ↓

Substitute a known-good ECU and recheck. If symptom/ indication goes away, replace the original ECU.

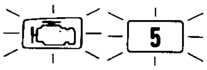




Troubleshooting Flowchart — MAP Sensor [D15B2 engine]

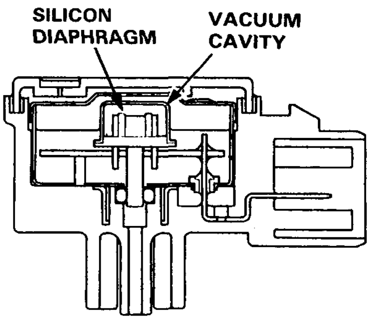


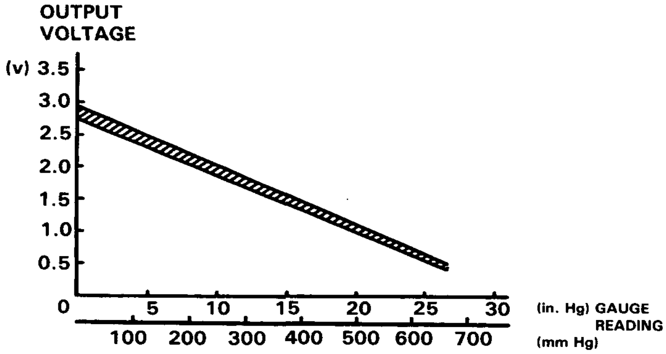
Self-diagnosis Check Engine light indicates code 3: An electrical problem in the Manifold Absolute Pressure (MAP) Sensor system.

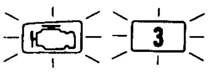


Self-diagnosis Check Engine light indicates code 45: Most likely a problem in the Fuel Metering System. Pressure (MAP) Sensor system.

The MAP sensor converts manifold absolute pressure into electrical signals and inputs the ECU.







- Engine is warm and running.
- Check Engine light has been reported on.
- With service check connector jumped (page 11-208), CODE 3 is indicated.

↓

Do the ECU Reset Procedure (page 11-209).

↓

Start the engine and allow it to idle.

↓

Is Check Engine light on and does it indicate CODE 3?

NO → **Intermittent failure, system is OK at this time (test drive may be necessary). Check for poor connection or loose wires at MAP sensor and ECU.**

YES ↓

Turn the ignition switch OFF.

↓

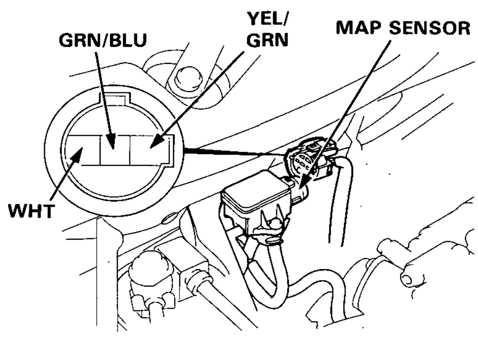
Disconnect the 3P connector from the MAP sensor.

↓

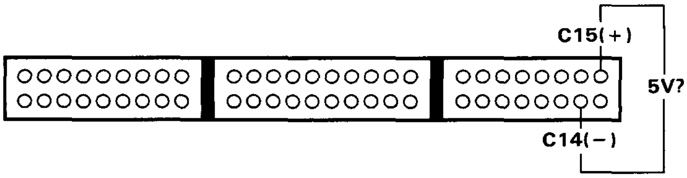
Turn the ignition switch ON.

↓

(To page 11-277)



(From page 11-276)



Measure voltage between YEL/GRN (+) terminal and body ground.

Is there approx. 5V?

YES → Measure voltage between YEL/GRN (+) terminal and GRN/BLU (−) terminal.

- Is there approx. 5V?
  - NO → **Repair open in GRN/BLU wire between ECU (C14) and MAP sensor.**
  - YES → Measure voltage between WHT (+) terminal and GRN/BLU (−) terminal.
    - Is there approx. 5V?
      - NO → (To page 11-278)
      - YES → Turn the ignition switch OFF.
        - Reconnect the 3P connector to the MAP sensor.
        - Connect the test harness between the ECU and connector (page 11-212).
        - Turn the ignition switch ON.
        - (To page 11-278)

NO → Connect the test harness "C" connector to the ECU only, not to the main wire harness (page 11-212).

Measure voltage between C15 (+) terminal and C14 (−) terminal.

Is there approx. 5 V?

- YES → **Repair open in YEL/GRN wire between ECU (C15) MAP sensor.**
- NO → **Substitute a *known-good* ECU and recheck. If symptom/indication goes away, replace the original ECU.**

(cont'd)

Troubleshooting Flowchart — MAP Sensor [D15B2 engine] (cont'd)

(From page 11-277)

Connect the test harness "C" connector to the ECU only, not to the main wire harness (page 11-212).

Measure voltage between C11 (+) terminal and C14 (−) terminal.

Is there approx. 5 V?

YES — **Repair short in WHT wire between ECU (C11) and MAP sensor.**
— Repair open in WHT wire between ECU (C11) and MAP sensor.

NO — **Substitute a known-good ECU and recheck. If prescribed voltage is now available, replace the original ECU.**

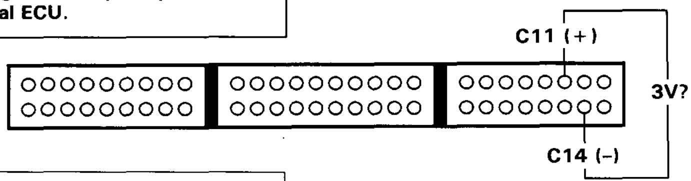
(From page 11-277)

Measure voltage between C11 (+) terminal and C14 (−) terminal.

Is there approx. 3 V ?

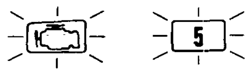
NO — **Replace MAP sensor.**

YES — **Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.**



(cont'd)

Troubleshooting Flowchart – MAP Sensor [D15B2 engine] (cont'd)



- **Check Engine light has been reported on.**
- **With service check connector jumped (page 11-208), CODE 5 is indicated.**

↓

Do the ECU Reset Procedure (page 11-209)

↓

Start the engine and keep engine speed at 2000 for one minute.

↓

Is Check Engine light on and does it indicate CODE 5?

NO →

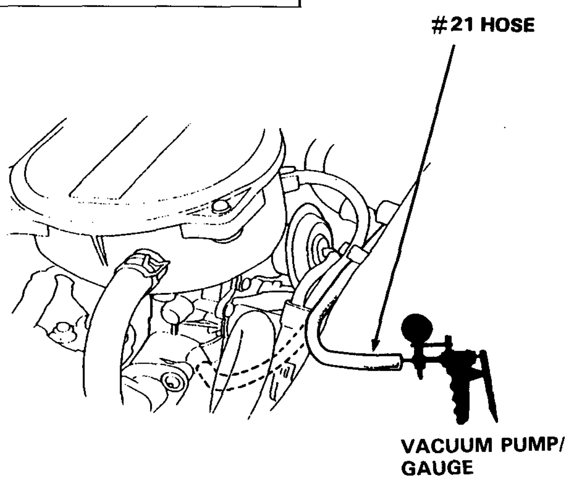
- **Intermittent failure, system is OK at this time (test drive may be necessary).**
- **Check vacuum hoses, pipes and connections.**
- **Make sure all connectors are secure.**

YES ↓

Stop the engine.

↓

Disconnect #21 hose from the throttle body, connect vacuum pump to the hose and apply vacuum.



↓

Does it hold vacuum?

NO → Connect a vacuum pump to the MAP sensor and apply vacuum.

↓

Does it hold vacuum?

NO → **Replace MAP sensor.**

YES ↓

Repair vacuum leak in hose routing between MAP sensor and intake manifold.

YES ↓

Connect a T-fitting from a vacuum gauge between the throttle body base and #21 hose.

↓

(To page 11-281)

(From page 11-281)

Start the engine.

Is there manifold vacuum?

NO → **Remove restriction from throttle body.**

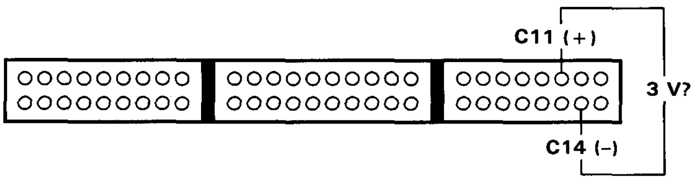
YES

Stop the engine.

Connect the test harnes between the ECU and connector (To page 11-212)

Turn the ignition switch ON.

Measure voltag between C11 (+) terminal and C14 (−) terminal.



Is there approx. 3 V ?

NO → **Replace MAP sensor.**

YES

Start the engine and allow it to idle.

Is there approx. 1 V?

NO → **Replace MAP sensor.**

YES

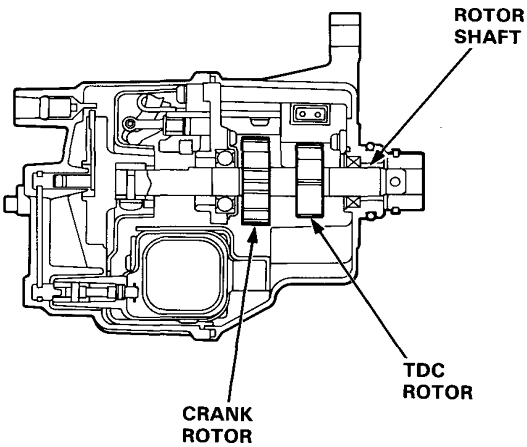
Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.

Troubleshooting Flowchart —— TDC/CRANK Sensor [D15B2 engine]

4 Self-diagnosis Check Engine light indicates code 4: A problem in the CRANK Sensor circuit.

8 Self-diagnosis Check Engine light indicated code 8: A problem in the TDC Sensor circuit.

The CRANK sensor determines timing for fuel injection and ignition of each cylinder and also detects engine RPM. The TDC sensor determines ignition timing at start-up (cranking) and when crank angle is abnormal.



4 or 8

- Check Engine light has been reported on.
- With service check connector jumped (page 11-208), CODE 4, 8 and/or 9 are indicated.

Do the ECU Reset Procedure (page 11-209).

Start the engine.

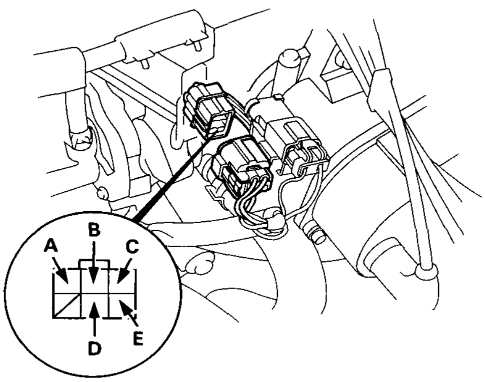
Is Check Engine light on and does it indicate CODE 4 or 8?

NO → **Intermittent failure, system is OK at this time (test drive may be necessary). Check for poor connections or loose wires at TDC/CRANK sensor and ECU.**

YES ↓

Stop the engine.

Disconnect the 6P connector from the TDC/CRANK sensor.



(To page 11-283)

(From page 11-282)

Measure resistance between terminals of the indicated sensor.
*see table

Is there 350 – 700 Ω?

- NO → **Replace the distributor sub-assembly (Section 23).**
- YES ↓

Check for continuity to body ground on both terminals of the indicated sensor.

Does continuity exist?

- YES → **Replace the distributor sub-assembly (Section 23).**
- NO ↓

Reconnect the connector.

Connect the test harness to the main wire harness only, not to the ECU (page 11-212).

Measure resistance between terminals of the indicated sensor on test harness.
*see table

Is there 350 – 700 Ω?

- NO → **Repair open in the indicated sensor wires. *see table**
- YES ↓

Check for continuity to body ground on C1 or C3 terminals.

Does continuity exist?

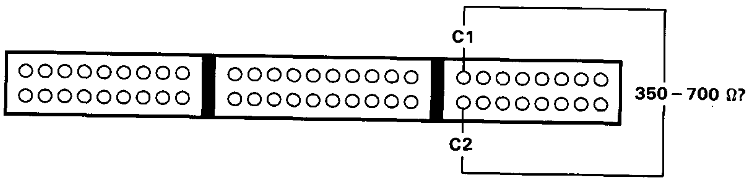
- YES → **Repair short to body ground in the indicated sensor wires.** *see table
- NO ↓

Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.

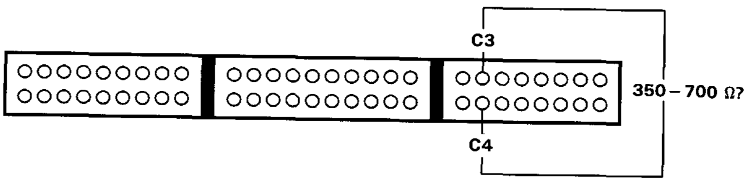
*:

SENSOR	CODE	SENSOR TERMINAL	ECU TERMINAL	WIRE COLOR
CRANK	4	E	C1	BLU/GRB
		D	C2	BLU/TEK
TDC	8	C	C3	ORN/BLU
		B	C4	WHT/BLU

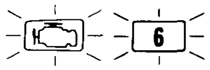
CRANK:



TDC:

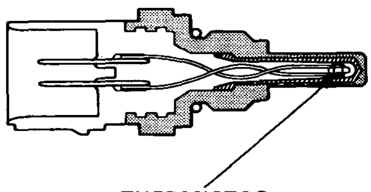


Troubleshooting Flowchart — TW Sensor [D15B2 engine]



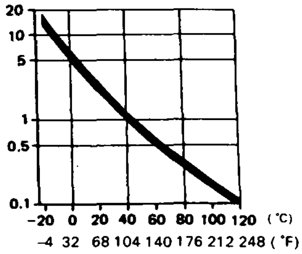
Self-diagnosis Check Engine light indicates code 6: A problem in the Coolant Temperature (TW) *Sensor circuit.*

The TW sensor is a temperature dependant resistor (thermistor). The resistance of the thermistor decreases as the coolant temperature increases as shown below.

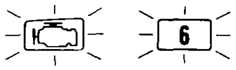


THERMISTOR

RESISTANCE (kΩ)



COOLANT TEMPERATURE



- **Check Engine light has been reported on.**
- **With service check connector jumped (page 11-208), CODE 6 is indicated.**

↓

Do the ECU Reset Procedure (page 11-209).

↓

Turn the ignition switch ON.

↓

Is Check Engine light on and does it indicate CODE 6?

- NO → **Intermittent failure, system is OK at this time (test drive may be necessary). Check for poor connections or loose wires at TW sensor and ECU.**
- YES ↓

Warm up engine to normal operating temperature (cooling fan comes on).

↓

Turn the ignition switch OFF.

↓

Disconnect the 2P connector from the TW sensor.

↓

Measure resistance between the 2 terminals on the TW sensor.

↓

Is there 200–400 Ω?

- NO → **Replace TW sensor.**
- YES ↓

(To page 11-285)

(From page 11-284)

Turn the ignition switch ON.

Measure voltage between RED/WHT and body ground.

Is there approx. 5V ?

YES → Measure voltage between RED/WHT (+) terminal and GRN/WHT (−) terminal.

Is there approx. 5V ?

- NO → **Repair open in GRN/WHT wire between ECU (C12) and TW sensor.**
- YES → **Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.**

NO → Turn the ignition switch OFF.

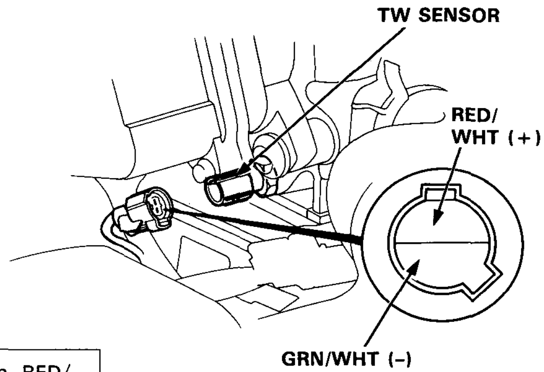
Connect the test harness "C" connector to the ECU only, not to the main wire harness (page 11-212).

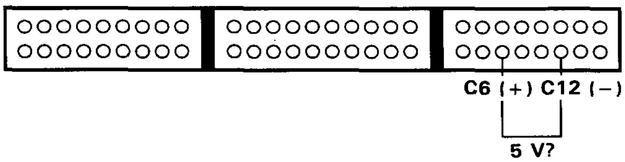
Turn the ignition switch ON.

Measure voltage between C6 (+) terminal and C12 (−) terminal.

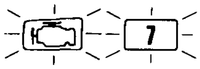
Is there approx. 5V?

- YES → **Repair open or short in RED/WHT wire between ECU (C6) and sensor.**
- NO → **Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.**



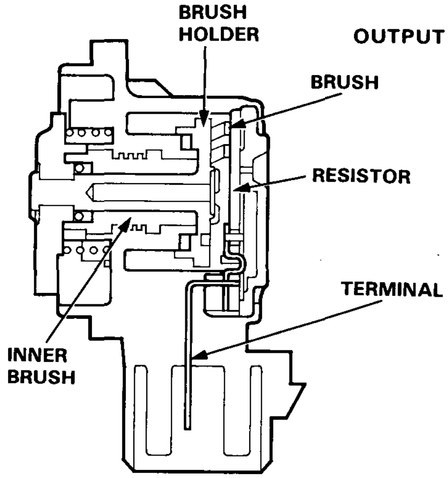


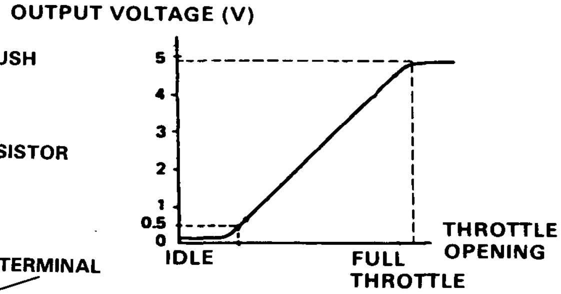
Troubleshooting Flowchart —— Throttle Angle Sensor [D15B2 engine]

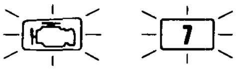


Self-diagnosis Check Engine light indicates code 7: A problem in the Throttle Angle Sensor circuit.

The throttle angle sensor is a potentiometer. It is connected to the throttle valve shaft. As the throttle angle changes, the throttle angle sensor varies the voltage signal to the ECU.







- **Engine is running.**
- **Check Engine light has been reported on.**
- **With service check connector jumped (page 11-208), CODE 7 is indicated.**

↓

Do the ECU Reset Procedure (page 11-209).

↓

Start the engine.

↓

Is Check Engine light on and does it indicate CODE 7?

- NO → **Intermittent failure, system is OK at this time (test drive may be necessary). Check for poor connections or loose wires at throttle angle sensor and ECU.**
- YES ↓

Turn the ignition switch OFF.

↓

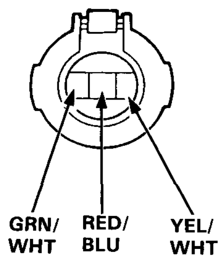
Disconnect the 3P connector from the throttle angle sensor.

↓

Turn the ignition switch ON.

↓

Measure voltage between YEL/WHT (+) terminal and GRN/WHT (−) terminal.



↓

Is there approx. 5V ?

- NO → Measure voltage between YEL/WHT (+) terminal and body ground.
  (To page 11-287)
- YES ↓
  (To page 11-287)

(From page 11-286)

Turn the ignition switch OFF.

Reconnect the 3P connector.

Connect the test harness between the ECU and connector (page 11-212).

Turn the ignition switch ON.

Measure voltage between C7 (+) terminal and C12 (−) terminal.

Is voltage 0.5 V at full close throttle, and approx. 4.5 V at full open throttle?
NOTE: There should be a smooth transition from 0.5 V to approx. 4.5 V as the throttle is depressed.

NO → **— Replace throttle angle sensor.**
— Repair open or short in RED/BLU, LT GRN wire between ECU (C7), and throttle angle sensor.

YES → **Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.**

(From page 11-286)

Is there approx. 5V ?

YES → **Repair open in GRN/WHT wire between ECU (C12) and throttle angle sensor.**

NO ↓

Turn the ignition switch OFF.

Connect the test harness between the ECU and connector (page 11-212).

Turn the ignition switch ON.

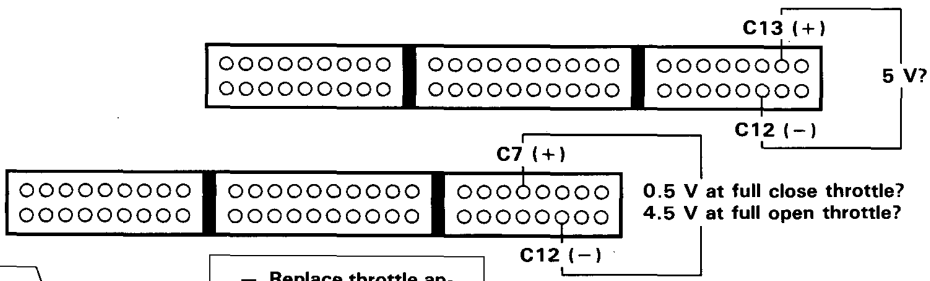
Measure voltage between C13 (+) terminal C12 (−) terminal.

Is there approx. 5V ?

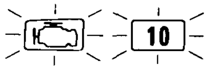
YES → **Repair open in YEL/WHT wire between ECU (C13) and throttle angle sensor.**

NO ↓

Substitute a known-good ECU and recheck. If prescribed voltage is now available, replace the original ECU.

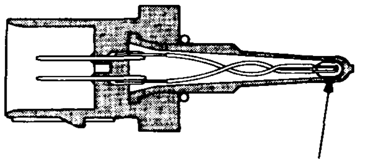


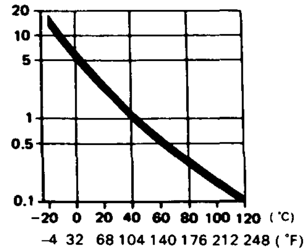
Troubleshooting Flowchart —— TA Sensor [D15B2 engine]

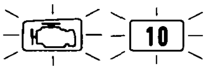


Self-diagnosis Check Engine light indicates code 10: A problem in the Intake Air Temperature (TA) Sensor circuit.

The TA sensor is a temperature dependant resistor (thermistor). The resistance of the thermistor decreases as the intake air temperature increases as shown below.







- **Check Engine light has been reported on.**
- **With service check connector jumped (page 11-208), CODE 10 is indicated.**

↓

Do the ECU Reset Procedure (page 11-209).

↓

Turn the ignition switch ON.

↓

Is Check Engine light on and does it indicate CODE 10?

- NO → **Intermittent failure, system is OK at this time (test drive may be necessary). Check for poor connections or loose wires at TA sensor and ECU.**
- YES ↓

Turn the ignition switch OFF.

↓

Disconnect the 2P connector from the TA sensor.

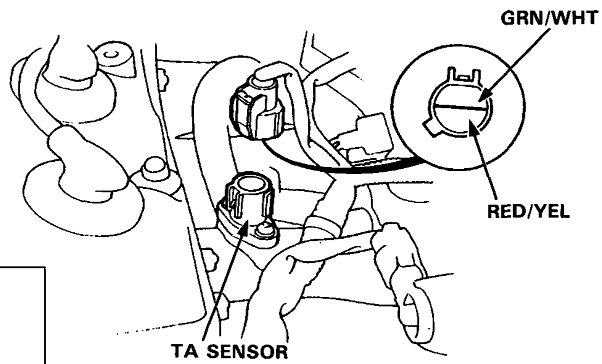
↓

Measure resistance between the 2 terminals on the TA sensor.

↓

Is there 0.4 – 4.0 kΩ?

- NO → **Replace TA sensor.**
- YES ↓



(To page 11-289)

(From page 11-288)

Turn the ignition switch ON.

Measure voltage between RED/ YEL (+) terminal and body ground.

Is there approx. 5 V ?

YES

Measure voltage between RED/ YEL (+) terminal and GRN/WHT (−) terminal.

Is there approx. 5 V ?

NO

Repair open in GRN/ WHT wire between ECU (C12) and TA sensor.

YES

Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.

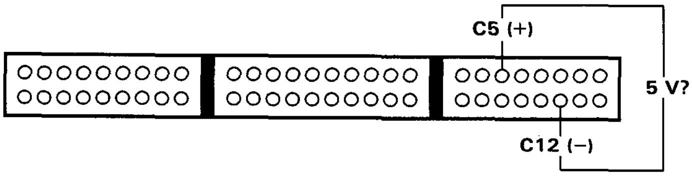
NO

Turn the ignition switch OFF.

Connect the test harness "C" connector to the ECU only, not to the main wire harness (page 11-212).

Turn the ignition switch ON.

Measure voltage between C5 (+) terminal and C12 (−) terminal.



Is there approx. 5V?

YES

Repair open or short in RED/YEL wire between ECU (C5) and TA sensor.

NO

Substitute a known-good ECU and recheck. If prescribed voltage is now available, replace the original ECU.

Troubleshooting Flowchart —— Ignition Output Signal [D15B2 engine]

15 — Self-diagnosis Check Engine light indicates code 15: A problem in the Ignition Output Signal circuit.

— Check Engine light has been reported on.
— With service check connector jumped (see page 11-208), CODE 15 is indicated.

Do the ECU Reset Procedure (page 11-209).

Start the engine.

NOTE: If the engine won't start, it may take 20 seconds of cranking to set the code.

Is Check Engine light on and does it indicate CODE 15?

NO → **Intermittent failure, system is OK at this time (test drive may be necessary)**
Check for poor connections or loose wires at igniter unit and ECU.

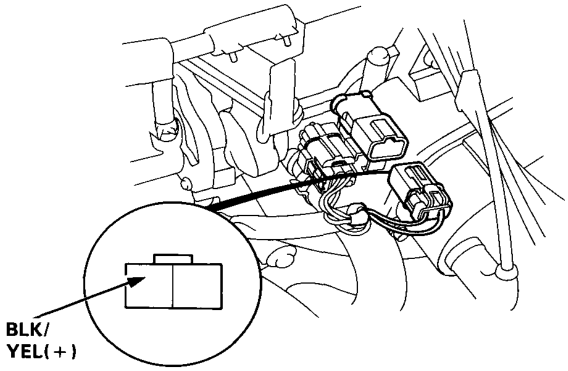
YES

Turn the ignition switch OFF.

Disconnect the 2P connector from the distributor

Turn the ignition switch ON.

Measure voltage between BLK / YEL (+) terminal and body ground.



Is there battery voltage ?

NO → **Repair open in BLK/YEL wire between the 2P connector and ignition switch.**

YES

(To page 11-291)

(From page 11-290)

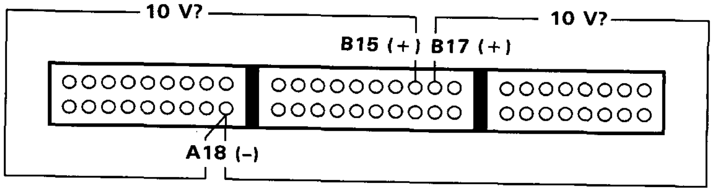
Turn the ignition switch OFF.

Reconnect the 2P connector.

Connect the test harness between the ECU and connector (page 11-212).

Turn the ignition switch ON.

Measure voltage individually between B15 (+), B17 (+) terminals and A18 (–) terminal.



Is there approx. 10 V?

NO

- **Replace the igniter unit.**
- **Repair open or short RED/GRN wires between igniter unit and ECU (B15 *or* B17).**

NOTE: If the RED/GRN wire was shorted, the igniter may be damaged.

YES

Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the *original* ECU.

Troubleshooting Flowchart — Vehicle Speed Sensor [D15B2 engine]

17 Self-diagnosis Check Engine light indicates code 17: A problem in the Vehicle Speed Sensor circuit.

The signal generated by the speed sensor produces pulses when the front wheels turn.

— Check Engine light has been reported on.
— With service check connector jumped (page 11-208), CODE 17 is indicated.

Do the ECU Reset Procedures (page 11-209).

Road test necessary,
In 2nd gear accelerate to 4,000 min^{-1} (rpm), then decelerate to 1,500 min^{-1} (rpm) with throttle fully closed.

Is Check Engine light on and does it indicate CODE 17?

NO → **Intermittent failure, system id OK at this time. Check for poor connections or loose wires a speed sensor and ECU.**

YES ↓

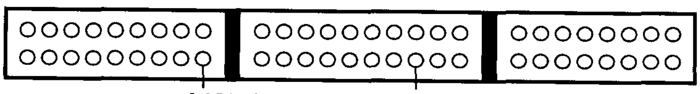
Block rear wheels and set the parking brake. Jack up the front of the car and support with safety stands.

⚠WARNING Block rear wheels before jacking up front of car.

Connect the test harness between the ECU and connector (page 11-212)

Turn the ignition switch ON.

Block the right front wheel and slowly rotate left front wheel and measure voltage between B16 (+) terminal and A18 (−) terminal.



A18(−) **B16 (+)**

0V↔12V?

Does voltage pulse 0 V and 12 V?

NO → Turn the ignition switch OFF.

(To page 11-293)

YES ↓

Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.

(From page 11-292)

Disconnect the "B" connector *from the ECU only, not the main* wire harness.

Turn the ignition switch ON.

Block the right front wheel and slowly rotate left front wheel and measure voltage between B16 (+) terminal and A18 (−) terminal.

Does voltage pulse 0 V and 12 V?

YES

Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the *original* ECU.

NO

- **Repair short in YEL/BLU wire between ECU (B16) and the speed sensor speedometer, or cruise control unit.**
- **Repair open in YEL/BLU wire between ECU (B16) and speed sensor.**
- **If wire is OK, test the speed sensor (*Section 23*).**

Troubleshooting Flowchart — A/T Lock-up Control Solenoid Valve [D15B2 engine]

19 — Self-diagnosis Check Engine light indicates code 19: A problem in the Lock-up Control Solenoid Valve circuit.

19

— Check Engine light has been reported on.
— With service check connector jumped (page 11-208), CODE 19 is indicated.

Do the ECU Reset Procedure (page 11-209).

Test drive necessary.
Drive the car for several miles so that the transmission upshfts and downshifts several times.

Does Check Engine light indicate CODE 19?

NO → **Intermittent failure, system is OK at this time. Check for poor connections or loose wires at lock-up control solenoid valve and ECU.**

YES ↓

Turn the ignition switch OFF.

Connect the test harness to the main harness only, not to the ECU (page 11-212)

Disconnect the 2P connector from the lock-up control solenoid valve.

Check for continutiy between A8 and body groun.

Does continuity exist?

YES → **Repair short in YEL wire between ECU (A8) and the 2P connector.**

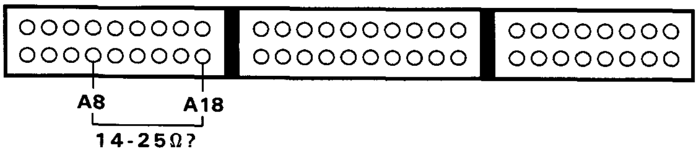
NO ↓

(To page 11-295)

(From page 11-294)

Reconnect the 2P connector.

Measure resistance between A8 terminal and A18 terminal.



Is there 14-25 Ω ?

NO → Check for continuity in YEL wire between A8 terminal and the 2P connector.

Does continuity exist?

YES → **Faulty lock-up control solenoid valve (section 14).**

NO → **Repair open in YEL wire between ECU (A8) and the 2P connector.**

YES → **Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.**

Idle Control System

System Troubleshooting Guide

NOTE:

- Across each row in the chart, the sub systems that could be sources of a symptom are ranked in the order they should be inspected, starting with ①. Find the symptom in the left column, read across to the most likely source, then refer to the page listed at the top of that column. If inspection shows the system is OK, try the next system ②, etc.
- If the idle speed is out of specification and the Check Engine light does not blink CODE 14, go to inspection described on page 11-299.

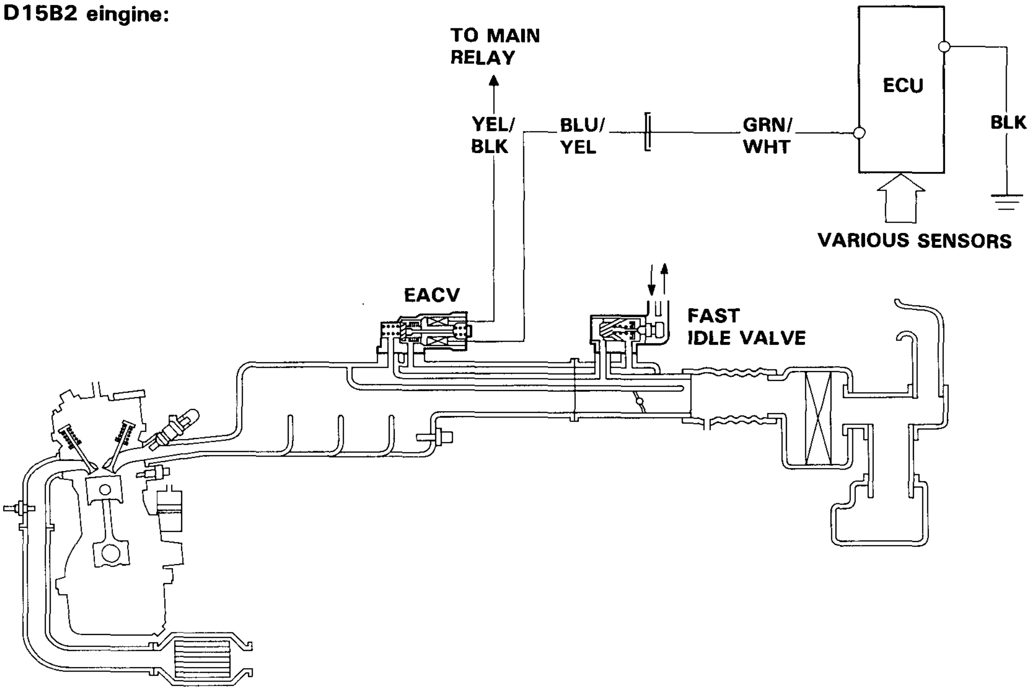
SYMPTOM \ SUB SYSTEM		IDLE ADJUSTING SCREW	EACV	AIR CONDI-TIONING SIGNAL	ALTER-NATOR FR SIGNAL	A/T SHIFT POSITION SIGNAL	M/T CLUTCH SWITCH SIGNAL (D15Z1 engine only)	STARTER SWITCH SIGNAL	BRAKE SWITCH SIGNAL	P/S OIL PRESSURE SWITCH SIGNAL	FAST IDLE VALVE	HOSES AND CONNEC-TIONS
PAGE		326, 328*	300, 316*	302, 318*	304, 320*	306, 322*	308	310, 324*	312	314	325	–
DIFFICULT TO START ENGINE WHEN COLD											①	
WHEN COLD FAST IDLE OUT OF SPEC (1,000 – 2,000 rpm)		③	②								①	
ROUGH IDLE			②									①
WHEN WARM ENGINE SPEED TOO HIGH		③	①							③	②	③
WHEN WARM ENGINE SPEED TOO LOW	Idle speed is below specified rpm (no load)	②	①									
	Idle speed does not increase after initial start up.		①									
	On models with automatic transmission, the idle speed drops in gear		②			①						
	Idle speeds drops when air conditioner in ON		②	①								
	Idle speed drops when steering wheel is turning		②							①		
	Idle speed fluctuates with electrical load		②		③							①
FREQUENT STALLING	WHILE WARMING UP	②	①									
	AFTER WARMING UP	①	②									
FAILS EMISSION TEST												①

*: D15B2 engine

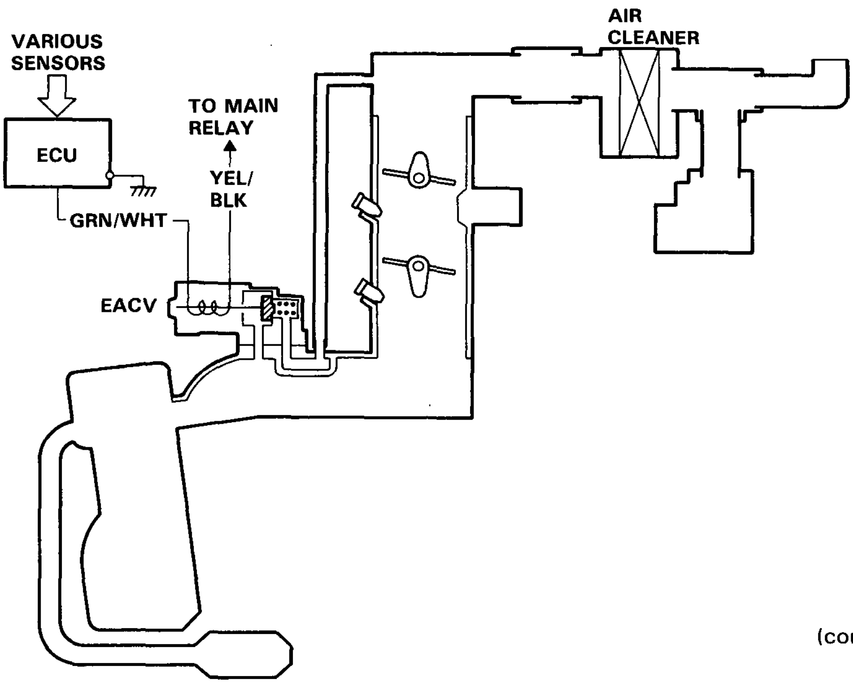
System Description

The idle speed of the engine is controlled by the Electronic Air Control Valve (EACV).
The valve changes the amount of air bypassing into the intake manifold in response to electric current sent from the ECU.
When the EACV is activated, the valve opens to maintain the proper idle speed.

Except D15B2 eingine:



D15B2 engine:

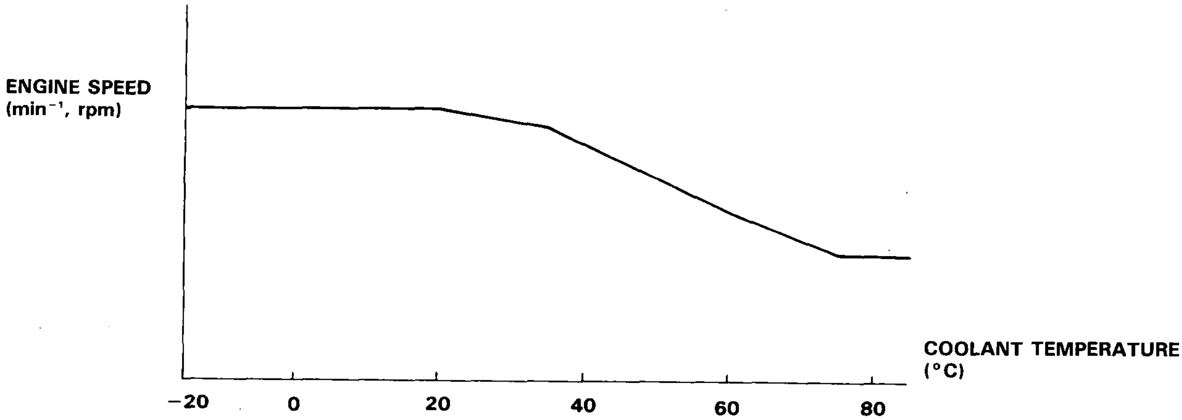


(cont'd)

System Description (cont'd)

1. After the engine starts, the EACV opens for a certain time. The amount of air is increased to raise the idle speed about 150-300 min^{-1} (rpm).

2. When the coolant temperature is low, the EACV is opened to obtain the proper fast idle speed. The amount of bypassed air is thus controlled in relation to the coolant temperature.



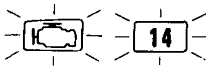
1. When the idle speed is out of specification and the Check Engine light does not blink CODE 14, check the following items:
   - Adjust the idle speed (page 11-326, 328*)
   - Air conditioning signal (page 11-302, 318*)
   - Alternator FR signal (page 11-304, 320*)
   - A/T shift position signal (page 11-306, 322*)
   - M/T clutch switch signal (D15Z1 engine only) (page 11-308)
   - Starter switch signal (page 11-310, 324*)
   - Brake switch signal (page 11-312)
   - P/S oil pressure switch signal (page 11-314)
   - Fast idle valve (page 11-325)
   - Hoses and connections
   - EACV and its mounting O-rings

   *: D15B2 engine

2. If the above items are normal, substitute a known-good EACV and readjust the idle speed (page 11-326, 328*).

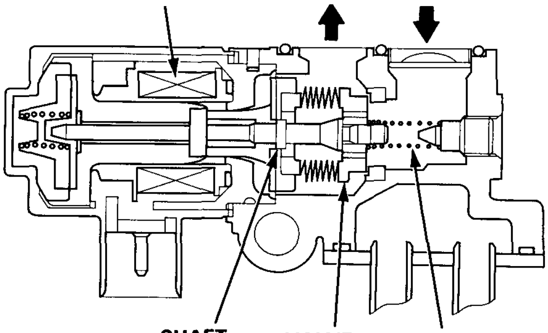
   - If the idle speed still cannot be adjusted to specification (and the Check Engine light does not blink CODE 14) after EACV replacement, substitute a known-good ECU and recheck. If symptom goes away, replace the original ECU.

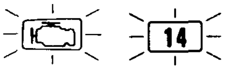
Troubleshooting Flowchart —— EACV

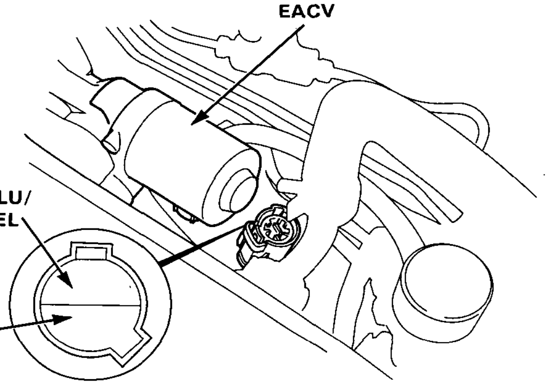


Self-diagnosis Check Engine light indicates code 14: A problem in the Electric Air Control Valve (EACV) circuit.

The EACV changes the amount of air bypassing the throttle body in response to a current signal from the ECU in order to maintain the proper idle speed.







— Check Engine light has been reported on.
— With service check connector jumped (page 11-208), CODE 14 is indicated.

↓

Do the ECU Reset Procedure (page 11-209)

↓

Start the engine.

↓

Is Check Engine light on and does it indicate CODE 14?

- NO → With the engine running and the accelerator pedal released, disconnect the 2P connector from the EACV.
  - ↓ Is there a reduction in engine rpm?
    - YES → **Intermittent failure, system is OK at this time (test driving may be necessary). Check for poor connection or loose wires at EACV and ECU.**
    - NO → **Substitute a known-good EACV and retest.**
- YES → Remove the 2P connector from the EACV.

(To page 11-301)

(From page 11-300)

Measure voltage between the YEL/BLK wire and body ground.

Is there battery voltage?

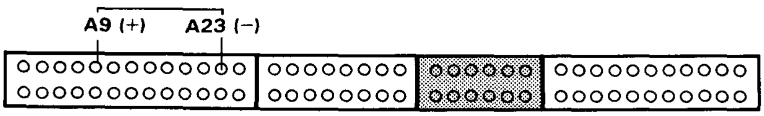
NO → **Repair open in YEL/BLK wire between EACV and main relay.**

YES ↓

Turn the ignition switch off and reconnect the 2P connector the EACV.

Connect the test harness "A" connector to the main wire harness only, not the ECU (page 11-212)

Turn the ignition switch ON.



Momentarily connect A9 terminal to A23 terminal several times.

Does the EACV click?

YES → **Substitute a known-good ECU and retest. If symptom/indication goes away, replace the original ECU.**

NO ↓

Repair open or short in GRN/WHT or BLU/YEL wire between EACV and ECU (A9). If the wire is OK, replace the EACV.

Idle Control System

Troubleshooting Flowchart —— Air Conditioning Signal

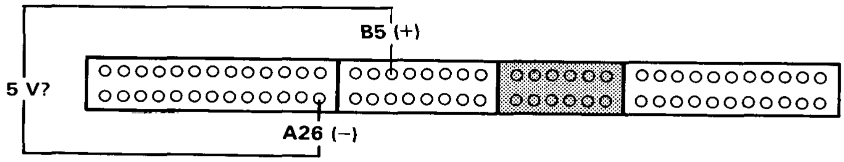
This signals the ECU when there is a demand for cooling from the air conditioning system.

Inspection of Air Conditioning Signal.

Connect the test harness between the ECU and connector. Disconnect "B" connector from the main wire harness only, not the ECU (page 11-212).

Turn the ignition switch ON.

Measure voltage between B5 (+) terminal and A26 (–) terminal.

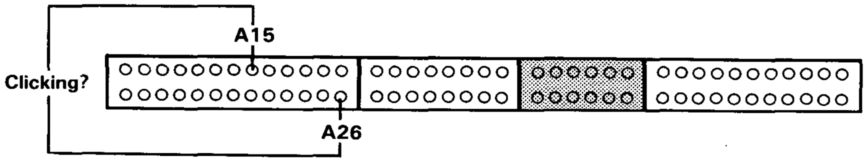


Is there approx. 5 V?

- NO → **Substitute a known-good ECU and recheck. If prescribed voltage is now available, replace the original ECU.**
- YES ↓

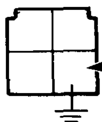
Reconnect "B" connector to the main wire harness.

Momentarily connect A15 terminal to A26 terminal several times.



Is there a clicking noise from the A/C compressor clutch?

- NO → Connect the BLK/RED terminal of the 4P connector on the A/C clutch relay to body ground.



BLK/RED

View from wire harness side

  Is there a clicking noise from the A/C compressor clutch?

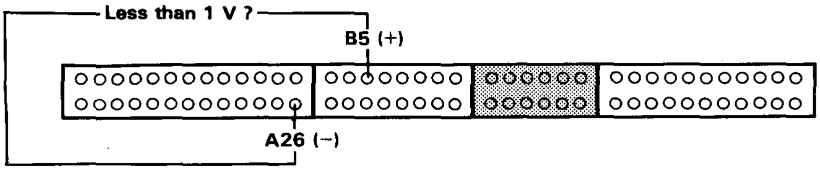
  - NO → **See Air conditioner inspection (section 22).**
  - YES → **Repair open in BLK/RED wire between ECU (A15) and A/C clutch relay.**

- YES ↓

Start the engine.

Blower switch ON.

(To page 11-303)



(From page 11-302)

A/C switch ON.

Does A/C operate ?

YES → **Air conditioning signal is OK.**

NO → Measure voltage between B5 (+) terminal and A26 (–) terminal.

Is voltage less than 1V?

NO → **Repair open in BLU/RED wire between ECU (B5) and A/C pressure switch.**

YES → **Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.**

Troubleshooting Flowchart — Alternator FR Signal

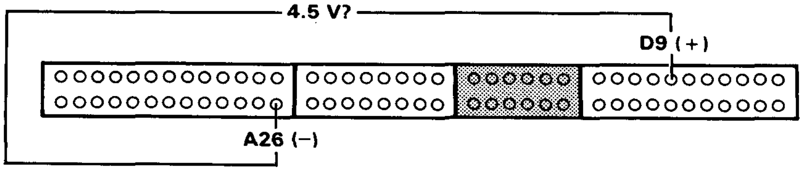
This signals the ECU when the alternator is charging.

Inspection of Alternator FR signal.

Connect the test harness between the ECU and connector. Disconnect "D" connector from the main wire harness only, not the ECU (page 11-212).

Turn the ignition switch ON.

Measure voltage between D9 (+) terminal and A26 (−) terminal.



Is there approx. 4.5 V?

NO → **Substitute a known-good ECU and recheck. If prescribed voltage is now available, replace the original ECU.**

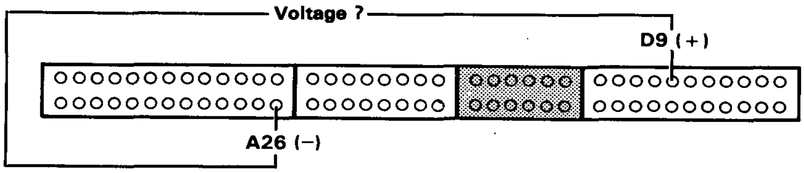
YES ↓

Turn the ignition switch OFF.

Reconnect "D" connector to the main wire harness.

Warm up engine to normal operating temperature (cooling fan comes on).

Measure voltage between D9 (+) terminal and A26 (−) terminal.



Does the voltage decrease when headlights and rear defogger are turned on ?

NO → Stop the engine.

YES ↓

Do the ECU Reset Procedure (page 11-209).

Alternator FR signal is OK.

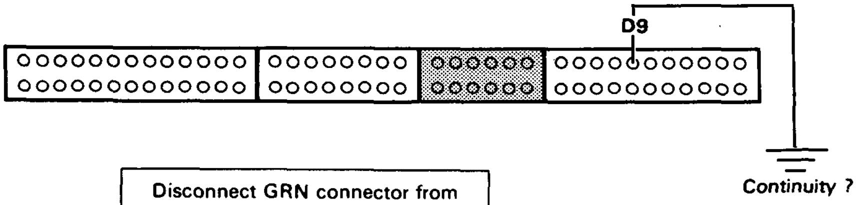
(To page 11-305)

(From page 11-304)

Disconnect "D" connector from ECU only, not the main wire harness.

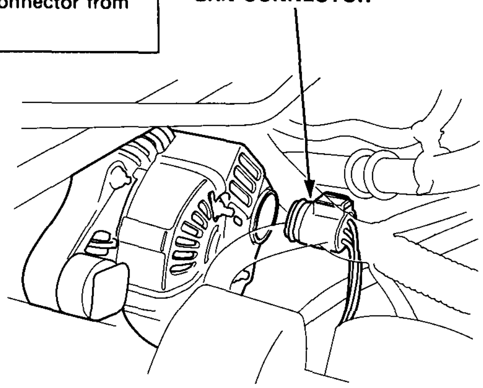
Disconnect the negative battery cable from the battery.

Check for continuity between D9 terminal and body ground.



Does continuity exist ?

YES → Disconnect GRN connector from the alternator.



Check for continuity between D9 terminal and body ground.

Does continuity exist ?

- **NO** → **See Alternator Inspection (section 23).**
- **YES** → **Repair short in PNK or BLU wire between ECU (D9) and alternator.**

NO → Disconnect GRN connector from the alternator.

Connect BLU wire to body ground.

Check for continuity between D9 terminal and body ground.

Does continuity exist ?

- **YES** → **See Alternator Inspection (section 23).**
- **NO** → **Repair open in PNK or BLU wire between ECU (D9) and alternator.**

Idle Control System

Troubleshooting Flowchart —— A/T Shift Position Signal

This signals the ECU when the transmission is in Neutral or Park.

Inspection of A/T Shift Position Signal.

Turn the ignition switch ON.

Observe the A/T shift indicator and select each position separately.

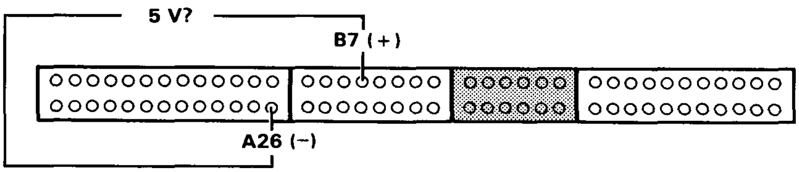
Does the indicator light properly?

NO → **See A/T Shift Position Indicator Inspection (section 14).**

YES

Turn the ignition switch OFF.

Connect the test harness between the ECU and connector. Disconnect "B" connector from the main wire harness only, not the ECU (page 11-212)



Turn the ignition switch ON.

Measure voltage between B7 (+) terminal and A26 (−) terminal.

Is there approx. 5 V?

NO → **Substitute a known-good ECU and recheck. If prescribed voltage is now available, replace the original ECU.**

YES

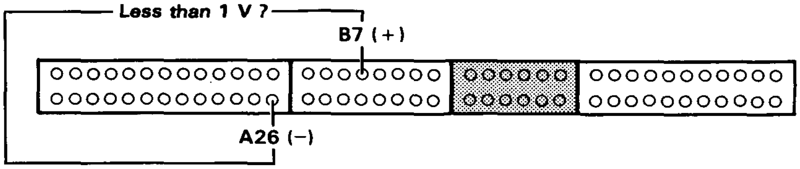
Turn the ignition switch OFF.

Reconnect "B" connector to the main wire harness.

Start the engine.

(To page 11-307)

(From page 11-306)

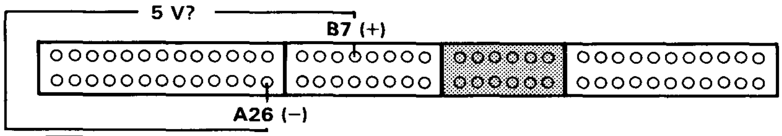


Measure voltage between B7 (+) terminal and A26 (−) terminal with the transmission in [N] and [P] individually.

Is there less than 1 V?

NO → **Repair open in GRN wire between ECU (B7) and gauge assembly.**

YES ↓

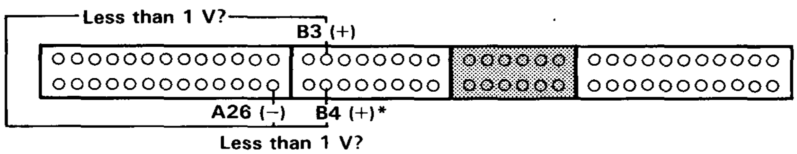


Measure voltage between B7 (+) terminal and A26 (−) terminal with the transmission in gear.

Is there approx. 5 V?

NO → **Repair short in GRN wire between ECU (B7) and gauge assembly.**

YES ↓



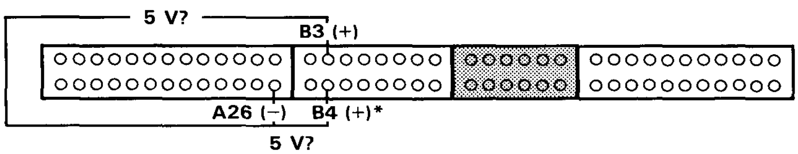
*: [D4]

Measure voltage between B3 or B4* terminal and A26 (−) terminal with the transmission in [D3] or [D4] individually.

Is there less than 1 V?

NO → **Repair open in GRN/BLU or GRN/BLK wire between ECU (B3 or B4*) and Shift Position Console Switch.**

YES ↓



Measure voltage between B3 or B4* (+) terminal and A26 (−) terminal with the transmission in [N] or [P].

Is there approx. 5V?

NO → **Repair short in GRN/BLU or GRN/BLK* wire between ECU (B3 or B4*) and Shift Position Console Switch.**

YES ↓

A/T shift position signal is OK.

Idle Control System

Troubleshooting Flowchart — M/T Clutch Switch Signal [D15Z1 engine] —

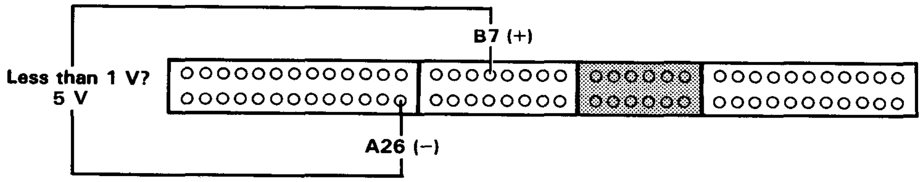
This signals the ECU when the clutch is engaged.

Inspection of clutch switch signal.

Connect the test harness between the ECU and connector (page11-212).

Turn the ignition switch ON.

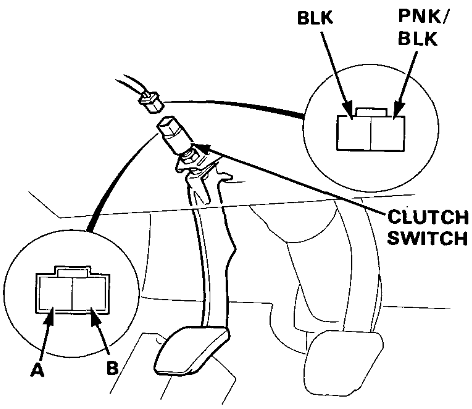
Measure voltage between B7 (+) terminal and A26 (−) terminal.



Is voltage less than 1 V?

- YES:
  - Depress the clutch pedal.
  - Measure voltage between B7 (+) terminal and A26 (−) terminal.
  - (To page 11-309)

- NO:
  - Turn the ignition switch OFF.
  - Disconnect the 2P connector from the clutch switch.
  - Check for continuity between the A terminal and B terminal on the clutch switch.



Does continuity exist?

- NO: **Replace the clutch switch.**
- YES:
  - Turn the ignition switch ON.
  - Measure voltage between PNK/BLK (+) terminal and body ground.

Is there approx. 5 V?

- NO: **Repair open in PNK/BLK wire between ECU (B7) and the clutch switch.**
- YES: **Repair open in BLK wire between the clutch switch and G301.**

(From page 11-308)

Is there approx. 5 V?

YES → **Clutch switch signal is OK.**

NO → Turn the ignition switch OFF.

Disconnect the 2P connector from the clutch switch.

Turn the ignition switch ON.

Measure voltage between B7 (+) terminal and A26 (−) terminal.

Is there approx. 5 V?

YES → **Replace the clutch switch.**

NO → Disconnect "B" connector from main wire harness only, not the ECU.

Is there approx. 5 V?

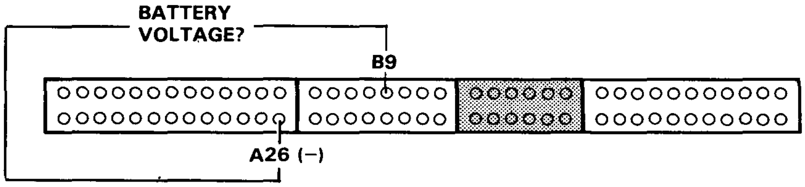
YES → **Repair short in PNK/BLK wire between ECU (B7) and the clutch switch.**

NO → **Substitute a known-good ECU and recheck. If prescribed voltage is now available, replace the original ECU.**

Idle Control System

Troubleshooting Flowchart — Starter Switch Signal

This signals the ECU when the engine is cranking.



Inspection of Starter Switch Signal.

Connect the test harness between the ECU and connector (page 11-212)

Measure voltage between B9 (+) terminal and A26 (−) terminal with the ignition switch in the start position.

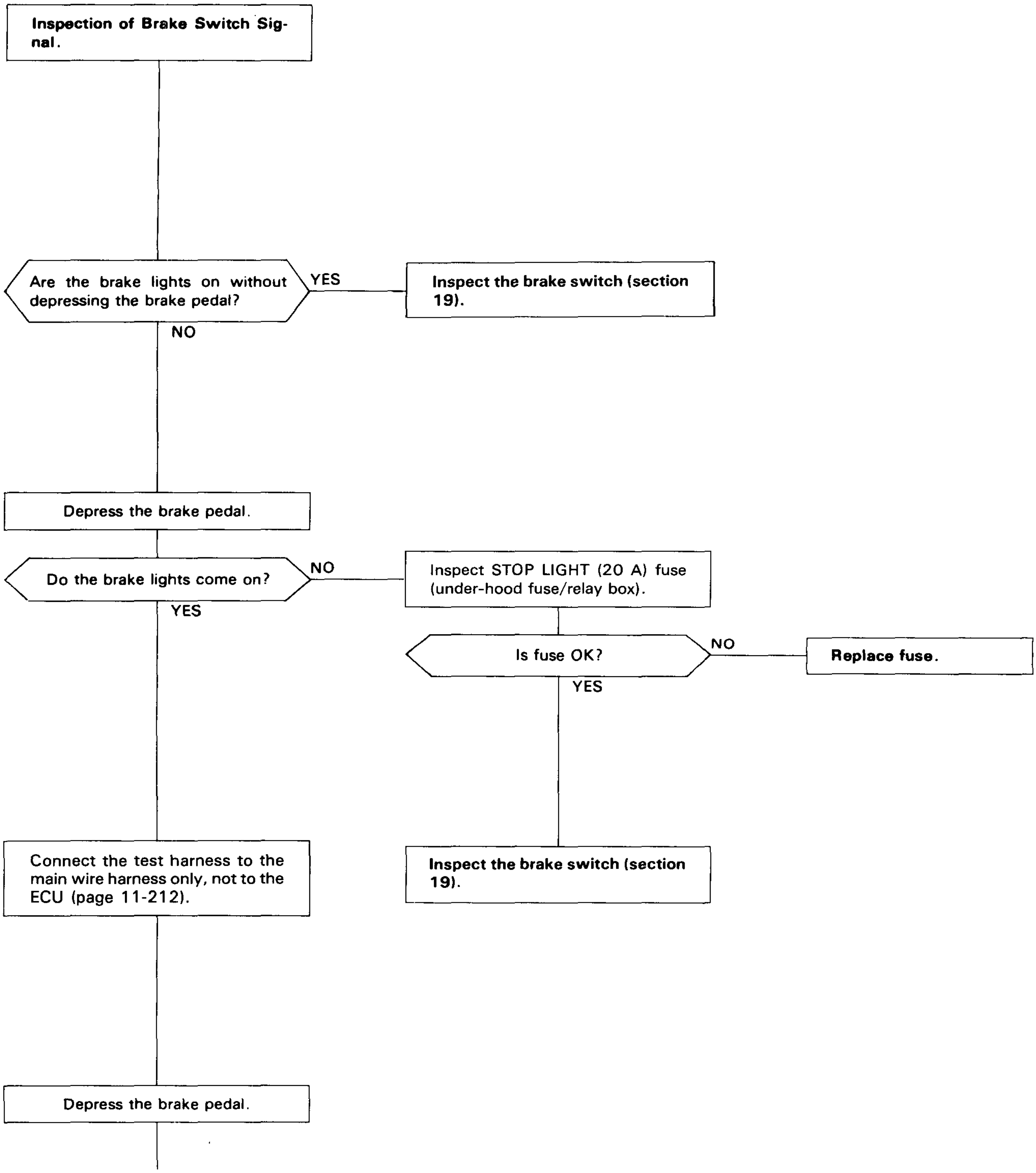
Is there battery voltage ?

- NO → Inspect STARTER SIGNAL(7.5A) fuse
  - Is STARTER SIGNAL(7.5A) fuse OK?
    - NO → **Replace fuse.**
    - YES → **Repair open in BLU/WHT wire between ECU (B9) and STARTER SIGNAL (7.5A) fuse.**
- YES → **Starter switch signal is OK.**

Idle Control System

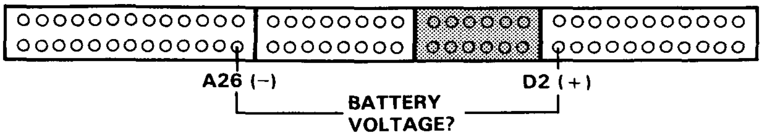
Troubleshooting Flowchart —— Brake Switch Signal

This signals the ECU when the brake pedal is depressed.



(To page 11-313)

(From page 11-312)



Measure voltage between D2 (+) terminal and A26 (−) terminal with the brake pedal depressed.

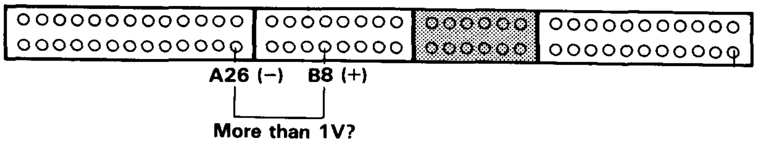
Is there battery voltage?

NO → **Repair open in GRN/WHT wire between the brake switch and ECU (D2).**

YES → **Brake switch signal is OK.**

Troubleshooting Flowchart — P/S Oil Pressure Signal

This signals the ECU when the power steering load is high.



Inspection of P/S Oil Pressure Signal

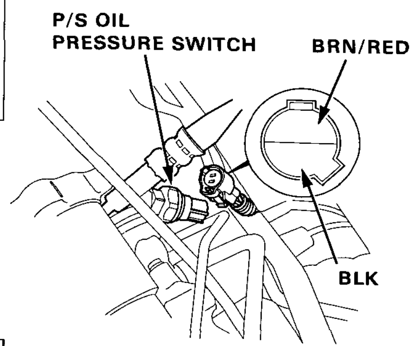
Connect the test harness between the ECU and connector (page 11-212).

Turn the ignition switch ON.

Measure voltage between B8 (+) terminal and A26 (−) terminal.

Is there more than 1V?

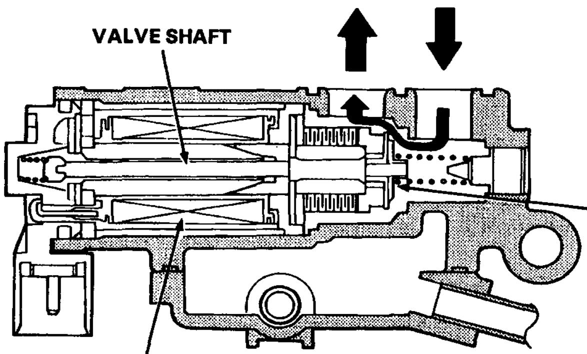
- YES → Disconnect the 2P connector from the P/S oil pressure switch.
  - Connect BRN/RED terminal to BLK terminal.
  - Is there more than 1V?
    - NO → **Replace P/S oil pressure switch.**
    - YES → **Repair open in BRN/RED wire between ECU (B8) and P/S oil pressure switch or BLK wire between P/S oil pressure switch and G302.**
- NO → Start the engine.
  - Turn steering wheel slowly.
  - Measure voltage between B8 (+) terminal and A26 (−) terminal while steering wheel is turning.
  - Is there battery voltage?
    - YES → **P/S oil pressure signal is OK.**
    - NO → Disconnect the 2P connector from the P/S oil pressure switch.
      - Is there battery voltage?
        - YES → **Replace P/S oil pressure switch.**
        - NO → **Repair short in BRN/RED wire between ECU (B8) and P/S oil pressure switch. If wire is OK, substitute a known-good ECU and recheck. If prescribed voltage is now available, replace the original ECU.**

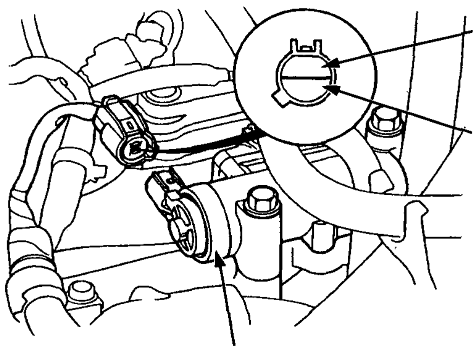


Troubleshooting Flowchart —— EACV [D15B2 engine]

[14] Self-diagnosis Check Engine light indicates code 14: A problem in the Electric Air Control Valve (EACV) circuit.

The EACV changes the amount of air bypassing the throttle body in response to a current signal from the ECU in order to maintain the proper idle speed.





[14]

– Check Engine light has been reported on.
– With service check connector jumped (page 11-208), CODE 14 is indicated.

↓

Do the ECU Reset Procedures (page 11-209).

↓

Start the engine.

↓

Is Check Engine light on and does it indicate CODE 14?

- NO → With the engine running and the accelerator pedal released, disconnect the 2P connector from the EACV.
  - ↓ Is there a reduction in engine rpm?
    - YES → **Intermittent failure, system is OK at this time (test driving may be necessary). Check for poor connection or loose wires at EACV and ECU**
    - NO → **Substitute a known-good EACV and retest.**
- YES → Remove the 2P connector from the EACV.

(To page 11-317)

(From page 11-316)

Measure voltage between the YEL/BLK wire and body ground.

Is there battery voltage?

NO → **Repair open in YEL/BLK wire between EACV and main relay.**

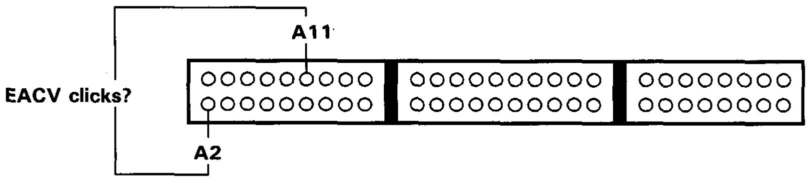
YES ↓

Turn the ignition switch off and reconnect the 2P connector the EACV.

Connect the test harness "A" connector to the main wire harness only, not the ECU (page 11-212).

Turn the ignition switch ON.

Momentarily connect A11 terminal to A2 terminal several times.



Does the EACV click?

YES → **Substitute a known-good ECU and retest. If symptom/indication goes away, replace the original ECU.**

NO ↓

Repair open or short in GRN/WHT, BLU/YEL wire between EACV and ECU (A11). If the wire is OK, replace the EACV.

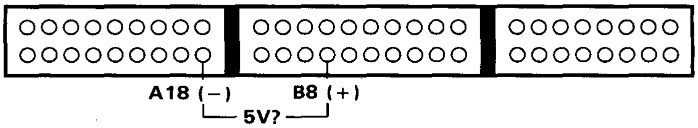
Troubleshooting Flowchart —— Air Conditioning Signal [D15B2 engine]

This signals the ECU when there is a demand for cooling from the air conditioning system.

Inspection of Air Conditioning Signal.

Connect the test harness between the ECU and connector. Disconnect "B" connector from the main wire harness only, not the ECU (page 11-212).

Turn the ignition switch ON.



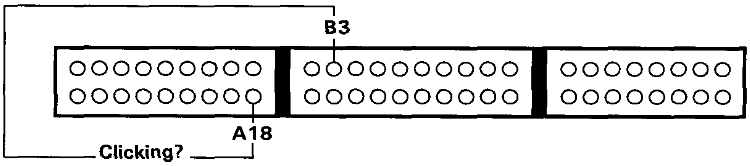
Measure voltage between B8 (+) terminal and A18 (−) terminal.

Is there approx. 5 V?

NO → **Substitute a known-good ECU and recheck. If prescribed voltage is now available, replace the original ECU.**

YES ↓

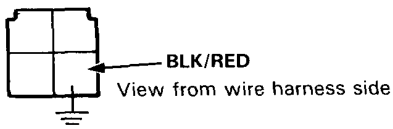
Reconnect "B" connector to the main wire harness.



Momentarily connect B3 terminal to A18 terminal several times.

Is there a clicking noise from the A/C compressor clutch?

NO → Connect the BLK/RED terminal of the 4P connector on the A/C clutch relay to body ground.



Is there a clicking noise from the A/C compressor clutch?

NO → **See Air conditioner inspection (section 22).**

YES → **Repair open in BLK/RED wire between ECU (B3) and A/C clutch relay.**

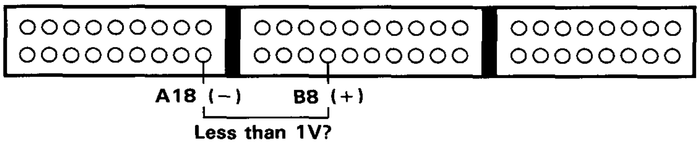
YES ↓

Start the engine.

Blower switch ON.

(To page 11-319)

(From page 11-318)



A/C switch ON.

Does A/C operate ?

- NO → Measure voltage between B8 (+) terminal and A18 (−) teminal.
  - Is voltage less than 1V?
    - NO → **Repair open in BLU/RED wire between ECU (B8) and A/C pressure switch.**
    - YES → **Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.**
- YES → **Air conditioning signal is OK.**

Troubleshooting Flowchart — Alternator FR Signal [D15B2 engine]

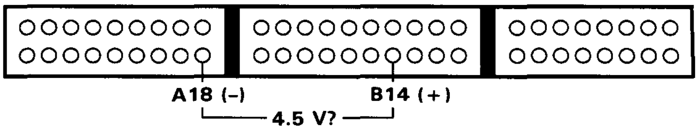
This signals the ECU when the alternator is charging.

Inspection of Alternator FR signal.

Connect the test harness between the ECU and connector. Disconnect "B" connector from the main wire harness only, not the ECU (page 11-212).

Turn the ignition switch ON.

Measure voltage between B14 (+) terminal and A18 (−) terminal.



Is there approx. 4.5 V?

NO → **Substitute a known-good ECU and recheck. If prescribed voltage is now available, replace the original ECU.**

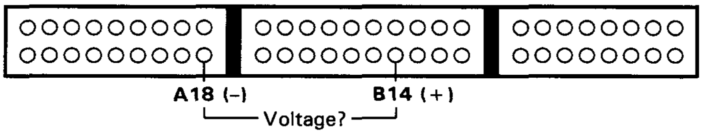
YES ↓

Turn the ignition switch OFF.

Reconnect "B" connector to the main wire harness.

Warm up engine to normal operating temperature (cooling fan comes on).

Measure voltage between B14 (+) terminal and A18 (−) terminal.



Does the voltage decrease when headlights and rear defogger are turned on ?

NO → Stop the engine. (To page 11-321)

YES ↓

Do the ECU Reset Procedure (page 11-209).

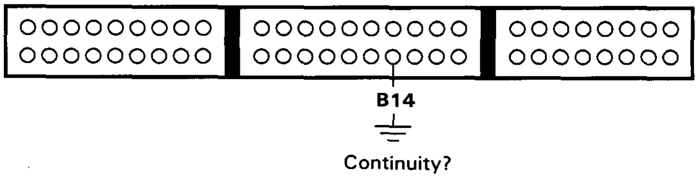
Alternator FR signal is OK.

(From page 11-320)

Disconnect "B" connector from ECU only, not the main wire harness.

Disconnect the negative battery cable from the battery.

Check for continuity between B14 terminal and body ground.



Does continuity exist ?

YES

Disconnect GRN connector from the alternator.

Check for continuity between B14 terminal and body ground.

Does continuity exist ?

NO

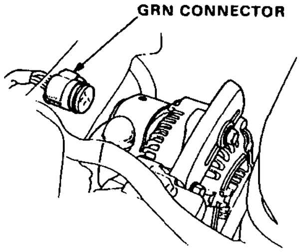
See Alternator Inspection (section 23).

YES

Repair short in PNK, BLU wire between ECU (B14) and alternator.

NO

Disconnect GRN connector from the alternator.



Connect BLU wire to body ground.

Check for continuity between B14 terminal and body ground.

Does continuity exist ?

YES

See Alternator Inspection (section 23).

NO

Repair open in PNK, BLU wire between ECU (B14) and alternator.

Troubleshooting Flowchart—A/T Shift Position Signal [D15B2 engine]

This signals the ECU when the transmission is in Neutral or Park.

Inspection of A/T Shift Position Signal.

Turn the ignition switch ON.

Observe the A/T shift indicator and select each position separately.

Does the indicator light properly?

NO → **See A/T Shift Position Indicator Inspection (section 14).**

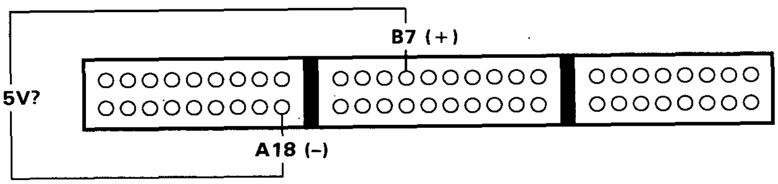
YES

Turn the ignition switch OFF.

Connect the test harness between the ECU and connector. Disconnect "B" connector from the main wire harness only, not the ECU (page 11-212).

Turn the ignition switch ON.

Measure voltage between B7 (+) terminal and A18 (−) terminal.



Is there approx. 5 V?

NO → **Substitute a known-good ECU and recheck. If prescribed voltage is now available, replace the original ECU.**

YES

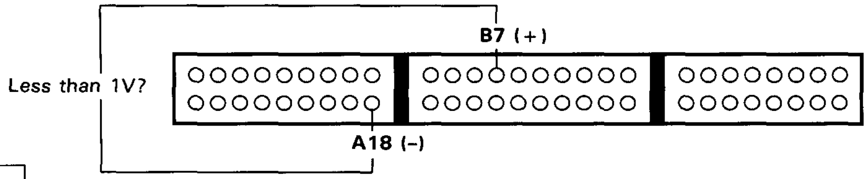
Turn the ignition switch OFF.

Reconnect "B" connector to the main wire harness.

Start the engine.

(To page 11-322)

(From page 11-322)

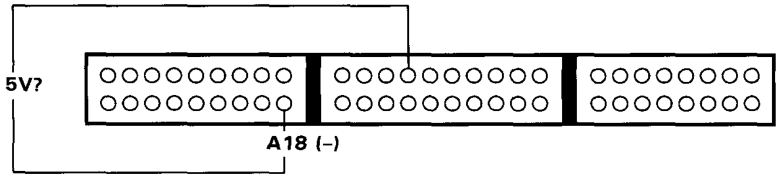


Measure voltage between B7 (+) terminal and A18 (–) terminal with the transmission in [N] and [P] individually.

Is there less than 1 V?

NO → **Repair open in GRN wire between ECU (B7) and gauge assembly.**

YES

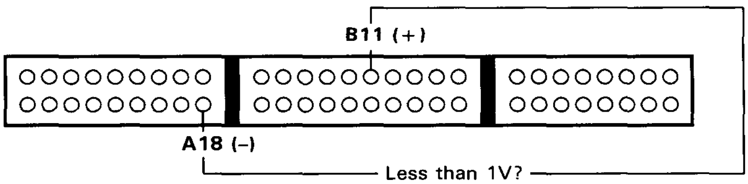


Measure voltage between B7 (+) terminal and A18 (–) terminal with the transmission in gear.

Is there approx. 5 V?

NO → **Repair short in GRN wire between ECU (B7) and gauge assembly.**

YES

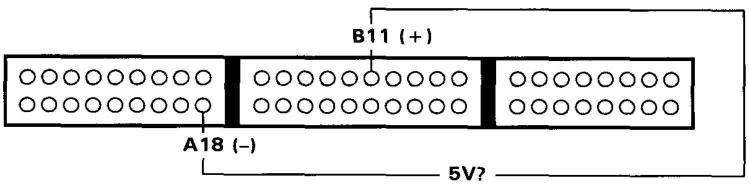


Measure voltage between B11 (+) terminal and A18 (–) terminal with the transmission in [D4]

Is there less than 1 V?

NO → **Repair open in GRN/BLK wire between ECU (B11) and shift position console switch.**

YES



Measure voltage between B11 (+) teminal and A18 (–) terminal with the transmission in [N] or [P].

Is there approx. 5 V?

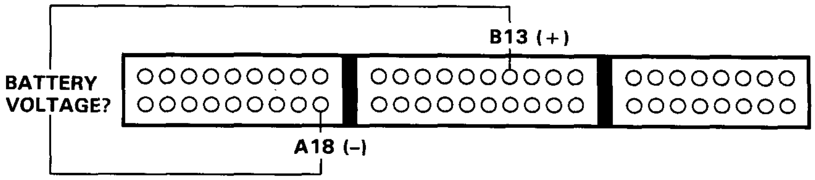
NO → **Repair short in GRN/BLK wire between ECU (B11) and shift position console switch**

YES

A/T shift position signal is OK.

Troubleshooting Flowchart — Starter Switch Signal [D15B2 engine]

This signals the ECU when the engine is cranking.



Inspection of Starter Switch Signal.

↓

Connect the test harness between the ECU and connector (page 11-212).

↓

Measure voltage between B13 (+) terminal and A18 (–) terminal when the ignition switch in the start position.

↓

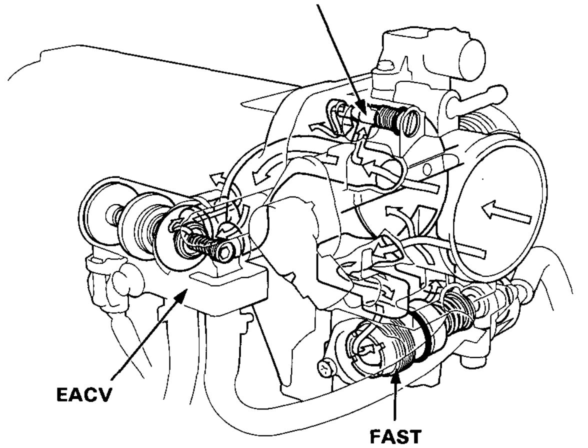
Is there battery voltage ?

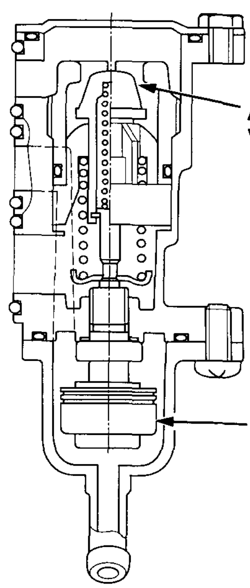
- NO → Inspect STARTER SIGNAL(7.5A) fuse
  - Is STARTER SIGNAL(7.5A) fuse OK?
    - NO → **Replace fuse.**
    - YES → **Repair open in BLU/WHT wire between ECU (B13) and STARTER SIGNAL (7.5A) fuse.**
- YES → **Starter switch signal is OK.**

Fast Idle Valve [Except D15B2, D15Z1 engine]

Description

To prevent erratic running when the engine is warming up, it is necessary to raise the idle speed. The fast idle air bypass valve is controlled by a thermowax plunger. When the engine is cold, the engine coolant surrounding the thermowax contracts the plunger, allowing additional air to be bypassed into the intake manifold so that the engine idles faster. When the engine reaches operating temperature, the vlave colses, reducing the amount of air bypassing into the manifold.

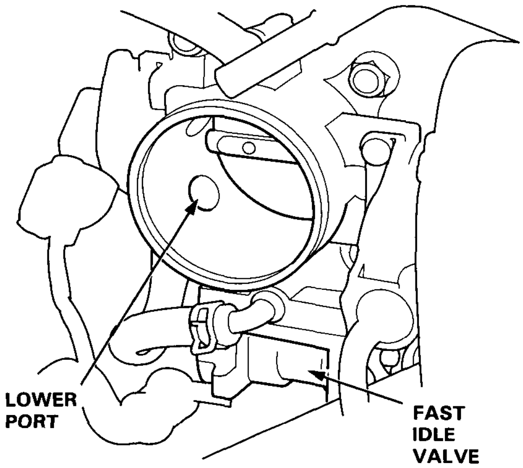




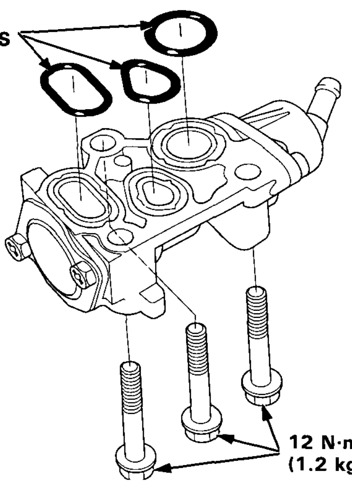
Inspection

NOTE: The fast idle valve is factory adjusted; it should not be disassembled.

1. Remove the intake air duct from the throttle body.
2. Start the engine.
3. Put your finger over the lower port in throttle body and make sure that there is air flow with the engine cold (coolant temperature below30°C, 86°F).



- If not, replace the fast idle valve and retest.



4. Warm up the engine (cooling fan comes on).
5. Check that the valve is completely closed. If not, air suction can be felt at the lower port in the throttle body.
   - If any suction is felt, the valve is leaking. Replace the fast idle valve and recheck.

Idle Control System

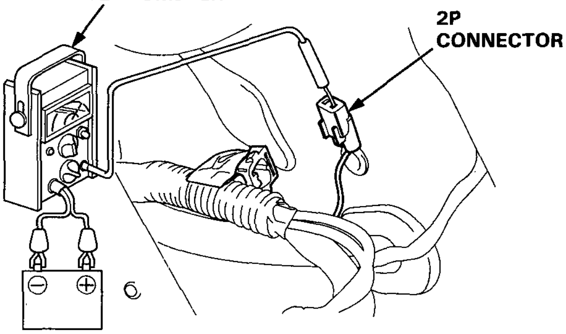
Idle Speed Setting [Except D15B2 engine]

Inspection/Adjustment

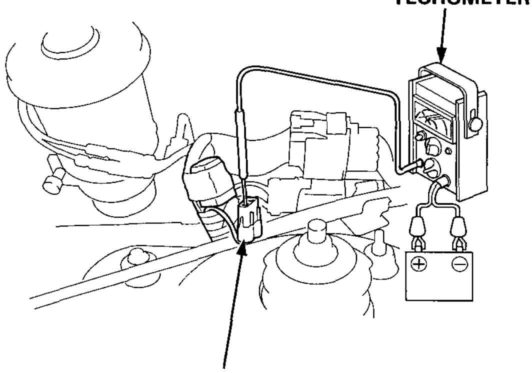
1. Start the engine and warm it up to normal operating temperature (the cooling fan comes on).

2. Connect a techometer.

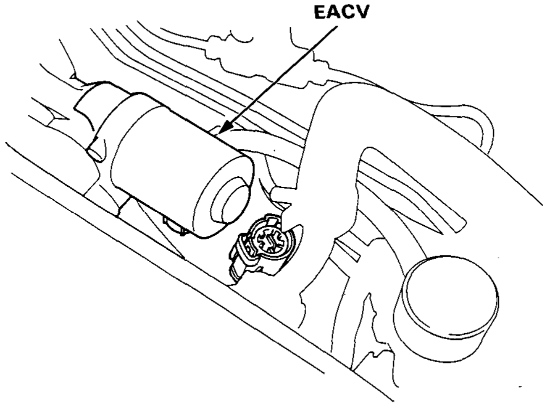
LHD:



RHD:



3. Disconnect the 2P connector from the EACV.



4. Start the engine with the accelerator pedal slightly depressed. Stabilize the engine speed at 1000, then slowly release the pedal until the engine idles.

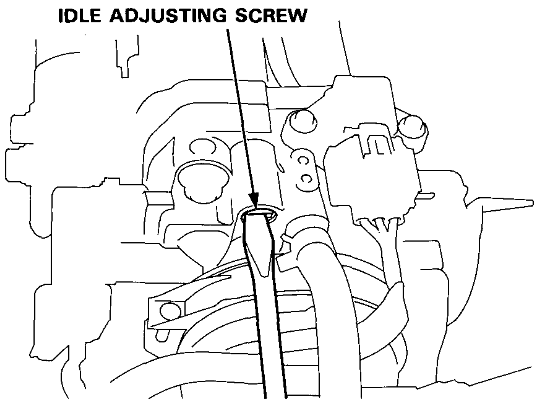
5. Check idling in no-load conditions: headlights, blower fan, rear defogger, cooling fan, and air conditioner are not operating.

   NOTE: (KS) Remove No. 16 (7.5 A) fuse in the under-dash fuse box, then check that the headlights and side marker lights are off.

   Idle speed should be:

Manual	D15Z1 engine: 420 ± 50 min^{-1} (rpm) Others: 420 ± 50 min^{-1}
Automatic	420 ± 50 min^{-1} (rpm) (in N or P)

   Adjust the idle speed, if necessary, by turning the idle adjusting screw.



6. Turn the ignition switch OFF.

7. Reconnect the 2P connector on the EACV, then remove BACK UP fuse in the under-hood fuse/relay box for 10 seconds to reset the ECU.

8. Restart and idle the engine with no-load conditions for one minute, then check the idle speed.

   NOTE: (KS) Remove No. 16 (7.5 A) fuse in the under-dash fuse box, then check that the headlights and side marker lights are off.

   Idle speed should be:

Manual	D15Z1 engine: 600 ± 50 min^{-1} (rpm) Others: 750 ± 50 min^{-1} (rpm)
Automatic	750 ± 50 min^{-1} (rpm) (in $\boxed{N}$ or $\boxed{P}$)

9. Idle the engine for one minute with headlights (Hi) ON and check the idle speed.

   Idle speed should be:

Manual	D15Z1 engine: 700 ± 50 min^{-1} (rpm) Others: 750 ± 50 min^{-1} (rpm)
Automatic	750 ± 50 min^{-1} (rpm) (in $\boxed{N}$ or $\boxed{P}$)

10. Turn the headlights and rear defogger off.
    Idle the engine for one minute with heater fan switch at HI and air conditioner on, then check the idle speed.

   Idle speed should be:

Manual	D15Z1 engine: 810 ± 50 min^{-1} (rpm) Others: 810 ± 50 min^{-1} (rpm)
Automatic	810 ± 50 min^{-1} (rpm) (in $\boxed{N}$ or $\boxed{P}$)

   NOTE: If the idle speed is not within specification, see System Trobleshooting Guide on page 11-296.

Idle Control System

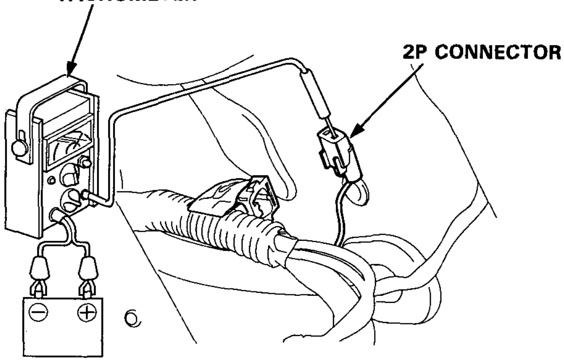
Idle Speed Setting [D15B2 engine]

Inspection/Adjustment

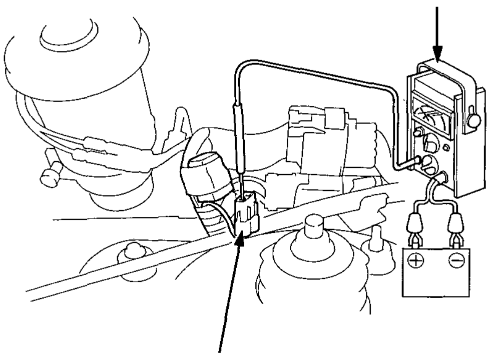
1. Start the engine and warm it up to normal operating temperature (the cooling fan comes on).

2. Connect a tachometer.

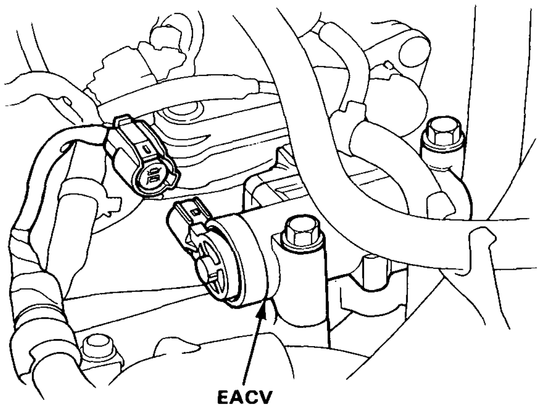
LHD:



RHD:



3. Disconnect the 2P connector from the EACV.



4. Start the engine with the accelerator pedal slightly depressed. Stabilize the engine speed at 1000, then slowly release the pedal until the engine idles.

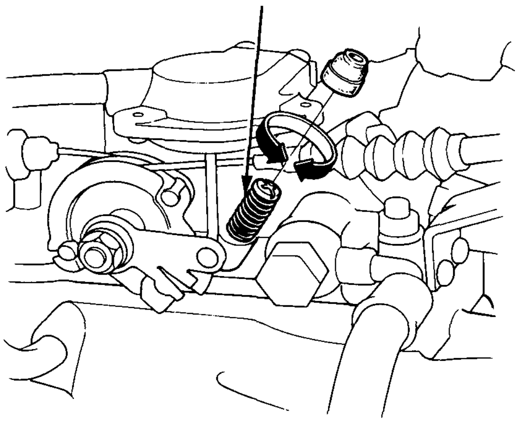
5. Check idling in no-load conditions: headlights, blower fan, rear defogger, cooling fan, and air conditioner are not operating.

   NOTE: (KS) Remove No. 16 (7.5 A) fuse in the under-dash fuse box, then check that the headlights and side marker lights are off.

   Idle speed should be:

Manual	625 ± 50 min^{-1} (rpm)
Automatic	625 ± 50 min^{-1} (rpm) (in $\boxed{N}$ or $\boxed{P}$)

   Adjust the idle speed, if necessary, by turning the idle adjusting screw.



6. Turn the ignition switch OFF.

7. Reconnect the 2P connector on the EACV, then remove BACK UP fuse in the under-hood fuse/relay box for 10 seconds to reset the ECU.

8. Restart and idle the engine with no-load conditions for one minute, then check the idle speed.

   NOTE: (KS) Remove No. 16 (7.5 A) fuse in the under-dash fuse box, then check that the headlights and side marker lights are off.

   Idle speed should be:

Manual	810 ± 50 min^{-1} (rpm)
Automatic	810 ± 50 min^{-1} (rpm) (in N or P)

9. Idle the engine for one minute with headlights (Hi) ON and check the idle speed.

   Idle speed should be:

Manual	810 ± 50 min^{-1} (rpm)
Automatic	810 ± 50 min^{-1} (rpm) (in N or P)

10. Turn the headlights and rear defogger off.
    Idle the engine for one minute with heater fan switch at HI and air conditioner on, then check the idle speed.

   Idle speed should be:

Manual	810 ± 50 min^{-1} (rpm)
Automatic	810 ± 50 min^{-1} (rpm) (in N or P)

NOTE: If the idle speed is not within specification, see System Trobleshooting Guide on page 11-296.

Fuel Supply System

System Troubleshooting Guide

NOTE: Across each row in the chart, the systems that could be sources of a symptom are ranked in the order they should be inspected starting with ①. Find the symptom in the left column, read across to the most likely source, then refer to the page listed at the top of that column. If inspection shows the system is OK, try the next most likely system ②, etc.

SYMPTOM \ SUB SYSTEM		FUEL INJECTOR	PRESSURE REGULATOR	FUEL FILTER	FUEL PUMP	MAIN RELAY	CONTAMI-NATED FUEL
PAGE		334, 338*	343	344	346	349	–
ENGINE WON'T START				③	①	②	
DIFFICULT TO START ENGINE WHEN COLD OR HOT				①			
ROUGH IDLE		①					②
POOR PERFORMANCE	MISFIRE OR ROUGH RUNNING	①	③				②
	FAILS EMISSION TEST	②	①				
	LOSS OF POWER	③		②	①		
FREQUENT STALLING	WHILE WARMING UP		①				
	AFTER WARMING UP		①				

*: B16A2 *engine*

Fuel Supply System

System Description

The fuel supply system consists of a fuel tank, in-tank high pressure fuel pump, main relay, fuel filter, pressureregulator, injectors, and fuel delivery and return lines. This system delivers pressure-regulated fuel to the injectors and cuts the fuel delivery when the engine is not running.

Fuel Pressure

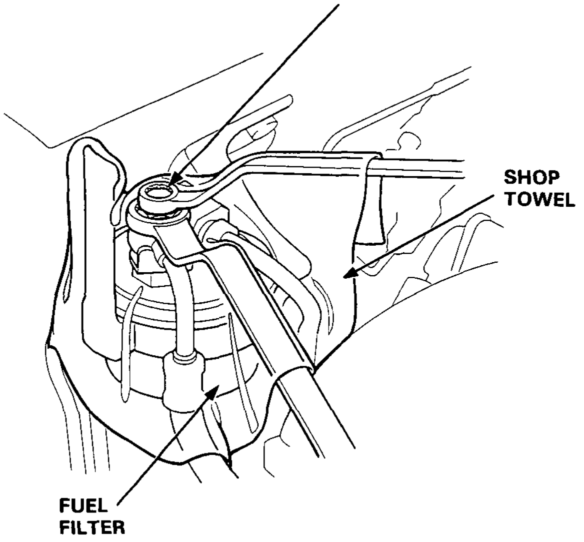
Relieving

⚠ WARNING

- **Do not smoke while working on the fuel system. Keep open flames or sparks away from the work area.**
- **Be sure to relieve fuel pressure while the engine is off.**

NOTE: Before disconnecting fuel pipes or hoses, release pressure from the system by loosening the 6 mm service bolt on top of the fuel filter.

1. Disconnect the battery negative cable from the battery negative terminal.
2. Remove fuel filter cap.
3. Use a box end wrench on the 6 mm service bolt at the fuel filter, while holding the psecial banjo bolt with another wrench.
4. Place a rag or shop towel over the 6 mm service bolt.
5. Slowly loosen the 6 mm service bolt one complete turn.



NOTE:
- A fuel pressure gauge can be attached at the 6 mm service bolt hole.
- Always replace the washer between the service bolt and the special banjo bolt, whenever the service bolt is loosened.
- Replace all wahers whenever the bolts are removed.

Inspection

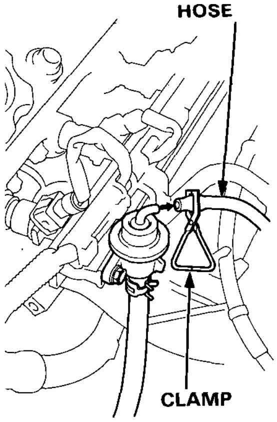
1. Relieve fuel pressure (page 11-332).
2. Remove the service bolt on the fuel filter while holding the banjo bolt with another wrench. Attach the special tool.
3. Start the engine.* Measure the fuel pressure with the engine idling and vacuum hose of the pressure regulator disconnected from the pressure regulator.

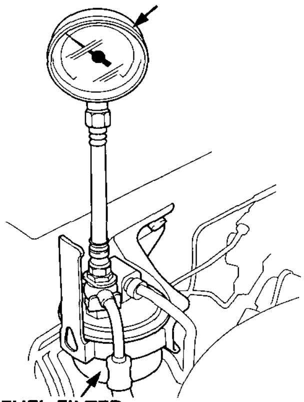
   Pressure should be:
   Except D15B2 engine:
   280−330 kPa (2.8−3.3 kg/cm², 40−47 psi)
   D15B2 engine:
   240−279 kPa (2.45−2.85 kg/cm², 35−41 psi)

4. Reconnect vacuum hose to the pressure regulator.

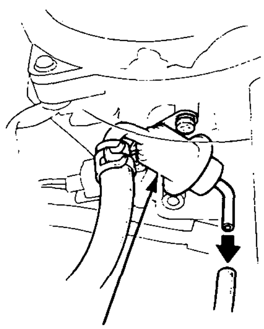
   Pressure should be:
   Except D15B2 engine:
   215−265 kPa (2.15−2.65 kg/cm ², 31−38 psi)
   D15B2 engine:
   200−240 kPa (2.04−2.45 kg/cm², 29−35 psi)

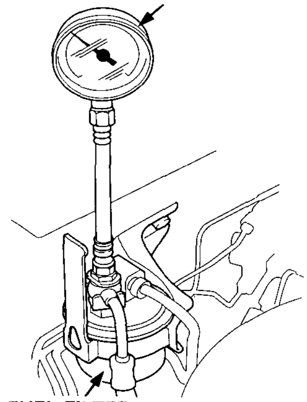
Except D15B2 engine:





D15B2 engine:





*: If the engine will not start, turn the ignition switch on, wait for two seconds, turn it off, then back on again and read the fuel pressure.

- If the fuel pressure is not as specified, first check the fuel pump (page 11-347). If the pump is OK, check the following:

— If the pressure is higher than specified, inspect for:
  - Pinched or clogged fuel return hose or piping.
  - Faulty pressure regulator (page 11-343)

— If the pressure is lower than specified, inspect for:
  - Clogged fuel filter.
  - Faulty pressure regulator (page 11-343)
  - Leakage in the fule line.

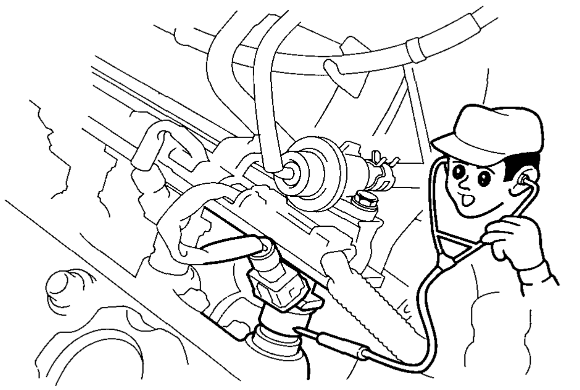
Fuel Injectors [Except D15B2 engine]

Testing

NOTE: Check the following items before tesing: idle speed, ignition timing and idle CO %

If the engine will run:

1. With the engine idling, disconnect each injector connector individually and inspect the change in the idling speed.
   - If the idle speed drop is almost the same for each cylinder, the injectors are normal.
   - If the idle speed or quality remains the same when you disconnect a particular injector, replace the injector and re-test.
2. Check the clicking sound of each injector by means of a stethoscope when the engine is idling.



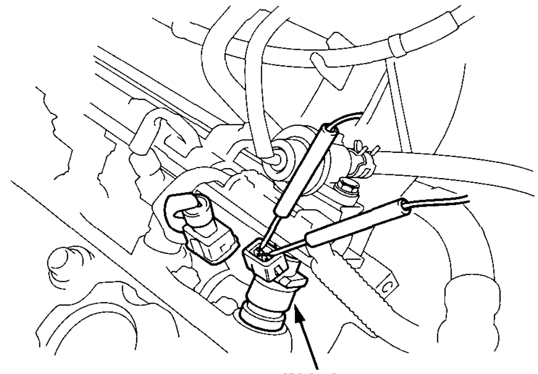
- If any injector fails to make the typical clicking sound, check the sound again after replacing the injector.
- If clicking sound is still absent, check the following.
  - Whether there is any short-circuiting, wire breakage or poor connection in the YEL/BLK wire between the main relay and the injector.
  - Whether there is any short-circuiting, wire breakage or poor connection in the wire between the injector and the ECU.

  If all is OK, check the ECU (page 11-219) and main relay (page 11-349).

If the engine cannot be started:

1. Remove the connector of the injector, and measure the resistance between the 2 terminals of the injector.

   Resistance should be: 10—13 Ω



- If the resistance is not as specified, replace the injector.
- If the resistance is as specified, check the pressure (page 11-332).
- If the fuel pressure is as specified, check the following:
  - Whether there is any short-circuiting, wire breakage or poor connection in the YEL/BLK wire between the main relay and the injector.
  - Whether there is any short-circuiting, wire breakage or poor connection in the wire between the injector and the ECU.

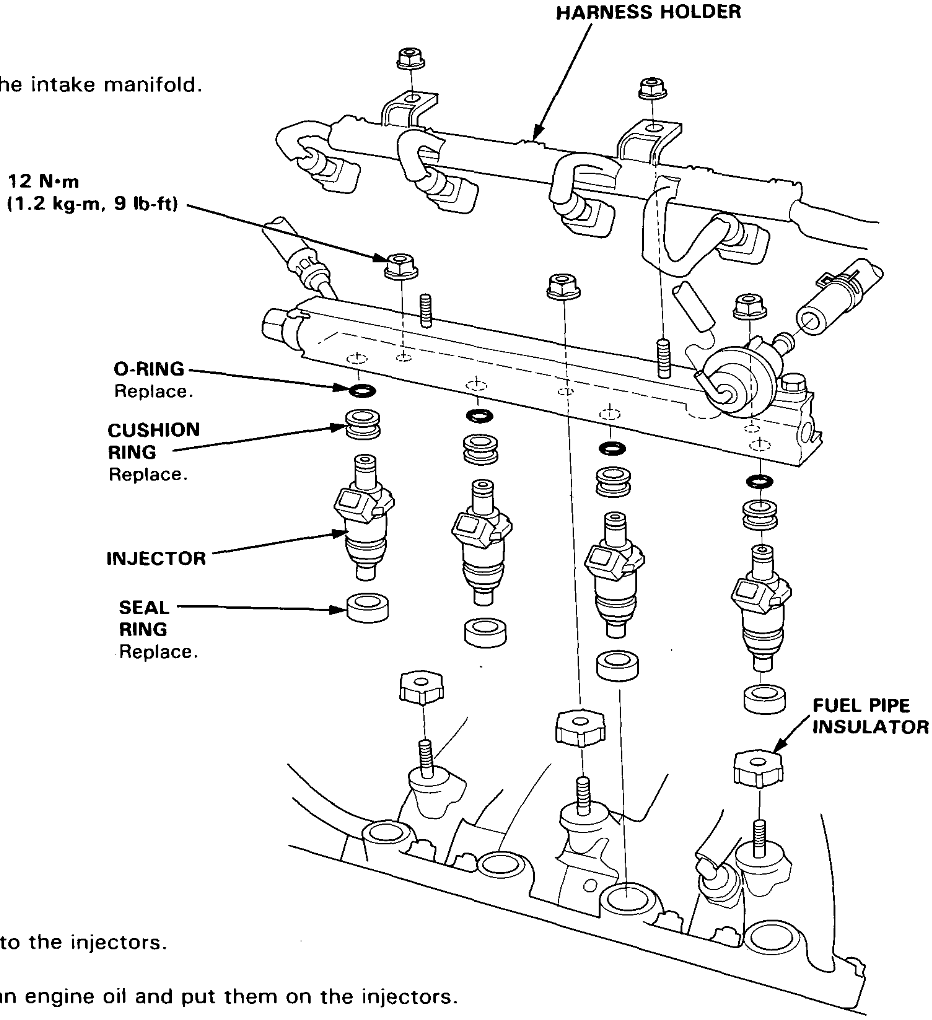
  If all is OK, check the ECU (page 11-219).

Replacement

WARNING Do not smoke when working on the fuel system. Keep open flames away from your work area.

1. Relieve fuel pressure (page 11-332).
2. Disconnect the connectors from the injectors.
3. Disconnect the vacuum hose and fuel return hose from the pressure regulator.

   NOTE: Place a rag or shop towel over the hoses before disconnecting them.
4. Disconnect the fuel hose from the fuel pipe.
5. Loosen the retainer nuts on the fuel pipe and harness holder.
6. Disconnect the fuel pipe.
7. Remove the injectors from the intake manifold.



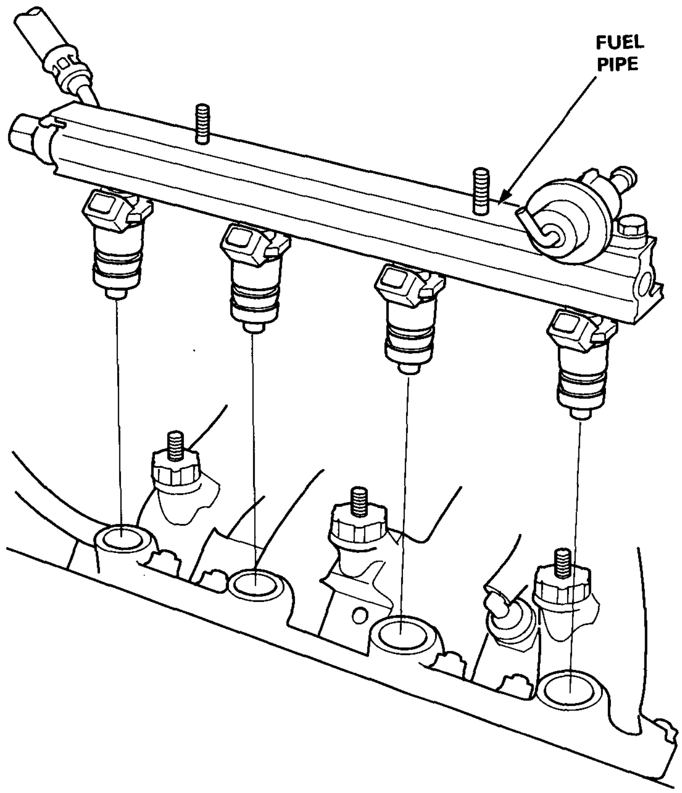
8. Slide new cushion rings onto the injectors.
9. Coat new O-rings with clean engine oil and put them on the injectors.
10. Insert the injectors into the fuel pipe first.
11. Coat new seal rings with clean engine oil and press them into the intake manifold.

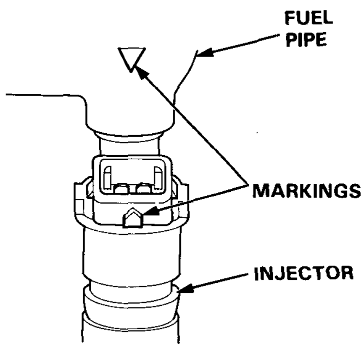
(cont'd)

Fuel Injectors [Except D15B2 engine] (cont'd)

12. Install the injectors and fuel pipe assembly in the manifold.

    CAUTION: To prevent damage to the O-ring, install the injectors in the fuel pipe first, then install them in the intake manifold.





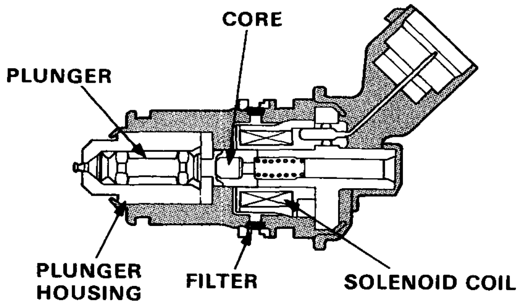
13. Align the center line on the connector with the mark on the fuel pipe. (D15Z1 engine only)
14. Install and tighten the retainer nuts.
15. Connect the fuel hose to the fuel pipe with new washers.
16. Connect the vacuum hose and fuel return hose to the pressure regulator.
17. Install the connectors on the injectors.
18. Replace the 6 mm service bolt washer and tighten the bolt.
19. Turn the ignition switch ON but do not operate the starter. After the fuel pump runs for approximately two seconds, the fuel pressure in the fuel line rises. Repeat this two or three times, then check whether there is any fuel leakage.

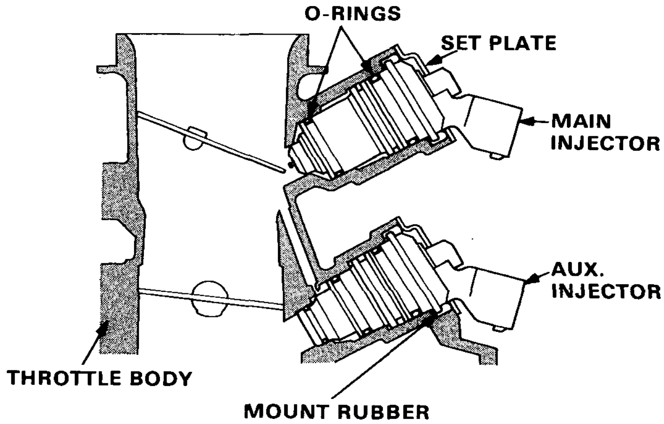
Fuel Injectors [D15B2 engine]

Troubleshooting Flowchart

16 Self-diagnosis Check Engine light indicates code 16: A problem in the fuel injector circuit.

The injectors are the solenoid-actuated constant-stroke pintle type consisting of a solenoid, plunger needle valve and housing. When current is applied to the solenoid coil, the valve lifts up and pressurized fuel is injected. Because the needle valve lift and the fuel pressure are constant, the injection quantity is determined by the length of time that the valve is open (i.e., the duration the current is supplied to the solenoid coil). The injector is sealed by two O-rings and a mount rubber. This also reduces operating noise.





16

- **Check engine light has been reported on.**
- **With service check connector jumped (page 11-208), CODE 16 is indicated.**

↓

Do the ECU Reset Procedure (page 11-209).

↓

Check for loose wires or connectors at fuel injectors.

↓

Are connections OK? — NO → **Repair as necessary.**

YES ↓

Start engine and hold at 2,000 min^{-1} (rpm) for 1 minute.

NOTE: If engine will not start, continue cranking for at least 15 second to reproduce CODE on ECU.

(To page 11-339)

(From page 11-338)

Does the engine start and run at 2000 min^{-1} (rpm) for 1 minute.

NO → Is Check Engine warning light on and does LED indicate CODE 16 ?

NO → See Troubleshooting Guide (page 11-206).

YES

Turn the ignition switch OFF.

Disconnect the 2P connector from the auxiliary injector.

Measure resistance between the 2 terminals of the injector.

Is resistance 6-10 Ω?

NO → Replace the injector.

YES

Turn the ignition switch ON.

Measure voltage between the auxiliary injectors YEL wire and body ground.

Is there approx. 10V?

NO →
- Repair open or short in YEL, BRN wire between aux. injector and ECU (A1, A3).
- Substitute a known-good ECU and recheck. If prescribed voltage is now available, replace the original ECU.

YES

(To page 11-340)

YES (engine starts and runs)

Is Check Engine warning light on and does LED indicate CODE 16 ?

NO → Intermittent failure (test drive may be necessary.)

YES

Turn the ignition switch OFF.

Disconnect the 2P connector from the main injector.

Measure resistance between the 2 terminals of the injector.

Is resistance 0.6—1.6 Ω?

NO → Replace the injector.

YES

Connect voltmeter positive to the main injector's YEL/BLK wire and negative to body ground.

Turn the ignition switch ON.

Is there battery voltage for two seconds?

NO → Repair open in YEL/BLK wire between main injector and main relay.

YES

Turn the ignition switch OFF.

Disconnect the 2P connector from the auxiliary injector.

Measure resistance between the 2 terminals of the injector.

(To page 11-340)

(cont'd)

Fuel Injectors [D15B2 engine] (cont'd)

(From page 11-339)

Is resistance 6-10 Ω?

NO → Replace the injector.

YES ↓

Connect voltmeter positive to YEL/BLK wire of auxiliary injector and negative to body ground.

Turn the ignition switch ON.

Is there battery voltage for two seconds?

NO → **Repair open in YEL/BLK wire between the 2P connector and the main relay.**

YES ↓

Connect voltmeter positive to YEL wire of auxiliary injector and negative to body ground.

Is there approx. 10V?

NO →
- **Repair open in YEL, BRN wire between auxiliary injector and ECU (A1, A3).**
- **Substitute a known-good ECU and recheck. If prescribed voltage is now available, replace the original ECU.**

YES ↓

Measure voltage between the main injector's RED wire and body ground.

(To page 11-341)

(From page 11-339)

Disconnect the 2P connector from the main injector.

Measure voltage between the main injector's RED wire and body ground.

Is there approx. 10 V?

NO →
- **Repair short in RED wire between main injector and ECU (A5, A7)**
- **Substitute a known-good ECU and recheck. If prescribed voltage is now available, replace the original ECU.**

YES ↓

Turn the ignition switch OFF.

Connect voltmeter positive to YEL/BLK wire of auxiliary injector and negative to body ground.

Turn the ignition switch ON.

(To page 11-341)

(From page 11-340)

Is there approx. 10V?

YES → Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.

NO →

- Repair open in RED wire between main injector and ECU (A5, A7).
- Substitute a known-good ECU and recheck. If prescribed voltage is now available, replace the original ECU.

(From page 11-340)

Is there battery voltage for 2 seconds?

YES → Substitute a known-good ECU and recheck. If prescribed voltage in now available, replace the original ECU.

NO →

Turn the ignition switch OFF.

Connect the test harness between the ECU and connector (page 11-212).

Connect following terminals individually to A18 ●A12 ●A14

Turn the ignition switch ON.

Is there battery voltage at YEL/BLK wire of aux. injector ?

NO →

- Repair open in YEL/BLK wire between aux. injector and main relay.
- Repair open in GRN/YEL wire between main relay and ECU (A12, A14).
- Replace main relay.

YES →

- Repair open in BLK wire between G101 (thermostat housing) and ECU (A2, A4).
- Substitute a known-good ECU and recheck. If prescribed voltage in now available, rep place the original ECU.

(cont'd)

Fuel Injectors [D15B2 engine] (cont'd)

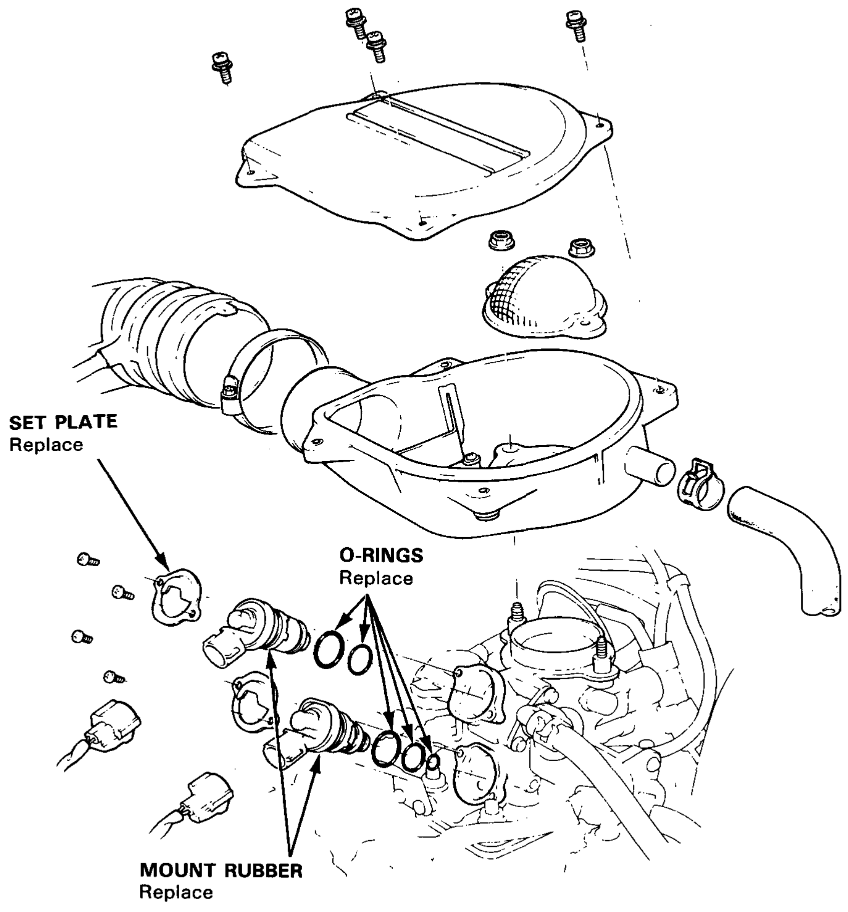
Replacement

⚠ WARNING
Do not smoke while working on fuel system. Keep open flame or spark away from work area.

1. Relieve fuel pressure (page 11-332)
2. Remove the air intake chamber.
3. Disconnect the 2P connector from the injector.
4. Loosen the screws, then remove the injector from the throttle body.

   NOTE:
   Place a rag or shop towel over the throttle body.
5. Coat new O-rings with clean engine oil and put them on the injector.
6. Insert the injector into the throttle body.

   NOTE:
   After the injector is inserted, be sure that it turns smoothly about 30°.
7. Turn the ignition switch ON but do not operate the starter. After the fuel pump runs for approx. 2 seconds, the fuel pressure in the fuel line rises. Repeat this two or three times, then check whether there is any fuel leakage.

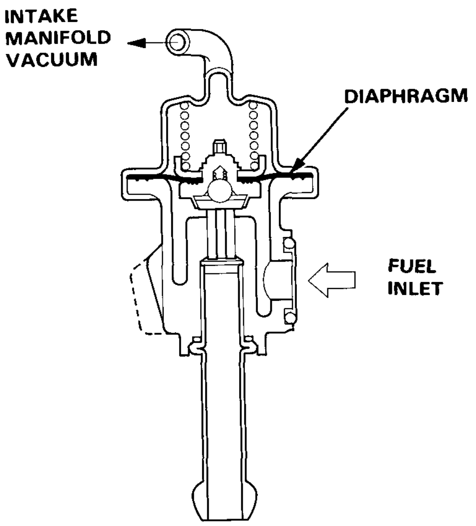


Pressure Regulator

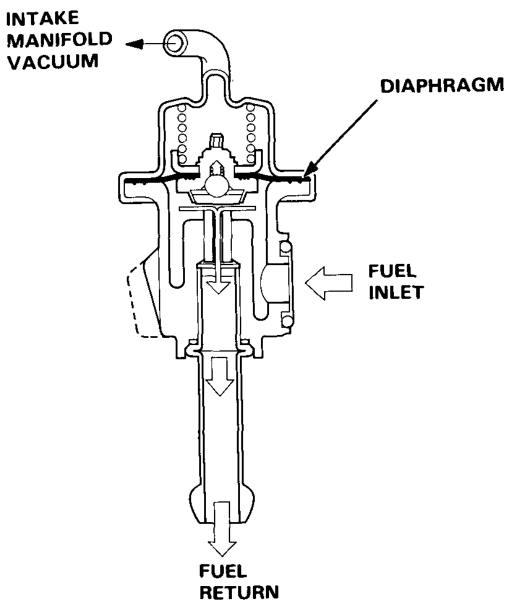
Description

The fuel pressure regulator maintains a constant fule pressure to the injectors. When the difference between the fuel pressure and manifold pressure exceeds 3.0 kg/cm² (43 psi) (Except D15B2 engine), 2.55 kg/cm² (36 psi) (D15B2 engine), the diaphragm is pushed upward, and the excess fuel is fed back into the fuel tank through the return line.

CLOSE



OPEN

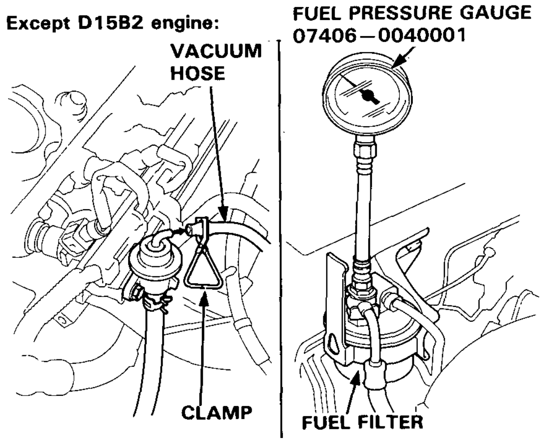


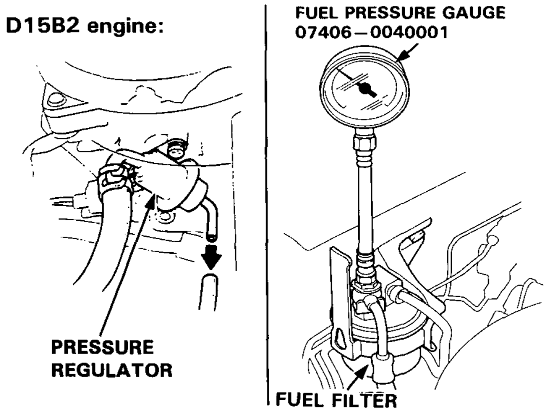
Testing

⚠ WARNING Do not smoke during the test. Keep open flames away from your work area.

1. Attach a pressure gauge to the service port of the fuel filter (page 11-333).

   Pressure should be:
   Except D15B2 engine:
   280–330 kPa (2.8–3.3 kg/cm², 40–47 psi)
   D15B2 engine:
   240–279 kPa (2.45–2.85 kg/cm², 35-41 psi)
   (with the regulator vacuum hose disconnected)





2. Reconnect the vacuum hose to the pressure regulator.

3. Check that the fuel pressure rises when the vacuum hose from the regulator is disconnected again.

   If the fuel pressure did not rise, replace the pressure regulator.

(cont'd)

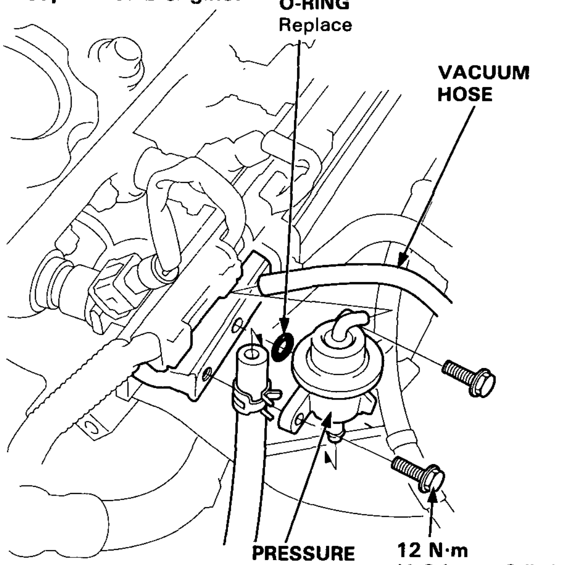
Pressure Regulator (cont'd)

Replacement

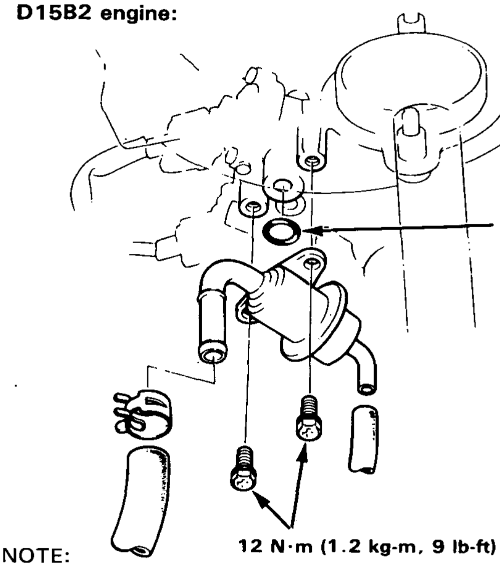
⚠WARNING Do not smoke while working on fuel system. Keep open flame away from work area.

1. Place a shop twoel under pressure regulator, then relieve fuel pressure (page 11-332).
2. Disconnect the vacuum hose and fuel return hose.
3. Remove the two 6 mm mounting bolts.

Except D15B2 engine:



D15B2 engine:



NOTE:
- Replace the O-ring.
- When assembling the regulator, apply clean engine oil to the O-ring and assemble it into its proper position, taking care not to damage the O-ring.

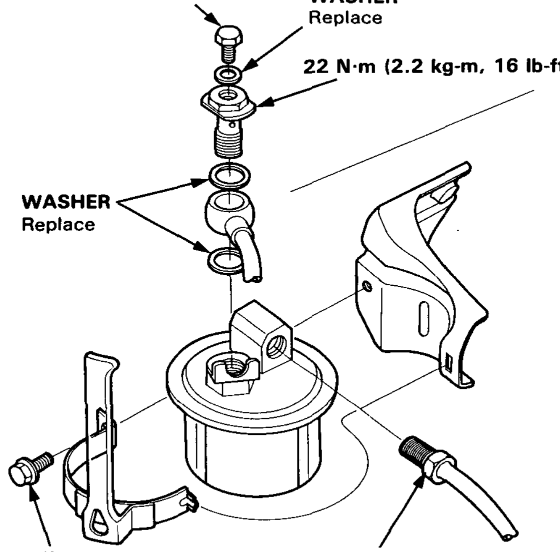
Fuel Filter

Replacement

⚠WARNING
- **Do not smoke while working on fuel system. Keep open flame away from work area.**
- **While replacing be careful to keep a safe distance between battery terminals and any tools.**

The filter should be replaced every 2 years or 40,000 km (24,000 miles), whichever comes first or whenever the fuel pressure drops below the specified value (280—330 kPa, 2.8—3.3 kg/cm², 40—47 psi) (D15B2 engine: 240—279 kPa, 2.45—2.85 kg/cm², 35-41 psi) with the pressure regulator vacuum hose disconnected) after making sure that the fuel pump and the pressure regulator are OK.

1. Disconnect the battery negative cable from the battery negative terminal.
2. Place a shop towel under and around the fule filter.
3. Relieve fuel pressure (page 11-332).
4. Remove the 12 mm banjo bolt and the fuel feed pipe from the filter.
5. Remove the fuel filter clamp and fuel filter.
6. When assembling, use new washers, as shown.

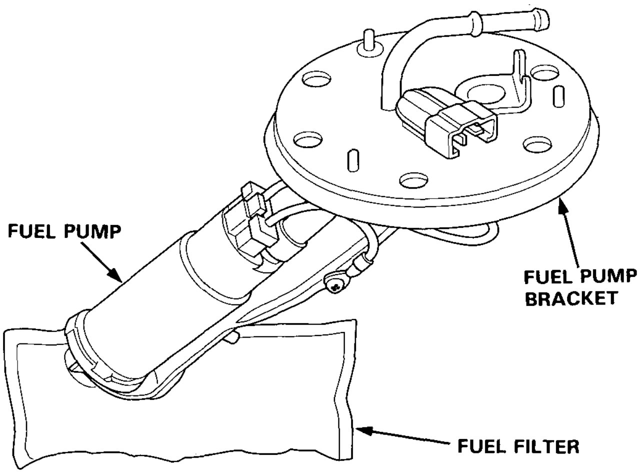


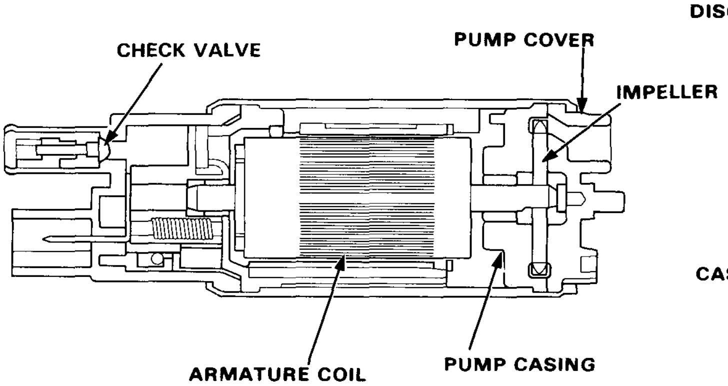
NOTE: Clean the flared joint of high pressure hoses thoroughly before reconnecting them.

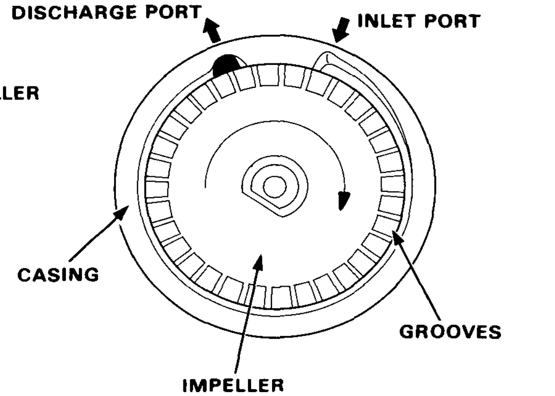
Fuel Pump

Description

Because of its compact impeller design, the fuel pump is installed inside the fuel tank, thereby saving space and simplifying the fuel line system.







The fuel pump is comprised of a DC motor, a circumference flow pump, a relief valve for protecting the fuel line systems, a check valve for retaining residual pressure, an inlet port, and a discharge port. The pump assembly consists of the impeller (driven by the motor), the pump casing (which forms the pumping chamber), and the pump cover.

OPERATION

(1) When the engine is started, the main relay actuates the pump, and the motor turns the impeller. Differential pressure is generated by the numerous grooves around the impeller.
(2) Fuel entering the inlet port flows inside the motor from the pumping chamber and is forced through the discharge port via the check valve. If fuel flow is obstructed at the discharge side of the fuel line, the relief valve will open to bypass the fuel to the inlet port and prevent excessive fuel pressure.
(3) When the engine stops, the pump stops automatically. However, a check valve closes by spring action to retain the residual pressure in the line, helping the engine to restart more easily.

Testing

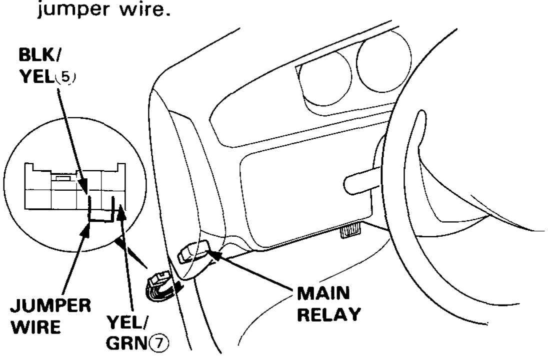
WARNING Do not smoke during the test. Keep open flame away from your work area.

If you suspect a problem with the fuel pump, check that the fuel pump actually runs; when it is ON, you will hear some noise if you hold your ear near the fuel pipe. The fuel pump should run for two seconds when the ignition switch is first turned on. If there is no noise at the fuel pipe, check as follows:

1. Remove the rear seat (section 20).
2. Remove the maintenance lid.
3. Disconnect the 2P connector.

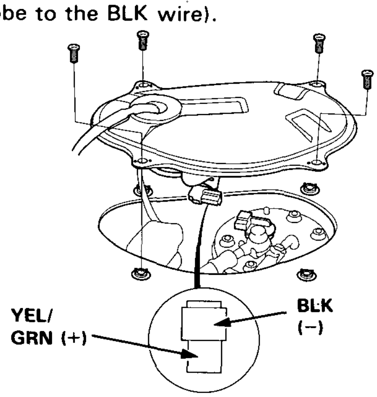
   CAUTION: Be sure to turn the ignition switch OFF before disconnecting the wires.

4. Disconnect the main relay connector and connect the BLK/YEL ⑤ wire and YEL/GRN ⑦ wire with a jumper wire.

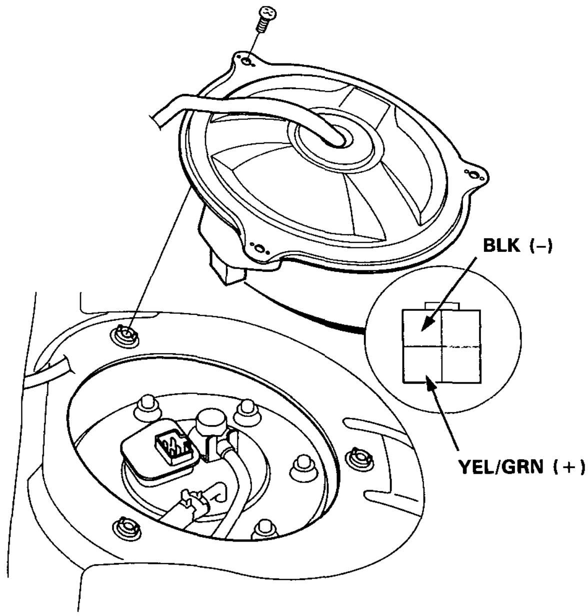


5. Check that battery voltage is available at the fuel pump connector when the ignition switch is turned ON (positive probe to the YEL/GRN wire, negative probe to the BLK wire).

2WD:



4WD:



- If battery voltage is available, replace the fuel pump.
- If there is no voltage, check the fuel pump ground and wire harness.

(cont'd)

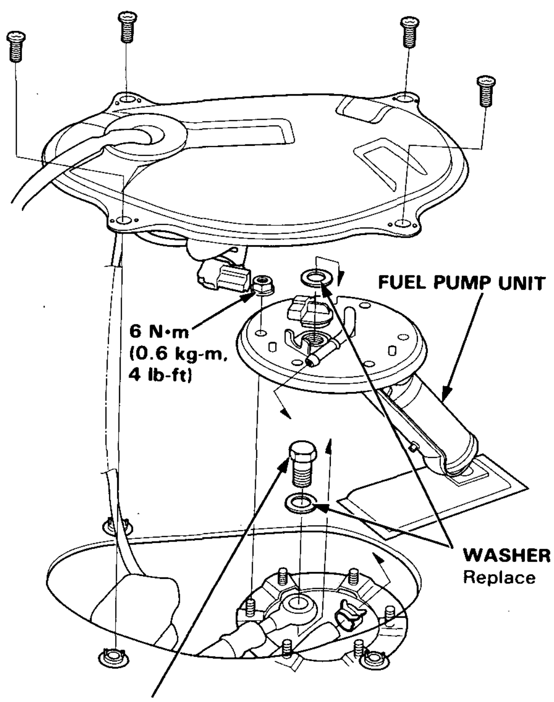
Fuel Pump (cont'd)

Replacement

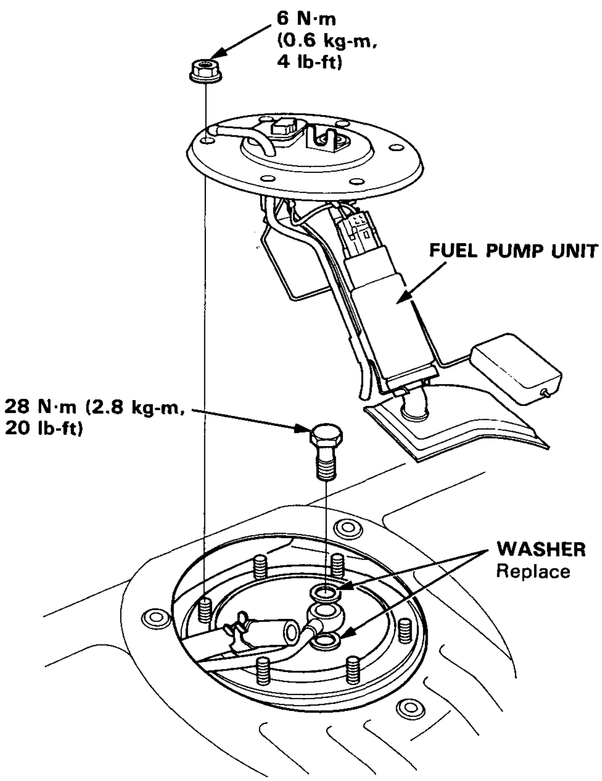
⚠ WARNING Do not smoke while working on fuel sysem. Keep open flames away from your work area.

1. Relieve fuel pressure (page 11-332).
2. Remove the rear seat (section 20).
3. Remove the maintenance lid.
4. Disconnect the fuel lines and connector.
5. Remove the fuel pump mounting nuts.
6. Remove the fuel pump from the fuel tank.

2WD:



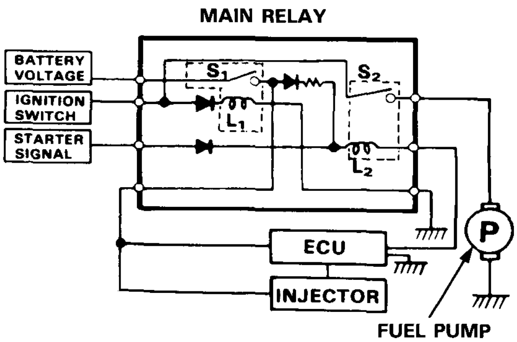
4WD:



Main Relay

Description

The main relay actually contains two individual relays. This relay is installed at the left side (RHD: right side) of the cowl.
One relay is energized whenever the ignition is on which supplies the battery voltage to the ECU, power to the injectors, and power for the second relay.
The second relay is energized for 2 seconds when the ignition is switched on, and when the engine is running which supplies power to the fuel pump.

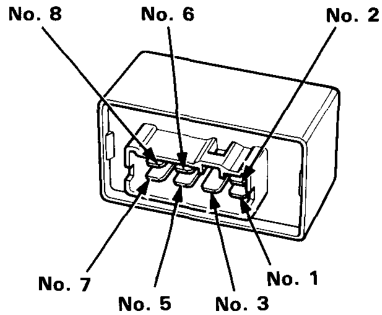


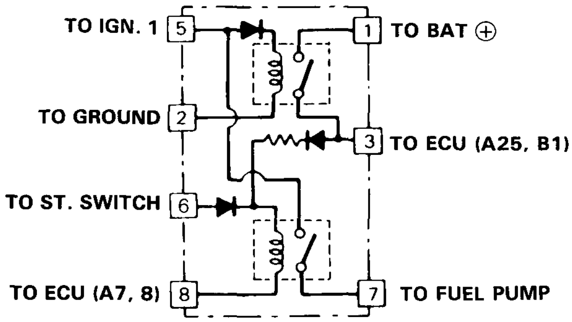
Relay Testing

NOTE: If the car starts and coninues to run, the main relay is OK.

1. Remove the main relay.

2. Attach the battery positive terminal to the No. 6 terminal and the battery negative terminal to the No. 8 terminal of the main relay. Then check for continuity between the No. 5 terminal and No. 7 terminal of the mian relay.
   - If there is continuity, go on to step 3.
   - If there is continuity, replace the relay and retest.





3. Attach the battery positive terminal to the No. 5 terminal and the battery negative treminal to the No. 2 terminal of the main relay. Then check that there is continuity between the No. 1 terminal and No. 3 terminal of the main relay.
   - If there is continuity, go no to step 4.
   - If there is no continuity, replace the relay and retest.

4. Attach the battery positive terminal to the No. 3 terminal and the battery negative terminal to the No. 8 terminal of the main relay. Then check that there is continuity between the No. 5 terminal and No. 7 terminal of the main relay.
   - If there is continuity, the relay is OK.
   - If there is no continuity, replace the relay and retest.

(cont'd)

Main Relay (cont'd)

Troubleshooting Flowchart

- Engine will not start.
- Inspection of main relay and relay harness.

Disconnect the main relay connectors.

Check for continuity between BLK terminal ② and body ground.

Does continuity exist?

NO → **Repair open in BLK wire between main relay and G101.**

YES

Measure the voltage between YEL/WHT terminal ① and body ground.

Is there battery voltage?

NO →
- **Replace ECU (15A) fuse.**
- **Repair open in the YEL/WHT wire between the main relay and the ECU (15A) fuse.**

YES

Turn the ignition switch ON.

Measure the voltage between BLK/YEL terminal ⑤ and body ground.

Is there battery voltage?

NO →
- **Replace ACG (S) (15A) fuse.**
- **Repair open in the BLK/YEL wire between the main relay and the ACG(S) (15A) fuse.**

YES

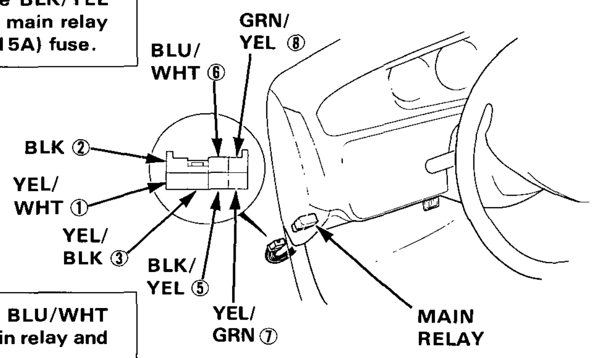
Turn the ignition switch to the START position.

Measure the voltage between BLU/WHT terminal ⑥ and body ground.

Is there battery voltage?

NO → **Repair open in the BLU/WHT wire between the main relay and the ignition switch.**

YES

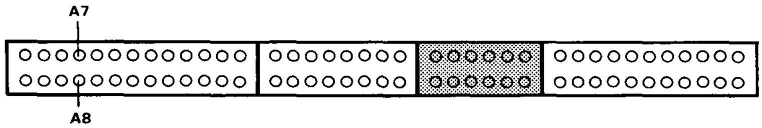


(To page 11-351)

(From page 11-350)

Turn the ignition switch off.

Connect the test harnes between the ECU and connector Disconnect "A" connector from the ECU only, not the main wire harness (page 11-212).



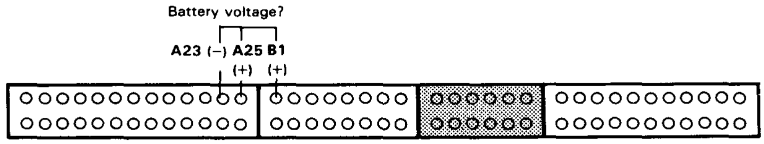
Check for continuity between GRN/YEL terminal ⑧ and the following terminals; A7, A8.

Does continuity exist?

NO → **Repair open in GRN/YEL wire between ECU (A7, A8) and main relay.**

YES

Reconnect "A" connector to the ECU.



Connect the main relay connector.

Turn the ignition switch ON.

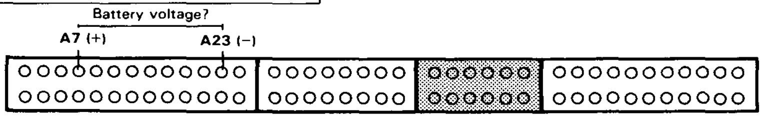
Measure the voltage between A23 (–) terminal and the following terminals: A25 (+) B1 (+).

Is there battery voltage?

NO →
- **Repair open in the YEL/BLK wire ③ between the ECU (A25,B1) and main relay.**
- ***Replace main relay.***

YES

Turn the ignition switch OFF.



Connect a voltmeter between A7 (+) terminal and A23 (–) terminal.

Is there battery voltage for two seconds when the ignition switch is first turned on?

YES → **Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.**

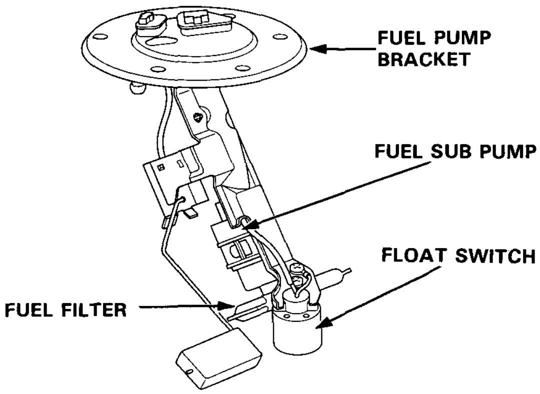
NO

Check the main relay (page 11-349).

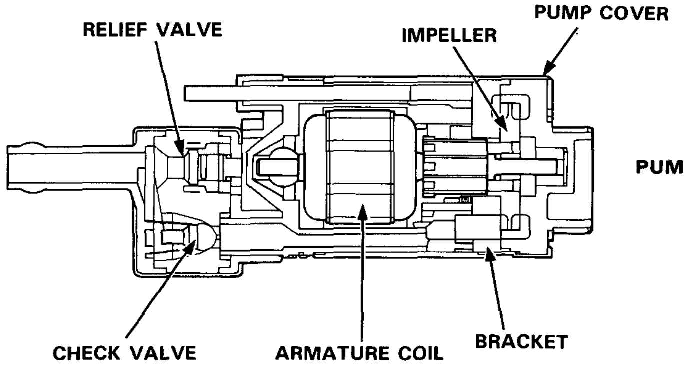
Fuel Sub Pump [4WD]

Description

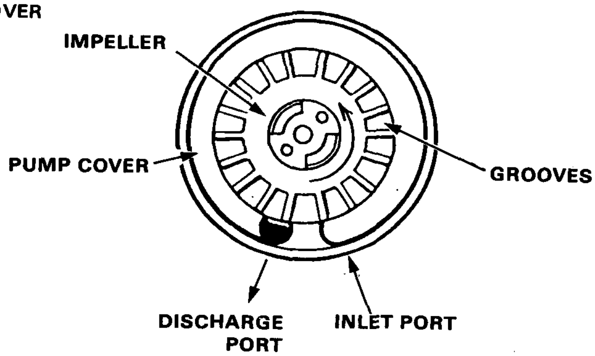
Because of its compact impeller design, the fuel sub pump is installed inside the fuel tank, thereby saving space and simplifying the fuel line system.



FUEL PUMP CROSS SECTION
(Side view)



PUMP ASSEMBLY CROSS SECTION



The fuel sub pump in comprised of a DC motor, a circumference flow pump, a relief valve for protecting the fuel line systems, a check valve for retaining residual pressure, an inlet port, and a discharge port. The pump assembly consists of the impeller(driven by the motor), the pump casing(which forms the pumping chamber), and the pump cover.

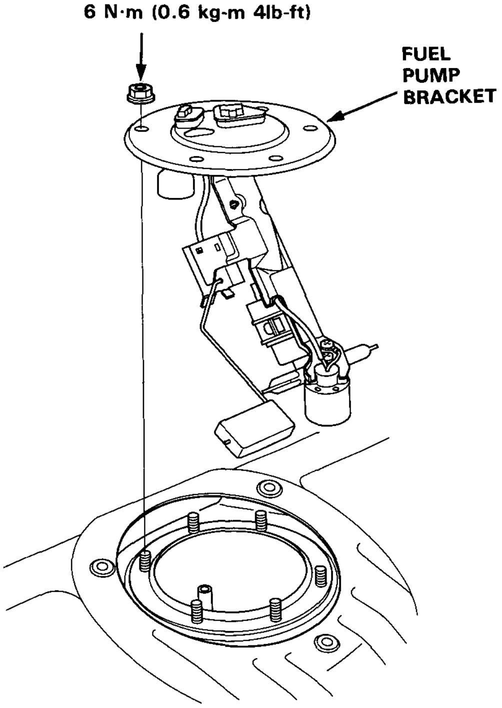
Operation

1. When the engine is started, the fuel cut-off relay actuates the pump, and the motor turns together with the impeller. Differential pressure is generated by the numerous grooves around the impeller.
2. Fuel entering the inlet port flows insine the motor from the pumping chamber and is forced through the discharge port via the check valve.
   If fuel flow is obstructed at the discharge side of the fuel line, the relief valve will open to bypass the fuel to the inlet port and prevent excessive fuel pressure.
3. When the engine stops, the pump stops automatically. However, a check valve closes by spring action to retain the residual pressure in the line, helping the engine to restart more easily.

Replacement

WARNING Do not smoke while working on fuel system. Keep open flame away from work area.

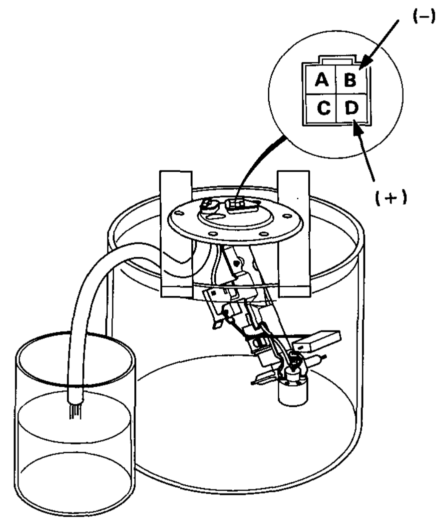
1. Remove the rear seat, then remove the maintenance access cover.
2. Remve the fuel pump mounting nuts.
3. Remove the fuel sub pump from the fuel tank.



Testing

WARNING Do not smoke during the test. Keep open flame away from your work area.

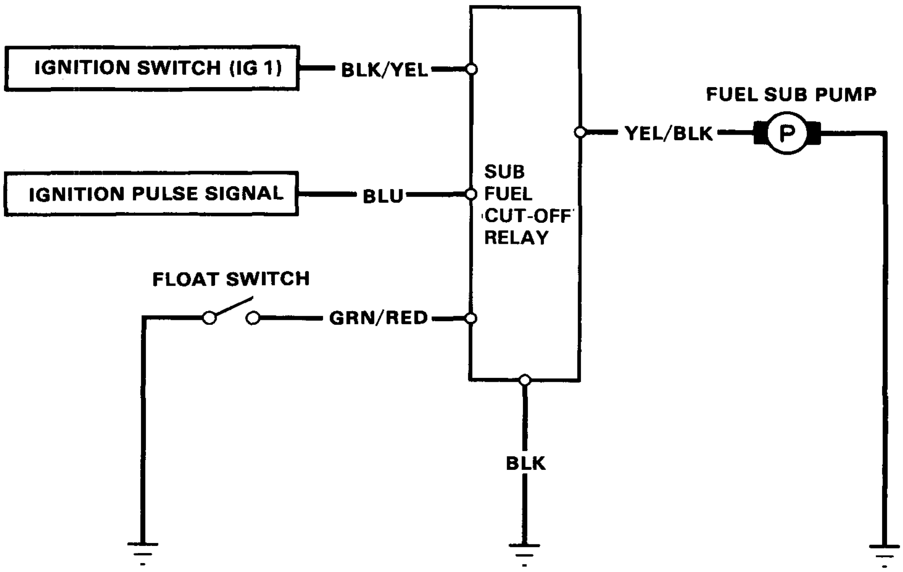
1. Remove the fuel sub pump.
2. Measure the amount of fuel flow for a minute by connecting battery positive to the D terminal, and negative to the B terminal.



Amount should be:
760 cm^3 (25.7 oz) min. in a minute at 12V

- If the fuel sub pump is OK, check for:
  - Clogged fuel filter.
  - Clogged fuel line.
  - Fuel cut-off relay failure (page 11-354).

Sub Fuel Cut-off Relay

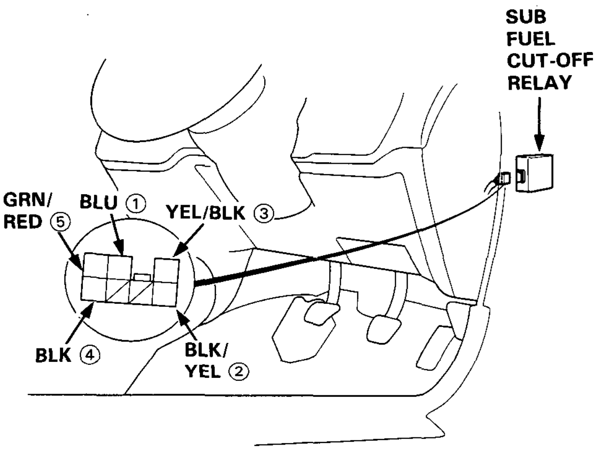


Operation

The switch is on when the right side fuel tank contains fuel. When power from the battery is supplied to the sub fuel cut-off relay and the engine is started by turning the ignition switch on, the ignition pulse signal is imput to the relay from the primary side of the ignition coil, the fuel sub pump operates and fuel is fed from the right to the left side. The ignition pulse signal is not generated by the primary side of the ignition coil when the engine stops; therefore, the fuel sub pump does not operate. Also, the float switch turns off when there is no fuel in the right side tank, so the sub fuel pump does not operate.

Testing

1. Keep the ignition switch in the OFF position.
2. Disconnect the 7P connector.
3. Check for continuity between the BLK wire ④ in the connector and body ground.



4. Attach the positive probe of voltmeter to the BLK/YEL wire ② and the negative probe to the BLK wire ④.
5. Turn the ignition switch ON.

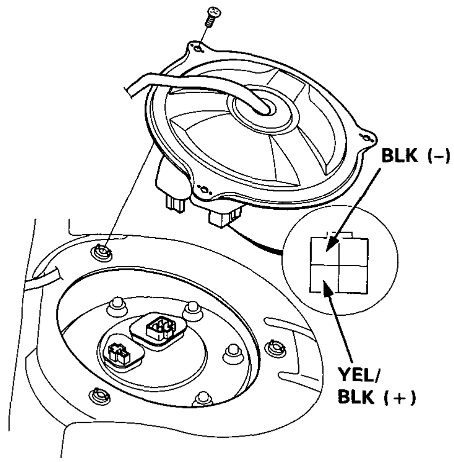
   Battery voltage should be available.
   - If there is no voltage, check the wiring from the ignition switch and the fuel cut-off relay as well as ACG (S) (15A) fuse.
6. Turn the ignition switch OFF.
   Attach the positive probe of voltmeter to the BLU wire ① and the negative probe to the BLK wire ④.
7. Turn the ignition swithc ON.

   Battery voltage should be available.

   - If there is no voltage, check the wiring between the ignition coil and the fuel cut-off relay.
8. Turn the igniton switch OFF.
   Connect a jumper wire between the YEL/BLK wire ③ and BLK/YEL wire ②.
9. Turn the igniton switch ON.

   The fuel sub pump should work.

   - If the fuel sub pump does not work, remove the maintenance access cover. Check that battery voltage is avaiable at the fuel sub pump connector when the ignition switch is turned ON (positive probe to the YEL/BLK wire, negative probe to the BLK wire).



— If battery voltage is available, replace the fuel pump.

— If ther is no voltage, check for continuity between teh YEL/BLK wire in the connector and the sub fuel cut-off relay.

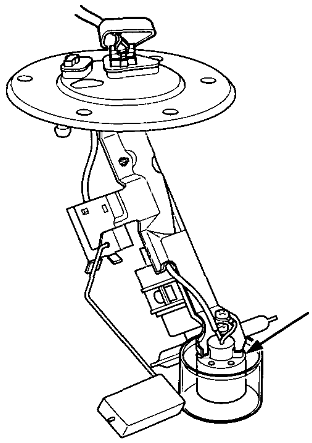
(cont'd)

Sub Fuel Cut-off Relay (cont'd)

10. Remove the fuel sub pump from the fuel tank.

11. Attach the positive probe of voltmeter to the GRN/RED wire ⑤ and the negative probe to the BLK wire ④.

12. Suspend the float switch in a container of water as shown.



13. Check for continuity between the GRN/RED wire ⑤ and the BLK wire ④.

    - If there is no continuity, replace the float switch.

If all the testes are OK, replace the sub fuel cut-off relay and retest.

Fuel Tank [2WD]

Replacement

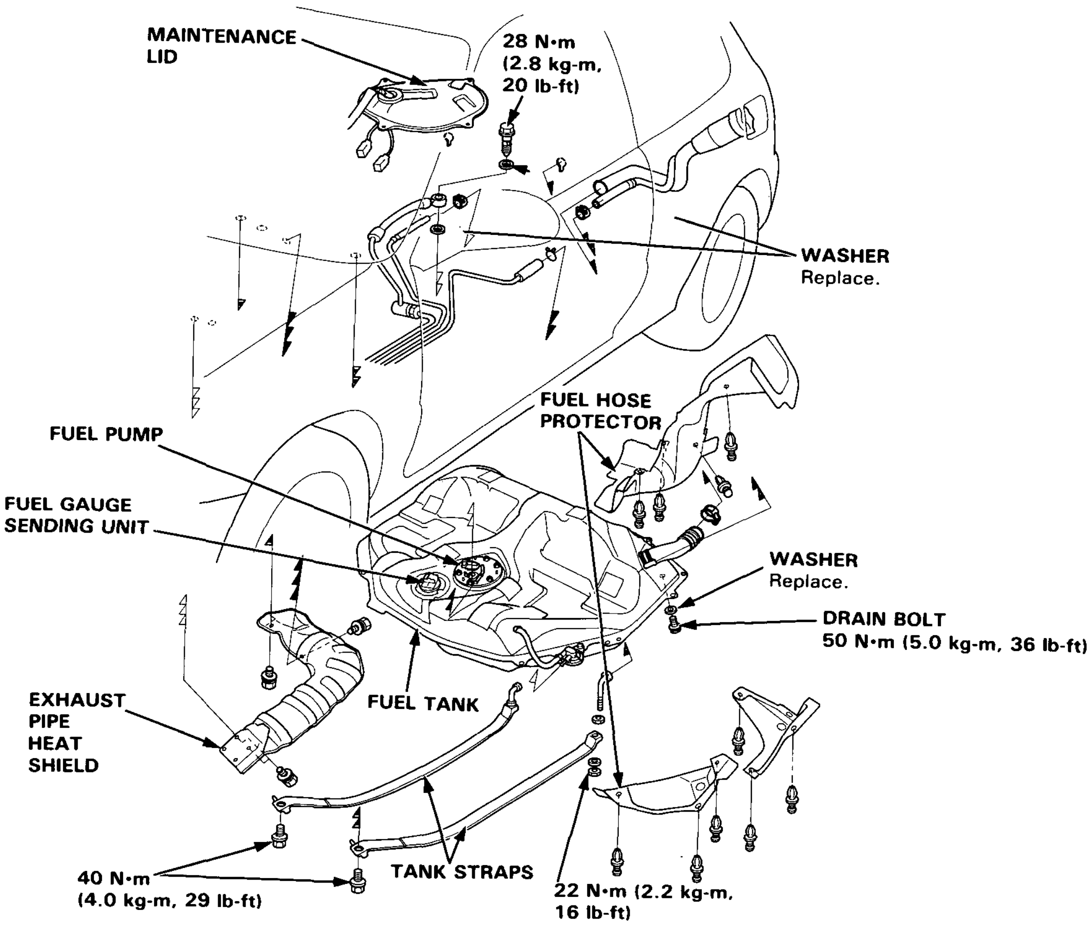
WARNING Do not smoke while working on fuel system. Keep open flame away from work your work area.

1. Block front wheels. Jack up the rear of the car and support with jackstands.
2. Remove the exhaust pipe heat shield.
3. Remove the drain bolt and drain the fuel into an approved container.
4. Remove the rear seat, and maintenance lid.
5. Disconnect the connectors from the fuel gauge sending unit and the fuel pump, then remove the fuel feed line and return hose.

   CAUTION: Be sure to turn the ignition switch OFF before disconnecting the wires.
6. Remove the fuel hose protectors.
7. Disconnect the hoses.

   CAUTION: When disconnecting the hoses, slide back the clamps, then twist hoses as you pull to avoid damaging them.
8. Place a jack, or other support, under the tank.
9. Remove the strap bolts and nuts, and let the straps fall free.
10. Remove the fuel tank.

    NOTE: The tank may stick on the undercoat applied to its mount. To remove, carefully pry it off the mount.
11. Install a new washer on the drain bolt and the fuel pump line, then install parts in the reverse order of removal.



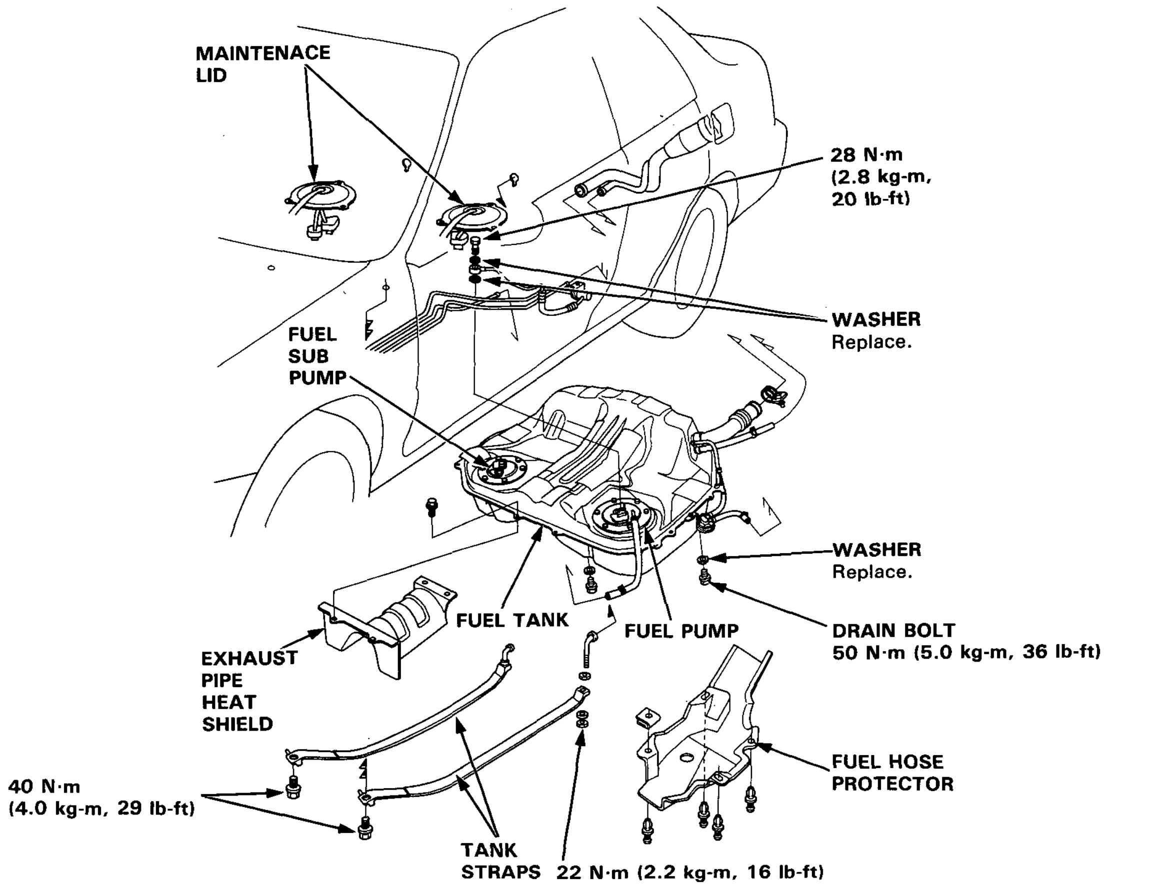
Fuel Supply System

Fuel Tank [4WD]

Replacement

⚠ WARNING Do not smoke while working on fuel system. Keep open flame away from work your work area.

1. Block front wheels. Jack up the rear of the car and support with jackstans.
2. Remove the exhaust pipe, exhaust pipe heat shield and muffler (section 9).
3. Remove the propeller shaft and rear differential (section 16).
4. Remove the exhaust pipe heat shield.
5. Remove the drain bolt and drain the fuel into an approved container.
6. Remove the rear seat, and maintenance lid.
7. Disconnect the connectors from the fuel gauge sending unit and the fuel pump, then remove the fuel feed line and return hose.
   CAUTION: Be sure to turn the ignition switch OFF before disconnecting the wires.
8. Remove the fuel hose protectors.
9. Disconnect the hoses.
   CAUTION: When disconnecting the hoses, slide back the clamps, then twist hoses as you pull to avoid damaging them.
10. Place a jack, or other support, under the tank.
11. Remove the strap bolts and nuts, and let the straps fall free.
12. Remove the fuel tank.
    NOTE: The tank may stick on the undercoat applied to its mount. To remove, carefully pry it off the mount.
13. Install a new washer on the drain bolt and the fuel pump line, then install parts in the reverse order of removal.



Air Intake System

System Troubleshooting Guide

NOTE: Across each row in the chart, the sub systems that could be sources of a symptom are ranked in the order they should be inspected starting with ①. Find the symptom in the left column, read across to the most likely source, then refer to the page listed at the top of that column. If inspection shows the system is OK, try the next system ②, etc.

Except D15B2 engine:

SUB SYTEM / PAGE / SYMPTOM	THROTTLE CABLE	THROTTLE BODY
PAGE	364	366
WHEN COLD FAST IDLE OUT OF SPEC	①	②
WHEN WARM ENGINE SPEED TOO HIGH	②	①
LOSS OF POWER	①	

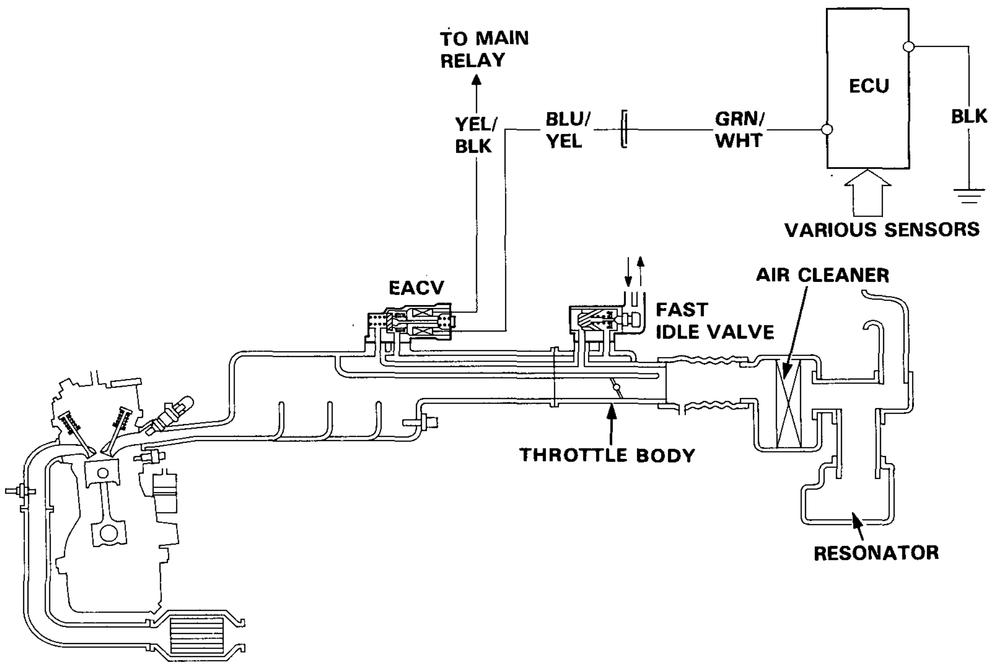
D15B2 engine:

SUB SYTEM / PAGE / SYMPTOM	THROTTLE CABLE	THROTTLE BODY	TANDEM CONTROL SYSTEM	THROTTLE CONTROL SYSTEM
PAGE	365	370	374	379
DIFFICULT TO START ENGINE WHEN COLD			①	
WHEN COLD FAST IDLE OUT OF SPEC	③	②		①
WHEN WARM ENGINE SPEED TOO HIGH	③	②		①
WHEN WARM ENGINE SPEED TOO LOW		①		
FREQUENT STALLING WHILE WARMING UP	①	②	①	
LOSS OF POWER	③	②	①	

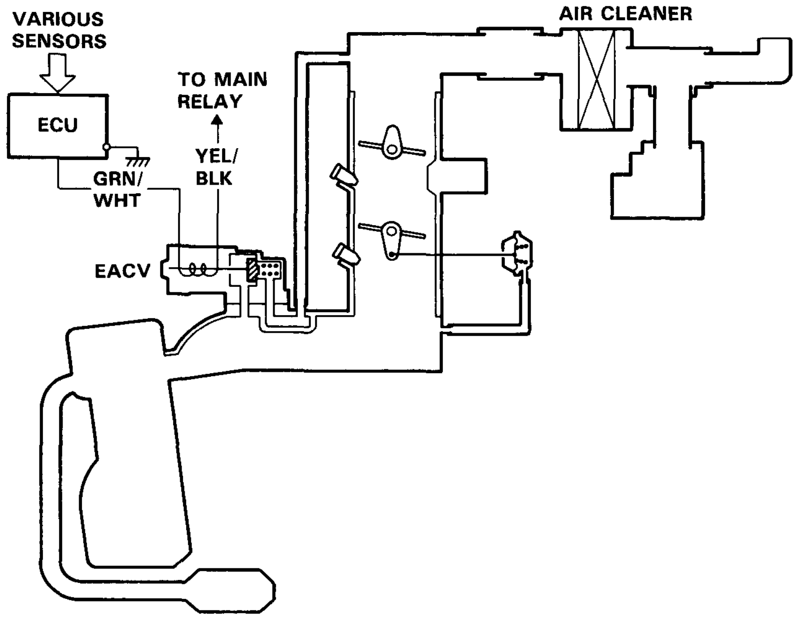
System Description

The system supplies air for all engine needs. It consists of the air cleaner, air intake pipe, throttle body, EACV, fast idle valve, tandem control system (D15B2 engine), throttle control system (D15B2 engine), and intake manifold. A resonator in the air intake pipe provides additonal silencing as air is drawn into the system.

Except D15B2 engine:

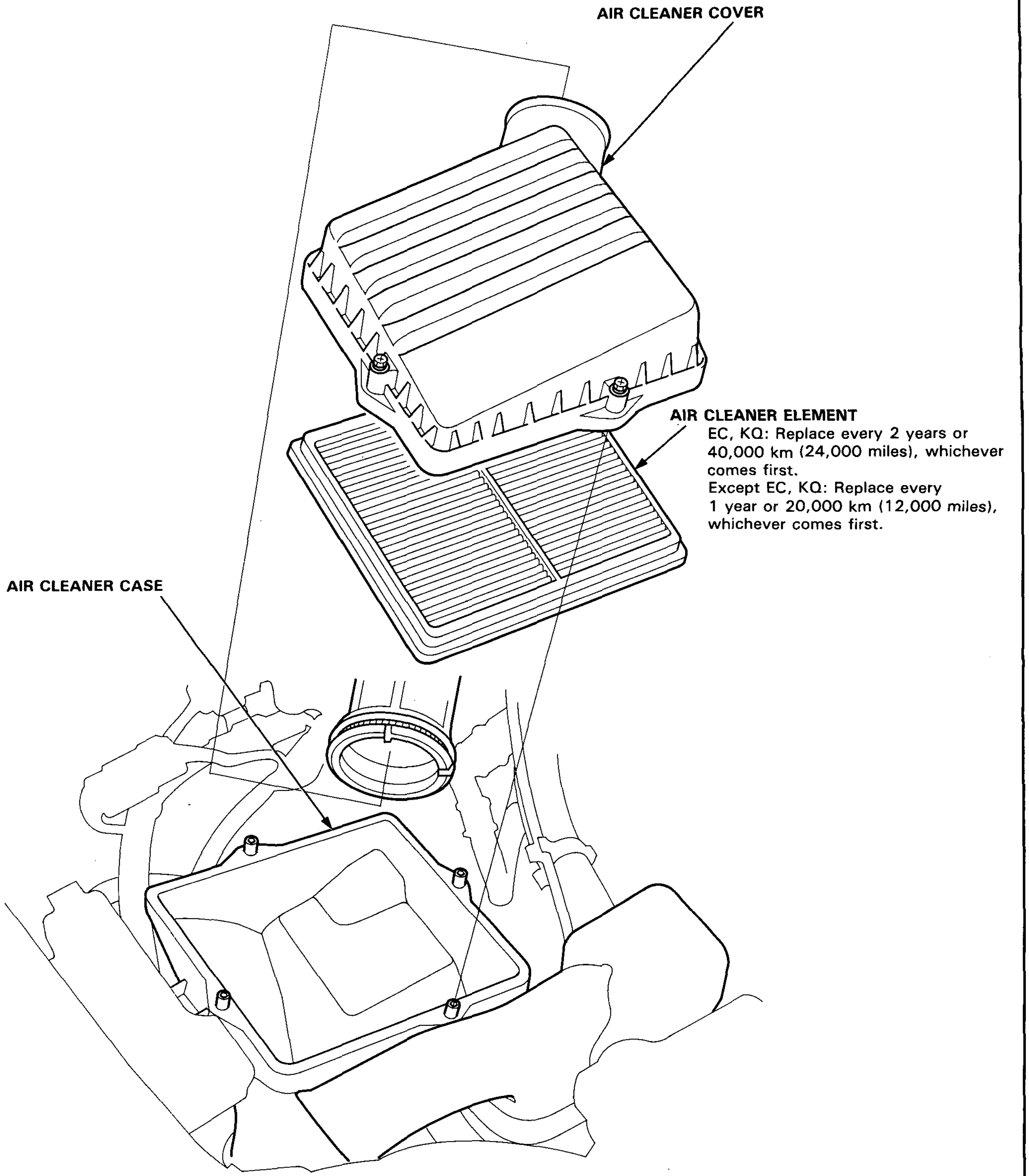


D15B2 engine:



Air Cleaner

Air cleaner Element Replacement

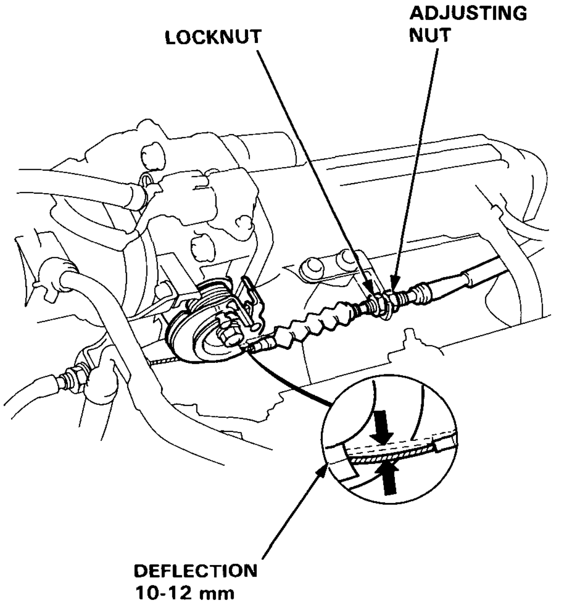


Air Intake System

Throttle Cable [Except D15B2 engine]

Inspection/Adjustment

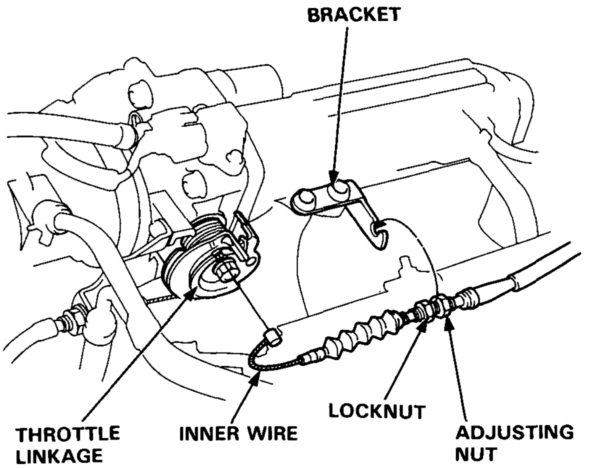
1. Warm up the engine to normal operating temperature (cooling fan comes on).
2. Check that the throttle cable operates smoothly with no binding or sticking. Repair as necessary.
3. Check cable free play at the throttle linkage. Cable deflection should be 10—12 mm (0.39—0.47 in.)



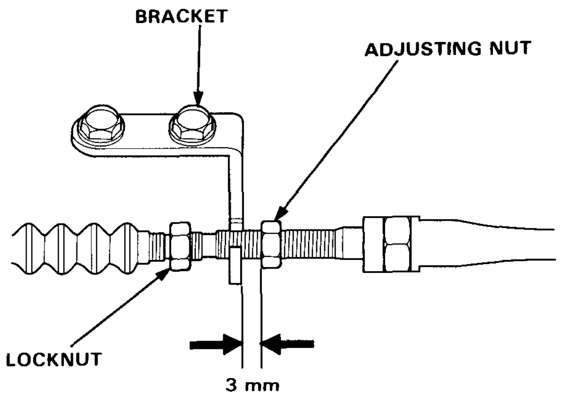
4. If deflection is not within specs, loosen the locknut and turn the adjusting nut until the deflection is as specified.
5. With the cable properly adjusted, check the throttle valve to be sure it opens fully when you push the accelerator pedal to the floor. Also check the throttle valve to be sure it returns to the idle position whenever you release the accelerator.

Installation

1. Fully open the throttle valve, then install the throttle cable in the throttle linkage and install the cable housing in the cable bracket.
2. Warm up the engine to normal operating temperature (the cooling fan comes on).



3. Hold the cable sheath, removing all slack from the cable.
4. Turn the adjusting nut until it is 3 mm away from the cable bracket.
5. Tighten the locknut. The cable deflection should now be 10—12 mm. If not, see Inspection/Adjustment.



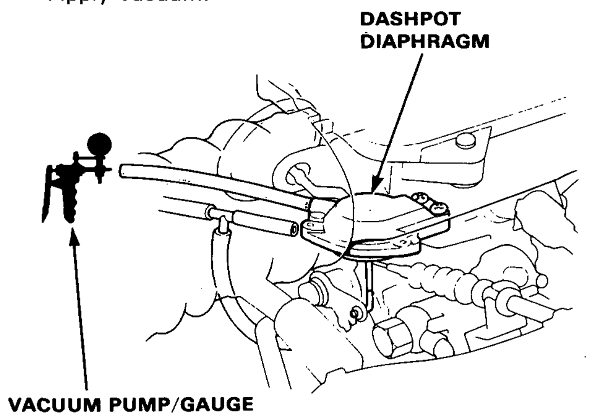
Throttle Cable [D15B2 engine]

Inspection/Adjustment

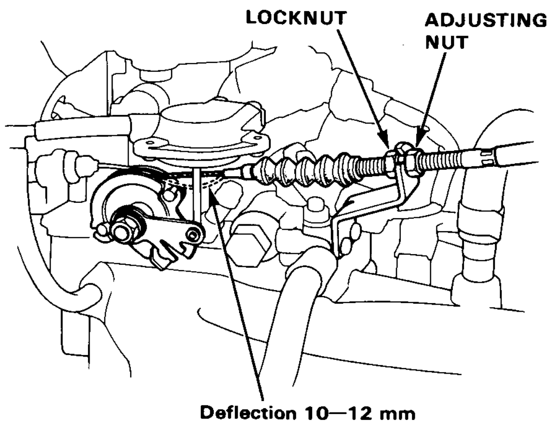
1. Warm up the engine to normal operating temperature (cooling fan comes on).

2. Check that the throttle cable operates smoothly with no binding or sticking. Repair as necessary.

3. Disconnect vacuum hose from the dashpot diaphragm and connect a vacuum pump to the diaphragm.
   Apply vacuum.



4. Check cable free play at the throttle linkage. Cable deflection should be 10—12 mm (0.39—0.47 in.)



5. If deflection is not within specs, loosen the locknut and turn the adjusting nut until the deflection is as specified.

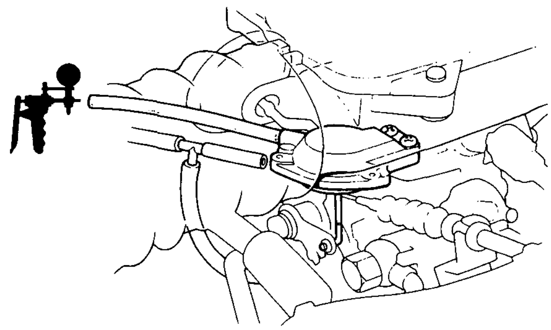
6. With the cable properly adjusted, check the throttle valve to be sure it opens fully when you push the accelerator pedal to the floor. Also check the throttle valve to be sure it returns to the idle position whenever you release the accelerator.

Installation

1. Fully open the throttle valve, then install the throttle cable in the throttle linkage and install the cable housing in the cable bracket.

2. Warm up the engine to normal operating teperature (the cooling fan comes on).

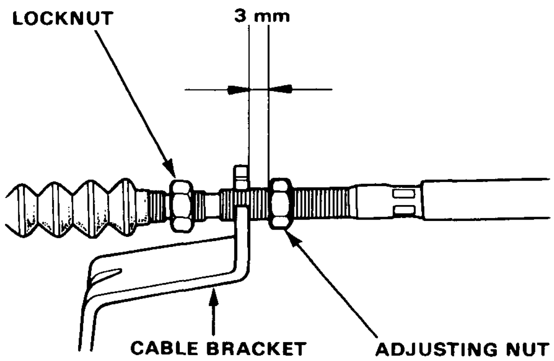
3. Disconnect vacuum hose from the dashpot daphragm and connect a vacuum pump to the diaphragm.



4. Hold the cable sheath, removing all slack from the cable.

5. Turn the adjusting nut until it is 3 mm away from the cable bracket.

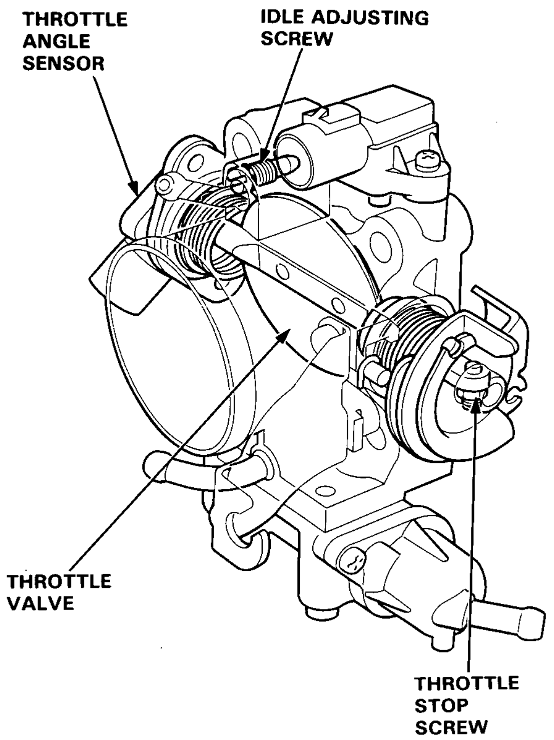
6. Tighten the locknut.



7. Disconnect the vacuum pump and connect the vacuum hose.

Trottle Body [Except D15B2 engine]

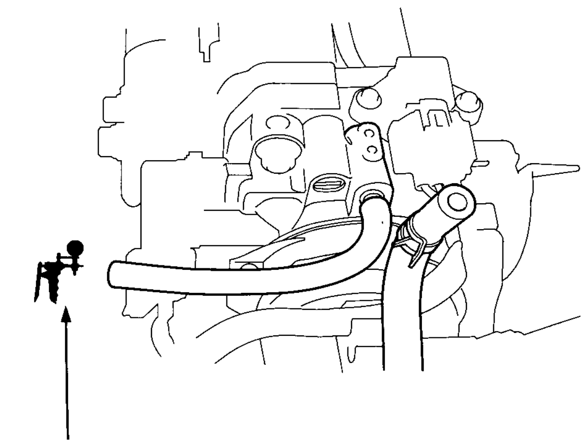
Description
The throttle body is of the single-barrel side-draft type. The lower portion of the throttle valve is heated by engine coolant which is fed from the cylinder head. The idle adjusting screw which increases/decreases bypass air and the canister/purge port are located on the top of the throttle body.



Inspection

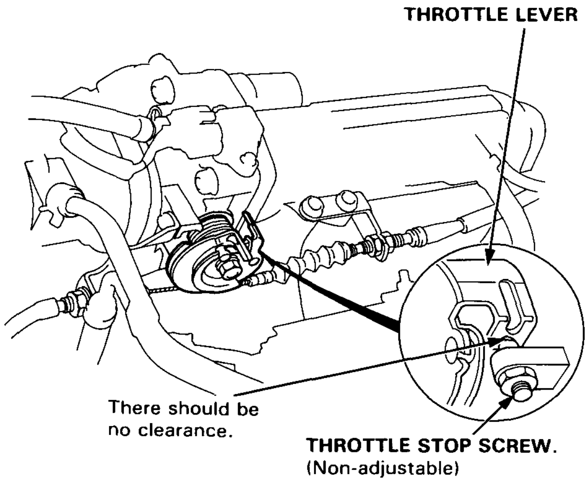
CAUTION: Do not adjust the throttle stop screw. It is preset at the factory.

1. Start the engine and allow it to reach normal operating temperature (cooling fan comes on).
2. Disconnect the vacuum hose (to the canister) from the top of the throttle body; connect a vacuum gauge to the throttle body.



3. Allow the engine to idle and check that the gauge indicates no vacuum.
   - If there is vacuum, check the throttle cable (page 11-364).
4. Check that vacuum is indicated on the gauge when the throttle is opened slightly from idle.
   - If the gauge indicates no vacuum, check the throttle body port. If the throttle body port is clogged, clean it with carburetor cleaner.
5. Stop the engine and check that the throttle cable operates smoothly without binding or sticking.
   - If there are any abnormalities in the above steps, check for:

   – Excessive wear or play in the throttle valve shaft.
   – Sticky or binding throttle lever at full close position.
   – Clearance between throttle stop screw and throttle lever at full close position.

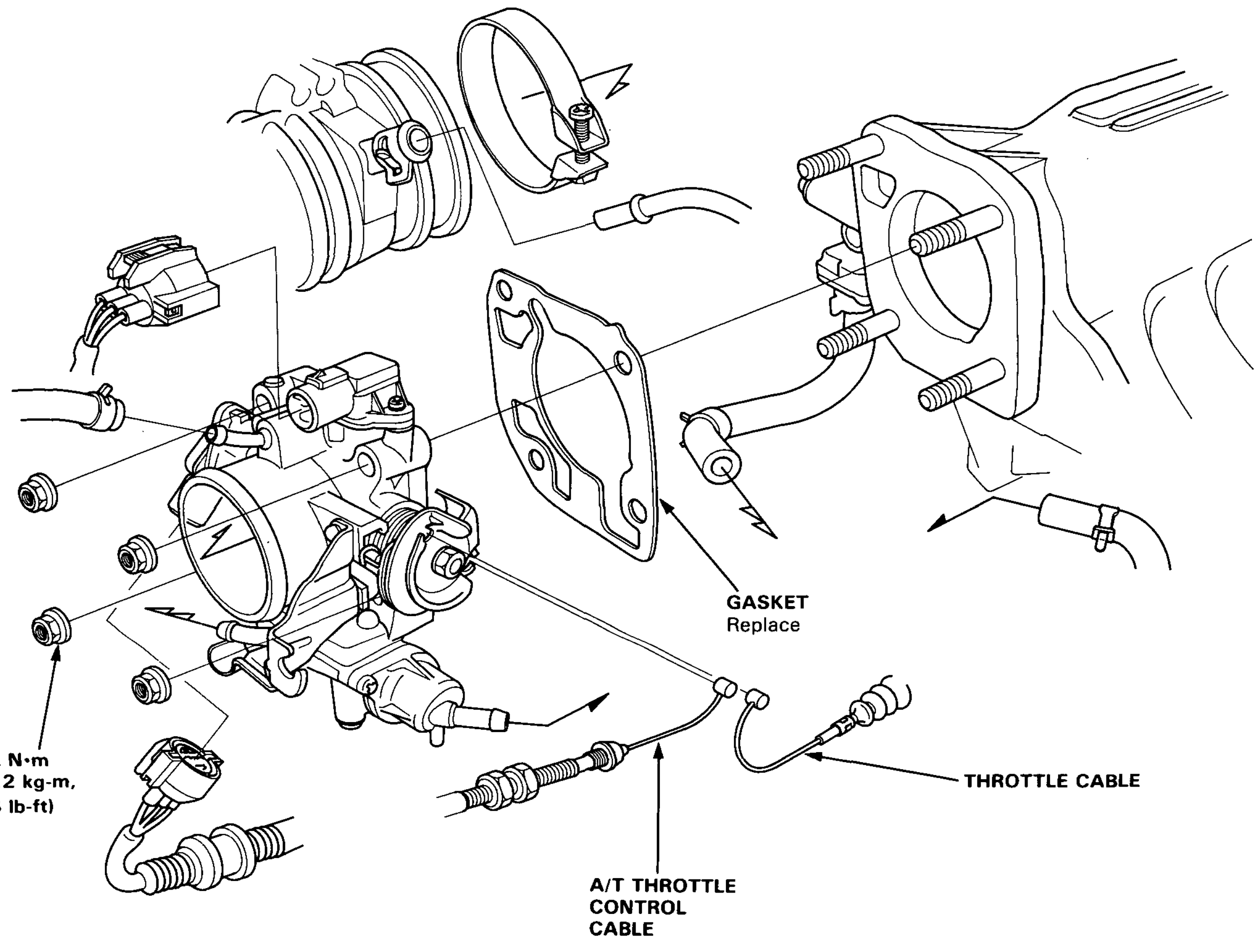


Replace the throttle body if there is excessive play in the throttle valve shaft or if the shaft is binding or sticking.

(cont'd)

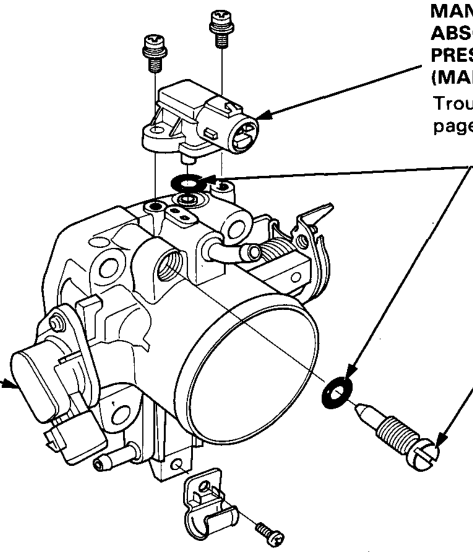
Throttle Body [Except D15B2 engine] (cont'd)

Diassembly

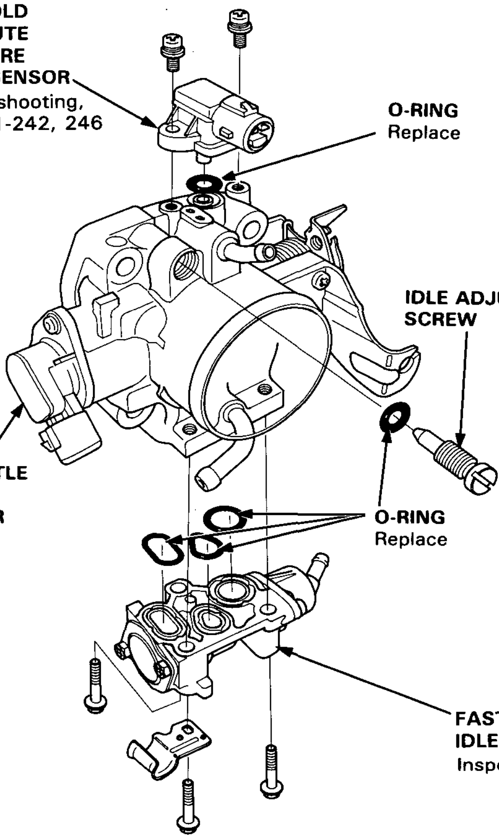


CAUTION:
- The throttle stop screw is non-adjustable.
- After reassembly, adjust the throttle cable (page 11-364), and A/T throttle control cable (section 14) for cars with A/T.

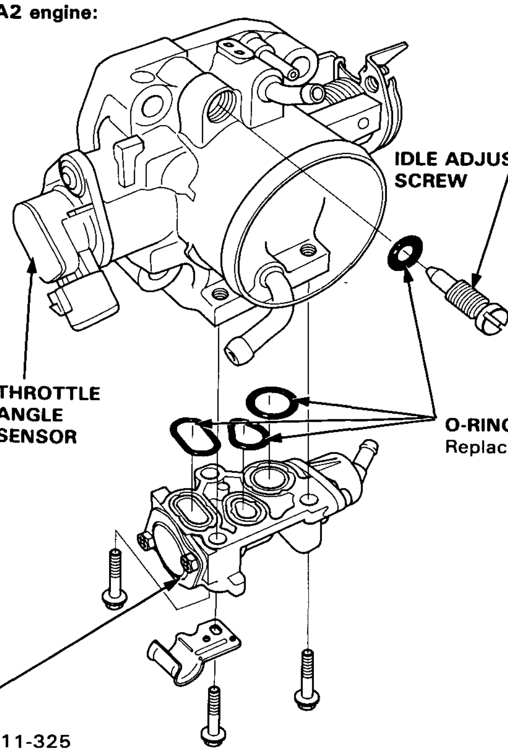
D15Z1 engine:



D16A7, D16Z6, D16Z7, D16A8, A16A9 engine:



B16A2 engine:

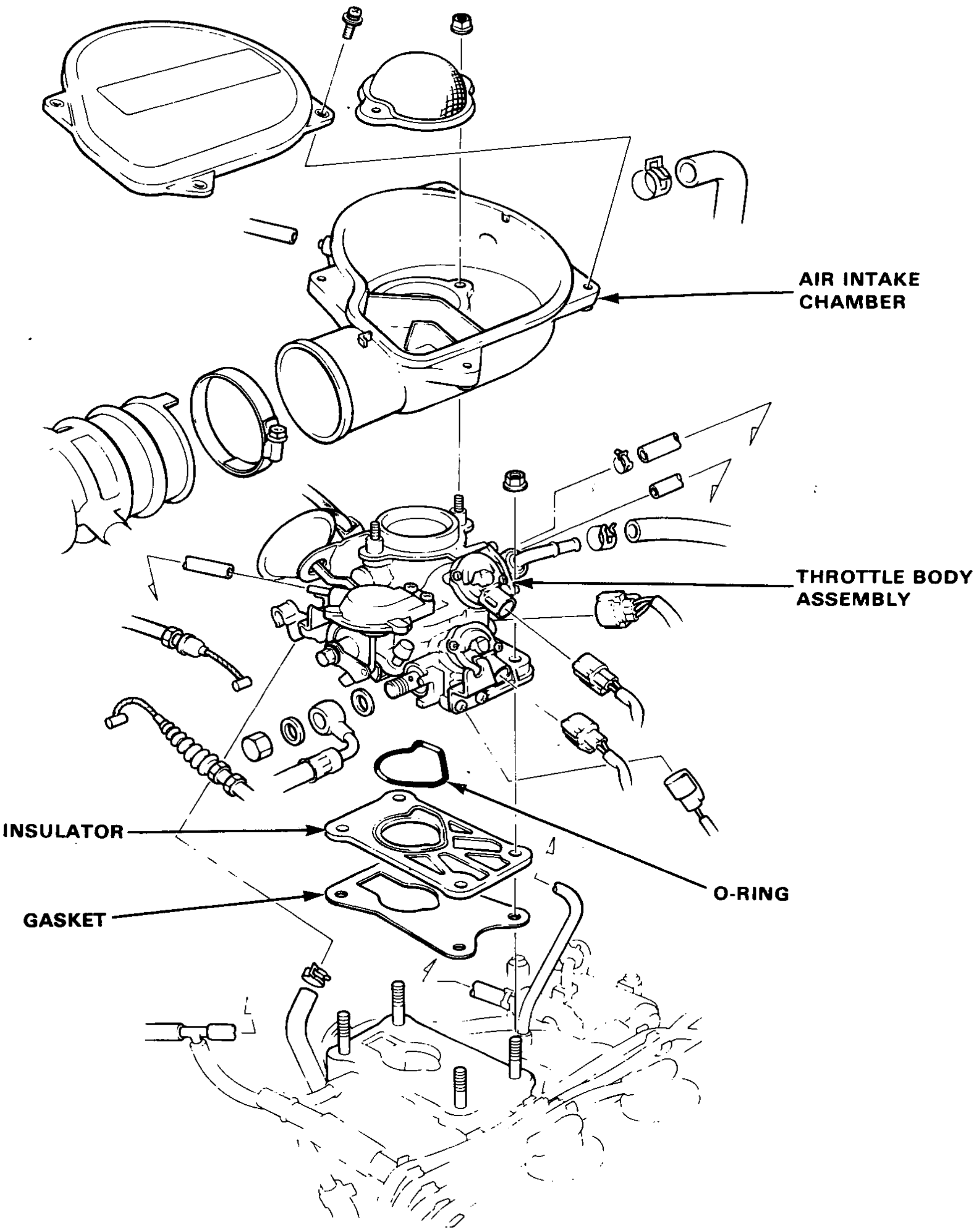


Air Intake System

Throttle Body [D15B2 engine]

Description

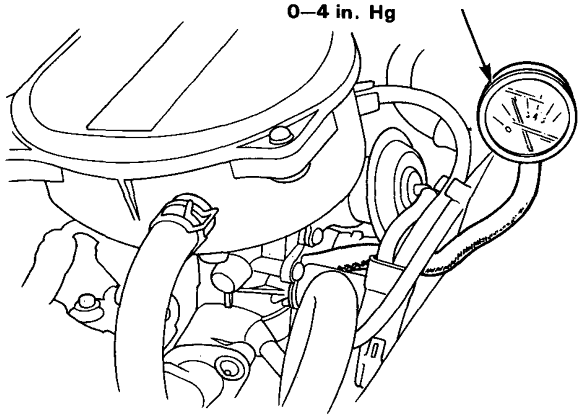
The throttle body is of the single-barrel down-draft type. The idle adjusting screw, which opens the throttle valve, and the canister purge port are located on the bottom of throttle body.



Inspection

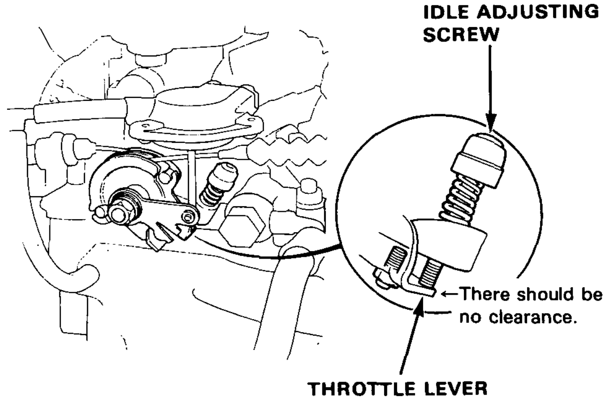
CAUTION: Do not adjust the throttle stop screw since it cannot be reset except at the factory.

1. Start the engine and warm it up to normal operating temperature (the cooling fan comes on).
2. Disconnect the vacuum hose (to the canister) from the throttle body and connect a vacuum gauge to the throttle body.



3. Allow the engine to idle and check that the gauge indicates little or no vacuum.
   - If there is measurable vacuum, check the throttle control system (page 11-380).
4. Check that vacuum increases when the throttle is opened slightly from idle.
   - If there is no increase in vacuum, check the throttle body port. If the throttle body port is clogged, cleant it with carburetor cleaner.
5. Stop the engine and check that the throttle cable operates smoothly without binding or sticking.
   - If there are any abnormalities in the above steps, check for:

– Excessive wear or play in the throttle valve shaft.
– Sticky or binding throttle lever at full close position.
– Clearance between idle adjusting screw and throttle lever at full close position.

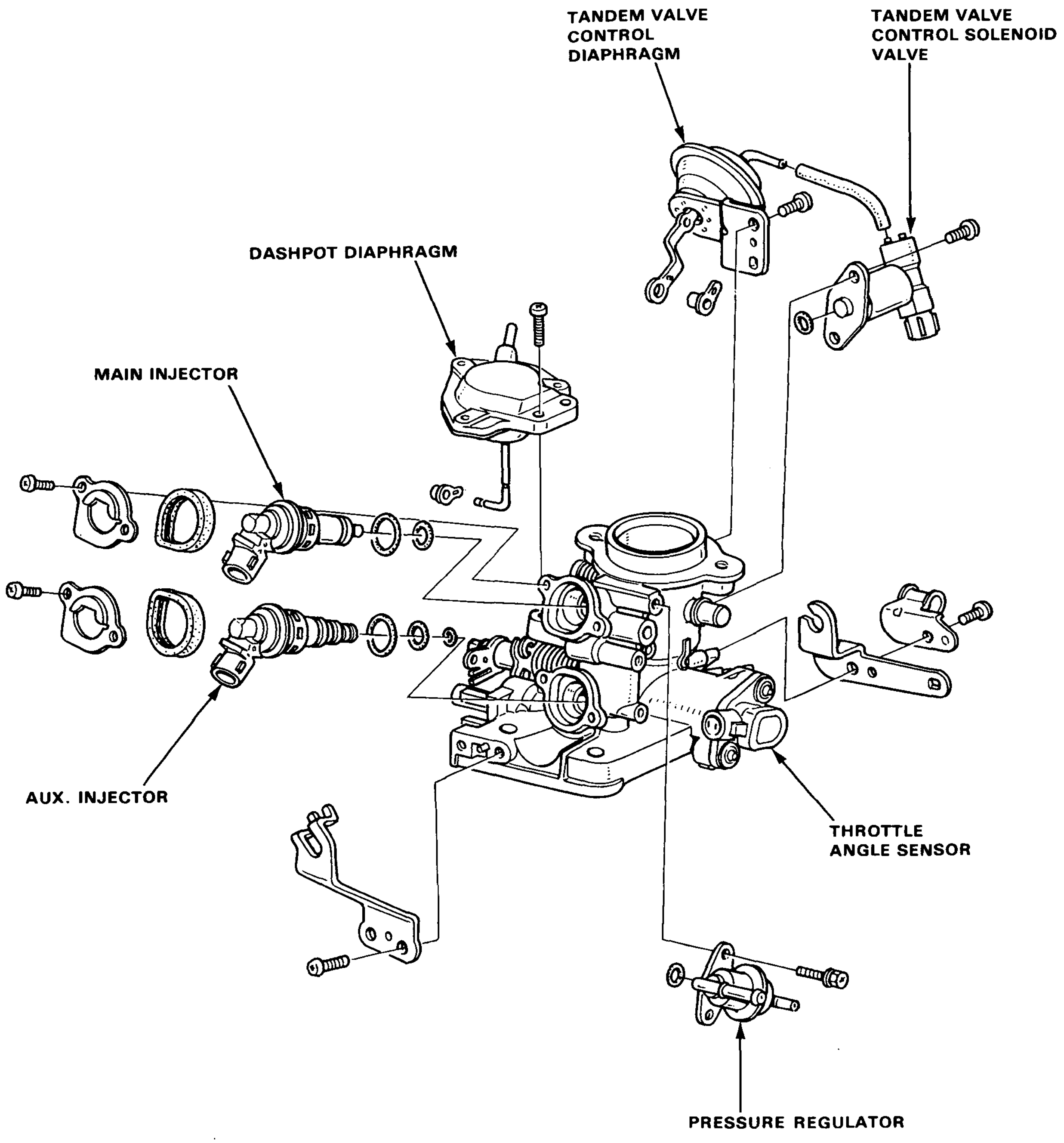


Replace the throttle body if there is excessive play in the throttle valve shaft or if the shaft is binding or sticking.

(cont'd)

Throttle Body [D15B2 engine] (cont'd)

Disassembly



Air Intake System

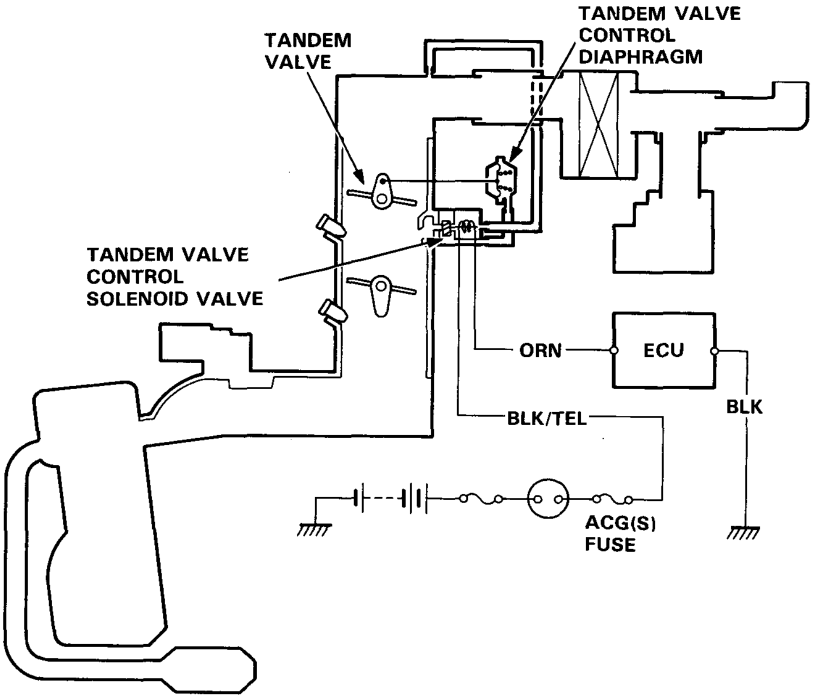
Tandem Control System [D15B2 engine]

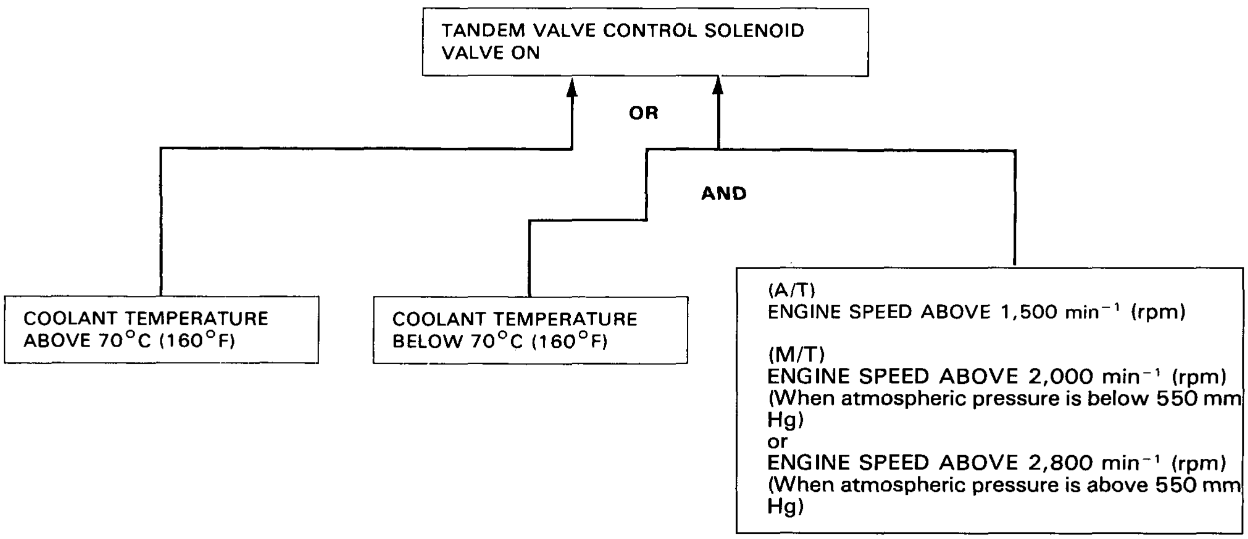
Description

The tandem valve is employed to improve atomization of fuel which is injected by the main fuel injector in response to various engine operating conditions.

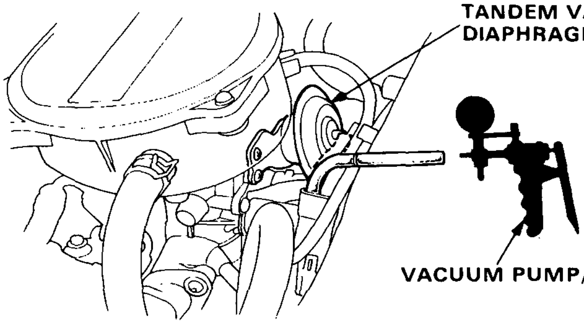
When the tandem valve control solenoid valve is de-activated, venturi vacuum is not applied to the diaphragm chamber of the tandem valve control diaphragm, so the tandem valve is nearly closed. The narrow clearance between the tandem valve and inner wall of the throttle body generates a rapid air flow which promotes atomization of the injected fuel from the main fuel injector.

When the tandem valve control solenoid valve is activated, venturi vacuum is applied on the tandem valve control diaphragm and the tandem valve is opened in response to venturi vacuum which represents the air flow rate through the venturi. Therefore good atomization of the injected fuel is provided regardless of air flow rate.





Troubleshooting Flowchart



Inspection of Tandem Control System

↓

Disconnect the vacuum hose from the tandem valve control diaphragm and connect a vacuum gauge to the hose.

↓

Start engine and allow to idle.
NOTE: Coolant temperature must be below 70°C (160°F).

↓

Is there vacuum ?

- YES → Disconnect the 2P connector from the tandem valve control solenoid valve.
  - Is there vacuum ?
    - YES → **Replace the solenoid valve.**
    - NO → Turn the ignition switch OFF.
      - Disconnect "B" connector from ECU.
      - Check for continuity to ground on the ORN wire.
      - Is there continuity to ground ?
        - YES → **Repair short to ground at ORN wire between ECU (B2) and the 2P connector.**
        - NO → **Substitute a known-good ECU and recheck. If symptom goes away, replace the original ECU.**
- NO → Raise engine speed to,
  - Manual: 3,000 min^{-1} (rpm)
  - Automatic: 2,000 min^{-1} (rpm)

  Is there vacuum ?
  - YES → (To page 11-376)
  - NO → Disconnect the 2P connector from the tandem valve control solenoid valve. → (To page 11-376)

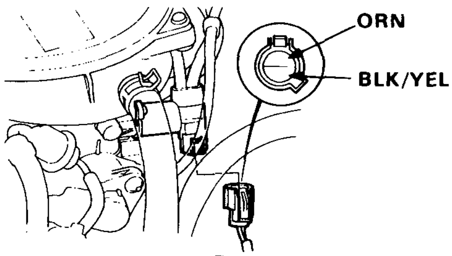
(cont'd)

Tandem Control System [D15B2 engine] (cont'd)

(From page 11-375)

(To page 11-375)

Measure voltage between BLK /YEL (+) terminal and ORN (−) terminal at 3,000 min^{-1} (rpm).



Is there battery voltage ?

YES → Remove the solenoid valve from the throttle body and check the port for blockage. If the port is OK, replace the solenoid valve.

NO ↓

Measure voltage between BLK/YEL (+) terminal and body ground.

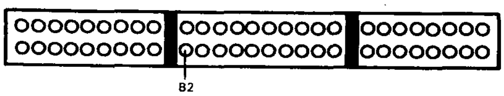
Is there battery voltage ?

NO → Repair open in BLK/YEL wire between the 2 P connector and ACG(S) (15A) fuse.

YES ↓

Turn the ignition switch OFF.

Connect the test harness between the ECU and connector (page 11-212).



Check for continuity of ORN wire between ECU (B2) and the 2P connector.

Does continuity exist ?

NO → Repair open in ORN wire between ECU (B2) and the 2P connector.

YES ↓

Substitute a known-good ECU and recheck. If symptom goes away, replace the original ECU.

(To page 11-377)

(From page 11-378)

Warm up engine to normal operating temperature (the cooling fan comes on).

Slowly open the throttle.

Is there vacuum ?

NO → **Substitute a known-good ECU and recheck. If symptom goes away, replace the original ECU.**

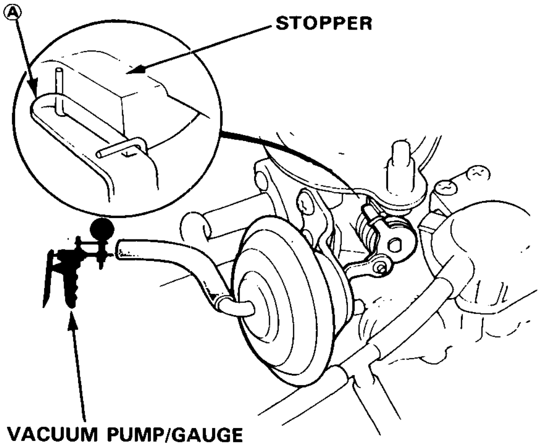
YES → **Tandem control system is OK.**

(cont'd)

Tandem Control System [D15B2 engine] (cont'd)

Tandem Valve Control Diaphragm Testing

1. Check the tandem valve shaft for binding or sticking.
2. Check the tandem valve for smooth movement.
   - If any fault is found, clean the linkage and shafts with carburetor cleaner.
3. Disconnect the vacuum hose from the tandem valve control diaphragm and connect a vacuum pump to the diaphragm.
4. Apply vacuum and check that Ⓐ of the tandem valve is in close contact with the stopper when the tandem valve is fully open.

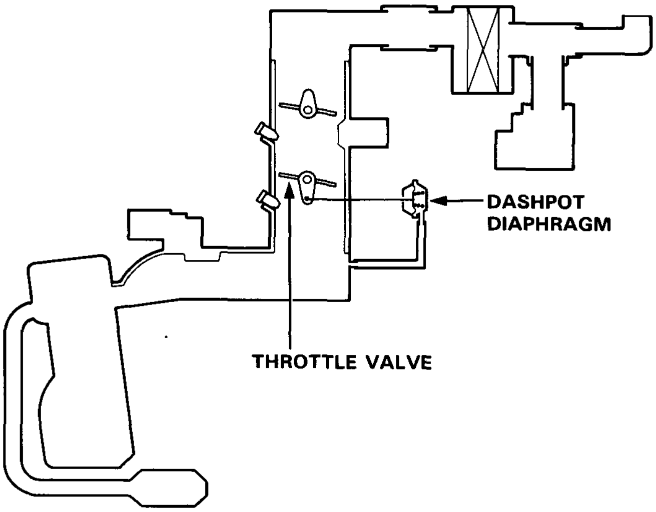


- If any fault is found, replace the tandem valve control diaphragm.

Throttle Control System [D15B2 engine]

Description

The dashpot diaphragm functions as a cranking opener.
When the engine is at idle, intake manifold vacuum is applied on the dashpot diaphragm and pulls up the diaphragm rod, so that the throttle valve is in the idle position.
During cranking with the starter, the spring in the dashpot diaphragm pushes the throttle valve open a certain amount for assisting engine starting.



(cont'd)

Throttle Control System [D15B2 engine] (cont'd)

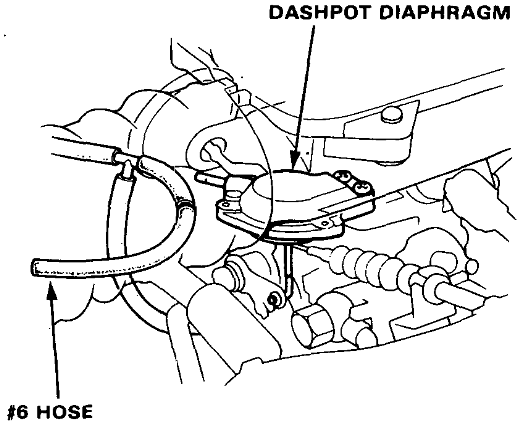
Testing

1. Start the engine and warm up to normal operating temperature (the cooling fan comes on).

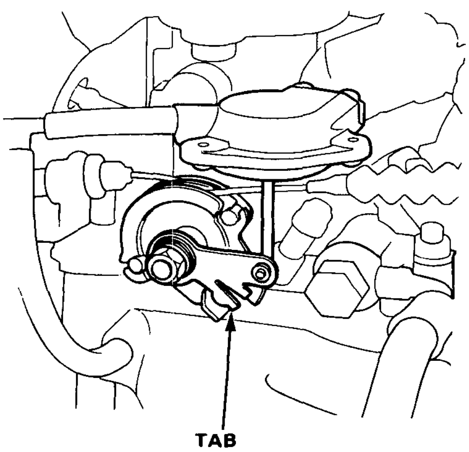
2. Disconnect the vacuum hose from the dashpot diaphragm and check the engine speed.

Engine speed should be:

Manual	2,500 ± 500 min^{-1} (rpm)
Automatic	2,500 ± 500 min^{-1} (rpm)

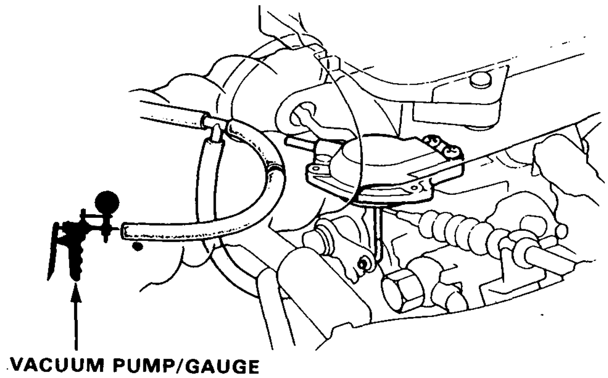


- If the engine speed is excessively high, adjust the engine speed by bending TAB.



- If the engine speed does not change, connect a vacuum pump to the vacuum hose and check vacuum.

  There should be vacuum.



  — If there is no vacuum, check the vacuum hose for proper connection, cracks, blockage or disconnected hose and replace the 3-way joint.
  — If there is vacuum, replace the dashpot diaphragm and retest.

3. Reconnect the vacuum hose and check the idle speed.

   Idle speed should be within specification (page 11-328).

System Troubleshooting Guide

NOTE: Across each row in the chart, the systems that could be sources of a symptom are ranked in the order they should be inspected starting with ①. find the symptom in the left column, read across to the most likely source, then refer to the page listed at the top of that coumn. If inspection shows the system is OK, try the next most likely system ②, etc.

Except D16A9 engine:

PAGE / SYMPTOM	SUB SYSTEM	CATALYTIC CONVERTER	EGR SYSTEM (D15Z1 engine only)	POSITIVE CRANKCASE VENTILATION SYSTEM	EVAPORATIVE EMISSION CONTROLS
		383	386	392	294
ROUGH IDLE			①	②	
FREQUENT STALLING	AFTER WARMING UP		①		
POOR PERFORMANCE	MISFIRE OR ROUGH RUNNING		①		
	FAILS EMISSION TEST	①	③		②
	LOSS OF POWER	①	②		

SYSTEM / SYMPTOM	SUB SYSTEM	POSITIVE CRANKCASE VENTILAITON SYSTEM	EVAPORATIVE EMISSION CONTROLS
		392	394
ROUGH IDLE		①	
POOR PERFORMANCE	FAILS EMISSION TEST		①

Emission Control System

System Description

The emission control system includes a three-way catalytic converter,* exhaust gas recirculation (EGR) system, crankcase ventilation system and evaporative control system. The emission control system is designed to meet federal and state emission standards.

*: D15Z1 engine

Tailpipe Emission

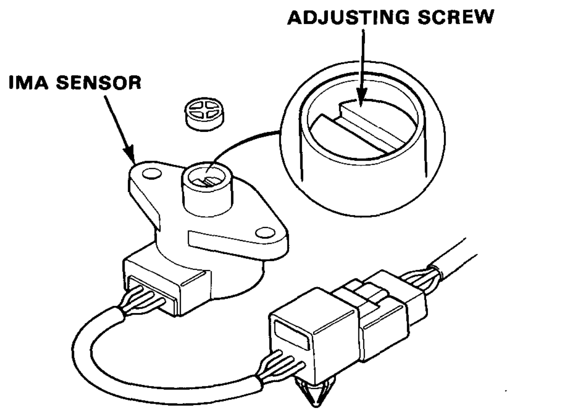
Inspection

WARNING Do not smoke during this procedure. Keep any open flame away from your work area.

1. Start the engine and warm up to normal operating temperature (cooling fan comes on).
2. Connect tachometer.
3. Check idle speed and adjust the idle speed, if necessary (page 11-326, 328).
4. Warm up and calibrate the CO meter according to the meter manufacture's instructions.
5. Check idle CO with the headights, heater blower, rear window defogger, cooling fan, and air conditioner off.

   Specified CO%:
   With CATA: 0.1 % maximum
   Without CATA: 1.0 ± 1.0 %

   - If unable to obtain this reading:
     On With CATA, see ECU troubleshooting guide (page 11-204, 206).
     On other models, adjust by turning the adjusting screw of the IMA sensor.

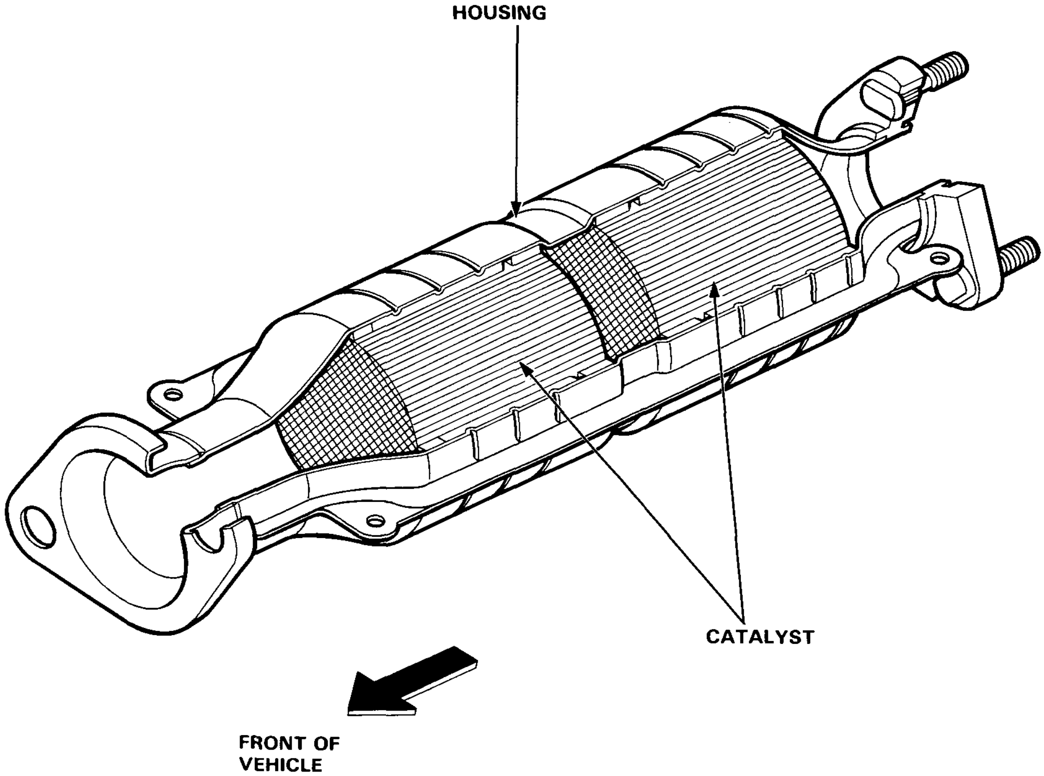


— If unable to obtain a CO reading of specified % by this procedure, check the engine tune-up condition.

Catalytic Converter

Description

The 3-way catalytic converter is used to convert hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx) in the exhaust gas to carbon dioxide (CO_2), dinitrogen (N_2) and water vapor.

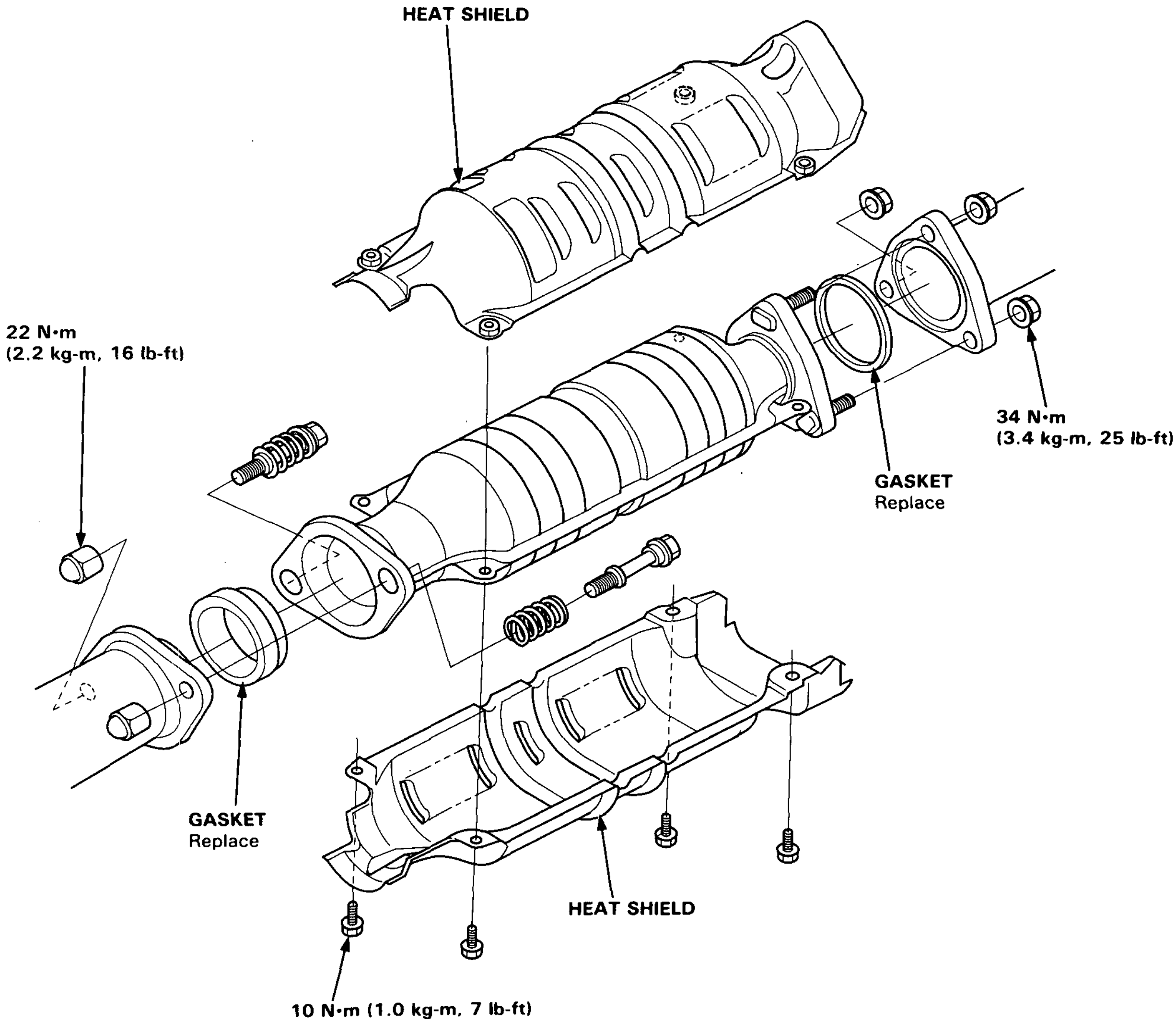


(cont'd)

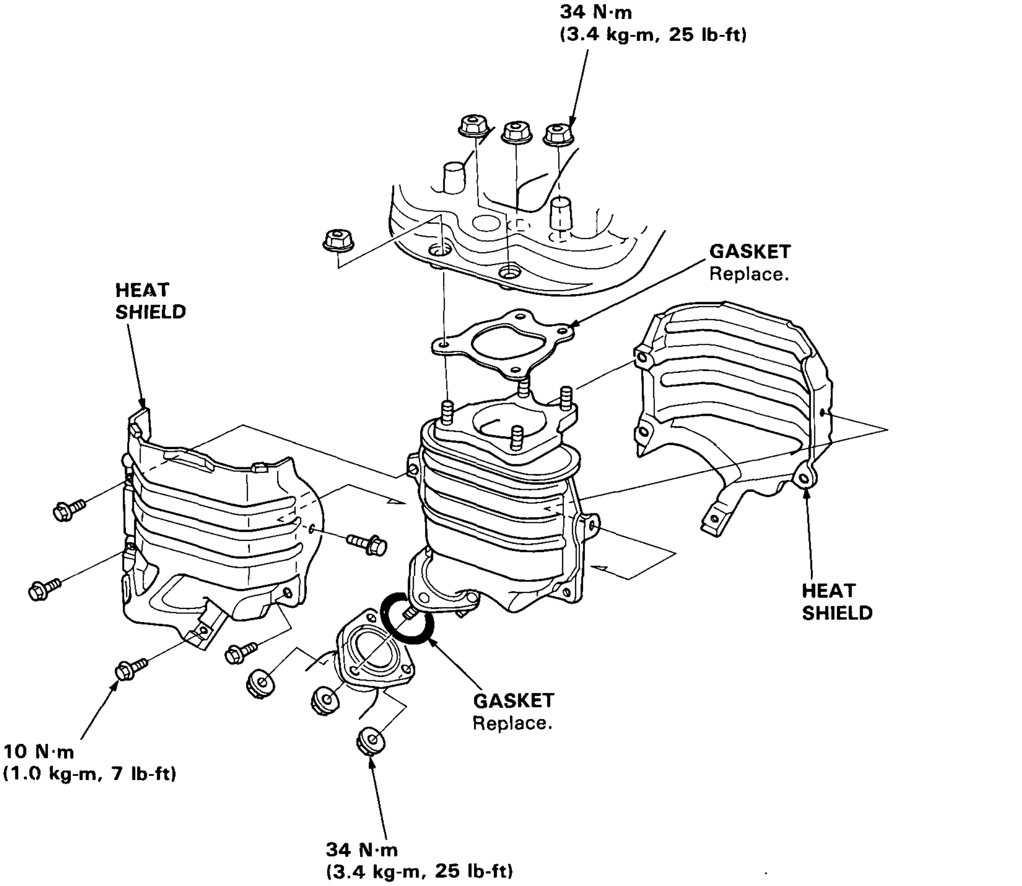
Catalytic Converter (cont'd)

Inspection
If excessive exhaust system back-pressure is suspected, remove the catalytic converter from the car and make a visual check for plugging, melting or cracking of the catalyst. Replace the catalytic converter if any of the visible area is damaged or plugged.

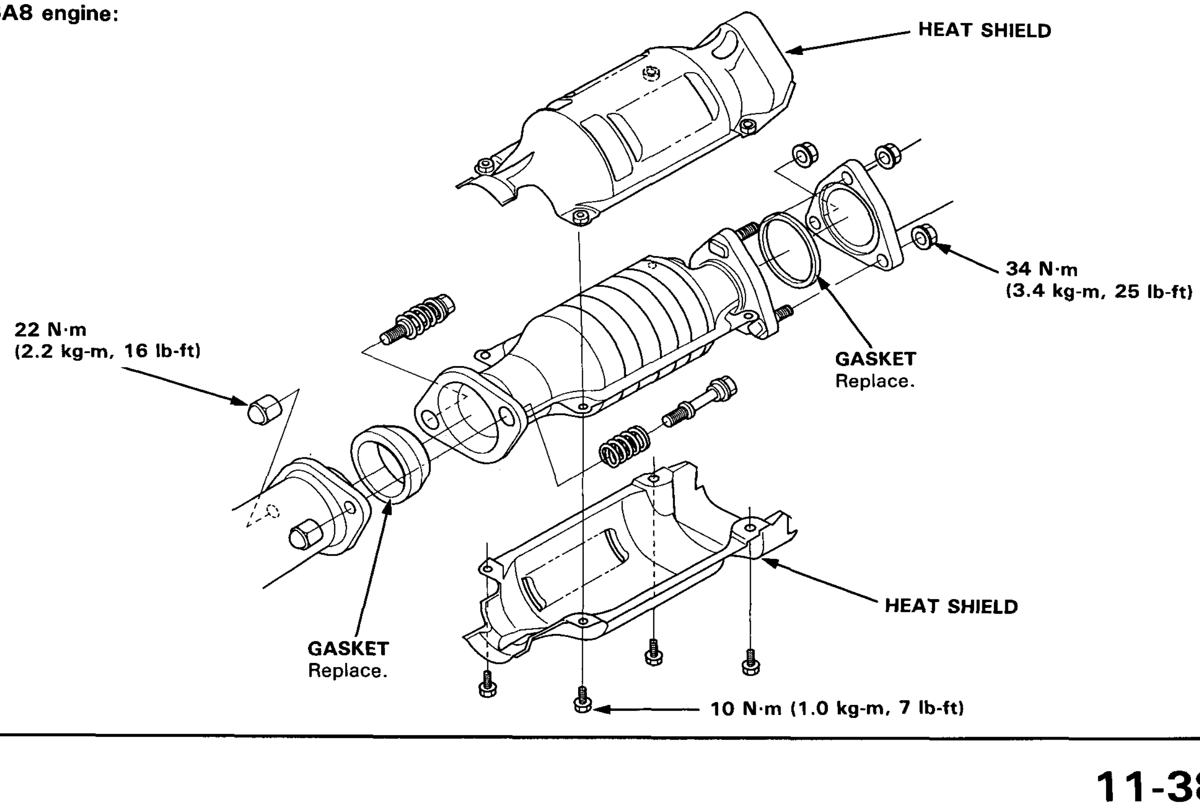
Except D15Z1, D16A8 engine:



D15Z1 engine:



D16A8 engine:

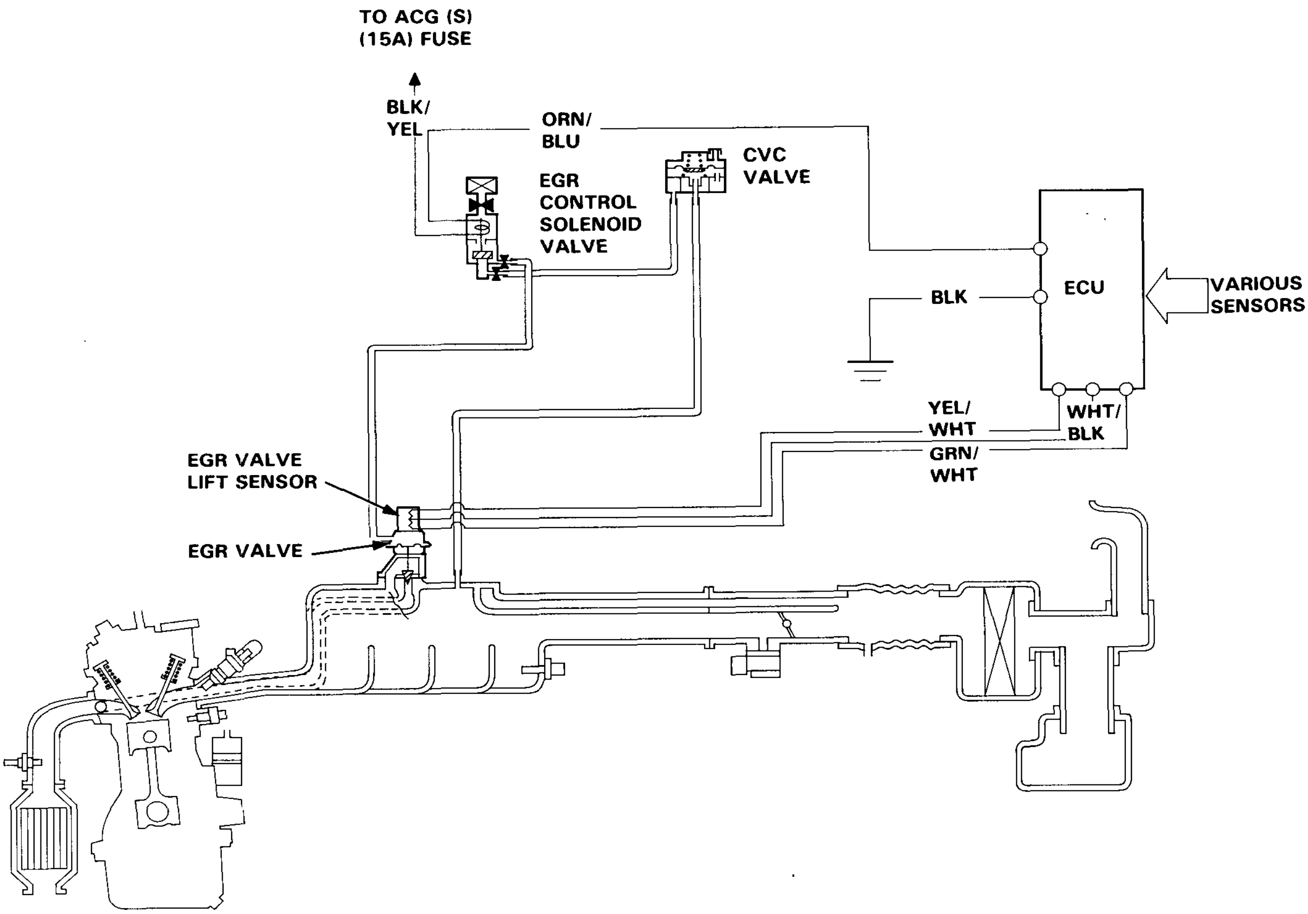


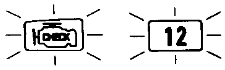
Exhaust Gas Recirculation System [D15Z1 engine]

Troubleshooting Flowchart

12 Self diagnosis Check Engine light indicates code 12: A problem in the Exhaust Gas Recirculation (EGR) system.

The EGR System is designed to reduce oxides of nitrogen emissions (NOx) by recirculating exhaust gas through the EGR valve and the intake manifold into the combustion chambers. It is comprised of the EGR valve, CVC valve, EGR control solenoid valve, ECU and various sensors.
The ECU memory contains ideal EGR valve lifts for varying operating conditions. The EGR valve lift sensor detects the amount of EGR valve lift and sends the information to the ECU. The ECU then compares it with the ideal EGR valve lift which is determined by signals sent from the other sensors. If there is any difference between the two, the ECU further controls current to the EGR control solenoid valve.





- Check Engine light has been reported on.
- With service check connector jumped (page 11-208), CODE 12 is indicated.

Do the ECU Reset Procedure (page 11-209).

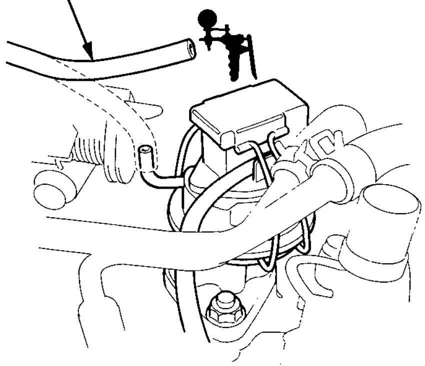
Road test necessary: Warm up the engine to normal operating temperature (cooling fan comes on).
Drive the car on the road for approx. 10 minutes. With the transmission in low gear, keep the engine speed in the 1700–2500 range.

Is Check Engine light on and does it indicate CODE 12?

NO → **Intermittent failure, system is OK at this time. Check for poor connections or loose wires at EGR valve, control box and ECU.**

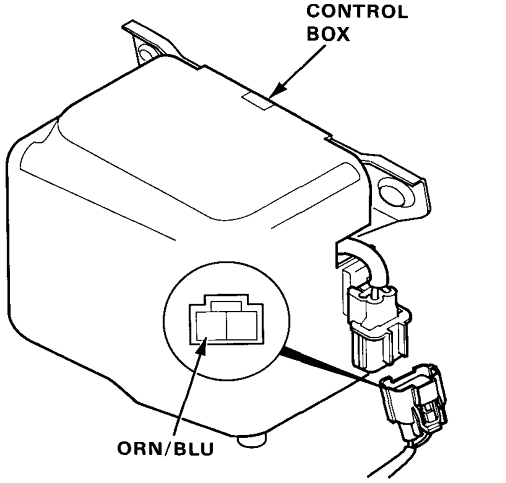
YES ↓

With the engine at idle, disconnect the #16 hose from the EGR valve and connect a vacuum pump/gauge to the hose.



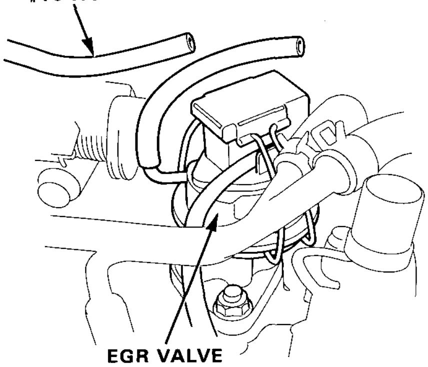
Is there any vacuum?

YES → Disconnect 2P connector from the control box and check the #16 hose for vacuum again.



NO ↓

Move the vacuum pump/gauge to the EGR valve.



(To page 11-388)

(To page 11-388)

(cont'd)

Exhaust Gas Recirculation System [D15Z1 engine] (cont'd)

(From page 11-387)

With the engine at idle, apply 200 mmHg of vacuum to the EGR valve.

Does the engine stall or run rough and does the EGR valve hold vacuum?

NO → **Replace EGR valve.**

YES ↓

Disconnect the 2P connector from the control box.

Measure voltage between BLK/YEL (+) terminal on the main wire harness and body ground.

Is there battery voltage ?

NO → **Repair open in BLK/YEL wire between the solenoid valve and ACG (S) (15A) fuse.**

YES ↓

Reconnect the vacuum pump/gauge to the #16 hose.

Start the engine and allow it to idle.

(To page 11-389)

(From page 11-387)

Is there any vacuum ?

YES → **Check vacuum hose routing of the entire EGR system. If hose routing is OK, replace EGR control solenoid valve.**

NO ↓

Turn the ignition switch OFF and disconnect the "A" connector from the ECU.

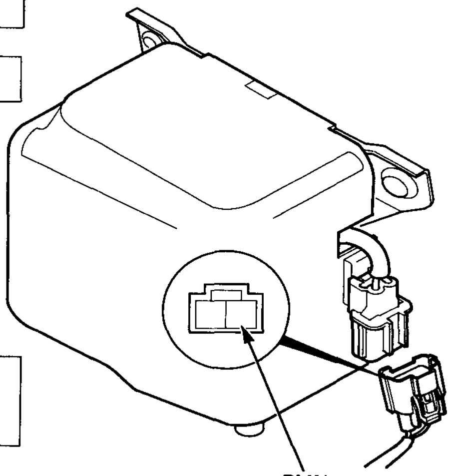
Check for continuity to ground on ORN/BLU wire of 2P connector.

Does continuity exist?

YES → **Repair short in ORN/BLU wire between EGR control solenoid valve and ECU (A11).**

NO ↓

Substitute a known-good ECU and retest. If symptom/indication goes away, replace the original ECU.



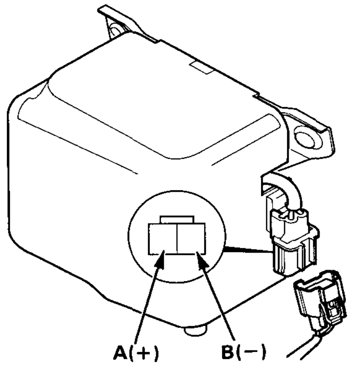
(From page 11-388)

Connect the battery positive terminal to the A terminal of the 2P connector. While watching the vacuum gauge, connect the battery negative terminal to the B terminal.

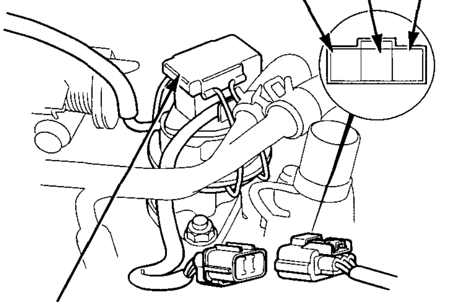
Is there approx. 200 mmHg within 1 second?

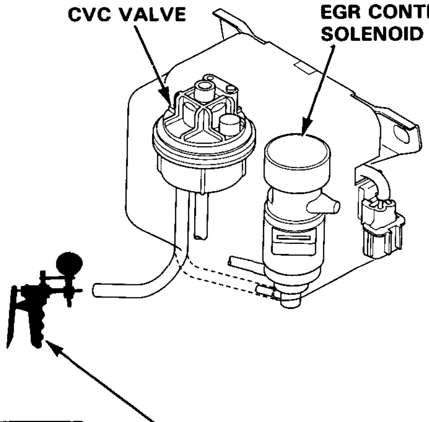
NO → Turn the ignition switch OFF and inspect the #16 and #10 hoses for leaks, restrictions, or misrouting.

- Are the hoses OK?
  - NO → **Correct as necessary.**
  - YES → Disconnect the lower hose on EGR control solenoid valve and connect a vacuum gauge to the hose.
    - Start the engine and allow it to idle.
    - Is there 150 — 250 mmHg of vacuum?
      - NO → **Replace CVC valve.**
      - YES → **Replace the EGR control solenoid valve.**



YES → Turn the ignition switch OFF and *reconnect the 2P connector to* the EGR control solenoid valve.





Disconnect 3P connector from the EGR valve.

Turn the ignition switch ON.

Measure voltage between YEL/WHT (+) terminal and GRN/WHT (−) terminal.

Is there approx. 5 V ?

- YES → (To page 11-390)
- NO → Measure voltage between YEL/WHT (+) terminal and body ground.
  - (To page 11-390)

(cont'd)

Exhaust Gas Recirculation System [D15Z1 engine] (cont'd)

(From page 11-389)

Is there approx. 5 V?

YES → **Repair open in GRN/WHT wire between EGR valve and ECU (D22).**

NO ↓

Connect the test harness "D" connector to the ECU only, not to the main wire harness (page 11-212).

Measure voltage between D20 (+) terminal and D22 (−) terminal.

Is there approx. 5 V?

YES → **Repair open in YEL/WHT wire between EGR valve and ECU (D20).**

NO ↓

Substitute a known-good ECU and recheck. If prescribed voltage is now available, replace the original ECU.

(From page 11-389)

Turn the ignition switch OFF.

Reconnect the 3P connector to the EGR valve.

Connect the test harness between the ECU and connector (page 11-212).

Turn the ignition switch ON.

Measure voltage between D12 (+) terminal and D22 (−) terminal.

Is the voltage approx. 1.2 V with no vacuum applied and approx. 4.3 V with 200 mm Hg of vacuum applied (to the EGR valve)?

NO →

- **Repair open or short in WHT/BLK wire between EGR valve and ECU (D12).**
- **If wire is OK, replace the EGR valve.**

YES ↓

(To page 11-391)

(From page 11-390)

Does the voltage consistently increase/decrease as the vacuum increases/decreases?

NO → **Replace the EGR valve.**

YES ↓

Reconnect the #16 hose to the EGR valve.

↓

Start the engine and allow it to idle.

↓

Connect A11 terminal to A26 terminal with a jumper wire.

↓

Did the engine stall or run rough?

NO → **Repair open in ORN/BLU wire between ECU (A11) and control solenoid valve.**

YES ↓

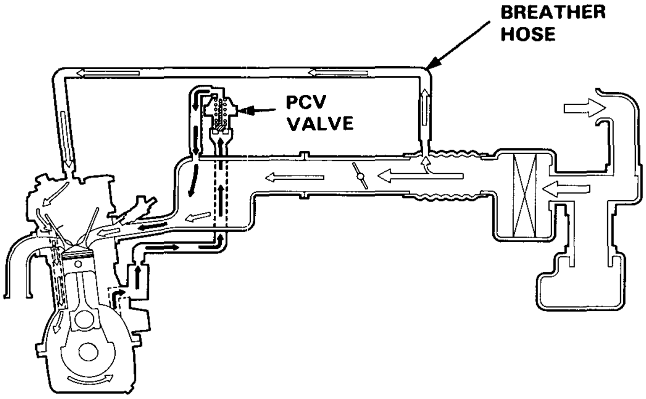
Substitute a known-good ECU and recheck. If symptom/indication goes away, replace the original ECU.

Positive Crankcase Ventilation System

Description

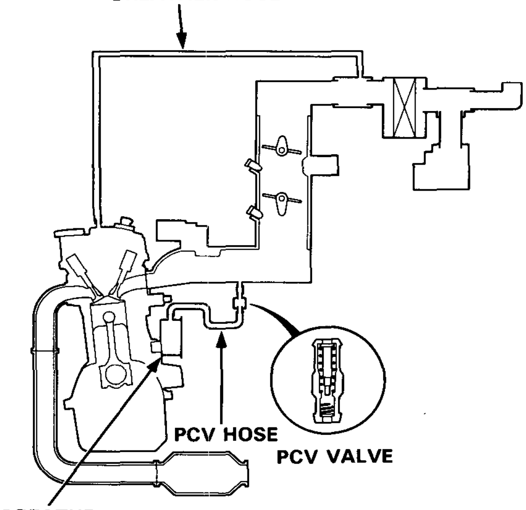
The Positive Crankcase Ventilation (PCV) system is designed to prevent blow-by gas from escaping to the atmosphere. The PCV valve contains a spring-loaded plunger. When the engine starts, the plunger in the PCV valve is lifted in proportion to intake manifold vacuum and the blow-by gas is drawn directly into the intake manifold.

Except D15B2 engine:



⬅ : BLOW-BY VAPOR
⇦ : FRESH AIR

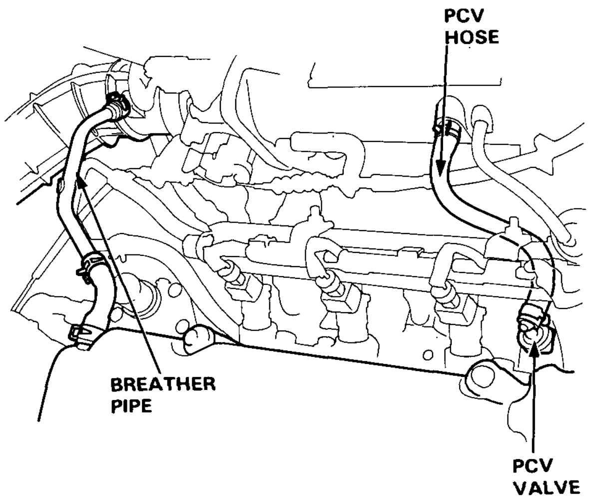
D15B2 engine:



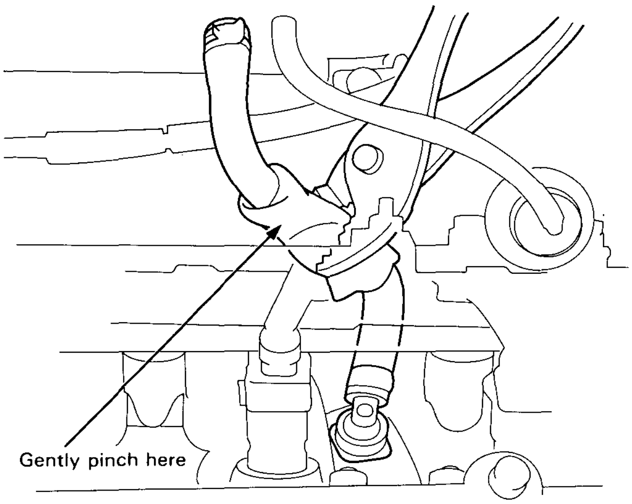
⬅ : BLOW-BY VAPOR
⇦ : FRESH AIR

Inspection (Except D15B2 engine)

1. Check the crankcase ventilation hoses and connections for leaks and clogging.



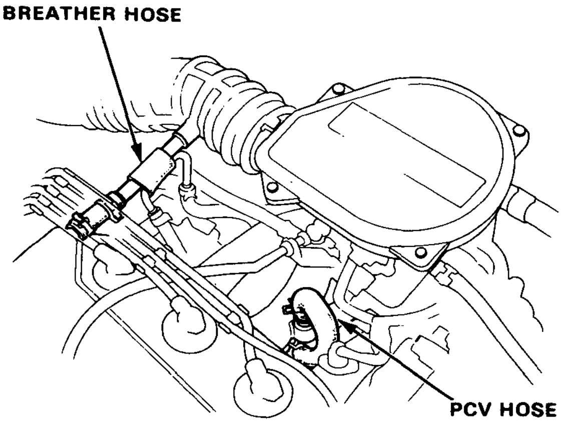
2. At idle, make sure there is a clicking sound from the PCV valve when the hose between PCV valve and intake manifold in lightly pinched with your fingers or pliers.



- If there is no clicking sound, check the PCV valve grommet for cracks or damage. If the grommet is OK, replace the PCV valve and recheck.

Inspection [D15B2 engine]

1. Check the crankcase ventilation hoses and connections for leaks and clogging.



2. At idle, make sure there is a clicking sound from the PCV valve when you lightly pinch the PCV hose with your fingers or pliers.

- If no clicking sound is heard, replace PCV valve and recheck.

Evaporative Emission Controls

Description

The evaporative controls are designed to minimize the amount of fuel vapor escaping to the atmosphere. The system consists of the following components:

A. Charcoal Canister
A canister for the temporary storage of fuel vapor until the fuel vapor can be purged from the canister into the engine and burned.

B. Vapor Purge Control System
Canister purging is accomplished by drawing fresh air through the canister and into a port ont he throttle body. The purging vacuum is controlled by the purge control diaphragm valve and the purge control solenoid valve.

Except D15B2 engine:

PURGE CONTROL SOLENOID VALVE OFF AFTER STARTING ENGINE

↑

COOLANT TEMPERATURE ABOVE D15Z1 engine: 75°C (167°F)
Others: 70°C (158°F)

D15B2 engine:

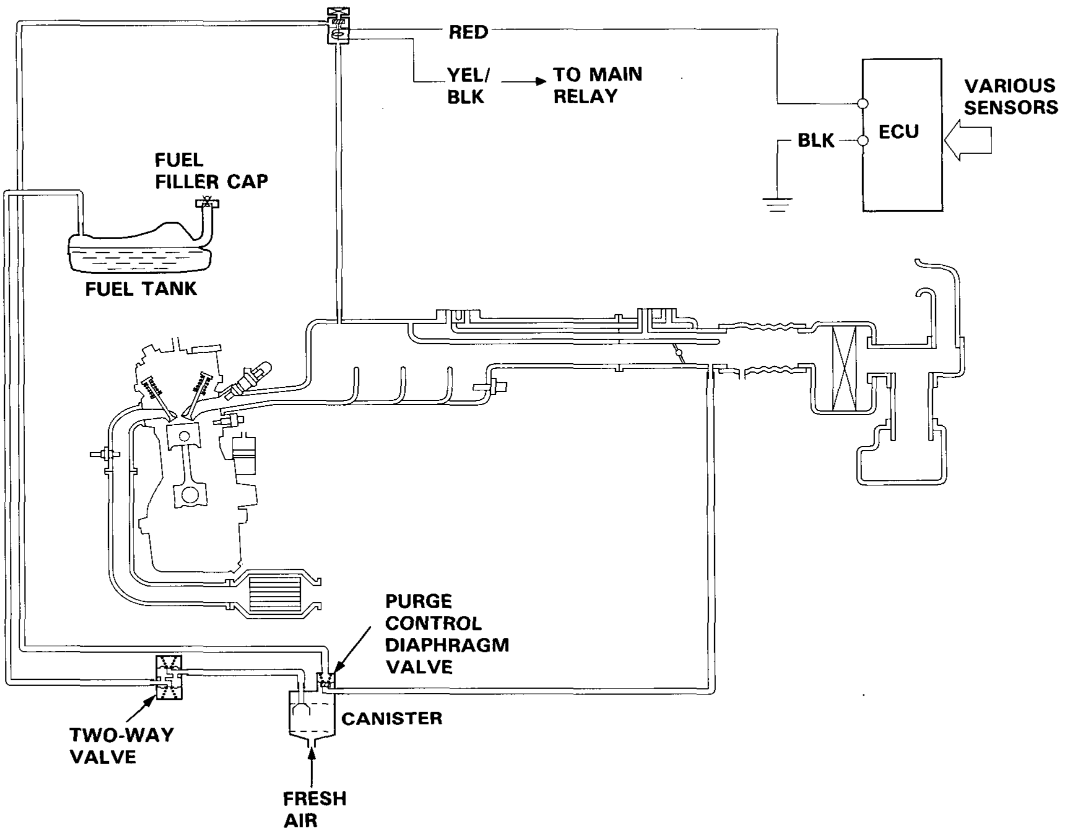
PURGE CUT-OFF SOLENOID VALVE OFF 5 SECONDS AFTER STARTING ENGINE

↑ AND ↑

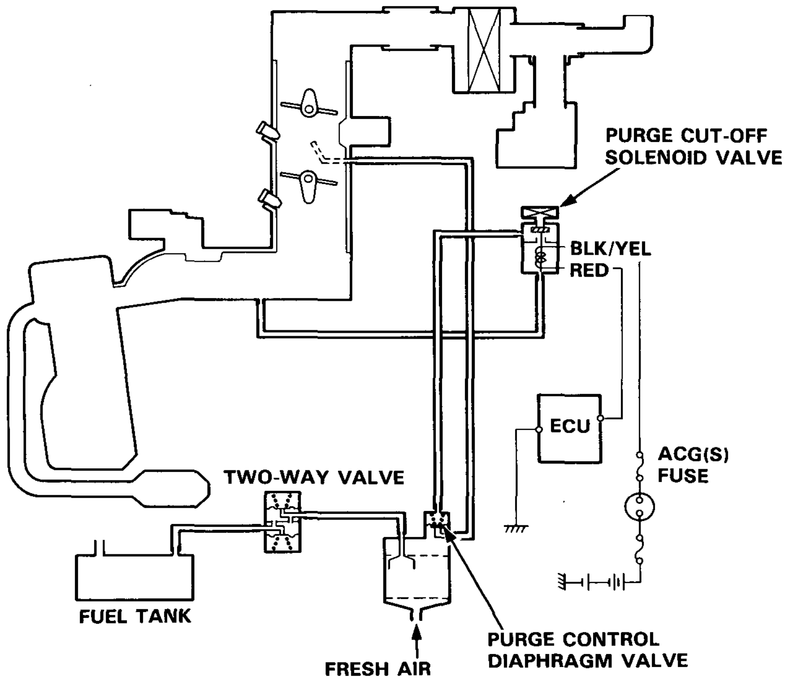
COOLANT TEMPERATURE ABOVE 80°C (176°F) | THROTTLE VALVE NOT FULLY CLOSED

C. Fuel Tank Vapor Control System
When fuel vapor pressure in the fuel tank is higher than the set value of the two-way valve, the valve opens and regulates the flow of fuel vapor to the canister.

Except D15B2 engine:



D15B2 engine:



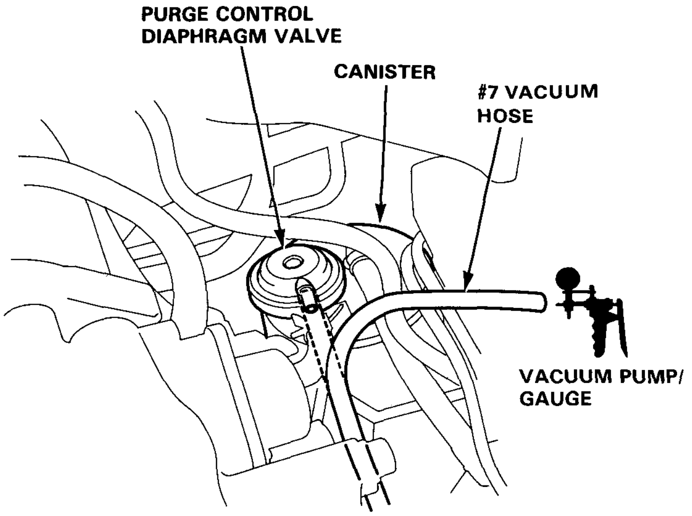
Emission Control System

Evaporative Emission Controls [Except D15B2 engine] (cont'd)

Troubleshooting Flowchart

Inspection of Evaporative Emission Controls

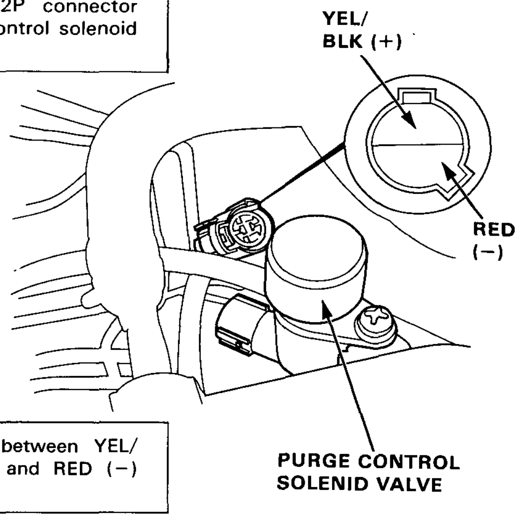
Disconnect #7 vacuum hose from the purge control diaphragm valve (on the charcoal canister) and connect a vacuum gauge to the hose.



Start the engine and allow it to idle.
NOTE: Engine coolant temperature must be below D15Z1 engine: 75°C (167°F), Others: 70°C (158°F).

Is there vacuum ?

YES → Disconnect the 2P connector from the purge control solenoid valve.



Measure voltage between YEL/ BLK (+) terminal and RED (−) terminal.

Is there battery voltage ?

YES → **Inspect vacuum hose routing. If OK, replace purge control solenoid valve.**

NO → Measure voltage between YEL/ BLK (+) terminal and body ground.

(To page 11-397)

NO → (To page 11-397)

(From page 11-396)

Warm up the engine to normal operating temperature (cooling fan comes on).

Check for vacuum at #7 vacuum hose after starting the engine.

Is there manifold vacuum?

- NO → Disconnect the 2P connector.
  - Is there manifold vacuum?
    - NO → Inspect vacuum hose routing. If OK, replace purge control solenoid valve.
    - YES → Inspect for a short in RED wire between ECU (A20) and the connector. If wire is OK, substitute a known-good ECU and recheck. If symptom goes away, replace the original ECU.
- YES ↓

Reconnect the hose.

Remove fuel filler cap.

(To page 11-398)

(From page 11-396)

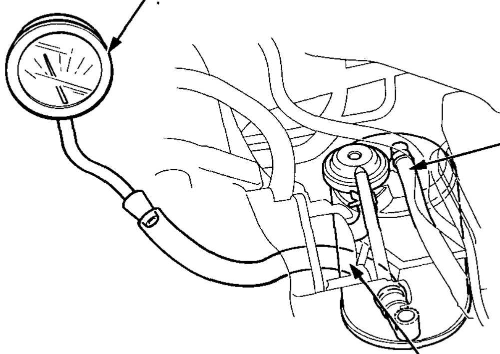
Is there battery voltage ?

- NO → Repair open in YEL/BLK wire between main relay and the 2P connector.
- YES → Inspect RED wire for an open to body ground between ECU (A20) and the connector. If wire is OK, substitute a known-good ECU and recheck. If symptom goes away, replace the original ECU.

(cont'd)

Evaporative Emission Controls [Except D15B2 engien] (cont'd)

(From page 11-397)



Connect a vacuum gauge to canister purge air hose.

Start the engine and raise speed to 3,500 min^{-1} (rpm)

Does vacuum appear on gauge within 1 minute ?

NO → **Replace the canister.**

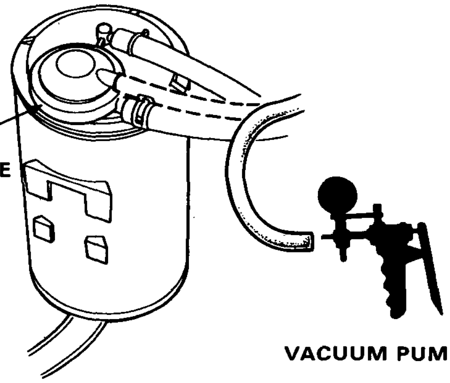
YES →

See two-way valve test to complete.
Evaporative emission controls are OK.

Evaporative Emission Controls [D15B2 engine]

Troubleshooting Flowchart

Inspection of Evaporative Emission Controls

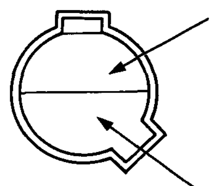


Disconnect #7 hose from the purge control diaphragm valve (on the charcoal canister) and connect a vacuum gauge to the hose.

Start the engine and allow to idle.
NOTE: Engine coolant temperature must be below 80 °C (176 °F).

Is there vacuum ?

YES → Disconnect the 2 P connector from the purge control solenoid valve.



Measure voltage between YEL/BLK (+) terminal and GRN(−) terminal.

Is there battery voltage ?

YES → **Inspect #7 hose routing. If OK, replace purge cut-off solenoid valve.**

NO → Measure voltage between YEL/BLK (+) terminaland body ground.

(To page 11-401)

NO (Is there vacuum ?) →

(To page 11-401)

(From page 11-400)

Warm up the engine to normal operating temperature (cooling fan comes on).

Check for vacuum at #7 hose 10 seconds after starting the engine.
Check with the throttle valve slightly opened.

Is there manifold vacuum ?

NO

YES

Reconnect the hose.

Remove fuel filler cap.

(To page 11-402)

(From page 11-400)

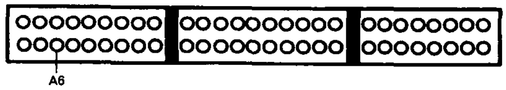
Is there battery voltage ?

NO: **Repair open in YEL/BLK, BLK/YEL wire between ACG(S)(15A) fuse and the 2 P connector.**

YES

Turn the ignition switch OFF.

Connect the test harness to the main wire harness only, not the ECU.



Check for continuity of RED wire between ECU (A6) and the 2 P connector.

Does continuity exist ?

NO: **Repair open in RED wire between ECU (A6) and the connector.**

YES

Substitute a known-good ECU and recheck. If symptom goes away, replace the original ECU.

Disconnect the 2 P connector.

Is there manifold vacuum ?

NO: **Inspect #7 hose routing. If OK, purge cut-off solenoid valve.**

YES

Turn the ignition switch OFF.

Disconnect "A" connector from ECU.

Check for continuity to ground on RED wire.

(To page 11-402)

(cont'd)

Evaporative Emission Control [D15B2 engine] (cont'd)

(From page 11-401)

Is there continuity to ground ?

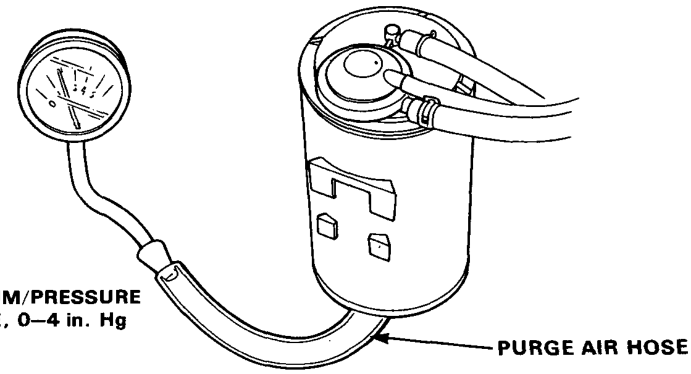
YES → **Repair short to ground in RED wire between ECU (A6) and the connector.**

NO → **Substitute a known-good ECU and recheck. If symptom goes away, replace the original ECU.**

(From page 11-401)

Connect a vacuum gauge to canister purge air hose.

Start the engine and raise speed to 3,500 min^{-1} (rpm).



Does vacuum appear on gauge within 1 minute ?

NO → **Replace the canister.**

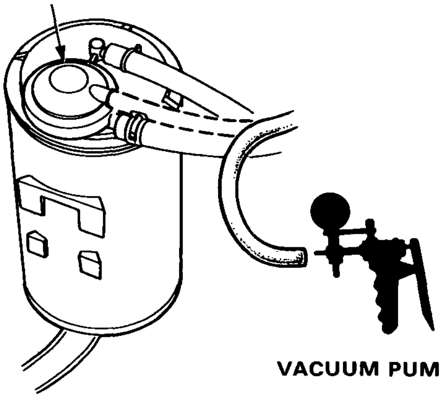
YES → **See two-way valve test to complete. Evaporative emission controls are OK.**

Evaporative Emission Controls [KY only]

1. Remove the fuel filler cap.

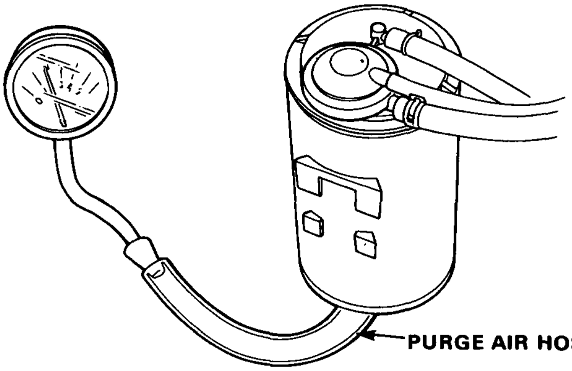
2. Start the engine and allow to idle.

3. Disconnect vacuum hose at the purge control diaphragm valve (on the charcoal canister) and connect a vacuum gauge to the hose.



- If there is no vacuum, check vacuum hose for blockage, cracks or disconnected hose, as well as vacuum port for blockage.

4. Disconnect the vacuum gauge and reconnect the hose.
5. Connect a vacuum gauge to canister purge air hose.



6. Raise engine speed to 3,500 min^{-1} (rpm).
Vacuum should appear on gauge within 1 minute.

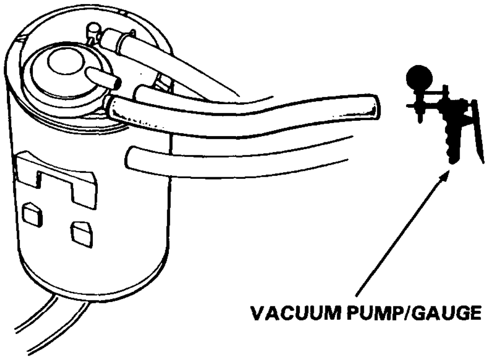
   - If vacuum appears on gauge in 1 minute, remove gauge, test is complete.
   - If no vaccum, disconnect vacuum gauge and reinstall fuel filler cap.

7. Remove charcoal canister and check for signs of damage or defects.

   - If defective, replace canister.

8. Stop engine. Disconnect upper vacuum hose from canister "PCV" fitting.
Connect a vacuum pump to canister "purge" fitting as shown, and apply vacuum.

   Vacuum should remain steady.



   - If vacuum drops, replace canister and retest.

9. Restart engine. Reconnect hose to canister ''PCV'' fitting.

   ''PURGE'' side vacuum should drop to zero.

   - If ''PURGE'' difr vacuum does not drop to zero, repalce the canister and retest.

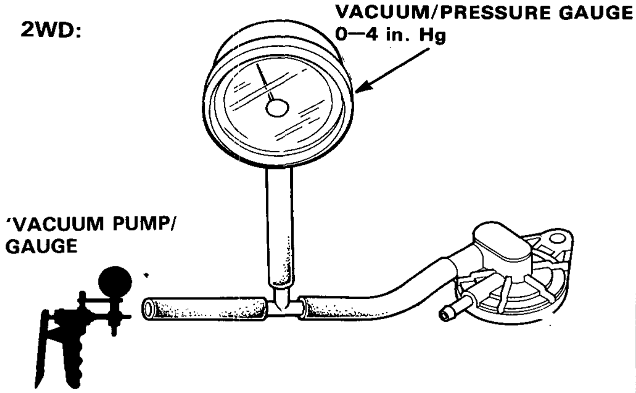
Emission Control System

Evaporative Emission Controls

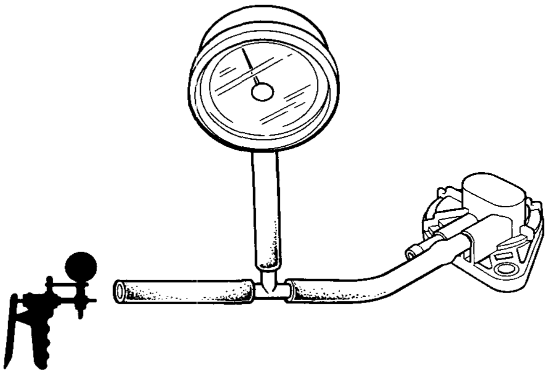
Two-Way Valve Test

1. Remove the fuel filler cap.
2. Remove vapor line from the fuel tank and connect to T-fitting from vacuum gauge and vacuum pump as shown.

2WD:



4WD:

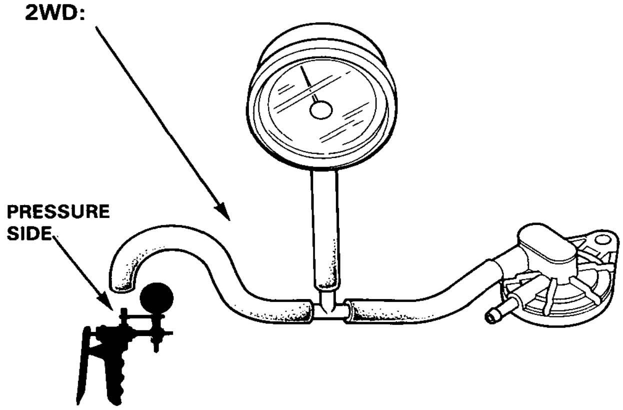


3. Apply vacuum slowly and continuously while watching the gauge.

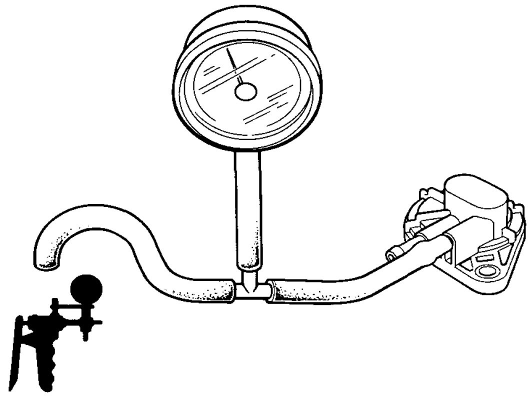
   Vacuum should stabilize momentarily at 5 to 15 mmHg (0.2 to 0.6 in. Hg).
   - If vacuum stabilizes (valve opens) below 5 mmHg (0.2 in. Hg) or above 15 mmHg (0.6 in. Hg), install new valve and retest.

4. Move vacuum pump hose from vacuum to pressure fitting, and move vacuum gauge hose from vacuum to pressure side as shown.

2WD:



4WD:



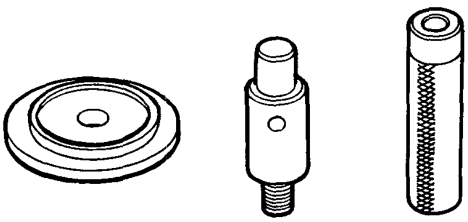
5. Slowly pressurize the vapor line while watching the gauge.

   Pressure should stabilize at 10 to 35 mmHg (0.4 to 1.4 in. Hg).
   - If pressure momentarily stabilizes (valve opens) at 10 to 35 mmHg (0.4 to 1.4 in. Hg), the valve is OK.
   - If pressure stabilizes below 10 mmHg (0.4 in. Hg) or above 35 mmHg (1.4 in. Hg), install a new valve and retest.

Clutch

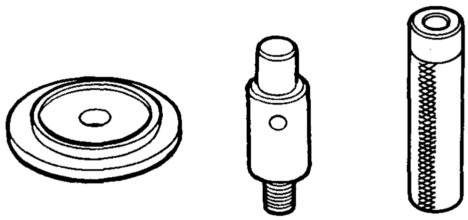
Special Tools

Ref. No.	Tool Number	Description	Qty	Remarks
①	07JAF–PM7010A	Clutch Alignment Tool	1	Except B16A2
①-1	07JAC–PM7011A	Clutch Alignment Disc	(1)	
①-2	07JAF–PM7012A	Clutch Alignment Shaft	(1)	Component Tools
①-3	07936–3710100	Handle	(1)	
②	07LAF–PR30200	Clutch Alignment Tool	1	B16A2
②-1	07LAF–PR30210	Clutch Alignment Shaft	(1)	
②-2	07JAC–PM7011A	Clutch Alignment Disc	(1)	Component Tools
②-3	07936–3710100	Handle	(1)	
③	07LAB–PV00100	Ring Gear Holder	1	07924–PD20003
④	07749–0010000	Outer Handle A	1	
⑤	07746–0010100	Outer Driver, 32 x 35 mm	1	



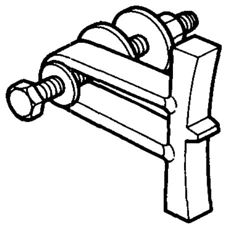
①-1 ①-2 ①-3

①

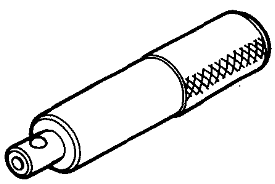


②-1 ②-2 ②-3

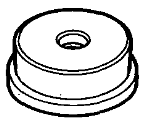
②



③

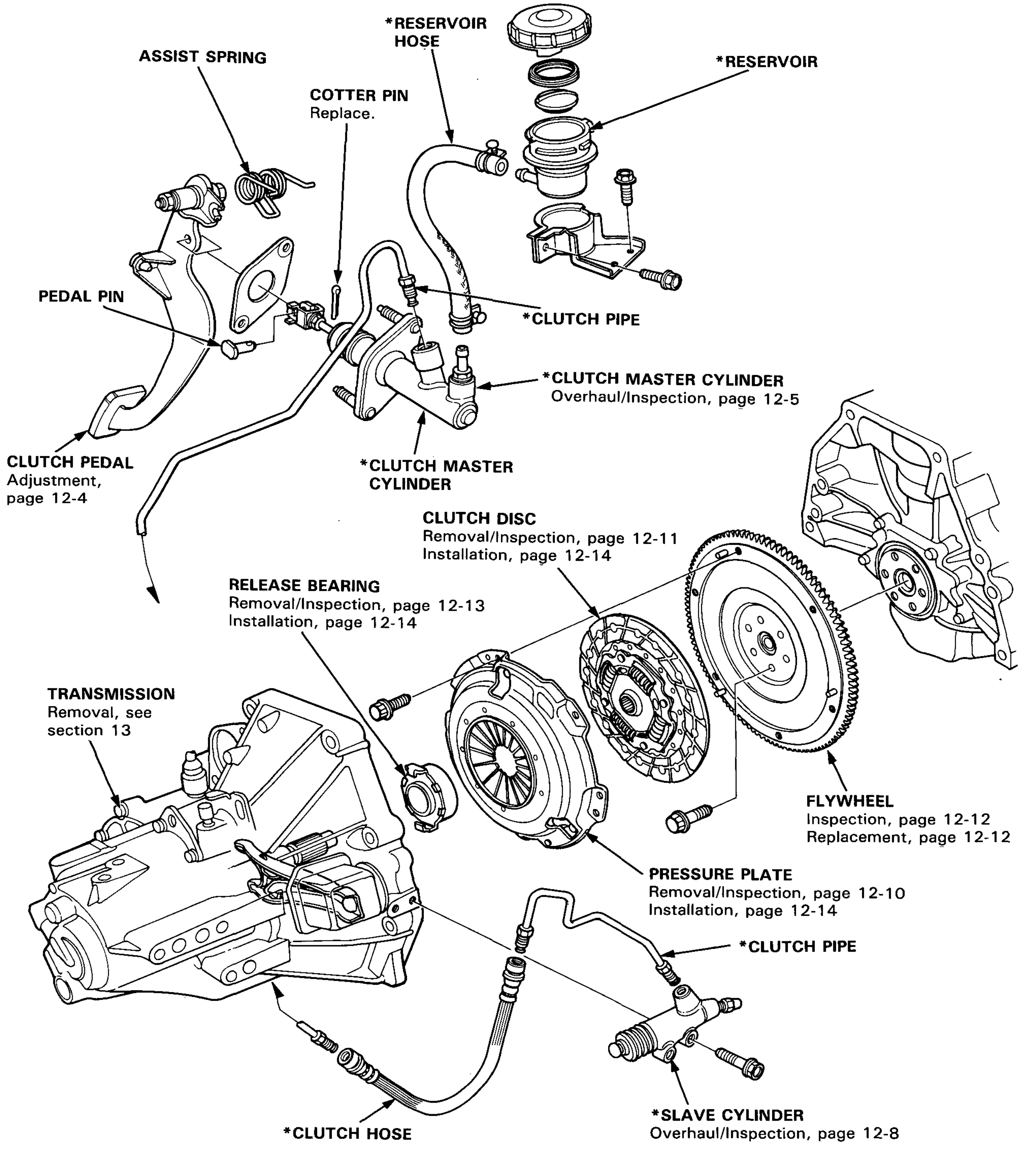


④



⑤

NOTE:
- Whenever the transmission is removed, clean and grease the release bearing sliding surface.
- If the parts marked * are removed, the clutch hydraulic system must be bled.

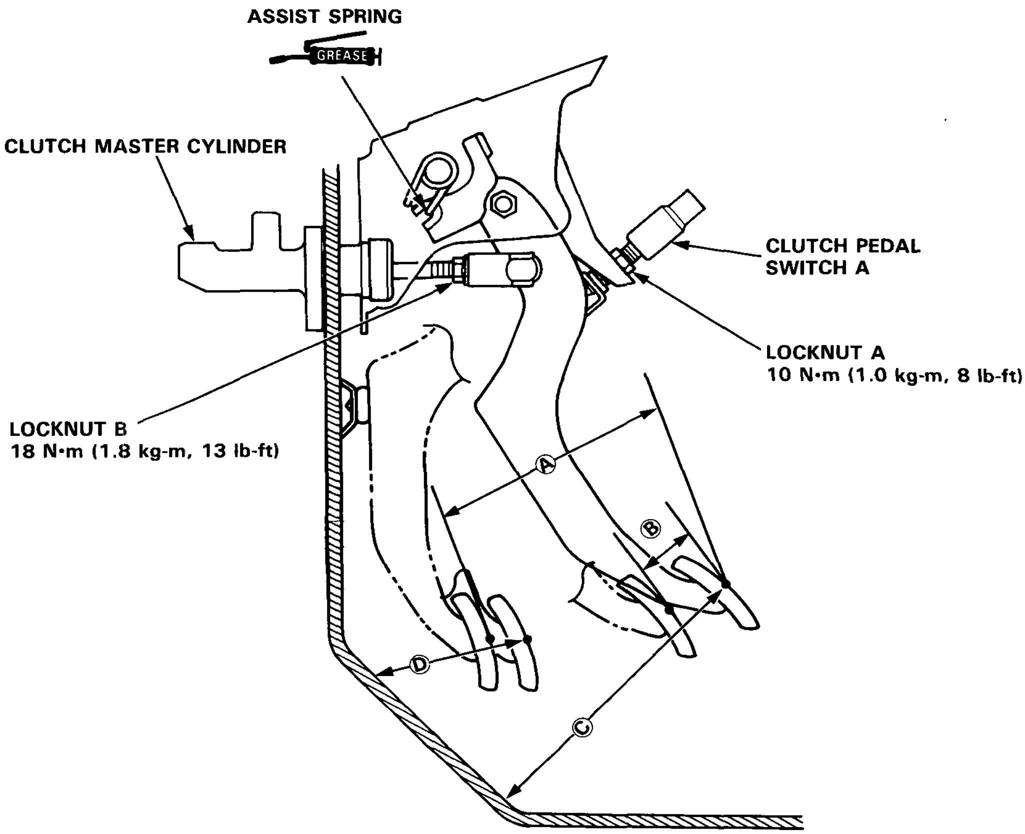


Pedal Free Play

NOTE:
- The clutch is self-adjusting to compensate for wear.
- Total clutch pedal free play is 9—15 mm (0.35—0.59 in).

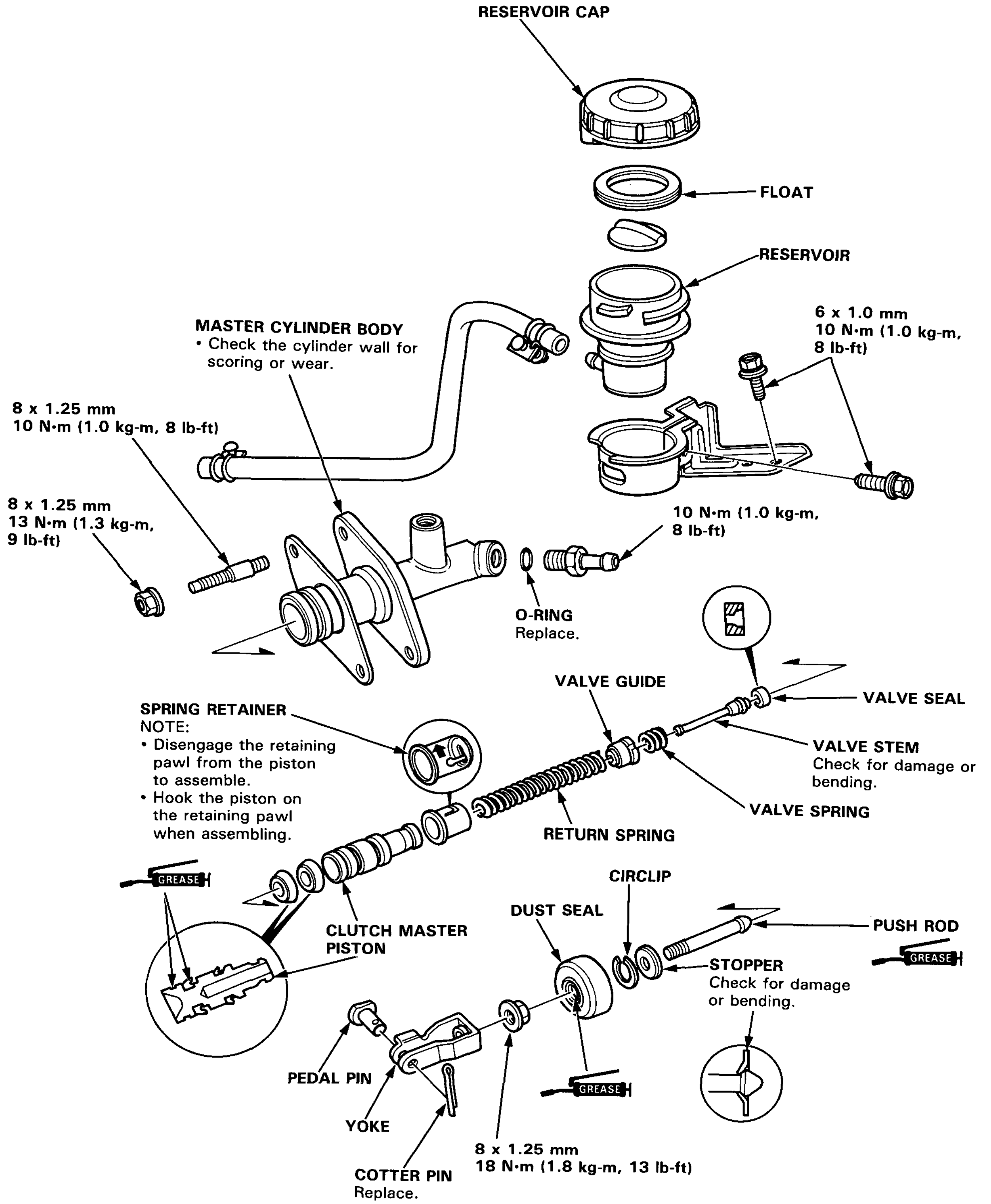
CAUTION: If there is no clearance between the master cylinder piston and push rod, the release bearing is held against the diaphragm spring, which can result in clutch slippage or other clutch problems.

1. Loosen locknut A, and back off the pedal switch until it no longer touches the clutch pedal.
2. Loosen locknut B, and turn the push rod in or out to get the specified stroke and height at the clutch pedal.
3. Tighten locknut B.
4. Thread in the clutch pedal switch A in until it contacts the clutch pedal.
5. Turn the switch in further 1/4—1/2 turn.
6. Tighten locknut A.



Ⓐ (STROKE AT PEDAL): 135—145 mm (5.31—5.71 in)
Ⓑ (PEDAL PLAY): 1.0—10.0 mm (0.04—0.37 in)
Ⓒ (CLUTCH PEDAL HEIGHT): 164 mm (6.46 in)
Ⓓ (CLUTCH PEDAL DISENGAGEMENT HEIGHT): 83 mm (3.27 in) minimum to the floor.

Overhaul/Inspection



Clutch Master Cylinder

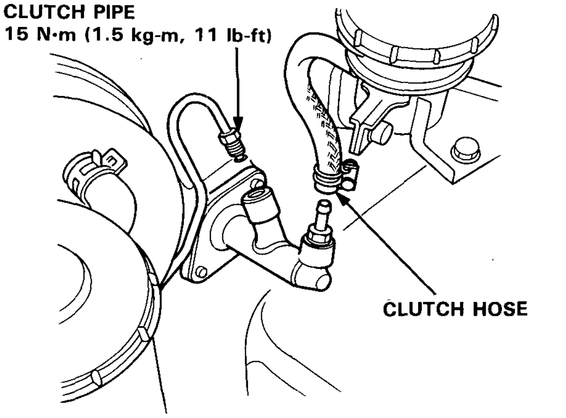
Removal/Installation

CAUTION:

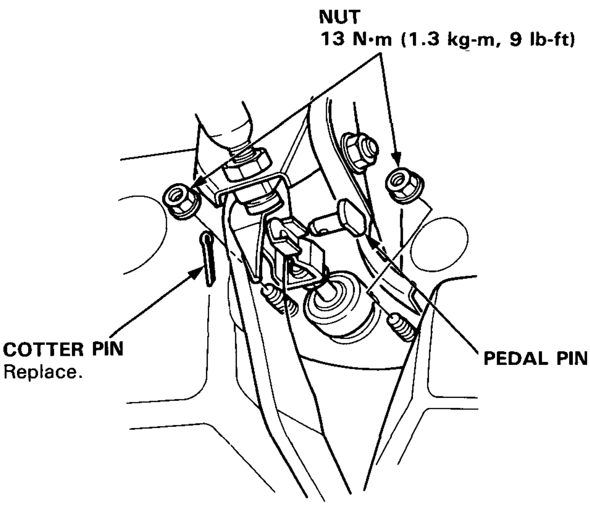
- **Avoid spilling brake fluid on painted surfaces, as it may damage the finish.**
- **Plug the end of the clutch pipe and reservoir hose with a shop towel to prevent fluid from flowing out of the clutch pipe and reservoir hose after disconnecting.**

1. The brake fluid may be sucked out through the top of the master cylinder reservoir (see section 19).

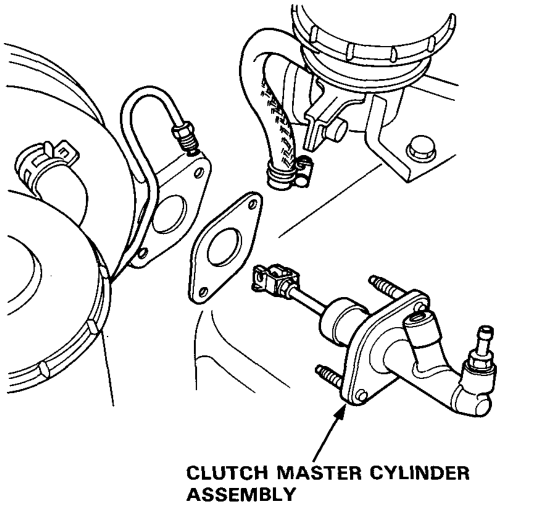
2. Disconnect the clutch pipe and clutch hose from the clutch master cylinder.



3. Pry out the cotter pin, and pull the pedal pin out of the yoke. Remove the nuts.



4. Remove the master clutch cylinder assembly.



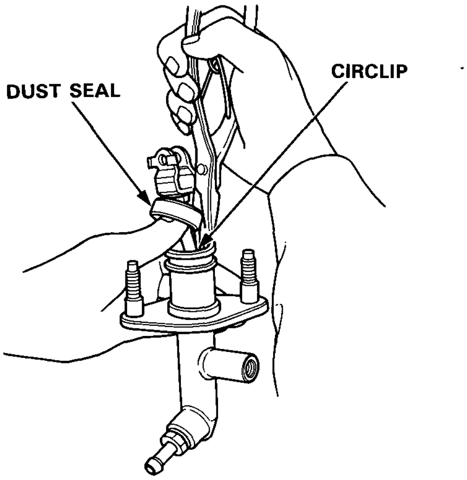
5. Install the clutch master cylinder in the reverse order of removal.

   NOTE: Bleed the clutch hydraulic system (see page12-6).

Disassembly

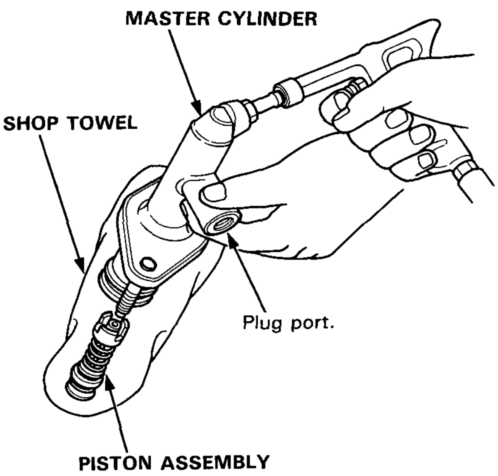
CAUTION: Avoid spilling brake fluid on paint as it may damage the finish.

1. Remove the dust seal from the master cylinder.
2. Pry the circlip off the master cylinder.



3. Carefully remove the piston by applying air pressure through the clutch line hose.

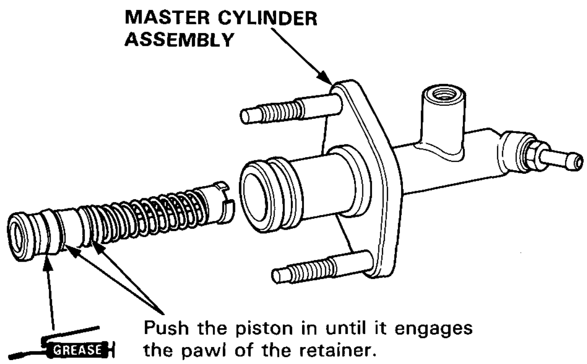
   CAUTION:
   - ***Hold a shop towel over the master cylinder, to stop the piston in case it comes out suddenly.***
   - **Plug the end of the clutch hose port with a shop towel to prevent fluid from coming out.**
   - **Clean all disassembled parts in solvent and blow through all ports and passages with compressed air.**



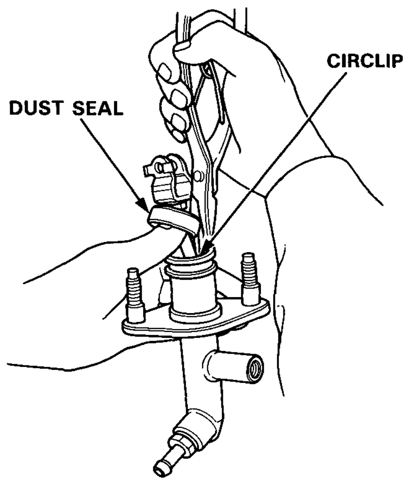
Reassembly

CAUTION:
- **Before assembling, make sure all parts are completely clean.**
- **Replace parts with new ones whenever specified to do so.**
- **Do not allow dust or water to enter the system.**
- **Do not mix different brands of brake fluid as they may not be compatible.**
- **Do not reuse the brake fluid which was drained out.**
- **Avoid spilling the brake fluid on painted surfaces, as it may damage the finish.**

1. Assemble the piston noting the proper direction of the parts (page 12-5).

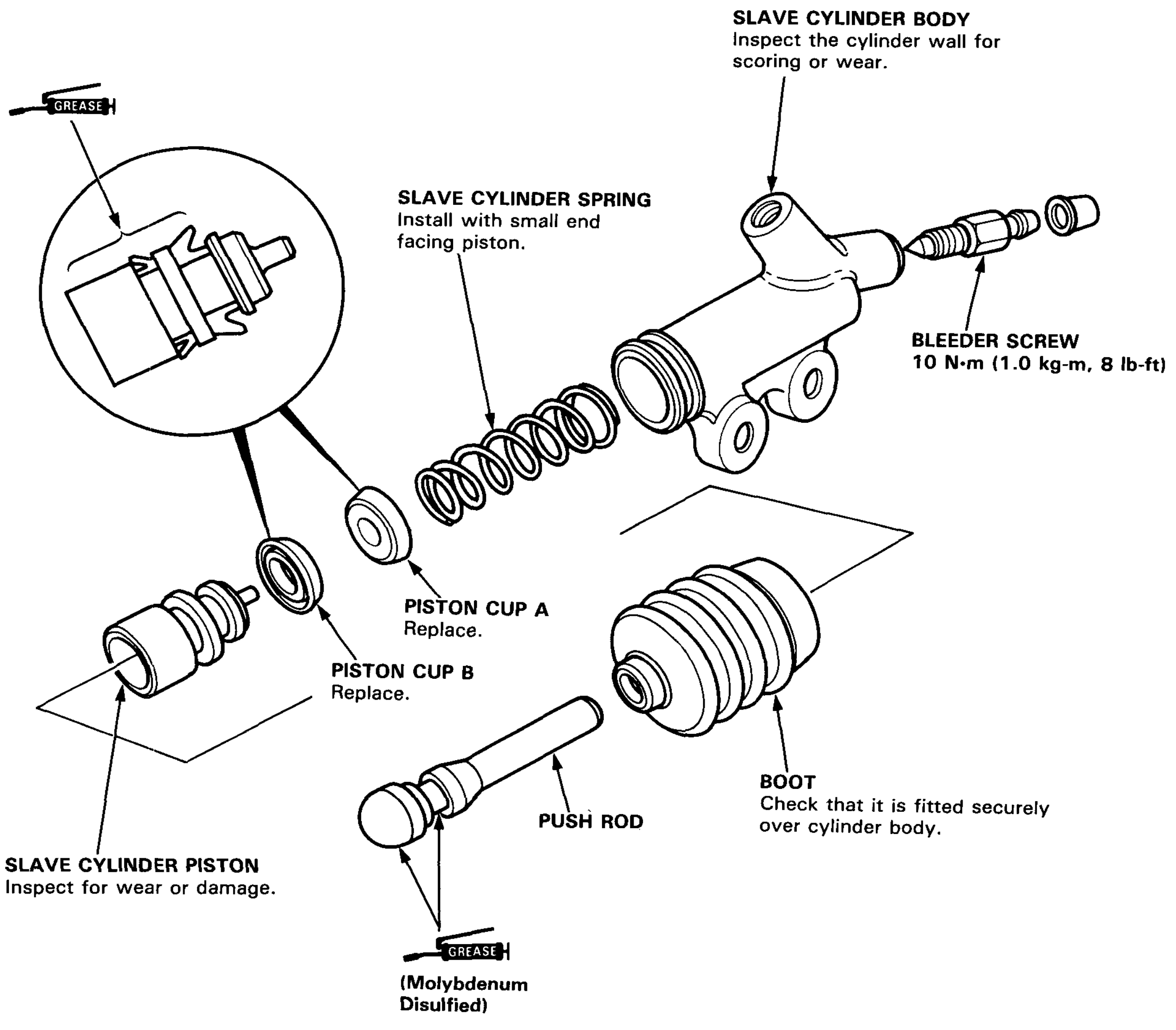


2. Slide the piston assembly into the mastert cylinder.
3. Install the circlip in the groove of the master cylinder.



4. Install the dust seal.

Overhaul/Inspection



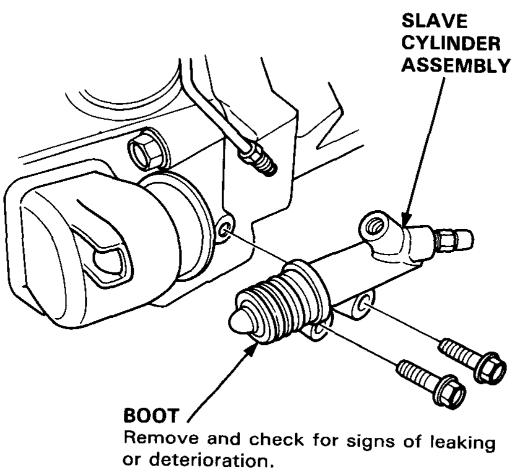
Slave Cylinder

Removal

1. Disconnect the clutch pipe from the slave cylinder.

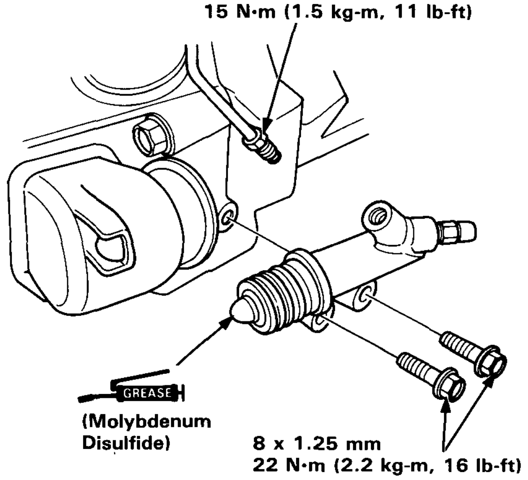
   CAUTION:
   - **Avoid spilling brake fluid on the painted surfaces, as it may damage the finish.**
   - **Plug the end of the clutch pipe with a shop towel to prevent brake fluid from coming out.**

2. Remove the slave cylinder from the clutch housing.

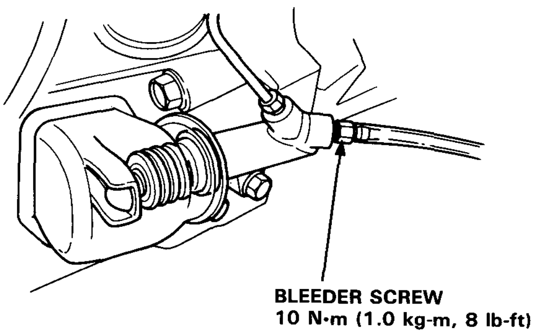


Installation

1. Install the slave cylinder assembly on the clutch housing.



2. Bleed the clutch hydraulic system.
   - Attach a hose to the bleeder screw and suspend the hose in a container of brake fluid.
   - Make sure there is an adequate supply of fluid at the master cylinder, then slowly pump the clutch pedal until no more bubbles appear at the bleeder hose.
   - Refill the master cylinder fluid when done.
   - Use only DOT 3 or 4 brake fluid.



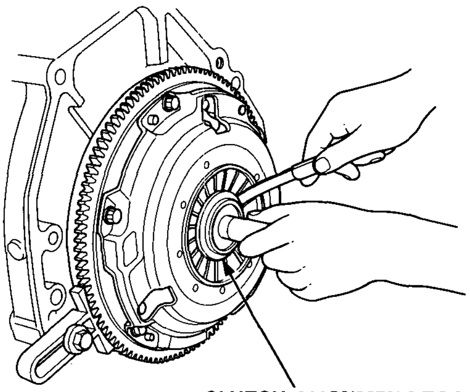
Pressure Plate

Removal/Inspection

1. Inspect the fingers of the diaphragm spring for wear at the release bearing contact area.

2. Check the diaphragm spring fingers for height using the special tools and a feeler gauge.

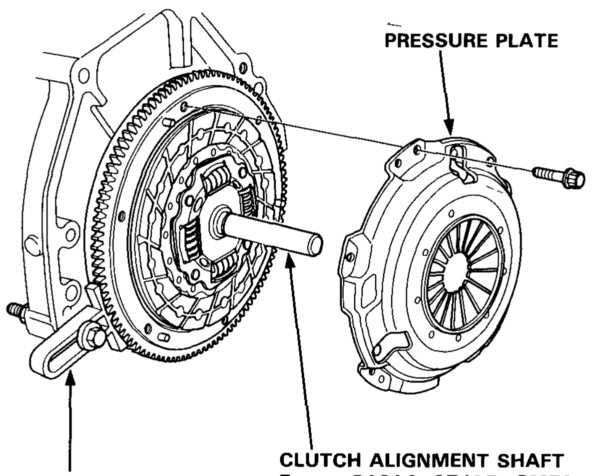
   Standard (New): 0.8 mm (0.03 in) Min.
   Service Limit: 1.0 mm (0.04 in) Max.



CLUTCH ALIGNMENT TOOL
Except B16A2: 07JAF–PM7012A
B16A2: 07LAF–PR30200

3. Install the ring gear holder, handle and Clutch Alignment Shaft.

4. To prevent warping, unscrew the pressure plate mounting bolts two turns at a time in a criss-cross pattern, then remove the pressure plate.

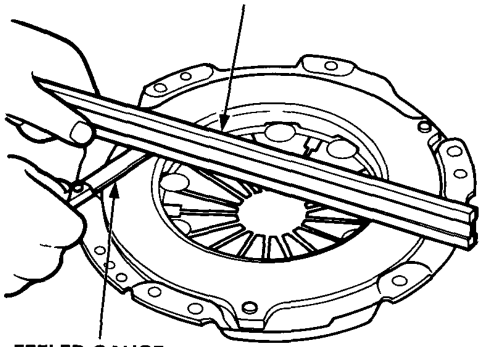


5. Inspect the pressure plate surface for wear, cracks, or burning.

6. Inspect the fingers of the diaphragm spring for wear at the release bearing contact area.

7. Inspect for warpage using a straight edge and feeler gauge. Measure across the pressure plate.

   Standard (New): 0.03 mm (0.001 in) Min.
   Service Limit: 0.15 mm (0.006 in)

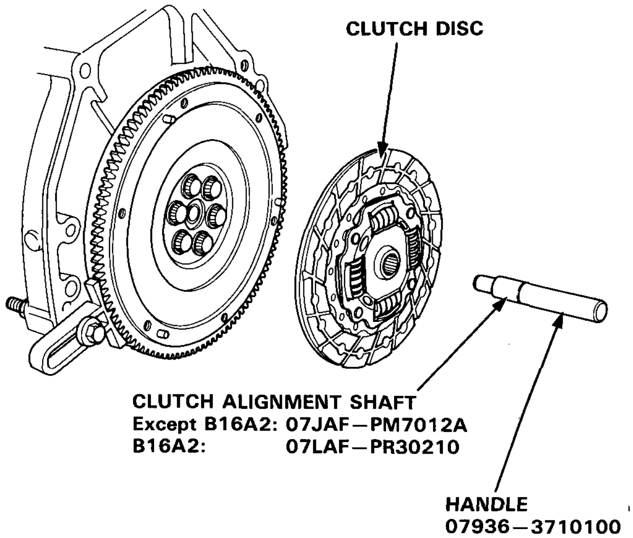


Clutch Disc

Removal/Inspection

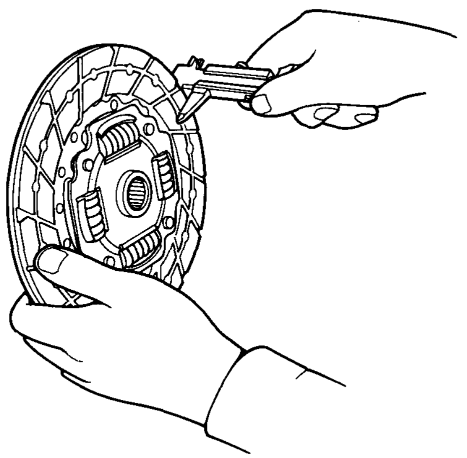
1. Remove the clutch disc and special tools.

2. Inspect lining of the clutch disc for signs of slipping or oil. Replace it, if it is burned black or oil soaked.



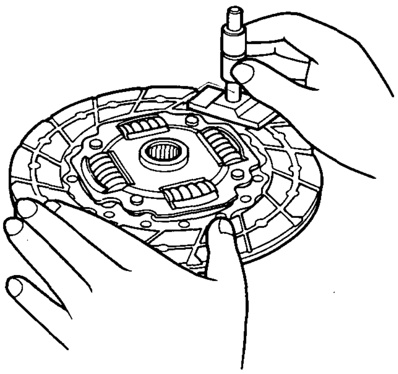
3. Measure the clutch disc thickness.

Clutch Disc Thickness:
Standard (New): 8.1–8.8 mm (0.32–0.35 in)
Service Limit: 5.7 mm (0.22 in)



4. Measure the depth from the lining surface to the rivets, on both sides.

Rivet Depth:
Standard (New): 1.3 mm (0.051 in)
Service Limit: 0.2 mm (0.008 in)



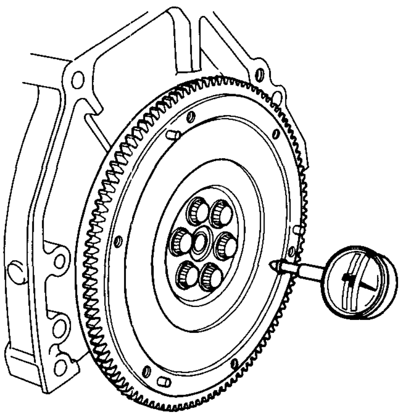
Flywheel

Inspection

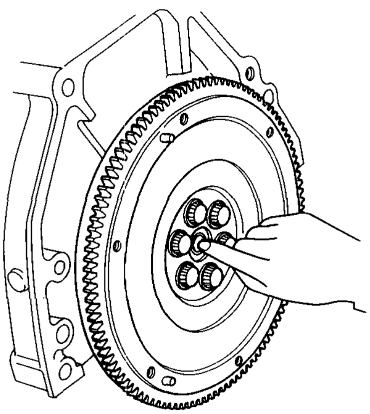
1. Inspect the ring gear teeth for wear or damage.
2. Inspect the clutch disc mating surface on the flywheel for wear, cracks or burning.
3. Measure the flywheel runout using a dial indicator through at least two full turns. Push against the flywheel each time you turn it to take up the crankshaft thrust washer clearance.

   NOTE: The runout can be measured with engine installed.

   Standard (New): 0.05 mm (0.002 in) Max.
   Service Limit: 0.15 mm (0.006 in)

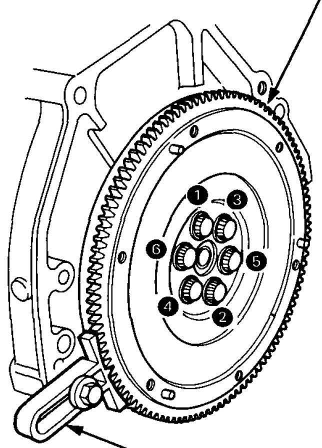


4. Turn the inner race of the flywheel bearing with your finger. The bearing should turn smoothly and quietly. Check that the bearing outer race fits tightly in the flywheel. Replace the bearing if the race does not turn smoothly, quietly, or fit tight in the flywheel.

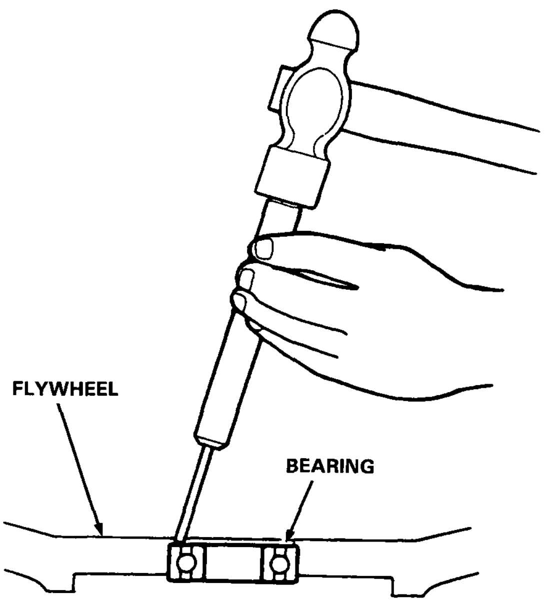


Replacement

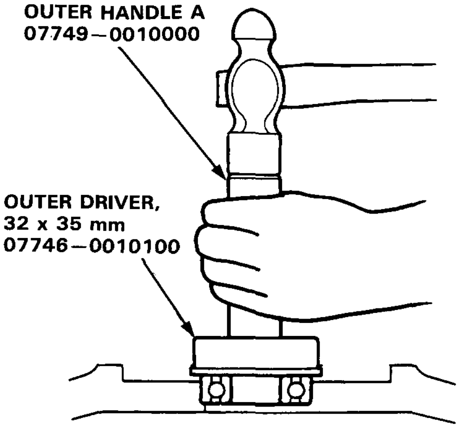
1. Install the ring gear holder.
2. Remove the flywheel mounting bolts and the flywheel.



3. Remove the ball bearing from the flywheel.



3. Drive in the new bearing into the flywheel using the special tools.

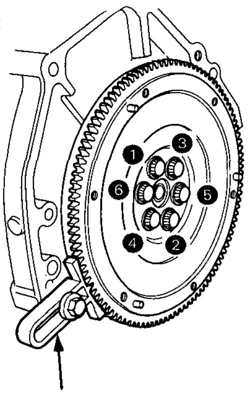


4. Align the hole in the flywheel with the crankshaft dowel pin and install the flywheel. Install the bolts finger-tight.

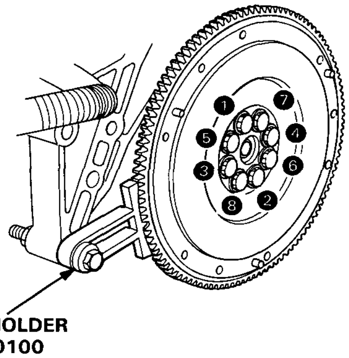
5. Install the special tool, then torque the flywheel bolts in a criss-cross pattern, as shown.

   Torque: 120 N·m (12.0 kg-m, 87 lb-ft)

Except B16A2:



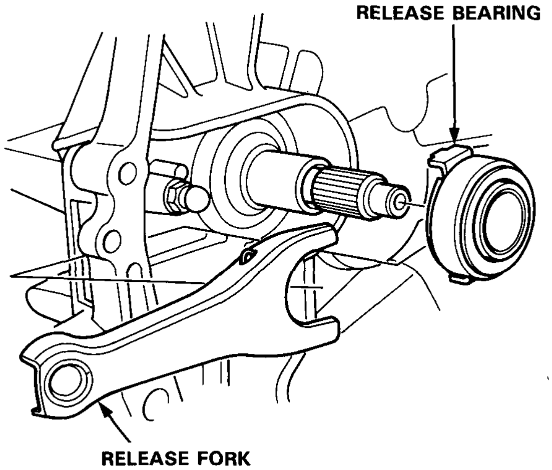
B16A2:



Removal/Inspection

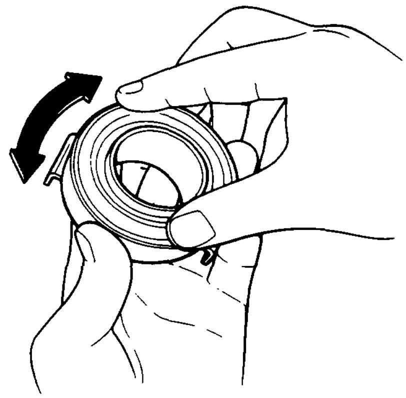
1. Remove the boot from the clutch housing.

2. Remove the release fork from the clutch housing by squeezing the release fork set spring with pliers. Remove the release bearing.



3. Check the release bearing for play by spinning it by hand.

   CAUTION: The bearing is packed with grease. Do not wash it in solvent.



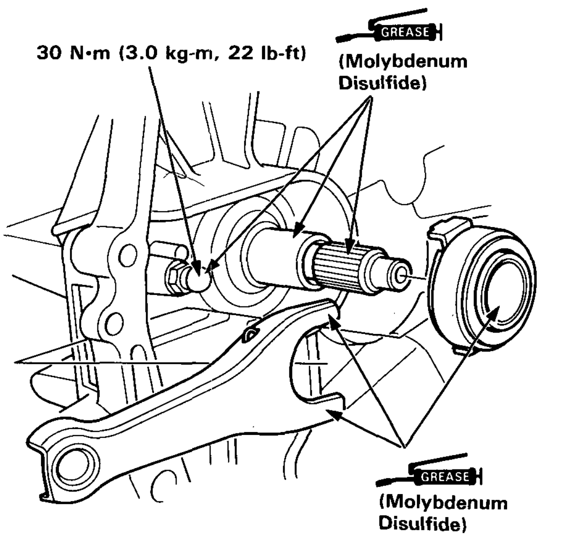
4. Replace the bearing with a new one if there is excessive play.

Release Bearing

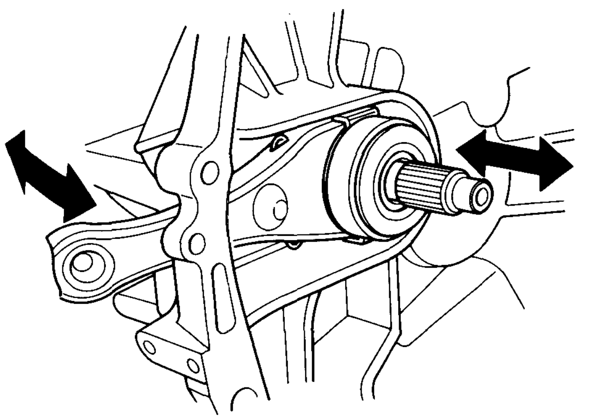
Installation

1. With the release fork slid between the release bearing pawls, install the bearing on the mainshaft while inserting the release fork through the hole in the clutch housing.

2. Align the detent of the release fork with the release fork bolt, then press the release fork over the release fork bolt.



3. Move the release fork right and left to make sure that the fork fits properly against the bearing, and that the bearing slides smoothly.



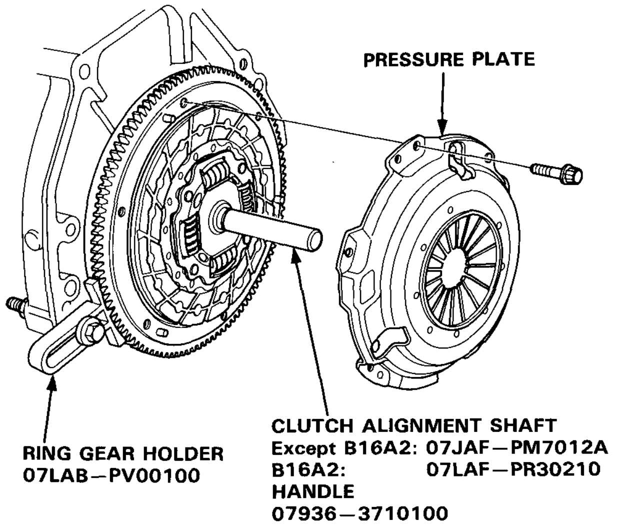
4. Install the boot.

Clutch Disc, Pressure Plate

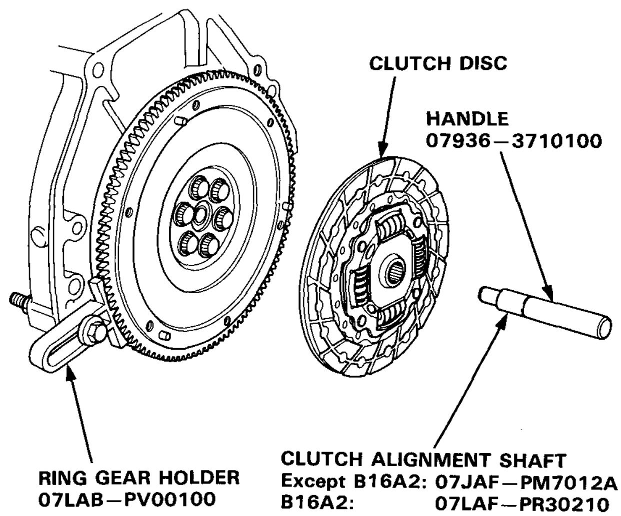
Installation

1. Install the ring gear holder.

2. Install the clutch disc using the special tools.

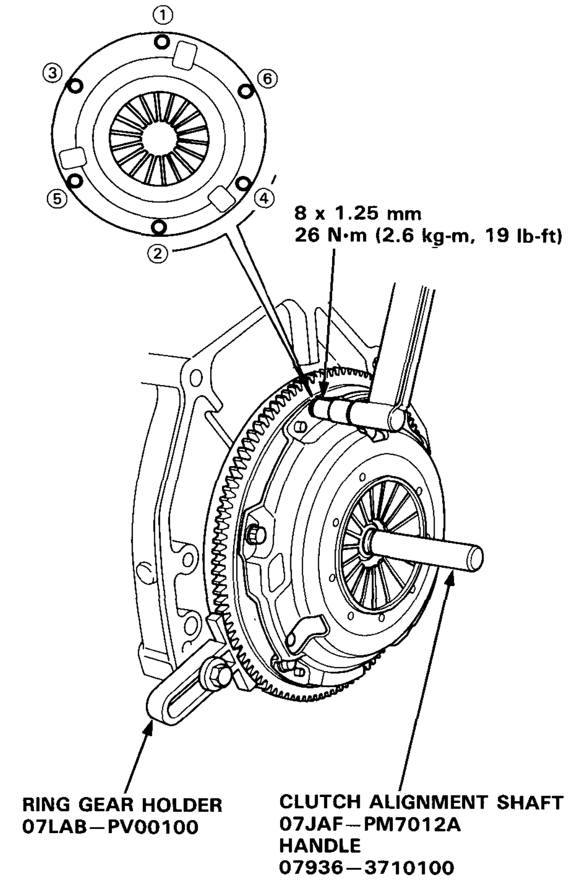


3. Install the pressure plate.

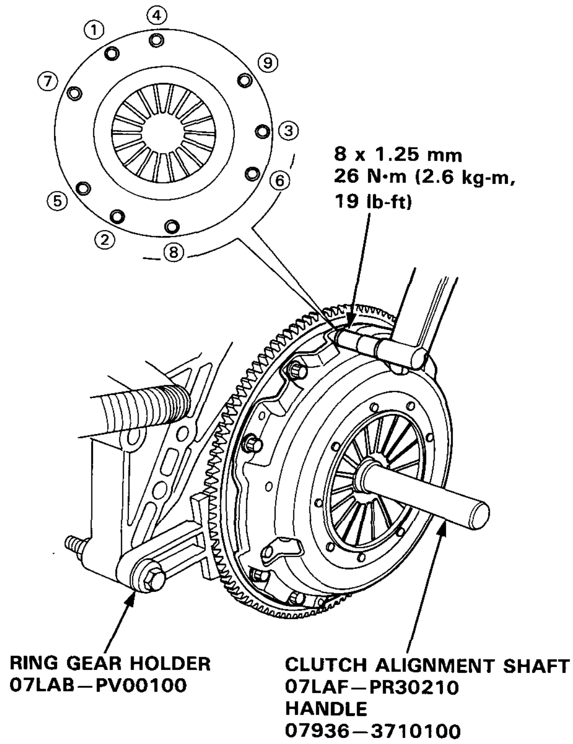


4. Torque the bolts in a criss-cross pattern as shown. Tighten them two turns at a time to prevent warping the diaphragm spring.

Except B16A2:



B16A2:

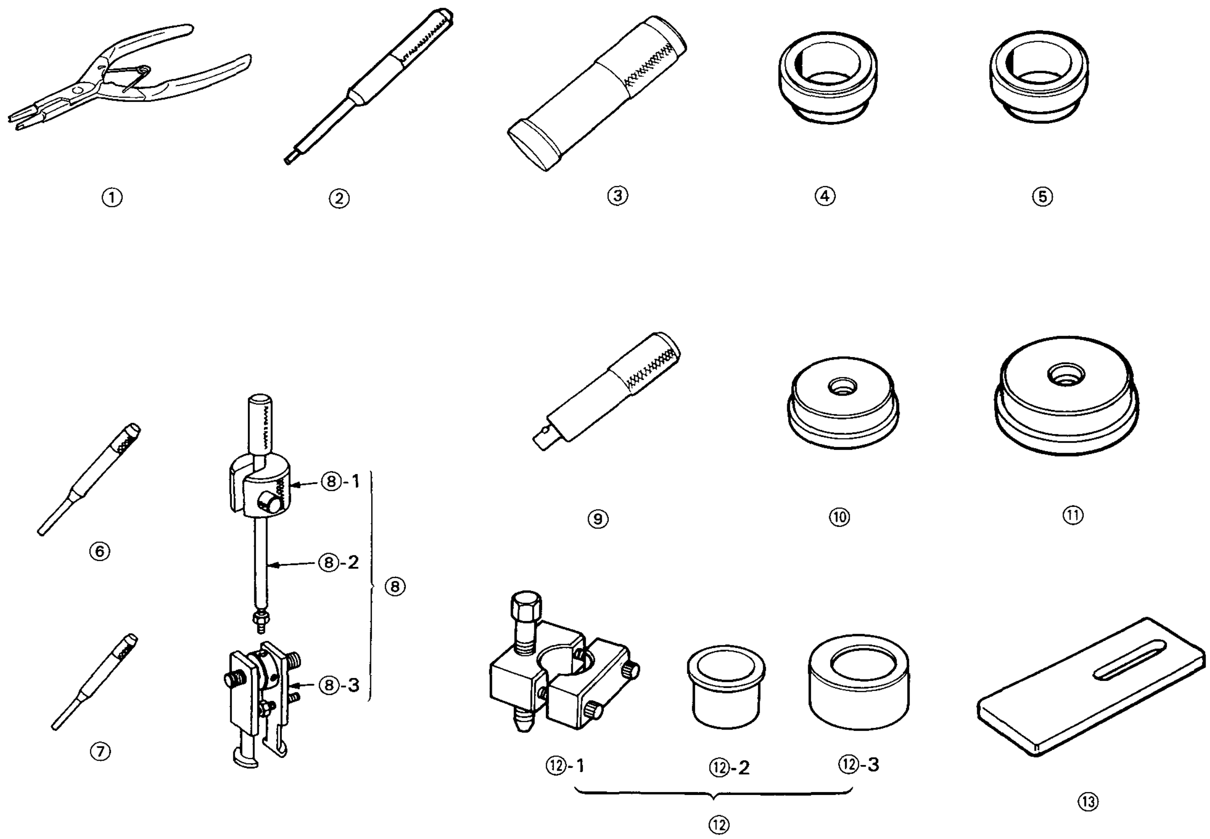


Manual Transmission

S20 Model Manual Transmission

Special Tools

Ref. No.	Tool Number	Description	Qty	Remarks
①	07744–0010600	Pin Driver, 8.0 mm	1	
②	07LGC–0010100	Snap Ring Plier	1	
③	07746–0030100	Inner Handle C	1	
④	07746–0030400	Inner Driver, 35 mm	1	
⑤	07746–0030300	Inner Driver, 30 mm	1	
⑥	07744–0010200	Pin Driver, 3.0 mm	1	
⑦	07744–0010400	Pin Driver, 5.0 mm	1	
⑧	07JAC–PH80000	Adjustable Bearing Remover Set	1	
⑧-1	07JAC–PH80100	Bearing Remover Attachment	(1)	Component Tools
⑧-2	07JAC–PH80200	Remover Handle Assembly	(1)	
⑧-3	07741–0010201	Remover Weight	(1)	
⑨	07749–0010000	Outer Handle A	1	
⑩	07746–0010300	Outer Driver, 42 x 47 mm	1	
⑪	07746–0010400	Outer Driver, 52 x 55 mm	1	
⑫	07GAJ–PG20102	Mainshaft Clearance Inspection Tool Set	1	
⑫-1	07GAJ–PG20110	Mainshaft Holder	(1)	Component Tools
⑫-2	07GAJ–PG20120	Collar	(1)	
⑫-3	07GAJ–PG20130	Mainshaft Base	(1)	
⑬	07979–PJ40001	Magnet Stand Base	1	

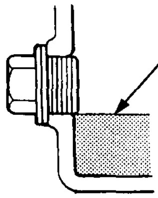


Maintenance

Transmission Oil

NOTE: Check the oil at operating temperature, engine OFF, and the car on level ground.

1. Remove the oil filler plug, then check the level and condition of the oil.



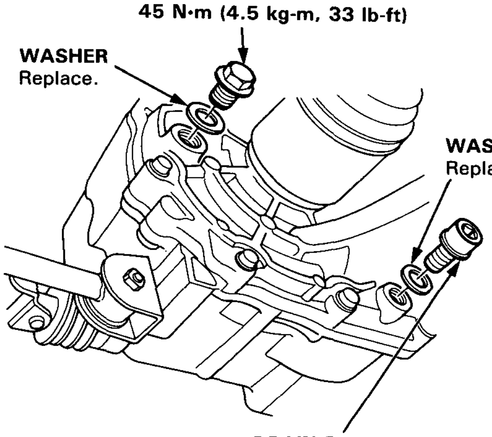
2. The oil level must be up to the filler hole. If it is below the hole, add oil until it runs out, then reinstall the oil filler plug.
3. If the oil is dirty, remove drain plug and drain transmission.
4. Reinstall the drain plug with a new washer, and refill to proper level.

   NOTE: The drain plug washer should be replaced at every oil change.

5. Reinstall the oil filler plug with a new washer.

   Oil Capacity
   1.8 ℓ (1.9 U.S. qt.) after drain.
   1.9 ℓ (2.0 U.S. qt.) after overhaul.

Use only SAE 10W—30 or 10W—40, SF or SG grade.

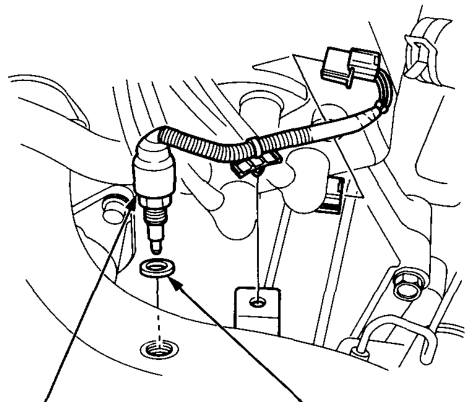


Back-up Light Switch

Replacement

NOTE: To check the switch, see section 23.

1. Disconnect the connector, then remove the switch connector from the connector clamp.
2. Remove the switch.
3. Install the new washer and switch.



Transmission Assembly

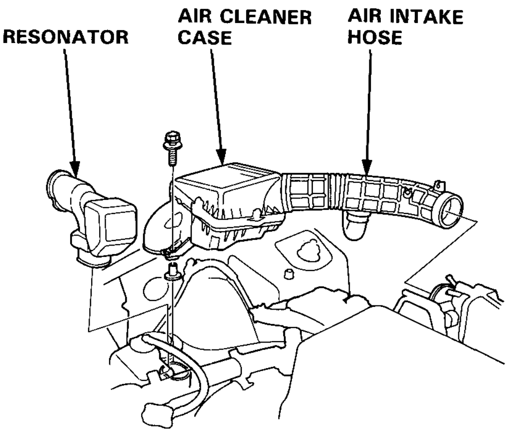
Removal

⚠ WARNING

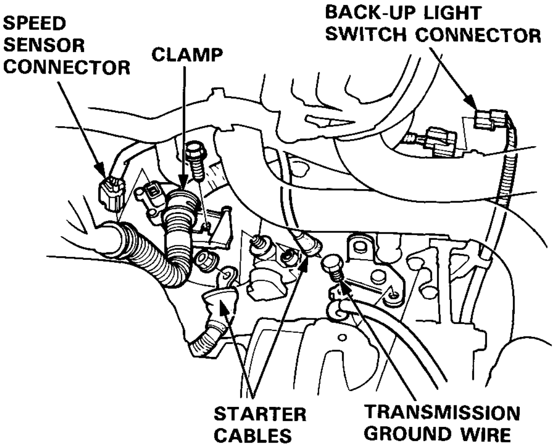
- **Make sure jacks and safety stands are placed properly, and hoist brackets are attached to correct position on the engine.**
- **Apply parking brake and block rear wheels so car will not roll off stands and fall on you while working under it.**

CAUTION: Use fender covers to avoid damaging painted surfaces.

1. Disconnect the battery negative (−) and positive (+) cables from the battery.
2. Remove the resonator, air intake hose, and air cleaner case.

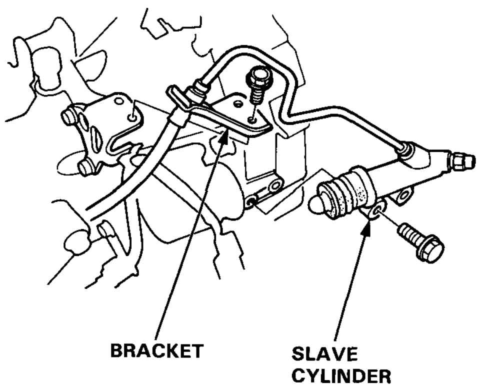


3. Disconnect the starter cables and transmission ground wire.
4. Remove the engine wire harness clamp.
5. Disconnect the back-up light switch and speed sensor connectors.

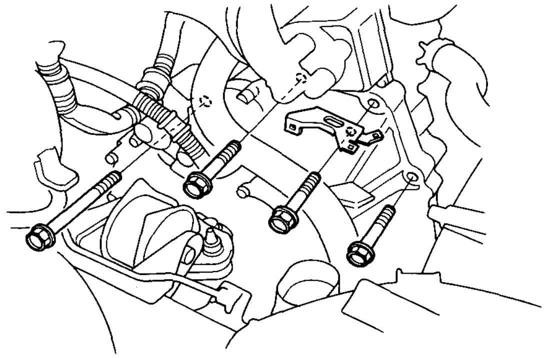


6. Remove the clutch pipe bracket and slave cylinder.

NOTE: Do not operate the clutch pedal once the slave cylinder has been removed.

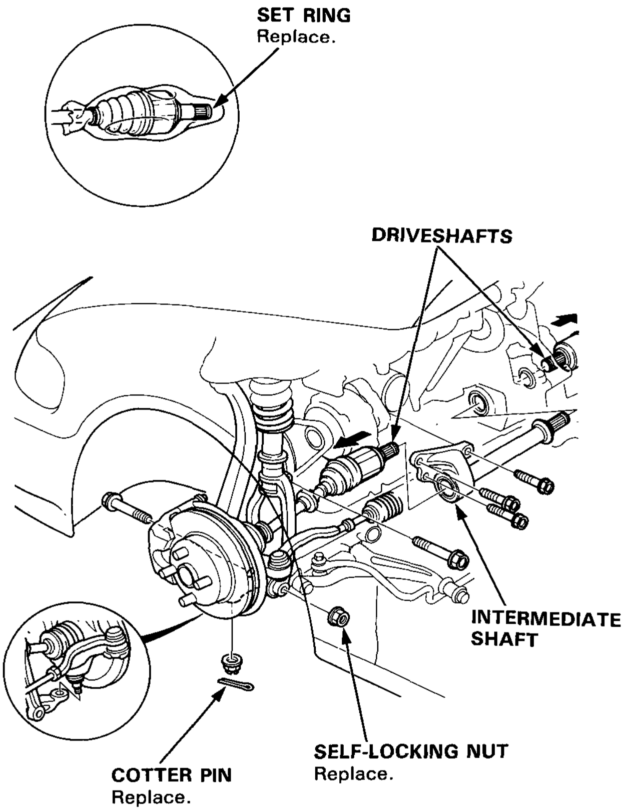


7. Remove the transmission housing bolts.

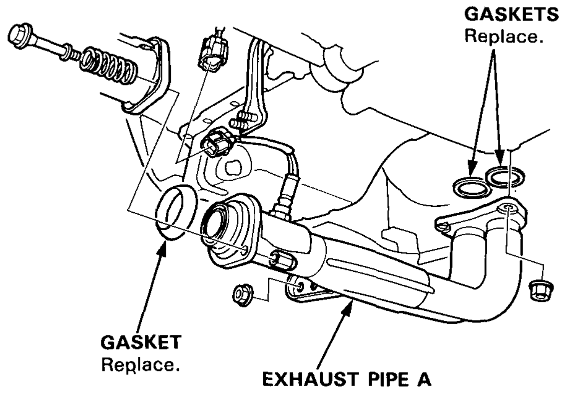


8. Remove the driveshafts and intermediate shaft (see section 16).

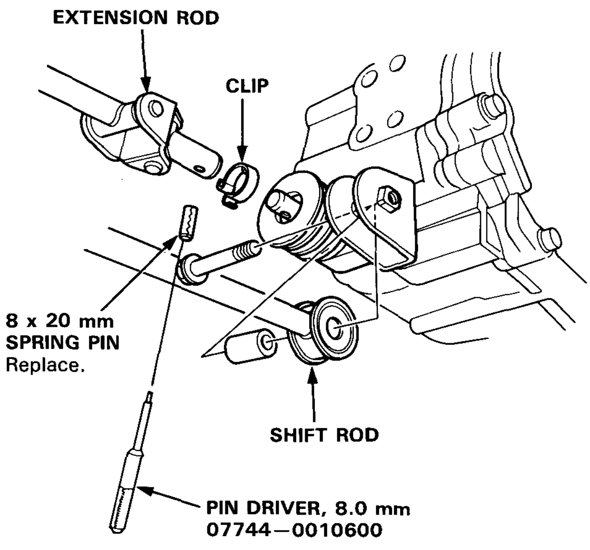
NOTE: Coat all precision finished surfaces with clean engine oil or grease. Tie plastic bags over the driveshaft ends.



9. Remove exhaust pipe A.



10. Remove the shift rod and extension rod.

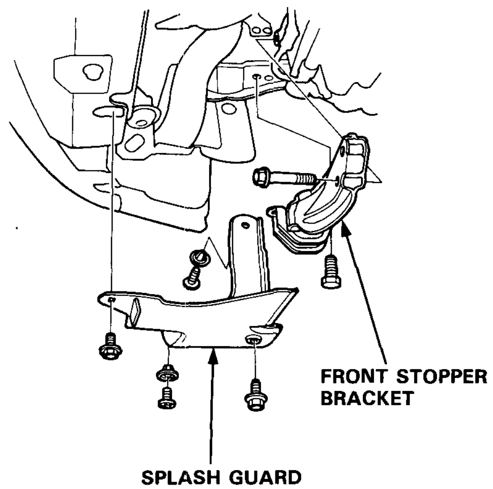


(cont'd)

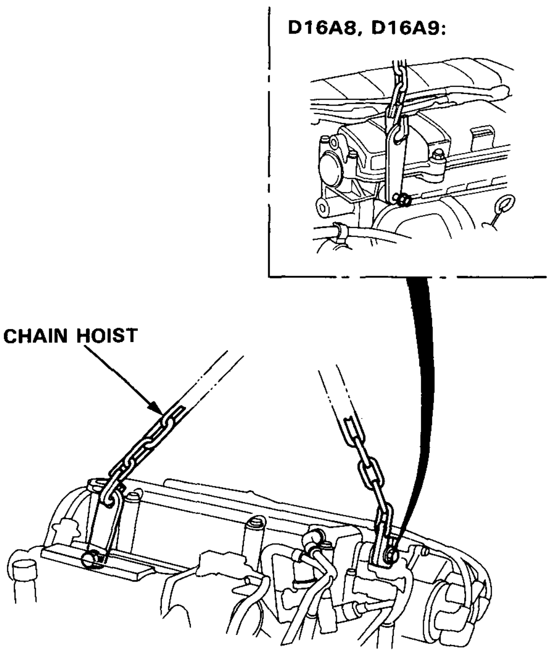
Transmission Assembly

Removal (cont'd)

11. Remove the splash guard and front stopper bracket.

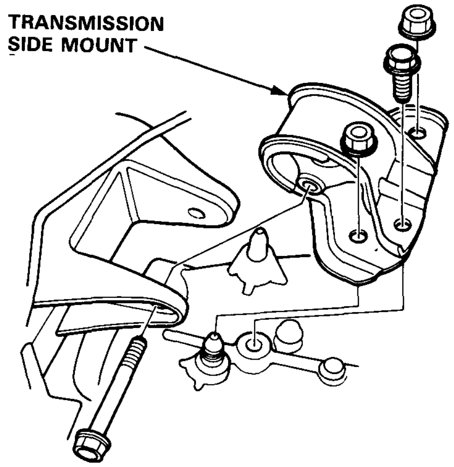


12. Install the bolts in the cylinder head and attach a chain hoist to the bolts, then lift the engine slightly to unload the mounts.

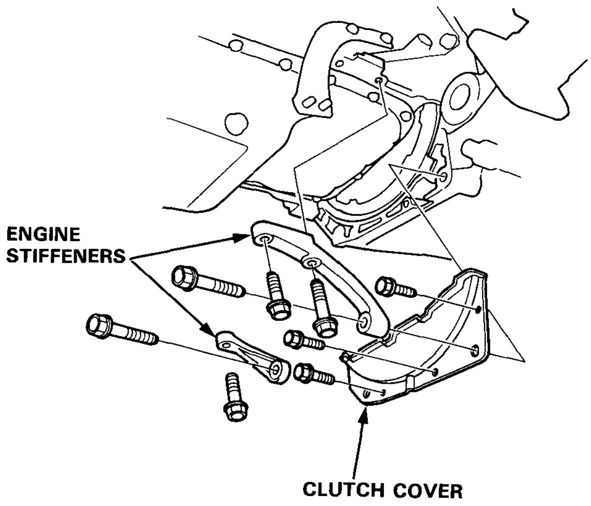


13. Place a jack under the transmission.

14. Remove the transmission side mount.

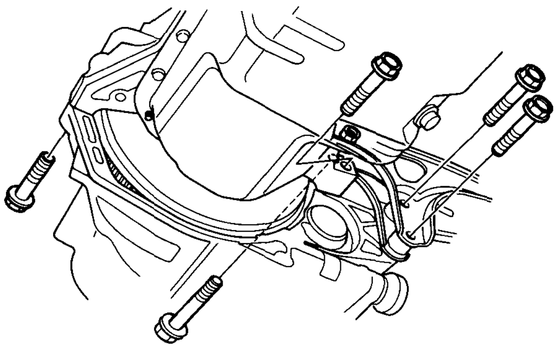


15. Remove engine stifferers and the clutch cover.



16. Remove the transmission rear mount bolts and transmission housing bolts.

17. Pull the transmission away from the engine until it clears the mainshaft.

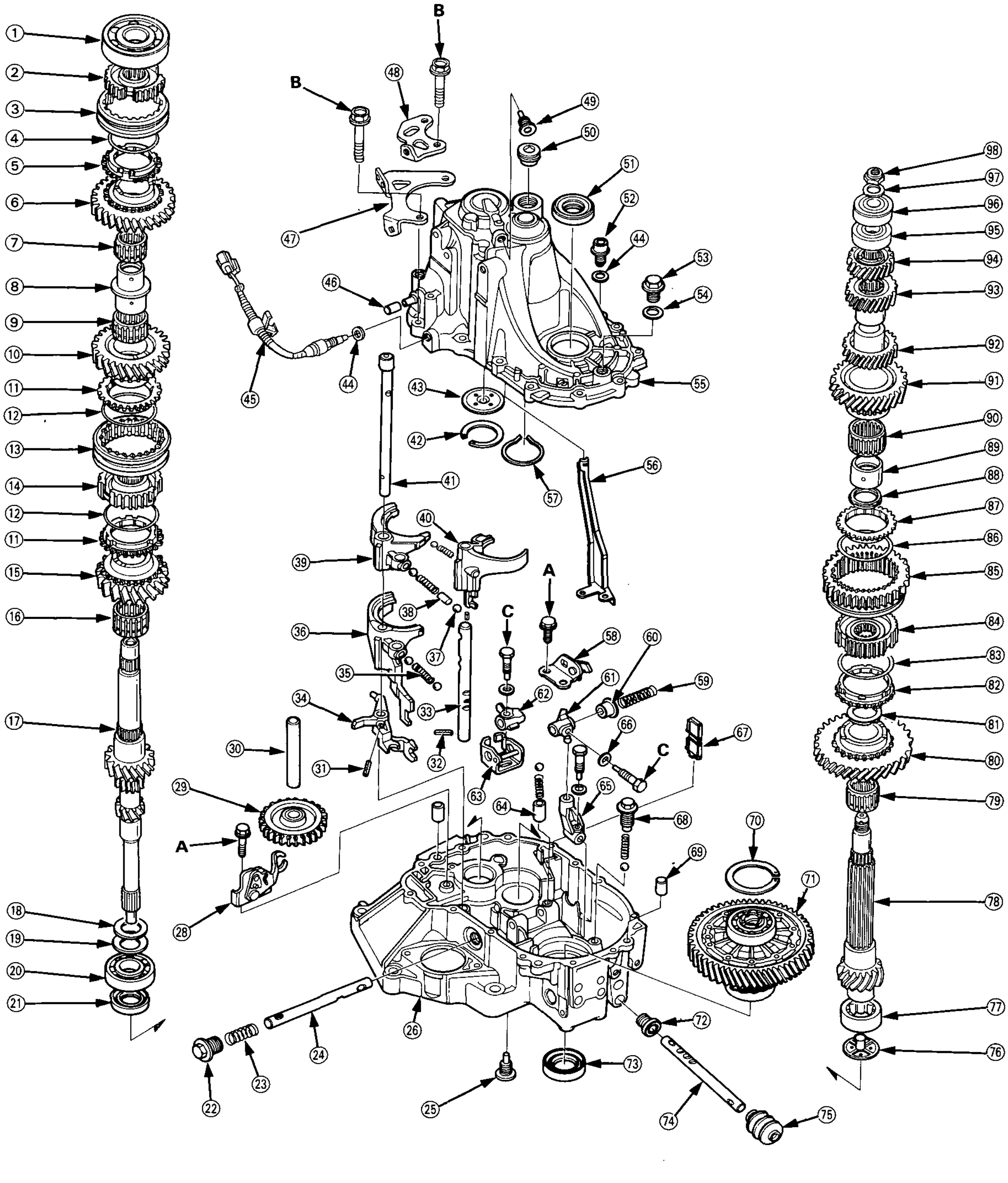


Illustrated Index

Refer to the drawing below for the transmission disassembly/reassembly.
Clean all parts thoroughly in solvent and dry with compressed air.

Lubricate all parts with oil before reassembly.

NOTE: This transmission uses no gaskets between the major housings; use P/N 08718—0001 sealant. Assemble the housings within 20 minutes after applying the sealant and allow it to cure at least 30 minutes after assembly before filling the transmission with oil.



NOTE: Always clean the magnet (67) whenever the transmission housing is disassembled.

Torque Value
A - 15 N•m (1.5 kg-m, 11 lb-ft) B - 28 N•m (2.8 kg-m, 21 lb-ft) C - 32 N•m (3.2 kg-m, 23 lb-ft)

(1) **BALL BEARING**
(2) **5TH SYNCHRO HUB**
(3) **5TH SYNCHRO SLEEVE**
(4) **SYNCHRO SPRING**
(5) **SYNCHRO RING**
(6) **5TH GEAR**
(7) **32 x 37 x 23.5 mm NEEDLE BEARING**
(8) **SPACER COLLAR**
(9) **34 x 39 x 23 mm NEEDLE BEARING**
(10) **4TH GEAR**
(11) **SYNCHRO RING**
(12) **SYNCHRO SPRING**
(13) **3RD/4TH SYNCHRO SLEEVE**
(14) **3RD/4TH SYNCHRO HUB**
(15) **3RD GEAR**
(16) **34 x 39 x 27.5 mm NEEDLE BEARING**
(17) **MAINSHAFT**
(18) **WASHER**
(19) **SPRING WASHER**
(20) **BALL BEARING**
(21) **26 x 42 x 7 mm OIL SEAL** Replace.
(22) **28 mm PLUG BOLT** **55 N•m (5.5 kg-m, 40 lb-ft)**
(23) **1ST/2ND SELECT SPRING**
(24) **SHIFT ARM SHAFT**
(25) **INTERLOCK GUIDE BOLT** **40 N•m (4.0 kg-m, 29 lb-ft)**
(26) **CLUTCH HOUSING**
(27)
(28) **REVERSE SHIFT HOLDER**
(29) **REVERSE IDLER GEAR**
(30) **REVERSE IDLER GEAR SHAFT**
(31) **5 x 22 mm SPRING PIN** Replace.
(32) **3 x 12 mm SPRING PIN** Replace.
(33) **1ST/2ND SHIFT FORK SHAFT**
(34) **5TH/REVERSE SHIFT PIECE**
(35) **SPRING**
(36) **3RD/4TH SHIFT FORK**
(37) **STEEL BALL**
(38) **5 x 10 mm ROLLER**
(39) **5TH SHIFT FORK**
(40) **1ST/2ND SHIFT FORK**
(41) **5TH/REVERSE SHIFT FORK SHAFT**
(42) **65 mm THRUST SHIM (*1)** **70 mm THRUST SHIM (*2)** **Selection, page 13-28**
(43) **OIL GUIDE PLATE**
(44) **WASHER** Replace.
(45) **BACK-UP LIGHT SWITCH** **25 N•m (2.5 kg-m, 18 lb-ft)**
(46) **BREATHER CAP**
(47) **RELEASE PIPE STAY**
(48) **TRANSMISSION HANGER B**
(49) **10 mm SEALING BOLT** **10 N•m (1.0 kg-m, 8 lb-ft)**
(50) **32 mm SEALING BOLT** **25 N•m (2.5 kg-m, 18 lb-ft)**
(51) **35 x 62 x 8 mm OIL SEAL (*3)** **40 x 62 x 9 mm OIL SEAL (*4)** Replace.
(52) **OIL DRAIN PLUG** **40 N•m (4.0 kg-m, 29 lb-ft)**
(53) **OIL FILLER PLUG** **45 N•m (4.5 kg-m, 33 lb-ft)**
(54) **WASHER** Replace.
(55) **TRANSMISSION HOUSING**
(56) **OIL GUTTER PLATE**
(57) **52 mm SNAP RING**
(58) **REVERSE LOCK CAM**
(59) **REVERSE SELECT SPRING**
(60) **REVERSE SELECT RETAINER**
(61) **SHIFT ARM C**
(62) **SHIFT ARM B**
(63) **INTERLOCK**
(64) **COLLAR**
(65) **SHIFT ARM A**
(66) **SPRING WASHER**
(67) **MAGNET**
(68) **SET BALL SPRING BOLT** **22 N•m (2.2 kg-m, 16 lb-ft)**
(69) **14 x 20 mm DOWEL PIN**
(70) **72 mm THRUST SHIM (*1)** **80 mm THRUST SHIM (*2)** Selection, See section 15
(71) **DIFFERENTIAL ASSEMBLY** See section 15
(72) **14 x 25 x 17.5 mm OIL SEAL** Replace.
(73) **35 x 56 x 8 mm OIL SEAL** Replace.
(74) **SHIFT ROD**
(75) **BOOT**
(76) **OIL GUIDE PLATE**
(77) **30 x 47 x 21 mm NEEDLE BEARING (*1)** **30 x 55 x 21 mm NEEDLE BEARING (*2)**
(78) **COUNTERSHAFT**
(79) **36 x 41 x 25.5 mm NEEDLE BEARING**
(80) **1ST GEAR**
(81) **FRICTION DAMPER**
(82) **SYNCHRO RING**
(83) **SYNCHRO SPRING**
(84) **1ST/2ND SYNCHRO HUB**
(85) **REVERSE GEAR**
(86) **SYNCHRO SPRING**
(87) **SYNCHRO RING**
(88) **FRICTION DAMPER**
(89) **DISTANCE COLLAR**
(90) **39 x 44 x 27 mm NEEDLE BEARING**
(91) **2ND GEAR**
(92) **3RD GEAR**
(93) **4TH GEAR**
(94) **5TH GEAR**
(95) **BALL BEARING (*1)** **NEEDLE BEARING (*2)**
(96) **BALL BEARING**
(97) **SPRING WASHER**
(98) **LOCKNUT** **110→0→110 N•m (11.0→0→11.0 kg-m, 80→0→80 lb-ft)**

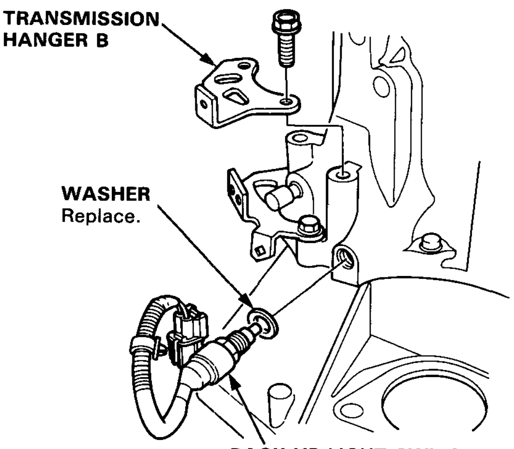
*1: Except D16Z6, D16Z7, D16A7, D16A8, D16A9
*2: D16Z6, D16Z7, D16A7, D16A8, D16A9
*3: Except D16A8, D16A9
*4: D16A8, D16A9

Transmission Housing

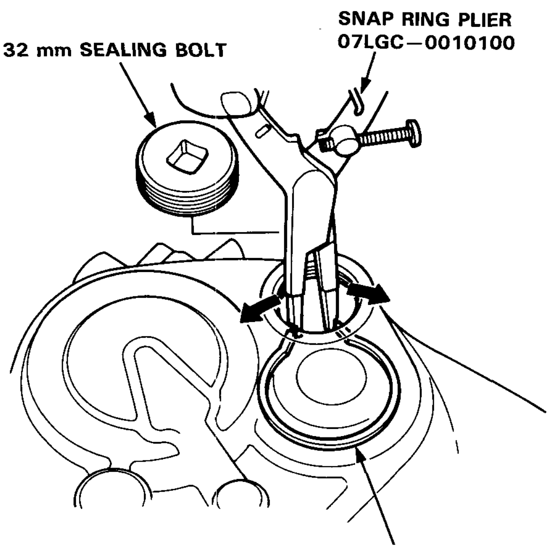
Removal

NOTE: Place the clutch housing on two pieces of wood thick enough to keep the mainshaft from the hitting the workbench.

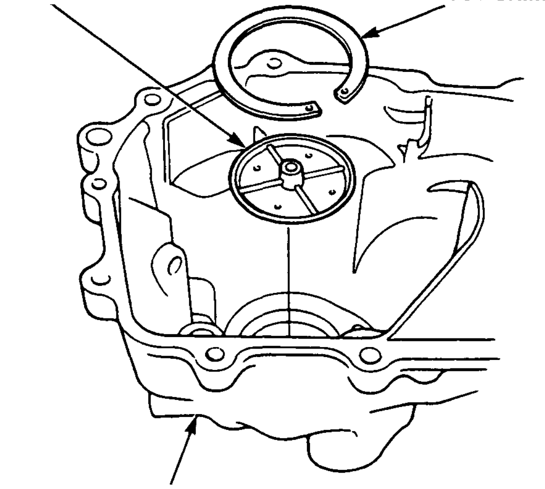
1. Remove the back-up light switch.
2. Remove the transmission hanger B.
3. Remove the transmission attaching bolts.



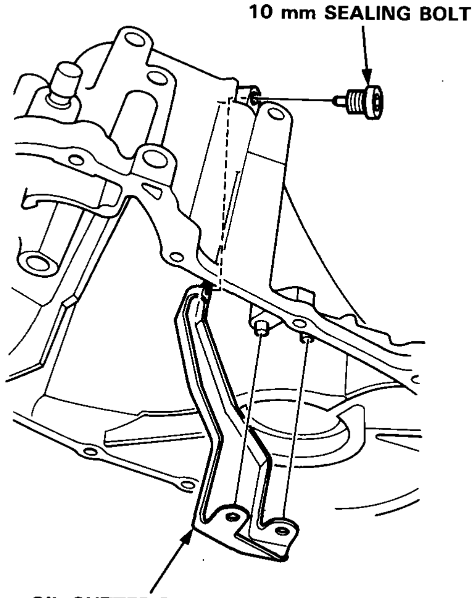
4. Remove the 32 mm sealing bolt.
5. Expand the snap ring on the countershaft ball bearing and remove it from the groove using a pair of snap ring pliers.



6. Separate the transmission housing from the clutch housing and wipe it clean of the sealant.
7. Remove the thrust shim and oil guide plate from the transmission housing.



8. Remove the 10 mm sealing bolt and oil gutter plate.

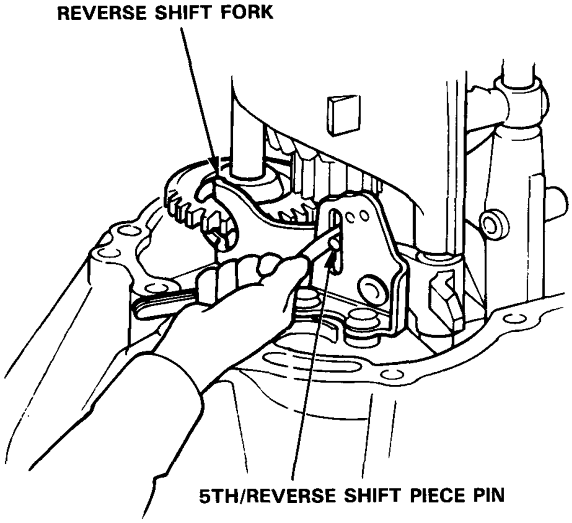


Reverse Shift Fork

Clearance Inspection

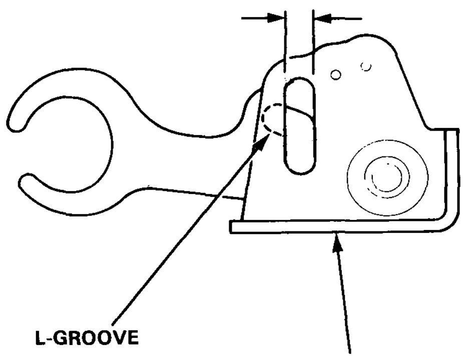
1. Measure the clearance between the reverse shift fork and shift piece pin.

Standard: 0.05—0.35 mm (0.002—0.014 in)
Service Limit: 0.5 mm (0.020 in)



2. If the clearance exceeds the service limit, measure the width of the groove in the reverse shift fork.

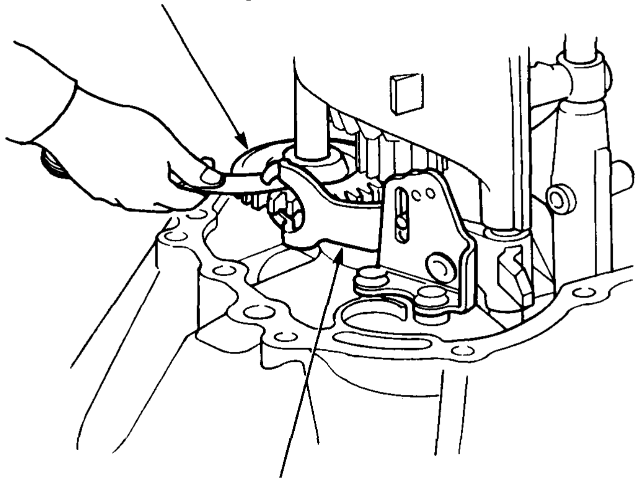
Standard: 7.05—7.25 mm (0.278—0.285 in)



If the width of the groove exceeds the standard, replace the reverse shift fork with a new one.
If the width of the groove is within the standard, replace the 5th/reverse shift piece with a new one.

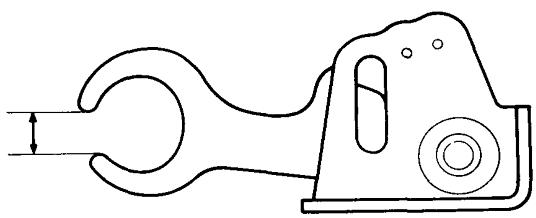
3. Measure the clearance between the reverse idler gear and reverse shift fork.

Standard: 0.5—1.0 mm (0.020—0.043 in)
Service Limit: 1.8 mm (0.071 in)



4. If the clearance exceeds the service limit, measure the width of the reverse shift fork pawl groove.

Standard: 12.7—13.0 mm (0.500—0.512 in)

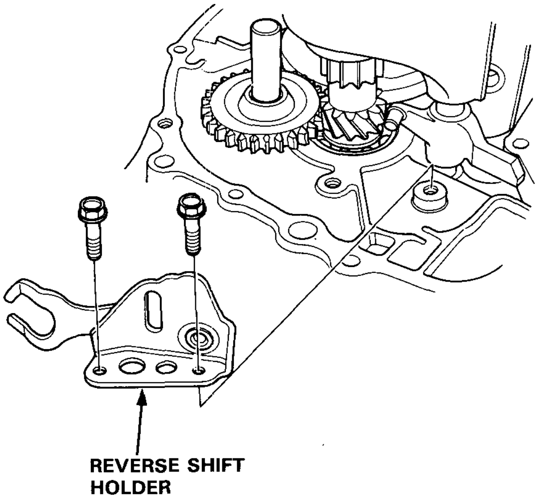


If the width exceeds the standard, replace the reverse shift arm with a new one.
If the width is within the standard, replace the reverse shift fork with a new one.

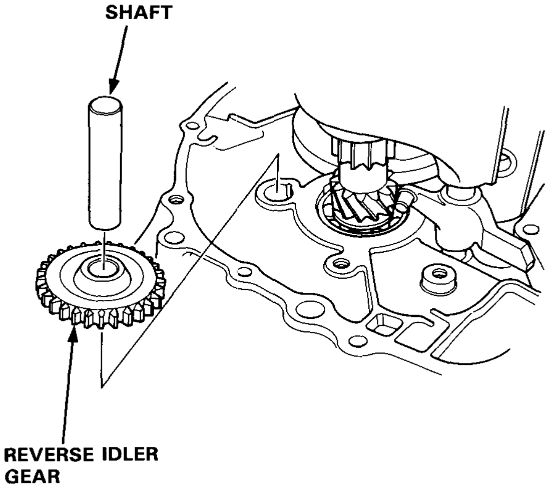
Reverse Idler Gear

Removal

1. Remove the reverse shift holder.



2. Remove the reverse idler gear shaft and gear.

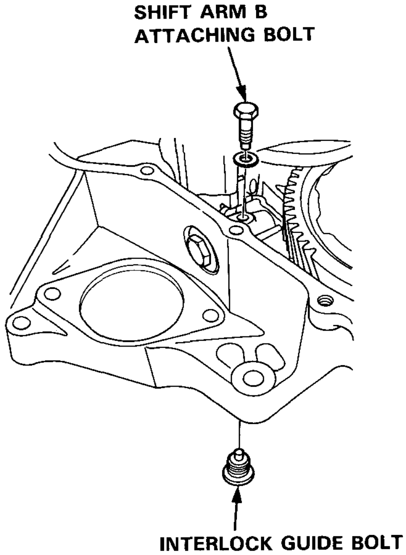


Mainshaft, Countershaft, Shift Fork

Disassembly

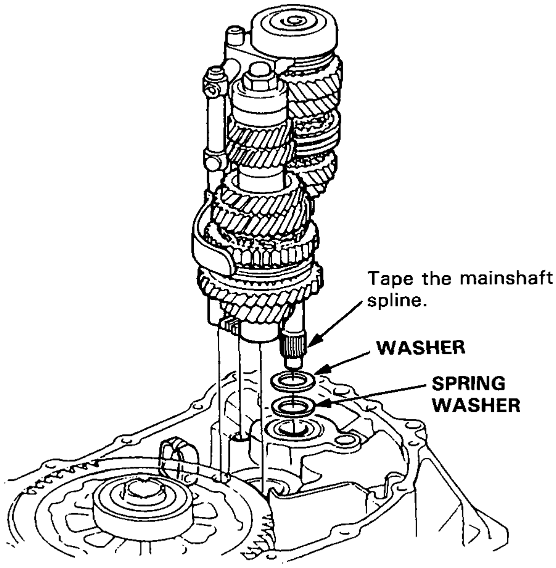
1. Remove the interlock guide bolt from under the clutch housing

2. Remove the shift arm B attaching bolt.



3. Remove the mainshaft and countershaft assemblies with the shift fork from the clutch housing.

   NOTE: Before removing the mainshaft and countershaft assemblies, tape the mainshaft spline to protect it.

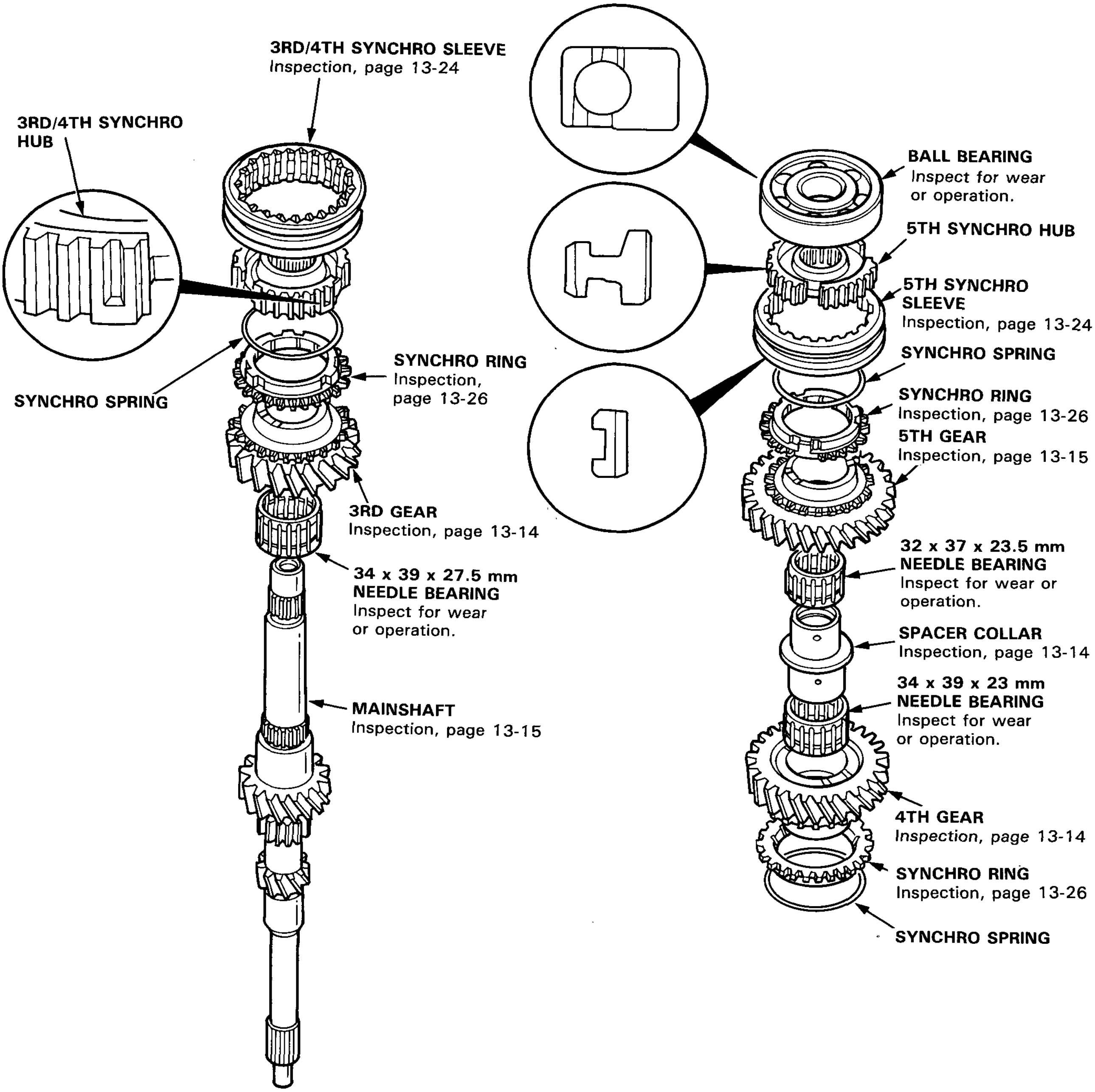


Mainshaft Assembly

Index

NOTE: The 3rd/4th and 5th synchro hubs are installed with a press.

Prior to reassembling, clean all the parts in solvent, dry them and apply lubricant to any contact surfaces.



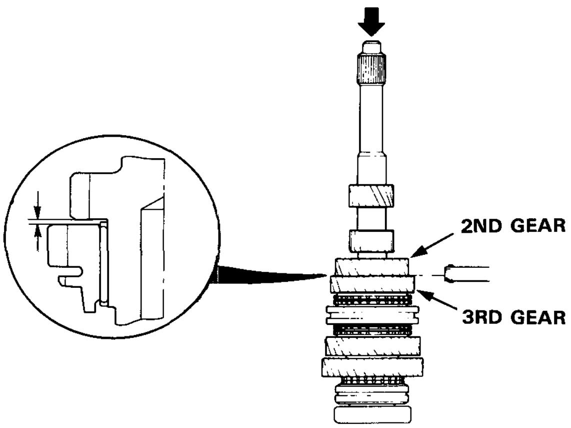
Mainshaft Assembly

Clearance Inspection

NOTE: If replacement is required, always replace the synchro sleeve and hub as a set.

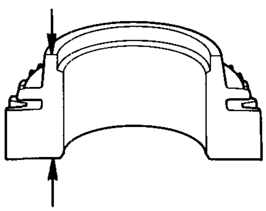
1. Measure the clearance between 2nd and 3rd gears.

   Standard: **0.06—0.21 mm (0.002—0.008 in)**
   Service Limit: **0.33 mm (0.013 in)**



2. If the clearance exceeds the service limit, measure the thickness of 3rd gear.

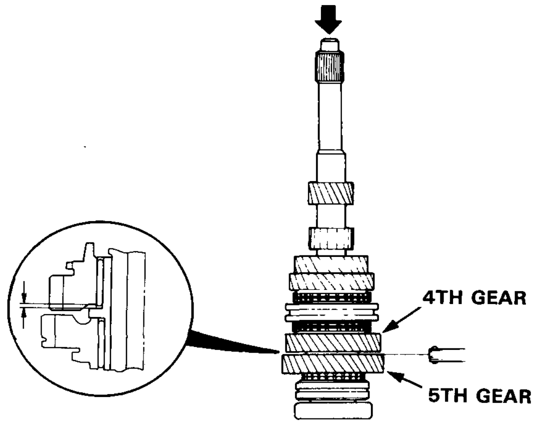
   Standard: **30.22—30.27 mm (1.190—1.192 in)**
   Service Limit: **30.15 mm (1.187 in)**



If the thickness of 3rd gear is less than the service limit, replace 3rd gear with a new one.
If the thickness of 3rd gear is within the service limit, replace the 3rd/4th synchro hub with a new one.

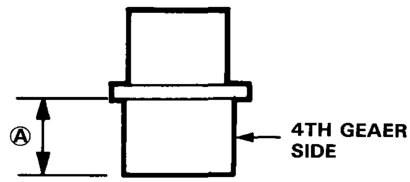
3. Measure the clearance between 4th gear and the spacer collar.

   Standard: **0.06—0.19 mm (0.002—0.004 in)**
   Service Limit: **0.31 mm (0.012 in)**



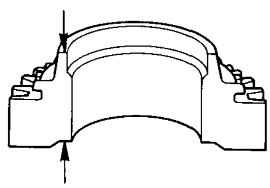
4. If the clearance exceeds the service limit, measure distance Ⓐ on the spacer collar.

   Standard: **22.83—22.86 mm (0.899—0.900 in)**
   Service Limit: **22.81 mm (0.898 in)**



5. If distance Ⓐ is more than the service limit, replace the spacer collar with a new one.
   If distance Ⓐ is within the service limit, measure the thickness of 4th gear.

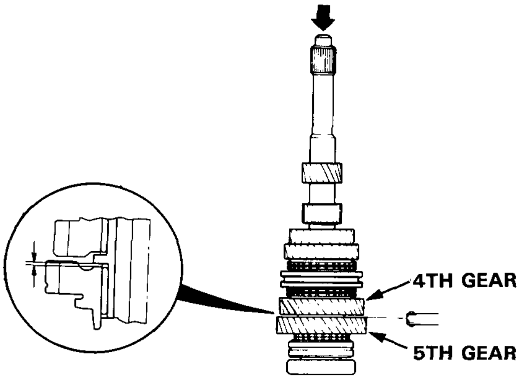
   Standard: **30.12—30.17 mm (1.186—1.188 in)**
   Service limit: **30.05 mm (1.183 in)**



If the thickness of 4th gear is less than the service limit, replace 4th gear with a new one.
If the thickness of 4th gear is within the service limit, replace the 3rd/4th synchro hub with a new one.

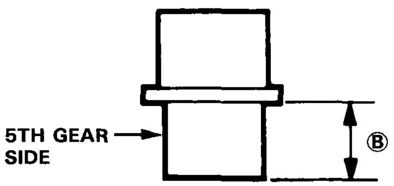
6. Measure the clearance between the spacer collar and 5th gear.

Standard: 0.06–0.19 mm (0.002–0.004 in)
Service limit: 0.31 mm (0.012 in)



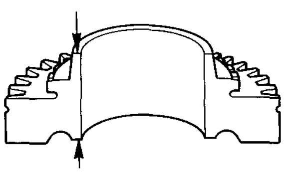
7. If the clearance exceeds the service limit, measure distance Ⓑ on the spacer collar.

Standard: 23.53–23.56 mm (0.926–0.928 in)
Service Limit: 23.51 mm (0.926 in)



8. If distance Ⓑ is more than service limit, replace the spacer collar with a new one.
If distance Ⓑ is within the service limit, measure thickness of 5th gear.

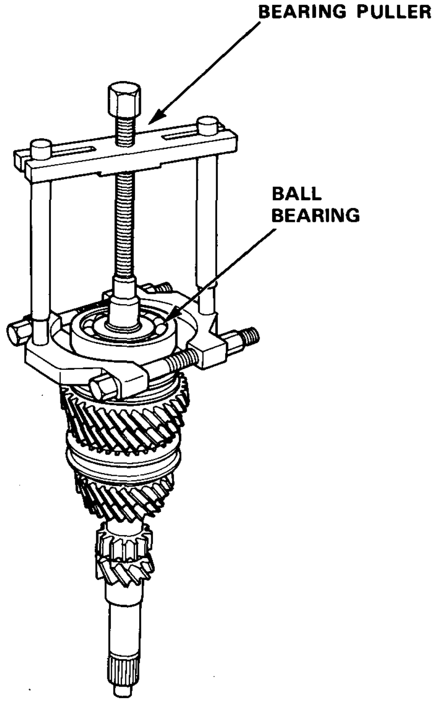
Standard: 28.42–28.47 mm (1.119–1.121 in)
Service Limit: 28.35 mm (1.116 in)



If the thickness of 5th gear is less than the service limit, replace 5th gear with a new one.
If the thickness of 5th gear is within the service limit, replace the 5th synchro hub with a new one.

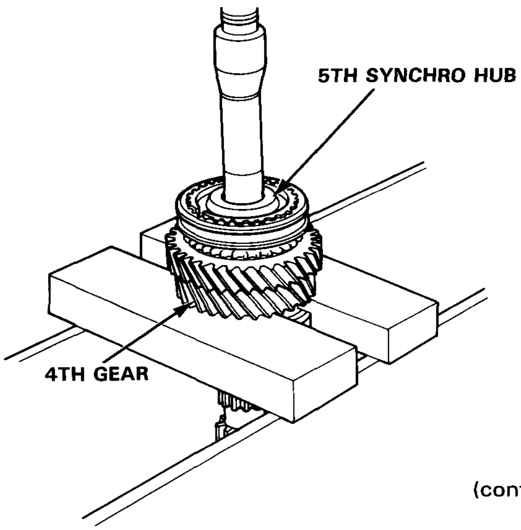
Disassembly

1. Remove the ball bearing using a bearing puller as shown.



CAUTION: Remove the synchro hubs using a press and steel blocks as shown. Use of a jaw-type puller can cause damage to the gear teeth.

2. Support 4th gear on steel blocks as shown and press the shaft out of the 5th synchro hub.

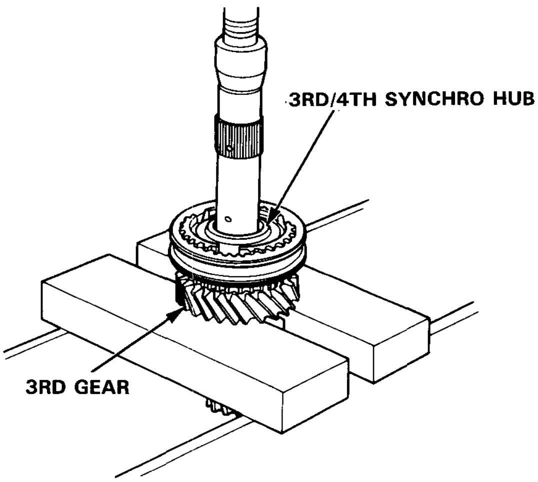


(cont'd)

Mainshaft Assembly

Disassembly (cont'd)

3. In the same manner as above, support the 3rd gear on steel blocks and press the shaft out of the 3rd/4th synchro hub.

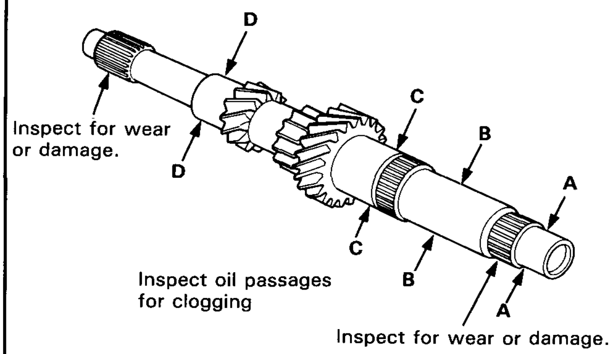


Inspection

1. Inspect the gear surface and bearing surface for wear or damage, then measure the mainshaft at points A, B, C and D.

Standard:
A: 21.987–22.000 mm (0.8656–0.8661 in)
B: 26.980–26.993 mm (1.0622–1.0627 in)
C: 33.984–34.000 mm (1.3380–1.3386 in)
D: 25.977–25.990 mm (1.0227–1.0232 in)

Service Limit:
A: 21.93 mm (0.8634 in)
B: 26.93 mm (1.0602 in)
C: 33.93 mm (1.3358 in)
D: 25.92 mm (1.0205 in)

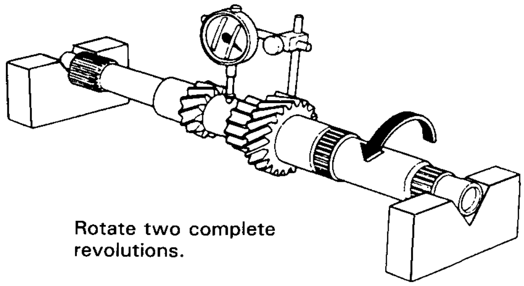


If any part of the mainshaft is less then the service limit, replace it with a new one.

2. Inspect for runout.

Standard: 0.02 mm (0.001 in) min.
Service Limit: 0.05 mm (0.002 in)

NOTE: Support the mainshaft at both ends as shown.



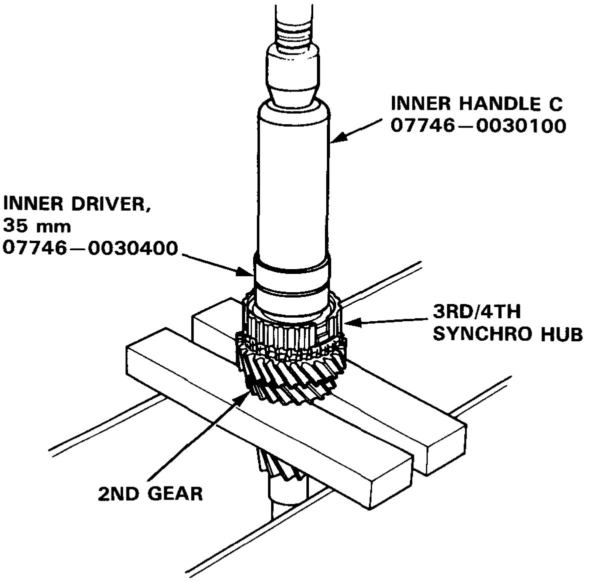
If the runout exceeds the service limit, replace the mainshaft with a new one.

Reassembly

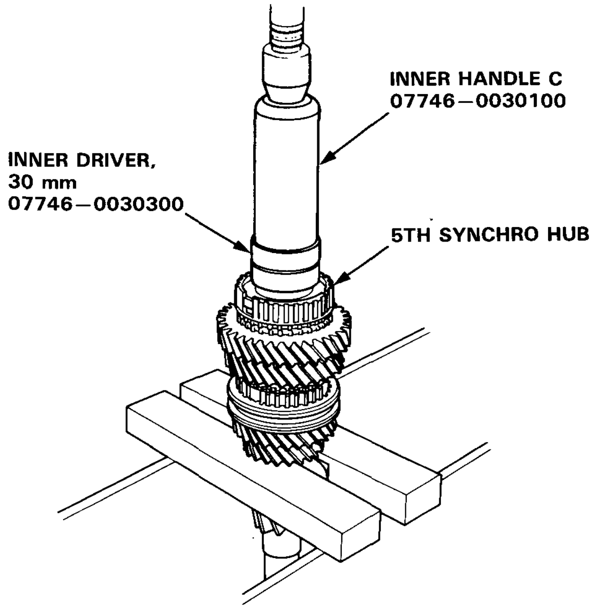
CAUTION: When installing the 3rd/4th and 5th synchro hubs, support the shaft on the steel blocks and install synchro hubs using a press.

1. Support 2nd gear on steel blocks as shown, then install the 3rd/4th synchro hub using a press.

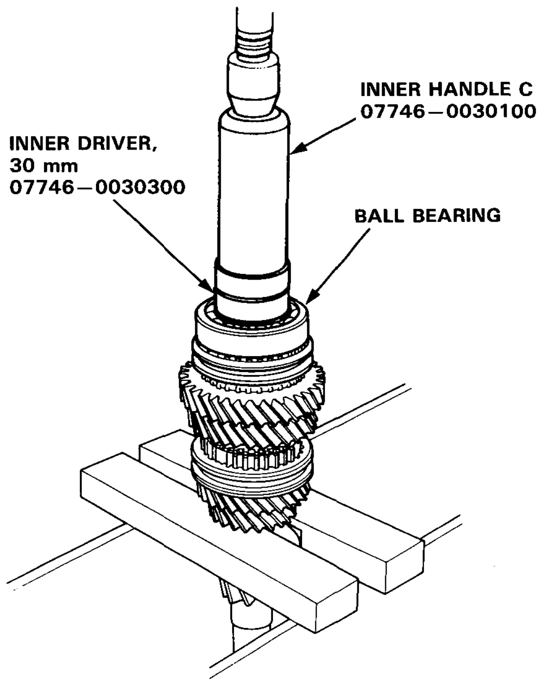
   NOTE: After installation, inspect the operation of the 3rd/4th synchro hub set.



2. Install the 5th synchro hub using a press as shown.



3. Install the ball bearing using a press as shown.

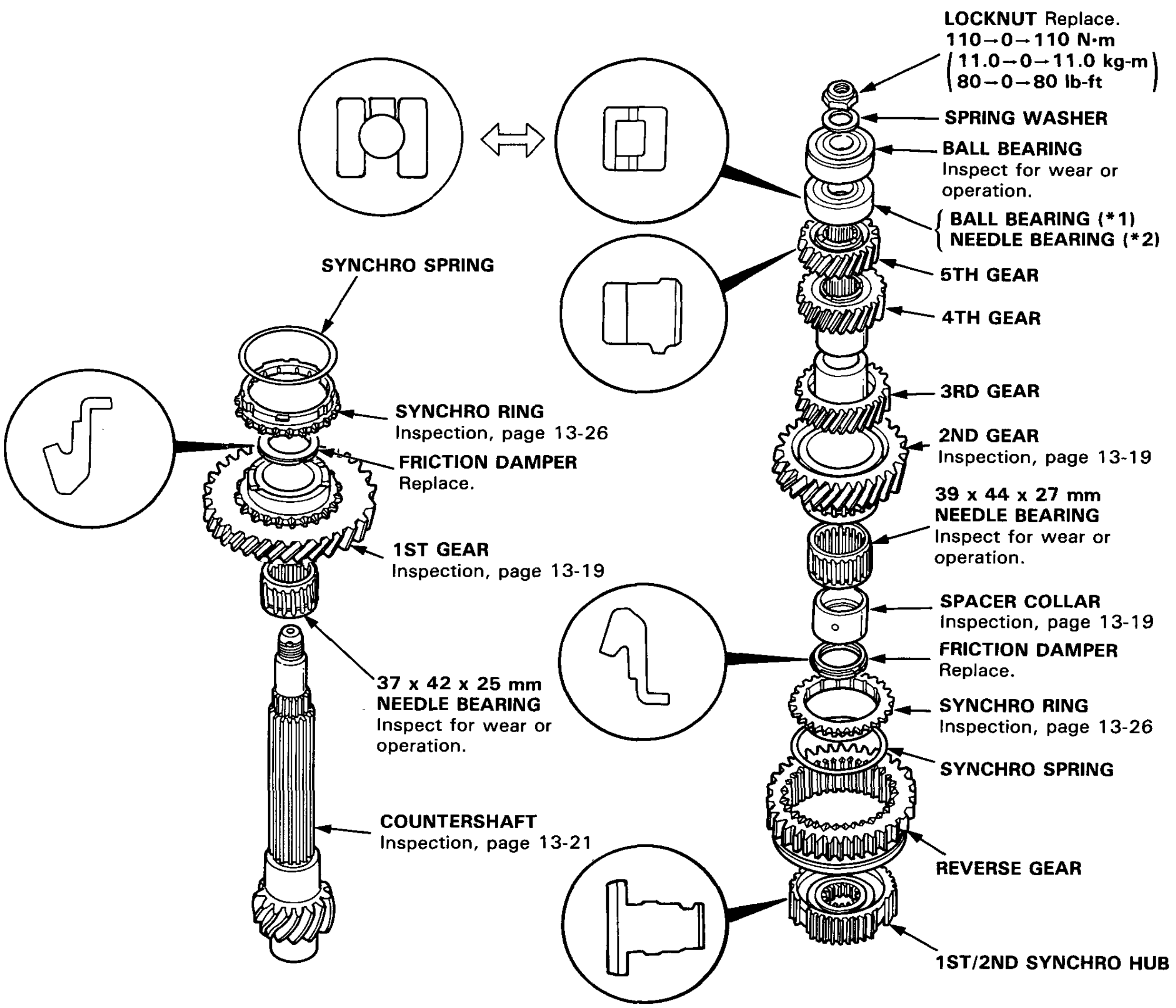


Countershaft Assembly

Index

NOTE: The 3rd, 4th and 5th gears are installed with a press.

Prior to reassembling, clean all the parts in solvent, dry them and apply lubricant to any contact surfaces. The 3rd, 4th and 5th gears, should be installed without lubrication using a press.



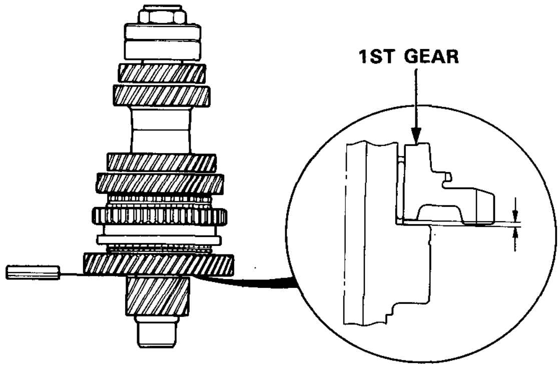
*1: Except D16Z6, D16Z7, D16A7, D16A8, D16A9
*2: D16Z6, D16Z7, D16A7, D16A8, D16A9

Clearance Inspection

NOTE: If replacement is required, always replace the synchro sleeve and hub as a set.

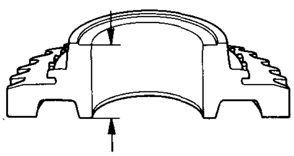
1. Measure the clearance between countershaft and 1st gear.

   Standard: 0.03–0.10 mm (0.001–0.004 in)
   Service Limit: 0.22 mm (0.009 in)



2. If the clearance exceeds the service limit, measure the thickness of 1st gear.

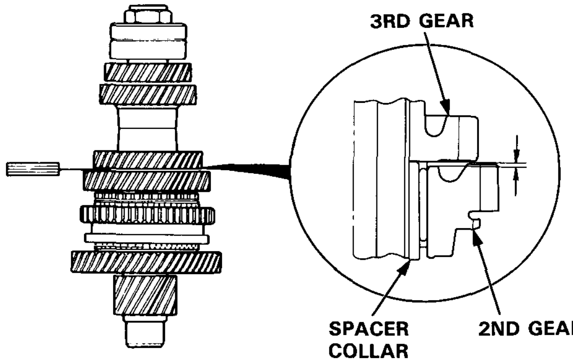
   Standard: 30.41–30.44 mm (1.197–1.198 in)
   Service Limit: 30.36 mm (1.195 in)



If the thickness of 1st gear is less than the service limit, replace 1st gear with a new one.
If the thickness of 1st gear is within the service limit, replace the 1st/2nd synchro hub with a new one.

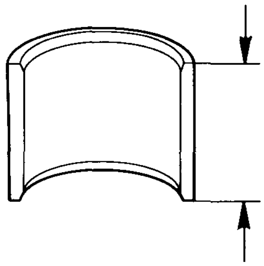
3. Measure the clearance between 2nd and 3rd gears.

   Standard: 0.03–0.11 mm (0.001–0.004 in)
   Service Limit: 0.23 mm (0.009 in)



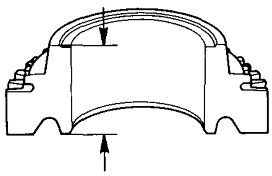
4. If the clearance exceeds the service limit, measure distance Ⓐ on the spacer collar.

   Standard: 32.03–32.06 mm (1.261–1.262 in)
   Service Limit: 32.01 mm (1.260 in)



5. If distance Ⓐ is more than the service limit, replace the spacer collar with a new one.
   If distance Ⓐ is within the service limit, measure the thickness of 2nd gear.

   Standard: 31.92–31.97 mm (1.257–1.259 in)
   Service Limit: 31.85 mm (1.254 in)



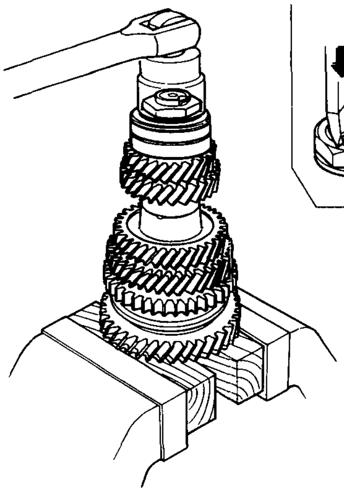
If the thickness of 2nd gear is less than the service limit, replace 2nd gear with a new one.
If the thickness of 2nd gear is within the service limit, replace the spacer collar with a new one.

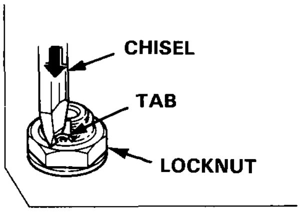
Countershaft Assembly

Disassembly

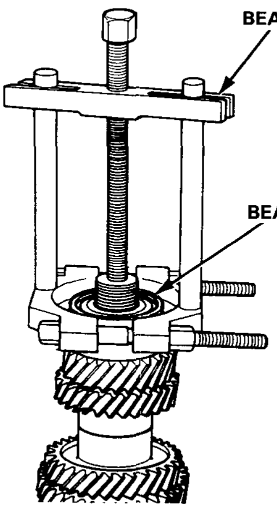
CAUTION: Remove the gears using a press and steel blocks as shown. Use of a jaw-type puller can damage the gear teeth.

1. Raise the locknut tab from the groove of the shaft and remove the locknut and the spring washer.

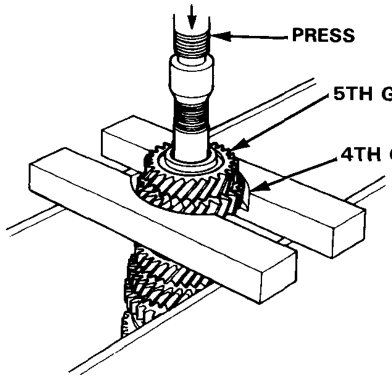




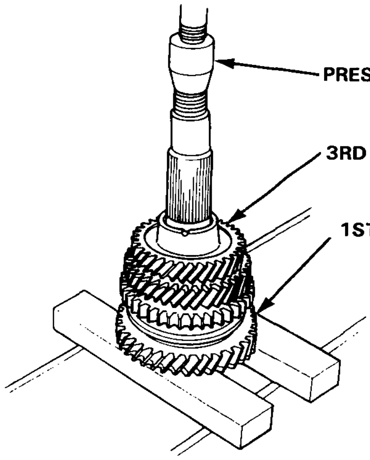
2. Remove the bearings using a bearing puller as shown.



3. Support 4th gear on steel blocks as shown and press the shaft out of 5th and 4th gears.



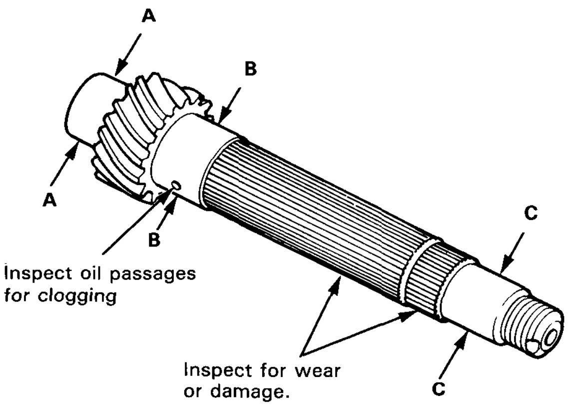
4. Support 1st gear on steel blocks as shown and press the shaft out of 3rd gear.



Inspection

1. Inspect the gear surfaces and bearing surfaces for wear or damage, then measure the countershaft at points A, B and C.

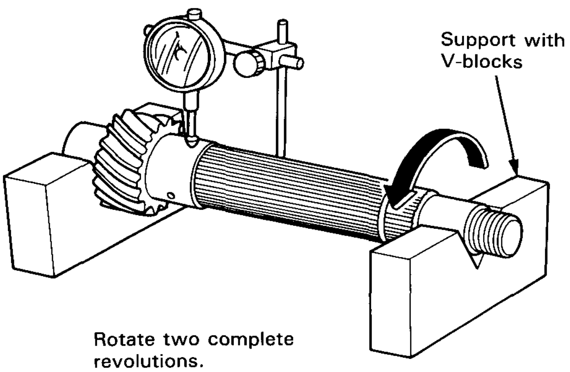
Standard: **A: 30.000–30.015 mm (1.1811–1.1817 in)**
B: 35.984–36.000 mm (1.4167–1.4173 in)
C: 24.980–24.993 mm (0.9835–0.9840 in)
Service Limit: **A: 29.95 mm (1.1791 in)**
B: 35.93 mm (1.4146 in)
C: 24.93 mm (0.9815 in)



If any part of the countershaft is less than the service limit, replace it with a new one.

2. Inspect for runout.

Standard: **0.02 mm (0.0008 in) min.**
Service Limit: **0.05 mm (0.0020 in)**

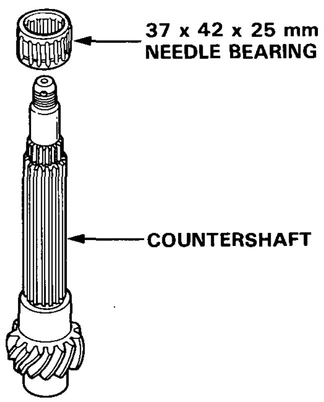


If the runout exceeds the service limit, replace the countershaft with a new one.

Reassembly

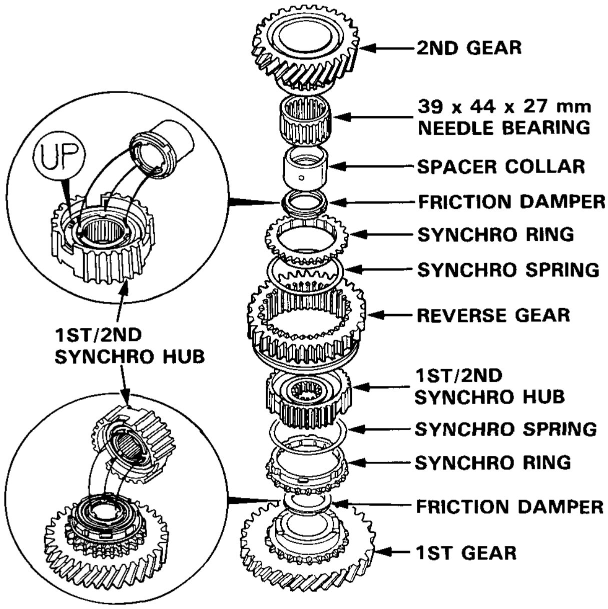
CAUTION:
- **Press the 3rd, 4th and 5th gears on the countershaft without lubrication.**
- **When installing the 3rd, 4th and 5th gears, support the shaft on steel blocks and install the gears using a press.**

1. Install the needle bearing on the countershaft.



2. Assemble the parts below as shown.

NOTE: Check that the finger of the friction damper is securely set in the groove of the 1st/2nd synchro HUB.



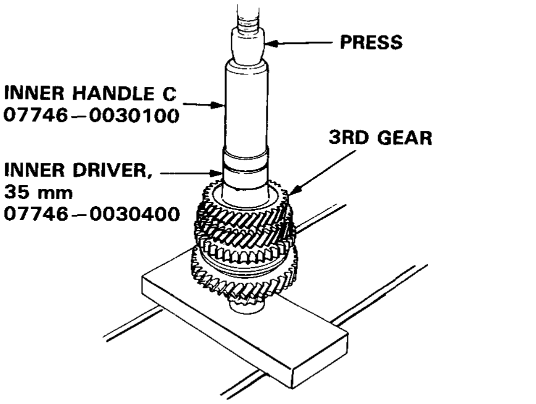
3. Place the parts assembled in Step 2, then install the parts on the countershaft.

(cont'd)

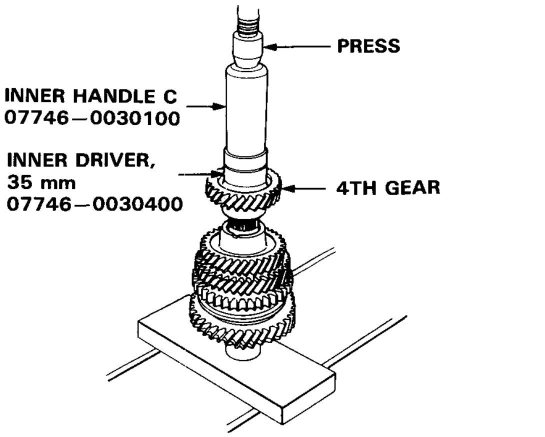
Countershaft Assembly

Reassembly (cont'd)

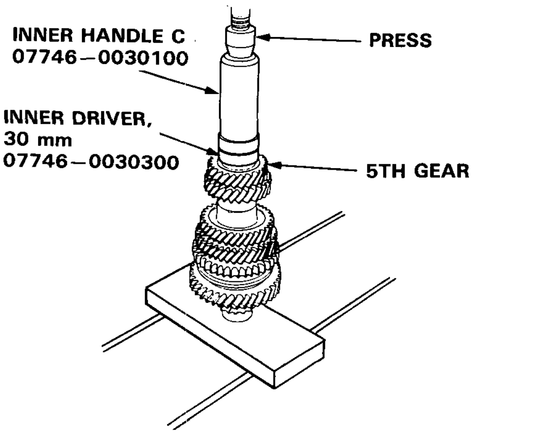
4. Support the countershaft on a steel block as shown and install 3rd gear using the special tools and a press.



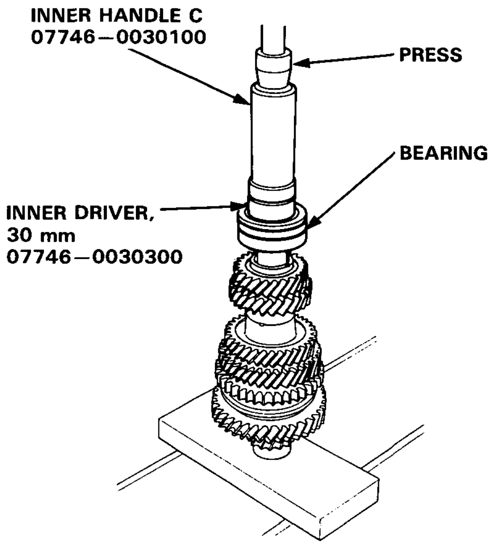
5. Install 4th gear using the special tools and a press as shown.



6. Install 5th gear using a press as shown.

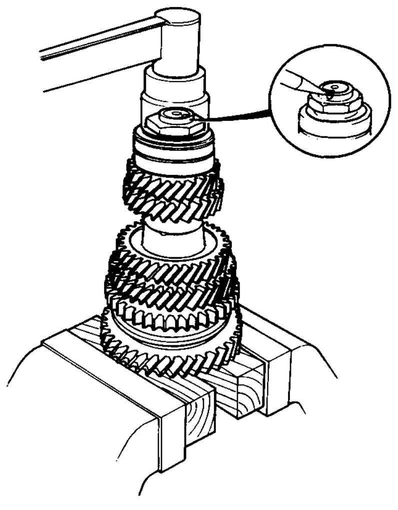


7. Install the bearings using a press as shown.



8. Install the spring washer, tighten the locknut, then stake the locknut tab into groove.

LOCKNUT
110→0→110 N·m
(11.0→0→11.0 kg-m, 80→0→80 lb-ft)

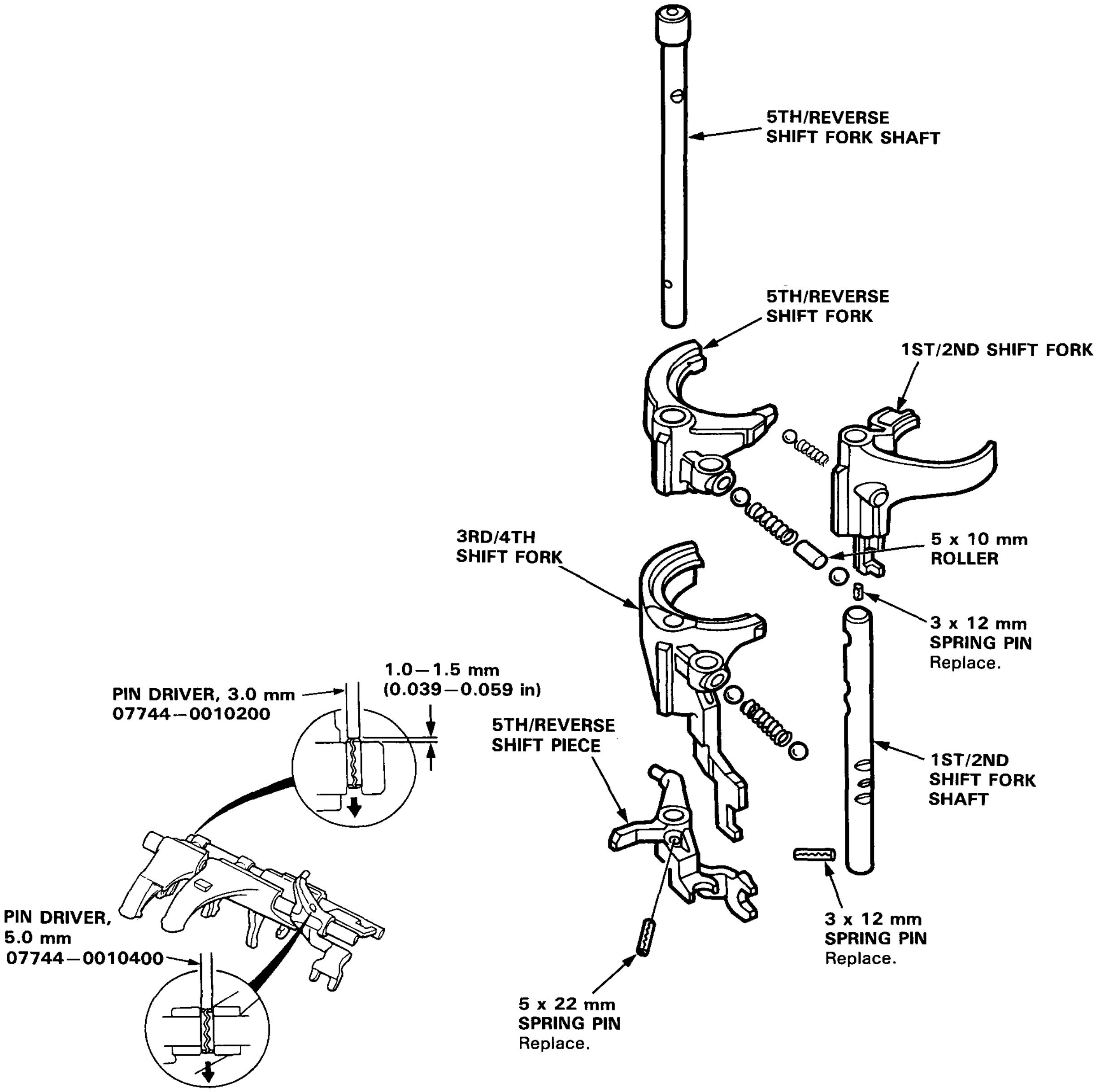


Shift Fork Assembly

Disassembly/Reassembly

NOTE:
- When disassembling, pay attention to the steel balls as the springs may force them out.
- When assembling, install the shift fork shaft with its detents facing the hole where the balls are inserted.

Prior to reassembling, clean all the parts in solvent, dry them and apply lubricant to any contact parts.

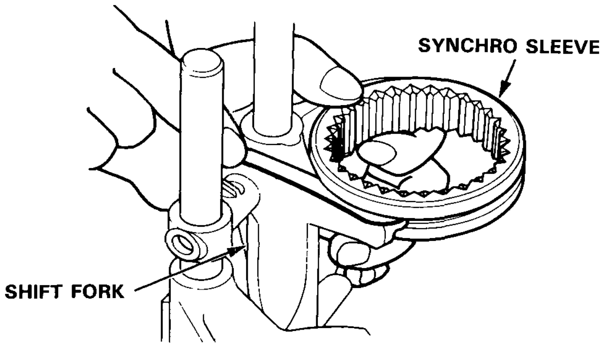


Shift Fork Assembly

Clearance Inspection

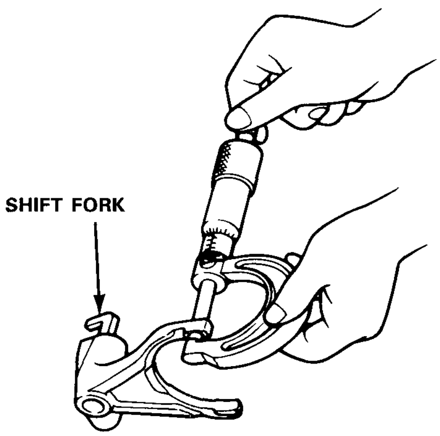
1. Measure the clearance between each shift fork and its matching synchro sleeve.

   Standard: 0.25–0.45 mm (0.010–0.018 in)
   Service Limit: 0.8 mm (0.032 in)



2. If the clearance exceeds the service limit, measure the thickness of the shift fork fingers.

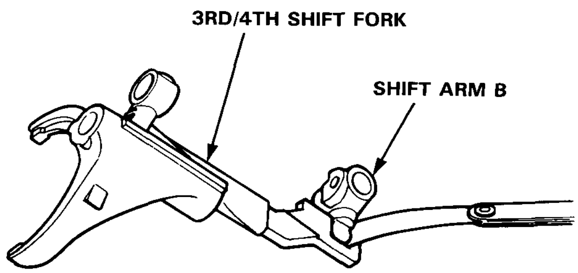
   Standard: 6.4–6.5 mm (0.252–0.255 in)



3. Replace the part that is out of tolerance. If it is the sleeve, the hub must also be replaced.

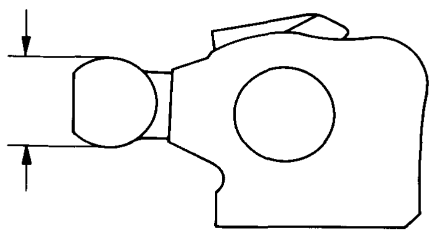
4. Measure the clearance between the 3rd/4th shift fork and shift arm B.

   Standard: 0.2–0.5 mm (0.008–0.020 in)
   Service Limit: 0.62 mm (0.024 in)



5. If the clearance exceeds the service limit, measure the width of the shift arm B.

   Standard: 12.9–13.0 mm (0.508–0.512 in)



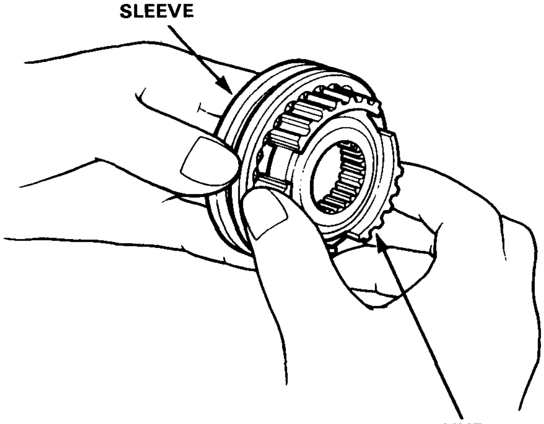
6. Replace the shift arm B with a new one if the width is beyond the standard value.

Synchro Sleeve, Synchro Hub

Inspection

1. Inspect gear teeth on all synchro hubs and sleeves for rounded off corners, which indicate wear.
2. Install each hub in its mating sleeve and check for freedom of movement.

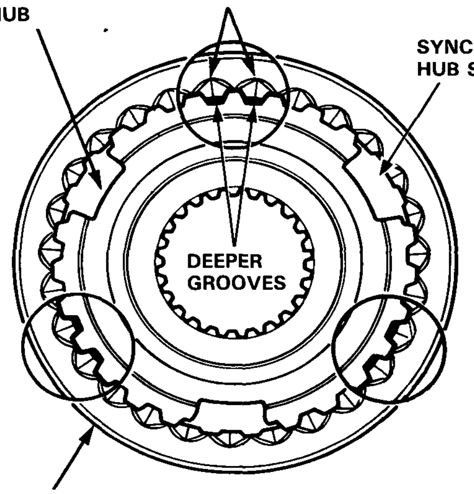
   NOTE: If replacement is required, always replace the synchro sleeve and hub as a set.



Installation

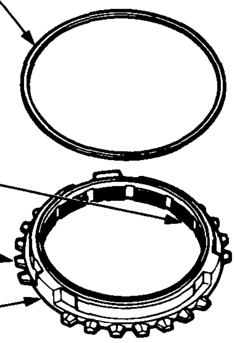
Each synchro sleeve has three sets of longer teeth (120 degrees apart) that must be matched with the three sets of deeper grooves in the hub when assembled.

NOTE: Installing the synchro sleeve with its longer teeth in the 1st/2nd synchro hub slots will damage the spring ring.



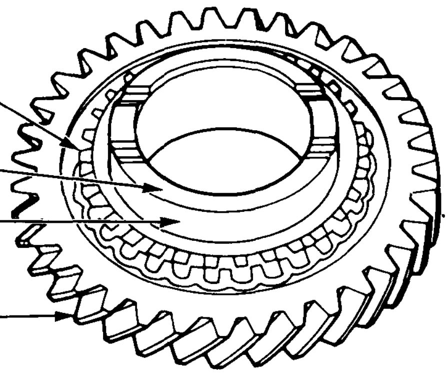
Sychro Ring, Gear

Inspection



1. Inspect the inside of the synchro ring for wear.
2. Inspect the synchro sleeve teeth and matching teeth on the synchro ring for wear (rounded off).

3. Inspect the synchro sleeve teeth and matching teeth on the gear for wear (rounded off).



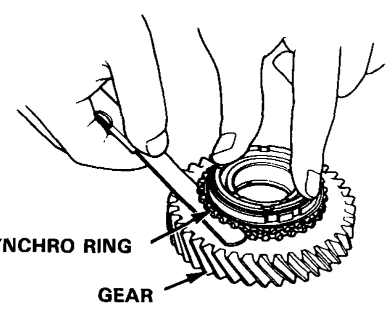
4. Inspect the gear hub thrust surface for wear.
5. Inspect the cone surface for wear or roughness.
6. Inspect the teeth on all gears for uneven wear, scoring, galling, cracks.
7. Coat the cone surface of the gear with oil and place the synchro ring on the matching gear. Rotate the ring, making sure that it does not slip.

   Measure the clearance between the ring and gear all the way around.

   NOTE: Hold the ring against the gear evenly while measuring the clearance.

   Ring-to-Gear Clearance
   Standard: **0.85–1.1 mm**
   (0.0335–0.0433 in)
   Service Limit: 0.4 mm (0.0157 in)

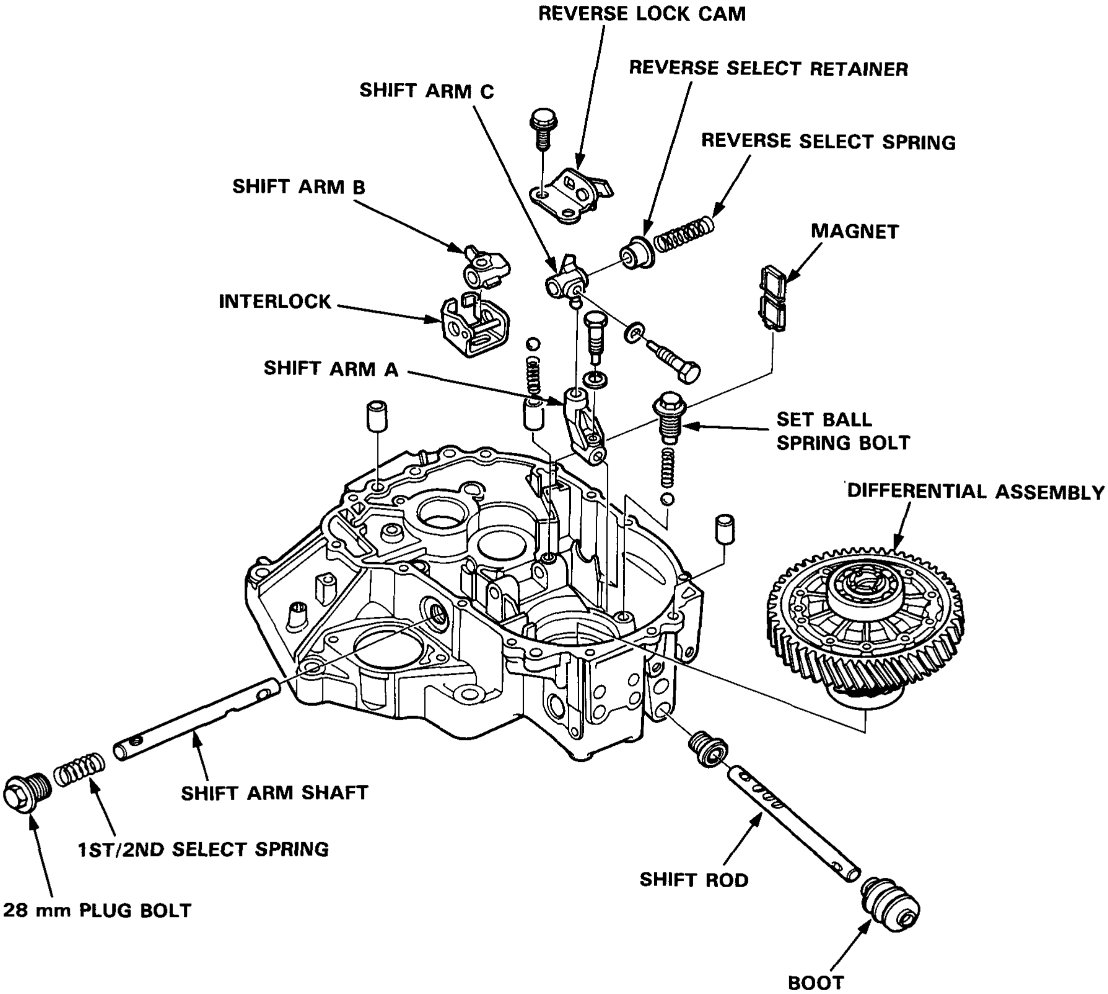
8. Separate the synchro ring and gear, then coat them with oil.
9. Install the synchro spring on the synchro ring, then set it aside for later reassembly.



Removal

1. Remove the differential assembly.
2. Remove the 28 mm plug bolt and 1st/2nd select spring.
3. Remove the shift arm B attaching bolt.
4. Remove the shift arm shaft.

   NOTE: Be careful not to lose the steel ball.
5. Remove shift arms C and B, and the interlock, then remove the reverse select spring and retainer.
6. Remove the shift arm A attaching bolt, the set ball spring bolt, set spring, and steel ball.
7. Remove shift arm A.
8. Remove the reverse lock cam.
9. Remove the magnet.

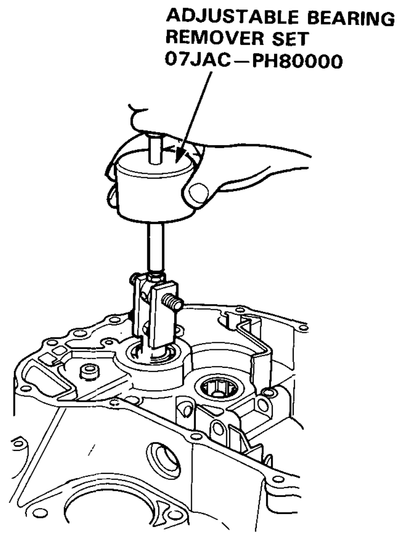


Clutch Housing Bearing

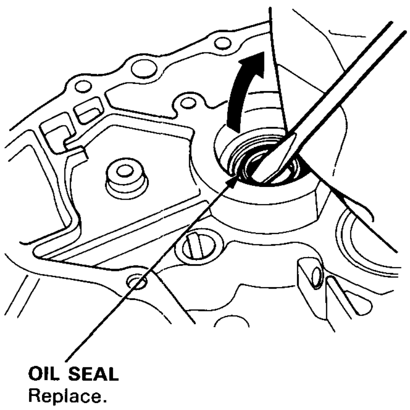
Replacement

Mainshaft

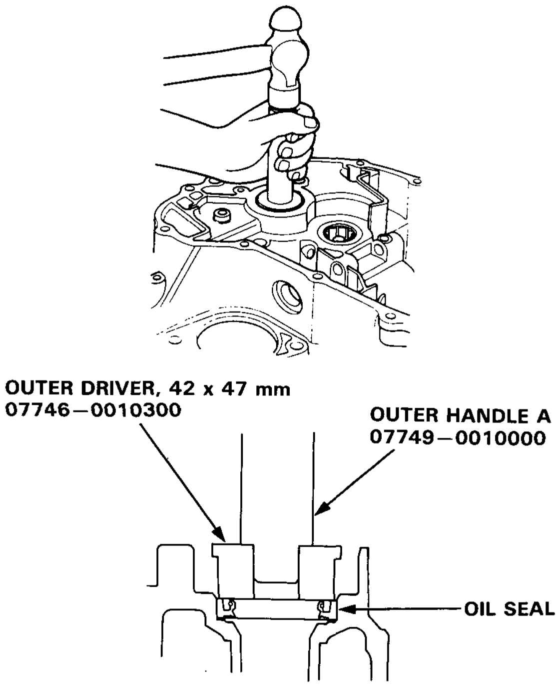
1. Remove the ball bearing using the special tools.



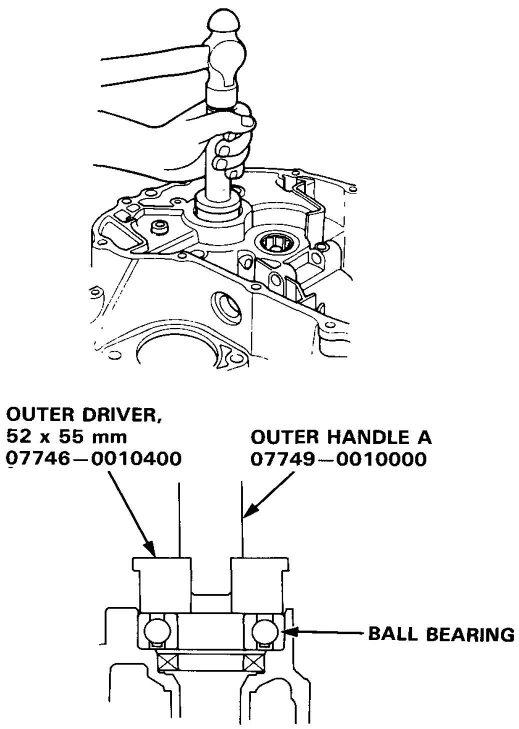
2. Remove the oil seal from the clutch housing.



3. Drive the new oil seal into the clutch housing using the special tools.

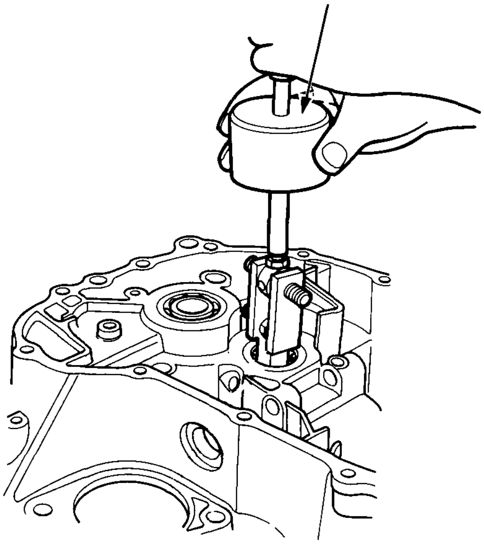


4. Drive the ball bearing into the clutch housing using the special tools.

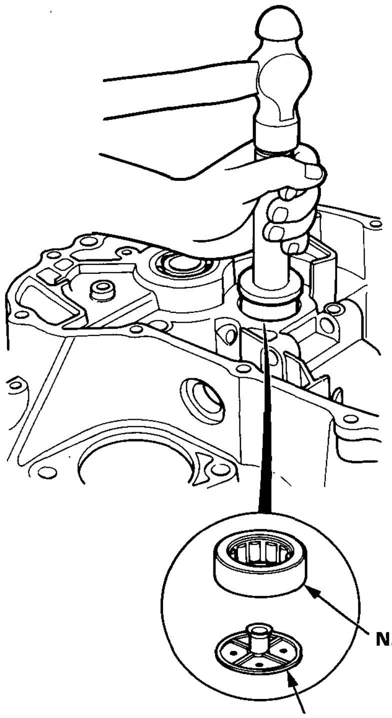


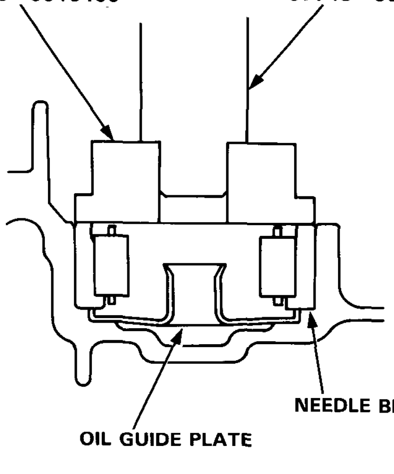
Countershaft

1. Remove the needle bearing using the special tools, then remove the oil guide plate.



2. Install the oil guide plate, then drive the needle bearing into the clutch housing using the special tools.

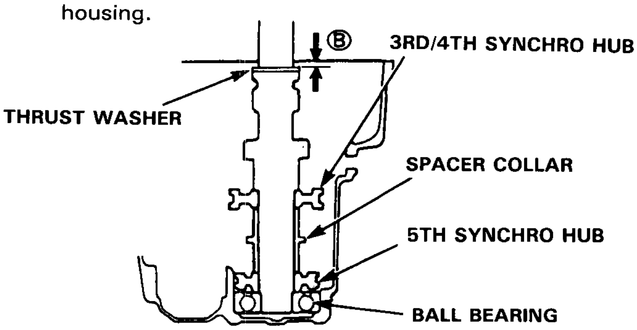




Mainshaft Thrust Shim

Adjustment

1. Remove the thrust shim and oil guide plate from the transmission housing.
2. Install the 3rd/4th synchro hub, spacer collar, 5th synchro hub, ball bearing, and thrust washer on the mainshaft. Install the assembly in the transmission housing.

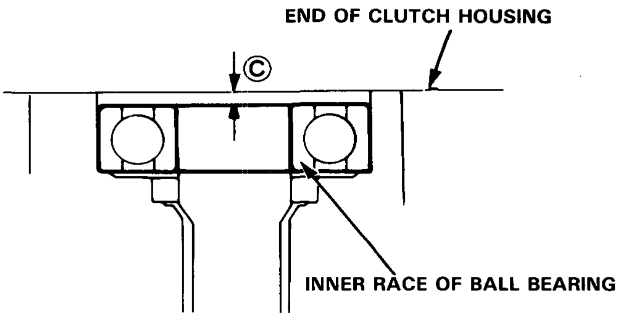


3. Measure the distance B between the end of the transmission housing and thrust washer.

   NOTE:
   - Use a straight edge and feeler gauge.
   - Measure at three locations and average the readings.

4. Measure the distance C between the surfaces of the clutch housing and bearing inner race.

   NOTE:
   - Use a straight edge and feeler gauge.
   - Measure at three locations and average the readings.



5. Select the proper shim (or shim pair) on the basis of the following calculations:

   NOTE: Do not use more than two shims.

   (Basis Formula)
   (B) + (C) − 0.95 = shim thickness

Example of calculation:
Distance B (2.00 mm) + Distance C (0.09 mm) = 2.09 mm subtract the spring washer height (0.95 mm) = the required thrust shim (1.14 mm)

65 mm Thrust Shim: Except D16Z6, D16Z7, D16A7, D16A8, D16A9

	PART NUMBER	THICKNESS
A	23931–PL3–A10	0.60 mm (0.0236 in)
B	23932–PL3–A10	0.63 mm (0.0284 in)
C	23933–PL3–A10	0.66 mm (0.0260 in)
D	23934–PL3–A10	0.69 mm (0.0272 in)
E	23935–PL3–A10	0.72 mm (0.0283 in)
F	23936–PL3–A10	0.75 mm (0.0295 in)
G	23937–PL3–A10	0.78 mm (0.0307 in)
H	23938–PL3–A10	0.81 mm (0.0319 in)
I	23939–PL3–A10	0.84 mm (0.0331 in)
J	23940–PL3–A10	0.87 mm (0.0343 in)
K	23941–PL3–A10	0.90 mm (0.0354 in)
L	23942–PL3–A10	0.93 mm (0.0366 in)
M	23943–PL3–A10	0.96 mm (0.0378 in)
N	23944–PL3–A10	0.99 mm (0.0390 in)
O	23945–PL3–A10	1.02 mm (0.0402 in)
P	23946–PL3–A10	1.05 mm (0.0413 in)
Q	23947–PL3–A10	1.08 mm (0.0425 in)
R	23948–PL3–A10	1.11 mm (0.0437 in)
S	23949–PL3–A10	1.14 mm (0.0449 in)
T	23950–PL3–A10	1.17 mm (0.0461 in)
U	23951–PL3–A10	1.20 mm (0.0472 in)
V	23952–PL3–A10	1.23 mm (0.0484 in)
W	23953–PL3–A10	1.26 mm (0.0496 in)
X	23954–PL3–A10	1.29 mm (0.0508 in)
Y	23955–PL3–A10	1.32 mm (0.0520 in)
Z	23956–PL3–A10	1.35 mm (0.0531 in)
AA	23957–PL3–A10	1.38 mm (0.0543 in)
AB	23958–PL3–A10	1.41 mm (0.0555 in)
AC	23959–PL3–A10	1.44 mm (0.0567 in)
AD	23960–PL3–A10	1.47 mm (0.0579 in)
AE	23961–PL3–A10	1.50 mm (0.0591 in)
AF	23962–PL3–A10	1.53 mm (0.0602 in)
AG	23963–PL3–A10	1.56 mm (0.0614 in)
AH	23964–PL3–A10	1.59 mm (0.0626 in)
AI	23965–PL3–A10	1.62 mm (0.0638 in)
AJ	23966–PL3–A10	1.65 mm (0.0650 in)
AK	23967–PL3–A10	1.68 mm (0.0661 in)
AL	23968–PL3–A10	1.71 mm (0.0673 in)
AM	23969–PL3–A10	1.74 mm (0.0685 in)
AN	23970–PL3–A10	1.77 mm (0.0697 in)
AO	23971–PL3–A10	1.80 mm (0.0709 in)

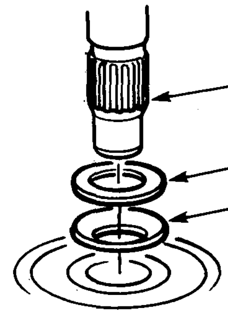
70 mm Thrust Shim: D16Z6, D16Z7, D16A7, D16A8, D16A9

	PART NUMBER	THICKNESS
A	23931–PL3–B00	0.60 mm (0.0236 in)
B	23932–PL3–B00	0.63 mm (0.0284 in)
C	23933–PL3–B00	0.66 mm (0.0260 in)
D	23934–PL3–B00	0.69 mm (0.0272 in)
E	23935–PL3–B00	0.72 mm (0.0283 in)
F	23936–PL3–B00	0.75 mm (0.0295 in)
G	23937–PL3–B00	0.78 mm (0.0307 in)
H	23938–PL3–B00	0.81 mm (0.0319 in)
I	23939–PL3–B00	0.84 mm (0.0331 in)
J	23940–PL3–B00	0.87 mm (0.0343 in)
K	23941–PL3–B00	0.90 mm (0.0354 in)
L	23942–PL3–B00	0.93 mm (0.0366 in)
M	23943–PL3–B00	0.96 mm (0.0378 in)
N	23944–PL3–B00	0.99 mm (0.0390 in)
O	23945–PL3–B00	1.02 mm (0.0402 in)
P	23946–PL3–B00	1.05 mm (0.0413 in)
Q	23947–PL3–B00	1.08 mm (0.0425 in)
R	23948–PL3–B00	1.11 mm (0.0437 in)
S	23949–PL3–B00	1.14 mm (0.0449 in)
T	23950–PL3–B00	1.17 mm (0.0461 in)
U	23951–PL3–B00	1.20 mm (0.0472 in)
V	23952–PL3–B00	1.23 mm (0.0484 in)
W	23953–PL3–B00	1.26 mm (0.0496 in)
X	23954–PL3–B00	1.29 mm (0.0508 in)
Y	23955–PL3–B00	1.32 mm (0.0520 in)
Z	23956–PL3–B00	1.35 mm (0.0531 in)
AA	23957–PL3–B00	1.38 mm (0.0543 in)
AB	23958–PL3–B00	1.41 mm (0.0555 in)
AC	23959–PL3–B00	1.44 mm (0.0567 in)
AD	23960–PL3–B00	1.47 mm (0.0579 in)
AE	23961–PL3–B00	1.50 mm (0.0591 in)
AF	23962–PL3–B00	1.53 mm (0.0602 in)
AG	23963–PL3–B00	1.56 mm (0.0614 in)
AH	23964–PL3–B00	1.59 mm (0.0626 in)
AI	23965–PL3–B00	1.62 mm (0.0638 in)
AJ	23966–PL3–B00	1.65 mm (0.0650 in)
AK	23967–PL3–B00	1.68 mm (0.0661 in)
AL	23968–PL3–B00	1.71 mm (0.0673 in)
AM	23969–PL3–B00	1.74 mm (0.0685 in)
AN	23970–PL3–B00	1.77 mm (0.0697 in)
AO	23971–PL3–B00	1.80 mm (0.0709 in)

6. Check the thrust clearance in the manner described below.

   NOTE:
   - Clean the thrust washer, spring washer and shim thoroughly before installation.
   - Install the thrust washer, spring washer and shim properly.

   a. Install the shims selected in the transmission housing.
   b. Install the thrust washer and spring washer in the mainshaft.

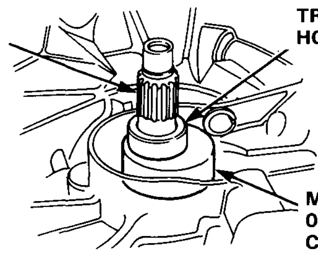


   c. Install the mainshaft in the clutch housing.
   d. Place the transmission housing over the mainshaft and onto the clutch housing.
   e. Tighten the clutch and transmission housings with several 10 mm bolts.
   f. Tap the mainshaft with a plastic hammer.

7. Check the thrust clearance in the manner described below.

   CAUTION: Measurement should be made at room temperature.

   a. Slide the mainshaft base and the collar over the mainshaft.

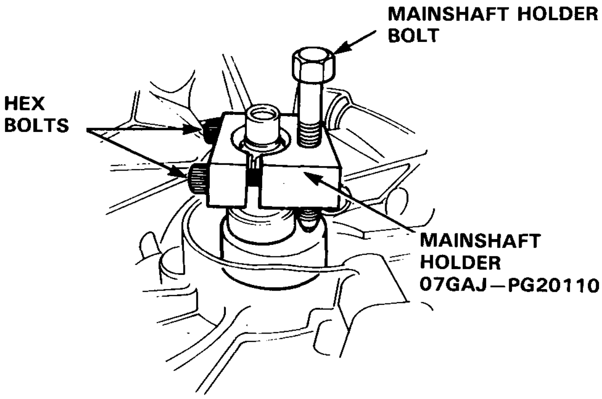


(cont'd)

Mainshaft Thrust Shim

Adjustment (cont'd)

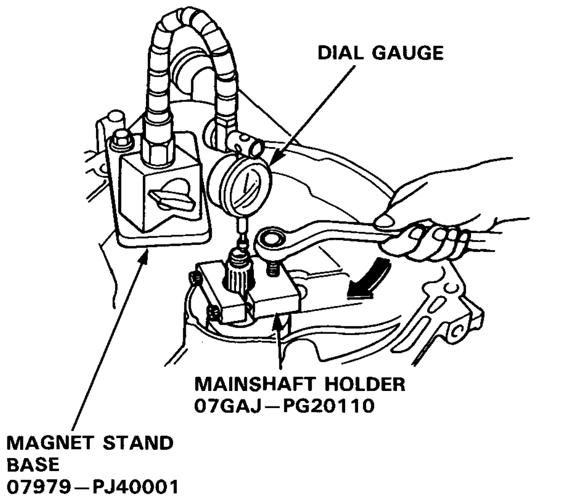
b. Attach the mainshaft holder to the mainshaft as follows:
  - Back-out the mainshaft holder bolt and loosen the two hex bolts.
  - Fit the holder over the mainshaft so its lip is towards the transmission.
  - Align the mainshaft holder's lip around the groove at the inside of the mainshaft splines, then tighten the hex bolts.



c. Seat the mainshaft fully by tapping its end with a plastic hammer.

d. Thread the mainshaft holder bolt in until it just contacts the wide surface of the mainshaft base.

e. Zero a dial gauge on the end of the mainshaft.



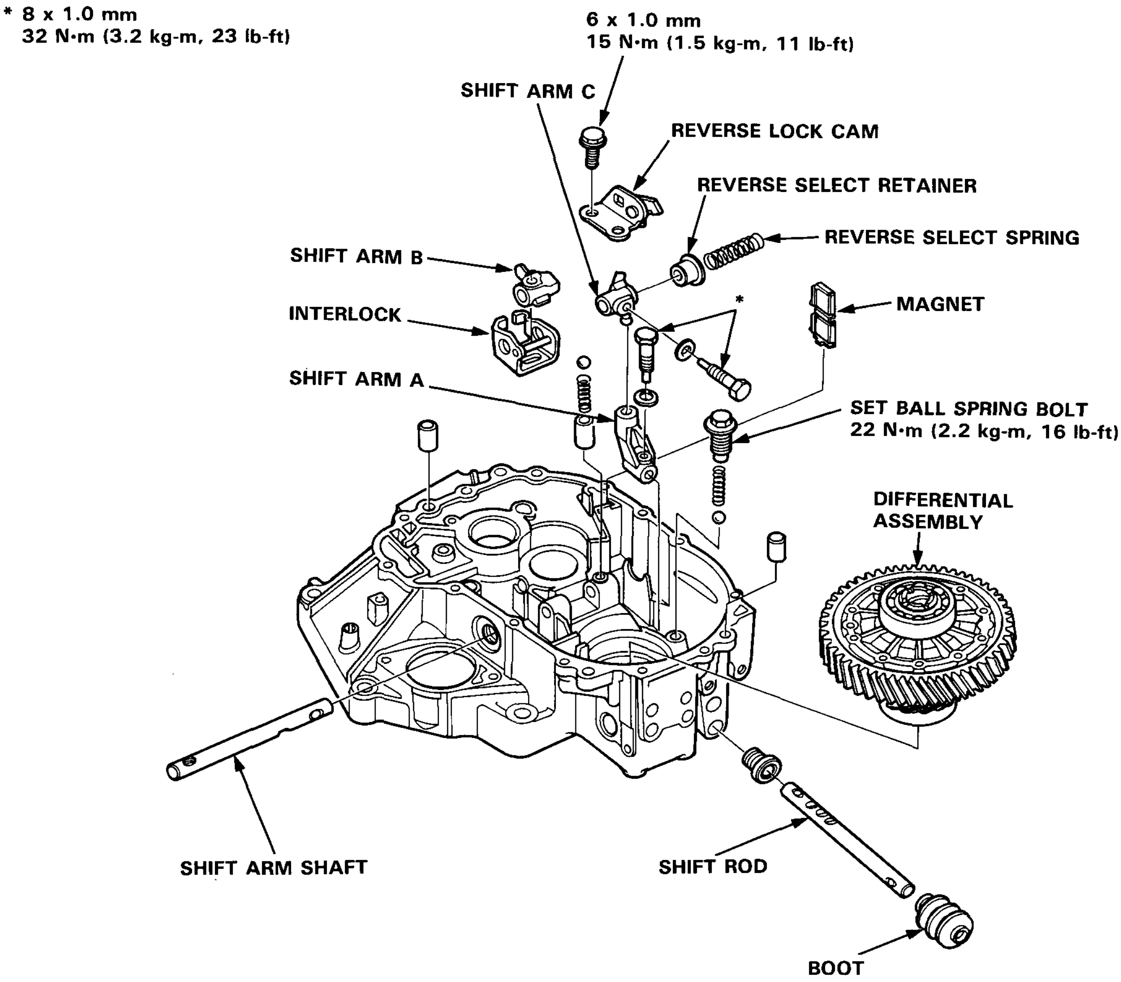
f. Turn the mainshaft holder bolt clockwise; stop turning when the dial gauge has reached its maximum movement. The reading on the dial gauge is the amount of mainshaft end play.

CAUTION: Turning the shaft holder bolt more than 60 degrees after the needle of the dial gauge stops moving may damage the transmission.

g. Clearance is correct if reading is between 0.11–0.18 mm (0.004–0.007 in).
If not, recheck necessary shim thickness.

Reassembly

1. Install the magnet and reverse lock cam.
2. Set shift arm A on the clutch housing, then install the shift rod.
3. Install the spring washer and shift arm A attaching bolt.
4. Install the steel ball, spring and set ball spring bolt.
5. Install shift arm B in the interlock, then set it on the clutch housing.
6. Insert shift arm shaft B in the clutch housing
7. Install the spring collar, spring, and steel ball into the case. Compress the ball and insert the shift arm shaft.
8. Install shift arm C in shift arm A, then insert the shift arm shaft.
9. Install the reverse select retainer and reverse select spring onto shift arm shaft.
10. Install the differential assembly.



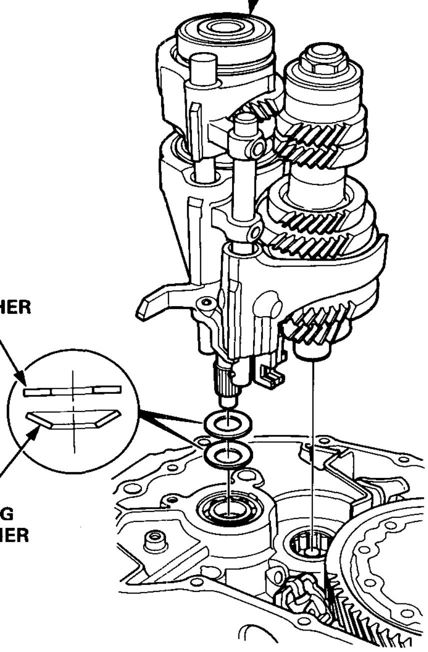
(cont'd)

Reassembly (cont'd)

11. Set the 36mm spring washer and washer.

12. Install the mainshaft, countershaft, and shift fork assemblies.

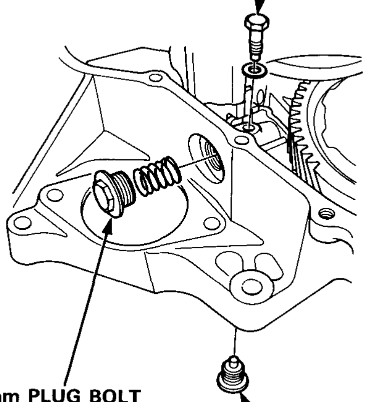
    NOTE: Align the finger of the interlock with the groove in the shift fork shaft.



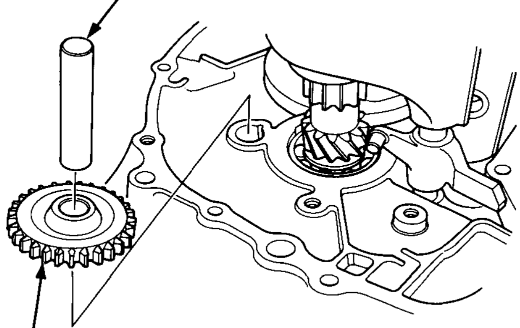
13. Install the spring washer and shift arm B attaching bolt.

14. Install the 1st/2nd select spring, 28mm plug bolt, and interlock guide bolt.

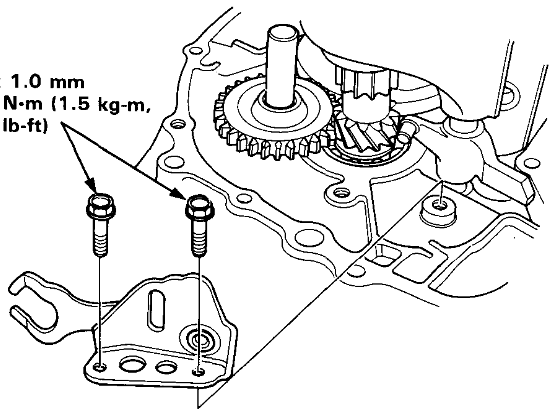
    NOTE: Apply liquid gasket (P/N 08718—0001)to the threads of the 28 mm plug bolt and interlock guide bolt.



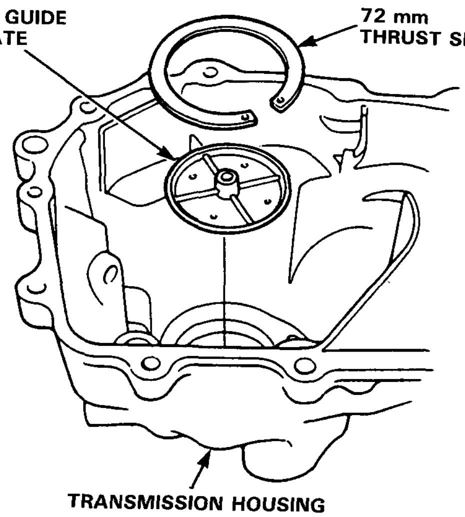
15. Install the reverse idler gear and reverse idler gear shaft.



16. Install the reverse shift holder.

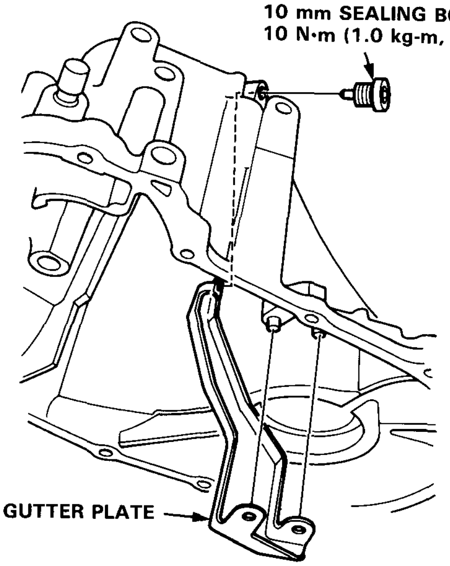


17. Install the oil guide plate and 72 mm thrust shim on the transmission housing.



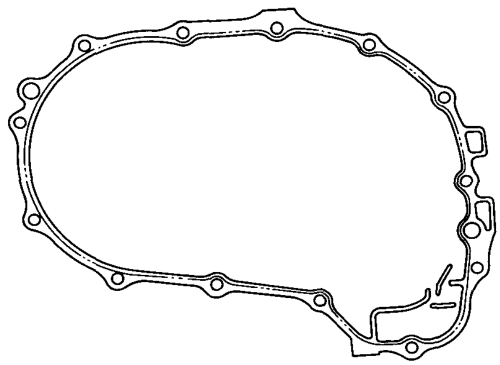
18. Install the oil gutter plate and 10 mm sealing bolt.

NOTE: Apply liquid gasket (P/N 08718–0001) to the threads of the 10 mm sealing bolt.



19. Apply liquid gasket to the transmission mating surface of the clutch housing.

NOTE: This transmission uses no gaskets between the major housings; use liquid gasket (P/N 08718–0001). Assemble the housing within 20 minutes after applying the liquid gasket and allow it to cure at least 30 minutes after assembly before filling it with oil.



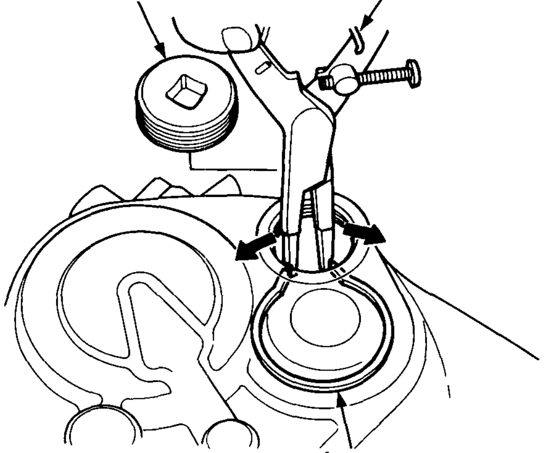
(cont'd)

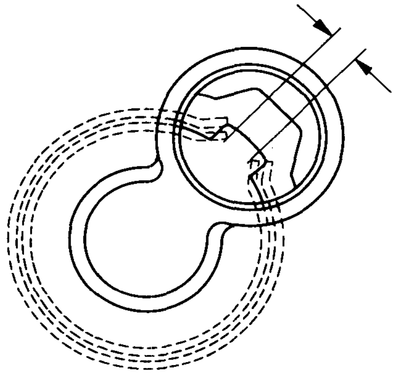
Reassembly (cont'd)

20. Install the transmission housing.
21. Lower the transmission housing with the snap ring expanded and set the snap ring in the groove of the countershaft bearing.

    NOTE: Check that the snap ring is securely seated in the groove of the countershaft bearing.
22. Install the 32 mm sealing bolt.

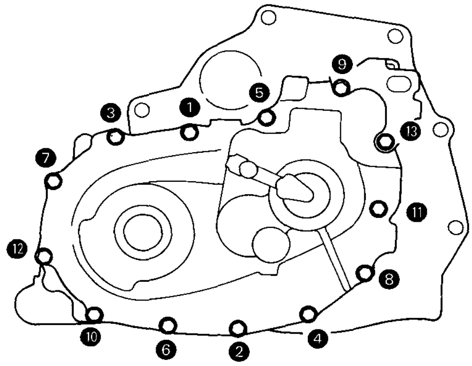
    NOTE: Apply liquid gasket (P/N 08718−0001) to the threads.



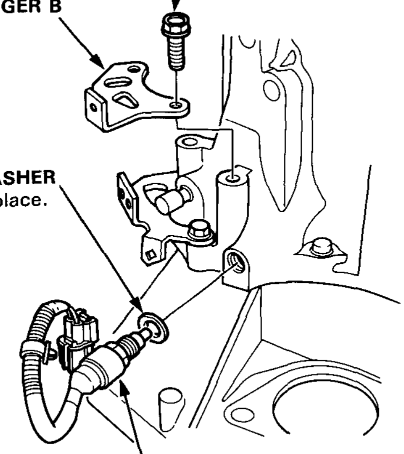


23. Tighten the transmission housing attaching bolts in the numbered sequence shown below.

8 x 1.25 mm
Torque: 28 N·m(2.8 kg-m, 20 lb-ft)

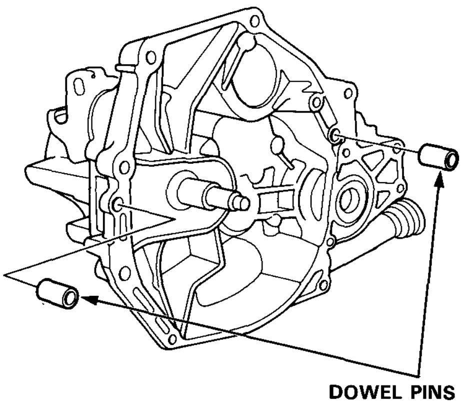


24. Install the back-up light switch and transmission hanger B.



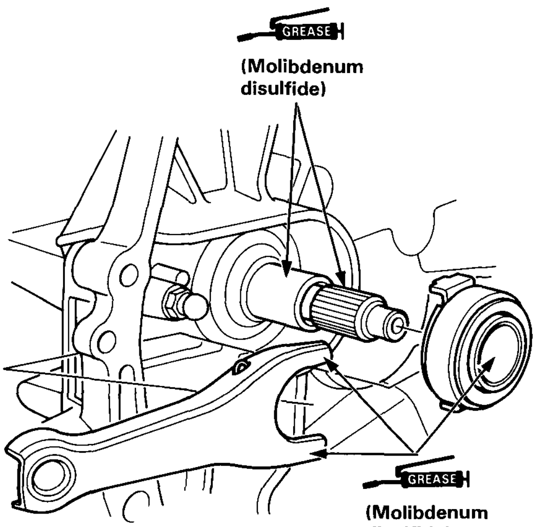
Installation

1. Install the dowel pins.



2. Apply grease to the parts as shown.

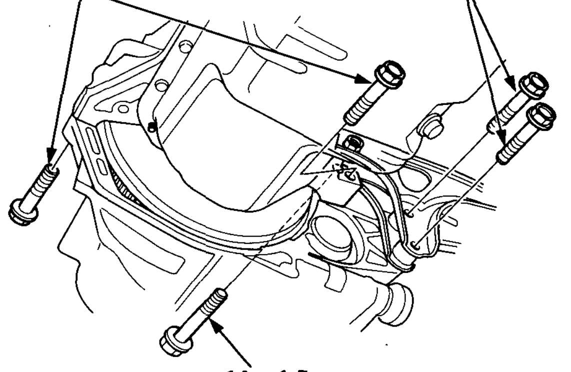
   NOTE: Use only molybdenum disulfide grease in this step.



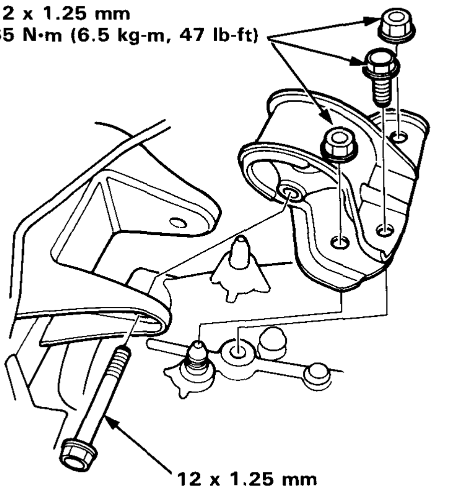
3. Install the release fork boot.

4. Place the transmission on the transmission jack, and raise it to the engine level.

5. Install the transmission mounting bolts and rear mount bolts.



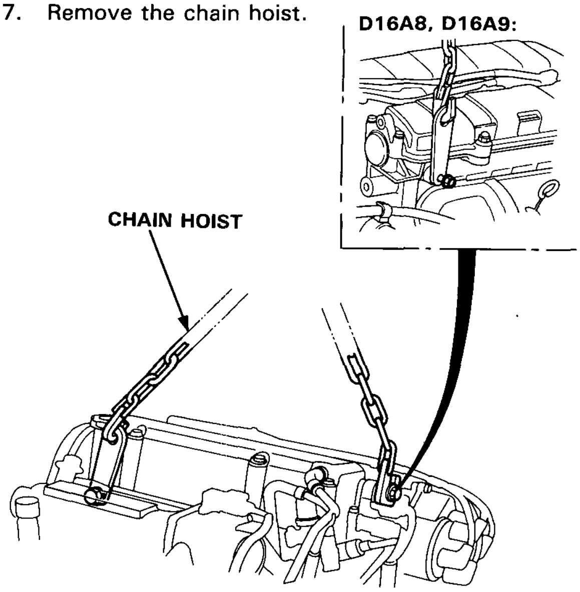
6. Raise the transmission, then install the transmission side mount.



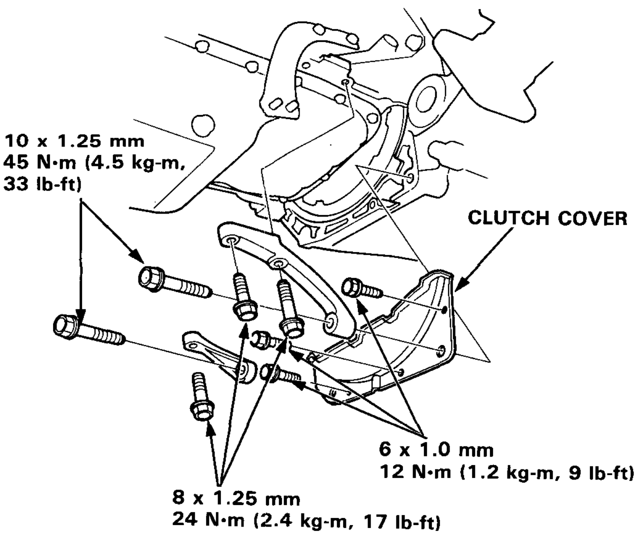
(cont'd)

Installation (cont'd)

7. Remove the chain hoist.

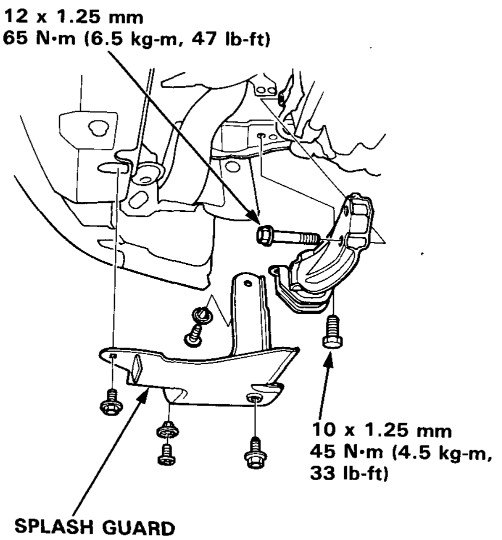


8. Install the clutch cover.



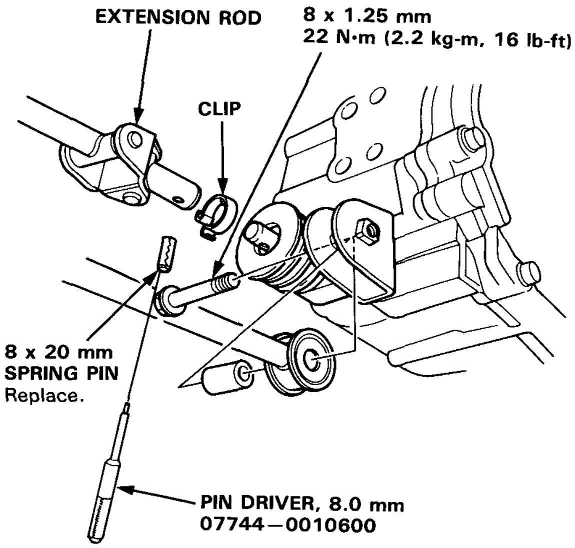
9. Install the front stopper bracket.

10. Install the splash guard.

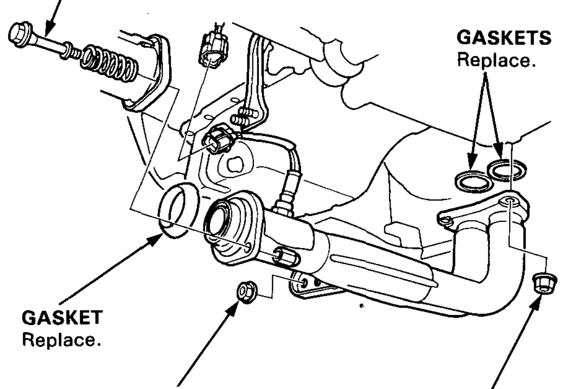


11. Install the shift rod, spring pin and clip.

12. Install the torque rod.



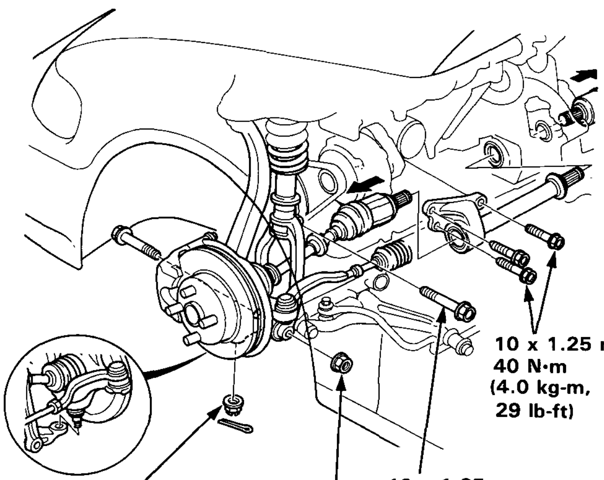
13. Install exhaust pipe A.



14. Install the intermediate shaft and driveshafts.

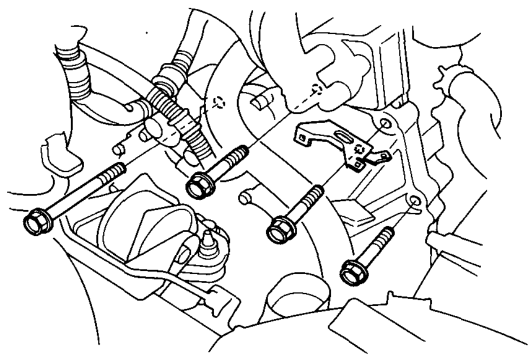
15. Install the ball joint onto the lower arm.

16. Install the damper fork.

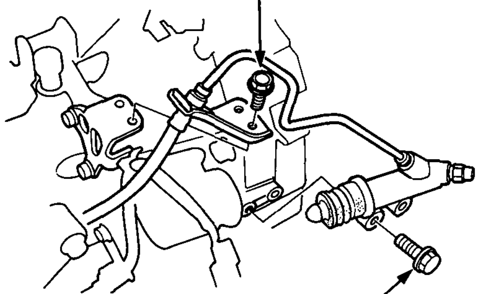


17. Install the transmission attaching bolts.

12 x 1.25 mm
60 N·m (6.0 kg-m, 43 lb-ft)



18. Install the slave cylinder, then install the clutch pipe stay.



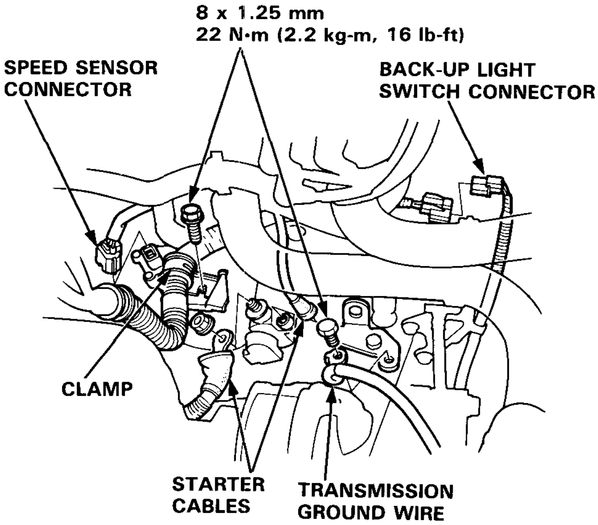
(cont'd)

Transmission Assembly

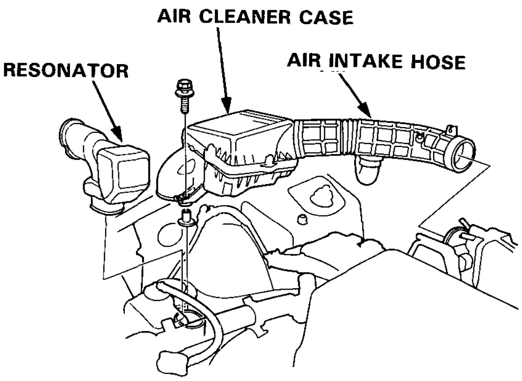
Installation (cont'd)

19. Connect the speed sensor and back-up light switch connectors and transmission ground wire.

20. Install the wire harness clamp.



21. Install the resonator, air cleaner case, and air intake hose.



22. Refill the transmission with oil.

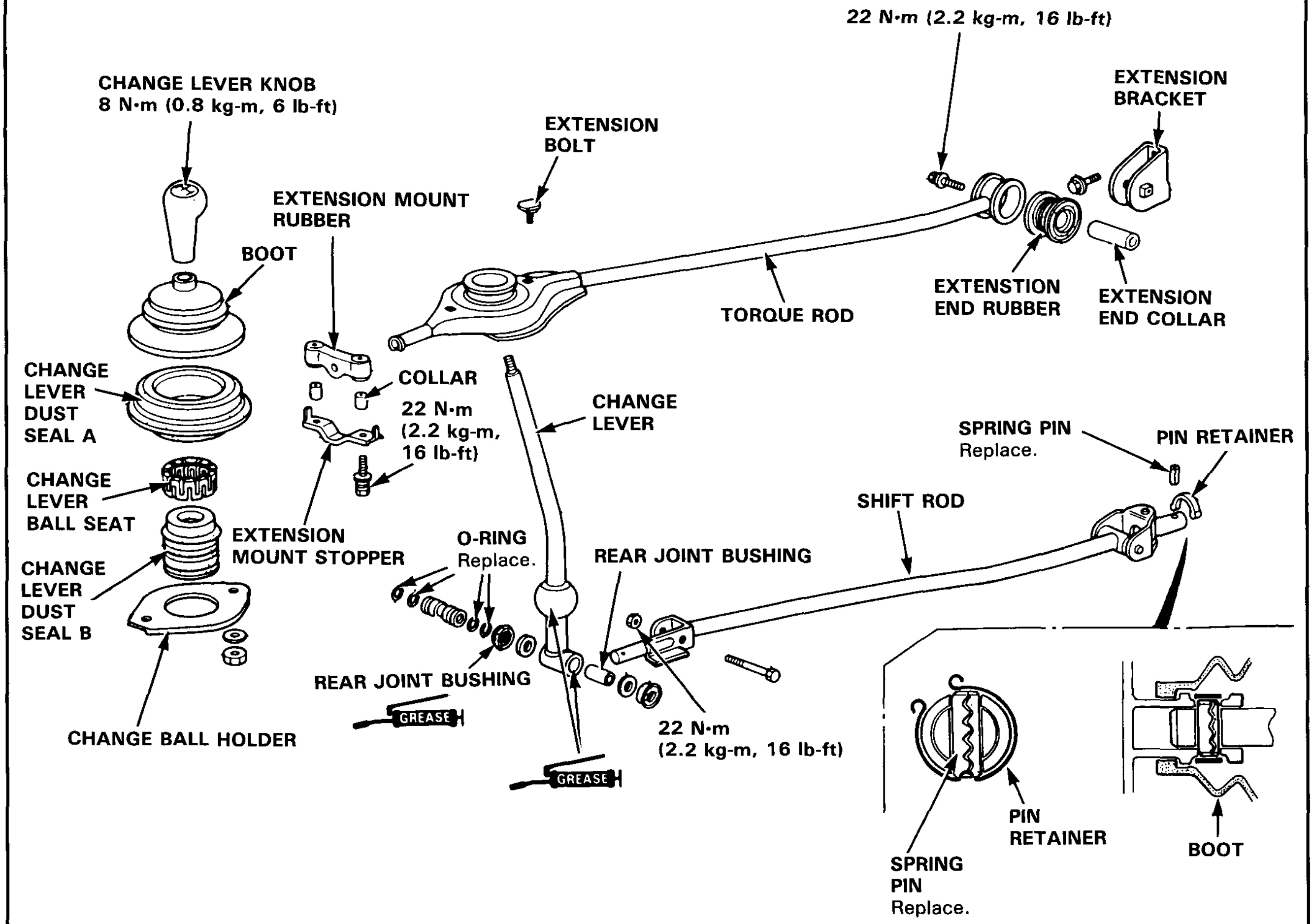
23. Connect the positive (+) and negative (−) cables to the battery.

24. Check the clutch operation.

25. Shift the transmission and check for smooth operation.

Gearshift Mechanism

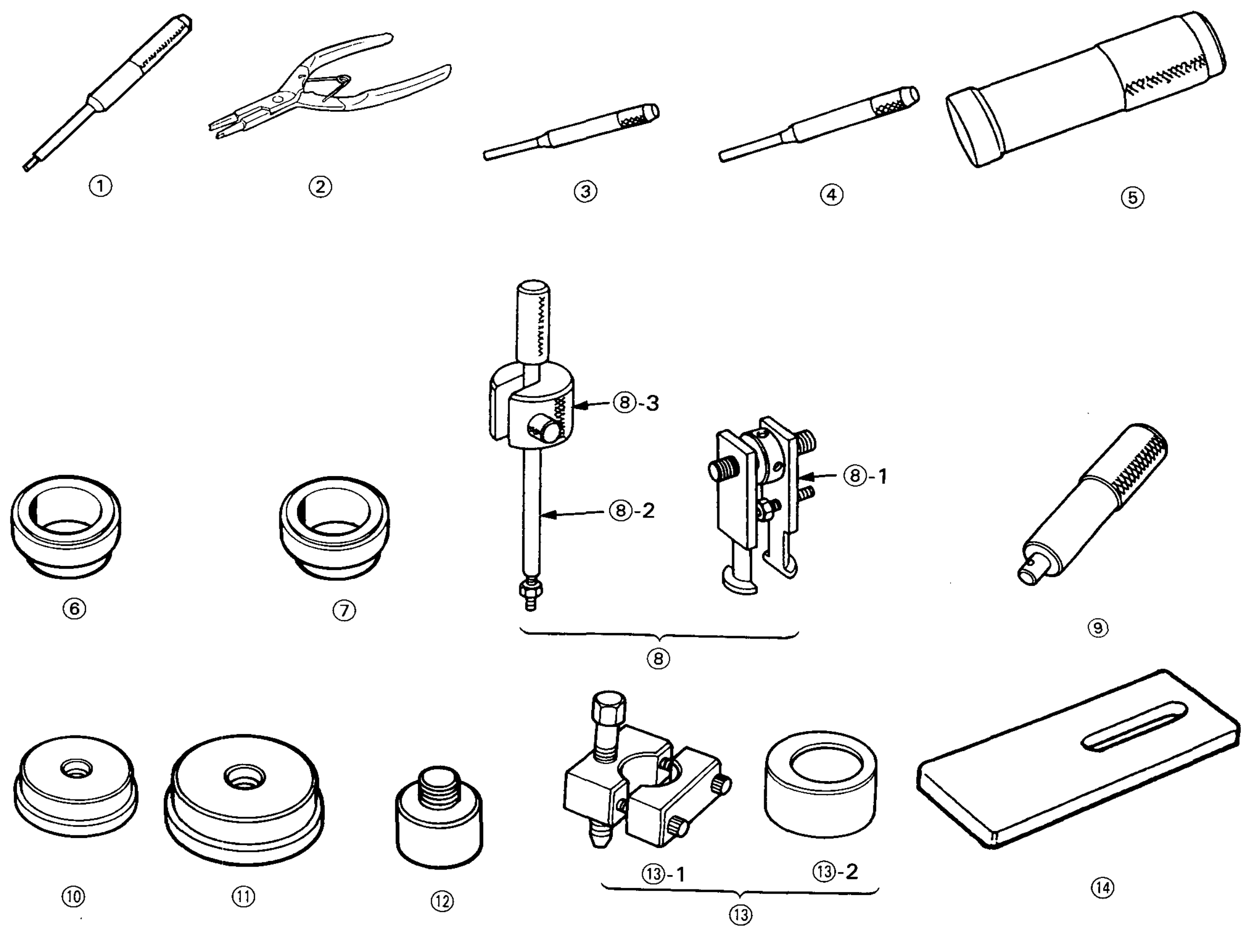
Overhaul



Y21 Model
Manual Transmission

Special Tools

Ref. No.	Tool Number	Description	Qty	Remarks
①	07744–0010600	Pin Driver, 8.0 mm	1	
②	07LGC–0010100	Snap Ring Plier	1	
③	07744–0010200	Pin Driver, 3.0 mm	1	
④	07744–0010400	Pin Driver, 5.0 mm	1	
⑤	07746–0030100	Inner Handle C	1	
⑥	07746–0030400	Inner Driver, 35 mm	1	
⑦	07746–0030300	Inner Driver, 30 mm	1	
⑧	07JAC–PH80000	Adjustable Bearing Remover Set	1	
⑧-1	07JAC–PH80100	Bearing Remover Attachement	(1)	
⑧-2	07JAC–PH80200	Remover Handle Assembly	(1)	Component Tools
⑧-3	07741–0010201	Remover Weight	(1)	
⑨	07749–0010000	Outer Handle A	1	
⑩	07746–0010300	Outer Driver, 42 x 47 mm	1	
⑪	07746–0010400	Outer Driver, 52 x 55 mm	1	
⑫	07746–0041100	PILOT DRIVER, 28 mm	1	
⑬	07GAJ–PG20102	Mainshaft Clearance Inspection Tools Set	1	
⑬-1	07GAJ–PG20110	Mainshaft Holder	(1)	Component Tools
⑬-2	07GAJ–PG20130	Mainshaft Base	(1)	
⑭	07979–PJ40001	Magnet Stand Base	1	

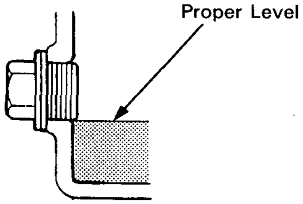


Maintenance

Transmission Oil

NOTE: Check the oil at operating temperature, engine OFF, and the car on level ground.

1. Remove the oil filler plug, then check the level and condition of the oil.

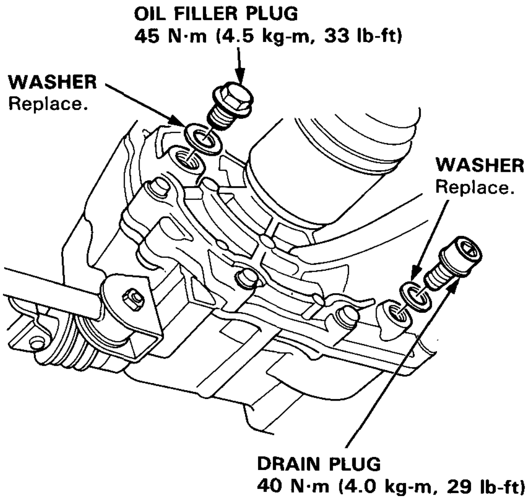


2. The oil level must be up to the filler hole. If it is below the hole, and oil until it runs out, then reinstall the oil filler plug.
3. If the oil is dirty, remove drain plug and drain transmission.
4. Reinstall the drain plug with a new washer, and refill to proper level.

   NOTE: The drain plug washer should be replaced at every oil change.
5. Reinstall the oil filler plug with a new washer.

Oil Capacity
2.2 ℓ (2.3 U.S. qt.) after drain.
2.3 ℓ (2.4 U.S. qt.) after overhaul.

Use only SEA 10W—30 or 10W—40, SF or SG grade.

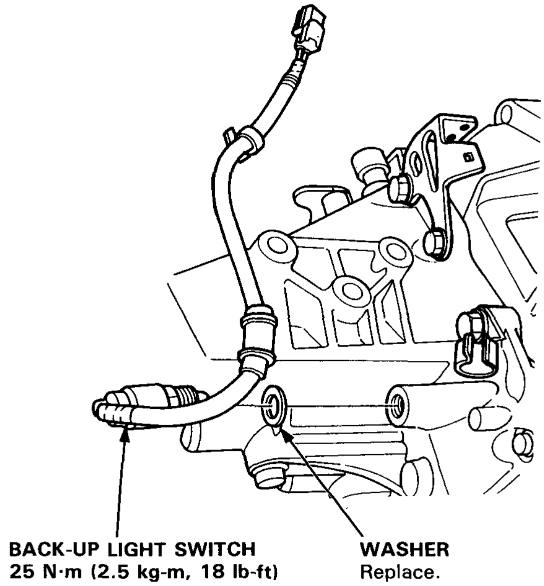


Back-up Light Switch

Replacement

NOTE: To check the switch, see section 23.

1. Disconnect the connector, then remove the switch connector from the connector clamp.
2. Remove the switch.
3. Install the new washer and switch.

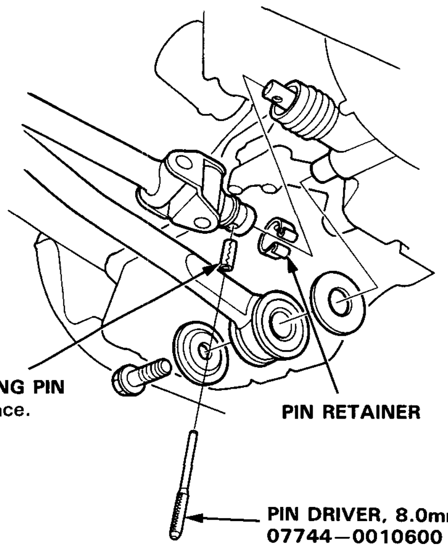


Transmission Assembly

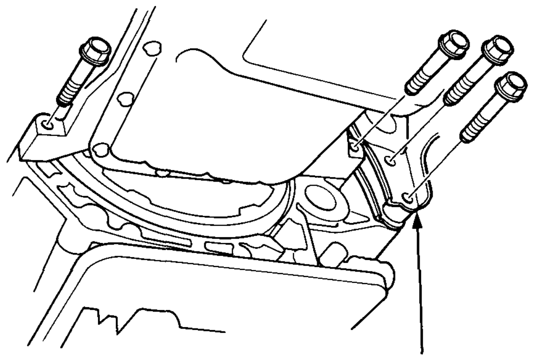
Removal

NOTE: Differences between the S20 model MT and Y21 model MT are covered in this page. Refer to page 13-4 for the information not covered in this page.

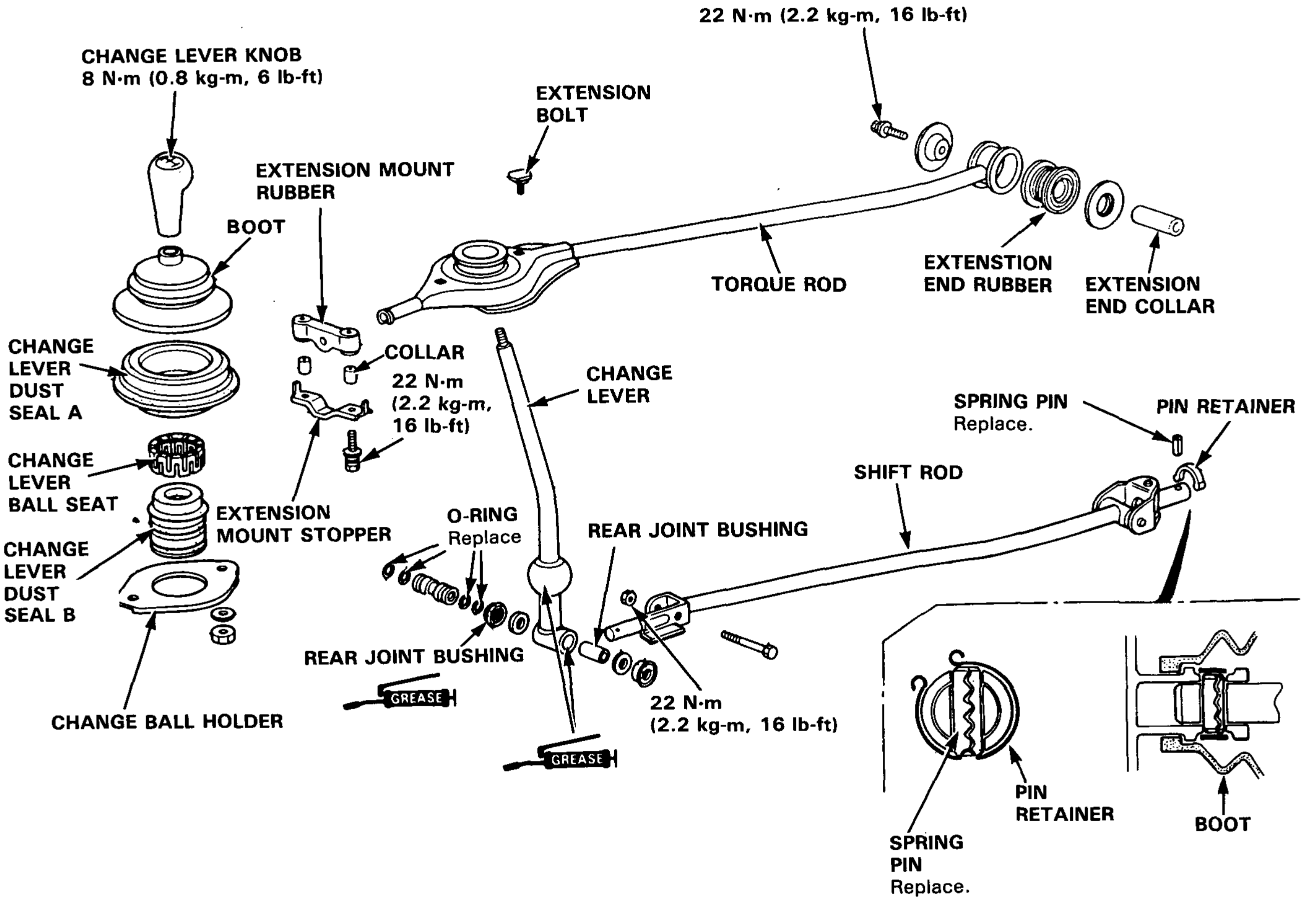
1. Remove the torque rod and shift rod.



2. Remove the transmission rear mount bolts and transmission housing bolts.



Overhaul

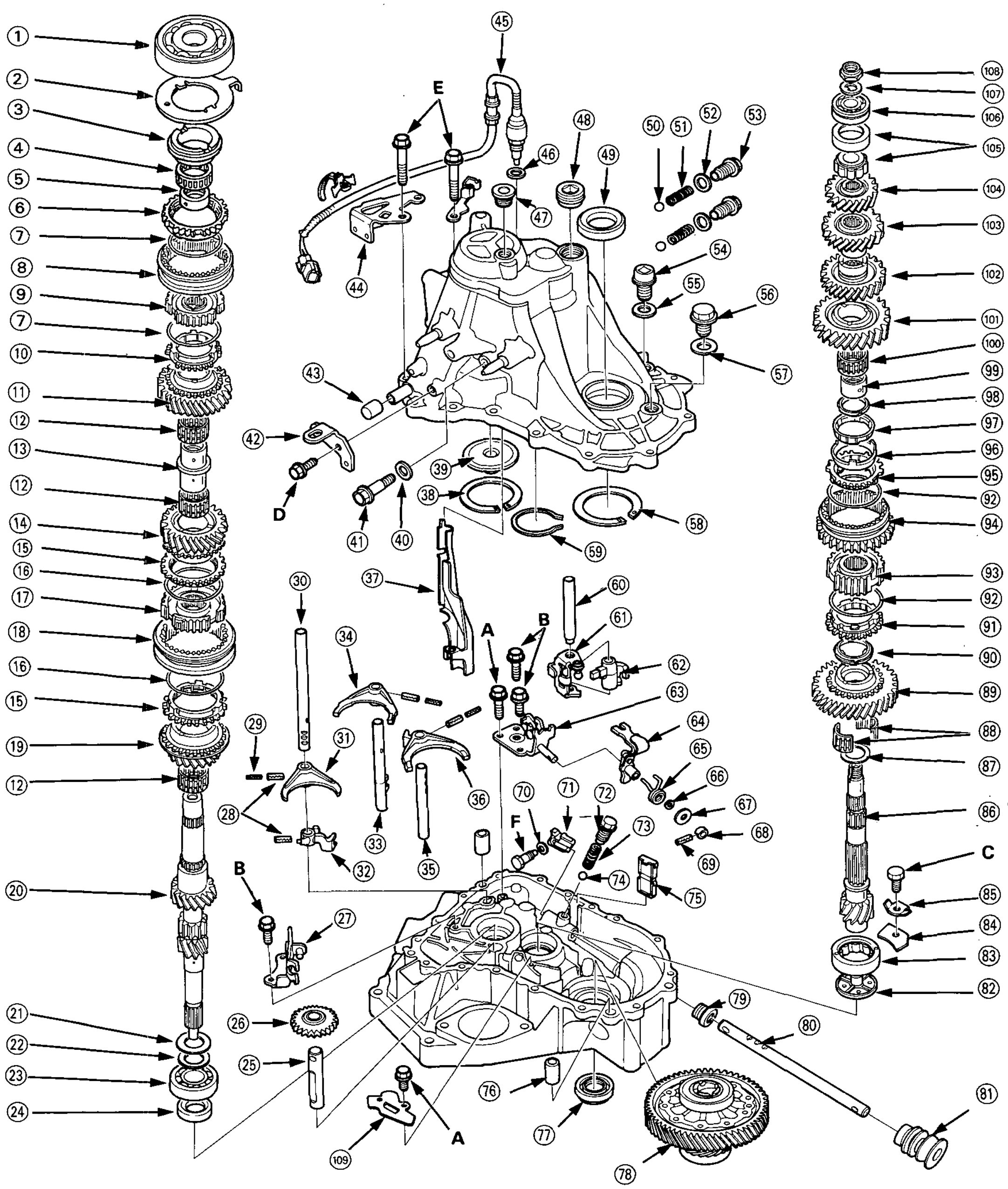

22 N·m (2.2 kg-m, 16 lb-ft)
CHANGE LEVER KNOB
8 N·m (0.8 kg-m, 6 lb-ft)
EXTENSION BOLT
EXTENSION MOUNT RUBBER
BOOT
TORQUE ROD
EXTENSTION END RUBBER
EXTENSION END COLLAR
CHANGE LEVER DUST SEAL A
COLLAR
22 N·m (2.2 kg-m, 16 lb-ft)
CHANGE LEVER
SPRING PIN
Replace.
PIN RETAINER
CHANGE LEVER BALL SEAT
SHIFT ROD
EXTENSION MOUNT STOPPER
O-RING
Replace
REAR JOINT BUSHING
CHANGE LEVER DUST SEAL B
REAR JOINT BUSHING
GREASE
CHANGE BALL HOLDER
22 N·m (2.2 kg-m, 16 lb-ft)
GREASE
PIN RETAINER
BOOT
SPRING PIN
Replace.

Illustrated Index

Refer to the drawing below for the transmission disassembly/reassembly.
Clean all parts throughly in solvent and dry with compressed air.

OIL Lubricate all parts with oil before reassembly.

NOTE: This transmission uses no gaskets between the major housings; use Honda Genuine Liquid Gasket (P/N 08718−0001). Assemble the housings within 20 minutes after applying the sealant and allow it to cure at least 30 minutes after assembly before filling the transmission with oil.



NOTE: Always clean the magnet (75) whenever the transmission housing is disassembled.

	Bolt Sise	Torque Value
A	6 x 1.0mm	12 N·m (1.2 kg-m, 9 lb-ft)
B	6 x 1.0mm	15 N·m (1.5kg-m, 11lb-ft)
C	8 x 1.0mm	15 N·m (1.5kg-m, 11lb-ft)
D	8 x 1.25mm	24 N·m (2.4kg-m, 17lb-ft)
E	8 x 1.25mm	28 N·m (2.8kg-m, 20lb-ft)
F	8 x 1.0mm	32 N·m (3.2kg-m, 23lb-ft)

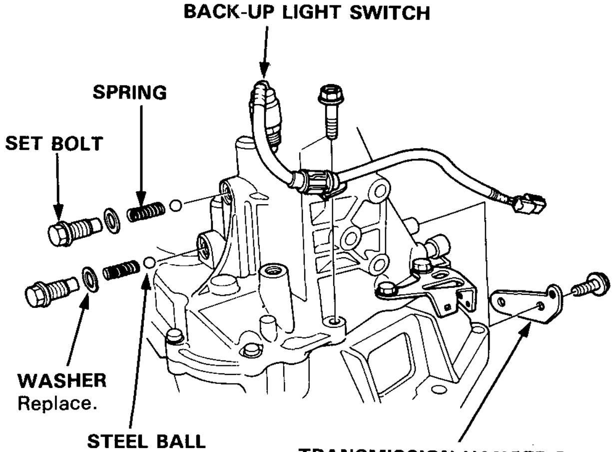
(1) BALL BEARING
(2) STOPPER RING
(3) TAPER RING
(4) NEEDLE BEARING
(5) COLLAR
(6) SYNCHRO RING
(7) SYNCHRO SPRING
(8) 5TH/REVERSE SYNCHRO SLEEVE
(9) 5TH/REVERSE SYNCHRO HUB
(10) SYNCHRO RING
(11) 5TH GEAR
(12) 38 x 43 x 26 mm NEEDLE BEARING
(13) SPACER COLLAR
(14) 4TH GEAR
(15) SYNCHRO RING
(16) SYNCHRO SPRING
(17) 3RD/4TH SYNCHRO HUB
(18) 3RD/4TH SYNCHRO SLEEVE
(19) 3RD GEAR
(20) MAINSHAFT
(21) WASHER
(22) SPRING WASHER
(23) BALL BEARING
(24) 28 x 41 x 7mm OIL SEAL Replace.
(25) REVERSE IDLER GEA SHAFT
(26) REVERSE IDLER GEAR
(27) REVERSE SHIFT FORK
(28) 5 x 22mm SPRING PIN Replace.
(29) 3 x 22 mm SPRING PIN Replace.
(30) 5TH/REVERSE SHIFT FORK SHAFT
(31) 5TH/REVERSE SHIFT FORK
(32) 5TH/REVERSE SHIFT PIECE
(33) 3RD/4TH SHIFT FORK SHAFT
(34) 3RD/4TH SHIFT FORK
(35) 1ST/2ND SHIFT FORK SHAFT
(36) 1ST/2ND SHFT FORK
(37) OIL GUTTER PLATE
(38) 72 mm THRUST SHIM
(39) OIL GUIDE PLATE
(40) 10 mm WASHER Replace.
(41) REVERSE IDLER GEAR SHAFT BOLT
55 N·m (5.5 kg-m, 40 lb-ft)
(42) TRANSMISSION HANGER B
(43) BREATHER CAP
(44) TRANSMISSION HANGER A
(45) BACK-UP LIGHT SWITCH
25 N·m (2.5 kg-m, 18 lb-ft)
(46) 14mm WASHER Replace.
(47) 16mm SEALING BOLT
30 N·m (3.0 kg-m, 22 lb-ft)
(48) 32mm SEALING BOLT
25 N·m (2.5 kg-m, 18 lb-ft)
(49) 40 x 62 x 9mm OIL SEAL Replace.
(50) STEEL BALL
(51) SPRING
(52) 12mm WASHER Replace.
(53) SET BOLT
22 N·m (2.2 kg-m, 16 lb-ft)
(54) OIL FILLER PLUG
45 N·m (4.5 kg-m, 33 lb-ft)
(55) 20mm WASHER Replace.
(56) OIL DRAIN PLUG
40 N·m (4,0 kg-m, 28 lb-ft)
(57) 14mm WASHER Replace.
(58) 80mm THRUST SHIM
(59) SNAP RING
(60) SHIFT PIECE SHAFT
(61) INTERLOCK
(62) SHIFT PIECE
(63) SHIFT ARM HOLDER
(64) SELECT ARM
(65) SELCT RETURN SPRING
(66) 10mm THRUST SHIM
(67) 10mm WASHER
(68) LOCK COLLAR
(69) 3 x 16mm SPRING PIN
Replace.
(70) 8mm SPRING WASHER
(71) CHANGE PIECE
(72) SEALING BOLT
22 N·m (2.2 kg-m, 16 lb-ft)
(73) SPRING
(74) STEEL BALL
(75) MAGNET
(76) 14 x 20mm DOWEL PIN
(77) 35 x 56 x 8mm OIL SEAL
Replace.
(78) DIFFERENTIAL ASSEMBLY
See section 15
(79) 14 x 25 x 16mm OIL SEAL
Replace.
(80) SHIFT ROD
(81) BOOT
(82) OIL GUIDE PLATE
(83) 33 x 60 x 20mm
NEEDLE BEARING
(84) BEARING RETAINER PLATE
(85) LOCK WASHER
(86) COUNTERSHAFT
(87) 40 x 50mm THRUST SHIM
(88) 37 x 42 x 25mm
NEEDLE BEARING
(89) 1ST GEAR
(90) FRICTION DAMPER
(91) SYNCHRO RING
(92) SYNCHRO SPRING
(93) 1ST/2ND SYNCHRO HUB
(94) REVERSE GEAR
(95) OUTER SYNCHRO RING
(96) SYNCHRO CORN
(97) INNER SYNCHRO RING
(98) FRICTION DAMPER
(99) DISTANCE COLLAR
(100) 42 x 47 x 23.5mm
NEEDLE BEARING
(101) 2ND GEAR
(102) 3RD GEAR
(103) 4TH GEAR
(104) 5TH GEAR
(105) NEEDLE BEARING
(106) BALL BEARING
(107) SPRING WASHER
(108) LOCKNUT Replace.
110→0→110N·m
(11.0→0→11.0kg-m,
80→0→80lb-ft)
(109) OIL CHAMBER PLATE

Transmission Housing

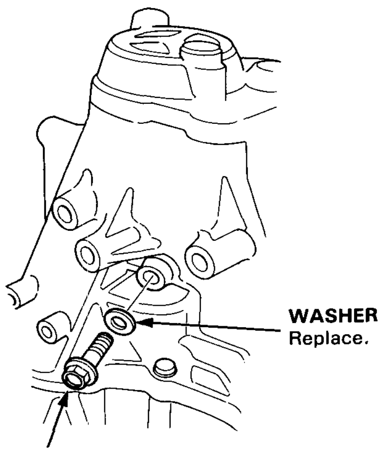
Removal

NOTE: Place the clutch housing on two pieces of wood thick enough to keep the mainshaft from the hitting the warkbench.

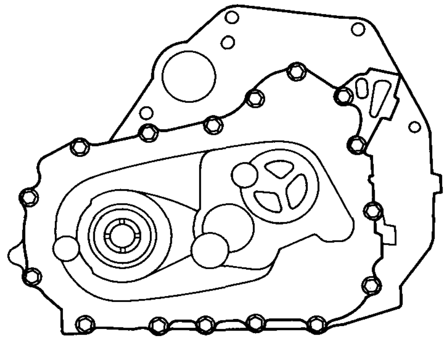
1. Remove the back-up light switch.
2. Remove the transmission hanger B.
3. Remove the set bolts, springs, and steel balls.



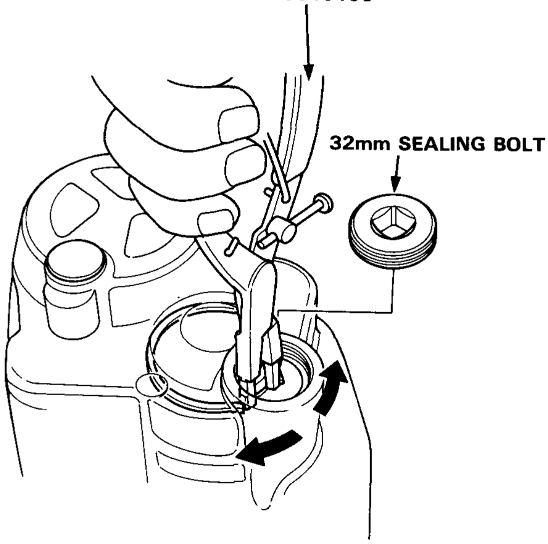
2. Remove the reverse idler gear shaft bolt.



3. Remove the transmission housing attaching bolts.

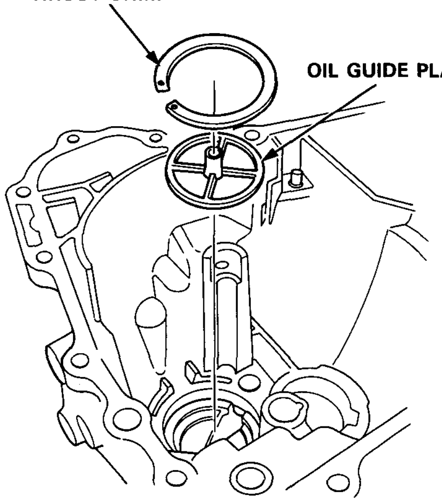


4. Remove the 32mm sealing bolt.
5. Expand the snap ring on the countershaft ball bearing and remove it from the groove using a pair of snap ring pliers.

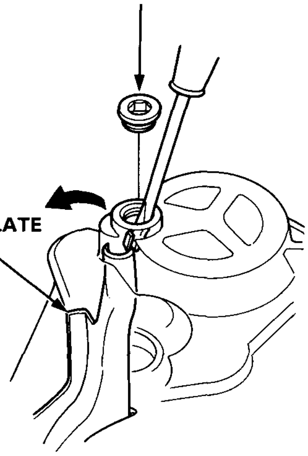


6. Separate the transmission housing from the clutch housing and wipe it clean of the sealant.

7. Remove the thrust shim and oil guide plate from the transmission housing.



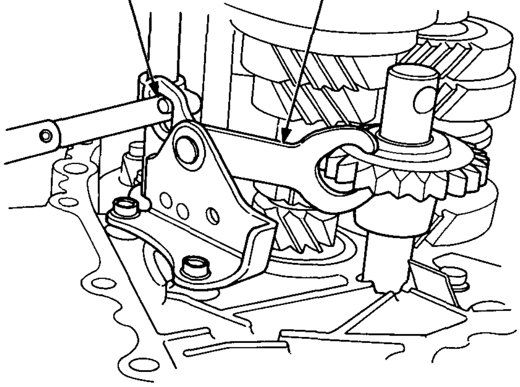
8. Remove the 16mm sealing bolt, then remove the oil gutter plate.



Clearance Inspection

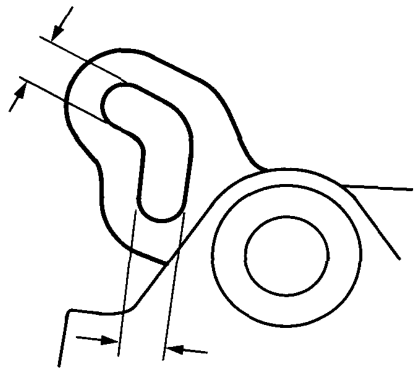
1. Measure the clearance between the reverse shift fork and 5th/reverse shift piece pin.

   Standard:
   Reverse Side: 0.05–0.45mm (0.002–0.018in)
   5th Side: 0.4–0.9mm (0.016–0.035in)



2. If the clearance exceeds the standard, measure the width of the groove in the reverse shift fork.

   Standard:
   Reverse Side: 7.05–7.25mm (0.278–0.285in)
   5th Side: 7.40–7.70mm (0.291–0.303in)



If the width of the groove exceeds the standard, replace the reverse shift fork with a new one.
If the width of the groove is within the standard, replace the 5th/reverse shift piece with a new one.

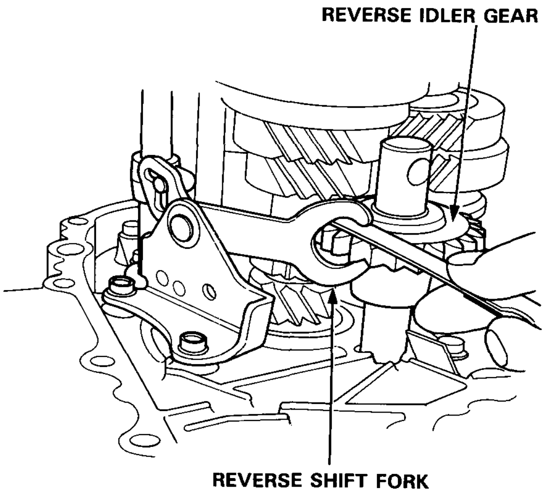
(cont'd)

Reverse Shift Fork, Reverse Idler Gear

Clearance Inspection (cont'd)

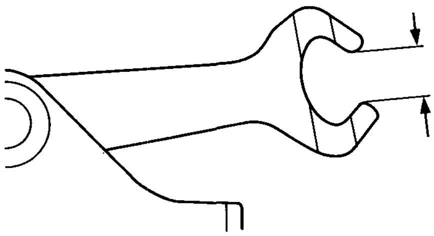
3. Measure the clearance between the reverse idler gear and reverse shift fork.

Standard: 0.5—1.1mm (0.020—0.043in)
Service Limit: 1.8mm(0.071in)



4. If the clearance exceeds the service limit, measure the width of the reverse shift fork pawl groove.

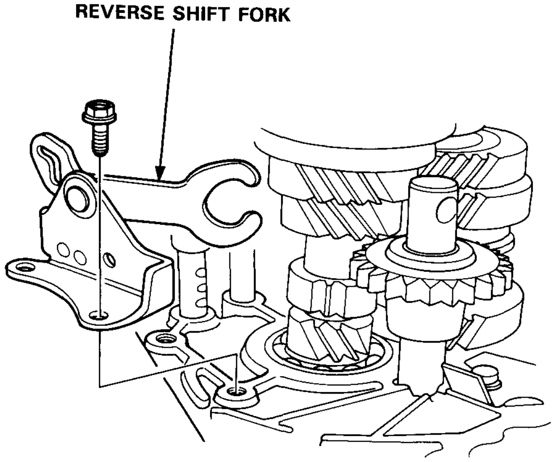
Standard: 13.0—13.3mm(0.512—0.524)



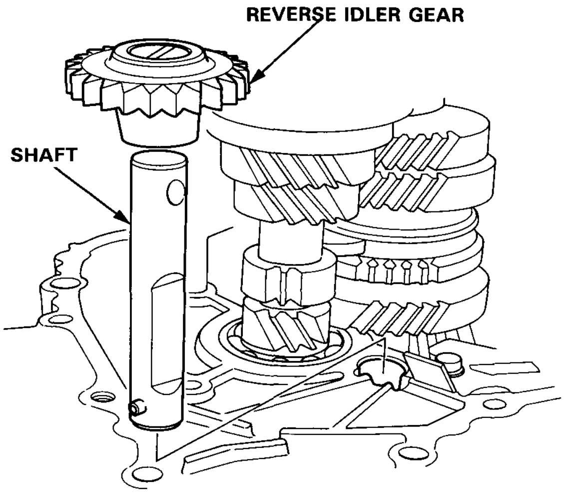
If the width exceeds the standard, replace the reverse shift arm with a new one.
If the width is within the standard, replace the reverse shift fork with a new one.

Removal

1. Remove the reverse shift fork.



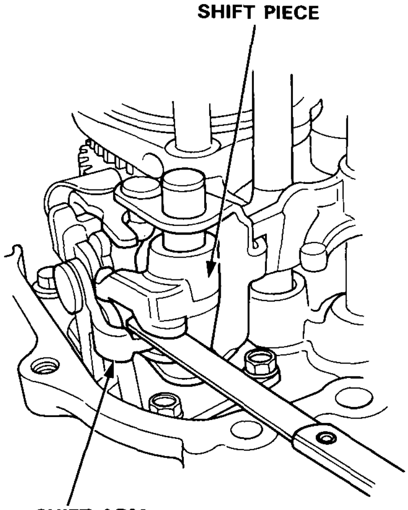
2. Shift the 3rd/4th shift fork to the 4th side, then remove the reverse idler gear and shaft.



Clearance Inspection

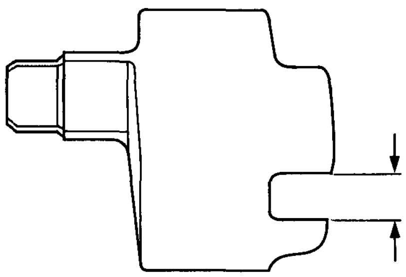
1. Measure the clearance between the shift piece and shift arm

Standard: 0.1–0.3mm (0.004–0.012in)
Service Limit: 0.6mm (0.024in)



2. If the clearance exceeds the service limit, measure the width of the groove in the shift piece.

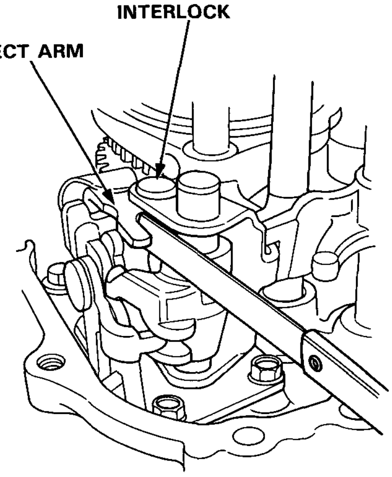
Standard: 8.1–8.2mm (0.319–0.329in)



If the width of the groove exceeds the standard, replace the shift piece.
If the width of the groove is within the standard, replace the shift arm.

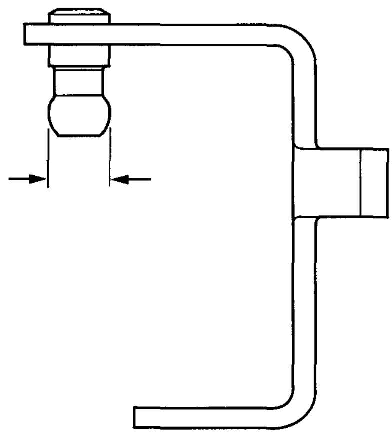
3. Measure the clearance between the select arm and interlock.

Standard: 0.05–0.25mm (0.002–0.01in)
Service Limit: 0.5mm (0.020in)



4. If the clearance exceeds the service limit, measure the width of the interlock.

Standard: 13.0–13.3mm (0.512–0.524in)



If the width exceeds the standard, replace the interlock.
If the width is within the standard, replace the interlock.

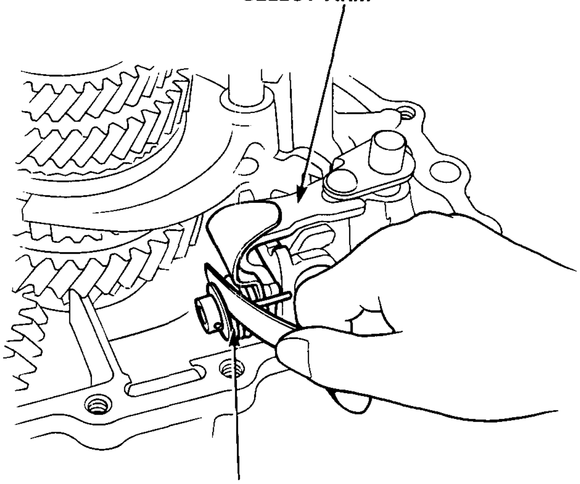
(cont'd)

Change Holder

Clearance Inspection (cont'd)

7. Measure the clearance between the select arm and shim.

Standard: 0.01--0.2mm (0.0004—0.008in)

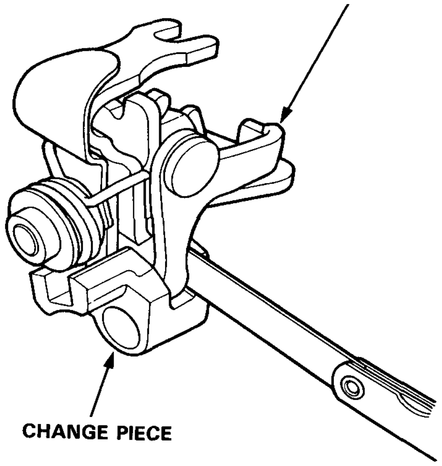


8. If the clearance exceeds the standard, select the appropriate thrust shim for the correct clearance from the chart below.

	PART NUMBER	THICKNESS
A	24435—689—000	0.8 mm (0.031in)
B	24436—689—000	1.0 mm (0.039in)
C	24437—689—000	1.2 mm (0.047in)
D	24438—689—000	1.4 mm (0.055in)
E	24439—689—000	1.6 mm (0.063in)

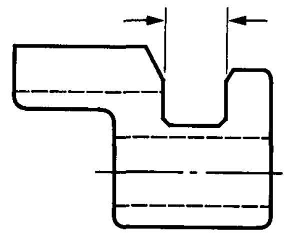
9. Measure the clearance between the shift arm holder and change piece.

Standard: 0.05—0.35mm (0.002—0.014in)
Service Limit: 0.8mm (0.031in)



10. If the clearance exceeds the service limit, measure the groove of the change piece.

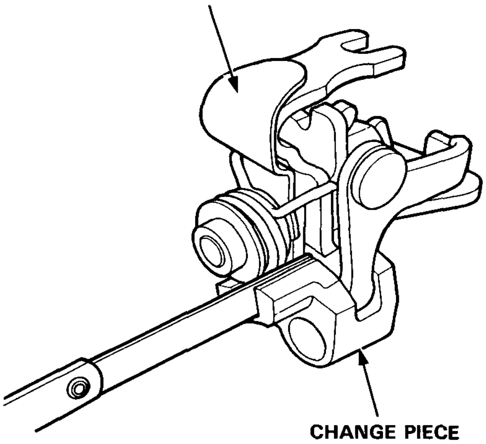
Standard: 11.8—12.0mm (0.465—0.472in)



If the groove exceeds the standard, replace the change piece.
If the groove is within the standard, replace the change piece.

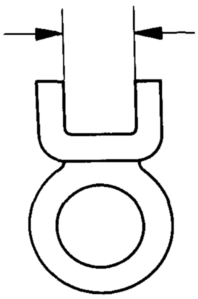
11. Measure the clearance between the select arm and change piece.

Standard: **0.05–0.25mm (0.002–0.01in)**
Service Limit: **0.5mm (0.020in)**



12. If the clearance exceeds the service limit, measure the width of the select arm.

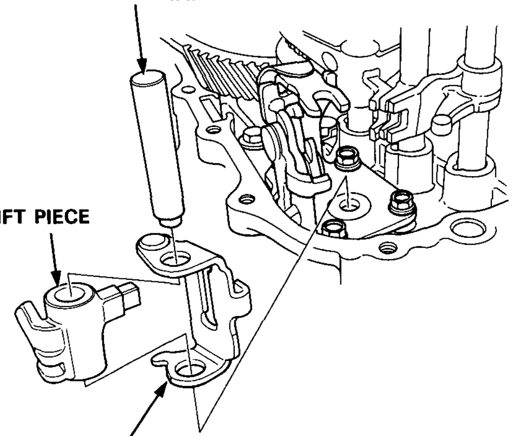
Standard: 11.9–12.0mm (0.469–0.472in)



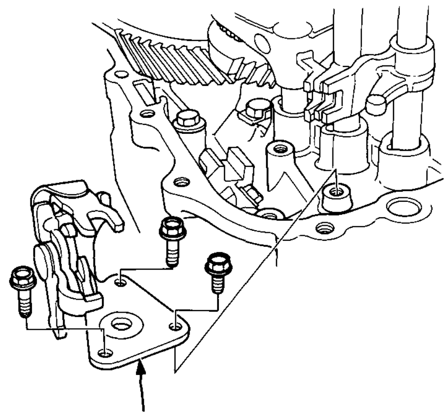
If the width exceeds the standard, replace the select arm.
If the width is within the standard, replace the change piece.

Removal

1. Remove the shift piece shaft, then remove the shift piece and inter lock.



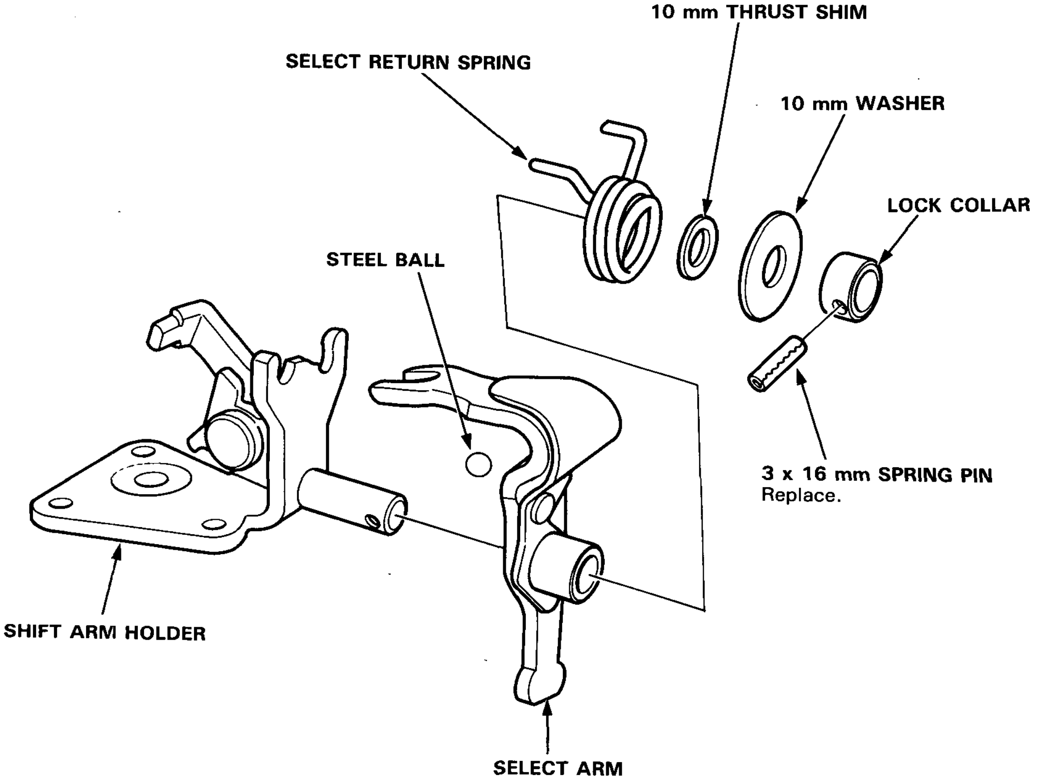
2. Remove the change holder assembly.

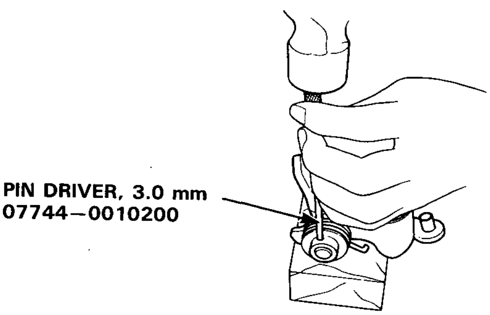


Change Holder Assembly

Disassembly/Reassembly

Prior to reassembling, clean all the parts in solvent, dry them and apply lubricant to any contact surfaces.



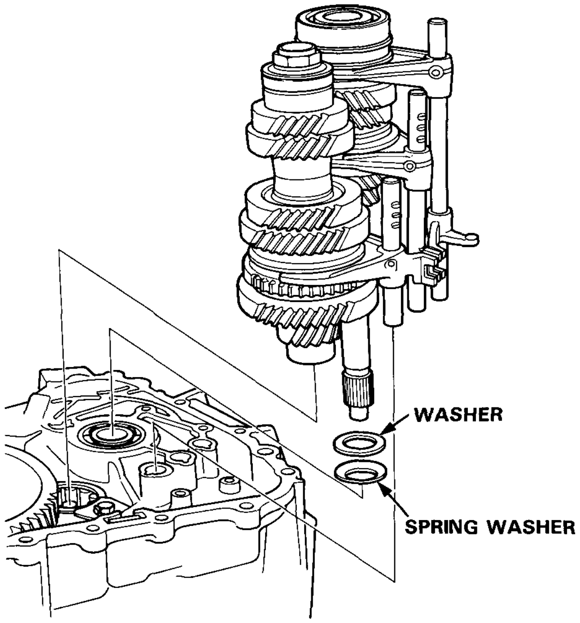


Mainshaft, Countershaft, Differential Assemblies

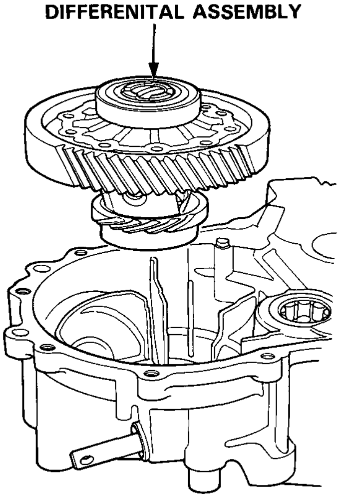
Removal

1. Remove the mainshaft and countershaft assemblies with the shift fork from the clutch housing.

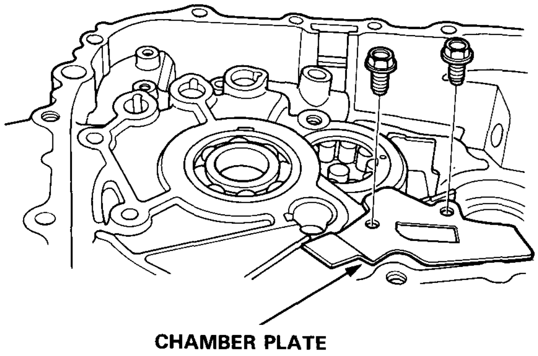
   NOTE: Before removing the mainshaft and countershaft assemblies, tape the mainshaft spline to protect it.



2. Remove the differential assembly.



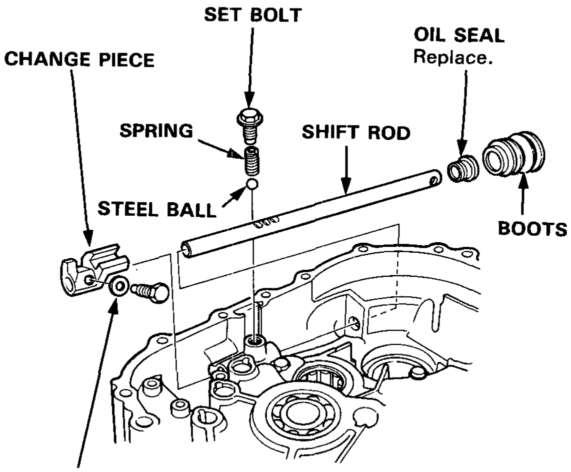
3. Remove the chamger plate.



Shift Rod

Removal

1. Remove the change piece attaching bolt and spring washer.
2. Remove the set bolt, then remove the spring and steel ball.
3. Remove the shift rod, then remove the change piece.



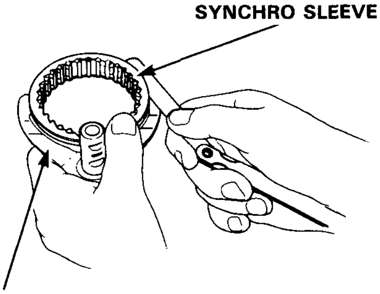
Shift Fork, Shift Piece

Clearance Inspection

NOTE: The synchro sleeve and suynchro hub should be replaced as a set.

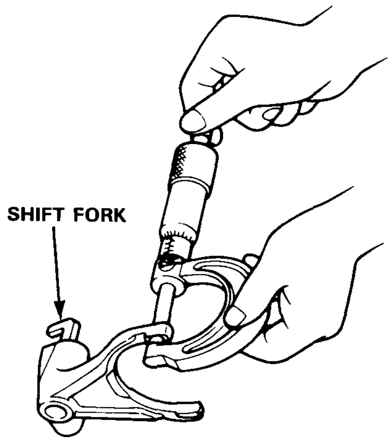
1. Measure the clearance between the synchro sleeve and shift fork.

   Standard: 0.45—0.65 mm (0.018—0.026 in)
   Service Limit: 1.0 mm (0.039 in)



2. If the clearance exceeds the service limti, measure the width of the shift fork fingers.

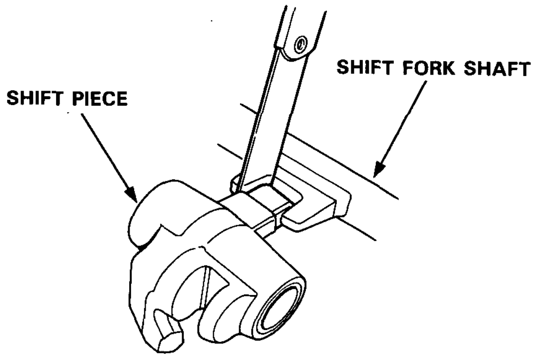
   Standard: 7.4—7.5 mm (0.291—0.295 in)



If the width of the shift fork fingers exceeds the standard, replace the shift fork with a new one.
If the width of the shift fork fingers is within the standard, replace the synchro sleeve with a new one.

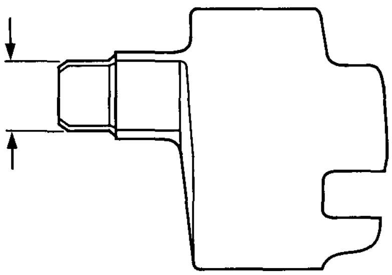
3. Measure the clearance between the shift piece asnd shift fork shafts.

Standard: **0.2–0.5 mm (0.008–0.020 in)**
Service Limit: **0.8 mm (0.031 in)**



4. If the clearance exceeds the service limit, measure the width of the shift piece.

Standard: 11.9–12.0 mm (0.469–0.472 in)



If the width of the shift piece exceeds the standard, replace the shift fork with a new one.
If the width is within the standard, replace the shit fork shaft a new one.

Shift Fork Assembly

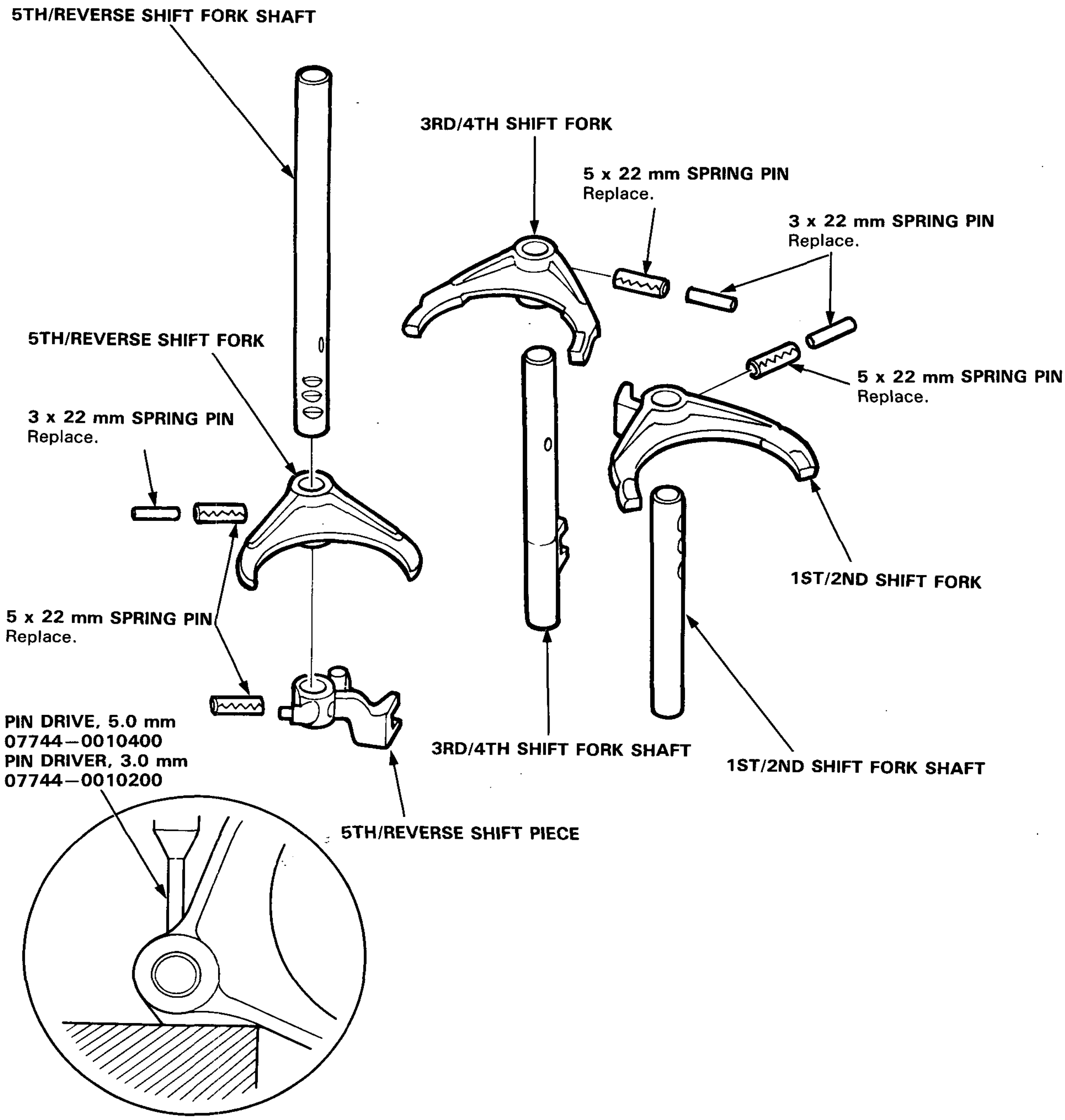
Disassembly/Reasembly

NOTE: Install the spring pins, so their grooves are 180° apart.

Prior to reassembling, clean all the parts in solvent, dry them and apply lubricant to any contact surfaces.

Disassembly: Remove with the 3 mm spring pin and 5 mm spring pin.

Reassembly; Install the 5 mm spring pin first, then install the 3 mm spring pin.

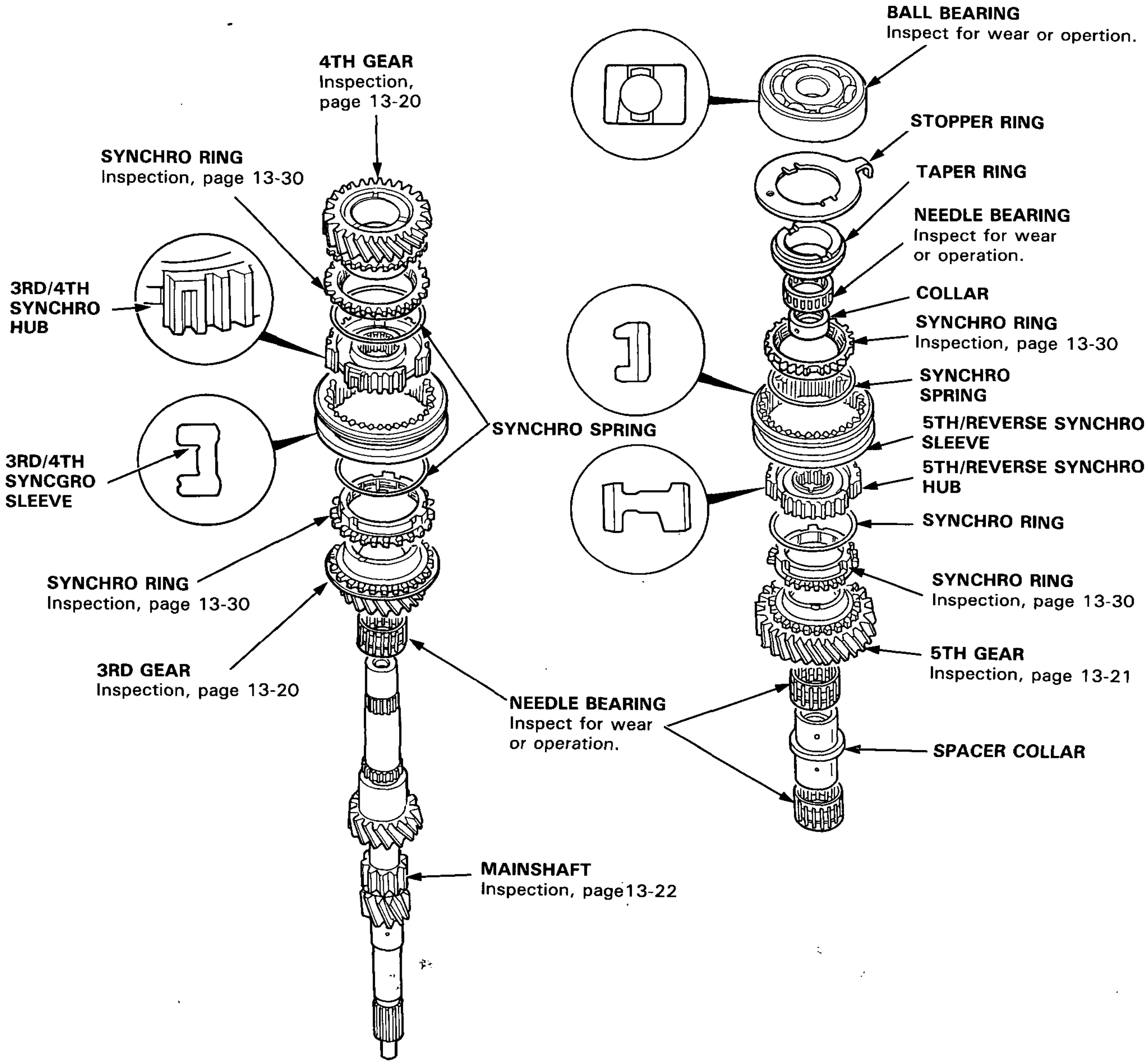


Mainshaft Assembly

Index

NOTE: The 3rd/4th and 5th synchro hubs are installed with a press.

Prior to reassembling, clean all the parts in solvent, dry them and apply lubricant to any contact surfaces. The 3rd/4th and 5th synchro hubs, however, should be installed with a press before lubricating them.



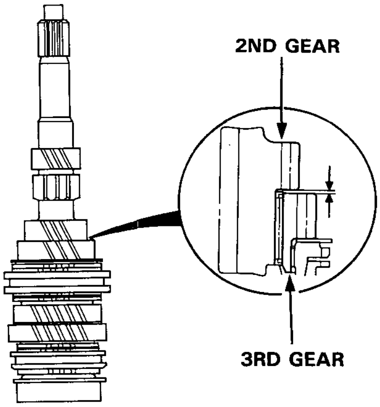
Mainshaft Assembly

Clearance Inspection

NOTE: If replacement is required, always the synchto sleeve and hobs as a set.

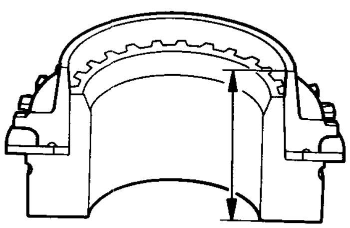
1. Measure the clearance between 2nd and 3rd gears.

Standard: 0.06–0.21mm (0.002–0.008 in)
Service Limit: 0.3 mm (0.012 in)



2. If the clearance exceeds the service limit, measure the thickness of 3rd gear.

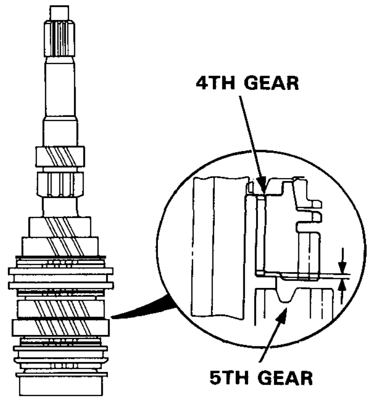
Standard: 34.92–34.97 mm (1.375–1.377 in)
Service Limit: 34.3 mm (1.350 in)



If the thickness of 3rd gear is less than the service limit, replace of 3rd gear with a new one.
If the thickness of 3rd gear is within the service limit, replace the 3rd/4th synchro hub with a new one.

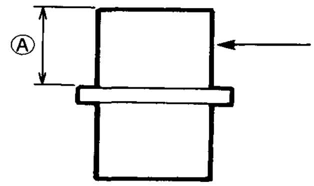
3. Measure the clearance between 4th gear and the spacer collar.

Standard: 0.06–0.21 mm (0.002–0.008 in)
Service Limit: 0.3 mm (0.012 in)



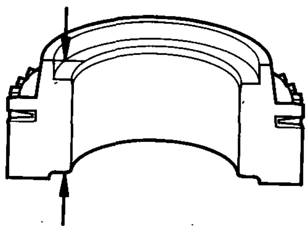
4. If the clearance exceeds the service limit, measure distance A on the spacer collar.

Standard: 26.03–26.08 mm (1.025–1.027 in)



5. If distance A is more than the standard replace the spacer collar with a new one.
If distance A is withtin the standard measure the thickness of 4th gear.

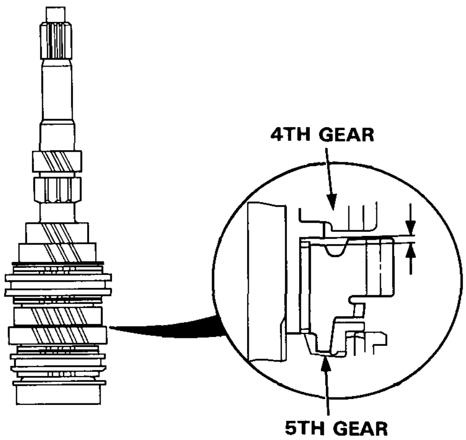
Standard: 31.42–31.47 mm (1,237–1,239 in)
Service Limit: 31.3 mm (1.232 in)



If the thickness of 4th gear is less than the service limit, replace 4th gear with a new one.
If the thickness of 4th gear is within the service limit, replace the 3rd/4th synchro hub with a new one.

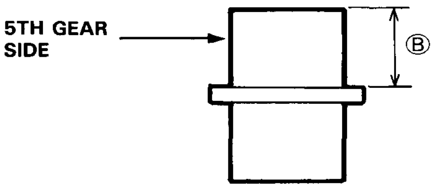
6. Measure the clearance between 5th gear and the spacer collar.

Standard: 0.06–0,21 mm (0.002–0.008 in)
Service Limit: 0.3 mm (0.012 in)



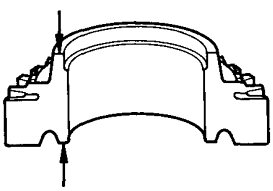
7. IF the clearance exceeds the service limit, measure distance B on the spacer collar.

Standard: 26.03–26.08 mm (1.025–1.027 in)



8. If distance B is more than the standard replace the spacer collar with a new one.
If distance B is within the standard measure the thickness of 5th gear.

Standard: 31.42–31.47 mm (1,237–1,239 in)
Service Limit: 31.3 mm (1.232 in)

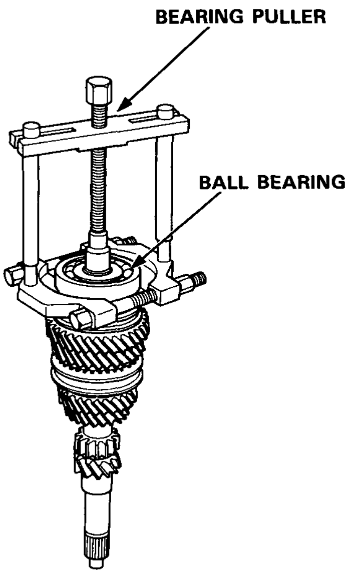


If the thickness of 5th gear is less than the service limit, replace 5th gear with a new one.
If the thickness of 5th gear is within the service limit, replace the 5th/reverse synchro hub with a new one.

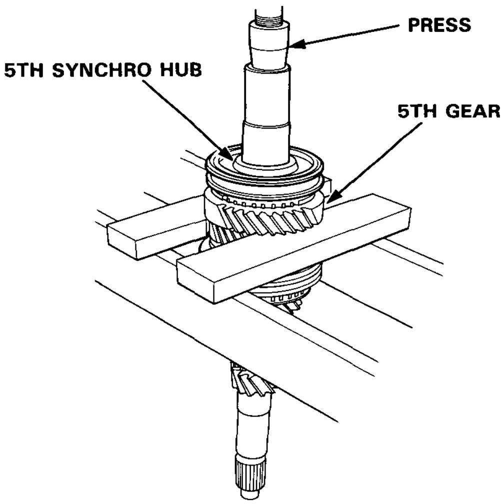
Disassembly

NOTE: Remove the synchro hubs using a press and steel blocks as shown. Use of a jow-tipe puller can cause damage to the gear teeth.

1. Remove the ball bearing using th bearing puller as shown.



2. Support 5th gear on steel blocks as shown and press the shaft out of the 5th synchro hub.

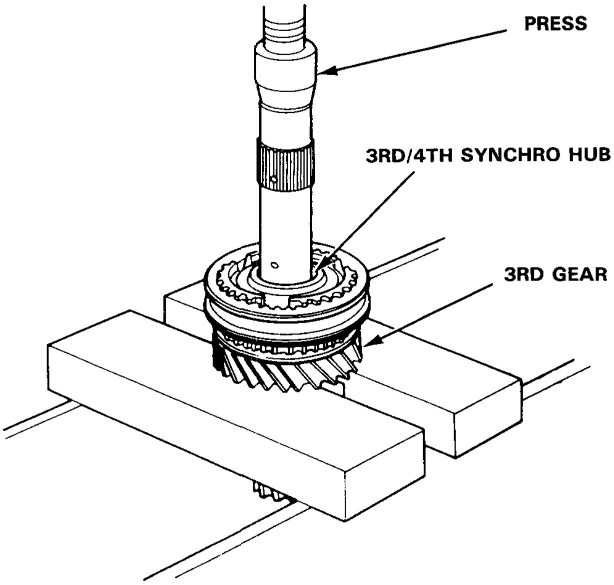


(cont'd)

Mainshaft Assembly

Disassembly (cont'd)

3. In the same manner as above, support the 3rd gear on steel blocks and press the shaft out of the 3rd/4th synchro hub.

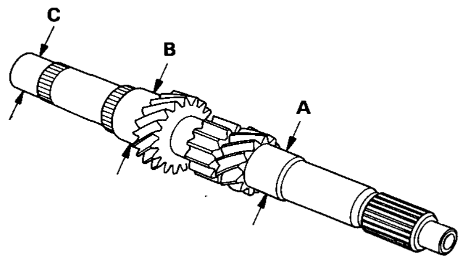


Inspection

1. Inspect the surface and bearing surface for wear or damage, then measure the mainshaft at points A, B, and C.

Standard: A: **27.977–27.990 mm (1,1015–1,1020 in)**
B: **37.984–38.000 mm (1,4954–1,4960 in)**
C: **27.987–28.000 mm (1.1018–1.1024 in)**

Service Limit: A: **27.930 mm (1.0996 in)**
B: **37.930 mm (1,4933 in)**
C: **27.940 mm (1.1000 in)**

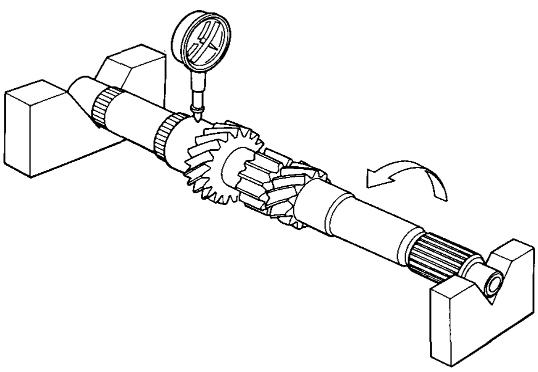


If any part of the mainshaft is less than the service limit, replace it with a new one.

2. Inspect for runout.

Standard: **0.02 mm (0.001 in)**
Service Limit: **0.05 mm (0.002 in)**

NOTE: Support the mainshaft at both ends as shown.

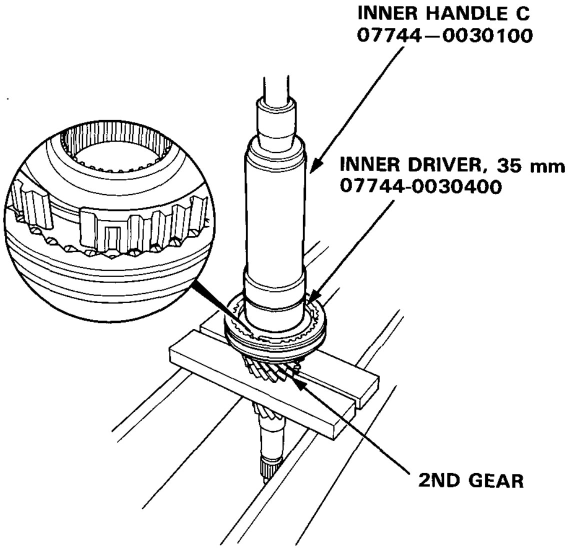


If the runout exceeds the service limit, replace the mainshaft with a new one.

Reassembly

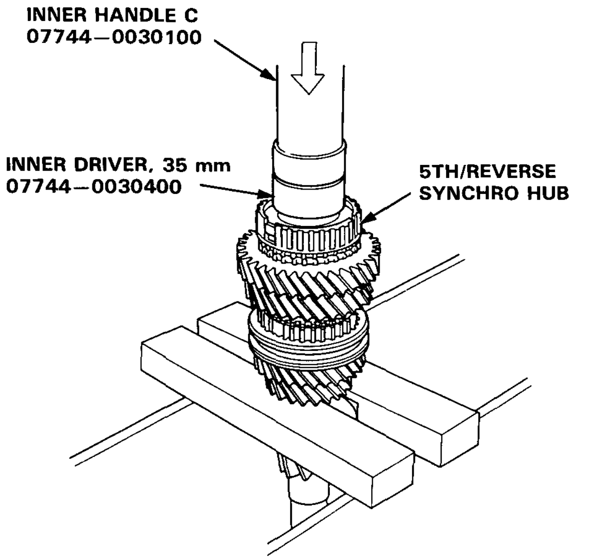
CAUTION:
- **Press the 3rd/4th and 5th synchro hubs on the main-shaft without lubrication.**
- **When installing the 3rd/4th and 5th synchro hubs, support the shaft on steel blocks and install the synchro hubs using a press.**
- **Install the 3rd/4th and 5th synchro hubs with a maximum pressure of 2.000 kg.**

1. Support 2nd gear on steel blocks as shown, then install the 3rd/4th synchro hub using the special tools and a press.

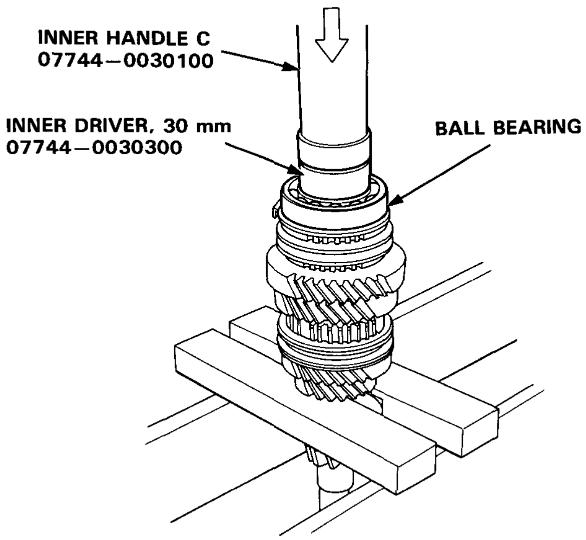


2. After installed, check the operation of the 3rd/4th synchro hub set.

3. Install the 5th/reverse synchro hub using th special tools and a press.



4. Install the ball bearing using the special tools and a press.

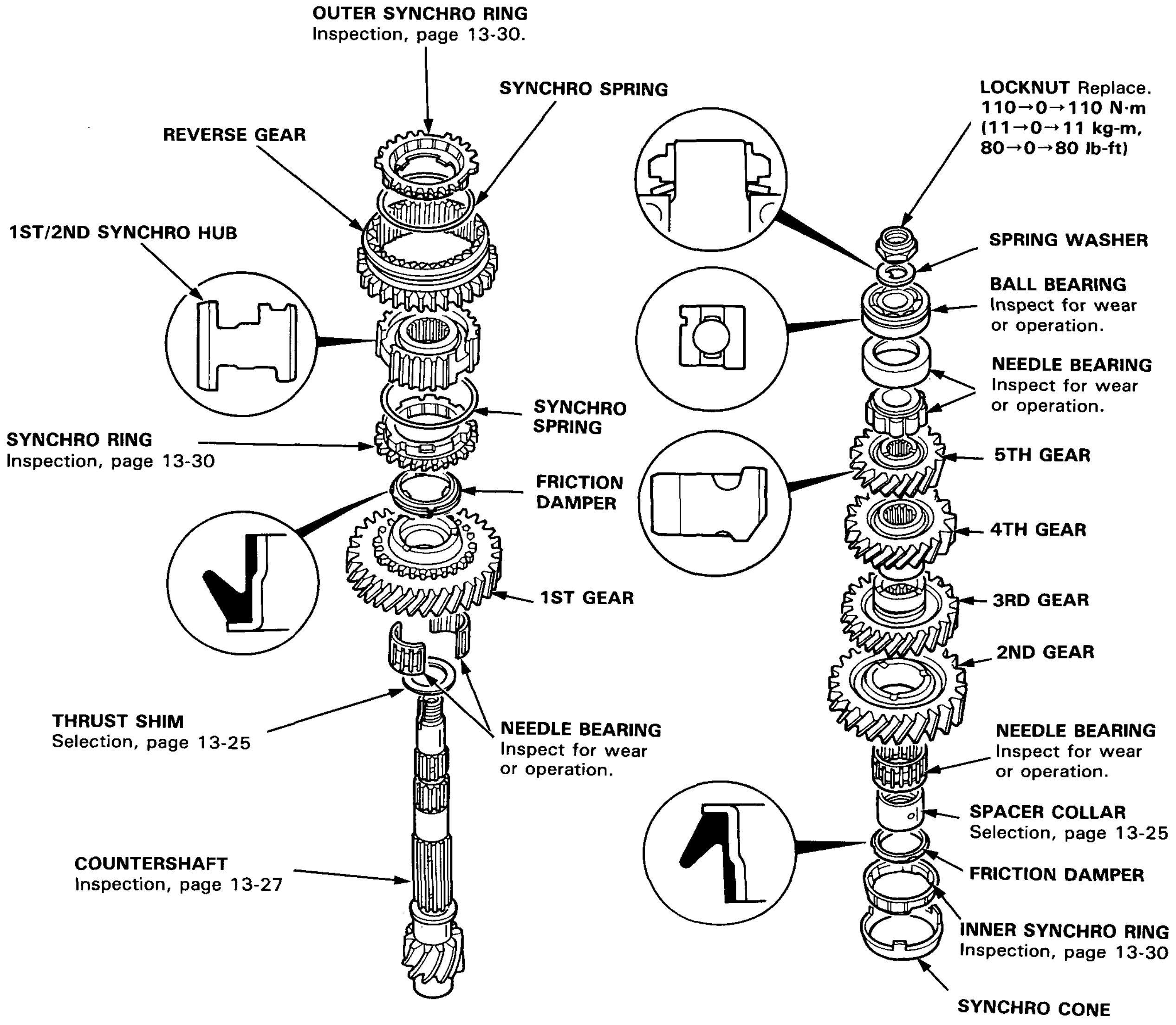


Countershaft Assembly

Index

NOTE: The 4th and 5th gears are installed with a press.

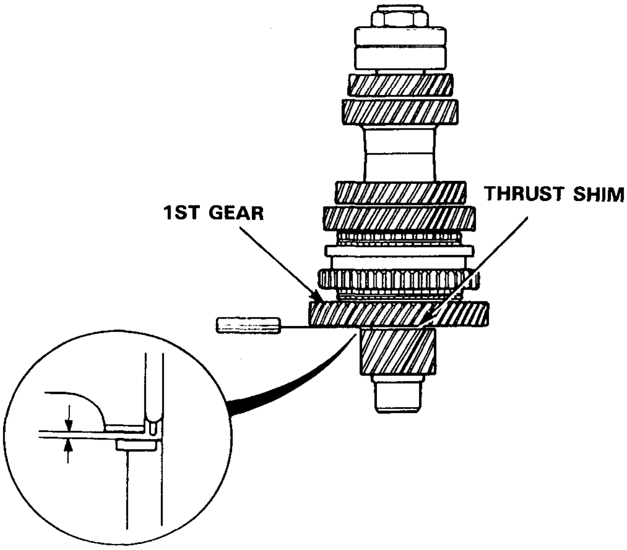
Prior to reassembling, clean all the parts in solvent, dry them and apply lubricant to any contact surfaces. The 4th and 5th gears, should be installed without lubrication using a press.



Clearance Inspection

1. Measure the clearance between the 1st gear and thrust shim.

   Standard: 0.04–0.12 mm (0.0016–00.0047 in)
   Service Limit: 0.18 mm (0.0071 in)

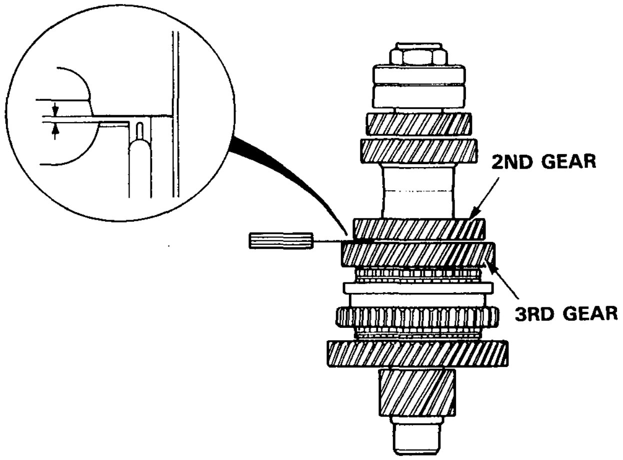


2. *If the clearance exceeds the service limit, select the* appropriate thrust shim for the correct clearance from the chart below.

	PART NUMBER	THICKNESS
A	23921–PK5–900	1.95 mm (0.0768 in)
B	23922–PK5–900	1.96 mm (0.0772 in)
C	23923–PK5–900	1.97 mm (0.0776 in)
D	23924–PK5–900	1.98 mm (0.0780 in)
E	23925–PK5–900	1.99 mm (0.0783 in)
F	23926–PK5–900	2.00 mm (0.0787 in)
G	23927–PK5–900	2.01 mm (0.0791 in)
H	23928–PK5–900	2.02 mm (0.0795 in)
I	23929–PK5–900	2.03 mm (0.0799 in)
J	23930–PK5–900	2.04 mm (0.0803 in)
K	23931–PK5–900	2.05 mm (0.0807 in)
L	23932–PK5–900	2.06 mm (0.0811 in)
M	23933–PK5–900	2.07 mm (0.0815 in)
N	23934–PK5–900	2.08 mm (0.0819 in)
O	23935–PK5–900	2.09 mm (0.0823 in)
P	23936–PK5–900	2.10 mm (0.0827 in)

3. Measure the clearance between the 2nd and 3rd gears.

   Standard: 0.05–0.12 mm (0.0020–0.0047 in)
   Service Limit: 0.18 mm (0.0071 in)



4. *If the clearance exceeds the service limti, select the* appropriate thrust shim for the correct clearance from the chart below.

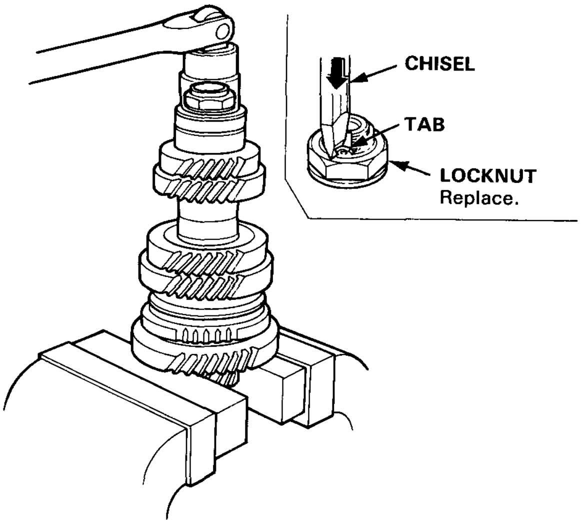
	PART NUMBER	THICHNESS
A	23917–P21–010	29.02–29.04 mm (1.1425–1.1433 in)
B	23918–P21–010	29.07–29.09 mm (1.1445–1.1453 in)

Countershaft Assembly

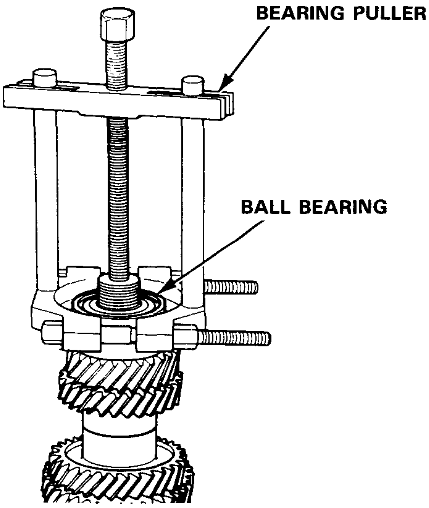
Disassembly

NOTE: Remove the gears using a press and steel blocks as shown. Use of a jow-tipe puller can damage the gear teeth.

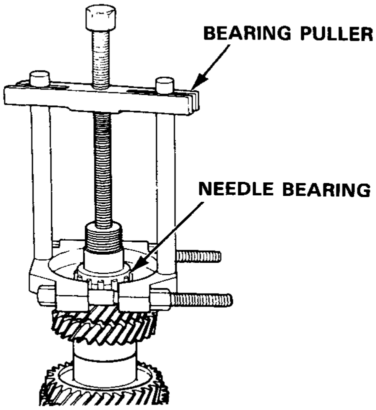
1. Raise the locknut tab from the groove of the shaft and remove the locknut and the spring washer.



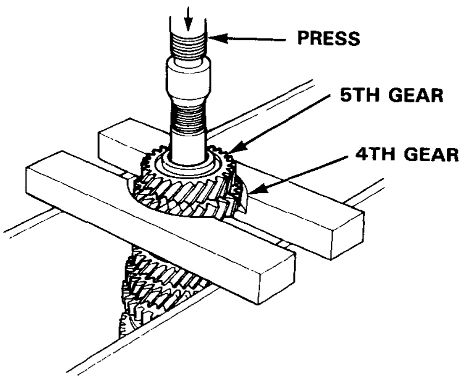
2. Remove the ball bearing using a bearing puller as shown.



3. Remove the bearing outer race, then remove the needle bearing using a bearing puller as shown.



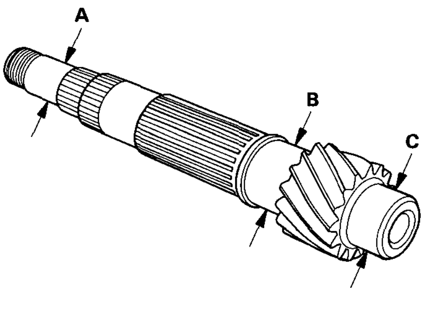
4. Support 4th gear on steel blocks as shown and press the shaft out of 5th and 4th gears.



Inspection

1. Inspect the surface and bearing surface for wear or damage, then measure the contershaft at points A, B, and C.

   Standard: **A: 24.980—27.993 mm (0.9835—1,1021 in)**
   B: 36.984—37.000 mm (1.4561—1.4567 in)
   C: 33.000—33.015 mm (1.2992—1.2998 in)
   Service Limit: **A: 24.940 mm (0.9819 in)**
   B: 36.930 mm (1.4539 in)
   C: 32.950 mm(1.2972 in)

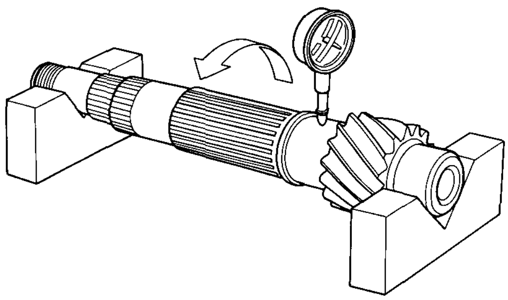


If any part of the coustershaft is less than the service limit, replace it with a new one.

2. Inspect for runout.

   Standard: **0.02 mm (0.001 in)**
   Service Limit: **0.05 mm (0.002 in)**

   NOTE: Support the countershaft at both ends as shown.



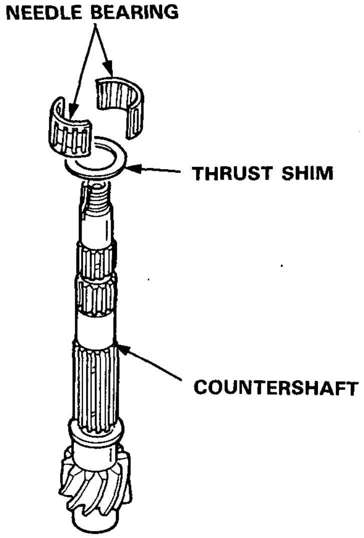
If the runout exceeds the service limit, replace the countershaft with a new one.

Countershaft Assembly

Reassembly

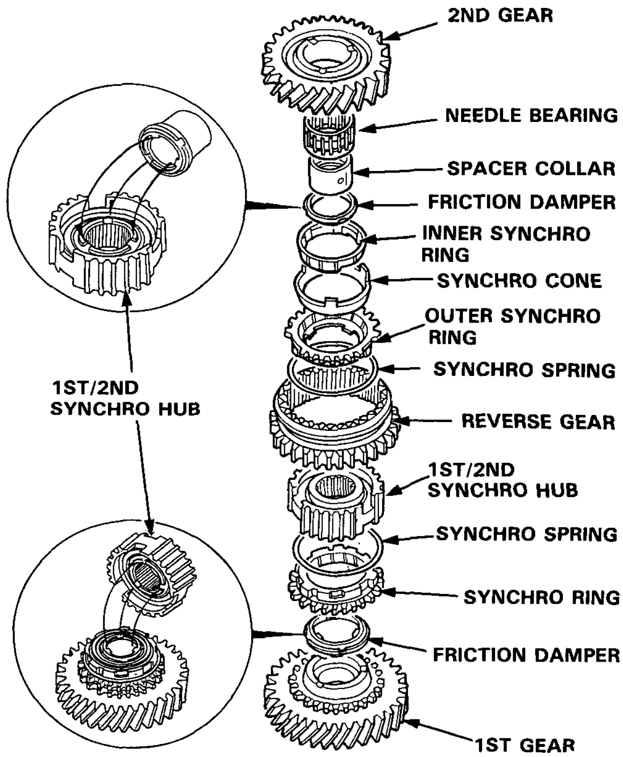
CAUTION:
- **Press the 4th and 5th gears on the countershaft without lubrication**
- **When installing the 4th and 5th gears, support the shaft on steel blocks and install the gears using a press.**
- **Install the 4th and 5th gears with a maximum pressure of 2,600 kg.**

1. Install the thrust shim and needle bearing on the countershaft.



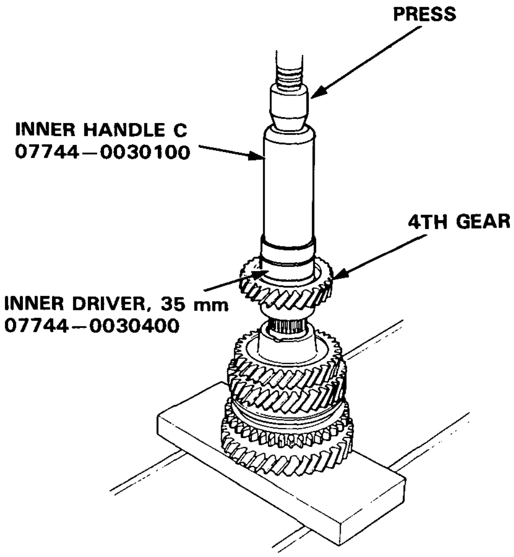
2. Assemble the parts below as shown.

   NOTE: Check that the fingers of the friction damper is securely set in the grooves of the 1st/2nd synchro hub.

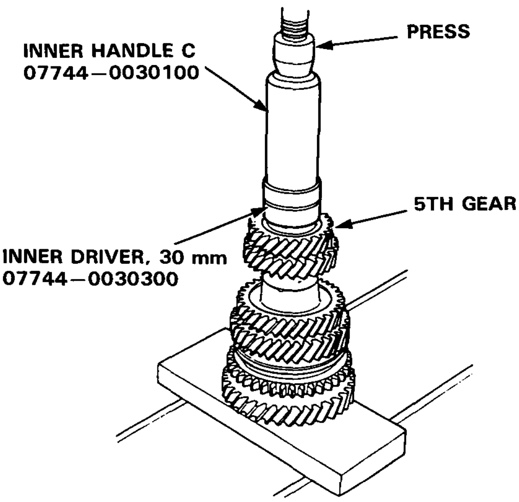


3. Place the parts assembled in Step 2, then install the parts on the countershaft.

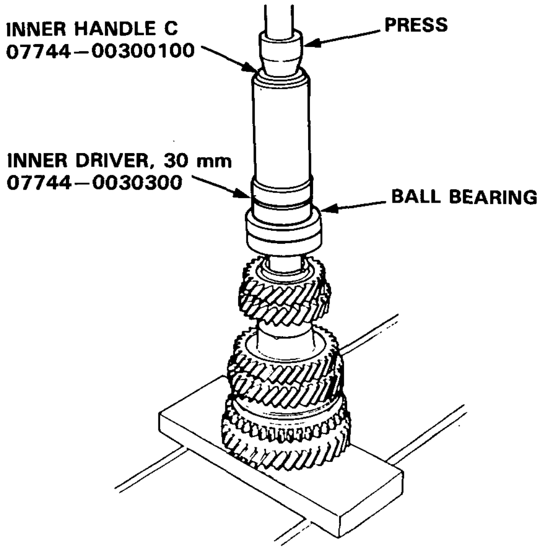
4. Support the countershaft on a steel block as shown and install 4th gear using the special tools and a press.



5. Support the countershaft on a steel block as shown and install 5th gear using the special tools and a press.

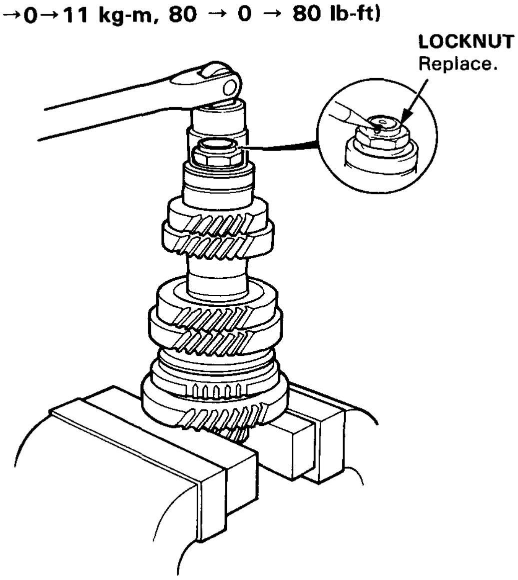


6. Install the needle bearing, then install the ball bearing using the special tools an da press.



7. Install the spring washer, tighten the locknut, then stake the locknut tab into groove

LOCK NUT
110→0→110 N·m
(11→0→11 kg-m, 80 → 0 → 80 lb-ft)



Synchro Ring, Gear

Inspection

1. Inspect the synchro ring and gear.

   A : Inspect the inside of the synchro ring for wear.

   B : Inspect the synchro sleeve teeth and matching teeth on the synchro ring for wear (rounded off).

   GOOD WORN

   C : Inspect the synchro sleeve teeth and matching teeth on the gear for wear (rounded off).

   GOOD WORN

   D : Inspect the gear hub thrust surface for wear.

   E : Inspect the cone surface for wear or roughness.

   F : Inspect the teeth on all gears for uneven wear, scoring, galling, cracks.

2. Coat the cone surface of the gear with oil and place the synchro ring on the matching gear. Rotate the ring, making sure that it does not slip.

   Measure the clearance between the ring and gear all the way around.

   NOTE: Hold the ring against the gear evenly while measuring the clearance.

   Ring-to-Gear Clearance
   Standard: 0.85–1.1 mm (0.0335–0.0433 in)
   Service Limit: 0.4 mm (0.0157 in)

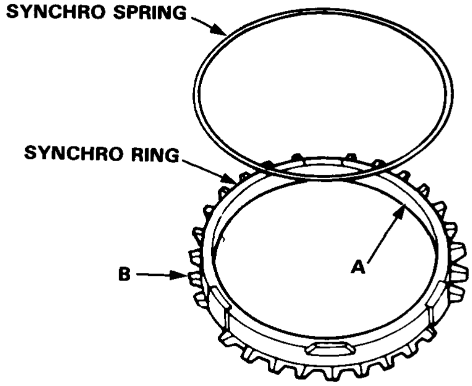
   Double Cone Synchro-to-Gear Clearance
   Standard:
   A: (Outer Synchro Ring to Synchro Cone) 0.5–1.0 mm (0.0197–0.0394 in)
   B: (Synchro Cone to Gear) 0.5–1.0 mm (0.0197–0.0394 in)
   C: (Outer Synchro Ring to Gear) 0.95–1.68 mm (0.0374–0.0661 in)

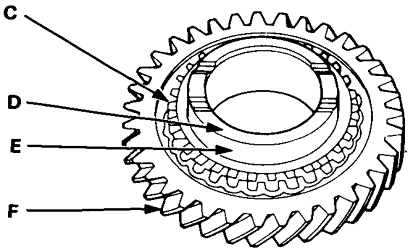
   Service Limit:
   A : 0.3 mm (0.0118 in)
   B : 0.3 mm (0.0118 in)
   C : 0.6 mm (0.0236 in)

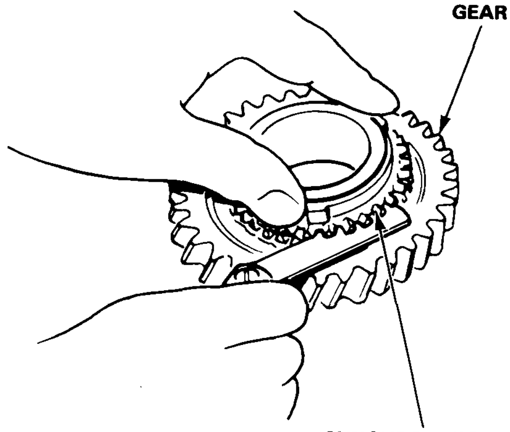
   If the clearance exceeds the service limit, replace the synchro ring and synchro cone.

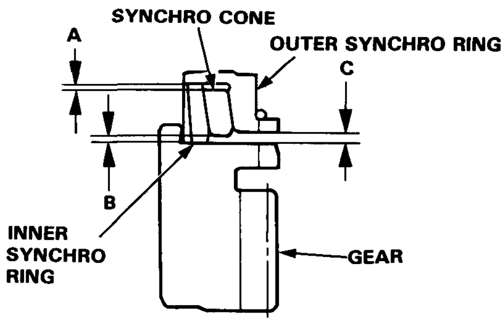
3. Separate the synchro ring and gear, then coat them with oil.

4. Install the synchro spring on the synchro ring, then set it aside for later reassembly.







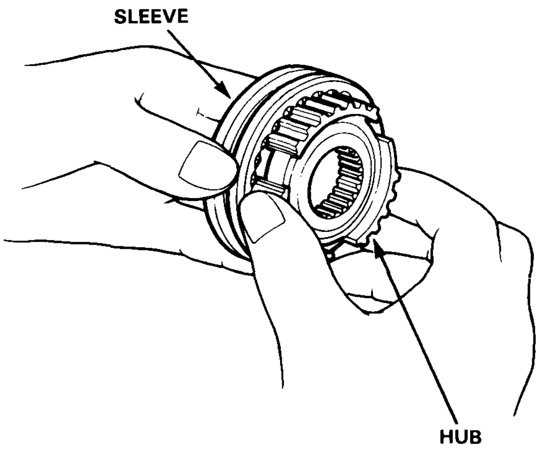


Synchro Sleeve, Synchro Hub

Inspection

1. Inspect gear teeth on all synchro hubs and sleeves for rounded off corners, which indicates wear.
2. Install each hub in its mating sleeve and check for freedom of movement.

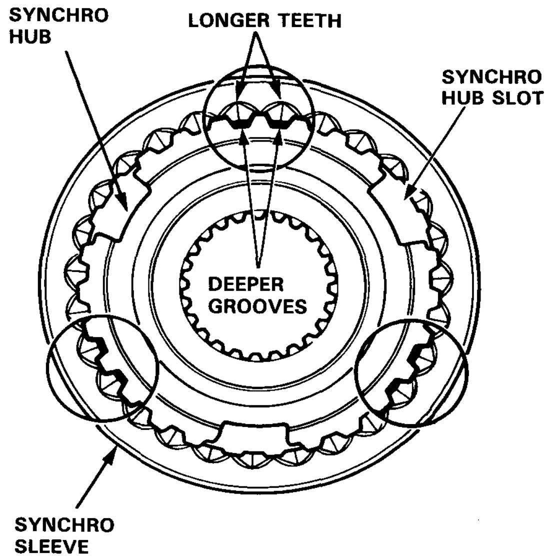
   NOTE: If replacement is required, always replace the synchro sleeve and hub as a set.



Installation

Each synchro sleeve has three sets of longer teeth (120 degrees apart) that must tbe matched with the three sets of deeper grooves in the hub when assembled.

NOTE: If replacement is required, always replace the synchro sleeve and hub as a set.

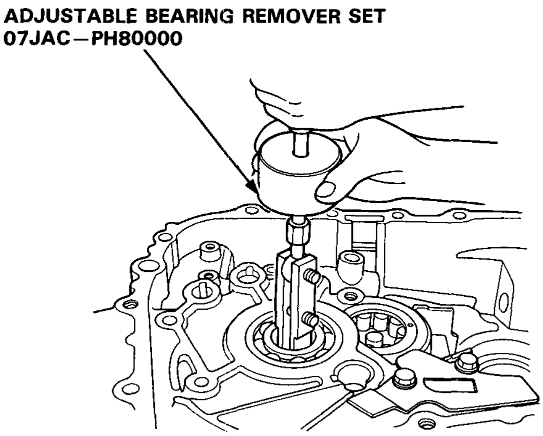


Clutch Housing Bearing

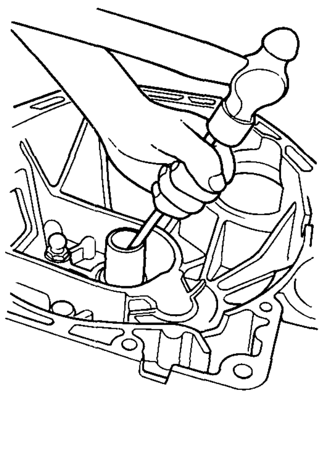
Replacement

Mainshaft

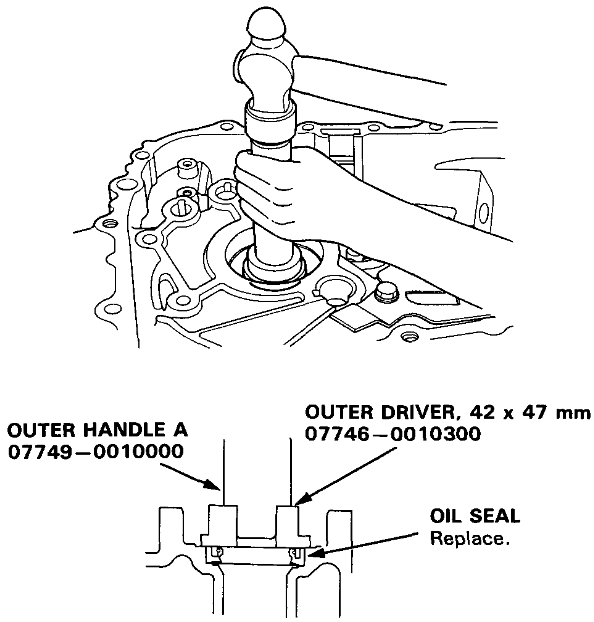
1. Remove the ball bearing using the special tools.



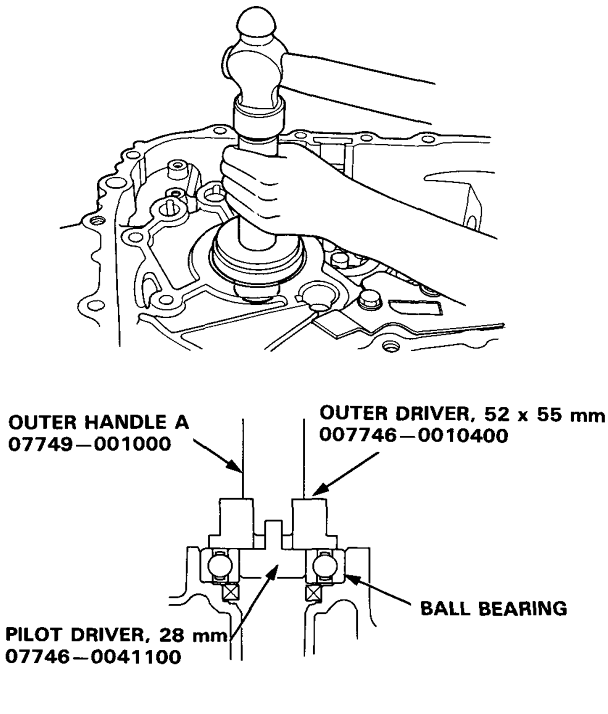
2. Remove the oil seal from the clutch housing.



3. Drive in the new oil seal into the clutch housing using the special tools.

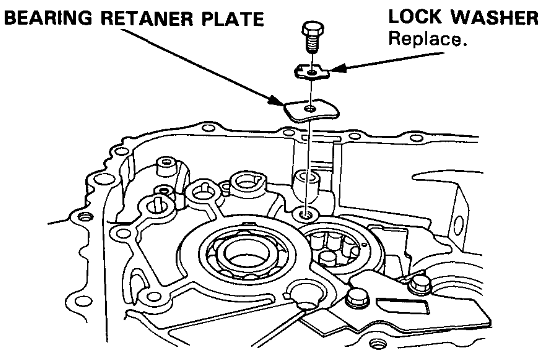


4. Drive the ball bearing into the clutch housing using the special tools.

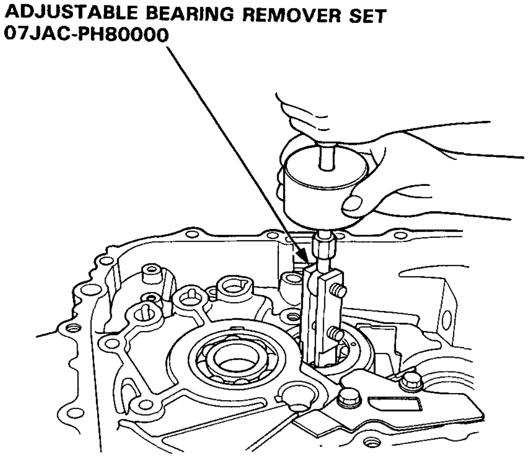


Countershaft

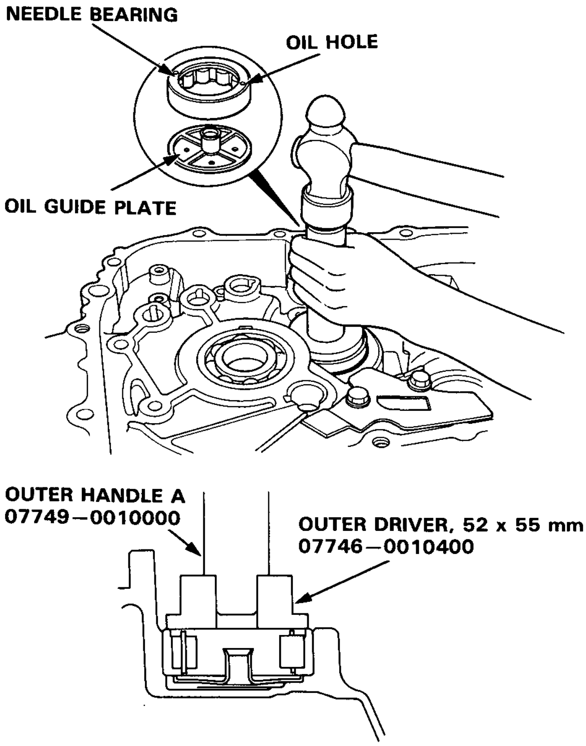
1. Bend the tab on the lock washer down, then remove the bolt and bearing retainer plate.



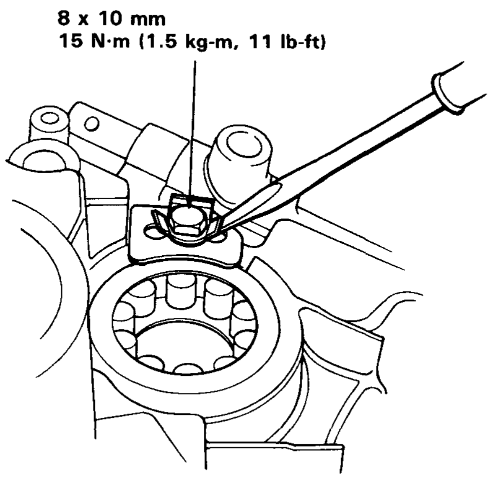
2. Remove the needle bearing using teh special tools, and remove the oil guide plate.



3. Install the oil guide plate, then drive in the needle bearing into the clutch housing using the special tools.



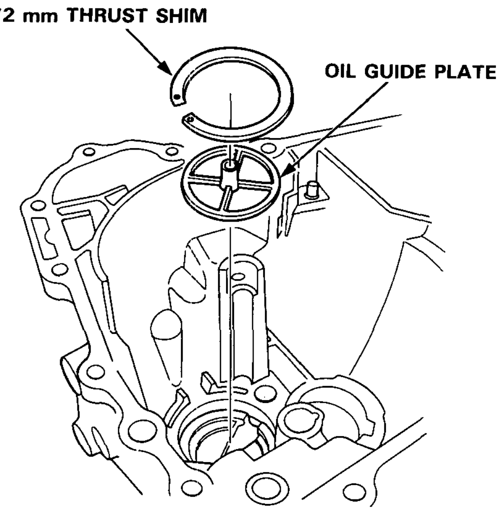
4. Install the bearing retainer plate and new lock washer, then bend the tab against the bolt head.



Mainshaft Thrust Shim

Adjustment

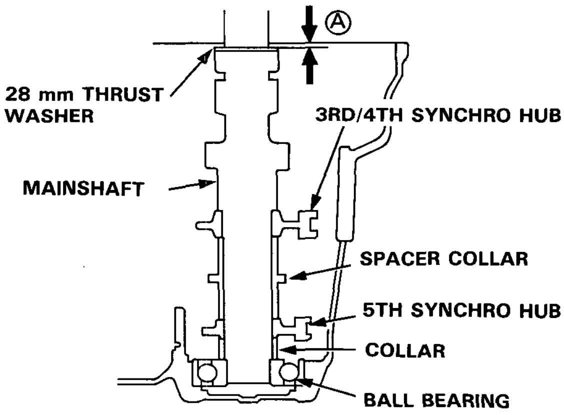
1. Remove the 72 mm thrust shim and oil guide plate form the transmission housing.



2. Install the 3rd/4th synchro hub, spacer collar, 5th synchro hub, collar, ball bearing, and 28 mm washer on the mainshaft. Install the assembly in the transmission housing.

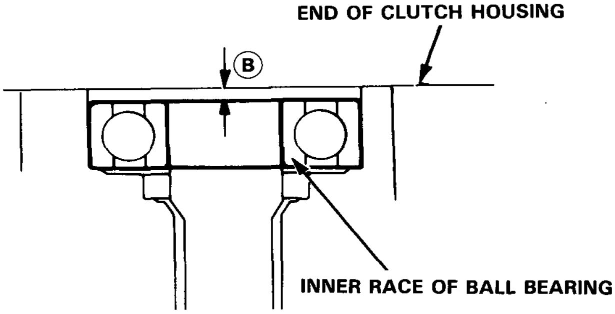
3. Measure the distance A between the end of the transmission housing and 28 mm washer.

   NOTE:
   - Use a straight edge and feeler gauge.
   - Measure at three locations and average the readings.



4. Measure the distance B between the surfaces of the clutch housing and bearing inner race.

   NOTE:
   - Use a straight edge and feeler gauge.
   - Measure at three locations and average the readings.



5. Selcet the proper shim (or shim pair) on the basis of the following calculations;

   NOTE: Do not use more than two shims.

   (Basis Formula)
   (A) + (B) − 1.00 = shim thickness

   Example of calculation;
   Distance A (2.05 mm) + Distance B (0.09 mm) = 2.14 mm subtract the spring washer height (1.00 mm) = the required thrust shim (1.14 mm)

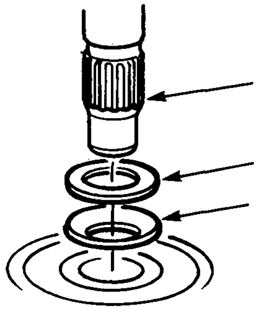
72 mm Thrust Shim

	PART NUMBER	THICKNESS
A	23931–P21–000	0.60 mm (0.0236 in)
B	23932–P21–000	0.63 mm (0.0284 in)
C	23933–P21–000	0.66 mm (0.0260 in)
D	23934–P21–000	0.69 mm (0.0272 in)
E	23935–P21–000	0.72 mm (0.0283 in)
F	23936–P21–000	0.75 mm (0.0295 in)
G	23937–P21–000	0.78 mm (0.0307 in)
H	23938–P21–000	0.81 mm (0.0319 in)
I	23939–P21–000	0.84 mm (0.0331 in)
J	23940–P21–000	0.87 mm (0.0343 in)
K	23941–P21–000	0.90 mm (0.0354 in)
L	23942–P21–000	0.93 mm (0.0366 in)
M	23943–P21–000	0.96 mm (0.0378 in)
N	23944–P21–000	0.99 mm (0.0390 in)
O	23945–P21–000	1.02 mm (0.0402 in)
P	23946–P21–000	1.05 mm (0.0413 in)
Q	23947–P21–000	1.08 mm (0.0425 in)
R	23948–P21–000	1.11 mm (0.0437 in)
S	23949–P21–000	1.14 mm (0.0449 in)
T	23950–P21–000	1.17 mm (0.0461 in)
U	23951–P21–000	1.20 mm (0.0472 in)
V	23952–P21–000	1.23 mm (0.0484 in)
W	23953–P21–000	1.26 mm (0.0496 in)
X	23954–P21–000	1.29 mm (0.0508 in)
Y	23955–P21–000	1.32 mm (0.0520 in)
Z	23956–P21–000	1.35 mm (0.0531 in)
AA	23957–P21–000	1.38 mm (0.0543 in)
AB	23958–P21–000	1.41 mm (0.0555 in)
AC	23959–P21–000	1.44 mm (0.0567 in)
AD	23960–P21–000	1.47 mm (0.0579 in)
AE	23961–P21–000	1.50 mm (0.0591 in)
AF	23962–P21–000	1.53 mm (0.0602 in)
AG	23963–P21–000	1.56 mm (0.0614 in)
AH	23964–P21–000	1.59 mm (0.0626 in)
AI	23965–P21–000	1.62 mm (0.0638 in)
AJ	23966–P21–000	1.65 mm (0.0650 in)
AK	23967–P21–000	1.68 mm (0.0661 in)
AL	23968–P21–000	1.71 mm (0.0673 in)
AM	23969–P21–000	1.74 mm (0.0685 in)
AN	23970–P21–000	1.77 mm (0.0697 in)
AO	23971–P21–000	1.80 mm (0.0709 in)

6. Check the thrust clearance in the manner described below.

   NOTE:
   - Clean the thrust washer, spring washer and shim thoroughly before installation.
   - Install the thrust washer, spring washer and shim properly.

   a. Install the shims selected in the transmission housing.
   b. Install the thrust washer and spring washer in the mainshaft.

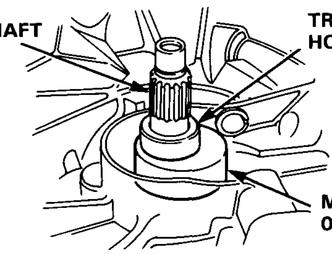


   c. Install the mainshaft in the clutch hosing.
   d. Place the transmission housing over the mainshaft and onto the clutch housing.
   e. Tighten the clutch and transmission housings with several 10 mm bolts.
   f. Tap the mainshaft with a plastic hammer.

7. Check the thrust clearance in the manner described below.

   CAUTION: Measurement should be made at room temperature.

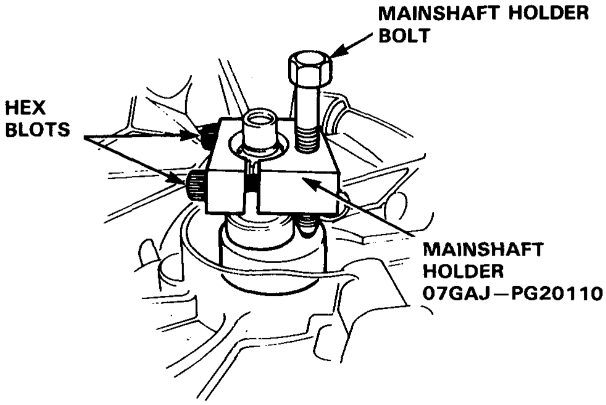
   a. Slide the mainshaft base and the collar over the mainshaft.



(cont'd)

Adjustment (cont'd)

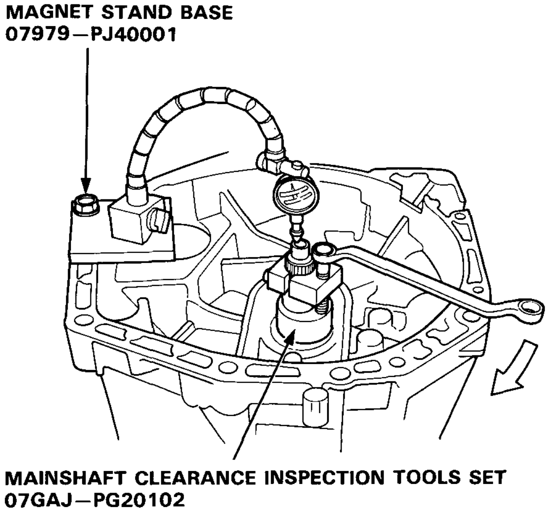
b. Attach the mainshaft holder to the mainshaft as follows:
- Back-out the mainshaft holder bolt and loosen the two hex bolts.
- Fit the holder over the mainshaft so its lip is towards the transmission.
- Align the mainshaft holder's lip around the groove at the inside of the mainshaft splines, then tighten the hex bolts.



c. Seat the mainshaft fully by tapping its end with a plastic hammer.

d. Thread the mainshaft holder bolt in until it just contacts the wide surface of the mainshaft base.

e. Zero a dial gauge on the end of the mainshaft.



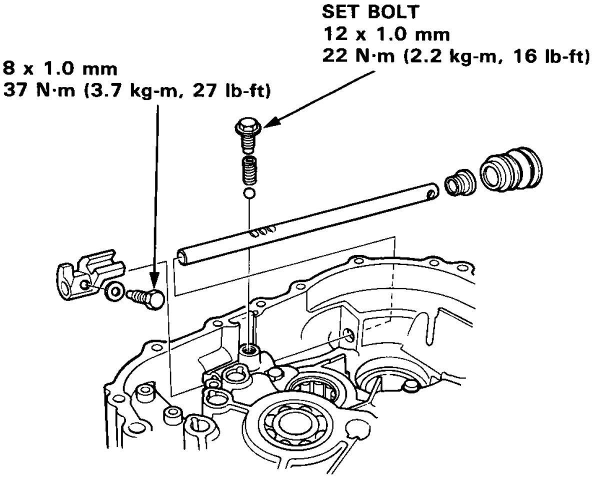
f. Turn the mainshaft holder bolt clockwise; stop turnig when the dial gauge has reached its maximum movement. The reading on the dial gauge is the amount of mainshaft end play.

CAUTION: Turnig the shaft holder bolt more than 60 degrees after the needle of the dial gauge stops moving may damage the transmission.

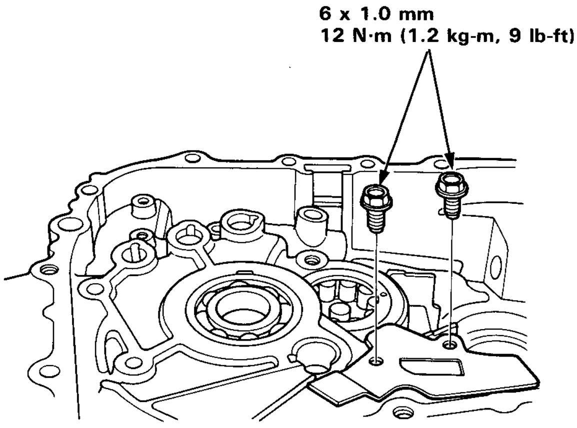
g. Clearance is correct if reading is between 0.11–0.18 mm (0.004–0.007 in).
If not, recheck necessary shim thickness.

Reassembly

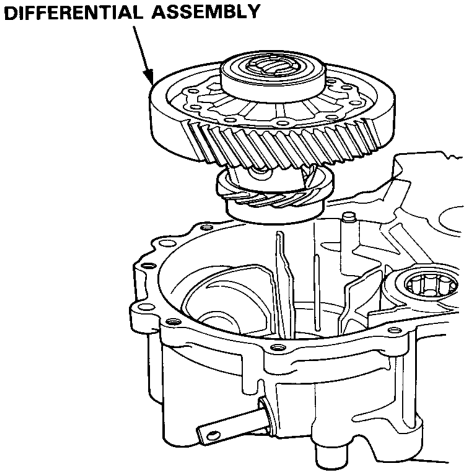
1. Set the change piece.
2. Install the shift rod.
3. Install the steel ball, spring, and set bolt.
4. Install the change piece attaching bolt.



5. Install the chamber plate.

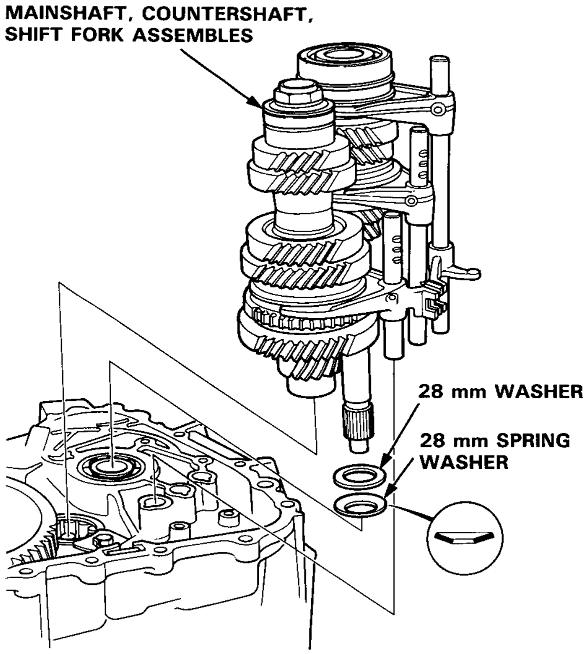


6. Install the differential assembly.



7. Set the 28 mm spring washer and washer.
8. Install the mainshaft, countershaft and shift fork assemblies.

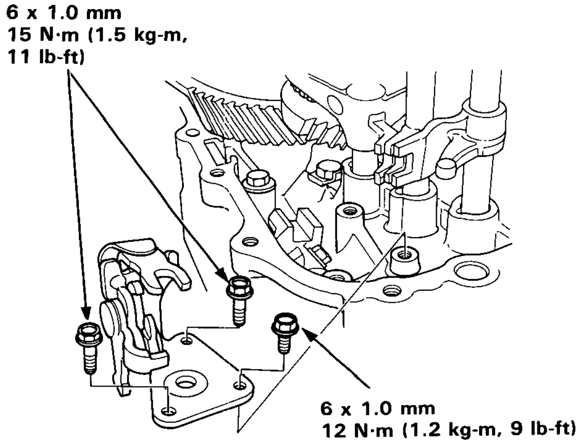
   NOTE: Align the finger of the interlock and groove of the shift fork shaft.



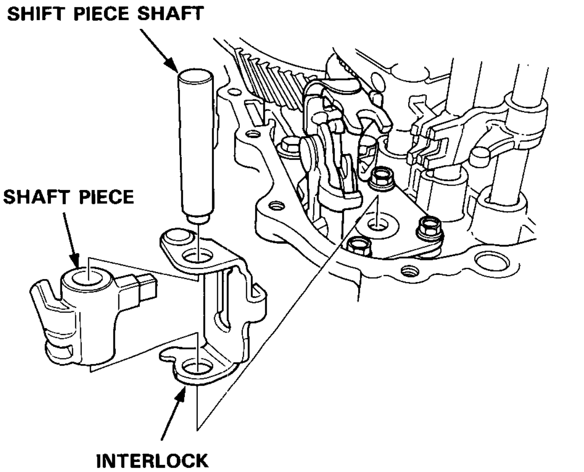
(cont'd)

Reassembly (cont'd)

9. Install the change holder assembly.

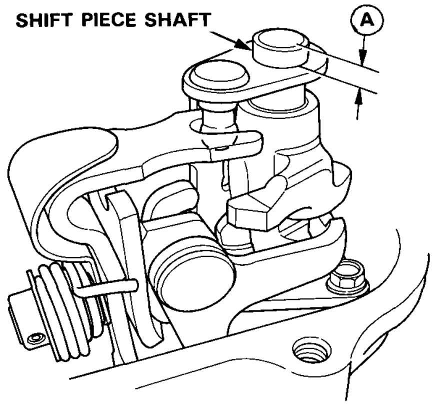


10. *Install the shift piece and interlock, then install the* shift piece shaft.

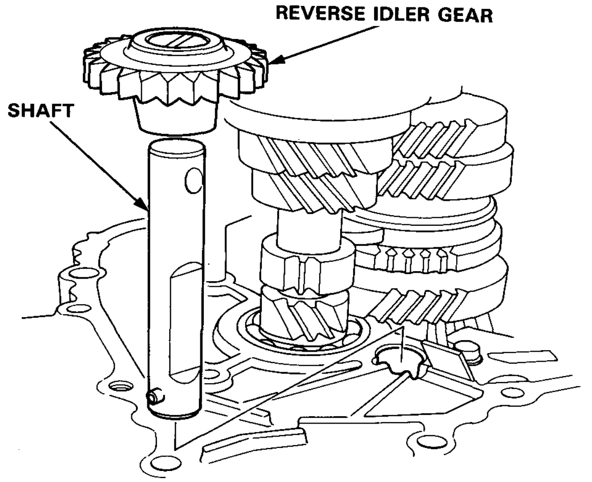


11. Measure the distance A after mounting the shift piece shaft. If not correct, check installation.

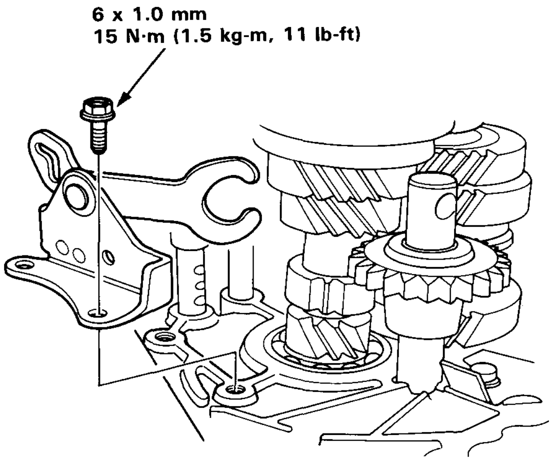
Distance A: 11.9–12.3 mm (0.469–0.484 in)



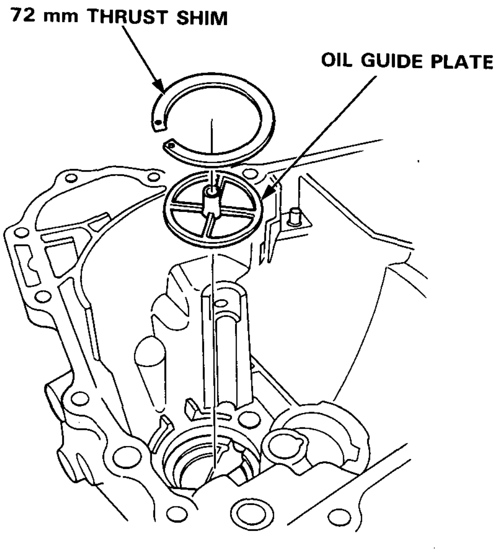
12. Shift the 3rd/4th shift fork to the 4th gear side, then install the reverse idler gear and shaft.



13. Install the reverse shift fork.

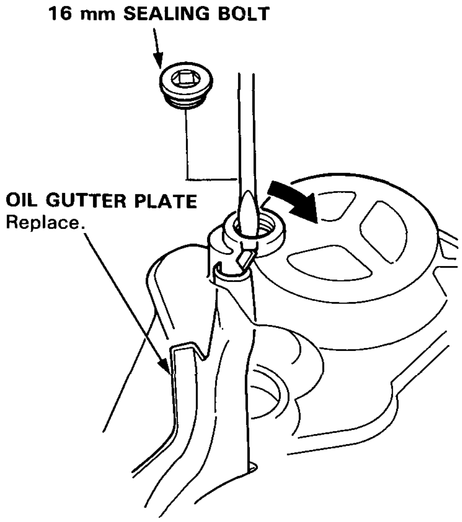


14. Install the oil guide plate and 72 mm thrust shim into the transmission housing.



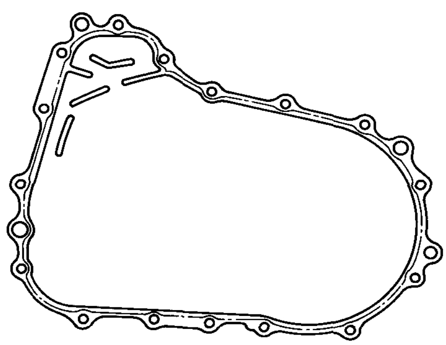
15. Install the oil gutter plate.

16. Bend the hook of the oil gutter plate, then install the 16 mm sealing bolt.



17. Apply liquid gasket to the transmission mating surface of the clutch housing.

NOTE: This transmission uses no gasket between the major housing; use Honda Genuine liquid gasket (P/N08718—0001). Assemble the housing within 20 minutes after applying the liquid gasket and allow it to cure at least 30 minutes after assembly before filling it with oil.

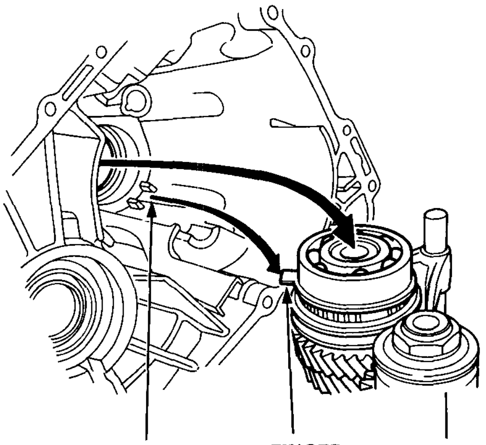


(cont'd)

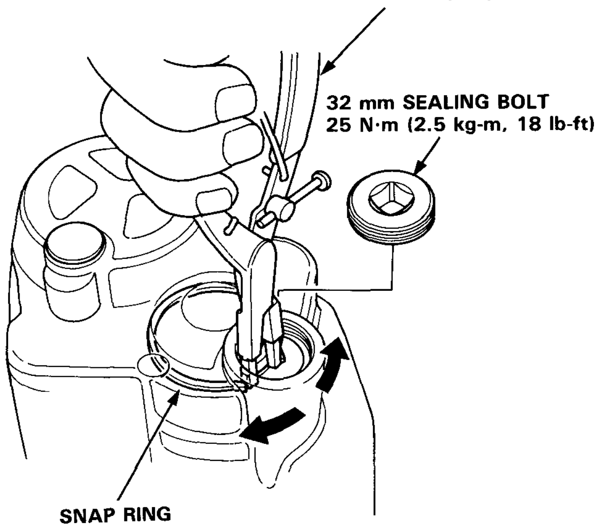
Reassembly (cont'd)

18. Install the 14 x 20 mm dowel pins.

19. Install the transmission housing by alining the groove in the housing with finger on the stopper ring.

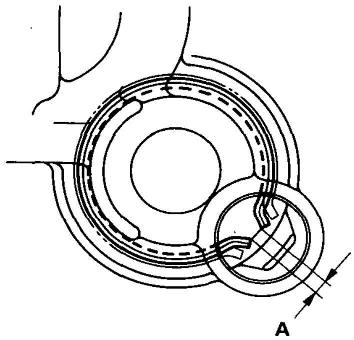


20. Lower the transmission housing with the snap ring expanded and set the snap ring in the groove of the countershaft bearing.

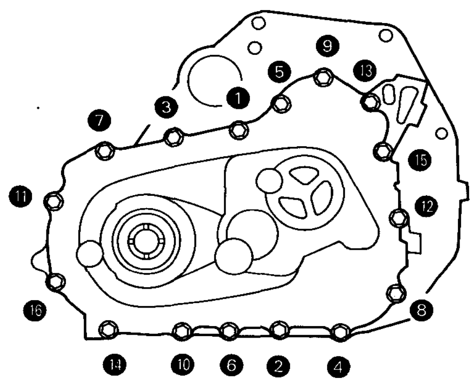


21. Check that the snap ring is securely seated in the groove of the countershaft gearing.

Dimension A as installed: 4.6−8.3 mm (0.181−0.327 in)

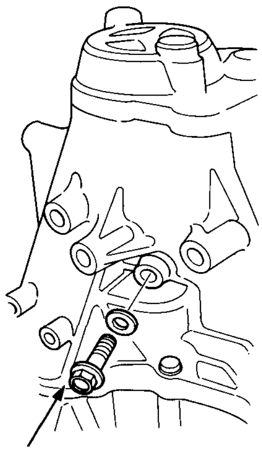


22. Tighten the transmission housing attaching bolts in the numbered sequence as shown.



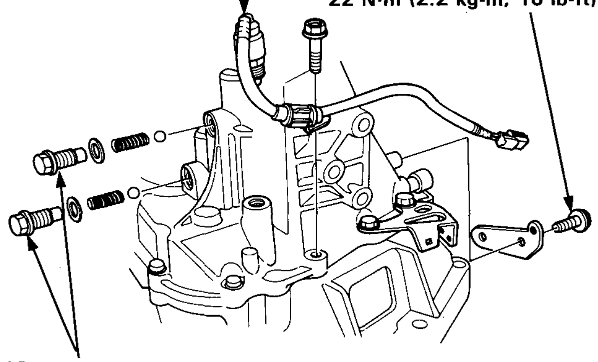
Installation (cont'd)

23. Tighten the reverse idler gear shaft bolt.



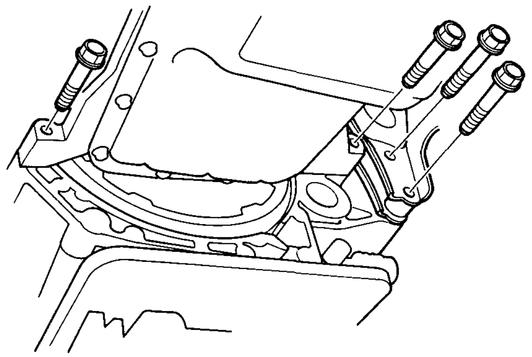
24. Install the steel balls, springs, and set bolts.

25. Install the back-up light switch and transmission hanger B.

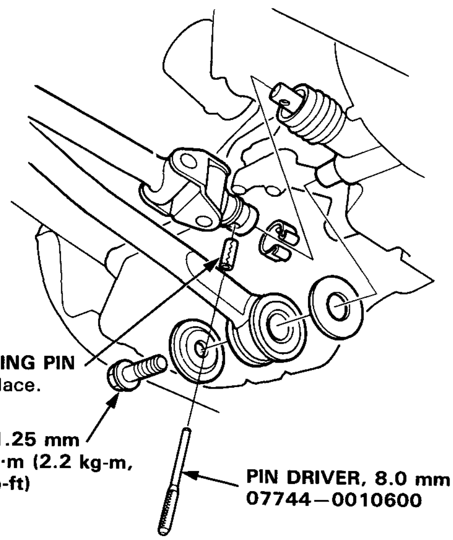


NOTE: Differences between the S20 model MT and Y21 model MT are covered in this page. Refer to page 13-4 for the information not covered in this page.

1. Install the transmission attaching bolts and transmission rear mount bolts.



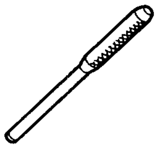
2. Install the torque rod and shift rod.



S22 Model
Manual Transmission

Special Tools

Ref. No.	Tool Number	Description	Remarks
①	07744–0010400	Pin Driver, 5.0 mm	
②	07749–0010000	Outer Handle A	
③	07746–0010500	Outer Driver, 62 x 68 mm	
④	07926–SD90000	Flange Holder	
⑤	07746–0010400	Outer Driver, 52 x 55 mm	
⑥	07JAJ–PH80200	Drivern Gear Dummy Shaft	
⑦	07KAF–PS30200	Bering Race Remover	
⑧	07JAJ–PH80100	Drive Gear Gauge	
⑨	07746–0030100	Inner Handle C	
⑩	07746–0030400	Inner Driver, 35 mm	



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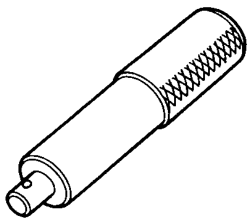

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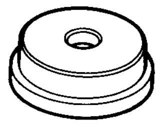

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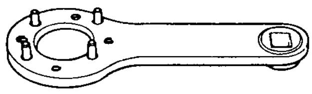

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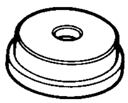

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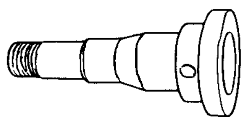

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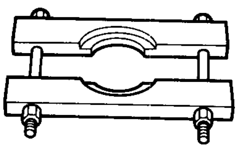

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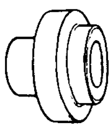

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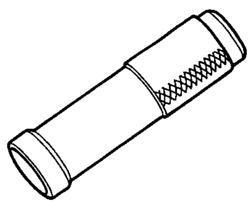

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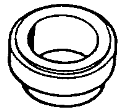
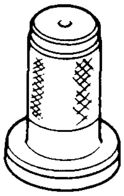


⑩

Special Tools

Ref. No.	Tool Number	Description	Remarks
⑪	07JAD–PL90100	Oil Seal Driver	
⑫	07LGC–0010100	Snap Ring Plier	
⑬	07746–0030200	Inner Driver, 25 mm	
⑭	07746–0010300	Outer Driver, 42 x 47 mm	
⑮	07746–0041100	Pilot Driver, 28 mm	
⑯	07JAC–PH80000	Adjustable Bearing Remover Set	
⑰	07746–0010600	Outer Driver, 72 x 75 mm	
⑱	07746–0010200	Outer Dirver, 37 x 40 mm	
⑲	07GAJ–PG20110	Mainshaft Holder	
⑳	07979–PG40001	Magnet Stand Base	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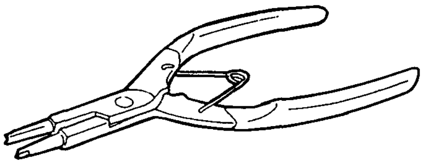
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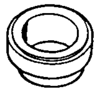
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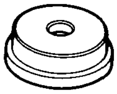
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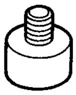
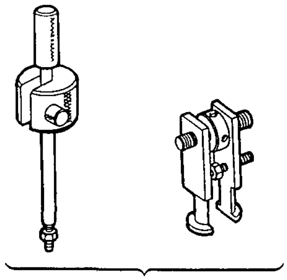

⑮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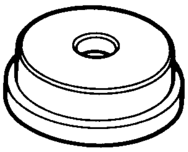
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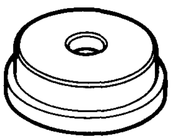
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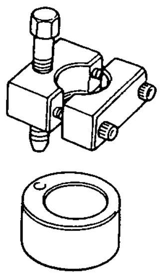
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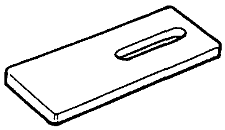

⑳

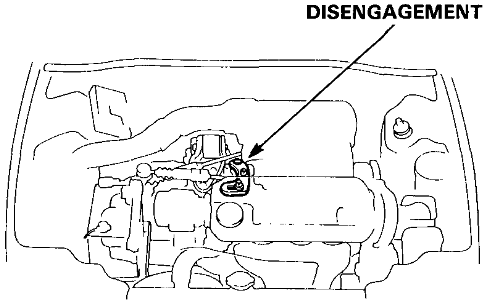
Service Precaution

(without ABS)

The Real Time 4WD system allows instantaneous shift from 2WD to 4WD automatically when greater traction is needed. To prevent accidents or injuries, the system must be released befor performing any services on the differential unit.

To release 4WD

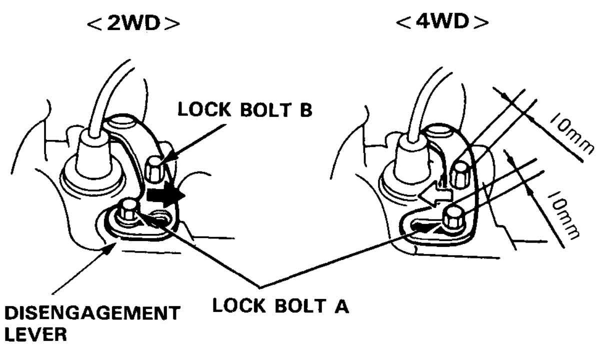
With the engine stopped, turn the shift bolt (painted orange) as described below.



1. Loosen the lock bolt A.
2. Move the lever by turning the lock bolt A counterclockwise.
3. Confirm that the lever is in the fully disengaged position by rocking the cat back and forth while placing slight counterclockwise pressure on the lock bolt A.
4. Tighten the lock bolt A.

   Torque: 12 N·m (1.2 kg-m, 9 lb-ft)

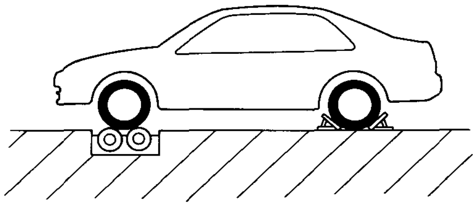
   NOTE: When the engine starts with the 4WD system disengaged, the rear differential clutch warning light should come on.



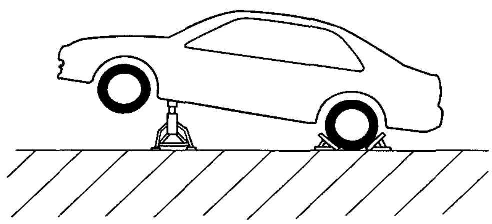
Operations Requiring 4WD Disengagement

- When using test appliances;
  Speedometer tester, brake tester, chassis dynamometer, etc.

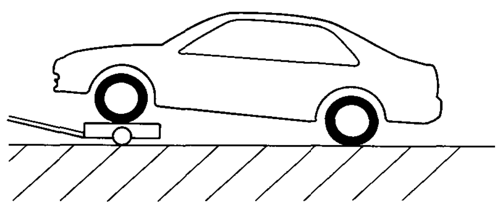
  CAUTION: Apply the parking brake and block the rear wheels before using a speedometer tester. When you use a chassis dynamometer, fix the car body with a rope to prevent it from moving.



- When running the engine with the car jacked up.



- When towing with raised front or rear wheels.

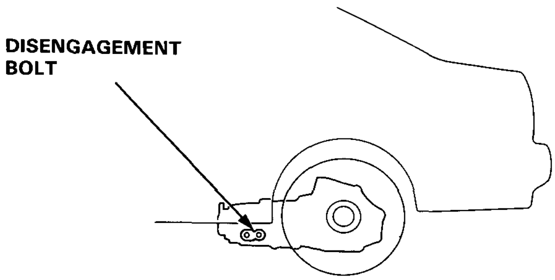


(with ABS)

The Real Time 4WD system allows instantaneous shift from 2WD to 4WD automatically when greater traction is needed. To prevent accidents or injuries, the system must be released before performing any services on the differential unit.

To release 4WD

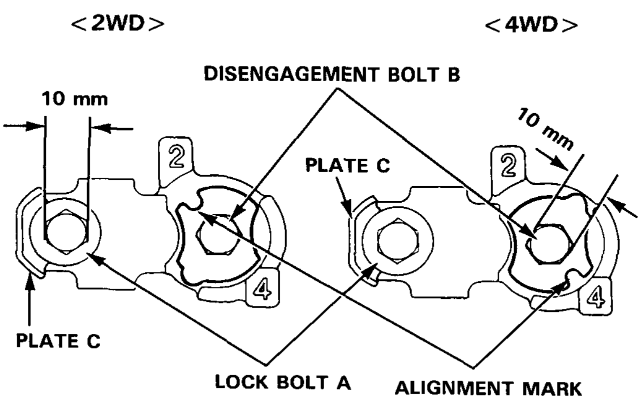
With the engine stopped, turn the shift bolt (painted orange) as described below.



1. Loosen the lock bolt A.
2. Align the mark on the disengagement bolt B with "2" to disengage the 4WD system.
3. Align the place C with the cutout in the disengagement bolt B and tighten the lock bolt A to the specified torque.

   Torque: 17 N·m (1.7 kg-m, 12 lb-ft)

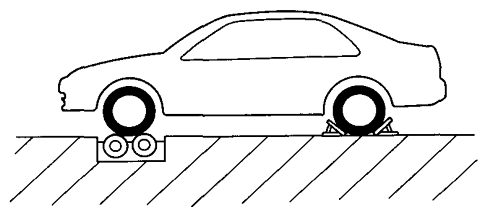
   NOTE: When the engine starts with the 4WD system disengaged, the rear differential clutch warning should come on.



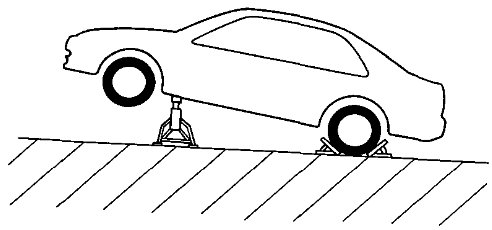
Operations Requiring 4WD Disengagement

- When using test appliances;
  Speedometer tester, brake tester, chassis dynamometer, etc.

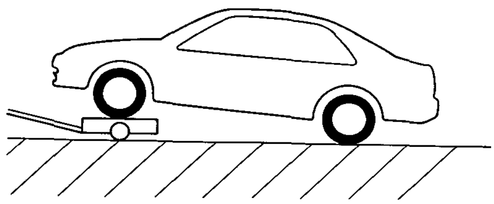
  CAUTION: Apply the parking brake and block the rear wheels before using a speedometer tester. When you use a chassis dynamometer, fix the car body with a rope to prevent it from moving.



- **When running the engine with the car jacked up.**



- **When towing with raised front or rear wheels.**



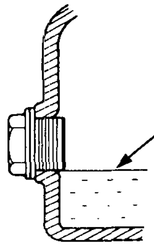
CAUTION: After servicing, be sure to engine the 4WD system (align the alignment mark "4") and tighten the lock bolt A securely.
Stop the engine and disconnect the ABS B2 fuse in the engine compartment for more 3 seconds.
The self-diagnosis lamp of the ABS control unit should stop blinking.

Maintenance

Transmission Oil

NOTE: Check the oil at operating temperature, engine OFF, and the cot on level ground.

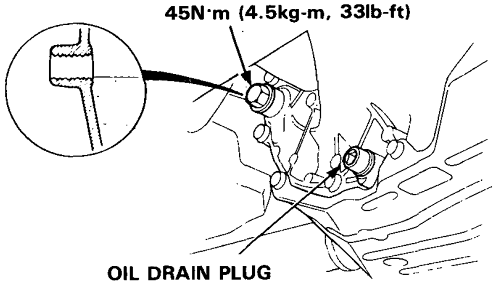
1. Remove the oil filler plug, then check the level and condition of the oil.



2. The oil level must be up to the filler hole, If it is below the hole, add oil until it runs out, then reinstall the oil filler plug.
3. If the oil is dirty, remove drain plug and drain transmission.
4. Reinstall the drain plug with a new washer, and refill to proper level.
5. Reinstall the oil filler plug with a new washer.

   Oil Capacity
   2.2 (2.3U.S. qt.) after drain.
   2.3 (2.4U.S. qt.) after overhaul.

Use only SEA 10W-30 or 10W-40, SF or SG grade.

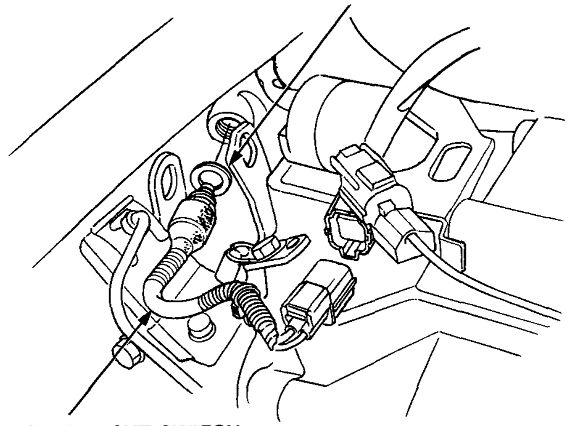


Back-up Light Switch

Replacement

NOTE: To check the switch, see section 23.

1. Disconnect the connector, then remove the switch connector from the connector clamp.
2. Remove the switch.
3. Install the new washer and switch.

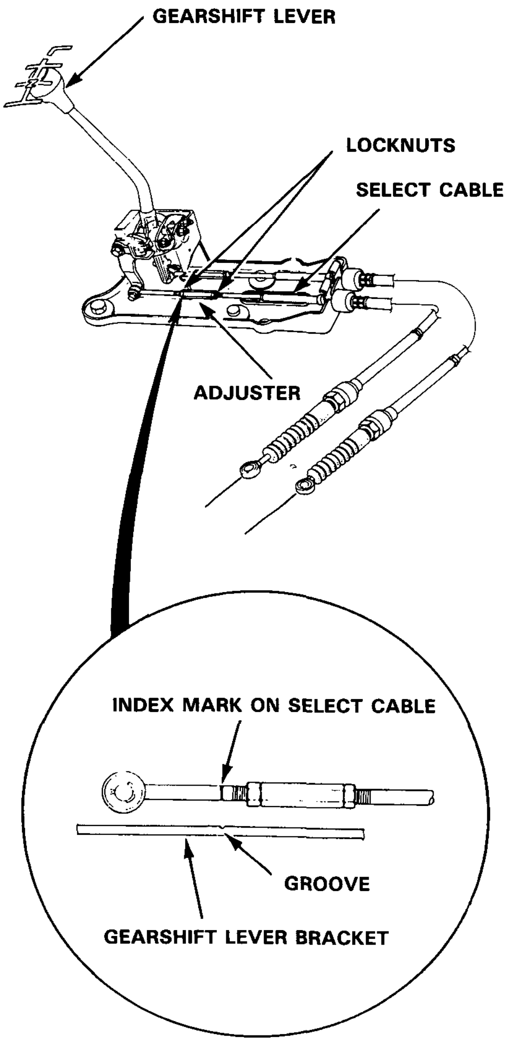


Gearshift Mechanism

Cable Adjustment

Select Cable

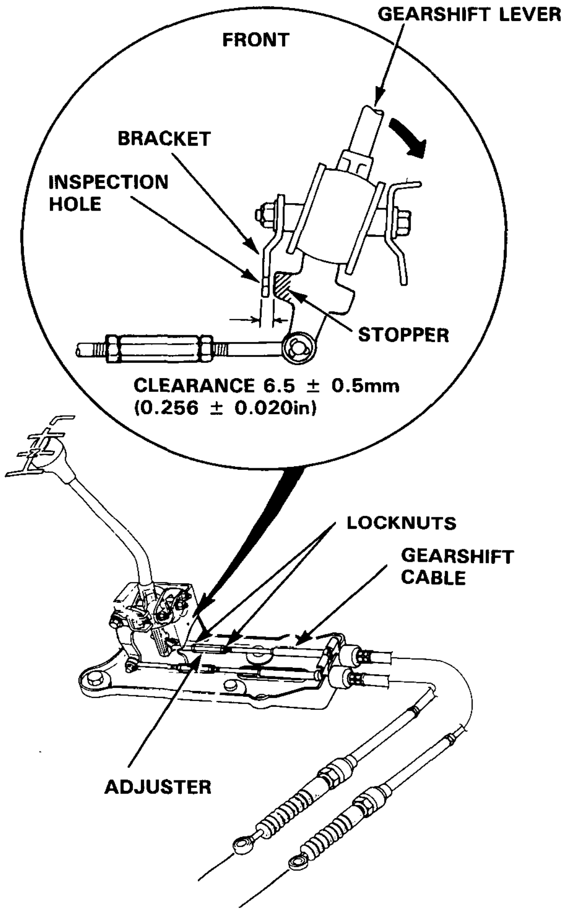
1. Remove the console (see section 20).
2. With the transmission in neutral, check that the groove in the lever bracket is aligned with the index mark on the select cable.



3. If the index mark is not aligned with the groove in the cable, loosen the lock nuts and turn the adjuster as necessary.

Shift Cable

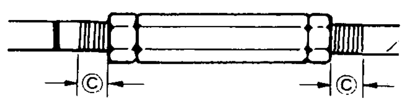
1. Remove the console (see section 20).
2. Place the transmission in 4th gear.
3. Measure the clearance between the gearshift lever bracket and stopper while pulling the lever backward.



4. If the clearance is outside specifications, loosen the nuts and turn the adjuster in or out until the corrct clearance is obtained.

NOTE:

- After adjustment, check operation of the gearshift lever.
- Also check that the threads C of the cables do not extend out of the cable adjuster by more than 10mm (0.39in).

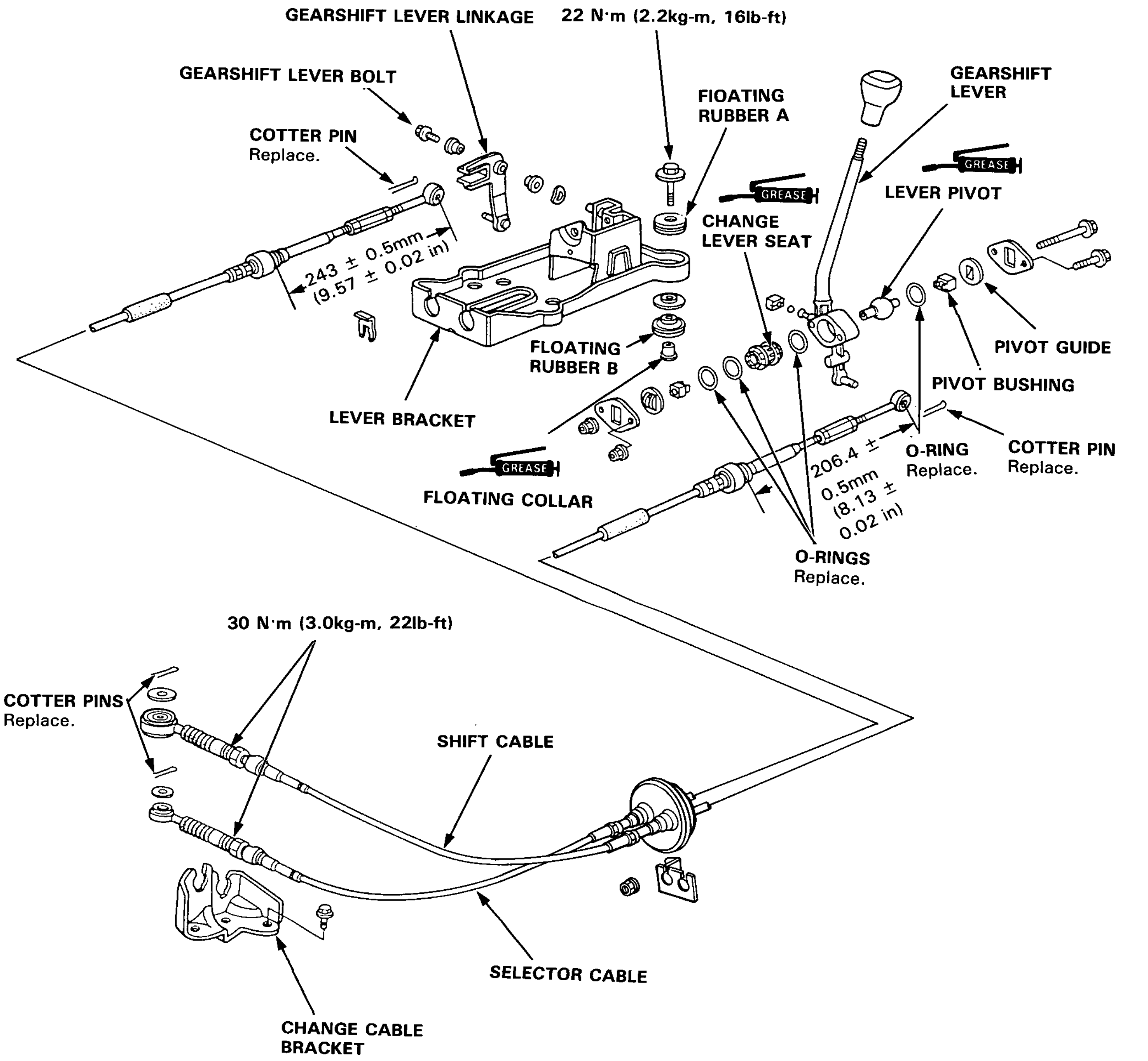


Gearshift Machanism

Overhaul

NOTE:

- Do not bend the shift cable and selector cable while dis/reassembling the gearshift mechanism.
- Replace the cables whenever they are damage.



Transmission Assembly

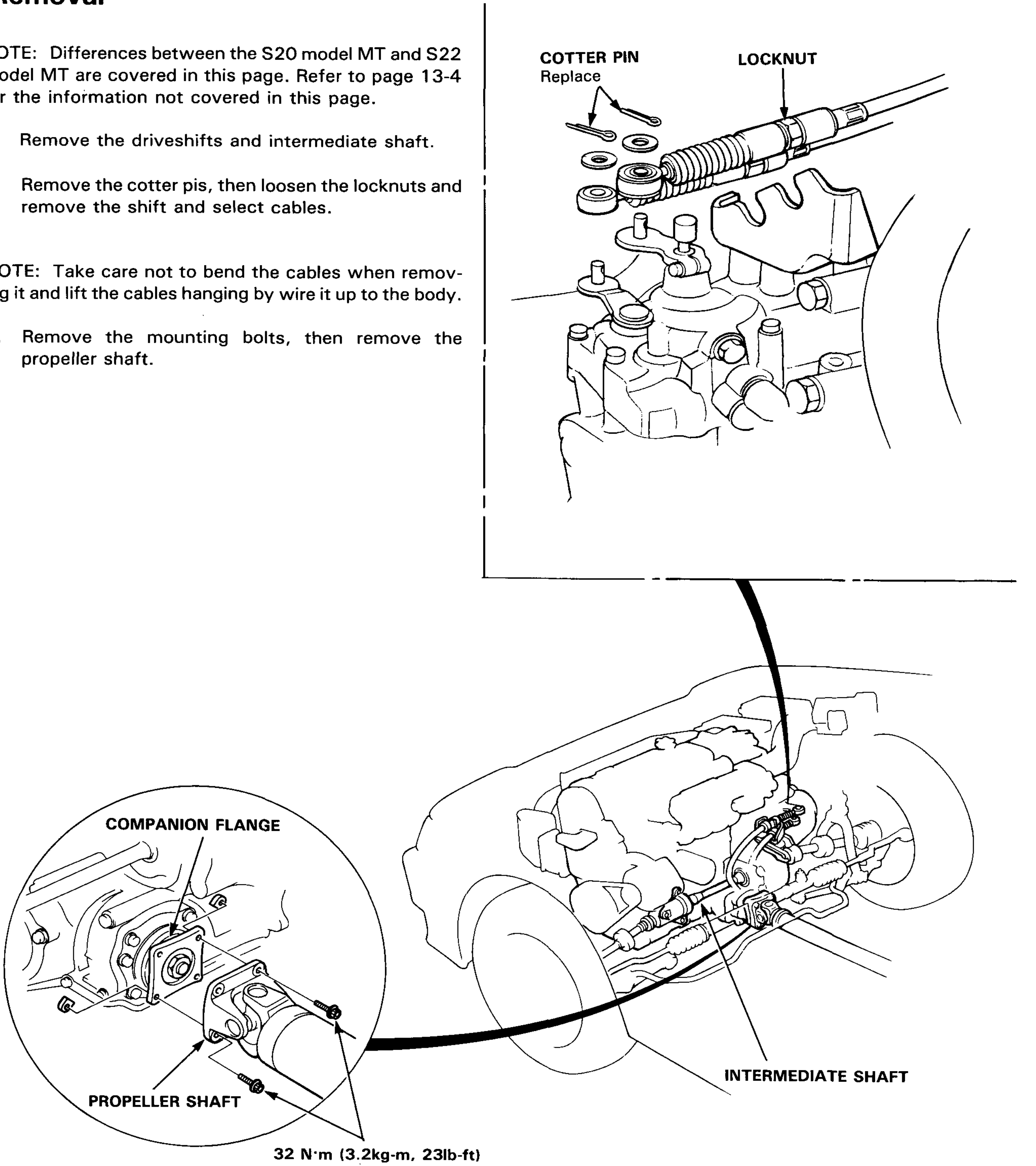
Removal

NOTE: Differences between the S20 model MT and S22 model MT are covered in this page. Refer to page 13-4 for the information not covered in this page.

1. Remove the driveshifts and intermediate shaft.
2. Remove the cotter pis, then loosen the locknuts and remove the shift and select cables.

NOTE: Take care not to bend the cables when removing it and lift the cables hanging by wire it up to the body.

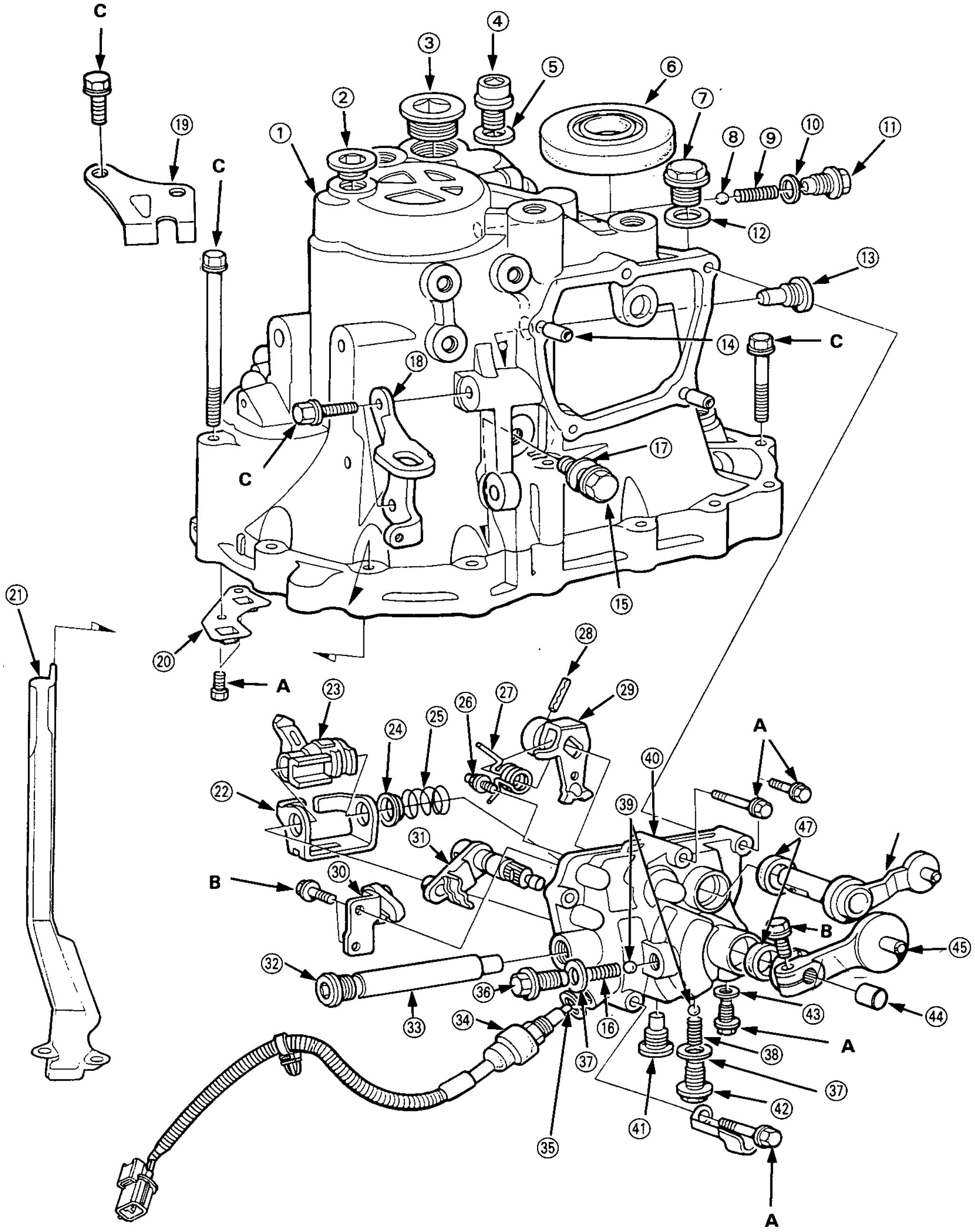
3. Remove the mounting bolts, then remove the propeller shaft.



Refer to the drawing below for the transmission disassembly.
Clean all parts thoroughly in solvent and dry with compressed air.

Lubricate all parts with oil befor reassembly.

NOTE: This transmission uses no gaskets between the major housings; use Honda Genuine Liquid Gasket (P/N 08718–0001).
Assemble the housings within 20 minutes after applying the sealant and allow it to cure at least 30 minutes after assembly before filling the transmission with oil.



	Bolt Sise	Torque Value
A	6 x 1.0mm	12 N·m (1.2 kg-m, 9 lb-ft)
B	6 x 1.0mm	15 N·m (1.5kg-m, 11lb-ft)
C	8 x 1.25mm	26 N·m (2.6kg-m, 19lb-ft)

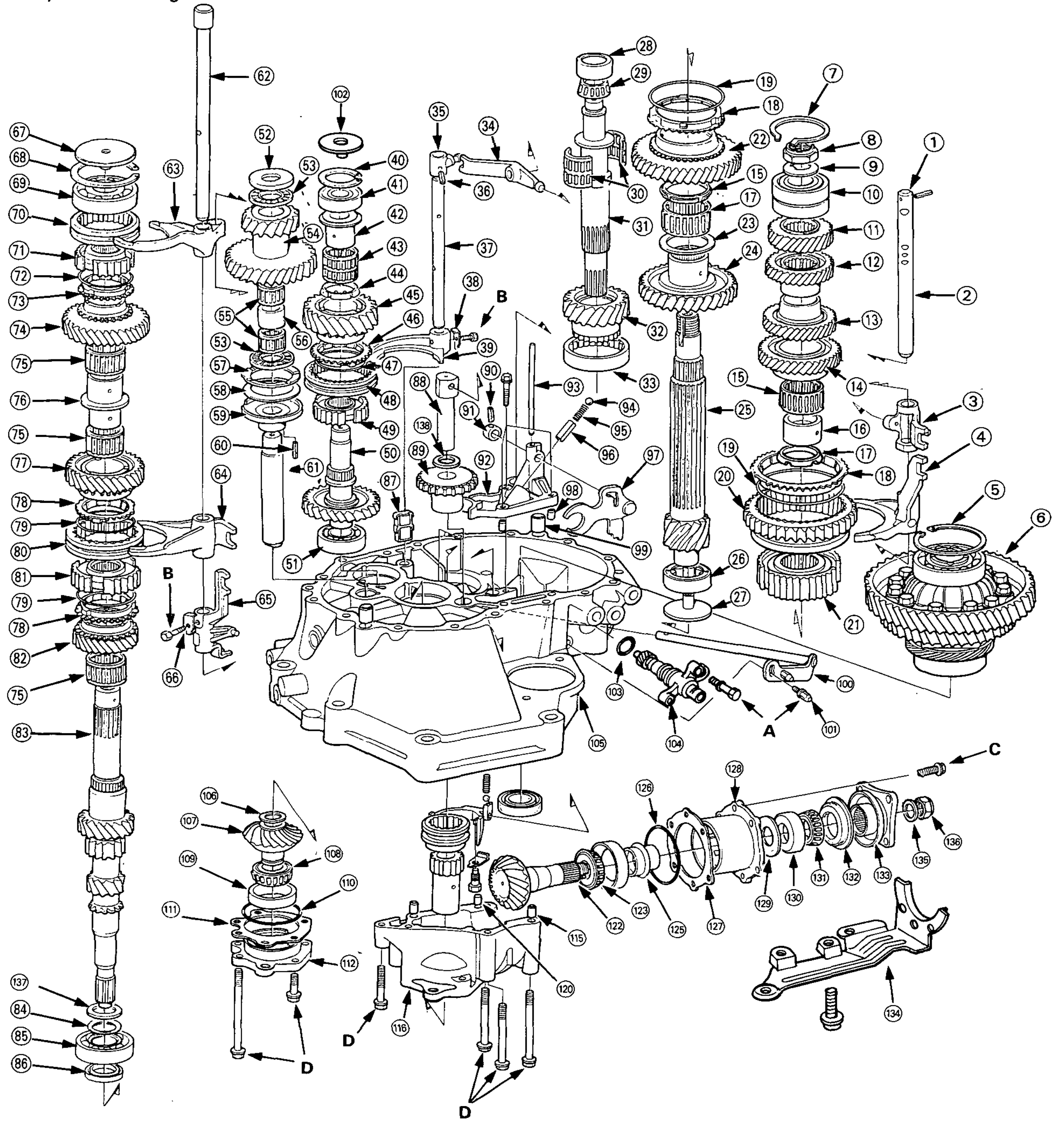
① **TRANSMISSION HOUSING**
② **18mm SEALING BOLT**
35 N·m (3.5kg-m, 25lb-ft)
③ **32mm SEALING BOLT**
70 N·m (7.0kg-m, 51lb-ft)
④ **OIL DRAIN PLUG**
40 N·m (4.0kg-m, 29lb-ft)
⑤ **14mm WASHER** Replace.
⑥ **40 x 76 x 9mm OIL SEAL**
Replace
⑦ **OIL FILLER PLUG**
45 N·m (4.5kg-m, 33lb-ft)
⑧ **STEEL BALL**
⑨ **SPRING**
⑩ **12mm WASHER** Replace.
⑪ **SET BOLT**
22 N·m (2.2kg-m, 16lb-ft)
⑫ **20mm WASHER** Replace.
⑬ **SUPER LOW SHIFT LEVER BOLT**
40 N·m (4.0kg-m, 29lb-ft)
⑭ **8 x 14mm DOWEL PIN**
⑮ **REVERSE IDLER GEAR SHAFT BOLT**
55 N·m (5.5kg-m, 40lb-ft)
⑯ **SPRING (L. = 24.2 mm)**
⑰ **10mm WASHER** Replace.
⑱ **TRANSMISSION HANGER**
⑲ **CLUTCH PIPE STAY**
⑳ **OIL COLLECT PLATE**
㉑ **OIL GUTTER PLATE**
㉒ **INTERLOCK**
㉓ **SHIFT ARM A**
㉔ **SUPER LOW SELECT RETAINER**
㉕ **SUPER LOW RETURN SPRING**
㉖ **SELECT RETURN PIN**
12 N·m (1.2kg-m, 9lb-ft)
㉘ **SELECT RETURN SPRING**
㉙ **5 x 25mm SPRING PIN**
Replace.
㉚ **SELECT LOCK CAM**
㉛ **SHIFT ARM**
㉜ **18mm PLUG**
40 N·m (4.0kg-m, 29lb-ft)
㉝ **SHIFT ARM SHAFT**
㉞ **BACK-UP LIGHT SWITCH**
25 N·m (2.5kg-m, 18lb-ft)
㉟ **14mm WASHER** Replace.
㊱ **SET BOLT**
22 N·m (2.2kg-m, 16lb-ft)
㊲ **12mm WASHER** Replace.
㊳ **SPRING (L. = 20.7 mm)**
㊴ **STEEL BALL**
㊵ **SHIFT ARM COVER**
㊶ **INTERLOCK BOLT**
40 N·m (4.0kg-m, 29lb-ft)
㊷ **SET BOLT**
22 N·m (2.2kg-m, 16lb-ft)
㊸ **6mm WASHER** Replace.
㊹ **BREATHER CAP**
㊺ **SHIFT LEVER**
㊻ **SELECT LEVER**
㊼ **16 x 23 x 5mm OIL SEAL**
Replace.

Illustrated Index

Refer to the drawing below for the transmission disassembly.
Clean all parts thoroughly in solvent and dry with compressed air.

OIL Lubricate all parts with oil before reassembly.

NOTE: This transmission uses no gaskets between the major housings; use Honda Genuine Liquid Gasket (P/N 08718–0001).
Assemble the housings within 20 minutes after appluing the sealant and allow it to cure at least 30 minutes after assembly before filling the transmission with oil.



NOTE: Always clean the magnet ⑮ whenever the transmission housing is disassembled.

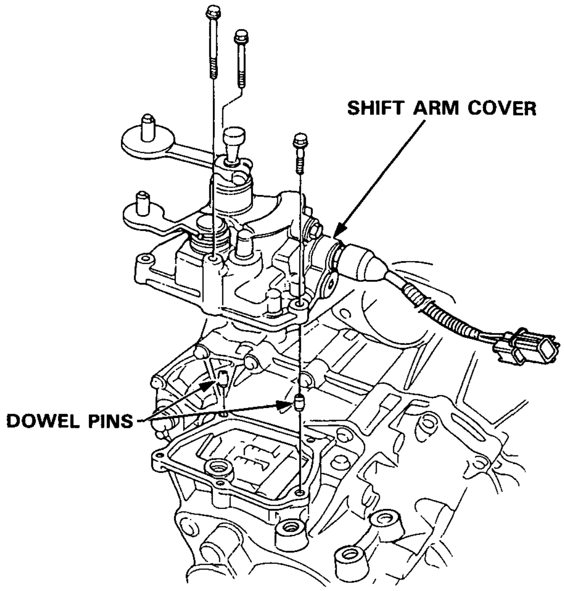
	Bolt Sise	Torque Value
A	6 x 1.0mm	12 N·m (1.2 kg-m, 9 lb-ft)
B	6 x 1.0mm	17 N·m (1.7kg-m, 12lb-ft)
C	8 x 1.25mm	26 N·m (2.6kg-m, 19lb-ft)
D	10 x 1.25mm	45 N·m (4.5kg-m, 33lb-ft)

① **3 x 22mm SPRING PIN** Replace.
② **1 ST/2ND SHIFT FORK PIECE A**
③ **SUPER LOW SHFT PIECE A**
④ **1ST/2ND SHIFT FORK**
⑤ **80mm SNAP RING**
⑥ **DIFFERENTIAL ASSEMBLY** See section 15
⑦ **60mm SNAP RING**
⑧ **LOCKNUT** Replace. **110→0→110N·m 11.0→0→11.0kg-m, 80→0→80lb-ft**
⑨ **SPRING WASHER**
⑩ **BALL BEARING**
⑪ **5TH GEAR**
⑫ **4TH GEAR**
⑬ **3RD GEAR**
⑭ **3ND GEAR**
⑮ **44 x 50 x 24mm NEEDLE BEARING**
⑯ **SPACER COLLAR** Selection, page 13-125
⑰ **FICTION DAMPER**
⑱ **SYNCHRO RING**
⑲ **SYNCHRO GEAR**
⑳ **REVERSE GEAR**
㉑ **1ST/2ND SYNCHRO HUB**
㉒ **1ST GEAR**
㉓ **THRUST SHIM** Selection, page 13-125
㉔ **SUPER LOW 3RD GEAR**
㉕ **COUNTERSHAFT**
㉖ **44 x 50 x 24mm NEEDLE BEARING**
㉗ **OIL GUIDE PLATE**
㉘ **BEARING OUTER RACE**
㉙ **BEARING INNER RACE**
㉚ **28 x 34 x 35mm NEEDLE BEARING**
㉛ **TRANSFER SHAFT**
㉜ **TRANSFER DRIVEN GEAR**
㉝ **28 x 34 x 35mm NEEDLE BEARING**
㉞ **SUPER LOW SHIFT LEVER**
㉟ **SUPER LOW SHIFT PIECE B**
㊱ **3 x 16mm SPRING PIN** Replace.
㊲ **SUPER LOW SHIFT FORK SHAFT**
㊳ **LOCK WASHER** Replace.
㊴ **SUPER LOW SHIFT FORK**
㊵ **47 mm THRUST SHIM** Selection, page 13-137
㊶ **BALL BEARING (6204)**
㊷ **SPACER COLLAR**
㊸ **28 x 34 x 35mm NEEDLE BEARING**
㊹ **FRICTION DAMPER**
㊺ **SUPER LOW 2ND GEAR**
㊻ **SYNCHRO RING**
㊼ **SYNCHRO SPRING**
㊽ **SUPER LOW SYNCHRO SLEEVE**
㊾ **SUPER LOW SYNCHRO HUB**
㊿ **SUPER LOW 2ND SHAFT**
(51) **BALL BEARING**
(52) **THRUST WASHER**
(53) **28 x 34 x 35mm THRUST NEEDLE BEARING**
(54) **SPACER COLLAR**
(55) **SUPER LOW 1ST GEAR**
(56) **SPACER COLLAR**
(57) **THRUST WASHER**
(58) **SPRING WASHER**
(59) **SPACER COLLAR**
(60) **2.5 x 10mm SPRING PIN** Replace.
(61) **SUPER LOW 1ST SHAFT**
(62) **5TH/REVESE SHIFT FORK**
(63) **5TH SHIFT FORK**
(64) **3RD/4TH SHIFT FORK**
(65) **5TH/REVERSE SHIFT PIECE**
(66) **LOCK WASHER** Replace.
(67) **OIL GUIDE PLATE**
(68) **75 mm THRUST SHIM** Selection, page 13-134
(69) **BALL BEARING**
(70) **5TH SYNCHRO SLEEVE**
(71) **5TH SYNCHRO HUB**
(72) **SYNCHRO SPRING**
(73) **SYNCHRO RING**
(74) **5TH GEAR**
(75) **35 x 40 x 26mm NEEDLE BEARING**
(76) **SPACER COLLAR**
(77) **4TH GEAR**
(78) **SYNCHRO RING**
(79) **SYBCHRO SPRING**
(80) **3RD/4TH SYNCHRO SLEEVE**
(81) **3RD/4TH SYNCHRO HUB**
(82) **3RD GEAR**
(83) **MAINSHAFT**
(84) **SPRING WASHER**
(85) **BALL BEARING**
(86) **28 x 41 x 7mm OIL SEA** Replace.
(87) **MAGNET**
(88) **REVERSE IDLER GEAR SHAFT**
(89) **REVERSE IDLER GEAR**
(90) **SPRING PIN** Replace.
(91) **LOCK COLLAR**
(92) **REVERSE SHIFT HOLDER**
(93) **SUPER LOW SHIFT PIECE BAR**
(94) **STEEL BALL**
(95) **SPRING**
(96) **SPRING COLLAR**
(97) **REVERSE SHIFT FORK**
(98) **8 x 14 mm DOWEL PIN**
(99) **14 x 20 mm DOWEL PIN**
(100) **2-4 SELECT LEVER**
(101) **STOPPER BOLT**
(102) **OIL GUIDE PLATE**
(103) **O-RING** Replace.
(104) **SPEED SENSOR**
(105) **CLUTCH HOUSING**
(106) **THRUST SHIM** Selection, page 13-106
(107) **TRANSFER DRIVE GEAR**
(108) **BEARING INNER RACE**
(109) **BEARING OUTER RACE**
(110) **O-RING** Replace.
(111) **TRANSFER THRUST SHIM** Selection, page 13-106
(112) **TRANSFER L. SIDE COVER**
(113) **SELECT SLEEVE**
(114) **TRANSFER SPACER COLLAR**
(115) **DOWEL PIN A**
(116) **TRANSFER HOUSING**
(117) **SPRING**
(118) **STEEL BALL**
(119) **SELECT FORK**
(120) **DOWEL PIN B**
(121) **35 x 54 x 8mm OIL SEAL Repalce.**
(122) **TRANSFER DRIVEN GEAR**
(123) **BEARING INNER RACE**
(124) **BEARING OUTER RACE**
(125) **TRANSFER SPACER**
(126) **O-RING** Replace.
(127) **DRIVEN GEAR THRUST SHIM** Selection, page 13-106
(128) **TRANSFER REAR COVER**
(129) **THRUST WASHER**
(130) **BEARING OUTER RACE**
(131) **BEARING INNER RACE**
(132) **38 x 60 x 11mm OIL SEAL** Replace.
(133) **COMPANION FLANGE**
(134) **TRANSFER DUST COVER**
(135) **SPRING WASHER**
(136) **LOCKNUT** Replace.
(137) **28mm WASHER**
(138) **WASHER**

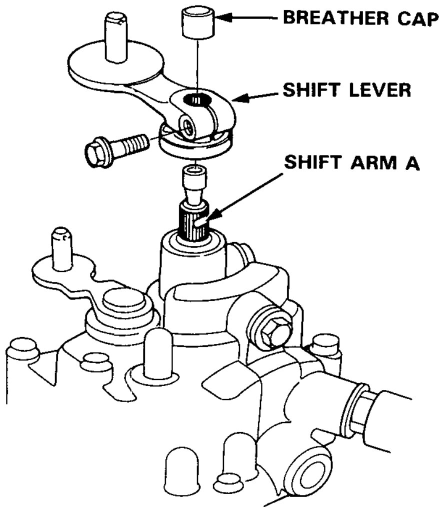
Shift Arm Cover

Disassembly

1. Remove the shift arm cover.

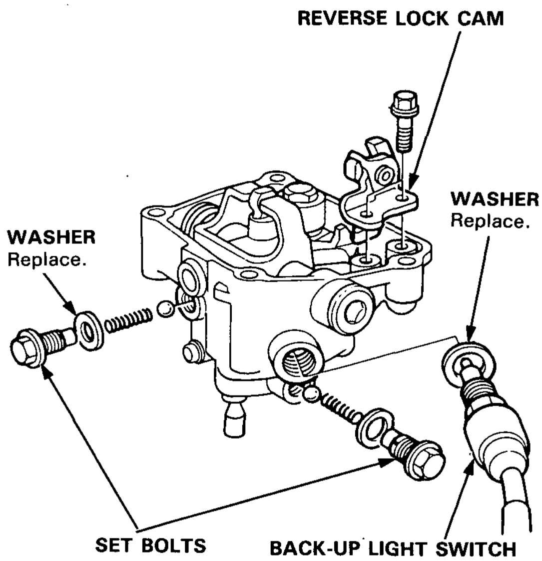


2. Remove the bolt and shift lever.

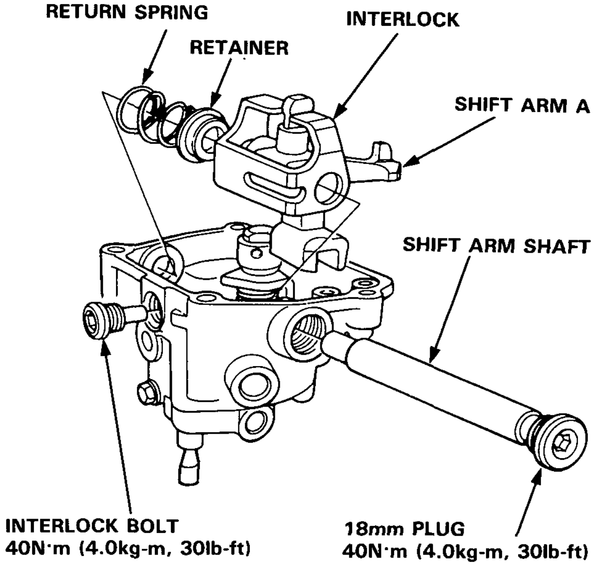


3. Remove the back-up light switch, set bolts, springs, and steel balls.

4. Remove the reverse lock cam.

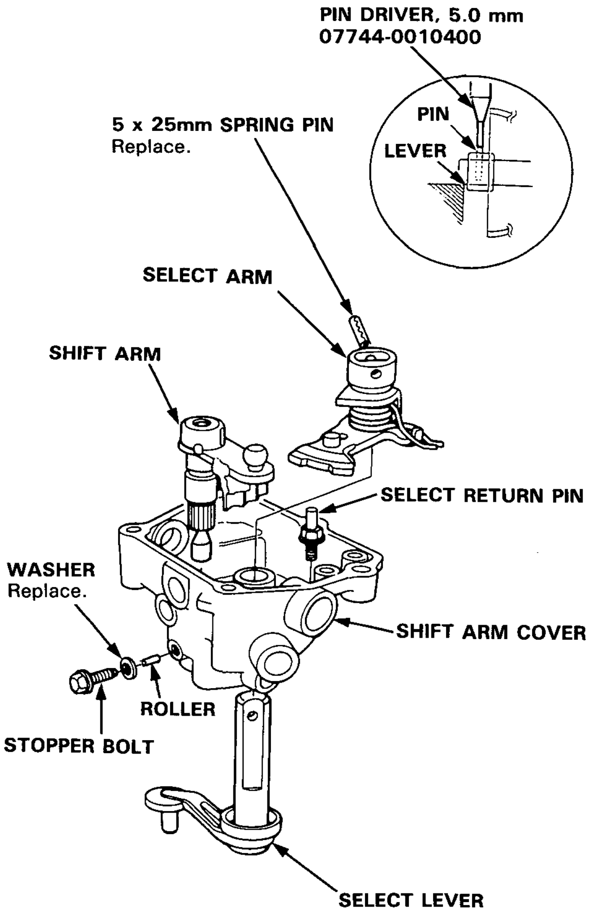


5. Remove the 18mm plug and inter lock, then remove the shift arm shaft, shift arm A, retainer, and spring.



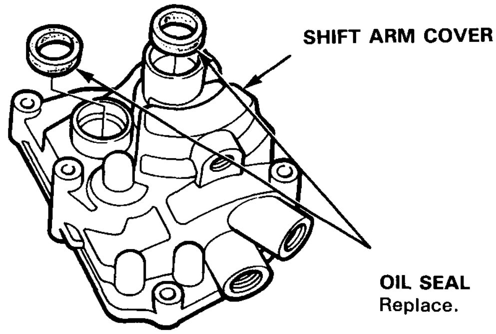
6. Remove the spring pin, then remove the select arm and select lever.

7. Remove the stopper bolt and shift lever.



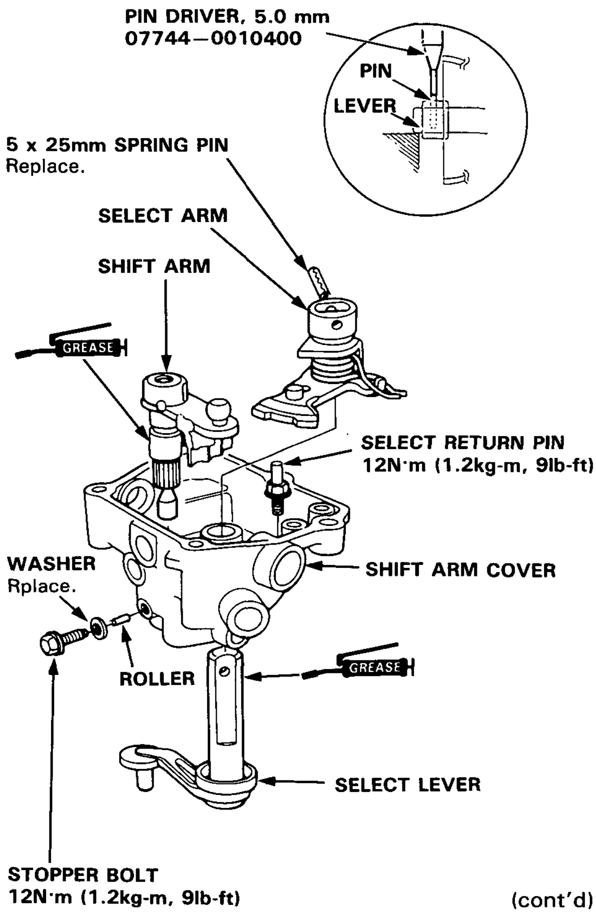
Reassembly

1. Install the new oil seals in the shift arm cover



2. Install the select lever and select arm, then install the spring pin.

3. Install the shift arm with the stopper bolt.



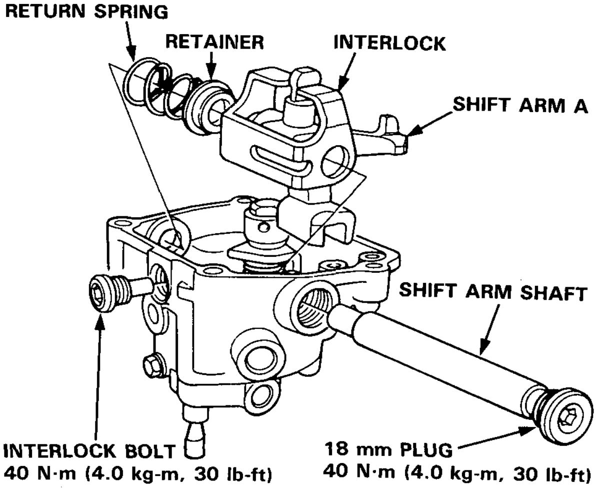
(cont'd)

Shift Arm Cover

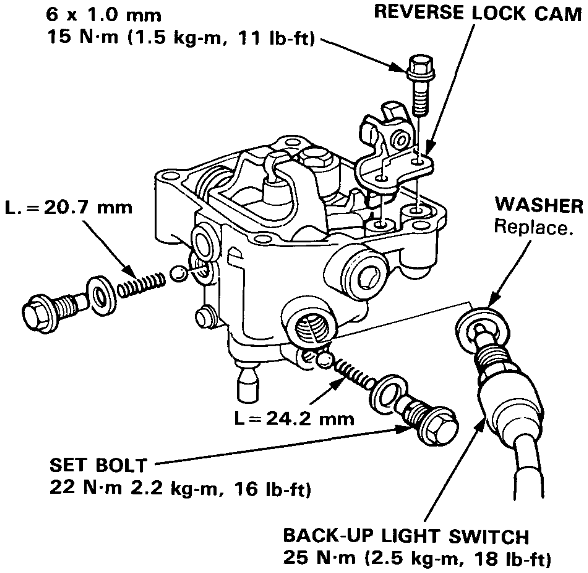
Reassembly (cont'd)

4. Set the shift arm A into the interlock, then install it to the shift arm cover.
5. Install the retainer and spring, then install the shift arm shaft.
6. Install the interlock bolt by align the bolt in the groove of the interlock, then install the 18 mm plug.

   NOTE: Apply liquid gasket to the thread of the interlock and 18 mm plug.

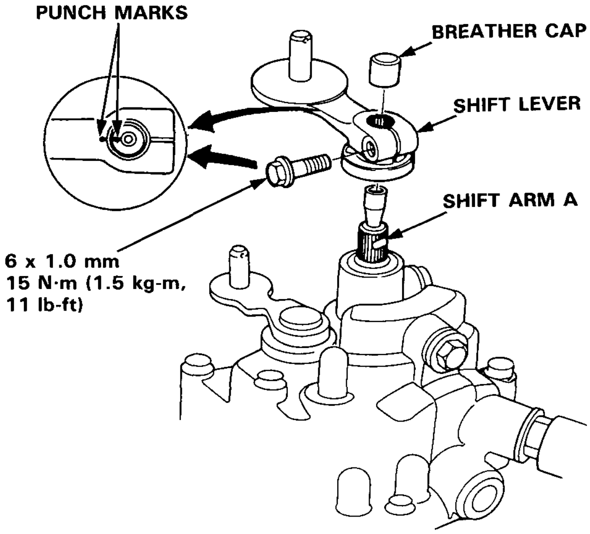


7. Install the reverse lock cam.
8. Install the steel balls, springs, set bolts, and back-up light switch.



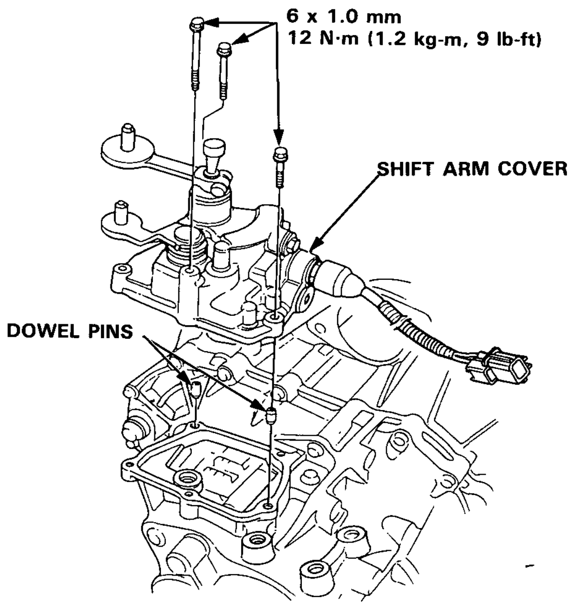
9. Install the shift lever and breather cap.

   NOTE: Align the punch mark on the shift lever with the one on shift arm A.



10. Apply liquid gasket to the transmission mating surface of the shift arm cover, then install the shift arm cover.

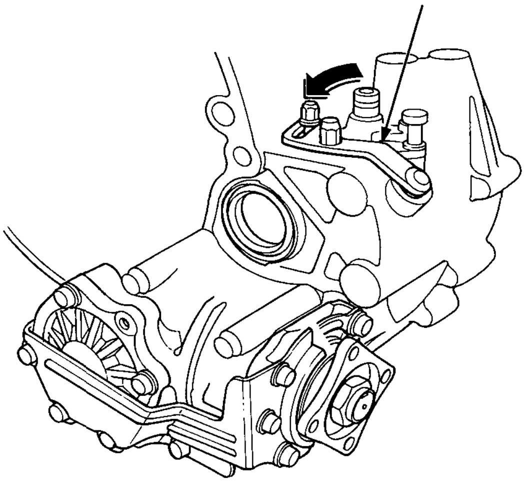
    NOTE: This transmission uses no gasket between the major housings, use Honda Genuine liquid gasket (P/N 08718–0001). Assemble the housing within 20 minutes after applying the liquid gasket and allow it to cure at least 30 minutes after assembly before filling it with oil.



Inspection

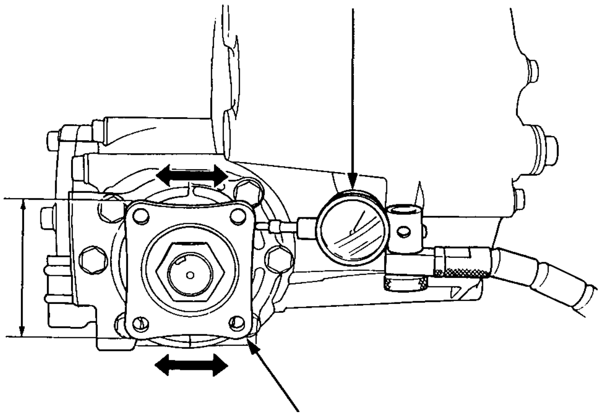
Backlash

1. Set the disengagement lever in 2WD.



2. Using a dial indicator, measure the backlash twice; once at the top of the companion flange, then rotate the companion flange 180° and measure it in the same way.

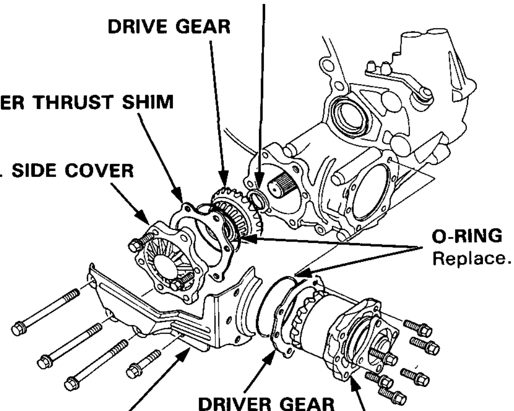
Standard: 0.10-0.15 mm (0.004-0.006 in)



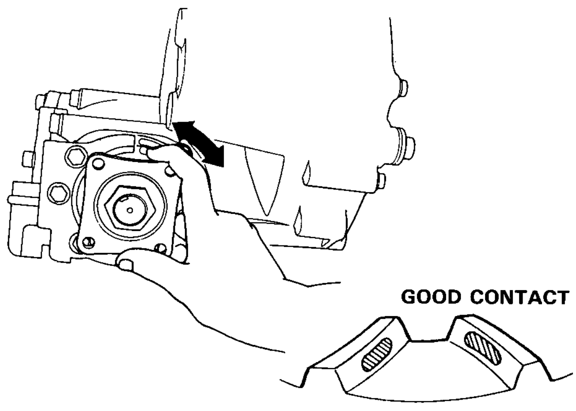
If the backlash is outside the specifications, adjust as per instructions described on page 13-106.

Gear Tooth Contact

1. Place the disengagement lever in 2WD.
2. Remove the transfer gear assembly from the clutch housing.



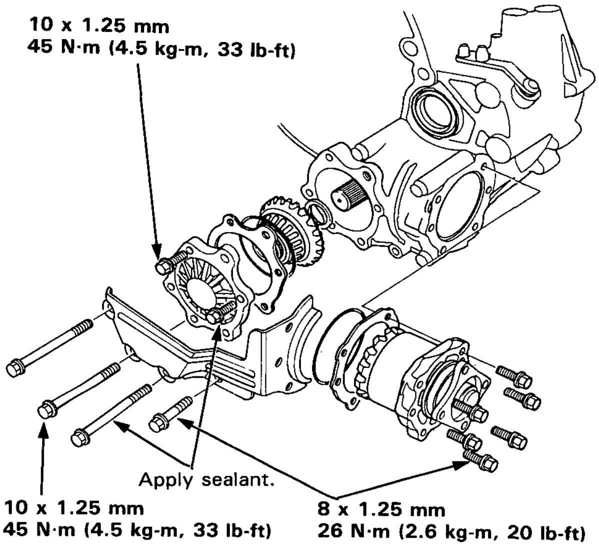
3. Apply Prussian Blue to the driven gear teeth evenly and reinstall it.
4. Torque the gear holder mounting bolts.
5. Turn the companion flange, then note tooth impression on the drive gear at more than three teeth.



If the pattern is too high or too low, correct as per instructions described on page 13-113.
If the tooth contact is correct, reassemble the drive gear assembly using new O-ring

Drive/Driven Gear Reassembly

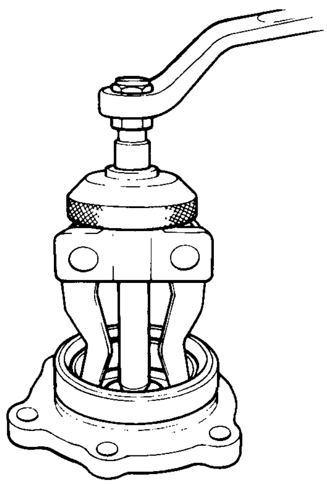
1. Set the disengagement 2WD.
2. Remove the L. side cover and driven gear assembly mounting bolts, then remove the transmission dust cover.
3. Remove the L. side cover, transfer thrust shim, and O-ring.
4. Remove the drive gear and drive gear thrust shim.
5. Remove the driven gear assembly, driven gear thrust shim, and O-ring.



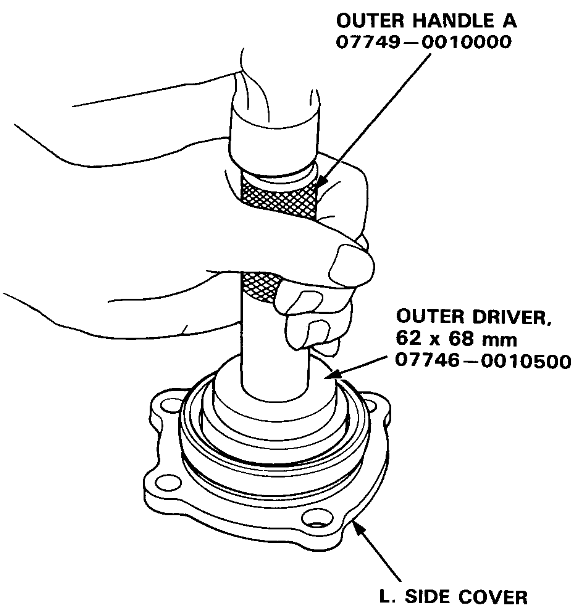
L. Side Cover Race Replacement

NOTE: The outer race should be replaced with the bearing as a set.

1. Remove the drive gear bearing race using a bearing puller as shown.

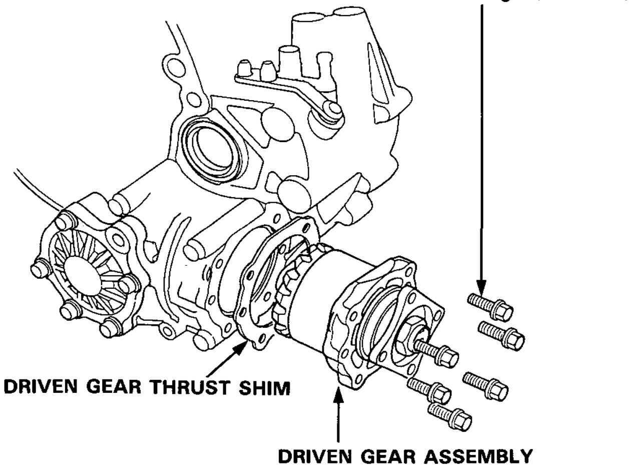


2. Install the bearing outer race using the special tools.

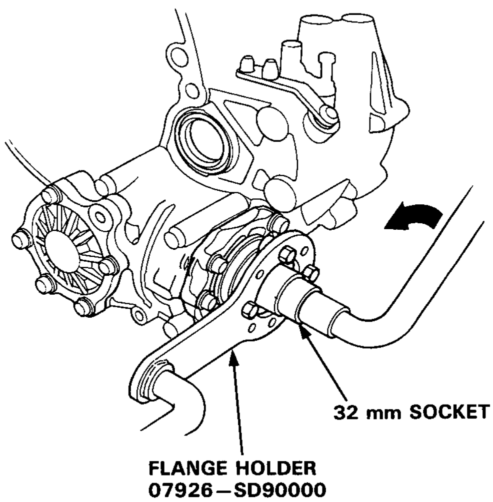


Transfer Driven Gear Disassembly

1. Install the driven gear assembly into the clutch housing, tighten the bolts.



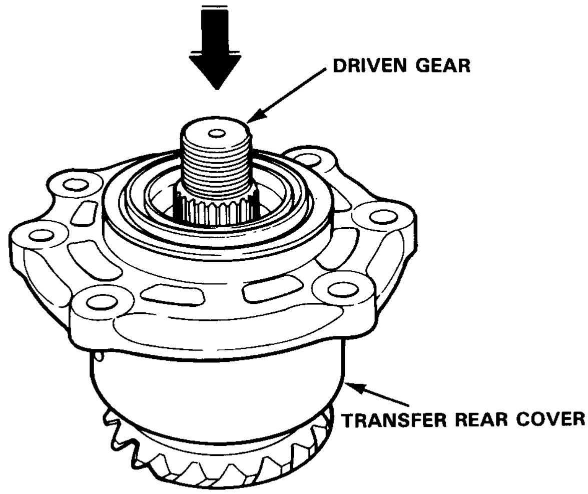
2. Hold the companion flange using a special tool, then remove the locknut with a 32 mm socket.



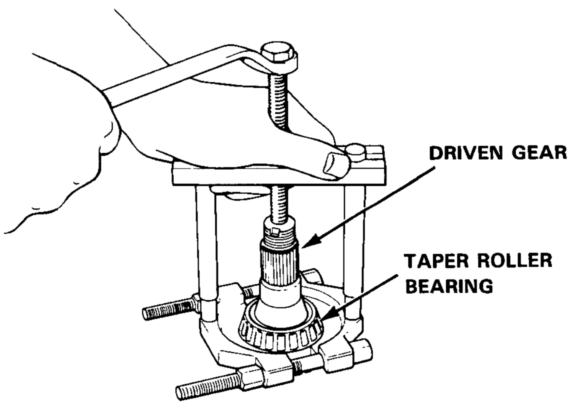
3. Remove the driven gear assembly.

4. Remove the companion flange from the driven gear shaft.

5. Remove the driven gear from the transfer rear cover by tapping the driven gear shaft.



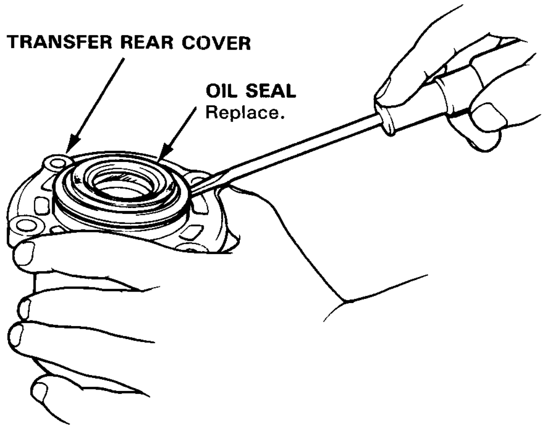
6. Remove the taper roller bearing from the driven gear shaft using a bearing puller.



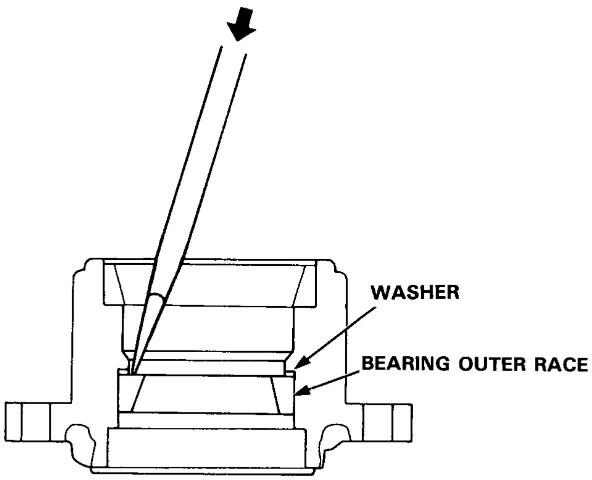
(cont'd)

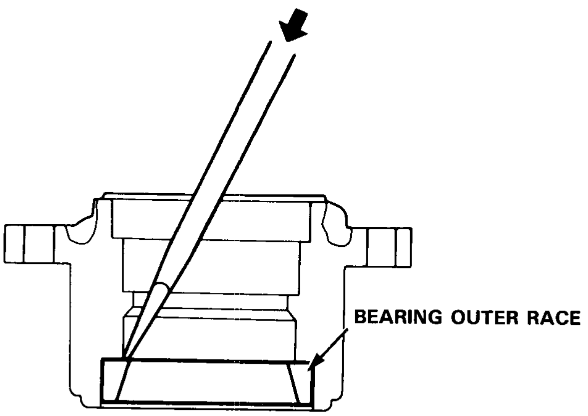
Transfer Driven Gear Disassembly (cont'd)

7. Remove the oil seal.



8. Remove the bearing outer races and washer from the transfer rear cover.

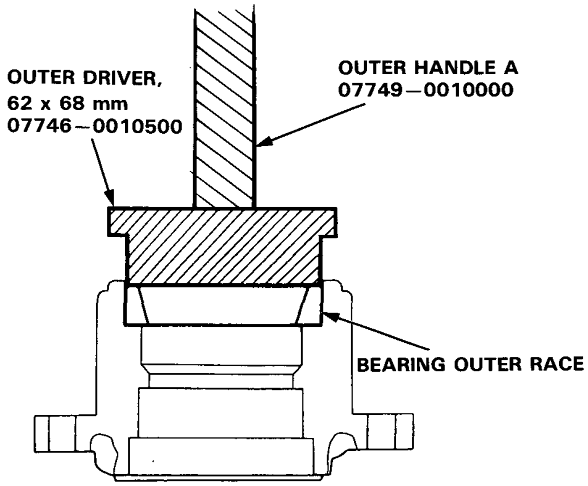




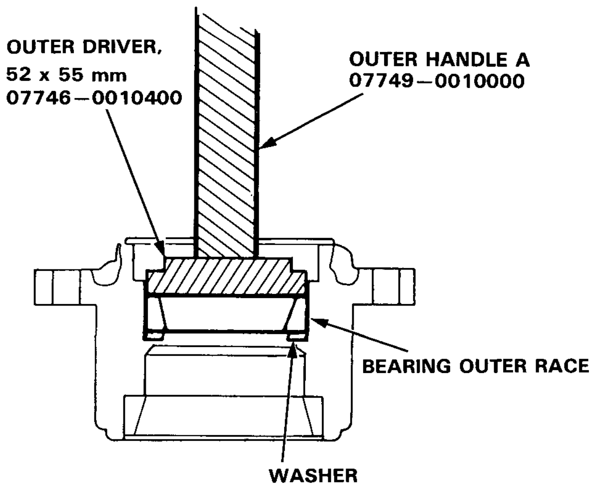
Driven Gear Preload Adjustment

NOTE: Clean all tools and parts thoroughly in solvent and dry with compressed air.

1. Install the bearing outer race using the special tools.

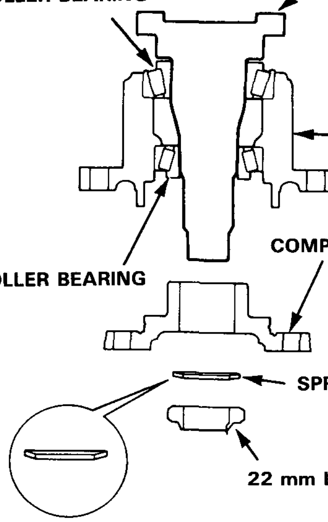


2. Install the washer and bearing outer race using the special tools.



3. Lubricate the races with clean gear oil.

4. Install the taper roller bearing onto the Driven Gear Dummy Shaft, then install the Driver Gear Dummy Shaft in the transfer rear cover.

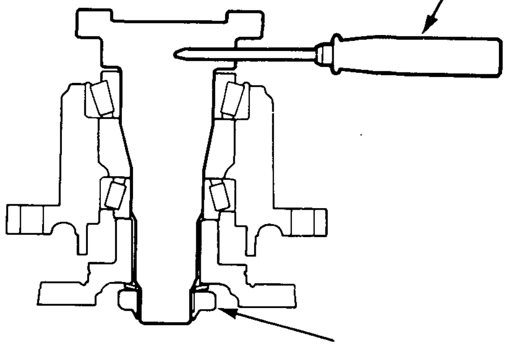


5. Install the taper roller bearing onto the dummy shaft.

6. Install the companion flange, spring washer, and 22 mm locknut on the dummy shaft

NOTE:
- Use a new 22 mm locknut.
- Do not install the oil seal.
- Install the lock washer with the dished side toward the transfer rear cover.

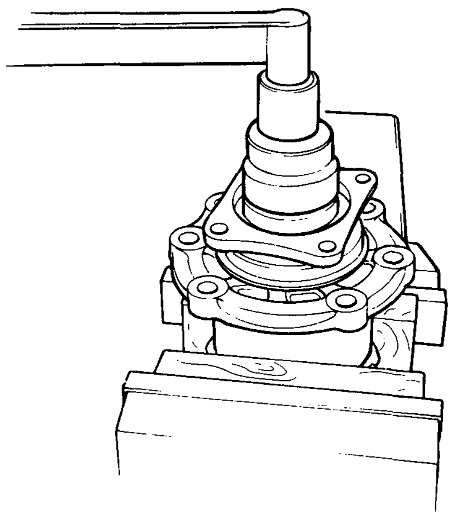
7. Hold the dummy shaft by inserting the end of a screwdriver into the hole in the shaft, then torque the 22 mm locknut to about 10 N·m (1.0 kg-m, 8 lb-ft).



8. Turn the companion flange several times to assure normal bearing contact.

9. Measure preload using a torque wrench.

Standard: 0.5—0.8 N·m
(5.0—8.0 kg-m, 4.3—6.9 lb-in)

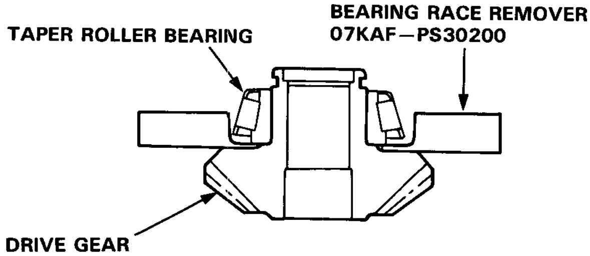


10. If the preload is outside the above limits, readjust by turning the locknut.

NOTE: Do not overtighten the locknut.

Thrust Shim Selection

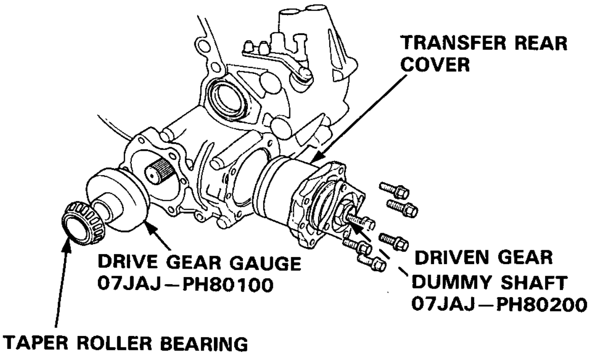
1. Remove the taper roller bearing using special tool.

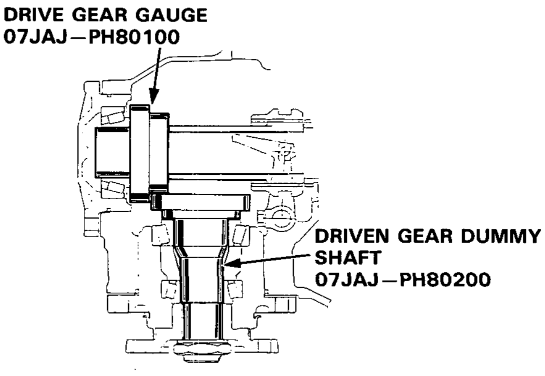


2. Insert the dummy shaft assembly into the transfer housing.

3. Lubricate the taper roller bearing with clean gear oil, then install it on the Drive Gear Gauge. Install the bearing and gauge onto the transfer shaft.

   NOTE:
   - Do not install the drive gear thrust shim.
   - Pull the dummy shaft assembly out slightly to allow the drive gear gauge to seat.

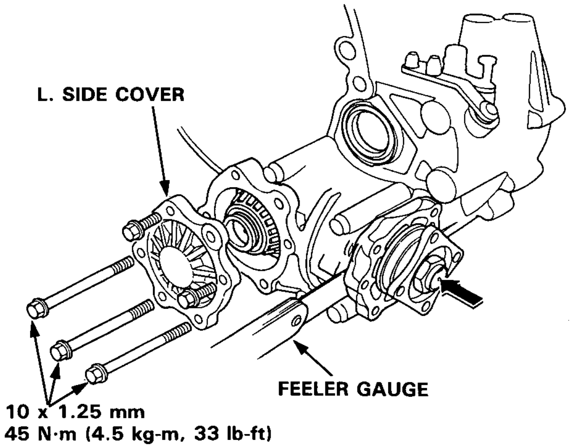




4. Install the L. side cover without the bolts.

5. To determine driven gear thrust shim thickness, rotate the companion flange several times to seat the bearings, measure the clearance between the transfer rear cover and transfer case at several locations with a feeler gauge, then record the average.

   NOTE: The clearance should be taken while pressing the dummy shaft all the way in.



6. The correct shim thickness is determined by recording the average clearance between the transfer rear cover and the transfer case, then adding to subtracting the machining tolerance, which is etched in to the driven gear.

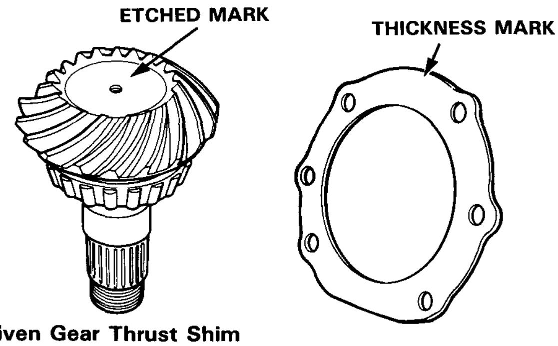
   NOTE: The number on each pinion is plus (+) or minus (–) tolerance in hundredth's of the a millimeter.

   Example 1:
   - Clearance measured in Step 5: 1.08 mm
   - Machining tolerance etched in the driven gear: (+2)

   Corrected shim thickness:
   1.08 + 0.02 = 1.10 mm

   Example 2:
   - Clearance measured in Step 5: 1.08 mm
   - Machining tolerance etched in the driven gear: (–3)

   Corrected driven gear thrust shim thickness:
   1.08 – 0.03 = 1.05 mm

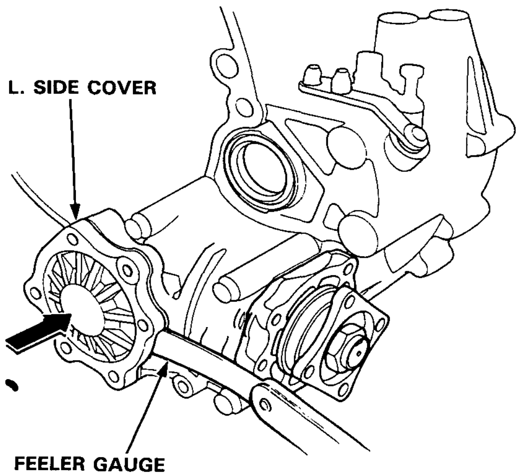


Driven Gear Thrust Shim

	PART NUMBER	THICKNESS
1	29481–PH8–000	0.50 mm (0.0197 in)
2	29482–PH8–000	0.85 mm (0.0335 in)
3	29483–PH8–000	0.90 mm (0.0354 in)
4	29484–PH8–000	0.95 mm (0.0374 in)
5	29485–PH8–000	1.00 mm (0.0394 in)
6	29486–PH8–000	1.05 mm (0.0413 in)
7	29487–PH8–000	1.10 mm (0.0433 in)
8	29488–PH8–000	1.15 mm (0.0453 in)
9	29489–PH8–000	1.20 mm (0.0472 in)
10	29491–PH8–000	1.25 mm (0.0492 in)
11	29492–PH8–000	1.30 mm (0.0512 in)

7. To determine the L. side cover thrust shim thickness measure the clearance between the transfer L. side cover and transfer case at several locations with a feeler gauge, and record the average.

   NOTE: The clearance should be measured while pressing the L. side cover all the way against the transfer case.



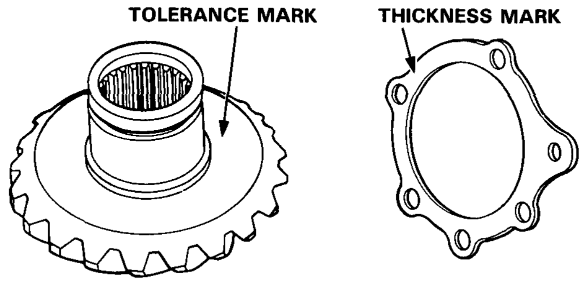
8. The correct shim thickness is determined by recording the clearance between the transfer case and the L. side cover, then adding or subtracting the machining tolerance, which is etched into the drive gear.

   Example 1:
   - Clearance measured in Step 7: 1.04 mm
   - Machining tolerance etched in the drive gear: (+2)

   Corrected shim thickness:
   1.04 + 0.02 = 1.06 mm

   Example 2:
   - Clearance measured in Step 7: 1.04 mm
   - Machining tolerance etched in the drive gear: (−1)

   Corrected driven gear thrust shim thickness:
   1.04 − 0.01 = 1.03 mm



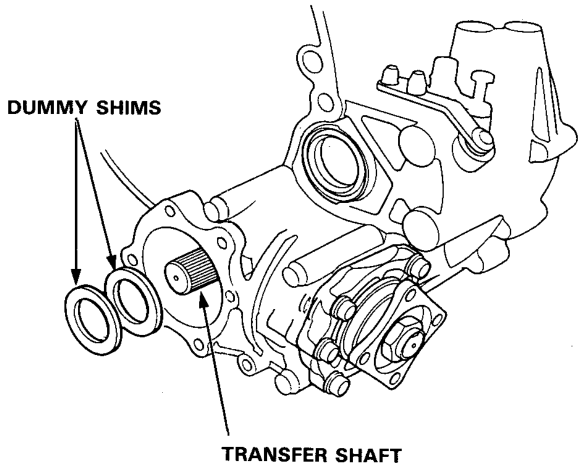
Transfer Thrust Shim

	PART NUMBER	THICKNESS
1	29461–PH8–901	0.30 mm (0.0118 in)
2	29462–PH8–901	1.00 mm (0.0394 in)
3	29463–PH8–901	1.03 mm (0.0406 in)
4	29464–PH8–901	1.06 mm (0.0417 in)
5	29465–PH8–901	1.09 mm (0.0429 in)
6	29466–PH8–901	1.12 mm (0.0441 in)
7	29467–PH8–901	1.15 mm (0.0453 in)
8	29468–PH8–901	1.18 mm (0.0465 in)
9	29469–PH8–901	1.21 mm (0.0476 in)
10	29471–PH8–901	1.24 mm (0.0488 in)
11	29472–PH8–901	1.27 mm (0.0500 in)
12	29473–PH8–901	1.30 mm (0.0512 in)
13	29474–PH8–901	1.33 mm (0.0524 in)

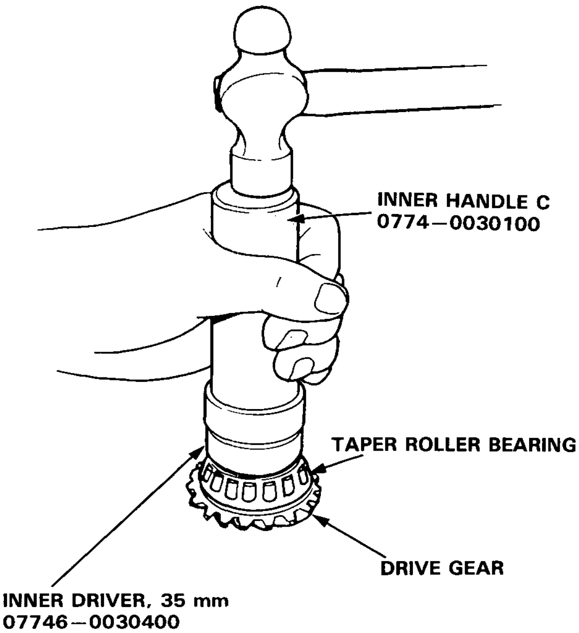
(cont'd)

Thrust Shim Selection (cont'd)

9. Install two 1.75 mm "dummy" shims (P/N 29415–PH8–000) on the transfer shaft.

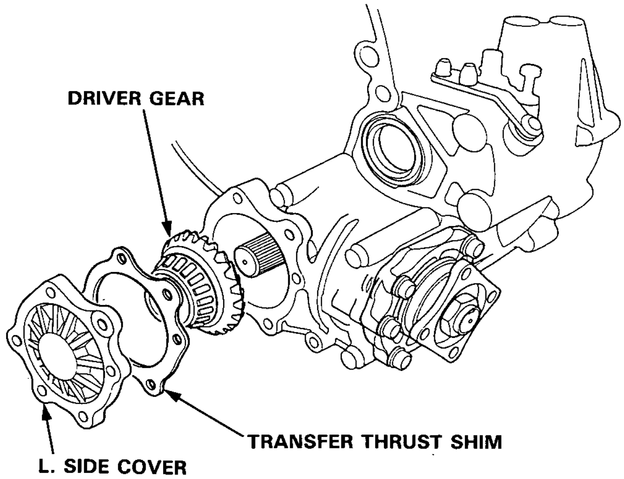


10. Press the taper roller bearing on the drive gear.

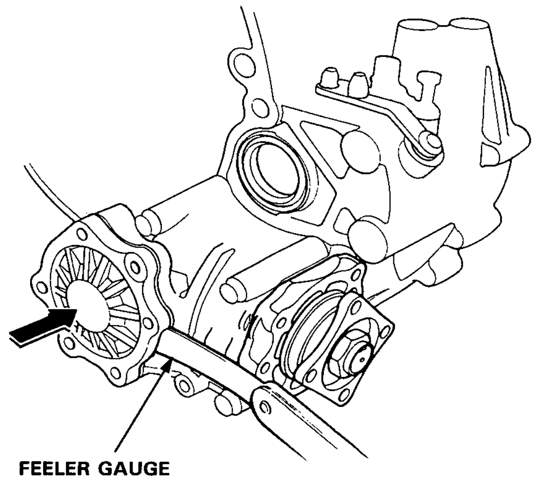


11. Install the drive gear onto the transfer shaft.

12. Place the shim selected in Step 7 on the L. side cover, then install the cover on the transfer case.



13. Rotate the companion flange several times to seat the bearings, measure the clearance between the L. side cover and transfer case at several locations while pushing against the L. side cover, and record the average.



14. Subtract the clearance measured in Step 13 from 3.5 mm to obtain the correct shim thickness.

Example:
- Clearance measured in Step 13: 1.57 mm
- Thickness of dummy shims: 3.5 mm

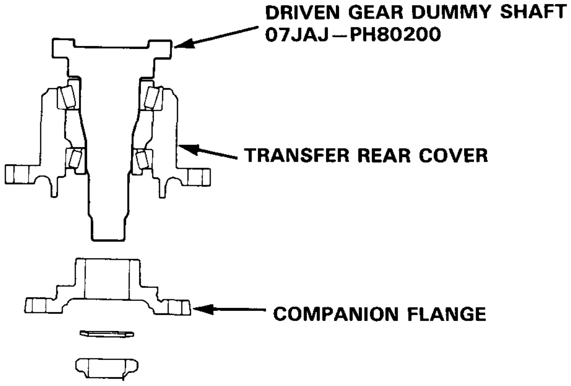
Corrected drive gear thrust shim:
1.57 + 3.5 = 1.93 mm thickness

Thrust Shim

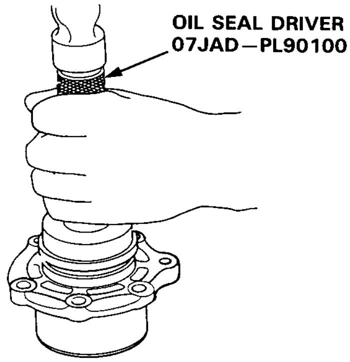
PART NUMBER	THICKNESS
29411–PH8–000	0.48 mm (0.0189 in)
29412–PH8–000	1.57 mm (0.0618 in)
29413–PH8–000	1.63 mm (0.0642 in)
29414–PH8–000	1.69 mm (0.0665 in)
29415–PH8–000	1.75 mm (0.0689 in)
29416–PH8–000	1.81 mm (0.0713 in)
29417–PH8–000	1.87 mm (0.0736 in)
29418–PH8–000	1.93 mm (0.0760 in)
29419–PH8–000	1.99 mm (0.0783 in)

Driven Gear Reassembly

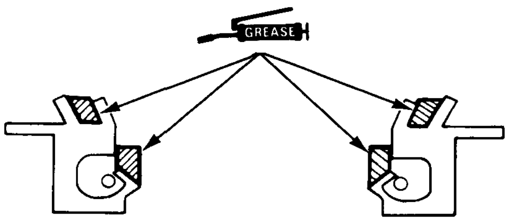
1. Remove the driven gear dummy shaft from the transfer rear cover.



2. Install the oil seal using the special tools into the transfer rear cover.



3. Coat the main and side sealing lips of the oil seal with grease.



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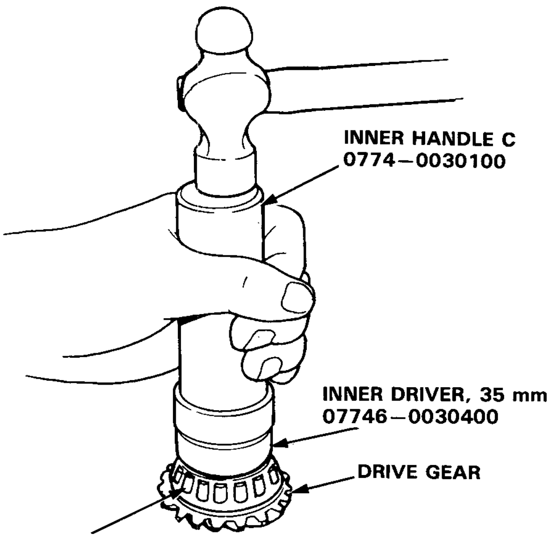
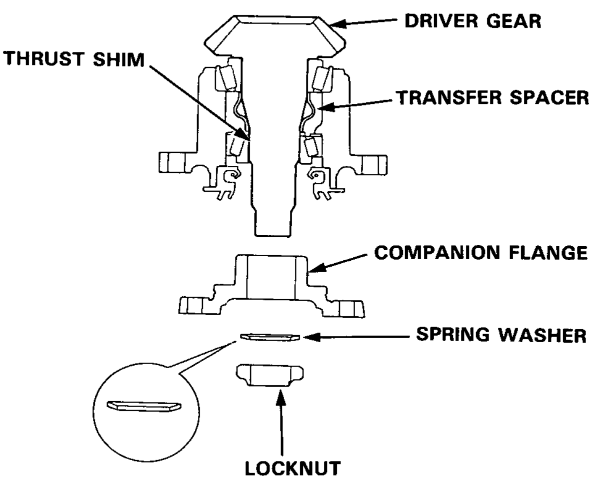
Driven Gear Reassembly (cont'd)

4. Install the taper roller bearing on the drive gear.

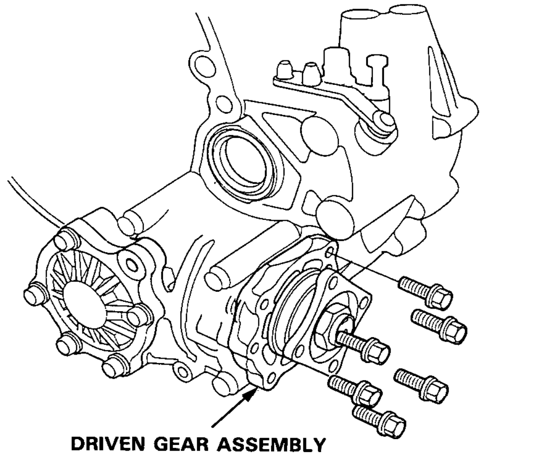


5. Install the following parts in the transfer rear cover;
   - Drive gear
   - Transfer spacer (new spacer)
   - Companion flange
   - Spring washer
   - 22 mm locknut

   NOTE: Install the spring washer with the dished side toward the companion flange.

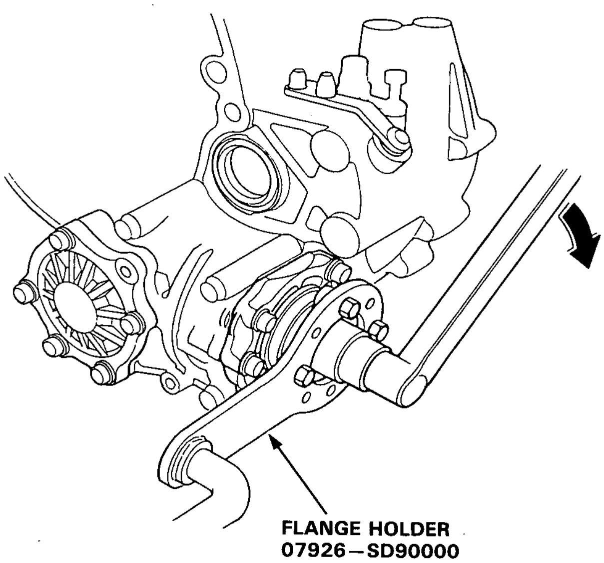


6. Temporarily install the drive gear assembly and mounting bolts in the transfer case.



7. Tighten the locknut to the specified torque.

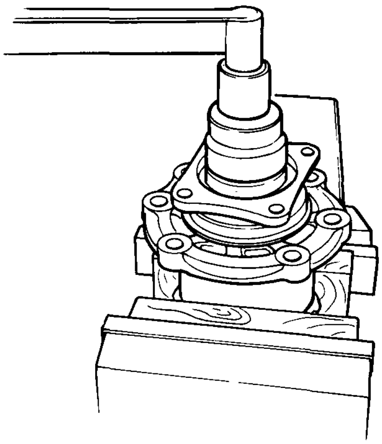
   Torque: 120 N·m (12 kg-m, 87 lb-ft)



8. Remove the drive gear assembly from the transfer case, and measure the preload.

   NOTE: Before measuring the preload, rotate the companion flange several times to assure normal bearing contact.

   Preload: 0.8—1.1 N·m
   (8.0—11.0 kg-cm, 7.0—9.5 lb-in)



   NOTE: If the preload exceeds 1.1 N·m (11.0 kg-cm, 9.5 lb-in), replace the transfer spacer with a new one and readjust. Do not try to adjust the preload by loosening the locknut.

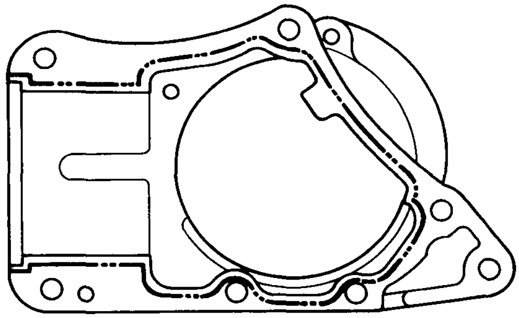
9. If the preload is less than 0.8 N·m (8 kg-cm, 7 lb-in), adjust by turning the locknut in a little at an time.

   NOTE: Replace the transfer spacer with a new one if the preload is still outside the above limits when the locknut is tightened to 230 N·m (23 kg-m, 166 lb-ft).

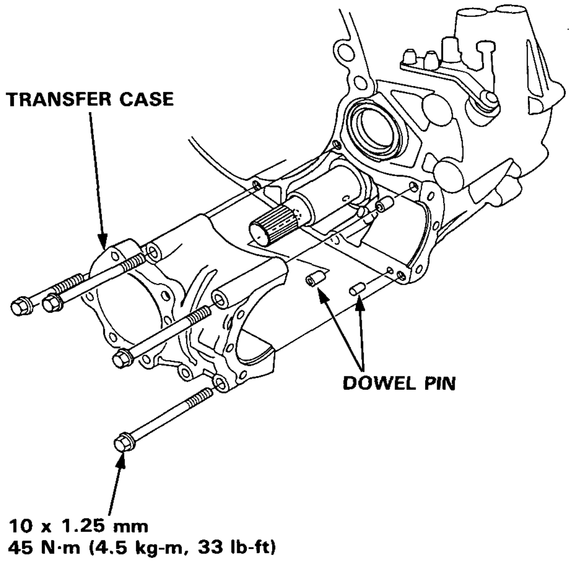
Drive/Driven Gear Reassembly

1. Apply liquid gasket to the clutch housing mating surface of the transfer case.

   NOTE: This transmission uses no gasket between the major housings; use Honda Genuine liquid gasket (P/N 08718—0001). Assemble the housing within 20 minutes after applying the liquid gasket and allow it to cure at least 30 minutes after assembly before filling it with oil.



2. Install the transfer case on the clutch housing.

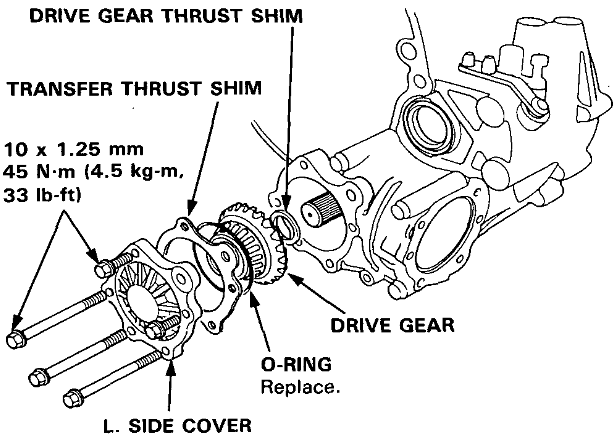


(cont'd)

Drive/Driven Gear Reassembly (cont'd)

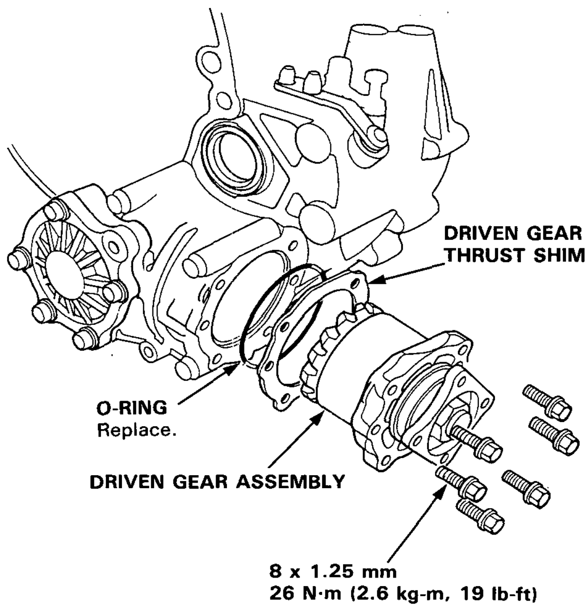
3. Install the following parts in and on the transfer case and shaft;

   – transfer thrust shim
   – drive gear (lubricant with clean gear oil)
   – drive gear thrust shim
   – L. side cover and bolts



4. Install the following parts;

   – driven gear thrust shim
   – driven gear assembly and bolts

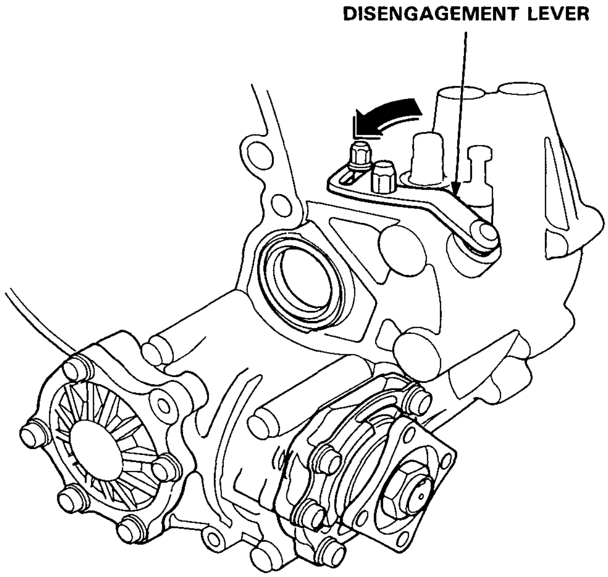


5. Measure the total bearing preload;

   a. Rotate the companion flange several times to assure normal bearing contact.
   b. Set the disengagement lever in 2WD.
   c. Measure the preload with a torque wrench.

   The total bearing preload should be 0.7–1.0 N·m (7.0–10.0 kg-cm, 6.1–8.75 lb-in) greater than the preload on the driven gear assembly alone (see page 13-109, step 8).

   Example:
   If the preload of the driven gear assembly alone was 0.9 N·m (9 kg-cm, 7.9 lb-in), the total bearing preload should be between 1.6 N·m (16 kg-cm, 14 lb-in) and 1.9 N·m (19 kg-cm, 16 lb-in)

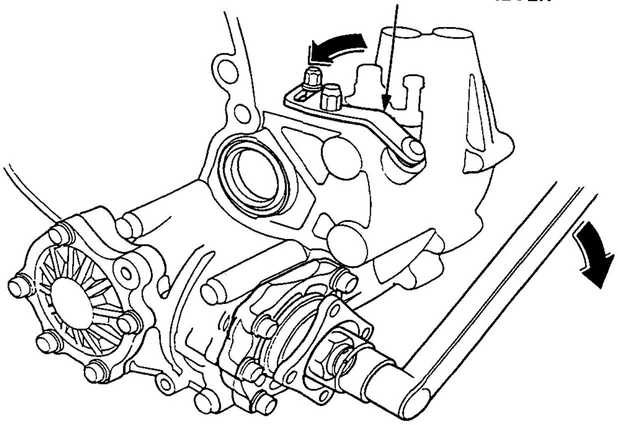


6. If the preload is outside of the specifications, adjust if by replacing the transfer thrust shim.

   - If the total bearing preload is less than the specification, reduce the size of the transfer thrust shim.
   - If the total bearing preload exceeds the specification, increase the size of the transfer thrust shim.

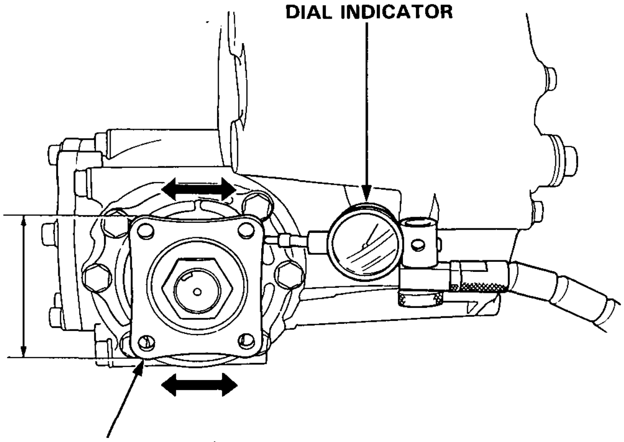
7. After the bearing preload has been adjusted properly, measure the gear backlash.

a. Place the disengagement lever in 2WD.

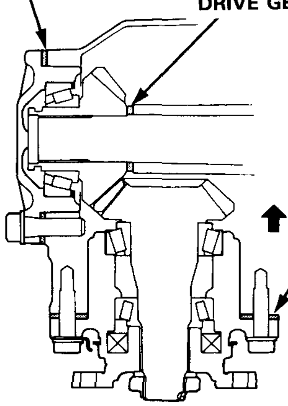


b. Using a dial indicator, measure the backlash at the top of the companion flange, then rotate the companion flange 180° and measure again.

Backlash: 0.10—0.15 mm (0.004—0.006 in)

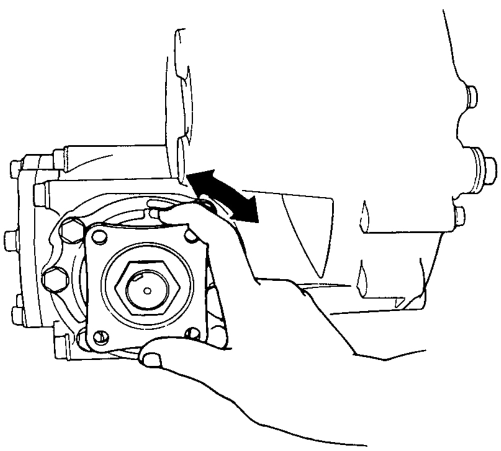


c. If the backlash is outside the specifications, adjust by changing the driven gear and drive gear thrust shims.



8. Check for proper tooth contact after the backlash adjustment has been completed.

a. Remove the driven gear assembly from the transfer case, and coat the driven gear teeth evenly with Prussian Blue.
b. Reinstall the driven gear assembly in the transfer case and tighten the bolts to the specified torque.
c. With the disengagement lever in 2WD, rotate the companion flange one full turn in both directions.



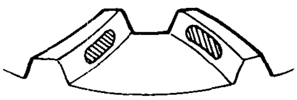
(cont'd)

Drive/Driven Gear Reassembly (cont'd)

d . Remove the driven gear assembly from the transfer case and note the tooth impression on the gear.

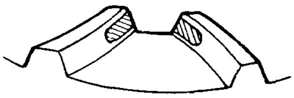
NOTE: Compare the tooth impression of the gear with the examples below and fallow the appropriate adjustment instructions.
Continue the check and adjustment procedure until the tooth contact is correct.

CORRECT TOOTH CONTACT

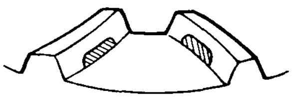


IMPROPER TOOTH CONTACT

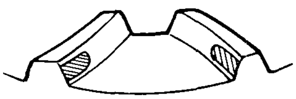
TOF CONTACT



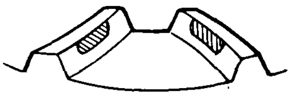
FLANK CONTACT



HEEL CONTACT



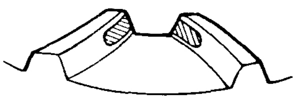
FACE CONTACT

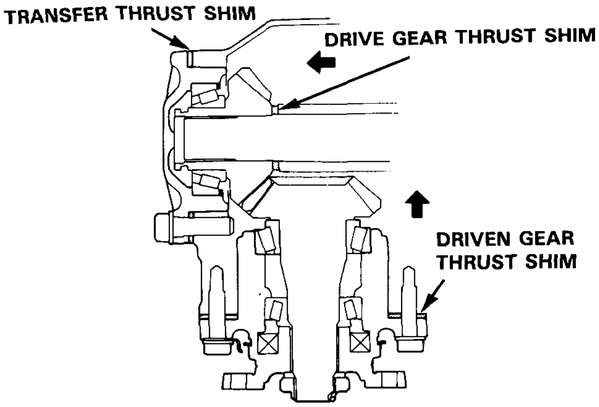


TOE CONTACT

If the pattern shows toe contact, use a thicker drive gear thrust shim and increase the thickness of the transfer thrust shim an equal amount.

TOE CONTACT



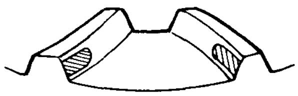


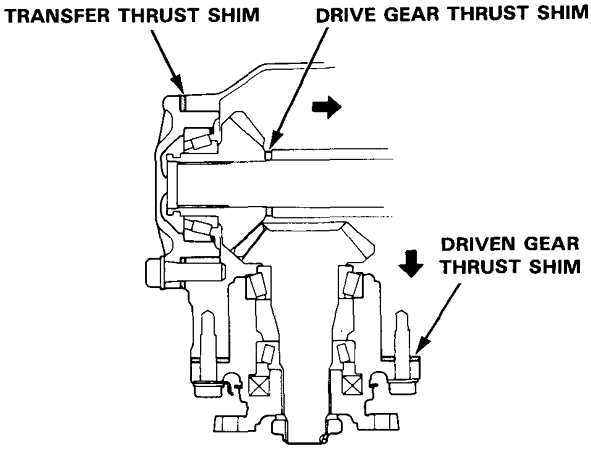
HEEL CONTACT

If the pattern shows heel contact, it indicates too much backlash. To correct, reduce the thickness of the drive gear thrust shim. The thickness of the transfer thrust shim must also be reduced by the amount by which the drive gear thrust shim thickness is reduced.

NOTE: The driven gear thrust shim will have to be changed also to compensate for the change in backlash.

HEEL CONTACT



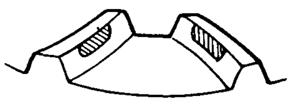


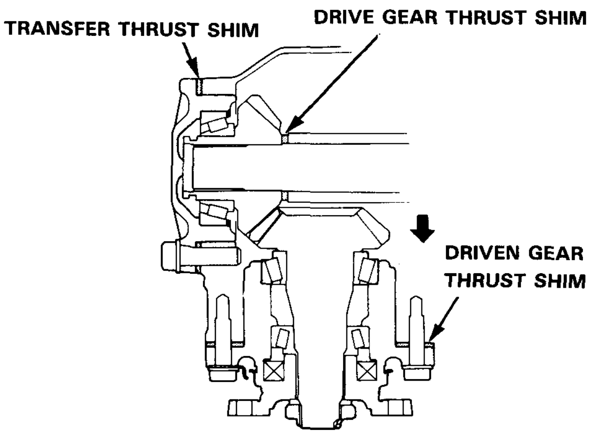
FACE CONTACT

To correct face contact, use a thicker driven gear thrust shim to move the driven gear away from the drive gear.
The backlash should remain within the limits.

If the backlash cannot be held within the limits (page 13-113), make correction in the same manner as for HEEL CONTACT.

FACE CONTACT



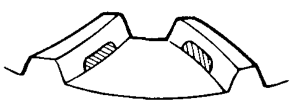


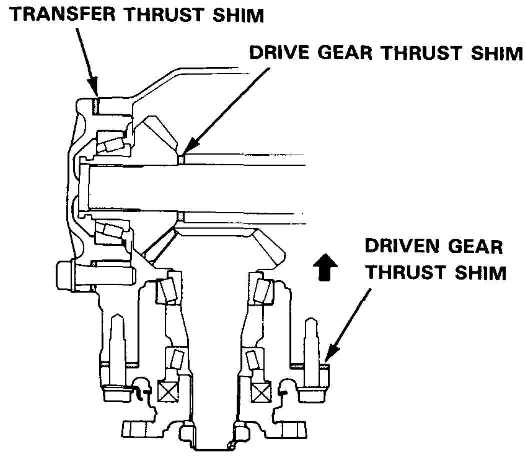
FLANK CONTACT

If the pattern shows flank contact, move the driven gear in toward the drive gear by using a thinner shim for the driven gear.
The backlash must remain within the limits.

If the backlash exceeds the limits (13-113), make correction in the same manner as for TOE CONTACT.

FLANK CONTACT

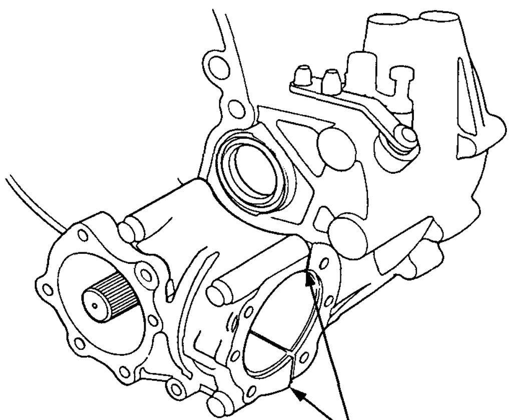




9. After the correct gear tooth contact, remove the transfer drive and driven gears.

10. Apply liquid gasket to the clutch housing and transfer case mating points on the driven gear mating *surface.*

    NOTE: This transmission uses no gasket between the major housings; use Honda Genuine liquid gasket (P/N 08718—0001). Assemble the housing within 20 minutes after applying the liquid gasket and allow it to cure at least 30 minutes after assembly before filling it with oil.



Apply liquid gasket to mating surfaces of clutch and transfer housing.

(cont'd)

Drive/Driven Gear Reassembly (cont'd)

11. Install the thrust shim and a new O-ring on the driven gear assembly, then install the assembly in the transfer case.

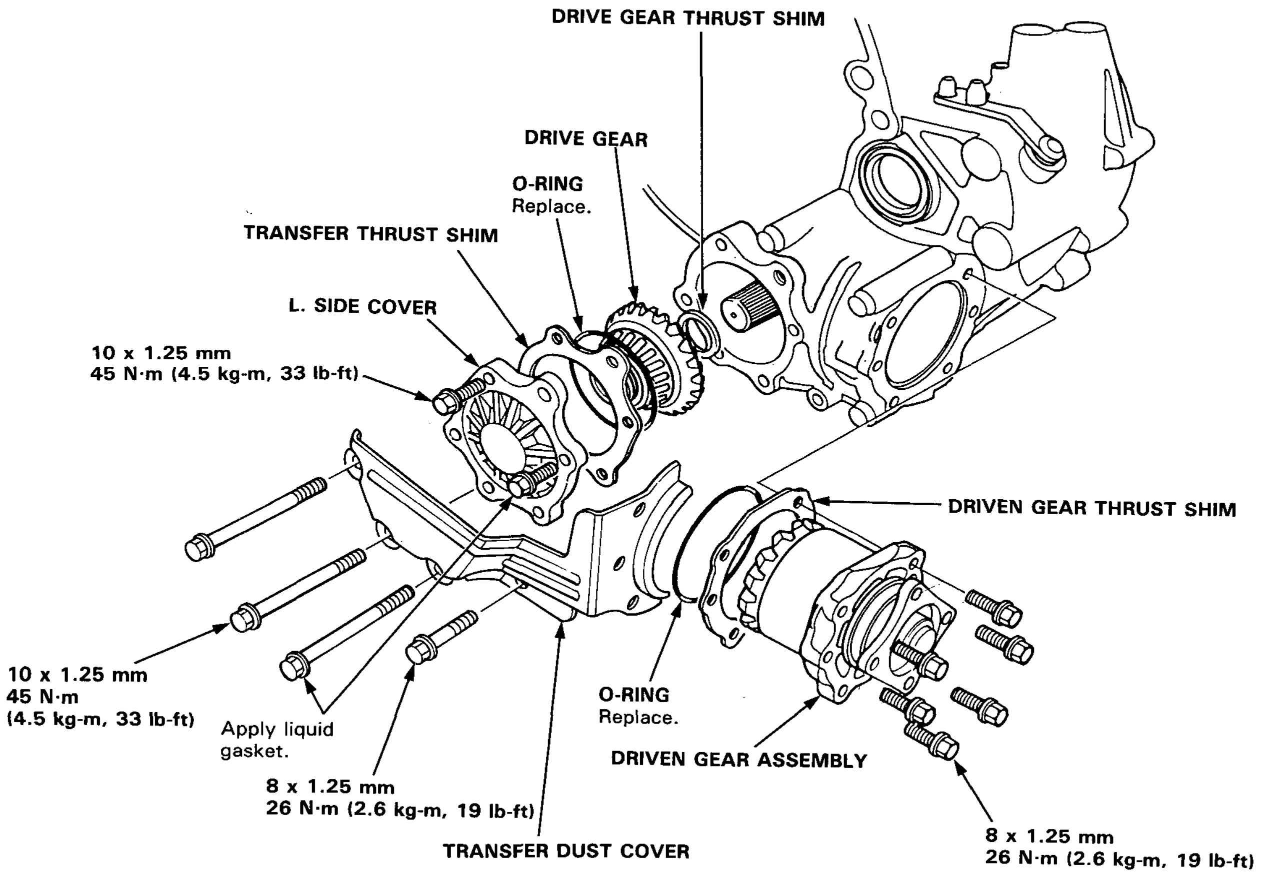
12. Install the drive gear thrust shim and drive gear onto the transfer shaft.

13. Place the transfer thrust shim and O-ring on the L. side cover and install them on the transfer case.

    NOTE:
    - Lubricant a new O-ring with gear oil.
    - Apply liquid gasket (P/N 08718–0001) to the threads.

14. Install the transfer dust cover.

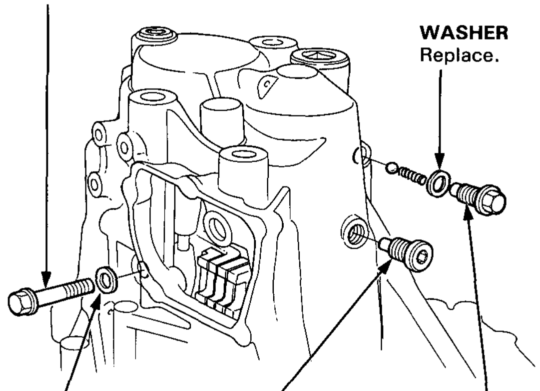
15. Measure the total bearing preload after assembly.



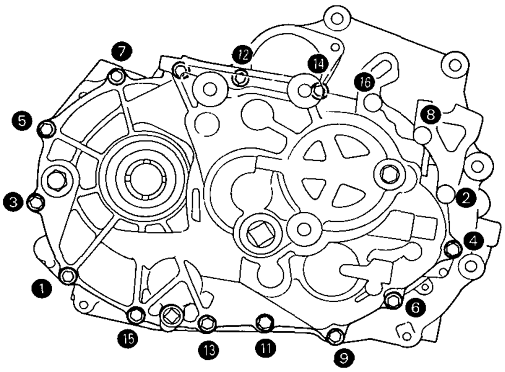
Removal

NOTE: Place the clutch housing on two pieces of wood thick enough to keep the mainshaft from the hitting the workbench.

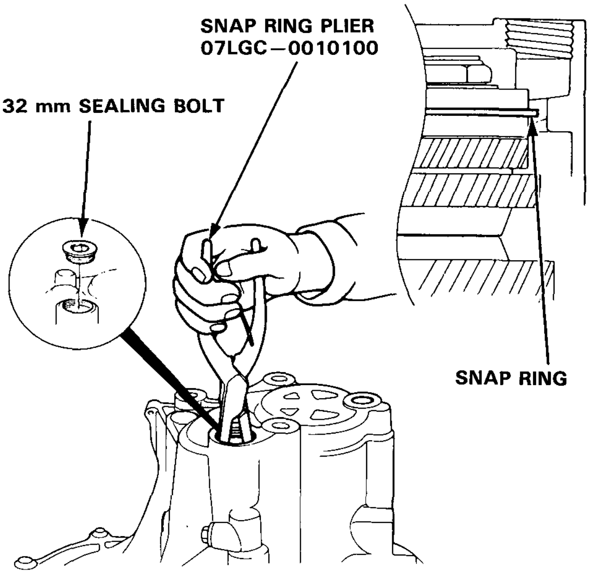
1. Remove the set bolt, spring, and steel ball.
2. Remove the super-low shift lever bolt and reverse idler shaft bolt.



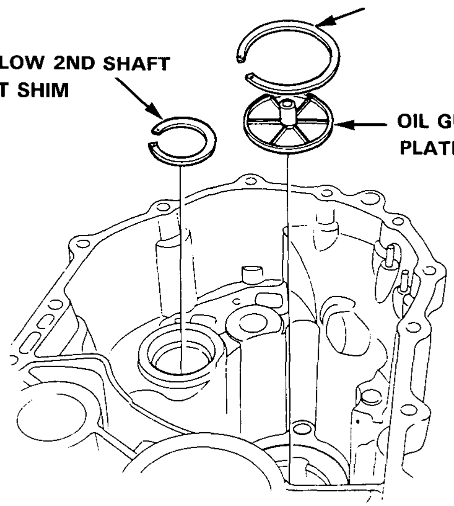
3. Remove the transmission attaching bolts.



4. Remove the 32 mm sealing bolt.
5. Expand the snap ring on the countershaft ball bearing and remove it from the groove using a pair of snap ring pliers.



6. Separate the transmission housing from the clutch housing and wipe if clean of the sealant.
7. Remove the thrust shim, oil guide plate, and super-low 2nd shaft thrust shim from the transmission housing.

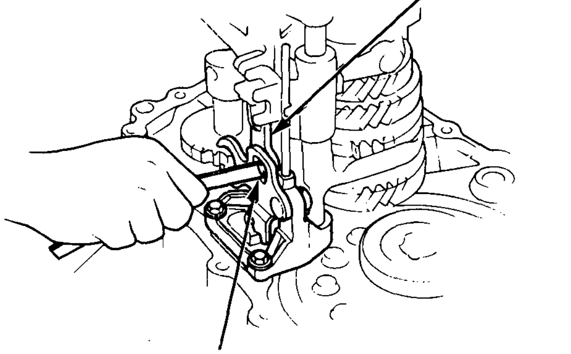


Reverse Shift Fork

Clearance Inspection

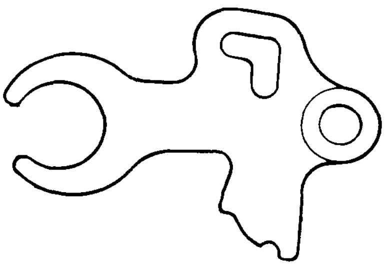
1. Measure the clearance between the reverse shift fork and 5th/reverse shift piece pin.

Standard: 0.05–0.35 mm (0.002–0.014 in)
Service Limit: 0.5 mm (0.020 in)



2. If the clearance exceed the service limit, measure the width of the groove in the reverse shift fork.

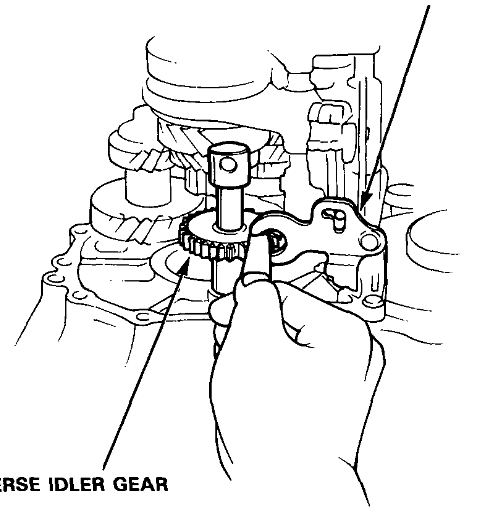
Standard: 7.05–7.25 mm (0.278–0.285 in)



If the width of the groove exceeds the standard, replace the reverse shift fork with a new one.
If the width of the groove is within the standard, replace the 5th/reverse shift piece with a new one.

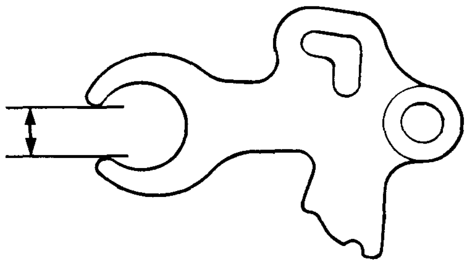
3. Measure the clearance between the reverse idler gear and reverse shift fork.

Standard: 0.5–1.1 mm (0.020–0.043 in)
Service Limit: 1.8 mm (0.071 in)



4. If the clearance exceeds the service limit, measure the width of the reverse shift fork pawl groove.

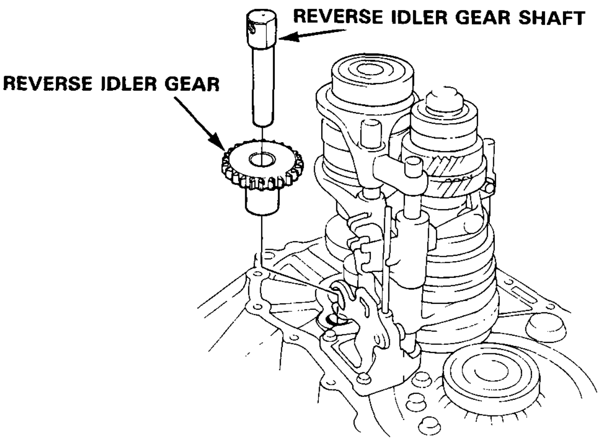
Standard: 13.0–13.3 mm (0.512–0.524 in)



If the width exceeds the standard, replace the reverse shift arm with a new one.
If the width is within the standard, replace the

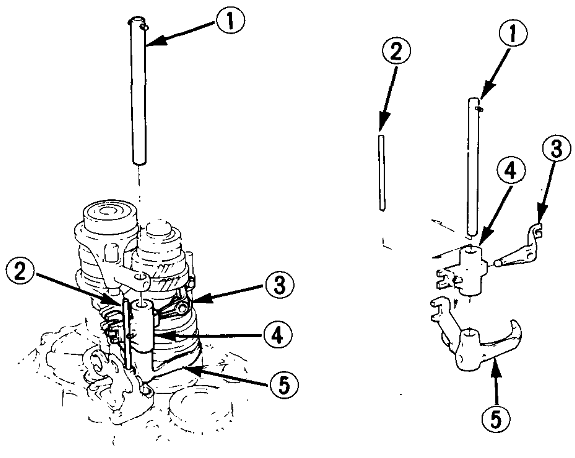
Removal

1. Remove the reverse idler gear and shaft from the clutch housing.



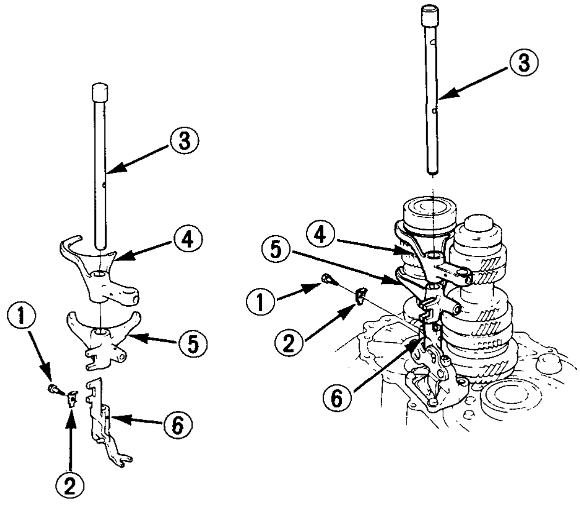
2. Remove the following parts, in the order shown, from the reverse shift holder assembly.

① **1ST/2ND SHIFT FORK SHAFT**
② **SUPER-LOW SHIFT PIECE BAR**
③ **SUPER-LOW SHIFT LEVER**
④ **SUPER-LOW SHIFT PIECE A**
⑤ **1ST/2ND SHIFT FORK**

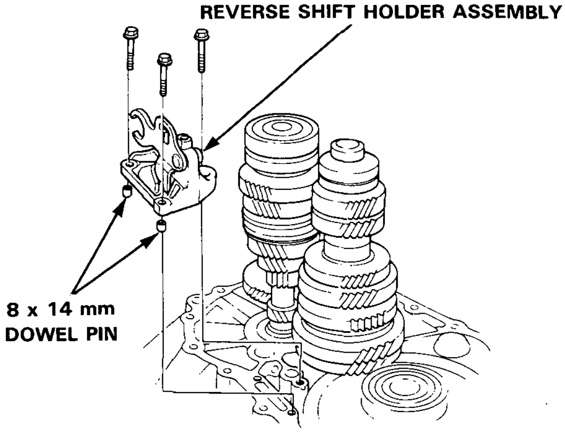


3. Remove the following parts, in the order shown, from the clutch housing.

① **SPECIAL BOLT**
② **LOCK PLATE**
③ **5TH/REVERSE SHIFT FORK SHAFT**
④ **5TH SHIFT FORK**
⑤ **3RD/4TH SHIFT FORK**
⑥ **REVERSE SHIFT FORK**



4. Remove the reverse shift holder assembly from the clutch housing.

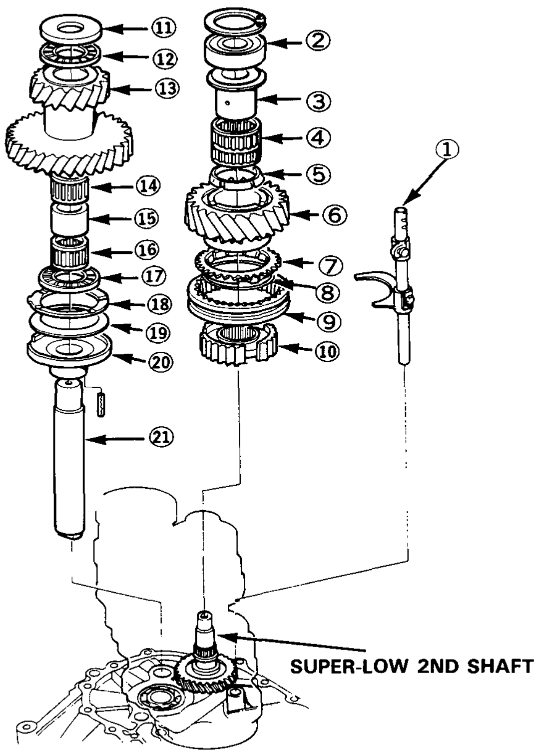


(cont'd)

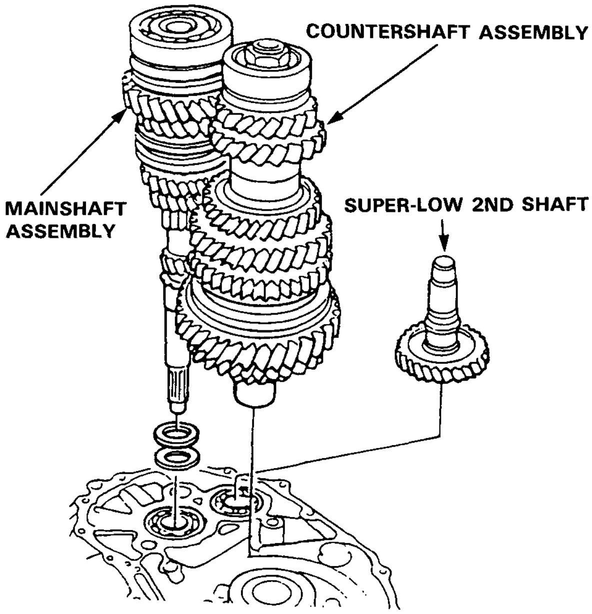
Removal (cont'd)

5. Remove the following parts from the clutch housing.,

① SUPER-LOW SHIFT FORK SHAFT ASSEMBLY
② BALL BEARING
③ SPACER COLLAR
④ NEEDLE BEARING
⑤ FRICTION DAMPER
⑥ SUPER-LOW 2ND GEAR
⑦ SYNCHRO RING
⑧ SYNCHRO SPRING
⑨ SUPER-LOW SYNCHRO SLEEVE
⑩ SUPER-LOW SYNCHRO HUB
⑪ THRUST WASHER
⑫ THRUST NEEDLE BEARING
⑬ SUPER-LOW 1ST GEAR
⑭ NEEDLE BEARING
⑮ SPACER COLLAR
⑯ NEEDLE BEARING
⑰ THRUST NEEDLE BEARING
⑱ THRUST WASHER
⑲ SPRING WASHER
⑳ SPACER COLLAR
㉑ SUPER-LOW 1ST SHAFT

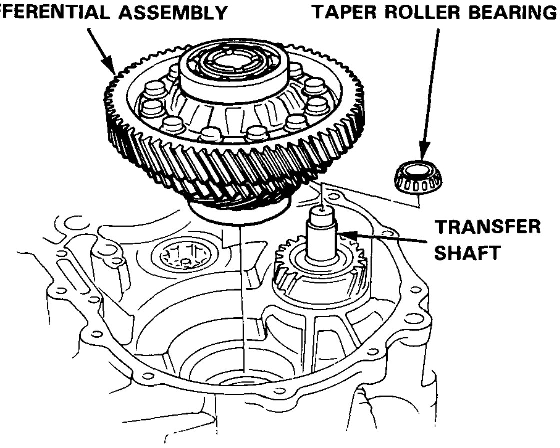


6. Remove the mainshaft and countershaft assemblies and super-low 2nd shaft from the clutch housing.



7. Remove the taper roller bearing from the transfer shaft.

8. Remove the differential assembly from the clutch housing.

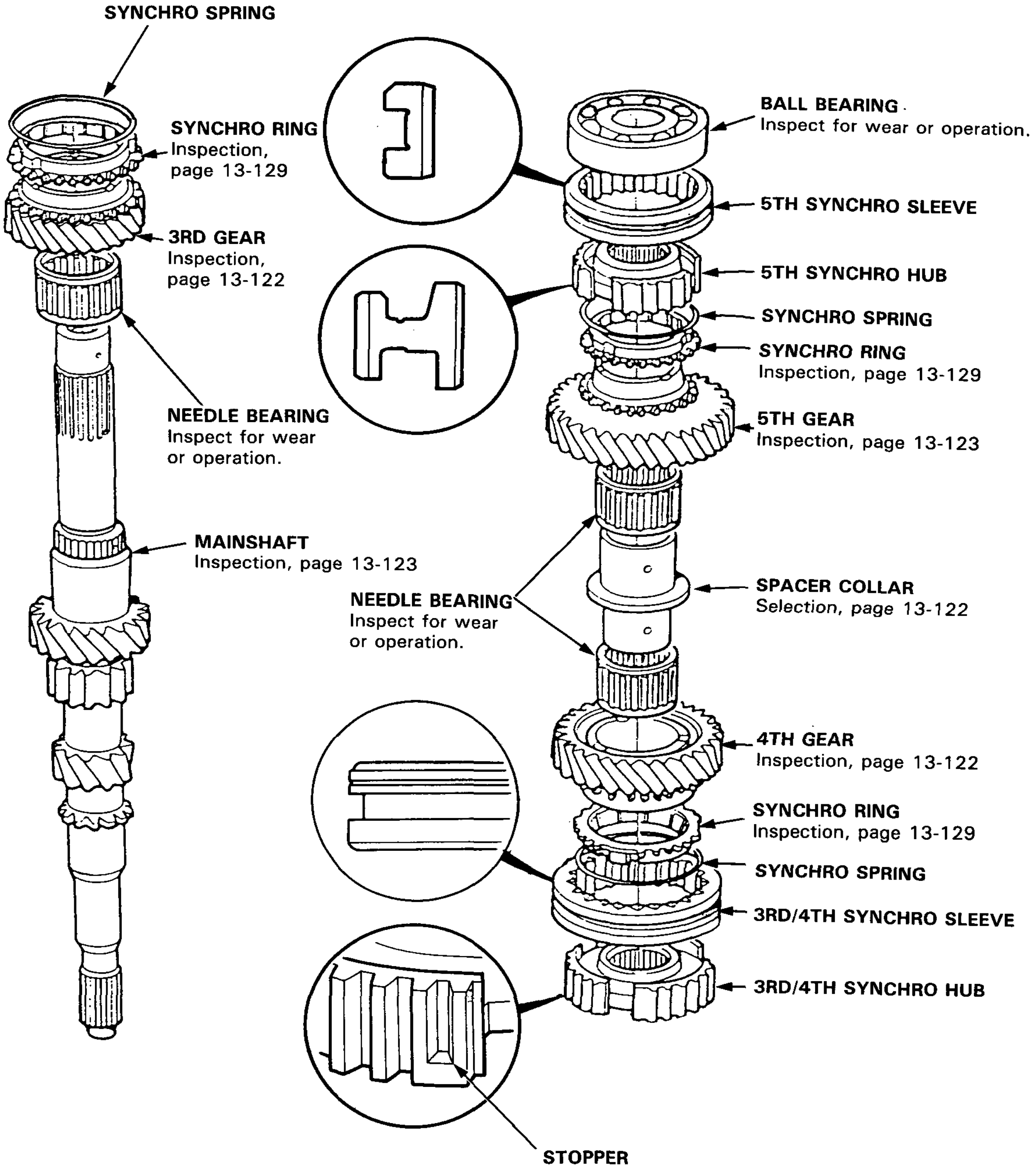


Mainshaft Assembly

Index

Prior to reassembling, clean all the parts in solvent, dry them and apply lubricant to any contact surfaces.

NOTE: After assembled, check the operation of the 3rd/4th synchro hub set.

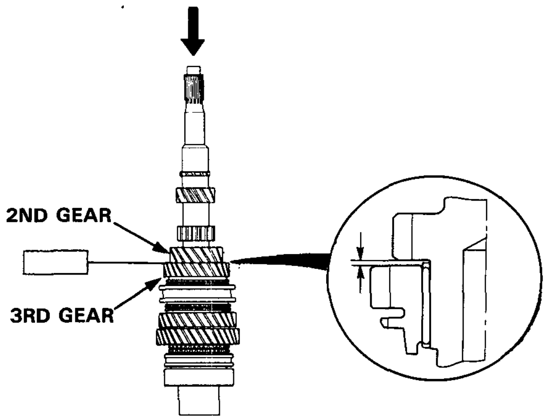


Clearance Inspection

NOTE: If replacement is required, always the synchro sleeve and hubs as a set.

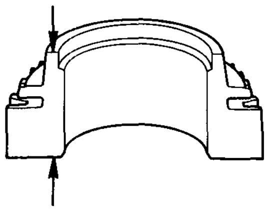
1. Push down on the bearing inner race about 30 kg (66 lb) using a socket wrench, then measure the clearance between 2nd and 3rd gears.

Standard: **0.06–0.21 mm (0.002–0.008 in)**
Service Limit: **0.3 mm (0.012 in)**



2. If the clearance exceeds the service limit, measure the thickness of 3rd gear.

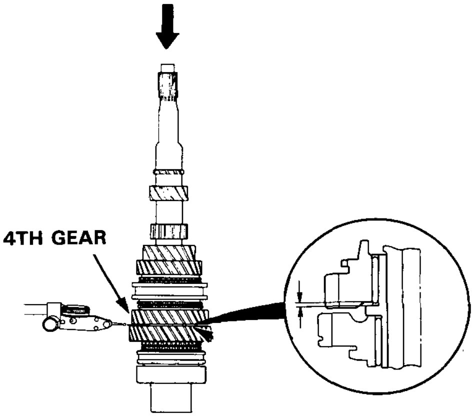
Standard: **34.92–34.97 mm (1.375–1.377 in)**
Service Limit: **34.3 mm (1.350 in)**



If the thickness of 3rd gear is less than the service limit, replace 3rd gear with a new one.
If the thickness of 3rd gear is within the service limit, replace the 3rd/4th synchro hub with a new one.

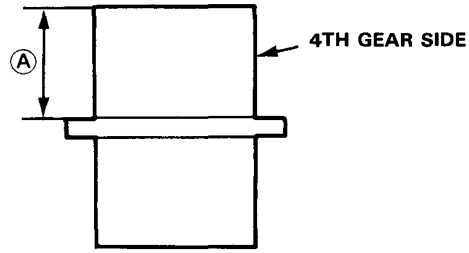
3. Measure the clearance between 4th gear and the spacer collar.

Standard: **0.06–0.21 mm (0.002–0.008 in)**
Service Limit: **0.3 mm (0.012 in)**



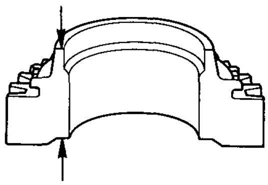
4. If the clearance exceeds the service limit, measure distance Ⓐ on the spacer collar.

Standard: **26.03–26.08 mm (1.025–1.027 in)**
Service limit: **26.01 mm (1.024 in)**



5. If distance Ⓐ is more than the service limit, replace the spacer collar with a new one.
If distance Ⓐ is within the service limit, measure the thicknes sof 4th gear.

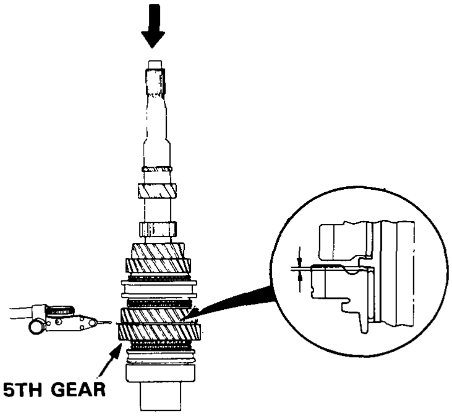
Standard: **30.92–30.97 mm (1.217–1.219 in)**
Service Limit: **30.8 mm (1.213 in)**



If the thickness of 4th gear is less than the service limit, replace 4th gear with a new one.
If the thickness of 4th gear is within the service limit, replace the 3rd/4th synchro hub with a new one.

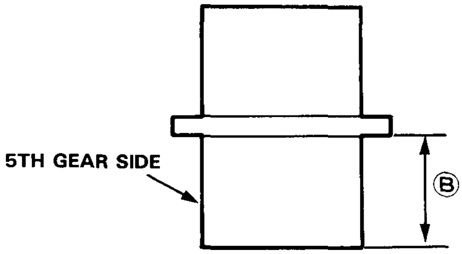
6. measure the clearance between 5th gear and the spacer collar.

Standard:	**0.06–0.21 mm (0.002–0.008 in)**
Service Limit:	**0.3 mm (0.012 in)**



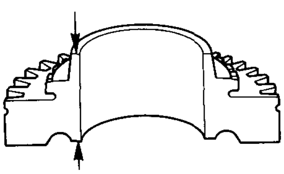
7. If the clearance exceeds the service limit, measure distance B on the spacer collar.

Standard:	**26.03–26.08 mm (1.025–1.027 in)**
Service Limit:	**26.01 mm (1.024 in)**



8. If distance Ⓑ is more than the service limit, replace the spacer collar with a new one.
   If distance Ⓑ is within the service limit, measure the thickness of 5th gear.

Standard:	**30.42–30.47 mm (1.198-1.120 in)**
Service Limit:	**30.3 mm (1.193 in)**

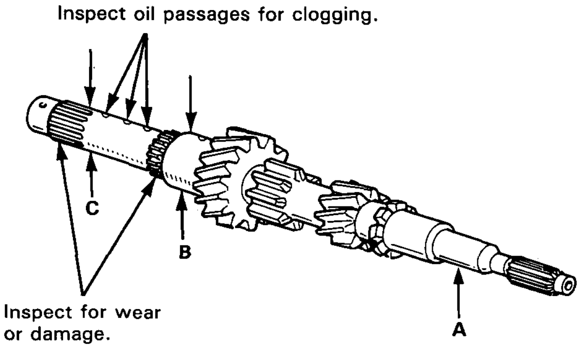


If the thickness of 5th gear is less than the service limit, replace 5th gear with a new one.
If the thickness of 5th gear is within the service limit, replace the 5th/reverse synchro hub with a new one.

Inspection

1. Inspect the surface and bearing surface for wear or damage, then measure the mainshaft at points A, B, and C.

Standard:	**A:**	**27.977–27.999 mm (1.1015–1.020 in)**
	B:	**34.984–35.000 mm (1.3773–1.3780 in)**
	C:	**27.987–28.000 mm (1.1018–1.1024 in)**
Service Limit:	**A:**	**27.920 mm (1.0992 in)**
	B:	**34.930 mm (1.4933 in)**
	C:	**27.930 mm (1.0996 in)**

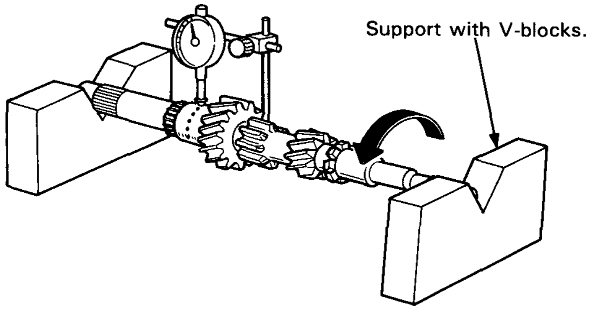


If any part of the mainshaft is less than the service limit, replace it with a new one.

2. Inspect for runout.

Standard:	**0.02 mm (0.001 in)**
Service Limit:	**0.05 mm (0.002 in)**

NOTE: Support the mainshaft at both ends as shown.



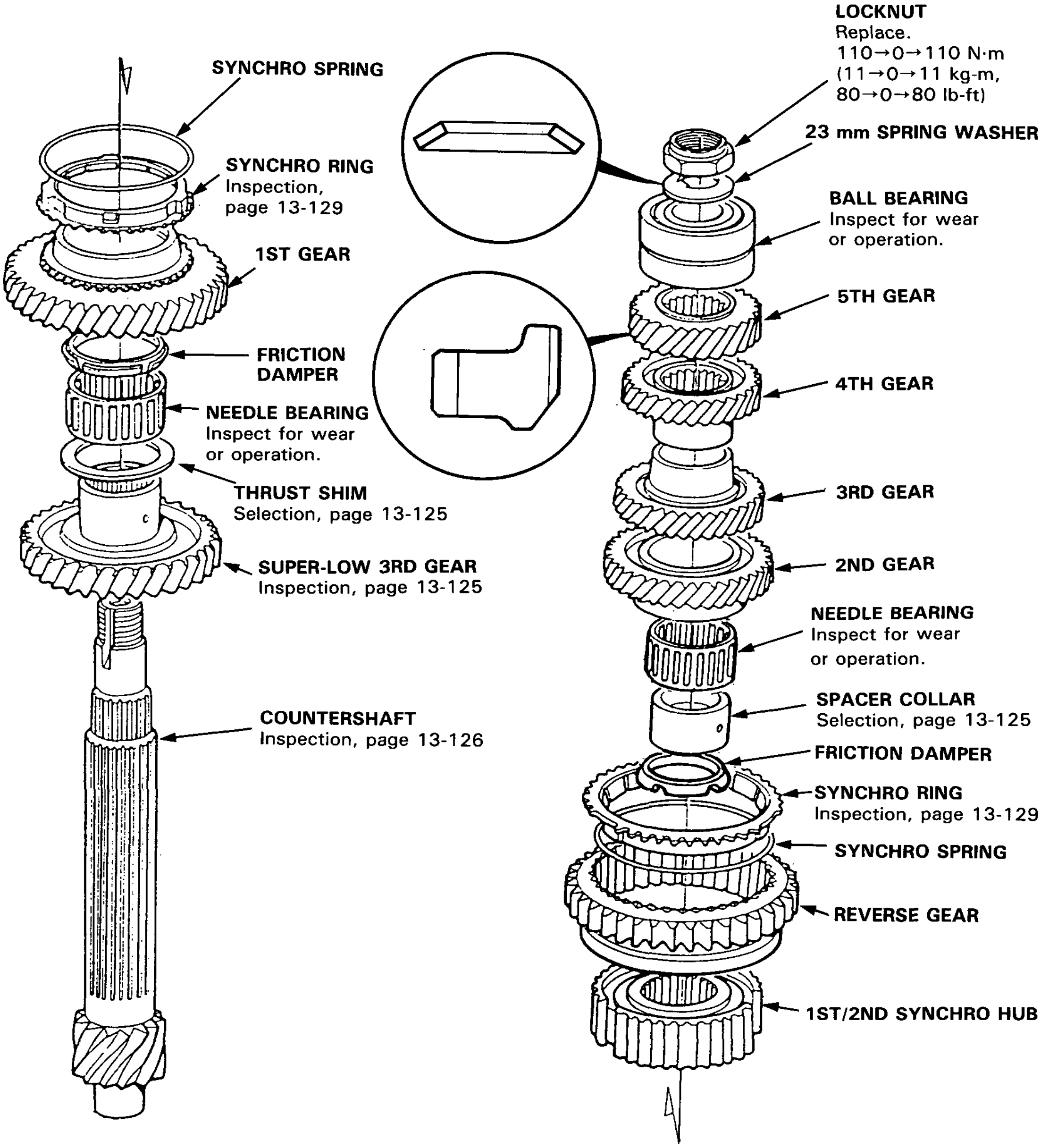
If the runout exceeds the service limit, replace the mainshaft with a new one.

Countershaft Assembly

Index

NOTE: The 5th gears are installed with a press.

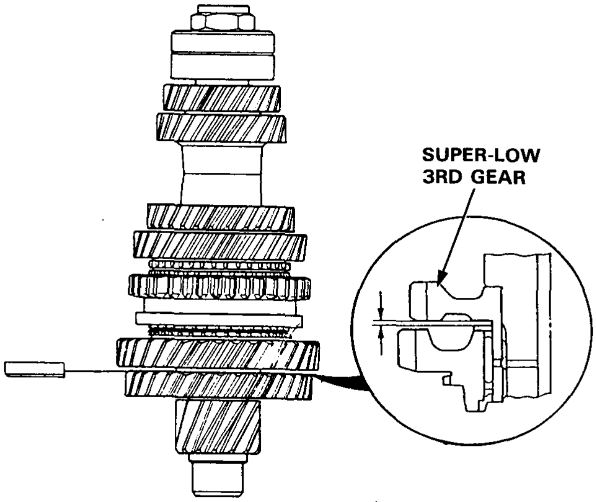
Prior to reassembling, clean all the parts in solvent, dry them and apply lubricant to any contact surfaces.



Clearance Inspection

1. Measure the clearance between the super-low 3rd gear and thrust shim.

Standard: 0.03–0.08 mm (0.0012–0.0031 in)
Service Limit: 0.18 mm (0.0071 in)

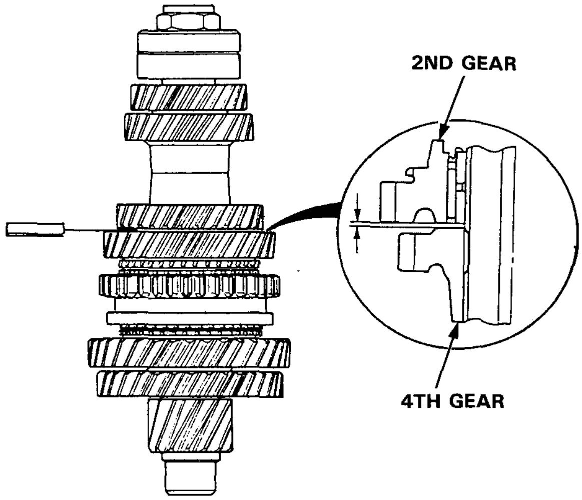


2. If the clearance exceeds the service limit, select the appropriate thrust shim for the correct clearance from the chart below.

	PART NUMBER	THICKNESS
A	23921–PH5–900	1.95 mm (0.0768 in)
B	23922–PH5–900	1.96 mm (0.0772 in)
C	23923–PH5–900	1.97 mm (0.0776 in)
D	23924–PH5–900	1.98 mm (0.0780 in)
E	23925–PH5–900	1.99 mm (0.0783 in)
F	23926–PH5–900	2.00 mm (0.0787 in)
G	23927–PH5–900	2.01 mm (0.0791 in)
H	23928–PH5–900	2.02 mm (0.0795 in)
I	23929–PH5–900	2.03 mm (0.0799 in)
J	23930–PH5–900	2.04 mm (0.0803 in)
K	23931–PH5–900	2.05 mm (0.0807 in)
L	23932–PH5–900	2.06 mm (0.0811 in)
M	23933–PH5–900	2.07 mm (0.0815 in)
N	23934–PH5–900	2.08 mm (0.0819 in)
O	23935–PH5–900	2.09 mm (0.0823 in)
P	23936–PH5–900	2.10 mm (0.0827 in)

1. Measure the clearance between the 2nd and 3rd gears.

Standard: 0.03–0.08 mm (0.0012–0.0031 in)
Service Limit: 0.18 mm (0.0071 in)



2. If the clearance exceeds the service limit, select the appropriate spacer collar for the correct clearance from the chart below.

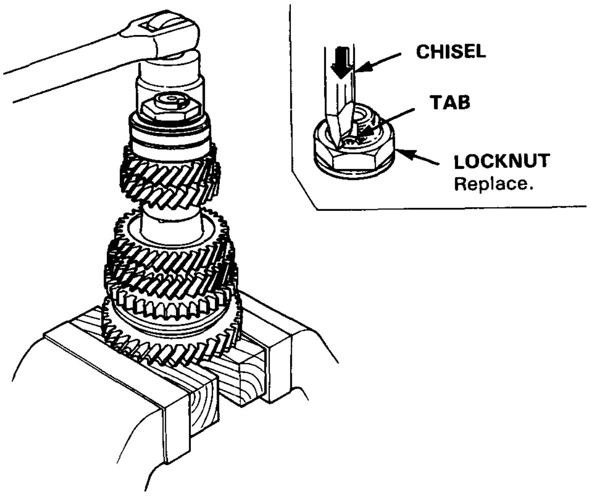
	PART NUMBER	THICKNESS
A	23911-PK-500	29.03-29.05 mm (1.1429-1.1437 in)
B	23912-PK-500	29.01-29.03 mm (1.1421-1.1429 in)
C	23913-PK-500	28.99-29.01 mm (1.1413-1.1421 in)
D	23914-PK-500	28.97-28.99 mm (1.1405-1.1413 in)
E	23915-PK-500	28.95-28.97 mm (1.1400-1.1405 in)

Countershaft Assembly

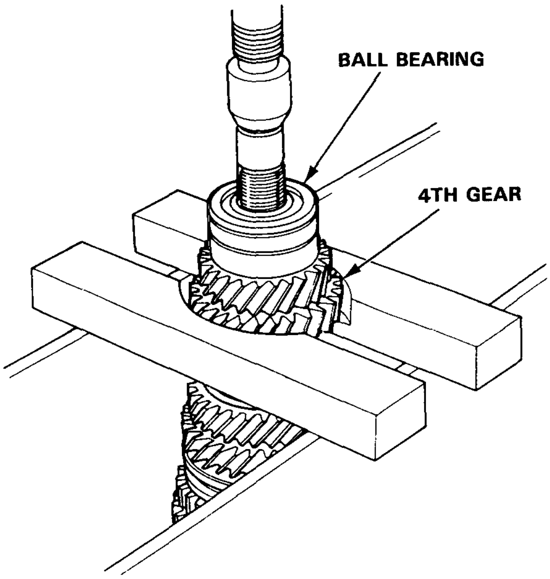
Disassembly

CAUTION: Remove the gears using a press and steel blocks as shown. Use of a jow-tipe puller can damage the gear teeth.

1. Raise the locknut tab from the groove of the shaft and remove the locknut and the spring washer.



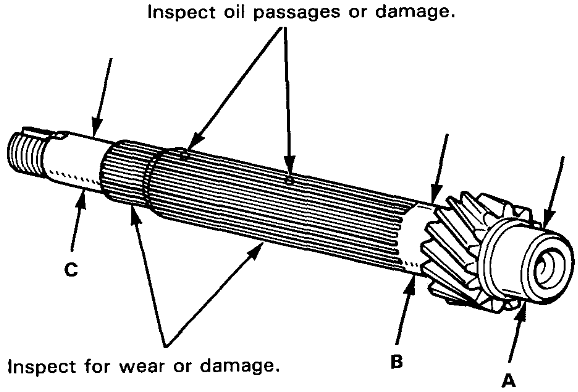
4. Support 4th gear on steel blocks as shown and press the shaft out of ball bearing.



Inspection

1. Inspect the surface and bearing surface for wear or damage, then measure the mainshaft at points A, B, and C.

Standard: **A: 29.000—29.015 mm (1.1417—1.1423)**
B: 30.464—30.480 mm (1.1994—1.2000 in)
C: 24.987—25.000 mm (0.9837—0.9843 in)
Service Limit: **A: 28.940 mm (1.1394 in)**
B: 30.410 mm (1.1972 in)
C: 24.930 mm (0.9815 in)

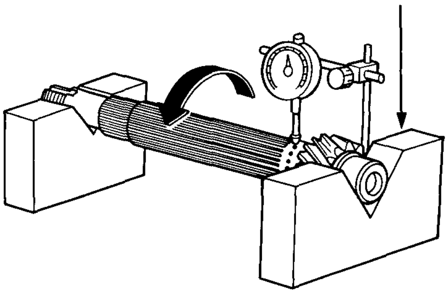


If any part of the countershaft is less than the service limit, replace it with a new one.

2. Inspect for runout.

Standard: **0.02 mm (0.001 in)**
Service Limit: **0.05 mm (0.002 in)**

NOTE: Support the countershaft at both ends as shown.

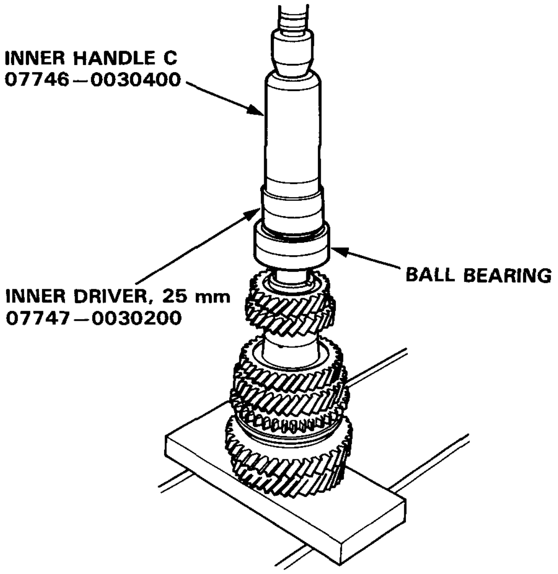


If the runout exceeds the service limit, replace the countershaft with a new one.

Countershaft Assembly

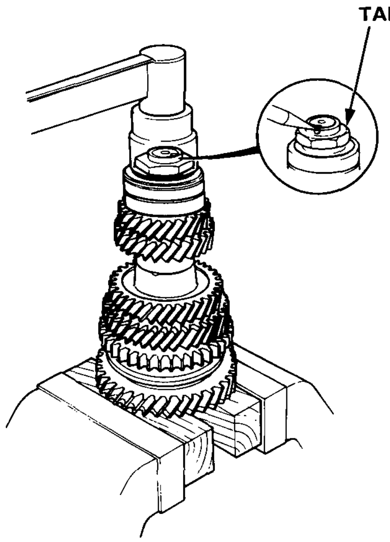
Reassembly

1. Install the ball bearing using the special tools and a press.



2. Install the spring washer, tighten the locknut, then stake the locknut tab into groove

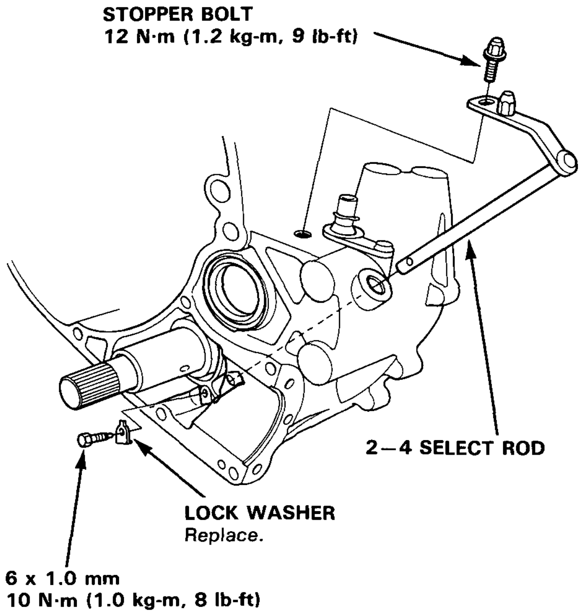
   LOCK NUT
   110→0→100 N·m
   (11→0→11 kg-m, 80→0→80 lb-ft)



Transfer Shaft

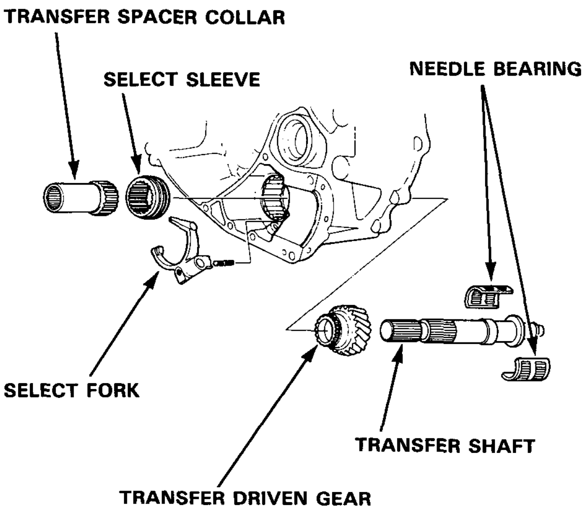
Replacement

1. Remove the 2–4 select lever form the clutch housing.



2. Remove the 2–4 select fork, 2–4 select sleeve, and transfer spacer collar from the clutch housing.

3. Remove the transfer shaft, needle bearing, and transfer driven gear from the transfer side of the clutch housing.



Shift Fork, Select Fork

Clearance Inspection

NOTE: The synchro sleeve and synchro hub should be replaced as a set.

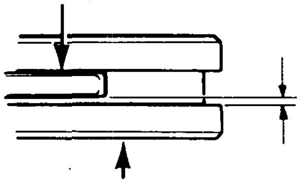
1. Measure the clearance between the shift fork and synchro sleeves.

Standard:

SHIFT FORK	THICKNESS
1ST/2ND 3RD/4TH SELECT	0.45–0.65 mm (0.018–0.026 in)
5TH SUPER LOW	0.25–0.45 mm (0.010–0.018 in)

Service Limit:

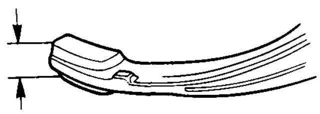
SHIFT FORK	THICKNESS
1ST/2ND 3RD/4TH SELECT	1.0 mm (0.039 in)
5TH SUPER LOW	0.8 mm (0.031 in)



2. If the clearance exceeds the service limit, measure the width of the shift fork fingers.

Standard:

SHIFT FORK	THICKNESS
1ST/2ND 3RD/4TH	7.4–7.5 mm (0.291–0.295 in)
SELECT 5TH	5.4–5.5 mm (0.213–0.217 in)
SUPER LOW	7.9–8.0 mm (0.311–0.315 in)



If the width of the shift fork fingers exceeds the standard, replace the shift fork with a new one.
If the width of the shift fork fingers is within the standard, replace the synchro sleeve with a new one.

Inspection

1. Inspect the synchro ring and gear.

   A : Inspect the inside of the synchro ring for wear.

   B : Inspect the synchro sleeve teeth and matching teeth on the synchro ring for wear (rounded off).

   GOOD WORN

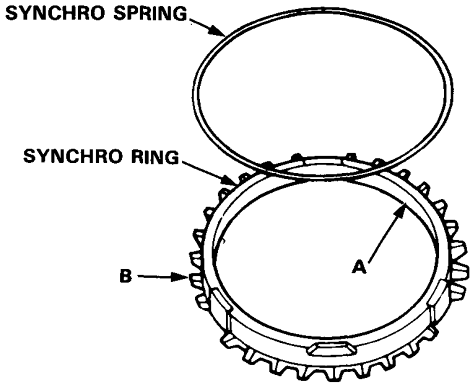
   C : Inspect the synchro sleeve teeth and matching teeth on the gear for wear (rounded off).

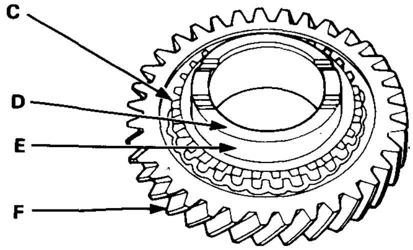
   GOOD WORN

   D : Inspect the gear hub thrust surface for wear.

   E : Inspet the cone surface for wear or roughness.

   F : Inspect the teeth on all gears for uneven wear, scoring, galling, cracks.





2. Coat the cone surface of the gear with oil and place the synchro ring on the matching gear. Rotate the ring, making sure that it does not slip.

   Measure the clearance between the ring and gear all the way around.

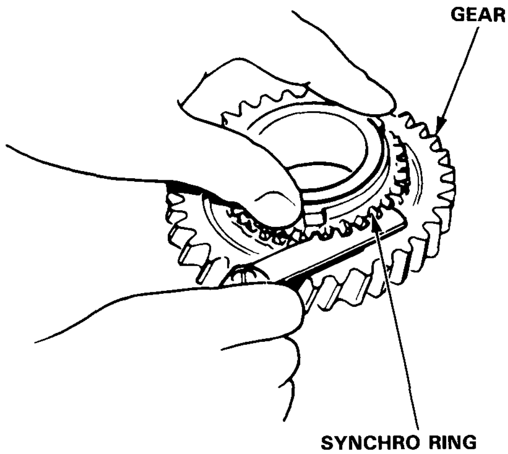
   NOTE: Hold the ring against the gear evenly while measureing the clearance.

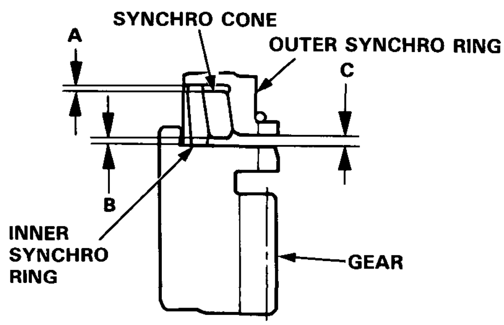
   Ring-to-Gear Clearance
   Standard: 0.85 – 1.1 mm (0.0335 – 0.0443 in)
   Service Limit: 0.4 mm (0.0157 in)

   Double Cone synchro-to-Gear Clearance
   Standard:
   A: (Outer Synchro Ring to Synchro Cone) 0.5 – 1.0 mm (0.0197 – 0.0394 in)
   B: (Synchro Cone to Gear) 0.5 – 1.0 mm (0.0197 – 0.0394 in)
   C: (Outer Synchro Ring to Gear) 0.95 – 1.68 mm (0.0374 – 0.0661 in)

   Service Limit:
   A: 0.3 mm (0.0118 in)
   B: 0.3 mm (0.0118 in)
   C: 0.6 mm (0.0236 in)

   If the clearance exceeds the serivce limit, replace the synchro ring and synchro cone.





3. Separate the synchro ring and gear, then coat them with oil.

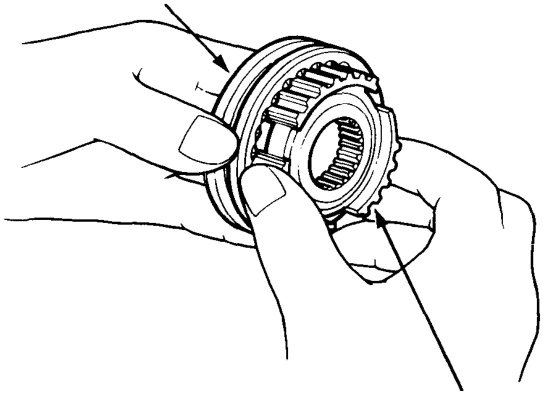
4. Install the synchro spring on the synchro ring, then set it aside for later reassembly.

Synchro Sleeve, Synchro Hub

Inspection

1. Inspect gear teeth on all synchro hubs and sleeves for rounded off corners, which indicates wear.
2. Install each hub in its mating sleeve and check for freedom of movement.

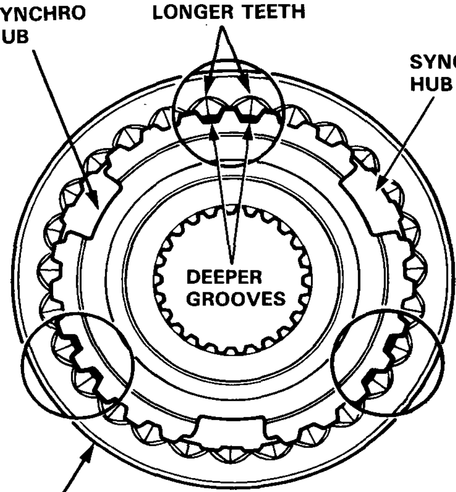
   NOTE: If replacement is required, always replace the synchro sleeve and hub as a set.



Installation

Each synchro sleeve has three sets of longer teeth (120 degrees apart) that must be matched with the three sets of deeper grooves in the hub when assembled.

NOTE: Installing the synchro sleeve with its longer teeth in the 1st/2nd synchro hub slots will damage the spring ring.

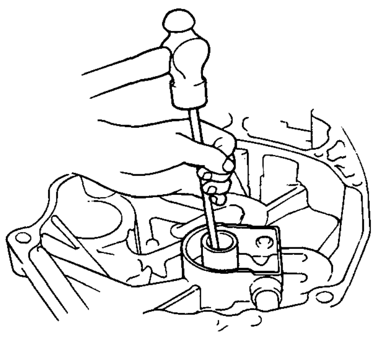


Clutch Housing Bearing

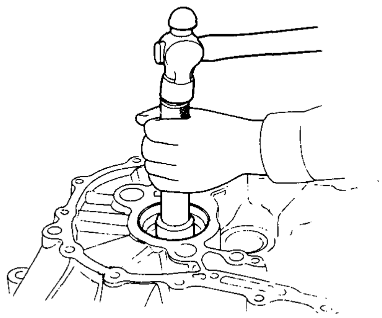
Replacement

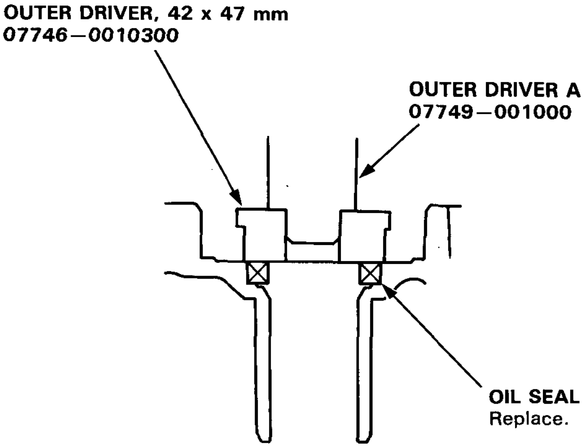
Mainshaft

1. Remove the ball bearing and oil seal.

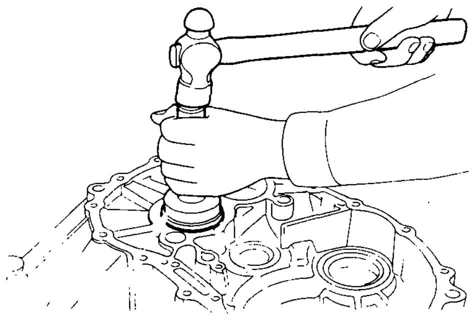


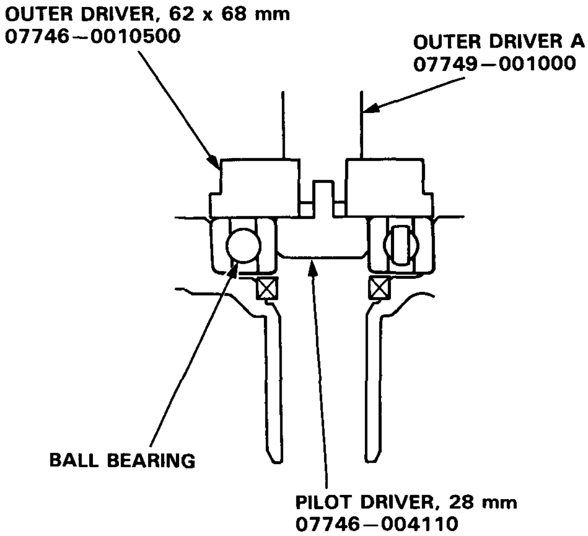
2. Drive the new oil seal into the clutch housing using the special tools.





3. Drive the ball bearing into the clutch housing using the special tools.



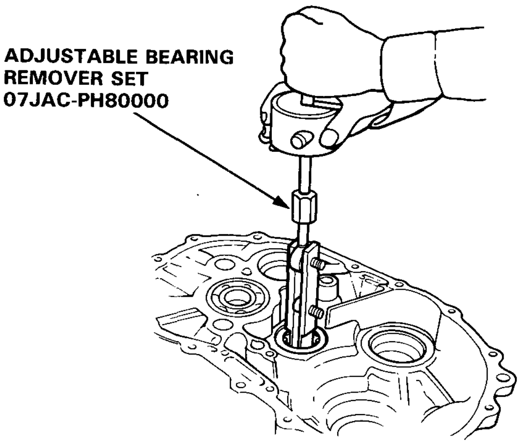


(cont'd)

Replacement (cont'd)

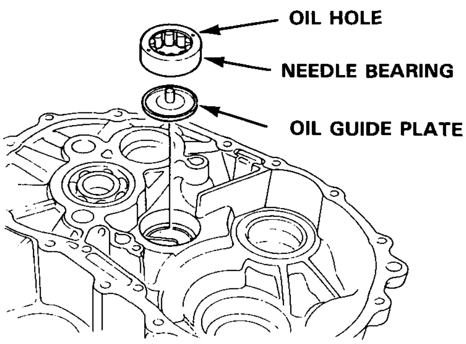
Countershaft

1. Remove the needle bearing using the special tools, and remove the oil guide plate.

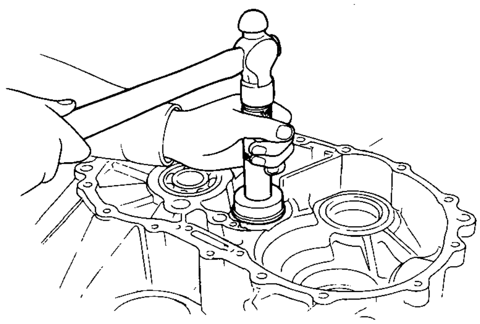


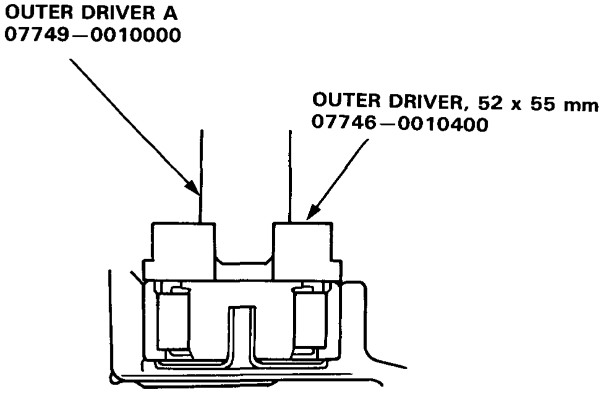
2. Install the oil guide plate, and set the bearing onto the clutch housing.

   NOTE: Position the bearing with the hole facing up.



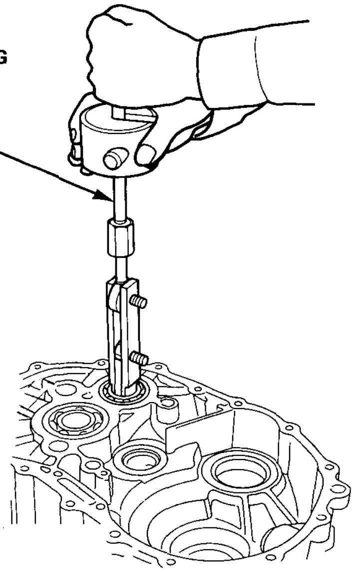
3. Drive the needle bearing into the clutch housing using the special tools.



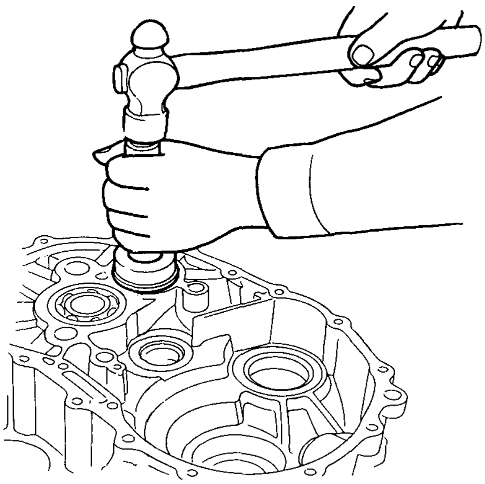


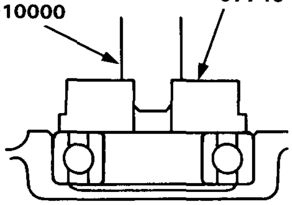
Super-low 2nd shaft

1. Remove the ball bearing using the special tools.



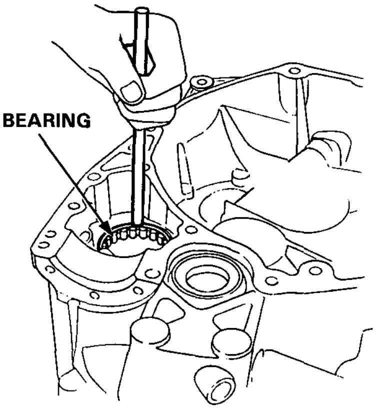
2. Install the ball bearing using the special tools.





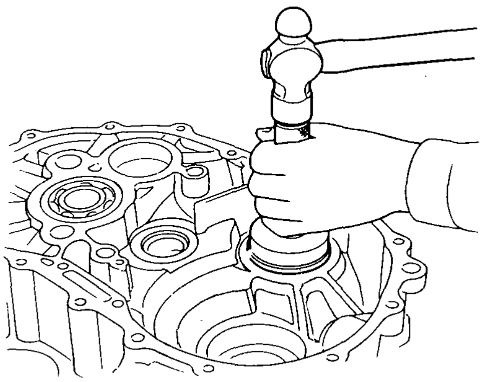
Transfer Shaft

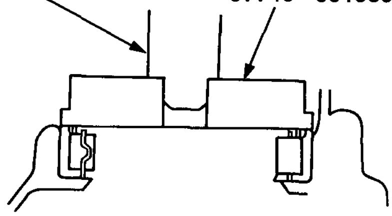
1. Remove the needle bearing using the special tools



2. Install the needle bearing using the special tools.

   NOTE: Position the bearing with the hole facing up.

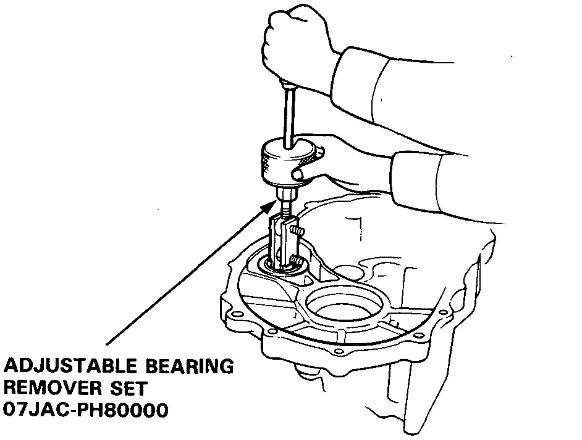




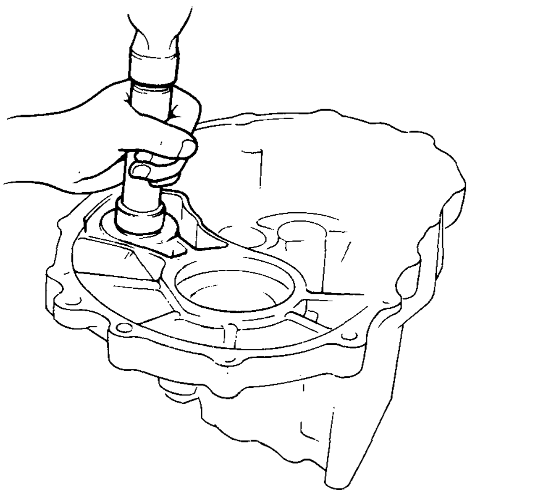
Transmission Housing Bearing

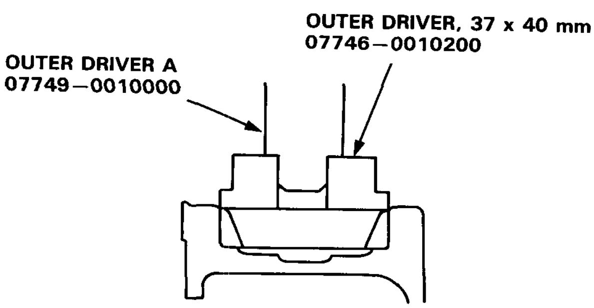
Replacement

1. Remove the bearing outer race using the special tools.



2. Install the bearing outer race using the special tools.

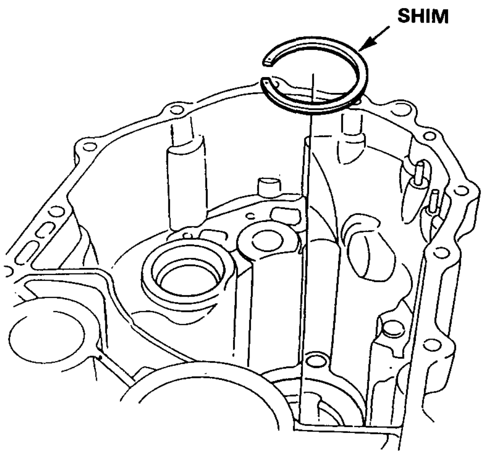




Mainshaft Thrust Shim

Adjustment

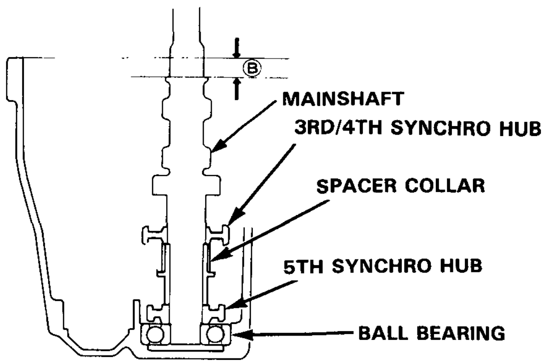
1. Remove the 75 mm thrust shim and oil guide plate form the transmission housing.



2. Install the 3rd/4th synchro hub, spacer collar, 5th synchro hub, ball bearing on the mainshaft. Install the assembly in the transmission housing.

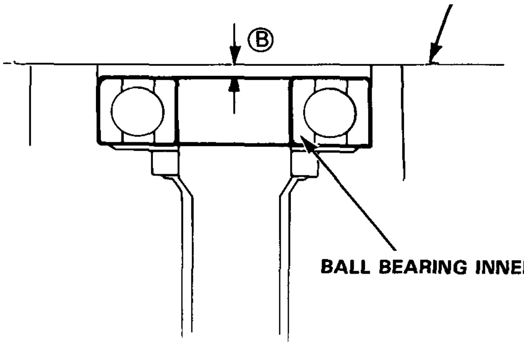
3. Measure the distance Ⓐ between the end of the transmission housing and mainshaft.

NOTE:
- Use a straight edge and feeler gauge.
- Measure at three locations and average the readings.



4. Measure the distance B between the surfaces of the clutch housing and bearing inner race.

NOTE:
- Use a straight edge and feeler gauge.
- Measure at three locations and average the readings.



5. Selcet the correct thickness thrust shim as follows;

NOTE: Do not use more than two shims.

(Basis Formula)
(A) + (B) − 0.8 = shim thickness

Example of calculation;
Distance Ⓐ (2.45 mm) + Distance Ⓑ (0.09 mm) = 2.14 mm subtract the spring washer height (1.00 mm) = the required thrust shim (1.74 mm)

75 mm Thrust Shim

	PART NUMBER	THICKNESS
A	23941–PH8–900	1.20 mm (0.0472 in)
B	23942–PH8–900	1.23 mm (0.0484 in)
C	23943–PH8–900	1.26 mm (0.0496 in)
D	23944–PH8–900	1.29 mm (0.0509 in)
E	23945–PH8–900	1.32 mm (0.0520 in)
F	23946–PH8–900	1.35 mm (0.0531 in)
G	23947–PH8–900	1.38 mm (0.0543 in)
H	23948–PH8–900	1.41 mm (0.0555 in)
I	23949–PH8–900	1.44 mm (0.0567 in)
J	23950–PH8–900	1.47 mm (0.0579 in)
K	23951–PH8–900	1.50 mm (0.0591 in)
L	23952–PH8–900	1.53 mm (0.0602 in)
M	23953–PH8–900	1.56 mm (0.0614 in)
N	23954–PH8–900	1.59 mm (0.0626 in)
O	23955–PH8–900	1.62 mm (0.0638 in)
P	23956–PH8–900	1.65 mm (0.0649 in)
Q	23957–PH8–900	1.68 mm (0.0661 in)
R	23958–PH8–900	1.71 mm (0.0673 in)
S	23959–PH8–900	1.74 mm (0.0685 in)
T	23960–PH8–900	1.77 mm (0.0697 in)
U	23961–PH8–900	1.80 mm (0.0709 in)
V	23962–PH8–900	1.83 mm (0.0720 in)
W	23963–PH8–900	1.86 mm (0.0732 in)
X	23964–PH8–900	1.89 mm (0.0744 in)
Y	23965–PH8–900	1.92 mm (0.0756 in)
Z	23966–PH8–900	1.95 mm (0.0768 in)
AA	23967–PH8–900	1.98 mm (0.0780 in)
AB	23968–PH8–900	2.01 mm (0.0791 in)
AC	23969–PH8–900	2.04 mm (0.0803 in)
AD	23970–PH8–900	2.07 mm (0.0815 in)
AE	23971–PH8–900	2.10 mm (0.0827 in)
AF	23972–PH8–900	2.13 mm (0.0839 in)
AG	23973–PH8–900	2.16 mm (0.0850 in)
AH	23974–PH8–900	2.19 mm (0.0862 in)
AI	23975–PH8–900	2.22 mm (0.0874 in)
AJ	23976–PH8–900	2.25 mm (0.0886 in)
AK	23977–PH8–900	2.28 mm (0.0898 in)
AL	23978–PH8–900	2.31 mm (0.0909 in)
AM	23979–PH8–900	2.34 mm (0.0921 in)
AN	23980–PH8–900	2.37 mm (0.0933 in)

(cont'd)

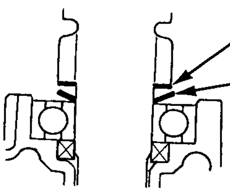
Mainshaft Thrust Shim

Adjustment (cont'd)

6. Check the thrust clearance in the manner described below.

NOTE:
- Clean the washer, and spring washer, thrust shim thoroughly before installation.
- Install the waseher, spring washer, and thrust shim properly.

a. Install the shims selected in the transmission housing.
b. Install the washer and spring washer in the mainshaft.

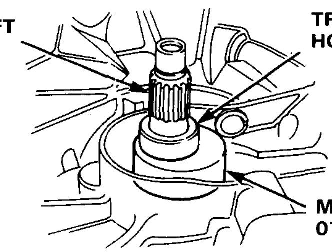


c. Install the mainshaft in the clutch housing.
d. Place the transmission housing over the mainshaft and onto the clutch housing.
e. Tighten the clutch and transmission housings with several 10 mm bolts.

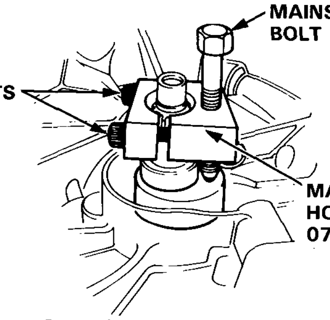
7. Check the thrust clearance in the manner described below.

CAUTION: Measurement should be made at room temperature.

a. Slide the mainshaft base and the collar over the mainshaft.



b. Attach the mainshaft holder to the mainshaft as follows:
- Back-out the mainshaft holder bolt and loosen the two hex bolts.
- Fit the holder over the mainshaft so its lip is towards the transmission.
- Align the mainshaft holder's lip around the groove at the inside of the mainshaft splines, then tighten the hex bolts.

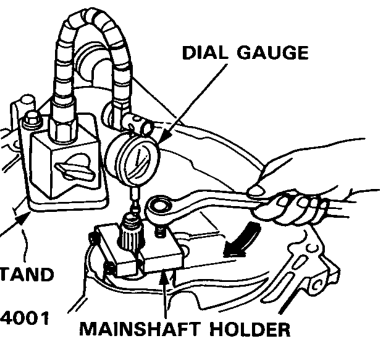


c. Seat the mainshaft fully by tapping its end with a plastic hammer.
d. Thread the mainshaft holder bolt in until it just contacts the wide surface of the mainshaft base.

e. Zero a dial gauge on the end of the mainshaft.

f. Turn the mainshaft holder bolt clockwise; stop turnig when the dial gauge has reached its maximum movement. The reading on the dial gauge is the amount of mainshaft end play.

CAUTION: Turnig the shaft holder bolt more than 60 degrees after the needle of the dial gauge stops moving may damage the transmission.

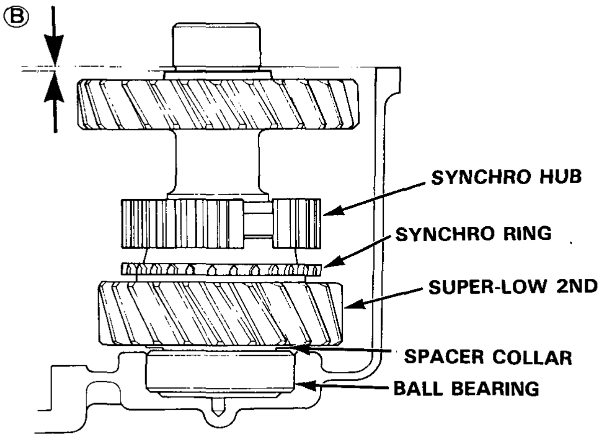


g. Clearance is correct if reading is between 0.10–0,16 mm (0.0039–0.0063 in). If not, recheck necessary shim thickness.

Thrust Shim Adjustment

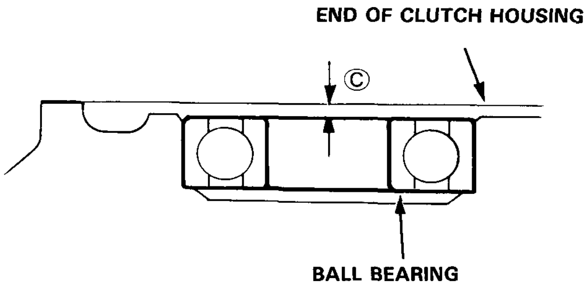
1. Remove the super-low 2nd shaft thrust shim.
2. Install the synchro hub, synchro spring, synchro ring on the super-low 2nd shaft; install the assembly in the transmission housing.
3. Measure the distance Ⓑ between the end of the transmission housing and super-low 2nd shaft.

   NOTE:
   - Use a straight edge and feeler gauge.
   - Measure at three locations and average the readings.



4. Measure the distance Ⓒ between the surfaces of the clutch housing and bearing inner race.

   NOTE:
   - Use a straight edge and feeler gauge.
   - Measure at three locations and average the readings.



5. Selcet proper shim (or shim pair) on the basis of the following calculations;

   NOTE: Do not use more than one shim.

   a. Add measurement Ⓑ in step 3 to the measurement Ⓒ in step 4.

   b. Subtract the 0.07—0.20 mm (0.0027—0.0079 in) from the distance in step 5-a.

   Example:

   B: 0.50 mm (0.0197 in)
   C: + 1.00 mm (0.0394 in)
   1.50 mm (0.0591 in)

   Max: 1.50 mm (0.0591 in)
   − 0.07 mm (0.0028 in)
   1.43 mm (0.0563 in)

   Min: 1.50 mm (0.0591 in)
   − 0.20 mm (0.0079 in)
   1.30 mm (0.0512 in)

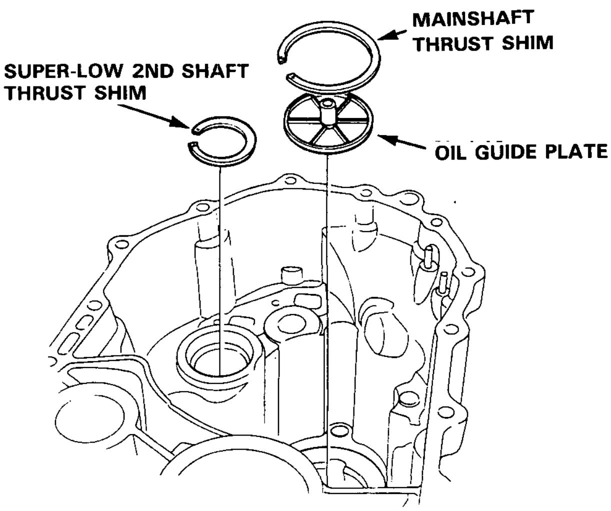
   c. The required thrust shim is 1.40 mm (0.0551 in).

	PART NUMBER	THICKNESS
A	23750—PH8—900	1.0 mm (0.0394 in)
B	23751—PH8—900	1.1 mm (0.0433 in)
C	23752—PH8—900	1.2 mm (0.0472 in)
D	23753—PH8—900	1.3 mm (0.0512 in)
E	23754—PH8—900	1.4 mm (0.0551 in)
F	23755—PH8—900	1.5 mm (0.0591 in)
G	23756—PH8—900	1.6 mm (0.0633 in)
H	23757—PH8—900	1.7 mm (0.0670 in)

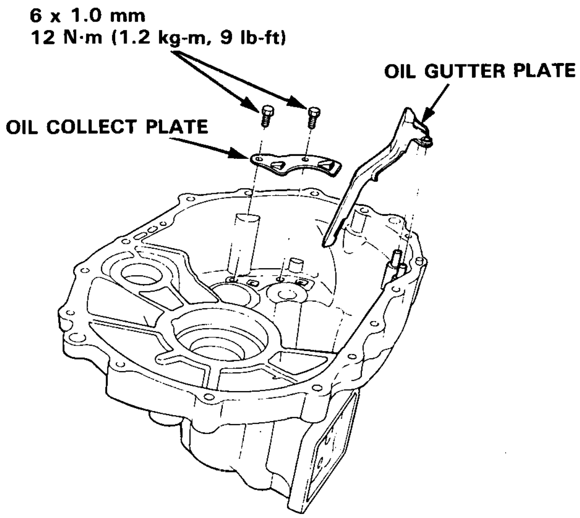
Reassembly

NOTE:
- Use the correct thrust shim to assure the proper mainshaft thrust clearance.
- For shim selection, refer to page 13-137.
- Use the correct thrust shim to assure the proper super-low 2nd shaft thrust clearance.
- For shim selection, refer to page 13-137.

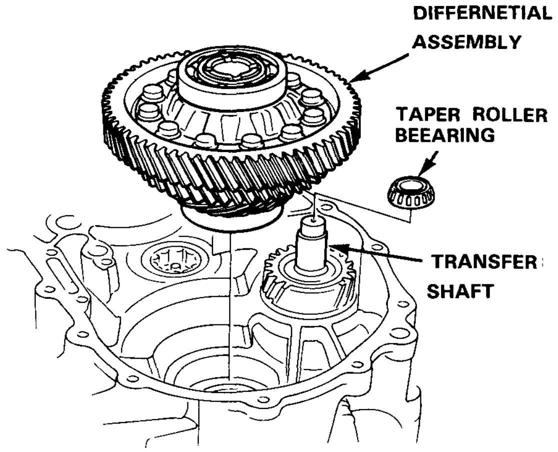
1. Install the oil guide plate, mainshaft thrust shim and super-low 2nd shaft thrust shim.



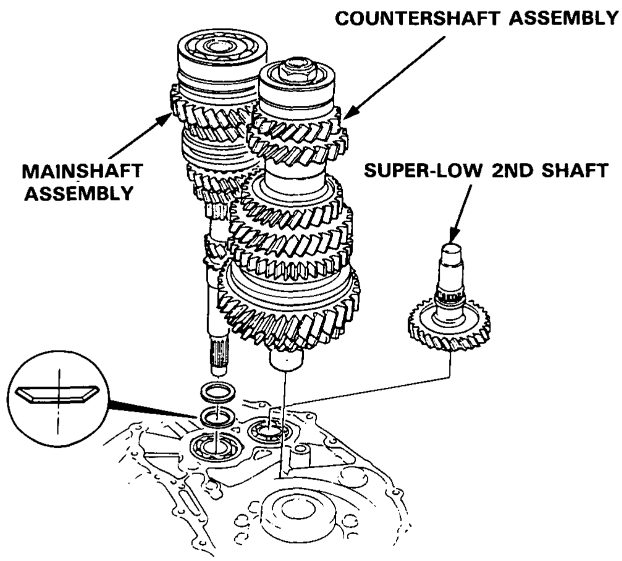
2. Install the oil gutter plate and oil collect plate in the transmission housing.



3. Install the transfer shaft assembly and 2-4 select rod.
4. Install the differential assembly in the clutch housing.
5. Put the bearing on the transfer shaft.



6. Install the spirng washer and thrust shim with the angle against the clutch housing as shown below. Install the super-low 2nd shaft, countershaft and mainshaft assemblies in the clutch housing.

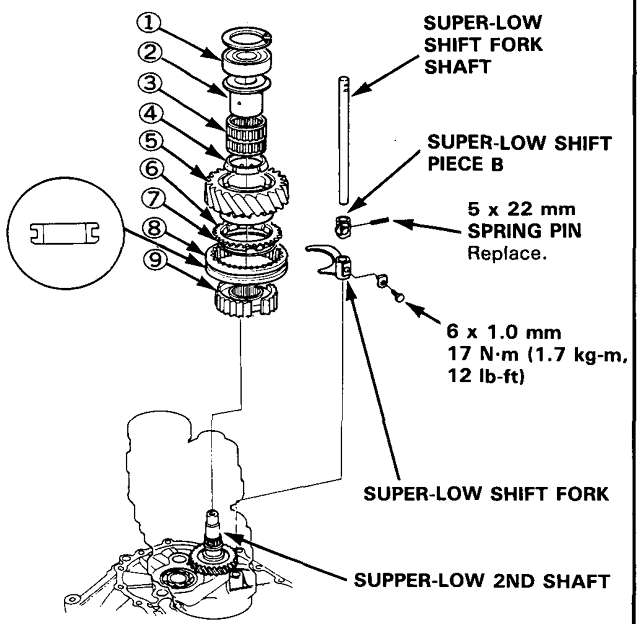


7. Install the super-low shift piece B and shift fork on the super-low shift shaft.

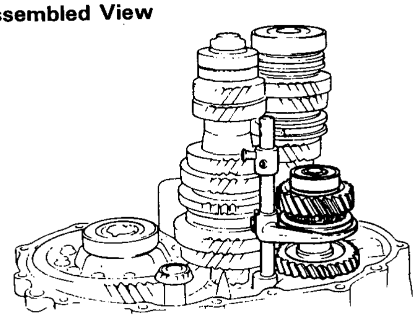
8. Assemble the super-low shift fork shaft assembly with the following parts, and install them on the super-low 2nd shaft.

NOTE: Note the installaion direction of the synchro sleeve.

① SUPER-LOW SYNCHRO HUB
② SUPER-LOW SYNCHRO SLEEVE
③ SYNCHRO SPRING
④ SYNCHRO RING
⑤ SUPER-LOW 2ND GEAR
⑥ FRICTION DAMPER
⑦ NEEDLE BEARING
⑧ SPACER COLLAR
⑨ BALL BEARING



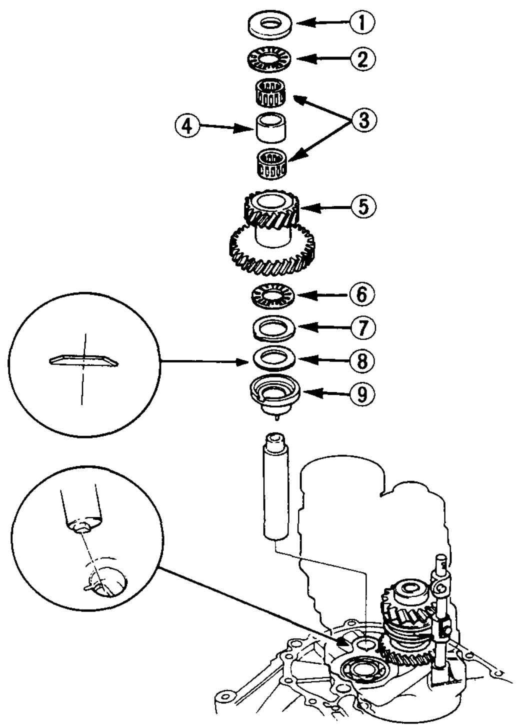
Assembled View



9. Install the following parts in the clutch housing;

NOTE:
- Align the lug on the end of the super-low 1st shaft with the groove in the clutch housing.
- Install the spring washer with the dished end fiacing down.

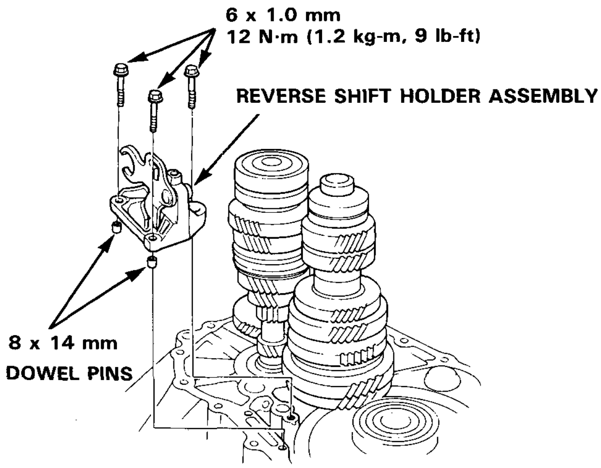
① SUPER-LOW 1ST SHAFT
② SPACER COLLAR
③ SPRING WASHER
④ THRUST WASHER
⑤ THRUST NEEDLE BEARING
⑥ SUPER-LOW 1ST GEAR
⑦ NEEDLE BEARING
⑧ SPACER COLLAR
⑨ NEEDLE BEARING
⑩ THRUSTNEELDE BEARING
⑪ THRUST WASHER



(cont'd)

Reassembly (cont'd)

10. Install the reverse shift holder assembly in the clutch housing.

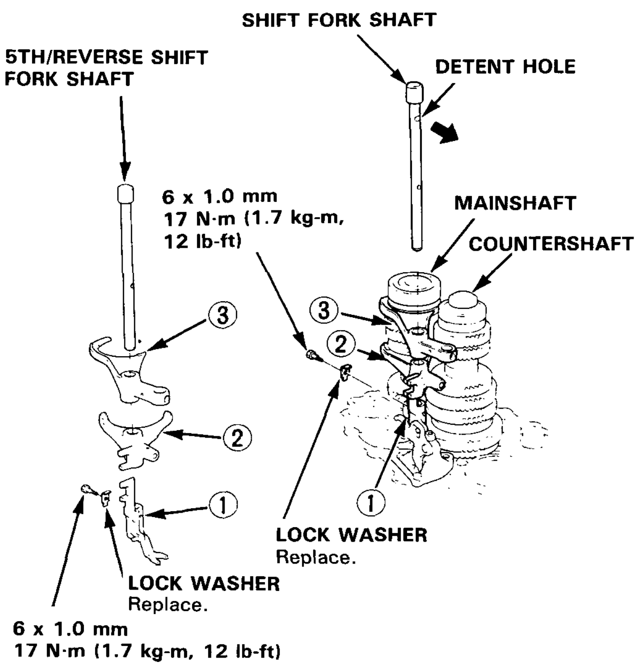


11. Install the following parts on the mainshaft;

    1 REVERSE SHIFT FORK
    2 3RD/4TH SHIFT FORK
    3 5TH SHIFT FORK

12. Slide the shift fork shaft down through each shift fork.

    NOTE: Install the shift fork shaft with the detent groove facing the countershaft.



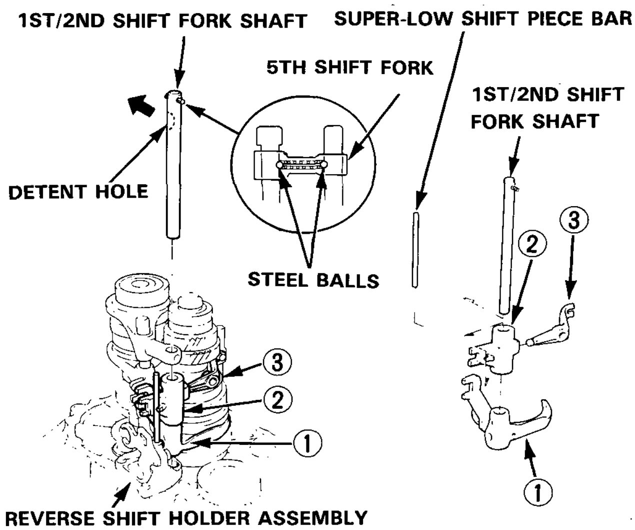
13. Install the following parts on the counter shaft;

    1 1ST/2ND SHIFT FORK
    2 SUPER-LOW SHIFT PIECE A
    3 SUPER-LOW SHIFT LEVER

14. Insert the steel balls and springs into the 5th shift fork, then slide the shift fork through each shift piece and shift lever.

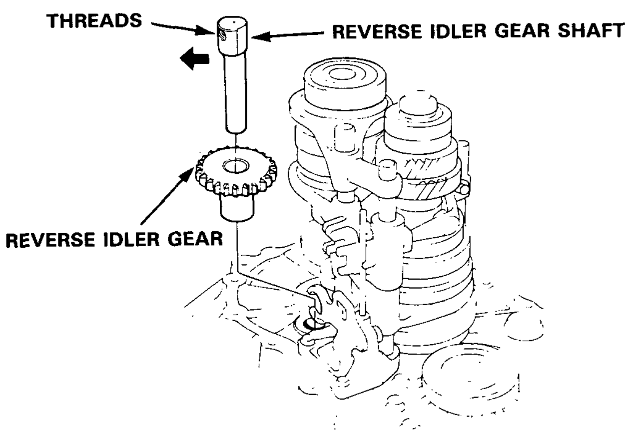
    NOTE: Install the shift fork shaft with the detent hole facing the mainshaft.

15. Install the super-low shift piece bar in the reverse shift holder assembly.



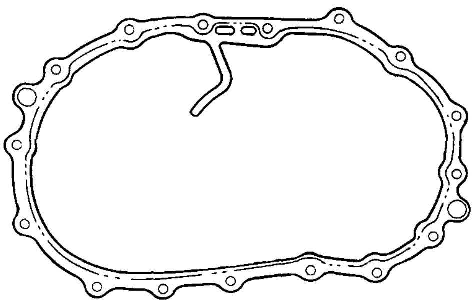
16. Install the reverse idler gear and shaft in the clutch housing.

    NOTE: Install the idler shaft with the threads facing outside.



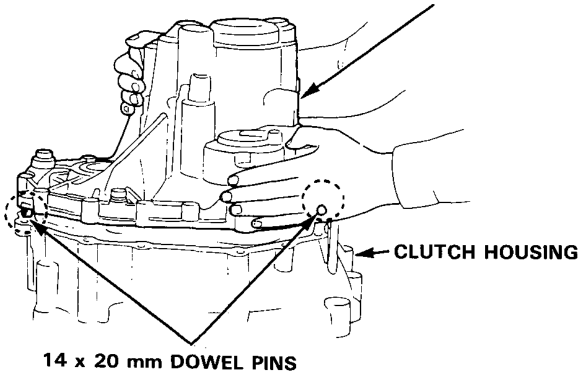
17. Apply liquid gasket to the transmission mating surface of the clutch housing.

NOTE: This transmission uses nogasket between the major housings; use Honda Genuine liquid gasket (P/N 08718—0001). Assemble the housing within 20 minutes after applying the liquid gasket and allow it to cure at least 30 minutes after assembly before filling it with oil.



18. Install the 14 x 20 mm dowel pins.

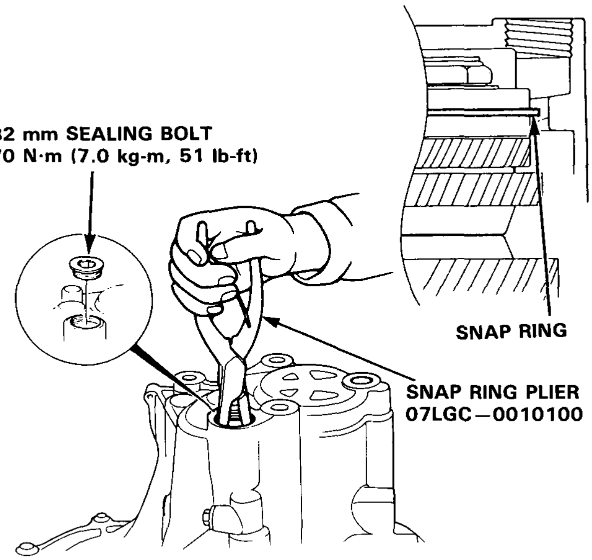
19. Install the transmission housing.



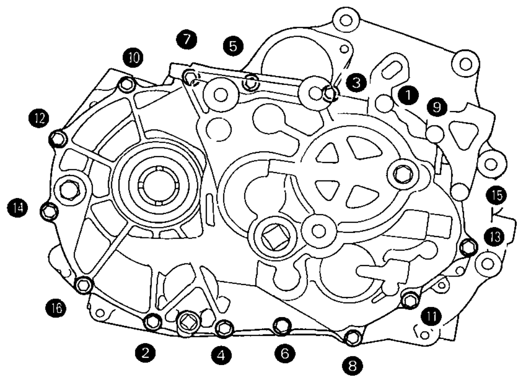
20. Lower the transmission housing with the snap ring expanded and set the snap ring in the groove of the counterhsaft bearing.

21. Install the 32 mm sealing bolt.

NOTE: Apply liquid gasket (P/N08718—0001) to the threads of the sealing bolt.



22. Tighten the transmission housing attaching bolts in the numbered sequence as shown.



(cont'd)

Transmission

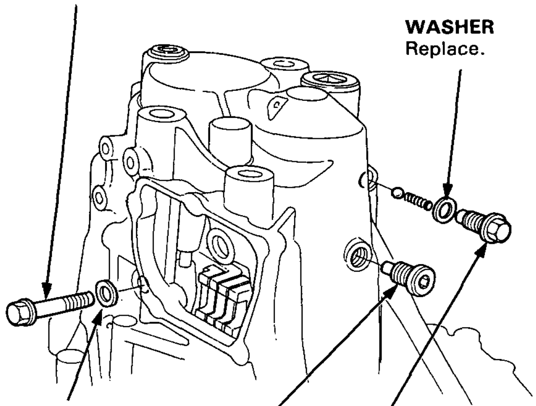
Reassembly (cont'd)

23. Install the steel ball, spring, and set bolt.

24. Install the reverse idler shaft bolt.

25. Install the super-low shift lever bolt.

    NOTE: Apply liquid gasket (P/N 08718–0001) to the threads of the super-low shift lever bolt.

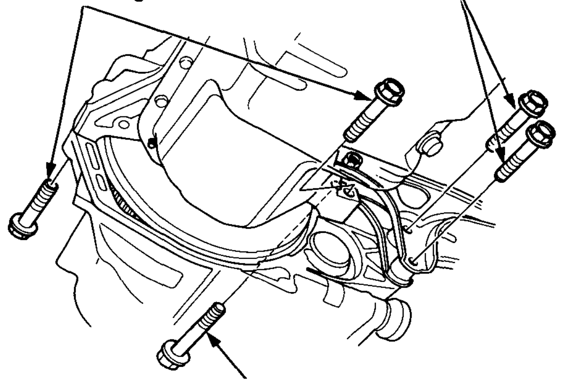


Transmission Assembly

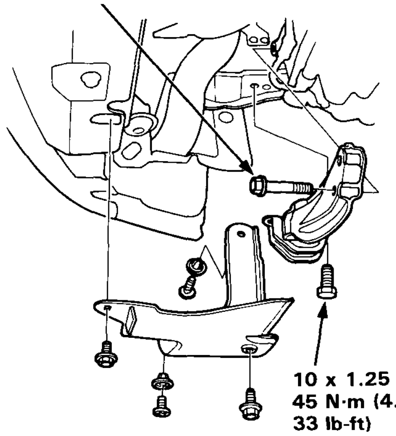
Installation

NOTE: Differences between the 2wd and 4 wd are covered in this page. Refer to page 13-37 for the information not covered in this page.

1. Install the rear mount bolts.



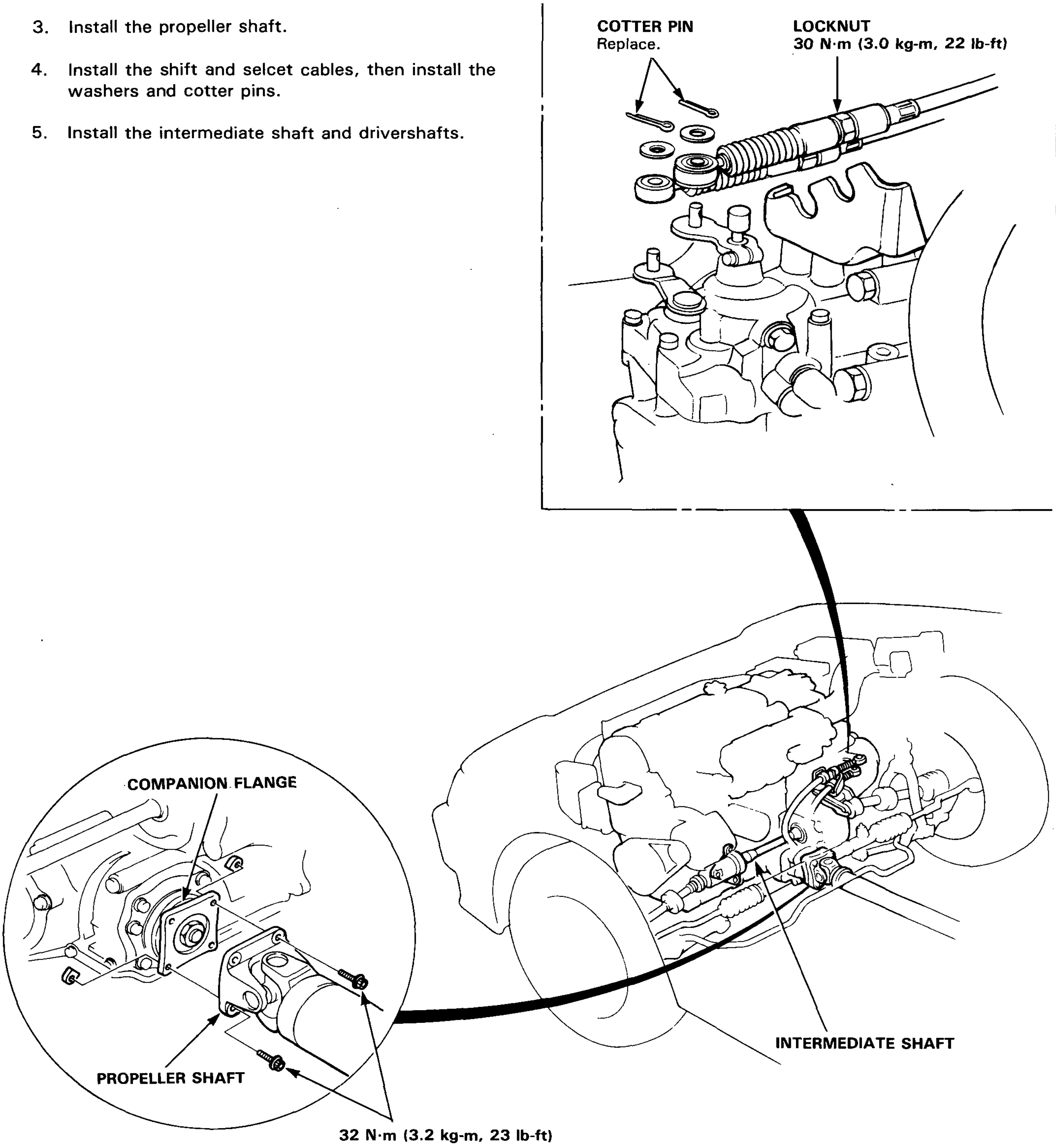
2. Install the front stopper bolts.



3. Install the propeller shaft.

4. Install the shift and selcet cables, then install the washers and cotter pins.

5. Install the intermediate shaft and drivershafts.

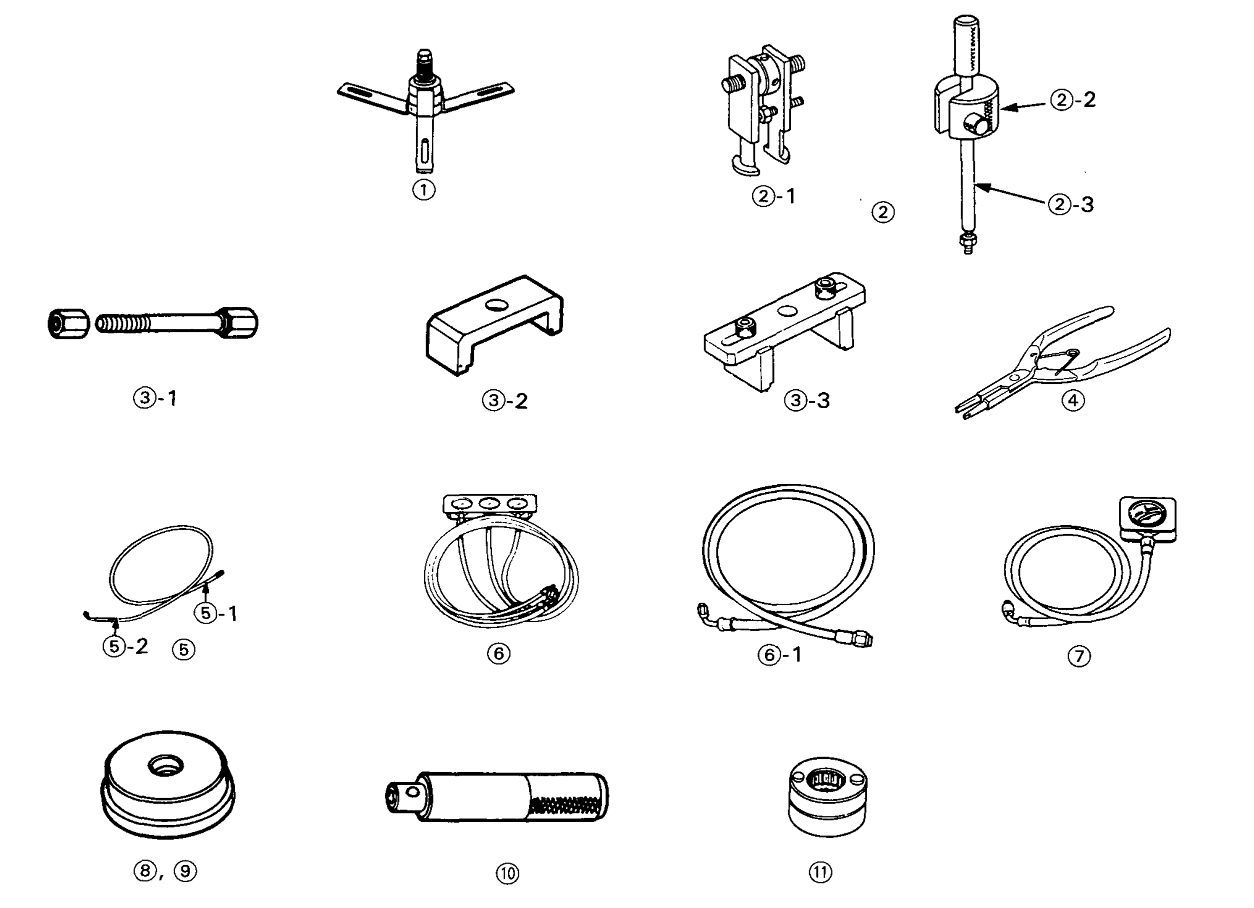


Automatic Transmission

2WD Automatic Transmission M48A

Special Tools

Ref No.	Tool Number	Description	Qty	Page Reference
①	07HAC–PK40101	Housing Puller	1	14-79
②	07JAC–PH80000	Adjustable Bearing Remover Set	1	14-112, 113
②-1	07JAC–PH80100	Bearing Remover Attachment	1	14-112, 113
②-2	07JAC–PH80200	Remover Handle Assembly	1	14-112, 113
②-3	07741–0010201	Remover Weight	1	14-112, 113
③	07LAE–PX40000	Clutch Spring Compressor Set	1	14-106, 109
③-1	07GAE–PG40200	Clutch Spring Compressor Bolt	1	14-106, 109
③-2	07HAE–PL50100	Clutch Spring Compressor Attachment	1	14-106, 109
③-3	07LAE–PX40100	Clutch Spring Compressor Attachment	1	14-106, 109
④	07LGC–0010100	Snap Ring Pliers	1	14-114
⑤	07MAJ–PY40100	A/T Oil Pressure Gauge Hose Assembly	1	14-56
⑤-1	07MAJ–PY40110	Oil Pressure Gauge Hose	1	14-56
⑤-2	07MAJ–PY40120	Oil Pressure Joint	1	14-56
⑥	07406–0020300	A/T Oil Pressure Gauge Set	1	14-56
⑥-1	07406–0020201	A/T Oil Pressure Gauge Hose	1	14-56
⑦	07406–0070000	A/T Low Pressure Gauge	1	14-56
⑧	07746–0010500	Attachment, 62 x 68 mm	1	14-112, 113, 114
⑨	07746–0010600	Attachment, 72 x 75 mm	1	14-112, 114
⑩	07749–0010000	Driver	1	14-112, 113, 114
⑪	07923–6890202	Mainshaft Holder	1	14-77, 120



The Automatic Transmission is a combination of a 3-element torque converter and dual-shaft automatic transmission which provides 4 speeds forward and 1 speed reverse. The entire unit is positioned in line with the engine.

TORQUE CONVERTER, GEARS, AND CLUTCHES

The torque converter consists of a pump, turbine and stator, assembled in a single unit.
They are connected to the engine crankshaft so they turn together as a unit as the engine turns. Around the outside of the torque converter is a ring gear which meshes with the starter pinion when the engine is being started. The entire torque converter assembly serves as a flywheel while transmitting power to the transmission mainshaft.
The transmission has two parallel shafts, the mainshaft and countershaft. The mainshaft is in line with the engine crankshaft. The mainshaft includes the clutches for 1st, and 2nd/4th, and gears for 3rd, 2nd, 4th, Reverse and 1st (3rd gear is integral with mainshaft, while reverse gear is integral with 4th gear).
The countershaft includes 3rd clutch and gears for 3rd, and 4th, Reverse and 1st.
4th and reverse gears can be locked to the countershaft at its center, providing 4th gear or Reverse, depending on which way the selector is moved.
The gears on the mainshaft are in constant mesh with those on the countershaft. When certain combinations of gears in the transmission are engaged by the clutches, power is transmitted from the mainshaft to the countershaft to provide $\boxed{D3}$, $\boxed{D4}$, $\boxed{2}$ and $\boxed{R}$.

HYDRAULIC CONTROL

The valve assembly includes the main valve body, secondary valve body, servo valve body, modulator valve body, regulator valve body and lock-up shift valve body, through the respective separator plates.
They are bolted to the torque converter case as an assembly.
The main valve body contains the manual valve, 1-2 shift valve, 2-3 shift valve, 3-4 shift valve, pressure relief valve, 2nd orifice control valve, torque converter check valve and oil pump gear.
The secondary valve body includes the CPC valve, REV control valve, lock-up cut valve, kickdown valves,3-2 timing valve, shift timing valve, 3rd orifice control valve and 4th exhaust valve.

The servo valve body contains the accumulator pistons, 3rd orifice control valve, throttle A and B valves, and the modulator valve. The regulator valve body contains the lock-up timing valves, pressure regulator valve and lock-up control valve. Fluid from the regulator passes through the manual valve to the various control valves.

The lock-up shift valve body contains the lock-up timing valve B and lock-up shift valve. The 1st, 3rd and 4th clutches receive oil from their respective feed pipes.

LOCK-UP MECHANISM

In $\boxed{D4}$, pressurized fluid is drained from the back of the torque converter through an oil passage, causing the lock-up piston to be held against the torque converter cover. As this takes place. the mainshaft rotates at the same speed as the engine crankshaft. Together with hydraulic control, an electronic control unit optimizes the timing of the lock-up mechanism.

The lock-up shift valve body controls the range of lock-up according to vehicle speed and throttle pressure. The lock-up timing valve controls the flow of oil to the lock-up shift valve in 3rd and 4th gear (in $\boxed{D4}$ range).

The lock-up cut valve is housed in the secondary valve body and prevents lock-up from taking place when the throttle is not opened sufficiently.

(cont'd)

Description

(cont'd)

GEAR SELECTION

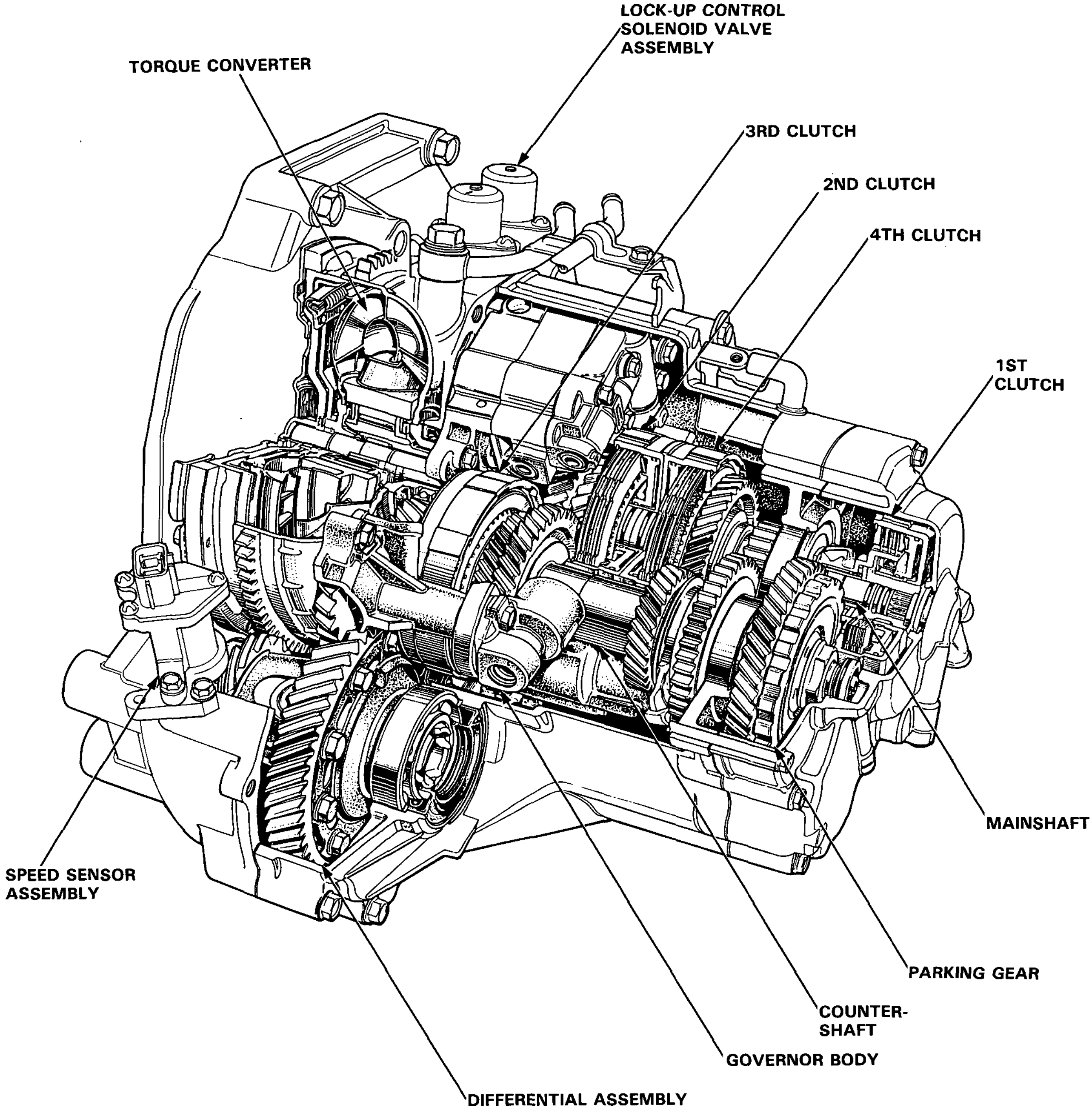
The selector lever has six positions: [P] PARK, [R] REVERSE, [N] NEUTRAL, [D4] 1st through 4th gear ranges, [D3] 1st through 3rd gear ranges, and [2] 2nd gear.

Position	Description
[P] PARK	Front wheels locked; parking pawl engaged with parking gear on countershaft. All clutches released.
[R] REVERSE	Reverse; reverse selector engaged with countershaft reverse gear and 4th gear clutch locked.
[N] NEUTRAL	All clutches released.
[D4] DRIVE (1 through 4)	General driving; starts off in 1st, shifts automatically to 2nd, 3rd, then 4th, depending on vehicle speed and throttle position. Downshift through 3rd, 2nd and 1st on deceleration to stop. The lock-up mechanism comes into operation in [D4].
[D3] DRIVE (1 through 3)	For rapid acceleration at highway speeds and general driving; starts off in 1st, shifts automatically to 2nd, then 3rd, depending on vehicle speed and throttle position. Downshifts through 2nd to 1st on deceleration to stop.
[2] SECOND	For engine braking or better traction starting off on loose or slippery surface; stays in 2nd gear, does not shift up or down.

Starting is possible only in [P] and [N] through the use of a slide-type, neutral-safety switch.

POSITION INDICATOR

A position indicator in the instrument panel shows what gear has been selected without having to look down at the console.



D15B4/D16A9 is shown.

Description

Clutches

The four speed automatic transmission uses hydraulically actuated clutches to engage or disengage the transmission gears. When clutch pressure is introduced into the clutch drum, the clutch piston is applied. This presses the friction discs and steel plates together, locking them so they don't slip. Power is then transmitted through the engaged clutch pack to its hub-mounted gear.

Likewise, when clutch pressure is bled from the clutch pack, the piston releases the friction discs and steel plates, and they are free to slide past each other while disengaged. This allows the gear to spin independently of its shaft, transmitting no power.

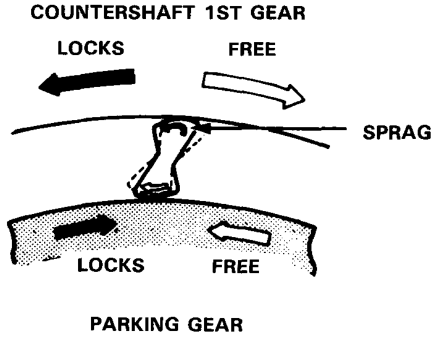
[1st Clutch]
The first clutch engages/disengages first gear, and is located at the end of the mainshaft, just behind the R side cover. The first clutch is supplied clutch pressure by its oil feed pipe within the mainshaft.

[2nd Clutch]
The second clutch engages/disengages second gear, and is located at the center of the mainshaft. The second clutch is joined back-to-back to the fourth clutch. The second clutch is supplied clutch pressure through the mainshaft by a circuit connected to the regulator valve body.

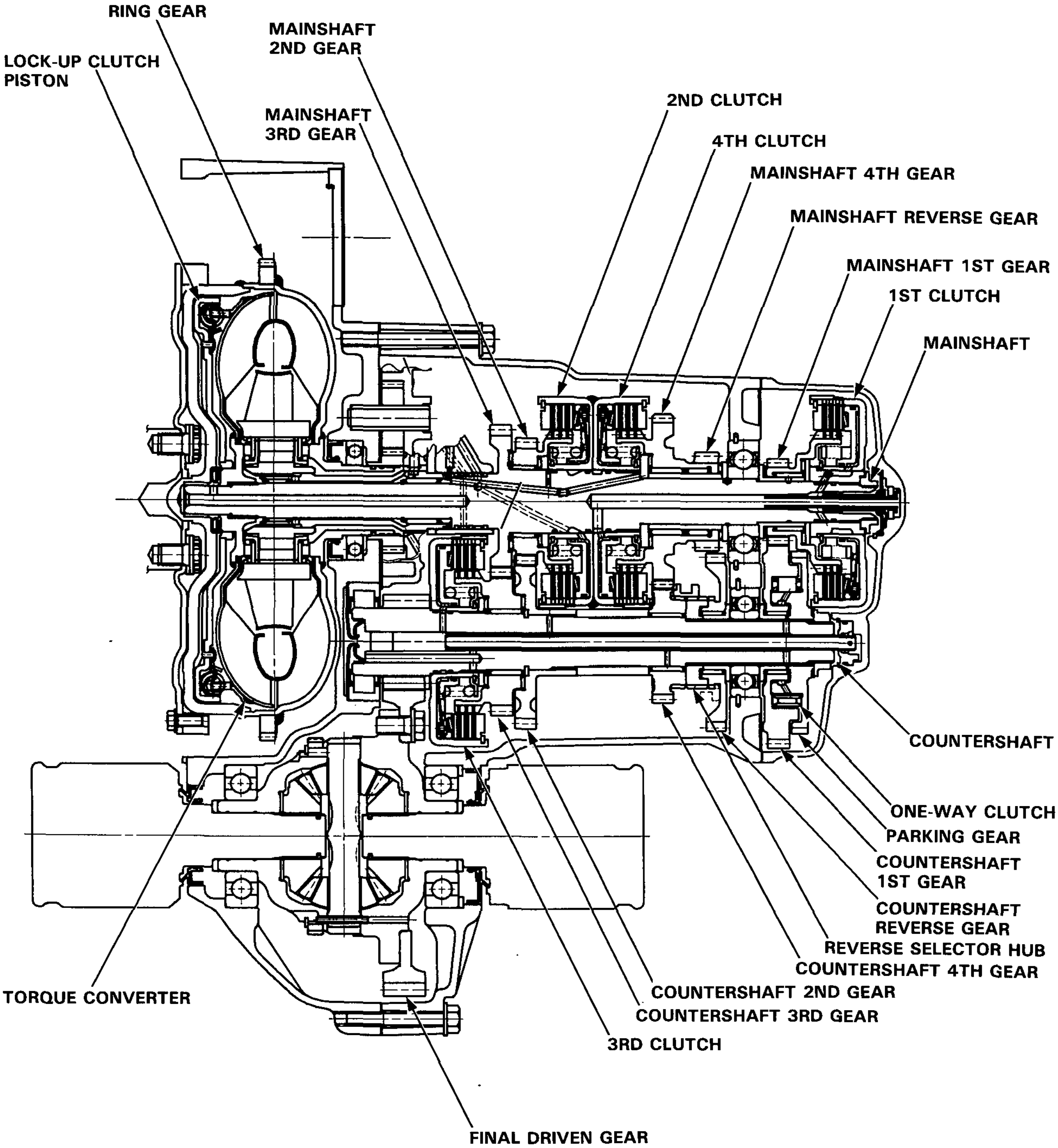
[3rd Clutch]
The third clutch engages/disengages third gear, and is located at the end of the countershaft, opposite the R side cover. The third clutch is supplied clutch pressure by its oil feed pipe within the countershaft.

[4th Clutch]
The fourth clutch engages/disengages fourth gear, as well as reverse gear, and is located at the center of the mainshaft. The fourth clutch is joined back-to-back to the second clutch. The fourth clutch is supplied clutch pressure by its oil feed pipe within the mainshaft.

[One-way Clutch]
The one-way clutch is positioned between the parking gear and first gear, with the parking gear splined to the countershaft. The first gear provides the outer race surface, and the parking gear provides the inner race surface. The one-way clutch locks up when power is transmitted from the mainshaft first gear to the countershaft first gear.
The first clutch and gears remain engaged in the 1st, 2nd, 3rd, and 4th gear ranges in the $\boxed{D_4}$, $\boxed{D_3}$ or $\boxed{2}$ position. However, the one-way clutch disengages when the 2nd, 3rd, or 4th clutches /gears are applied in the $\boxed{D_4}$, $\boxed{D_3}$ or $\boxed{2}$ position. This is because the increased rotational speed of the gears on the countershaft over-ride the locking "speed range" of the one-way clutch. Thereafter, the one-way clutch free-wheels with the first clutch still engaged.



NOTE: View from R. side cover side.


RING GEAR
MAINSHAFT 2ND GEAR
LOCK-UP CLUTCH PISTON
MAINSHAFT 3RD GEAR
2ND CLUTCH
4TH CLUTCH
MAINSHAFT 4TH GEAR
MAINSHAFT REVERSE GEAR
MAINSHAFT 1ST GEAR
1ST CLUTCH
MAINSHAFT
COUNTERSHAFT
ONE-WAY CLUTCH
PARKING GEAR
COUNTERSHAFT 1ST GEAR
COUNTERSHAFT REVERSE GEAR
REVERSE SELECTOR HUB
COUNTERSHAFT 4TH GEAR
COUNTERSHAFT 2ND GEAR
COUNTERSHAFT 3RD GEAR
3RD CLUTCH
TORQUE CONVERTER
FINAL DRIVEN GEAR

(cont'd)

Clutches (cont'd)

Lock-up Clutch

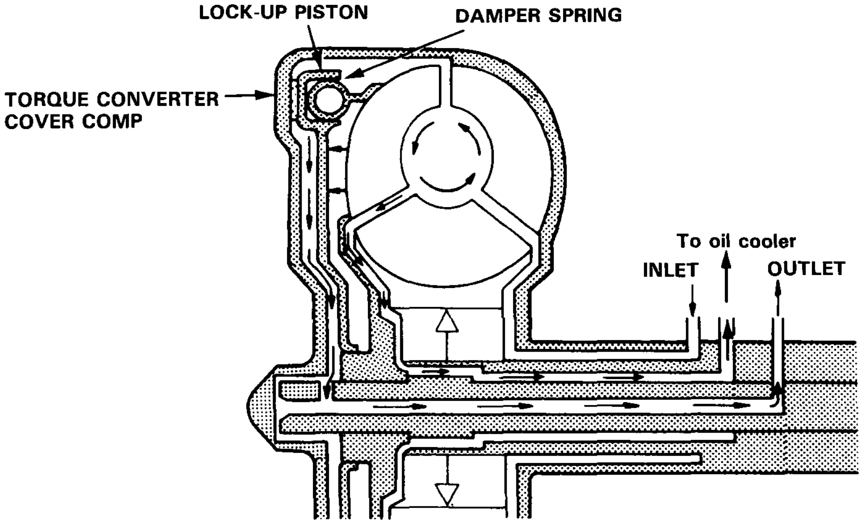
1. Operation (clutch on)

With the lock-up clutch on, the oil in the chamber between the torque converter cover and lock-up piston is discharged, and the converter oil exerts pressure through the piston against the converter cover. As a result, the converter turbine is locked on the converter cover firmly. The effect is to bypass the converter, thereby placing the car in direct drive.

Power flow

The power flows by way of:

Engine
↓
Drive plate
↓
Torque converter cover
↓
Lock-up piston
↓
Damper spring
↓
Turbine
↓
Mainshaft

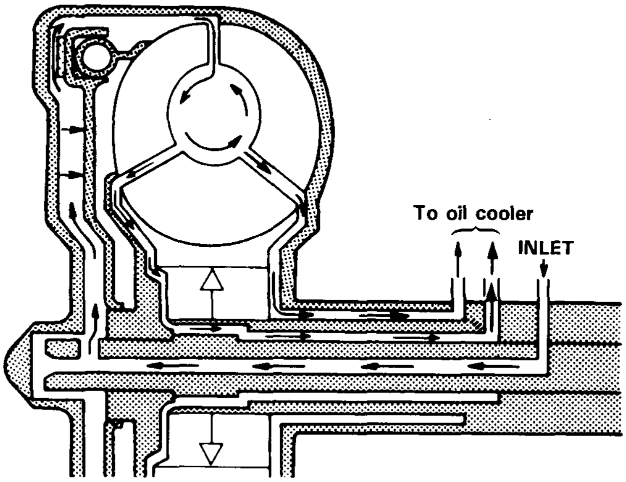


2. Operation (clutch off)

With the lock-up clutch off, the oil flows in the reverse of CLUTCH ON. As a result, the lock-up piston is moved away from the converter cover; that is, the torque converter lock-up is released.

Power flow

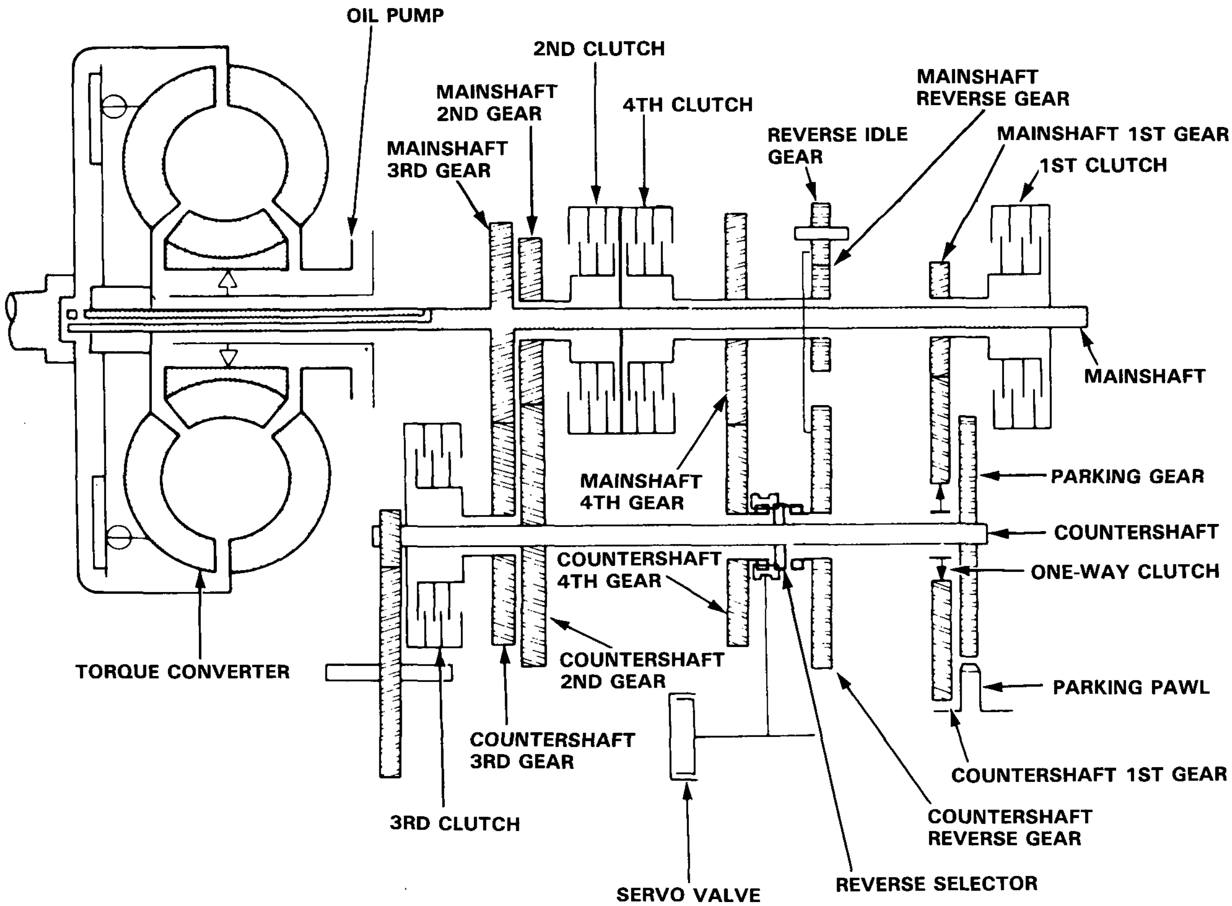
Engine
↓
Drive plate
↓
Torque converter cover
↓
Pump
↓
Turbine
↓
Mainshaft



Power Flow

POSITION		TORQUE CONVERTER	1ST GEAR 1ST CLUTCH	1ST GEAR ONE-WAY CLUTCH	2ND GEAR 2ND CLUTCH	3RD GEAR 3RD CLUTCH	4TH GEAR	4TH CLUTCH	REVERSE GEAR	PARKING GEAR
P		○	×	×	×	×	×	×	×	○
R		○	×	×	×	×	×	○	○	×
N		○	×	×	×	×	×	×	×	×
D3	1ST	○	○	○	×	×	×	×	×	×
D3	2ND	○	*○	×	○	×	×	×	×	×
D3	3RD	○	*○	×	×	○	×	×	×	×
D4	1ST	○	○	○	×	×	×	×	×	×
D4	2ND	○	*○	×	○	×	×	×	×	×
D4	3RD	○	*○	×	×	○	×	×	×	×
D4	4TH	○	*○	×	×	×	○	○	×	×
2	2ND	○	×	×	○	×	×	×	×	×

○: Engaged ×: Not Engaged *: Although the 1st clutch engages, driving power in not transmitted as the one-way clutch races.



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Description

Power Flow (cont'd)

Power transmission channels are shown in the following figures classified by positions [N], [2], [D3], [D4], [R] and [P].

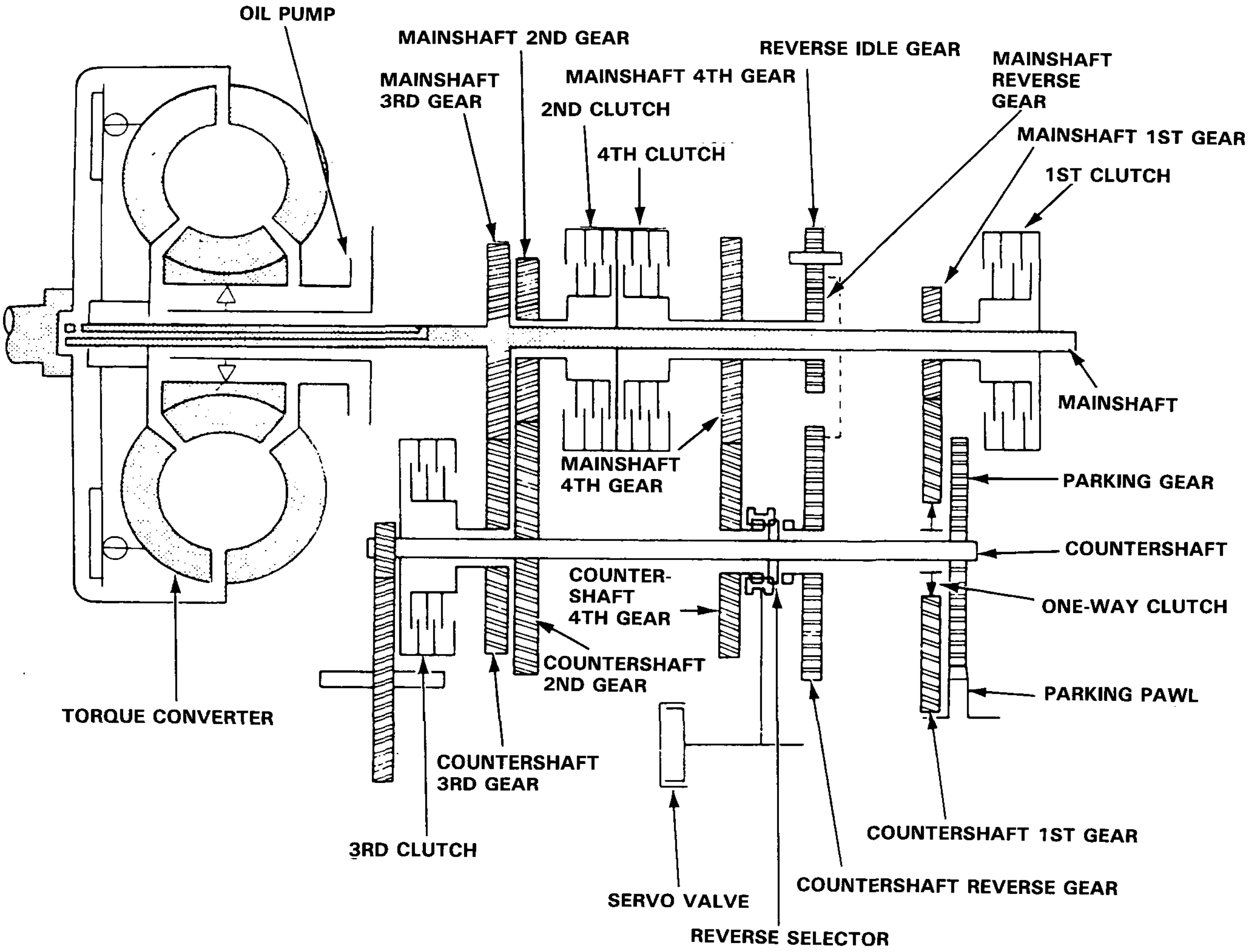
[N] Position

Each clutch is not connected because hydraulic pressure is retained by the manual valve in the main valve body.

(1) Starting the engine causes the oil pump to operate immediately, filling the torque converter with ATF.

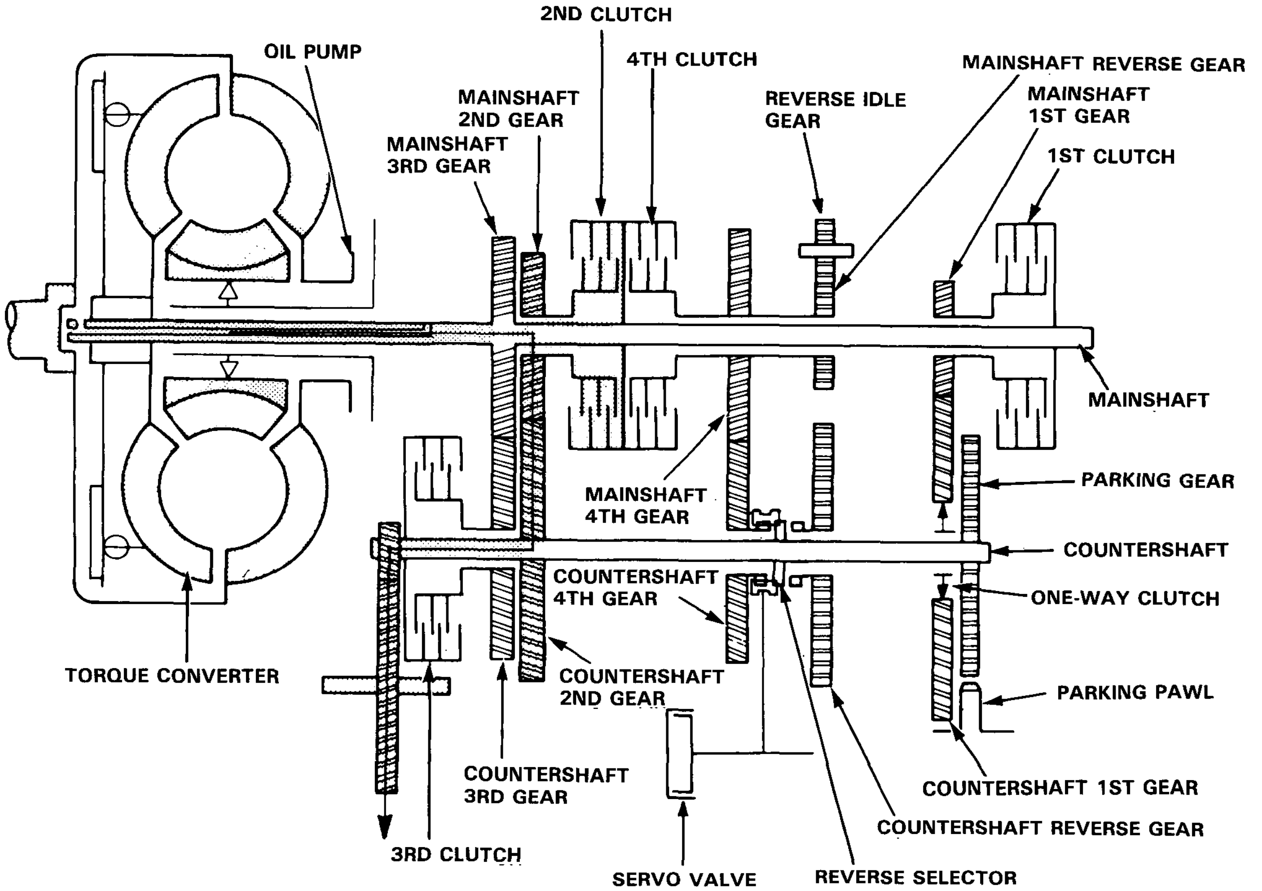
(2) Power is not transmitted to the countershaft because the 1st to the 4th clutches are releasaed (i.e. these clutches have received no hydraulic pressure).

(3) Despite the clutch being released, the torque converter, oil pump and mainshaft rotate.



[2] *Position*

[2] Position is fixed at the 2nd speed.
Hydraulic pressure is applied to the 2nd clutch, which is then connected. Engine motive power is transmitted via the torque converter to the mainshaft. Because the 2nd clutch is connected, motive power is transmitted from the mainshaft 2nd gear to the countershaft 2nd gear.



(cont'd)

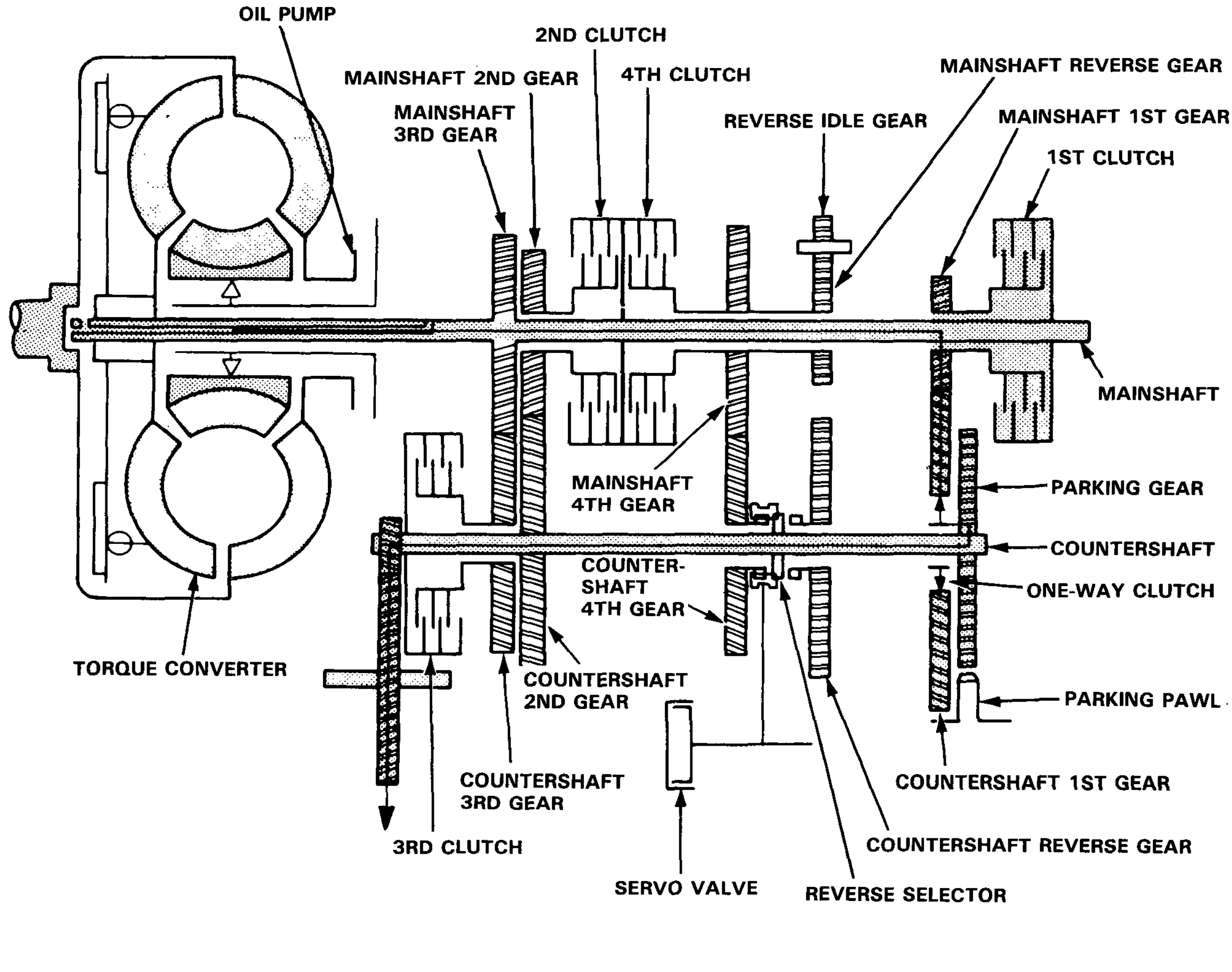
Power Flow (cont'd)

D3 or D4 Position

In D3 or D4 position, the throttle valve opening (engine load) is balanced with the car speed so as to transmit power to the optimal gear of the 1st, 2nd, 3rd and 4th gears (in D4 position). Transmission channels are shown below for each gear.

D3 or D4 Position, 1st speed

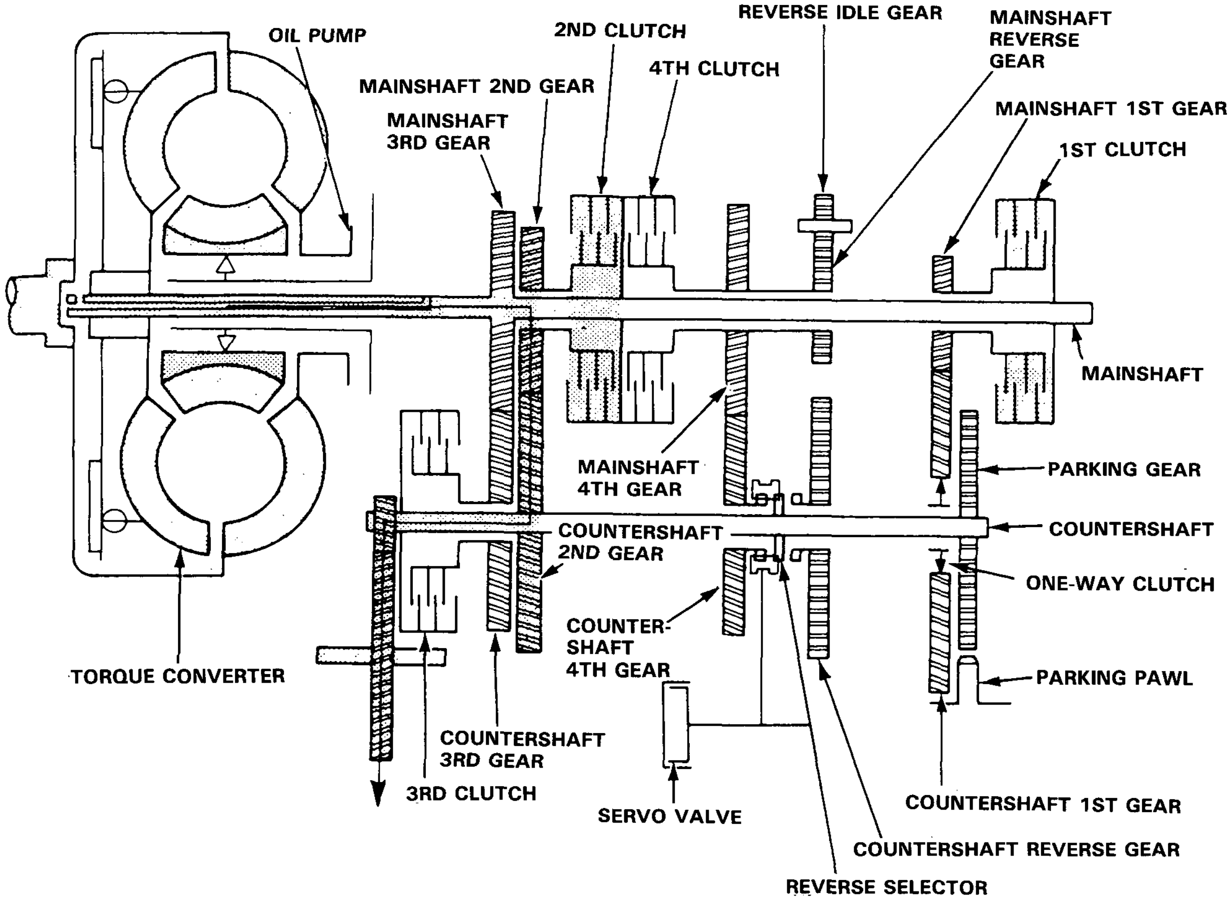
(1) Hydraulic pressure is applied to the 1st clutch, resulting in clutch engagement. Engine power is transmitted via the torque converter to the mainshaft. Because the 1st clutch is engaged, power is transmitted from the mainshaft 1st gear to the counter shaft 1st gear.
(2) Power is then transmitted from the one-way clutch to the parking gear and then to the countershaft.



D3 or D4 Position, 2nd speed

(1) Hydraulic pressure is applied to the 2nd clutch, resulting in clutch engagement. Engine power is transmitted via the torque converter to the mainshaft. Because the 2nd clutch is engaged, power is transmitted from the mainshaft 2nd gear to the countershaft 2nd gear.

(2) When driving in the 2nd speed also, the 1st clutch is engaged. The 2nd speed mechanism rotates the countershaft faster than the 1st speed mechanism due to the gear ratio difference. This causes the one-way clutch to rotate idly, resulting in no power being received from the 1st speed mechanism.



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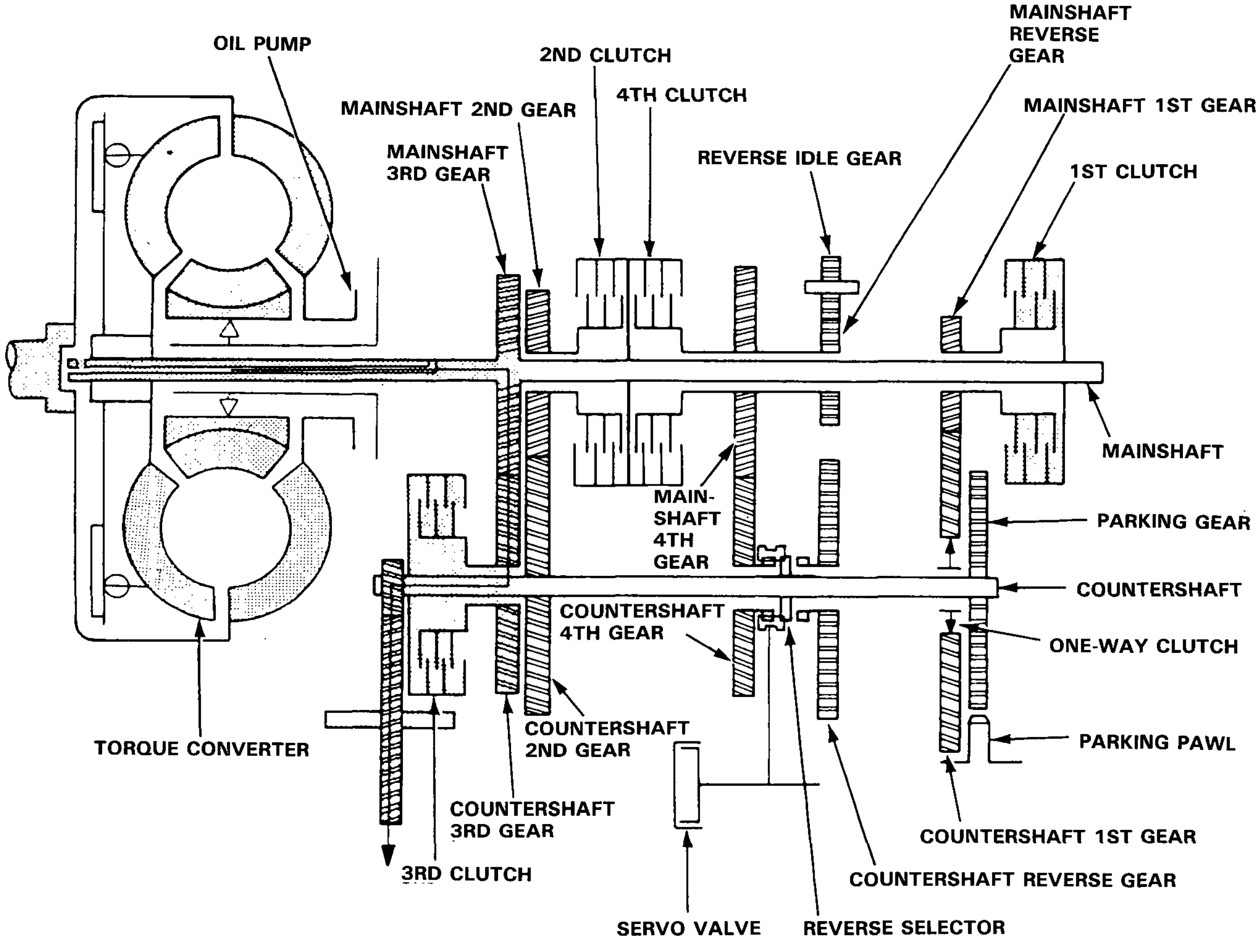
Description

Power Flow (cont'd)

[D3] or [D4] Position, 3rd speed

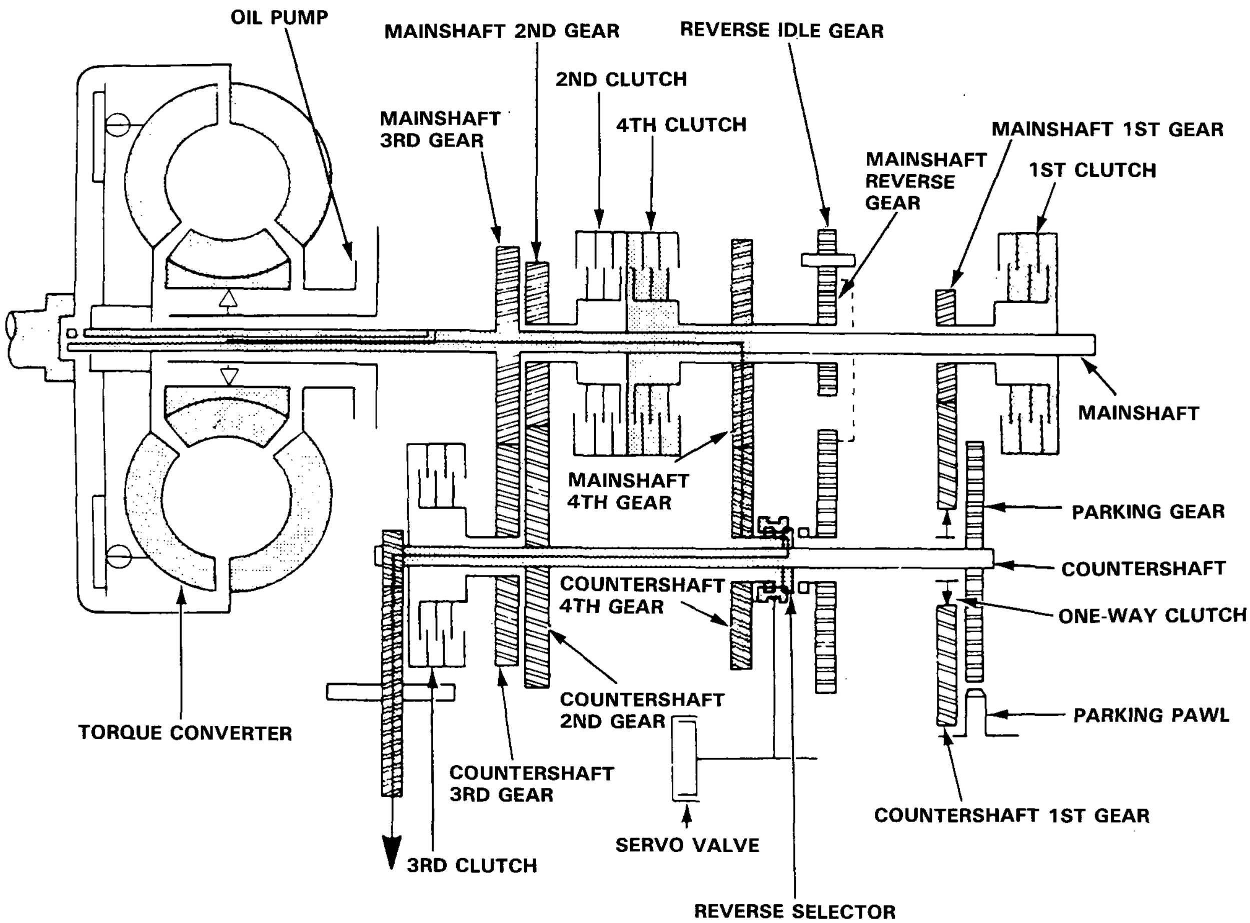
(1) Hydraulic pressure is applied to the 3rd clutch, resulting in clutch engagement. Engine power is transmitted via the torque converter to the mainshaft, then from the mainshaft 3rd gear to the countershaft 3rd gear.

(2) Because the 3rd clutch is engaged, power is transmitted from the 3rd clutch to the countershaft, thus output can be obtained from the transmission.
In 3rd speed also, the 1st clutch is engaged, but without receiving power from the 1st speed mechanism for the same reason as in the case of 2nd speed.



D4 **Position, 4th speed**

Hydraulic pressure is applied to the 4th clutch, resulting in clutch engagement. Engine power is transmitted via the torque converter to the mainshaft, via the 4th clutch to the mainshaft 4th gear, then to the countershaft-mounted countershaft 4th gear, then via the selector hub to the countershaft. Thus output can be obtained from the transmission. In 4th speed also, the 1st clutch is engaged, but without receiving power from the 1st speed mechanism for the same reason as in the case of 2nd speed.



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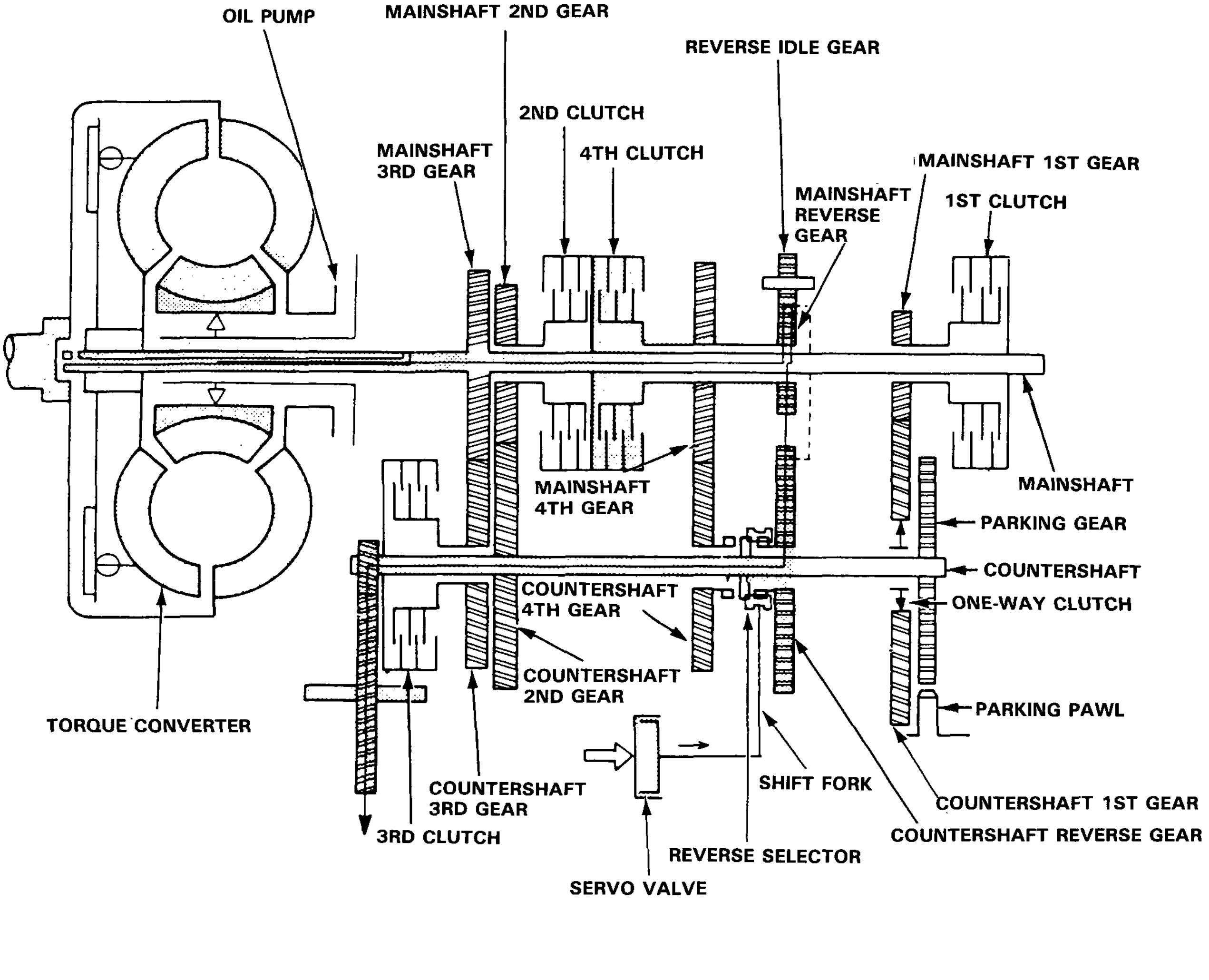
Power Flow (cont'd)

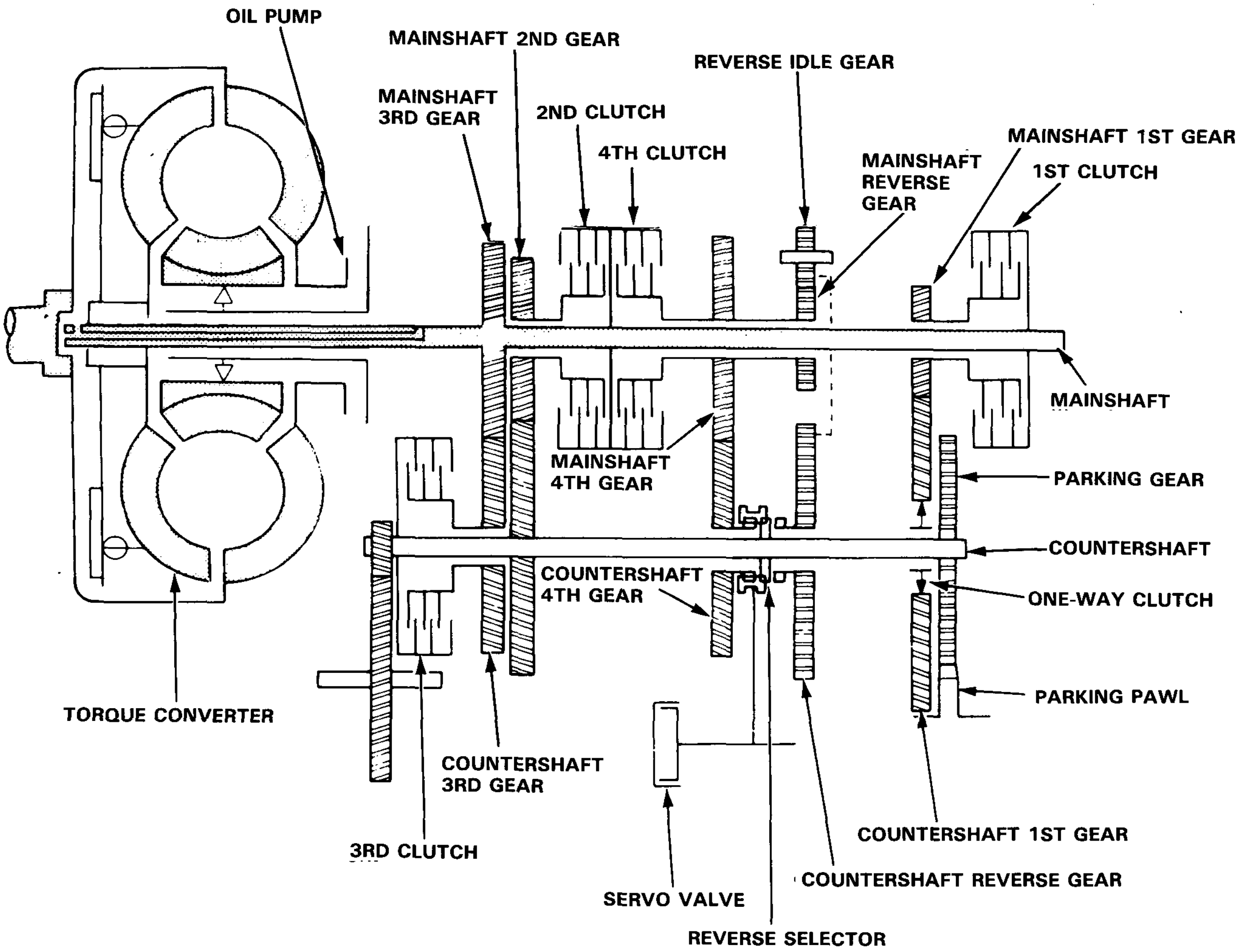
R Position

(1) The hydraulic pressure channel is switched by the manual valve to the 4th clutch and the servo valve, thus the 4th clutch is engaged.
(2) Hydraulic pressure acts on the shift fork shaft. The shift fork interlocking with the shift fork shaft causes the reverse selector to mesh with the reverse hub and the countershaft reverse gear.
(3) Engine power is transmitted via the torque converter to the mainshaft. Because the 4th clutch is engaged, the power drives mainshaft 4th and reverse gears united with the 4th clutch. Because, at this time, hydraulic pressure is applied to the servo valve, the reverse selector moves toward the countershaft reverse gear. This causes the power from the mainshaft reverse gear to change its rotation direction via the reverse idle gear. This power is then transmitted to the countershaft reverse gear, selector hub and then to the countershaft.



[P] Position

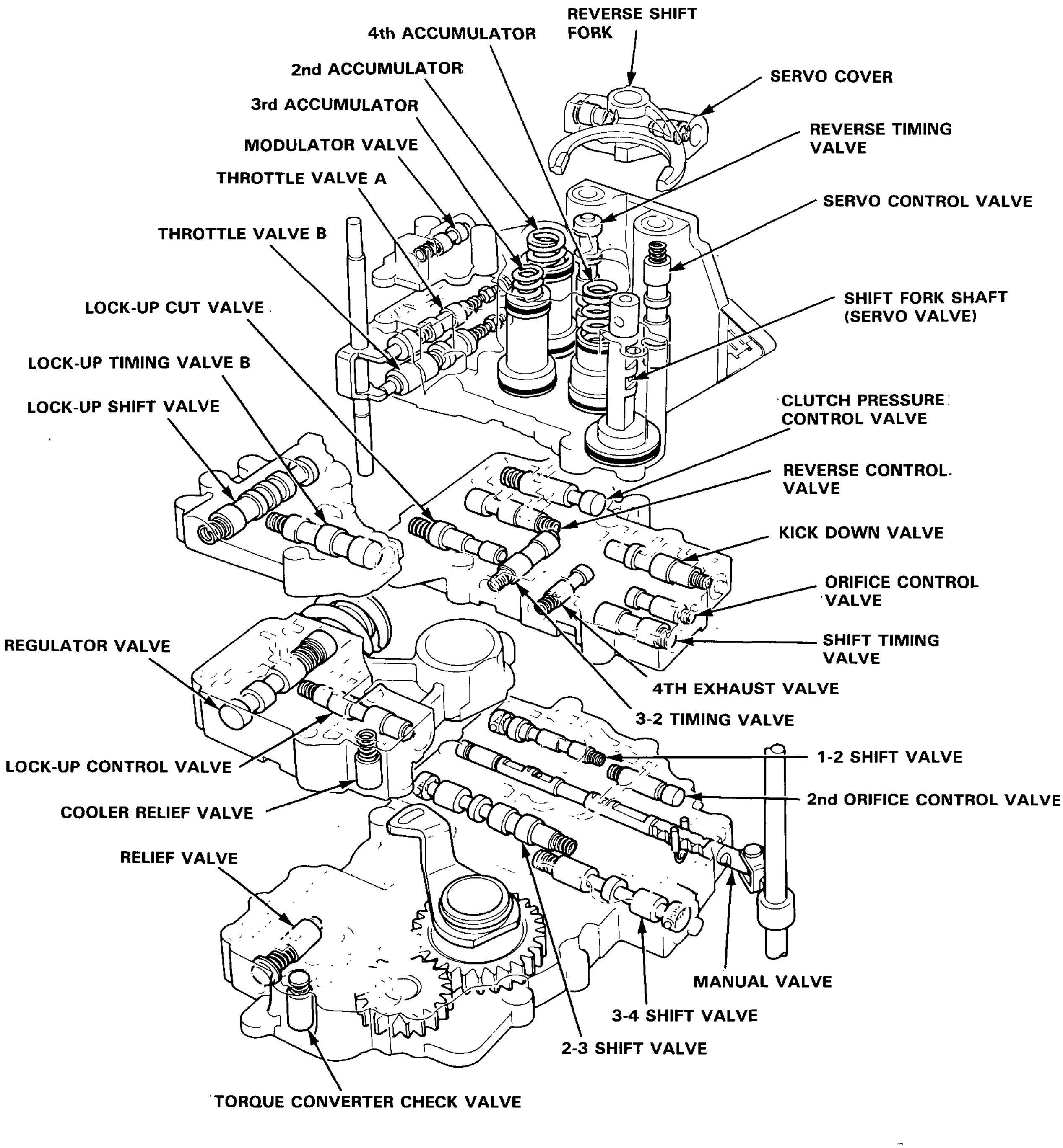
In [P] position, hydraulic pressure is not applied to each clutch resulting in idle rotation of the mainshaft, just like in [N] position. However, the mechanical parking mechanism interlocking with the manual vale causes the parking pawl to mesh with the parking gear, thereby locking the countershait.



Description

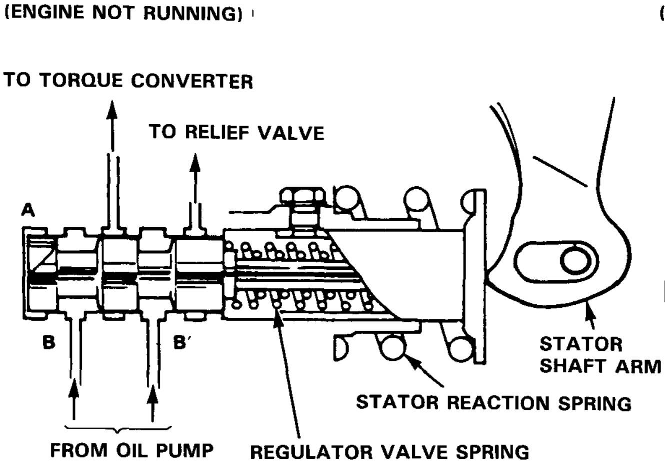
Hydraulic Control

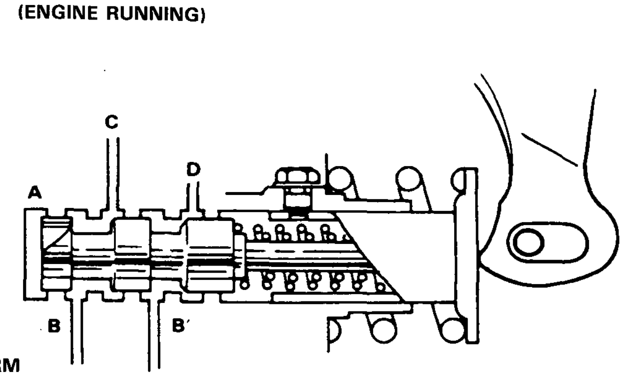
In the hydraulic control unit, the regulator valve, manual valve and oil pump connected to the torque converter are unified and contained inside the valve body. The valve body includes the main valve body. the regulator valve body, the secondary valve body, the servo body, and the lock-up valve body.
The oil pump is driven by splines on the right end of the torque converter which is attached to the engine. Oil flows through the regulator valve, to maintain specified pressure through the main valve body to the manual valve, governor valve, and servo body, directing pressure to each of the clutches.



Regulator Valve

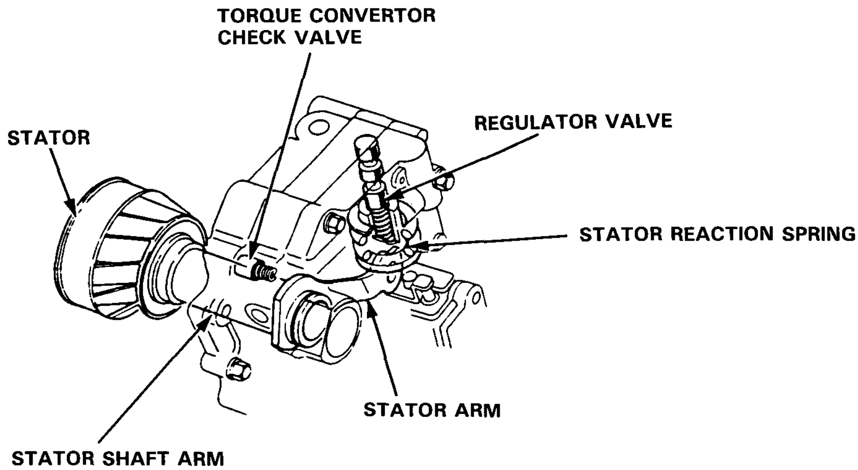
The regulator valve maintains a constant hydraulic pressure sent from the oil pump to the hydraulic control system. while also furnishing oil to the lubricating system and torque converter.
Oil flows through B and B'. The oil which enters through B flows through the valve orifice to A pushing the regulator valve to the right. According to the level of hydraulic pressure through B, the position of the valve changes, and the amount of the oil through B'. from D thus changes. This operation is continued, thus maintaining the line pressure.





Stator Reaction Hydraulic Pressure Control

Hydraulic pressure increase according to torque is performed by the regulator valve using stator torque reaction. The stator shaft is splined in the stator and its arm end contacts the regulator spring cap. When the car is accelerating or climbing (Torque Converter Range), stator torque reaction acts on the stator shaft and the stator arm pushes the regulator spring cap ➡ direction in proportion to the reaction. The spring compresses and the valve moves to increase the regulated control pressure or line pressure. Line pressure is maximum when the stator reaction is maximum.



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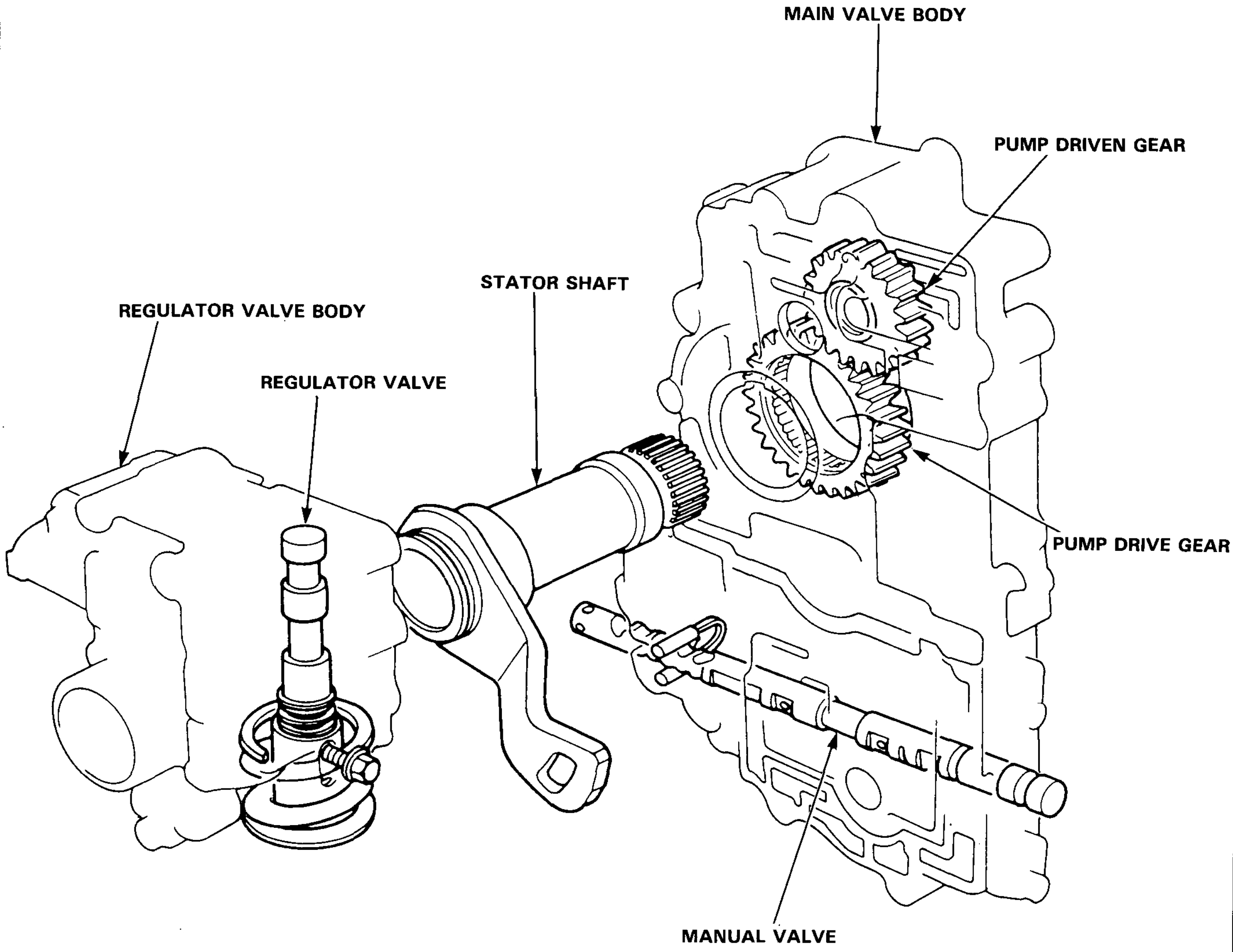
Description

Hydraulic Control (cont'd)

Oil Pump

The external tooth gear type oil pump consists of a housing united with the main valve body, a pump drive gear, a pump driven gear, and a pump shaft. the oil pump is installed on the torque converter housing. The pump's driving force is transmitted by the torque converter pump (directly connected to the engine) to the pump drive gear that is connected by a spline to the pump shaft. The gears are provided in the housing. The intake and exhaust lines and the torque converter line are provided in the housing.

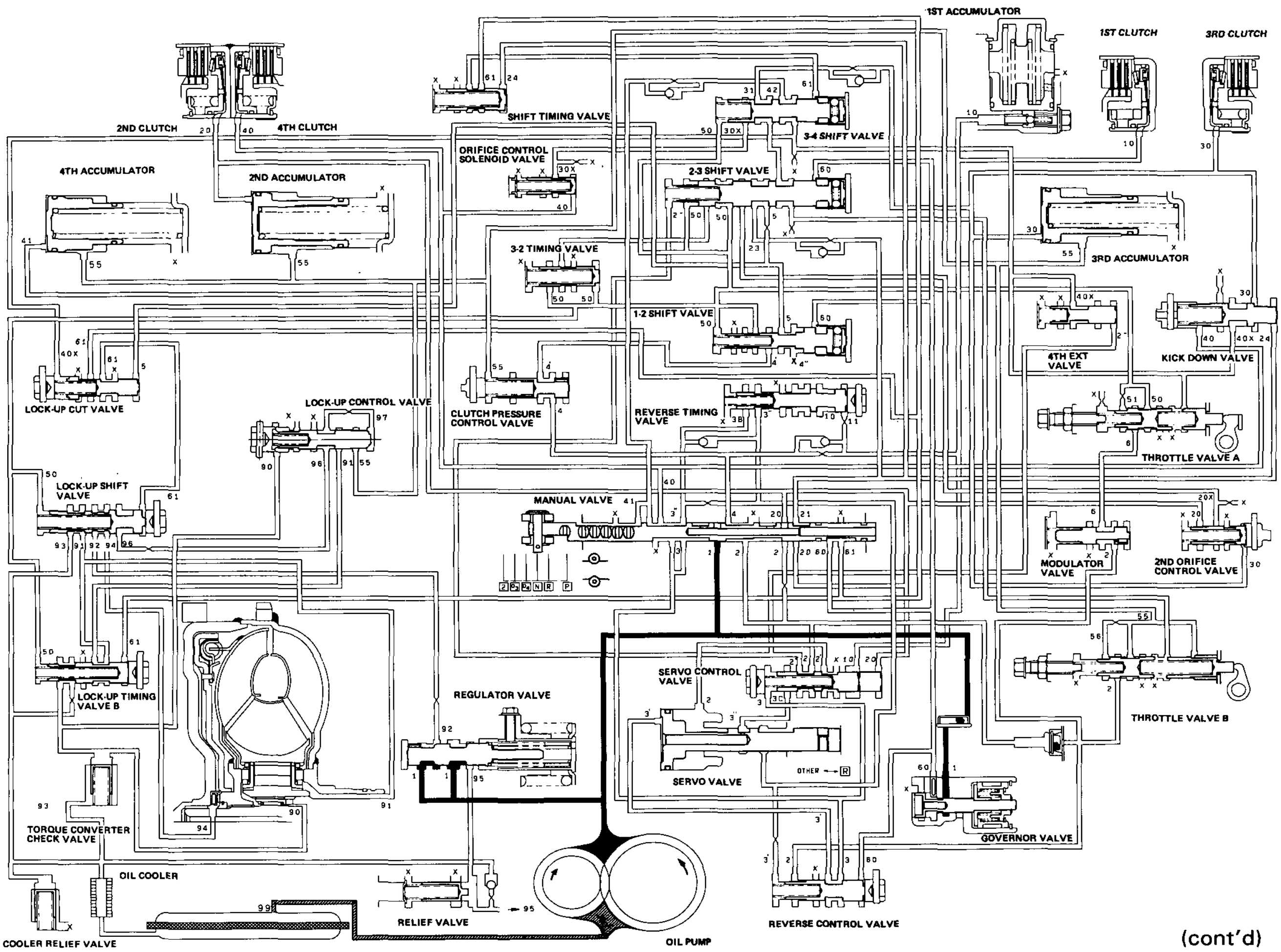


Hydraulic Flow D12B1/D15B3

No.	DESCRIPTION OF PRESSURE	No.	DESCRIPTION OF PRESSURE	No.	DESCRIPTION OF PRESSURE	No.	DESCTIPTION OF PRESSURE
1	LINE	10	1ST CLUTCH	40	4TH CLUTCH	90	TORQUE CONVERTER
2	↑	11	↑	41	↑	91	↑
3	↑	20	2ND CLUTCH	42	↑	92	↑
3′	↑	21	↑	50	THROTTLE A	93	OIL COOLER
3″	↑	22	↑	51	↑	94	TORQUE CONVERTER
4	↑	23	↑	55	THROTTLE B	95	LUBRICATION
4′	↑	24	↑	56	↑	96	TORQUE CONVERTER
5	↑	30	3RD CLUTCH	60	GOVERNOR	97	↑
6	MODULATOR	31	↑	61	↑	99	SUCTION

[N] Position

When the manual valve is in neutral, it prevents oil from flowing to the shift valves and clutches. The regulator valve serves to maintain the line pressure at a constant level. The torque converter check valve prevents oil pressure within the torque converter from falling below a predetemined limit.



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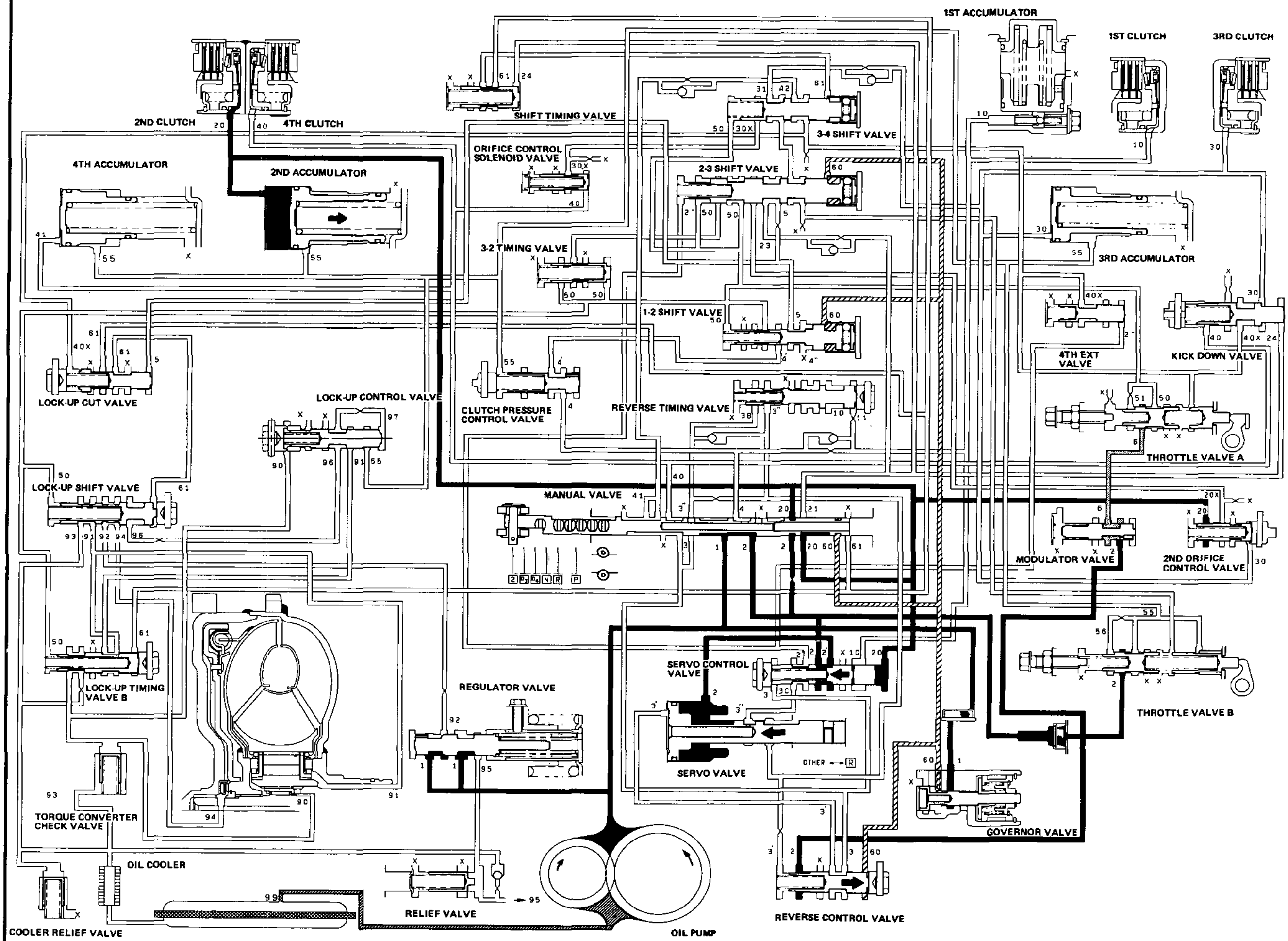
NOTE: When used, "left" or "right" indicates direction on the flow chart.

Hydraulic Flow D12B1/D15B3 (cont'd)

[2] Position

Oil from the oil pump travels through the manual valve to the second clutch; second clutch is on. It also flows through the governor valve to the 1-2 and 2-3 shift valves. The modulator and throttle valves also receive oil from the pump.

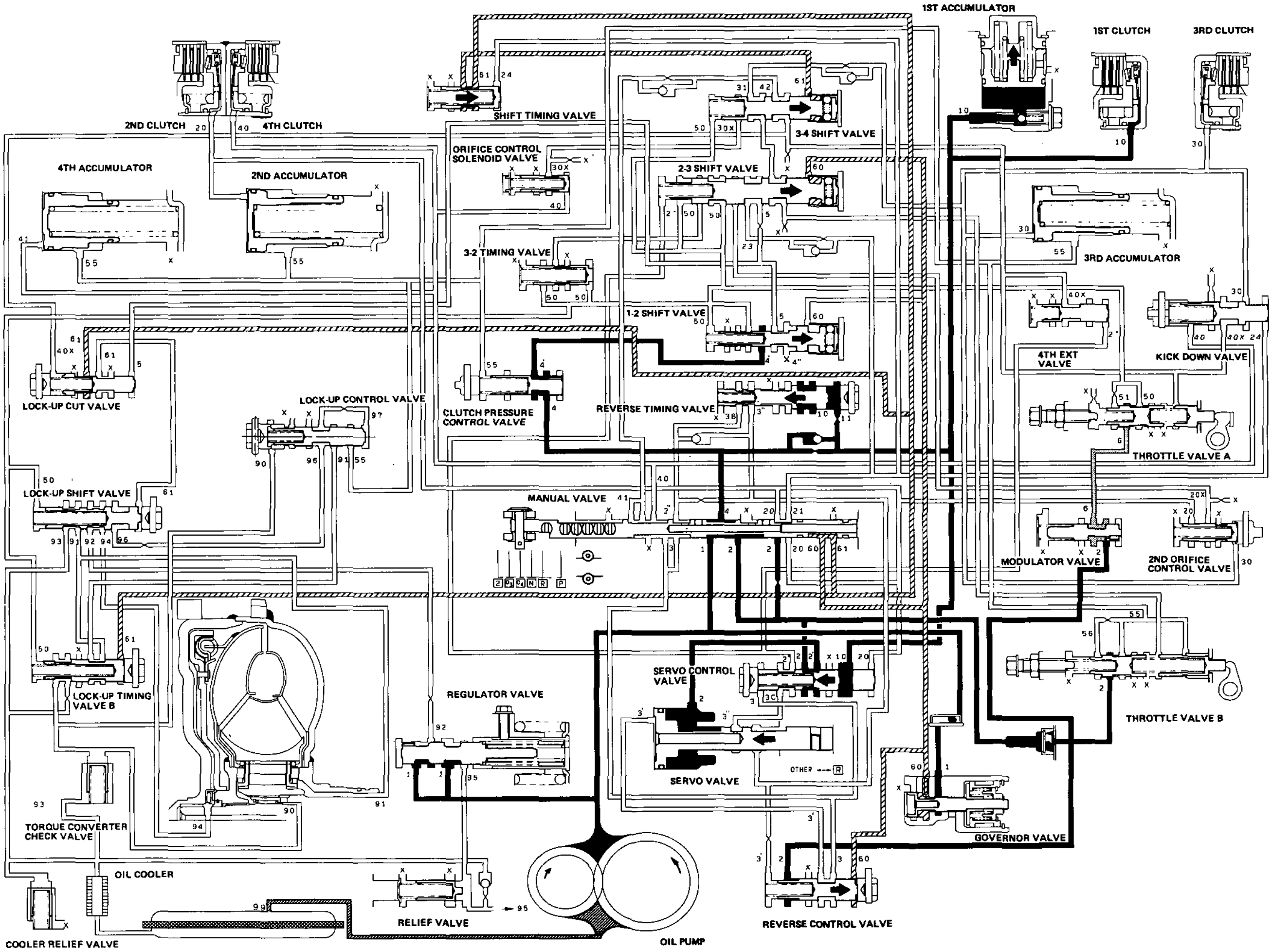


NOTE: When used, "left" or "right" indicates direction on the flow chart.

D3 or D4 Position

1. 1st speed

The manual valve directs oil to the first clutch through the port (4) and inlet (10). Line pressure is applied to the governor valve, modulator valve and throttle valves. In this transmission, two pressures from throttle valve A and the governor valve oppose each other in attempting to move the shift valves. In the Ist speed range, the 1-2 shift valve is moved to the right since the pressure (60) from the governor valve is lower than the pressure (50) from throttle valve A. With the 1-2 shift valve moved to the right, no oil is directed to the 2nd, 3rd and 4th clutches; that is, only the first clutch is on.



NOTE: When used, "left" or "right" indicates direction on the flow chart.

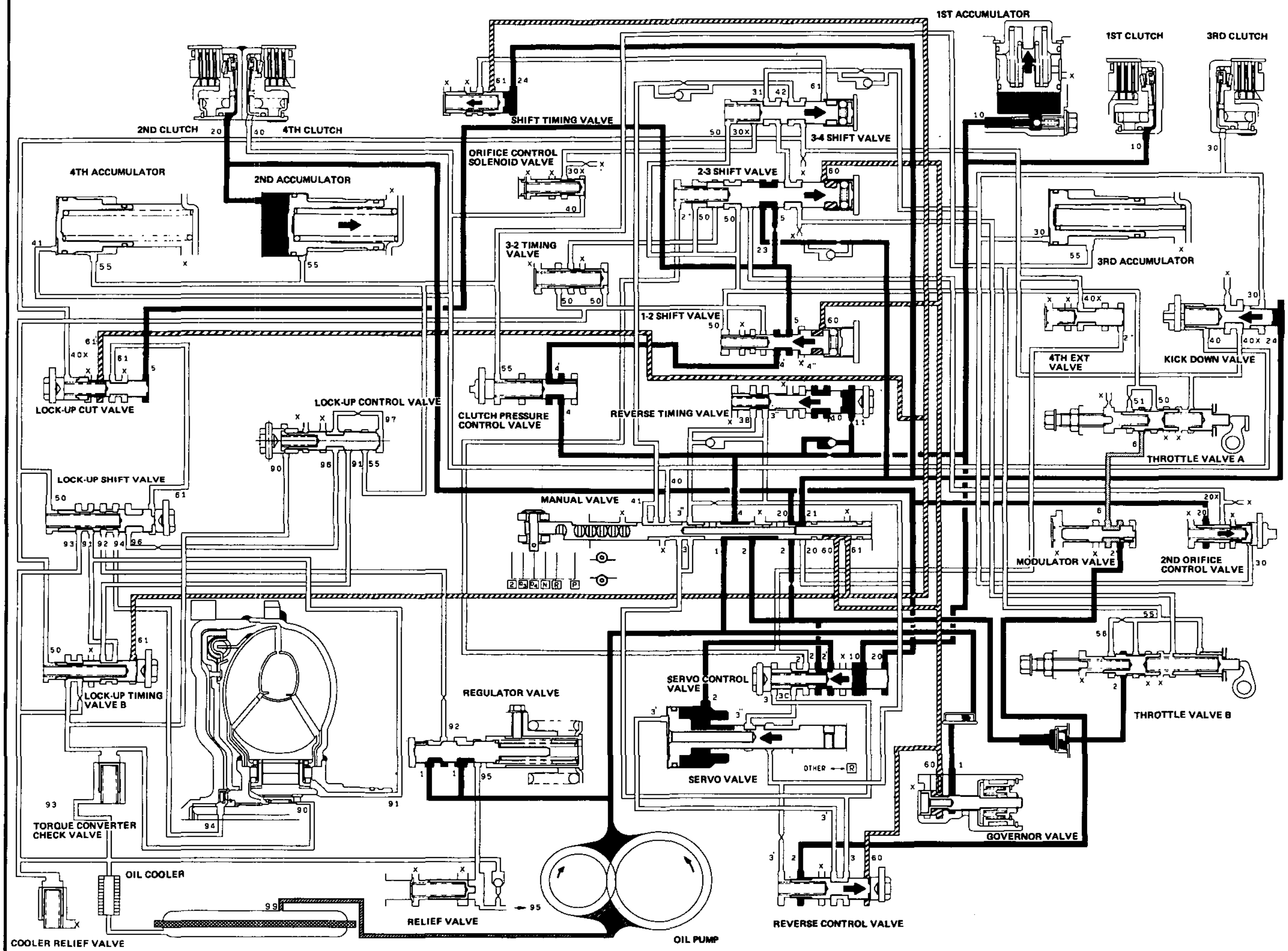
(cont'd)

Hydraulic Flow D12B1/D15B3 (cont'd)

D3 or D4 Position

2. 2nd speed

As the vehicle picks up speed, this increase oil pressure from the governor valve. This pressure is applied to one end of the 1-2 shift valve. When governor pressure (60) exceeds throttle pressure (50) and spring force combination, the 1-2 shift valve is moved to the left. This causes the transmission to upshift from first to second by admitting line pressure (5) to the 2nd clutch through the 2-3 shift valve and manual valve. The accumulator reduces shock during shifting. The first clutch remains on during this series of operations but no power is transmitted through this clutch since it is freewheeling on the one-way clutch. At times the line pressure (5) from the LC shift valve through the LC timing valve A is cut by the LC cut valve or LC timing valve A so the lock-up clutch remains released.

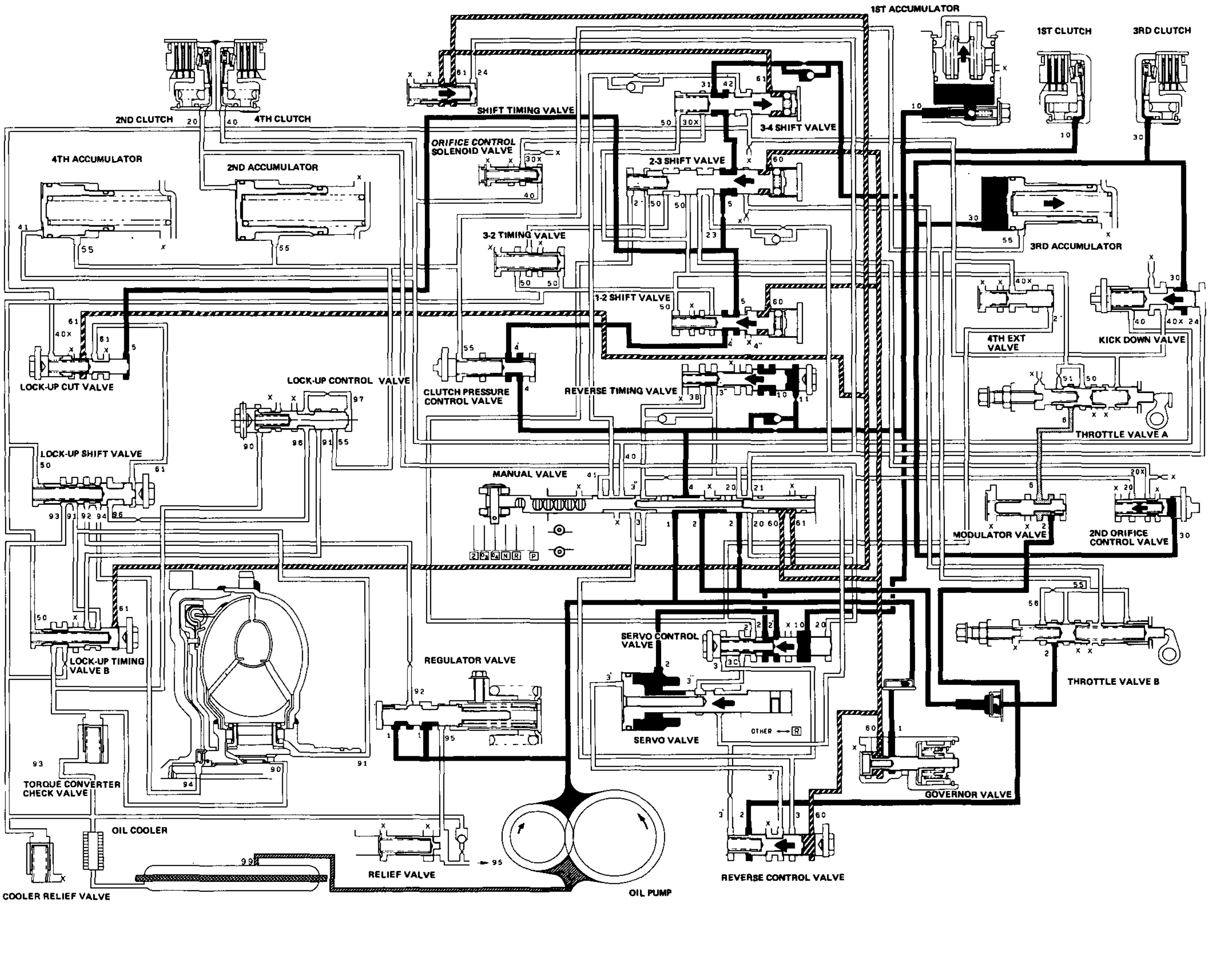


NOTE:
- When used, "left" or "right" indicates direction on the flow chart.
- LC: Lock-up

D3 or D4 Position

3. 3rd speed

With a further increase in vehicle speed, the governor pressure (60) is sufficient to overcome the throttle pressure (50) and spring force combination working on the end of the 2-3 shift valve. The 2-3 shift valve is moved to the left. This moves the shift valve to cut off line pressure (5) from the 2nd clutch. As the 2-3 shift valve so moves, it transmits line pressure (5) to the 3rd clutch through an accumulator and causes the transmission to up shift from second to third. As in the 2nd speed range, no power is transmitted through the first clutch because it is freewheeling on the one-way clutch.



NOTE: When used, "left" or "right" indicates direction on the flow chart.

(cont'd)

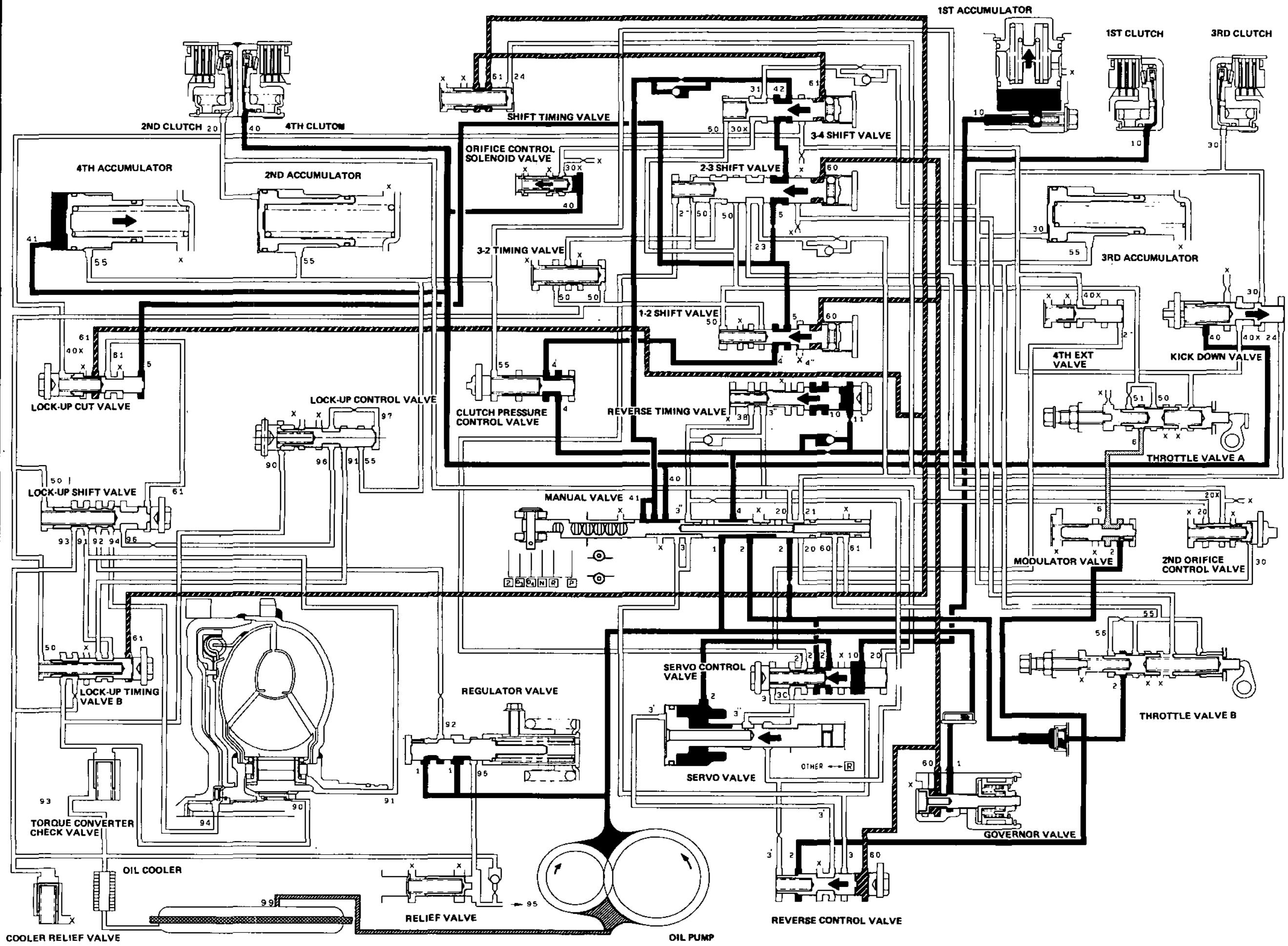
Description

Hydraulic Flow D12B1/D15B3 (cont'd)

D4 Position

4. 4th speed

The governor pressure passes through the manual valve and shift timing valve on it way to the 3-4 shift valve. As the governor pressure increases with vehicle speed, it exceeds the throttle A pressure applied on the other end of the 3-4 shift valve and the spring force combination. The 3-4 shift valve is moved to the left. The line pressure passage to the 3rd clutch (30) is closed and the passage to the 4th clutch (42) is opened by the movement of 3-4 shiit valve. The 4th clutch pressure line is then pressurized to engage the 4th clutch. At the same time remaining 3rd clutch pressure is released by the movement of the 3rd orifice control valve as it opens the X exhaust port for the remaining pressure of the 3rd clutch. The 4th clutch pressure is also applied on LC timing valve A to raise the lock-up release point approx. 30 km/h so that quick acceleration at kick down from the 4th speed range remains possible. The other 4th clutch pressure is transmitted to the kick down valve to hold the remaining 4th clutch pressure high during kick down from the 4th speed range in order to reduce kick down shock. This remaining 4th clutch pressure acts to release the lock-up clutch by cutting line pressure (5) at the LC cut valve.

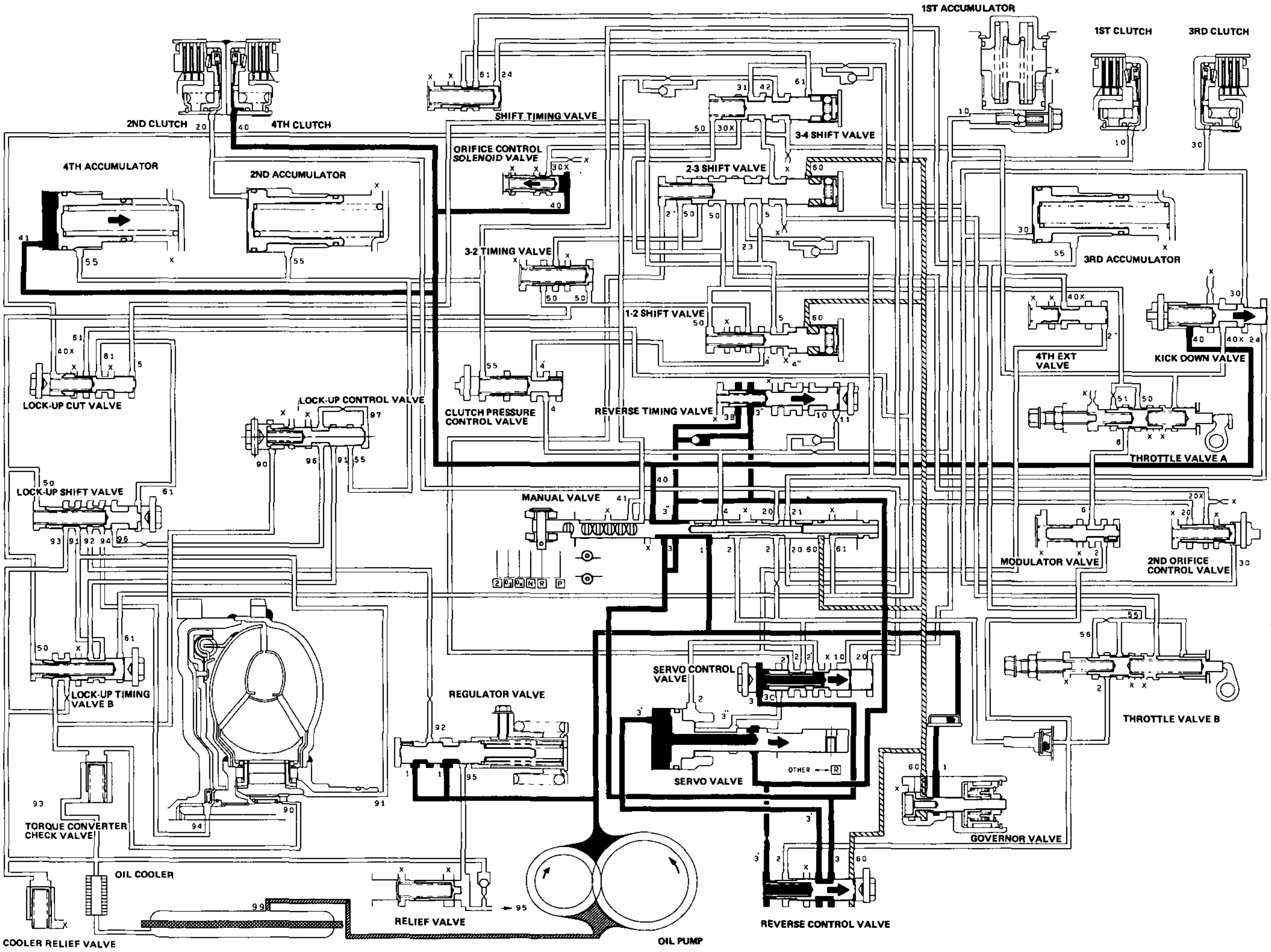


NOTE:

- When used, "left" of "right" indicates direction on the flow chart.
- LC: Lock-up

[R] Position

When the select level is placed in Reverse, this moves the manual valve, allowing line pressure (3) to travel to the servo valve through the reverse control valve. The reverse shift fork, which is installed on the servo valve, moves the selector into reverse gear. At the end of the servo valve stroke, the line pressure passage (3') opens and the 4th clutch pressure line is pressurized. Provision are made to guard against accidental shifting into reverse while the vehicle is in motion. When vehicle speed reaches a certain level (approx. 30 km/h), line pressure is cut by the governor pressure (60) which activates the reverse control valve.
When shifting from the [R] to the [D4], [D3] or [2] position, the servo control valve is moved to the left by first or second clutch pressure. The servo control valve combines with the reverse shift fork shaft detent system to control movement of the servo valve.



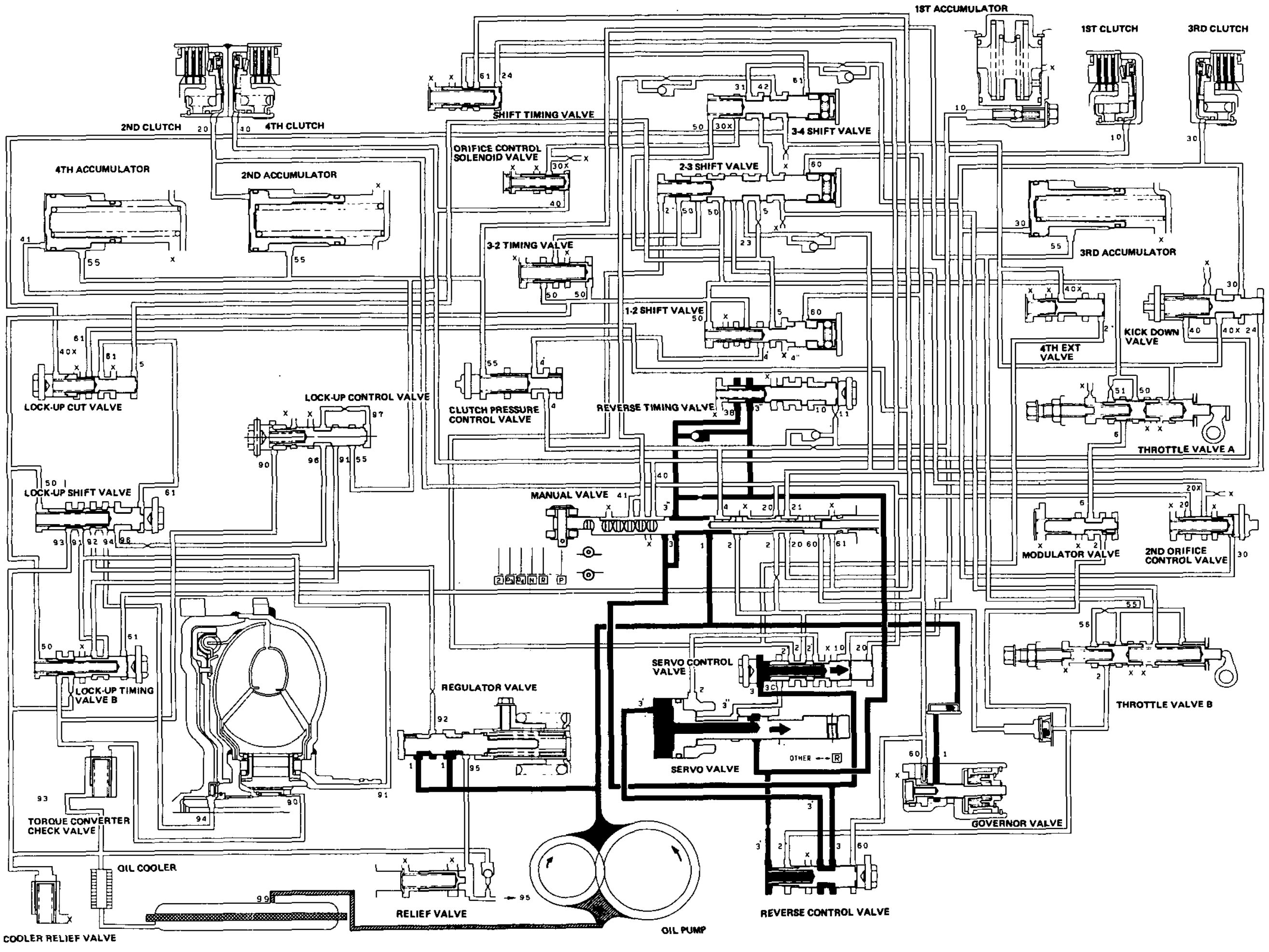
NOTE: When used, "left" or "right" indicates direction on the flow chart. (cont'd)

Description

Hydraulic Flow D12B1/D15B3 (cont'd)

[P] Position

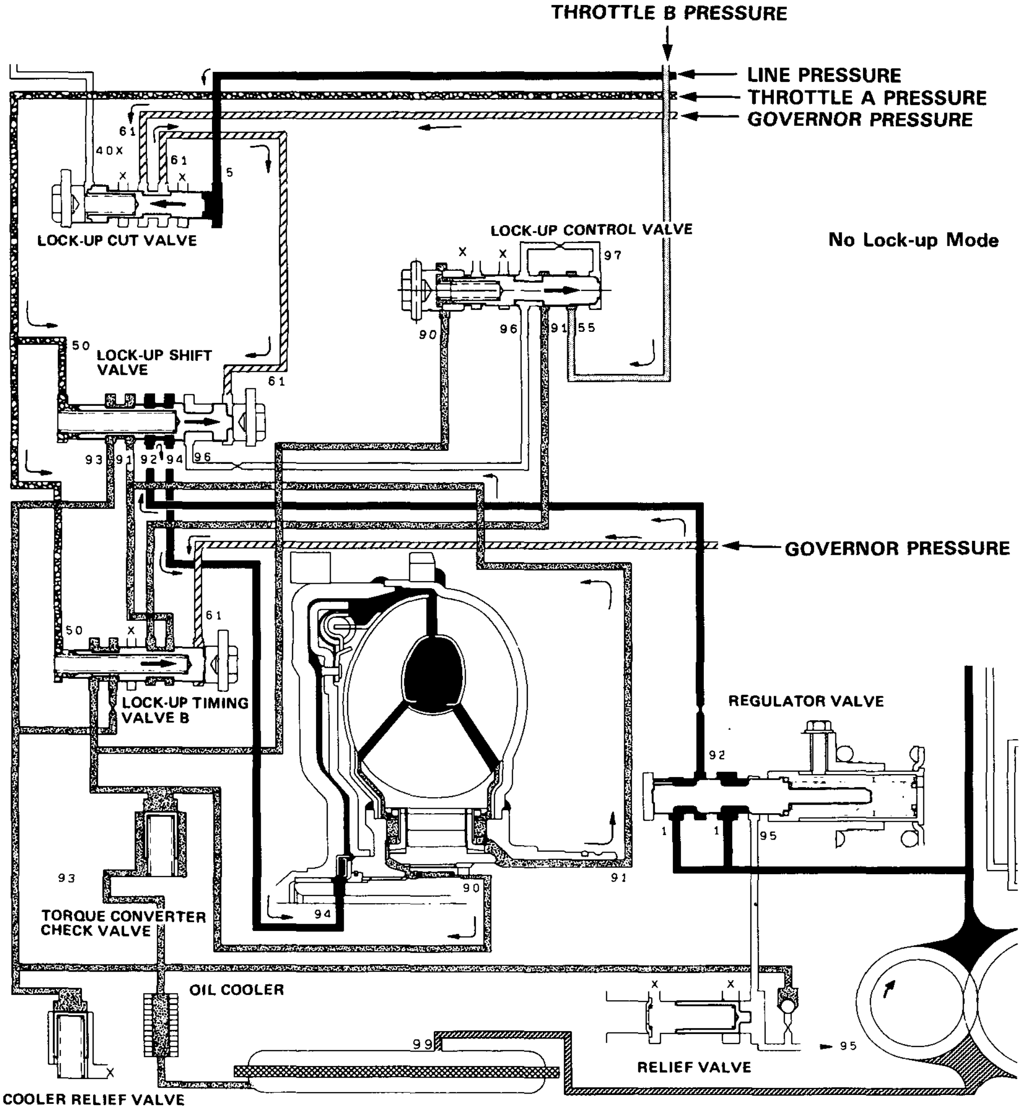
The flow of fluid through the torque converter is the same as in the [N] position. The line pressure (1) becomes the line pressure (3) as it passes the manual valve. The line pressure (3) flows through the reverse control valve to the servo valve, causing the reverse shift fork to be moved to the reverse position same as in the [R] position.
However, the hydraulic pressure is not supplied to the clutches. The power is not transmitted.



NOTE: When used, "left" or "right" indicates direction on the flow chart.

Lock-up Operation

1. Description
   Lock-Up comes into operation in the [D4] position 2nd speed or above, depending on the vehicle speed, the opening of the throttle, etc. for improved fuel economy and quieter operation.
2. Major Components
   The L/C cut valve, L/C timing valve A, L/C shift valve, L/C timing valve B and L/C control valve combines to actuate the L/C clutch.



NOTE:

- When used, "left" or "right" indicates direction on the flow chart.
- L/C: Lock-up

(cont'd)

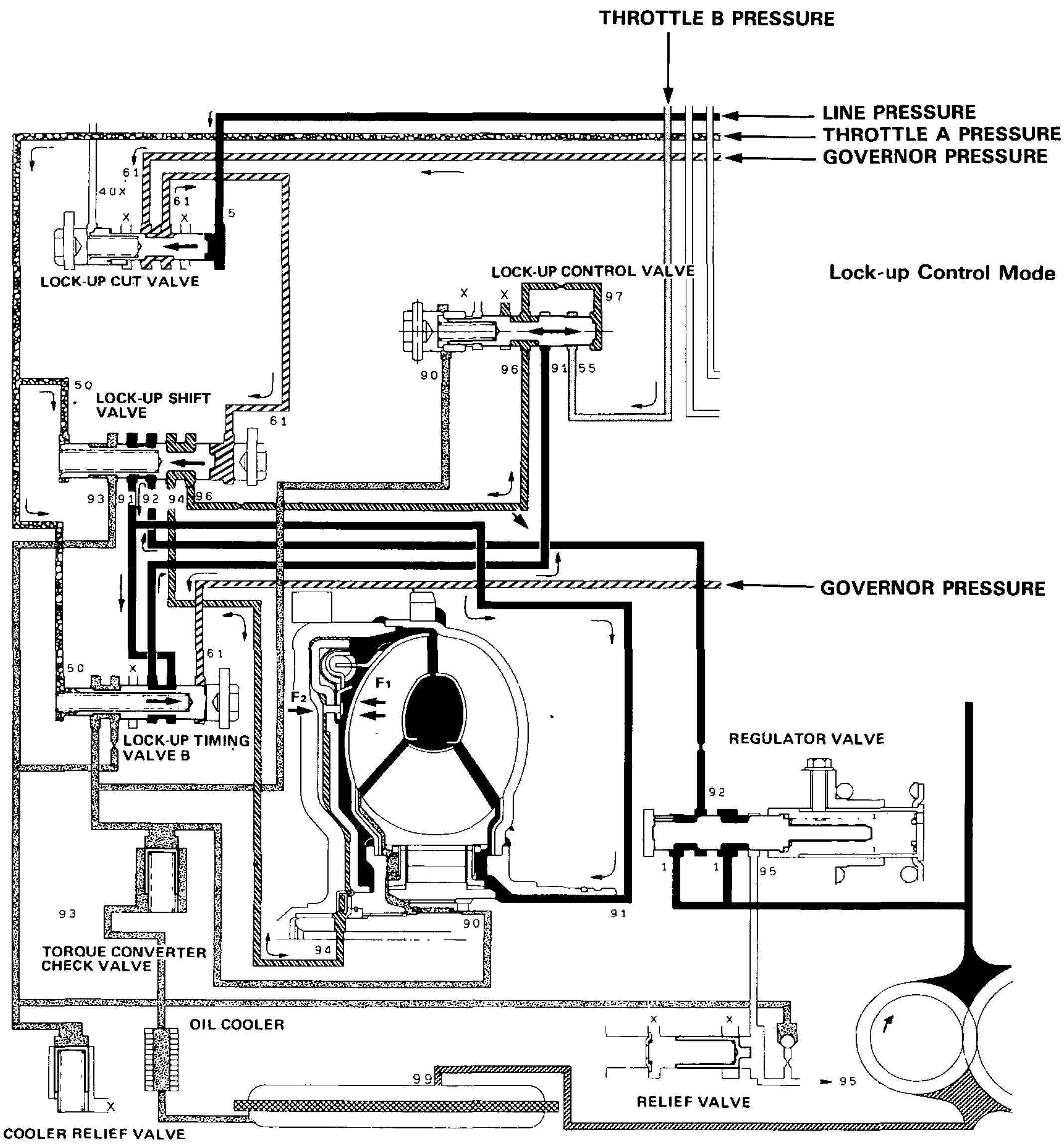
Description

Lock-up System D12B1/D15B3 (cont'd)

3. Operation

(1) When the throttle opening is at predetermined value or higher in the [D4] position 2nd speed or above, the throttle B pressure is applied to at the end of the L/C cut valve, causing the valve to move to the left. This uncovers the oil port, leading the line pressure to the L/C timing valve A.

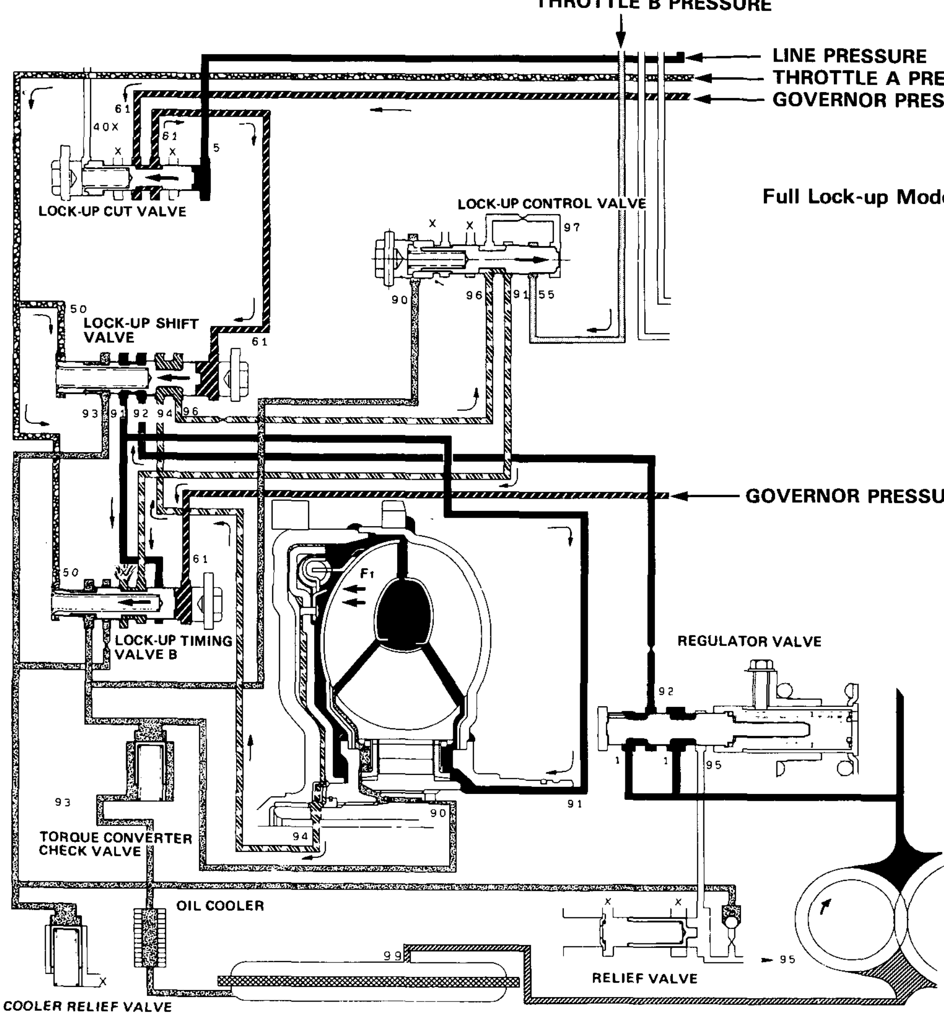
(2) Governor pressure works on the end of the L/C timing valve A only in the [D4] position. Thus, as the governor pressure increases, the L/C timing valve A is moved to the right, leading the line pressure from the L/C cut valve to the L/C shift valve through the L/C timing valve A.



NOTE:

- When used, "left" or "right" indicates direction on the flow chart.
- L/C: Lock-up

(3) As the line pressure is applied to the right end of the L/C shift valve, the valve is moved to the left.
(4) Torque converter pressure from the regulator valve then flows through the L/C shift valve into the torque converter from the right side (back side) of the L/C piston.
(5) Pressure in the right side of the L/C piston makes the L/C piston stroke and locks up the L/C clutch.
At the same time, the torque converter pressure in the L/C control valve from the L/C shift valve and L/C timing valve B is applied on the left side of the L/C piston. However, this pressure is maintained lower than the pressure on the other side by the two opposing pressures working on both sides of the plunger in the L/C control valve. In this way, lock-up capacity is controlled. The position of the plunger in the L/C timing valve B determines the lock-up control, or full lock-up mode. If the throttle A pressure working on the left end of the L/C timing valve B plunger is greater than the governor pressure on the right end, lock-up capacity is controlled. Full lock-up is achieved in the opposite case as the pressure to the left (back) side of the L/C piston is cut by the timing valve B and the remaining pressure is released from the orifice of the L/C control valve.
(6) When the throttle opening is below the predetermined valve, the throttle B pressure is lowered gradually, causing the L/C timing valve A to move to the left. At the same time, the L/C cut valve and L/C shift valve are also moved to the right.
(7) As the L/C shift valve is moved to the right, the torque converter circuit switches to the left (back) side of the L/C piston to release the lock-up.



NOTE:
- When used, "left" of "right" indicates direction on the flow chart.
- L/C: Lock-up

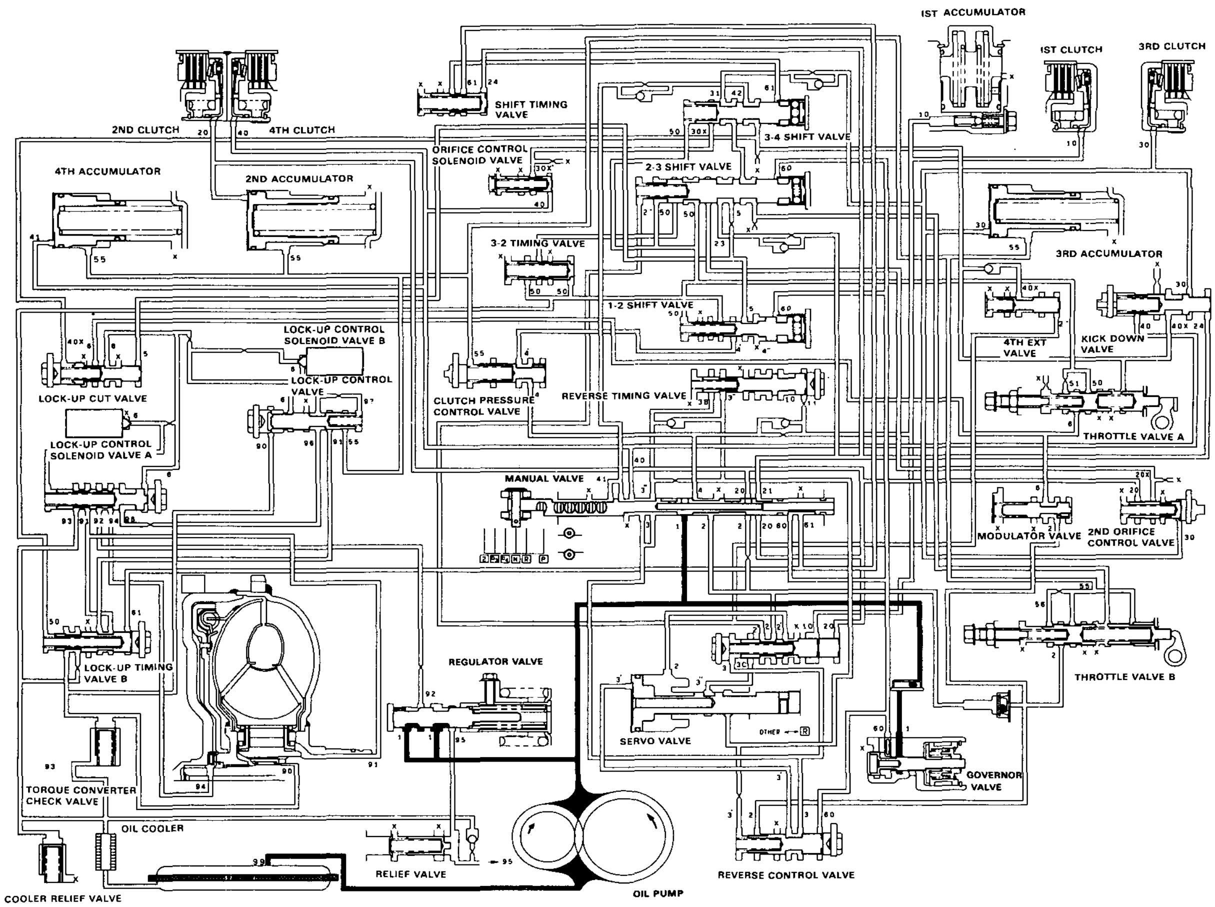
Description

Hydraulic Flow D15B4/D16A9

No.	DESCRIPTION OF PRESSURE	No.	DESCRIPTION OF PRESSURE	No.	DESCRIPTION OF PRESSURE	No.	DESCTIPTION OF PRESSURE
1	LINE	10	1ST CLUTCH	41	4TH CLUTCH	91	TORQUE CONVERTER
2	LINE	11	1ST CLUTCH	42	4TH CLUTCH	92	TORQUE CONVERTER
3	LINE	20	2ND CLUTCH	50	THROTTLE A	93	OIL COOLER
3′	LINE	21	2ND CLUTCH	51	THROTTLE A	94	TORQUE CONVERTER
3″	LINE	23	2ND CLUTCH	55	THROTTLE B	95	LUBRICATION
4	LINE	24	2ND CLUTCH	56	THROTTLE B	96	TORQUE CONVERTER
4′	LINE	30	3RD CLUTCH	60	GOVERNOR	97	TORQUE CONVERTER
5	LINE	31	3RD CLUTCH	61	GOVERNOR	99	SUCTION
6	MODULATOR	40	4TH CLUTCH	90	TORQUE CONVERTER	X	BLEED

[N] Position

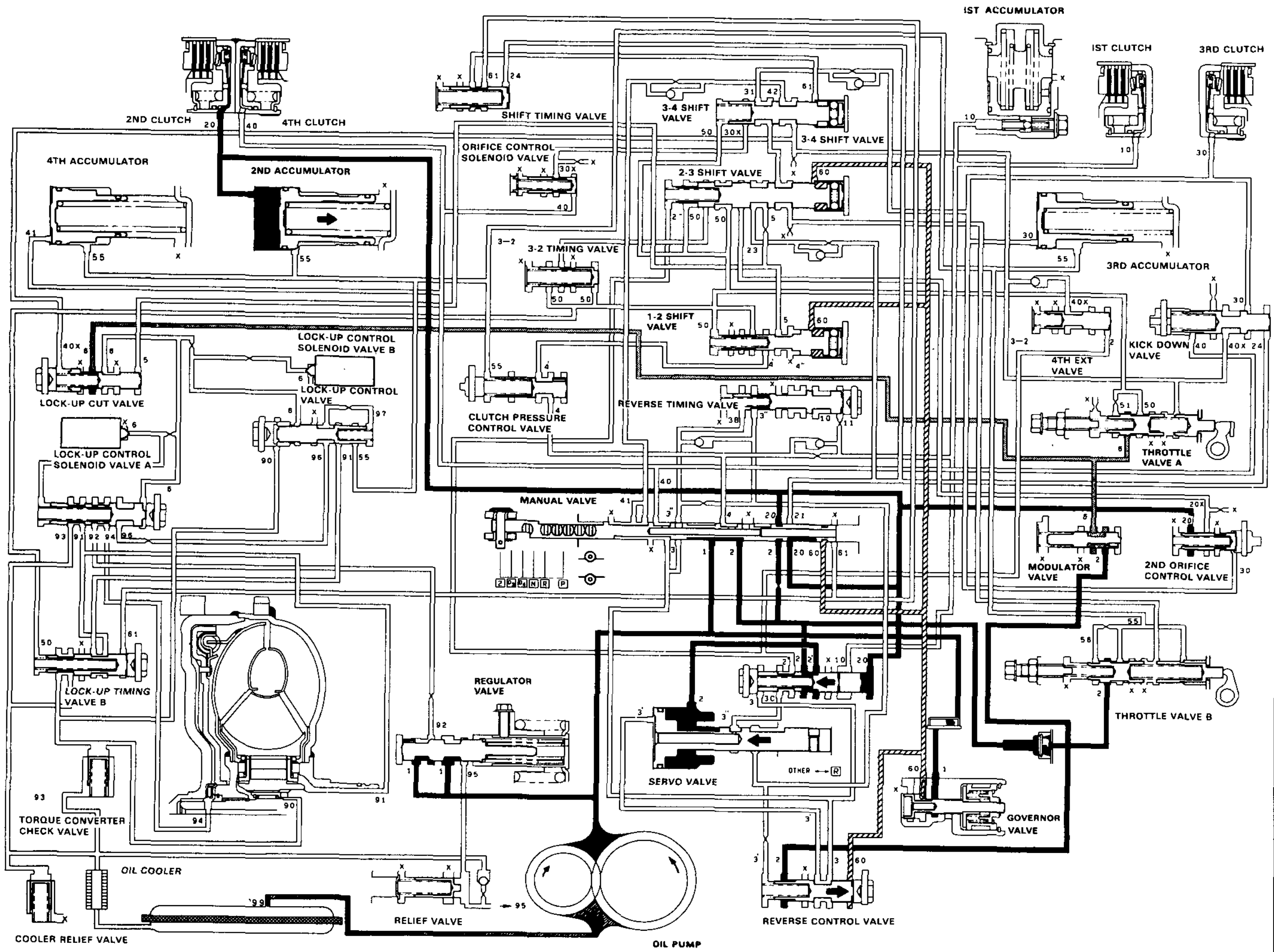
When the manual valve is in neutral, it prevents the oil from flowing to the shift valves and clutches.
The regulator valve maintains the line pressure at a constant level.
The torque converter check valve prevents oil pressure within the torque converter from falling below a predetemined limit.



NOTE: When used, "left" or "right" indicates direction on the flow chart.

[2] Position

Oil from the oil pump travels through the manual valve to the second clutch; the second clutch is on. It also flows through the governor valve to the 1-2 and 2-3 shift valves. The modulator valve and throttle valve B receive the oil from the pump. The throttle valve A receives the oil from the modulator valve.



NOTE: When used, "left" of "right" indicates direction on the flow chart.

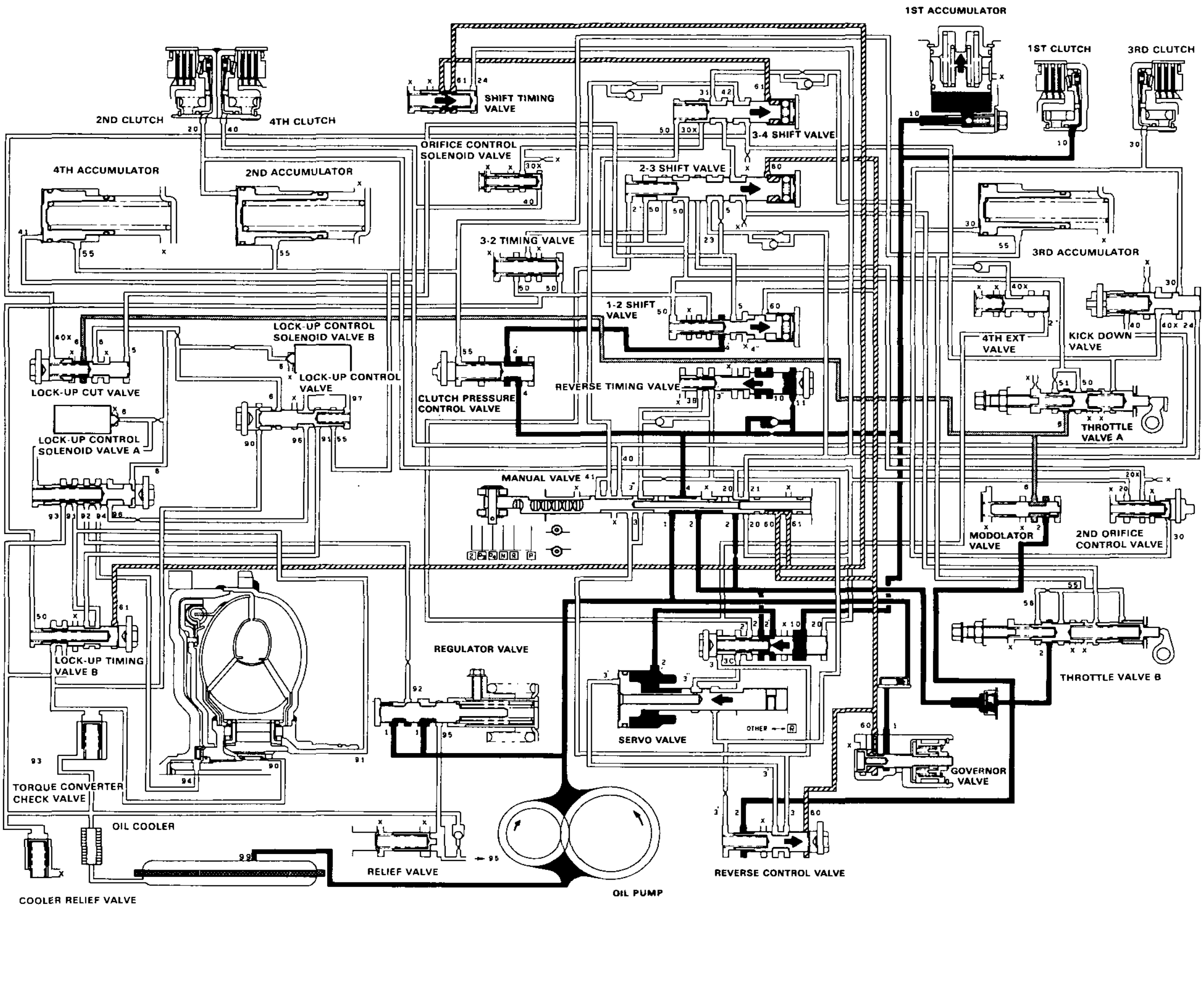
(cont'd)

Hydraulic Flow D15B4/D16A9 (cont'd)

D3 or D4 Position

1. 1st speed

The manual valve directs the oil to the first clutch through the port (4) and inlet (10). The line pressure is applied to the governor valve, modulator valve and throttle valves. In this transmission, two pressures from the throttle valve A and governor valve oppose each other in attempting to move the shift valves. In the first gear range, the 1-2 shift valve is moved to the right since the pressure (60) from the governor valve is lower than the pressure (50) from the throttle valve A. With the 1-2 shift valve moved to the right, no oil is directed to the 2nd, 3rd and 4th clutches; that is, only the first clutch is on.



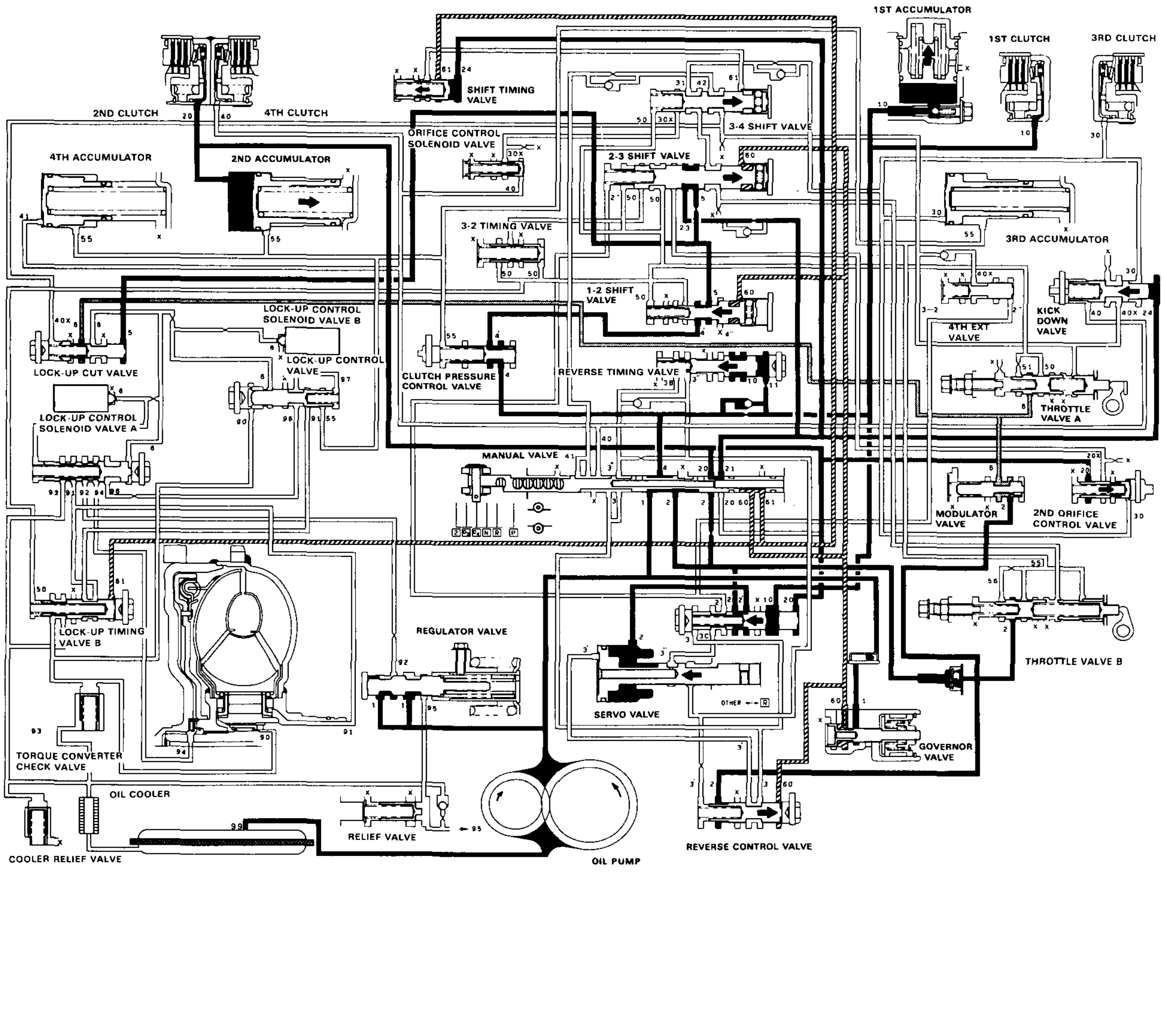
NOTE: When used, "left" of "right" indicates direction on the flow chart.

[D3] or [D4] Position

2. 2nd speed

The flow of fluid up the 1-2 and 2-3 shift valve is the same as in first gear. When the vehicle speed reaches the prescribed value, the governer pressure increases. At the 1-2 shift valve, the governer pressure (60) overcomes the throttle A pressure and spring force combination. The 1-2 shift valve is moved to the left. The movement of the 1-2 shift valve causes the hydraulic pressure lines to be changed. The line pressure (2) at the manual valve becomes line pressure (4), passing through the clutch pressure control valve and 1-2 shift valve, becoming line pressure)5), and on to the 2-3 shift valve. The 2-3 shift valve causes the line pressure (5) to become second clutch pressure (23). This pressure passes through the orifice and manual valve to the second clutch and second accumulator, consequently the vehicle will move as the engine power is transmitted.

The hydraulic pressure also flows to the first clutch. However no power will transmit by means of the one-way clutch.



NOTE: When used, "left" of "right" indicates direction on the flow chart.

(cont'd)

Description

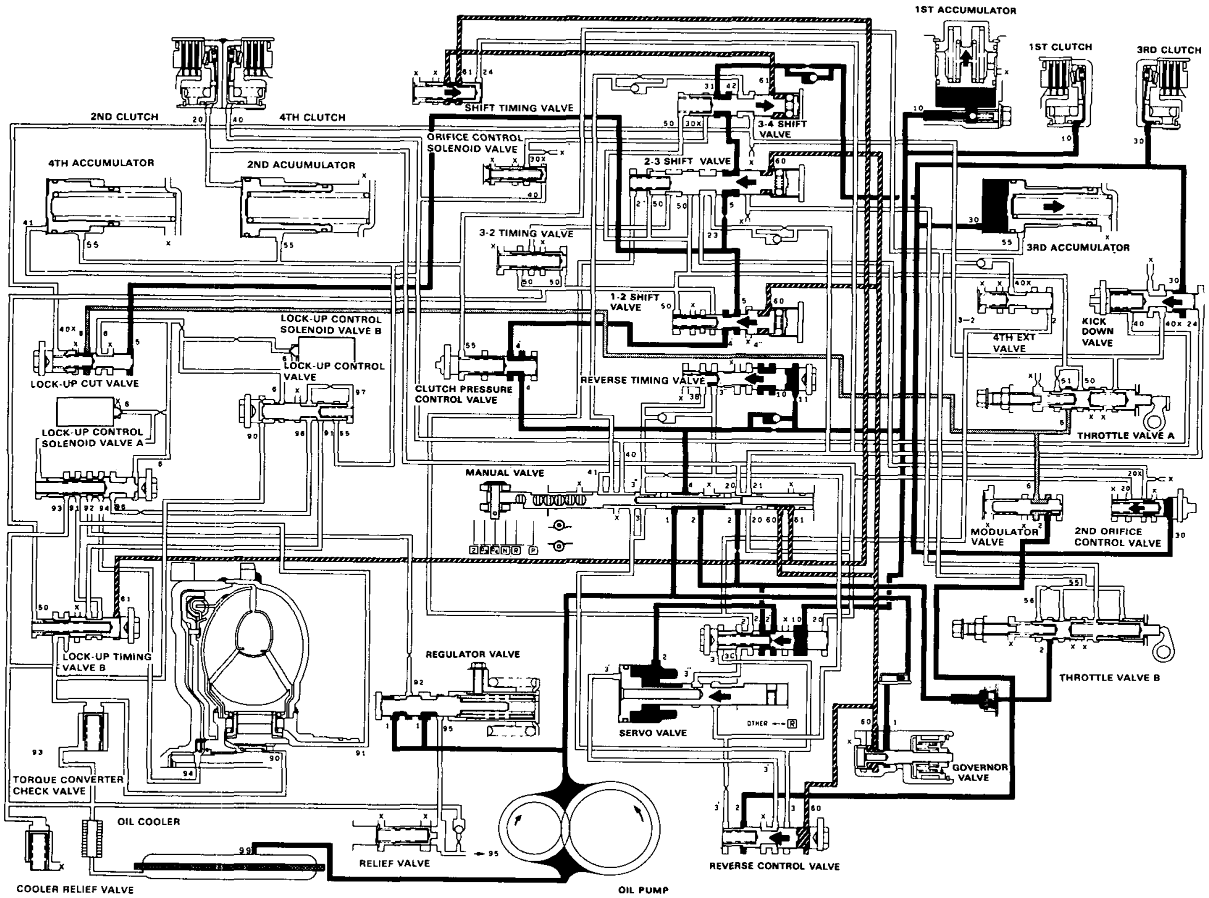
Hydraulic Flow D15B4/D16A9 (cont'd)

D3 or D4 Position

3. 3rd speed

The flow of fluid up to the 1-2 and 2-3 shift valve is the same as in second gear. When the vehicle speed reaches the prescribed value, the governer pressure increases. In the 2-3 shift valve, the governer pressure overcomes the throttle A pressure (50) and spring force combination. The 2-3 shift valve is moved to the left. The movement of the 2-3 shift valve causes hydraulic line pressure to be changed and the oil port leading to the second clutch is closed. The line pressure passes through the manual valve, clutch pressure control valve, 1-2 and 3-4 shift valves to the third clutch and third accumulator, consequently the vehicle will move as the engine power is transmitted.

The hydraulic pressure also flows to the first clutch. However no power will transmit by means of the one-way clutch as in second gear.



NOTE: When used, "left" of "right" indicates direction on the flow chart.

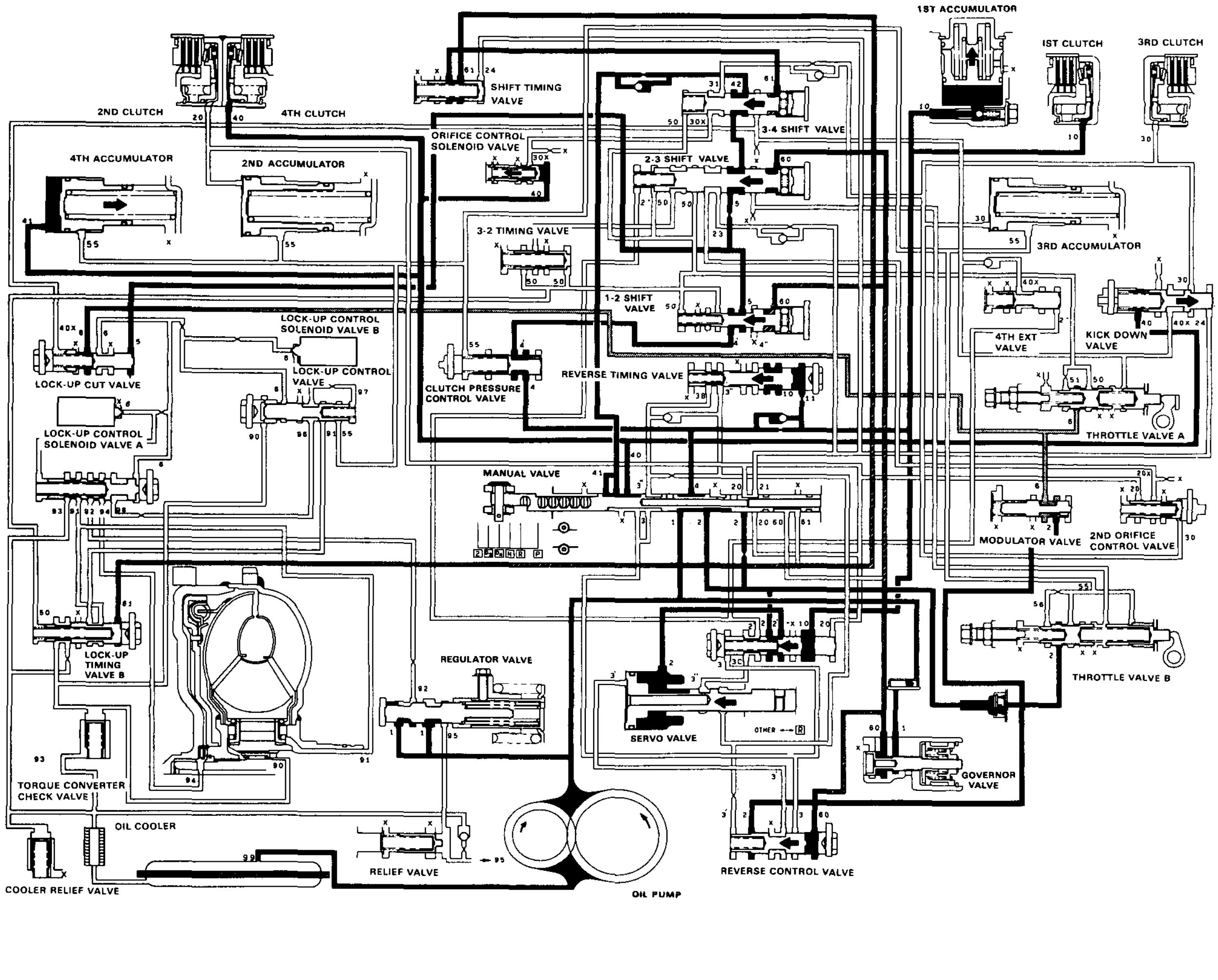
[D4] Position

4. 4th speed

The flow of fluid up to the 1-2, 2-3 and 3-4 shift valve is same as in the third gear.

The governer pressure is not directed by the manual valve and flows through the shift timig valve to the 3-4 shift valve. When the vehicle speed reaches the prescribed value, the governer pressure increases. In the 3-4 shift valve, the governer overcomes the throttle A pressure and spring force combination. The 3-4 shift valve is moved to the left. The pressure (61) movement of the 3-4 shift valve cause the hydraulic pressure line to be changed and the oil port leading to the third clutch is closed. The line pressure passes through the manual valve, clutch pressure control valve, 1-2 shift valve, 2-3 shift valve, 3-4 shift valve and manual valve to the fourth clutch and fourth accumulator, consequently the vehicle will move as the engine power is transmitted.

The hydraulic pressure also flows to the first clutch. However no power will transmit by means of the one-way clutch as in second and third gears.



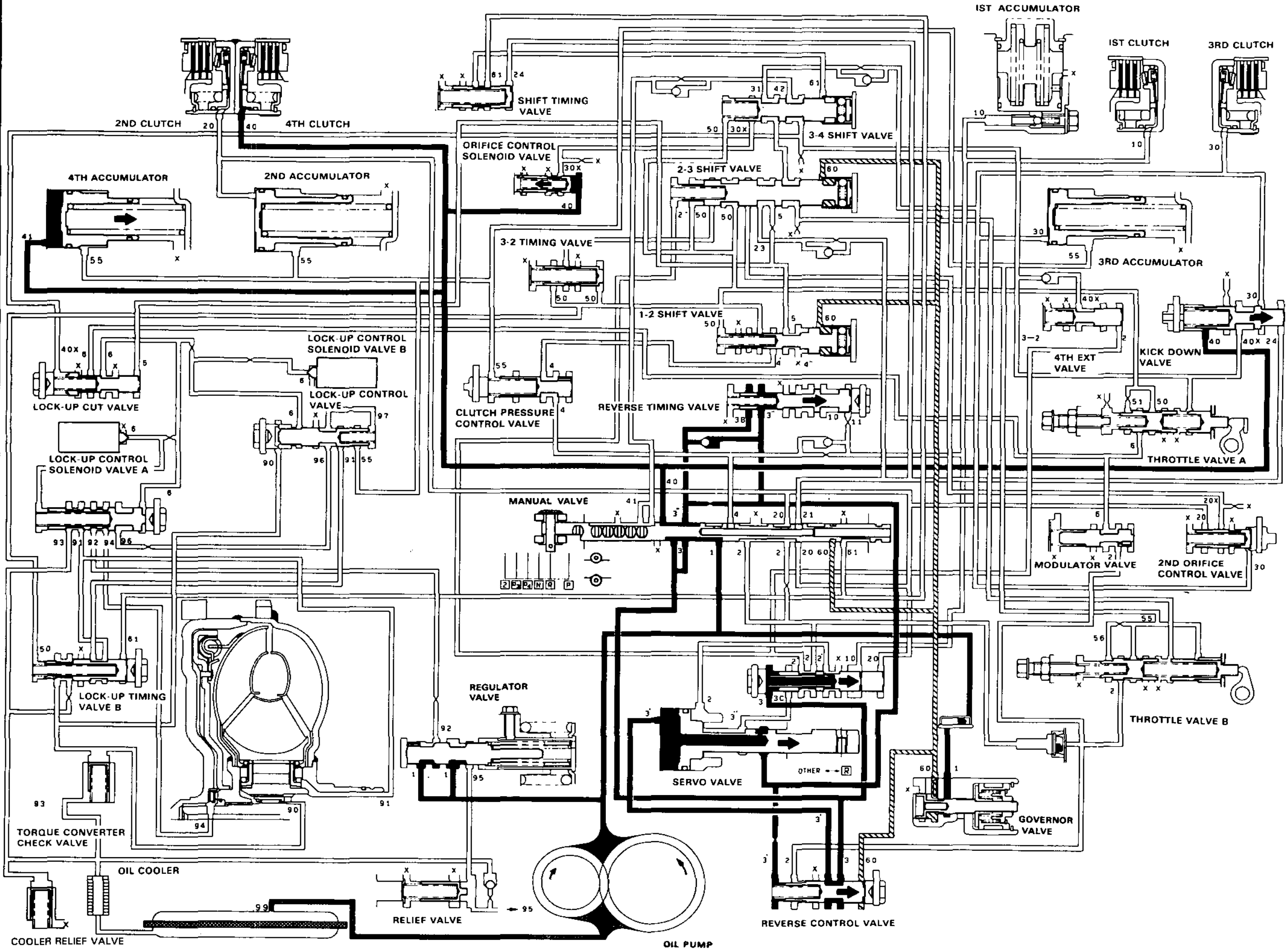
NOTE: When used, "left" of "right" indicates direction on the flow chart. (cont'd)

Description

Hydraulic Flow D15B4/D16A9 (cont'd)

[R] Position

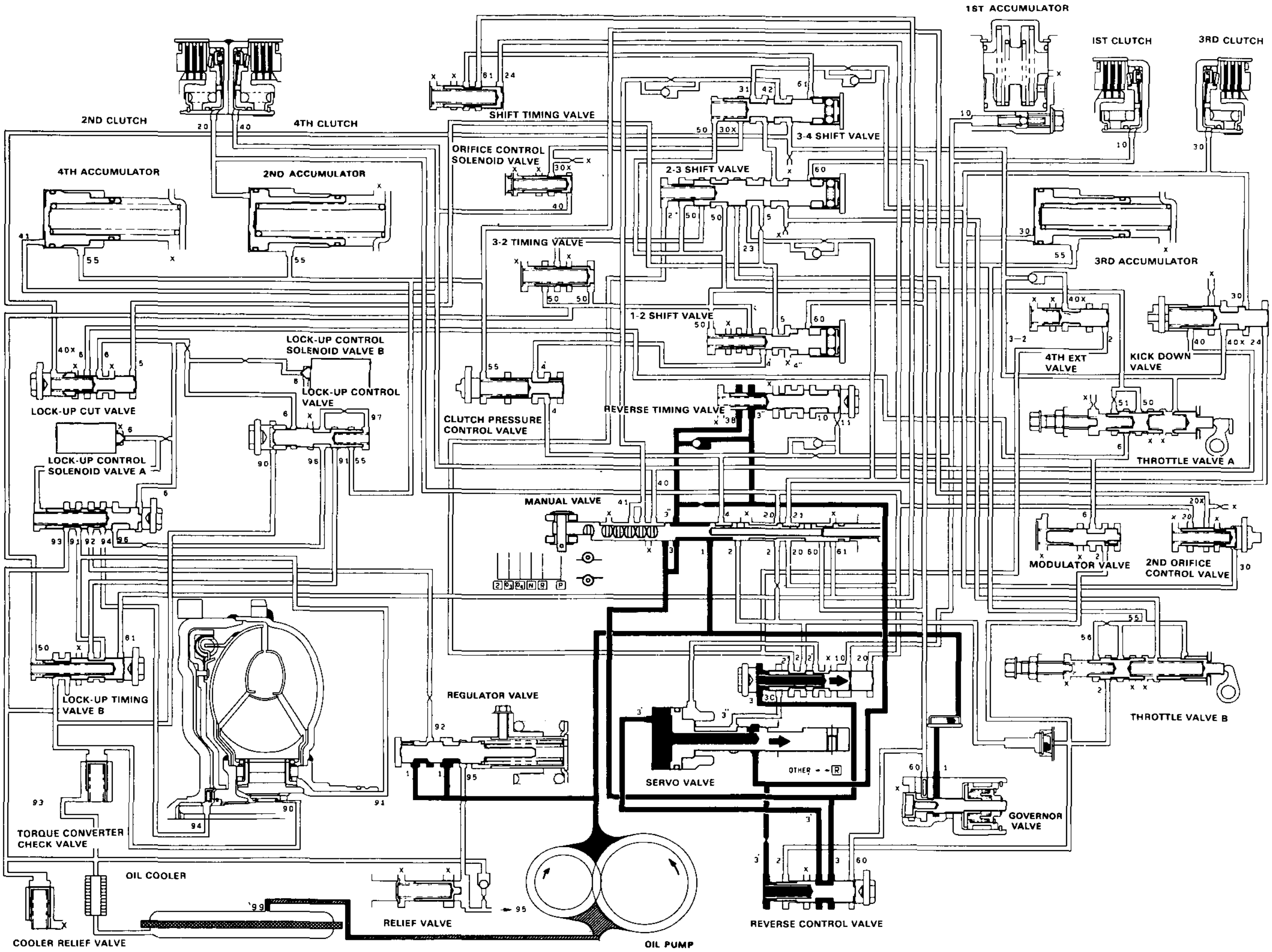
The flow of fluid through the torque converter circuit is the same as in the [N] position. The fluid (1) from the oil pump flows through the manual valve and becomes the line pressure (3). It passes through the reverse control valve to the servo valve, causing the shift fork shaft to be moved in the reverse direction. Also the fluid (3') flows through the manual valve to the fourth clutch; the power is transmitted through the fourth clutch.
When driving forward and at about 30 km/h and the gear shift lever is shifted to the [R] position, the governer pressure (60) moves the reverse control valve to the left. This results in cutting off the oil passage which has line pressure (3) and is directed to the servo valve. Even though the manual valve is set to the [R] position, the transmission will not shift into reverse gear.



NOTE: When used, "left" of "right" indicates direction on the flow chart.

[P] Position

The flow of fluid through the torque converter is the same as in the [N] position. The line pressure (1) becomes the line pressure (3) as it passes the manual valve. The line pressure (3) flows through the reverse control valve to the servo valve, causing the reverse shift fork to be moved to the reverse position same as in the [R] position. However, the hydraulic pressure is not supplied to the clutches. The power is not transmitted.



NOTE: When used, "left" of "right" indicates direction on the flow chart.

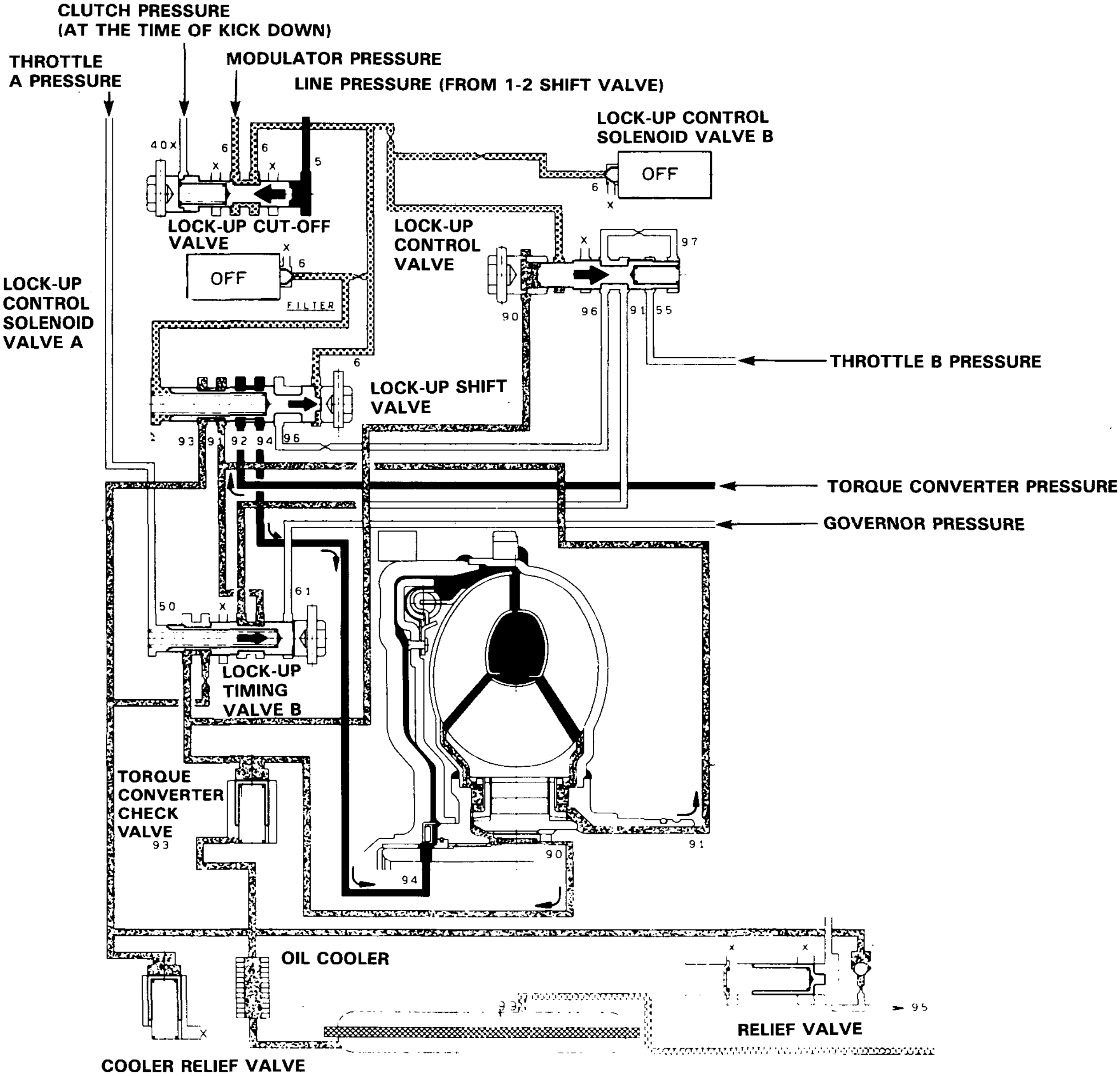
Description

Lock-up System D15B4/D16A9

Lock-UP Operation

1. No Lock-Up

The pressurized fluid regulated by the modulator works on both ends of the lock-up shift valve and on the left side of the lock-up control valve. Since, under this condition, the pressures working on both ends of the lock-up shift valve are equal, the shift valve is moved to the right by the tension of the valve spring alone. The fluid from the oil pump will flows through the left side of the lock-up clutch to the torque converter; i.e., the lock-up clutch is in OFF condition.



NOTE: When used, "left" or "right" indicates direction on the flow chart.

2. Partial Lock-Up

Lock-Up Control Solenoid Valave A: ON   Lock-up Control Solenoid Valve B: OFF

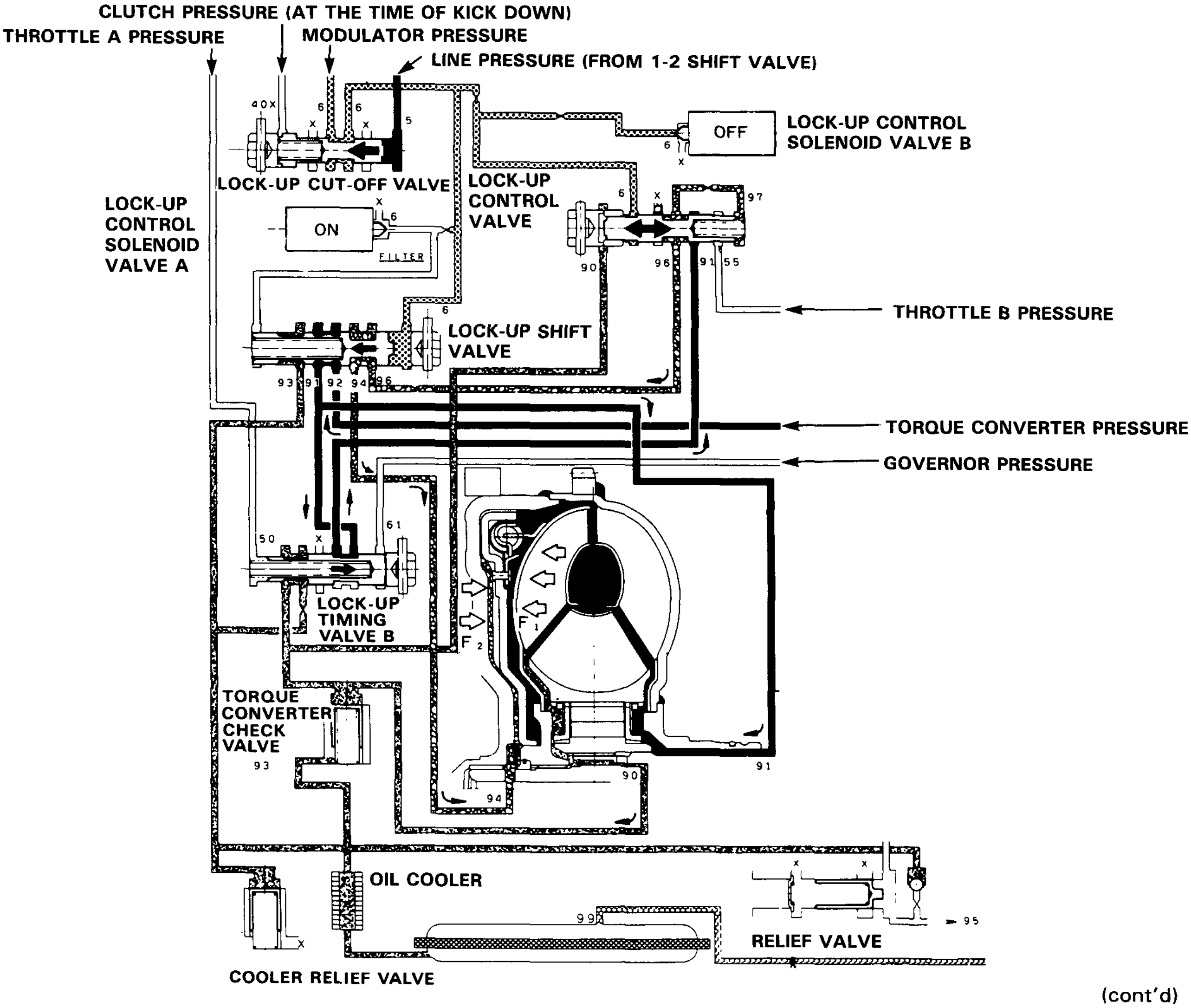
The ECU switches the solenoid valve A to ON to release the modulator pressure in the left cavity of the lock-up shift valve. The modulator pressure in the right cavity of the lock-up shift valve overcomes the spring force, thus the lock-up shift valve is moved to the left side.

The torque converter pressure is separated to the two passages:

Torque Converter Inner Pressure: entered into right side—to engage lock-up clutch

Torque Converter Back Pressure: entered into left side—to disengage lock-up clutch

The back pressure (F2) is regulated by the lock-up control valve, whereas the position of the lock-up timing valve B is determined by the governor pressure, tension of the valve spring and pressure regulated by the governor. Also the position of the lock-up control valve is determined by the throttle B pressure, back pressure of the lock-up control valve and torque converter pressure regulated by the check valve. In low speed range, the throttle B pressure working on the right side of the lock-up control valve is low, causing the valve to be moved to the right. With the lock-up control solenoid valve B kept off, the modulator pressure is maintained in the left end of the lock-up control valve; in other words, the lock-up control valve is moved byt slightly to the left side. This slight movement of the lock-up control valve causes the back pressure to be lowered slightly, resulting in partial.



(cont'd)

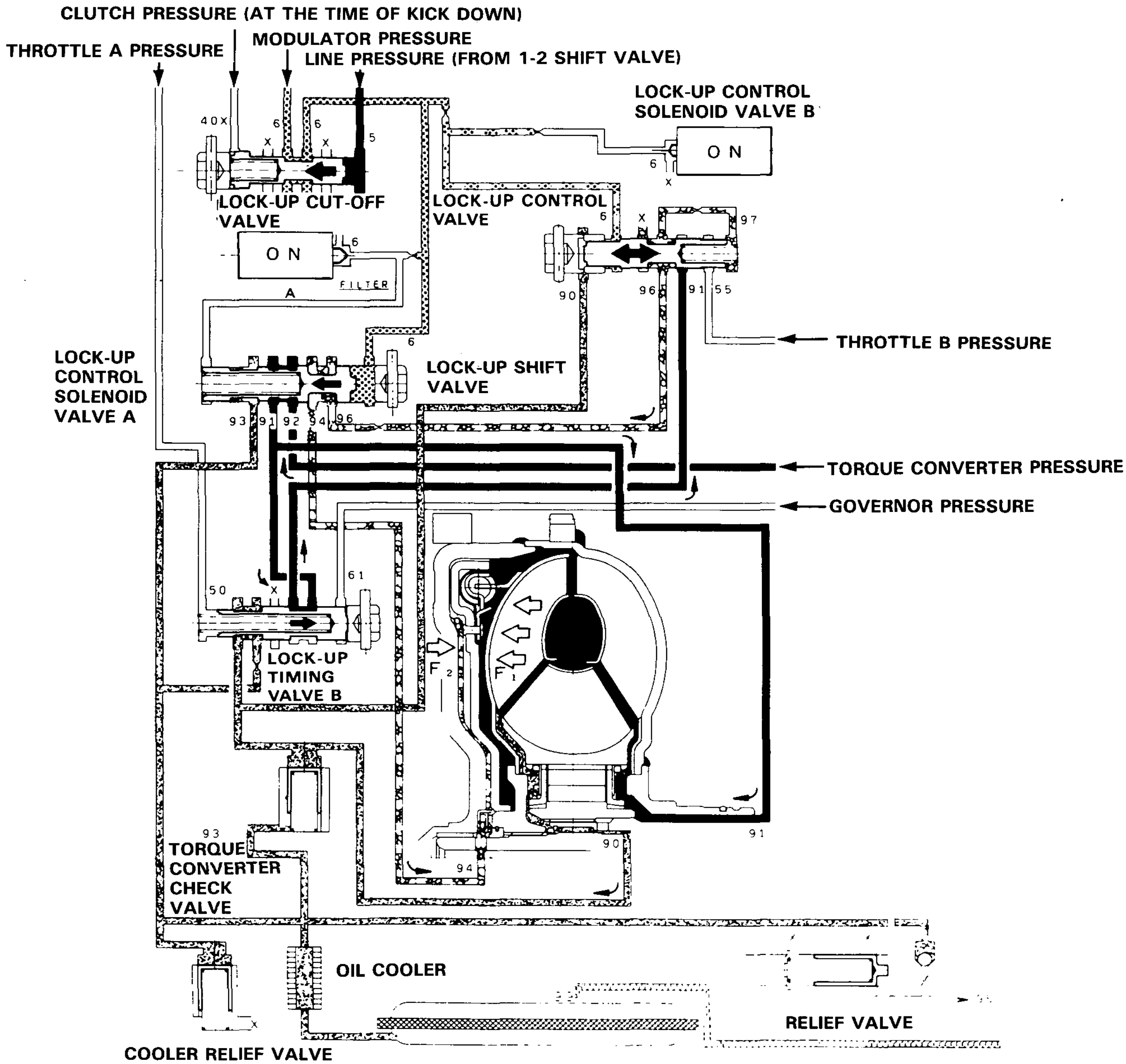
NOTE: When used, "left" or "right" indicates direction on the flowchart.

Description

Lock-up System D15B4/D16A9 (cont'd)

3. Half Lock-up
   Lock-up Control Solenoid Valve A: ON   Lock-up Control Solenoid Valve B: ON

The modulator pressure is released by the solenoid valve B, causing the modulator pressure in the left cavity of the lock-up control valve to lower.
Also, the throttle A pressure in the left cavity of the lock-up timing valve B is low. However the governor pressure is still low at this time, consequently the lock-up timing valve B is kept on the right side by the spring force.
With the lock-up control solenoid valve B turned ON, the lock-up control valve is moved somewhat to the left side, causing the back pressure (F2) to lower. This allows a greater amount of the fluid (F1) to work on the lock-up clutch so as to engage the clutch. The back pressure (F2) which still exists prevents the clutch from engaging fully.

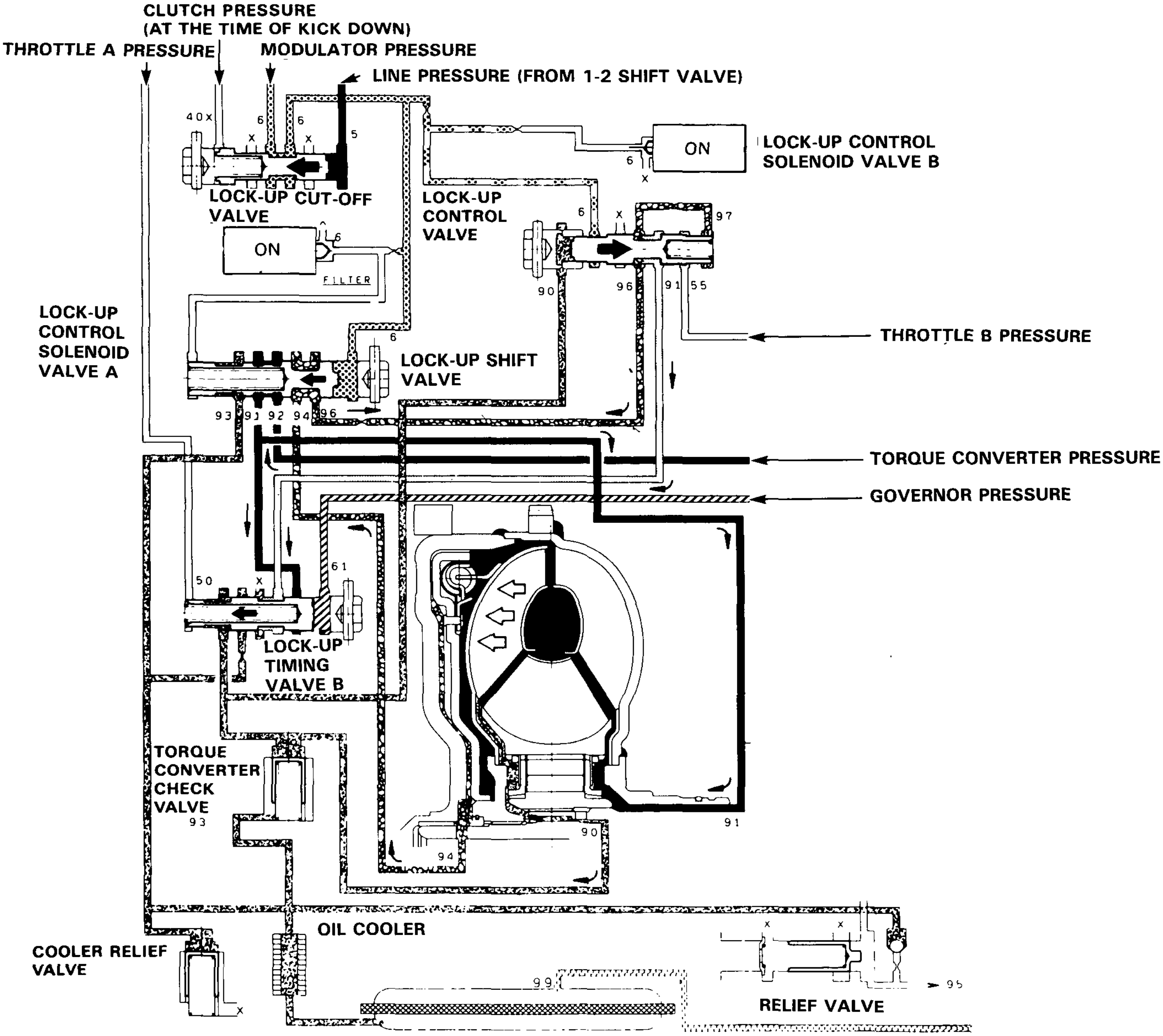


NOTE: When used, "left" or "right" indicates direction on the flowchart.

4. Full Lock-up

Lock-up Control Solenoid Valve A: ON   Lock-up Control Solenoid Valve B: ON

When the vehicle speed further increases, the governor pressure is increased.
The lock-up timing valve B overcomes the spring force and moves to the left side. Also this valve closes the oil port leading to the torque converter check valve.
Under this condition, the throttle B pressure working on the right end of the lock-up control valve becomes greater than that on the left end (modulator pressure in the left end has already been released by the solenoid valve B); i. e., the lock-up control valve is moved to the left. As this happens, the torque converter back pressure is released fully, causing the lock-up clutch to be engaged fully.



NOTE: When used, "left" or "right" indicates direction on the flowchart.

(cont'd)

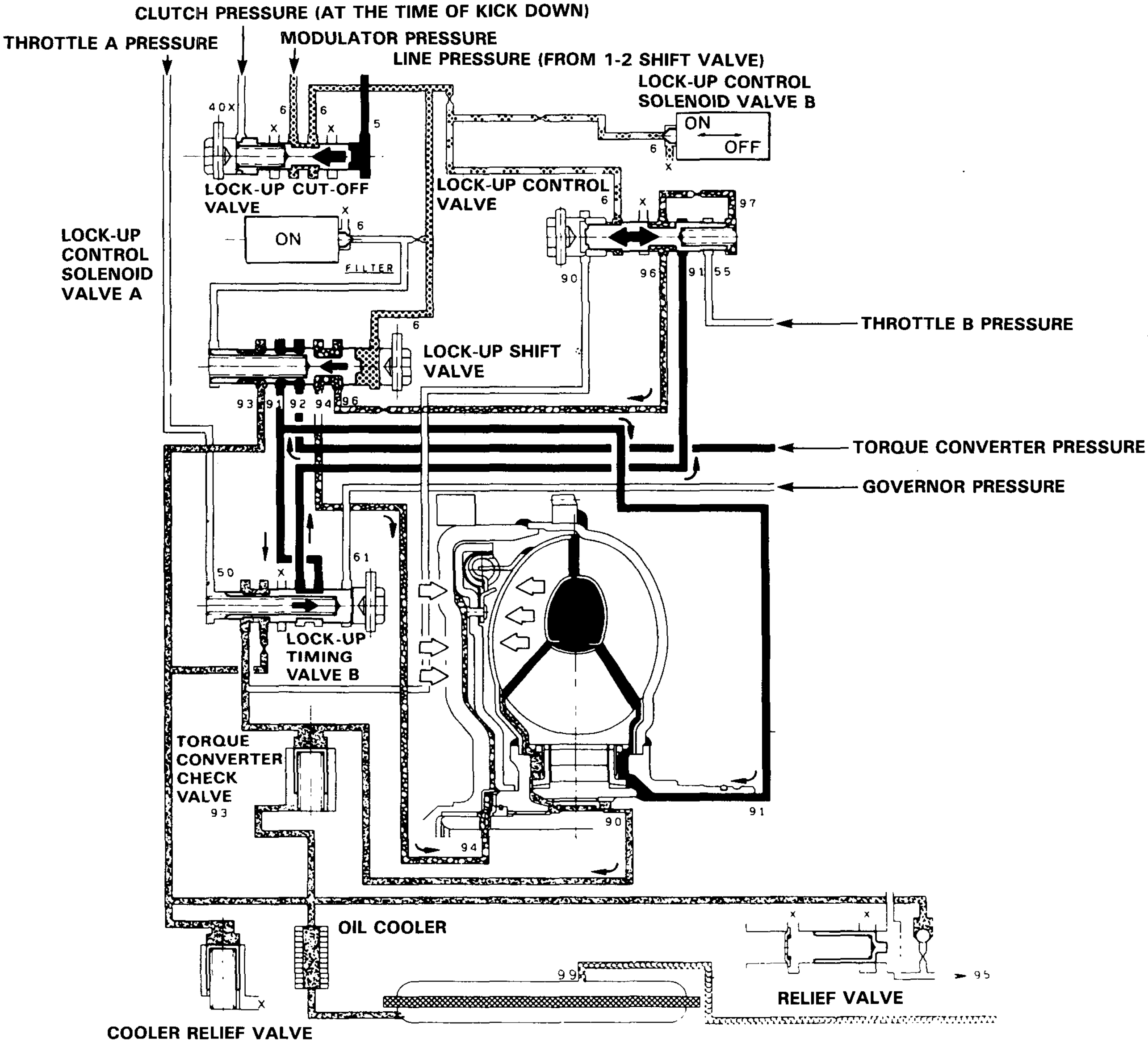
Description

Lock-up System D15B4/D16A9 (cont'd)

5. Deceleration Lock-Up

Lock-Up Control Solenoid Valve A: ON   Lock-Up Control Solenoid Valve B: Duty Operation (ON ↔ OFF)

The ECU switches the solenoid valve B to on and off alternately in high speed under certain condition. The slight lock-up and half lock-up regions are maintained so as to lock the torque converter properly.



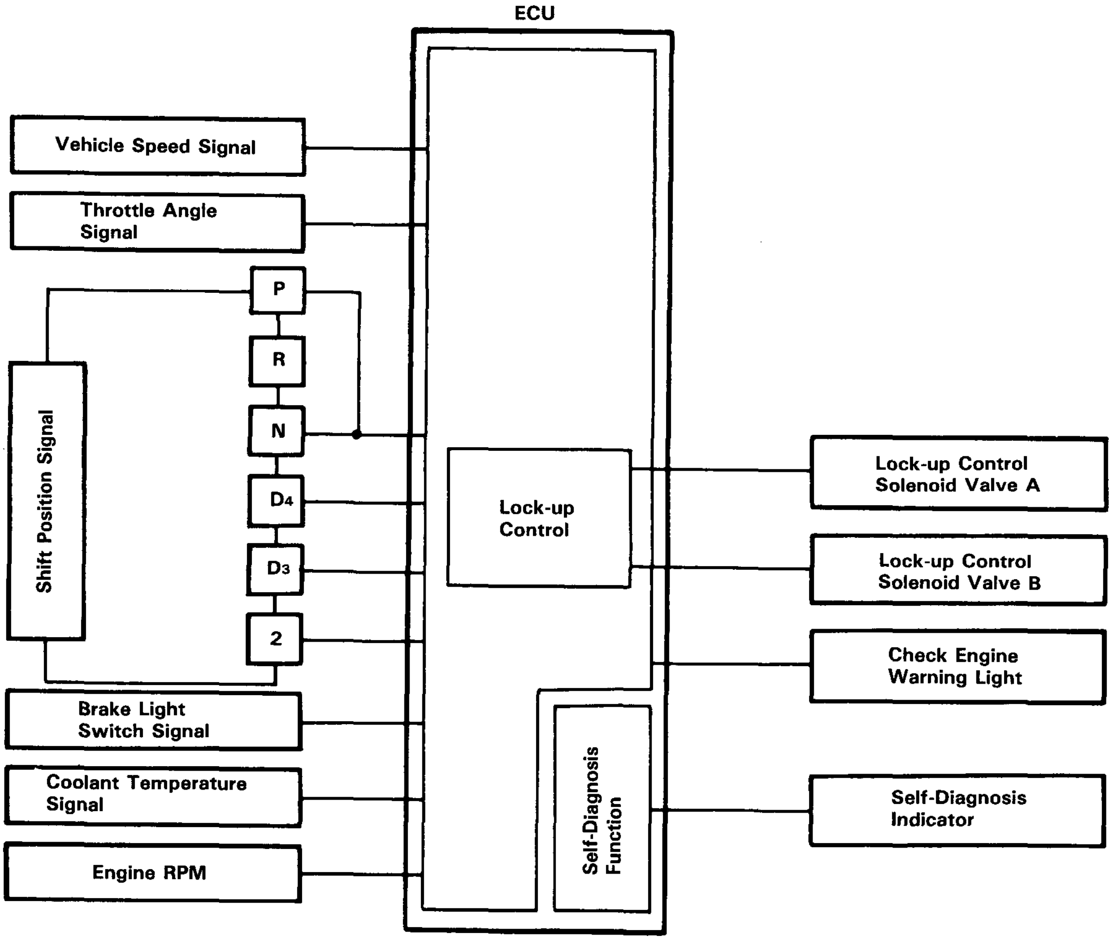
NOTE: When used, "left" or "right" indicates direction on the flow chart.

Electronic Lock-up Control System

The electronic lock-up control system consists of the ECU, sensors, and 2 solenoid valves. Lock-up is electronically controlled for comfortable driving under all conditions.
The ECU is located under the dashboard on the passenger's side.

Lock-up control
From sensor input signals, the ECU detects whether to turn the lock-up ON or OFF and activates lock-up control solenoid valve A and/or B accordingly.
The combination of driving signals to lock-up control solenoid valves A and B is shown in the table below.

Solenoid valve / Lock-up condition	A	B
Lock-up OFF	OFF	OFF
Lock-up, slight	ON	OFF
Lock-up, half	ON	ON
Lock-up, full	ON	ON
Lock-up during deceleration	ON	Duty operation OFF ⟷ ON



Electrical Troubleshooting D15B4/D16A9

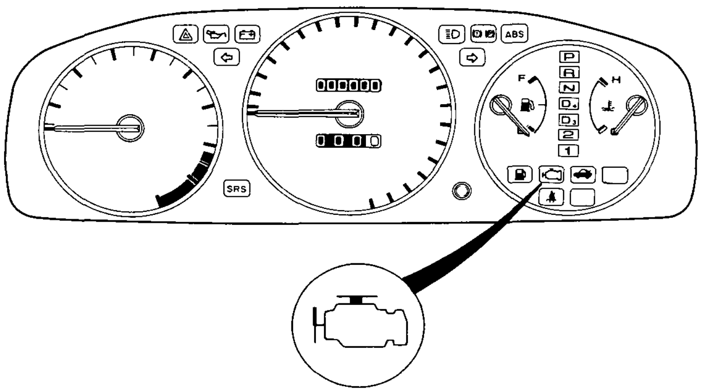
If the lock-up control system is suspected to be faulty, do the following:

1. Check the Check Engine Light (B16A9) or PGM-CARB control unit LED (D15B4).

   D16A9
   -1. If the Check Engine Light comes on, check and inspect PGM-FI system according to PGM-FI Troubleshooting (See Section 11).

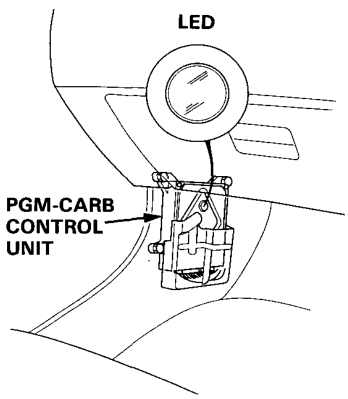
   D15B4
   -1. If the LED blinks, check and inspect PGM-CARB system according to PGM-CARB troubleshooting (See Section 11).

D16A9



CHECK ENGINE LIGHT

D15B4



2. D16A9: If the Check Engine Light does not come on or blink other than nineteen times;
   D15B4: If the LED does not blink other than eleven times;
   Check and inspect according to the Symptom-to-Component Chart (14-48 thru 51).

3. Check the lock-up control solenoid valve (14-47).

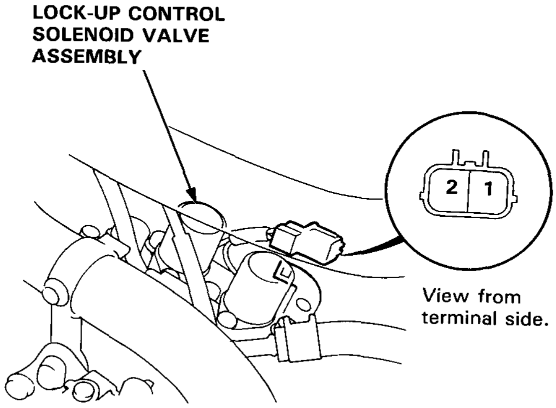
Lock-up Control Solenoid Valve A/B (D15B4/D16A9)

Test

NOTE: Lock-up control solenoid valves A and B must be removed/replaced as an assembly.

1. Disconnect the connector from the lock-up control solenoid valve A/B.
2. Measure the resistance between the No. 1 terminal (SOL. V A) of the lock-up control solenoid valve connector and body ground and between the No. 2 terminal (SOL. V B) and body ground.

   STANDARD: 14.1 — 15.5 Ω (at 25°C)



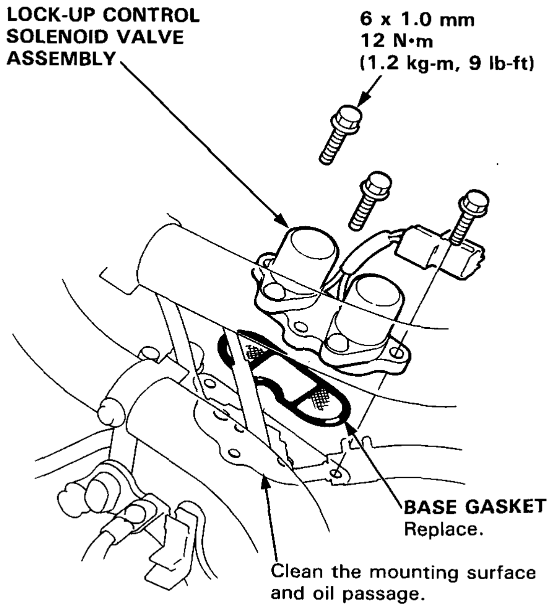
3. Replace the lock-up control solenoid valve assembly if the resistance is out of specification.
4. Connect the No. 1 terminal of the lock-up control solenoid valve connector to the battery positive terminal and body ground. A clicking sound should be heard. Connect the No. 2 terminal to the battery positive terminal and body ground.
   A clicking sound should be heard.
5. If not, check for continuity between the ECU A19 or A17 harness and body ground (See Section 11).
6. Replace the lock-up control solenoid valve assembly if there is continuity between the ECU A19 or A17 harness and body ground (See Section 11).

Replacement

1. Remove the mounting bolts and lock-up control solenoid valve assembly.

   NOTE: Be sure to remove or replace the lock-up control solenoid valves A and B as an assembly.

2. Check the lock-up control solenoid valve oil passages for dust or dirt and replace as an assembly, if necessary.



3. Clean the mounting surface and oil passages of the lock-up control solenoid valve assembly and install a new base gasket.
4. Check the connector for rust, dirt or oil and reconnect it securely.

Symptom-to-Component Chart

SYMPTOM	Check these items on the PROBABLE CAUSE LIST	Check these items on the NOTES CHART
Engine runs, but car does not move in any gear.	1, 6, 7, 16	K, L, R, S
Car moves in [R] and [2], but not in [D3] or [D4].	8, 29, 44, 48	C, M, O
Car moves in [D3], [D4], [R], but not in [2].	9, 30, 49	C, L
Car moves in [D3], [D4], [2], but not in [R].	1, 11, 22, 34, 38, 39, 40	C, L, Q
Car moves in [N].	1, 8, 9, 10, 11, 46, 47	C, D
Excessive idle vibration.	5, 17	B, K, L
Slips in all gears.	6, 7, 16	C, L, U
No engine braking in [2] position.	9	C, D, L
Slips in 1st gear.	8, 29, 44, 48	C, N, O, U
Slips in 2nd gear.	9, 20, 23, 30, 49	C, L, U
Slips in 3rd gear.	10, 21, 23, 31, 44	C, L, U
Slips in 4th gear.	11, 23, 32	C, L, U
Slips in reverse gear.	11, 32, 34	C
Flares on 1—2 upshift.	3, 15	E, L, V
Flares on 2—3 upshift.	3, 15, 24, 44	E, L, V
Flares on 3—4 upshift.	3, 15, 25, 44	E, L, V
No upshift, trans stays in low gear.	14, 19, 23	G, L
No downshift to low gear.	12, 19	G, L
Late upshift.	14	L, V
Erratic shifting.	2, 14, 26	V
Harsh shift (up and down shifting).	2, 4, 15, 23, 24, 27, 47	A, E, H, I, L, V
Harsh shift (1—2).	2, 9	C, D, V
Harsh shift (2—3).	2, 10, 23, 24	C, D, H, L, V
Harsh shift (3—4).	2, 11, 23, 25	C, D, I, L, V
Harsh kick-down shifts.	2, 23, 27, 28	L, V, Q
Harsh kick-down shift (2—1).	48	O
Harsh downshift at closed throttle.	15	E, T
Harsh shift when manually shifting to [1].	33	L
Axle(s) slips out of trans on turns.	43, 50	L, P, Q
Axle(s) stuck in trans.	43	L, Q
Ratcheting noise when shifting into [R].	6, 7, 38, 39, 40	K, L, Q
Loud popping noise when taking off in [R].	38, 39, 40	L, Q
Ratcheting noise when shifting from [R] to [P] or from [R] to [N].	38, 39, 40, 45	L, Q
Noise from trans in all selector lever positions.	6, 17	K, L, Q
Noise from trans only when wheels are rolling.	39, 42	L, Q
Gear whine, rpm related (pitch changes with shifts).	8, 13, 41	K, L, Q
Gear whine, speed related (pitch changes with speed).	38, 42	L, Q
Trans will not shift into 4th gear in [D4].	1, 21, 28, 32	L
Lock-up clutch does not lock up smoothly.	17, 36, 37	L
Lock-up clutch does not operate properly.	2, 3, 15, 18, 35, 36, 37	E, L, V
Transmission has multitude of problems shifting. At disassembly, large particles of metal are found on magnet.	43	L,Q

	PROBABLE CAUSE
1.	Shift cable broken/out of adjustment.
2.	Throttle cable too short.
3.	Throttle cable too long.
4.	Wrong type ATF.
5.	Idle rpm too low/high.
6.	Oil pump worn or binding.
7.	Rgulator valve stuck.
8.	1st clutch defective.
9.	2nd clutch defective.
10.	3rd clutch defective.
11.	4th clutch defective.
14.	Modulator valve stuck.
15.	Throttle B valve stuck.
16.	ATF strainer clogged.
17.	Torque convertor defective.
18.	Torque convertor check valve stuck.
19.	1—2 shift valve stuck.
20.	2—3 shift valve stuck.
21.	3—4 shift valve stuck.
22.	Servo control valve stuck.
23.	Clutch pressure control (CPC) valve stuck.
24.	2nd orifice control valve stuck.
25.	Orifice control valve stuck.
26.	3—2 kick-down valve stuck.
27.	4—3 kick-down valve stuck.
28.	4th exhaust valve stuck.
29.	1st accumulator defective.
30.	2nd accumulator defective.
31.	3rd accumulator defective.
32.	4th/reverse accumulator defective.
34.	Servo valve stuck.
35.	Lock-up timing valve stuck.
36.	Lock-up shift valve stuck.
37.	Lock-up control valve stuck.
38.	Shift fork bent.
39.	Reverse gears worn/damaged (3 gears).
40.	Reverse selector worn.
41.	3rd gears worn/damaged (2 gears).
42.	Final gears worn/damaged (2 gears).
43.	Differential pinion shaft worn.
44.	Feedpipe O-ring broken.
45.	4th gears worn/damaged (2 gears).
46.	Gear clearance incorrect.
47.	Clutch clearance incorrect.
48.	One-way (sprag) clutch defective.
49.	Sealing rings/guide worn.
50.	Axle-inboard joint clip missing.

(cont'd)

Symptom-to-Component Chart (cont'd)

The following symptoms can be caused by improper repair or assembly.	Check these items on the PROBABLE CAUSE DUE TO IMPROPER REPAIR	Items on the NOTES CHART
Car creeps in [N].	R1, R2	
Car does not move in [D3] or [D4].	R4	
Trans locks up in [R].	R3, R12	
Excessive drag in trans.	R6	R, K
Excessive vibration, rpm related.	R7	
Noise with wheels moving only.	R5	
Main seal pops out.	R8	S
Various shifting problems.	R9, R10	
Harsh upshifts.	R11	

PROBABLE CAUSE DUE TO IMPROPER REPAIR	
R1.	Improper clutch clearance.
R2.	Improper gear clearance.
R3.	Parking brake lever installed upside down.
R4.	One-way (sprag) clutch installed upside down.
R5.	Reverse selector hub installed upside down.
R6.	Oil pump binding.
R7.	Torque converter not fully seated in oil pump.
R8.	Main seal improperly installed.
R9.	Springs improperly installed.
R10.	Valves improperly installed.
R11.	Ball check valves not installed.
R12.	Shift fork bolt not installed.

NOTES	
B.	Set idle rpm in gear to specified idle speed. If still no good, adjust motor mounts as outlined in engine section of service manual.
C.	If the large clutch piston O-ring is broken, inspect the piston groove for rough machining.
D.	If the clutch pack is seized or is excessively worn, inspect the other clutches for wear and check the orifice control valves and throttle valves for free movement.
E.	If throttle valve B is stuck, inspect the clutches for wear.
G.	If the 1—2 shift valve is stuck closed, the transmission will not upshift. If stuck open, the transmission has no 1st gear.
H.	If the 2—3 orifice control valve is stuck, inspect the 2nd and 3rd clutch packs for wear.
I.	If the 2/3-4 orifice control valve is stuck, inspect the 3rd and 4th clutch packs for wear.
J.	If the clutch pressure control valve (CPC) is stuck closed, the transmission will not shift out of 1st gear.
K.	Improper alignment of main valve body and torque convertor housing may cause oil pump seizure. The symptoms are mostly an rpm-related ticking noise or a high pitched squeek.
L.	If the oil screen is clogged with particles of steel or aluminum, inspect the oil pump and differential pinion shaft. If both are OK and no cause for the contamination is found, replace the torque converter.
M.	If the 1st clutch feedpipe guide in the R. side cover is scored by the mainshaft, inspect the ball bearing for excessive movement in the transmission housing. If OK, replace the R. side cover as it is dented. The O-ring under the guide is probably worn.
N.	Replace the mainshaft if the bushings for the 1st and 4th feedpipe are loose or damaged. If the 1st feedpipe is damaged or out of round, replace it. If the 4th feedpipe is damaged or out of round, replace the R. side cover.
O.	A worn or damaged one-way (sprag) clutch is mostly a result of shifting the trans in $\boxed{D_3}$ or $\boxed{D_4}$ while the wheels rotate in reverse, such as rocking the car in snow.
P.	Inspect the frame for collision damage.
Q.	Inspect for damage or wear: 1. Reverse selector gear teeth chamfers. 2. Engagement teeth chamfers of countershaft 4th and reverse gear. 3. Shift fork for scuff marks in center. 4. Differential pinion shaft for wear under pinion gears. 5. Bottom of 3rd clutch for swirl marks. Replace items 1, 2, and 4 if worn or damaged. If trans makes clicking, grinding or whirring noise, also replace mainshaft 4th gear and reverse idler gear and countershaft 4th gear in addition to 1, 2, 3 or 4. If differential pinion shaft is worn, overhaul differential assembly and replace oil screen and thoroughly clean trans, flush torque converter, cooler and lines. If bottom of 3rd clutch is swirled and trans makes gear noise, replace the countershaft and ring gear.
R.	Be very careful not to damage the torque converter housing when replacing the main ball bearing. You may also damage the oil pump when you torque down the main valve body. This will result in oil pump seizure if not detected. Use proper tools.
S.	Install the main seal flush with the torque converter housing. If you push it into the torque converter housing until it bottoms out, it will block the oil return passage and result in damage.
T.	Harsh downshifts when coasting to a stop with zero throttle may be caused by a bent-in throttle valve retainer/cam stopper. Throttle cable adjustment may clear this problem.
U.	Check if separator plate is installed. If it was not installed, the servo valve may have been pushed out by hydraulic pressure causing a leak (internal) affecting all forward gears.
V.	Throttle cable adjustment is essential for proper operation of the transmission. Not only does it affect the shift points if misadjusted, but also the shift quality and lock-up clutch operation. A too long adjusted cable will result in throttle pressure being too low for the amount of engine torque input into the transmission and may cause clutch slippage. A too short adjusted cable will result in too high throttle pressures which may cause harsh shifts, erratic shifts and torque converter hunting.

NOTE: Warm up the engine to operating temperature.

1. Apply parking brake and block the wheels. Start the engine, then move the selector lever to $\boxed{D_4}$ position while depressing the brake pedal. Depress the accelerator pedal, and release it suddenly. Engine should not stall.
2. Repeat same test in $\boxed{D_3}$ positon.
3. Shift the selector lever to $\boxed{D_4}$ position and check that the shift points occur at approximate speeds shown. Also check for abnormal noise and clutch slippage.

D12B1 and D15B3 engine: $\boxed{D_4}$ or $\boxed{D_3}$ Position

- **Upshift**

Throttle opening	Unit of speed	1st → 2nd	2nd → 3rd	3rd → 4th
1/8 throttle	km/h	17-19	32-38	49-55
	mph	11-12	20-23	31-34
4/8 throttle	km/h	29-37	58-70	93-105
	mph	18-23	36-44	58-65
Full-opened throttle	km/h	53-58	98-105	151-158
	mph	33-36	61-65	94-98

- **Downshift**

Throttle opening	Unit of speed	4th → 3rd	3rd → 2nd	2nd → 1st
Full-closed throttle	km/h	——	16-18	10-11
	mph	——	10-11	6-7
Full-opened throttle	km/h	132-140	85-93	43-47
	mph	82-87	53-58	27-29

- **Lock-up: $\boxed{D_4}$ Position**

Throttle opening	Unit of speed	Lock-up ON
1/8 throttle	km/h	47-55
	mph	29-34
Full-opened throttle	km/h	150-157
	mph	93-98

D15B4 engine: $\boxed{D_4}$ or $\boxed{D_3}$ Position

- **Upshift**

Throttle opening	Unit of speed	1st → 2nd	2nd → 3rd	3rd → 4th
1/8 throttle	km/h	17-19	32-38	49-55
	mph	11-12	20-23	31-34
4/8 throttle	km/h	27-35	57-69	91-103
	mph	17-22	35-43	57-64
Full-opened throttle	km/h	53-58	102-109	156-163
	mph	33-36	63-68	97-101

- **Downshift**

Throttle opening	Unit of speed	4th → 3rd	3rd → 2nd	2nd → 1st
Full-closed throttle	km/h	——	16-18	10-11
	mph	——	10-11	6-7
Full-opened throttle	km/h	138-146	89-97	43-47
	mph	86-91	55-60	27-29

- **Lock-up: $\boxed{D_4}$ Position**

Throttle opening	Unit of speed	Lock-up ON
1/8 throttle	km/h	69-75
	mph	43-47
Full-opened throttle	km/h	143-150
	mph	89-93

(cont'd)

D16A9 engine: D4 or D3 Position

- **Upshift**

Throttle opening	Unit of speed	1st → 2nd	2nd → 3rd	3rd → 4th
1/8 throttle	km/h	17-19	33-38	49-55
	mph	11-12	20-23	31-34
4/8 throttle	km/h	31-39	61-73	93-105
	mph	19-24	38-45	58-65
Full-opened throttle	km/h	58-63	111-118	156-164
	mph	36-39	69-73	97-102

- **Downshift**

Throttle opening	Unit of speed	4th → 3rd	3rd → 2nd	2nd → 1st
Full-closed throttle	km/h	——	16-18	10-11
	mph	——	10-11	6-7
Full-opened throttle	km/h	138-146	99-107	42-46
	mph	86-91	62-66	26-29

- **Lock-up: D4 Position**

Throttle opening	Unit of speed	Lock-up ON
1/8 throttle	km/h	69-75
	mph	43-47
Full-opened throttle	km/h	140-147
	mph	87-91

4. Accelerate to about 35 mph (57 km/h) so the transmission is in 4th, then shift D4 to 2. The car should immediately begin slowing down from engine braking.

   CAUTION: Do not shift from D4 or D3 to 2 at speeds over 62.5 mph (100 km/h); you may damage the transmission.

5. Check for abnormal noise and clutch slippage in the following positions.

   2 (2nd Gear) Position
   —1. Accelerate from a stop at full throttle. Check that there is no abnormal noise or clutch slippage.
   —2. Upshifts and downshifts should not occur with the selector in this position.

   R (Reverse) Position
   Accelerate from a stop at full throttle, and check for abnormal noise and clutch slippage.

6. Test in P (Parking) Position
   Park car on slope (approx. 16°), apply the parking brake, and shift into P position. Release the brake; the car should not move.

Stall Speed

Test

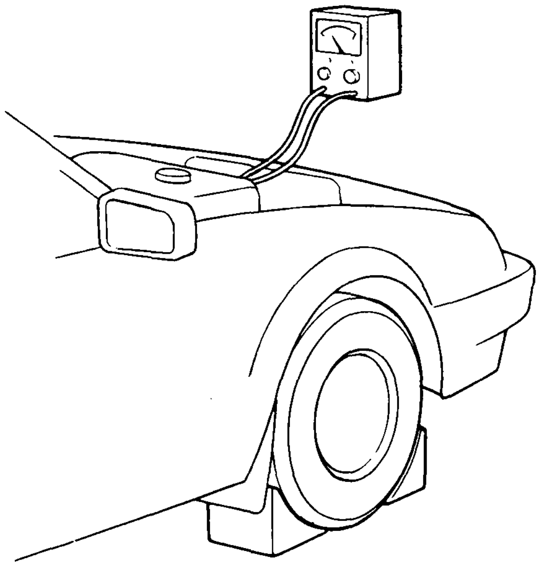
CAUTION:
- **To prevent transmission damage, do not test stall speed for more than 10 seconds at a time.**
- **Do not shift the lever while rising the engine speed.**
- **Be sure to remove the pressure gauge before testing stall speed.**

1. Engage parking brake and block the front wheels.
2. Connect the tachometer, and start the engine.
3. After the engine has warmed up to normal operating temperature, shift into [D3].
4. Fully depress the brake pedal and accelerator for 6 to 8 seconds, and note engine speed.
5. Allow 2 minutes for cooling, then repeat same test in [D4], [2], and [R].

NOTE: Stall speed in [D3], [D4], [2] and [R] must be the same, and must also be within limits.

Stall Speed RPM:
Specification: 2,750 rpm
Service Limit: 2,300–2,900 rpm

TROUBLE	PROBABLE CAUSE
Stall rpm high in [2], [D3], [D4], and [R]	• Low fluid level or oil pump output. • Clogged oil strainer. • Pressure regulator valve stuck closed. • Slipping clutch
Stall rpm high in [D3] and [D4] only	• Slippage of 1st clutch
Stall rpm low in [2], [D3], [D4], and [R]	• Engine output low, throttle cable misadjusted. • Oil pump seized. • Torque converter one-way clutch slipping.



Pressure Testing

⚠WARNING

- **While testing, be careful of the rotating front wheels.**
- **Make sure lifts, jacks, and safety stands are placed properly. (see page 1-6 thru 1-8).**

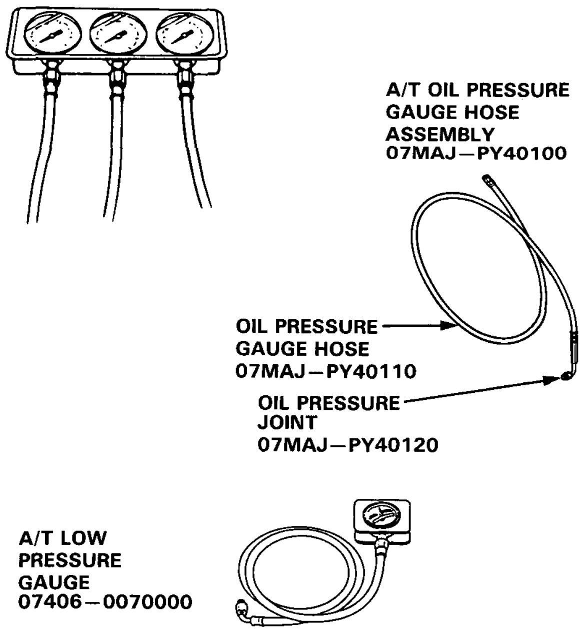
CAUTION:

- **Before testing, be sure the transmission fluid is filled to the proper level.**
- **Warm up the engine before testing.**

1. Raise the car. (see page 1-6).
2. Warm up the engine, then stop the engine and connect a tachometer.
3. Connect the oil pressure gauge to each inspection hole(s).

   TORQUE: 18 N·m (1.8 kg-m, 12 lb-ft)

   CAUTION: Connect the oil pressure gauge securely, be sure not to allow dust and other foreign particles to enter the inspection hole.



NOTE: Use the A/T Oil Pressure Gauge Set or A/T Low Pressure Gauge replacing the oil pressure gauge hose assembly. The A/T Oil Pressure Gauge Hose (07406—0020201) may also be used.

4. Start the engine and measure the respective pressure as follows.
   - Line Pressure
   - Clutch Pressure
   - Clutch Low/High Pressure
   - Throttle A/Throttle B Pressure
   - Governor Pressure
5. Install a new washer and the sealing bolt in the inspection hole and tighten to the secified torque.

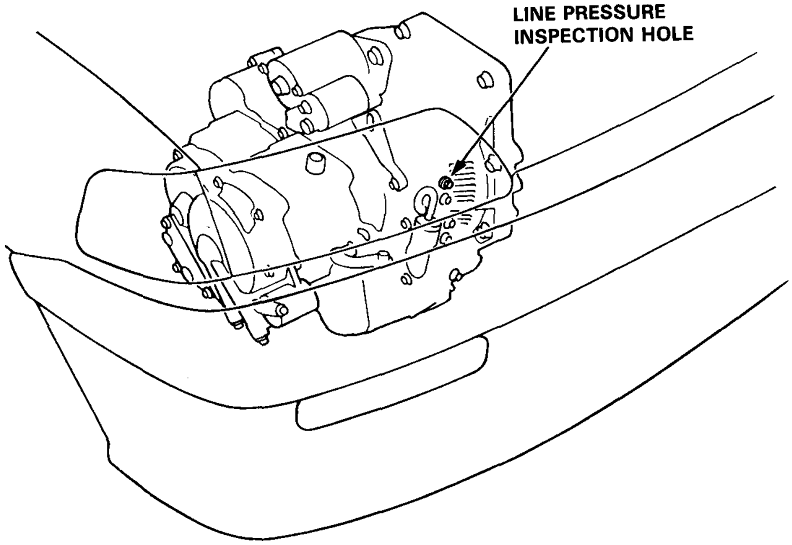
   TORQUE: 18 N·m (1.8 kg-m, 12 lb-ft)

   NOTE: Do not reuse old aluminum washers.

- **Line Pressure Measurement**

NOTE: Higher pressures may be indicated if measurements are made in selector positions other than [N] or [P].

—1. Set the parking brake and block both rear wheels securely.
—2. Run the engine at 2,000 rpm.
—3. Shift the select lever to [N] or [P].
—4. Measure line pressure.



- **D12B1**

PRESSURE	SELECTOR POSITION	SYMPTOM	PROBABLE CAUSE	FLUID PRESSURE	
				Standard	Service Limit
Line	[N] or [P]	No (or low) Line pressure	Torque converter, oil pump pressure regulator, torque converter check valve, oil pump.	800—850 kPa (8.0—8.5 kg/cm^2, 114—121 psi)	750 kPa (7.5 kg/cm^2, 107 psi)

- **D15B3, D15B4 and D16A9**

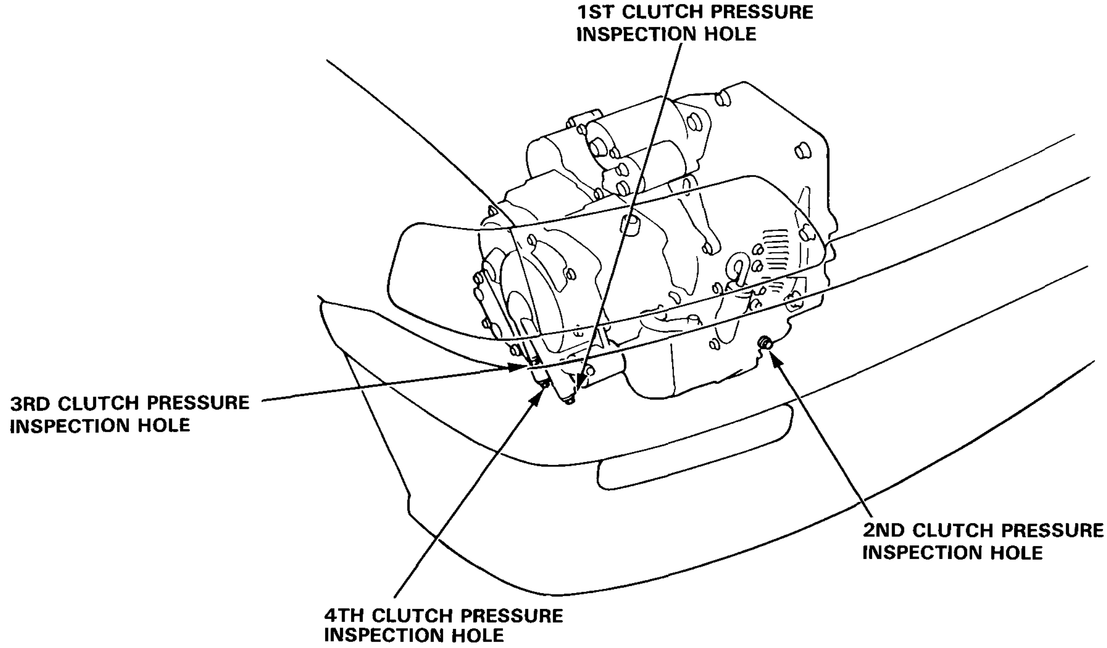
PRESSURE	SELECTOR POSITION	SYMPTOM	PROBABLE CAUSE	FLUID PRESSURE	
				Standard	Service Limit
Line	[N] or [P]	No (or low) Line pressure	Torque converter, oil pump pressure regulator, torque converter check valve, oil pump.	850—900 kPa (8.5—9.0 kg/cm^2, 121—128 psi)	800 kPa (8.0 kg/cm^2, 114 psi)

(cont'd)

- **Clutch Pressure Measurement**

⚠WARNING While testing, be careful of the rotating front wheels.

—1. Set the parking brake and block both rear wheels securely.
—2. Raise the front of the car and support with safety stands.
—3. Allow the front wheels to rotate freely.
—4. Run the engine at 2,000 rpm.
—5. Measure each clutch pressure.



• **D12B1**

PRESSURE	SELECTOR POSITION	SYMPTOM	PROBABLE CAUSE	FLUID PRESSURE	
				Standard	Service Limit
1st Clutch	D3 or D4	No or low 1st pressure	1st Clutch	800–850 kPa (8.0–8.5 kg/cm², 114–121 psi)	750 kPa (7.5 kg/cm², 107 psi)
2nd Clutch (2nd hold)	2	No or low 2nd pressure	2nd Clutch	800–850 kPa (8.0–8.5 kg/cm², 114–121 psi)	750 kPa (7.5 kg/cm², 107 psi)
2nd Clutch	D3 or D4	No or low 2nd pressure	2nd Clutch	420 kPa (4.2 kg/cm², 60 psi) (throttle control lever fully closed) 800–850 kPa (8.0–8.5 kg/cm², 114–121 psi) (throttle open more than 1/4)	370 kPa (3.7 kg/cm², 53 psi) (throttle control lever fully closed) 750 kPa (7.5 kg/cm², 107 psi) (throttle open more than 1/4)
3rd Clutch	D3	No or low 3rd pressure	3rd Clutch		
4th Clutch	D4	No or low 4th pressure	4th Clutch		
	R		Servo valve or 4th Clutch	800–850 kPa (8.0–8.5 kg/cm², 114–121 psi)	750 kPa (7.5 kg/cm², 107 psi)

• **D15B3, D15B4 and D16A9**

PRESSURE	SELECTOR POSITION	SYMPTOM	PROBABLE CAUSE	FLUID PRESSURE	
				Standard	Service Limit
1st Clutch	D3 or D4	No or low 1st pressure	1st Clutch	850–900 kPa (8.5–9.0 kg/cm², 121–128 psi)	800 kPa (8.0 kg/cm², 114 psi)
2nd Clutch (2nd hold)	2	No or low 2nd pressure	2nd Clutch	850–900 kPa (8.5–9.0 kg/cm², 121–128 psi)	800 kPa (8.0 kg/cm², 114 psi)
2nd Clutch	D3 or D4	No or low 2nd pressure	2nd Clutch	420 kPa (4.2 kg/cm², 60 psi) (throttle control lever fully closed) 850–900 kPa (8.5–9.0 kg/cm², 121–128 psi) (throttle open more than 1/4)	370 kPa (3.7 kg/cm², 53 psi) (throttle control lever fully closed) 800 kPa (8.0 kg/cm², 114 psi) (throttle open more than 1/4)
3rd Clutch	D3	No or low 3rd pressure	3rd Clutch		
4th Clutch	D4	No or low 4th pressure	4th Clutch		
	R		Servo valve or 4th Clutch	850–900 kPa (8.5–9.0 kg/cm², 121–128 psi)	800 kPa (8.0 kg/cm², 114 psi)

(cont'd)

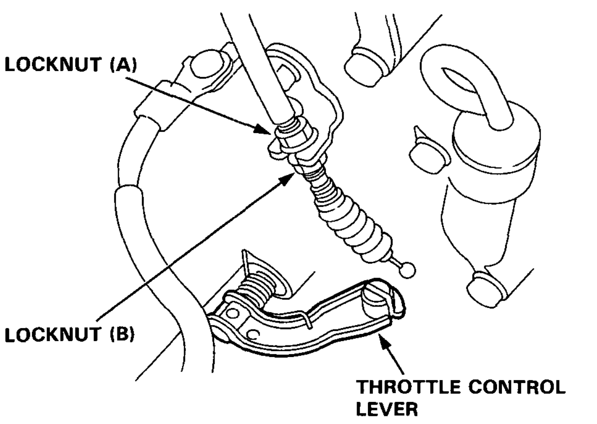
- **Clutch Low/High Pressure Measurement**

⚠WARNING While testing, be careful of the rotating front wheels.

—1. Allow the front wheels to rotate freely.

—2. Remove the cable end of the throttle control cable from the throttle control lever.

NOTE: Do not loosen the locknuts, simply unhook the cable end.

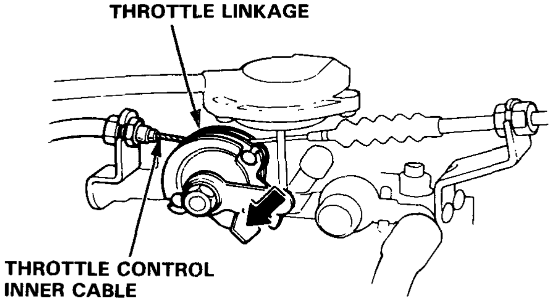


—3. Start the engine and let it idle.

—4. Shift the select lever to $\boxed{D_4}$ position.

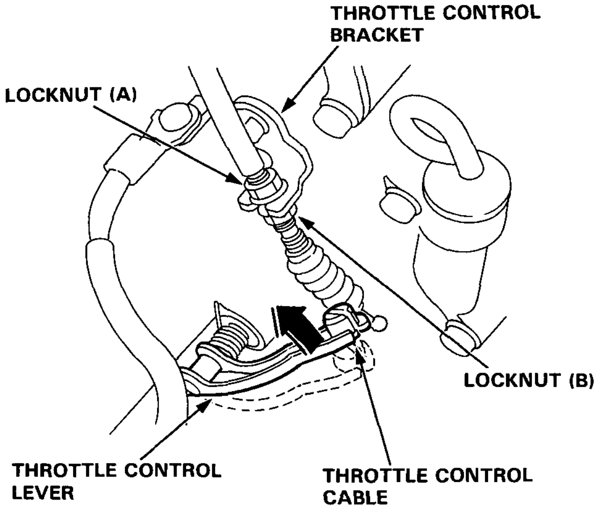
—5. Slowly move the throttle linkage to increase engine rpm until pressure is indicated on the oil pressure gauge. Then release the throttle linkage, allowing engine return to an idle, and measure the pressure reading.

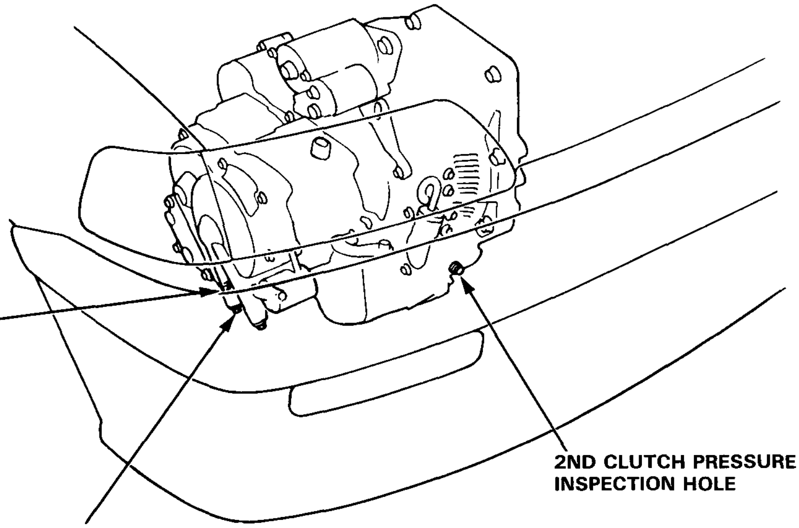
—6. Repeat step —5. for each clutch pressure being inspected.



—7. With the engine idling, lift the throttle control lever up approximately 1/2 of its possible travel and increase the engine rpm until pressure is indicated on the oil pressure gauge, then measure the highest pressure reading obtained.

—8. Repeat step —7. for each clutch pressure being inspected.





• **D12B1**

PRESSURE	SELECTOR POSITION	SYMPTOM	PROBABLE CAUSE	FLUID PRESSURE	
				Standard	Service Limit
2nd Clutch	D4	No or low 2nd pressure	2nd Clutch	420–850 kPa (4.2–8.5 kg/cm², 60–121 psi) varies with throttle opening	370 kPa (3.7 kg/cm², 53 psi) with lever released. 750 kPa (7.5 kg/cm², 107 psi) with lever in full throttle position.
3rd Clutch		No or low 3rd pressure	3rd Clutch		
4th Clutch		No or low 4th pressure	4th Clutch		

• **D15B3, D15B4 and D16A9**

PRESSURE	SELECTOR POSITION	SYMPTOM	PROBABLE CAUSE	FLUID PRESSURE	
				Standard	Service Limit
2nd Clutch	D4	No or low 2nd pressure	2nd Clutch	420–900 kPa (4.2–9.0 kg/cm², 60–128 psi) varies with throttle opening	370 kPa (3.7 kg/cm², 53 psi) with lever released. 800 kPa (8.0 kg/cm², 114 psi) with lever in full throttle position.
3rd Clutch		No or low 3rd pressure	3rd Clutch		
4th Clutch		No or low 4th pressure	4th Clutch		

(cont'd)

Pressure Testing

(cont'd)

- **Throttle A/Throttle B Pressure measurement**

⚠WARNING **While testing, be careful of the rotating front wheels.**

—1. Allow the front wheels to rotate freely.

—2. Remove the cable end of the throttle control cable from the throttle control lever.

NOTE: Do not loosen the locknuts, simply unhook the cable end.

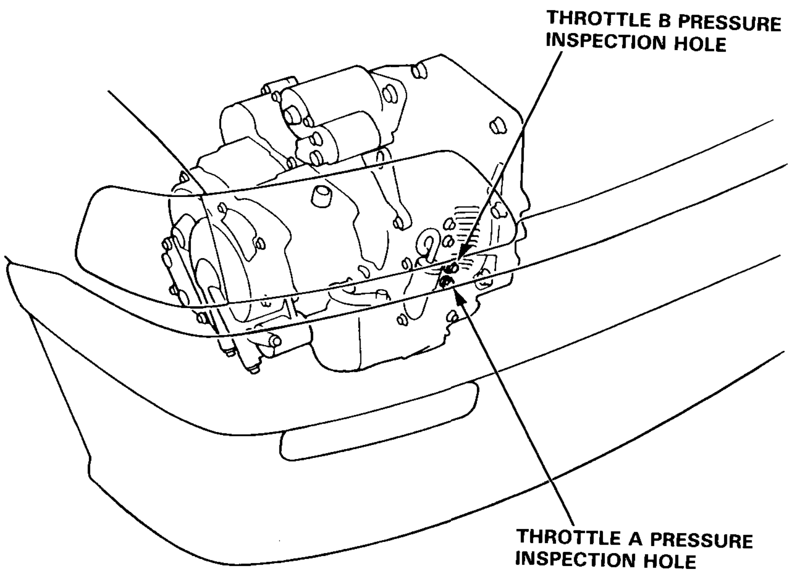
—3. Shift the selector lever to $\boxed{D_4}$, or $\boxed{D_3}$ position.

—4. Run the engine at 1,000 rpm.

—5. Measure full-closed throttle A/B pressure.

—6. Move the throttle control lever to full-opened throttle position.

—7. Measure full-opened throttle A/B pressure.



- **D12B1 and D15B3**

PRESSURE	SELECTOR POSITION	SYMPTOM	PROBABLE CAUSE	FLUID PRESSURE	
				Standard	Service Limit
Throttle A	D3 or D4	No (or low) throttle pressure	Throttle valve A Throttle modulator valve	0–5 kPa (0–0.05 kg/cm², 0–1 psi) with lever released. 515–530 kPa (5.15–5.3 kg/cm², 73–75 psi with lever in full throttle position.	510 kPa (5.1 kg/cm², 73 psi) with lever in full throttle position.
Throttle B	D3 or D4	No (or low) throttle pressure	Throttle valve B	0 kPa (0 kg/cm², 0 psi) with lever released. 800–850 kPa (8.0–8.5 kg/cm², 114–121 psi) with lever in full throttle position.	750 kPa (7.5 kg/cm², 107 psi) with lever in full throttle position.

- **D15B4**

PRESSURE	SELECTOR POSITION	SYMPTOM	PROBABLE CAUSE	FLUID PRESSURE	
				Standard	Service Limit
Throttle A	D3 or D4	No (or low) throttle pressure	Throttle valve A Throttle modulator valve	0–5 kPa (0–0.05 kg/cm², 0–1 psi) with lever released. 515–530 kPa (5.15–5.3 kg/cm², 73–75 psi) with lever in full throttle position.	510 kPa (5.1 kg/cm², 73 psi) with lever in full throttle position.
Throttle B	D3 or D4	No (or low) throttle pressure	Throttle valve B	0 kPa (0 kg/cm², 0 psi) with lever released. 850–900 kPa (8.5–9.0 kg/cm², 121–128 psi) with lever in full throttle position.	800 kPa (8.0 kg/cm², 114 psi) with lever in full throttle position.

- **D16A9**

PRESSURE	SELECTOR POSITION	SYMPTOM	PROBABLE CAUSE	FLUID PRESSURE	
				Standard	Service Limit
Throttle A	D3 or D4	No (or low) throttle pressure	Throttle valve A Throttle modulator valve	0–5 kPa (0–0.05 kg/cm², 0–1 psi) with lever released. 495–510 kPa (4.95–5.1 kg/cm², 70–73 psi) with lever in full throttle position.	490 kPa (4.9 kg/cm², 70 psi) with lever in full throttle position.
Throttle B	D3 or D4	No (or low) throttle pressure	Throttle valve B	0 kPa (0 kg/cm², 0 psi) with lever released. 800–850 kPa (8.0–8.5 kg/cm², 114–121 psi) with lever in full throttle position.	750 kPa (7.5 kg/cm², 107 psi) with lever in full throttle position.

(cont'd)

Pressure Testing

(cont'd)

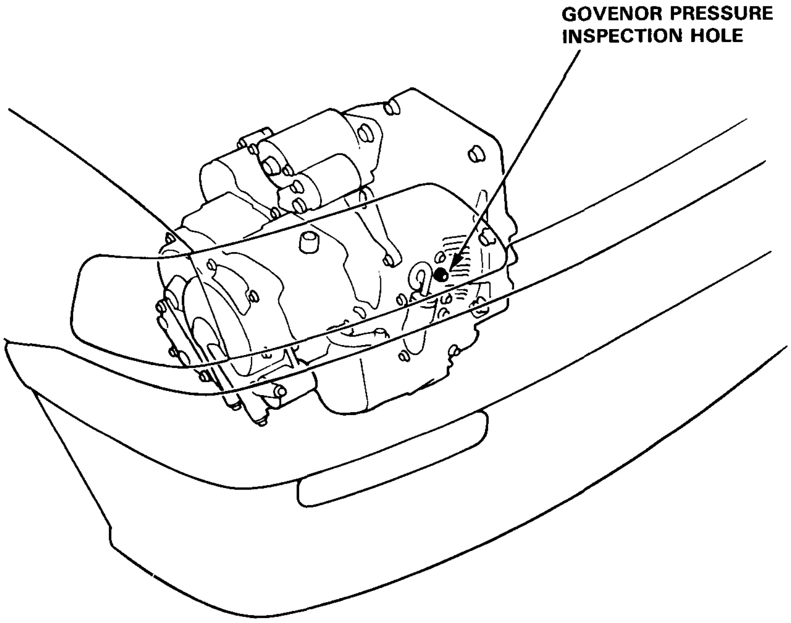
- **Govenor Pressure Measurement**

⚠WARNING While testing, be careful of the rotating front wheels.

—1. Allow the front wheels to rotate freely.

—2. Run the vehicle at 38 mph (60 km/h).

—3. Measure the governor pressure.



PRESSURE	SELECTOR POSITION	SYMPTOM	PROBABLE CAUSE	FLUID PRESSURE	
				Standard	Service Limit
Govenor	$\boxed{D_4}$ or $\boxed{D_3}$	No (or low) Govenor pressure	Govenor valve	151—161 kPa (1.51—1.61 kg/cm^2, 21—23 psi)	146 kPa (1.46 kg/cm^2, 21 psi)

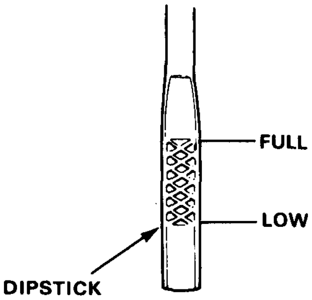
Fluid Level

Checking/Changing

Checking

NOTE: *Check the fluid level with the engine at normal operating temperature.*

1. Park the car on level ground. Shutt off the engine.
2. Remove the dipstick (yellow loop) from the transmission and wipe it with a clean cloth.
3. Insert the dipstick into the transmission.
4. Remove the dipstick and check the fluid level. It should be between the upper and lower marks.

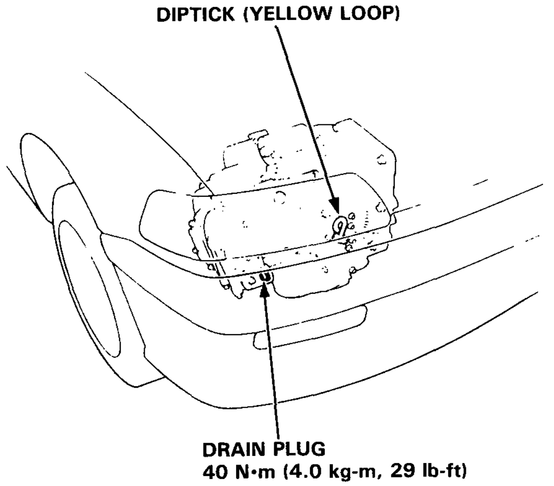


5. If the level is below the lower mark, add fluid into the tube to bring it to the upper mark. Use Honda Premium Formula Automatic Transmission Fluid or an equivalent DEXRON® II Automatic Transmission Fluid (ATF) only.
6. Insert the dipstick back in the transmission.

Changing

1. Bring the transmission up to operating temperature by driving the car. Park the car on level ground, turn the engine off, then remove drain plug.
2. Reinstall the drain plug with a new washer, then refill the transmission to the upper mark on the dipstick.

Automatic transmission Capacity:
2.4 ℓ (2.5 U.S. qts, 2.1 Imp. qt) at change
5.4 ℓ (5.7 U.S. qts, 4.8 Imp. qt) after overhaul



Removal

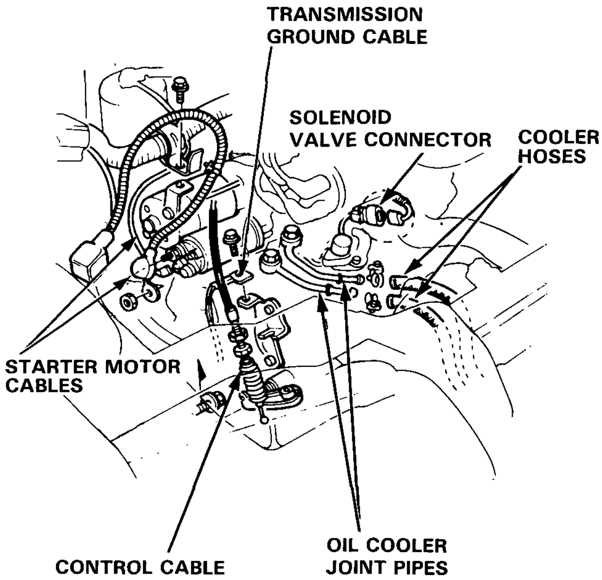
⚠WARNING

- **Make sure lifts, jacks and safety stands are placed properly, and hoist brackets are attached to the correct position on the engine (see pages 1-6 thru 1-8).**
- **Apply parking brake and block rear wheels, so car will not roll off stands and fall on you while working under it.**

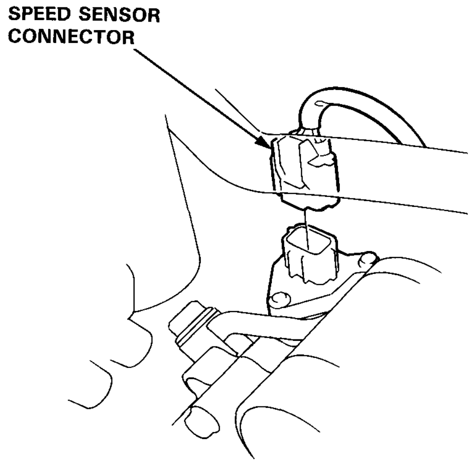
CAUTION: Use fender covers to avoid damaging painted surfaces.

1. Disconnect the battery negative (−) and positive (+) cables from the battery.
2. Remove the air intake hose.
3. Disconnect the starter motor and transmission ground cables.
4. Disconnect the lock-up control solenoid valve connector.
5. Disconnect the throttle control cable at the control lever.
6. Remove the ATF cooler hoses at the joint pipes. Turn the ends of the cooler hoses up to prevent ATF from flowing out, then plug the joint pipes.

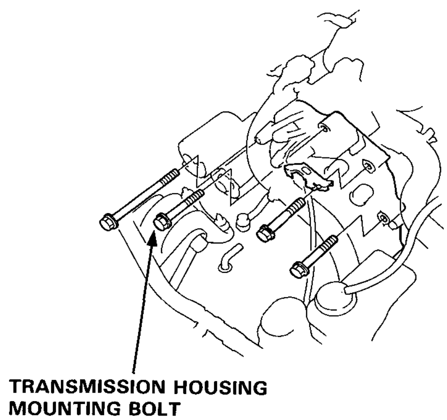
   NOTE: Check for any signs of leakages at the hose joints.



7. Disconnect the speedometer sensor connector.



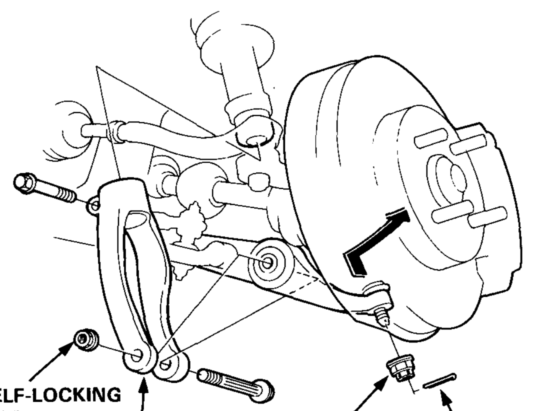
8. Remove the transmission housing mounting bolts.



9. Remove the drain plug and drain the automatic transmission fluid (ATF). Reinstall the drain plug with a new sealing washer (see page 14-65).

10. Remove the cotter pins and castle nuts, then separate the ball joints from the lower arm (see Section 18).

11. Remove the damper fork bolts, then separate the damper fork and damper.



12. Remove the driveshafts.

- For D12B1/D15B3/D15B4

—1. Pry the right and left driveshafts out of the differential.

—2. Pull on the inboard joint and remove the right and left driveshafts (see Section 16).

—3. Tie plastic bags over the driveshaft ends.

NOTE: Coat all precision finished surfaces with clean engine oil or grease.

- For D16A9

—1. Pry the right driveshaft out of the differential.

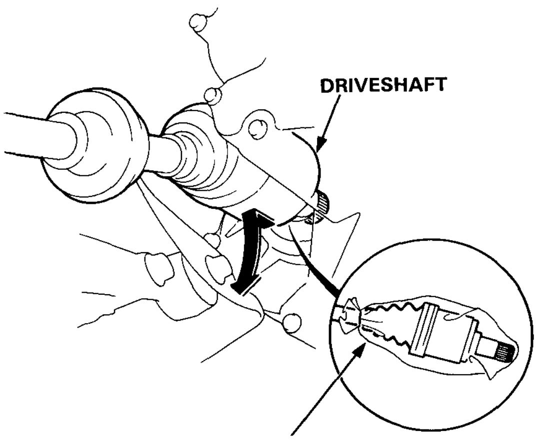
—2. Pry the left driveshaft out of the intermediate shaft.

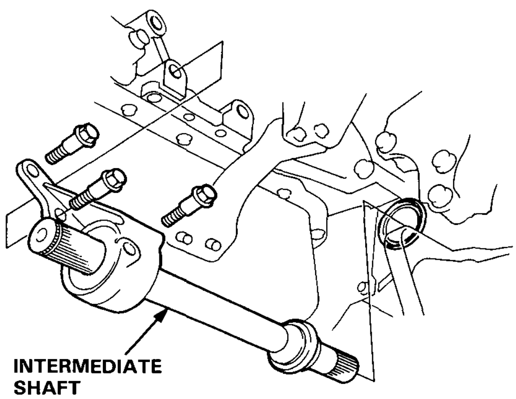
—3. Pull on the inboard joint and remove the right and left driveshafts (see Section 16).

—4. Remove the intermediate shaft.

—5. Tie plastic bags over the driveshaft and intermediate shaft ends.

NOTE: Coat all precision finished surfaces with clean engine oil or grease.

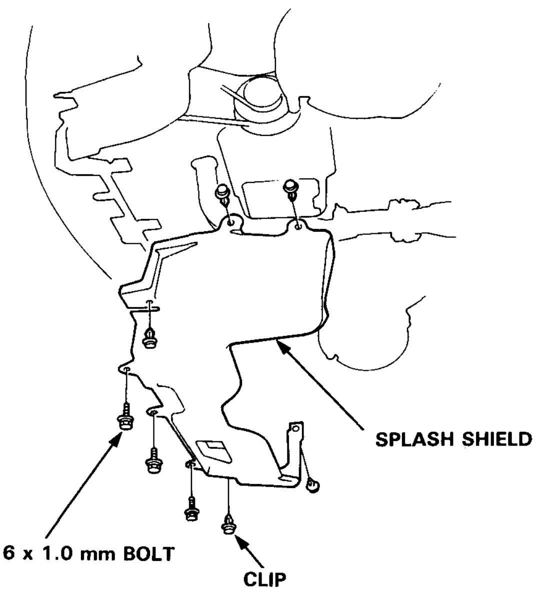




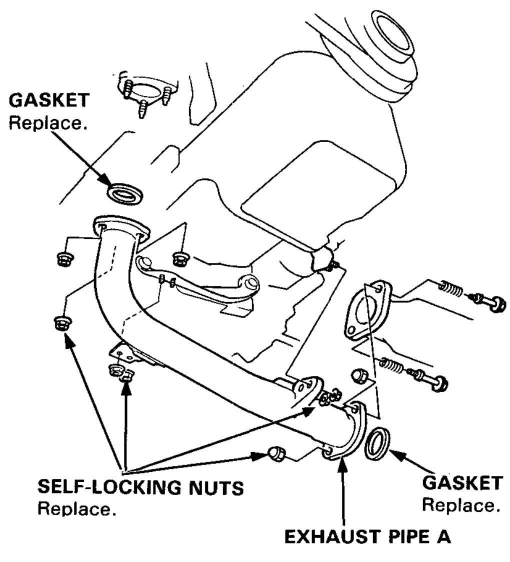
(cont'd)

Removal (cont'd)

13. Remove the splash shield.



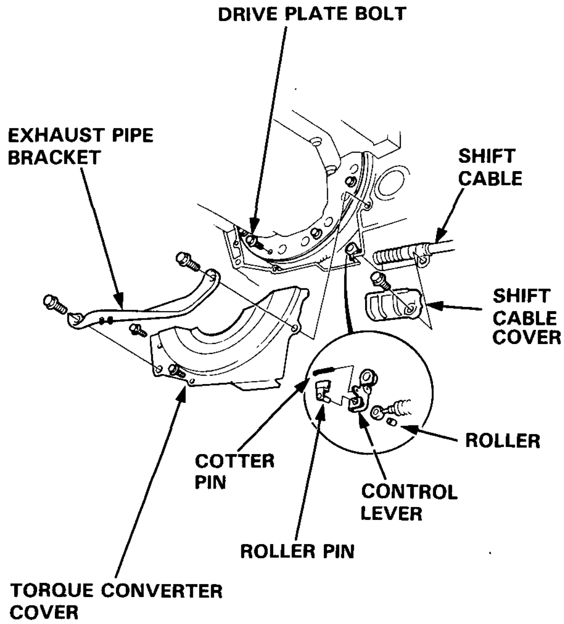
14. Remove the exhaust pipe A.



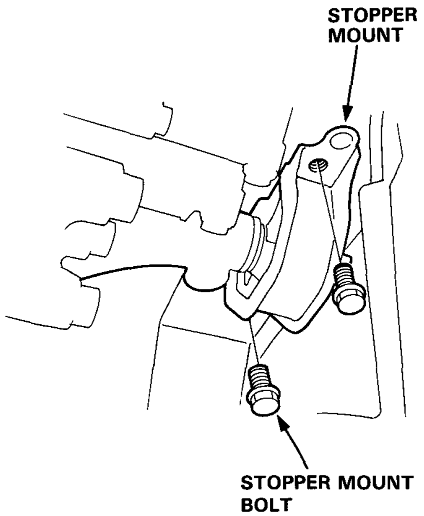
15. Remove the exhaust pipe bracket, torque converter cover and shift control cable holder. Then remove the shift control cable by removing the cotter pin, control pin and control lever.

CAUTION: Take care not to bend the shift control cable while removing it.

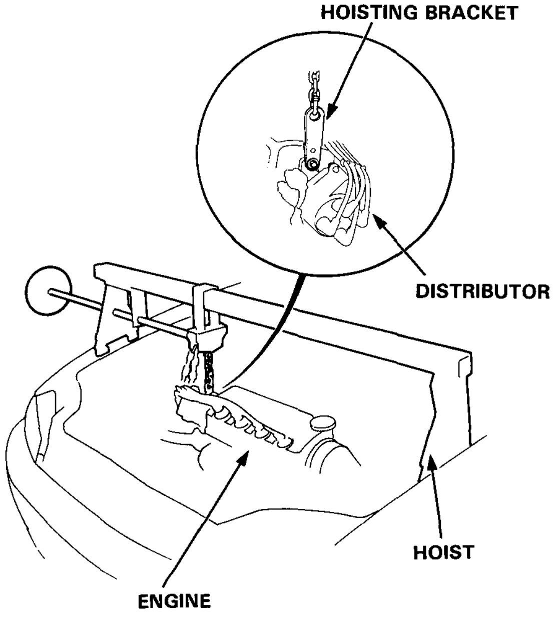
16. Remove the 8 drive plate bolts one at a time while rotating the crankshaft pulley.



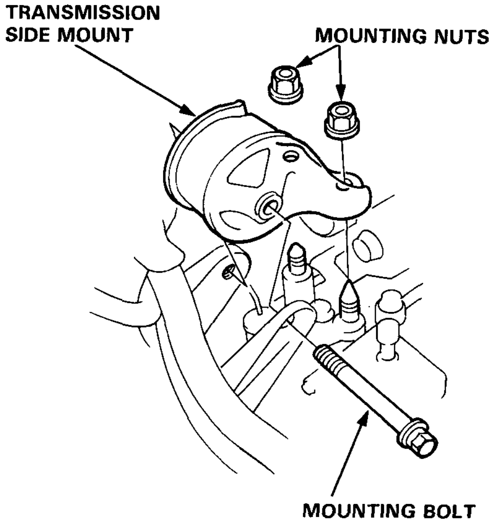
17. Remove the stopper mount bolts.



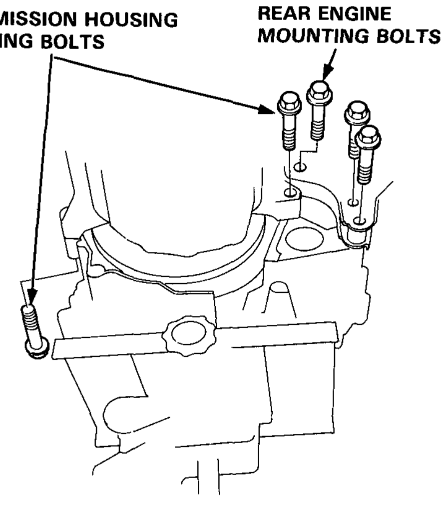
18. Attach a hoisting bracket to the engine using the distributor mounting bolt, then lift the engine slightly.



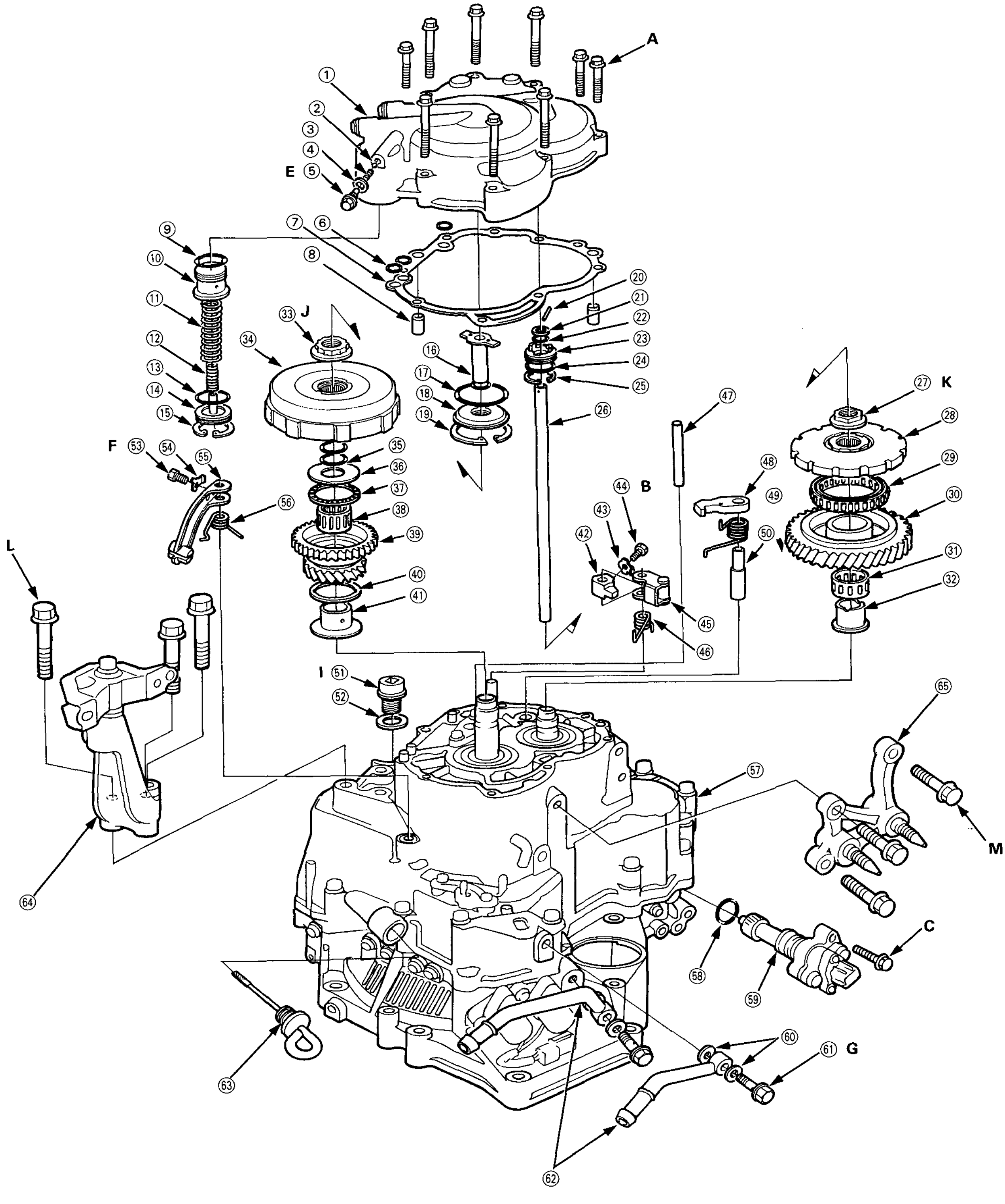
19. Place a jack under the transmission and raise the transmission just enough to take weight off of the mounts, then remove the transmission side mount.



20. Remove the transmission housing mounting bolts and rear engine mounting bolts.



21. Pull the transmission away from the engine until it clears the 14 mm dowel pins, then lower it on the transmission jack.



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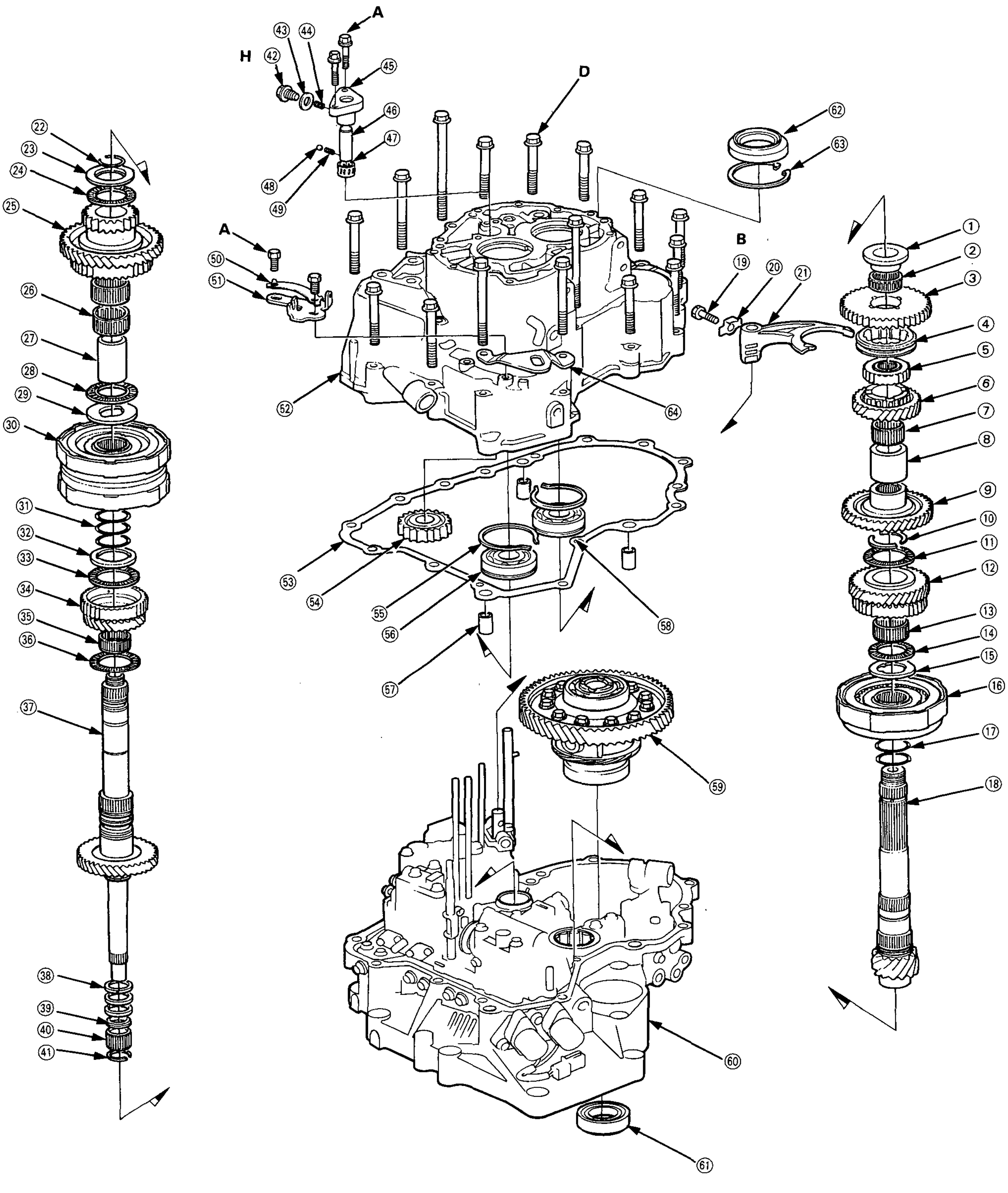
1. **R.SIDE COVER**
2. **STEEL BALL**
3. **ONE-WAY SPRING**
4. **SEALING WASHER** Replace.
5. **SEALING BOLT**
6. **O-RING** Replace.
7. **R.SIDE COVER GASKET** Replace.
8. **DOWEL PIN**
9. **O-RING** Replace.
10. **1ST ACCUMULATOR PISTON**
11. **1ST ACCUMULATOR SPRING A**
12. **1ST ACCUMULATOR SPRING B**
13. **O-RING** Replace.
14. **1ST ACCUMULATOR COVER**
15. **SNAP RING**
16. **1ST CLUTCH FEED PIPE**
17. **O-RING** Replace.
18. **FEED PIPE FLANGE**
19. **SNAP RING**
20. **ROLLER**
21. **WASHER**
22. **O-RING** Replace.
23. **FEED PIPE FLANGE**
24. **O-RING** Replace.
25. **SNAP RING**
26. **3RD CLUTCH FEED PIPE**
27. **COUNTERSHAFT LOCKNUT** Replace.
28. **PARKING GEAR**
29. **ONE-WAY CLUTCH**
30. **COUNTERSHAFT 1ST GEAR**
31. **NEEDLE BEARING**
32. **COUNTERSHAFT 1ST GEAR COLLAR**
33. **MAINSHAFT LOCKNUT** Replace.
34. **1ST CLUTCH ASSEMBLY**
35. **O-RING** Replace.
36. **THRUST WASHER**
37. **THRUST NEEDLE BEARING**
38. **NEEDLE BEARING**
39. **MAINSHAFT F 1ST GEAR**
40. **THRUST WASHER**
41. **MAINSHAFT 1ST GEAR COLLAR**
42. **PARKING BRAKE STOPPER**
43. **LOCK WASHER** Replace.
44. **SPECIAL BOLT**
45. **PARKING BRAKE LEVER**
46. **PARKING BRAKE SPRING**
47. **PARKING BRAKE PAWL STOPPER**
48. **PARKING BRAKE PAWL**
49. **PARKING BRAKE PAWL SPRING**
50. **PARKING BRAKE PAWL SHAFT**
51. **DRAIN PLUG**
52. **SEALING WASHER** Replace.
53. **5 mm BOLT**
54. **LOCK WASHER** Replace.
55. **THROTTLE CONTROL LEVER**
56. **THROTTLE CONTROL LEVER SPRING**
57. **TRANSMISSION HOUSING**
58. **O-RING** Replace.
59. **SPEED SENSOR**
60. **SEALING WASHER** Replace.
61. **JOINT BOLT**
62. **ATF COOLER PIPES**
63. **ATF LEVEL GAUGE**

TORQUE SPECIFICATIONS

Ref. No	Torque Value	Bolt Size	Remarks
A	12 N•m (1.2 kg-m, 9 lb-ft)	6 x 1.0 mm	
B	14 N•m (1.4 kg-m, 10 lb-ft)	6 x 1.0 mm	Special bolt
C	22 N•m (2.2 kg-m, 16 lb-ft)	8 x 1.25 mm	
E	18 N•m (1.8 kg-m, 13 lb-ft)	8 x 1.25 mm	
F	8 N•m (0.8 kg-m, 6 lb-ft)	5 x 0.8 mm	
G	29 N•m (2.9 kg-m, 21 lb-ft)	12 x 1.25 mm	ATF cooler pipe joint bolt
I	40 N•m (4.0 kg-m, 29 lb-ft)	14 x 1.5 mm	Drain plug
J	95 N•m (9.5 kg-m, 69 lb-ft)	19 x 1.25 mm	Mainshaft locknut (flange nut): Left-hand threads
K	140 → 0 → 140 N•m (14.0 → 0 → 14.0 kg-m, 101 → 0 → 101 lb-ft)	23 x 1.25 mm	Countershaft locknut (flange nut)
L	65 N•m (6.5 kg-m, 47 lb-ft)	12 x 1.25 mm	Stopper mount bracket bolt
M	39 N•m (3.9 kg-m, 28 lb-ft)	10 x 1.25 mm	Transmission mount bracket bolt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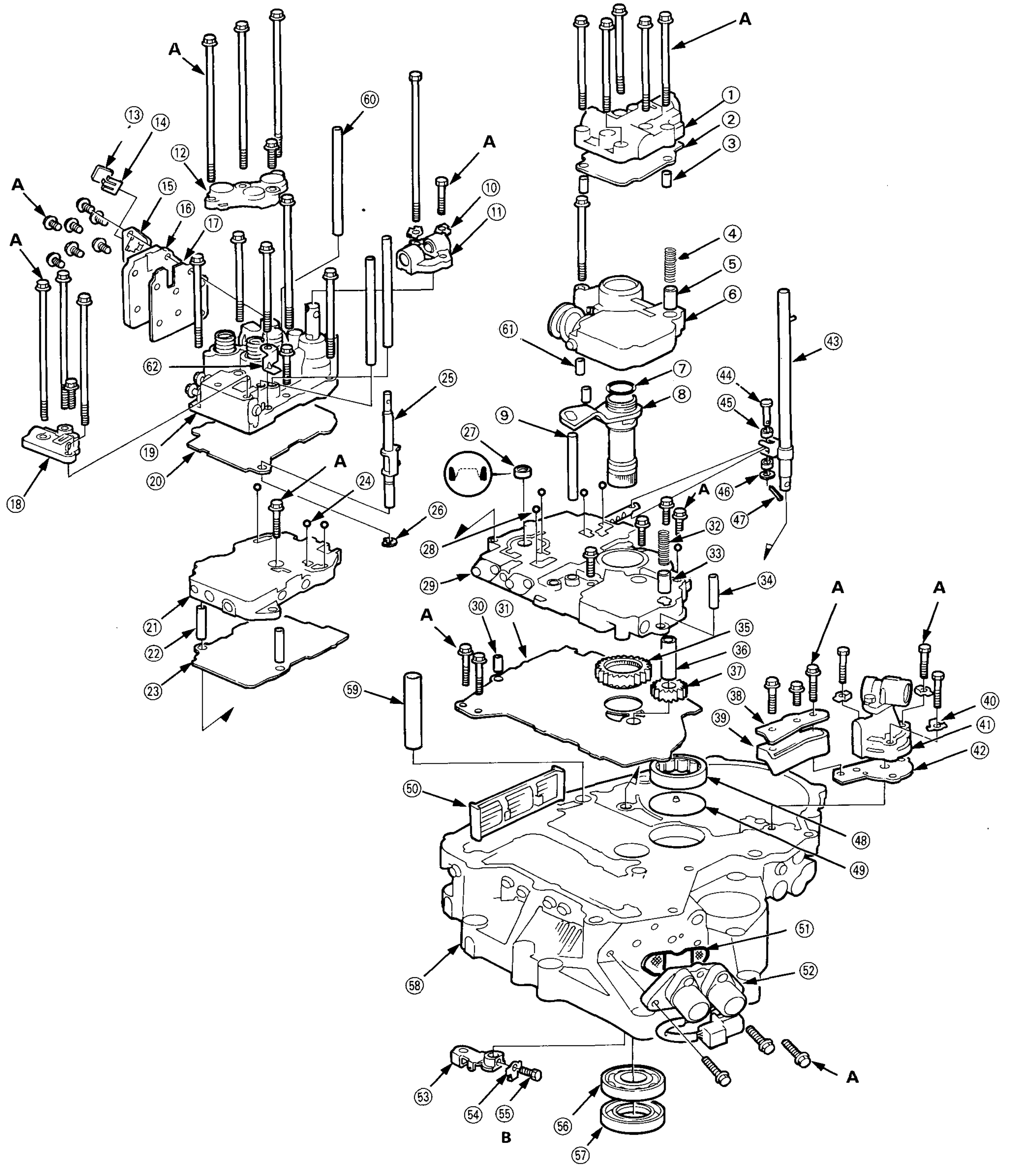
① REVERS GEAR COLLAR
② NEEDLE BEARING
③ COUNTERSHAFT REVERSE GEAR
④ REVERSE SELECTOR
⑤ REVERSE SELECTOR HUB
⑥ COUNTERSHAFT 4TH GEAR
⑦ NEEDLE BEARING
⑧ DISTANCE COLLAR 28 mm Selective part
⑨ COUNTERSHAFT 2ND GEAR
⑩ COTTERS
⑪ THRUST NEEDLE BEARING
⑫ COUNTERSHAFT 3RD GEAR
⑬ NEEDLE BEARING
⑭ THRUST NEEDLE BEARING
⑮ SPLINED WASHER Selective part
⑯ 3RD CLUTCH ASSEMBLY
⑰ O-RING Replace.
⑱ COUNTERSHAFT
⑲ SPECIAL BOLT
⑳ LOCK WASHER Replace.
㉑ REVERSE SHIFT FORK
㉒ SNAP RING
㉓ THRUST WASHER
㉔ THRUST NEEDLE BEARING
㉕ MAINSHAFT 4TH/REVERSE GEAR
㉖ NEEDLE BEARING
㉗ 4TH/REVERSE GEAR COLLAR
㉘ THRUST NEEDLE BEARING
㉙ THRUST WASHER
㉚ 2ND/4TH CLUTCH ASSEMBLY
㉛ O-RING Replace.
㉜ THRUST WASHER Selective part
㉝ THRUST NEEDLE BEARING
㉞ MAINSHAFT 2ND GEAR
㉟ NEEDLE BEARING
㊱ THRUST NEEDLE BEARING
㊲ MAINSHAFT
㊳ SEALING RING, 35 mm
㊴ SEALING RING, 29 mm
㊵ NEEDLE BEARING
㊶ SET RING
㊷ HOLDER BOLT
㊸ WASHER
㊹ REVERSE IDLER GEAR SHAFT SPRING
㊺ REVERSE IDLER GEAR SHAFT HOLDER
㊻ REVERSE IDLER GEAR SHAFT
㊼ NEEDLE BEARING
㊽ REVERSE IDLE GEAR SHAFT SPRING
㊾ STEEL BALL
㊿ LOCK WASHER Replace.
51 THROTTLE CONTROL CABLE STAY
52 TRANSMISSION HOUSING
53 TRANSMISSION HOUSING GASKET Replace.
54 REVERSE IDLER GEAR
55 SNAP RING
56 TRANSMISSIN HOUSING MAINSHAT BEARING
57 DOWEL PIN
58 TRANSMISSION HOUSING COUNTERSHAFT BEARING
59 DIFFERENTIAL ASSEMBLY
60 TORQUE CONVERTER HOUSING
61 OIL SEAL Replace.
62 OIL SEAL Replace.
63 SET RING Selective part
64 TRNSMISSION HANGER

TORQUE SPECIFICATIONS

Ref. No	Torque Value	Bolt Size	Remarks
A	12 N·m (1.2 kg-m, 9 lb-ft)	6 x 1.0 mm	
B	14 N·m (1.4 kg-m, 10 lb-ft)	6 x 1.0 mm	Special bolt
D	34 N·m (3.4 kg-m, 25 lb-ft)	8 x 1.25 mm	

Illustrated Index

Torque Converter Housing/Valve Body



1. **LOCK-UP VALVE BODY**
2. **LOCK-UP SEPARATOR PLATE**
3. **DOWEL PIN**
4. **TORQUE CONVERTER CHECK VALVE SPRING**
5. **TORQUE CONVERTER CHECK VALVE**
6. **REGULATOR VALVE BODY**
7. **O-RING** Replace.
8. **STATOR SHAFT**
9. **STOPPER SHAFT**
10. **LOCK WASHER** Replace.
11. **DETENT BASE**
12. **ACCUMULATOR COVER**
13. **MAGNET**
14. **MAGNET HOLDER**
15. **MAGNET COVER**
16. **SERVO COVER**
17. **SERVO COVER SEPARATOR PLATE**
18. **MODULATOR VALVE BODY**
19. **SERVO BODY**
20. **SERVO SEPARATOR PLATE**
21. **SECONDARY VALVE BODY**
22. **DOWEL PIN**
23. **SECONDARY SEPARATOR PLATE**
24. **CHECK BALL**
25. **THROTTLE CONTROL SHAFT**
26. **E-RING**
27. **FILTER** Replace.
28. **CHECK BALL**
29. **MAIN VALVE BODY**
30. **DOWEL PIN**
31. **MAIN SEPARATOR PLATE**
32. **COOLER RELIEF VALVE SPRING**
33. **COOLER RELIEF VALVE**
34. **OIL FEED PIPE**
35. **OIL PUMP DRIVE GEAR**
36. **OIL PUMP DRIVEN GEAR SHAFT**
37. **OIL PUMP DRIVEN GEAR**
38. **BODY COVER**
39. **BYPASS BODY**
40. **LOCK WASHER** Replace.
41. **GOVERNOR BODY**
42. **GOVERNOR BODY SEPARATOR PLATE**
43. **CONTROL SHAFT**
44. **ROLLER PIN**
45. **ROLLER**
46. **WASHER**
47. **COTTER PIN** Replace.
48. **TORQUE CONVERTER HOUSING COUNTERSHAFT NEEDLE BEARING**
49. **OIL GUIDE PLATE** Replace.
50. **ATF STRAINER**
51. **LOCK-UP CONTROL SOLENOID FILTER/GASKET** Replace.
52. **LOCK-UP CONTROL SOLENOID VALVE ASSEMBLY**
53. **CONTROL LEVER**
54. **LOCK WASHER** Replace.
55. **SPECIAL BOLT**
56. **MAINSHAFT BEARING**
57. **OIL SEAL** Replace.
58. **TORQUE CONVERTER HOUSING**
59. **SUCTION PIPE**
60. **OIL FEED PIPE**
61. **DOWEL PIN**
62. **LOCK PLATE**

NOTE: Only the D15B4 and D16A9 use ⑤① ⑤②.

TORQUE SPECIFICATIONS

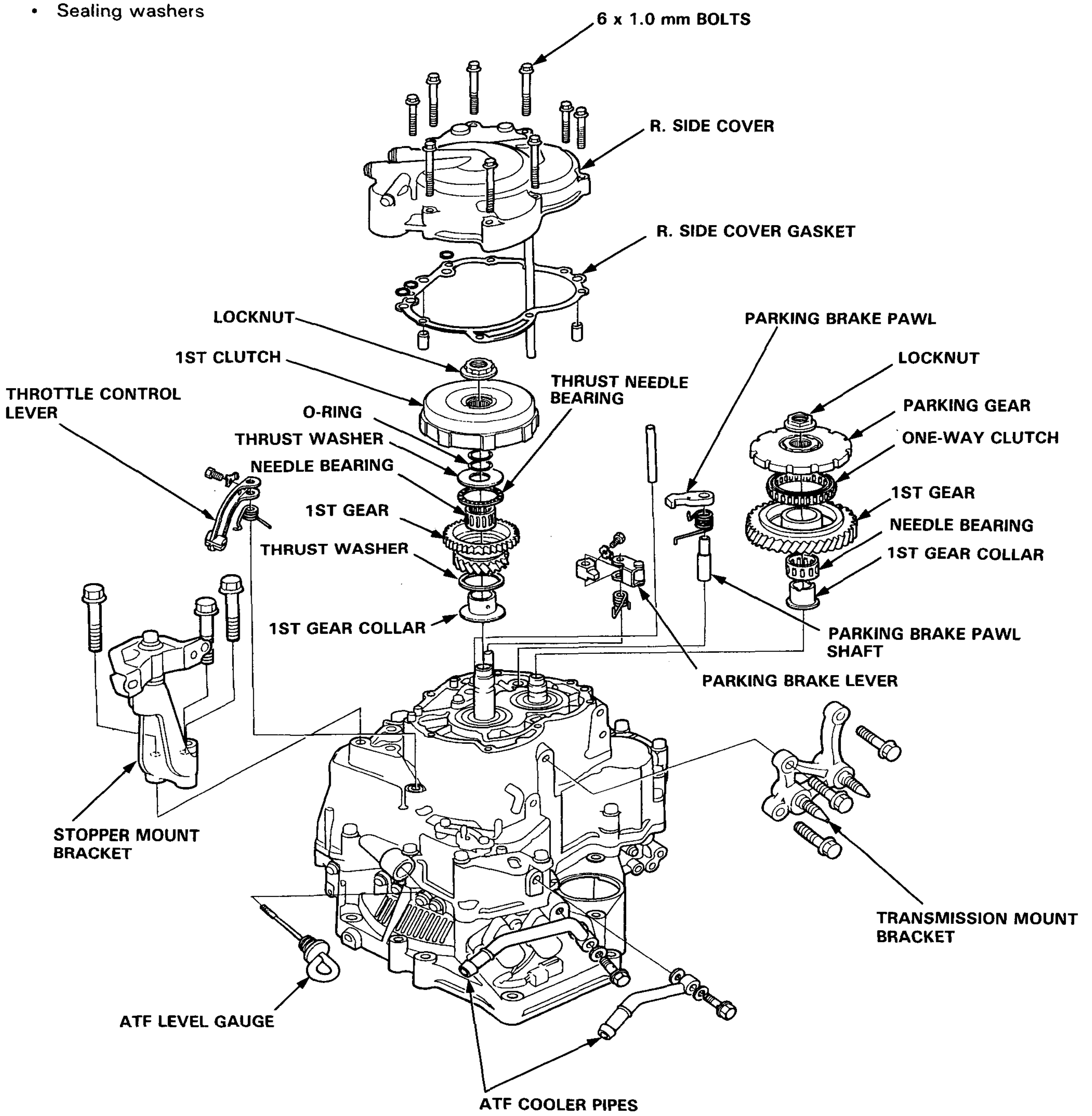
Ref. No	Torque Value	Bolt Size	Remarks
A	12 N•m (1.2 kg-m, 9 lb-ft)	6 x 1.0 mm	
B	14 N•m (1.4 kg-m, 10 lb-ft)	6 x 1.0 mm	Special bolt

R. Side Cover

Removal

NOTE:

- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- When removing the transmission R.side cover, replace the following:
  - R.side cover gasket
  - Lock washers
  - O-rings
  - Each shaft locknut
  - Sealing washers

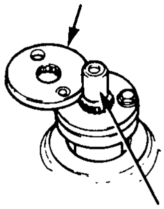


1. Remove the transmission mount bracket and stopper mount.

2. Remove the 9 bolts securing the R. side cover, then remove the cover.

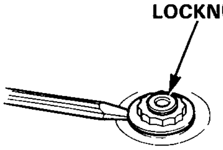
3. Slip the special tool onto the mainshaft.

4. Engage the parking brake pawl with the parking gear.



5. Pry the lock tabs of the each shaft locknut, then remove the locknuts from each shaft.

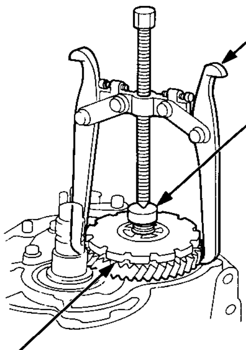
NOTE:
- Mainshaft locknut has left-hand threads.
- Clean the old countershaft locknut, it is used when installing to press the parking gear on the countershaft.



6. Remove the special tool from the mainshaft after removing the locknuts.

7. Remove the 1st clutch, thrust washer, thrust needle bearing, needle bearing and 1st gear from the mainshaft.

8. Remove the parking gear using a puller from the countershaft as shown. Then remove the countershaft 1st gear, needle bearing and 1st gear collar.



9. Remove the thrust washer and 1st gear collar from the mainshaft, and needle bearing and 1st gear collar from the countershaft.

10. *Remove the parking brake pawl, spring, shaft, and* stopper from the housing.

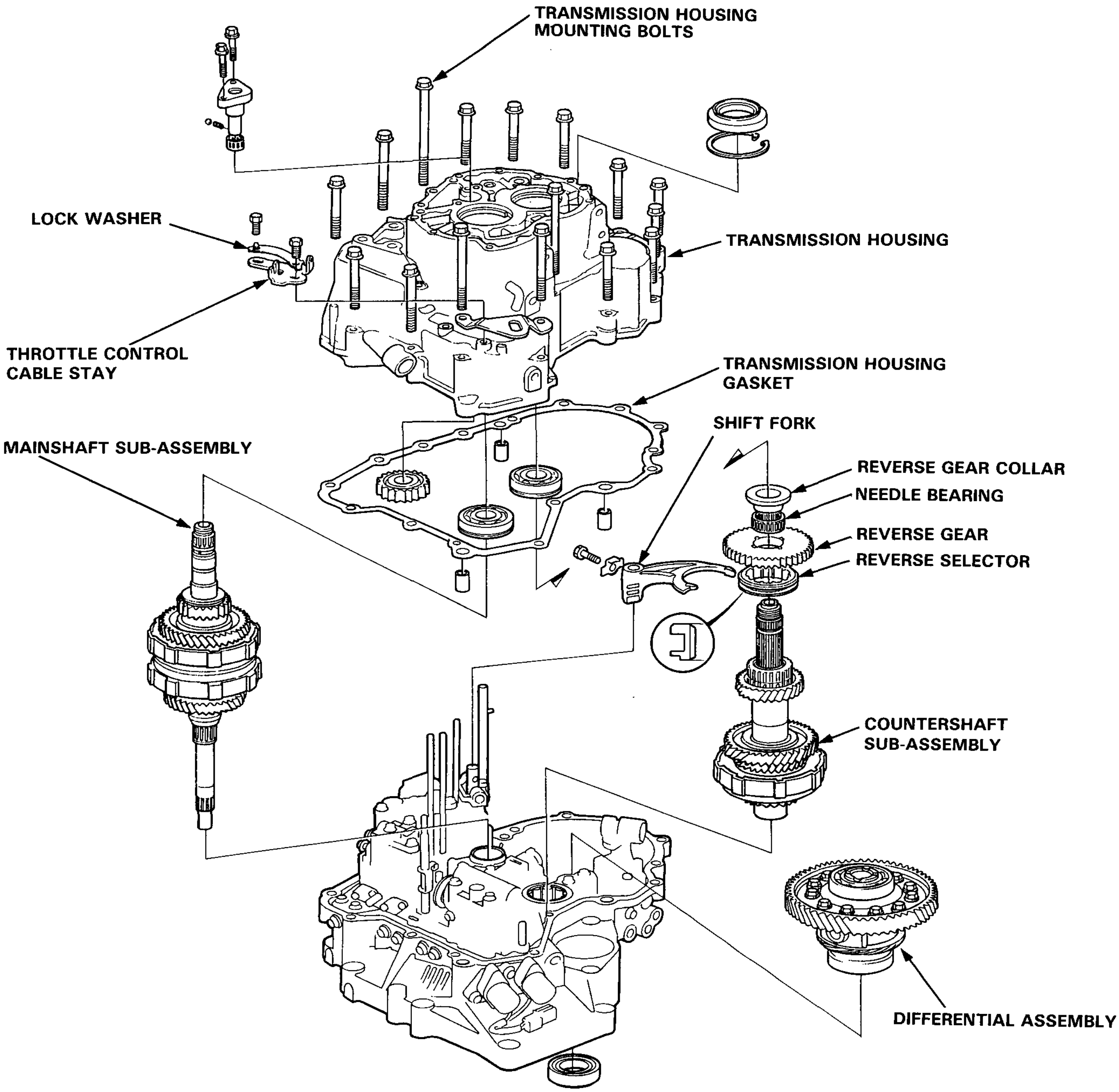
11. Remove the parking brake lever from the control shaft.

12. Remove the throttle control lever and spring from the throttle control shaft.

13. Remove the ATF cooler pipes and ATF level gauge.

Transmission Housing

Removal



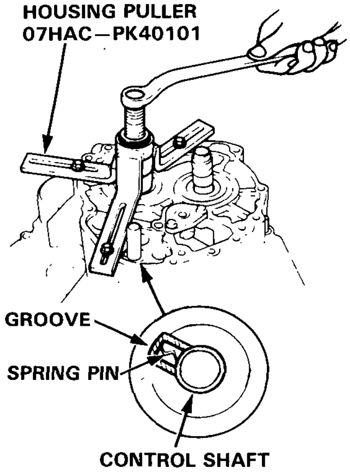
NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- When removing the transmission housing, replace the following:
  - Transmission housing gasket.
  - Lock washer

1. Remove the throttle control cable stay.

2. Remove the transmission housing mounting bolts.

3. Align the spring pin with the transmission housing groove by turning the control shaft.

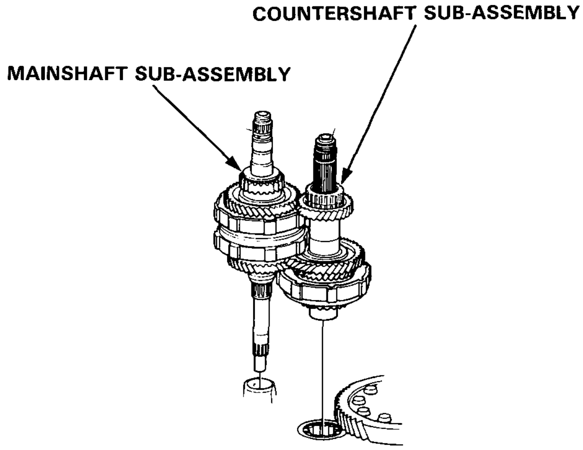
4. Install the special tool on the transmission housing, then remove the housing as shown.



5. Remove the reverse gear collar and needle bearing from the countershaft.

6. Remove the lock bolt securing the shift fork, then remove the fork with the reverse selector from the countershaft.

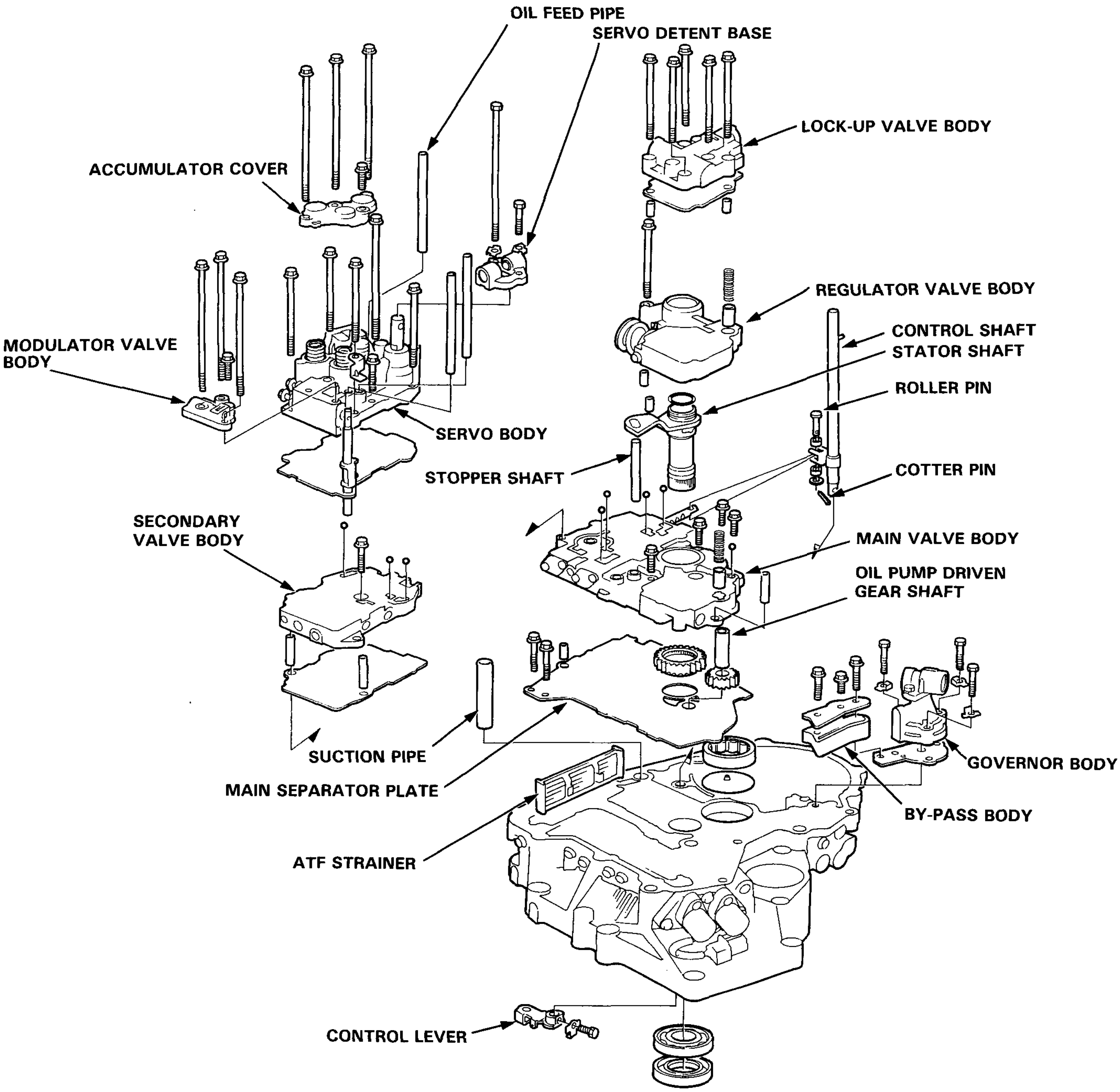
7. Remove the mainshaft and countershaft together.



8. Remove the differential assembly.

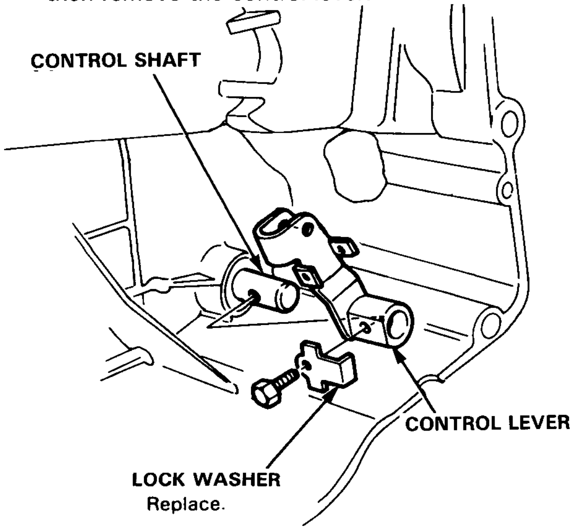
Torque Converter Housing/Valve Body

Removal



NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- When removing the valve body replace the following:
  - O-rings
  - Lock washers

1. Remove the lock bolt securing the control lever, then remove the control lever.



2. Remove the oil feed pipes and suction pipe.

3. Remove the 2 bolts securing the servo detent base, then remove the servo detent base.

4. Remove the 4 bolts securing the accumulator cover, then remove the accumulator cover.

   NOTE: The accumulator cover is spring loaded, to prevent stripping the threads in the servo body, press down on the accumulator cover while unscrewing the bolts in a criss-cross pattern.

5. Remove the 4 bolts securing the modulator valve body, then remove the modulator valve body.

6. Remove the 6 bolts securing the servo body, then remove the servo body and separator plate.

7. Remove the 1 bolt securing the secondary valve body, then remove the secondary valve body and separator plate.

8. Remove the 5 bolts securing the lock-up valve body, then remove the lock-up valve body and separator plate.

9. Remove the 1 bolt securing the regulator valve body, then remove the regulator valve body.

10. Remove the stator shaft and stopper shaft.

11. Remove the cotter pin and roller pin from the control shaft, then remove the control shaft from the torque converter housing.

12. Remove the 4 bolts securing the main valve body, then remove the main valve body.

13. Remove the oil pump driven gear shaft, then remove the oil pump gears.

14. Remove the 2 bolts securing the main separator plate, then remove the main separator plate with the 1 dowel pin.

15. Remove the 3 bolts securing the by-pass body, then remove the by-pass body.

16. Remove the 3 bolts securing the governor body, then remove the governor body and separator plate.

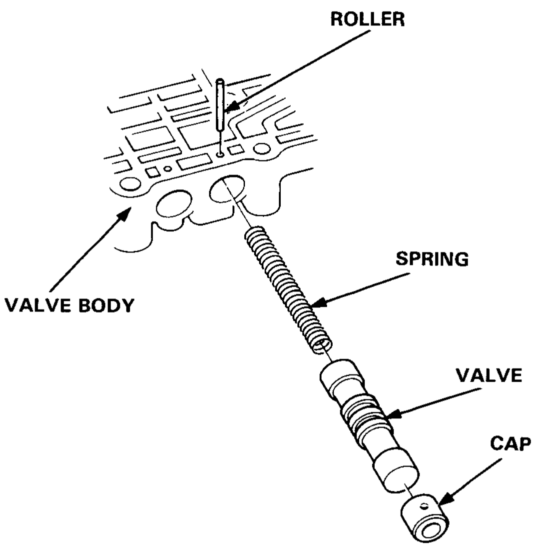
17. Remove the ATF strainer.

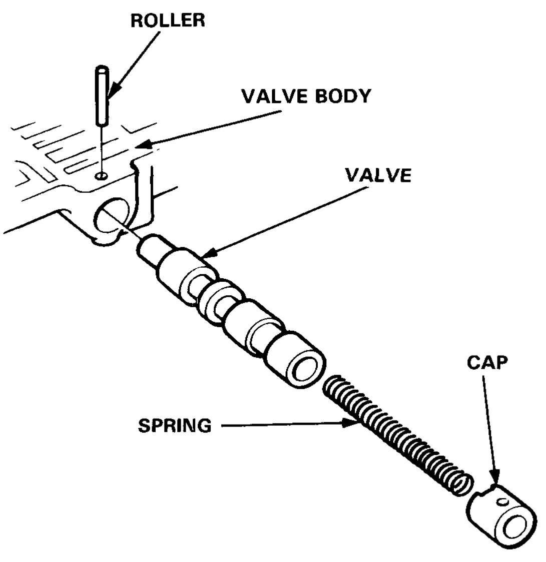
Valve

Assembly

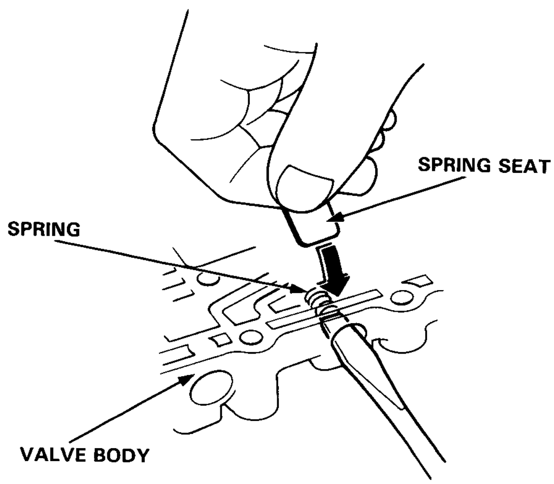
NOTE: Coat all parts with ATF before assembly.

- Install the valve, valve spring and cap in the valve body and secure with the roller.

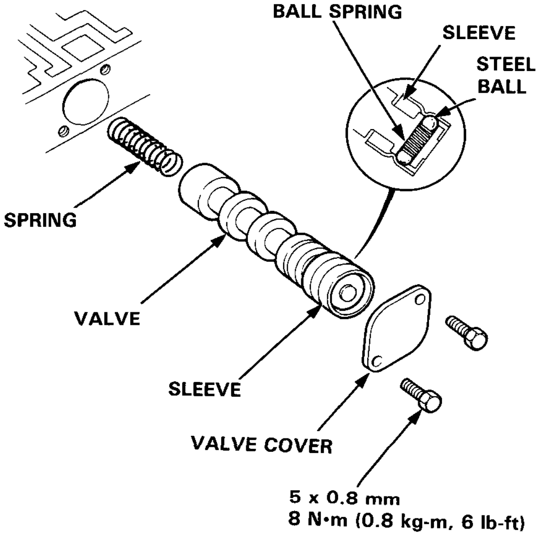




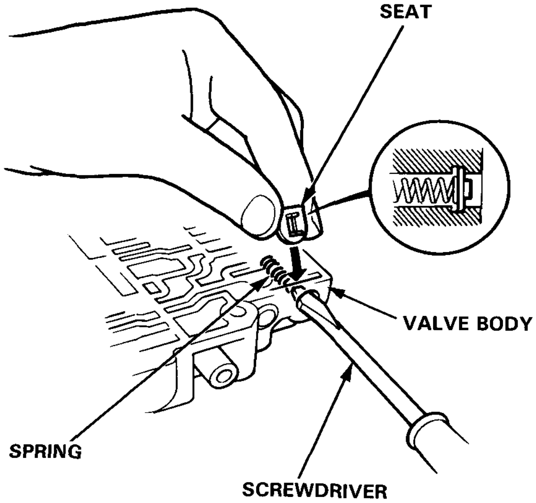
- Set the spring in the valve and install it in the valve body. Push the spring in with a screwdriver, then install the spring seat.



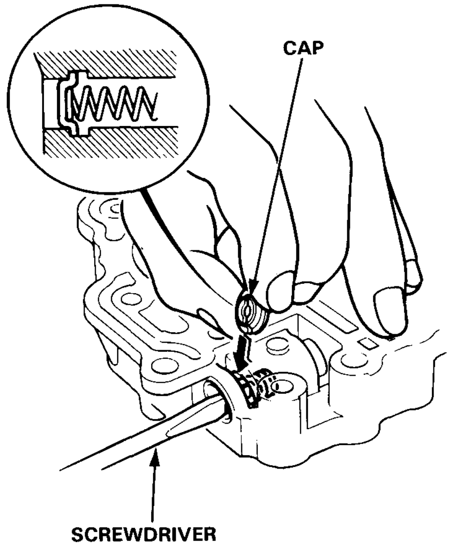
- Slide the spring into the hole in the big end of the shift valve. While holding the steel balls with the tips of your fingers, put the sleeve over the shift valve. Place the shift spring in the shift valve, then slip it into the valve body and install the valve cover.



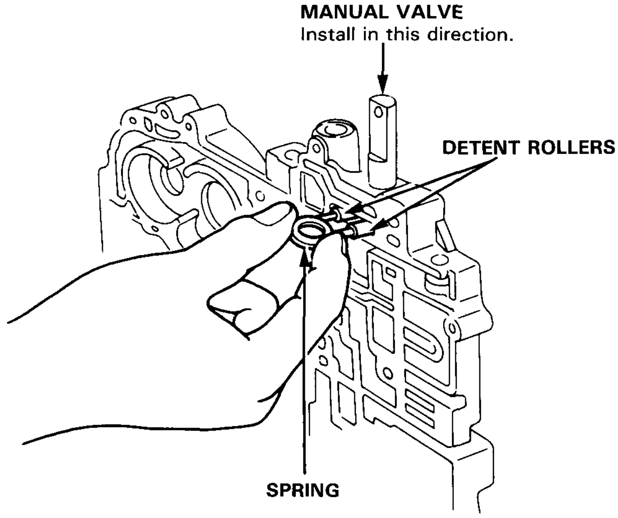
- Set the valve spring in the valve and install it in the valve body. Push the spring in with a screwdriver, then install the spring seat.



- Set the spring in the valve and install in the valve boy.
  Install the spring with a screwdriver, then install the valve cap with the cutout aligned with the screwdriver.



- Install the manual valve in the direction shown, then install the spring with the detent rollers.

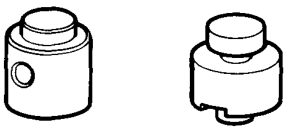


Valve Caps

Description

- Caps with one projected tip and one flat end are installed with the flat end toward the spring.
- Caps with a projected tip on each end are installed with the smaller tip toward the spring. The small tip is a spring guide.

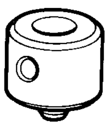
Toward outside of valve body.



Toward spring.

- Caps with one projected tip and hollow end are installed with the tip toward the spring. The tip is a spring guide.

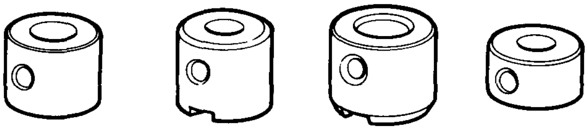
Toward outside of valve body.



Toward spring.

- Caps with hollow ends are installed with the hollow end away from the spring.
- Caps with notched ends are installed with the notch toward the spring.
- Caps with flat ends and a hole through the center are installed with the smaller hole toward the spring.

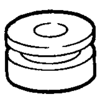
Toward outside of valve body.



Toward spring.

- Caps with flat ends and a groove around cap are installed with the groove side toward the spring.

Toward outside of valve body.



Toward spring.

Valve Body

Repair

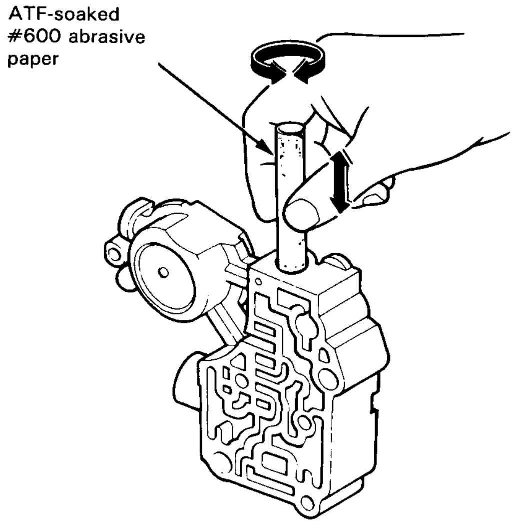
NOTE: This repair is only necessary if one or more of the valves in a valve body do not slide smoothly in their bores. You may use this procedure to free the valves in the valve bodies.

1. Soak a sheet of #600 abrasive paper in ATF for about 30 minutes.
2. Carefully tap the valve body so the sticking valve drops out of its bore.

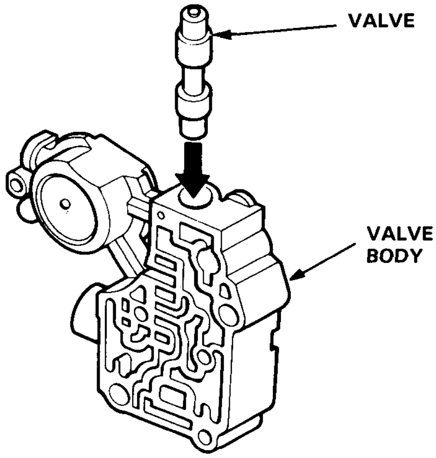
   CAUTION: It may be necessary to use a small screwdriver to pry the valve free. Be careful not to scratch the bore with the screwdriver.

3. Inspect the valve for any scuff marks. Use the ATF-soaked #600 paper to polish off any burrs that are on the valve, then wash the valve in solvent and dry it with compressed air.
4. Roll up half a sheet of ATF-soaked paper and insert it in the valve bore of the sticking valve.
   Twist the paper slightly, so that it unrolls and fits the bore tightly, then polish the bore by twisting the paper as you push it in and out.

   CAUTION: The valve body is aluminum and doesn't require much polishing to remove any burrs.



5. Remove the #600 paper and thoroughly wash the entire valve body in solvent, then dry with compressed air.
6. Coat the valve with ATF then drop it into its bore. It should drop to the bottom of the bore under its own weight. If not, repeat step 4, then retest.



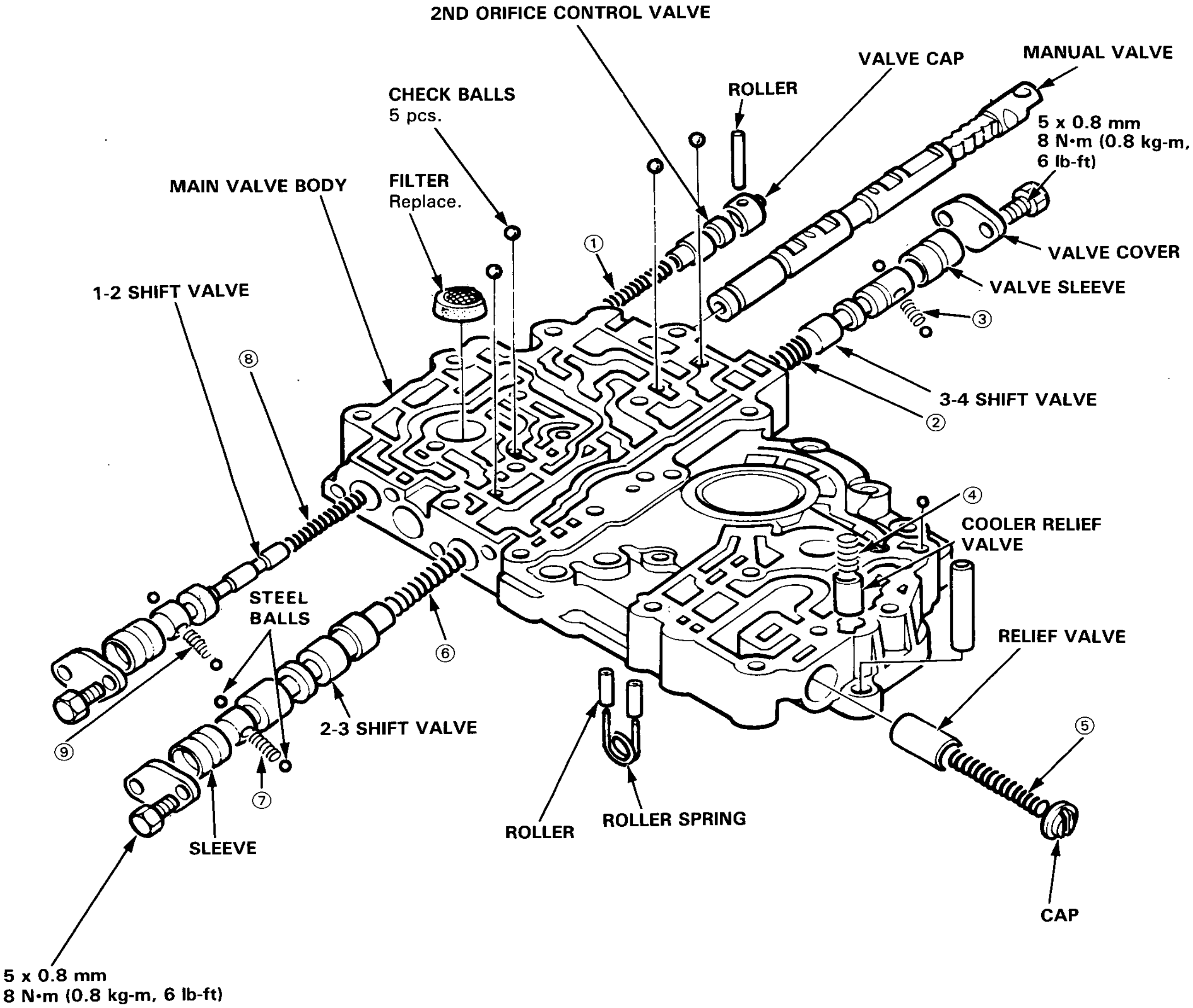
7. Remove the valve and thoroughly clean it and the valve body with solvent. Dry all parts with compressed air, then reassemble using ATF as a lubricant.

Main Valve Body

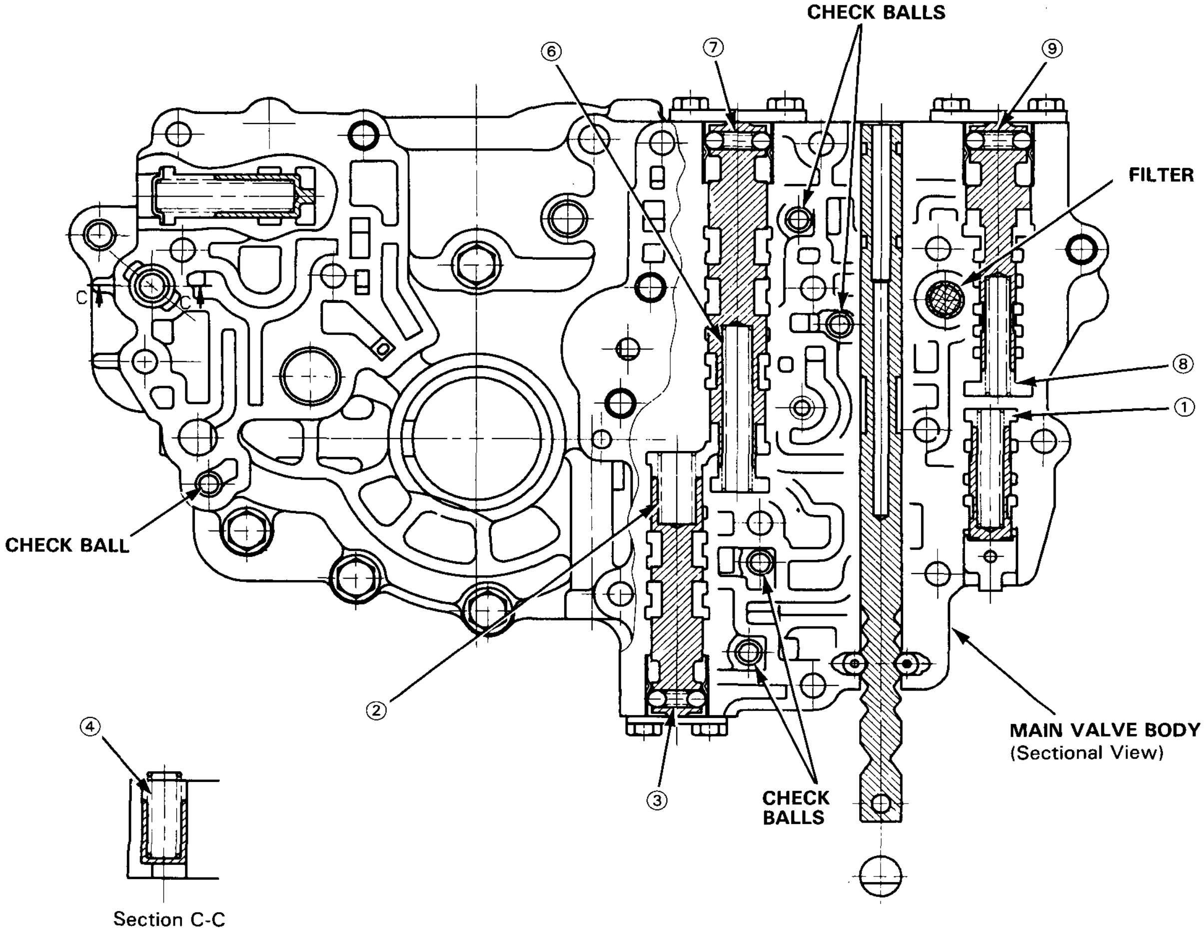
Disassembly/Inspection/Reassembly

NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- Replace valve body as an assembly if any parts are worn or damaged.
- Check all valves for free movement. If any fail to slide freely, see Valve Body Repair on page 14-85.
- Coat all parts with ATF before reassembly.

CAUTION: Do not use a magnet to remove the check balls; it may magnetized the balls.



Sectional View



SPRING SPECIFICATIONS

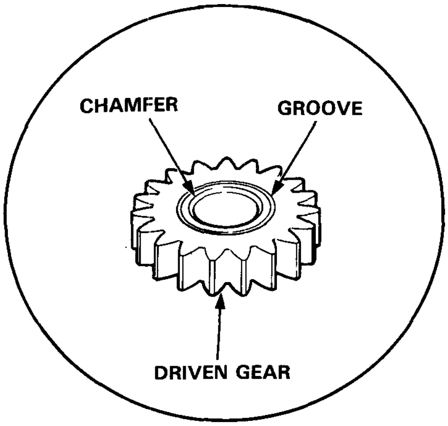
Unit of length: mm (in)

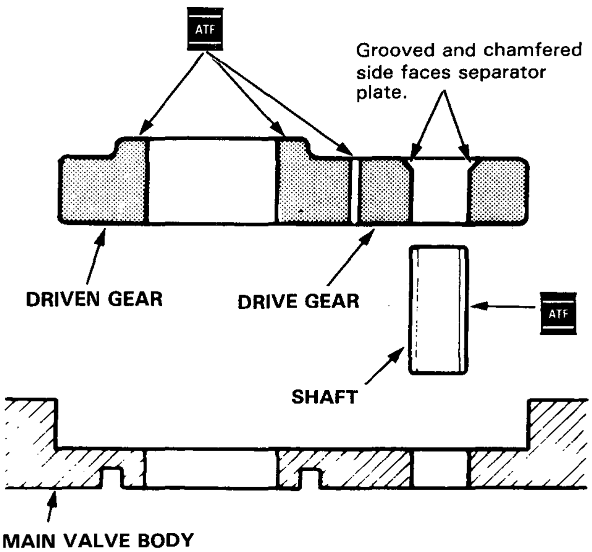
No.	Spring	Standard (New)			
		Wire Dia.	O.D.	Free Length	No. of Coils
①	Orifice control valve spring	0.9 (0.035)	6.6 (0.260)	44.0 (1.732)	22.0
②	3-4 shift valve spring	0.7 (0.028)	9.6 (0.378)	32.9 (1.295)	6.4
③	3-4 shift ball spring	0.45 (0.018)	4.5 (0.177)	12.0 (0.472)	6.7
④	Cooler relief valve spring	1.1 (0.043)	8.4 (0.331)	36.4 (1.433)	12.0
⑤	Relief valve spring	1.0 (0.039)	8.4 (0.331)	52.0 (2.047)	23.0
⑥	2-3 shift valve spring	0.7 (0.028)	7.6 (0.299)	43.0 (1.693)	12.7
⑦	2-3 shift ball spring	0.4 (0.016)	4.5 (0.177)	14.7 (0.579)	7.3
⑧	1-2 shift valve spring	0.5 (0.020)	4.5 (0.177)	44.5 (1.752)	35.1
⑨	1-2 shift ball spring	0.4 (0.016)	4.5 (0.177)	11.3 (0.445)	8.0

Oil Pump

Inspection

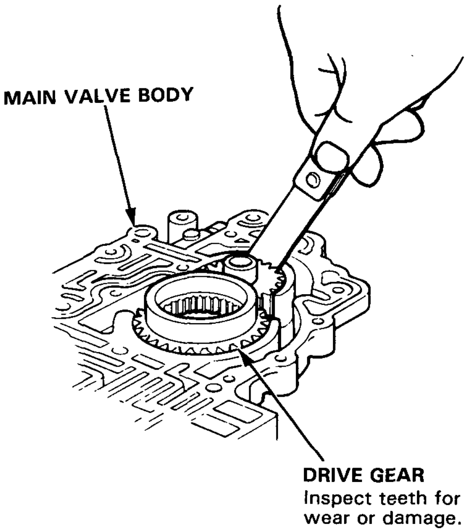
1. Install the pump gears and shaft in the main valve body.





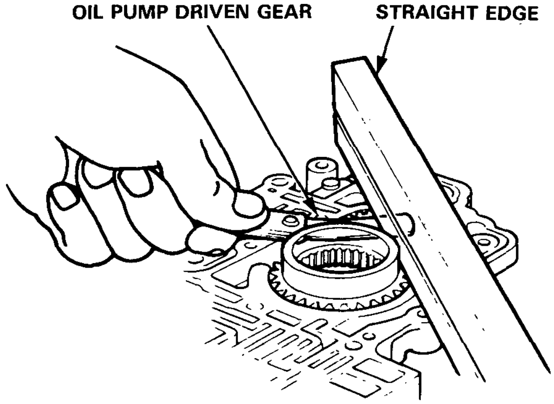
2. Install the oil pump shaft and measure the side clearance of the drive and driven gears.

Pump Gears Side (Radial) Clearance:
Standard (New): Drive gear
0.240–0.266 mm
(0.009–0.010 in)
Driven gear
0.063–0.088 mm
(0.002–0.003 in)



3. Measure the thrust clearance of the driven gear-to-main valve body.

Drive/Driven Gear thrust (Axial) Clearance:
Standard (New): 0.03–0.05 mm
(0.001–0.002 in)
Service Limit: 0.07 mm (0.0028 in)



Regulator Valve Body

Disassembly/Inspection/Reassembly

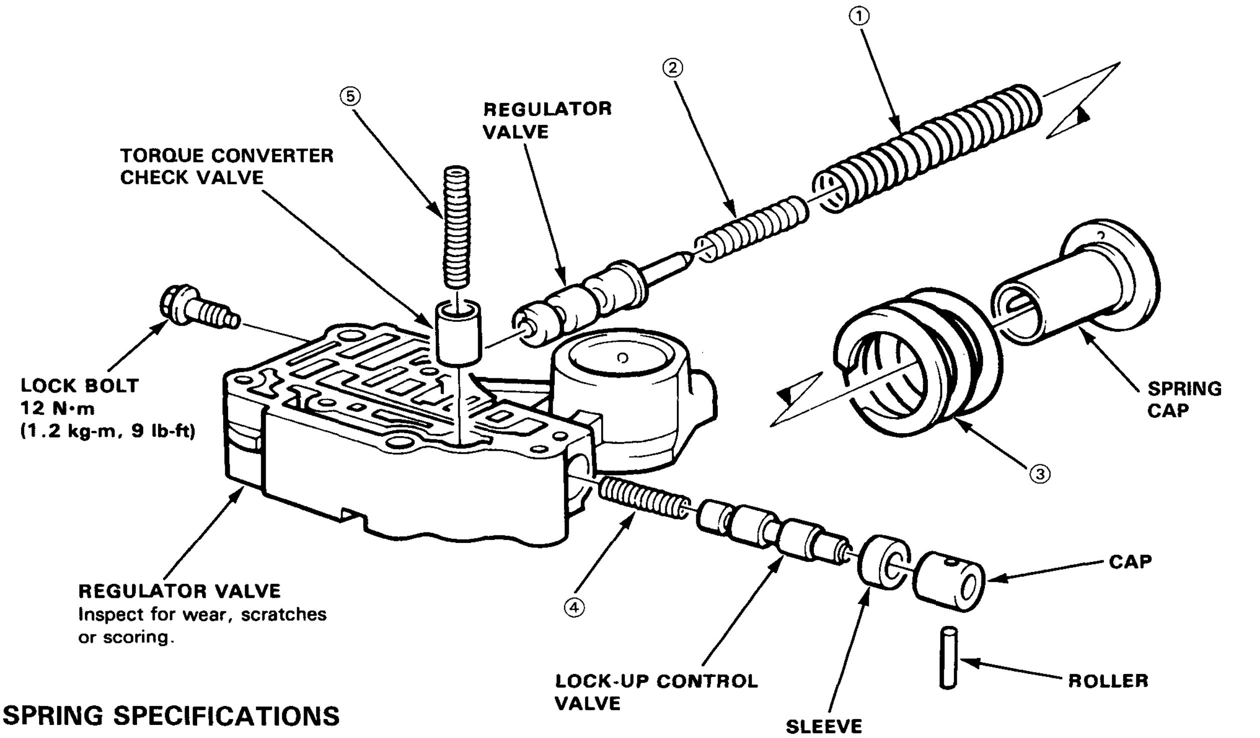
NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- Replace valve body as an assembly if any parts are worn or damaged.
- Check all valves for free movement. If any fail to slide freely, see Valve Body Repair on page 14-85.

1. Hold the regulator spring cap in place while removing the lock bolt . Once the bolt is removed, release the spring cap slowly.

   CAUTION: The regulator spring cap can pop out when the lock bolt is removed.

2. Reassembly is in the reverse order of disassembly.

   NOTE:
   - Coat all parts with ATF.
   - Align the hole in the regulator cap with the hole in the valve body, press the spring cap into the body and tighten the lock bolt.



SPRING SPECIFICATIONS

Unit of length: mm (in)

No.	Spring		Standard (New)			
			Wire Dia.	O.D.	Free Length	No. of Coils
①	Regulator valve spring A	D12B1	1.8 (0.071)	14.7 (0.579)	86.5 (3.406)	16.5
		Others	1.8 (0.071)	14.7 (0.579)	88.1 (3.468)	16.5
②	Regulator valve spring B		1.8 (0.071)	9.6 (0.378)	44.0 (1.732)	7.5
③	Stator reaction spring		5.5 (0.217)	*26.4 (1.039)	30.3 (1.193)	2.1
④	Lock-up control valve spring	D12B1/D15B3	0.7 (0.028)	6.6 (0.260)	32.5 (1.280)	14.0
		D15B4/D16A9	0.6 (0.024)	6.6 (0.260)	32.8 (1.291)	15.8
⑤	Torque converter check valve spring		1.1 (0.043)	8.4 (0.331)	36.4 (1.433)	12.0

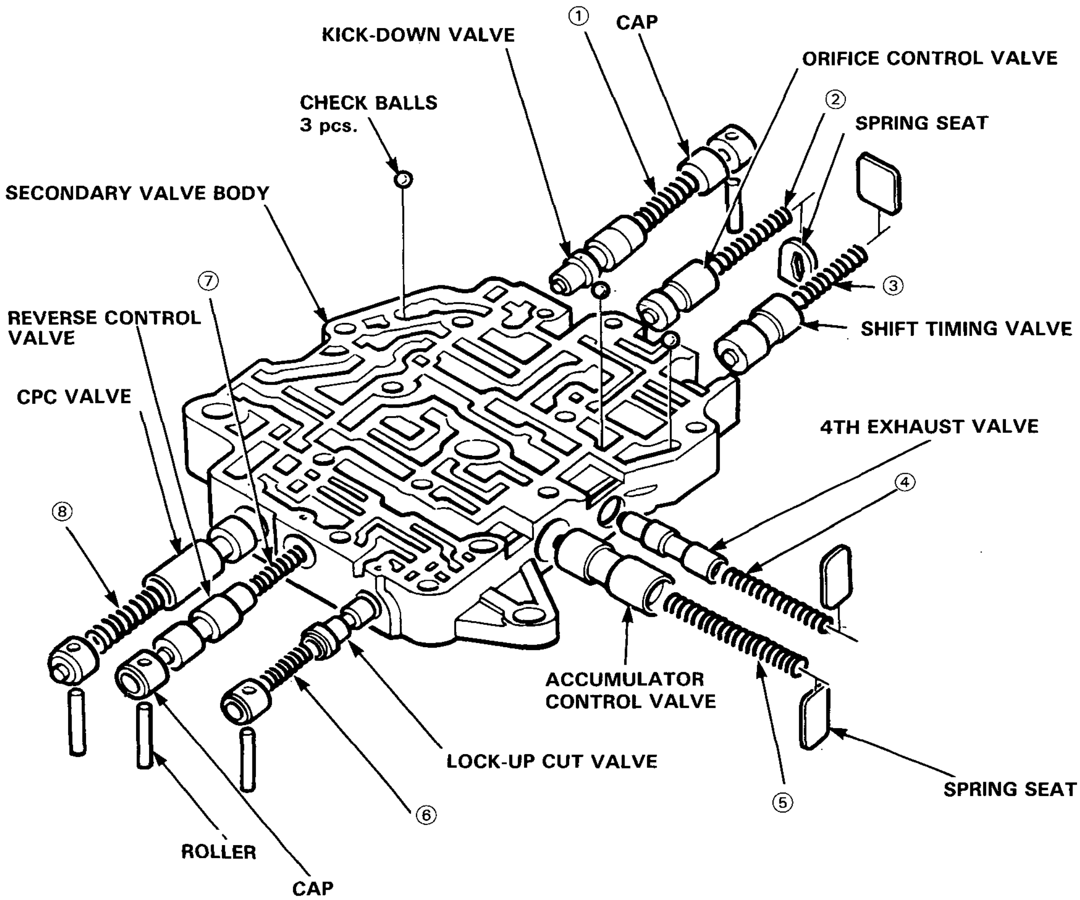
*: Inside Diameter

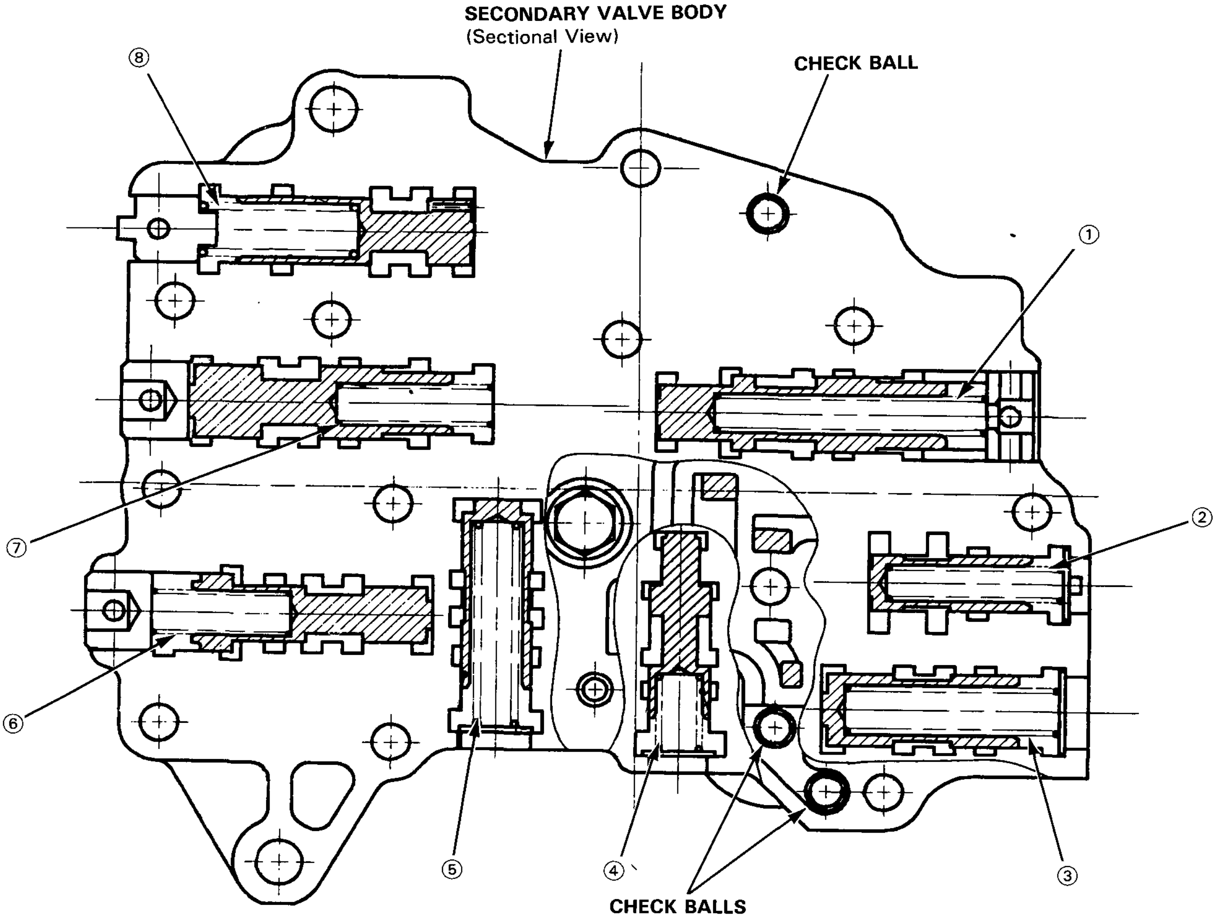
Secondary Valve Body

Disassembly/Inspection/Reassembly

NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- Replace valve body as an assembly if any parts are worn or damaged.
- Check all valves for free movement. If any fail to slide freely, see Valve Body Repair on page 14-85.
- Coat all parts with ATF before reassembly.

CAUTION: Do not use a magnet to remove the check balls; it may magnetized the balls.





SPRING SPECIFICATIONS

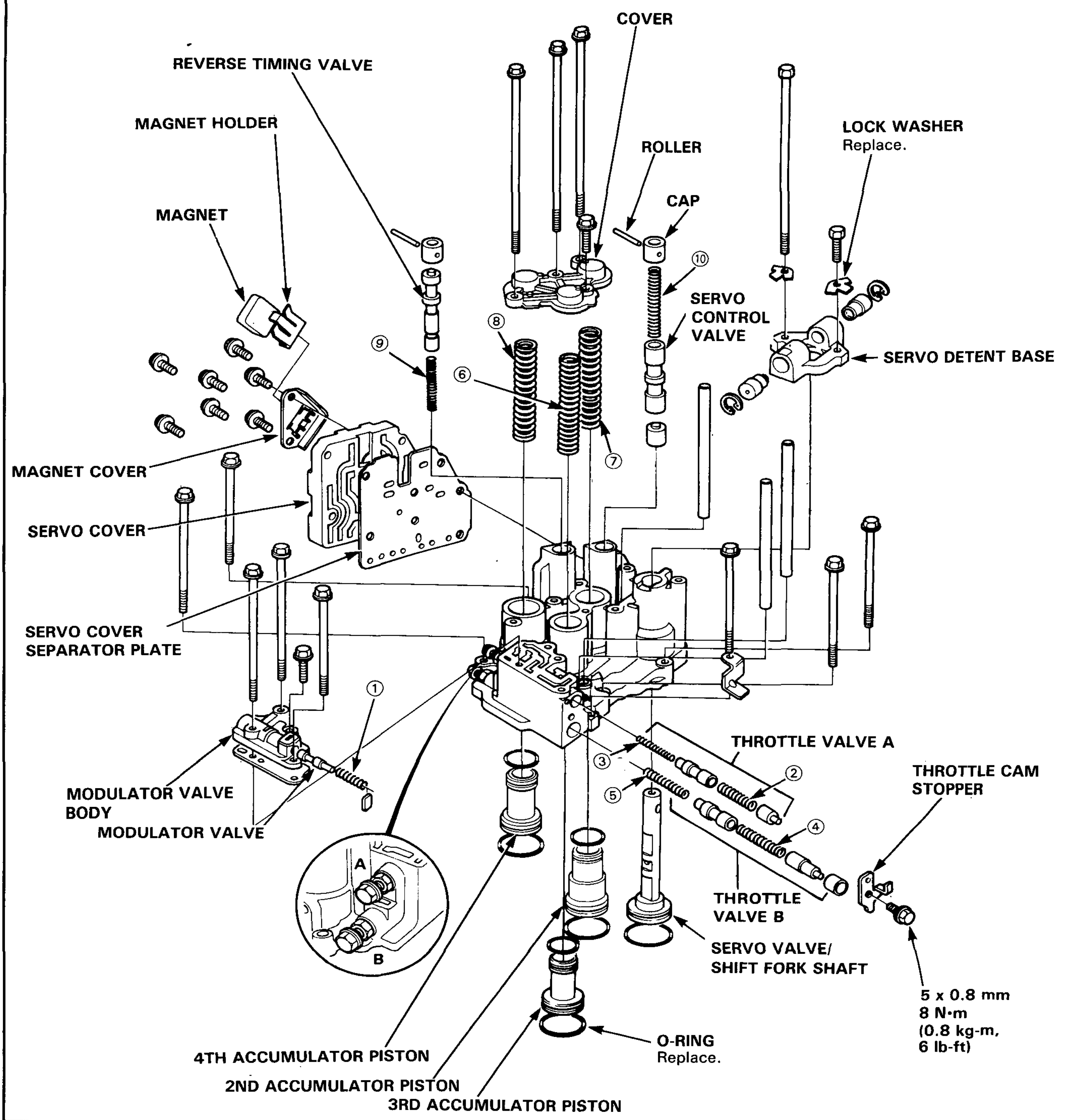
Unit of length: mm (in)

No.	Spring	Standard (New)			
		Wire Dia.	O.D.	Free Length	No. of Coils
①	Kick-down valve spring	1.0 (0.039)	10.1 (0.398)	38.9 (1.531)	12.5
②	Orifice control valve spring	0.9 (0.035)	6.1 (0.240)	35.9 (1.413)	20.0
③	Shift timing valve spring	0.9 (0.035)	8.6 (0.339)	42.9 (1.689)	21.4
④	4th exhaust valve spring	0.9 (0.035)	6.1 (0.240)	43.7 (1.720)	20.3
⑤	Accumulator valve spring D12B1/D15B3	1.2 (0.047)	7.7 (0.303)	45.1 (1.776)	19.8
	D15B4/D16A9	1.2 (0.047)	7.7 (0.303)	45.6 (1.795)	21.8
⑥	Lock-up cut valve spring	0.7 (0.028)	7.6 (0.299)	29.0 (1.412)	18.0
⑦	Reverse control valve spring	0.7 (0.028)	7.6 (0.299)	37.2 (1.465)	15.3
⑧	CPC (Clutch Pressure Control) valve spring	0.9 (0.035)	8.6 (0.339)	18.2 (0.717)	5.54

Servo Body

Disassembly/Inspection/Reassembly

NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- Replace valve body as an assembly if any parts are worn or damaged.
- Coat all parts with ATF before reassembly.
- Replace the O-rings and filters.



SPRING SPECIFICATIONS

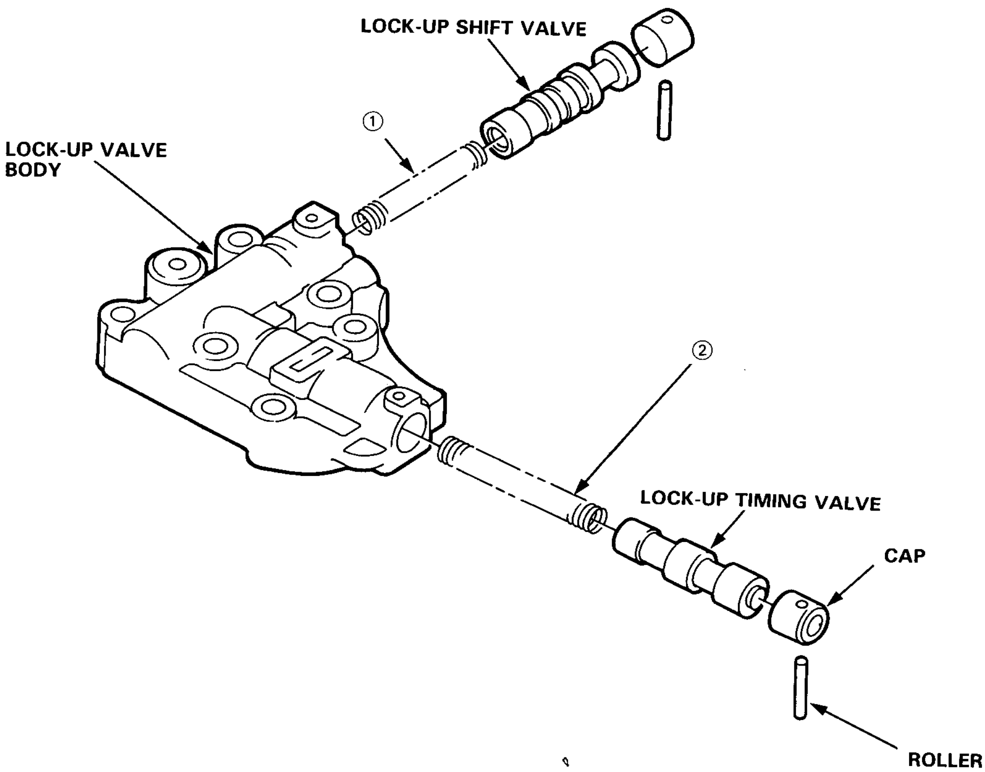
Unit of length: mm (in)

No.	Spring		Standard (New)			
			Wire Dia.	O.D.	Free Length	No. of Coils
①	Modulator valve spring	D12B1/D15B3	1.2 (0.047) 1.2 (0.047)	9.4 (0.370) 9.4 (0.370)	26.3 (1.035) 27.2 (1.071)	8.0 8.0
		D15B4/D16A9	1.2 (0.047) 1.2 (0.047)	9.4 (0.370) 9.4 (0.370)	26.3 (1.035) 26.4 (1.039)	8.0 8.0
②	Throttle valve A spring	D12B1/D15B3	1.1 (0.043) 1.1 (0.043) 1.0 (0.039) 1.0 (0.039)	8.5 (0.335) 8.5 (0.335) 8.5 (0.335) 8.5 (0.335)	22.3 (0.878) 22.3 (0.878) 22.2 (0.874) 22.1 (0.870)	8.1 7.6 6.0 5.5
		D15B4/D16A9	1.0 (0.039) 1.0 (0.039) 1.0 (0.039) 1.0 (0.039)	8.5 (0.335) 8.5 (0.335) 8.5 (0.335) 8.5 (0.335)	22.2 (0.874) 22.1 (0.870) 22.5 (0.886) 22.3 (0.878)	6.0 5.5 7.3 6.6
③	Throttle valve A adjusting spring		0.8 (0.031)	6.2 (0.244)	27.0 (1.063)	8.5
④	Throttle valve B spring	D12B1/D15B3	1.4 (0.055) 1.4 (0.055) 1.6 (0.063)	8.5 (0.335) 8.5 (0.335) 8.5 (0.335)	41.4 (1.630) 41.4 (1.630) 41.3 (1.626)	8.4 7.8 13.9
		D15B4/D16A9	1.6 (0.063) 1.6 (0.063) 1.6 (0.063)	8.5 (0.335) 8.5 (0.335) 8.5 (0.335)	41.3 (1.626) 41.4 (1.630) 41.3 (1.626)	13.9 11.7 15.0
⑤	Throttle valve B adjusting spring		0.8 (0.031)	6.2 (0.244)	30.0 (1.181)	8.0
⑥	3rd accumulator spring		2.9 (0.114)	15.5 (0.689)	79.5 (3.130)	15.0
⑦	2nd accumulator spring		3.9 (0.154)	20.2 (0.795)	74.9 (2.949)	10.9
⑧	4th accumulator spring		3.5 (0.138)	18.6 (0.732)	77.4 (3.047)	10.2
⑨	Reverse timing valve spring		0.7 (0.028)	5.6 (0.220)	43.8 (1.724)	21.7
⑩	Servo control valve spring		1.0 (0.039)	7.6 (0.299)	44.0 (1.732)	18.2

Lock-up Valve Body

Disassembly/Inspection/Reassembly

NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- Replace valve body as an assembly if any parts are worn or damaged.
- Check all valves for free movement. If any fail to slide freely, see Valve Body Repair on page 14-85.
- Coat all parts with ATF before reassembly.



SPRING SPECIFICATIONS

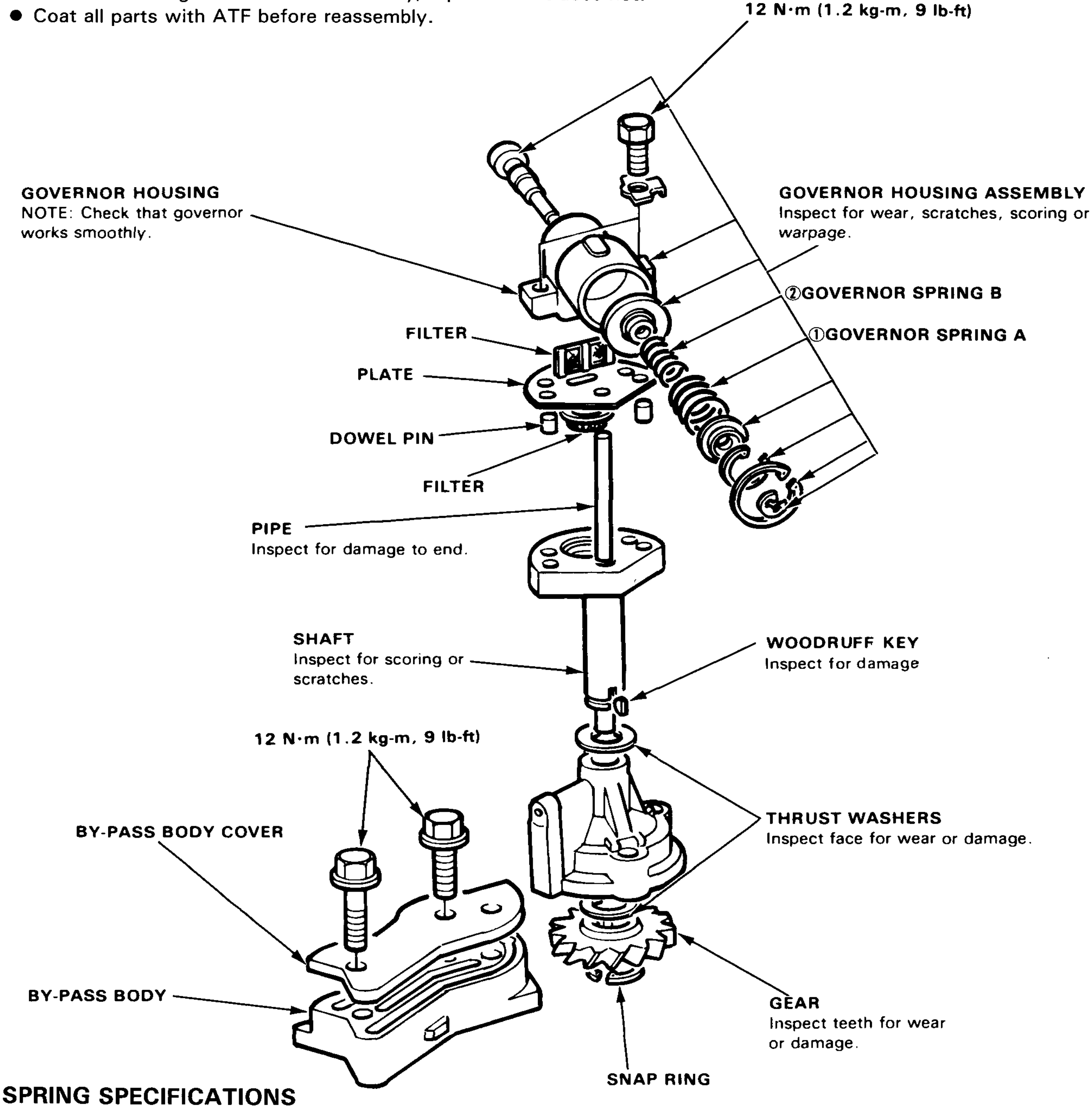
Unit of length: mm (in)

No.	Spring		Standard (New)			
			Wire Dia.	O.D.	Free Length	No. of Coils
①	Lock-up shift valve spring	D12B1/D15B3	0.7 (0.028)	8.1 (0.319)	39.0 (1.535)	15.4
		D15B4/D16A9	1.1 (0.043)	8.1 (0.319)	51.8 (2.039)	22.3
②	Lock-up timing valve spring		1.0 (0.039)	6.6 (0.260)	52.3 (2.059)	30.1

Governor Valve

Disassembly/Inspection/Reassembly

NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner, and dry with compressed air. Blow out all passages.
- Check that the governor works smoothly; replace it if it does not.
- Coat all parts with ATF before reassembly.



SPRING SPECIFICATIONS

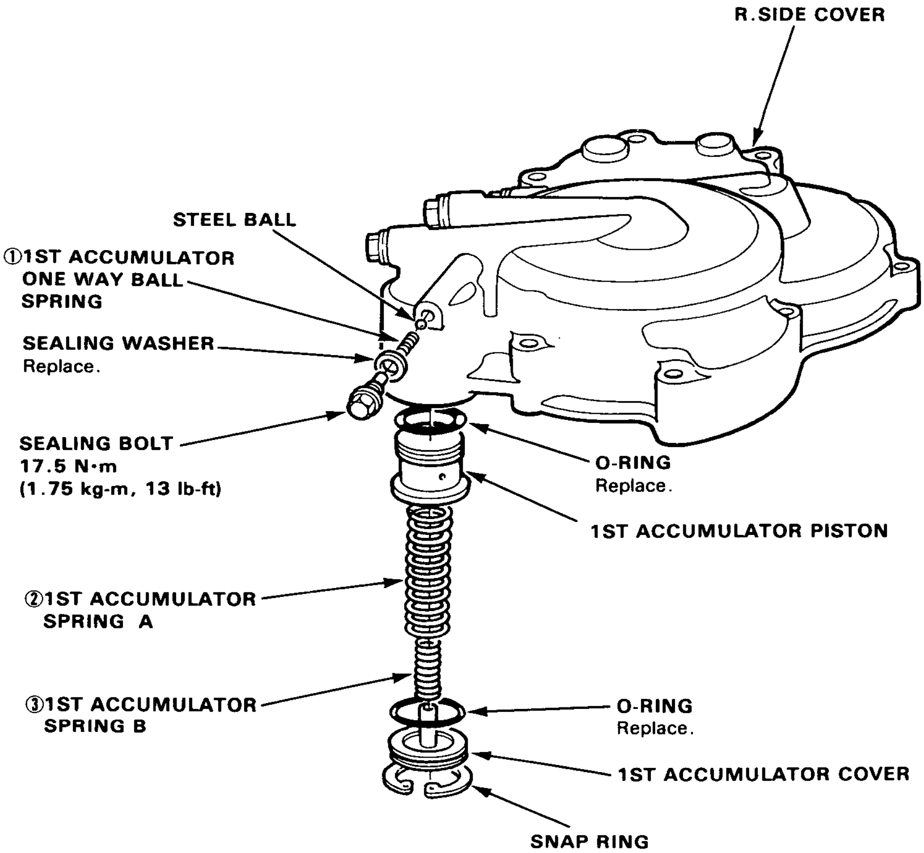
Unit of length: mm (in)

No.	Spring	Standard (New)			
		Wire Dia.	O.D.	Free Length	No. of Coils
①	Governor spring A	1.0 (0.039)	18.8 (0.740)	20.4 (0.803)	4.0
②	Governor spring B	0.9 (0.035)	11.8 (0.465)	27.8 (1.094)	6.0

1st Accumulator/R. Side Cover

Disassembly/Inspection/Reassembly

NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner, and dry with compressed air. Blow out all passages.
- Coat all parts with ATF before reassembly.



SPRING SPECIFICATIONS

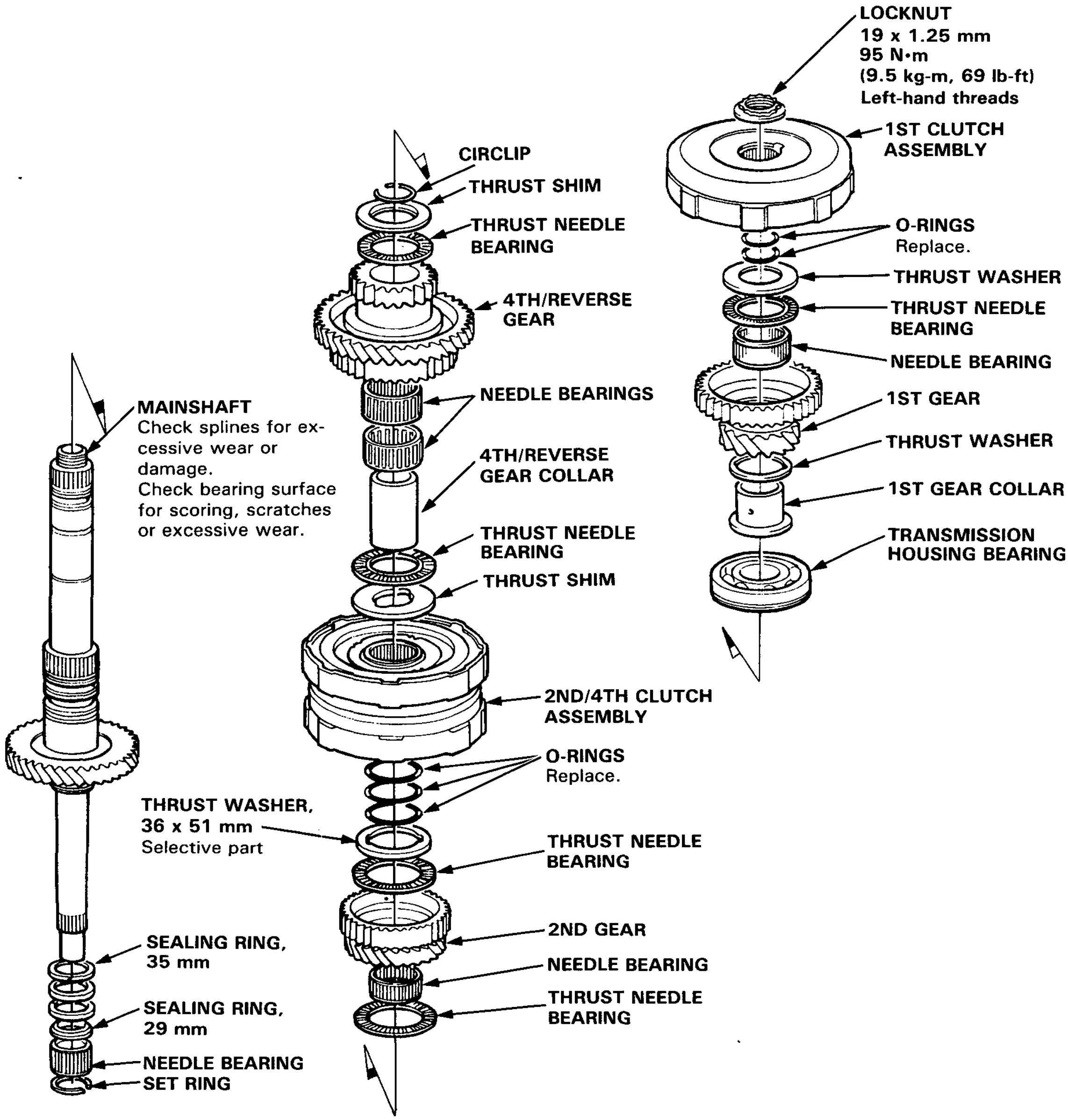
Unit of length: mm (in)

No.	Spring	Standard (New)			
		Wire Dia.	O.D.	Free Length	No. of Coils
①	1st accumulator one way ball spring	0.29 (0.011)	4.0 (0.157)	14.0 (0.551)	13.0
②	1st accumulator spring A	2.34 x 2.90 (0.092 x 0.114)	21.5 (0.846)	66.7 (2.626)	10.2
③	1st accumulator spring B	2.8 (0.110)	13.1 (0.516)	40.0 (1.575)	8.8

Mainshaft

Disassembly/Inspection/Reassembly

NOTE:
- Lubricate all parts with ATF during reassembly.
- Install thrust needle bearings with unrolled edge of bearing retainer facing washer.
- Inspect thrust needle and needle bearings for galling and rough movement.
- Before installing the O-rings, wrap the shaft splines with tape to prevent damaging the O-rings.
- Locknut has left-hand threads.



Mainshaft

Inspection

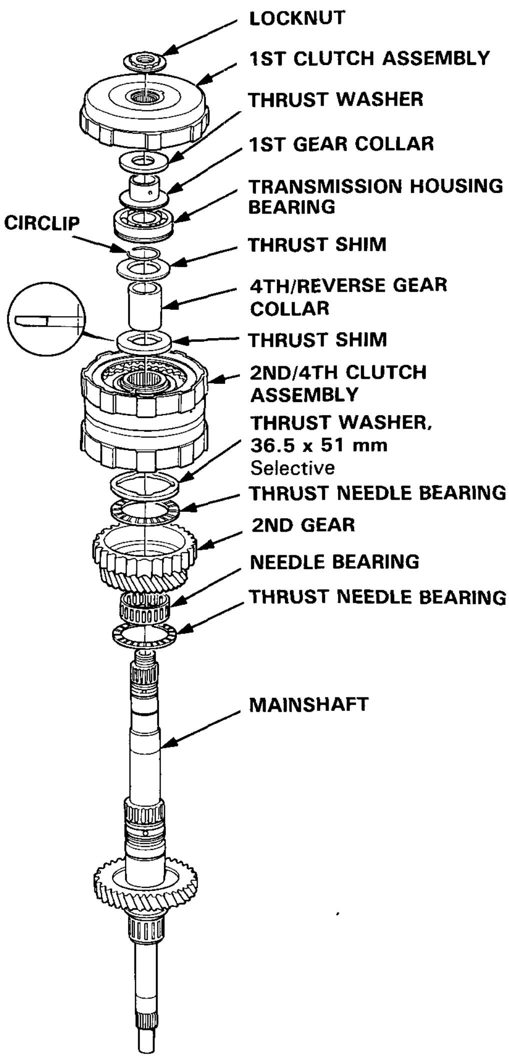
- Clearance Measurement

NOTE: Lubricate all parts with ATF during assembly.

1. Remove the mainshaft bearing from the transmission housing (see page 14-114).

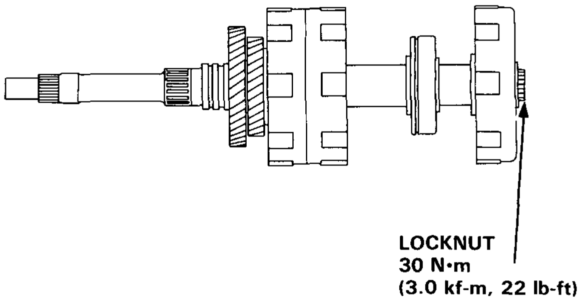
2. Assemble the parts below on the mainshaft.

NOTE: Do not assemble the O-rings while inspecting.



3. Torque the mainshaft locknut to 30 N•m (3.0 kg-m, 22 lb-ft).

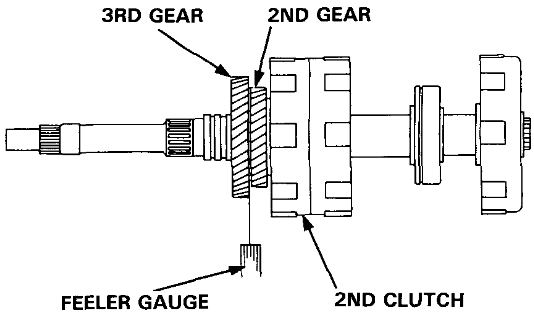
NOTE: Mainshaft locknut has left-hand threads.

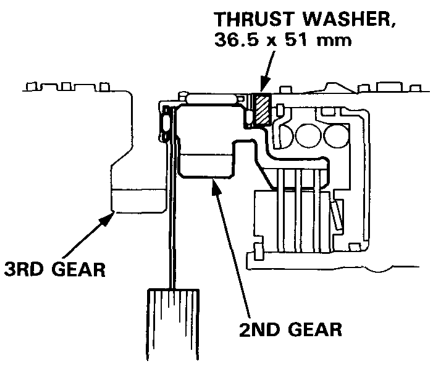


4. Hold the 2nd gear against the 2nd clutch. Measure the clearance between the 2nd gear and the 3rd gear with a feeler gauge.

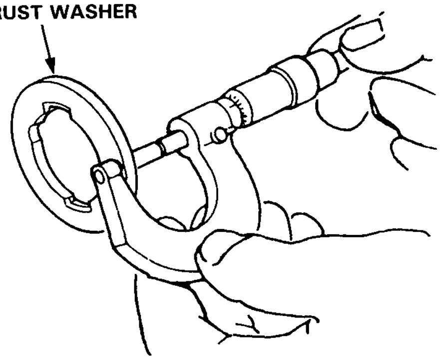
NOTE: Take measurements in at least three places and take the average as the actual clearance.

STANDARD: 0.05–0.13 mm (0.002–0.005 in)





5. If the clearance is out of tolerance, remove the thrust washer and measure the thickness.



6. Select and install a new washer then recheck.

THRUST WASHER 36.5 x 51 mm

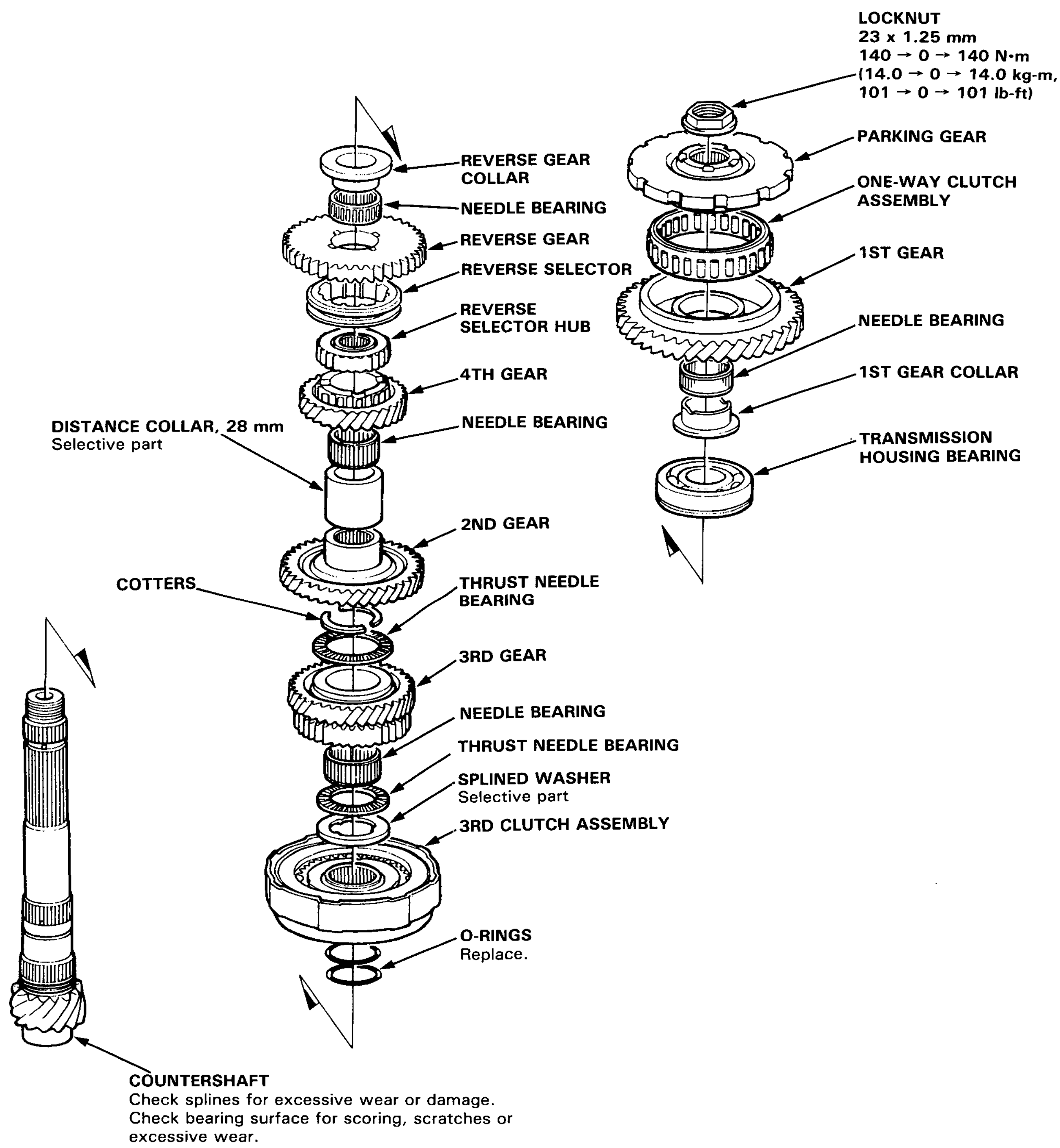
No.	Part Number	Thickness
1	90441-PC9-010	3.50 mm (0.138 in)
2	90442-PC9-010	3.55 mm (0.140 in)
3	90443-PC9-010	3.60 mm (0.142 in)
4	90444-PC9-010	3.65 mm (0.144 in!
5	90445-PC9-010	3.70 mm (0.146 in)
6	90446-PC9-010	3.75 mm (0.148 in)
7	90447-PC9-010	3.80 mm (0.150 in)
8	90448-PC9-010	3.85 mm (0.152 in)
9	90449-PC9-010	3.90 mm (0.154 in)

7. After replacing the thrust washer, make sure the clearance is within tolerance.

Countershaft

Disassembly/Inspection/Reassembly

NOTE:
- Lubricate all parts with ATF before reassembly.
- Install thrust needle bearings with unrolled edge of bearing retainer facing washer.
- Inspect thrust needle and needle bearings for galling and rough movement.
- Before installing the O-rings, wrap the shaft splines with tape to prevent damaging the O-rings.



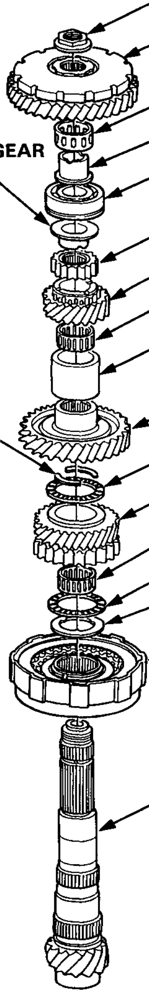
Inspection

- Clearance Measurement

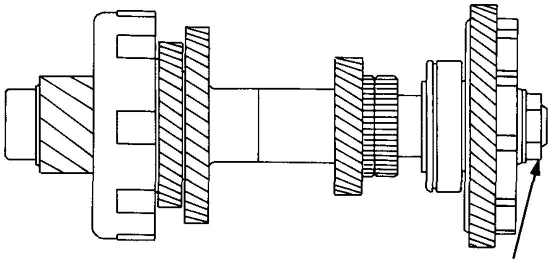
  NOTE: Lubricate all parts with ATF during assembly.

1. Remove the countershaft bearing from the transmission housing (see page 14-114).
2. Assemble the parts below on the countershaft.

   NOTE: Do not assemble the O-rings while inspecting.



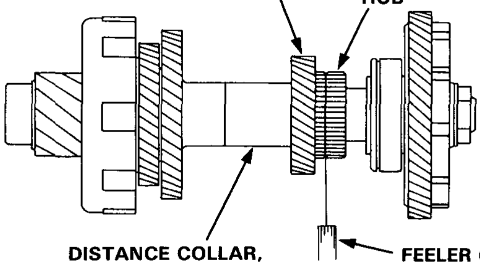
3. Torque the countershaft locknut to 30 N•m (3.0 kg-m, 22 lb-ft).

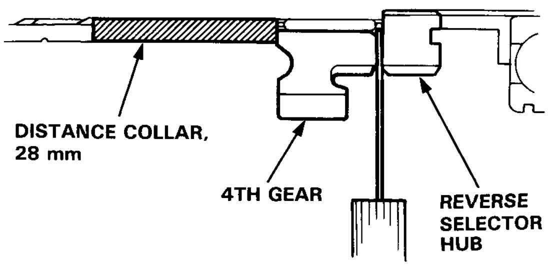


4. Measure the clearance between the 4th gear and the reverse selector hub with a feeler gauge.

   NOTE: Take measurements in at least three places and take the average as the actual clearance.

   STANDARD: 0.05–0.13 mm (0.002–0.005 in)





(cont'd)

Countershaft

Inspection (cont'd)

5. Measure the clearance between the 3rd gear and 2nd gear with a feeler gauge, with the feeler gauge from step 4 between the 4th gear and reverse selector hub.

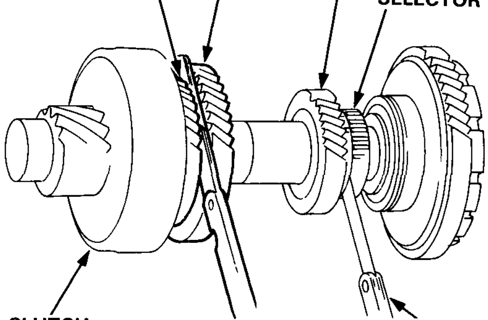
   —1. Measure the clearance with the 3rd gear pushed towards the 3rd clutch.

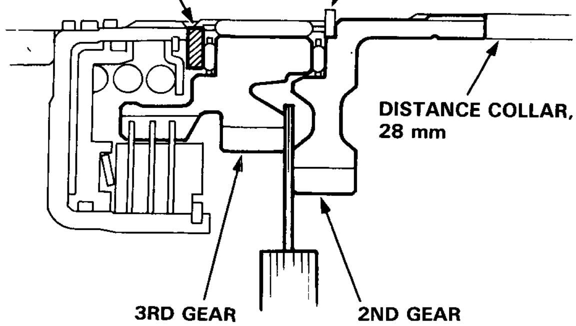
   —2. Measure the clearance with the 3rd gear pushed towards the 2nd gear.

   NOTE: Take measurements in at least three places and take the average as the actual clearance.

   —3. Subtract the measurements of step-2. from step-3., and you have the clearance between the 3rd gear and 2nd gear.

   STANDARD: 0.05—0.13 mm (0.002—0.005 in)





6. If the clearance is out of tolerance, remove the splined washer and/or distance collar and measure the thickness and/or the width.

7. Select and install a new distance collar then recheck.

DISTANCE COLLAR 28 mm

No.	Part Number	Thickness
1	90503-PC9-000	39.00 mm (1.535 in)
2	90504-PC9-000	39.10 mm (1.539 in)
3	90505-PC9-000	39.20 mm (1.543 in)
4	90507-PC9-000	39.30 mm (1.547 in)
5	90508-PC9-000	39.05 mm (1.537 in)
6	90509-PC9-000	39.15 mm (1.541 in)
7	90510-PC9-000	39.25 mm (1.545 in)
8	90511-PC9-000	38.90 mm (1.531 in)
9	90512-PC9-000	38.95 mm (1.533 in)

8. After replacing the distance collar, make sure the clearance is within tolerance.

9. Select and install a new splined washer then recheck.

SPLINED WASHER 35 x 50 mm

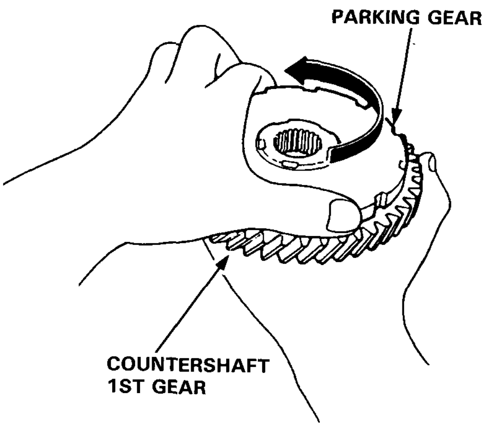
No.	Part Number	Thickness
1	90411-PA9-000	3.00 mm (0.118 in)
2	90412-PA9-000	3.05 mm (0.120 in)
3	90413-PA9-000	3.10 mm (0.122 in)
4	90414-PA9-000	3.15 mm (0.124 in)
5	90415-PA9-000	3.20 mm (0.126 in)
6	90416-PA9-000	3.25 mm (0.128 in)
7	90417-PA9-000	3.30 mm (0.130 in)
8	90418-PA9-000	3.35 mm (0.132 in)
9	90419-PA9-000	3.40 mm (0.134 in)
10	90423-PA9-000	2.90 mm (0.114 in)
11	90424-PA9-000	2.95 mm (0.116 in)

10. After replacing the splined washer, make sure the clearance is within tolerance.

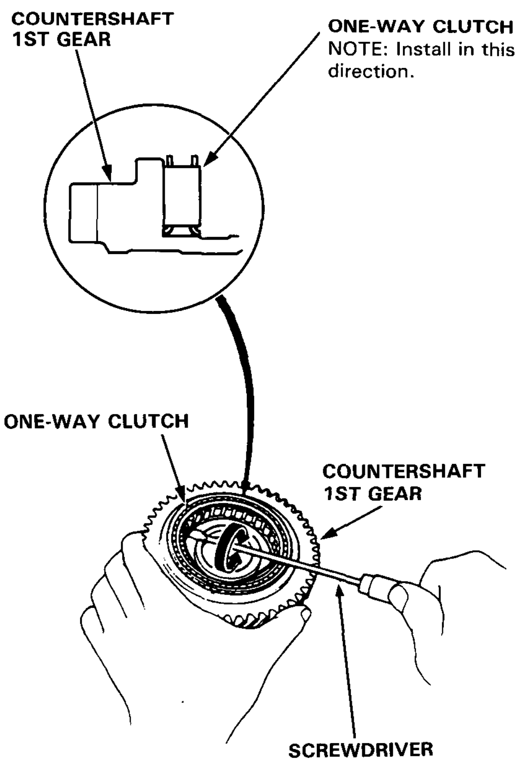
One-Way Clutch/Parking Gear

Disassembly and Inspection

1. Separate the countershaft 1st gear from the parking gear by turning the parking gear in the direction shown.

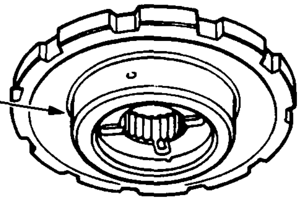


2. Remove the one-way clutch by prying it up with the end of a screwdriver.

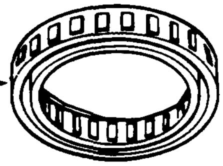


Inspect the parts as follows:

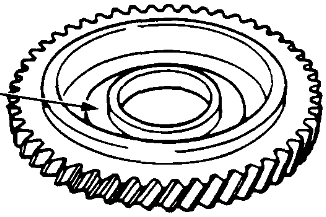
Inspect the parking gear for wear or scoring.



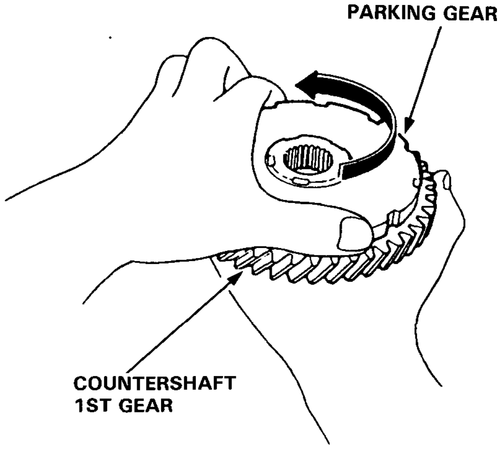
Inspect the one-way clutch for damage or faulty movement.



Inspect the countershaft 1st gear for wear or scoring.

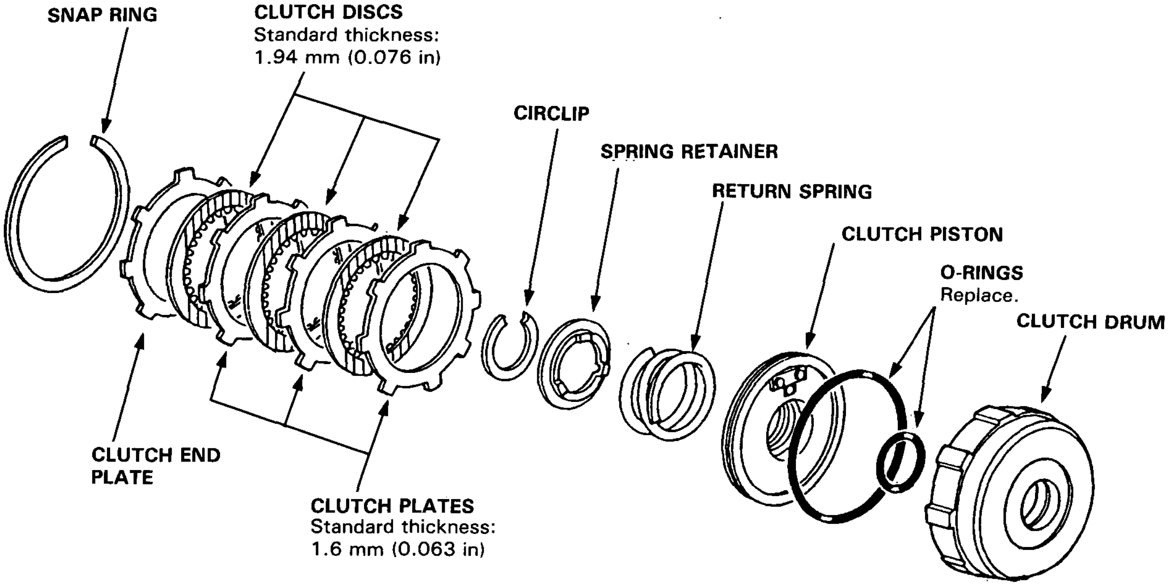


3. After the parts are assembled, hold the countershaft 1st gear and turn the parking gear in direction shown to be sure it turns freely.

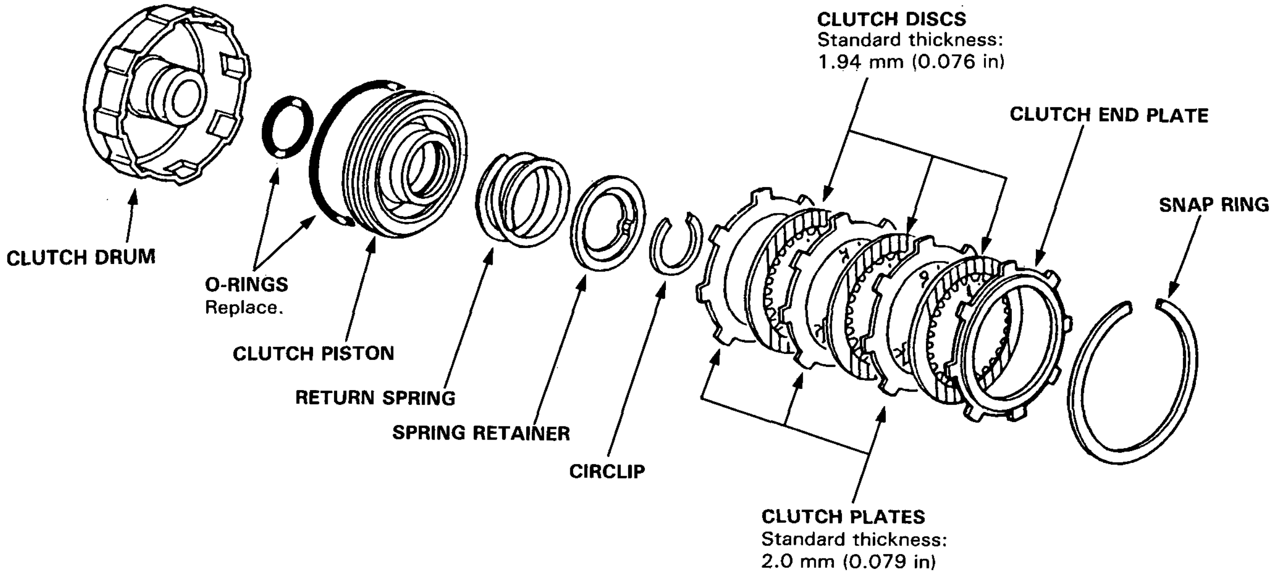


Illustrated Index

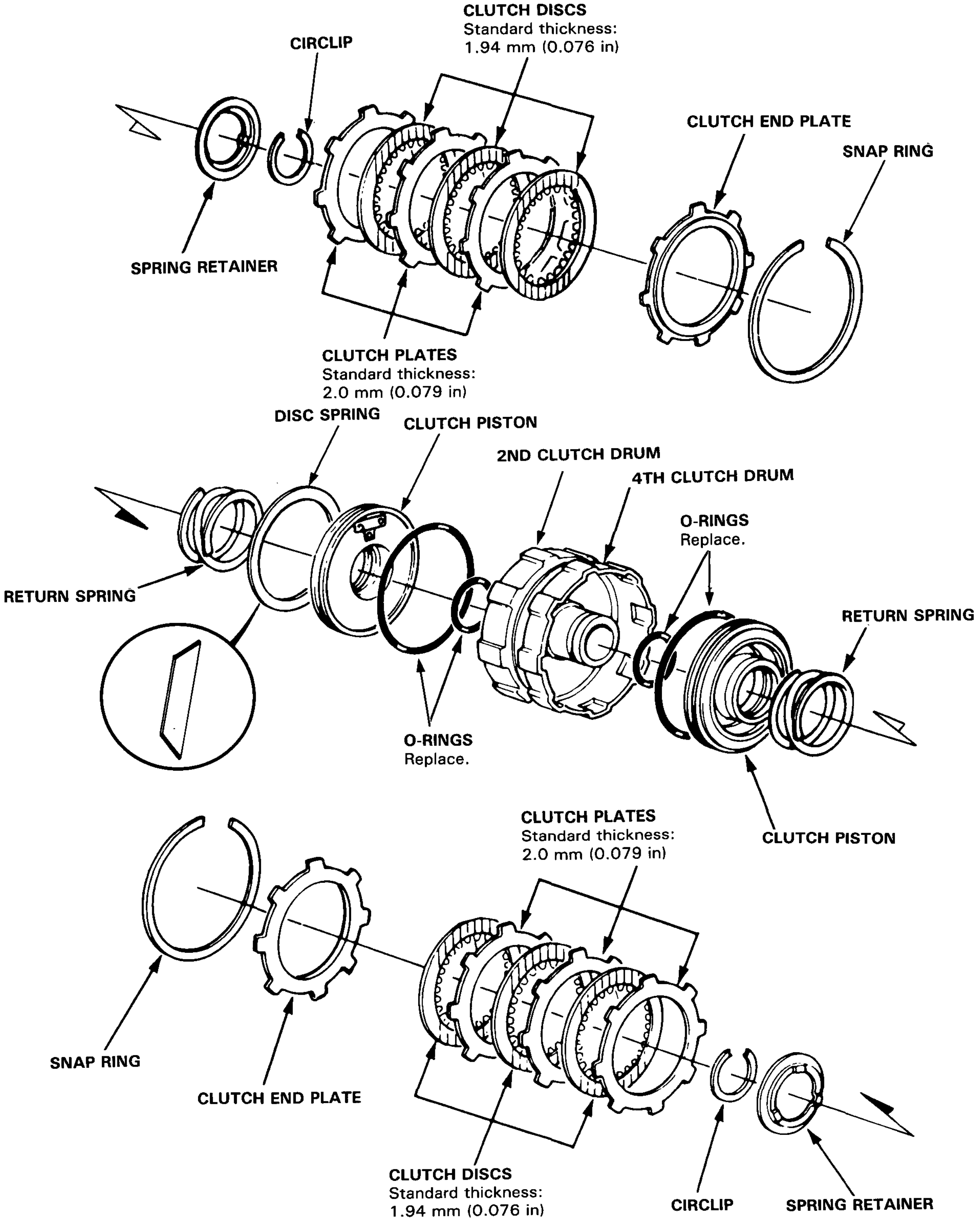
1ST CLUTCH



3RD CLUTCH

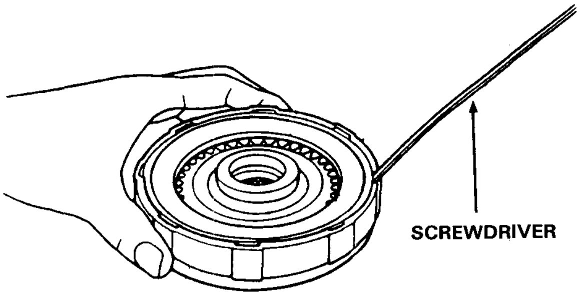


2ND/4TH CLUTCH



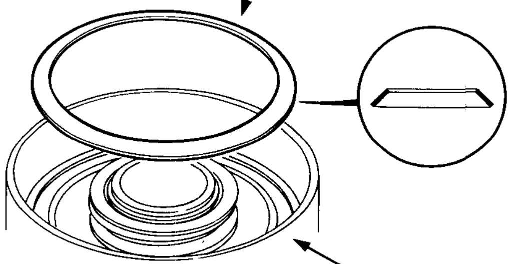
Disassembly

1. Remove the snap rings, then remove the clutch end plate, clutch discs and plates.

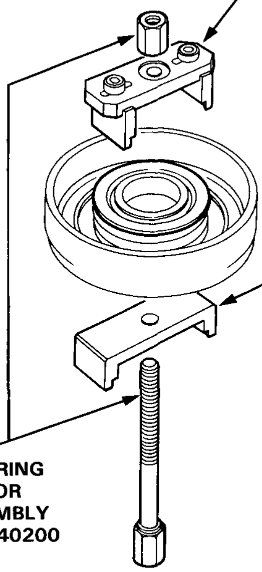


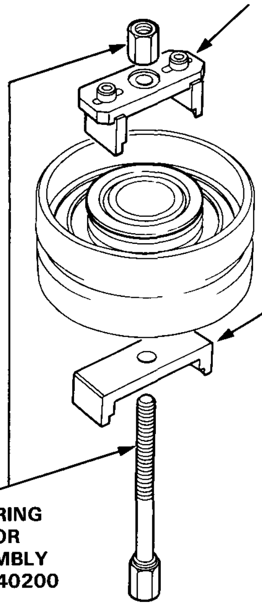
2. Remove the disc spring.

   NOTE: For 2nd clutch.

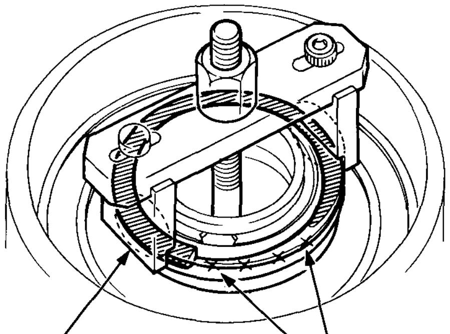


3. Install the special tools as shown.

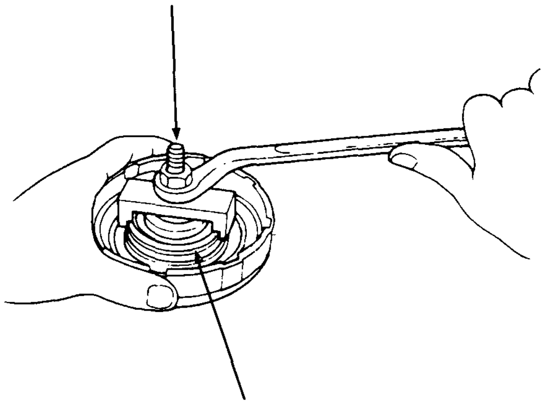




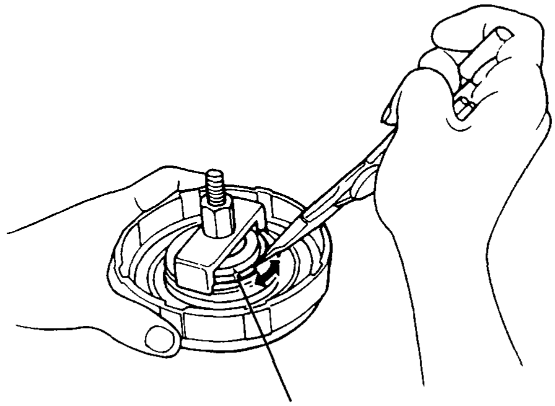
CAUTION: **If either end of the compressor attachment is set over an area of the spring retainer which is unsupported by the return spring, the retainer may be damaged.**



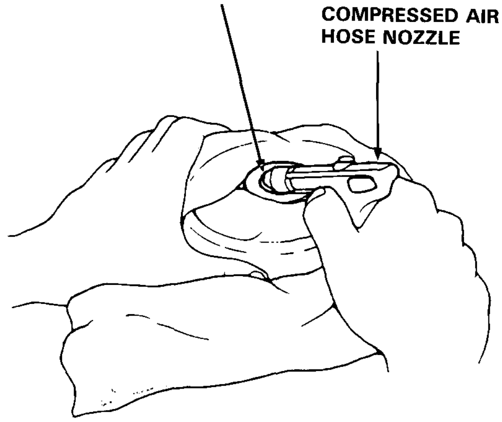
4. Compress the clutch return spring.



5. Remove the circlip. Then remove the special tools, spring retainer and return spring.



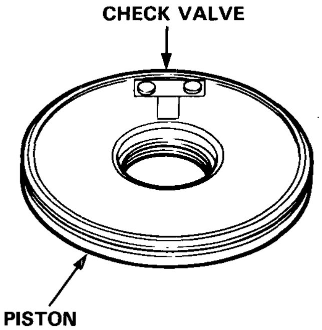
6. Wrap a shop towel around the clutch drum and apply air pressure to the oil passage to remove the piston. Place a finger tip on the other end while applying air pressure.



Reassembly

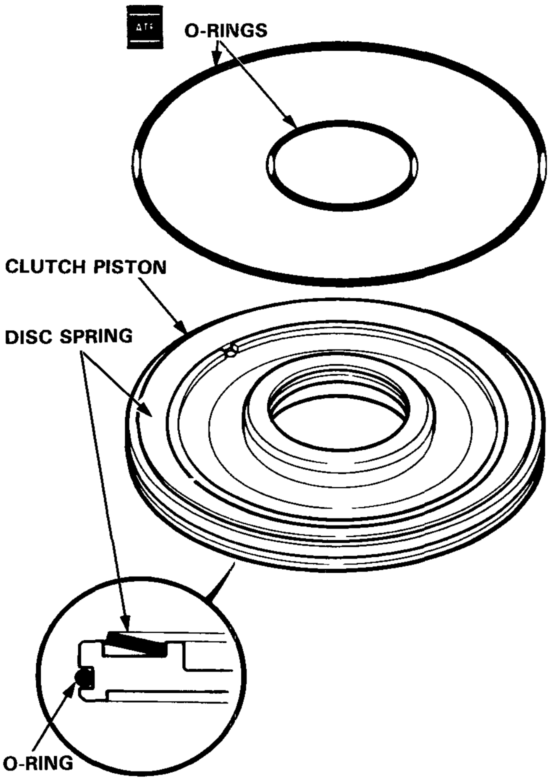
NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner, and dry with compressed air.
- Blow out all passages.
- Lubricate all parts with ATF before reassembly.

1. Inspect for a loose check valve.



2. Install a new O-ring on the clutch piston.
3. Be sure that the disc spring is securely staked.

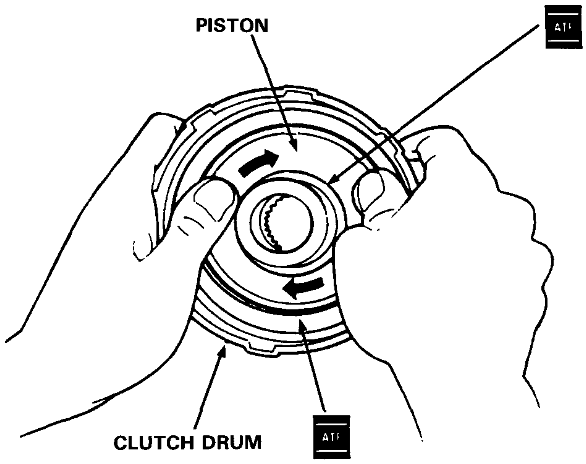
   NOTE: For 1st, 3rd and 4th clutches.



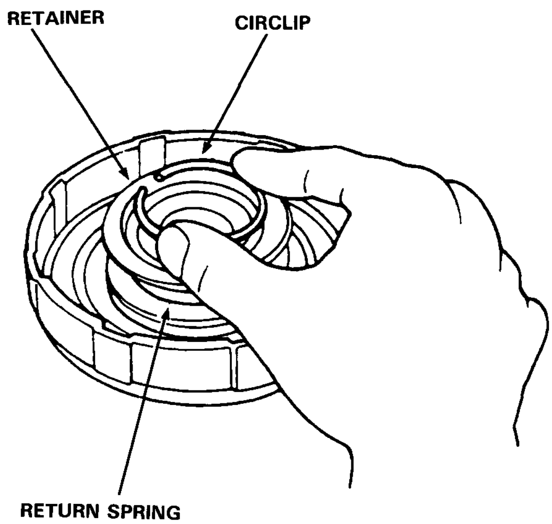
4. Install the piston in the clutch drum. Apply pressure and rotate to ensure proper seating.

   NOTE: Lubricate the piston O-ring with ATF before installing.

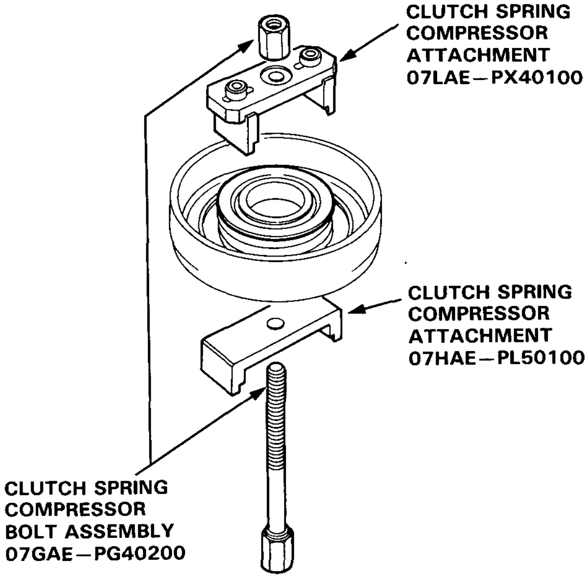
   CAUTION: Do not pinch O-ring by installing the piston with force.

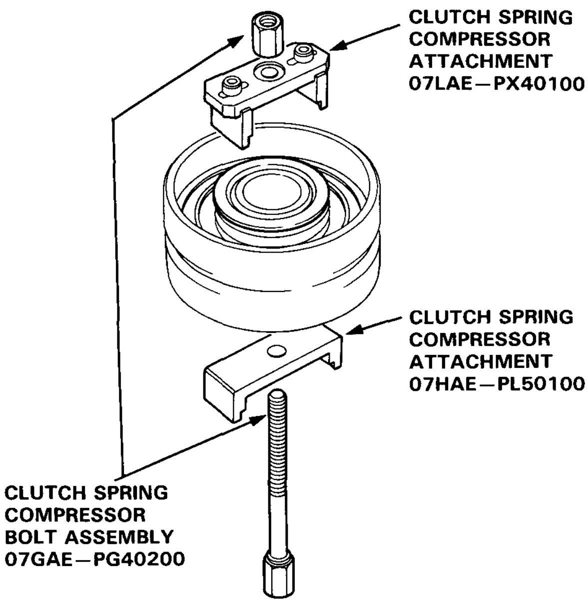


5. Install the return spring and spring retainer and position the circlip on the retainer.

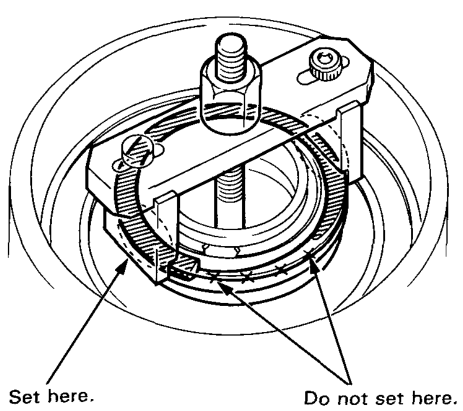


6. Install the special tools as shown.

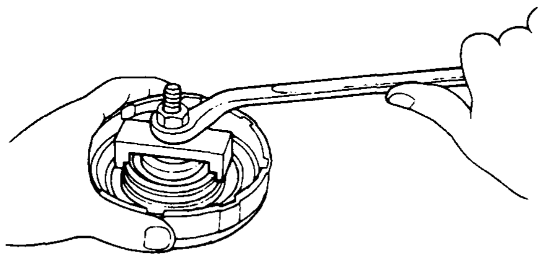




CAUTION: If either end of the compressor attachment is set over an area of the spring retainer which is unsupported by the retainer spring, the retainer may be damaged.



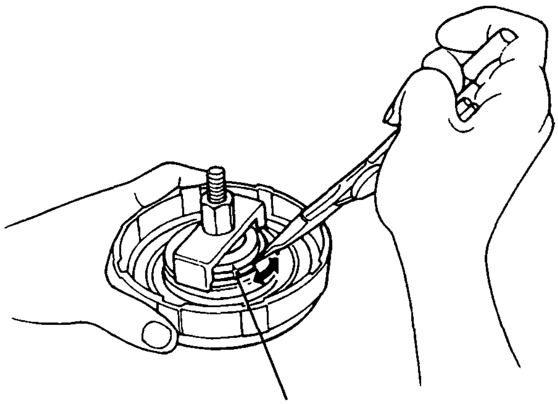
7. Compress the clutch return spring.



(cont'd)

Reassembly (cont'd)

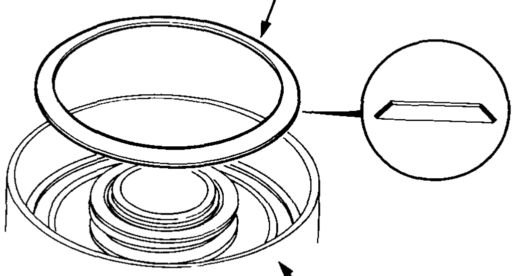
8. Install the circlip.



9. Remove the special tools.

10. Install the disc spring.

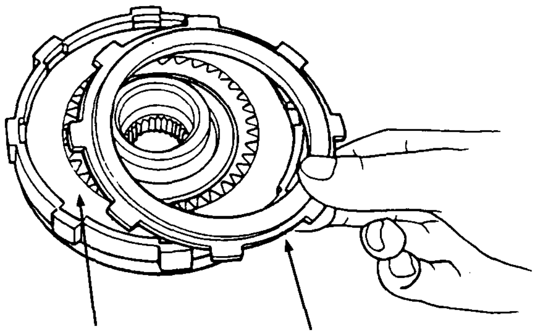
NOTE:
- For 2nd clutch.
- Install the disc spring in the direction shown.



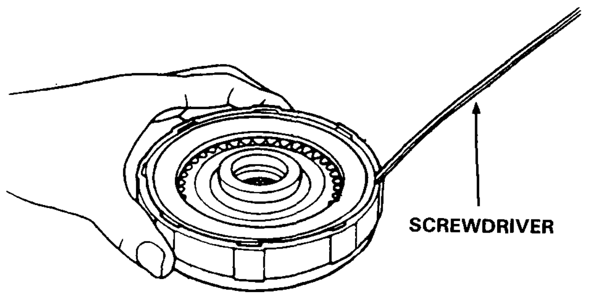
11. Soak the clutch discs thoroughly in ATF for a minimum of 30 minutes.

12. Starting with a clutch plate, alternately install the clutch plates and discs. Install the clutch end plate with flat side toward the disc.

NOTE: Before installing the plates and discs, make sure the inside of the clutch drum is free of dirt or other foreign matter.



13. Install the snap ring.

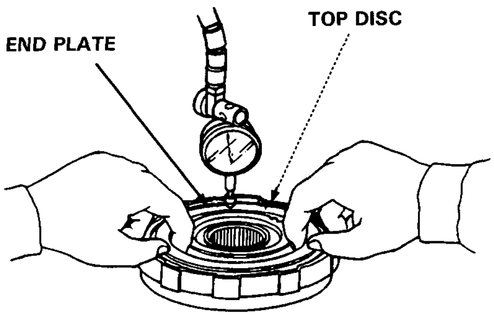


14. Measure the clearance between the clutch end plate and top disc with a dial indicator. Zero the dial indicator with the clutch end plate lowered and lift it up to the snap ring. The distance that the clutch end plate moves is the clearance between the clutch end plate and top disc.

NOTE: Measure at three locations.

End Plate-to-Top Disc Clearance:

Clutch	Service Limit
1st	0.65—0.85 mm (0.026—0.033 in)
2nd	0.65—0.85 mm (0.026—0.033 in)
3rd	0.40—0.60 mm (0.016—0.024 in)
4th	0.40—0.60 mm (0.016—0.024 in)



15. If the clearance is not within the service limits, select a new clutch end plate from the following table.

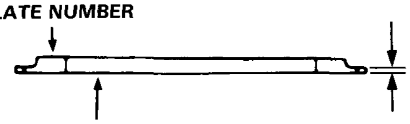
NOTE: If the thickest clutch and plate is installed but the clearance is still over the standard, replace the clutch discs and clutch plates.

CLUTCH END PLATE
- **D12B1/D15B3**

Plate No.	Part Number	Thickness mm (in)
1	22551—PA9—010	2.3 mm (0.091)
2	22552—PA9—010	2.6 mm (0.102)
3	22553—PA9—010	2.9 mm (0.114)
4	22554—PA9—010	3.2 mm (0.126)
5	22555—PA9—010	3.5 mm (0.138)
11	22561—PA9—010	2.15 mm (0.085)
12	22562—PA9—010	2.45 mm (0.096)
13	22563—PA9—010	2.75 mm (0.108)
14	22564—PA9—010	3.05 mm (0.120)
15	22565—PA9—010	2.35 mm (0.132)
16	22566—PA9—010	3.65 mm (0.144)

- **D15B4/D16A9**

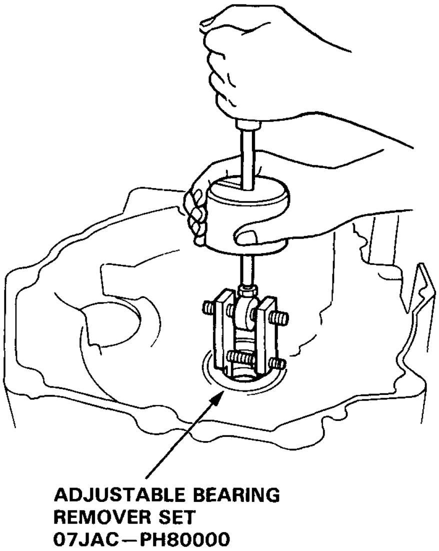
Plate No.	Part Number	Thickness
1	22551—PC9—000	2.4 mm (0.094 in)
2	22552—PC9—000	2.5 mm (0.098 in)
3	22553—PC9—000	2.6 mm (0.102 in)
4	22554—PC9—000	2.7 mm (0.106 in)
5	22555—PC9—000	2.8 mm (0.110 in)
6	22556—PC9—000	2.9 mm (0.114 in)
7	22557—PC9—000	3.0 mm (0.118 in)
8	22558—PC9—000	3.1 mm (0.122 in)
9	22559—PC9—000	3.2 mm (0.126 in)
10	22560—PC9—000	3.3 mm (0.130 in)
11	22561—PC9—000	2.1 mm (0.082 in)
12	22562—PC9—000	2.2 mm (0.086 in)
13	22563—PC9—000	2.3 mm (0.090 in)



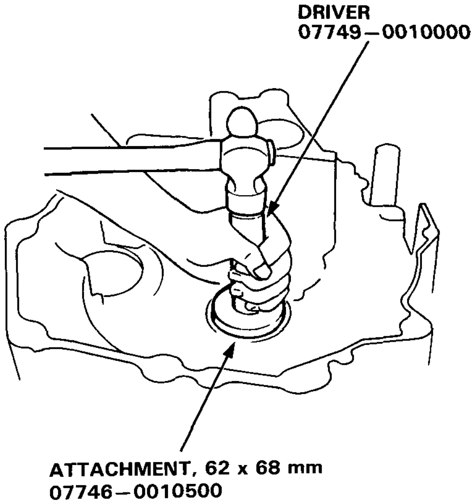
Torque Converter Housing Bearings

Mainshaft Bearing Replacement

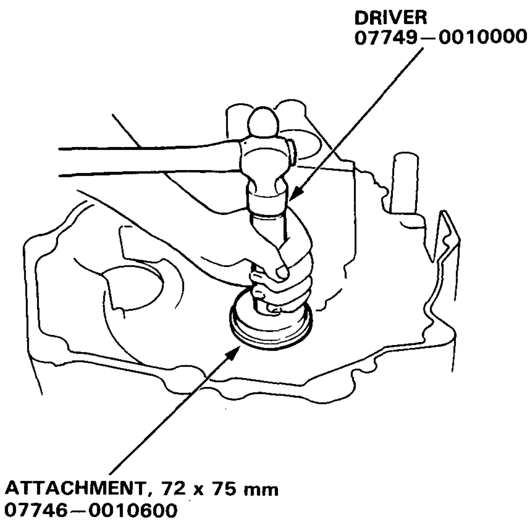
1. Pull up the mainshaft bearing and oil seal using the special tools as shown.



2. Drive in the new mainshaft bearing *until it bottoms* in the housing, using the special tools as shown.

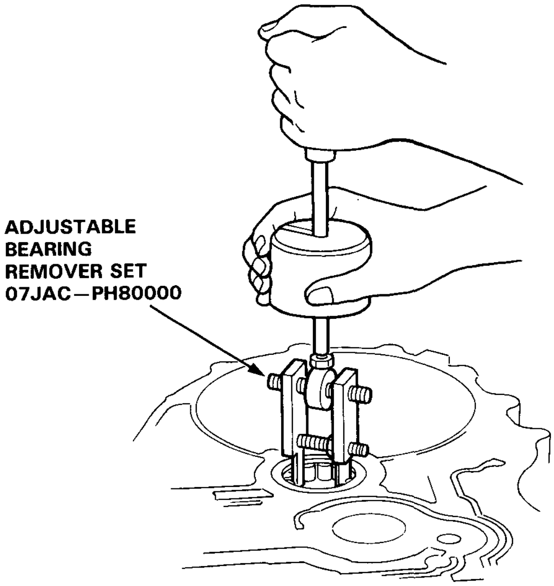


3. Install the new oil seal flush with the housing using the special tools as shown.



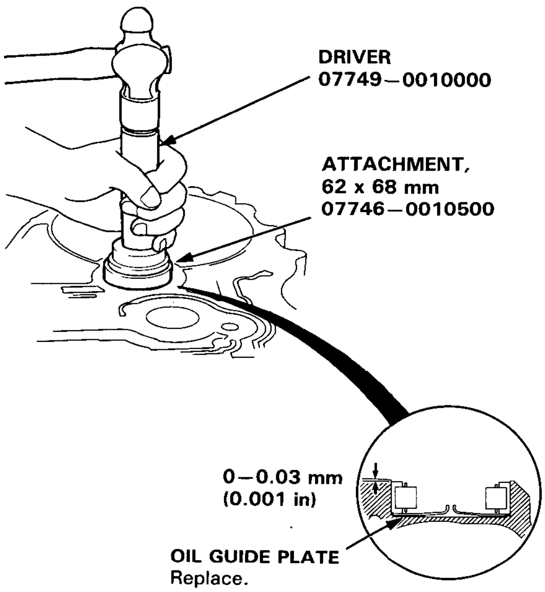
Countershaft Bearing Replacement

1. Remove the countershaft bearing using the special tool.



2. Replace the oil guide plate.

3. Drive the new bearing into the housing using the special tools as shown.

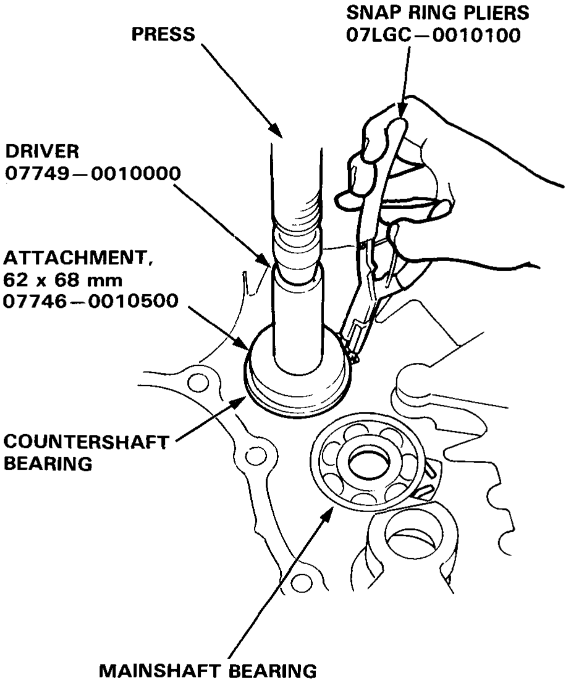


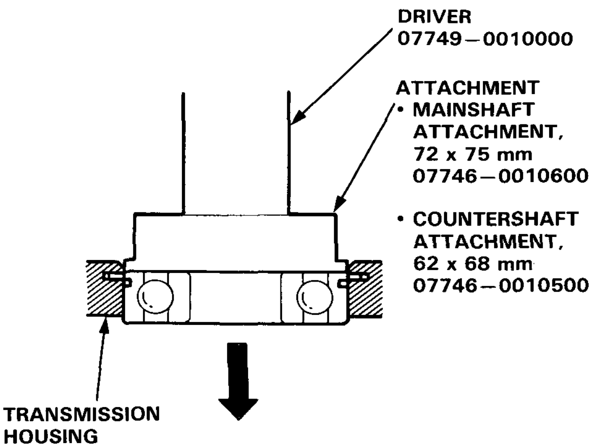
Transmission Housing Bearings

Mainshaft/Countershaft Bearing Replacement

1. To remove the mainshaft and countershaft bearings from the transmission housing, expand each snap ring with snap ring pliers, then push the bearing out using the special tools and a press as shown.

   NOTE: Do not remove the snap rings unless it's necessary to clean the grooves in the housing.

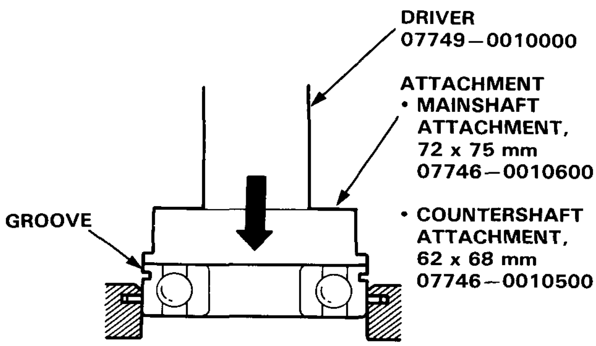




2. Expand each snap ring with snap ring pliers, insert the new bearing part-way into the housing using the special tools and a press as shown. Install the bearing with the groove facing outside the housing.

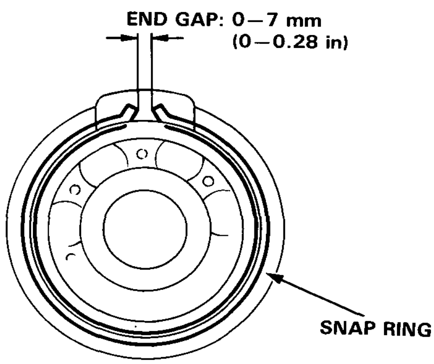
   NOTE: Coat all parts with ATF.

3. Release the pliers, then push the bearing down into the housing until the ring snaps in place around it.



4. After installing the bearing verify the following:

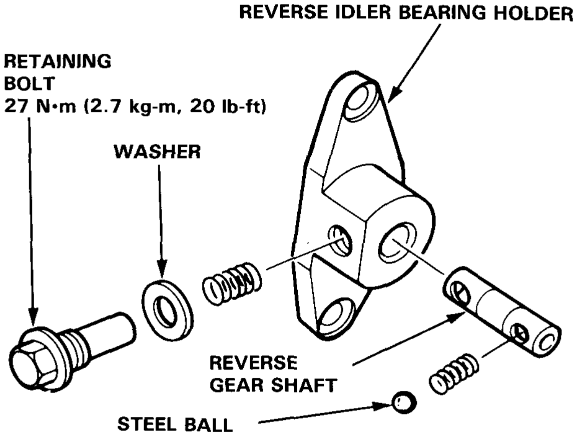
   - The snap ring is seated in the bearing and housing grooves.
   - The snap ring operates.
   - The ring end gap is correct.



Installation

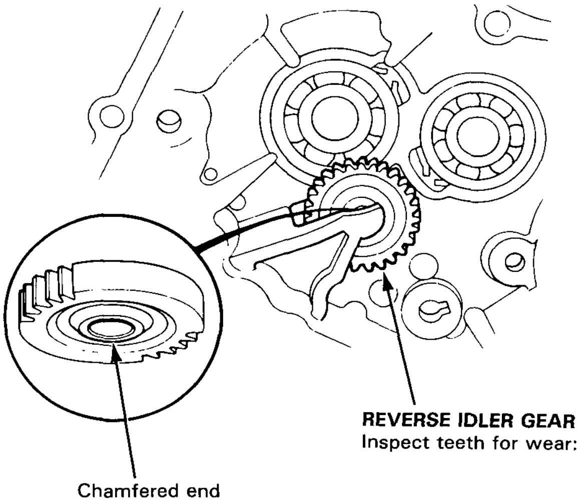
1. Assemble the reverse idler bearing holder.

   NOTE: Align the hole in the shaft with the spring.

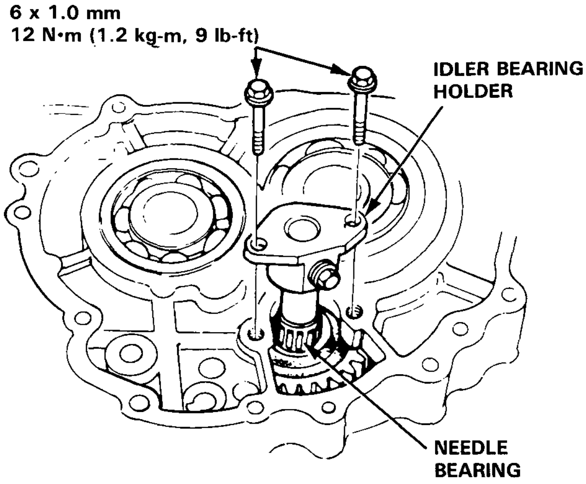


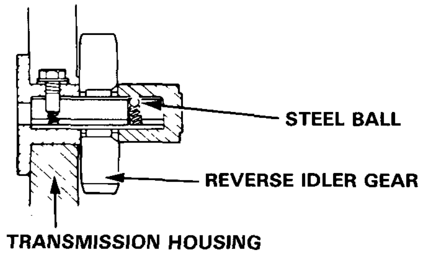
2. Install the reverse idler gear.

   NOTE: Install the reverse idler gear so that the larger chamfer on the shaft bore faces the torque converter housing.



3. Install the needle bearing on the idler gear shaft.
4. Install the reverse idler bearing holder into the transmission housing.
5. Tighten the reverse idler bearing holder bolts.
6. Install the spring and then tighten the retaining bolt and washer.

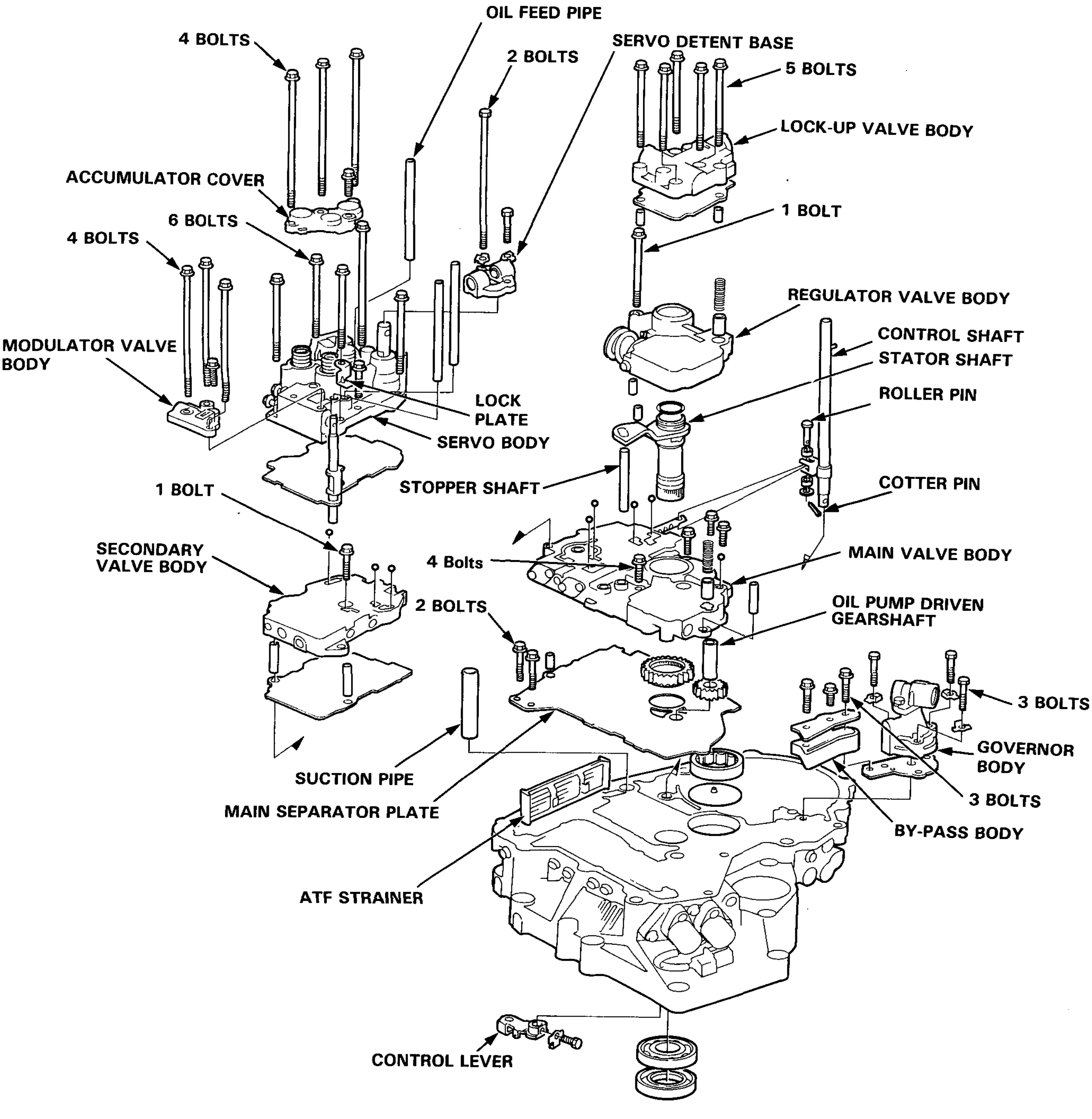




Transmission/Valve Body

Reassembly

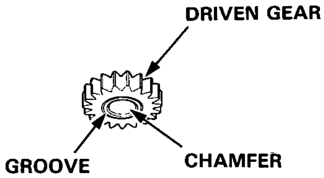
NOTE:
- Coat all parts with ATF.
- Replace the below parts:
  - O-rings
  - Lock washers
  - Gaskets
  - Locknuts
  - Sealing washer

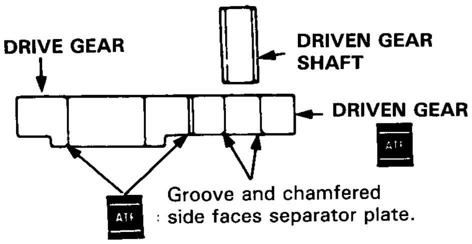


1. Install the ATF strainer in the torque converter housing.

2. Install the main separator plate with 1 dowel pin and 2 bolts on the torque converter housing. Then install the oil pump gears and oil pump driven gear shaft.

   NOTE: Install the oil pump driven gear with its grooved and chamfered side facing down.

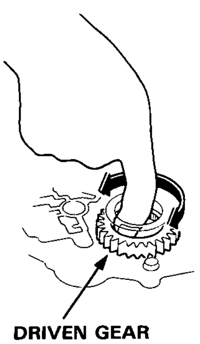


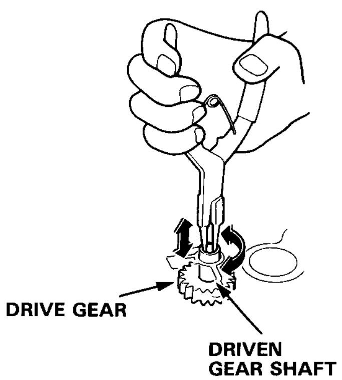


3. Install the main valve body with 4 bolts. And make sure the pump drive gear rotates smoothly in the normal operating direction and pump shaft moves smoothly in the axial and normal operating directions.

4. If the pump gear and pump shaft do not move freely, loosen the valve body bolts, realign the shaft, and then retighten to the specified torque.

   CAUTION: Failure to align the pump shaft correctly will result in seized pump gear or pump shaft.





5. Install the stator shaft and stopper shaft.

6. Install the 2 dowel pins, cooler relief valve and spring in the main valve body.

7. Install the regulator valve body with 1 bolt on the main valve body.

8. Install the torque converter check valve and spring in the regulator valve body.

9. Install the 2 dowel pins and separator plate on the regulator valve body, then install the lock-up valve body with 5 bolts.

10. Install the secondary separator plate with 2 dowel pins on the secondary valve body, then install the secondary valve body on the main valve body with 1 bolt.

11. Install the servo separator plate on the secondary valve body by inserting the throttle control shaft into the secondary valve body.

12. Install the servo body on the secondary valve body with 6 bolts and the lock plate.

13. Install the modulator valve body on the servo body with 4 bolts.

14. Install the accumulator cover on the servo body with 4 bolts.

15. Install the servo detent base on the servo body with 2 bolts and new lock washers.

16. Install the control shaft in the torque converter housing, then install the roller pin through the manual valve.

17. Install new cotter pin into the roller pin, then bend the cotter pin.

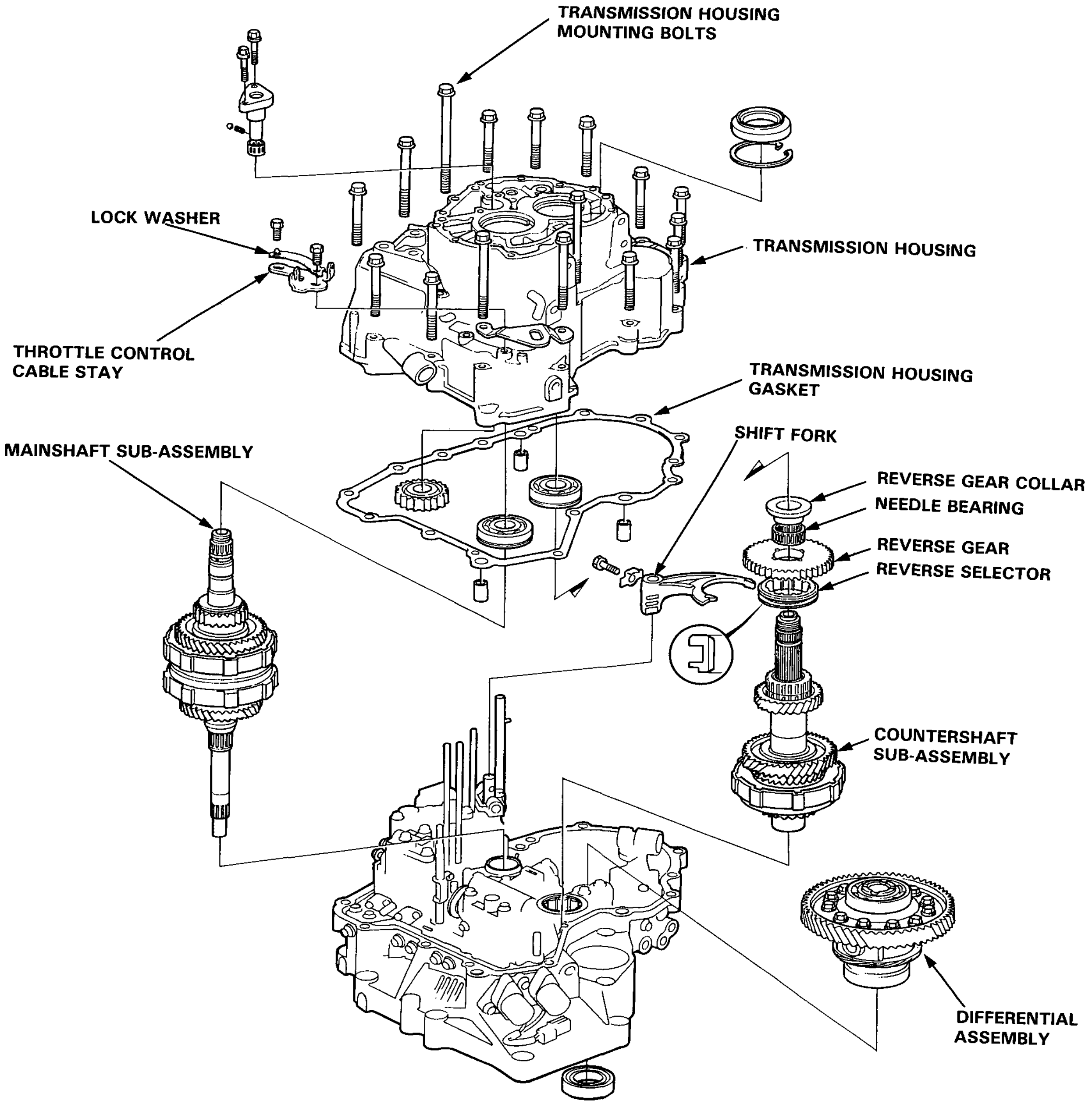
18. Install the governor separator plate and governor body with 3 bolts and new lock washers.

19. Install the by-pass body and body cover with 3 bolts.

20. Install 3 oil feed pipes in the servo body, 1 pipe in the main valve body and the suction pipe in the housing.

(cont'd)

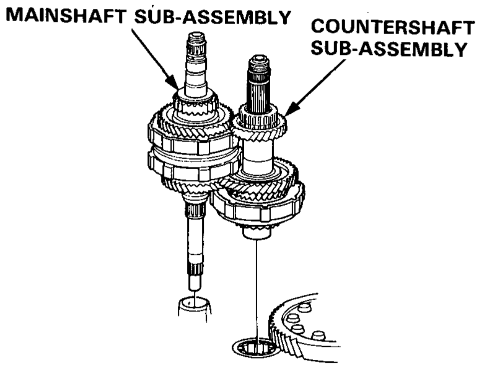
Reassembly (cont'd)



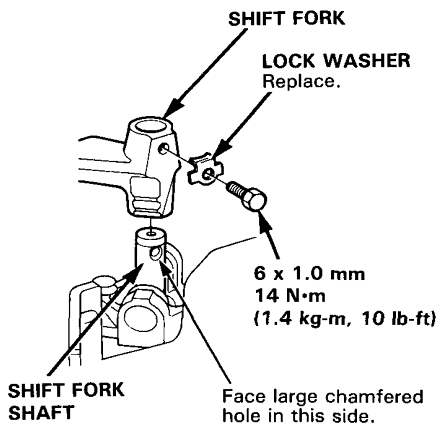
21. Install the reverse idler gear and gear shaft holder in the transmission housing (page 14-115).

22. Install the differential assembly in the torque converter housing.

23. Install the mainshaft sub-assembly and the countershaft sub-assembly together.



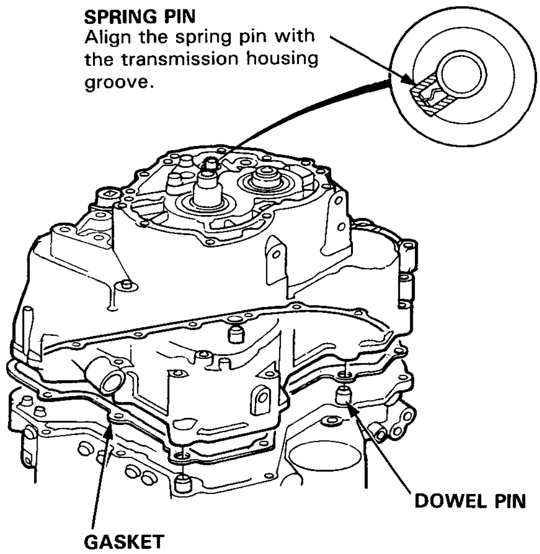
24. Turn the shift fork shaft so large chamfered hole facing fork bolt hole. Then install the shift fork and torque the lock bolt. Bend the lock tab against the bolt head.



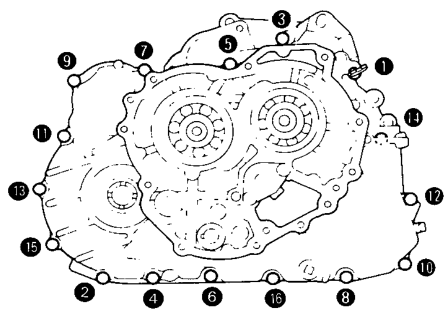
25. Install the reverse gear, needle bearing and reverse gear collar on the countershaft.

26. Align the spring pin with the transmission housing groove turning the control shaft.

27. Place the transmission housing on the torque converter housing.



28. Install the transmission housing bolts and transmission hanger, then torque bolts to 34 N•m (3.4 kg-m, 25 lb-ft) in two or more steps as shown.

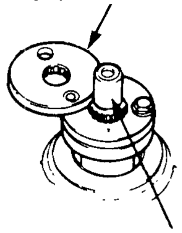


29. Install the throttle control cable stay and lock plate on the transmission housing.

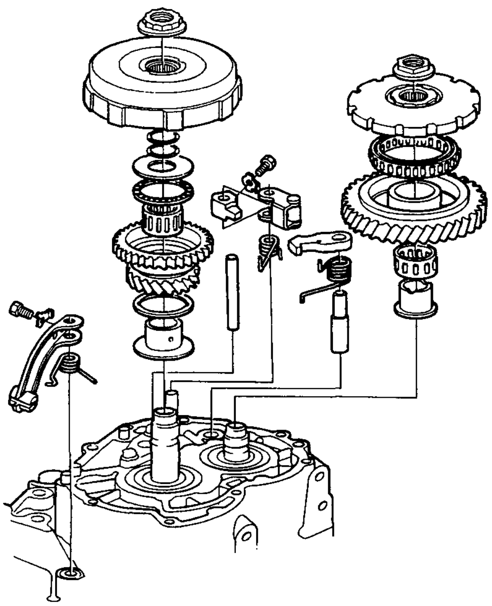
(cont'd)

Reassembly (cont'd)

30. Slip the special tool onto the mainshaft.

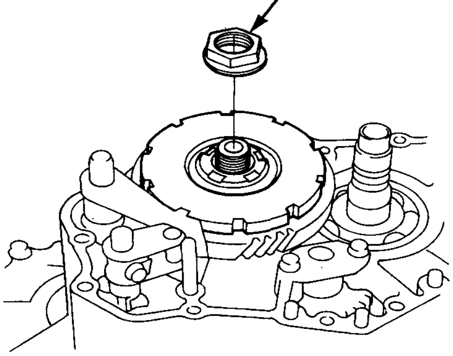


31. Install the parking brake lever on the control shaft.
32. Assemble the one-way clutch and parking gear with the countershaft 1st gear.
33. Install the 1st gear collar, needle bearing and parking gear/1st gear assembly on the countershaft.
34. Install the parking brake pawl with shaft and spring, then engage the parking brake pawl to the parking gear.



35. Tighten the old locknut to press the parking gear to specified torque, then loosen it.

TORQUE: 140 N·m (14.0 kg-m, 101 lb-ft)



36. Install the 1st gear collar and thrust washer on the mainshaft.
37. Install new O-rings on the mainshaft.

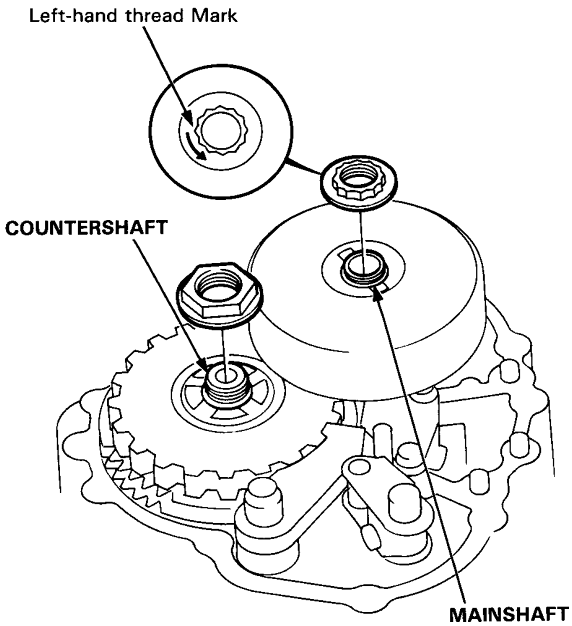
    NOTE: Before installing the O-rings, wrap the shaft splines with tape to prevent damaging the O-rings.

38. Install the thrust washer, thrust needle bearing, needle bearing and 1st gear on the 1st clutch, then install them on the mainshaft.

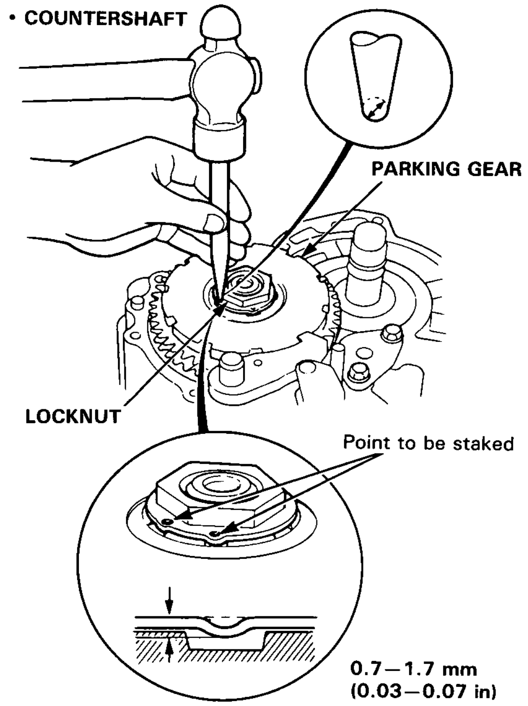
39. Install new locknuts on each shaft, then tighten them to specified torque.

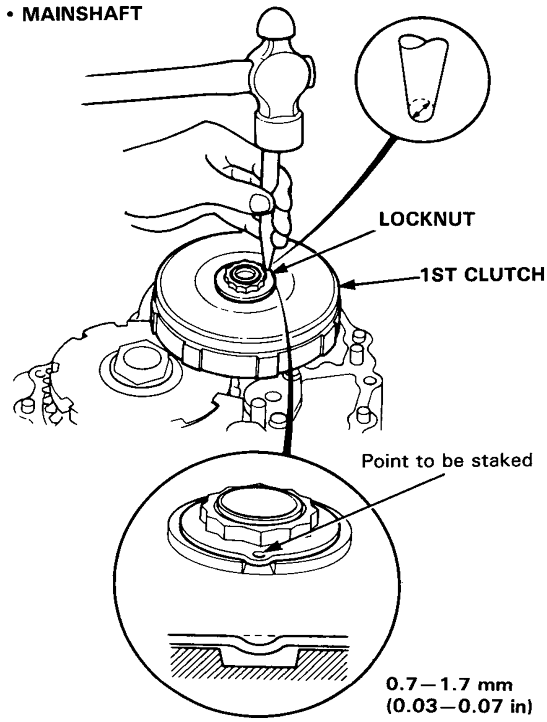
TORQUE:
Mainshaft
95 N·m (9.5 kg-m, 69 lb-ft)
Countershaft
140 N·m (14.0 kg-m, 101 lb-ft)

NOTE: Mainshaft locknut has left-hand threads.



40. Stake each locknut using a 3.5 mm punch.





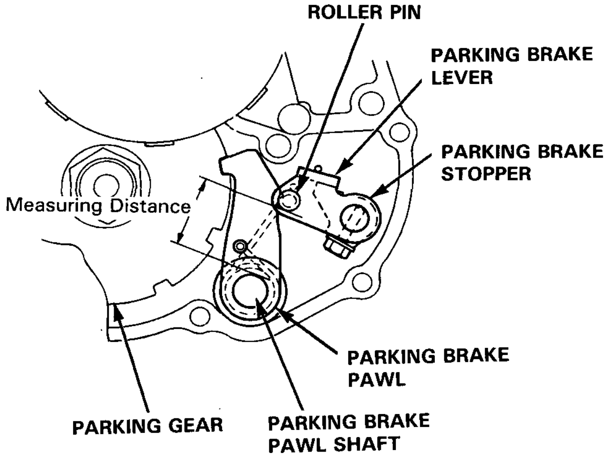
(cont'd)

Reassembly (cont'd)

41. Set the parking brake lever in the PARK position, then verify that the parking brake pawl engages the parking gear.

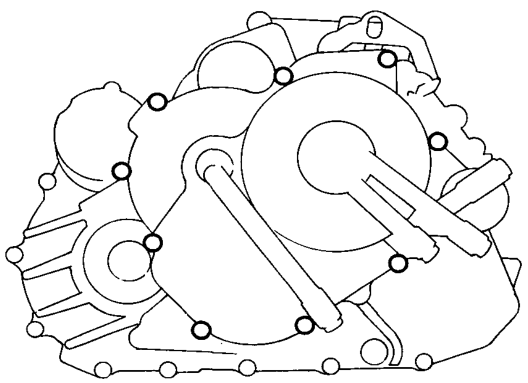
42. If the pawl does not engage fully, check the parking brake pawl stopper clearance as described on page 14-123.

43. Tighten the lock bolt and bend over the lock tab.



44. Install the R. side cover.

TORQUE: 12 N•m (1.2 kg-m, 9 lb-ft)

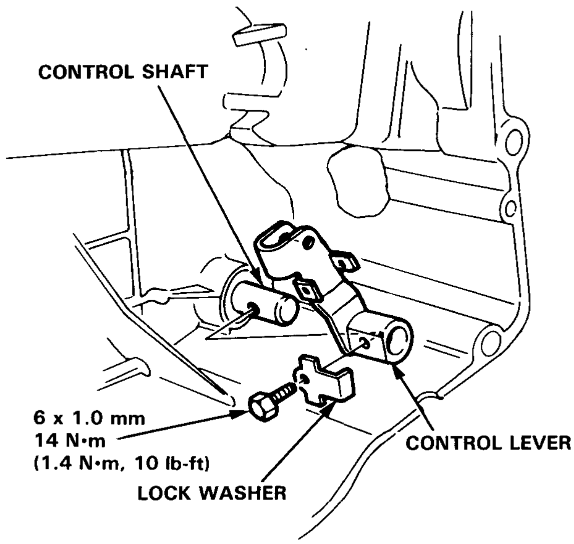


45. Install the throttle control lever with a new lock washer on the end of the throttle control shaft. Tighten the lock bolt and bend the lock tab.

TORQUE: 8 N•m (0.8 kg-m, 6 lb-ft)

46. Install the control lever with a new lock washer on the end of the control shaft. Tighten the lock bolt and beld lock tab.

TORQUE: 14 N•m (1.4 kg-m, 10 lb-ft)



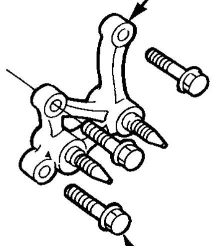
47. Install the ATF cooler pipes with new sealing washers.

TORQUE: 29 N•m (2.9 kg-m, 21 lb-ft)

48. Install the ATF level gauge.

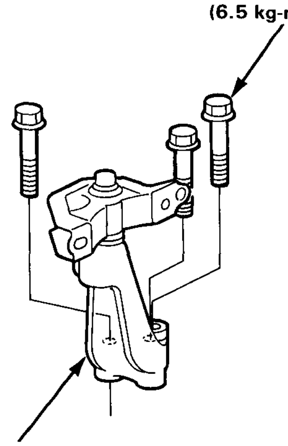
49. Install the transmission mount bracket on the transmission housing.

    TORQUE: 39 N·m (3.9 kg-m, 28 lb-ft)



50. Install the stopper mount bracket on the transmission housing.

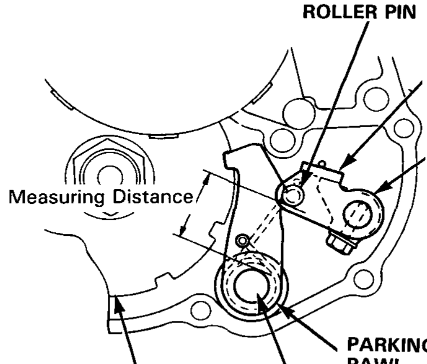
    TORQUE: 65 N·m (6.5 kg-m, 47 lb-ft)



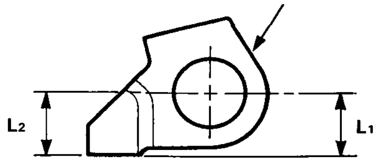
Inspection/Adjustment

1. Set the parking brake lever in the PARK position.
2. Measure the distance between the parking brake pawl and the parking brake lever roller pin as shown.

   STANDARD: 30.7—31.7 mm (1.21—1.25 in)



3. If the measurement is out of tolerance, select and install the appropriate parking brake stopper from the table below.



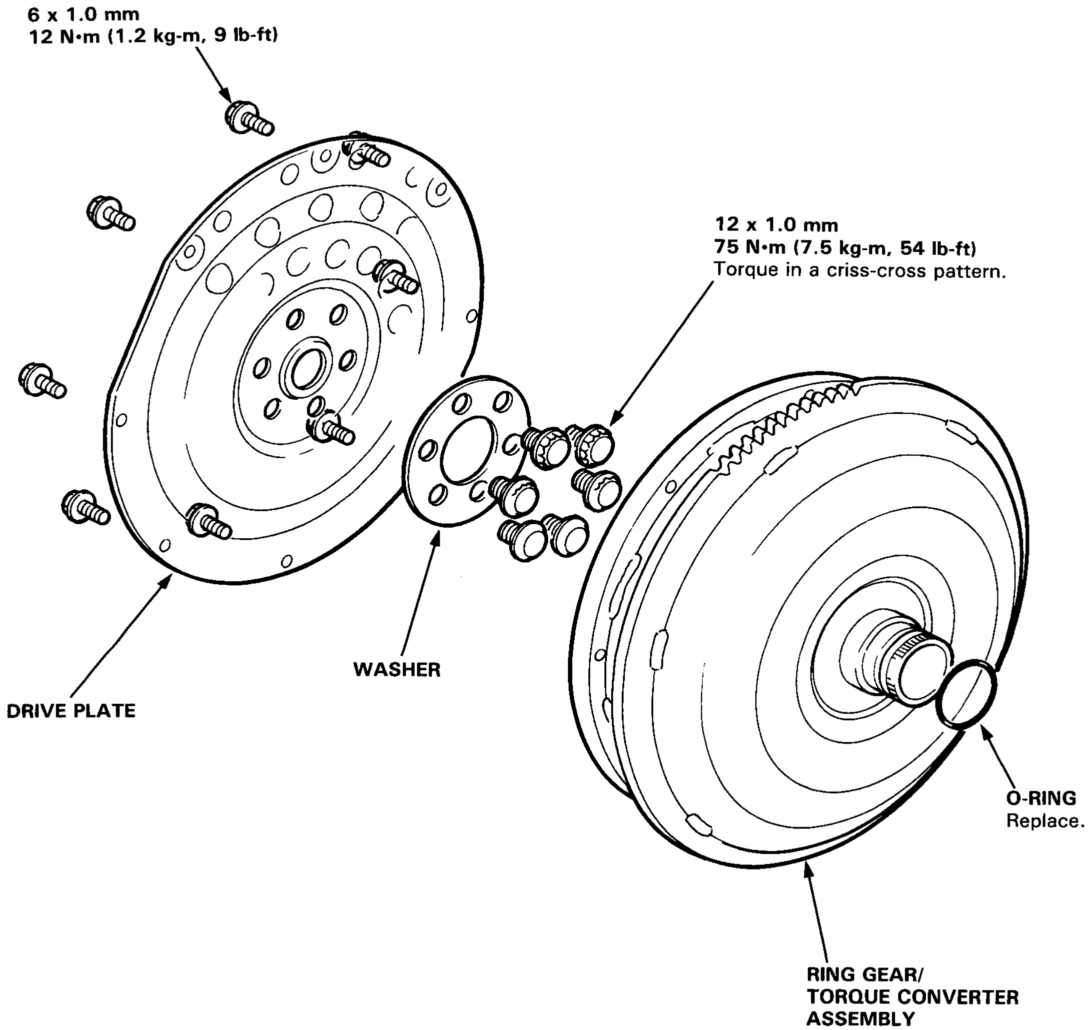
PARKING BRAKE STOPPER

Mark	Part Number	L_1	L_2
1	24537-PA9-003	11.00 mm 0.433 in	11.00 mm 0.433 in
2	24538-PA9-003	10.80 mm 0.425 in	10.65 mm 0.419 in
3	24539-PA9-003	10.60 mm 0.417 in	10.30 mm 0.406 in

4. After replacing the parking brake stopper, make sure the distance is within torelance.

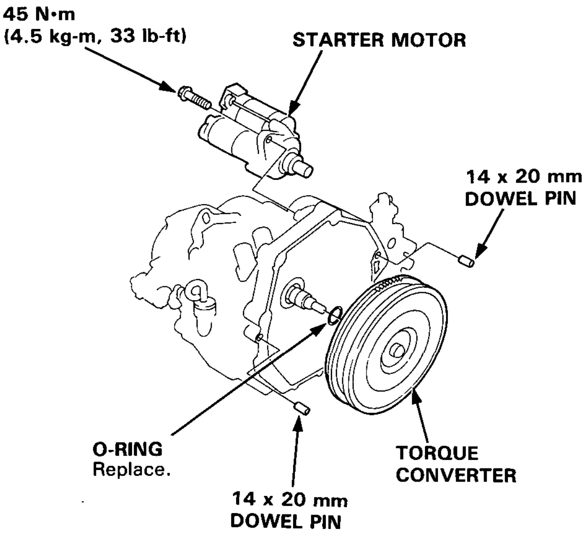
Torque Converter

Disassembly



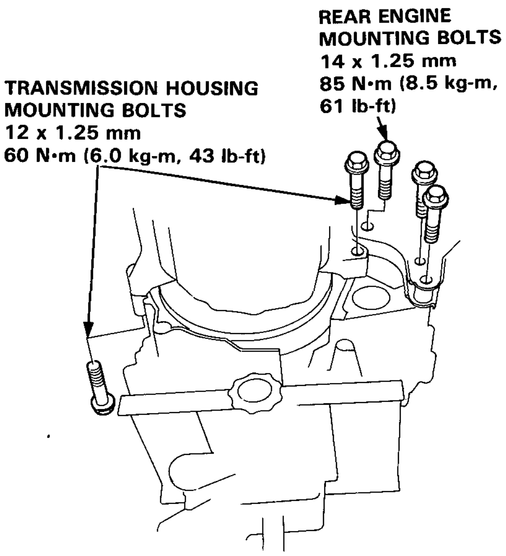
Installation

1. Install the starter motor on the torque converter housing, and install the 14 mm dowel pins in the torque converter housing.

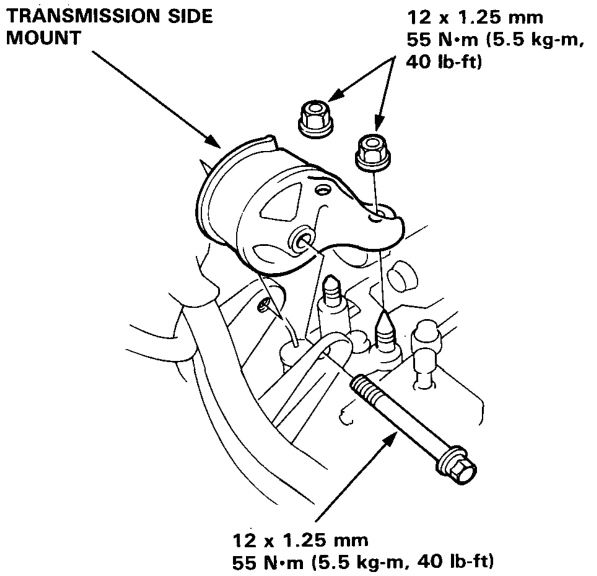


2. Place the transmission on a jack, and raise to the engine level.

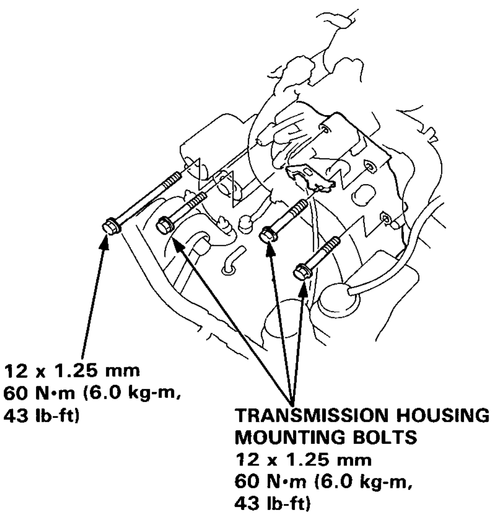
3. Attach the transmission on the engine then install two transmission housing mounting bolts and 3 rear engine mounting bolts.



4. Install the transmission side mount.



5. Install the remaining transmission housing mounting bolts.



(cont'd)

Installation (cont'd)

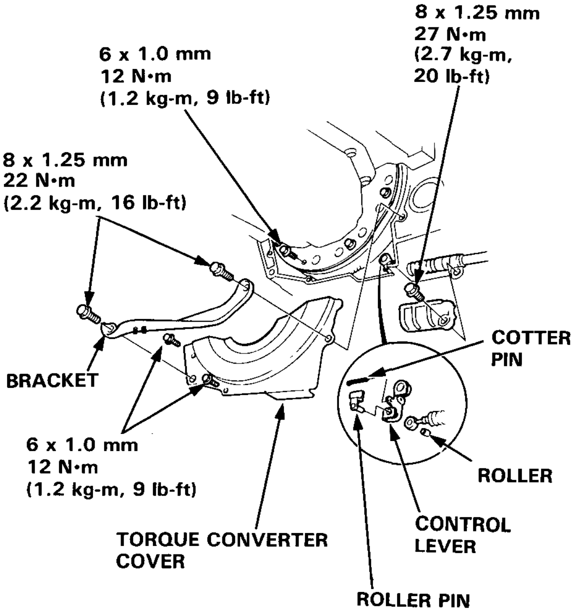
6. Remove the transmission jack and the hoist from the engine.

7. Attach the torque converter to the drive plate with 8 bolts and torque to 12 N•m (1.2 kg-m, 9 lb-ft). Rotate the crankshaft as necessary to tighten the bolts to 1/2 of the specified torque, then final torque, in a criss-cross pattern. Check for free rotation after tightening the last bolt.

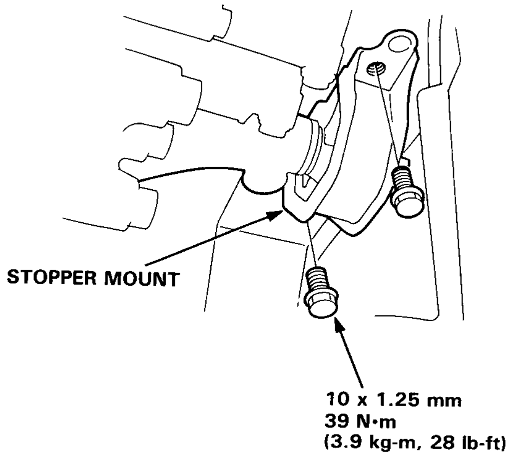
8. Install the shift cable with the roller, control pin and new cotter pin on the control lever.

   CAUTION: Take care not to bend the shift cable.

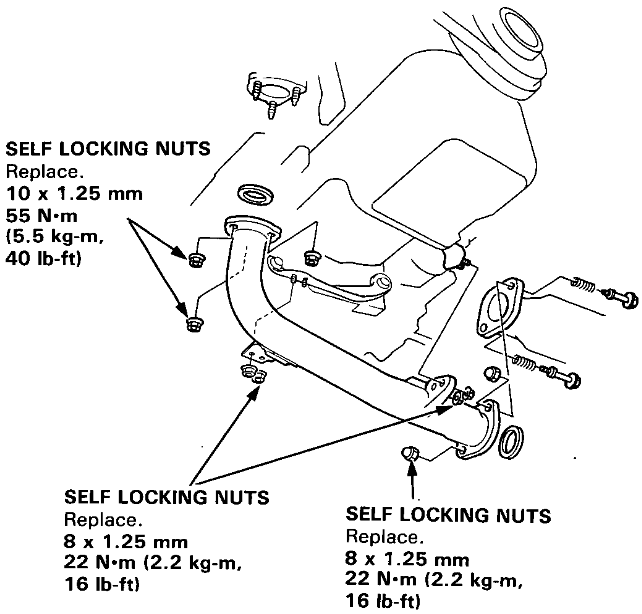
9. Install the shift cable cover, torque converter cover and exhaust pipe bracket.



10. Install the stopper mounting bolts.



11. Install the exhaust pipe A.



12. Inatall the driveshafts.

NOTE: Turn the right and left steering knuckle fully outward, and axial into the differential until you feel *its spring clip engage the side gear.*

- For D12B1/D15B3/D15B4

—1. Install a new set ring on the end of the each driveshaft.

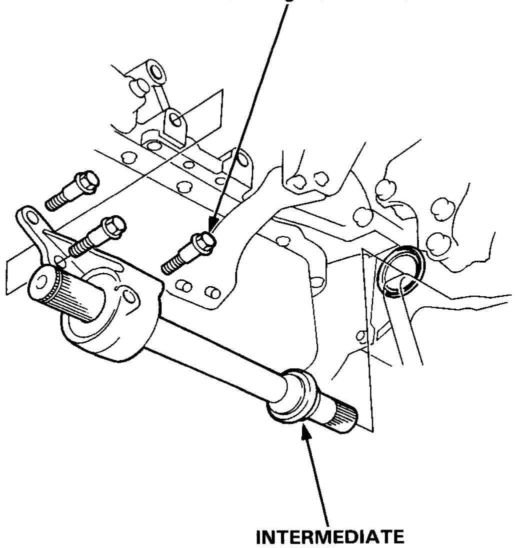
—2. Install the right and left driveshafts (see Section 16).

- For D16A9

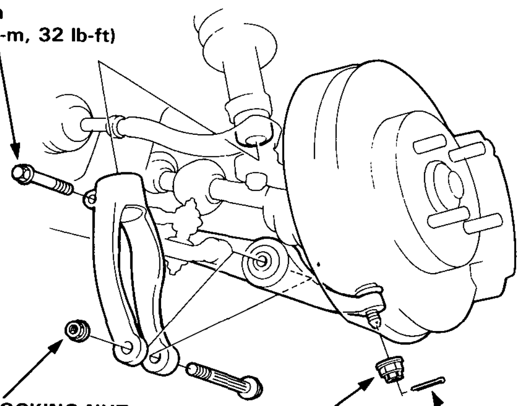
—1. Install a new set ring on the end of the right drive shaft and intermediate shaft.

—2. Install the intermediate shaft.

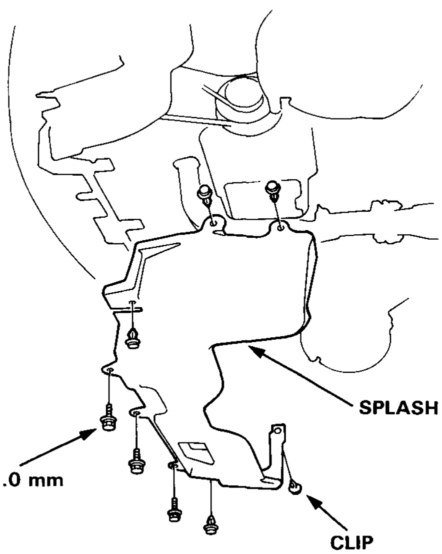
—3. Install the right and left driveshafts (see Section 16).



13. Install the damper fork. And install the boll joint to the lower arm with a new castle nuts and cotter pins.



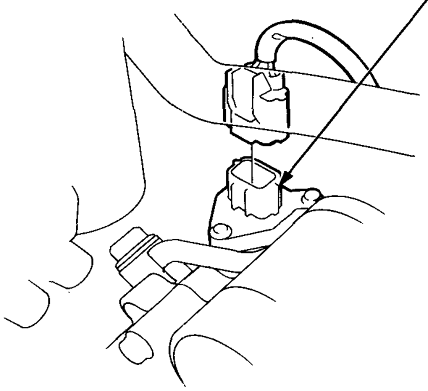
14. Install the splash shield.



(cont'd)

Installation (cont'd)

15. Connect the speedometer sensor connector.



16. Connect the ATF cooler hoses to the joint pipes.
17. Connect the throttle control cable.
18. Connect the lock-up control solenoid valve connector.
19. Connect the starter motor and transmission ground cables.
20. Install the air intake hose.
21. Refill the transmission with ATF (see page 14-65).
22. Connect the battery positive (+) and negative (−) cables to the battery.
23. Check the ignition timing (see Section 23).
24. Start the engine. Set the parking brake, and shift the transmission through all gears three times. Check for proper shift cable adjustment.
25. Let the engine reach operating temperature with the transmission in Neutral or Park, then turn it off and check fluid level.
26. Road test as described on pages 14-52 thru 14-54.

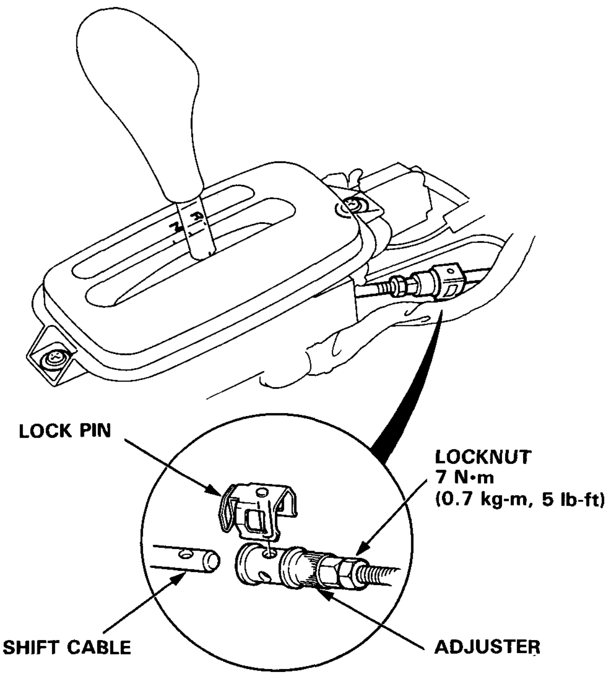
Shift Cable

Removal/Installation

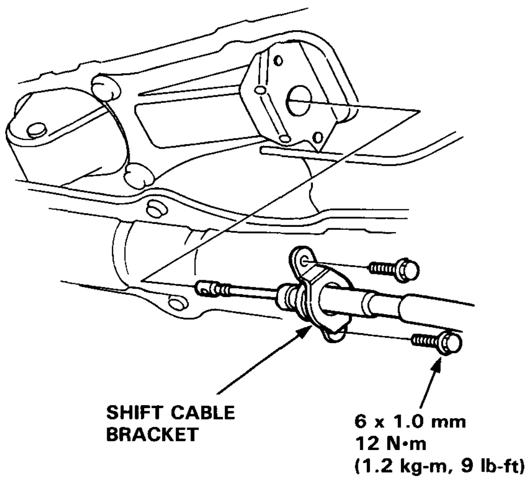
⚠WARNING Make sure lifts are placed properly (see page 1-9 thru 1-11).

NOTE: LHD is shown; RHD is similar.

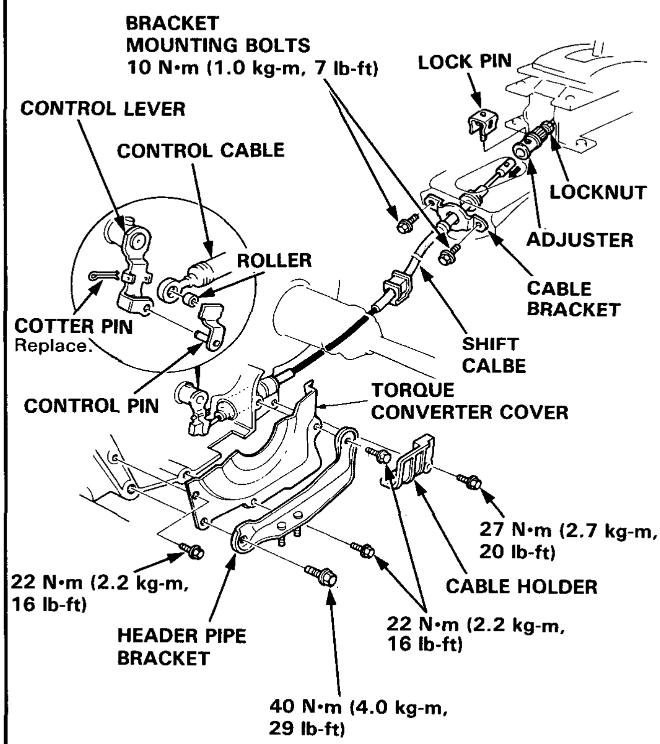
1. Remove the center console (see page 20-80).
2. Shift to [N] position, then remove the lock pin from the cable adjuster.



3. Remove the shift cable bracket.



4. Remove the exhaust pipe A.
5. Remove the shift cable holder.
6. Remove the exhaust pipe bracket, torque converter cover and shift cable cover.
7. Remove the shift cable by removing the cotter pin, control pin and control lever roller from the control lever. Take care not to bend the cable when removing/installing it.



8. Install the shift cable in the reverse order of removal.
9. *Check the cable adjustment on reassembly, on page 14-130.*

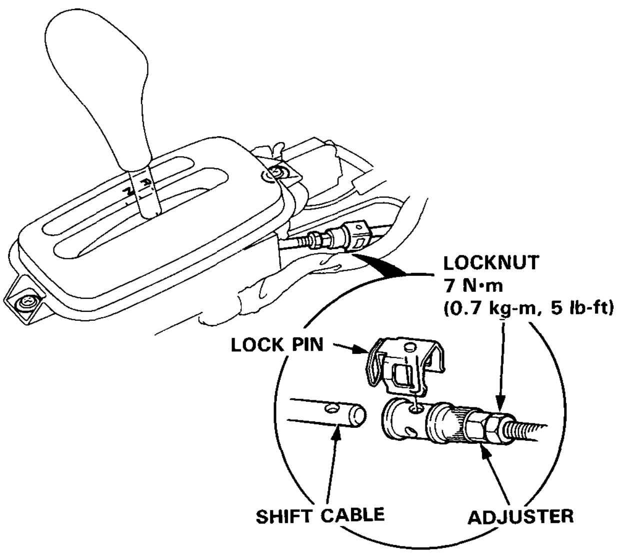
Shift Cable

Adjustment

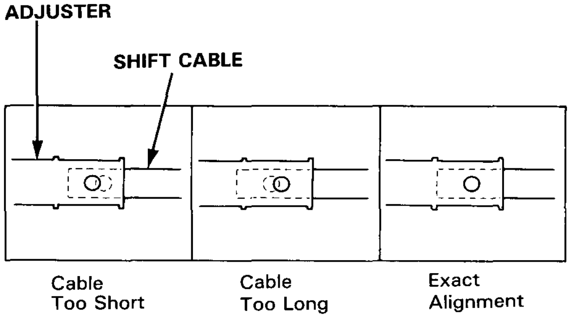
⚠WARNING Make sure lifts are placed properly (see page 1-9 thru 1-11).

NOTE: LHD is shown; RHD is similar.

1. Start the engine. Shift to [P] position to see if the reverse gear engages. If not, refer to troubleshooting on page 14-48 thru 51.
2. With the engine off, remove the center console (see page 20-80).
3. Shift to [N] position, then remove the lock pin from the cable adjuster.



4. Check that the hole in the adjuster is perfectly aligned with the hole in the shift cable. There are two holes in the end of the shift cable. They are positioned 90° apart to allow cable adjustment in 1/4 turn increments.

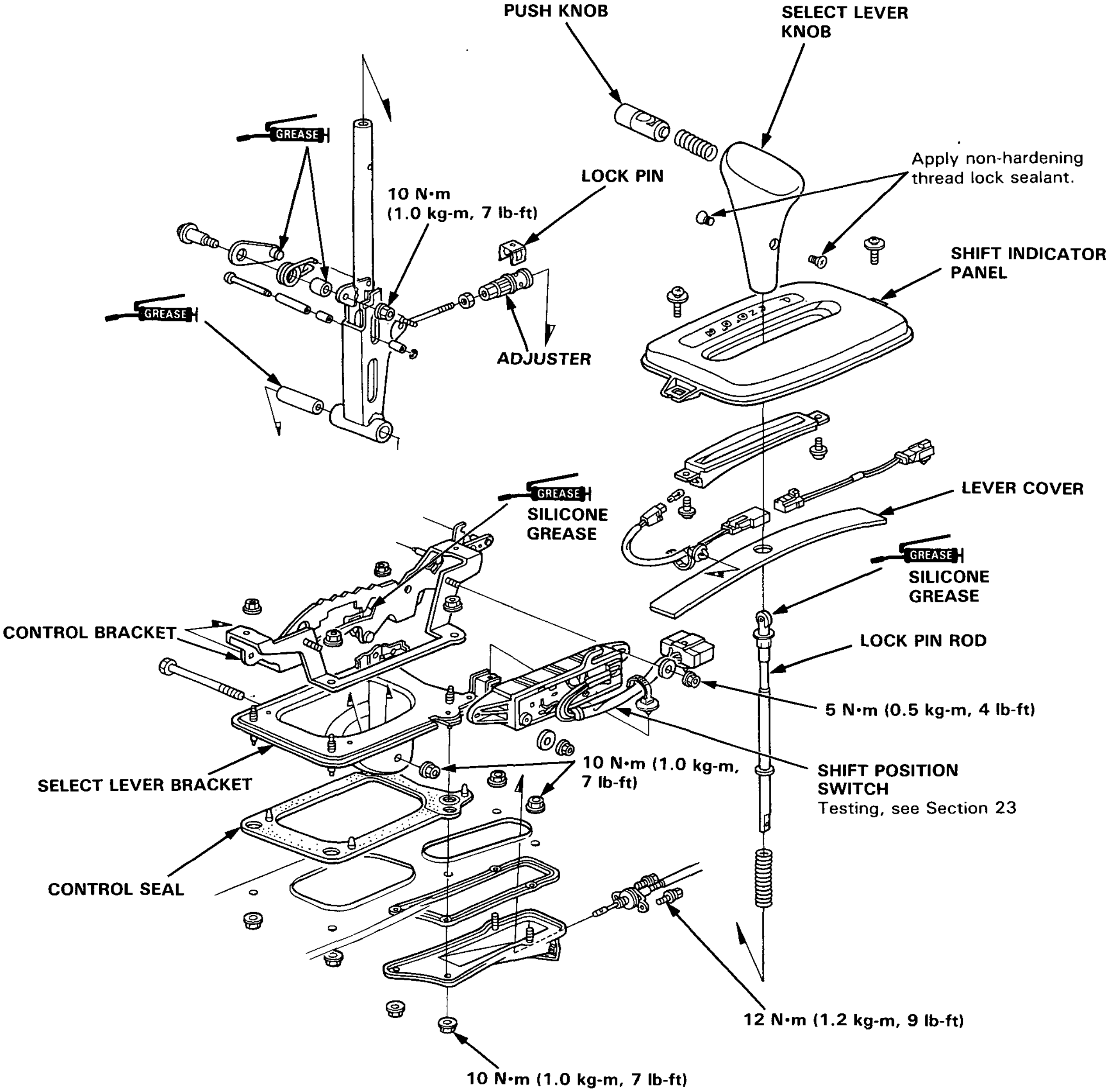


5. If not perfectly aligned, loosen the locknut on shift cable and adjust as required.
6. Tighten the locknut to 7 N·m (0.7 kg-m, 5 lb-ft).
7. Install the lock pin on the adjuster. If you feel the lock pin binding as you reinstall it, the cable is still out of adjustment and must be readjsuted.
8. Move the select to each gear and verify that the shift position indicator follows the shift position console switch.
9. Start the engine and check the shift lever in all gears. If any gear does not work properly, refer to troubleshooting on page 14-48 thru 51.
10. Insert the ignition key into the key cylinder on the shift indicator panel, verify that the shift lock lever is released.

Gearshift Selector

Disassembly/Reassembly

NOTE: LHD is shown; RHD is symmetrical.



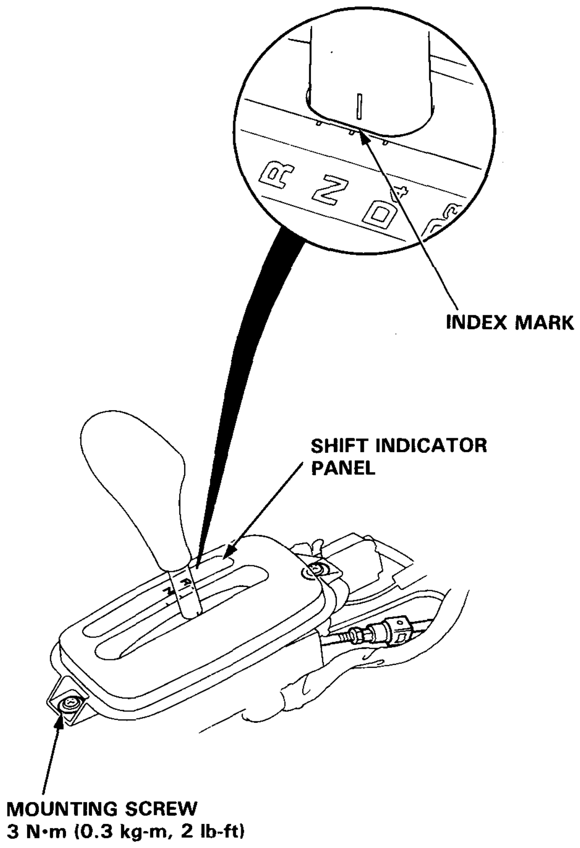
Shift Indicator Panel

Adjustment

NOTE: LHD is shown; RHD is similar.

1. Check that the index mark of the indicator aligns with the $\boxed{N}$ mark of the shift indicator panel with the transmission in NEUTRAL.
2. If not aligned,remove the center console. (see page 20-80).
3. Remove the shift indicator panel mounting screws and adjust by moving the panel.

   NOTE: Whenever the shift indicator panel is removed, reinstall the panel as described above.



Throttle Control Cable

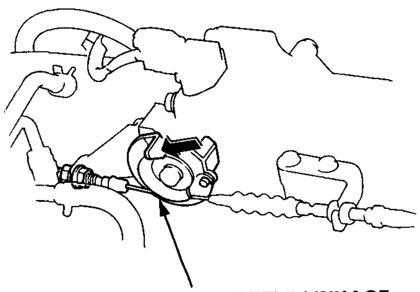
Inspection

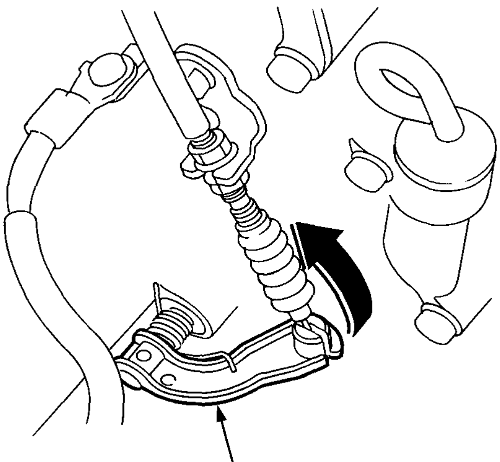
NOTE: Before inspecting the throttle control cable, make sure;

- Throttle cable free play is correct (See Section 11).
- Idle speed is correct (See Section 11).
- To warm up the engine to normal operating temperature (cooling fan comes on).

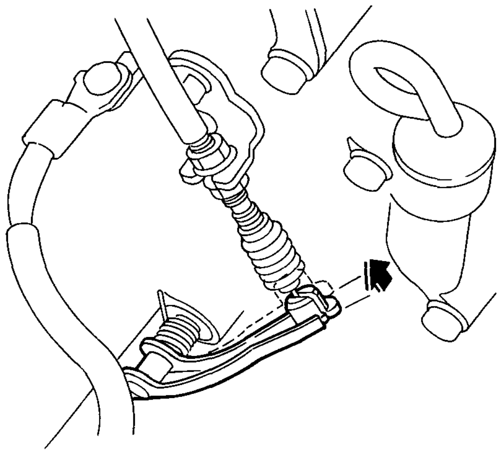
1. Verify that the throttle control lever is synchronized with the throttle linkage while depressing and releasing the accelerator pedal.

2. If the throttle control lever is not synchronized with the throttle linkage, adjust the throttle control cable.



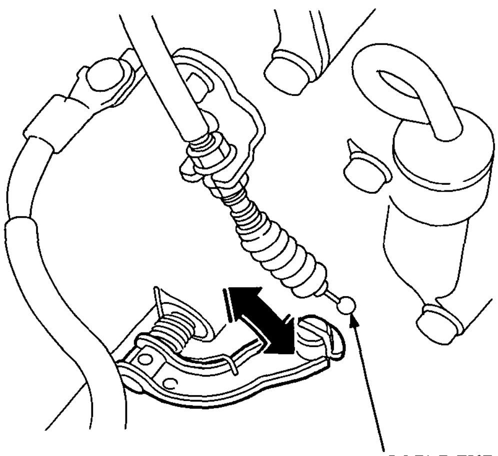


3. Check that there is play in the throttle control lever while depressing the accelerator pedal to the full-throttle position.



4. Remove the cable end of the throttle control cable from the throttle control lever.

5. Check that the throttle control lever moves smoothly.



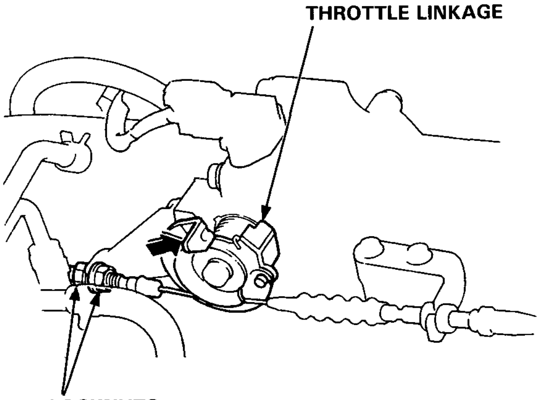
Throttle Control Cable

Adjustment

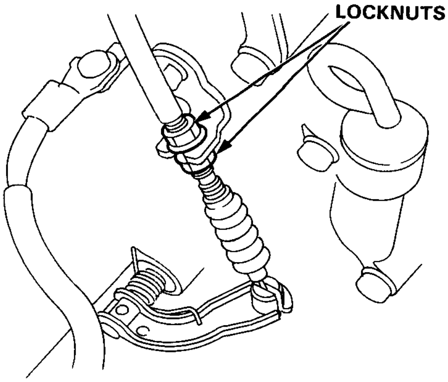
NOTE: Before inspecting the throttle control cable, make sure;

- Throttle cable free play is correct (See Section 11).
- Idle speed is correct (See Section 11).
- To warm up the engine to normal operating temperature (cooling fan comes on).

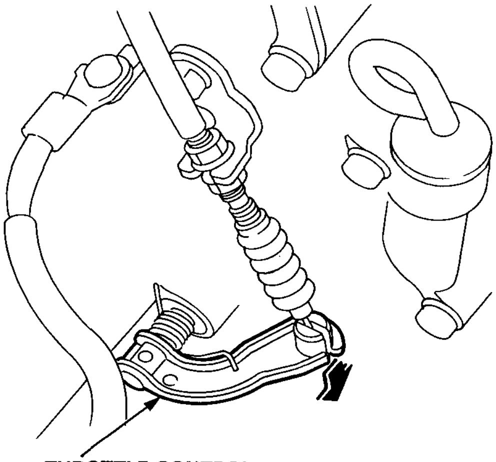
1. Verify that the throttle linkage is in the full-closed position.
2. Loosen the locknut of the throttle control cable; D15B4/D16A8/D16A9 at the throttle linkage.



D12B1/D15B3 at the throttle control cable stay



3. Remove the free play of the throttle control cable with the locknut, while pushing the throttle control lever to the full-closed position as shown.

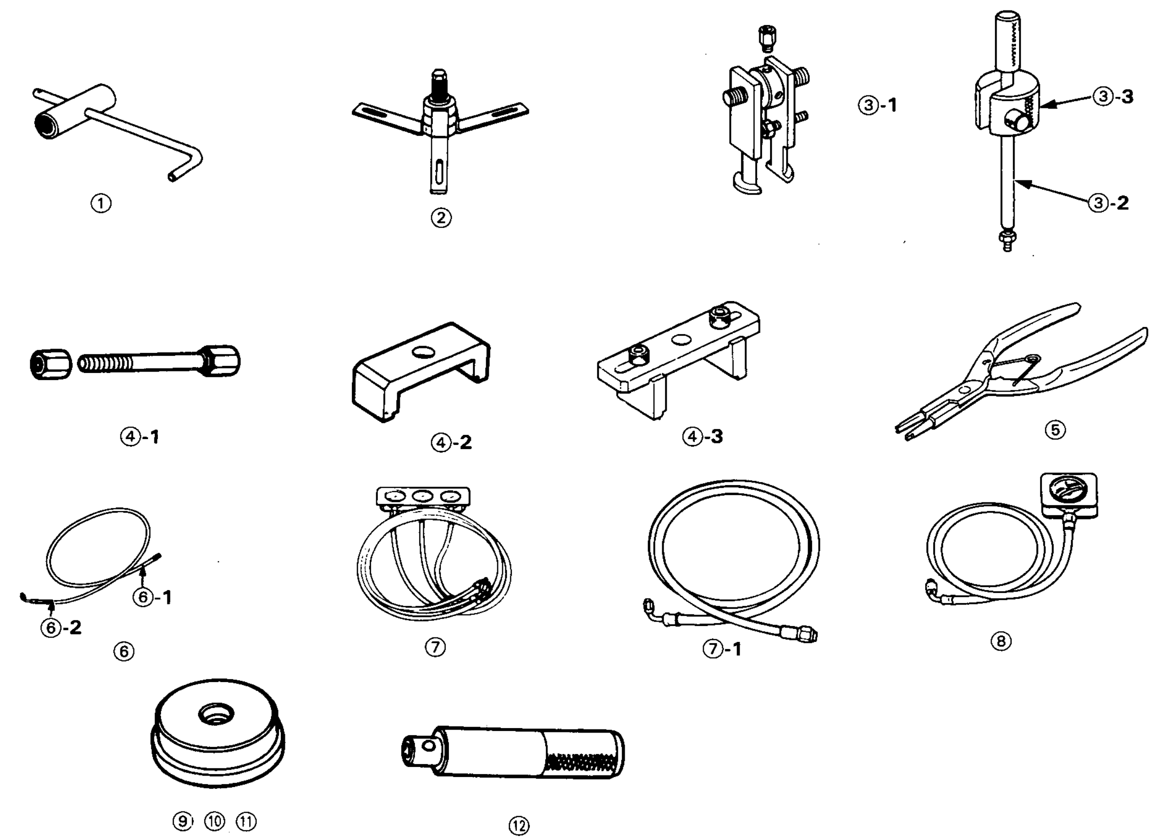


4. Tighten the locknut.
5. After tightening the locknuts, inspect the synchronization and throttle control lever movement.

2WD Automatic Transmission
M24A

Special Tools

Ref No.	Tool Number	Description	Qty	Page Reference
①	07GAB–PF50101	Mainshaft Holder	1	14-217, 264
②	07HAC–PK40101	Housing Puller	1	14-219
③	07JAC–PH80000	Adjustable Bearing Remover Set	1	14-255, 256
③-1	07JAC–PH80100	Bearing Remover Attachment	1	14-255, 256
③-2	07JAC–PH80200	Remover Handle Assembly	1	14-255, 256
③-3	07741–0010201	Remover Weight	1	14-255, 256
④	07LAE–PX40000	Clutch Spring Compressor Set	1	14-249, 252
④-1	07GAE–PG40200	Clutch Spring Compressor Bolt	1	14-249, 252
④-2	07HAE–PL50100	Clutch Spring Compressor Attachment	1	14-249, 252
④-3	07LAE–PX40100	Clutch Spring Compressor Attachment	1	14-249, 252
⑤	07LGC–0010100	Snap Ring Pliers	1	14-245, 257, 258
⑥	07MAJ–PY40100	A/T Oil Pressure Gauge Hose Assembly	1	14-200
⑥-1	07MAJ–PY40110	Oil Pressure Gauge Hose	1	14-200
⑥-2	07MAJ–PY40120	Oil Pressure Joint	1	14-200
⑦	07406–0020003	A/T Oil Pressure Gauge Set	1	14-200
⑦-1	07406–0020201	A/T Oil Pressure Gage Hose	1	14-200
⑧	07406–0070000	A/T Low Pressure Gauge	1	14-200
⑨	07746–0010100	Attachment, 32 x 35 mm	1	14-245
⑩	07746–0010500	Attachment, 62 x 68 mm	1	14-245, 255, 256, 257, 258
⑪	07746–0010600	Attachment, 72 x 75 mm	1	14-255, 257
⑫	07749–0010000	Driver	1	14-245, 255, 256, 257, 258



The automatic transmission is a combination of a 3-element torque converter and triple-shaft automatic transmission which provides 4 speeds forward and 1 reverse. The entire unit is positioned in line with the engine.

Torque Converter, Gears and Clutches

The torque converter consists of a pump, turbine and stator, assembly in a single unit. The torque converter is connected to the engine crankshaft so they turn together as a unit as the engine turns. Around the outside of the torque converter is a ring gear which meshes with the starter pinion when the engine is being started. The entire torque converter assembly serves as a flywheel while transmitting power to the transmission mainshaft.
The transmission has three parallel shafts, the mainshaft, countershaft and sub-shaft. The mainshaft is in line with the engine crankshaft.
The mainshaft includes the clutches for 1st, and 2nd/4th, and gears for 3rd, 2nd, 4th, reverse and 1st (3rd gear is integral with the mainshaft, while reverse gear is integral with the 4th gear).
The countershaft includes the 3rd clutch and gears for 3rd, 2nd, 4th, reverse, 1st and parking. Reverse and 4th gears can be locked to the countershaft at its center, providing 4th gear or reverse, depending on which way the selector is moved.
The sub-shaft includes the 1st-hold clutch and gear for 1st and 4th.
The gears on the mainshaft are in constant mesh with those on the countershaft and secondary shaft. When certain combinations of gears in the transmission are engaged by the clutches, power is transmitted from the mainshaft to the countershaft via the sub-shaft to provide $\boxed{D_4}$, $\boxed{D_3}$, $\boxed{2}$, $\boxed{1}$ and $\boxed{R}$.

Hydraulic Control

The valve body assembly includes the main valve body, secondary valve body, regulator valve body, servo body, modulator valve body, lock-up valve body, and governor body, through the respective separator plates.
They are bolted on the torque converter housing.
The main valve body contains the manual valve, 1-2 shift valve, 2-3 shift valve, 3-4 shift valve, 3-2 timing valve, 4th exhaust valve, relief valve, and oil pump gears.
The secondary valve body contains the 4-3 kick-down valve, 3-2 kick-down valve, 2-3 orifice control valve, 2-1 timing valve, Clutch Pressure Control (CPC) valve, servo control valve, reverse control valve, and governor cut valve.
The regulator valve body contains the pressure regulator valve, lock-up control valve, torque converter check valve, and cooler relief valve.
The servo body contains the servo valve which is integrated with the reverse shift fork, throttle valves A and B, 2/3-4 orifice control valve, and accumulators.
The modulator valve body bolted on the servo body contains the modulator valve.
The lock-up valve body contains the lock-up shift valve and lock-up timing valve B, and is bolted on the regulator valve body.
The governor body is bolted on the torque converter housing near the differential.
Fluid from the regulator passes through the manual valve to the various control valves.

Lock-up Mechanism

In $\boxed{D_4}$ and $\boxed{D_3}$ position, in 2nd, 3rd and 4th, pressurized fluid is drained from the back of the torque converter through an oil passage, causing the lock-up piston to be held against the torque converter cover. As this takes place, the mainshaft rotates at the same speed as the engine crankshaft. Together with hydraulic control, the ECU optimizes the timing of the lock-up mechanism.
The lock-up shift valve controls the range of lock-up according to the lock-up control solenoid valves A and B, and throttle valve B. When the lock-up control solenoid valves A and B are mounted on the torque converter housing, and are controlled by the ECU.

(cont'd)

Description

(cont'd)

Gear Selection

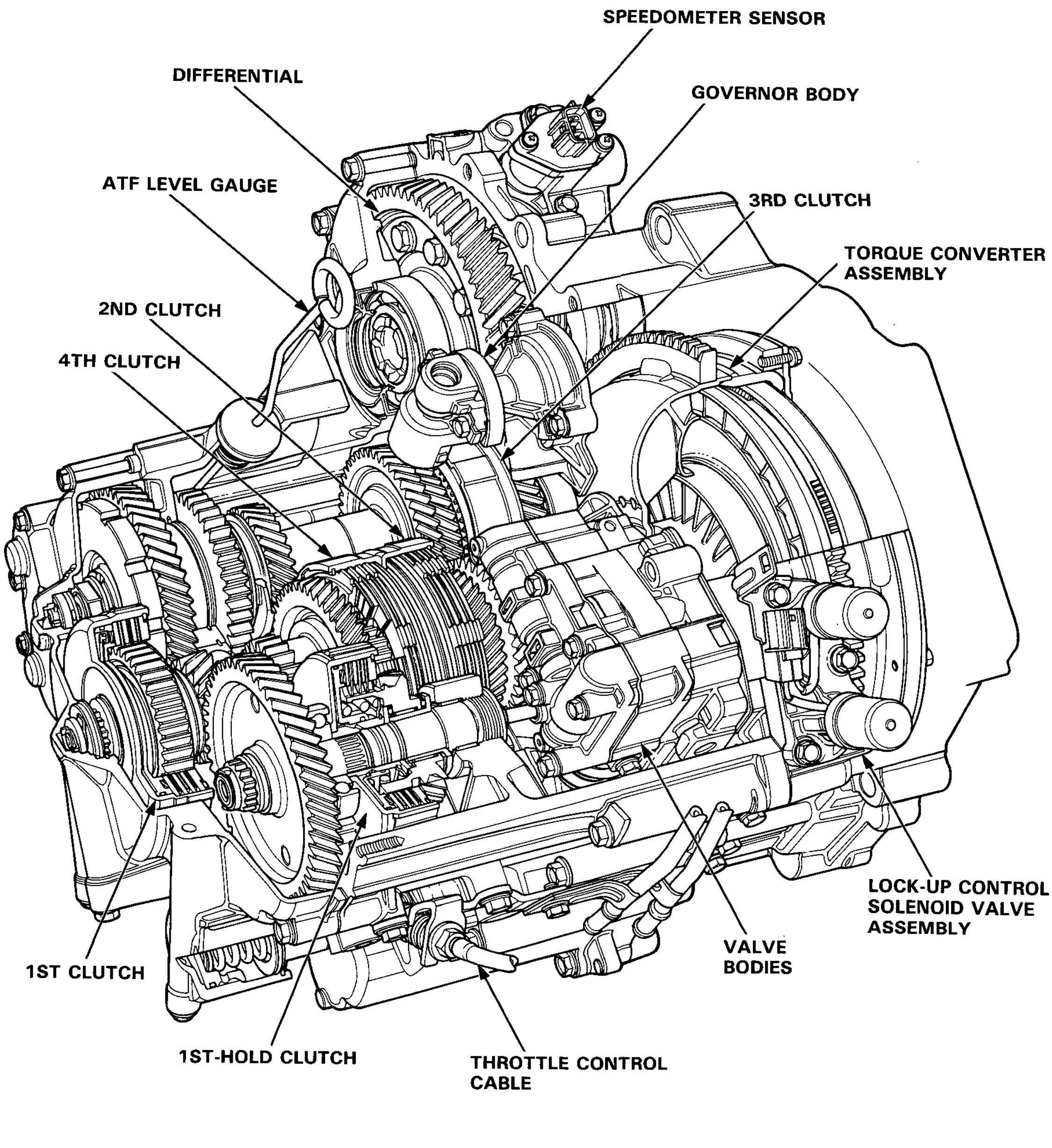
The selector lever has seven positions; [P] PARK, [R] REVERSE, [N] NEUTRAL, [D4] 1st through 4th positions, [D3] 1st through 3rd positions, [2] 2nd gear and [1] 1st gear.

Position	Description
[P] PARK	Front wheels locked; parking pawl engaged with parking gear on countershaft. All clutches released.
[R] REVERSE	Reverse; reverse selector engaged with countershaft reverse gear and 4th clutch locked.
[N] NEUTRAL	All clutches released.
[D4] DRIVE (1 through 4)	General driving; starts off in 1st, shifts automatically to 2nd, 3rd, then 4th, depending on vehicle speed and throttle position. Downshifts through 3rd, 2nd and 1st on deceleration to stop. The lock-up mechanism comes into operation in 2nd, 3rd and 4th when the transmission in [D4] or [D3] .
[D3] DRIVE (1 through 3)	For rapid acceleration at highway speeds and general driving; starts off in 1st, shifts automatically to 2nd then 3rd, depending on vehicle speed and throttle position. Downshifts through lower gears on deceleration to stop.
[2] SECOND	Driving in 2nd gear; stays in 2nd gear, does not shift up and down. For engine braking or better traction starting off on loose or slippery surface.
[1] FIRST	Driving in 1st gear; stays in 1st gear, does not shift up and down. For engine braking.

Starting is possible only in [P] and [N] position through use of a slide-type, neutral-safety switch.

Position Indicator

A position indicator in the instrument panel shows what gear has been selected without having look down at the console.


SPEEDOMETER SENSOR
DIFFERENTIAL
GOVERNOR BODY
ATF LEVEL GAUGE
3RD CLUTCH
TORQUE CONVERTER ASSEMBLY
2ND CLUTCH
4TH CLUTCH
LOCK-UP CONTROL SOLENOID VALVE ASSEMBLY
VALVE BODIES
1ST CLUTCH
1ST-HOLD CLUTCH
THROTTLE CONTROL CABLE

Description

Clutches

The four speed automatic transmission uses hydraulically actuated clutches to engage or disengage the transmission gears. When clutch pressure is introduced into the clutch drum, the clutch piston is applied. This presses the friction discs and steel plates together, locking them so they don't slip. Power is then transmitted through the engaged clutch pack to its hub-mounted gear.

Likewise, when clutch pressure is bled from the clutch pack, the piston releases the friction discs and steel plates, and they are free to slide past each other while disengaged. This allows the gear to spin independently of its shaft, transmitting no power.

[1st Clutch]
The first clutch engages/disengages first gear, and is located at the end of the mainshaft, just behind the R side cover. The first clutch is supplied clutch pressure by its oil feed pipe within the mainshaft.

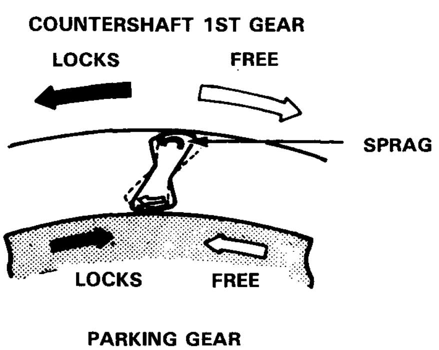
[1st-hold Clutch]
The first hold clutch engages/disengages 1st-hold or 1 position, and is located at the center of the sub-shaft. The 1st-hold clutch is supplied clutch pressure by its oil feed pipe within the sub-shaft.

[2nd Clutch]
The second clutch engages/disengages second gear, and is located at the center of the mainshaft. The second clutch is joined back-to-back to the fourth clutch. The second clutch is supplied clutch pressure through the mainshaft by a circuit connected to the regulator valve body.

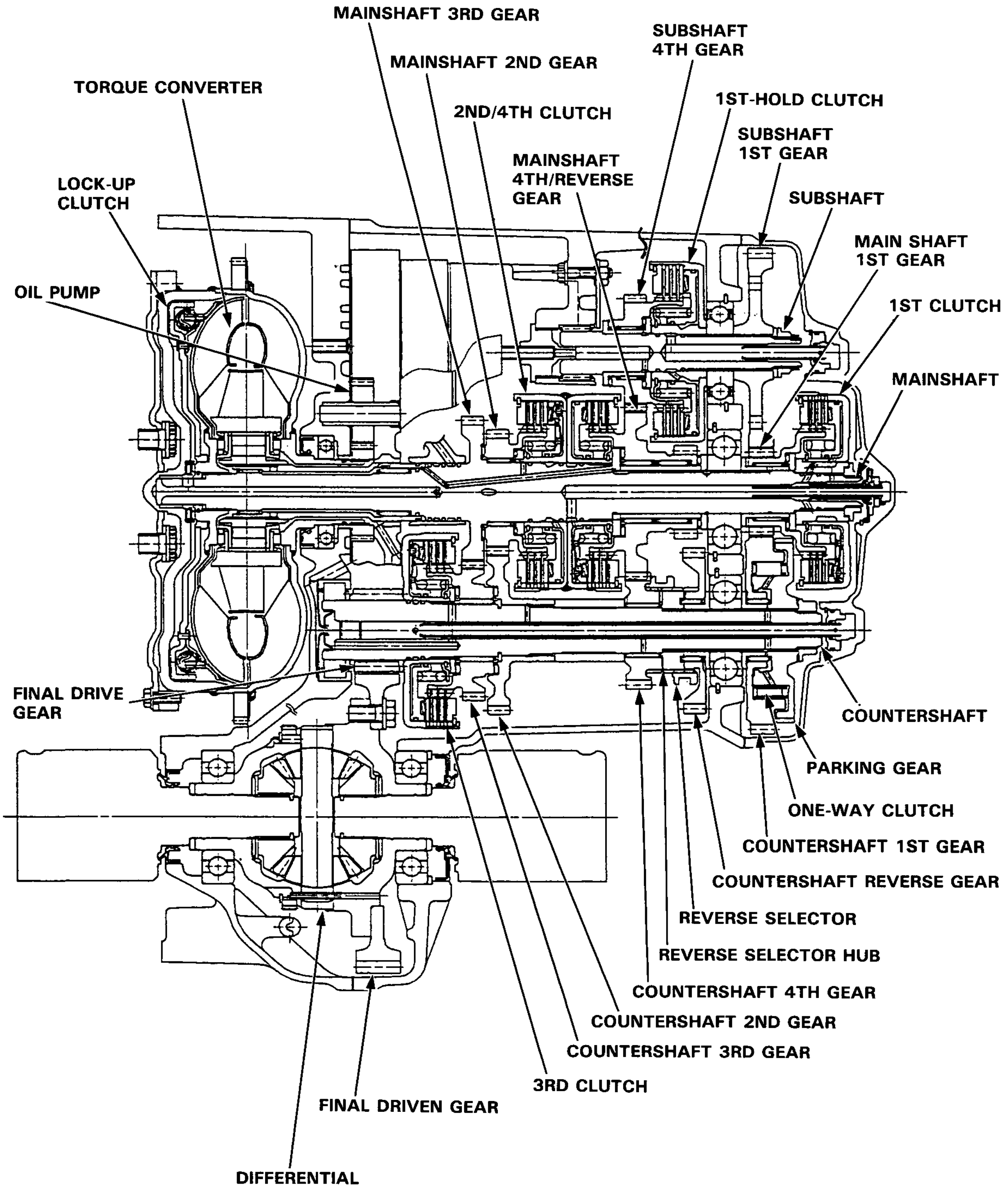
[3rd Clutch]
The third clutch engages/disengages third gear, and is located at the end of the countershaft, opposite the R side cover. The third clutch is supplied clutch pressure by its oil feed pipe within the countershaft.

[4th Clutch]
The fourth clutch engages/disengages fourth gear, as well as reverse gear, and is located at the center of the mainshaft. The fourth clutch is joined back-to-back to the second clutch. The fourth clutch is supplied clutch pressure by its oil feed pipe within the mainshaft.

[One-way Clutch]
The one-way clutch is positioned between the parking gear and first gear, with the parking gear splined to the countershaft. The first gear provides the outer race surface, and the parking gear provides the inner race surface. The one-way clutch locks up when power is transmitted from the mainshaft first gear to the countershaft first gear.
The first clutch and gears remain engaged in the 1st, 2nd, 3rd, and 4th gear ranges in the $\boxed{D_4}$, $\boxed{D_3}$ or $\boxed{2}$ position. However, the one-way clutch disengages when the 2nd, 3rd, or 4th clutches /gears are applied in the $\boxed{D_4}$, $\boxed{D_3}$ or $\boxed{2}$ position. This is because the increased rotational speed of the gears on the countershaft over-ride the locking "speed range" of the one-way clutch. Thereafter, the one-way clutch free-wheels with the first clutch still engaged.



NOTE: View from R. side cover side.


MAINSHAFT 3RD GEAR
SUBSHAFT 4TH GEAR
MAINSHAFT 2ND GEAR
TORQUE CONVERTER
1ST-HOLD CLUTCH
2ND/4TH CLUTCH
SUBSHAFT 1ST GEAR
MAINSHAFT 4TH/REVERSE GEAR
LOCK-UP CLUTCH
SUBSHAFT
MAIN SHAFT 1ST GEAR
OIL PUMP
1ST CLUTCH
MAINSHAFT
FINAL DRIVE GEAR
COUNTERSHAFT
PARKING GEAR
ONE-WAY CLUTCH
COUNTERSHAFT 1ST GEAR
COUNTERSHAFT REVERSE GEAR
REVERSE SELECTOR
REVERSE SELECTOR HUB
COUNTERSHAFT 4TH GEAR
COUNTERSHAFT 2ND GEAR
COUNTERSHAFT 3RD GEAR
3RD CLUTCH
FINAL DRIVEN GEAR
DIFFERENTIAL

(cont'd)

Clutches (cont'd)

Lock-up Clutch

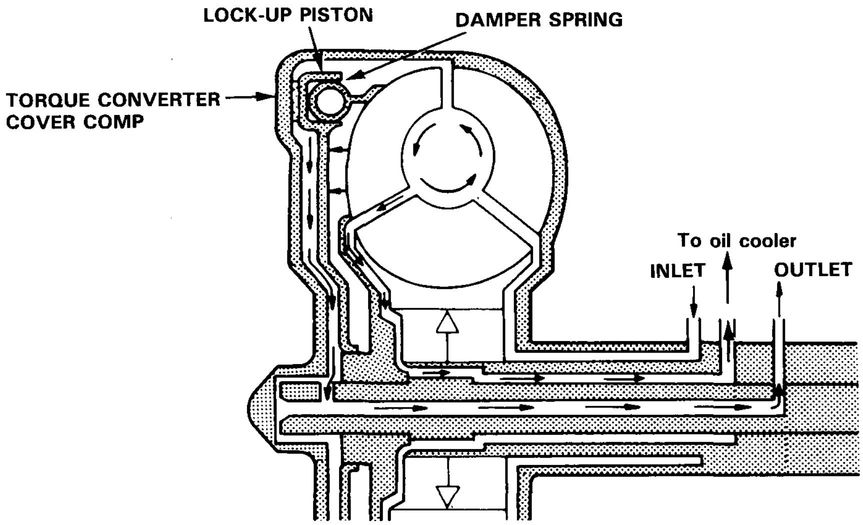
1. Operation (clutch on)

With the lock-up clutch on, the oil in the chamber between the torque converter cover and lock-up piston is discharged, and the converter oil exerts pressure through the piston against the converter cover. As a result, the converter turbine is locked on the converter cover firmly. The effect is to bypass the converter, thereby placing the car in direct drive.

Power flow

The power flows by way of:

Engine
↓
Drive plate
↓
Torque converter cover
↓
Lock-up piston
↓
Damper spring
↓
Turbine
↓
Mainshaft

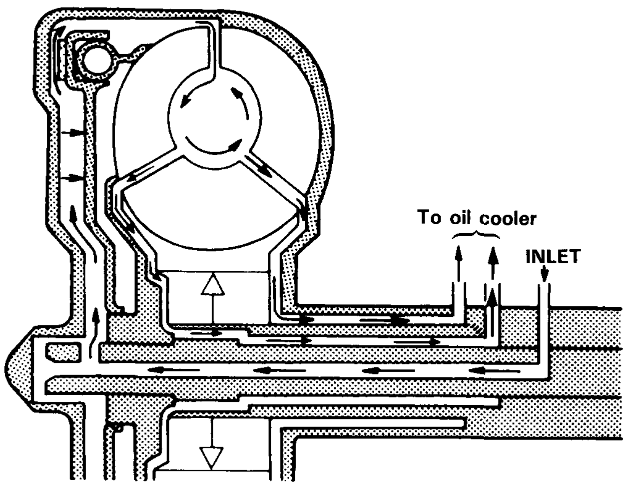


2. Operation (clutch off)

With the lock-up clutch off, the oil flows in the reverse of CLUTCH ON. As a result, the lock-up piston is moved away from the converter cover; that is, the torque converter lock-up is released.

Power flow

Engine
↓
Drive plate
↓
Torque converter cover
↓
Pump
↓
Turbine
↓
Mainshaft



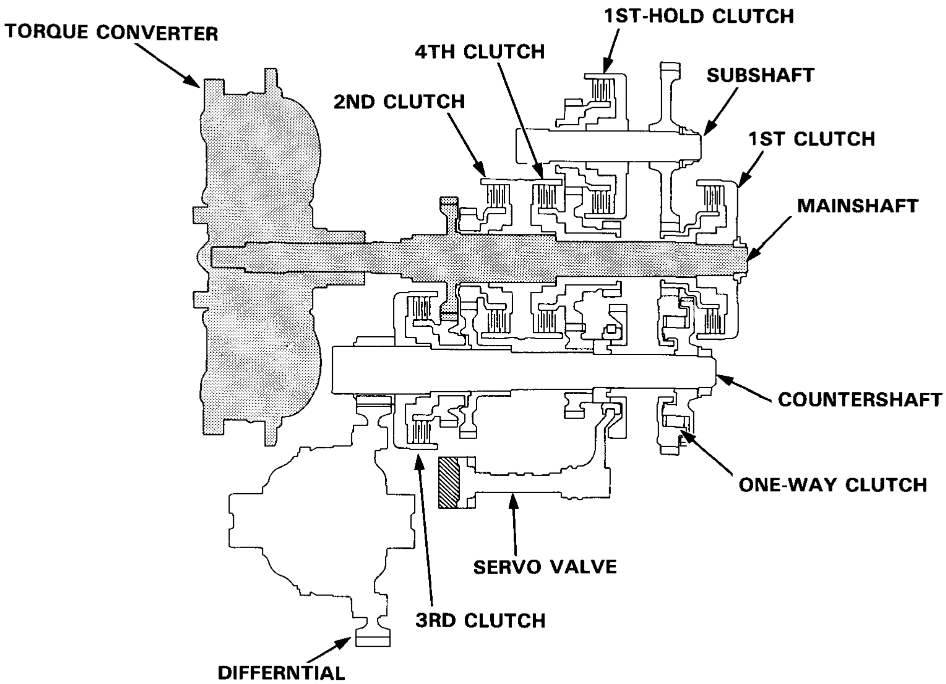
Power Flow

PART / RANGE		TORQUE CONVERTER	1ST-HOLD CLUTCH	1ST GEAR 1ST CLUTCH	2ND GEAR 2ND CLUTCH	3RD GEAR 3RD CLUTCH	4TH GEAR	4TH CLUTCH	REVERSE GEAR	PARKING GEAR
P		○	×	×	×	×	×	×	×	○
R		○	×	×	×	×	×	○	○	×
N		○	×	×	×	×	×	×	×	×
D4	1ST	○	×	○	×	×	×	×	×	×
	2ND	○	×	○*	○	×	×	×	×	×
	3RD	○	×	○*	×	○	×	×	×	×
	4TH	○	×	○*	×	×	○	○	×	×
D3	1ST	○	×	○	×	×	×	×	×	×
	2ND	○	×	○*	○	×	×	×	×	×
	3RD	○	×	○*	×	○	×	×	×	×
2		○	×	○*	○	×	×	×	×	×
1		○	○	○	×	×	×	×	×	×

○: Operates, ×: Doesn't operate, *: Although the 1st clutch engages, driving power is not transmitted because the one-way clutch slips.

N Position
Hydraulic pressure is not applied to the clutches. Power is not transmitted to the countershaft.

P Position
Hydraulic pressure is not applied to the clutches. Power is not transmitted to the countershaft.
The countershaft is locked by the parking pawl interlocking the parking gear.



(cont'd)

Description

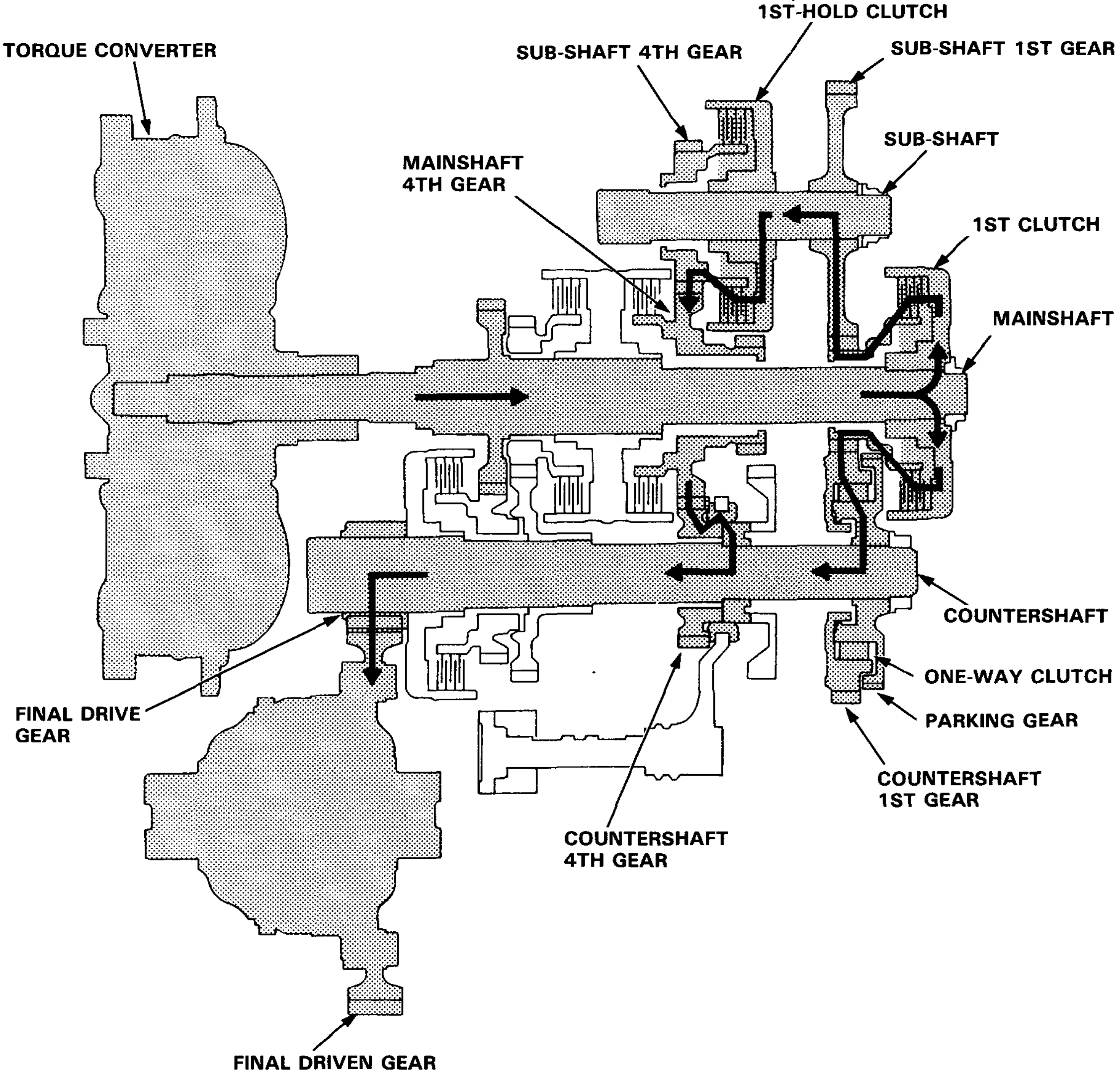
Power Flow (cont'd)

[1] Position

At [1] position, hydraulic pressure is applied to the 1st clutch and 1st-hold clutch.

The power flow when accelerating is as follows;

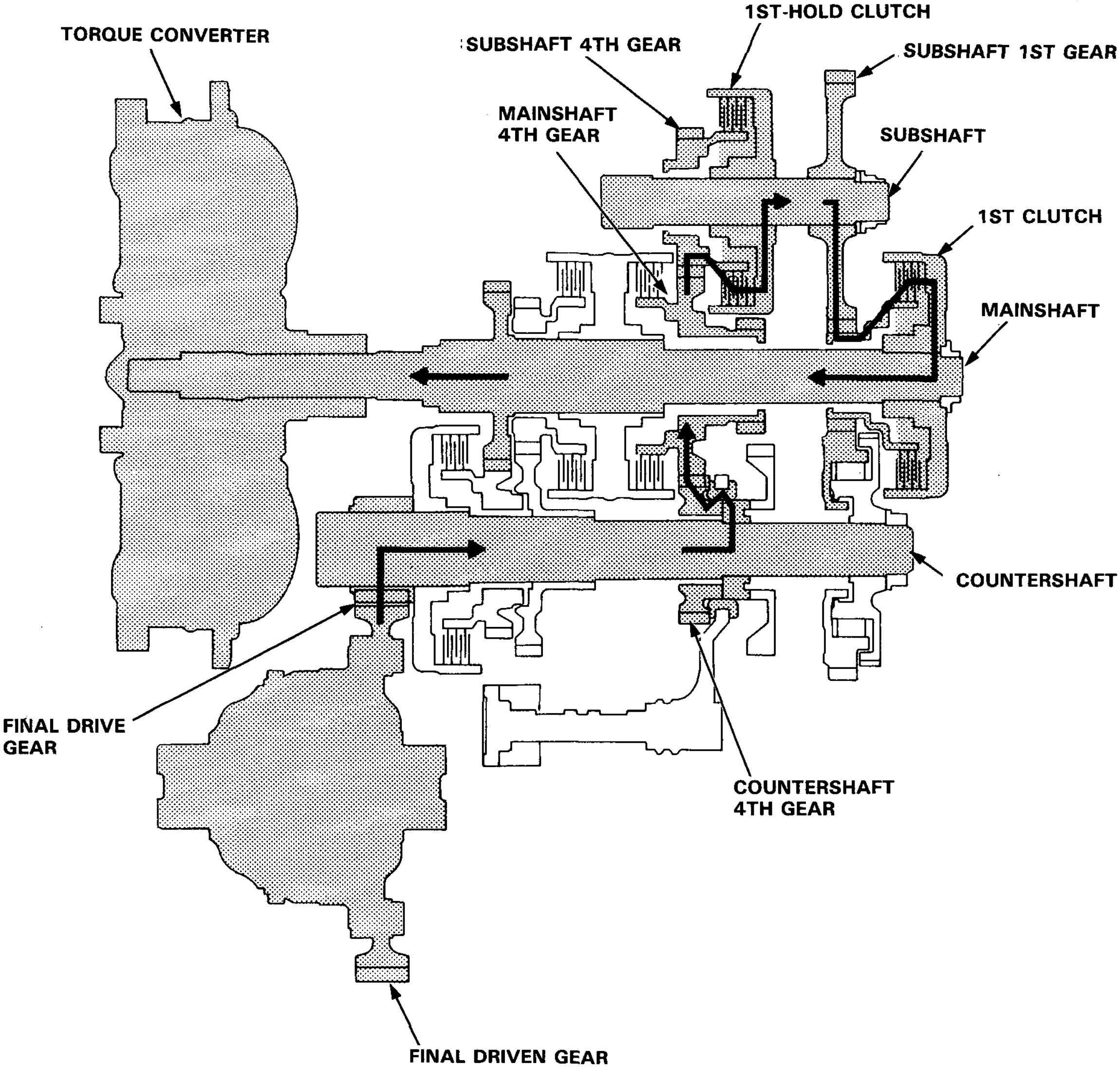
1. Hydraulic pressure is applied to the 1st clutch on the mainshaft and power is transmitted via the 1st clutch to the mainshaft 1st gear.
2. Hydraulic pressure is also applied to the 1st-hold clutch on the sub-shaft. Power transmitted to the mainshaft 1st gear is conveyed via the countershaft 1st gear to the one-way clutch, and via the sub-shaft 1st gear to the 1st-hold clutch. The one-way clutch is used to drive the countershaft, and the 1st-hold clutch drives the countershaft via the 4th gears.
3. Power is transmitted to the final drive gear and drives the final driven gear.



1 Position

The power flow when decelerating is as follows;

1. Rolling resistance from the road surface goes through the front wheels to the final drive gear, then to the sub-shaft 1st gear via the 4th gear and 1st-hold clutch which is applied during deceleration.
2. The one-way clutch becomes free at this time because torque reverses.
3. The counterforce conveyed to the countershaft 4th gear turns the sub-shaft 4th gear via the mainshaft 4th gear. At this time, since hydraulic pressure is also applied to the 1st clutch, counterforce is also transmitted to the mainshaft. As a result, engine braking can be obtained with 1st gear.



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Description

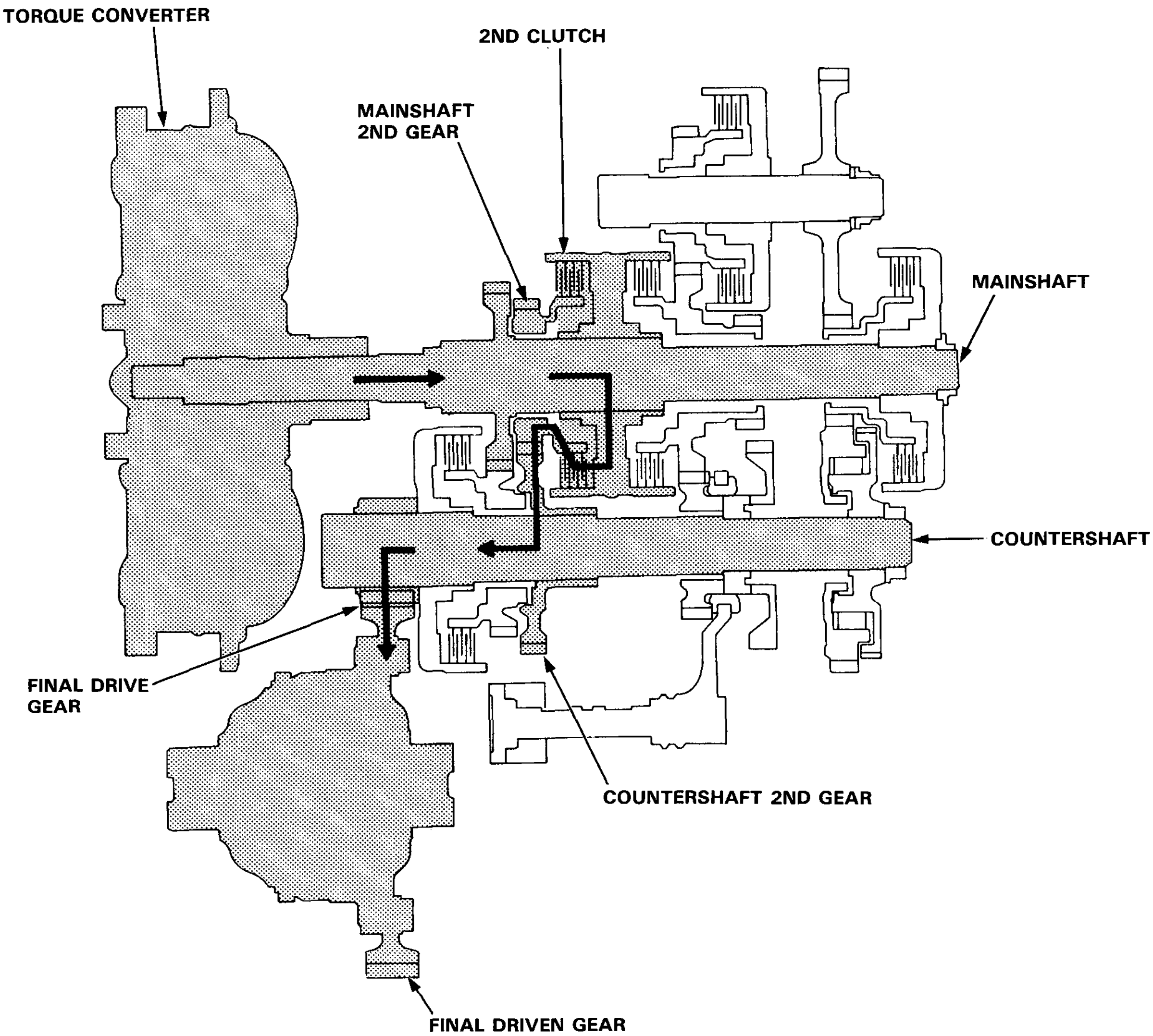
Power Flow (cont'd)

[2] Position

[2] Position is provided to drive only 2nd speed.

1. Hydraulic pressure is applied to the 2nd clutch on the mainshaft and power is transmitted via the 2nd clutch to the mainshaft 2nd gear.
2. Power transmitted to the mainshaft 2nd gear is conveyed via the countershaft 2nd gear, and drives the countershaft.
3. Power is transmitted to the final drive gear and drives the final driven gear.

   NOTE: Hydraulic pressure is also applied to the 1st clutch, but since the rotation speed of the 2nd gear exceeds that of 1st gear, power from 1st gear is cut off at the one-way clutch.

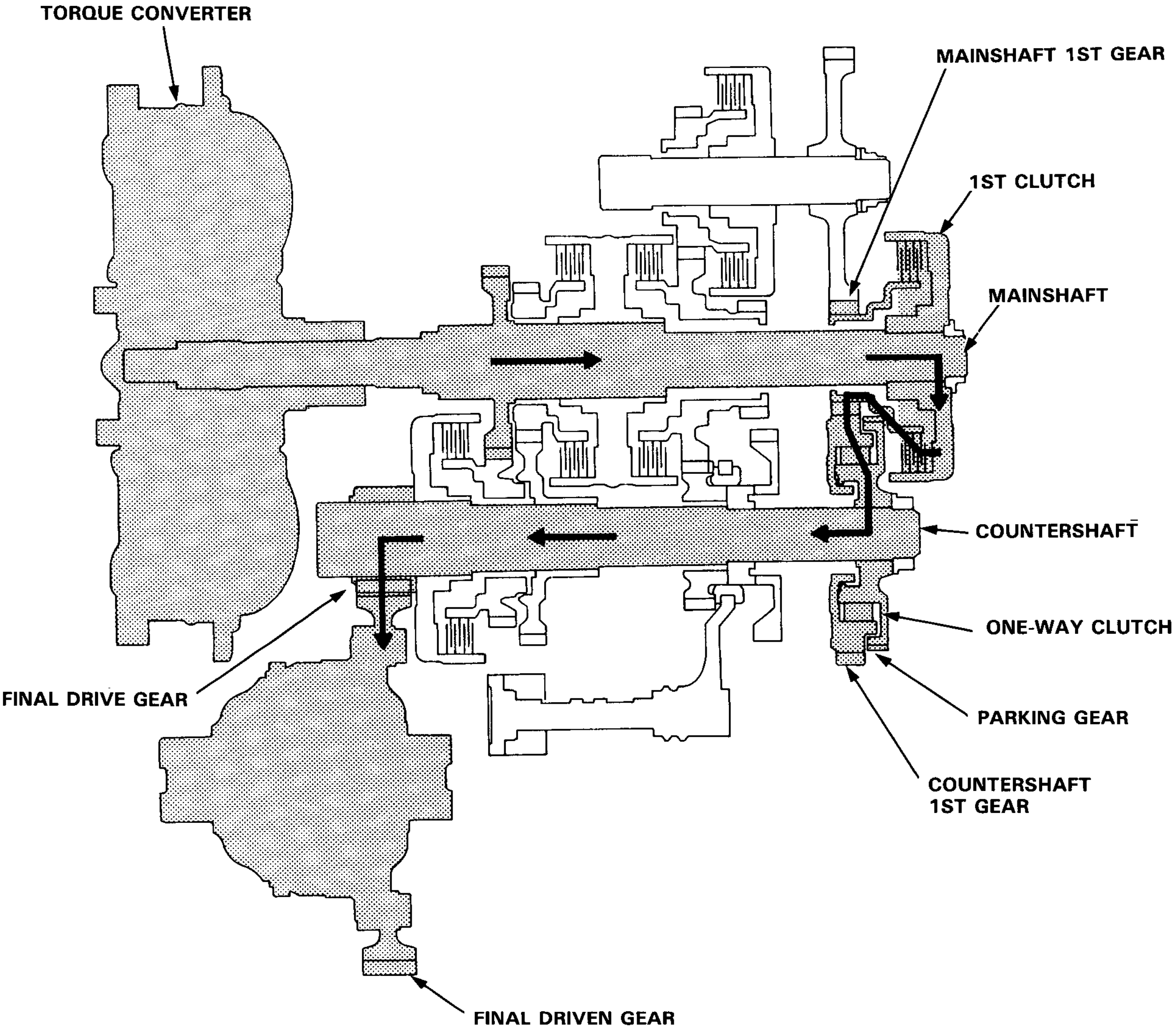


In [D4] or [D3] position, the optimum gear is automatically selected from 1st, 2nd, 3rd and 4th speeds, according to conditions such as the balance between throttle opening (engine load) and vehicle speed.

[D4] or [D3] Position, 1st speed

1. Hydraulic pressure is applied to the 1st clutch, which rotates together with the mainshaft, and the mainshaft 1st gear rotates.
2. Power is transmitted to the countershaft 1st gear, and drives the countershaft via the one-way clutch.
3. Power is transmitted to the final drive gear and drives the final driven gear.

NOTE: In [D4] or [D3] position, hydraulic pressure is not applied to the 1st-hold clutch.



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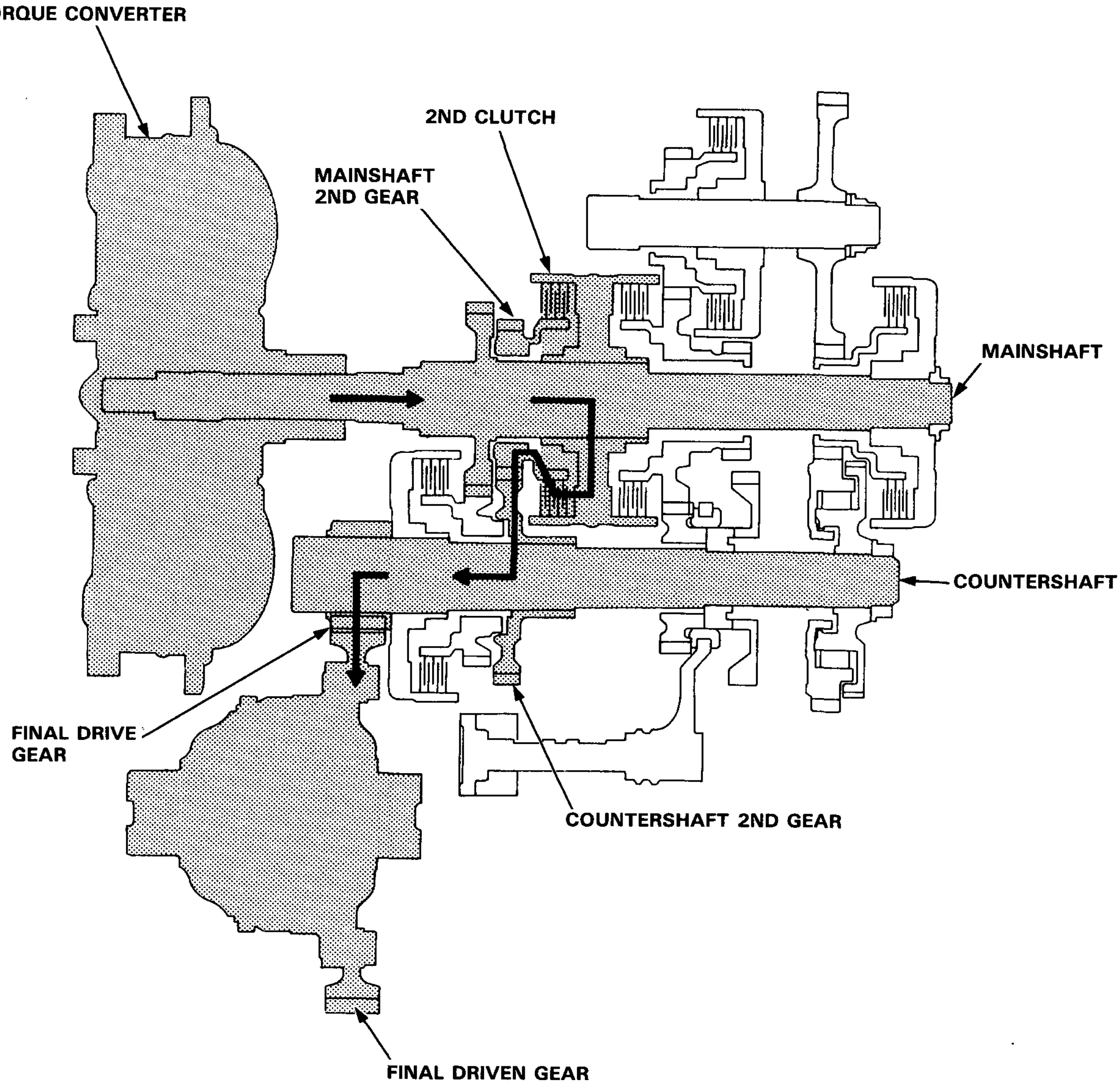
Description

Power Flow (cont'd)

D4 or D3 Position, 2nd speed

1. Hydraulic pressure is applied to the 2nd clutch, which rotates together with the mainshaft, and the mainshaft 2nd gear rotates.
2. Power is transmitted to the countershaft 2nd gear, and drives the countershaft.
3. Power is transmitted to the final drive gear and drives the final driven gear.

NOTE: In D4 or D3 position, 2nd speed, hydraulic pressure is also applied to the 1st clutch, but since the rotation speed of 2nd gear exceeds that of 1st gear, power from 1st gear is cut off at the one-way clutch.

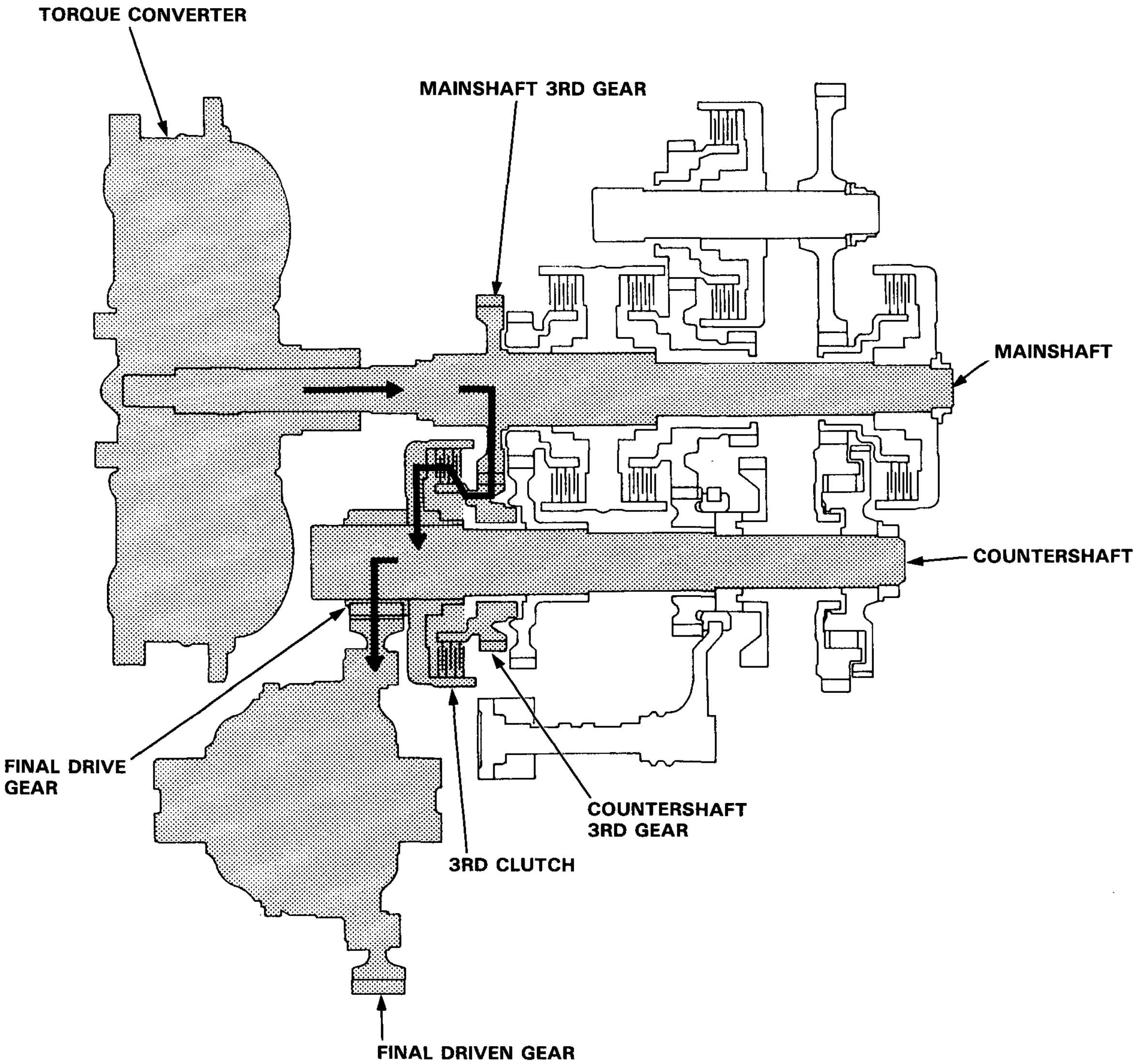


D4 or D3 Position, 3rd speed

1. Hydraulic pressure is applied to the 3rd clutch. Power from the mainshaft 3rd gear is transmitted to the countershaft 3rd gear.

2. Power is transmitted to the final drive gear and drives the final driven gear.

   NOTE: In D4 or D3 position, 3rd speed, hydraulic pressure is also applied to the 1st clutch, but since the rotation speed of 3rd gear exceeds that of 1st gear, power from 1st gear is cut off at the one-way clutch.



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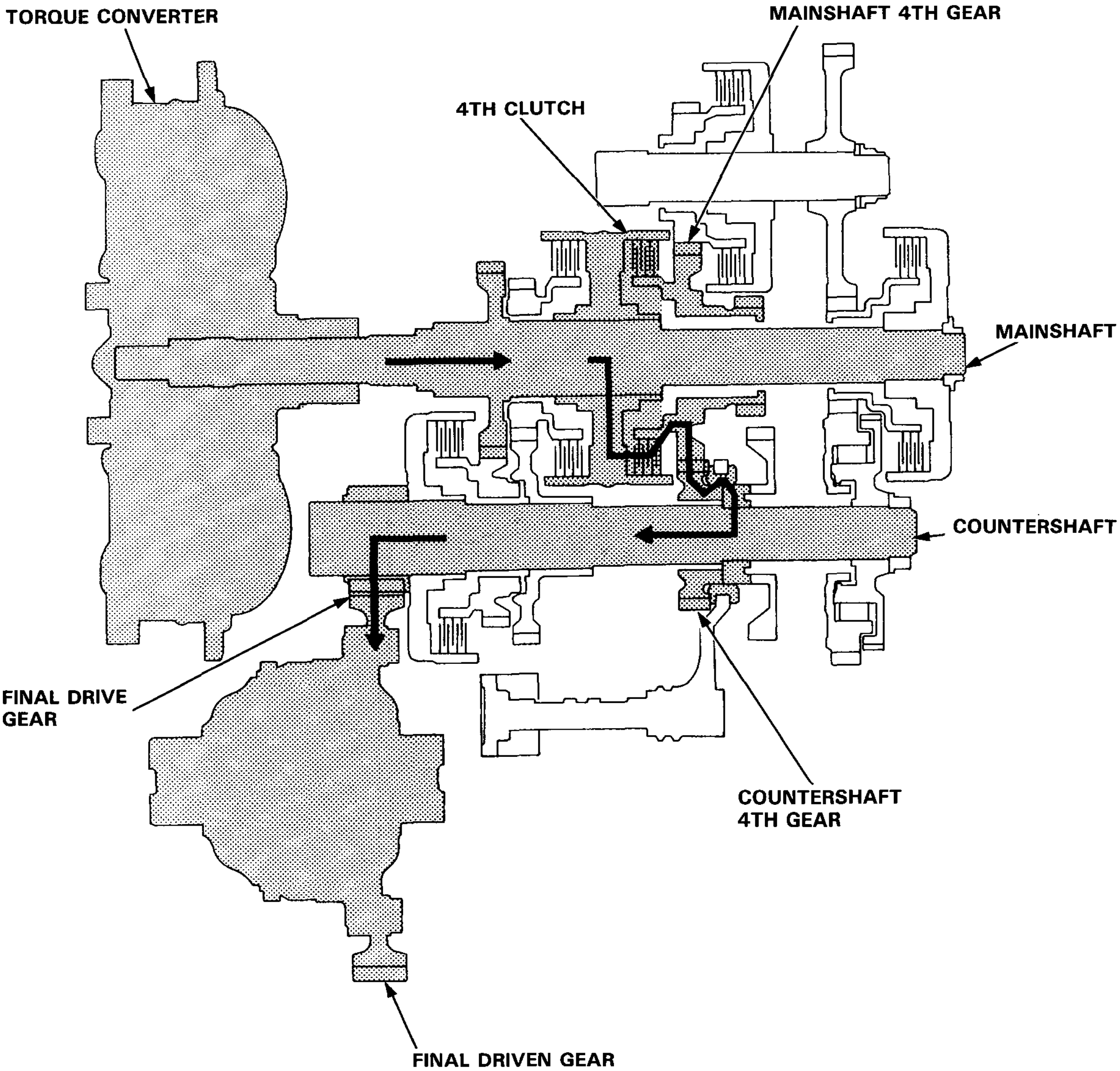
Description

Power Flow (cont'd)

D4 Position, 4th speed

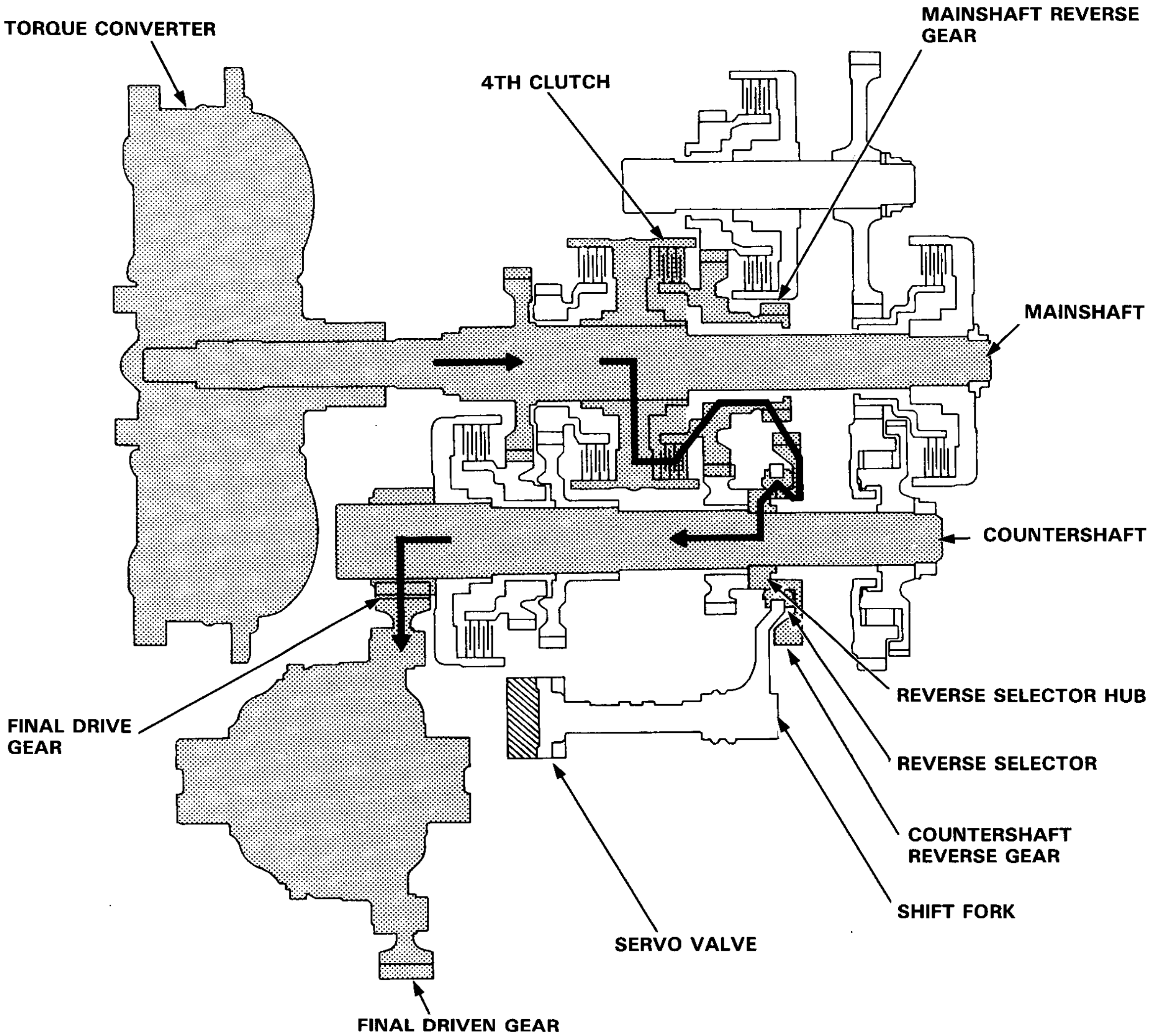
1. Hydraulic pressure is applied to the 4th clutch, which rotates together with the mainshaft, and the mainshaft 4th gear rotates.
2. Power is transmitted to the countershaft 4th gear, and drives the countershaft.
3. Power is transmitted to the final drive gear and drives the final driven gear.

NOTE: In D4 position, 4th speed, hydraulic pressure is also applied to the 1st clutch, but since the rotation speed of 4th gear exceeds that of 1st gear, power from 1st gear is cut off at the one-way clutch.



[R] Position

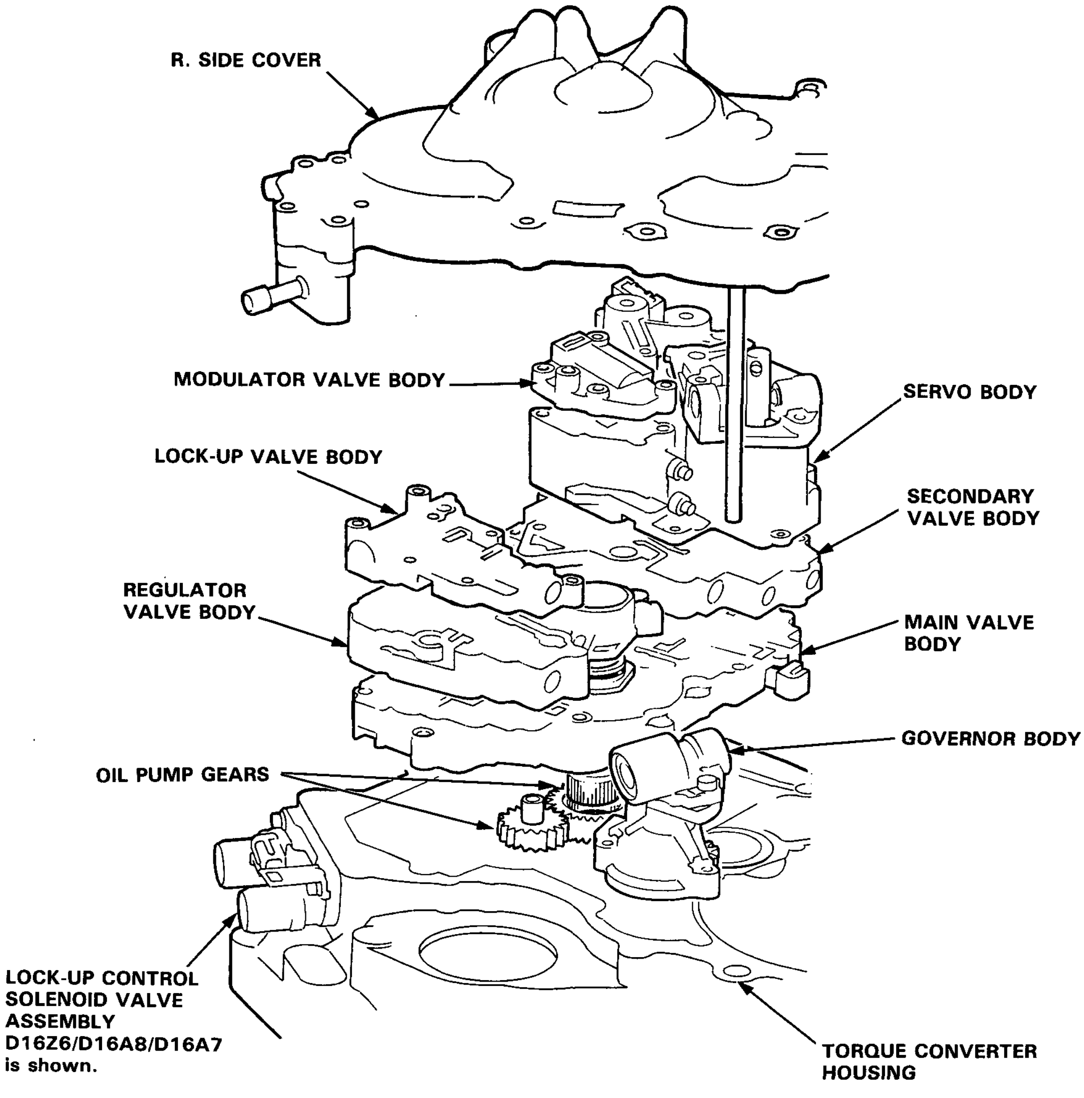
1. Hydraulic pressure is switched by the manual valve to the servo valve, which moves the reverse shift fork to the reverse position. The reverse shift fork engages with the reverse selector, reverse selector hub and the countershaft reverse gear.
2. Hydraulic pressure is also applied to the 4th clutch. Power is transmitted from the mainshaft reverse gear via the reverse idler gear to the countershaft reverse gear.
3. Rotation direction of the countershaft reverse gear is changed via the reverse idler gear.
4. Power is transmitted to the final drive gear and drives the final driven gear.



Description

Hydraulic Control

The valve bodies include the main valve body, secondary valve body, regulator valve body, servo body, lock-up valve body and modulator valve body.
The oil pump is driven by splines behind the torque converter which is attached to the engine. Oil flows through the regulator valve to maintain specified pressure through the main valve body to the manual valve, directing pressure to each of the clutches.

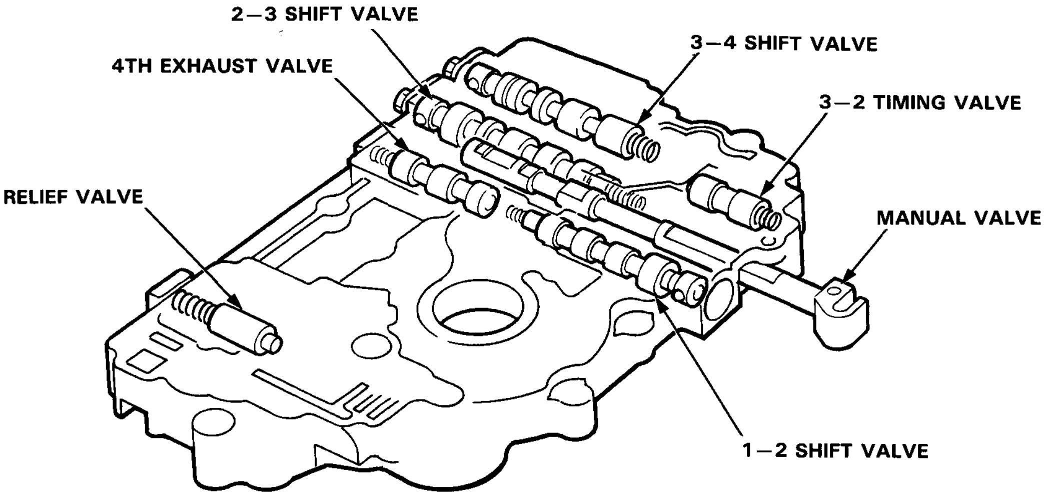


D16Z6/D16A8/D16A7 is shown.

Main Valve Body

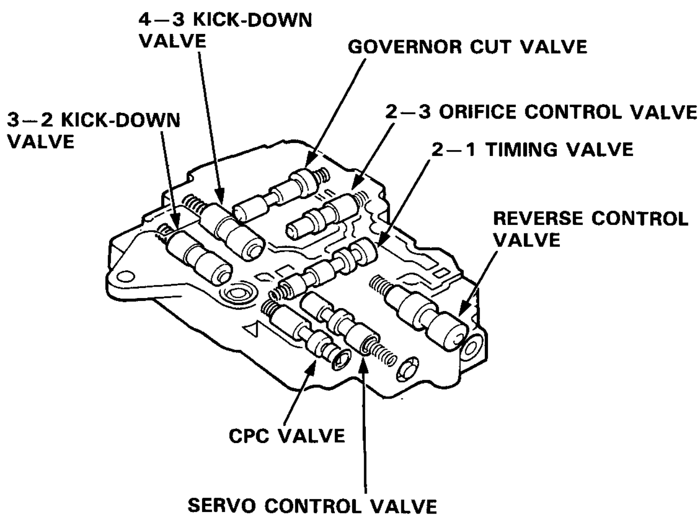
The manual valve, 1—2 shift valve, 2—3 shift valve, 3—4 shift valve, 4th exhaust valve, 3—2 timing valve, and relief valve are all built into the main valve body.

The primary function of this valve body is switching oil passages on and off and controlling the hydraulic pressure going to the hydraulic control system.



Secondary Valve Body

The secondary valve body is located on the main valve body. The 3—2 kick-down valve, 4—3 kick-down valve, 2—3 orifice control valve, governor cut valve, 2—1 timing valve, reverse control valve, servo control valve, and clutch pressure control (CPC) valve are built into the secondary valve body.



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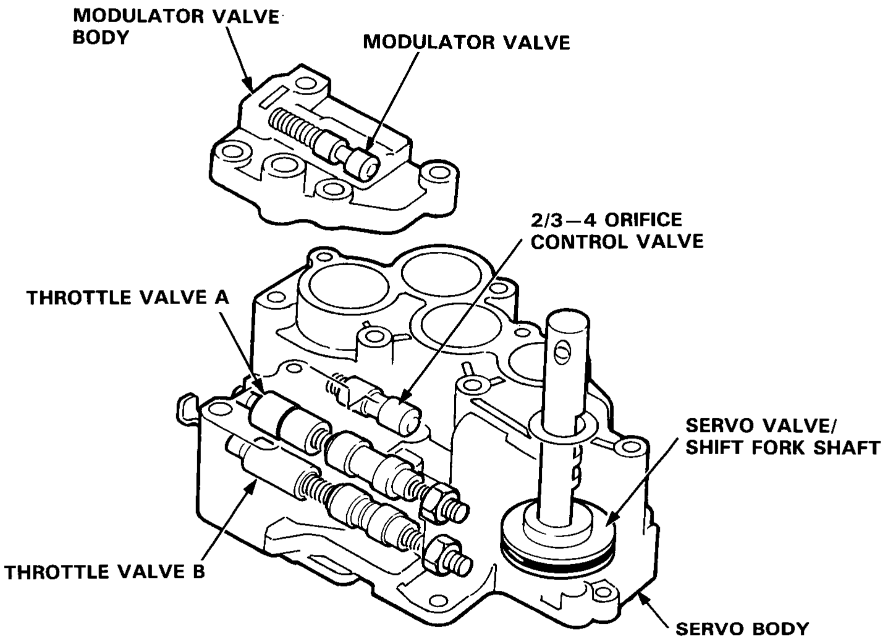
Description

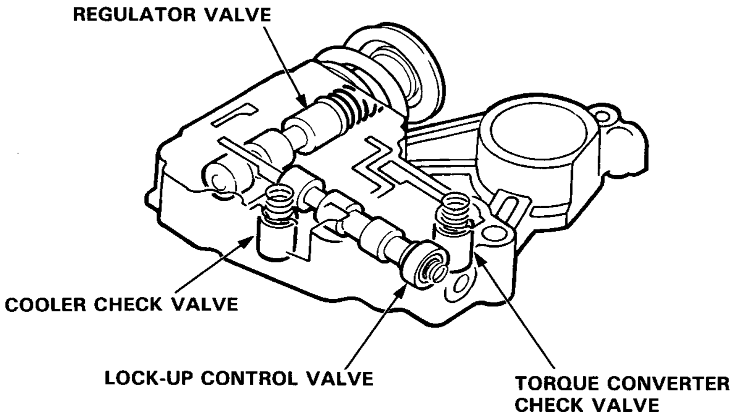
Hydraulic Control (cont'd)

Servo Body
The servo body is located on the secondary valve body.
The servo valve which is integrated with the shift fork, throttle valve A and B, 2/3—4 orifice control valve, and accumulator pistons are all built into the servo body.

Modulator Valve Body
The modulator valve body with the modulator valve is located on the servo body.



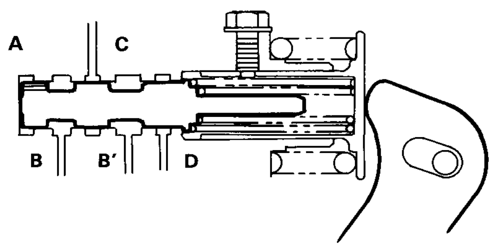
Regulator Valve Body
The regulator valve body is located on the main valve body. The regulator valve body consists of the regulator valve, torque converter check valve, cooler check valve, and lock-up control valve.

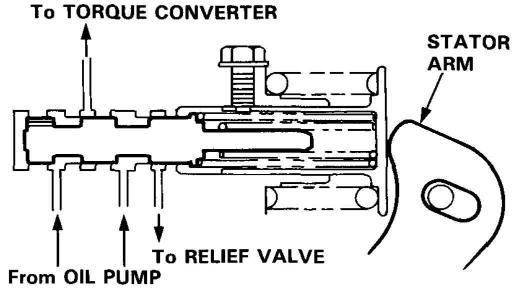


Regulator Valve

The regulator valve maintains a constant hydraulic pressure from the oil pump to the hydraulic control system, while also furnishing oil to the lubricating system and torque converter.

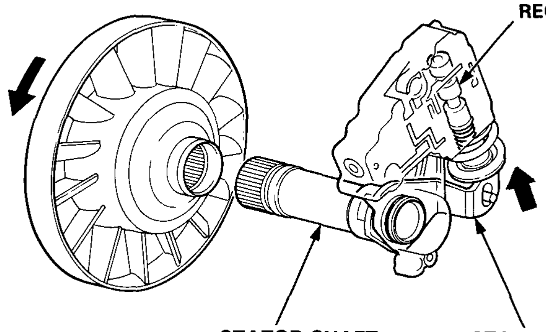
Oil flows through B and B'. The oil which enters through B flows through the valve orifice to A, pushing the regulator valve to the right. According to the level of hydraulic pressure through B, the position of the valve changes, and the amount of the oil through B' from D thus changes. This operation is continued, thus maintaining the line pressure.





Stator Reaction Hydraulic Pressure Control

Hydraulic pressure increase, according to torque, is performed by the regulator valve using stator torque reaction. The stator shaft is splined to the stator and its arm end contacts the regulator spring cap. When the car is accelerating or climbing (Torque Converter Range), stator torque reaction acts on the stator shaft and the stator arm pushes the regulator spring cap in this ➡ direction in proportion to the reaction. The spring compresses and the valve moves to increase the regulated control pressure or line pressure. Line pressure is maximum when the stator reaction is maximum.



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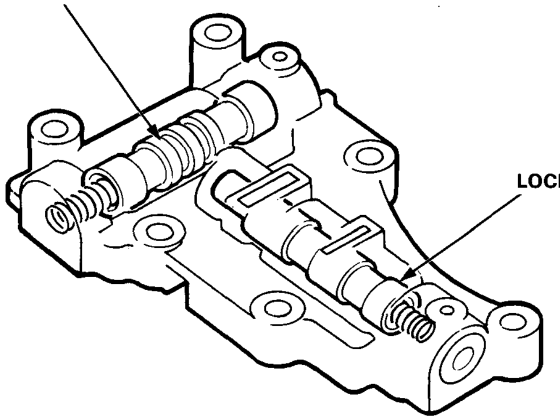
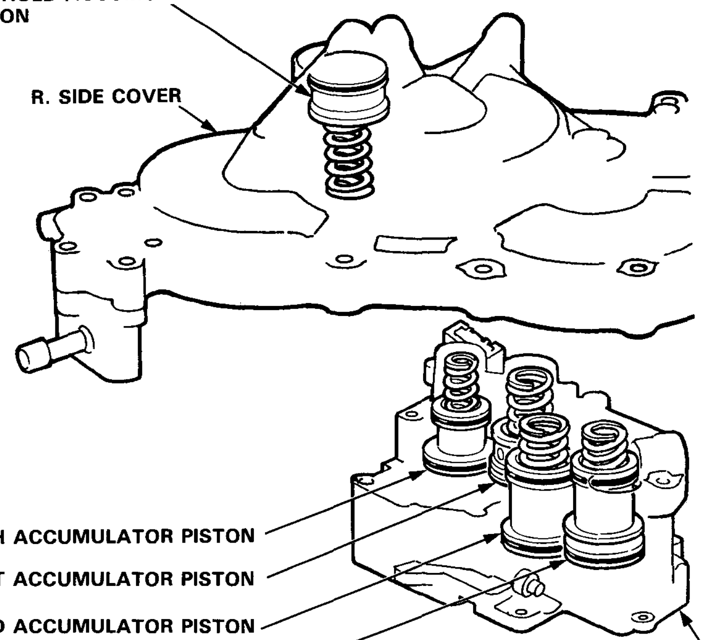
Hydraulic Control (cont'd)

Lock-up Valve Body
The lock-up valve body with the lock-up shift valve and lock-up timing valve is located on the regulator valve body.



Accumulator Pistons
The accumulator pistons are built into the servo body and R. side cover. The 1st-hold clutch accumulator piston is in the R. side cover, and the 1st, 2nd, 3rd, and 4th clutch accumulator pistons are built in the servo body.



Hydraulic Flow D15B2

General Chart of Hydraulic Pressure

Oil Pump → Regulator Valve → { Line Pressure / Torque Converter Pressure / Lubrication Pressure }

Distribution of Hydraulic Pressure

- Regulator Valve → { Line Pressure / Torque Converter Pressure / Lubrication Pressure }
- Manual Valve → To Select Line Pressure
- Modulator Valve → Modulator Pressure
- 1-2 Shift Valve
- 2-3 Shift Vavle
- 3-4 Shift Valve } → Clutch Pressure
- Throttle Valve A → Throttle A Pressure
- Throttle Valve B → Throttle B Pressure
- Governor Valve → Governor Pressure

NO.	DESCRIPTION OF PRESSURE	NO.	DESCRIPTION OF PRESSURE	NO.	DESCRIPTION OF PRESSURE
1	LINE	16	1ST-HOLD CLUTCH	57	THROTTLE B
2	LINE	18	LINE	58	THROTTLE B
3	LINE	20	2ND CLUTCH	60	GOVERNOR
3′	LINE	21	2ND CLUTCH	61	GOVERNOR
3″	LINE	25	LINE	90	TORQUE CONVERTER
4	LINE	30	3RD CLUTCH	91	TORQUE CONVERTER
4′	LINE	31	3RD CLUTCH	92	TORQUE CONVERTER
5	LINE	40	4TH CLUTCH	93	OIL COOLER
5′	LINE	41	4TH CLUTCH	94	TORQUE CONVERTER
5″	LINE	50	THROTTLE A	95	LUBRICATION
6	MODULATOR	51	THROTTLE A	96	TORQUE CONVERTER
6′	MODULATOR	52	THROTTLE A	97	TORQUE CONVERTER
10	1ST CLUTCH	55	THROTTLE B	99	SUCTION
15	1ST-HOLD CLUTCH	56	THROTTLE B	X	BLEED

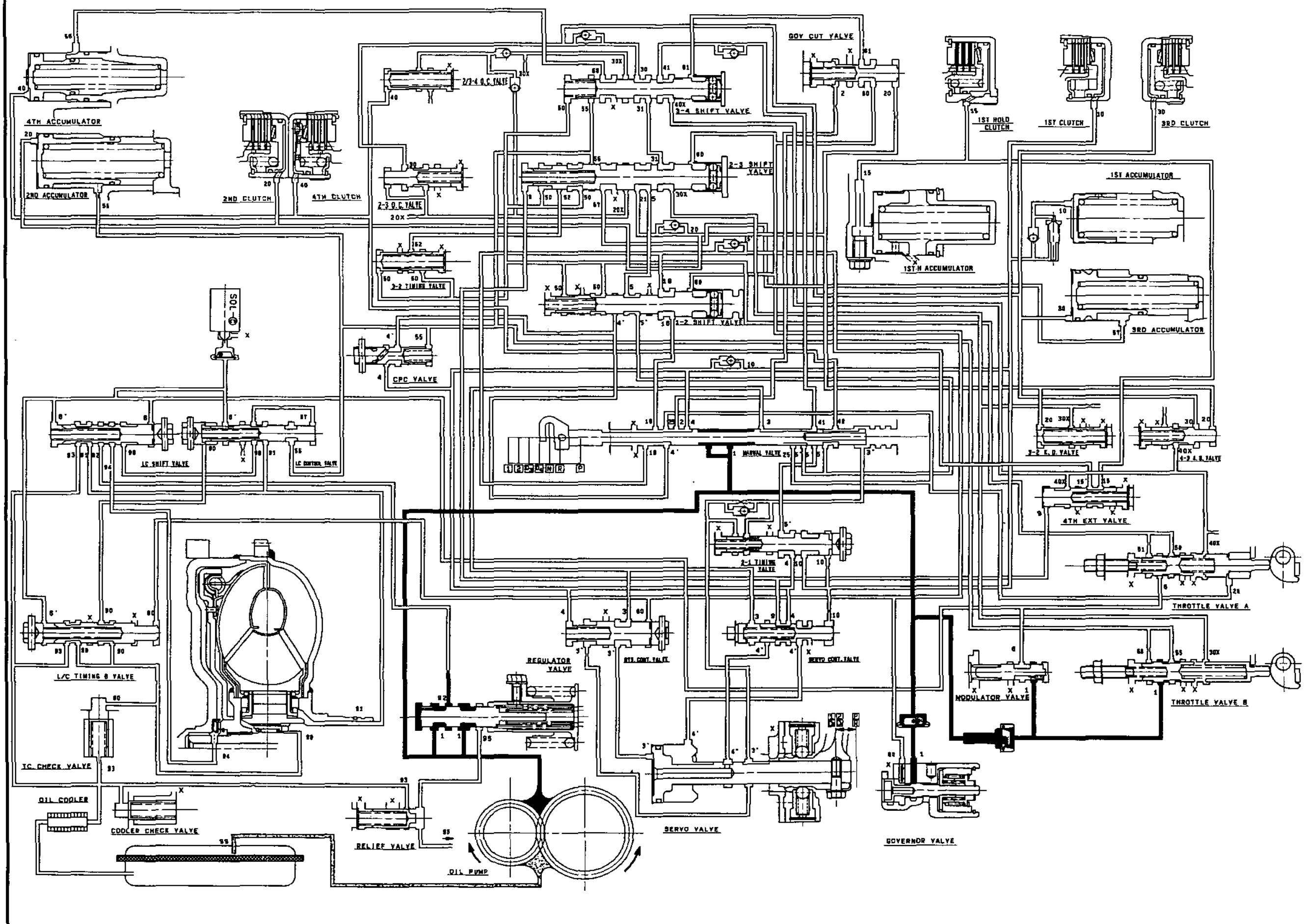
(cont'd)

Description

Hydraulic Flow D15B2 (cont'd)

[N] Position

As the engine turns, the oil pump also starts to operate. Automatic transmission fluid is drawn from (99) and discharged into (1). Then, ATF pressure is controlled by the regulator valve and becomes line pressure (1). The torque converter inlet pressure (92) enters (94) of torque converter through the orifice and discharges into (90).
The torque converter check valve prevents the torque converter pressure from falling.
Under this condition, the hydraulic pressure is not applied to the clutches.

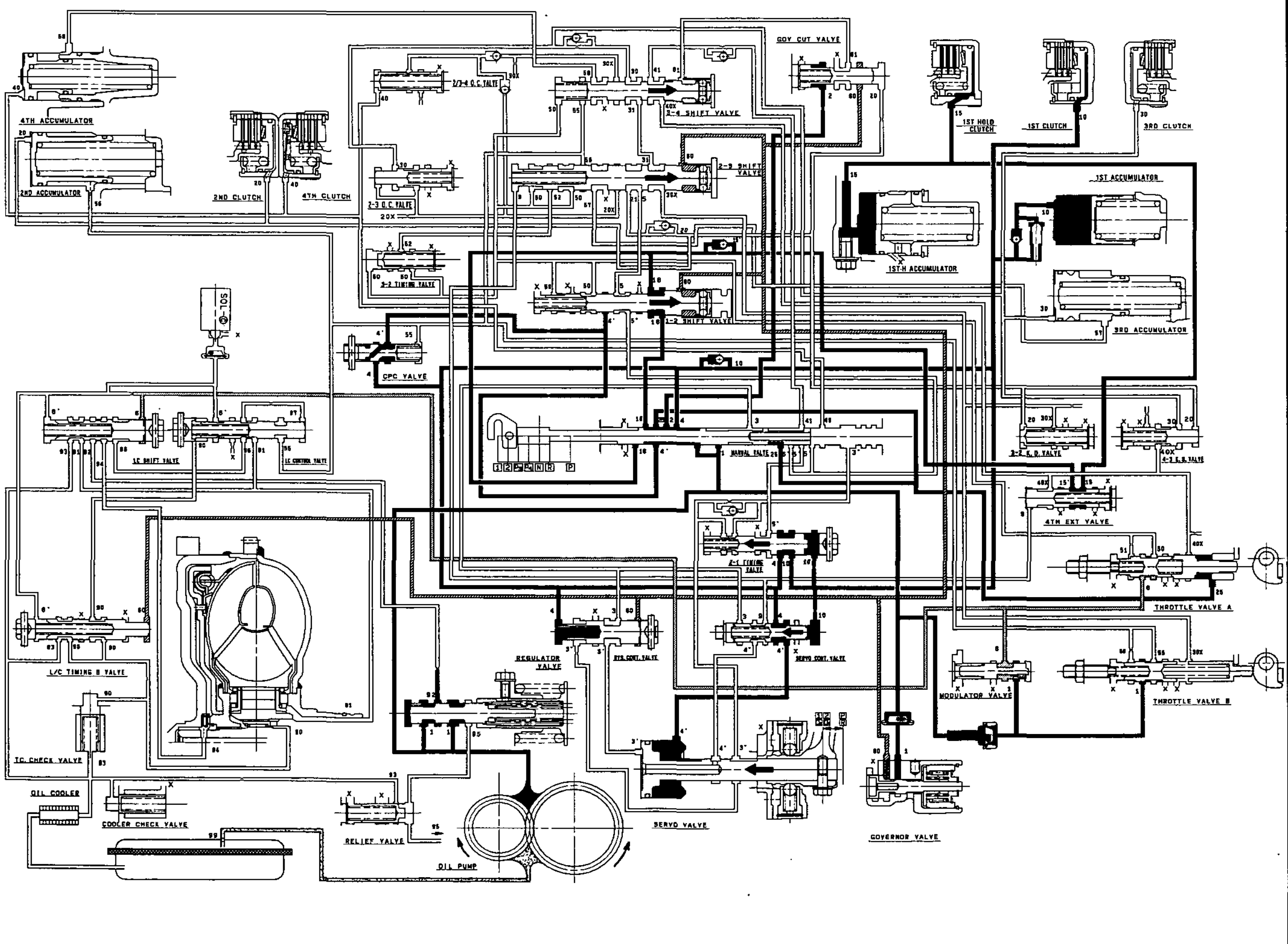


[1] Position

The line pressure (1) becomes the line pressure (4) and 1st-hold clutch pressure (16) as it passes through the manual valve. Also, the line pressure (1) goes to the governor valve and becomes the governor pressure (60). The governor pressure (60) is supplied to the 1-2 and 2-3 shift valves. The shift valves remain on the right side because the governor pressure is lower than the valve spring tention and the throttle A pressure supplied to the left side of the shift valves.
The line pressure (4) becomes the 1st clutch pressure (10) via the orifice, then goes to the 1st clutch. The 1st clutch pressure (10) is also supplied to the servo control valve and 2-1 timing valve to move them to the left side.
The 1st-hold clutch pressure (16) goes to the 1st-hold clutch via the 1-2 shift valve, orifice and 4th exhaust valve.
In the [1] position, the 1st clutch and 1st-hold clutch are engaged.
The line pressure (4) also goes to the servo valve via the servo control valve, and holds on the servo valve in the driving range.

NOTE:

- When used, "left" and "right" indicates direction on the flowchart.
- SOL-©: Lock-up Control Solenoid Valve A



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Description

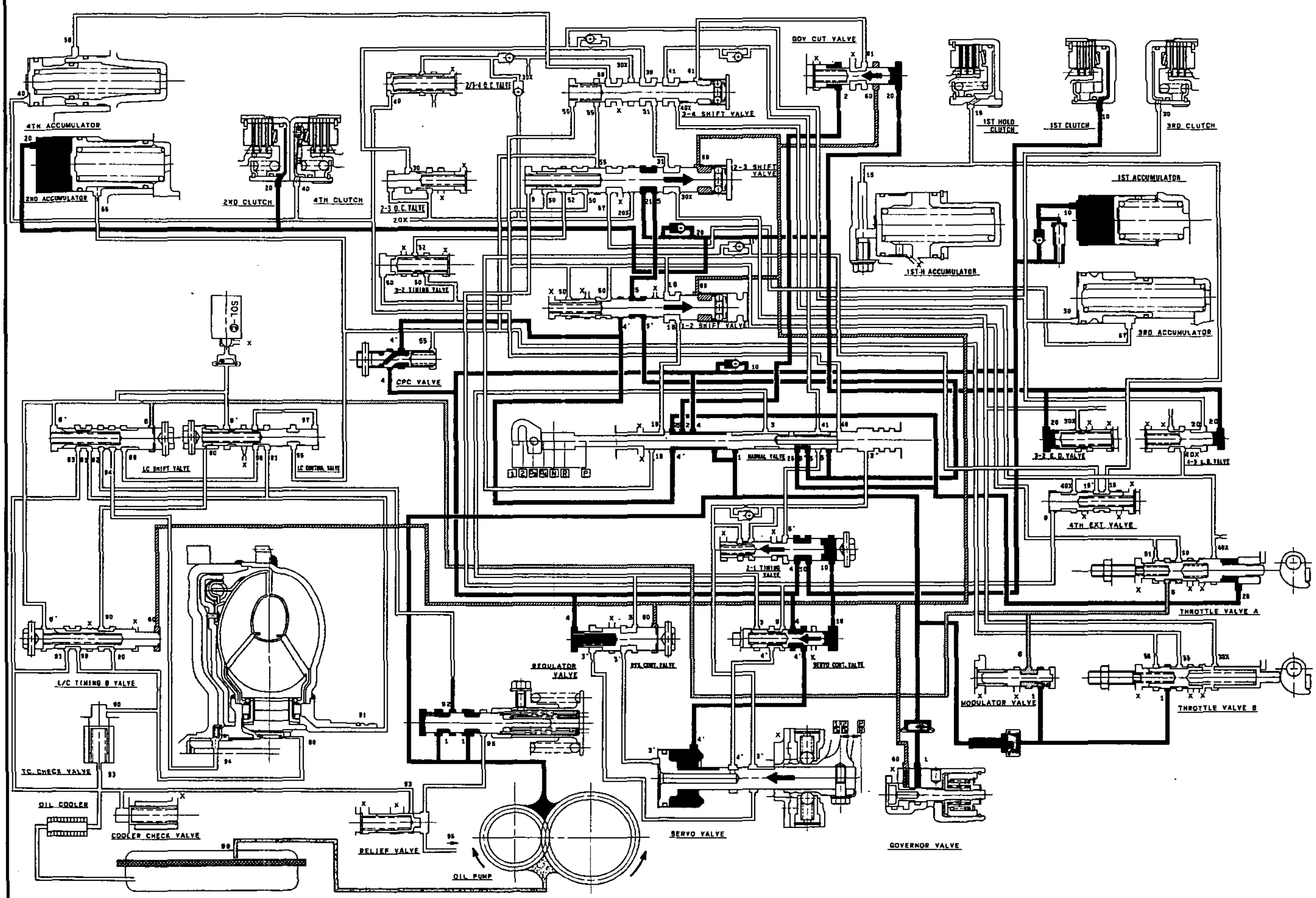
Hydraulic Flow D15B2 (cont'd)

[2] Position

The line pressure (1) becomes the line pressure (2), (4), (4'), (25) as it passes through the manual valve. Also, the line pressure (1) goes to the governor valve and becomes the governor pressure (60). The governor pressure (60) is supplied to the 1-2 and 2-3 shift valves, but the 1-2 and 2-3 shift valves remain on the right side.
The line pressure (25) goes to the 2-3 shift valve via the 1-2 shift valve and becomes the 2nd clutch pressure (21). The 2nd clutch pressure (21) becomes the 2nd clutch pressure (20) as it passes through the orifice, then goes to the 2nd clutch.
The line pressure (4) becomes the 1st clutch pressure (10) and flows to the 1st clutch, servo control valve and 2-1 timing valve. The line pressure (4') also holds on the servo valve in the driving range as in the [1] Position.
In the [2] position, the 1st clutch and 2nd clutch are engaged.

NOTE:

- When used, "left" and "right" indicates direction on the flowchart.
- SOL-Ⓒ: Lock-up Control Solenoid Valve A

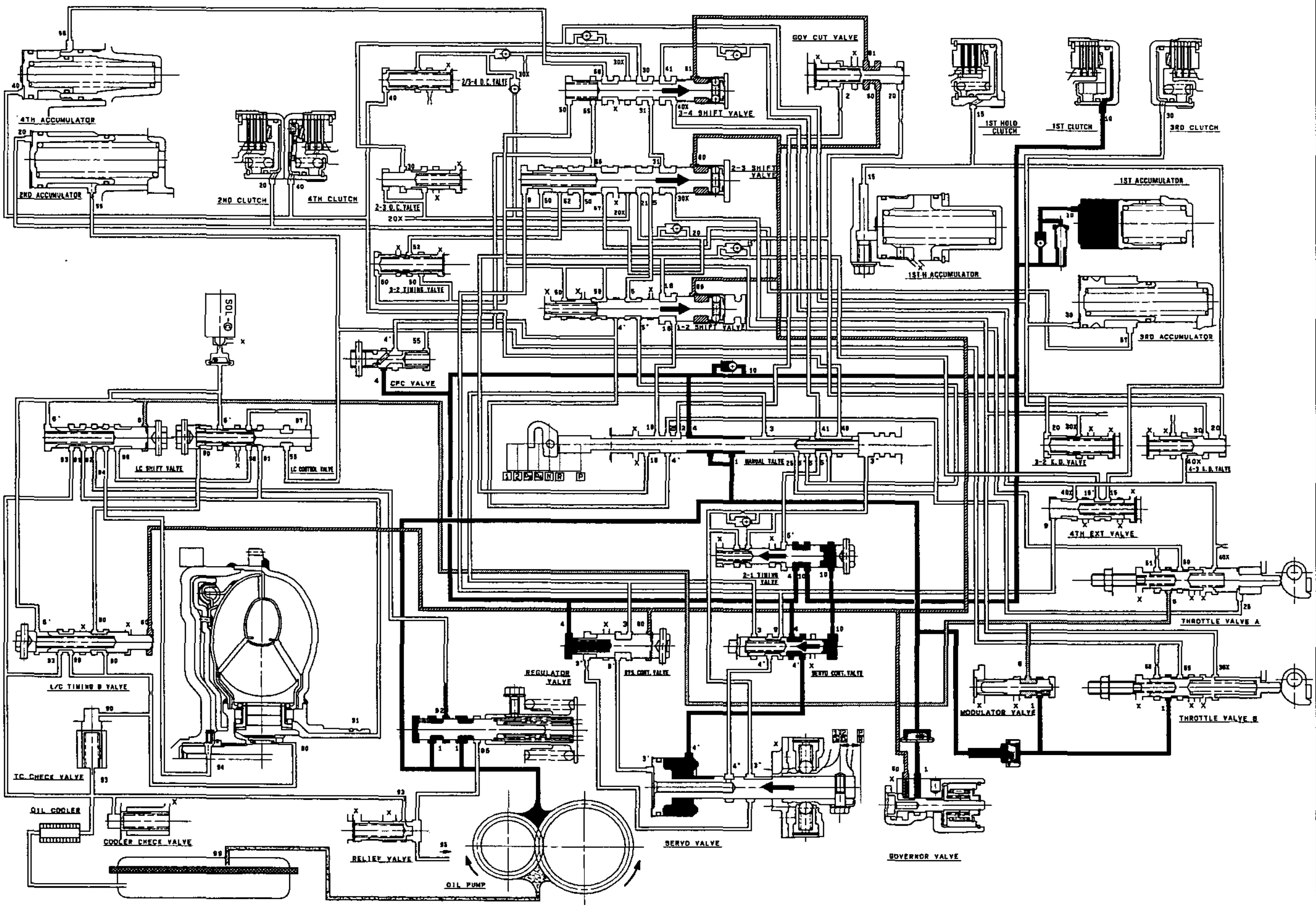


D4 or D3 Position

1. 1st speed
   The flow of fluid through the torque converter is the same as in the N position. The line pressure (1) becomes the line pressure (4).The line pressure (4) becomes the 1st clutch pressure (10) as it passes through the orifice. The 1st clutch pressure (10) is supplied to the 1st clutch and, consequently the vehicle will move as the engine power is transmitted.
   The line pressure (1) becomes the governor pressure (60) by the governor valve and travels to each shift valve. But, all shift valves remain on the right side because the governor pressure (60) is lower than the shift valve spring tension and the throttle A pressure.
   The line pressure (1) also flows to the modulator valve and throttle valve B.

In the D4 or D3 position, the line pressure (4') flows to the servo valve and holds it on in the driving range as in the 1 and 2 position

NOTE:
- When used, "left" or "right" indicates direction on the flowchart.
- SOL-Ⓒ: Lock-up Control Solenoid Valve A



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Description

Hydraulic Flow D15B2 (cont'd)

2. 2nd speed

The flow of fluid up to the 1-2 and 2-3 shift valves is the same as the 1st speed range. As the speed of the car reaches the prescribed value, the 1-2 shift valve is moved to the left side by the governor pressure (60) and uncovers the oil port leading to the 2nd clutch; the 2nd clutch is engaged.

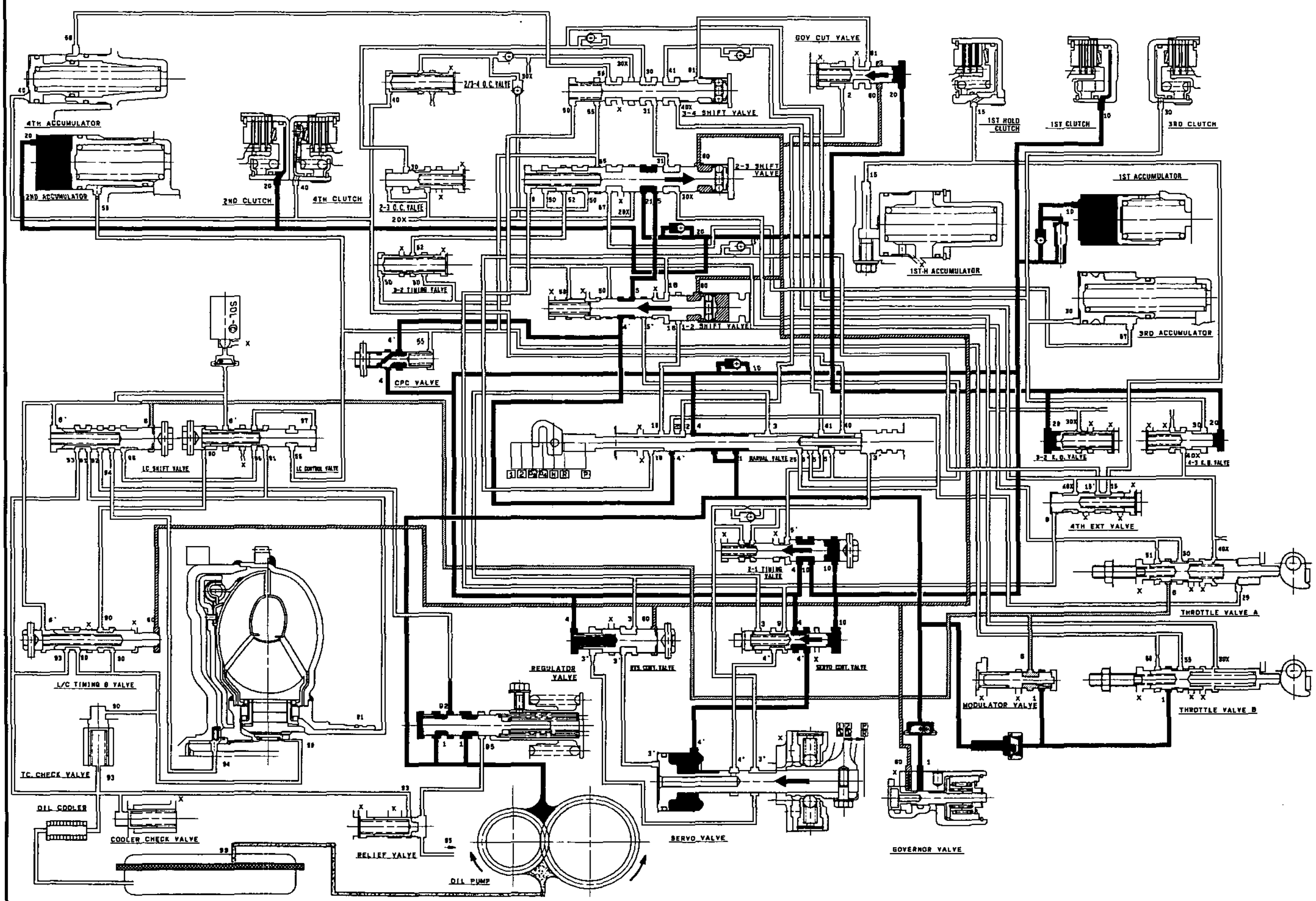
Fluid flows by way of:

Line Pressure (4) → CPC Valve-Line Pressure (4') → 1-2 Shift Valve-Line Pressure (5) → 2-3 Shift Valve-2nd Clutch Pressure (21) → Orifice-2nd Clutch Pressure (20) → 2nd Clutch.

The 2nd clutch pressure (20) is also supplied to the governor cut valve. The governor cut valve is moved to the left side to cover the oil port of the governor pressure (60) to the 3-4 shift valve. The hydraulic pressure also flows to the 1st clutch. However, no power is transmitted by means of the one-way clutch.

NOTE:

- When used, "left" or "right" indicates direction on the flowchart.
- SOL-Ⓒ: Lock-up Control Solenoid Valve A



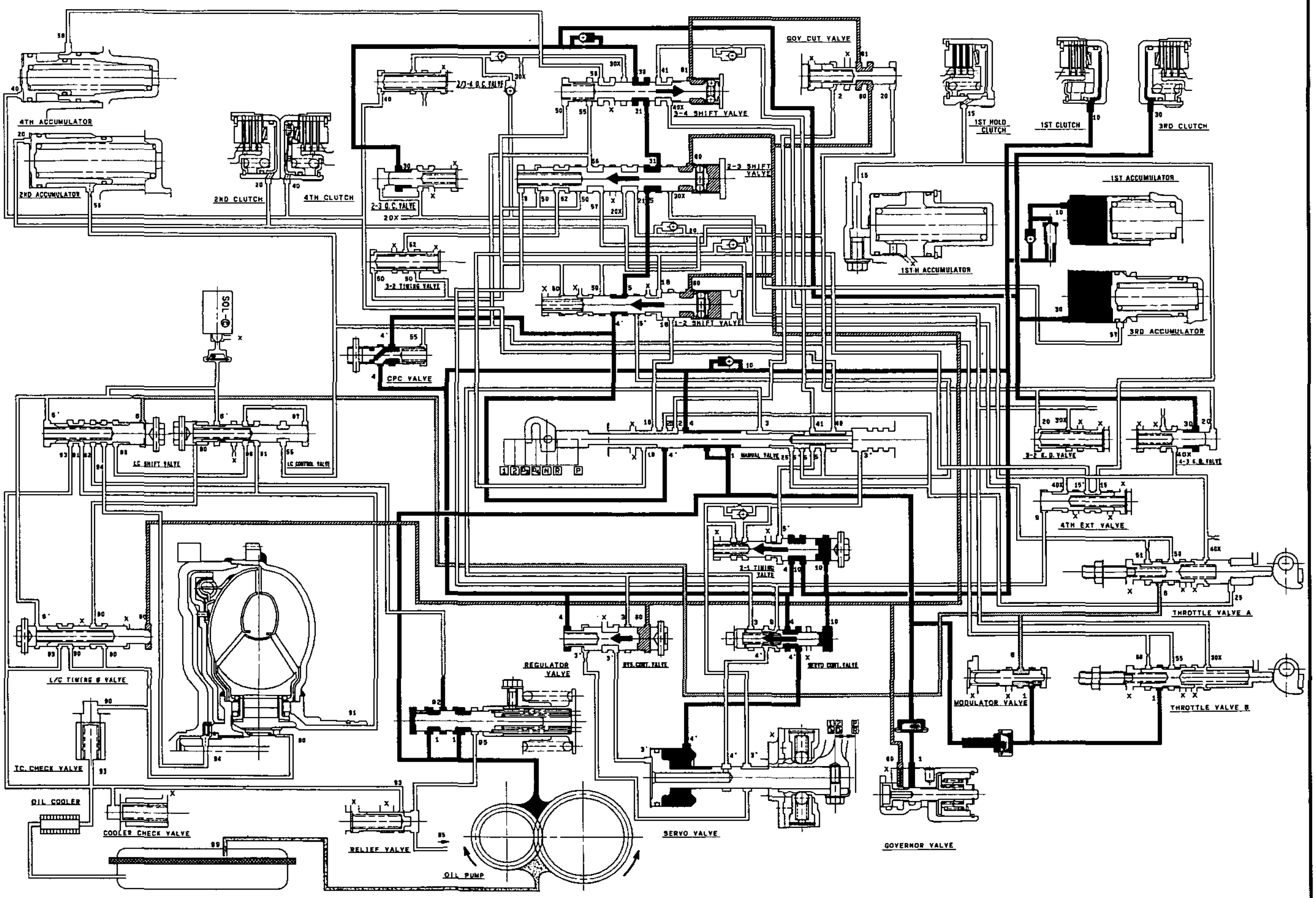
3. 3rd speed

The flow of fluid up to the 1-2, 2-3 and 3-4 shift valves is the same as the 2nd speed range. As the speed of the car reaches the prescribed value, the 2-3 shift valve is moved to the left side by the governor pressure (60) and uncovers the oil port leading to the 3rd clutch. Since the 1-2 shift valve is kept on the left side, and the 3-4 shift valve is on the right side to uncover the oil port leading to the 3rd clutch, the 3rd clutch is engaged.
Fluid flows by way of:

Line Pressure (4) → CPC Valve-Line Pressure (4') → 1-2 Shift Valve-Line Pressure (5) → 2-3 Shift Valve-3rd Clutch Pressure (31) → 3-4 Shift Valve-3rd Clutch Pressure (30) → Orifice → 3rd Clutch.

The hydraulic pressure also flows to the 1st clutch. However, no power is transmitted by means of the one-way clutch as in the 2nd speed.

NOTE:
- When used, "left" and "right" indicates direction on the flowchart.
- SOL-Ⓒ: Lock-up Control Solenoid Valve A



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Desription

Hydraulic Flow D15B2 (cont'd)

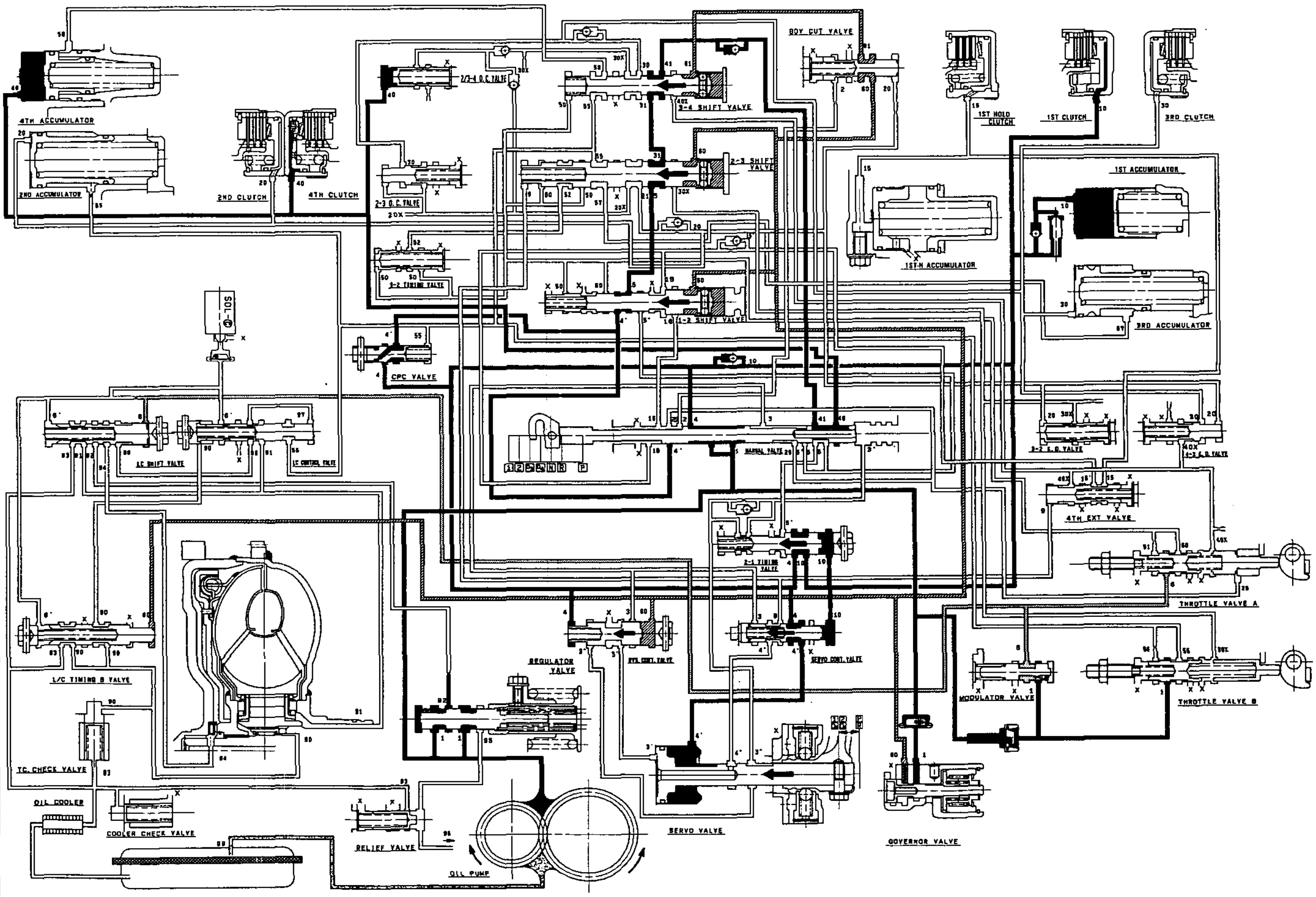
4. 4th speed

The flow of fluid up to the 1-2, 2-3 and 3-4 shift valves is the same as the 3rd speed range. As the speed of the car reaches the prescribed value, the 3-4 shift valve is moved to the left side by the governor pressure (60) and uncovers the oil port leading to the 4th clutch. Since the 1-2 and 2-3 shift valves are kept on the left side, the fluid flows through to the 4th clutch; the power is transmitted through the 4th clutch.
Fluid flows by way of:

Line Pressure (4) → CPC Valve-Line Pressure (4') → 1-2 Shift Valve-Line Pressure (5) → 2-3 Shift Valve-3rd Clutch Pressure (31) → 3-4 Shift Valve-4th Clutch Pressure (41) → Orifice → Manual Valve-4th Clutch Pressure (40) → 4th Clutch.

The hydraulic pressure also flows to the 1st clutch. However, no power is transmitted by means of the one-way clutch as in the 3rd speed.

NOTE:
- When used, "left" or "right" indicates direction on the flowchart.
- SOL-©: Lock-up Control Solenoid Valve A



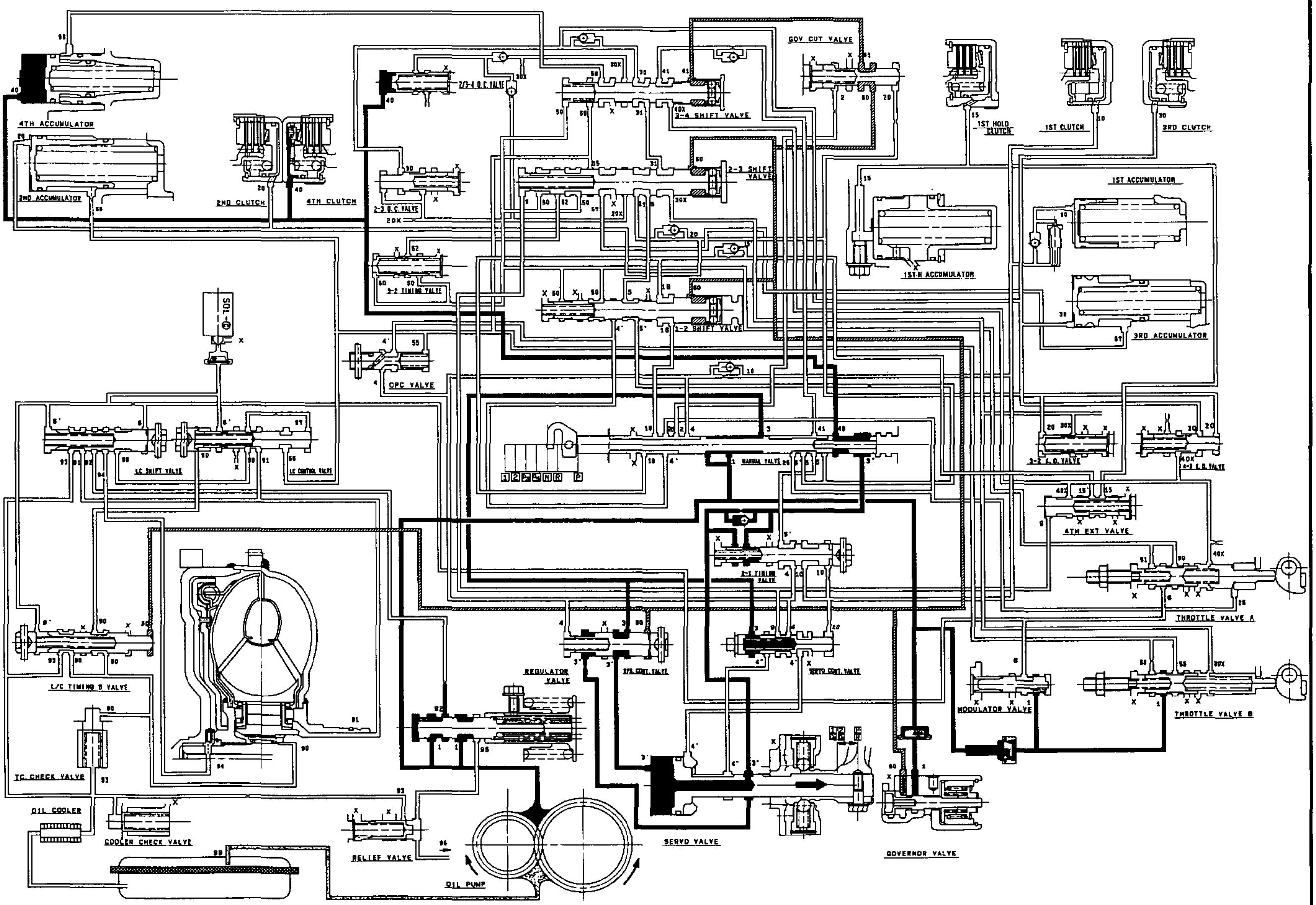
[R] Position

The flow of fluid through the torque converter circuit is the same as in the [N] position. The line pressure (1) becomes the line pressure (3) as it passes the manual valve. It then flows through the reverse control valve to the servo valve, causing the reverse shift fork shaft to be moved to the reverse position. The line pressure (3'') from the servo valve goes to the manual valve and becomes the 4th clutch pressure (40). Then it goes to the 4th clutch; the power is transmitted through the 4th clutch.

When the [R] position is selected while the vehicle is moving forward at more than a certain speed, the line pressure (3) is cut by the governor pressure (60) which activates the reverse control valve.

When shifting to [R] from [D4], [D3], [2] or [1] position, the servo control valve is moved to the left side by 1st clutch pressure (10). The servo control valve combines with the reverse shift fork shaft detent system to control movement of the servo valve.

NOTE:
- When used, "left" and "right" indicates direction on the flowchart.
- SOL-Ⓒ: Lock-up Control Solenoid Valve A



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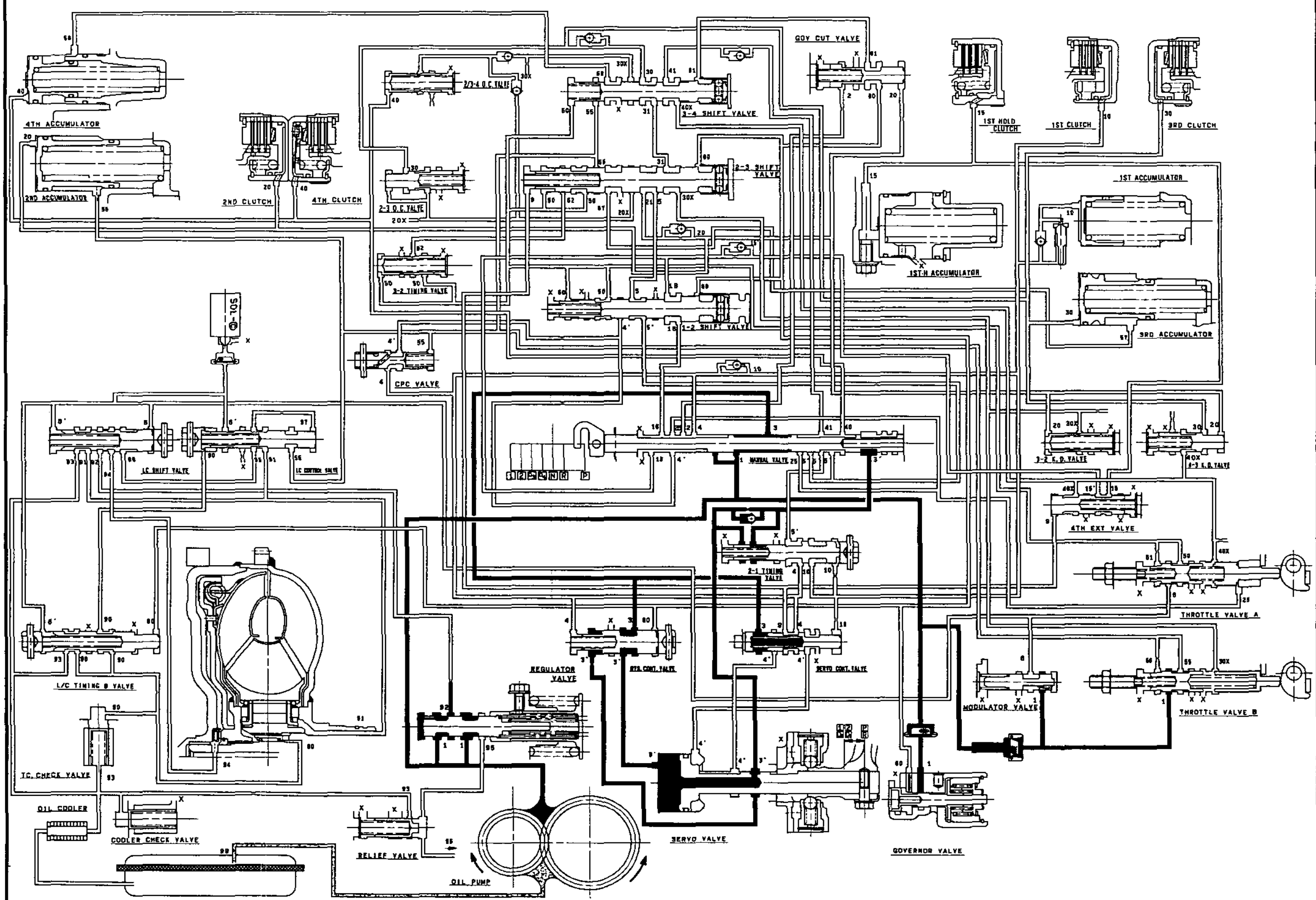
Description

Hydraulic Flow D15B2 (cont'd)

[P] Position

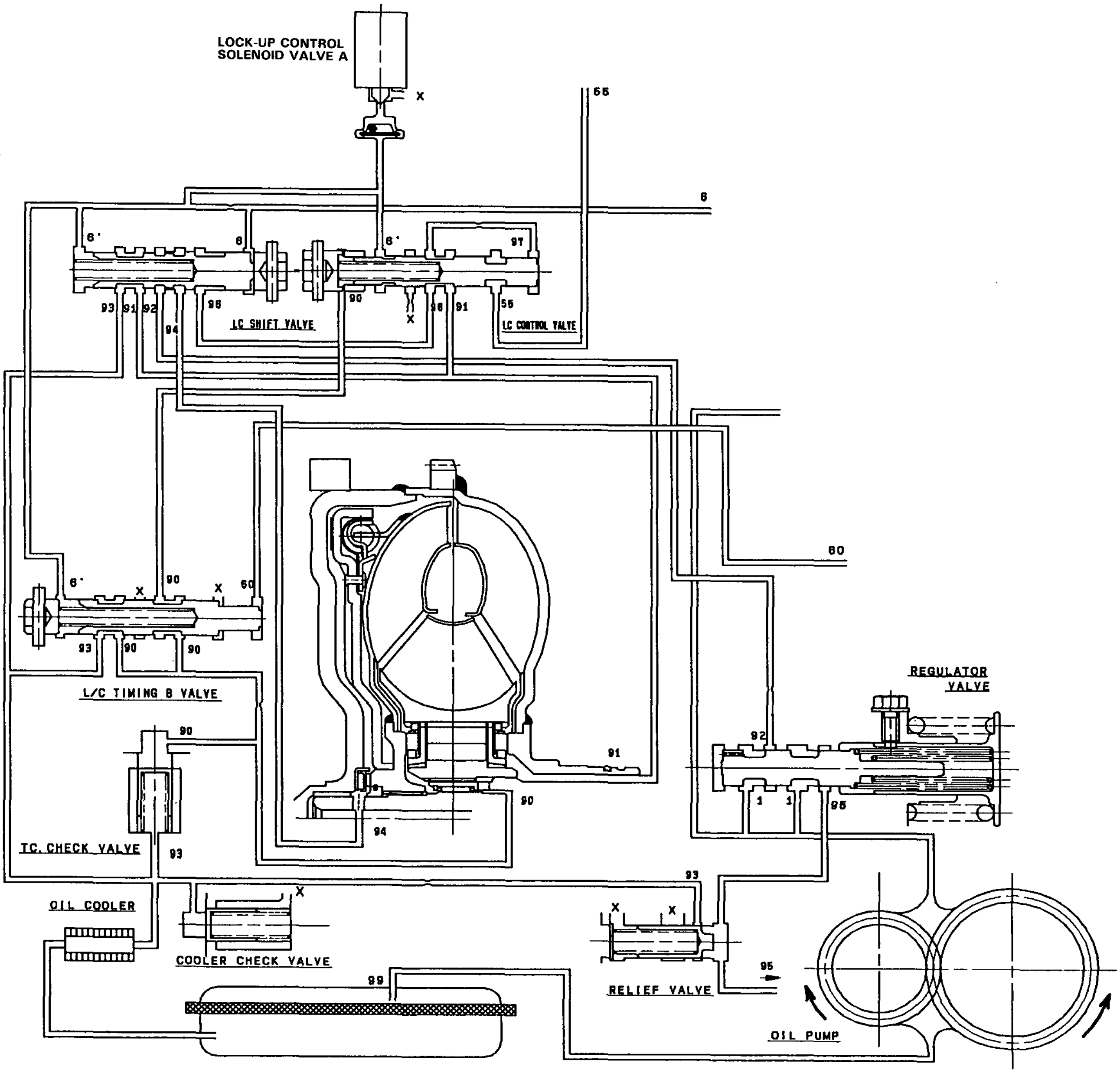
The flow of fluid through the torque converter is the same as in the [N] position. The line pressure (1) becomes the line pressure (3) as it passes the manual valve. The line pressure (3) flows through the reverse control valve to the servo valve, causing the reverse shift fork to be moved to the reverse position as in the [R] position.
However, the hydraulic pressure is not supplied to the clutches. The power is not transmitted.



Lock-up System D15B2

In [D4] or [D3] in 2nd, 3rd and 4th, pressurized fluid is drained from the back of the torque converter through an oil passage, causing the lock-up piston to be held against the torque converter cover. As this takes place, the mainshaft rotates at the same speed as the engine crankshaft. Together with hydraulic control, the ECU optimizes the timing of the lock-up system. Under certain conditions, the lock-up operation is applied during deceleration, in 2nd, 3rd and 4th speed.

The lock-up shift valve controls the range of lock-up according to vehicle speed and lock-up control solenoid valve A. When lock-up control solenoid valve A activate, modulator pressure changes. Lock-up control solenoid valve A is mounted on the torque converter housing and is controlled by the ECU.



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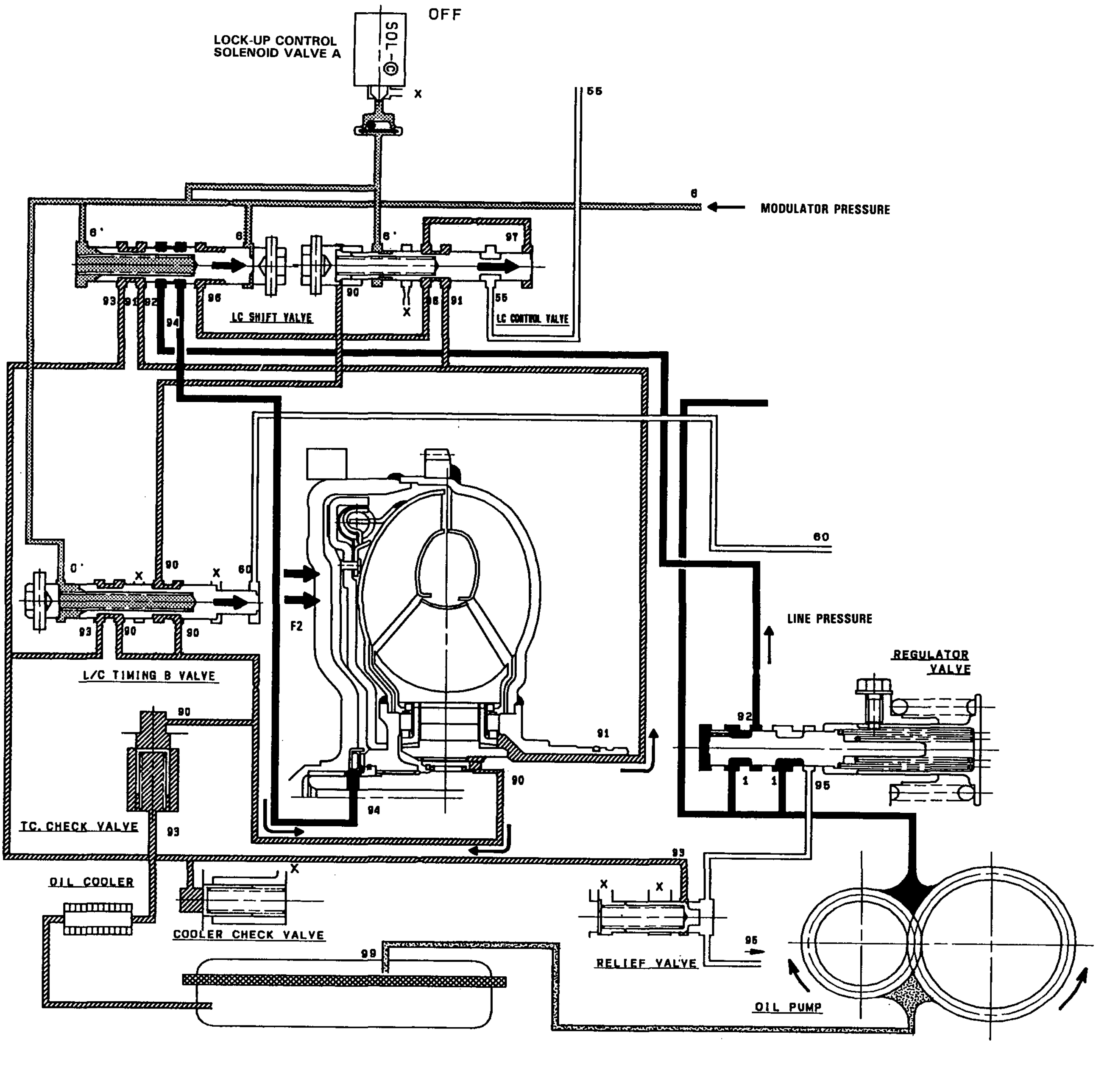
Lock-up System D15B2 (cont'd)

No Lock-up
Pressured fluid regulated by the modulator works on both ends of the lock-up shift valve and on the left side of the lock-up control valve. Under this condition, the pressure on both ends of the lock-up shift valve are equal, and the lock-up shift valve is moved to the right side by the tension of the valve spring alone. The fluid from the oil pump will flow through the left side of the lock-up clutch to the torque converter; i.e., the lock-up clutch is in OFF condition.

NOTE: When used, "left" or "right" indicates direction on the flowchart.



Lock-up Control Mode

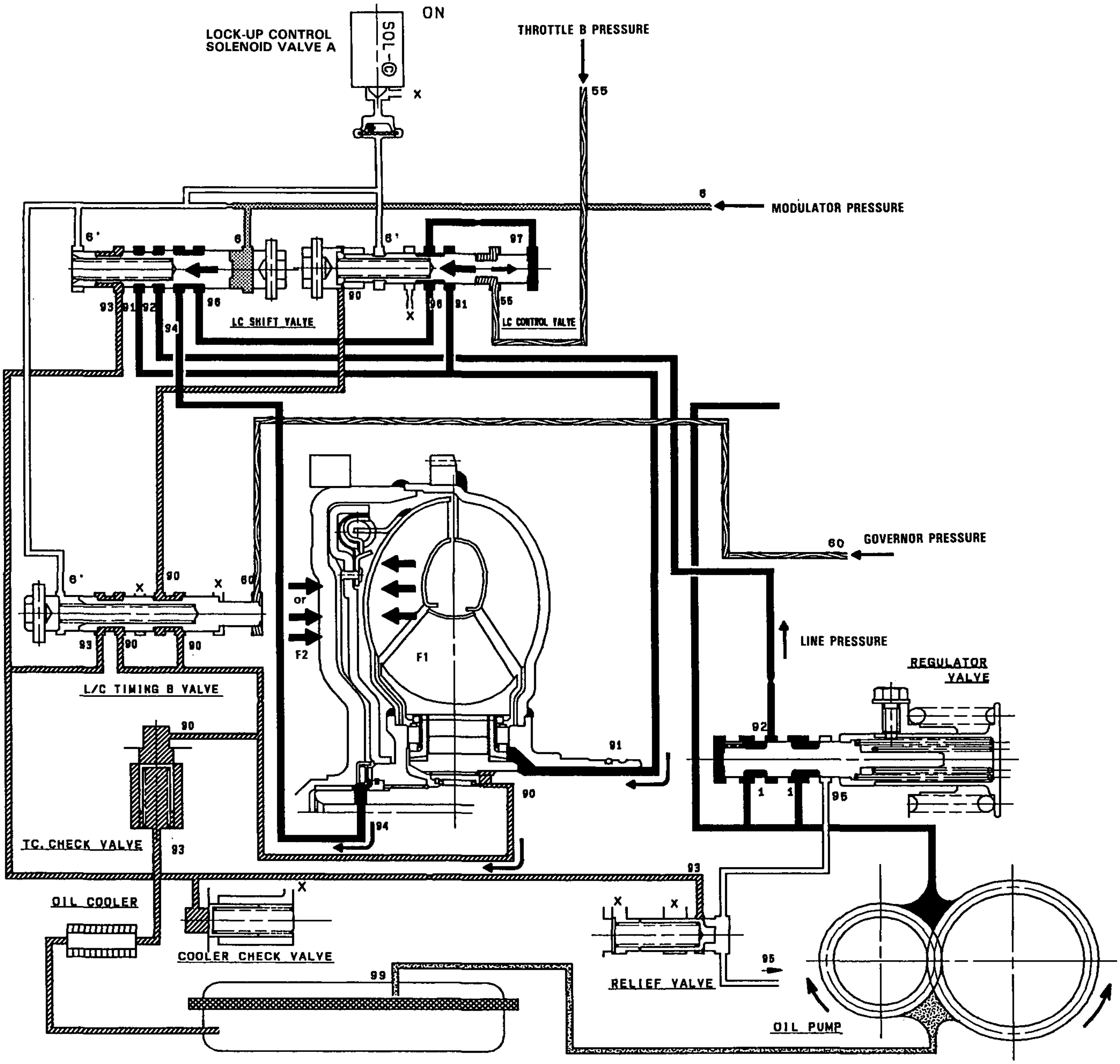
Lock-up Control Solenoid Valve A: ON

The modulator pressure is released by the solenoid valve A, causing the modulator pressure in the left cavity of the lock-up control valve to lower.

Also, the modulator pressure in the left cavity of the lock-up timing valve is low. However, the governor pressure is still low at this time, consequently the lock-up timing valve is kept on the right side by the spring force.

As the modulator pressure released, the lock-up control valve is moved somewhat to the left side, causing the back pressure (F2) to lower. This allows a greater amount of the fluid (F1) to work on the lock-up clutch so as to engage the clutch. The back pressure (F2) which still exists prevents the clutch from engaging fully.

NOTE: When used, ''left'' or ''right'' indicates direction on the flowchart.



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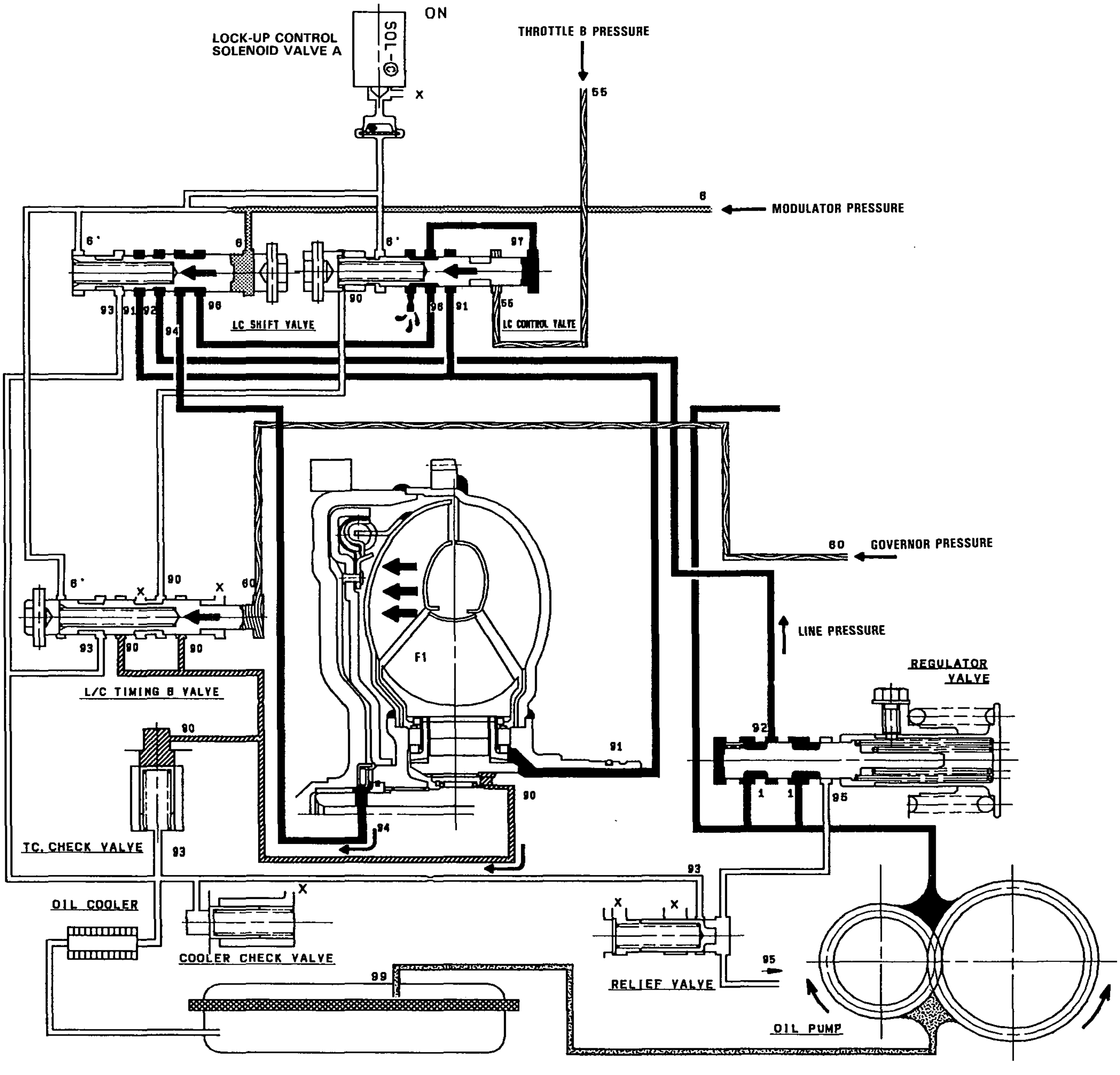
Lock-up System D15B2 (cont'd)

Full Lock-up

Lock-up Control Solenoid Valve A: ON

When the vehicle speed further increases, the governor pressure is increased. The lock-up timing valve overcomes the spring force and moves to the left side. Also this valve closes the oil port leading to the torque converter check valve. Under this condition, the throttle B pressure working on the right side of the lock-up control valve becomes greater than that on the left end (modulator pressure in the left end has already been released by the solenoid valve A); i. e., the lock-up control valve is moved to the left side. As this happens, the torque converter back pressure is released fully, causing the lock-up clutch to be engaged fully.

NOTE: When used, "left" or "right" indicates direction on the flowchart.



Lock-up Control System D16Z6/D16A8/D16A7

Lock-up control

From sensor input signals, the ECU detects whether to turn the lock-up ON or OFF and activates lock-up control solenoid valve A and/or B accordingly.
The combination of driving signals to lock-up control solenoid valves A and B is shown in the table below.

Solenoid valve / Lock-up condition	A	B
Lock-up OFF	OFF	OFF
Lock-up, slight	ON	Duty operation OFF ⟷ ON
Lock-up, half	ON	ON
Lock-up, full	ON	ON
Lock-up during deceleration	ON	Duty operation OFF ⟷ ON

Description

Hydraulic Flow D16Z6/D16A8/D16A7

General Chart of Hydraulic Pressure

Oil Pump → Regulator Valve → Line Pressure / Torque Converter Pressure / Lubrication Pressure

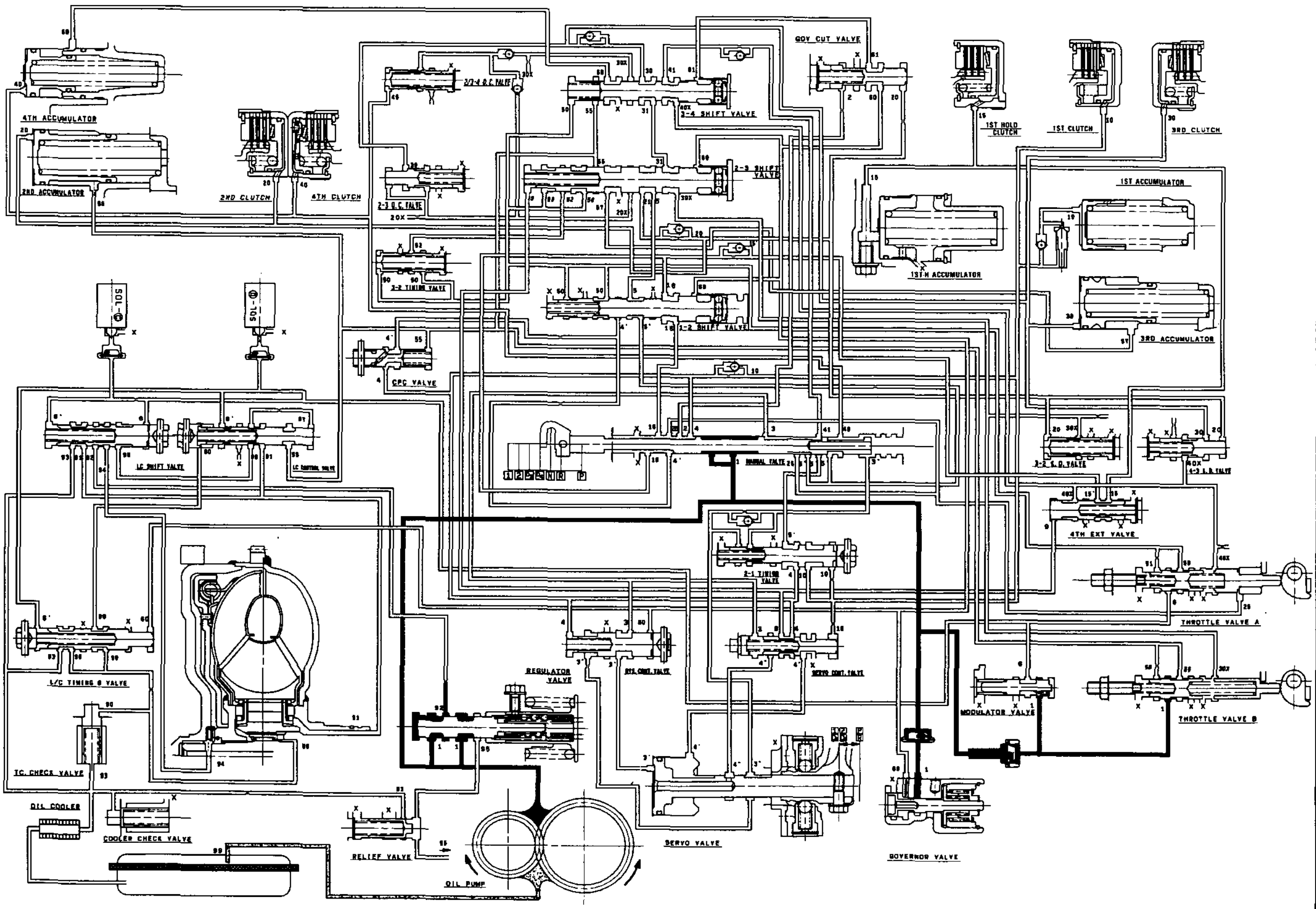
Distribution of Hydraulic Pressure

- Regulator Valve → Line Pressure / Torque Converter Pressure / Lubrication Pressure
- Manual Valve → To Select Line Pressure
- Modulator Valve → Modulator Pressure
- 1-2 Shift Valve
- 2-3 Shift Vavle → Clutch Pressure
- 3-4 Shift Valve
- Throttle Valve A → Throttle A Pressure
- Throttle Valve B → Throttle B Pressure
- Governor Valve → Governor Pressure

NO.	DESCRIPTION OF PRESSURE	NO.	DESCRIPTION OF PRESSURE	NO.	DESCRIPTION OF PRESSURE
1	LINE	16	1ST-HOLD CLUTCH	57	THROTTLE B
2	LINE	18	LINE	58	THROTTLE B
3	LINE	20	2ND CLUTCH	60	GOVERNOR
3′	LINE	21	2ND CLUTCH	61	GOVERNOR
3″	LINE	25	LINE	90	TORQUE CONVERTER
4	LINE	30	3RD CLUTCH	91	TORQUE CONVERTER
4′	LINE	31	3RD CLUTCH	92	TORQUE CONVERTER
5	LINE	40	4TH CLUTCH	93	OIL COOLER
5′	LINE	41	4TH CLUTCH	94	TORQUE CONVERTER
5″	LINE	50	THROTTLE A	95	LUBRICATION
6	MODULATOR	51	THROTTLE A	96	TORQUE CONVERTER
6′	MODULATOR	52	THROTTLE A	97	TORQUE CONVERTER
10	1ST CLUTCH	55	THROTTLE B	99	SUCTION
15	1ST-HOLD CLUTCH	56	THROTTLE B	X	BLEED

[N] Position

As the engine turns, the oil pump also starts to operate. Automatic transmission fluid is drawn from (99) and discharged into (1). Then, ATF pressure is controlled by the regulator valve and becomes line pressure (1). The torque converter inlet pressure (92) enters (94) of torque converter through the orifice and discharges into (90).
The torque converter check valve prevents the torque converter pressure from falling.
Under this condition, the hydraulic pressure is not applied to the clutches.



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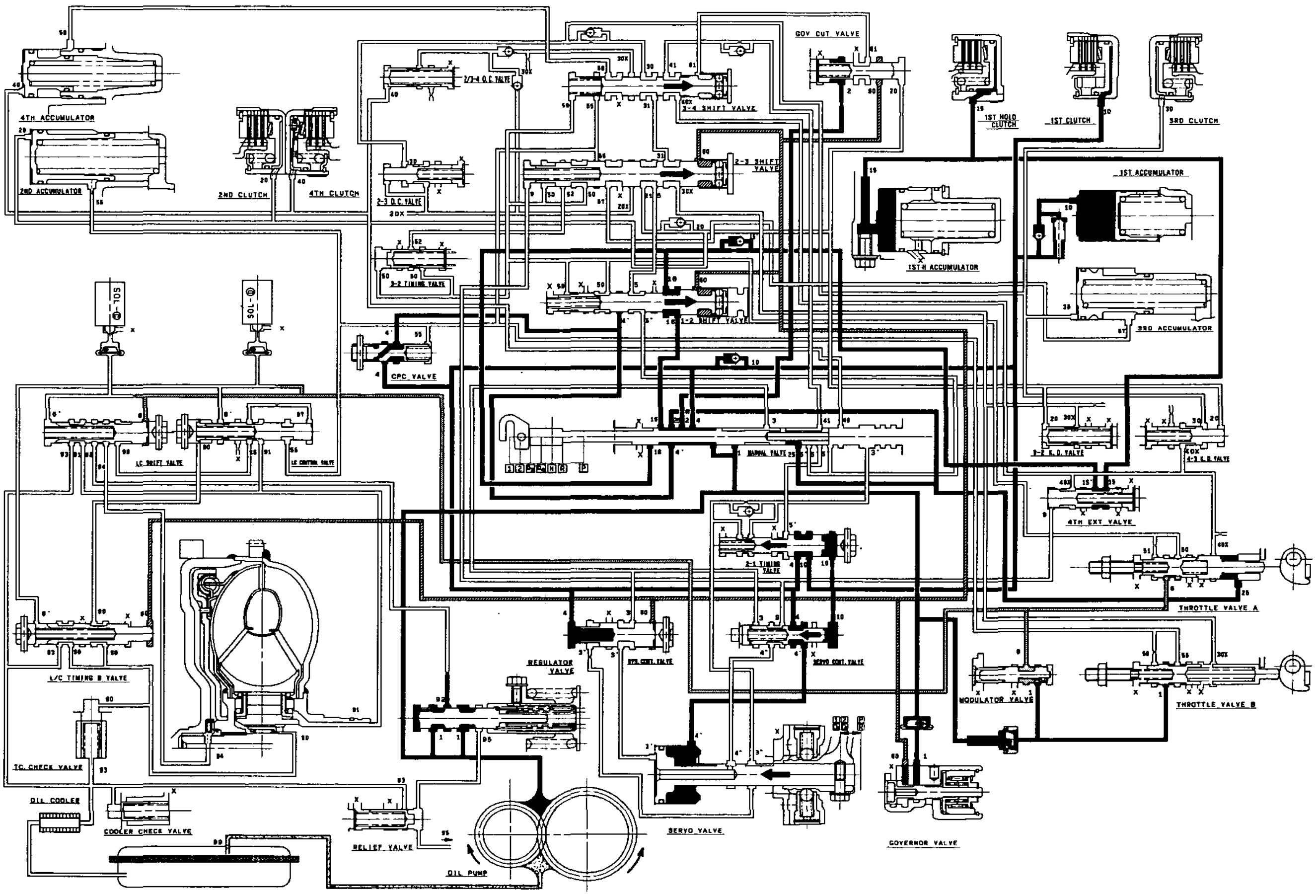
Hydraulic Flow D16Z6/D16A8/D16A7 (cont'd)

[1] Position

The line pressure (1) becomes the line pressure (4) and 1st-hold clutch pressure (16) as it passes through the manual valve. Also, the line pressure (1) goes to the governor valve and becomes the governor pressure (60). The governor pressure (60) is supplied to the 1-2 and 2-3 shift valves. The shift valves remain on the right side because the governor pressure is lower than the valve spring tention and the throttle A pressure supplied to the left side of the shift valves.
The line pressure (4) becomes the 1st clutch pressure (10) via the orifice, then goes to the 1st clutch. The 1st clutch pressure (10) is also supplied to the servo control valve and 2-1 timing valve to move them to the left side.
The 1st-hold clutch pressure (16) goes to the 1st-hold clutch via the 1-2 shift valve, orifice and 4th exhaust valve.
In the [1] position, the 1st clutch and 1st-hold clutch are engaged.
The line pressure (4) also goes to the servo valve via the servo control valve, and holds on the servo valve in the driving range.

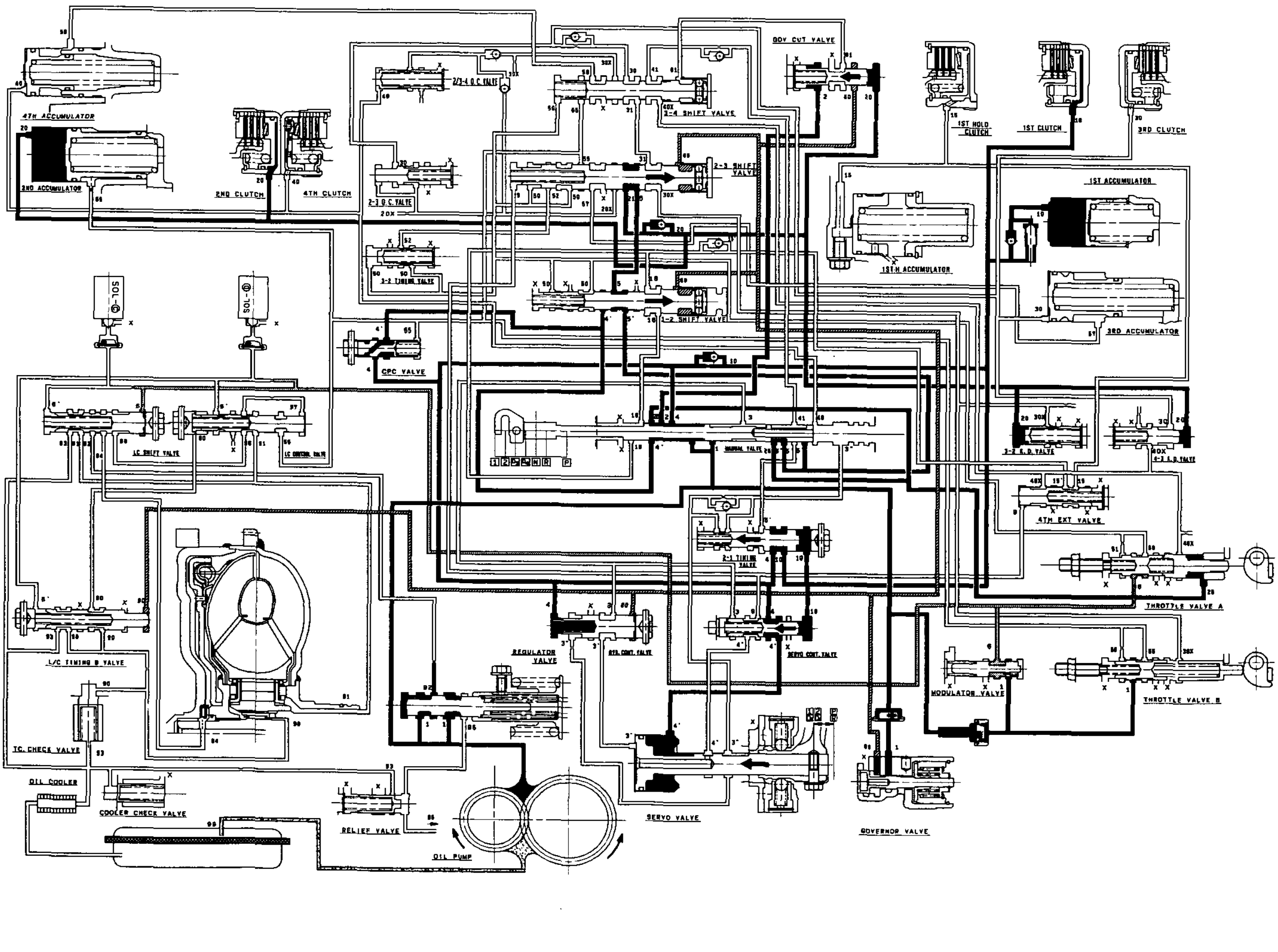
NOTE:
- When used, "left" and "right" indicates direction on the flowchart.
- SOL-Ⓒ: Lock-up Control Solenoid Valve A
- SOL-Ⓓ: Lock-up Control Solenoid Valve B



[2] Position

The line pressure (1) becomes the line pressure (2), (4), (4'), (25) as it passes through the manual valve. Also, the line pressure (1) goes to the governor valve and becomes the governor pressure (60). The governor pressure (60) is supplied to the 1-2 and 2-3 shift valves, but the 1-2 and 2-3 shift valves remain on the right side.
The line pressure (25) goes to the 2-3 shift valve via the 1-2 shift valve and becomes the 2nd clutch pressure (21). The 2nd clutch pressure (21) becomes the 2nd clutch pressure (20) as it passes through the orifice, then goes to the 2nd clutch.
The line pressure (4) becomes the 1st clutch pressure (10) and flows to the 1st clutch, servo control valve and 2-1 timing valve. The line pressure (4') also holds on the servo valve in the driving range as in the [1] Position.
In the [2] position, the 1st clutch and 2nd clutch are engaged.

NOTE:
- When used, "left" and "right" indicates direction on the flowchart.
- SOL-©: Lock-up Control Solenoid Valve A
- SOL-Ⓓ: Lock-up Control Solenoid Valve B



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Description

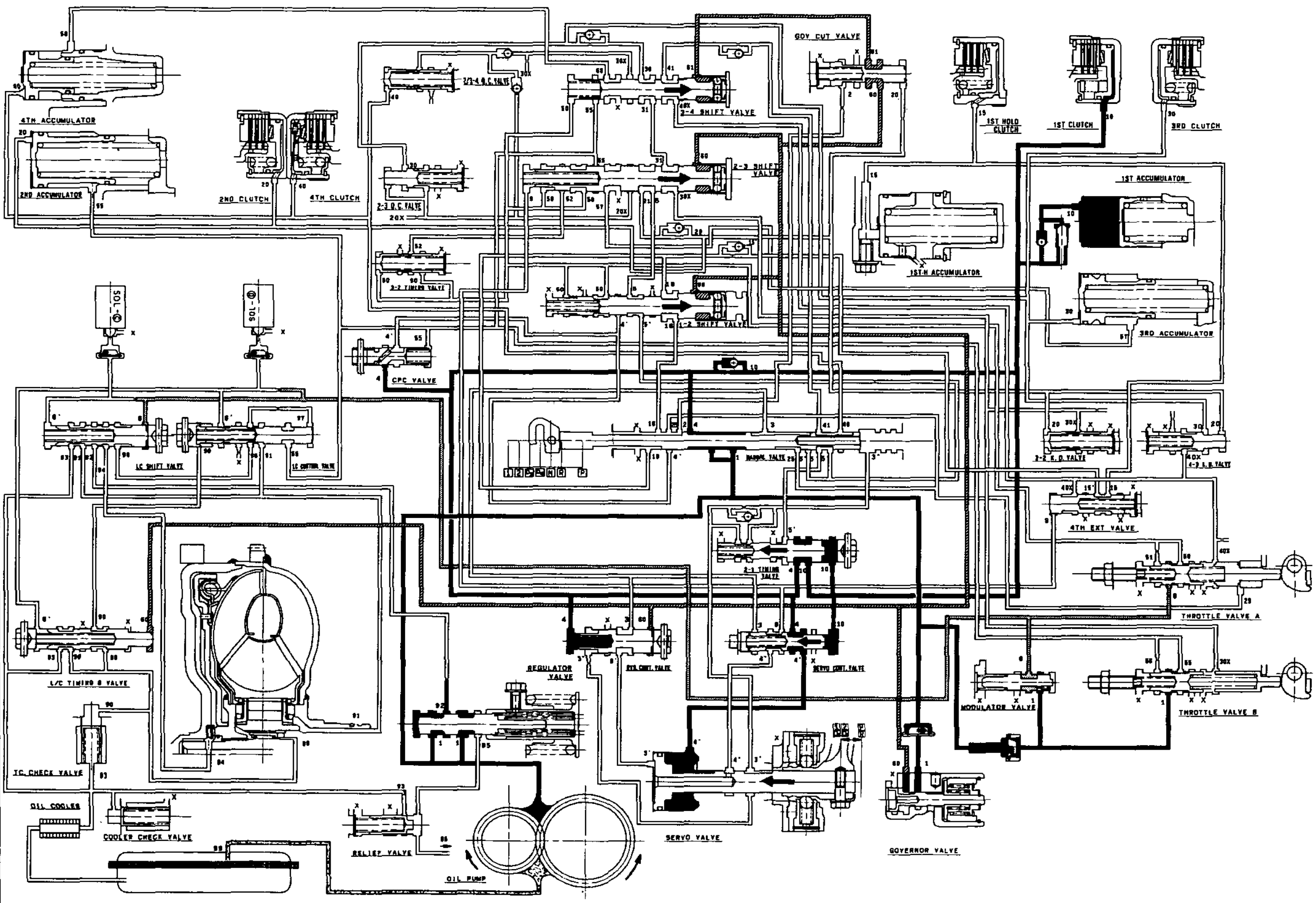
Hydraulic Flow D16Z6/D16A8/D16A7 (cont'd)

[D4] or [D3] Position

1. 1st speed
   The flow of fluid through the torque converter is the same as in the [N] position. The line pressure (1) becomes the line pressure (4).The line pressure (4) becomes the 1st clutch pressure (10) as it passes through the orifice. The 1st clutch pressure (10) is supplied to the 1st clutch and, consequently the vehicle will move as the engine power is transmitted.
   The line pressure (1) becomes the governor pressure (60) by the governor valve and travels to each shift valve. But, all shift valves remain on the right side because the governor pressure (60) is lower than the shift valve spring tension and the throttle A pressure.
   The line pressure (1) also flows to the modulator valve and throttle valve B.

In the [D4] or [D3] position, the line pressure (4') flows to the servo valve and holds it on in the driving range as in the [1] and [2] position

NOTE:
- When used, "left" or "right" indicates direction on the flowchart.
- SOL-Ⓒ: Lock-up Control Solenoid Valve A
- SOL-Ⓓ: Lock-up Control Solenoid Valve B



2. 2nd speed

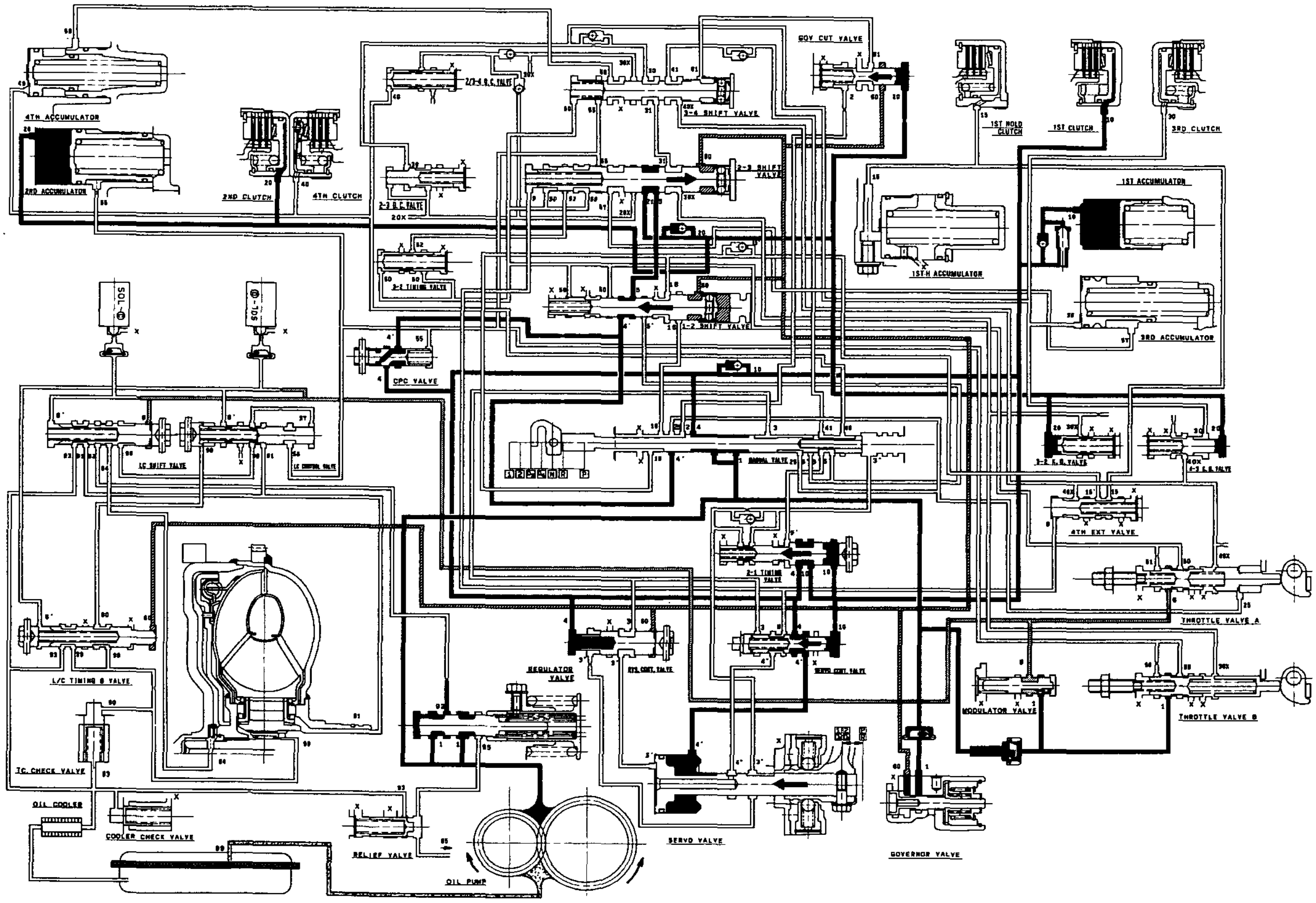
The flow of fluid up to the 1-2 and 2-3 shift valves is the same as the 1st speed range. As the speed of the car reaches the prescribed value, the 1-2 shift valve is moved to the left side by the governor pressure (60) and uncovers the oil port leading to the 2nd clutch; the 2nd clutch is engaged.

Fluid flows by way of:

Line Pressure (4) → CPC Valve-Line Pressure (4') → 1-2 Shift Valve-Line Pressure (5) → 2-3 Shift Valve-2nd Clutch Pressure (21) → Orifice-2nd Clutch Pressure (20) → 2nd Clutch.

The 2nd clutch pressure (20) is also supplied to the governor cut valve. The governor cut valve is moved to the left side to cover the oil port of the governor pressure (60) to the 3-4 shift valve. The hydraulic pressure also flows to the 1st clutch. However, no power is transmitted by means of the one-way clutch.

NOTE:
- When used, "left" or "right" indicates direction on the flowchart.
- SOL-Ⓒ: Lock-up Control Solenoid Valve A
- SOL-Ⓓ: Lock-up Control Solenoid Valve B



(cont'd)

Hydraulic Flow D16Z6/D16A8/D16A7 (cont'd)

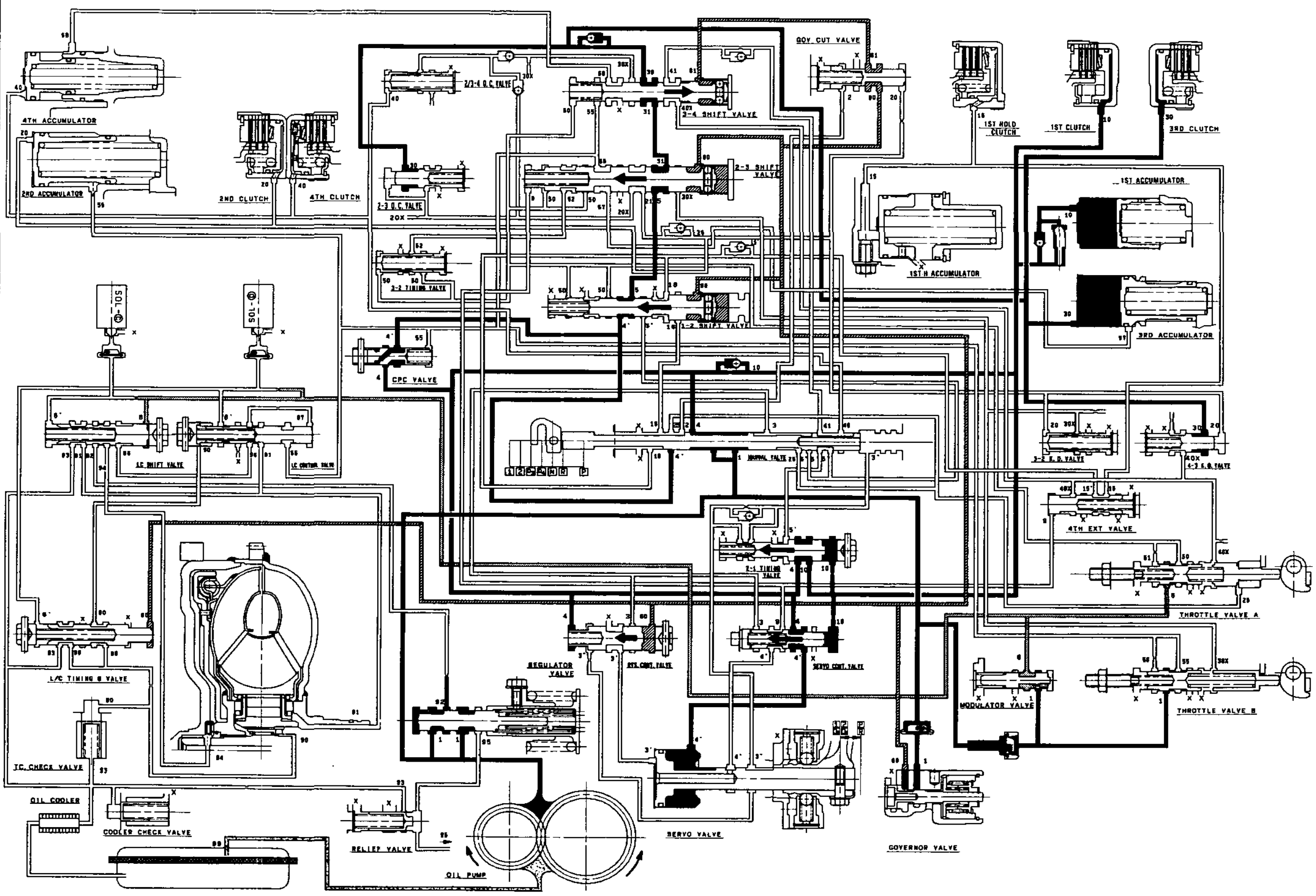
3. 3rd speed

The flow of fluid up to the 1-2, 2-3 and 3-4 shift valves is the same as the 2nd speed range. As the speed of the car reaches the prescribed value, the 2-3 shift valve is moved to the left side by the governor pressure (60) and uncovers the oil port leading to the 3rd clutch. Since the 1-2 shift valve is kept on the left side, and the 3-4 shift valve is on the right side to uncover the oil port leading to the 3rd clutch, the 3rd clutch is engaged.
Fluid flows by way of:

Line Pressure (4) → CPC Valve-Line Pressure (4') → 1-2 Shift Valve-Line Pressure (5) → 2-3 Shift Valve-3rd Clutch Pressure (31) → 3-4 Shift Valve-3rd Clutch Pressure (30) → Orifice → 3rd Clutch.

The hydraulic pressure also flows to the 1st clutch. However, no power is transmitted by means of the one-way clutch as in the 2nd speed.

NOTE:
- When used, "left" and "right" indicates direction on the flowchart.
- SOL-Ⓒ: Lock-up Control Solenoid Valve A
- SOL-Ⓓ: Lock-up Control Solenoid Valve B



4. 4th speed

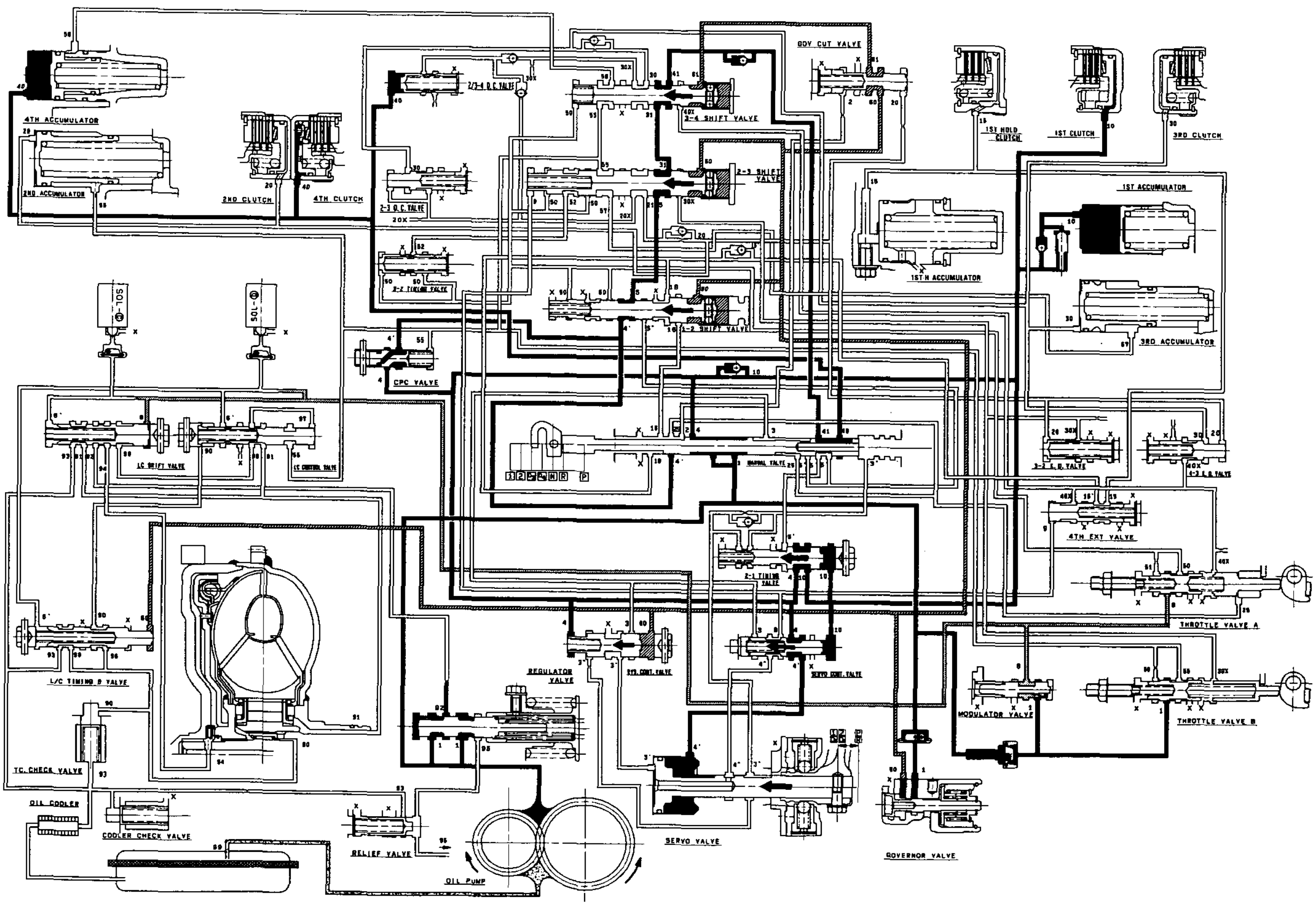
The flow of fluid up to the 1-2, 2-3 and 3-4 shift valves is the same as the 3rd speed range. As the speed of the car reaches the prescribed value, the 3-4 shift valve is moved to the left side by the governor pressure (60) and uncovers the oil port leading to the 4th clutch. Since the 1-2 and 2-3 shift valves are kept on the left side, the fluid flows through to the 4th clutch; the power is transmitted through the 4th clutch.
Fluid flows by way of:

Line Pressure (4) → CPC Valve-Line Pressure (4') → 1-2 Shift Valve-Line Pressure (5) → 2-3 Shift Valve-3rd Clutch Pressure (31) → 3-4 Shift Valve-4th Clutch Pressure (41) → Orifice → Manual Valve-4th Clutch Pressure (40) → 4th Clutch.

The hydraulic pressure also flows to the 1st clutch. However, no power is transmitted by means of the one-way clutch as in the 3rd speed.

NOTE:

- When used, "left" or "right" indicates direction on the flowchart.
- SOL-Ⓒ: Lock-up Control Solenoid Valve A
- SOL-Ⓓ: Lock-up Control Solenoid Valve B



(cont'd)

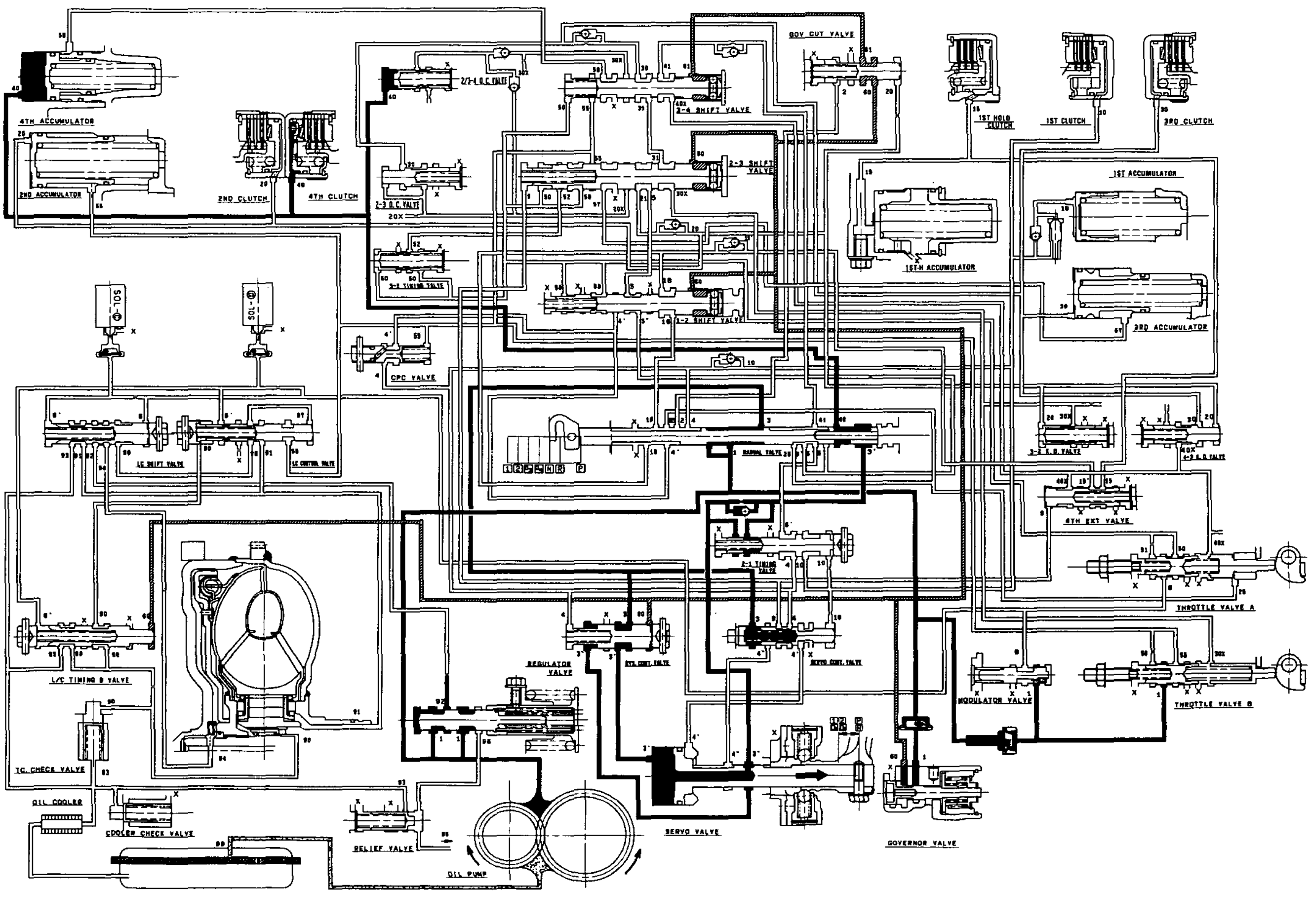
Description

Hydraulic Flow D16Z6/D16A8/D16A7 (cont'd)

[R] Position

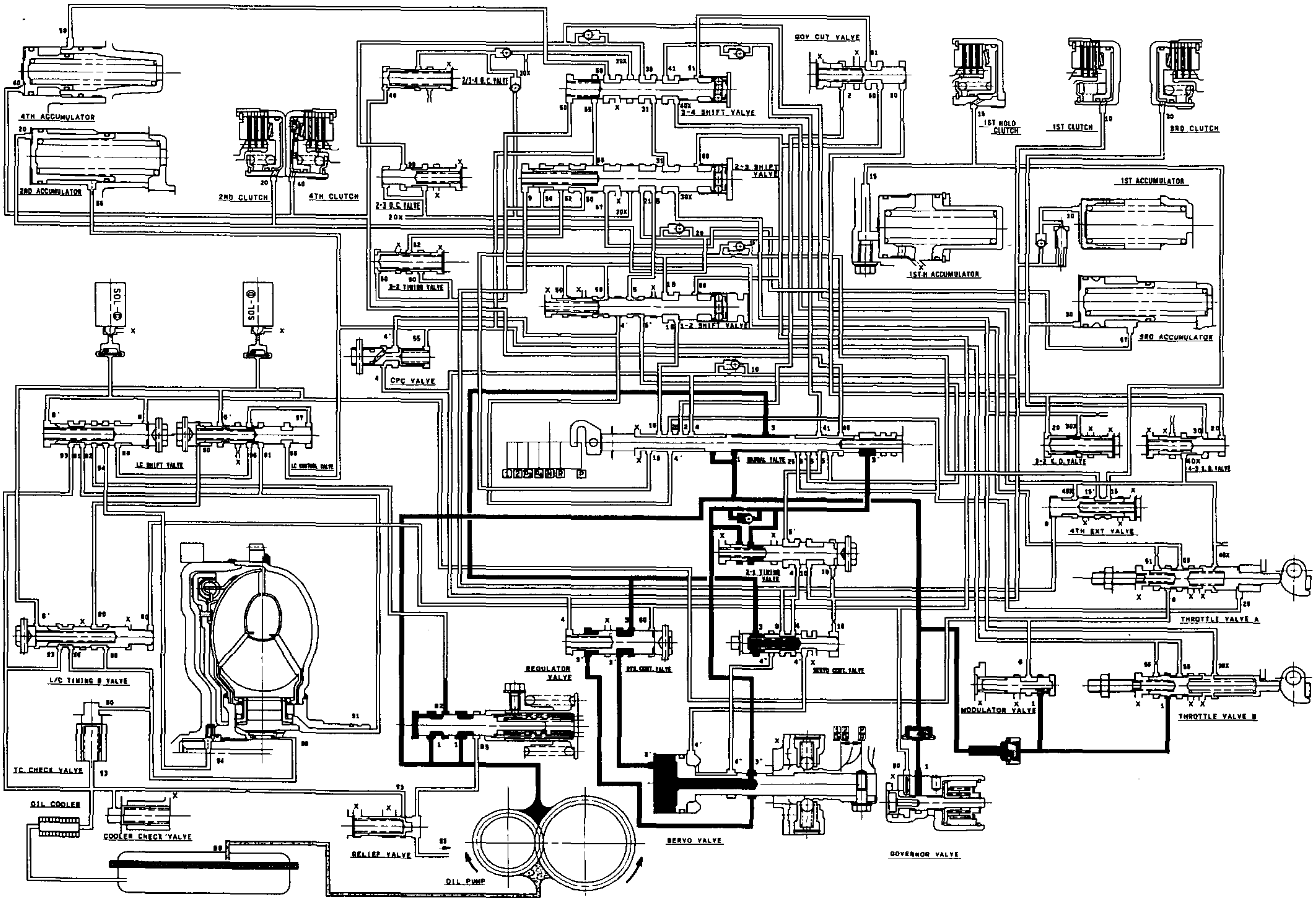
The flow of fluid through the torque converter circuit is the same as in the [N] position. The line pressure (1) becomes the line pressure (3) as it passes the manual valve. It then flows through the reverse control valve to the servo valve, causing the reverse shift fork shaft to be moved to the reverse position. The line pressure (3'') from the servo valve goes to the manual valve and becomes the 4th clutch pressure (40). Then it goes to the 4th clutch; the power is transmitted through the 4th clutch.
When the [R] position is selected while the vehicle is moving forward at more than a certain speed. The line pressure (3) is cut by the governor pressure (60) which activates the reverse control valve.
When shifting to [R] from [D4], [D3], [2] or [1] position, the servo control valve is moved to the left side by 1st clutch pressure (10). The servo control valve combines with the reverse shift fork shaft detent system to control movement of the servo valve.

NOTE:
- When used, "left" and "right" indicates direction on the flowchart.
- SOL-Ⓒ: Lock-up Control Solenoid Valve A
- SOL-Ⓓ: Lock-up Control Solenoid Valve B



[P] Position

The flow of fluid through the torque converter is the same as in the [N] position. The line pressure (1) becomes the line pressure (3) as it passes the manual valve. The line pressure (3) flows through the reverse control valve to the servo valve, causing the reverse shift fork to be moved to the reverse position as in the [R] position.
However, the hydraulic pressure is not supplied to the clutches. The power is not transmitted.

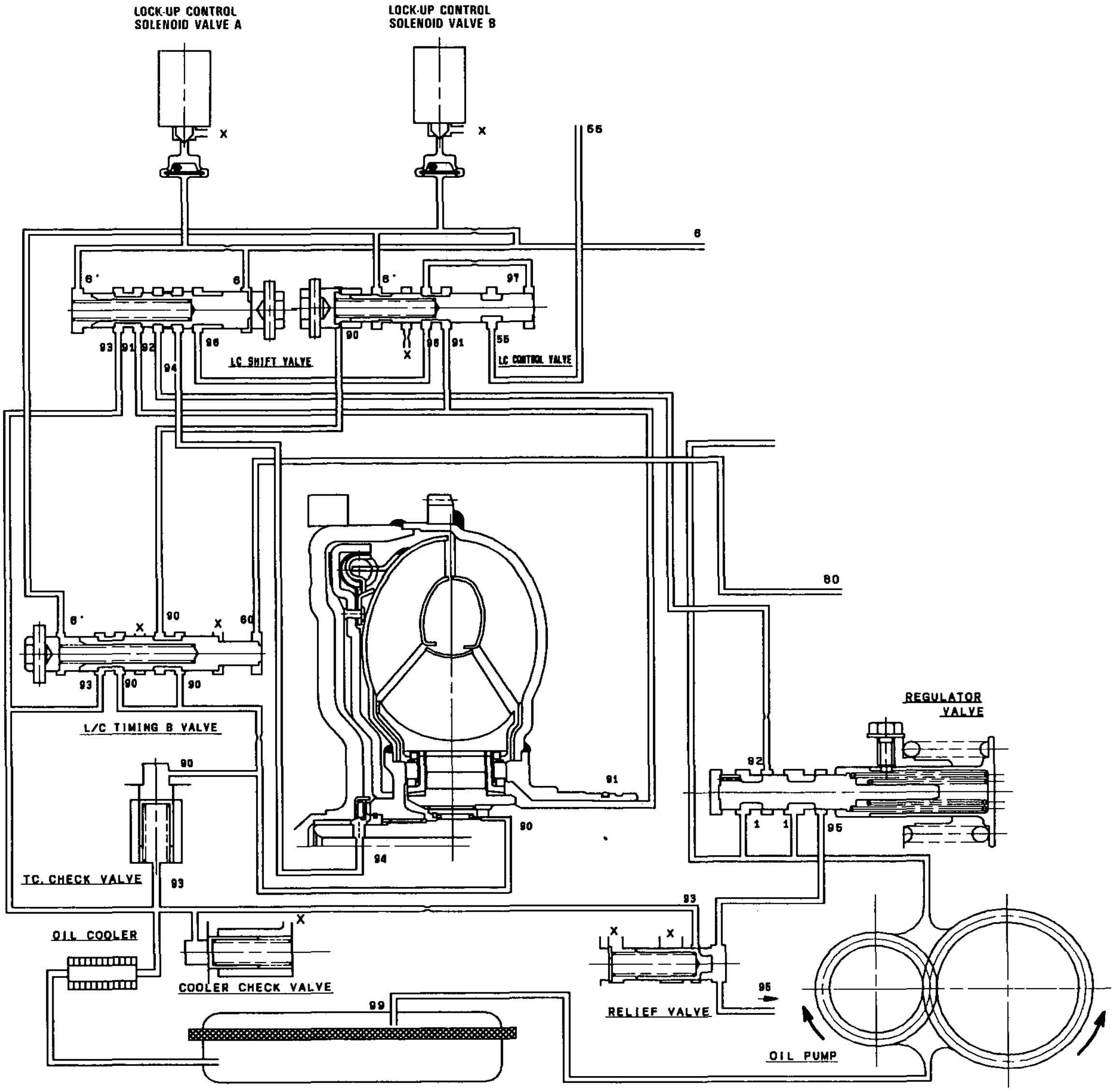


Description

Lock-up System D16Z6/D16A8/D16A7

In $\boxed{D_4}$ or $\boxed{D_3}$ in 2nd, 3rd and 4th, pressurized fluid is drained from the back of the torque converter through an oil passage, causing the lock-up piston to be held against the torque converter cover. As this takes place, the mainshaft rotates at the same speed as the engine crankshaft. Together with hydraulic control, the ECU optimizes the timing of the lock-up system. Under certain conditions, the lock-up operation is applied during deceleration, in 2nd, 3rd and 4th speed.

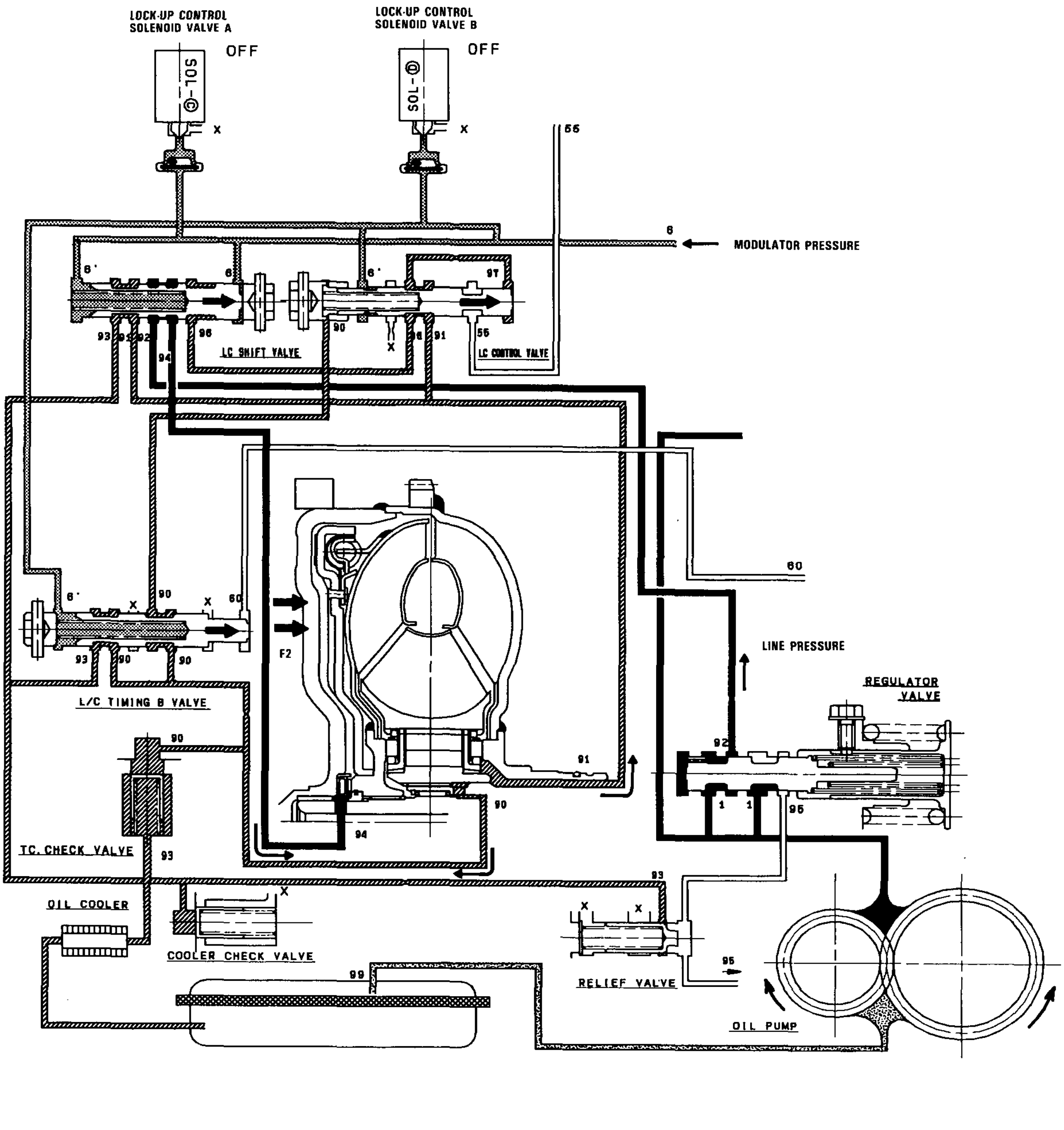
The lock-up shift valve controls the range of lock-up according to lock-up control solenoid valves A and B, and the throttle valve. When lock-up control solenoid valves A and B activate, modulator pressure changes. Lock-up control solenoid valves A and B are mounted on the torque converter housing and are controlled by the ECU.



No Lock-up

Pressured fluid regulated by the modulator works on both ends of the lock-up shift valve and on the left side of the lock-up control valve. Under this condition, the pressure on both ends of the lock-up shift valve are equal, and the lock-up shift valve is moved to the right side by the tension of the valve spring alone. The fluid from the oil pump will flow through the left side of the lock-up clutch to the torque converter; i.e., the lock-up clutch is OFF.

NOTE: When used, ''left'' or ''right'' indicates direction on the flowchart.



(cont'd)

Lock-up System D16Z6/D16A8/D16A7 (cont'd)

Partial Lock-up

Lock-up Control Solenoid Valve A: ON   Lock-up Control Solenoid Valve B: Duty operation (ON ↔ OFF)

The ECU switches the solenoid valve A to ON to release the modulator pressure in the left cavity of the lock-up shift valve. The modulator pressure in the right cavity of the lock-up shift valve overcomes the spring force, thus the lock-up shift valve is moved to the left side.

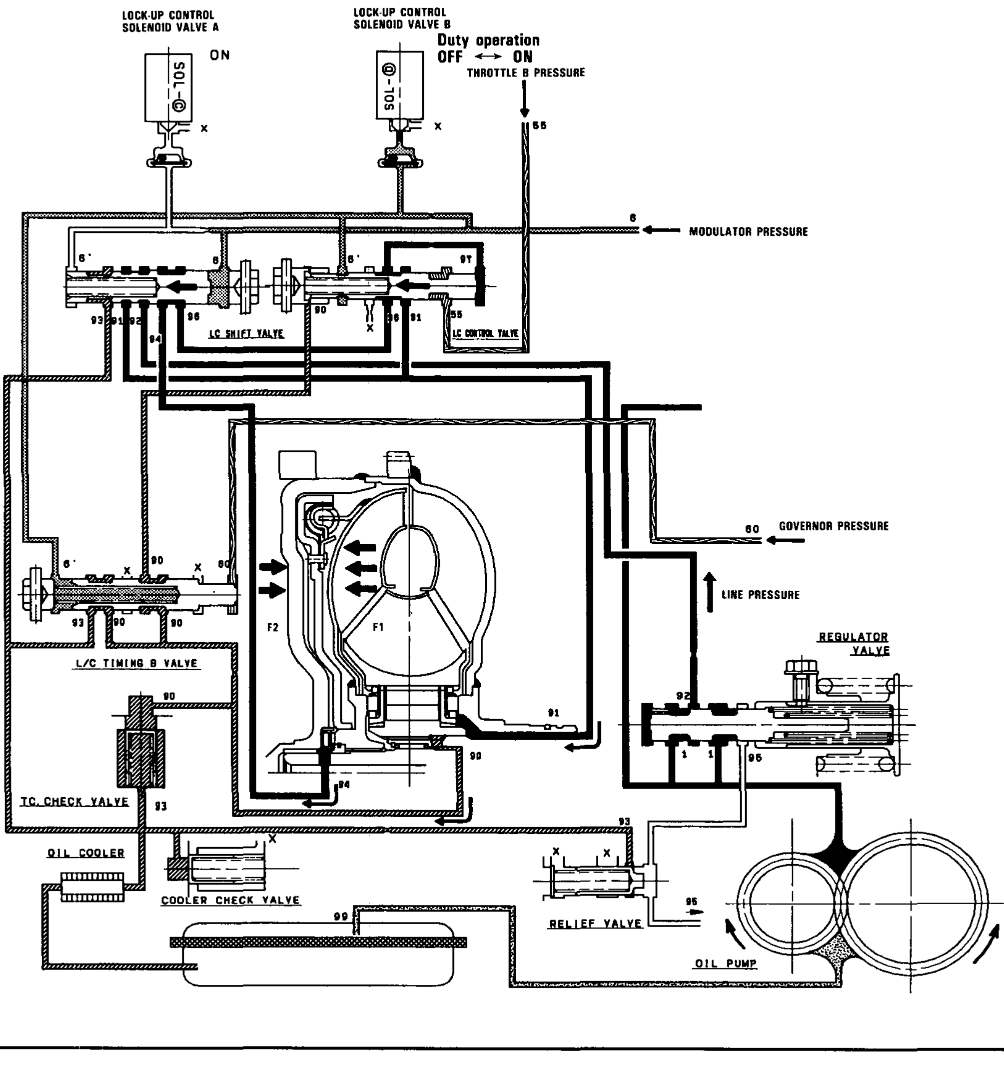
The torque converter pressure is separated into two passages:

Torque Converter Inner Pressure: entered into right side—to engage lock-up clutch

Torque Converter Back Pressure: entered into left side—to disengage lock-up clutch

The back pressure (F2) is regulated by the lock-up control valve, whereas the position of the lock-up timing valve is determined by the governor pressure, tension of the valve spring and pressure regulated by the modulator. Also the position of the lock-up control valve is determined by the throttle B pressure, torque converter back pressure and torque converter pressure regulated by the check valve. In low speed range, the throttle B pressure working on the right side of the lock-up control valve is low, causing the valve to be moved to the right side. With the lock-up control solenoid valve B to ON and OFF alternately, the modulator pressure is maintained in the left side of the lock-up control valve; in other words, the lock-up control valve is moved slightly to the left side. This slight movement of the lock-up control valve causes the back pressure (F2) to be lowered slightly, resulting in partial lock-up.

NOTE: When used, "left" or "right" indicates direction on the flowchart.



Half Lock-up

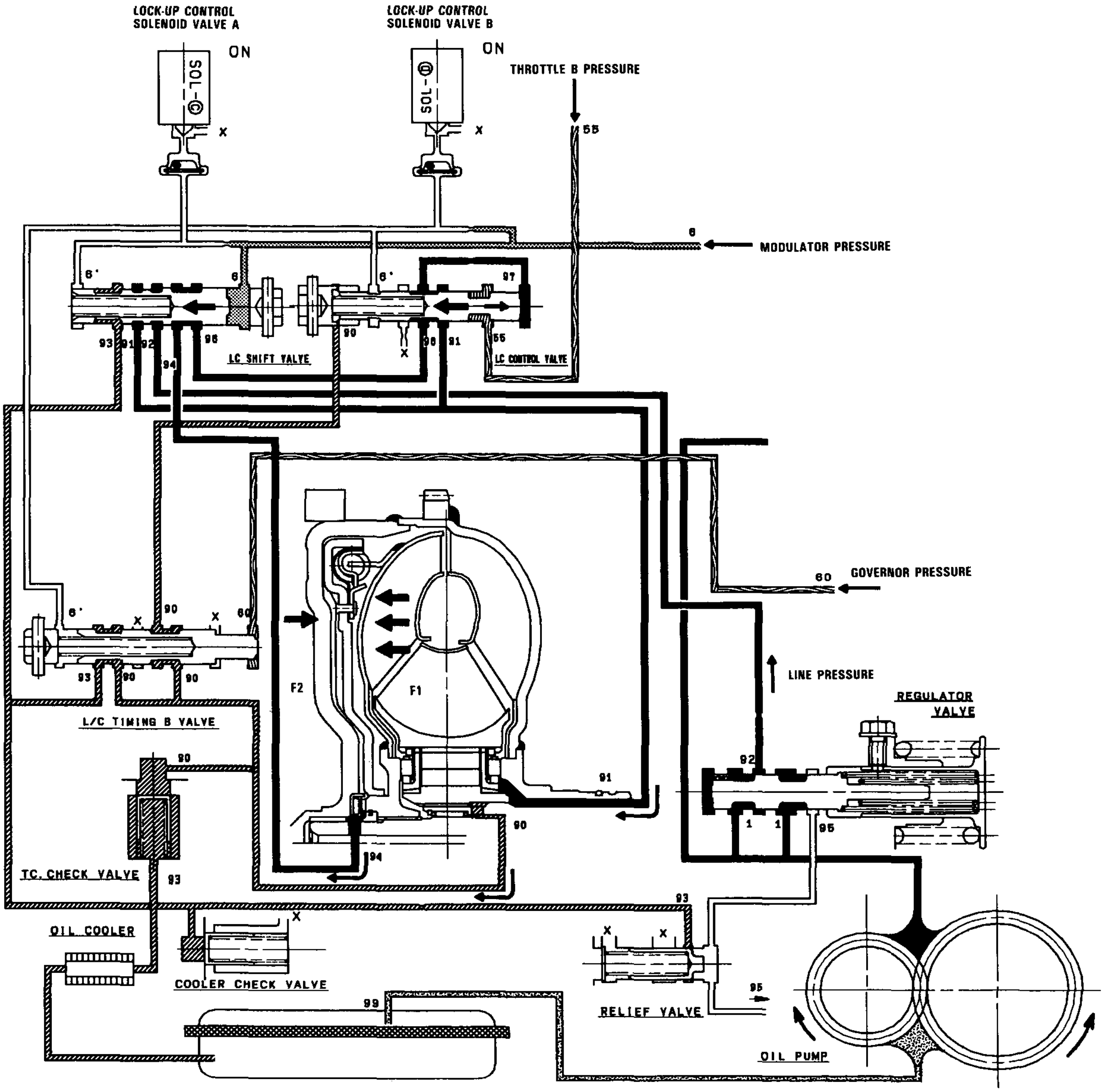
Lock-up Control Solenoid Valve A: ON   Lock-up Control Solenoid Valve B: ON

The modulator pressure is released by the solenoid valve B, causing the modulator pressure in the left cavity of the lock-up control valve to lower.

Also, the modulator pressure in the left cavity of the lock-up timing valve is low. However, the governor pressure is still low at this time, consequently the lock-up timing valve is kept on the right side by the spring force.

With the lock-up control solenoid valve B turned ON, the lock-up control valve is moved somewhat to the left side, causing the back pressure (F2) to lower. This allows a greater amount of the fluid (F1) to work on the lock-up clutch so as to engage the clutch. The back pressure (F2) which still exists prevents the clutch from engaging fully.

NOTE: When used, ''left'' or ''right'' indicates direction on the flowchart.



(cont'd)

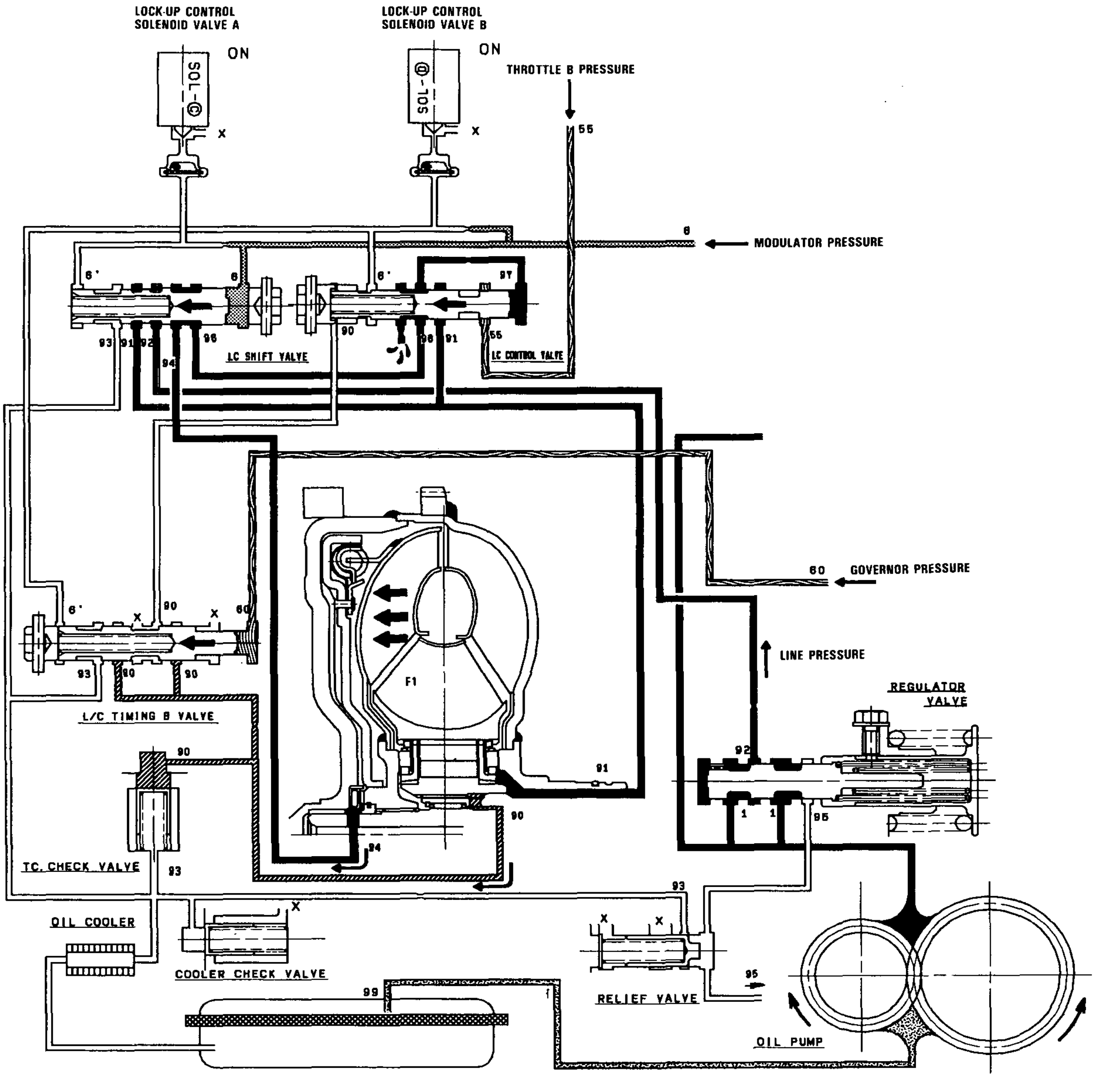
Lock-up System D16Z6/D16A8/D16A7 (cont'd)

Full Lock-up

Lock-up Control Solenoid Valve A: ON   Lock-up Control Solenoid Valve B: ON

When the vehicle speed further increases, the governor pressure is increased. The lock-up timing valve overcomes the spring force and moves to the left side. Also this valve closes the oil port leading to the torque converter check valve. Under this condition, the throttle B pressure working on the right side of the lock-up control valve becomes greater than that on the left end (modulator pressure in the left end has already been released by the solenoid valve B); i. e., the lock-up control valve is moved to the left side. As this happens, the torque converter back pressure is released fully, causing the lock-up clutch to be engaged fully.

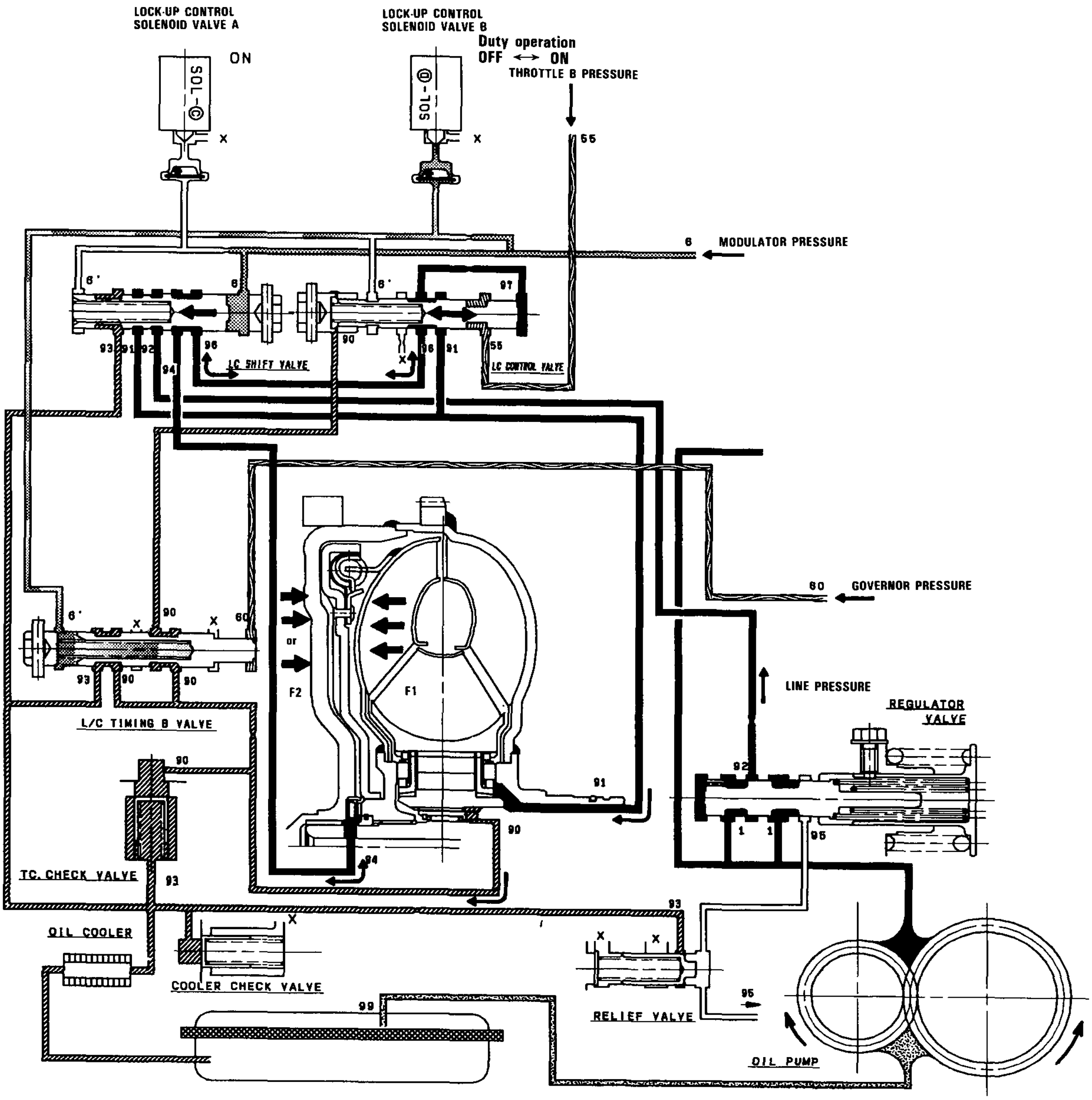
NOTE: When used, "left" or "right" indicates direction on the flowchart.



Deceleration Lock-up

Lock-up Control Solenoid Valve A: ON   Lock-up Control Solenoid Valve B: Duty Operation (ON ↔ OFF)
The ECU switches the solenoid valve B to ON and OFF alternately at high speeds under certain conditions. The slight lock-up and half lock-up regions are maintained so as to lock the torque converter properly.

NOTE: When used, "left" or "right" indicates direction on the flowchart.

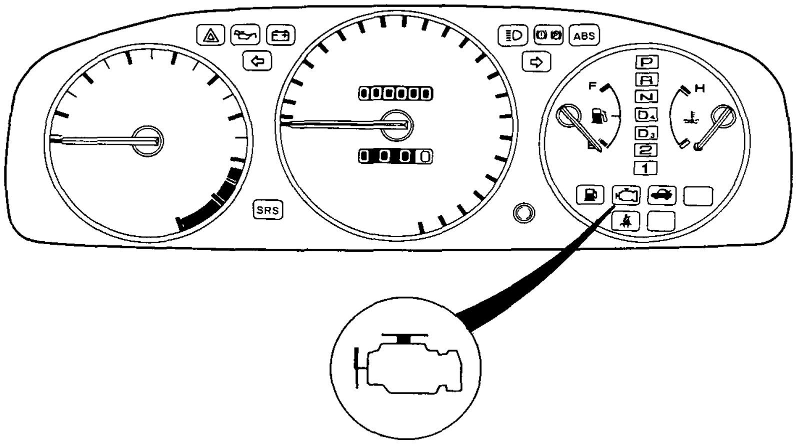


Troubleshooting

Electrical Troubleshooting

If the lock-up control system is suspected to be faulty, do the following:

1. If the Check Engine Light comes on, check and inspect PGM-FI system according to PGM-FI Troubleshooting (See Section 11).



CHECK ENGINE LIGHT

2. If the Check Engine Light does not come on or it blinks other than nineteen times, check and inspect according to the Symptom-to-Component Chart (see page 14-190 thru 193).

3. Check the lock-up control solenoid valve (see page 14-189).

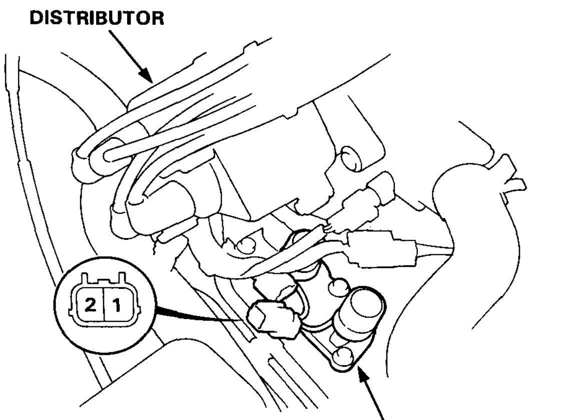
Lock-up Control Solenoid Valve A/B

Test

NOTE:
- Lock-up control solenoid valve must be removed/replaced as an assembly.
- D16Z6, D16A8 and D16A7 are shown; D15B2 is similar.
- Only the D15B2 engine uses the lock-up control solenoid valve A.

1. Disconnect the connector from the lock-up control solenoid valve A/B.
2. Measure the resistance between the No. 1 terminal (SOL. V A) of the lock-up control solenoid valve connector and body ground and between the No. 2 terminal (SOL. V B) and body ground.

STANDARD:
D16Z6/D16A8/D16A7: 14.1 – 15.5 Ω (at 25°C)
D15B2: 14.25 – 15.75 Ω (at 25°C)



View from terminal side.

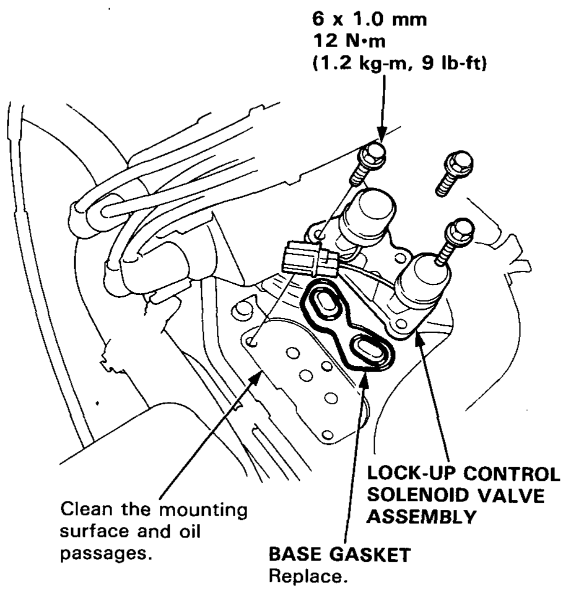
3. Replace the lock-up control solenoid valve assembly if the resistance is out of specification.
4. Connect the No. 1 terminal of the lock-up control solenoid valve connector to the battery positive terminal and body ground. A clicking sound should be heard. Connect the No. 2 terminal to the battery positive terminal and body ground.
A clicking sound should be heard.
5. If not, check for continuity between the ECU A19 or A17 harness and body ground.
(See Section 11)
6. Replace the lock-up control solenoid valve assembly if there is continuity between the ECU A19 or A17 harness and body ground.
(See Section 11).

Replacement

1. Remove the mounting bolts and lock-up control solenoid valve assembly.

   NOTE: Be sure to remove or replace the lock-up control solenoid valve as an assembly.

2. Check the lock-up control solenoid valve oil passages for dust or dirt and replace as an assembly, if necessary.



3. Clean the mounting surface and oil passages of the lock-up control solenoid valve assembly and install a new base gasket.
4. Check the connector for rust, dirt or oil and reconnect it securely.

Hydraulic System

Symptom-to-Component Chart

SYMPTOM	Check these items on the PROBABLE CAUSE LIST	Check these items on the NOTES CHART
Engine runs, but car does not move in any gear.	1, 6, 7, 16	K, L, R, S
Car moves in [R] and [2], but not in [D3], [D4] or [1].	8, 29, 44, 48	C, M, O
Car moves in [D3], [D4], [1], [R], but not in [2].	9, 30, 49	C, L
Car moves in [D3], [D4], [2], [1], but not in [R].	1, 11, 22, 34, 38, 39, 40	C, L, Q
Car moves in [N].	1, 8, 9, 10, 11, 46, 47	C, D
Excessive idle vibration.	5, 17	B, K, L
Slips in all gears.	6, 7, 16	C, L, U
No engine braking in [1] position.	12	C, D, L
Slips in 1st gear.	8, 29, 44, 48	C, N, O, U
Slips in 2nd gear.	9, 20, 23, 30, 49	C, L, U
Slips in 3rd gear.	10, 21, 23, 31, 44	C, L, U
Slips in 4th gear.	11, 23, 32	C, L, U
Slips in reverse gear.	11, 32, 34	C
Flares on 1—2 upshift.	3, 15	E, L, V
Flares on 2—3 upshift.	3, 15, 24, 44	E, L, V
Flares on 3—4 upshift.	3, 15, 25, 44	E, L, V
No upshift, trans stays in low gear.	14, 19, 23	G, L
No downshift to low gear.	12, 19	G, L
Late upshift.	14	L, V
Erratic shifting.	2, 14, 26	V
Harsh shift (up and down shifting).	2, 4, 15, 23, 24, 27, 47	A, E, H, I, L, V
Harsh shift (1—2).	2, 9	C, D, V
Harsh shift (2—3).	2, 10, 23, 24	C, D, H, L, V
Harsh shift (3—4).	2, 11, 23, 25	C, D, I, L, V
Harsh kick-down shifts.	2, 23, 27, 28	L, V, Q
Harsh kick-down shift (2—1).	48	O
Harsh downshift at closed throttle.	15	E, T
Harsh shift when manually shifting to [1].	33	L
Axle(s) slips out of trans on turns.	43, 50	L, P, Q
Axle(s) stuck in trans.	43	L, Q
Ratcheting noise when shifting into [R].	6, 7, 38, 39, 40	K, L, Q
Loud popping noise when taking off in [R].	38, 39, 40	L, Q
Ratcheting noise when shifting from [R] to [P] or from [R] to [N].	38, 39, 40, 45	L, Q
Noise from trans in all selector lever positions.	6, 17	K, L, Q
Noise from trans only when wheels are rolling.	39, 42	L, Q
Gear whine, rpm related (pitch changes with shifts).	8, 13, 41	K, L, Q
Gear whine, speed related (pitch changes with speed).	38, 42	L, Q
Trans will not shift into 4th gear in [D4].	1, 21, 28, 32	L
Lock-up clutch does not lock up smoothly.	17, 36, 37	L
Lock-up clutch does not operate properly.	2, 3, 15, 18, 35, 36, 37	E, L, V
Transmission has multitude of problems shifting. At disassembly, large particles of metal are found on magnet.	43	L,Q

PROBABLE CAUSE	
1.	Shift cable broken/out of adjustment.
2.	Throttle cable too short.
3.	Throttle cable too long.
4.	Wrong type ATF.
5.	Idle rpm too low/high.
6.	Oil pump worn or binding.
7.	Regulator valve stuck.
8.	1st clutch defective.
9.	2nd clutch defective.
10.	3rd clutch defective.
11.	4th clutch defective.
12.	1st-hold clutch defective.
14.	Modulator valve stuck.
15.	Throttle B valve stuck.
16.	ATF strainer clogged.
17.	Torque convertor defective.
18.	Torque convertor check valve stuck.
19.	1—2 shift valve stuck.
20.	2—3 shift valve stuck.
21.	3—4 shift valve stuck.
22.	Servo control valve stuck.
23.	Clutch pressure control (CPC) valve stuck.
24.	2—3 orifice control valve stuck.
25.	2/3-4 orifice control valve stuck.
26.	3—2 kick-down valve stuck.
27.	4—3 kick-down valve stuck.
28.	4th exhaust valve stuck.
29.	1st accumulator defective.
30.	2nd accumulator defective.
31.	3rd accumulator defective.
32.	4th/reverse accumulator defective.
33.	1st-hold accumulator defective.
34.	Servo valve stuck.
35.	Lock-up timing valve stuck.
36.	Lock-up shift valve stuck.
37.	Lock-up control valve stuck.
38.	Shift fork bent.
39.	Reverse gears worn/damaged (3 gears).
40.	Reverse selector worn.
41.	3rd gears worn/damaged (2 gears).
42.	Final gears worn/damaged (2 gears).
43.	Differential pinion shaft worn.
44.	Feedpipe O-ring broken.
45.	4th gears worn/damaged (2 gears).
46.	Gear clearance incorrect.
47.	Clutch clearance incorrect.
48.	One-way (sprag) clutch defective.
49.	Sealing rings/guide worn.
50.	Axle-inboard joint clip missing.

(cont'd)

Symptom-to-Component Chart (cont'd)

The following symptoms can be caused by improper repair or assembly.	Check these items on the PROBABLE CAUSE DUE TO IMPROPER REPAIR	Items on the NOTES CHART
Car creeps in [N].	R1, R2	
Car does not move in [D3] or [D4].	R4	
Trans locks up in [R].	R3, R12	
Excessive drag in trans.	R6	R, K
Excessive vibration, rpm related.	R7	
Noise with wheels moving only.	R5	
Main seal pops out.	R8	S
Various shifting problems.	R9, R10	
Harsh upshifts.	R11	

PROBABLE CAUSE DUE TO IMPROPER REPAIR	
R1.	Improper clutch clearance.
R2.	Improper gear clearance.
R3.	Parking brake lever installed upside down.
R4.	One-way (sprag) clutch installed upside down.
R5.	Reverse selector hub installed upside down.
R6.	Oil pump binding.
R7.	Torque converter not fully seated in oil pump.
R8.	Main seal improperly installed.
R9.	Springs improperly installed.
R10.	Valves improperly installed.
R11.	Ball check valves not installed.
R12.	Shift fork bolt not installed.

NOTES	
B.	Set idle rpm in gear to specified idle speed. If still no good, adjust motor mounts as outlined in engine section of service manual.
C.	If the large clutch piston O-ring is broken, inspect the piston groove for rough machining.
D.	If the clutch pack is seized or is excessively worn, inspect the other clutches for wear and check the orifice control valves and throttle valves for free movement.
E.	If throttle valve B is stuck, inspect the clutches for wear.
G.	If the 1—2 shift valve is stuck closed, the transmission will not upshift. If stuck open, the transmission has no 1st gear.
H.	If the 2—3 orifice control valve is stuck, inspect the 2nd and 3rd clutch packs for wear.
I.	If the 2/3-4 orifice control valve is stuck, inspect the 3rd and 4th clutch packs for wear.
J.	If the clutch pressure control valve (CPC) is stuck closed, the transmission will not shift out of 1st gear.
K.	Improper alignment of main valve body and torque convertor housing may cause oil pump seizure. The symptoms are mostly an rpm-related ticking noise or a high pitched squeek.
L.	If the oil screen is clogged with particles of steel or aluminum, inspect the oil pump and differential pinion shaft. If both are OK and no cause for the contamination is found, replace the torque converter.
M.	If the 1st clutch feedpipe guide in the R. side cover is scored by the mainshaft, inspect the ball bearing for excessive movement in the transmission housing. If OK, replace the R. side cover as it is dented. The O-ring under the guide is probably worn.
N.	Replace the mainshaft if the bushings for the 1st and 4th feedpipe are loose or damaged. If the 1st feedpipe is damaged or out of round, replace it. If the 4th feedpipe is damaged or out of round, replace the R. side cover.
O.	A worn or damaged one-way (sprag) clutch is mostly a result of shifting the trans in $\boxed{D_3}$ or $\boxed{D_4}$ while the wheels rotate in reverse, such as rocking the car in snow.
P.	Inspect the frame for collision damage.
Q.	Inspect for damage or wear: 1. Reverse selector gear teeth chamfers. 2. Engagement teeth chamfers of countershaft 4th and reverse gear. 3. Shift fork for scuff marks in center. 4. Differential pinion shaft for wear under pinion gears. 5. Bottom of 3rd clutch for swirl marks. Replace items 1, 2, and 4 if worn or damaged. If trans makes clicking, grinding or whirring noise, also replace mainshaft 4th gear and reverse idler gear and countershaft 4th gear in addition to 1, 2, 3 or 4. If differential pinion shaft is worn, overhaul differential assembly and replace oil screen and thoroughly clean trans, flush torque converter, cooler and lines. If bottom of 3rd clutch is swirled and trans makes gear noise, replace the countershaft and ring gear.
R.	Be very careful not to damage the torque converter housing when replacing the main ball bearing. You may also damage the oil pump when you torque down the main valve body. This will result in oil pump seizure if not detected. Use proper tools.
S.	Install the main seal flush with the torque converter housing. If you push it into the torque converter housing until it bottoms out, it will block the oil return passage and result in damage.
T.	Harsh downshifts when coasting to a stop with zero throttle may be caused by a bent-in throttle valve retainer/cam stopper. Throttle cable adjustment may clear this problem.
U.	Check if separator plate is installed. If it was not installed, the servo valve may have been pushed out by hydraulic pressure causing a leak (internal) affecting all forward gears.
V.	Throttle cable adjustment is essential for proper operation of the transmission. Not only does it affect the shift points if misadjusted, but also the shift quality and lock-up clutch operation. A too long adjusted cable will result in throttle pressure being too low for the amount of engine torque input into the transmission and may cause clutch slippage. A too short adjusted cable will result in too high throttle pressures which may cause harsh shifts, erratic shifts and torque converter hunting.

Road Test

NOTE: Warm up the engine to operating temperature.

1. Apply parking brake and block the wheels. Start the engine, then move the selector lever to [D4] position while depressing the brake pedal. Depress the accelerator pedal, and release it suddenly. Engine should not stall.

2. Repeat same test in [D3] position.

3. Shift the selector lever to [D4] position and check that the shift points occur at approximate speeds shown. Also check for abnormal noise and clutch slippage.

D15B2: [D4] or [D3] Position

- Upshift

Throttle Opening	Unit of speed	1st → 2nd	2nd → 3rd	3rd → 4th
Full-closed throttle	Km/h	15 – 19	35 –39	49 –53
	mph	9 – 12	22 – 24	30 – 33
3/16 throttle	Km/h	20 – 24	45 – 49	63 – 69
	mph	12 – 15	28 – 30	39 – 43
6/16 throttle	Km/h	25 – 33	57 – 69	80 – 92
	mph	16 – 21	35 – 43	50 – 57
Full-opened throttle	Km/h	49 – 53	92 – 99	146 – 157
	mph	30 – 33	57 – 62	91 – 98

- Downshift

Throttle Opening	Unit of speed	4th → 3rd	3rd → 2nd	2nd → 1st
Full-closed throttle	Km/h	——	29 – 33	9 – 13
	mph	——	18 – 21	6 – 8
Full-opened throttle	Km/h	124 – 135	85 – 92	42 – 46
	mph	77 – 84	53 – 57	26 – 29

- Lock-up

Throttle Opening	Unit of speed	[D4] Position		[D3] Position	
		Lock-up ON	Lock-up OFF	Lock-up ON	Lock-up OFF
Full-closed throttle	Km/h	24 –27	23 –26	97 – 103	92 – 98
	mph	15 – 17	14 – 16	60 – 64	57 – 61
6/16 throttle	Km/h	107 – 113	87 – 93	107 – 113	92 – 98
	mph	66 – 70	54 – 58	66 – 70	57 – 61
Full-opened throttle	Km/h	141 – 147	136 – 142	132 – 138	126 – 132
	mph	88 – 91	85 – 88	82 – 86	78 – 82

D16Z6: D4 or D3 Position

- Upshift

Throttle Opening	Unit of speed	1st → 2nd	2nd → 3rd	3rd → 4th
Full-closed throttle	Km/h	15 — 19	35 —39	49 —53
	mph	9 — 12	22 — 24	30 — 33
3/16 throttle	Km/h	21 — 25	48 — 52	64 — 70
	mph	13 — 16	30 — 32	40 — 43
6/16 throttle	Km/h	26 — 34	62 — 74	83 — 95
	mph	16 — 21	39 — 46	52 — 59
Full-opened throttle	Km/h	57 — 62	106 — 113	155 — 165
	mph	35 — 39	66 — 70	96 — 103

- Downshift

Throttle Opening	Unit of speed	4th → 3rd	3rd → 2nd	2nd → 1st
Full-closed throttle	Km/h	——	29 — 33	9 — 13
	mph	——	18 — 21	6 — 8
Full-opened throttle	Km/h	134 — 145	94 — 102	40 — 44
	mph	83 — 90	58 — 63	25 — 27

- Lock-up

Throttle Opening	Unit of speed	D4 Position		D3 Position	
		Lock-up ON	Lock-up OFF	Lock-up ON	Lock-up OFF
Full-closed throttle	Km/h	24 —27	23 —26	97 — 103	92 — 98
	mph	15 — 17	14 — 16	60 — 64	57 — 61
6/16 throttle	Km/h	107 — 113	87 — 93	107 — 113	92 — 98
	mph	66 — 70	54 — 58	66 — 70	57 — 61
Full-opened throttle	Km/h	151 — 157	145 —151	132 — 138	127 — 133
	mph	94 — 98	90 — 94	82 — 86	79 — 83

(cont'd)

(cont'd)

D16A8: [D4] or [D3] Position

- Upshift

Throttle Opening	Unit of speed	1st → 2nd	2nd → 3rd	3rd → 4th
Full-closed throttle	Km/h	15 — 19	31 —35	45 —49
	mph	9 — 12	19 — 22	28 — 30
3/16 throttle	Km/h	18 — 22	42 — 46	59 — 65
	mph	11 — 14	26 — 29	37 — 40
6/16 throttle	Km/h	26 — 34	54 — 66	77 — 89
	mph	16 — 21	34 — 41	48 — 55
Full-opened throttle	Km/h	56 — 60	108 — 115	159 — 169
	mph	35 — 37	67 — 71	99 — 105

- Downshift

Throttle Opening	Unit of speed	4th → 3rd	3rd → 2nd	2nd → 1st
Full-closed throttle	Km/h	——	13 — 17	10 — 14
	mph	——	8 — 11	6 — 9
Full-opened throttle	Km/h	143 — 154	96 — 104	43 — 48
	mph	89 — 96	60 — 65	27 — 30

- Lock-up

Throttle Opening	Unit of speed	[D4] Position		[D3] Position	
		Lock-up ON	Lock-up OFF	Lock-up ON	Lock-up OFF
Full-closed throttle	Km/h	15 — 19	13 — 17	98 — 102	93 — 97
	mph	9 — 12	8 — 11	61 — 63	58 — 60
6/16 throttle	Km/h	108 — 112	85 — 89	108 — 112	93 — 97
	mph	67 — 70	53 — 55	67 — 70	58 — 60
Full-opened throttle	Km/h	158 — 162	153 — 157	132 — 136	128 — 132
	mph	98 — 101	95 — 98	82 — 85	80 — 82

D16A7: [D4] or [D3] Position

- Upshift

Throttle Opening	Unit of speed	1st→2nd	2nd→3rd	3rd→4th
Full-closed throttle	Km/h	15–19	36–40	50–54
	mph	9–12	22–25	31–34
3/16 throttle	Km/h	20–24	46–50	63–69
	mph	12–15	29–31	39–43
6/16 throttle	Km/h	25–33	58–70	81–93
	mph	16–21	36–43	50–58
Full-opened throttle	Km/h	50–55	93–101	149–159
	mph	31–34	58–63	93–99

- Downshift

Throttle Opening	Unit of speed	4th→3rd	3rd→2nd	2nd→1st
Full-closed throttle	Km/h	——	29–33	9–13
	mph	——	18–21	6–8
Full-opened throttle	Km/h	127–138	86–94	43–48
	mph	79–86	53–58	27–30

- Lock-up

Throttle Opening	Unit of speed	[D4] Position		[D3] Position	
		Lock-up ON	Lock-up OFF	Lock-up ON	Lock-up OFF
Full-closed throttle	Km/h	24–27	23–26	98–104	92–98
	mph	15–17	14–16	61–65	57–61
6/16 throttle	Km/h	107–114	87–93	107–113	92–98
	mph	66–71	54–58	66–70	57–61
Full-opened throttle	Km/h	141–147	134–141	132–138	127–133
	mph	88–91	83–88	82–86	79–83

4. Accelerate to about 35 mph (57 km/h) so the transmission is in 4th, then shift [D4] to [2]. The car shoud immediately begin slowing down from engine braking.
   CAUTION: Do not shift from [D4] or [D3] to [2] or [0] at speeds over 99 mph (160 km/h); you may damage the transmission.
5. Check for abnormal noise and clutch slippage in the following positions.

   [1] (1st Gear) Position
   —1. Accelerate from a stop at full throttle. Check that there is no abnormal noise or clutch slippage.
   —2. Upshifts and downshifts should not occur with the selector in this position.

   [2] (2nd Gear) Position
   —1. Accelerate from a stop at full throttle. Check that there is no abnormal noise or clutch slippage.
   —2. Upshifts and downshifts should not occur with the selector in this position.

   [R] (Reverse) Position
   Accelerate from a stop at full throttle, and check for abnormal noise and clutch slippage.

6. Test in [P] (Parking) Position
   Park car on slope (approx. 16°), apply the parking brake, and shift into [P] position. Release the brake; the car should not move.

Stall Speed

Test

CAUTION:
- **To prevent transmission damage, do not test stall speed for more than 10 seconds at a time.**
- **Do not shift the lever while raising the engine speed.**
- **Be sure to remove the pressure gauge before testing stall speed.**

1. Engage the parking brake and block all four wheels.
2. Connect the tachometer, and start the engine.
3. After the engine has warmed up to normal operating temperature, shift into [2] position.
4. Fully depress the brake pedal and accelerator for 6 to 8 seconds, and note engine speed.
5. Allow 2 minutes for cooling, then repeat same test in [1], [D4] and [R] position.

   NOTE:
   - Stall speed test must be made only for checking the cause of trouble.
   - Stall speed in [D4], [2], [1] and [R] must be same, and must also be within limits.

   Stall Speed RPM: rpm
   Specification: 2,600 rpm
   Service Limit: 2,400–2,800 rpm

TROUBLE	PROBABLE CAUSE
Stall rpm high in [D4], [2], [1] and [R] position	• Low fluid level or oil pump output • Clogged oil strainer • Pressure regulator valve stuck closed • Slipping clutch
Stall rpm high in [1] position	• Slippage of 1st clutch, 1st-hold clutch or 1st gear one-way clutch
Stall rpm high in [2] position	• Slippage of 2nd clutch.
Stall rpm high in [D4] position	• Slippage of 1st clutch, 1st gear one-way clutch
Stall rpm high in [R] position	• Slippage of 4th clutch
Stall rpm low in [D4], [2], [1] and [R] position	• Engine output low • Torque converter one-way clutch slipping

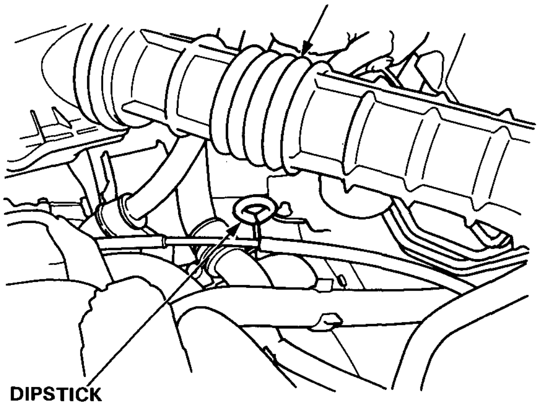
Fluid Level

Checking/Changing

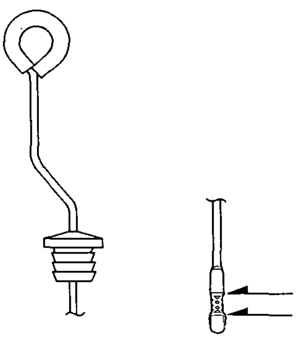
Checking

NOTE: Check the fluid level with the engine at normal operating temperature.

1. Park the car on level ground. Shut off the engine.
2. Remove the dipstick (yellow loop) from the transmission and wipe it with a clean cloth.
3. Insert the dipstick into the transmission.



4. Remove the dipstick and check the fluid level. It should be between the upper and lower marks.

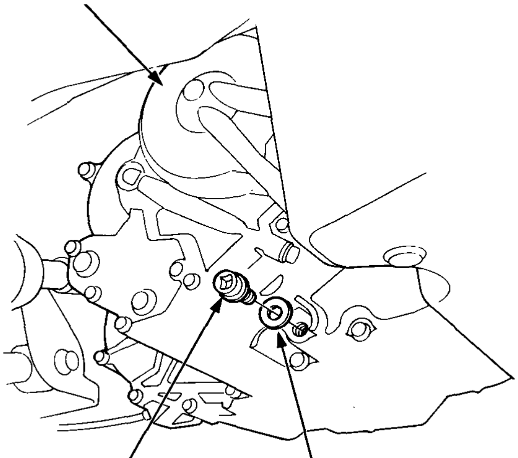


5. If the level is below the lower mark, add fluid into the tube to bring it to the upper mark. Use Honda Premium Formula Automatic Transmission Fluid or an equivalent DEXRON® II Automatic Transmission Fluid (ATF) only.
6. Insert the dipstick back in the transmission.

Changing

1. Bring the transmission up to operating temperature by driving the car. Park the car on level ground, turn the engine off, then remove drain plug.
2. Reinstall the drain plug with a new washer, then refill the transmission to the upper mark on the dipstick.

Automatic Transmission Fluid Capacity:
2.7 ℓ (2.8 US qt., 2.4 Imp qt.) at change
5.9 ℓ (6.2 US qt., 5.2 Imp qt.) after overhaul



Pressure Testing

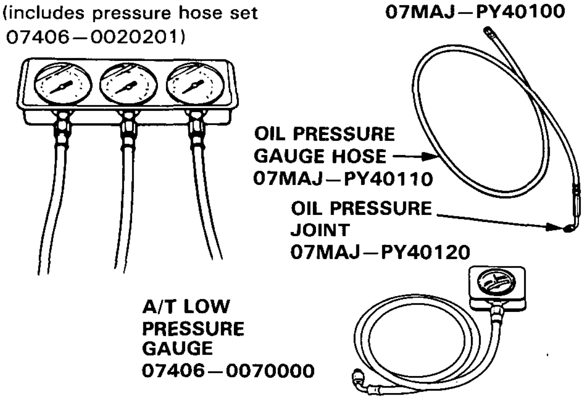
⚠WARNING
- **While testing, be careful of the rotating front wheels.**
- **Make sure lifts, jacks, and safety stands are placed properly (see page 1-9 thru 1-11).**

CAUTION:
- **Before testing, be sure the transmission fluid is filled to the proper level.**
- **Warm up the engine before testing.**

1. Raise the car (see page 1-9 thru 1-11).
2. Warm up the engine, then stop the engine and connect a tachometer.
3. Connect the oil pressure gauge to each inspection hole(s).

   TORQUE: 18 N·m (1.8 kg-m, 12 lb-ft)

   CAUTION: Connect the oil pressure gauge securely, be sure not to allow dust and other foreign particles to enter the inspection hole.



NOTE: Use the A/T Oil Pressure Gauge Set or A/T Low Pressure Gauge replacing the oil pressure gauge hose assembly. The A/T Oil Pressure Gauge Hose (07406–0020201) may also be used.

4. Start the engine and measure the respective pressure as follows.
   - Line Pressure
   - Throttle A/Throttle B Pressure
   - Clutch Pressure
   - Clutch Low/High Pressure
   - Governor Pressure
5. Install a new washer and the sealing bolt in the inspection hole and tighten to the specified torque.

   TORQUE: 18 N·m (1.8 kg-m, 12 lb-ft)

   NOTE: Do not reuse old aluminum washers.

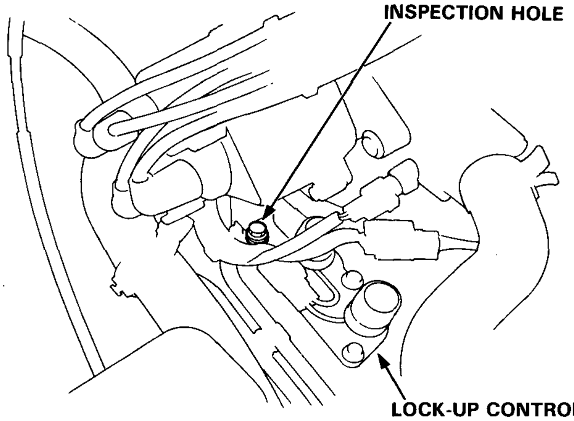
- **Line Pressure**

–1. Set the parking brake and block both rear wheels securely.

–2. Run the engine at 2,000 rpm.

–3. Shift the select lever to [N] or [P].

–4. Measure line pressure.



PRESSURE	SELECTOR POSITION	SYMPTOM	PROBABLE CAUSE	FLUID PRESSURE Standard		Service Limit
Line	[N] or [P]	No (or low) line pressure	Torque converter, oil pump pressure regulator, torque converter check valve, oil pump.	D16Z6 D16A8 D16A7	850–900 kPa ($8.5–9.0 kg/cm^2$, 121–128 psi)	800 kPa ($8.0 kg/cm^2$, 114 psi)
				D15B2	800–850 kPa ($8.0–8.5 kg/cm^2$, 114–121 psi)	750 kPa ($7.5 kg/cm^2$, 107 psi)

NOTE: Higher pressures may be indicated if measurements are made in selector positions other than [N] or [P].

- **Throttle A/Throttle B Pressure Measurement**

⚠WARNING While testing, be careful of the rotating front wheels.

—1. Allow the front wheels to rotate freely.

—2. Remove the cable end of the throttle control cable from the throttle control lever.

NOTE: Do not loosen the locknuts, simply unhook the cable end.

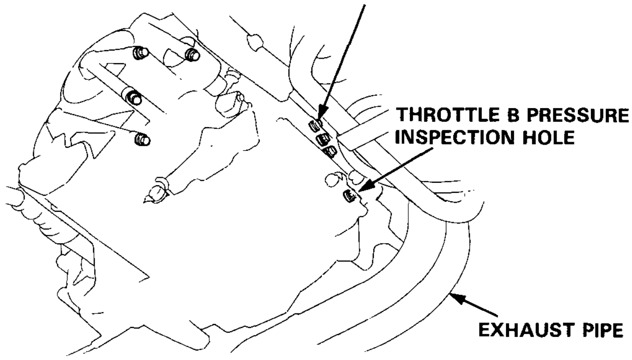
—3. Shift the selector lever to [D4] or [D3] position.

—4. Run the engine at 1,000 rpm.

—5. Measure full-closed throttle A/B pressure.

—6. Move the throttle control lever to full-opened throttle position.

—7. Measure full-opened throttle A/B pressure.



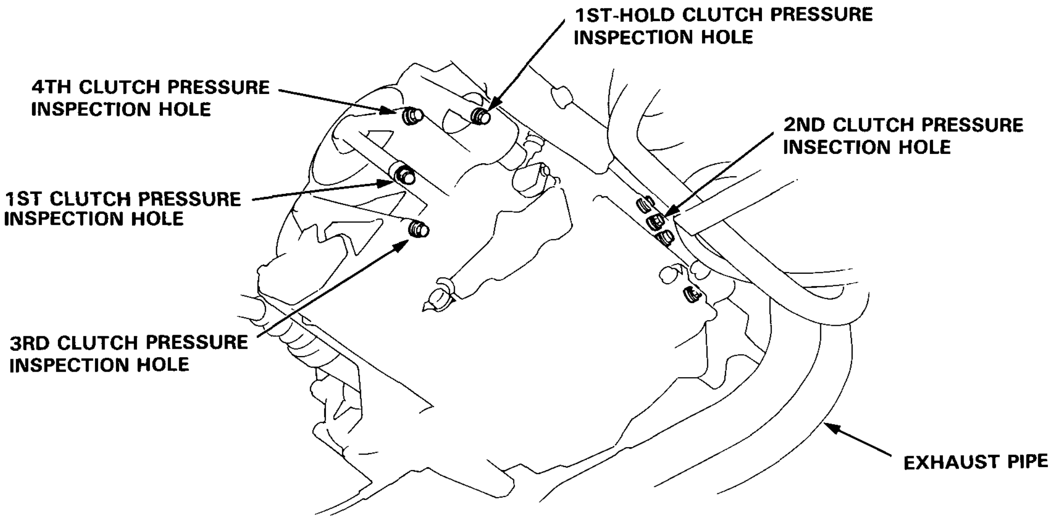
PRESSURE	SELECTOR POSITION	SYMPTOM	PROBABLE CAUSE	FLUID PRESSURE		
				Standard		Service Limit
Throttle A	[D4] or [D3]	Pressure too high	Throttle Valve A Modulator valve	0—5 kPa (0—0.05 kg/cm², 0—0.7 psi) throttle full closed		——
		No or low Throttle A pressure		D16A7	515—530 kPa (5.15—5.3 kg/cm², 73—75 psi) throttle full opened	510 kPa (5.1 kg/cm², 73 psi) throttle full opened
				D16A8	535—550 kPa (5.35—5.5 kg/cm², 76—78 psi) throttle full opened	530 kPa (5.3 kg/cm², 75 psi) throttle full opened
				D15B2 D16Z6	505—520 kPa (5.05—5.2 kg/cm², 72—74 psi) throttle full opened	500 kPa (5.0 kg/cm², 71 psi) throttle full opened
Throttle B	[D4] or [D3]	Pressure too high	Throttle Valve B	0—15 kPa (0—0.15 kg/cm², 0—2 psi) throttle full closed		——
		No or low Throttle B pressure		D16Z6 D16A8 D16A7	800—850 kPa (8.0—8.5 kg/cm², 114—121 psi) throttle full closed	750 kPa (7.5 kg/cm², 107 psi) throttle full opened
				D15B2	850—900 kPa (8.5—9.0 kg/cm², 121—128 psi) throttle full opened	800 kPa (8.0 kg/cm², 114 psi) throttle full opened

(cont'd)

- **Clutch Pressure Measurement**

⚠WARNING **While testing, be careful of the rotating front wheels.**

—1. Set the parking brake and block both rear wheels securely.
—2. Raise the front of the car and support with safety stands.
—3. Allow the front wheels to rotate freely.
—4. Run the engine at 2,000 rpm.
—5. Measure each clutch pressure.



D16Z6/D16A8/D16A7

PRESSURE	SELECTOR POSITION	SYMPTOM	PROBABLE CAUSE	FLUID PRESSURE	
				Standard	Service Limit
1st Clutch	[1] or [D4]	No or low 1st pressure	1st Clutch	850—900 kPa (8.5—9.0 kg/cm^2, 121—128 psi)	800 kPa (8.0 kg/cm^2, 114 psi)
1st-hold Clutch	[1]	No or low 1st-hold pressure	1st-hold Clutch		
2nd Clutch	[2]	No or low 2nd pressure	2nd Clutch		
2nd Clutch	[D4]	No or low 2nd pressure	2nd Clutch	400 kPa (4.0 kg/cm^2, 57 psi) (throttle fully closed) 850—900 kPa (8.5—9.0 kg/cm^2, 121—128 psi) (throttle more than 1/8 opened)	350 kPa (3.5 kg/cm^2, 50 psi) (throttle fully closed) 800 kPa (8.0 kg/cm^2, 114 psi) (throttle more than 1/8 opened)
3rd Clutch		No or low 3rd pressure	3rd Clutch		
4th Clutch		No or low 4th pressure	4th Clutch		
	[R]		Servo Valve or 4th Clutch	850—900 kPa (8.5—9.0 kg/cm^2, 121—128 psi)	800 kPa (8.0 kg/cm^2, 114 psi)

D15B2

PRESSURE	SELECTOR POSITION	SYMPTOM	PROBABLE CAUSE	FLUID PRESSURE	
				Standard	Service Limit
1st Clutch	[1] or [D4]	No or low 1st pressure	1st Clutch	800—850 kPa (8.0—8.5 kg/cm^2, 114—121 psi)	750 kPa (7.5 kg/cm^2, 107 psi)
1st-hold Clutch	[1]	No or low 1st-hold pressure	1st-hold Clutch		
2nd Clutch	[2]	No or low 2nd pressure	2nd Clutch		
2nd Clutch	[D4]	No or low 2nd pressure	2nd Clutch	400 kPa (4.0 kg/cm^2, 57 psi) (throttle fully closed) 800—850 kPa (8.0—8.5 kg/cm^2, 114—121 psi) (throttle more than 1/8 opened)	350 kPa (3.5 kg/cm^2, 50 psi) (throttle fully closed) 750 kPa (7.5 kg/cm^2, 107 psi) (throttle more than 1/8 opened)
3rd Clutch		No or low 3rd pressure	3rd Clutch		
4th Clutch		No or low 4th pressure	4th Clutch		
	[R]		Servo Valve or 4th Clutch	800—850 kPa (8.0—8.5 kg/cm^2, 114—121 psi)	750 kPa (7.5 kg/cm^2, 107 psi)

(cont'd)

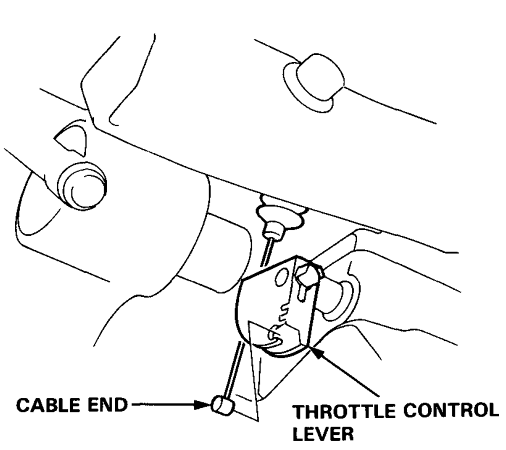
- **Clutch Low/High Pressure Measurement**

⚠WARNING While testing, be careful of the rotating front wheels.

—1. Allow the front wheels to rotate freely.

—2. Remove the cable end of the throttle control cable from the throttle control lever.

NOTE: Do not loosen the locknuts, simply unhook the cable end.

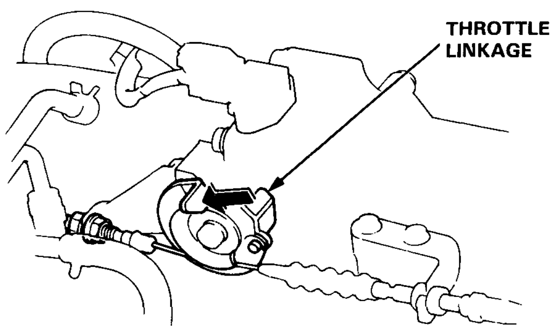


—3. Start the engine and let it idle.

—4. Shift the select lever to $\boxed{D_4}$ position.

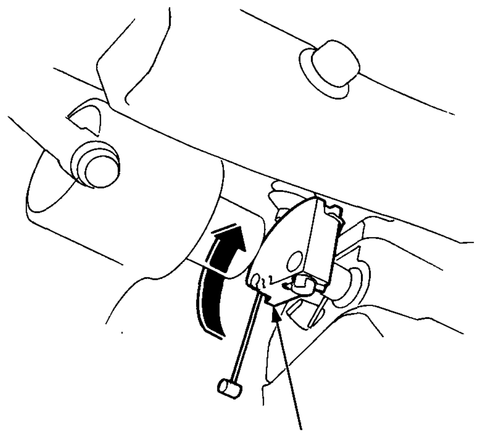
—5. Slowly move the throttle linkage to increase engine rpm until pressure is indicated on the oil pressure gauge.
Then release the throttle linkage, allowing the engine to return to an idle, and measure the pressure reading.

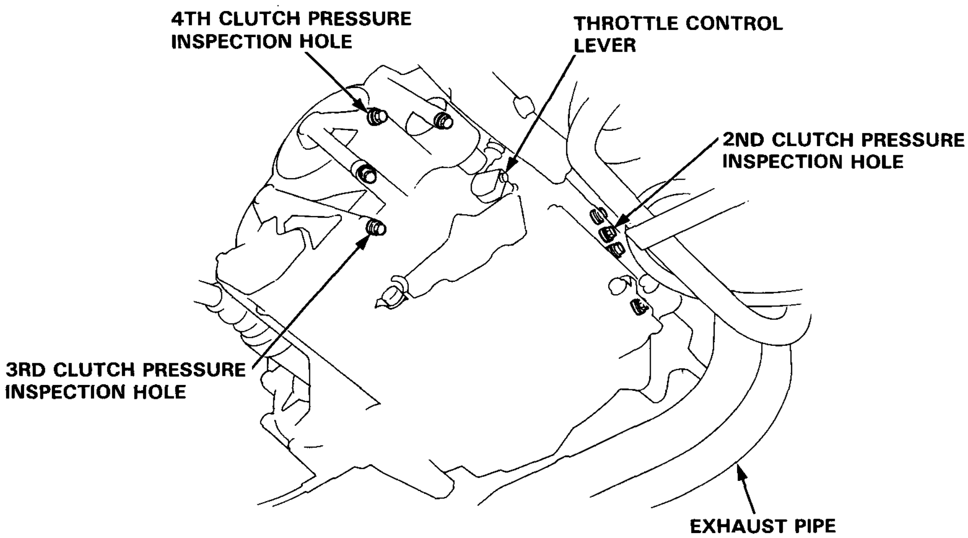
—6. Repeat step 5 for each clutch pressure being inspected.



—7. With the engine idling, lift the throttle control lever up approximately 1/2 of its possible travel and increase the engine rpm until pressure is indicated on the gauge, then measure the highest pressure reading obtained.

—8. Repeat step 7 for each clutch pressure being inspected.





D16Z6/D16A8/D16A7

PRESSURE	SELECTOR POSITION	SYMPTOM	PROBABLE CAUSE	FLUID PRESSURE	
				Standard	Service Limit
2nd Clutch	D4	No or low 2nd pressure	2nd Clutch	400–900 kPa (4.0–9.0 kg/cm², 57–128 psi) varies with throttle opening	350 kPa (3.5 kg/cm², 50 psi) with throttle control lever released 800 kPa (8.0 kg/cm², 114 psi) with throttle control lever more than 1/8 opened
3rd Clutch		No or low 3rd pressure	3rd Clutch		
4th Clutch		No or low 4th pressure	4th Clutch		

D15B2

PRESSURE	SELECTOR POSITION	SYMPTOM	PROBABLE CAUSE	FLUID PRESSURE	
				Standard	Service Limit
2nd Clutch	D4	No or low 2nd pressure	2nd Clutch	400–850 kPa (4.0–8.5 kg/cm², 57–121 psi) varies with throttle opening	350 kPa (3.5 kg/cm², 50 psi) with throttle control lever released 750 kPa (7.5 kg/cm², 107 psi) with throttle control lever more than 1/8 opened
3rd Clutch		No or low 3rd pressure	3rd Clutch		
4th Clutch		No or low 4th pressure	4th Clutch		

(cont'd)

Pressure Testing

(cont'd)

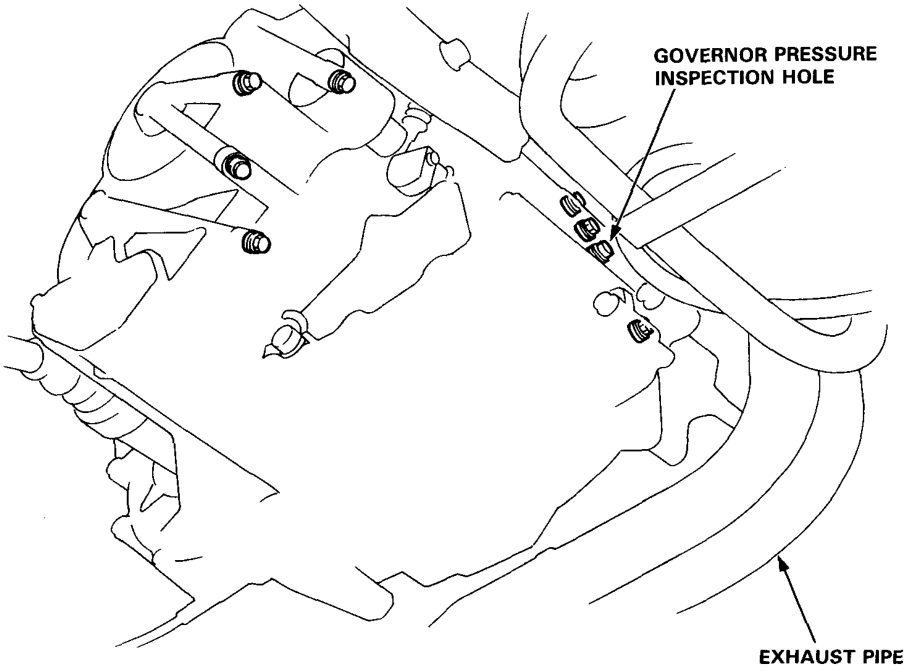
- **Governor Pressure Measurement**

⚠WARNING **While testing, be careful of the rotating front wheels.**

—1. Allow the front wheels to rotate freely.

—2. Run the vehicle at 38 mph (60 km/h).

—3. Measure the governor pressure.



PRESSURE	SELECTOR POSITION	SYMPTOM	PROBABLE CAUSE	FLUID PRESSURE		
				Standard		Service Limit
Governor	D4 or D3	No or low governor pressure	Governor Valve	D16Z6 D16A8 D15B2	180—190 kPa (1.8—1.9 kg/cm², 26—27 psi)	175 kPa (1.75 kg/cm², 25 psi)
				D16A7	182—192 kPa (1.82—1.92 kg/cm², 26—27 psi)	177 kPa (1.77 kg/cm², 25 psi)

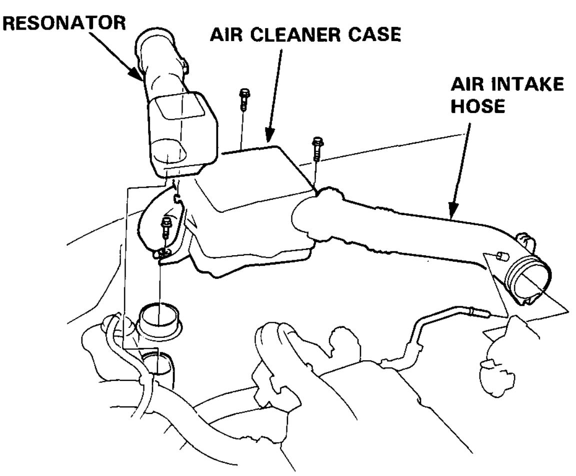
Removal

⚠ WARNING

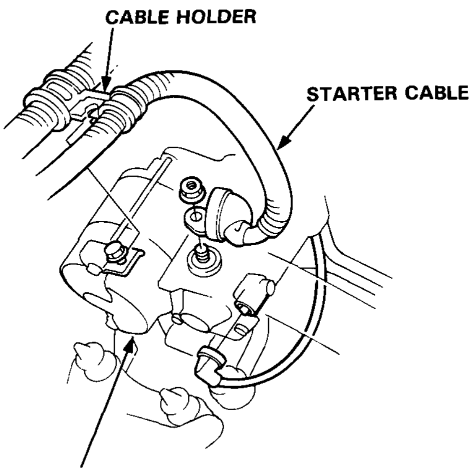
- **Make sure lifts, jacks and safety stands are placed properly, and hoist brackets are attached to the correct position on the engine (see pages 1-9 thru 1-11).**
- **Apply parking brake and block rear wheels, so car will not roll off stands and fall on you while working under it.**

CAUTION: Use fender covers to avoid damaging painted surfaces.

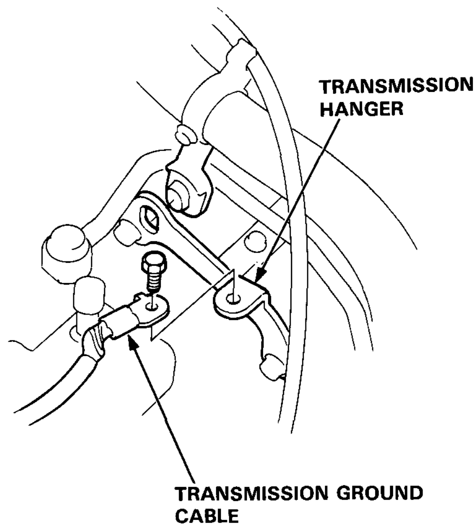
1. Disconnect the battery negative (−) and positive (+) cables from the battery.
2. Remove the resonator, air intake hose and air cleaner case.



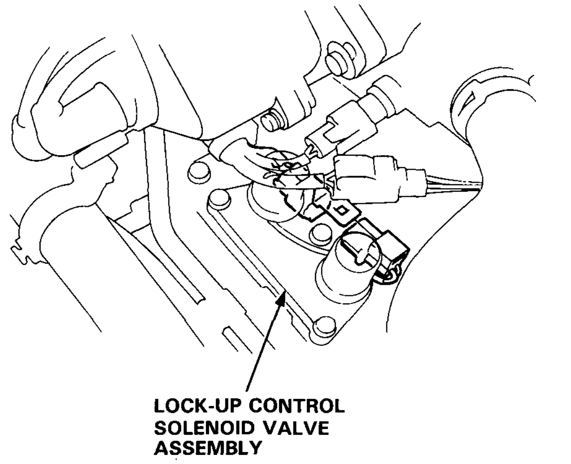
3. Remove the starter motor cable and cable holder from the starter motor.



4. Remove the transmission ground cable from the transmission.



5. Disconnect the lock-up control solenoid valve connector and remove the cable clamp from the lockup control solenoid connector stay.



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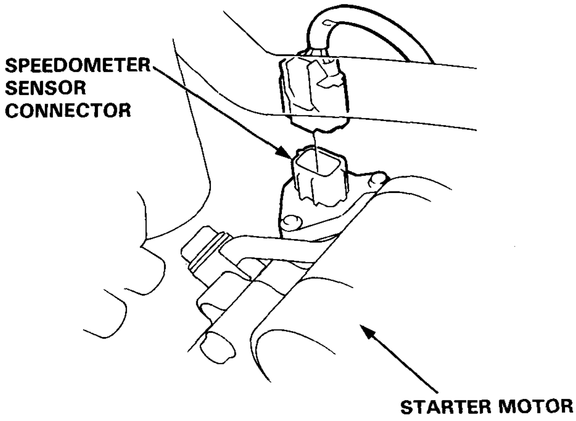
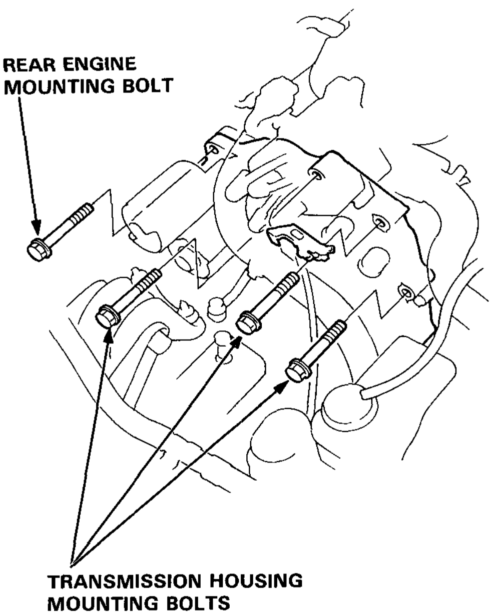
Removal (cont'd)

6. Disconnect the speedometer sensor connector.



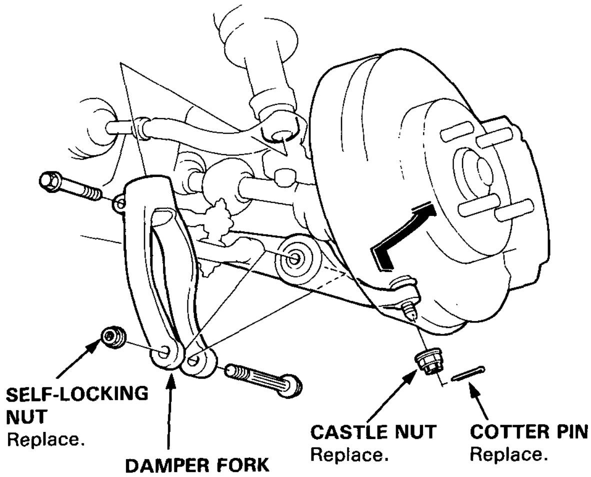
7. Remove the transmission housing mounting bolts and rear engine mounting bolt.



8. Remove the drain plug and drain the automatic transmission fluid (ATF). Reinstall the drain plug with a new sealing washer (see page 14-199).

9. Remove the cotter pins and castle nuts, then separate the ball joints from the lower arm (see Section 18).

10. Remove the damper fork bolts, then separate the damper fork and damper.



11. Remove the driveshafts.

- For D15B2/D15A7/D16Z6

—1. Pry the right and left driveshafts out of the differential.

—2. Pull on the inboard joint and remove the right and left driveshafts (see Section 16).

—3. Tie plastic bags over the driveshaft ends.

NOTE: Coat all precision finished surfaces with clean engine oil or grease.

- For D16A8

—1. Pry the right driveshaft out of the differential.

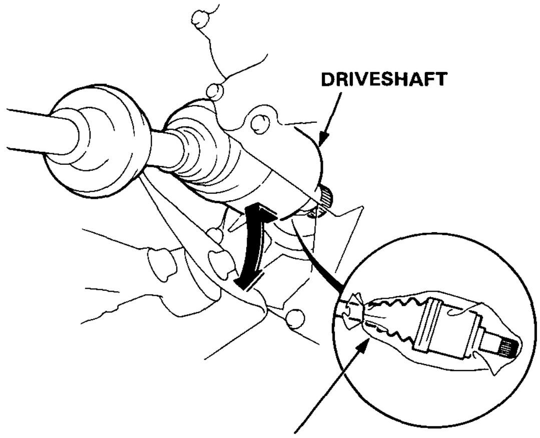
—2. Pry the left driveshaft out of the intermediate shaft.

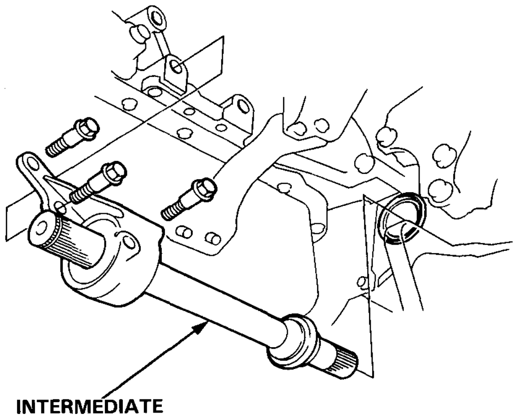
—3. Pull on the inboard joint and remove the right and left driveshafts (see Section 16).

—4. Remove the intermediate shaft.

—5. Tie plastic bags over the driveshaft and intermediate shaft ends.

NOTE: Coat all precision finished surfaces with clean engine oil or grease.

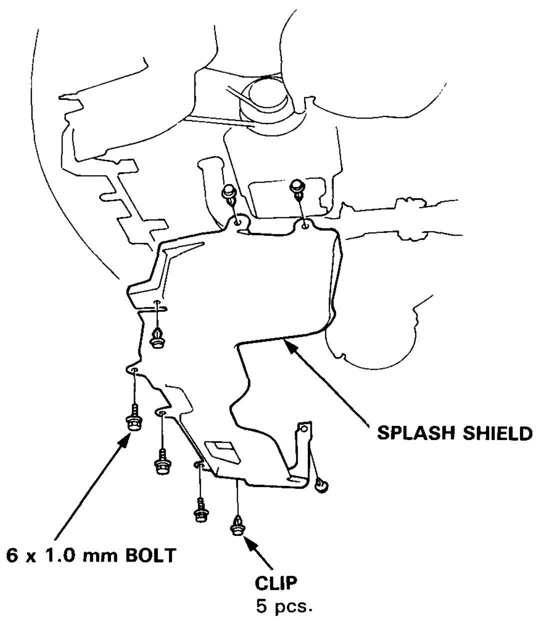




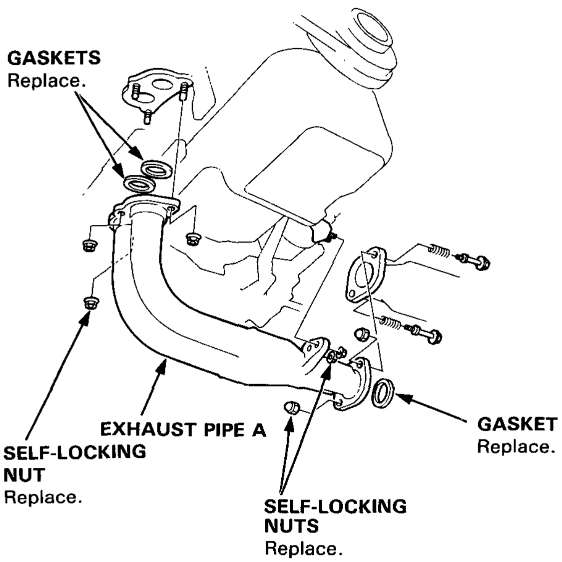
(cont'd)

Removal (cont'd)

12. Remove the splash shield.

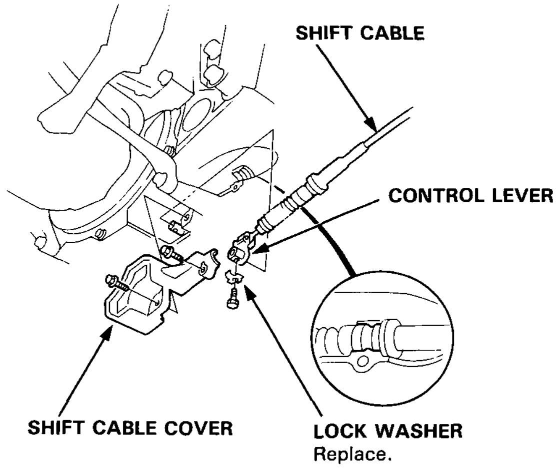


13. Remove the exhaust pipe A.



14. Remove the shift cable cover, then remove the shift cable by removing the control lever.

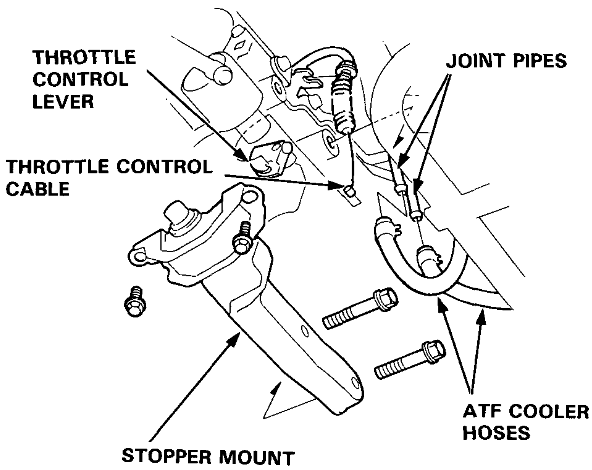
    CAUTION: Take care not to bend the shift control cable while removing it.



15. Remove the stopper mount, then remove the end of the throttle control cable from the throttle control lever.

16. Remove the ATF cooler hoses at the joint pipes. Turn the ends of the cooler hoses up to prevent ATF from flowing out, then plug the joint pipes.

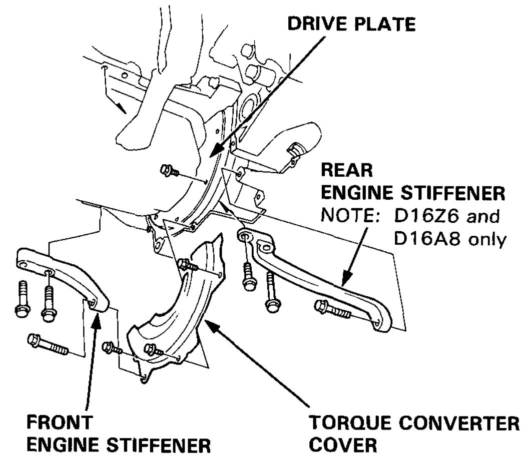
    NOTE: Check for any signs of leakage at the hose joints.



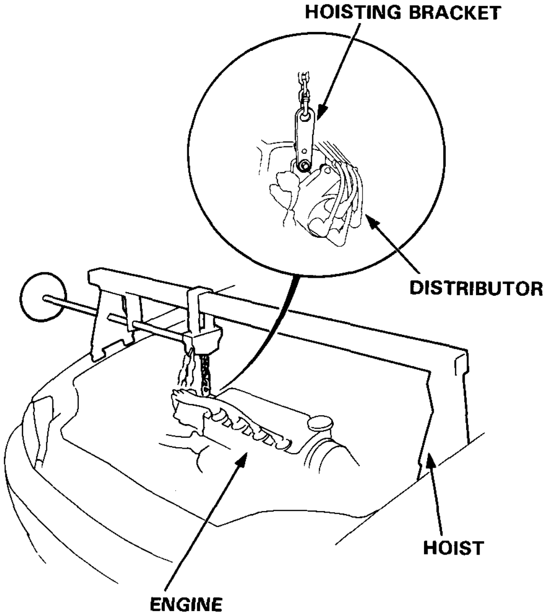
17. Remove the engine stiffeners and torque converter cover.

    NOTE: Only the D16Z6 and D16A8 engine use a rear engine stiffener.

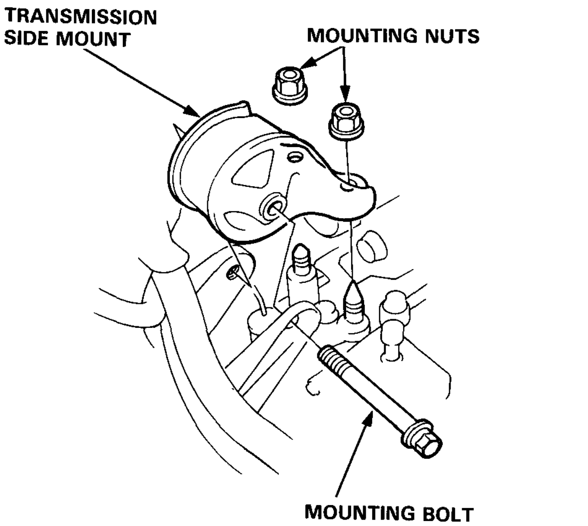
18. Remove the 8 drive plate bolts one at a time while rotating the crankshaft pulley.



19. Attach a hoisting bracket to the engine using the distributor mounting bolt, then lift the engine slightly.

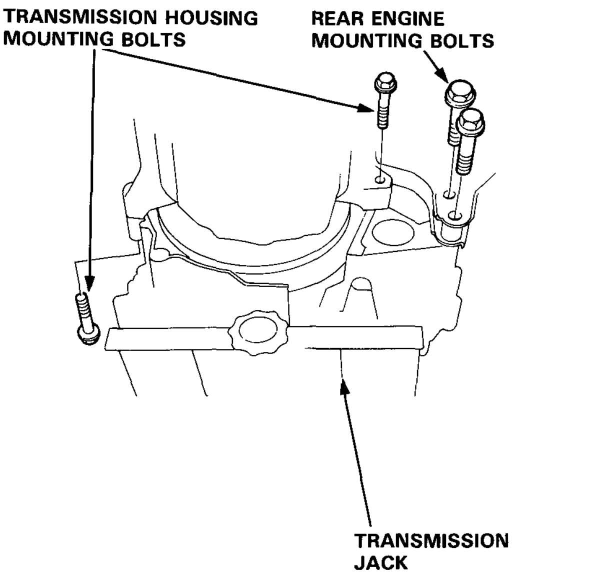


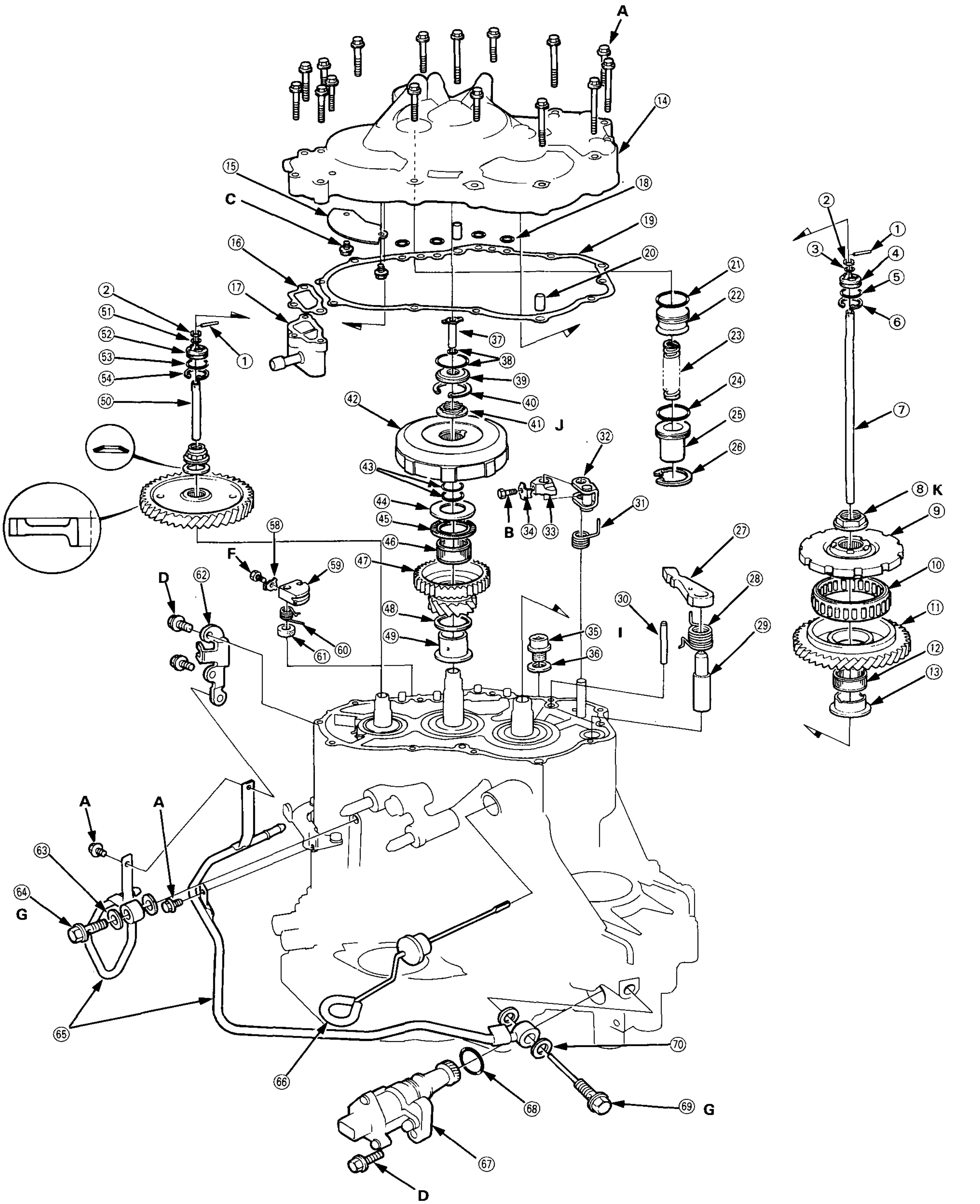
20. Place a jack under the transmission and raise the transmission just enough to take weight off of the mounts, then remove the transmission side mount.



21. *Remove the transmission housing mounting bolts* and rear engine mounting bolts.

22. Pull the transmission away from the engine until it clears the 14 mm dowel pins, then lower it on the transmission jack.





A
B
C
D
F
G
I
J
K

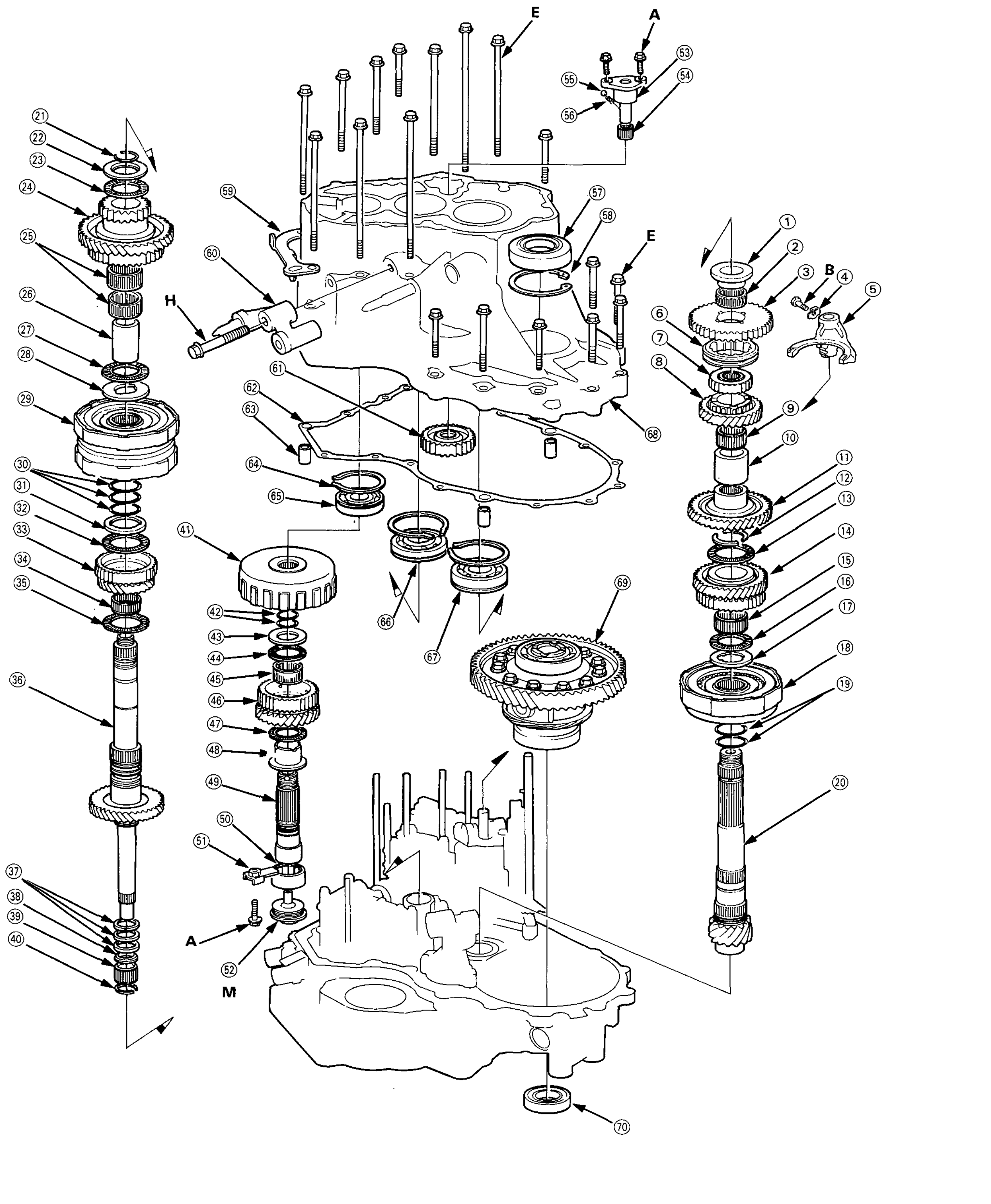
1. **ROLLER**
2. **COLLAR**
3. **O-RING** Replace.
4. **FEED PIPE FLANGE**
5. **O-RING** Replace.
6. **CIRCLIP**
7. **3RD CLUTCH FEED PIPE**
8. **COUNTERSHAFT LOCKNUT (FLANGE NUT)** Replace.
9. **PARKING GEAR**
10. **ONE-WAY CLUTCH ASSEMBLY**
11. **COUNTERSHAFT 1ST GEAR**
12. **NEEDLE BEARING**
13. **COUNTERSHAFT 1ST GEAR COLLAR**
14. **R. SIDE COVER**
15. **BREATHER COVER**
16. **BREATHER CHAMBER GASKET** Replace.
17. **BREATHER CHAMBER**
18. **O-RINGS** Replace.
19. **R. SIDE COVER GASKET** Replace.
20. **DOWEL PINS**
21. **O-RING** Replace.
22. **1ST-HOLD ACCUMULATOR PISTON**
23. **1ST-HOLD ACCUMULATOR SPRING**
24. **O-RING** Replace.
25. **1ST-HOLD ACCUMULATOR COVER**
26. **CIRCLIP**
27. **PARKING BRAKE PAWL**
28. **PARKING BRAKE PAWL SPRING**
29. **PARKING BRAKE PAWL SHAFT**
30. **PARKING BRAKE PAWL STOPPER**
31. **PARKING BRAKE LEVER SPRING**
32. **PARKING BRAKE LEVER**
33. **PARKING BRAKE STOPPER**
34. **LOCK WAHSER** Replace.
35. **DRAIN PLUG**
36. **SEALING WASHER** Replace.
37. **1ST CLUTCH FEED PIPE**
38. **O-RING** Replace.
39. **FEED PIPE GUIDE**
40. **CIRCLIP**
41. **MAINSHAFT LOCKNUT (FLANGE NUT)** Replace.
42. **1ST CLUTCH ASSEMBLY**
43. **O-RING** Replace.
44. **THRUST WASHER**
45. **THRUST NEEDLE BEARING**
46. **NEEDLE BEARING**
47. **MAINSHAFT 1ST GEAR**
48. **THRUST WASHER**
49. **MAINSHAFT 1ST GEAR COLLAR**
50. **1ST-HOLD CLUTCH FEED PIPE**
51. **O-RING** Replace.
52. **FEED PIPE GUIDE**
53. **O-RING** Replace.
54. **CIRCLIP**
55. **SUBSHAFT LOCKNUT (FLANGE NUT)** Replace.
56. **SUBSHAFT DISC SPRING** Replace.
57. **SUBSHAFT 1ST GEAR**
58. **LOCK WASHER** Replace.
59. **THROTTLE CONTROL LEVER**
60. **THROTTLE CONTROL LEVER SPRING**
61. **OIL SEAL** Replace.
62. **THROTTLE CONTROL CABLE HOLDER**
63. **SEALING WASHERS** Replace.
64. **ATF COOLER PIPE JOINT BOLT**
65. **ATF COOLER PIPES**
66. **ATF LEVEL GAUGE**
67. **SPEED SENSOR**
68. **O-RING** Replace.
69. **ATF COOLER PIPE JOING BOLT**
70. **SEALING WASHERS** Replace.

TORQUE SPECIFICATIONS

Ref. No.	Torque Value	Bolt Size	Remarks
A	12 N•m (1.2 kg-m, 9 lb-ft)	6 x 1.0 mm	
B	14 N•m (1.4 kg-m, 10 lb-ft)	6 x 1.0 mm	Special bolt
C	11 N•m (1.1 kg-m, 8 lb-ft)	6 x 1.0 mm	
D	22 N•m (2.2 kg-m, 16 lb-ft)	8 x 1.25 mm	
F	8 N•m (0.8 kg-m, 6 lb-ft)	5 x 0.8 mm	
G	29 N•m (2.9 kg-m, 21 lb-ft)	12 x 1.25 mm	ATF cooler pipe joint bolt
I	40 N•m (4.0 kg-m, 29 lb-ft)	14 x 1.5 mm	Drain plug
J	95 N•m (9.5 kg-m, 69 lb-ft)	19 x 1.25 mm	Mainshaft locknut (flange nut): Left-hand threads
K	140→0→140 N•m (14.0→0→14.0 kg-m, 101→0→101 lb-ft)	23 x 1.25 mm	Countershaft locknut (flange nut)
L	95 N•m (9.5 kg-m, 69 lb-ft)	19 x 1.25 mm	Secondary shaft locknut (flange nut)

Illustrated Index

Transmission Housing

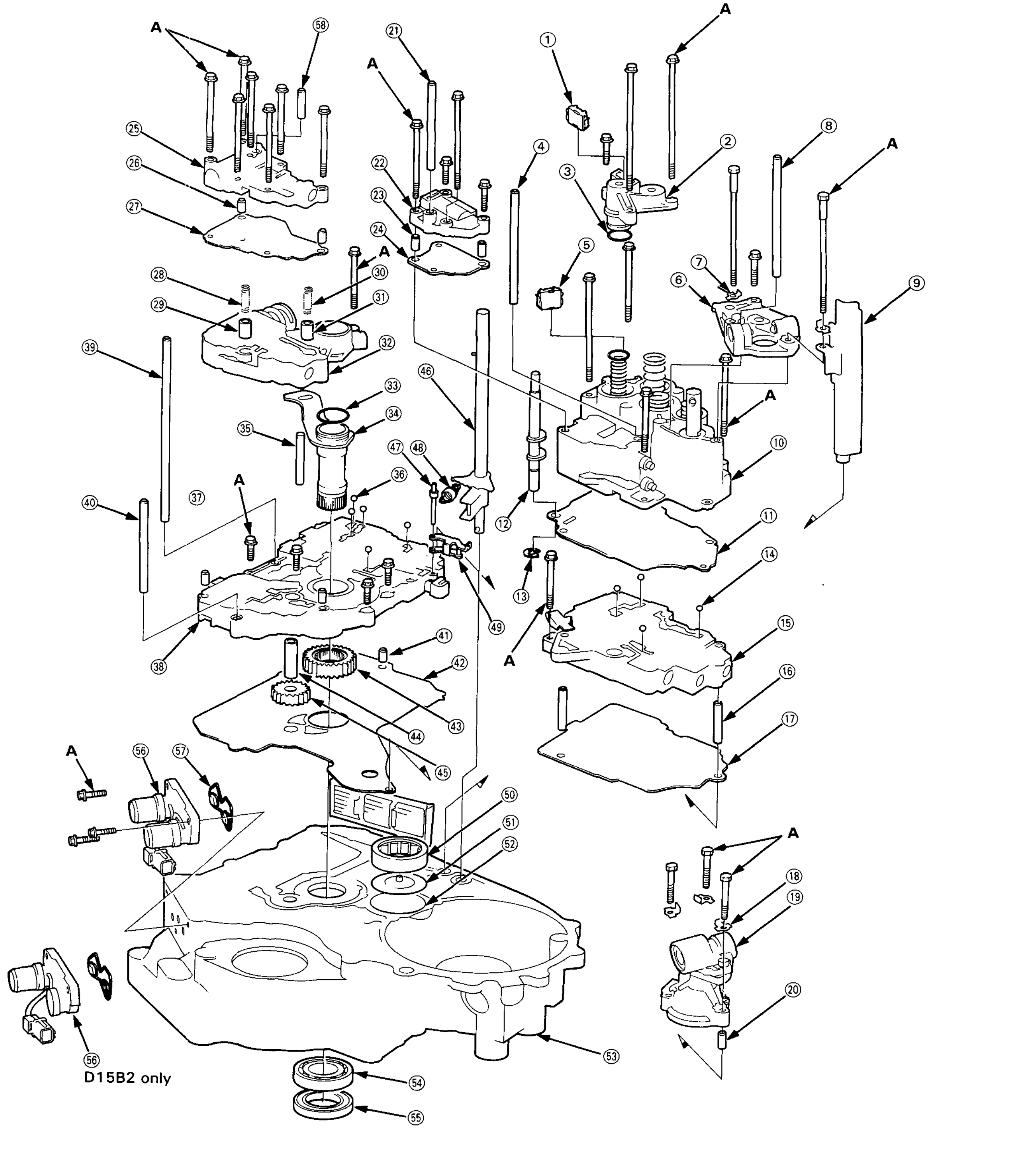


① **COUNTERSHAFT REVERSE GEAR COLLAR**
② **NEEDLE BEARING**
③ **COUNTERSHAFT REVERSE GEAR**
④ **LOCK WASHER** Replace.
⑤ **REVERSE SHIFT FORK**
⑥ **REVERSE SELECTOR**
⑦ **REVERSE SELECTOR HUB**
⑧ **COUNTERSHAFT 4TH GEAR**
⑨ **NEEDLE BEARING**
⑩ **DISTANCE COLLAR, 28 mm**
⑪ **COUNTERSHAFT 2ND GEAR**
⑫ **COTTERS**
⑬ **THRUST NEEDLE BEARING**
⑭ **COUNTERSHAFT 3RD GEAR**
⑮ **NEEDLE BEARING**
⑯ **THRUST NEEDLE BEARING**
⑰ **SPLINED WASHER** Selective part
⑱ **3RD CLUTCH ASSEMBLY**
⑲ **O-RINGS** Replace.
⑳ **COUNTERSHAFT**
㉑ **CIRCLIP**
㉒ **THRUST SHIM**
㉓ **THRUST NEEDLE BEARING**
㉔ **MAINSHAFT 4TH/REVERSE GEAR**
㉕ **NEEDLE BEARINGS**
㉖ **4TH/REVERSE GEAR COLLAR**
㉗ **THRUST NEEDLE BEARING**
㉘ **THRUST SHIM**
㉙ **2ND/4TH CLUTCH ASSEMBLY**
㉚ **O-RINGS** Replace.
㉛ **THRUST WASHER, 36.5 x 51 mm** Selective part
㉜ **THRUST NEEDLE BEARING**
㉝ **MAINSHAFT 2ND GEAR**
㉞ **NEEDLE BEARING**
㉟ **THRUST NEEDLE BEARING**
㊱ **MAINSHAFT**
㊲ **SEALING RINGS, 35 mm**
㊳ **SEALING RING, 29 mm**
㊴ **NEEDLE BEARING**
㊵ **SET RING**
㊶ **1ST-HOLD CLUTCH ASSEMBLY**
㊷ **O-RINGS** Replace.
㊸ **THRUST SHIM**
㊹ **THRUST NEEDLE BEARING**
㊺ **NEEDLE BEARING**
㊻ **SUBSHAFT 4TH GEAR**
㊼ **THRUST NEEDLE BEARING**
㊽ **SUBSHAFT 4TH GEAR COLLAR**
㊾ **SUBSHAFT**
㊿ **NEEDLE BEARING**
(51) **NEEDLE BEARING STOPPER**
(52) **OIL GUIDE CAP**
(53) **REVERSE IDLER GEAR SHAFT/HOLDER**
(54) **NEEDLE BEARING**
(55) **STEEL BALL**
(56) **REVERSE IDLER GEAR SHAFT SPRING**
(57) **OIL SEAL** Replace.
(58) **SET RING, 80 mm** Selective part
(59) **TRANSMISSION HANGER**
(60) **TRANSMISSION MOUNT BRACKET**
(61) **REVERSE IDLER GEAR**
(62) **TRANSMISSION HOUSING GASKET** Replace.
(63) **DOWEL PIN**
(64) **SNAP RINGS**
(65) **TRANSMISSION HOUSING SUBSHAFT BEARING**
(66) **TRANSMISSION HOUSING MAINSHAFT BEARING**
(67) **TRANSMISSION HOUSING COUNTERSHAFT BEARING**
(68) **TRANSMISSION HOUSING**
(69) **DIFFERENTIAL ASSEMBLY**
(70) **OIL SEAL** Replace.

TORQUE SPECIFICATIONS

Ref. No.	Torque Value	Bolt Size	Remarks
A	12 N•m (1.2 kg-m, 9 lb-ft)	6 x 1.0 mm	
B	14 N•m (1.4 kg-m, 10 lb-ft)	6 x 1.0 mm	Special bolt
E	34 N•m (3.4 kg-m, 25 lb-ft)	8 x 1.25 mm	
H	50 N•m (5.0 kg-m, 36 lb-ft)	12 x 1.25 mm	
M	40 N•m (4.0 kg-m, 29 lb-ft)	30 x 1.5 mm	Oil guide cap

Torque Converter Housing/Valve Body



1. **ATF MAGNET** Clean.
2. **ACCUMULATOR COVER**
3. **O-RING** Replace.
4. **OIL FEED PIPE**
5. **ATF MAGNET** Clean.
6. **DENTENT BASE**
7. **LOCK WASHERS** Replace.
8. **OIL FEED PIPE**
9. **BAFFLE PLATE**
10. **SERVO BODY**
11. **SERVO SEPARATOR PLATE**
12. **THROTTLE CONTROL SHAFT**
13. **E-RING**
14. **CHECK BALLS**
15. **SECONDARY VALVE BODY**
16. **DOWEL PINS**
17. **SECONDARY SEPARATOR PLATE**
18. **LOCK WASHERS** Replace.
19. **GOVERNOR BODY**
20. **DOWEL PIN**
21. **OIL FEED PIPE**
22. **MODULATOR VALVE BODY**
23. **DOWEL PINS**
24. **MODULATOR SEPARATOR PLATE**
25. **LOCK-UP VALVE BODY**
26. **DOWEL PINS**
27. **LOCK-UP SEPARATOR PLATE**
28. **TORQUE CONVERTER CHECK VALVE SPRING**
29. **TORQUE CONVERTER CHECK VALVE**
30. **COOLER CHECK VALVE SPRING**
31. **COOLER CHECK VALVE**
32. **REGULATOR VALVE BODY**
33. **O-RING** Replace.
34. **STATOR SHAFT**
35. **STOPPER SHAFT**
36. **CHECK BALLS**
37. **DOWEL PINS**
38. **MAIN VALVE BODY**
39. **OIL FEED PIPE**
40. **OIL FEED PIPE**
41. **DOWEL PIN**
42. **MAIN SEPARATOR PLATE**
43. **OIL PUMP DRIVE GEAR**
44. **OIL PUMP DRIVEN GEAR SHAFT**
45. **OIL PUMP DRIVEN GEAR**
46. **CONTROL SHAFT**
47. **DETENT SPRING**
48. **DETENT ARM SHAFT**
49. **DETENT ARM**
50. **ATF STRAINER** Clean or replace.
51. **TORQUE CONVERTER HOUSING COUNTERSHAFT NEEDLE BEARING**
52. **OIL GUIDE PLATE** Replace.
53. **TORQUE CONVERTER HOUSING**
54. **TORQUE CONVERTER HOUSING MAINSHAFT BALL BEARING**
55. **OIL SEAL** Replace.
56. **LOCK-UP CONTROL SOLENOID VALVE ASSEMBLY**
57. **LOCK-UP CONTROL SOLENOID FILTER/GASKET** Replace.
58. **OIL FEED PIPE**

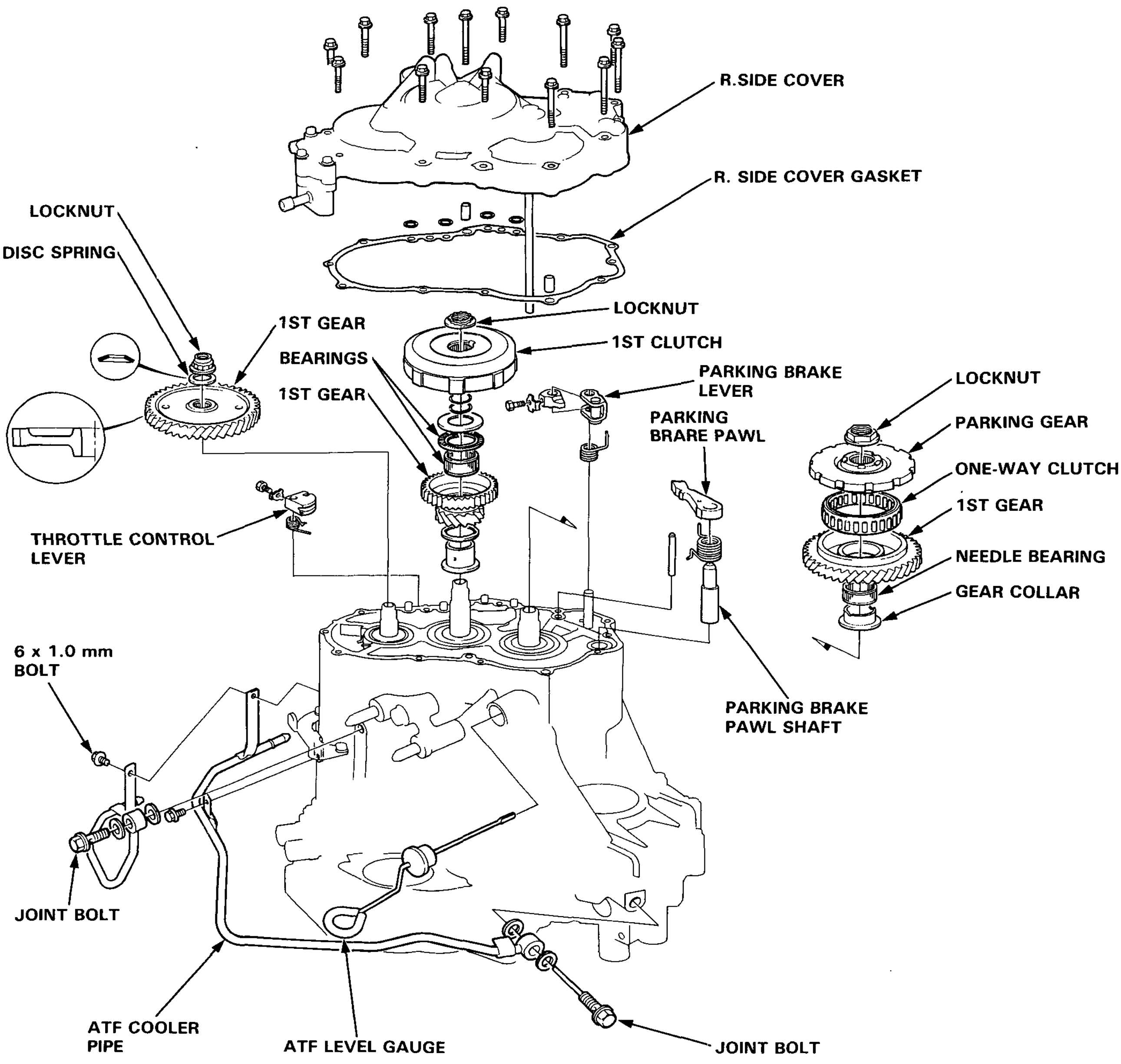
TORQUE SPECIFICATIONS

Ref. No.	Torque Value	Bolt Size	Remarks
A	12 N•m (1.2 kg-m, 9 lb-ft)	6 x 1.0 mm	

R. Side Cover

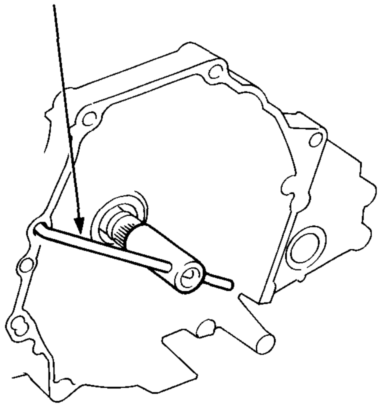
Removal

NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- When removing the transmission R. side cover, replace the following:
  - R. side cover gasket
  - Lock washers
  - O-rings
  - Each shaft locknut
  - Disc spring
  - Sealing washers



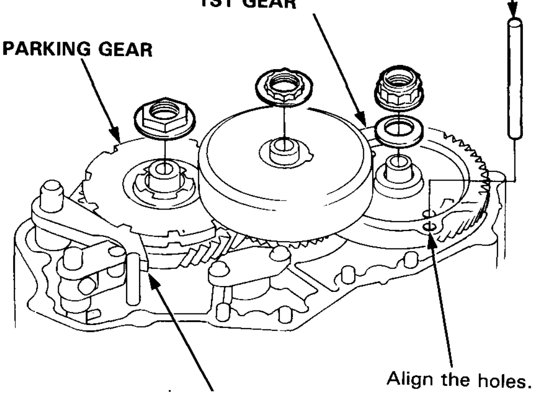
1. Remove the 16 bolts securing the R. side cover, then remove the cover.

2. Slip the special tool onto the mainshaft.



3. Engage the parking brake pawl with the parking gear.

4. Align the hole of the subshaft 1st gear with the hole of the transmission housing, then insert a pin to lock the subshaft while removing the subshaft locknut.

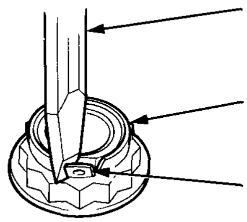


5. Pry the lock tabs of the mainshaft and countershaft locknuts.

6. Cut the lock tab of the subshaft locknut using a chisel as shown. Then remove the locknut from each shaft.

NOTE:
- Mainshaft locknut has left-hand threads.
- Clean the old countershaft locknut, it is used when installing to press the press fitting parking gear on the countershaft.

CAUTION: Keep all of the chiseled particles out of the transmission.



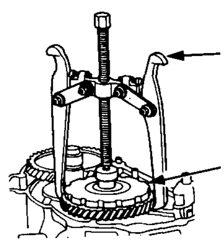
7. Remove the special tool from the mainshaft after removing the locknut.

8. Remove the 1st clutch and mainshaft 1st gear assembly from the mainshaft.

9. Remove the subshaft 1st gear.

10. Remove the parking brake pawl.

11. Remove the parking gear, one-way clutch and countershaft 1st gear assembly. Use a puller for press fitting parking gear as shown.



12. Remove the parking brake lever from the control shaft.

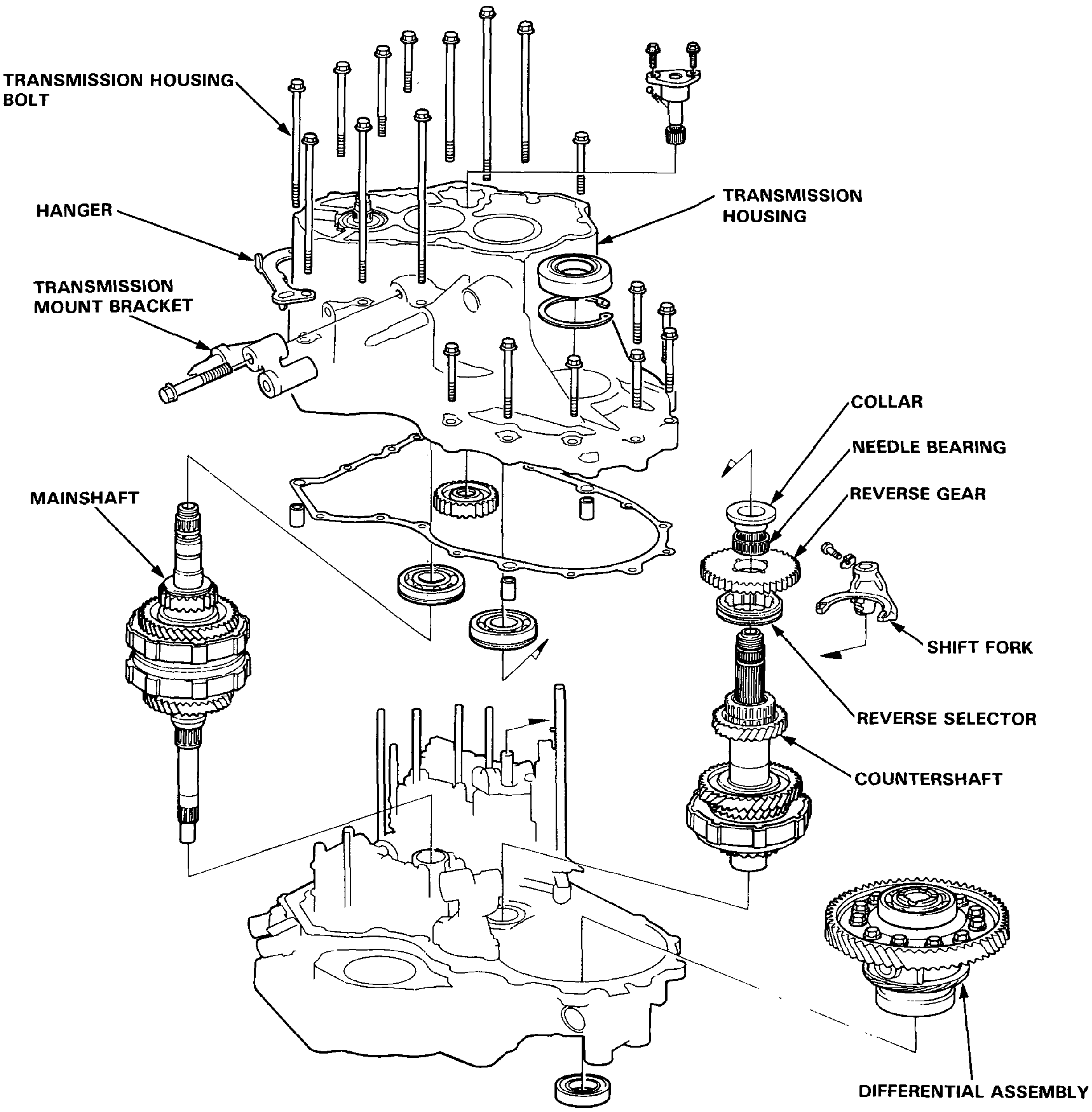
13. Remove the throttle control lever from the throttle control shaft.

14. Remove the ATF cooler pipes.

15. Remove the ATF level gauge.

Transmission Housing

Removal



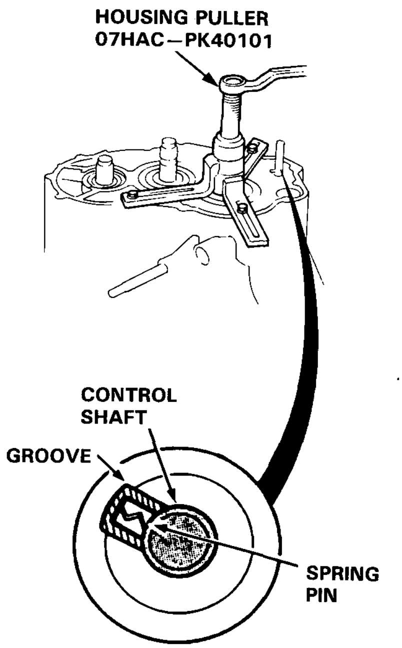
NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- When removing the transmission housing, replace the following:
  - Transmission housing gasket
  - Lock washer

1. Remove the transmission mount bracket.

2. Remove the transmission housing mounting bolts and hanger.

3. Align the spring pin with the transmission housing groove by turning the control shaft.

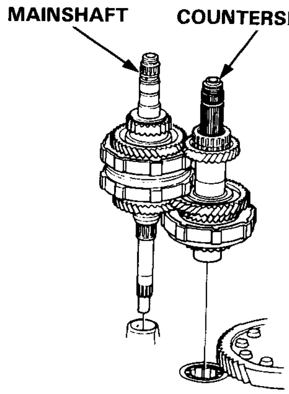
4. Install the special tool on the transmission housing, then remove the housing as shown.



5. Remove the countershaft reverse gear with the collar and needle bearing.

6. Remove the lock bolt securing the shift fork, then remove the fork with the reverse selector from the countershaft.

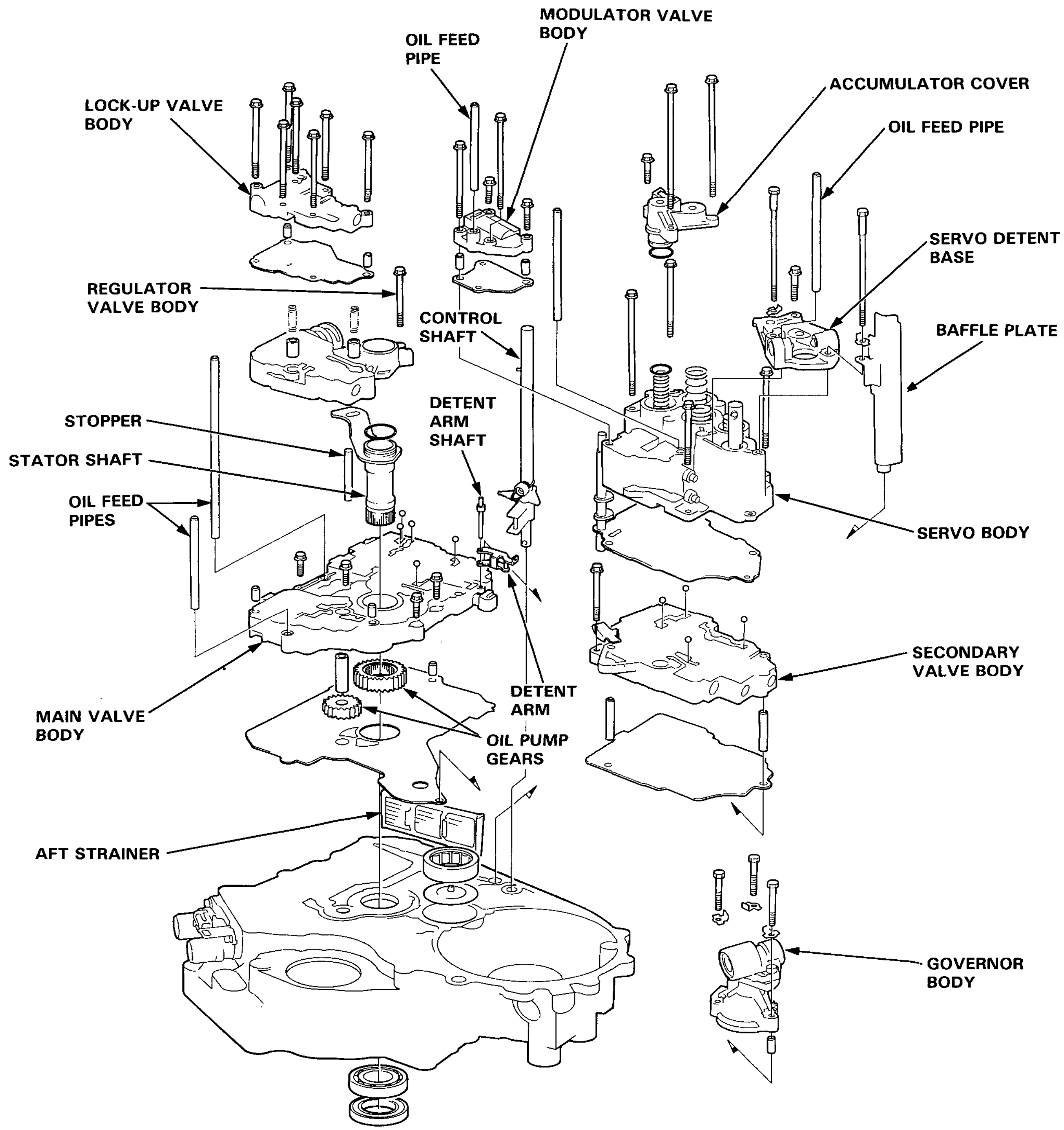
7. Remove the countershaft and mainshaft subassembly together.



8. Remove the differential assembly.

Torque Converter Housing/Valve Body

Removal



NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- When removing the valve body replace the following:
  - O-rings
  - Lock washer

1. Remove the oil feed pipes from the servo body, modulator valve body and main valve body.

2. Remove the 3 bolts securing the accumulator cover, then remove the accumulator cover.

3. Remove the 3 bolts securing the servo detent base, then remove the servo detent base and baffle plate.

4. Remove the 4 bolts securing the modulator valve body, then remove the modulator valve body and separator plate.

5. Remove the 4 bolts securing the servo body, then remove the servo body and separator plate.

6. Remove the 1 bolts securing the secondary valve body, then remove the secondary valve body and separator plate.

7. Remove the 7 bolts securing the lock-up valve body, then remove the lock-up valve body and separator plate.

8. Remove the 1 bolt securing the regulator valve body, then remove the regulator valve body.

9. Remove the stator shaft and stopper shaft.

10. Remove the detent spring from the detent arm, then remove the control shaft from the torque converter housing.

11. Remove the detent arm and detent arm shaft from the main valve body.

12. Remove the 4 bolts securing the main valve body, then remove the main valve body.

13. Remove the oil pump driven gear shaft, then remove the oil pump gears.

14. Remove the 3 bolts securing the governor body, then remove the governor body.

15. Remove the main separator plate with 2 dowel pins.

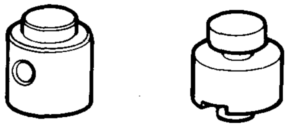
16. Remove the ATF strainer.

Valve Caps

Description

- Caps with one projected tip and one flat end are installed with the flat end toward the spring.
- Caps with a projected tip on each end are installed with the smaller tip toward the spring. The small tip is a spring guide.

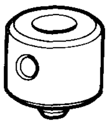
Toward outside of valve body.



Toward spring.

- Caps with one projected tip and hollow end are installed with the tip toward the spring. The tip is a spring guide.

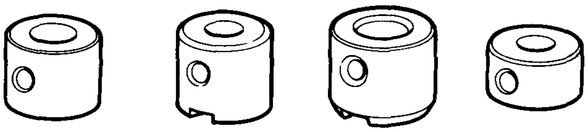
Toward outside of valve body.



Toward spring.

- Caps with hollow ends are installed with the hollow end away from the spring.
- Caps with notched ends are installed with the notch toward the spring.
- Caps with flat ends and a hole through the center are installed with the smaller hole toward the spring.

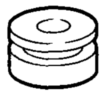
Toward outside of valve body.



Toward spring.

- Caps with flat ends and a groove around cap are installed with the groove side toward the spring.

Toward outside of valve body.



Toward spring.

Valve Body

Repair

NOTE: This repair is only necessary if one or more of the valves in a valve body do not slide smoothly in their bores. You may use this procedure to free the valves in the valve bodies.

1. Soak a sheet of #600 abrasive paper in ATF for about 30 minutes.

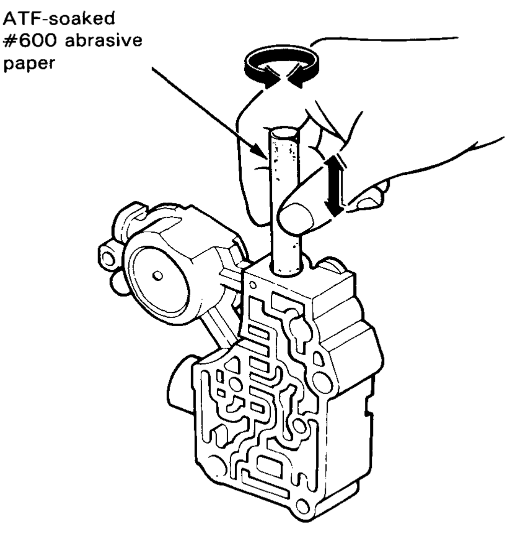
2. Carefully tap the valve body so the sticking valve drops out of its bore.

   CAUTION: It may be necessary to use a small screwdriver to pry the valve free. Be careful not to scratch the bore with the screwdriver.

3. Inspect the valve for any scuff marks. Use the ATF-soaked #600 paper to polish off any burrs that are on the valve, then wash the valve in solvent and dry it with compressed air.

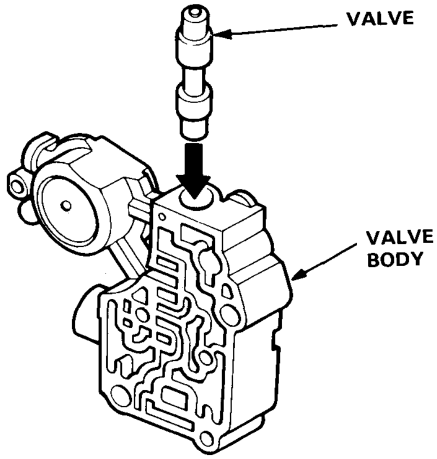
4. Roll up half a sheet of ATF-soaked paper and insert it in the valve bore of the sticking valve.
   Twist the paper slightly, so that it unrolls and fits the bore tightly, then polish the bore by twisting the paper as you push it in and out.

   CAUTION: The valve body is aluminum and doesn't require much polishing to remove any burrs.



5. Remove the #600 paper and thoroughly wash the entire valve body in solvent, then dry with compressed air.

6. Coat the valve with ATF then drop it into its bore. It should drop to the bottom of the bore under its own weight. If not, repeat step 4, then retest.



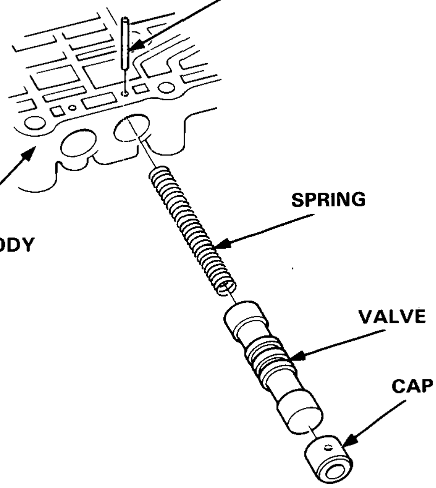
7. *Remove the valve and thoroughly clean it and the* valve body with solvent. Dry all parts with compressed air, then reassemble using ATF as a lubricant.

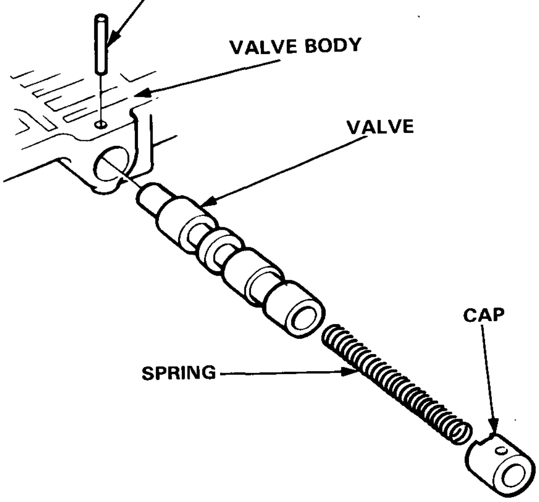
Valve

Assembly

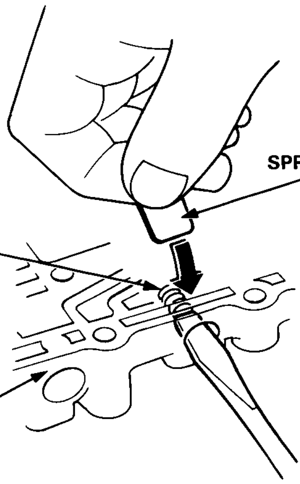
NOTE: Coat all parts with ATF before assembly.

- Install the valve, valve spring and cap in the valve body and secure with the roller.

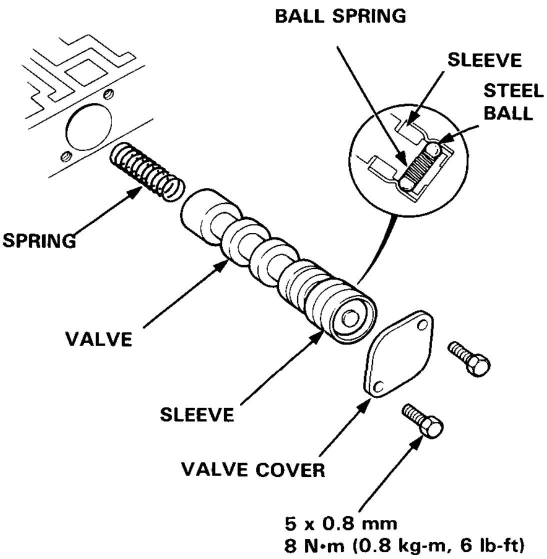




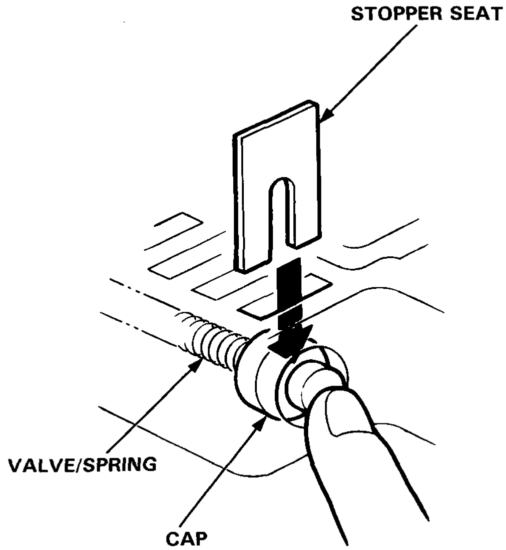
- Set the spring in the valve and install it in the valve body. Push the spring in with a screwdriver, then install the spring seat.



- Slide the spring into the hole in the big end of the shift valve. While holding the steel balls with the tips of your fingers, put the sleeve over the shift valve. Place the shift spring in the shift valve, then slip it into the valve body and install the valve cover.



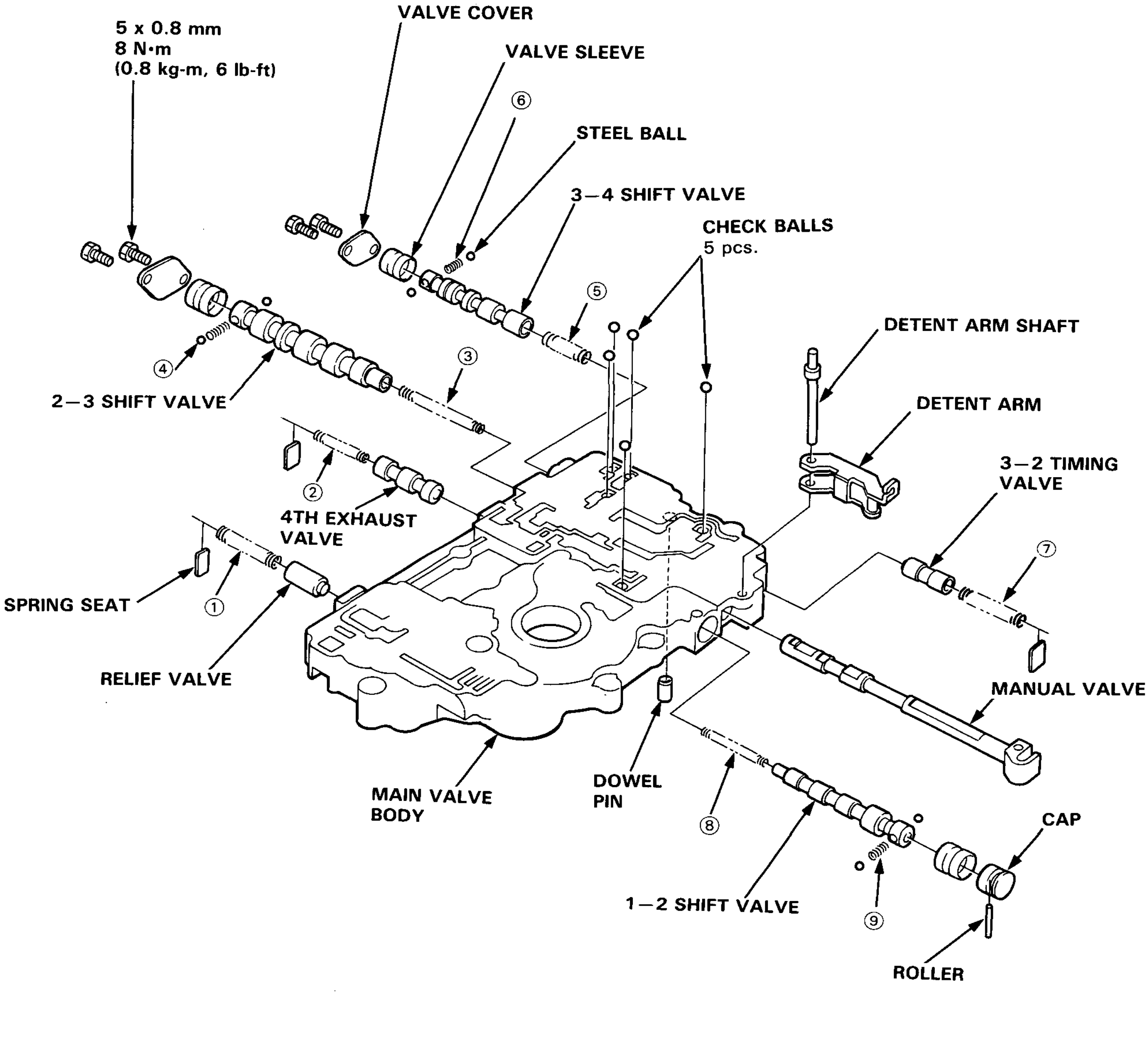
- Install the valve, spring and cap in the valve body. Push the cap, the install the stopper seat.

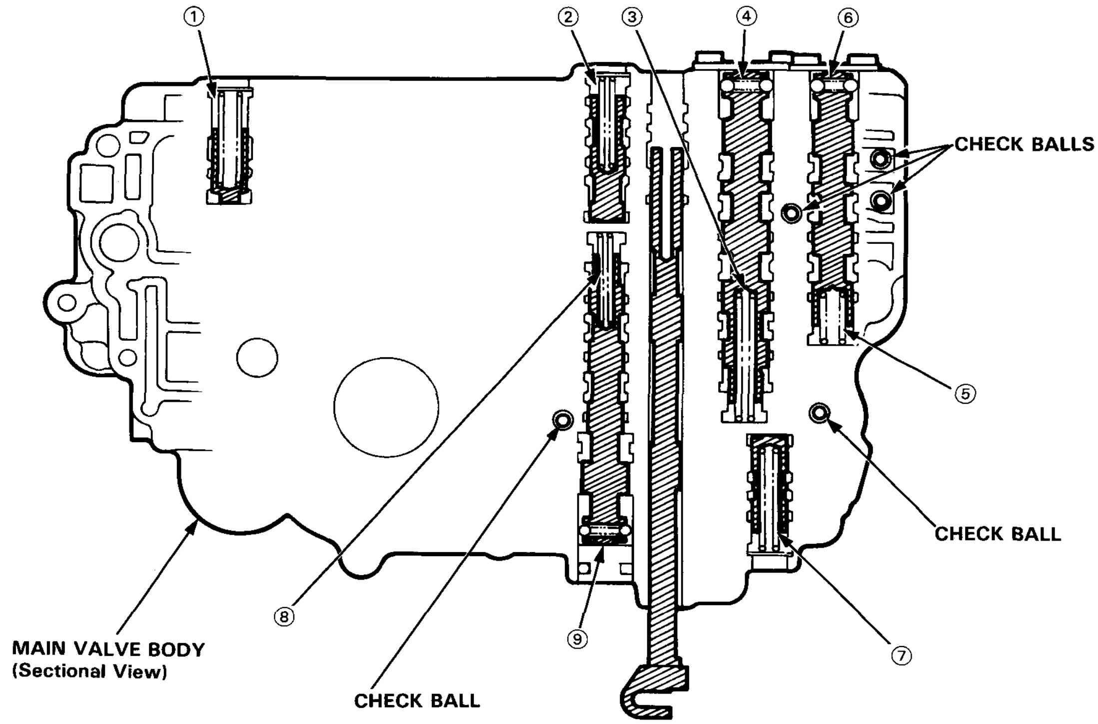


Disassembly/Inspection/Reassembly

NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- Replace valve body as an assembly if any parts are worn or damaged.
- Check all valves for free movement. If any fail to slide freely, see Valve Body Repair on page 14-225.
- Coat all parts with ATF before reassembly.

CAUTION: Do not use a magnet to remove the check balls; it may magnetize the balls.





SPRING SPECIFICATIONS

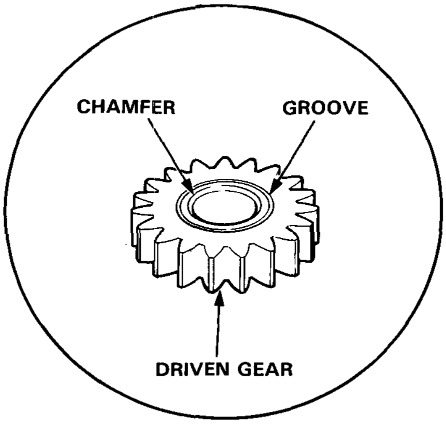
Unit of length: mm (in)

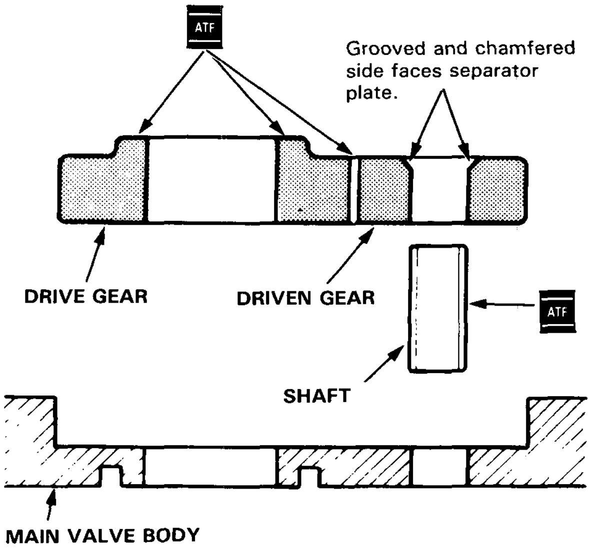
No.	Spring		Standard (New)			
			Wire Dia.	O.D.	Free Length	No. of Coils
①	Relief valve spring		1.1 (0.043)	8.6 (0.339)	37.1 (1.461)	13.4
②	4th exhaust valve spring		0.9 (0.035)	6.6 (0.260)	43.3 (1.705)	22.0
③	2-3 shift valve spring	D16Z6/D16A7/ D15B2	0.9 (0.035)	7.1 (0.280)	64.7 (2.547)	32.1
		D16A8	0.9 (0.035)	7.6 (0.299)	53.4 (2.102)	28.5
④	2-3 shift ball spring	D16Z6/D16A7/ D15B2	0.4 (0.016)	4.5 (0.177)	14.7 (0.579)	7.3
		D16A8	0.5 (0.020)	4.5 (0.177)	13.2 (0.520)	10.5
⑤	3-4 shift valve spring	D16Z6/D16A7/ D15B2	0.9 (0.035)	9.6 (0.378)	32.5 (1.280)	10.3
		D16A8	0.8 (0.031)	9.6 (0.378)	27.1 (1.067)	7.8
⑥	3-4 shift ball spring	D16Z6/D16A7/ D15B2	0.5 (0.020)	4.5 (0.177)	11.3 (0.445)	7.4
		D16A8	0.45 (0.018)	4.5 (0.177)	13.5 (0.531)	8.2
⑦	3-2 timing valve spring		1.2 (0.047)	8.6 (0.339)	46.9 (1.847)	15.2
⑧	1-2 shift valve spring	D16Z6/D16A7/ D15B2	0.45 (0.018)	5.1 (0.201)	52.8 (2.079)	29.0
		D16A8	0.5 (0.020)	6.1 (0.240)	52.0 (2.047)	18.8
⑨	1-2 shift ball spring		0.45 (0.018)	4.5 (0.177)	10.7 (0.421)	12.7

Oil Pump

Inspection

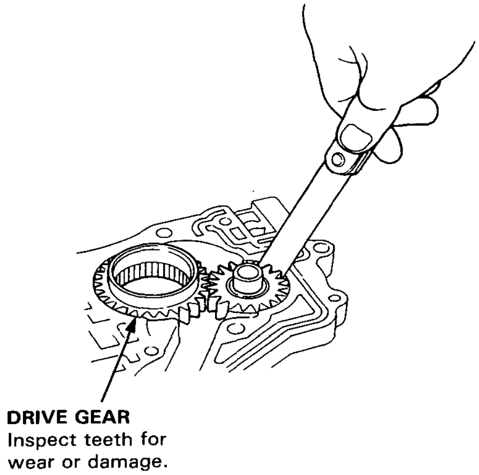
1. Install the pump gears and shaft in the main valve body.





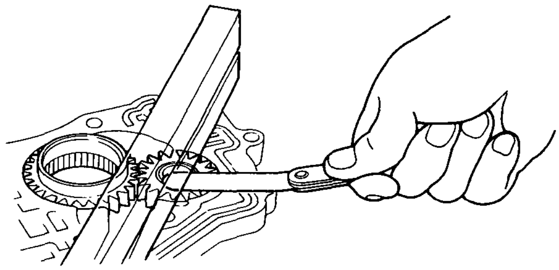
2. Install the oil pump shaft and measure the side clearance of the drive and driven gears.

Pump Gears Side (Radial) Clearance:
Standard (New): Drive gear
0.210–0.265 mm
(0.0083–0.0104 in)
Driven gear
0.07–0.125 mm
(0.0028–0.0049 in)



3. Measure the thrust clearance of the driven gear-to-main valve body.

Drive/Driven Gear thrust (Axial) Clearance:
Standard (New): 0.03–0.05 mm
(0.001–0.002 in)
Service Limit: 0.07 mm (0.0028 in)



Regulator Valve Body

Disassembly/Inspection/Reassembly

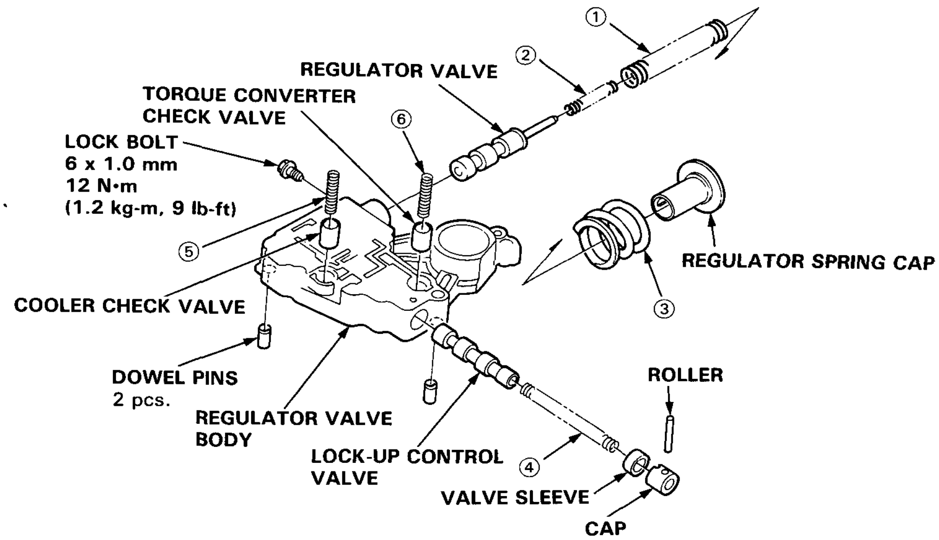
NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- Replace valve body as an assembly if any parts are worn or damaged.
- Check all valves for free movement. If any fail to slide freely, see Valve Body Repair on page 14-225.

1. Hold the regulator spring cap in place while removing the lock bolt. Once the bolt is removed, release the spring cap slowly.

   CAUTION: The regulator spring cap can pop out when the lock bolt is removed.

2. Reassembly is in the reverse of the disassembly.

   NOTE:
   - Coat all parts with ATF.
   - Align the hole in the regulator cap with the hole in the valve body, press the spring cap into the body and tighten the lock bolt.



SPRING SPECIFICATIONS

Unit of length: mm (in)

No.	Spring		Standard (New)			
			Wire Dia.	O.D.	Free Length	No. of Coils
①	Regulator valve spring A	D16Z6/D16A8/ D16A7	1.8 (0.071)	14.7 (0.579)	88.6 (3.488)	16.5
		D15B2	1.8 (0.071)	14.7 (0.579)	86.5 (3.406)	16.5
②	Regulator valve spring B		1.8 (0.071)	9.6 (0.378)	44.0 (1.732)	7.5
③	Stator reaction spring		5.5 (0.217)	*26.4 (1.039)	30.3 (1.193)	2.1
④	Lock-up control valve spring		0.9 (0.035)	6.6 (0.260)	41.0 (1.614)	23.3
⑤	Cooler check valve spring		1.1 (0.043)	8.4 (0.331)	33.8 (1.331)	12.5
⑥	Torque converter check valve spring		1.1 (0.043)	8.4 (0.331)	33.8 (1.331)	12.5

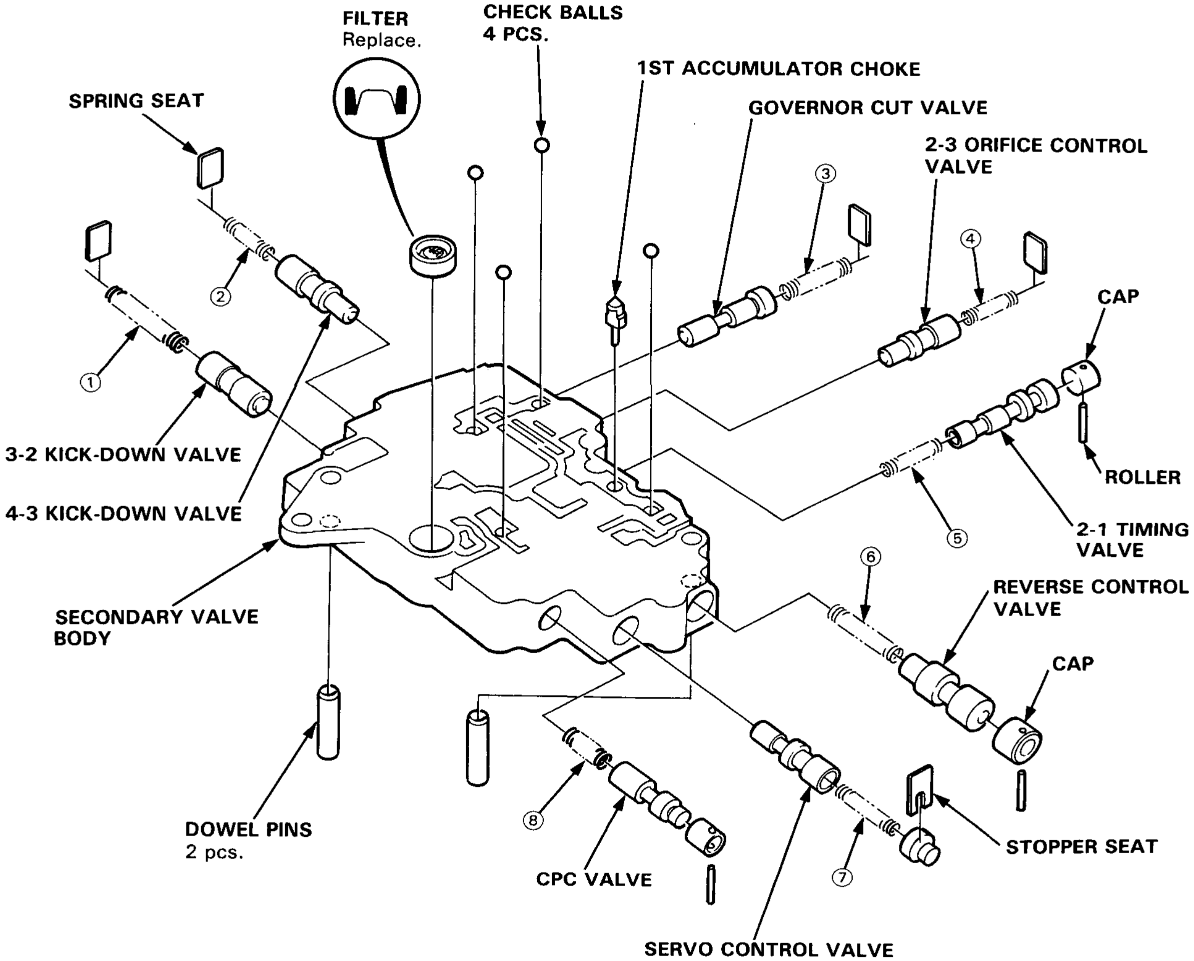
*: Inside Diameter

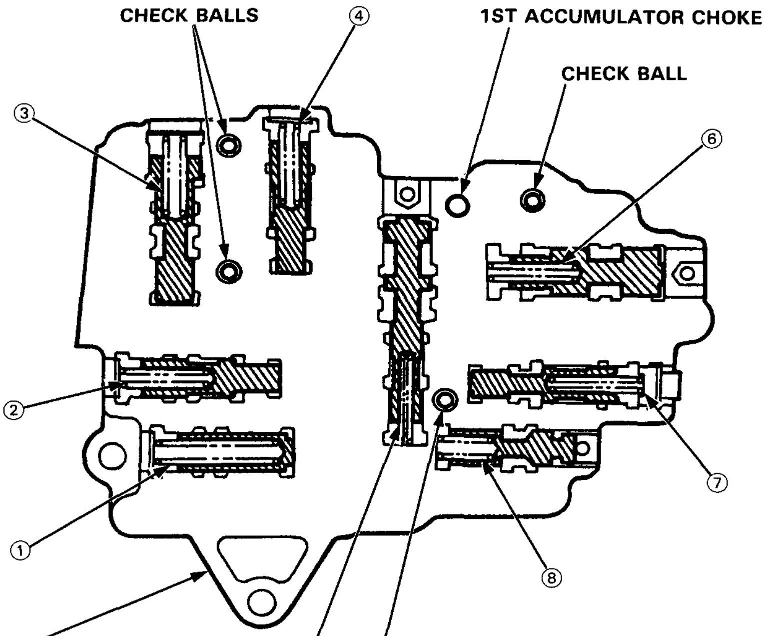
Secondary Valve Body

Disassembly/Inspection/Reassembly

NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- Replace valve body as an assembly if any parts are worn or damaged.
- Check all valves for free movement. If any fail to slide freely, see Valve Body Repair on page 14-225.
- Coat all parts with ATF before reassembly.

CAUTION: Do not use a magnet to remove the check balls; it may magnetize the balls.





SPRING SPECIFICATIONS

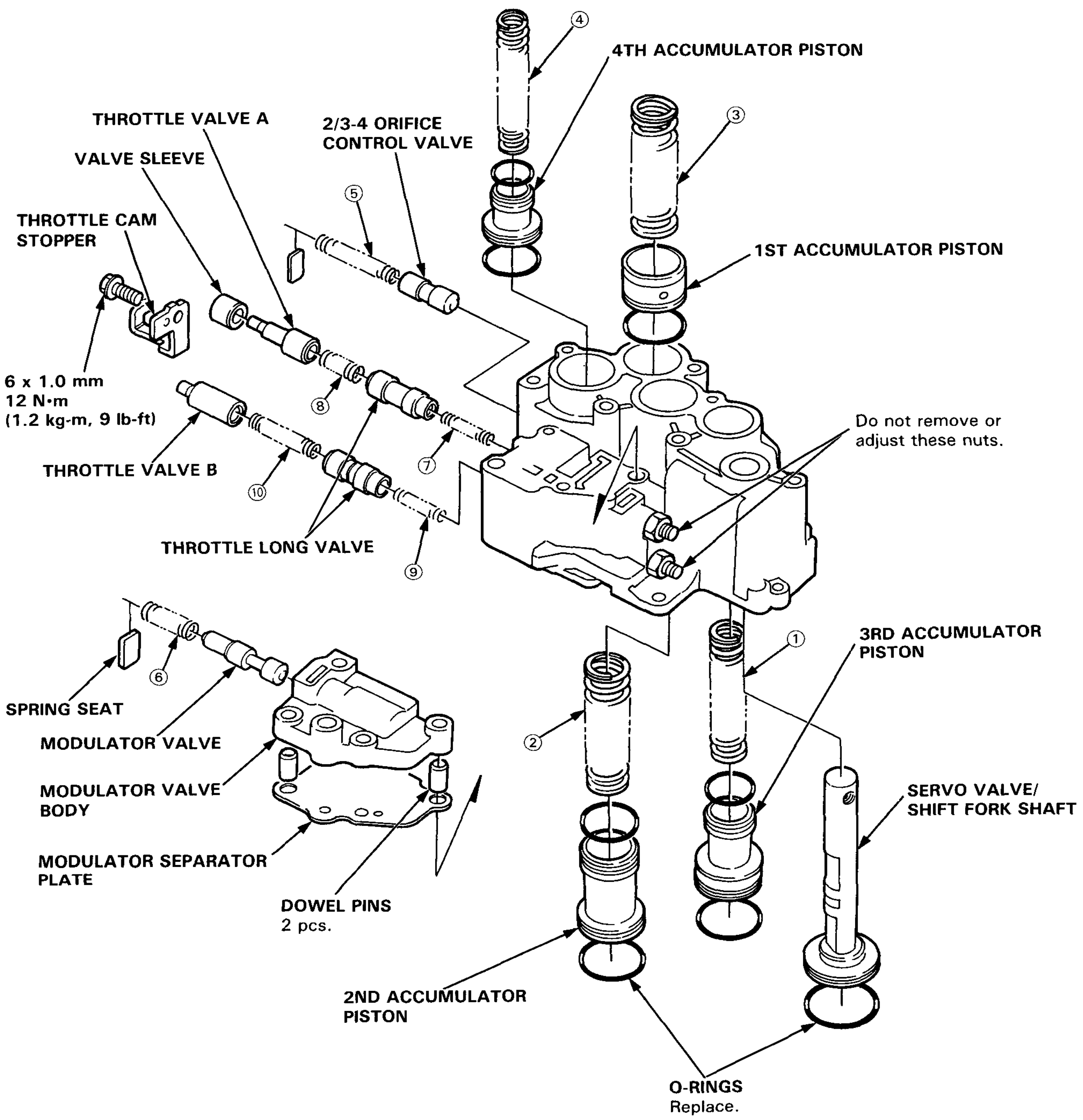
Unit of length: mm (in)

No.	Spring	Standard (New)			
		Wire Dia.	O.D.	Free Length	No. of Coils
①	3-2 kick-down valve spring	1.3 (0.051)	8.6 (0.339)	45.6 (1.795)	17.0
②	4-3 kick-down valve spring	1.0 (0.039)	6.6 (0.260)	29.9 (1.177)	14.7
③	Governor cut valve spring	0.8 (0.031)	7.6 (0.299)	44.5 (1.752)	17.0
④	2-3 orifice control valve spring	0.9 (0.035)	6.6 (0.260)	33.2 (1.307)	14.9
⑤	2-1 timing valve spring	0.7 (0.028)	5.6 (0.220)	33.0 (1.299)	21.7
⑥	Reverse control valve spring	0.7 (0.028)	7.1 (0.280)	40.0 (1.575)	20.8
⑦	Servo control valve spring	0.9 (0.035)	6.4 (0.252)	34.1 (1.343)	17.5
⑧	CPC (Clutch Pressure Control) valve spring	0.9 (0.035)	8.4 (0.331)	24.9 (0.980)	9.8

Servo Body

Disassembly/Inspection/Reassembly

NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- Replace valve body as an assembly if any parts are worn or damaged.
- Coat all parts with ATF before reassembly.
- Replace the O-rings and filters.



SPRING SPECIFICATIONS

Unit of length: mm (in)

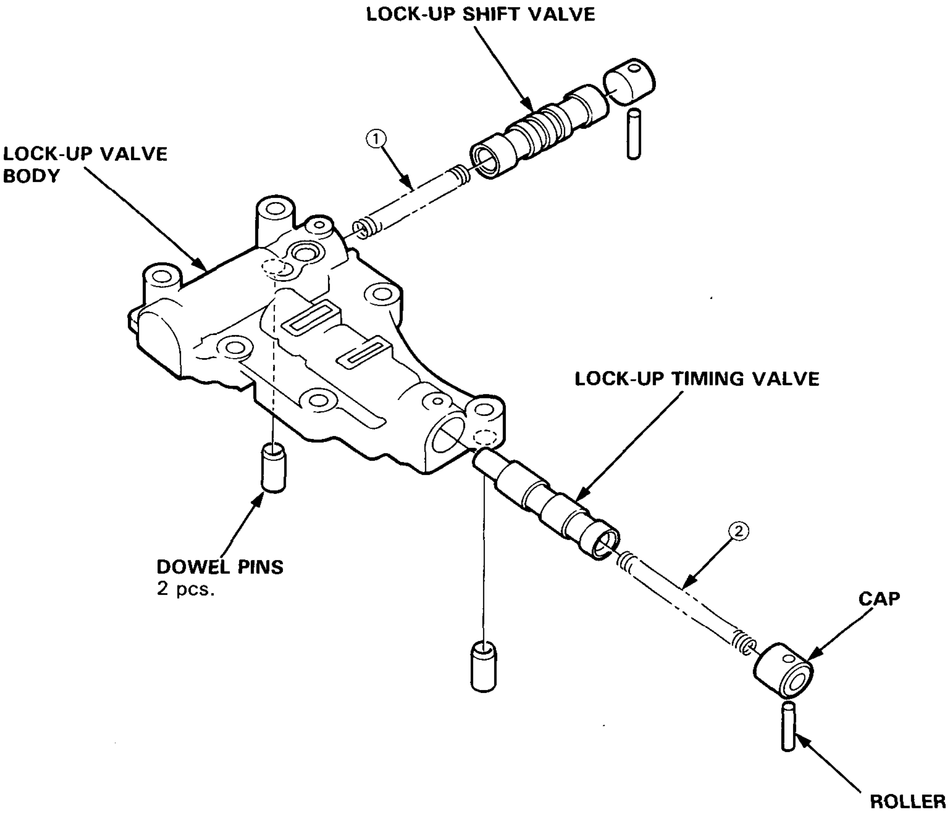
No.	Spring		Standard (New)			
			Wire Dia.	O.D.	Free Length	No. of Coils
①	3rd accumulator spring		2.6 (0.102)	17.5 (0.689)	91.8 (3.614)	15.8
②	2nd accumulator spring		3.5 (0.138)	22.0 (0.866)	75.4 (2.968)	8.7
③	1st accumulator spring		2.6 (0.102)	24.3 (0.957)	79.8 (3.142)	8.5
④	4th accumulator spring		2.6 (0.102)	16.0 (0.630)	89.4 (3.520)	16.2
⑤	2/3-4 orifice control valve spring		1.0 (0.039)	8.6 (0.339)	51.9 (2.043)	19.8
⑥	Modulator valve spring	D16Z6/D16A7/ D15B2	1.2 (0.047)	*7.0 (0.276)	27.2 (1.071)	8.0
		D16A8	1.2 (0.047)	*7.0 (0.276)	27.6 (1.087)	7.7
⑦	Throttle valve A adjusting spring		0.8 (0.031)	6.2 (0.244)	27.0 (1.063)	8.5
⑧	Throttle valve A spring	D16Z6/D16A7 D15B2	1.1 (0.043) 1.0 (0.039) 1.1 (0.043) 1.0 (0.039)	8.5 (0.335) 8.5 (0.335) 8.5 (0.335) 8.5 (0.335)	22.3 (0.878) 22.2 (0.874) 22.3 (0.878) 22.1 (0.870)	8.1 6.0 7.6 5.5
		D16A8	1.0 (0.039) 1.0 (0.039) 1.1 (0.043) 1.0 (0.039)	8.5 (0.335) 8.5 (0.335) 8.5 (0.335) 8.5 (0.335)	22.2 (0.874) 22.1 (0.870) 22.3 (0.878) 22.3 (0.878)	6.0 5.5 8.1 6.2
⑨	Throttle valve B adjusting spring		0.8 (0.031)	6.2 (0.244)	30.0 (1.181)	8.0
⑩	Throttle valve B spring		1.4 (1.653) 1.4 (1.653) 1.4 (1.653)	8.5 (0.335) 8.5 (0.335) 8.5 (0.335)	41.5 (1.634) 41.5 (1.634) 41.6 (1.638)	10.5 11.2 12.4

*: Inside diameter

Lock-up Valve Body

Disassembly/Inspection/Reassembly

NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- Replace valve body as an assembly if any parts are worn or damaged.
- Check all valves for free movement. If any fail to slide freely, see Valve Body Repair on page 14-225.
- Coat all parts with ATF before reassembly.



SPRING SPECIFICATIONS

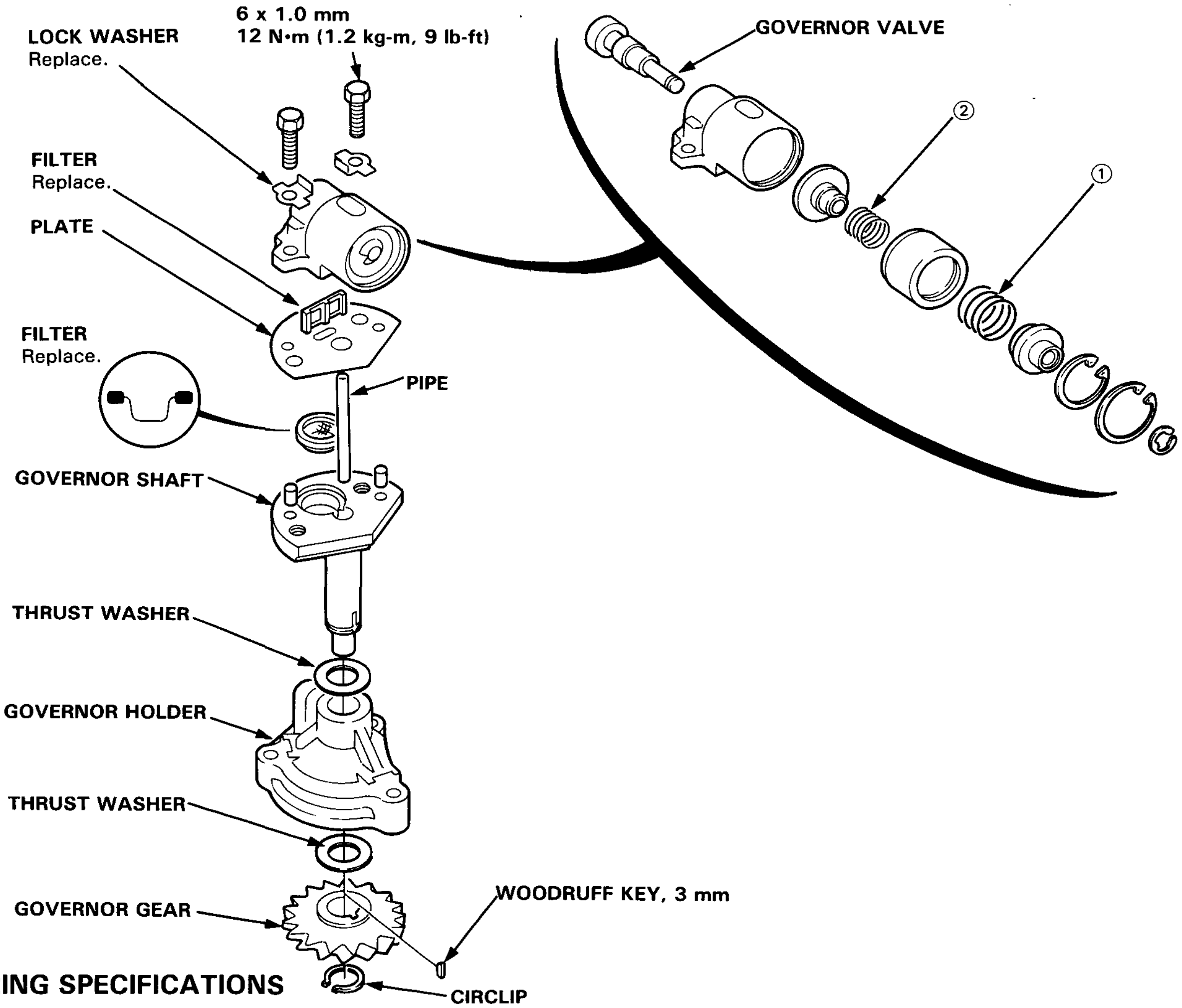
Unit of length: mm (in)

No.	Spring		Standard (New)			
			Wire Dia.	O.D.	Free Length	No. of Coils
①	Lock-up shift valve spring		0.9 (0.035)	7.6 (0.299)	73.7 (2.902)	32.0
②	Lock-up timing valve spring	D16Z6/D16Z7/ D15B2	0.8 (0.031)	6.6 (0.260)	61.5 (2.421)	27.6
		D16A8	0.7 (0.028)	6.6 (0.260)	64.3 (2.531)	22.4

Governor Body

Disassembly/Inspection/Reassembly

NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- Check that the governor works smoothly; replace it if it does not.
- Coat all parts with ATF before reassembly.



SPRING SPECIFICATIONS

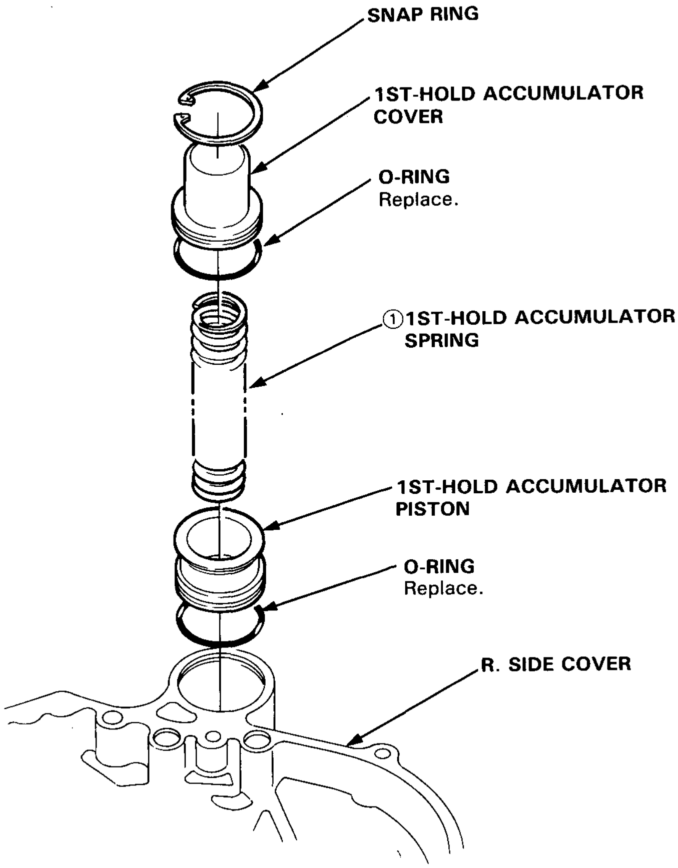
Unit of length: mm (in)

No.	Spring		Standard (New)			
			Wire Dia.	O.D.	Free Length	No. of Coils
①	Governor spring A	D16Z6/D16A7/ D15B2	1.0 (0.039)	18.8 (0.740)	32.9 (1.295)	4.1
		D16A8	1.0 (0.039)	18.8 (0.740)	18.0 (0.709)	4.0
②	Governor spring B	D16Z6/D16A7/ D15B2	0.9 (0.035) 0.9 (0.035)	11.8 (0.465) 11.8 (0.465)	27.8 (1.094) 29.1 (1.146)	6.0 6.0
		D16A8	0.8 (0.031) 0.8 (0.031) 0.8 (0.031)	11.8 (0.465) 11.8 (0.465) 11.8 (0.465)	30.0 (1.181) 34.4 (1.354) 30.9 (1.217)	6.3 6.3 6.0

1st-hold Accumulator/R. Side Cover

Disassembly/Inspection/Reassembly

NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- Coat all parts with ATF before reassembly.



SPRING SPECIFICATIONS

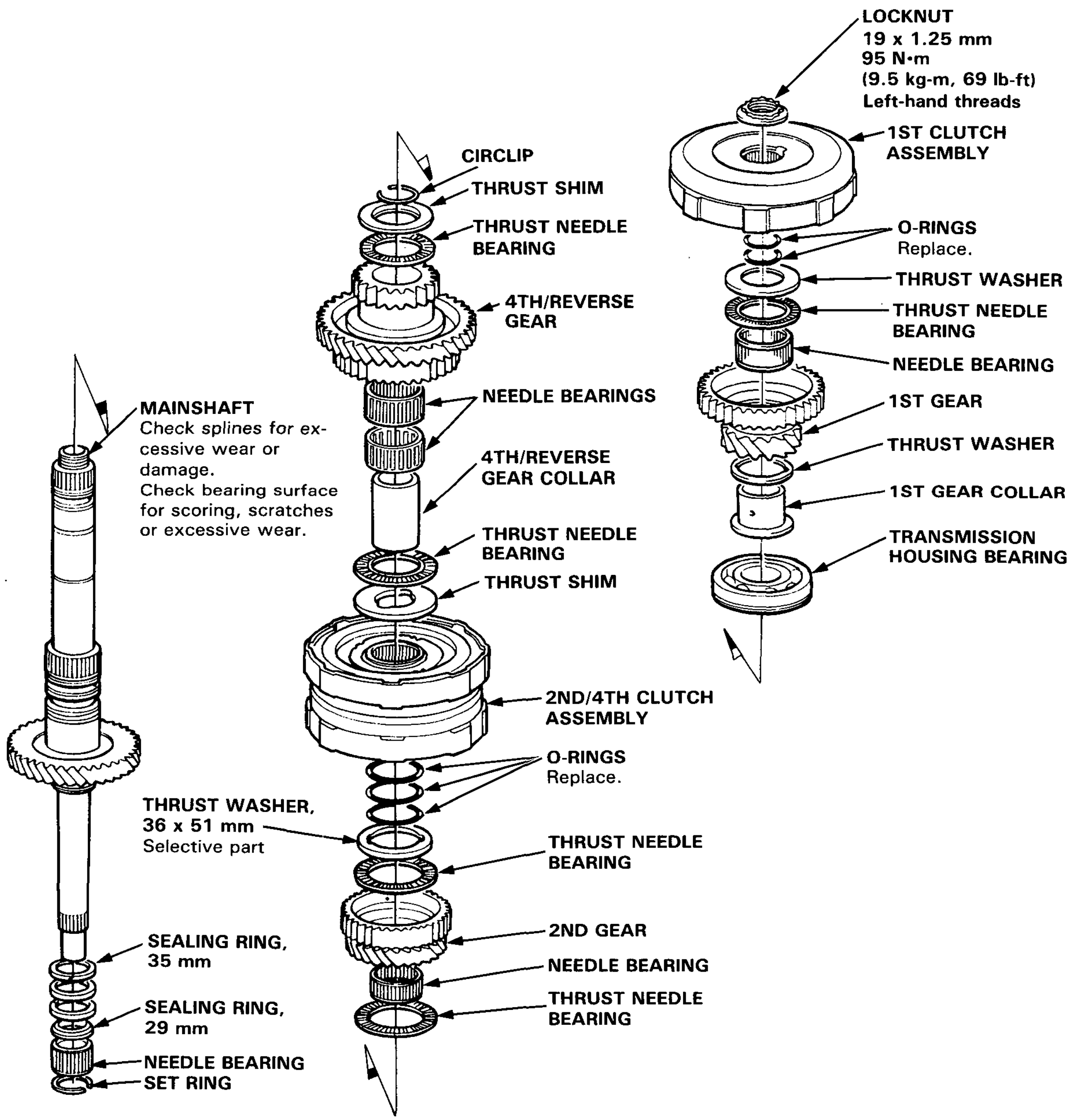
Unit of length: mm (in)

No.	Spring	Standard (New)			
		Wire Dia.	O.D.	Free Length	No. of Coils
①	1st-hold accumulator spring	4.0 (0.157)	21.5 (0.846)	71.7 (2.823)	8.3

Mainshaft

Disassembly/Inspection/Reassembly

NOTE:
- Lubricate all parts with ATF during reassembly.
- Install thrust needle bearings with unrolled edge of bearing retainer facing washer.
- Inspect thrust needle and needle bearings for galling and rough movement.
- Before installing the O-rings, wrap the shaft splines with tape to prevent damaging the O-rings.
- Locknut has left-hand threads.



Mainshaft

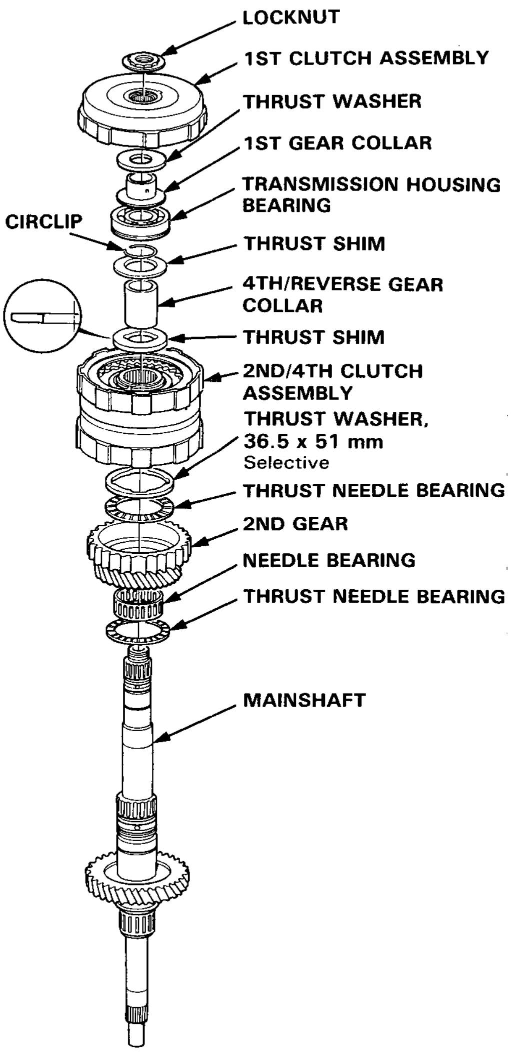
Inspection

- Clearance Measurement

  NOTE: Lubricate all parts with ATF during assembly.

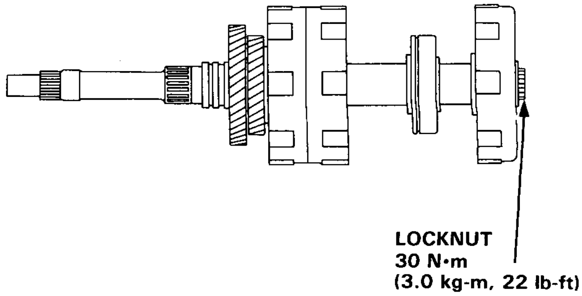
1. Remove the mainshaft bearing from the transmission housing (see page 14-259).
2. Assemble the parts below on the mainshaft.

   NOTE: Do not assemble the O-rings while inspecting.



3. Torque the mainshaft locknut to 30 N•m (3.0 kg-m, 22 lb-ft).

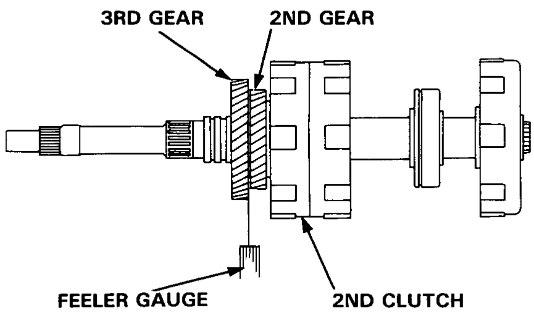
   NOTE: Mainshaft locknut has left-hand threads.

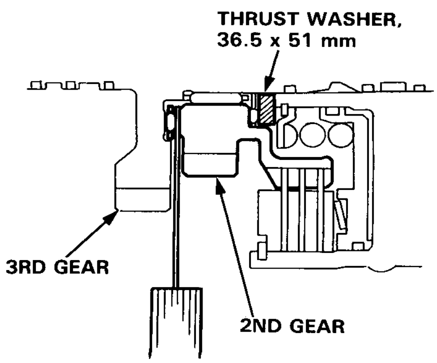


4. Hold the 2nd gear against the 2nd clutch. Measure the clearance between the 2nd gear and the 3rd gear with a feeler gauge.

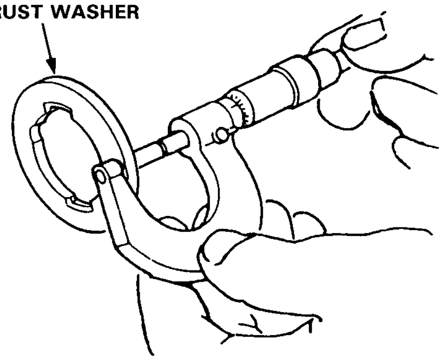
   NOTE: Take measurements in at least three places and take the average as the actual clearance.

   STANDARD: 0.05–0.13 mm (0.002–0.005 in)





5. If the clearance is out of tolerance, remove the thrust washer and measure the thickness.



6. Select and install a new washer then recheck.

THRUST WASHER 36.5 x 51 mm

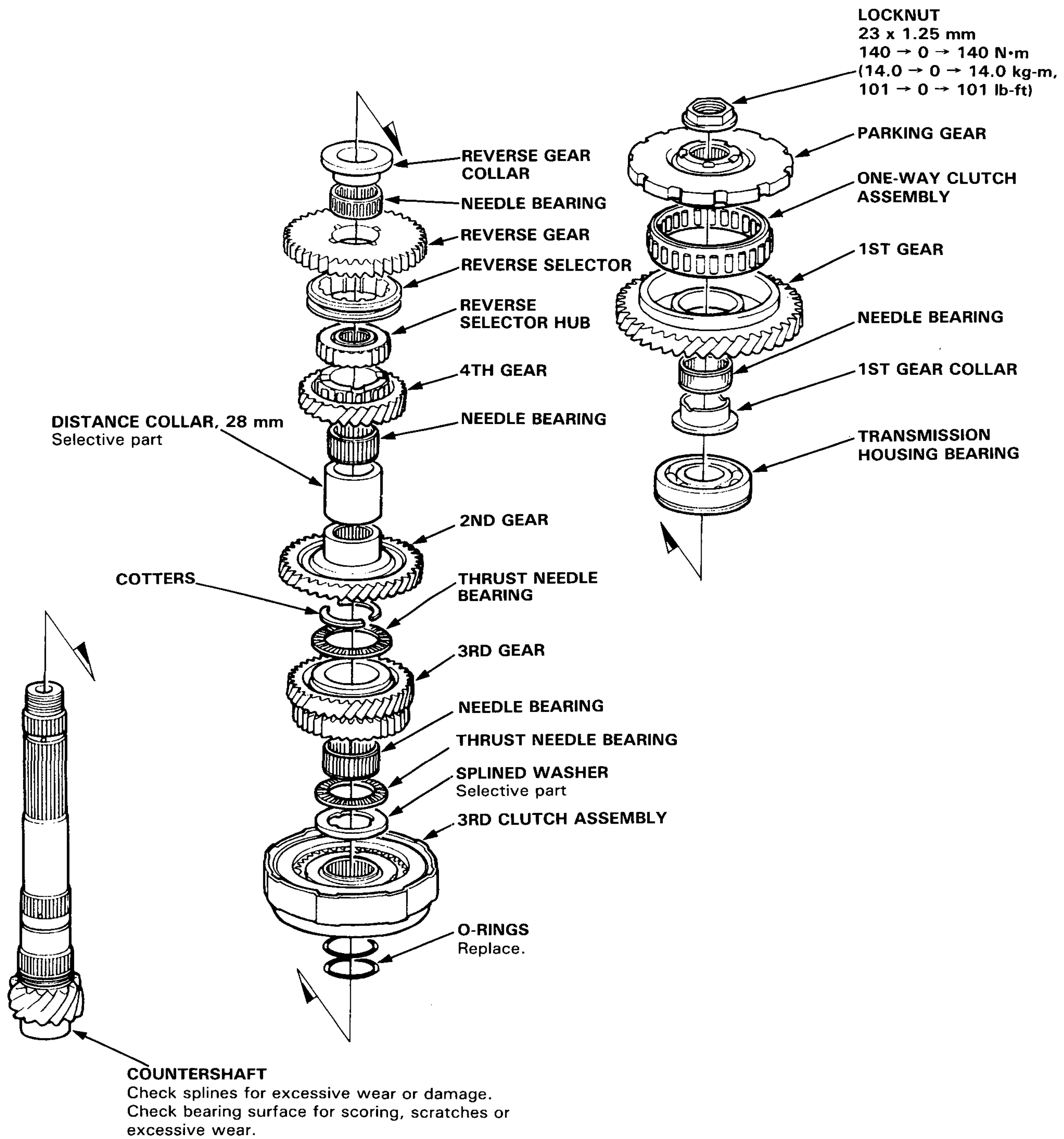
No.	Part Number	Thickness
1	90441-PC9-010	3.50 mm (0.138 in)
2	90442-PC9-010	3.55 mm (0.140 in)
3	90443-PC9-010	3.60 mm (0.142 in)
4	90444-PC9-010	3.65 mm (0.144 in!
5	90445-PC9-010	3.70 mm (0.146 in)
6	90446-PC9-010	3.75 mm (0.148 in)
7	90447-PC9-010	3.80 mm (0.150 in)
8	90448-PC9-010	3.85 mm (0.152 in)
9	90449-PC9-010	3.90 mm (0.154 in)

7. After replacing the thrust wa3her, make sure the clearance is within tolerance.

Countershaft

Disassembly/Inspection/Reassembly

NOTE:
- Lubricate all parts with ATF before reassembly.
- Install thrust needle bearings with unrolled edge of bearing retainer facing washer.
- Inspect thrust needle and needle bearings for galling and rough movement.
- Before installing the O-rings, wrap the shaft splines with tape to prevent damaging the O-rings.



Inspection

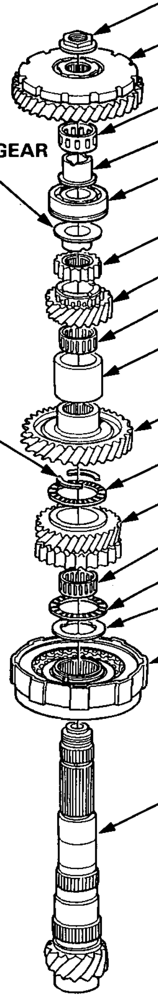
- Clearance Measurement

NOTE: Lubricate all parts with ATF during assembly.

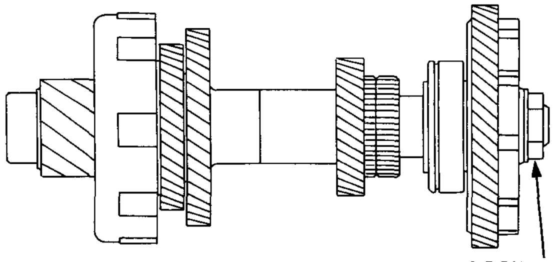
1. Remove the countershaft bearing from the transmission housing (see page 14-259).

2. Assemble the parts below on the countershaft.

   NOTE: Do not assemble the O-rings while *inspecting.*



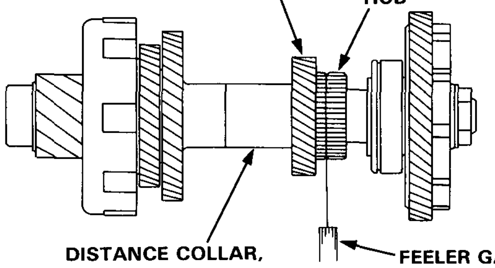
3. *Torque the countershaft locknut to 30 N•m (3.0 kg-m, 22 lb-ft).*

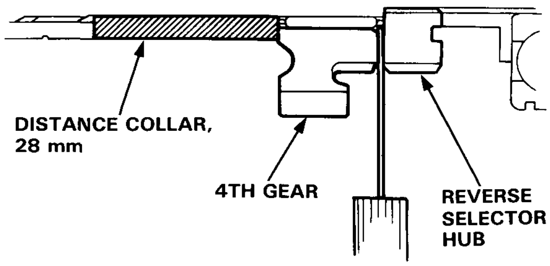


4. Measure the clearance between the 4th gear and the reverse selector hub with a feeler gauge.

   NOTE: Take measurements in at least three places and take the average as the actual clearance.

   STANDARD: 0.05–0.13 mm (0.002–0.005 in)





(cont'd)

Inspection (cont'd)

5. Measure the clearance between the 3rd gear and 2nd gear with a feeler gauge, with the feeler gauge from step 4 between the 4th gear and reverse selector hub.

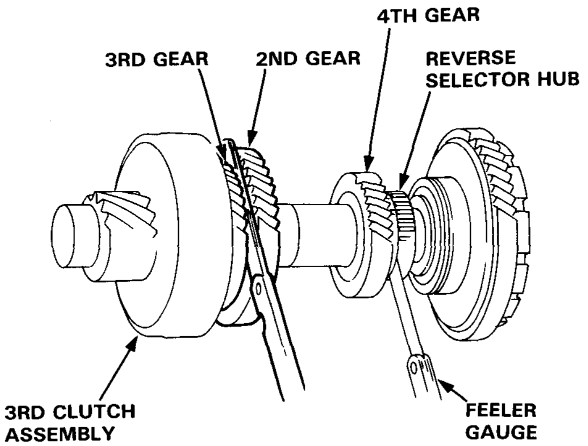
   —1. Measure the clearance with the 3rd gear pushed towards the 3rd clutch.

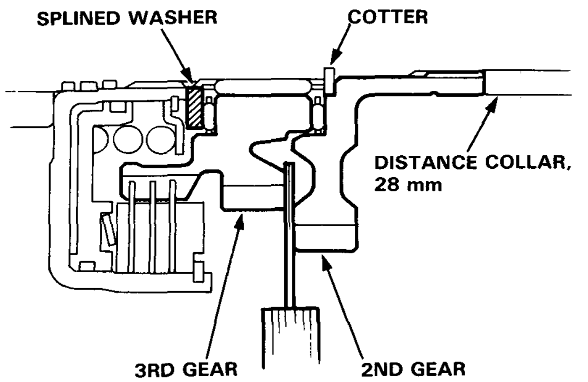
   —2. Measure the clearance with the 3rd gear pushed towards the 2nd gear.

   NOTE: Take measurements in at least three places and take the average as the actual clearance.

   —3. Subtract the measurements of step —2. from step —3., and you have the clearance between the 3rd gear and 2nd gear.

   STANDARD: 0.05—0.13 mm (0.002—0.005 in)





6. If the clearance is out of tolerance, remove the splined washer and/or distance collar and measure the thickness and/or the width.

7. Select and install a new distance collar then recheck.

DISTANCE COLLAR 28 mm

No.	Part Number	Thickness
1	90503-PC9-000	39.00 mm (1.535 in)
2	90504-PC9-000	39.10 mm (1.539 in)
3	90505-PC9-000	39.20 mm (1.543 in)
4	90507-PC9-000	39.30 mm (1.547 in)
5	90508-PC9-000	39.05 mm (1.537 in)
6	90509-PC9-000	39.15 mm (1.541 in)
7	90510-PC9-000	39.25 mm (1.545 in)
8	90511-PC9-000	38.90 mm (1.531 in)
9	90512-PC9-000	38.95 mm (1.533 in)

8. After replacing the distance collar, make sure the clearance is within tolerance.

9. Select and install a new splined washer then recheck.

SPLINED WASHER 35 x 52 mm

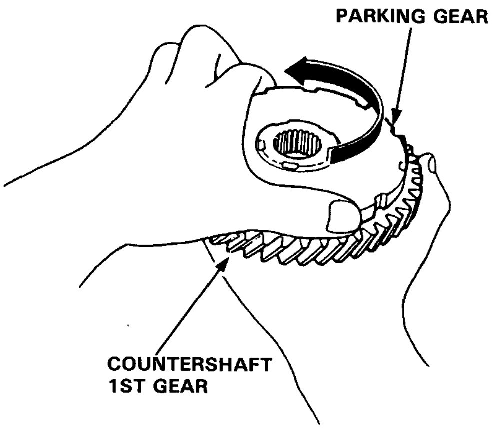
No.	Part Number	Thickness
1	90411-PF4-000	3.00 mm (0.118 in)
2	90412-PF4-000	3.05 mm (0.120 in)
3	90413-PF4-000	3.10 mm (0.122 in)
4	90414-PF4-000	3.15 mm (0.124 in)
5	90415-PF4-000	3.20 mm (0.126 in)
6	90416-PF4-000	3.25 mm (0.128 in)
7	90417-PF4-000	3.30 mm (0.130 in)
8	90418-PF4-000	3.35 mm (0.132 in)
9	90419-PF4-000	3.40 mm (0.134 in)
10	90411-P24-J00	3.45 mm (0.136 in)
11	90412-P24-J00	3.50 mm (0.138 in)

10. After replacing the splined washer, make sure the clearance is within tolerance.

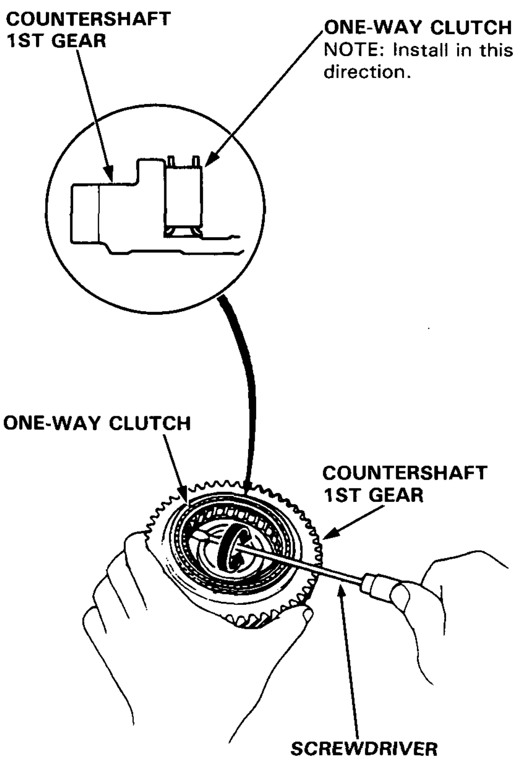
One-Way Clutch/Parking Gear

Disassembly and Inspection

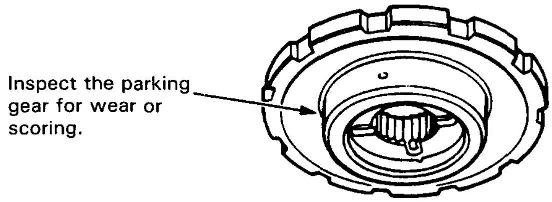
1. Separate the countershaft 1st gear from the parking gear by turning the parking gear in the direction shown.

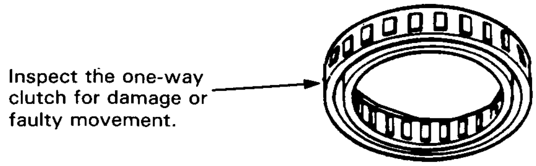


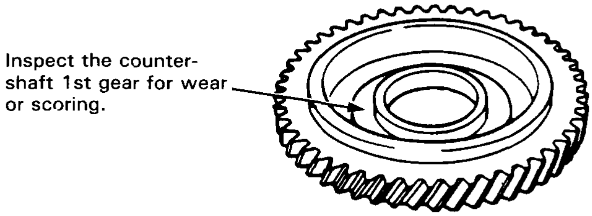
2. Remove the one-way clutch by prying it up with the end of a screwdriver.



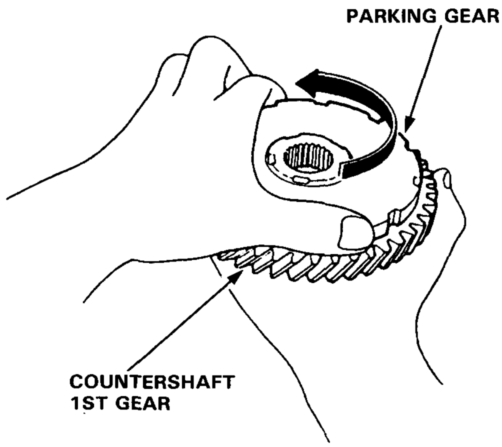
Inspect the parts as follows:







3. After the parts are assembled, hold the countershaft 1st gear and turn the parking gear in direction shown to be sure it turns freely.



Sub-shaft

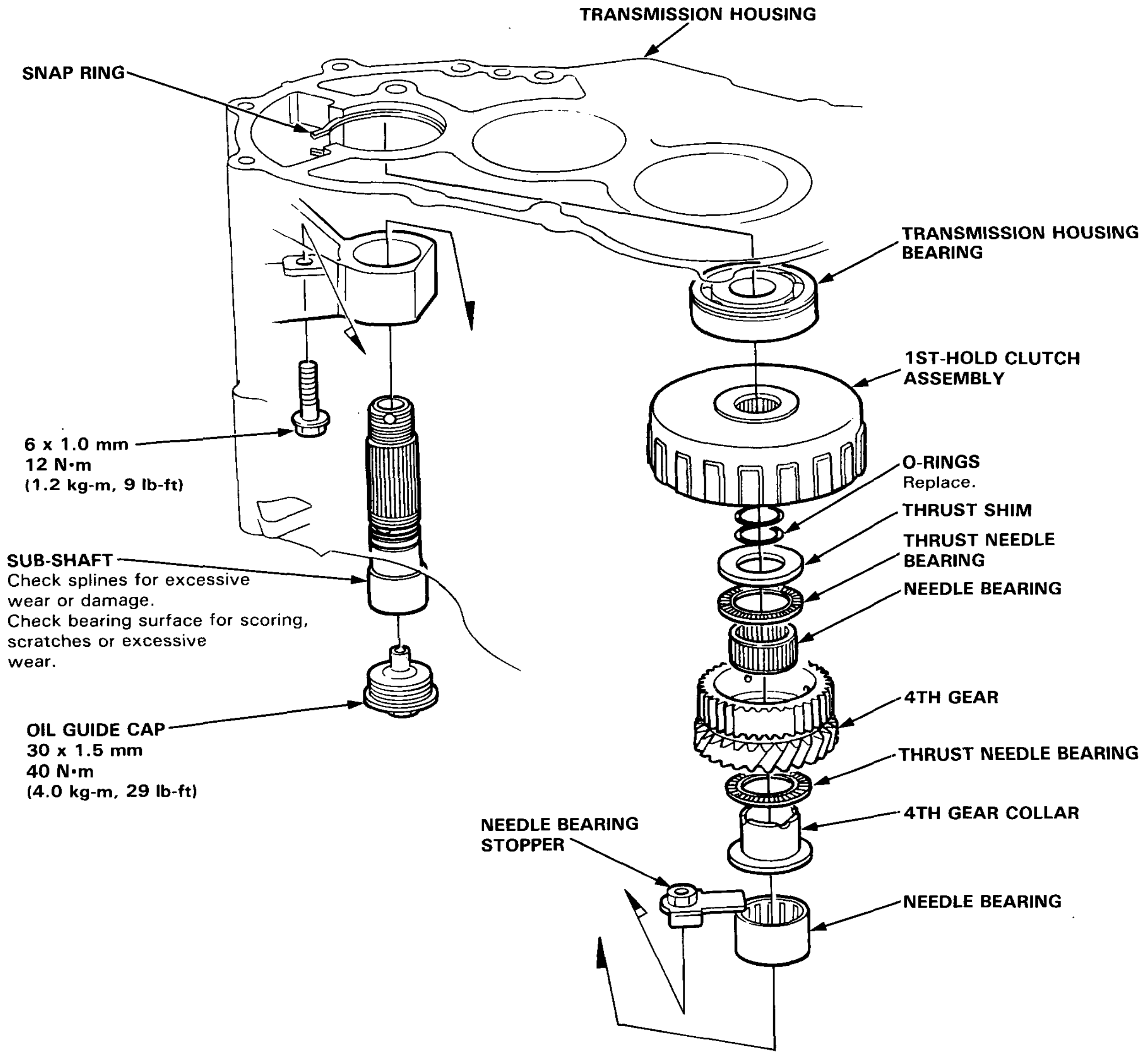
Disassembly/Inspection/Reassembly

NOTE:
- Lubricate all parts with ATF before reassembly.
- Install thrust needle bearings with unrolled edge of bearing retainer facing washer.
- Inspect thrust needle and needle bearings for galling and rough movement.
- Before installing the O-rings, wrap the shaft splines with tape to prevent damaging the O-rings.

1. Remove the oil guide cap.

2. Remove the sub-shaft, 1st-hold clutch assembly and 4th gear assembly.

3. Assemble the sub-shaft in the reverse order of removal.

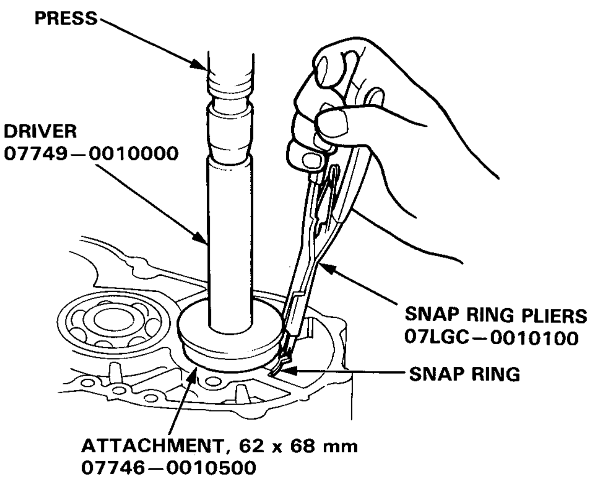


Sub-shaft Bearings

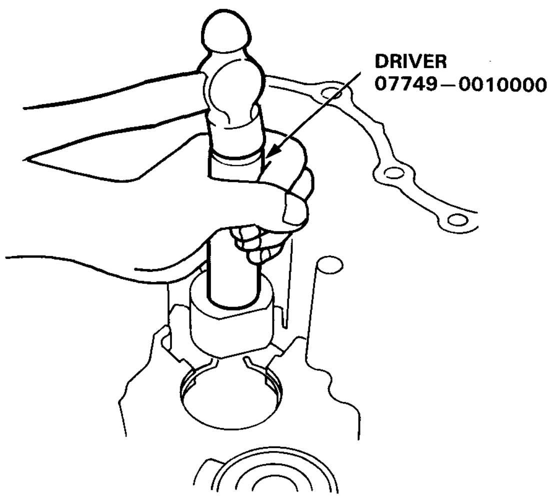
Replacement

NOTE: Lubricate all parts with ATF before reassembly.

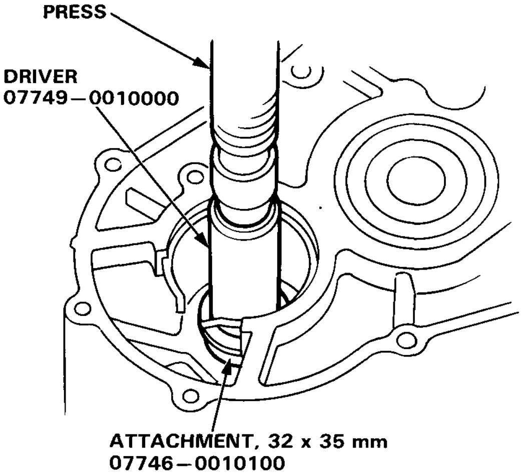
1. To remove the sub-shaft ball bearing from the transmission housing, expand the snap ring with snap ring pliers, then push the bearing out using the special tool and a press as shown.



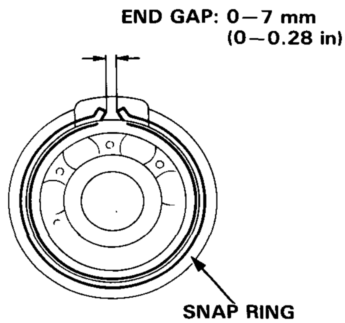
2. Remove the needle bearing stopper.
3. Remove the needle bearing from the transmission housing using the special tool.



4. Install the new needle bearing in the transmission housing using the special tools and a press as shown.



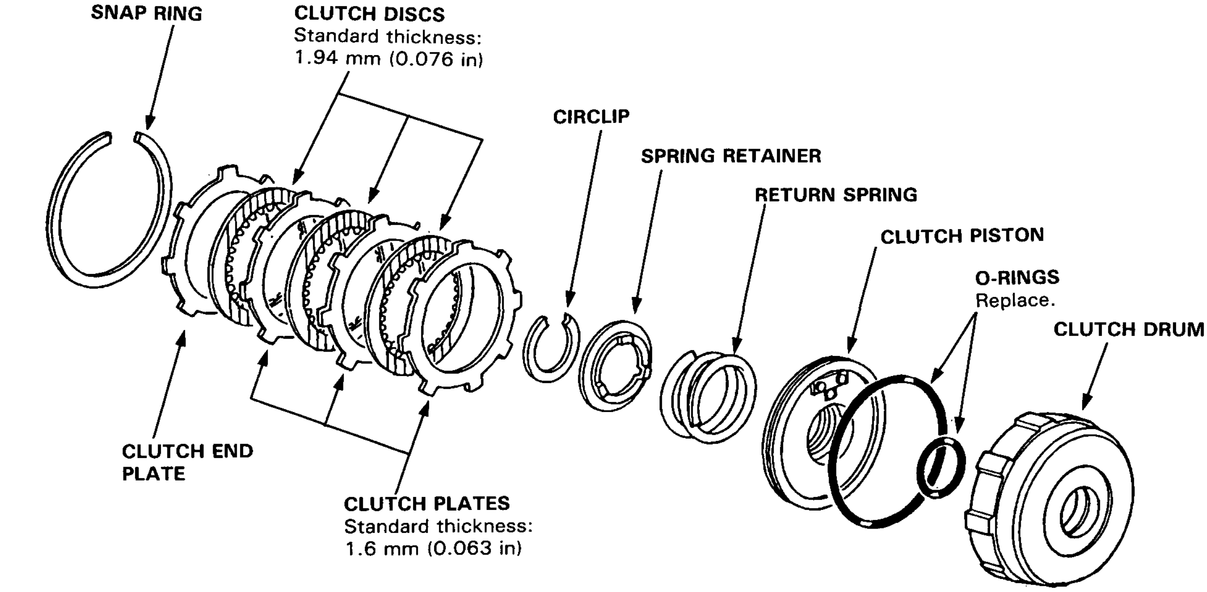
5. Expand the snap ring with snap ring pliers, then insert the ball bearing part-way into the housing using the special tool and a press as described on step 1. Install the bearing with the groove facing outside the housing.
6. Release the pliers, then push the bearing down into the housing until the snap ring snaps in place around it.
7. After installing the ball bearing verify the following:
   - The snap ring is seated in the bearing and housing grooves.
   - The snap ring operates.
   - The ring end gap is correct.



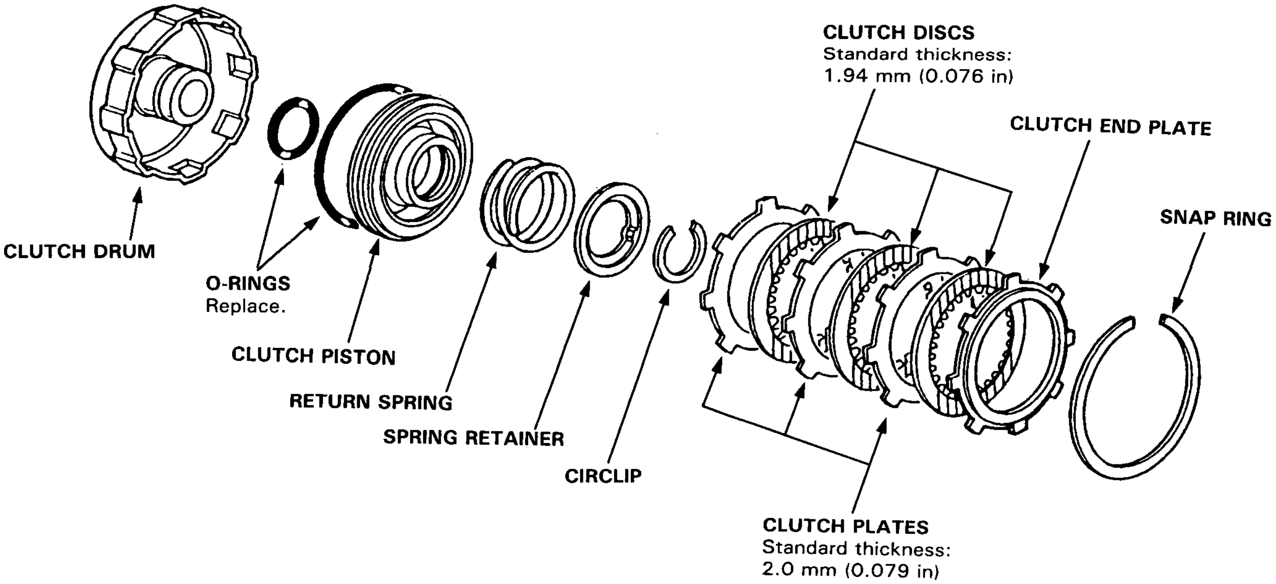
Clutch

Illustrated Index

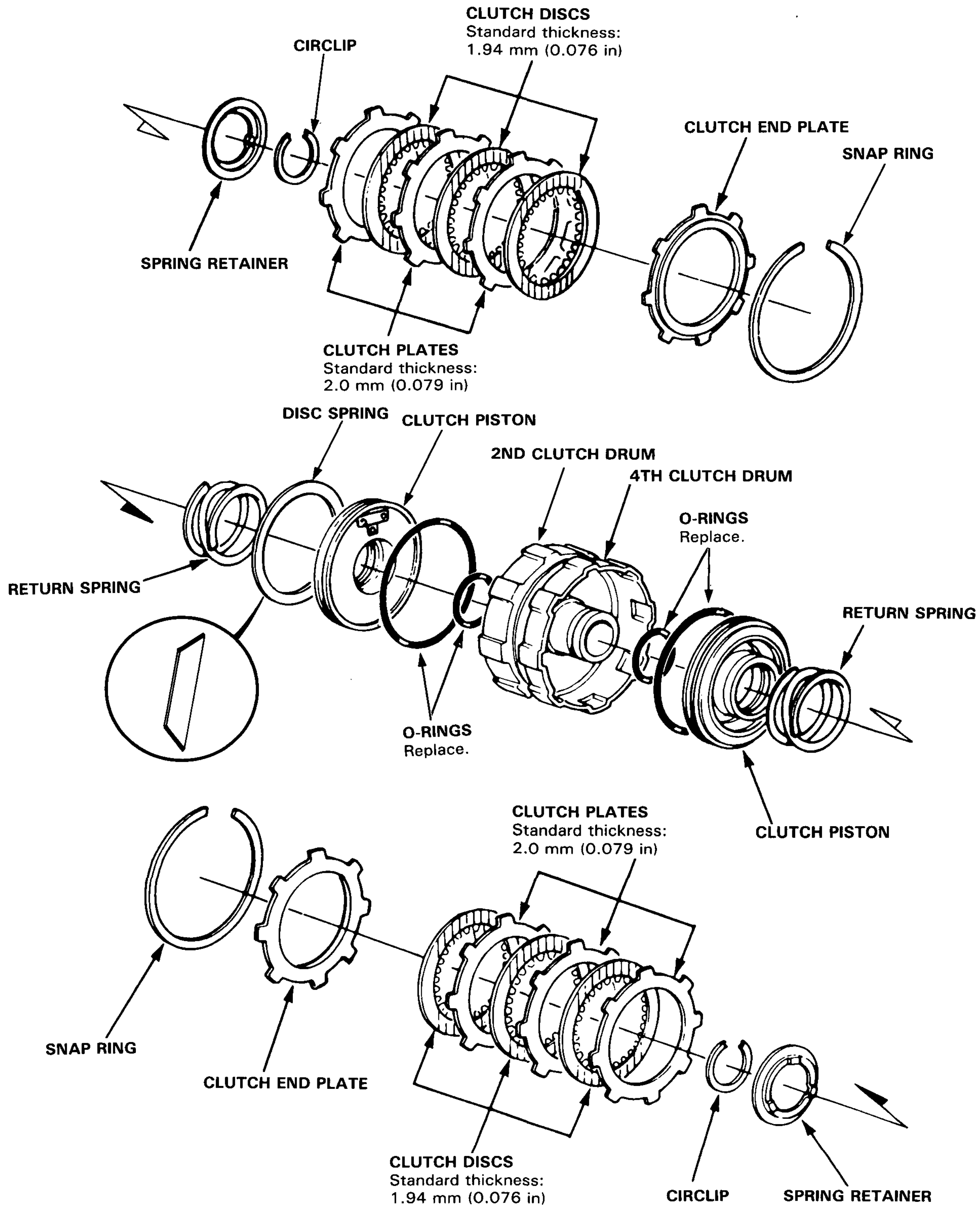
1ST CLUTCH



3RD CLUTCH



2ND/4TH CLUTCH



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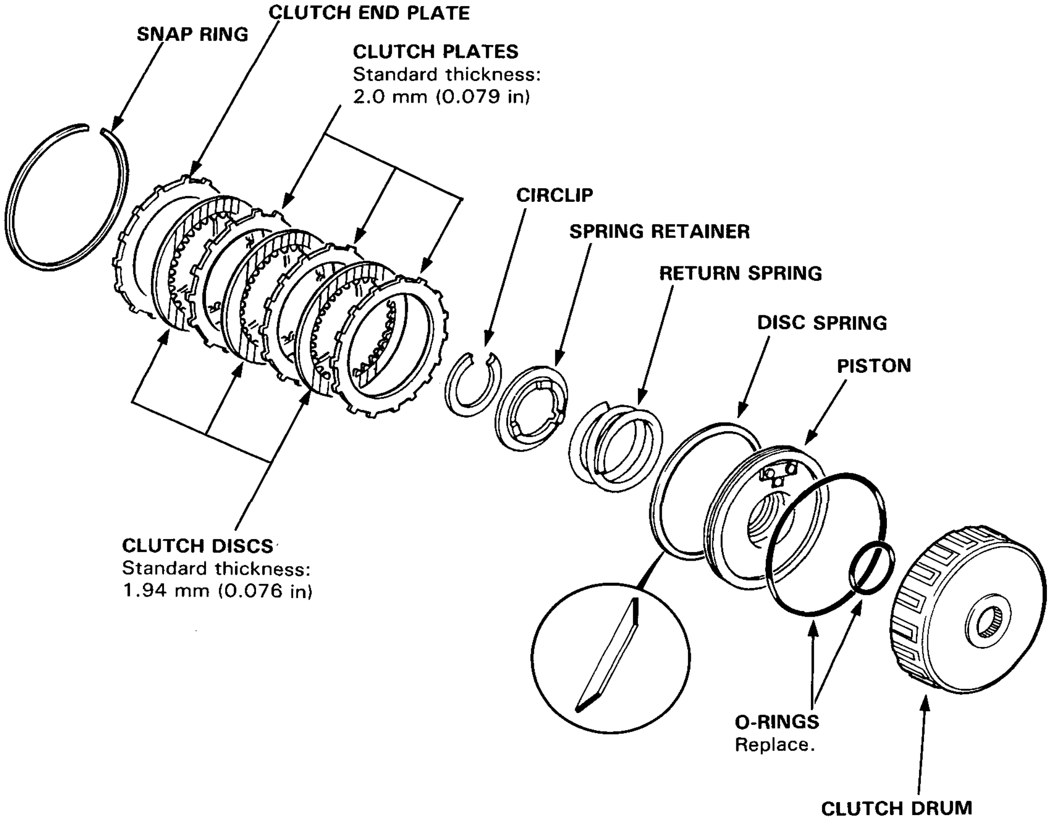
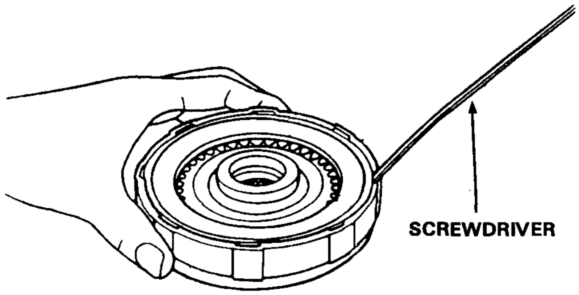
Illustrated Index (cont'd)

1ST-HOLD CLUTCH



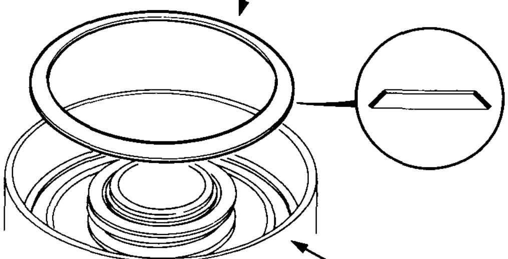
Disassembly

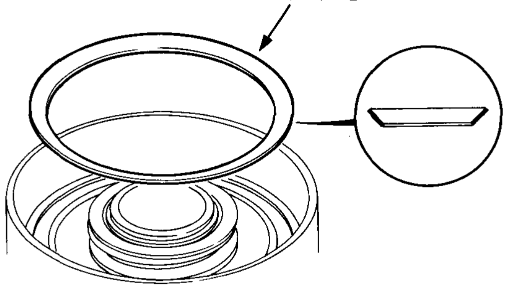
1. Remove the snap rings, then remove the clutch end plate, clutch discs and plates.



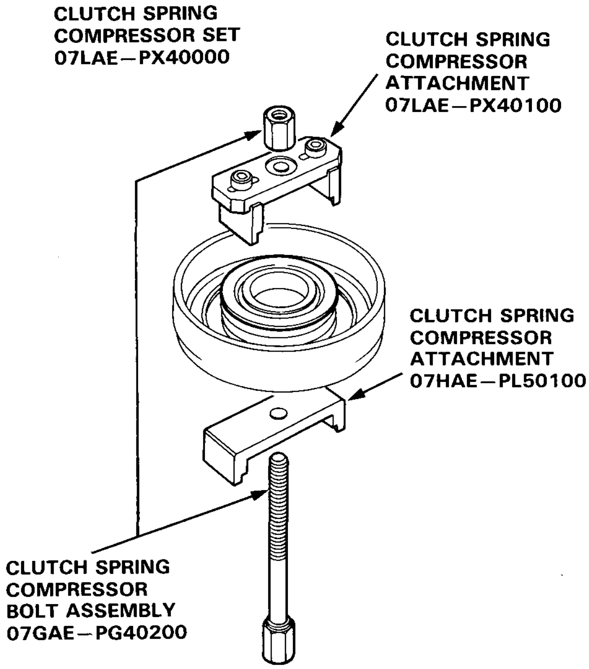
2. Remove the disc spring.

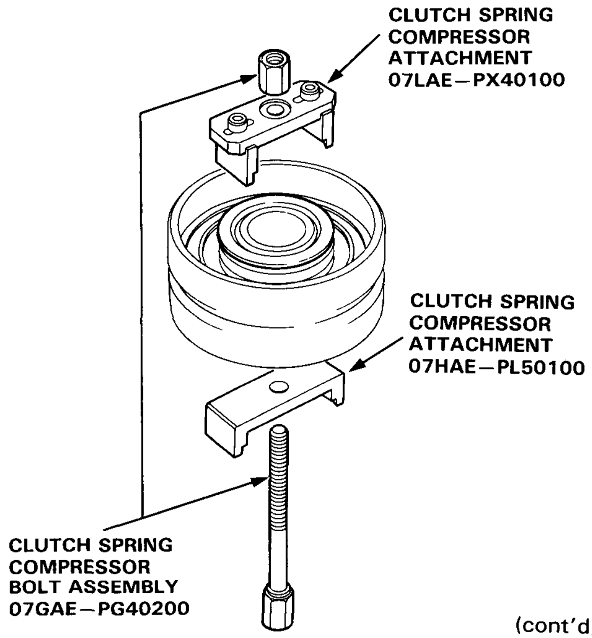
NOTE: For 1st-hold, and 2nd clutches





3. Install the special tools as shown.

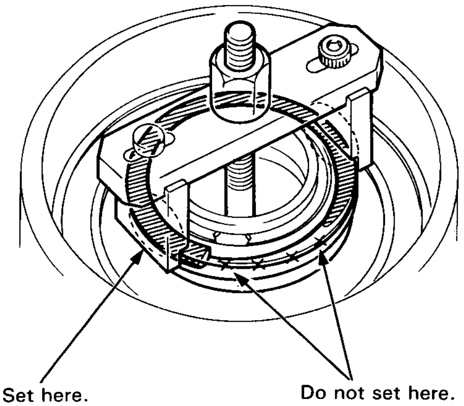




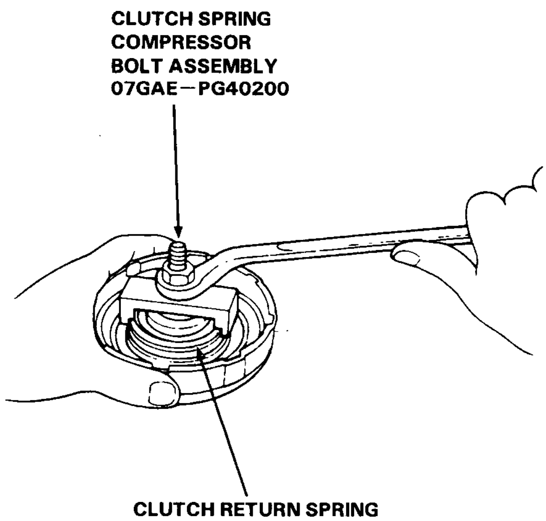
(cont'd)

Disassembly (cont'd)

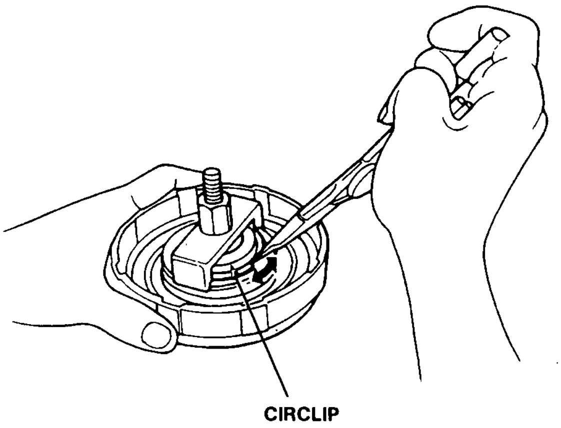
CAUTION: If either end of the compressor attachment is set over an area of the spring retainer which is unsupported by the return spring, the retainer may be damaged.



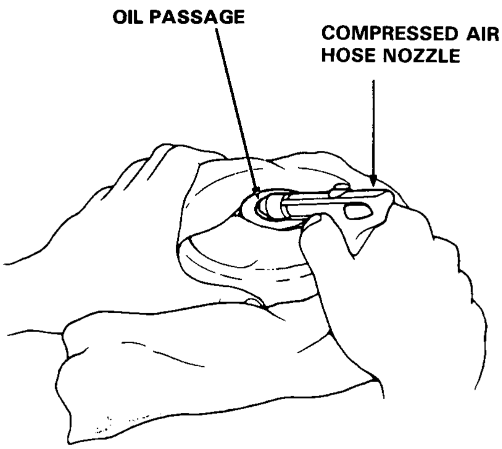
4. Compress the clutch return spring.



5. Remove the circlip. Then remove the special tools, spring retainer and return spring.



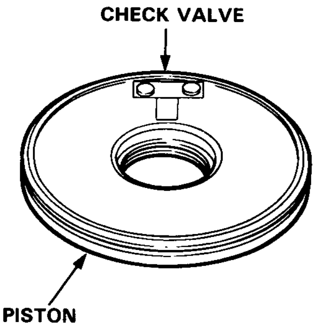
6. Wrap a shop towel around the clutch drum and apply air pressure to the oil passage to remove the piston. Place a finger tip on the other end while applying air pressure.



Reassembly

NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner, and dry with compressed air.
- Blow out all passages.
- Lubricate all parts with ATF before reassembly.

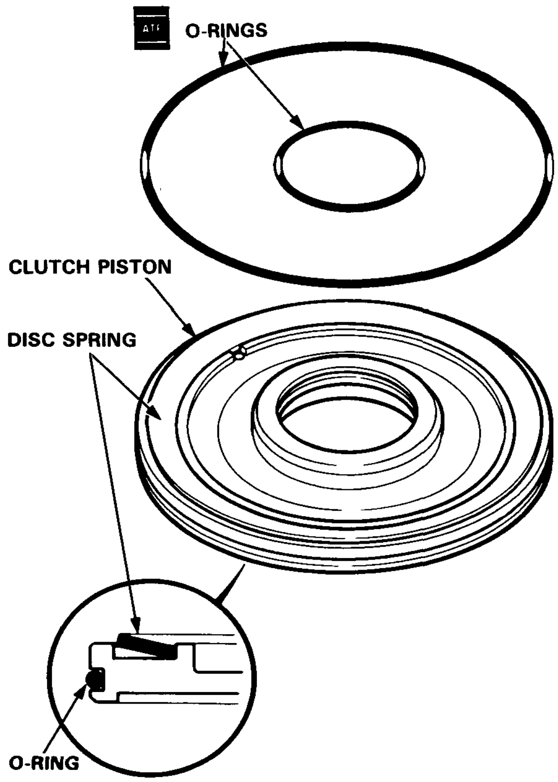
1. Inspect for a loose check valve.



2. Install a new O-ring on the clutch piston.

3. Be sure that the disc spring is securely staked.

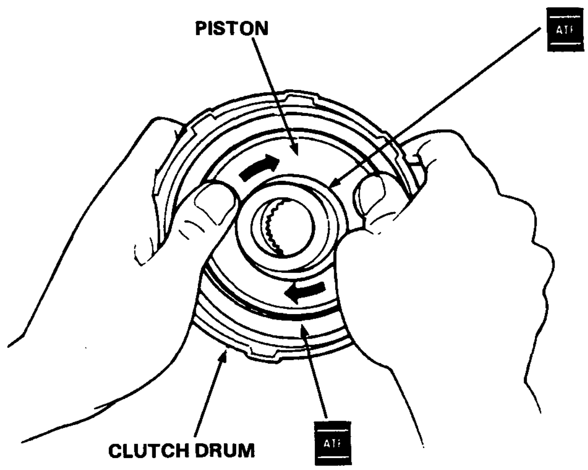
   NOTE: For 1st, 3rd and 4th clutches.



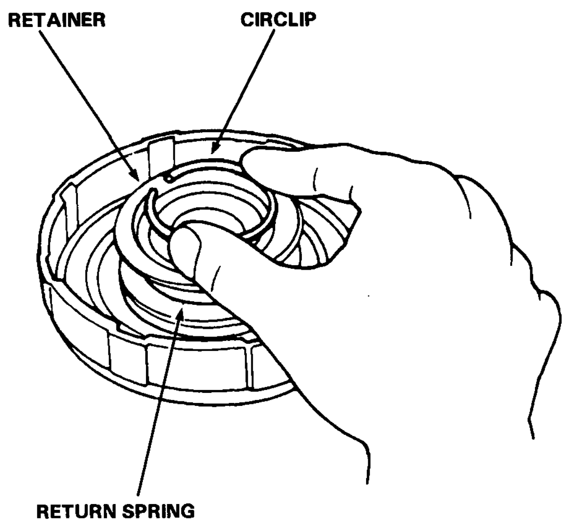
4. Install the piston in the clutch drum. Apply pressure and rotate to ensure proper seating.

   NOTE: Lubricate the piston O-ring with ATF before installing.

   CAUTION: Do not pinch O-ring by installing the piston with force.



5. Install the return spring and spring retainer and position the circlip on the retainer.



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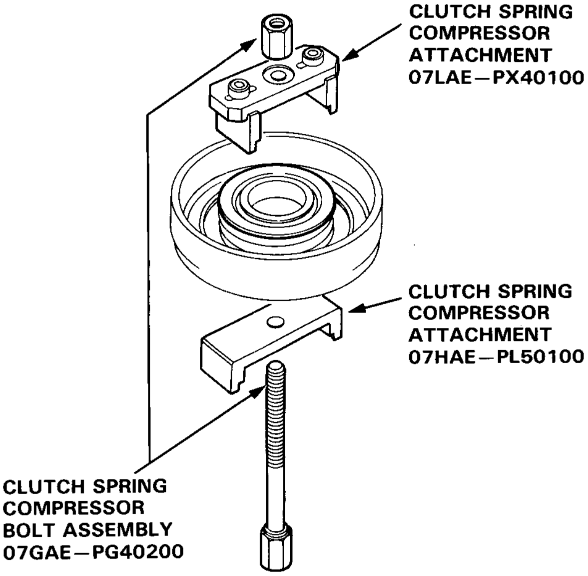
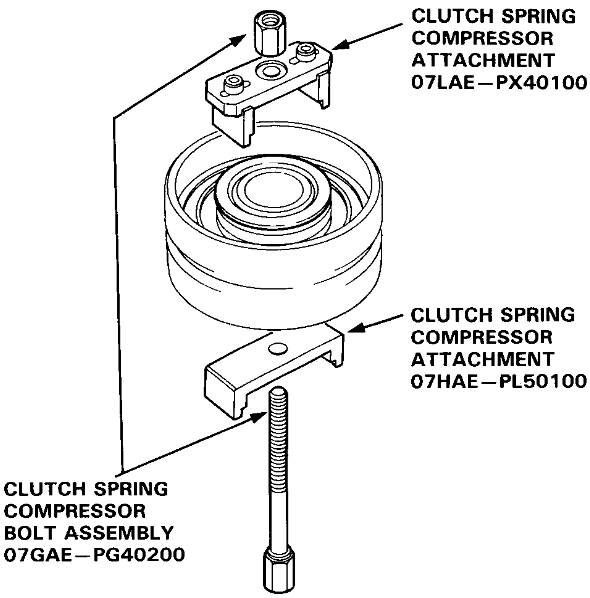
Reassembly (cont'd)

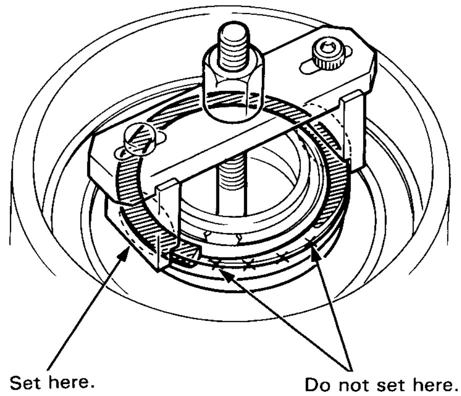
6. Install the special tools as shown.

CLUTCH SPRING
COMPRESSOR SET
07LAE–PX40000

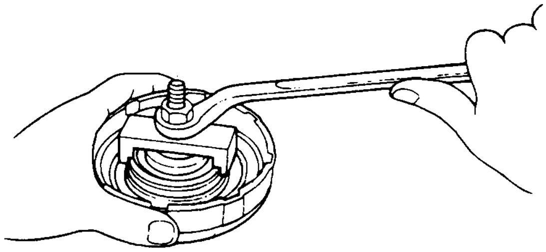




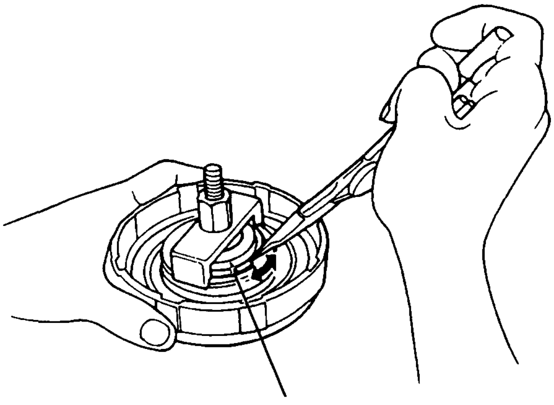
CAUTION: If either end of the compressor attachment is set over an area of the spring retainer which is unsupported by the retainer spring, the retainer may be damaged.



7. Compress the clutch return spring.



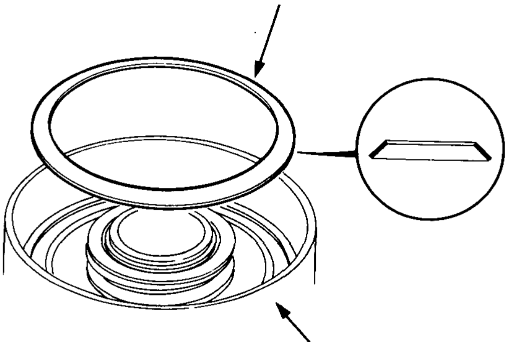
8. Install the circlip.

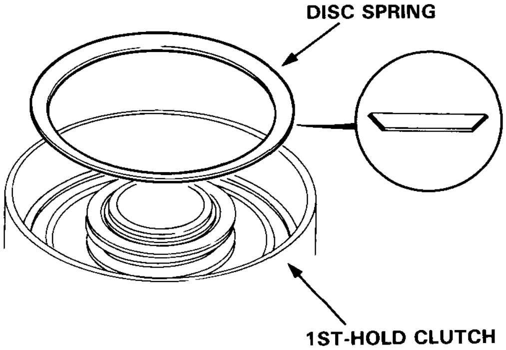


9. Remove the special tools.

10. Install the disc spring.

NOTE:
- For 1st-hold and 2nd clutches.
- Install the disc spring in the direction shown.

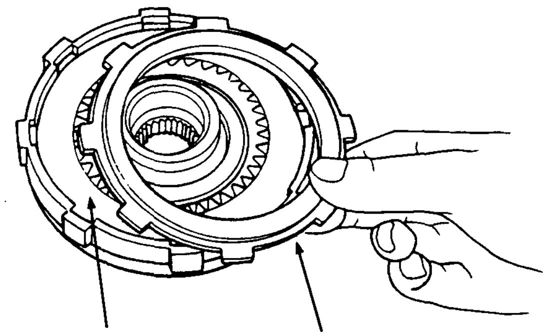




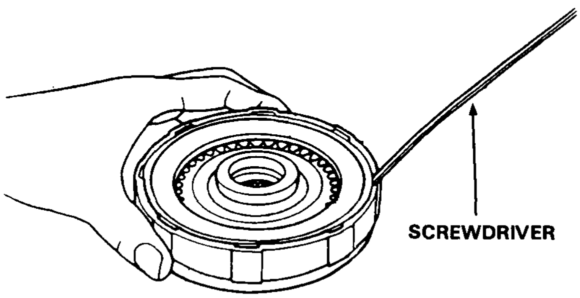
11. Soak the clutch discs thoroughly in ATF for a minimum of 30 minutes.

12. Starting with a clutch plate, alternately install the clutch plates and discs. Install the clutch end plate with flat side toward the disc.

NOTE: Before installing the plates and discs, make sure the inside of the clutch drum is free of dirt or other foreign matter.



13. Install the snap ring.



(cont'd)

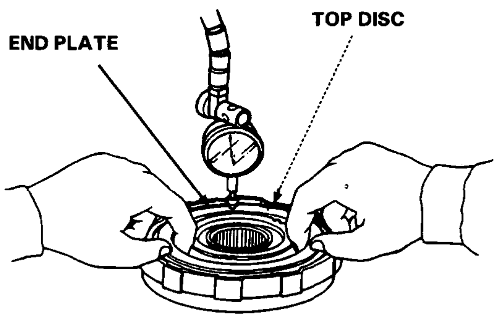
Reassembly (cont'd)

14. Measure the clearance between the clutch end plate and top disc with a dial indicator. Zero the dial indicator with the clutch end plate lowered and lift it up to the snap ring. The distance that the clutch end plate moves is the clearance between the clutch end plate and top disc.

    NOTE: Measure at three locations.

End Plate-to-Top Disc Clearance:

Clutch	Service Limit
1st	0.65–0.85 mm (0.026–0.033 in)
2nd	0.65–0.85 mm (0.026–0.033 in)
3rd	0.40–0.60 mm (0.016–0.024 in)
4th	0.40–0.60 mm (0.016–0.024 in)
1st-Hold	0.50–0.80 mm (0.020–0.031 in)



15. If the clearance is not within the service limits, select a new clutch end plate from the following table.

    NOTE: If the thickest clutch and plate is installed but the clearance is still over the standard, replace the clutch discs and clutch plates.

1ST, 2ND, 3RD and 4TH CLUTCH

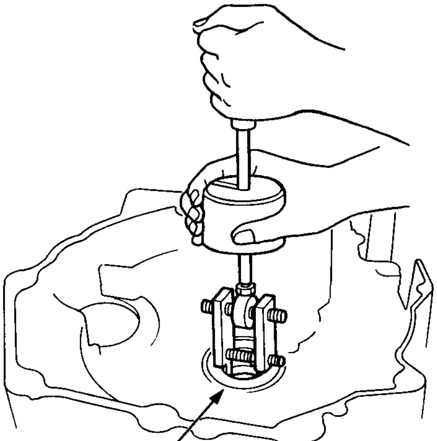
Plate No.	Part Number	Thickness
1	22551–PC9–000	2.4 mm (0.094 in)
2	22552–PC9–000	2.5 mm (0.098 in)
3	22553–PC9–000	2.6 mm (0.102 in)
4	22554–PC9–000	2.7 mm (0.106 in)
5	22555–PC9–000	2.8 mm (0.110 in)
6	22556–PC9–000	2.9 mm (0.114 in)
7	22557–PC9–000	3.0 mm (0.118 in)
8	22558–PC9–000	3.1 mm (0.122 in)
9	22559–PC9–000	3.2 mm (0.126 in)
10	22560–PC9–000	3.3 mm (0.130 in)
11	22561–PC9–000	2.1 mm (0.082 in)
12	22562–PC9–000	2.2 mm (0.086 in)
13	22563–PC9–000	2.3 mm (0.090 in)

1ST-HOLD CLUTCH

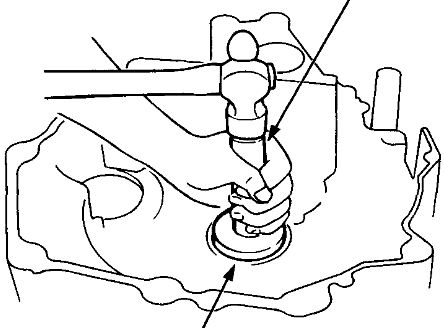
Plate No.	Part Number	Thickness
1	22551–PS5–030	2.1 mm (0.082 in)
2	22552–PS5–030	2.2 mm (0.086 in)
3	22553–PS5–030	2.3 mm (0.090 in)
4	22554–PS5–030	2.4 mm (0.094 in)
5	22555–PS5–030	2.5 mm (0.098 in)
6	22556–PS5–030	2.6 mm (0.102 in)
7	22557–PS5–030	2.7 mm (0.106 in)

Mainshaft Bearing Replacement

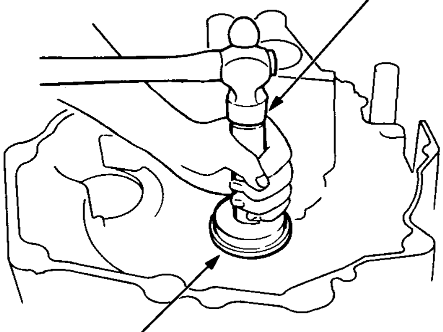
1. Pull up the mainshaft bearing and oil seal using the special tools as shown.



2. Drive in the new mainshaft bearing until it bottoms in the housing, using the special tools as shown.



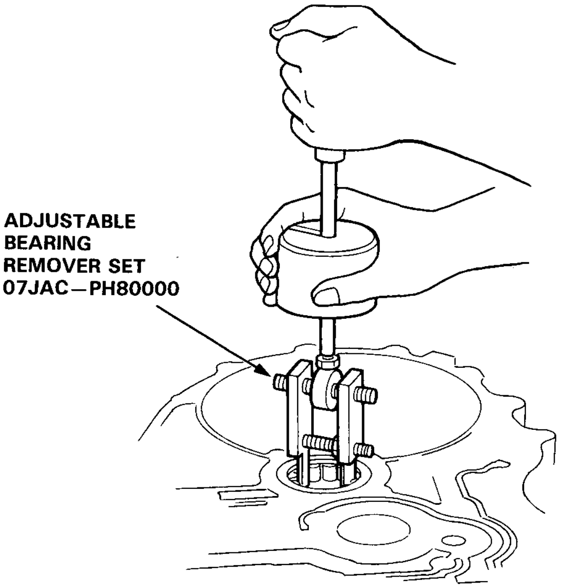
3. Install the new oil seal flush with the housing using the special tools as shown.



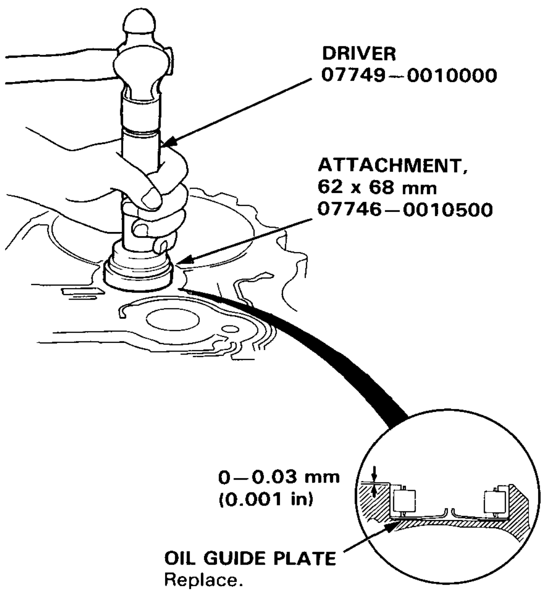
Torque Converter Housing Bearings

Countershaft Bearing Replacement

1. Remove the countershaft bearing using the special tool.



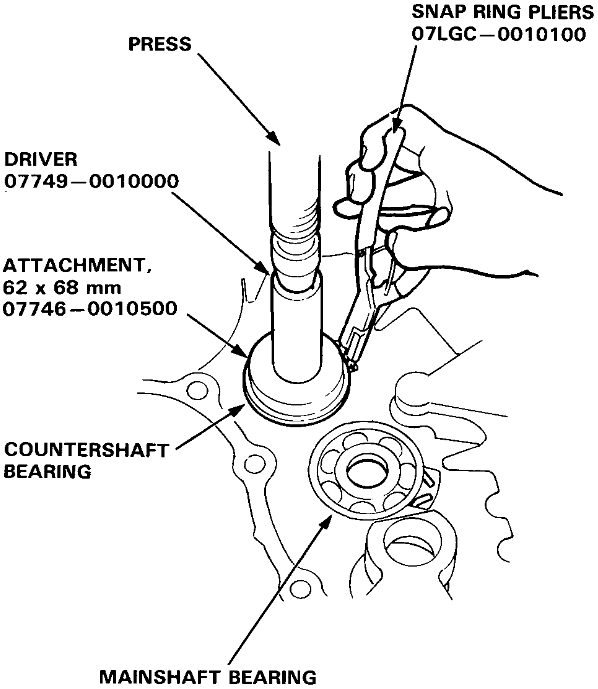
2. Replace the oil guide plate.
3. Drive the new bearing into the housing using the special tools as shown.

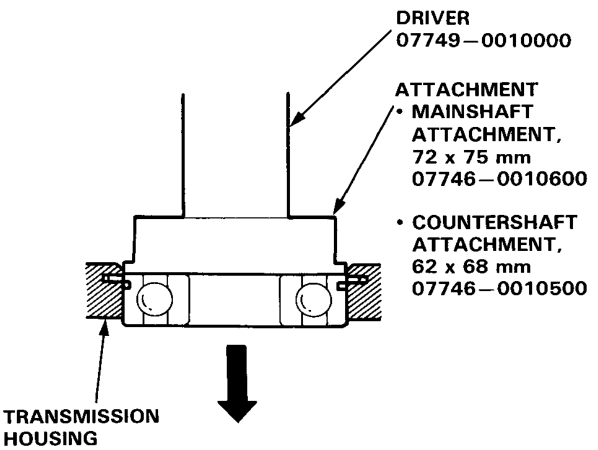


Mainshaft/Countershaft Bearing Replacement

1. To remove the mainshaft and countershaft bearings from the transmission housing, expand each snap ring with snap ring pliers, then push the bearing out using the special tools and a press as shown.

   NOTE: Do not remove the snap rings unless it's necessary to clean the grooves in the housing.

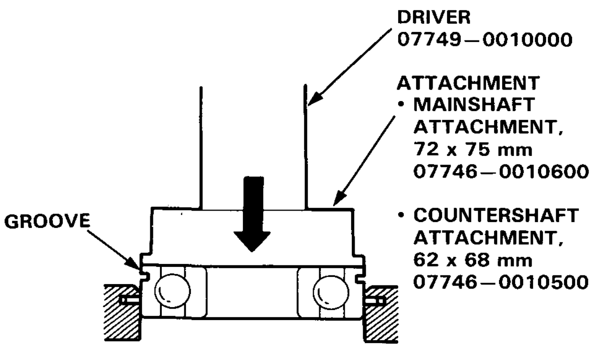




2. Expand each snap ring with snap ring pliers, insert the new bearing part-way into the housing using the special tools and a press as shown. Install the bearing with the groove facing outside the housing.

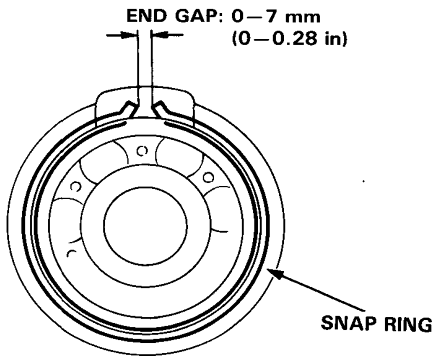
   NOTE: Coat all parts with ATF.

3. Release the pliers, then push the bearing down into the housing until the ring snaps in place around it.



4. After installing the bearing verify the following:

   - The snap ring is seated in the bearing and housing grooves.
   - The snap ring operates.
   - The ring end gap is correct.

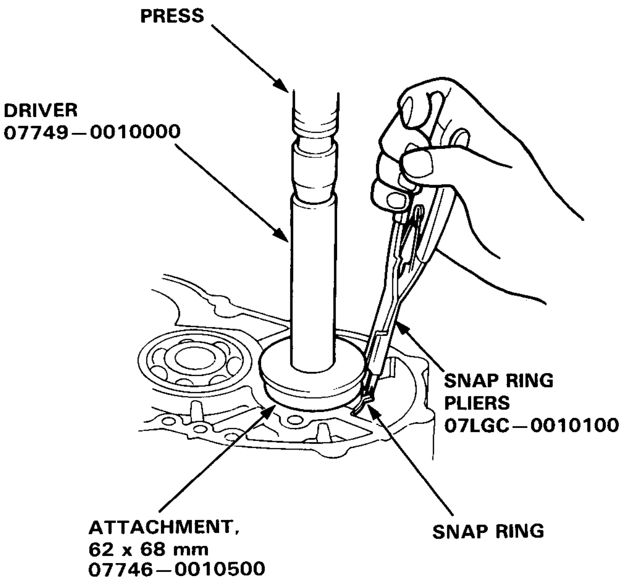


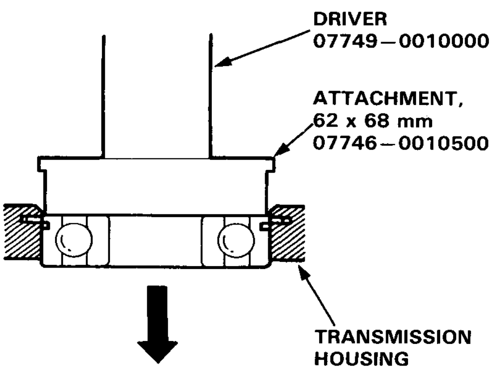
Transmission Housing Bearing

Sub-shaft Bearing Replacement

1. To remove the sub-shaft bearing from the transmission housing, expand the snap ring with snap ring pliers, then push the bearing out using the special tools and a press as shown.

   NOTE: Do not remove the snap ring unless it's necessary to clean the groove in the housing.

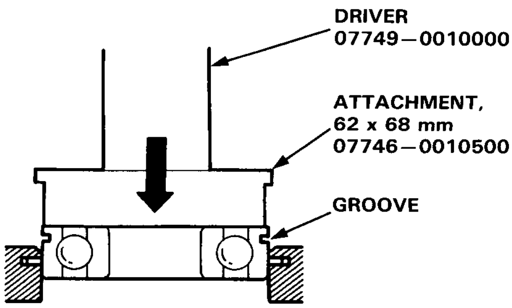




2. Expand the snap ring with snap ring pliers, insert the new bearing part-way into the housing using the special tools and a press as shown. Install the bearing with the groove facing outside the housing.

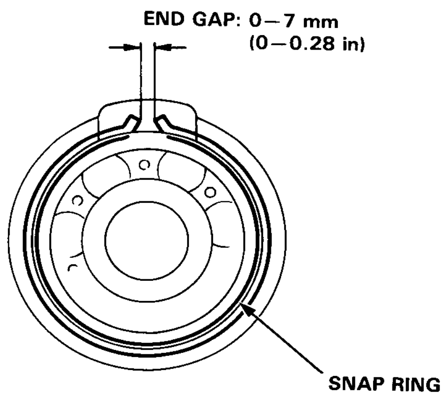
   NOTE: Coat all parts with ATF.

3. Release the pliers, then push the bearing down into the housing until the ring snaps in place around it.



4. After installing the bearing verify the following:

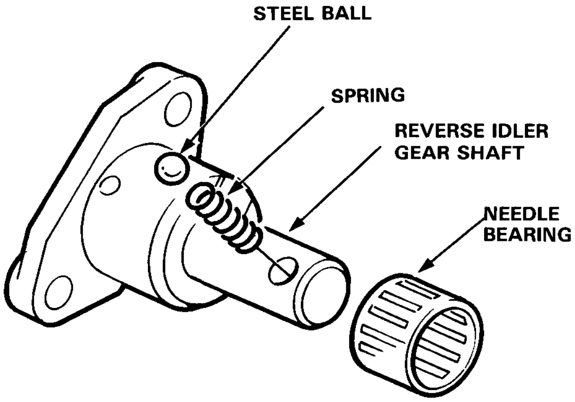
   - The snap ring is seated in the bearing and housing grooves.
   - The snap ring operates.
   - The ring end gap is correct.



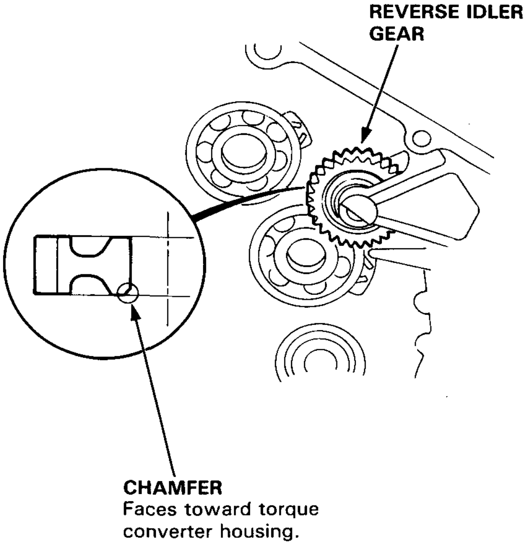
Installation

1. Set the spring in the reverse idler shaft. Push the spring in with the steel ball then install the needle bearing.

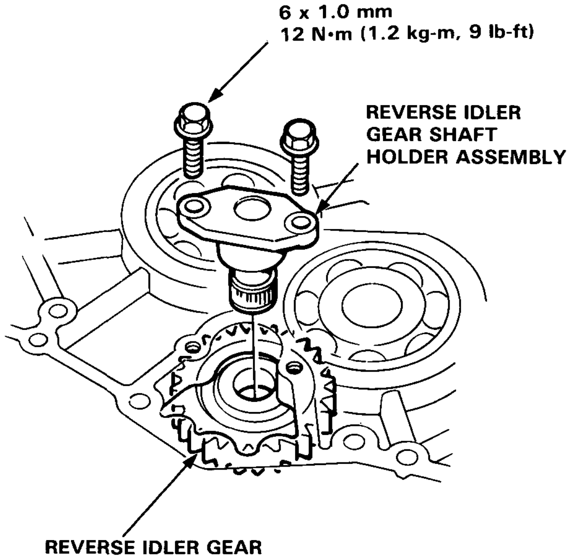
   NOTE: The steel ball is under spring pressure. Take care not to let it pop out.

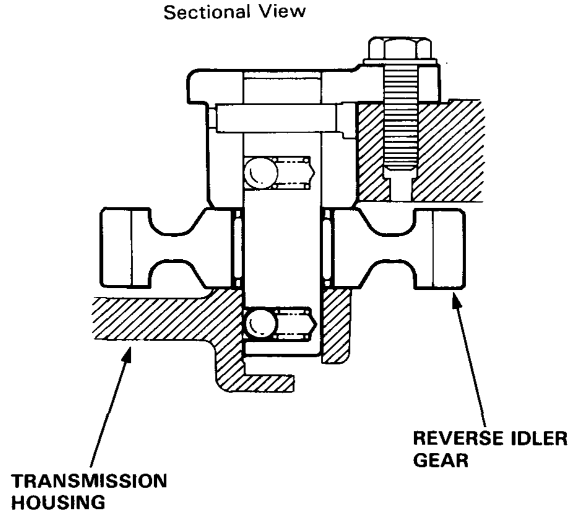


2. Install the reverse idler gear with the large chamfer on the shaft bore facing the torque converter housing.



3. Install the reverse idler shaft holder into the transmission housing, then tighten the bolts.

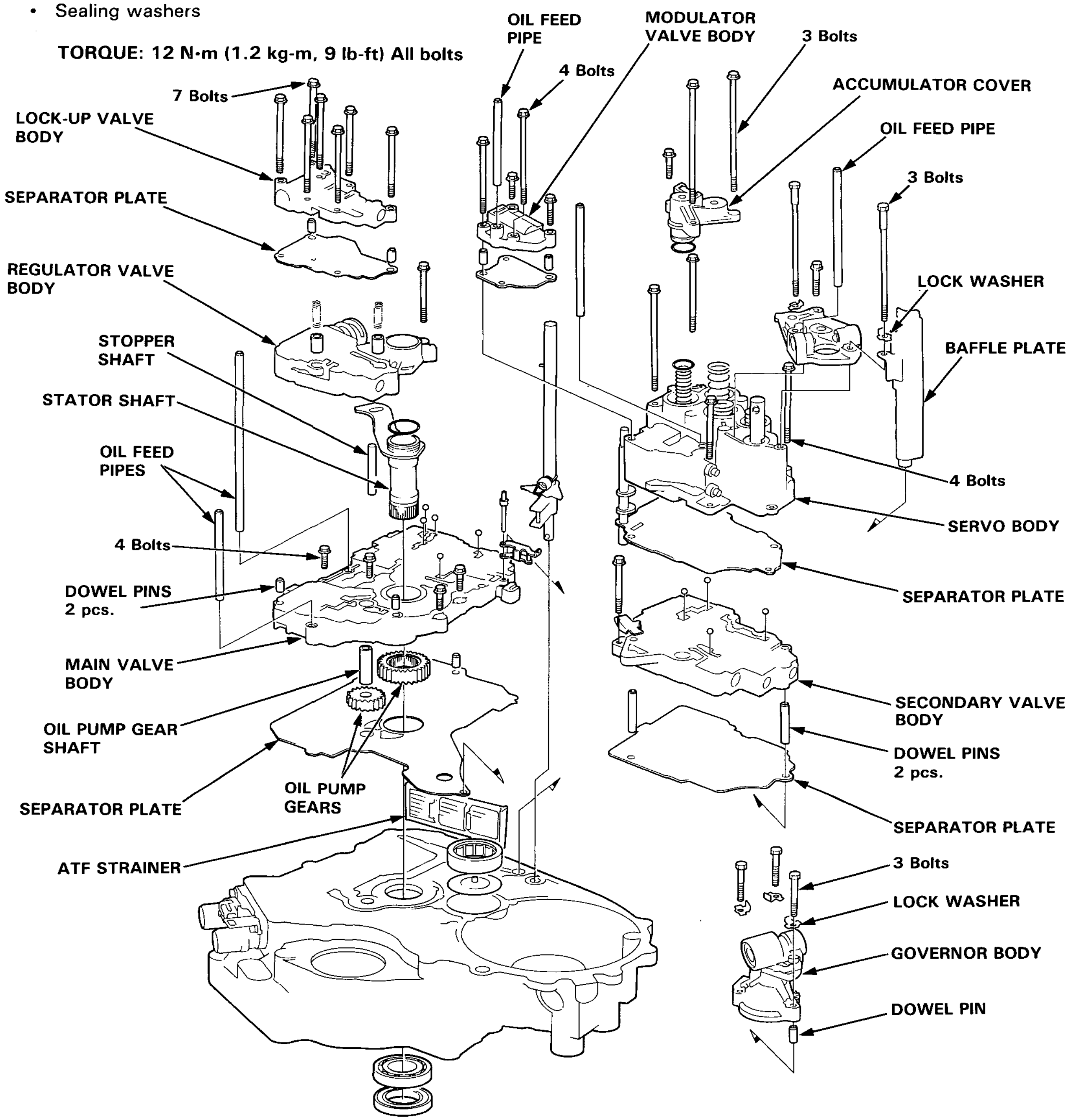




Reassembly

NOTE:
- Coat all parts with ATF.
- Replace the below parts:
  - O-rings
  - Lock washers
  - Gaskets
  - Locknuts
  - Spring washer
  - Sealing washers

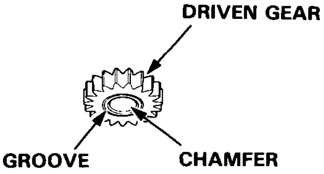
TORQUE: 12 N·m (1.2 kg-m, 9 lb-ft) All bolts

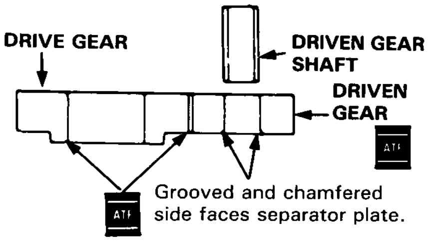


1. Install the ATF strainer in the torque converter housing.

2. Install the main separator plate with 2 dowel pins on the torque converter housing. Then install the oil pump drive gear, driven gear and driven gear shaft.

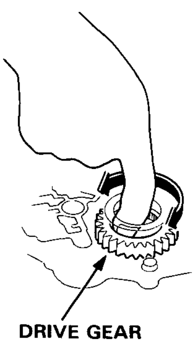
   NOTE: Install the oil pump driven gear with its grooved and chamfered side facing down.

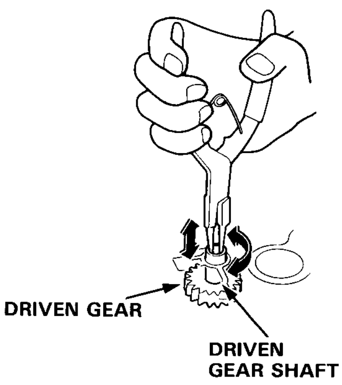




3. Install the main valve body with 4 bolts. And make sure the pump drive gear rotates smoothly in the normal operating direction and the pump shaft moves smoothly in the axial and normal operating directions. If the pump gear and pump shaft do not move freely, loosen the valve body bolts, realign the shaft, and then retighten to the specified torque.

   CAUTION: Failure to align the pump shaft correctly will result in seized pump gear or pump shaft.





4. Install the stator shaft and stopper shaft.

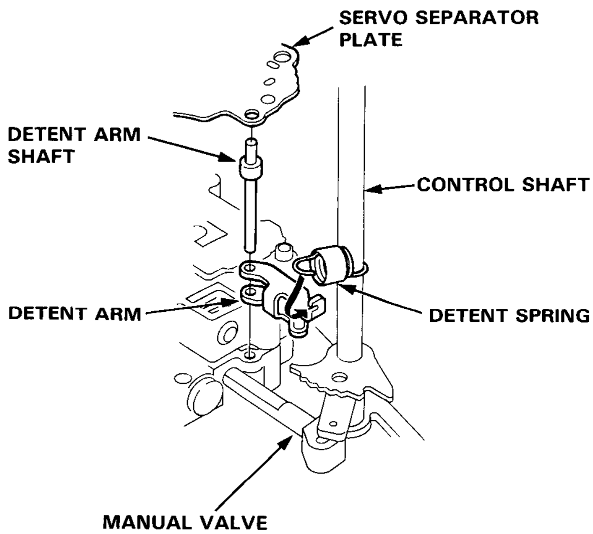
5. Install the regulator valve body with one bolt.

6. Install the lock-up valve body, separator plate and 2 dowel pins with 7 bolts.

7. Install the secondary valve body, separator plate and 2 dowel pins with 1 bolt.

8. Install the control shaft in the housing, with the control shaft and manual valve together.

9. Install the detent arm and arm shaft in the main valve body, then hook the detent spring to the detent arm.



10. Install the servo body and separator plate with 4 bolts.

11. Install the modulator valve body, separator plate and 2 dowel pins with 4 bolts.

12. Install the accumulator cover with 3 bolts.

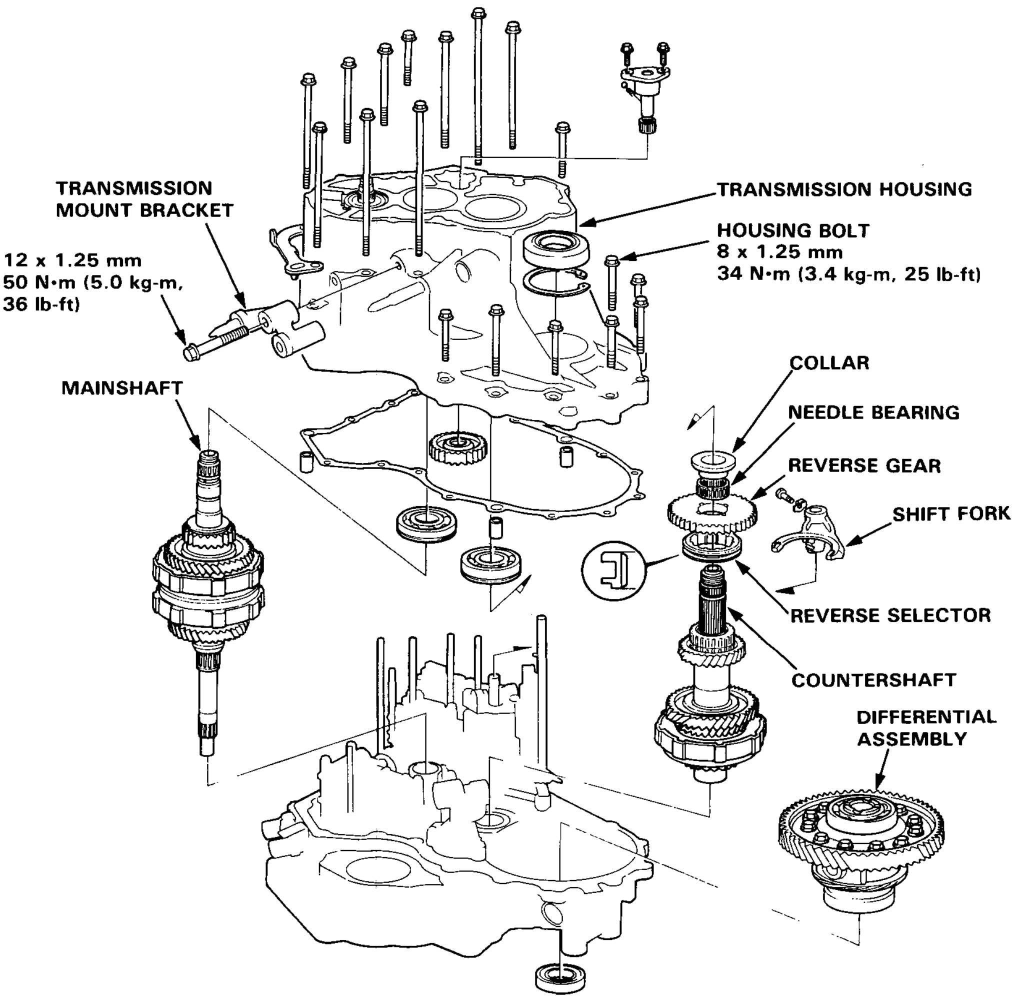
13. Install the detent base, baffle plate with 3 bolts and new lock washers.

14. Install the governor body with 3 bolts and new lock washers.

15. Install the oil feed pipes.

(cont'd)

Reassembly (cont'd)



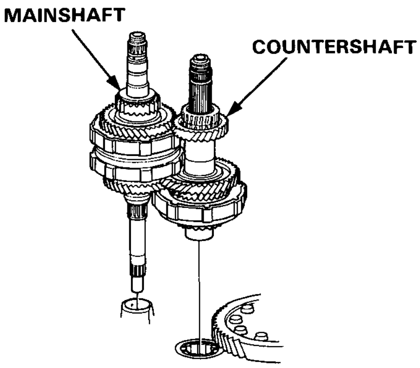
16. Install the sub-shaft assembly in the transmission housing (page 14-246).

17. Install the reverse idler gear and gear shaft holder (page 14-261).

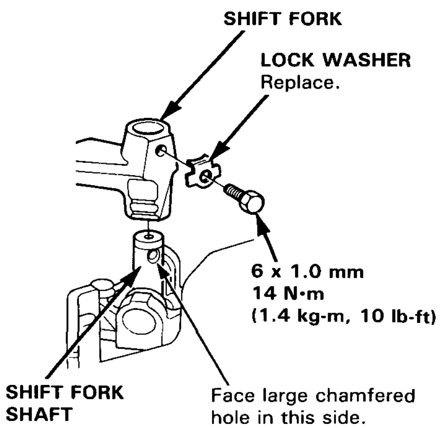
18. Install the differential assembly in the torque converter housing.

    CAUTION: Take care not to damage the governor body.

19. Install the mainshaft and countershaft sub-assembly together in the torque converter housing.



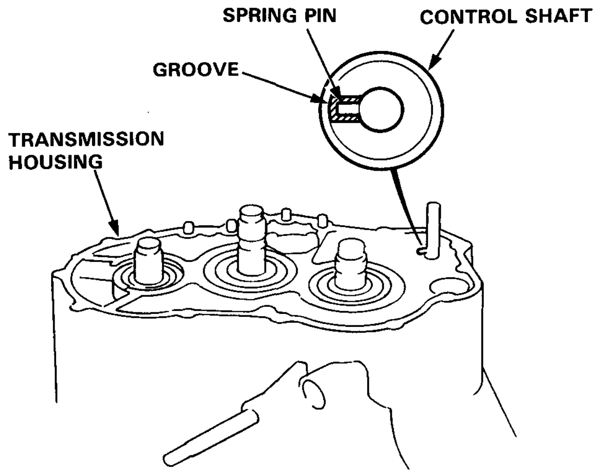
20. Turn the shift fork so large chamfered hole facing fork bolt hole, then install the shift fork with the reverse selector and torque the lock bolt. Bend the lock tab against the bolt head.



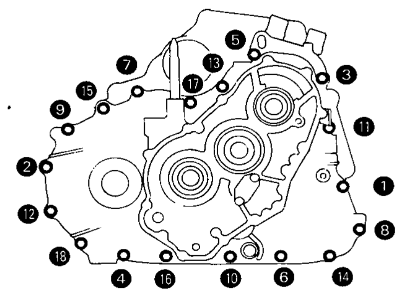
21. Install the reverse gear with the collar and needle bearing on the countershaft.

22. Align the spring pin with the transmission housing groove by turning the control shaft.

23. Place the transmission housing on the torque converter housing with a new gasket and the dowel pins.



24. Install the transmission housing bolts and transmission hanger, then torque bolts to 34 N•m (3.4 kg-m, 25 lb-ft) in two or more steps as shown.

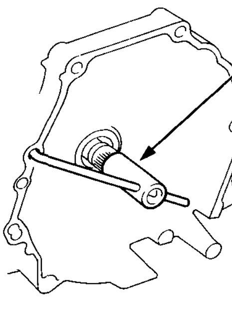


25. Install the transmission mount braket on the transmission housing.

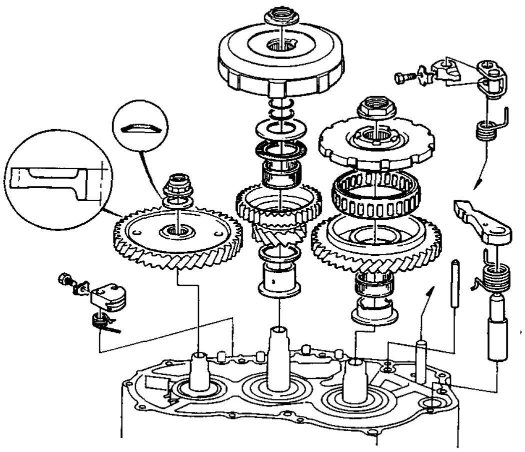
(cont'd)

Reassembly (cont'd)

26. Slip the special tool onto the mainshaft.

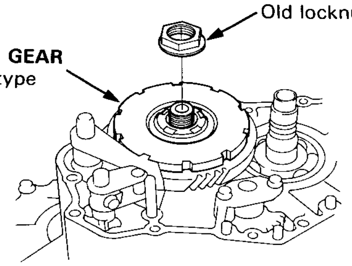


27. Install the parking brake lever on the control shaft.
28. Install the parking gear, countershaft 1st gear and one-way clutch assembly on the countershaft.
29. Install the parking brake pawl in the transmission housing, then engage it with the parking gear.



30. Tighten the old locknut to press the press fitting parking gear to specified torque, then loosen it.

TORQUE: 140 N·m (14.0 kg-m, 101 lb-ft)



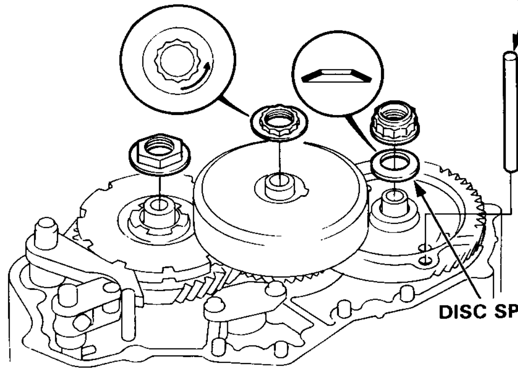
31. Install the mainshaft 1st gear and 1st clutch assembly on the mainshaft, and subshaft 1st gear on the subshaft.
32. Align the hole of the sub-shaft 1st gear with the hole of the transmission housing, then insert a pin to lock the subshaft while tightening the subshaft locknut.
33. Install the disc spring on the subshaft, and new locknuts on each shaft.

CAUTION: Install the disc spring in the direction shown.

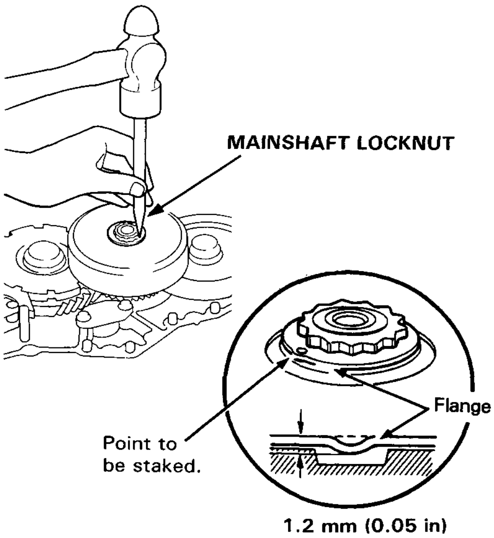
34. Tighten the locknuts to specified torque.

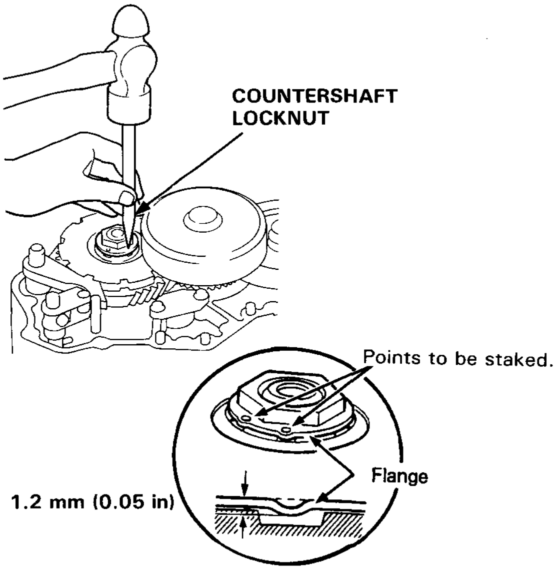
TORQUE:
- **MAINSHAFT 95 N·m (9.5 kg-m, 69 lb-ft)**
- **COUNTERSHAFT**
  140 N·m (14.0 kg-m, 101 lb-ft)
- **SUB-SHAFT**
  95 N·m (9.5 kg-m, 69 lb-ft)

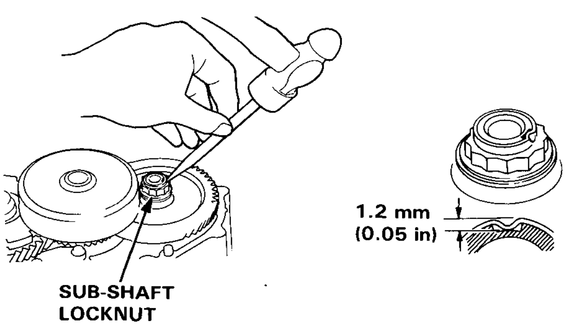
NOTE: Mainshaft locknut has left-hand threads.



35. Stake each locknut using a 3.5 mm punch.



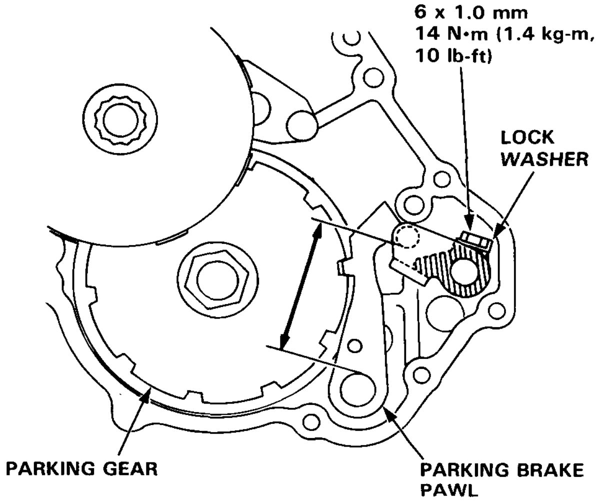




36. Set the parking brake lever in the PARK position, then verify that the parking brake pawl engages to the parking gear.

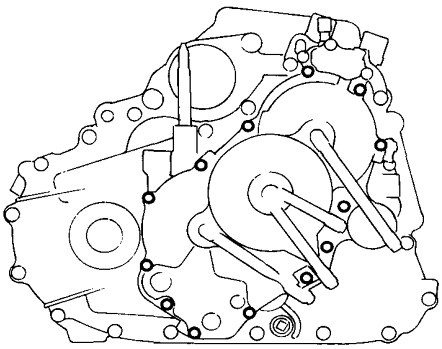
37. If the pawl does not engage fully, check the parking brake pawl stopper clearance as described on page 14-268.

38. Tighten the lock bolt and bend the lock tab.



39. Install the R. side cover.

TORQUE: 12 N·m (1.2 kg-m, 9 lb-ft)



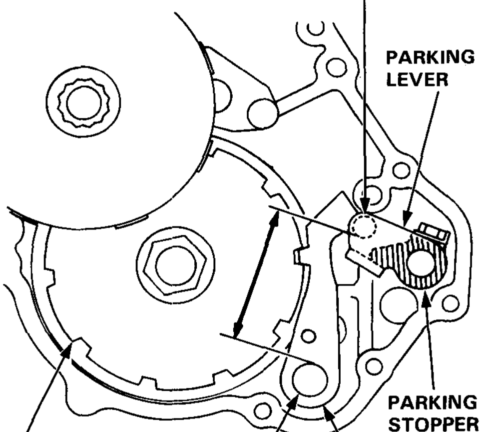
40. Install the ATF cooler pipes and ATF level gauge.

Parking Brake Stopper

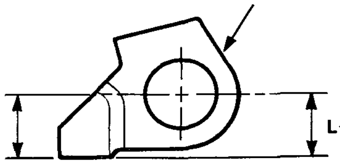
Inspection/Adjustment

1. Set the parking brake lever in the Park position.
2. Measure the distance between the face of the parking brake pawl shaft and face of the parking brake lever roller pin as shown.

   STANDARD: 67.25–68.25 mm (2.65–2.69 in)



3. If the measurement is out of tolerance, select and install the appropriate parking brake stopper from the table below.



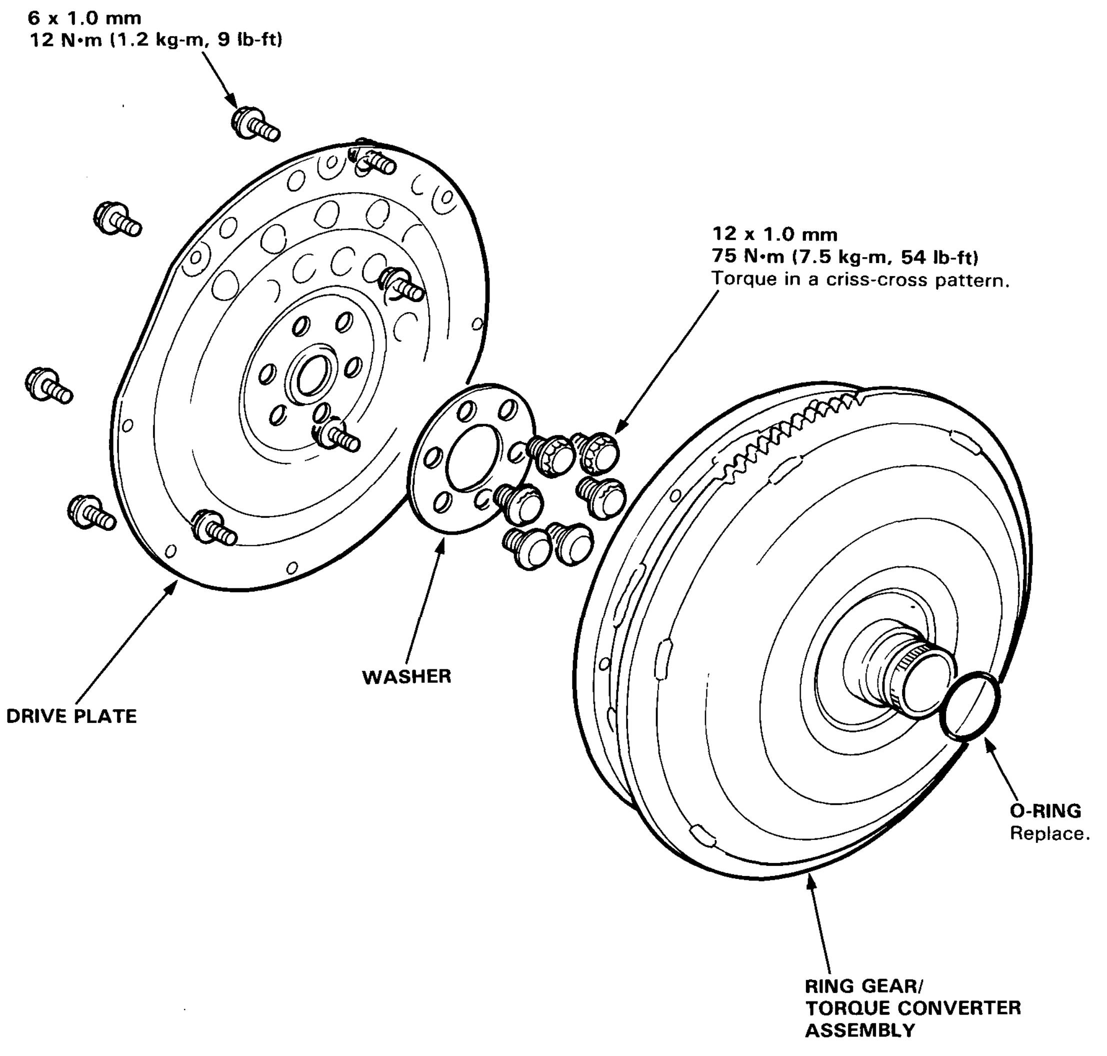
PARKING BRAKE STOPPER

Mark	Part Number	L_1	L_2
1	24537-PA9-003	11.00 mm (0.433 in)	11.00 mm (0.433 in)
2	24538-PA9-003	10.80 mm (0.425 in)	10.65 mm (0.419 in)
3	24539-PA9-003	10.60 mm (0.417 in)	10.30 mm (0.406 in)

4. After replacing the parking brake stopper, make sure the distance is within torelance.

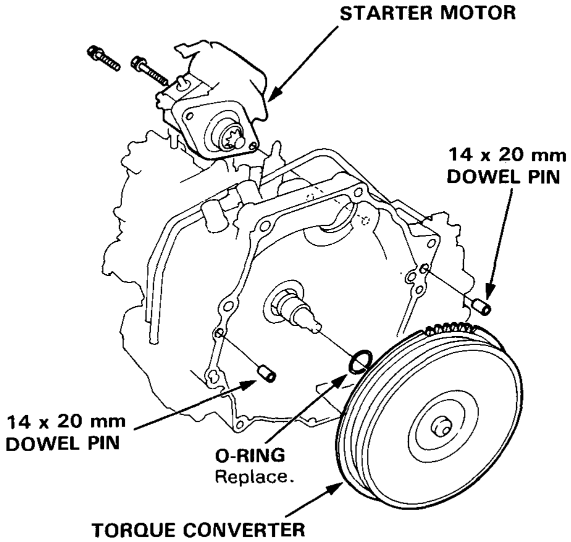
Torque Converter

Disassembly



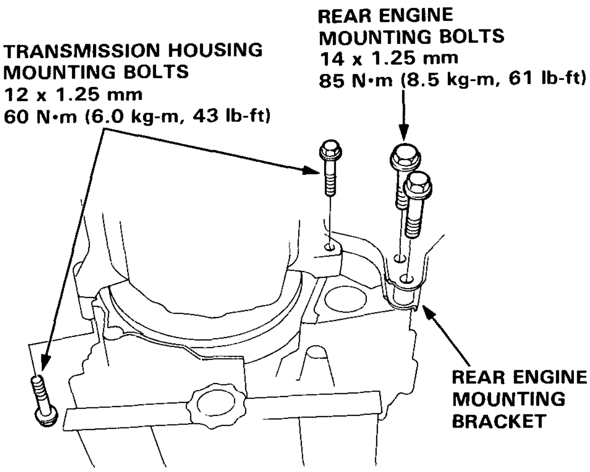
Installation

1. Install the starter motor on the torque converter housing, then install the 14 mm dowel pins in the torque converter housing.

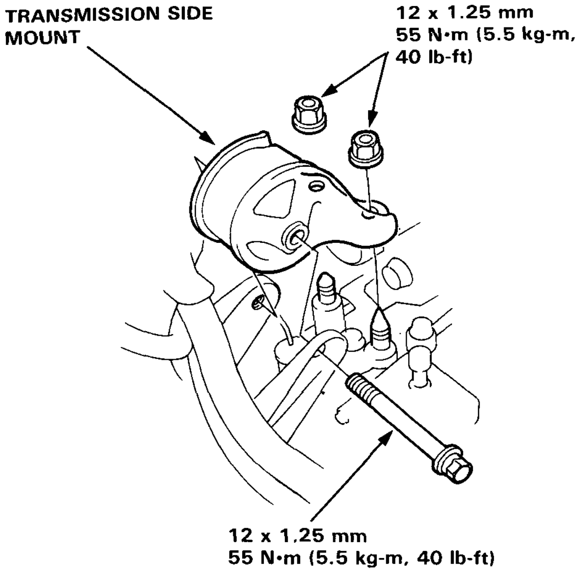


2. Place the transmission on a transmission jack, and raise to the engine level.

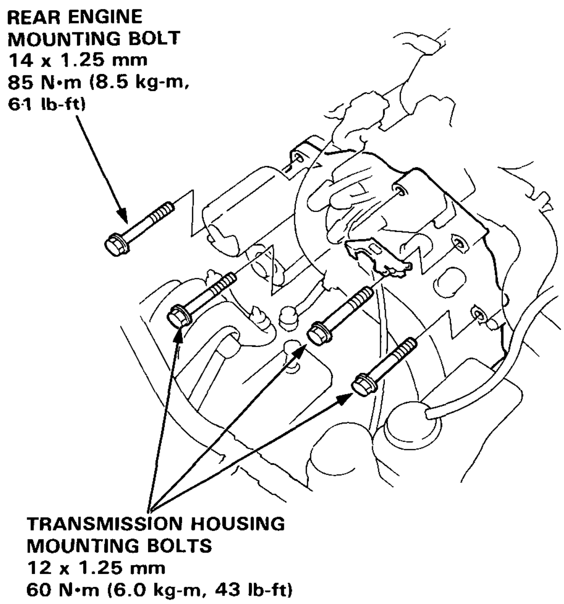
3. Attach the transmission to the engine, then install two transmission housing mounting bolts and two rear engine mounting bolts.



4. Install the transmission side mount.



5. Install the remaining transmission housing mounting bolts and the remaining rear engine mounting bolt.

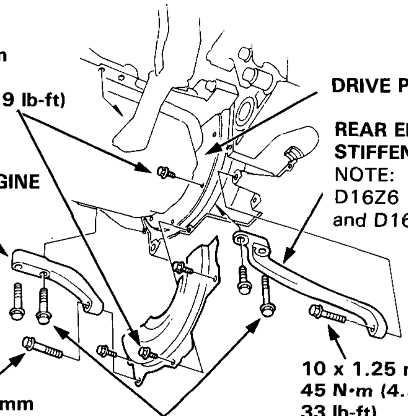


6. Remove the transmission jack and the hoist from the engine.

7. Attach the torque converter to the drive plate with 8 bolts and torque to 12 N•m (1.2 kg-m, 9 lb-ft). *Rotate the crankshaft as necessary to tighten the* bolts to 1/2 of the specified torque, then final torque, in a criss-cross pattern.
   Check for free rotation after tightening the last bolt.

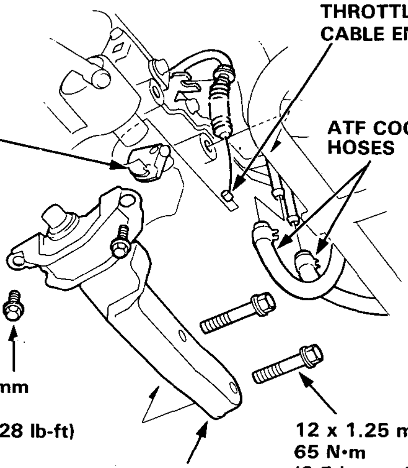
8. Install the torque converter cover and engine stiffeners.

   NOTE: Only the D16Z6 and D16A8 engine use a rear engine stiffener.



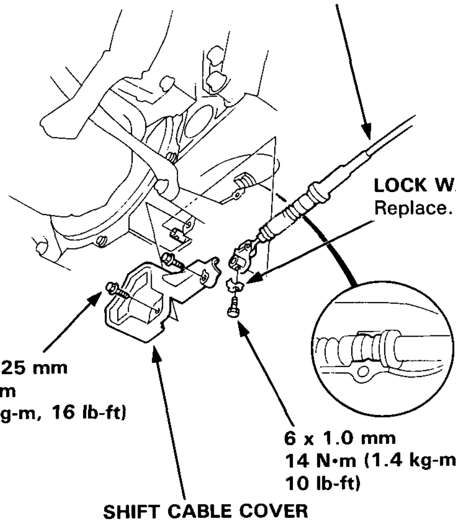
9. Connect the ATF cooler hoses to the joint pipes.

10. Connect the throttle control cable and install the stopper mount.

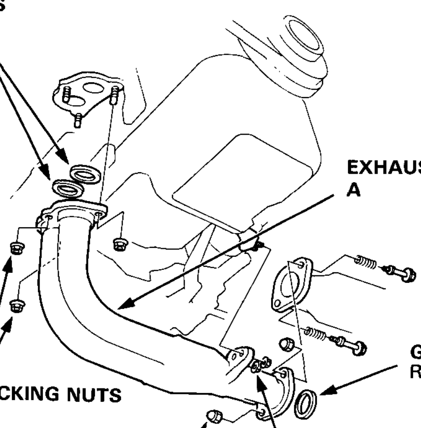


11. Install the control lever with a new lock washer to the control shaft, then install the shift cable cover.

    CAUTION: Take care not to bend the shift cable.



12. Install the exhaust pipe A.



(cont'd)

Installation (cont'd)

13. Install the driveshafts.

NOTE: Turn the right and left steering knuckle fully outward, and axial into the differential until you feel its spring clip engage the side gear.

- For D15B2/D15A7/D16Z6

—1. Install a new set ring on the end of the each driveshaft.

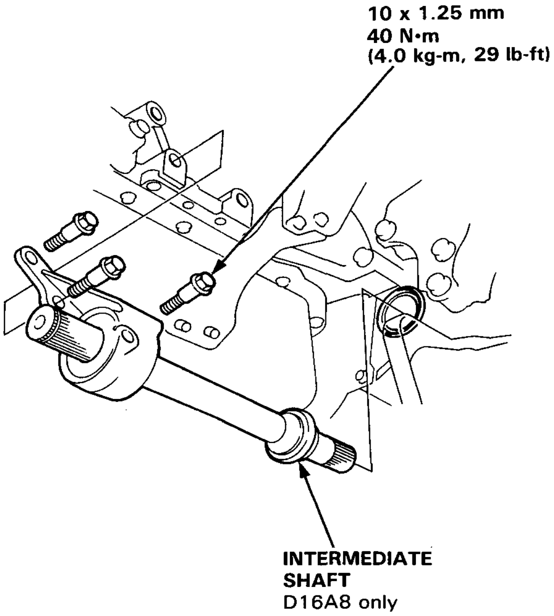
—2. Install the right and left driveshafts (see Section 16).

- For D16A8

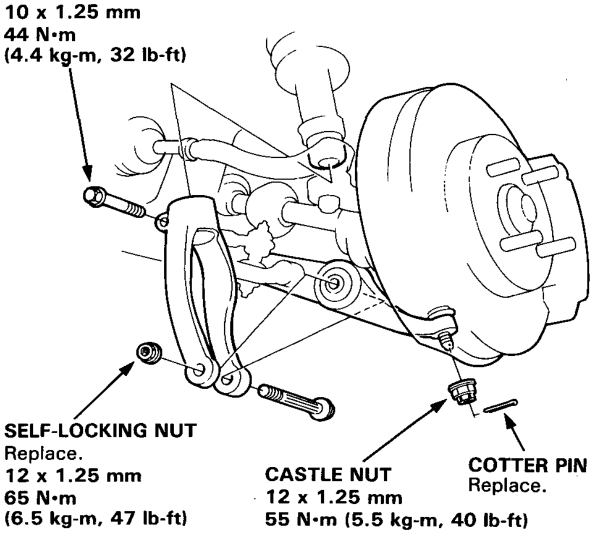
—1. Install a new set ring on the end of the right drive shaft and intermediate shaft.

—2. Install the intermediate shaft.

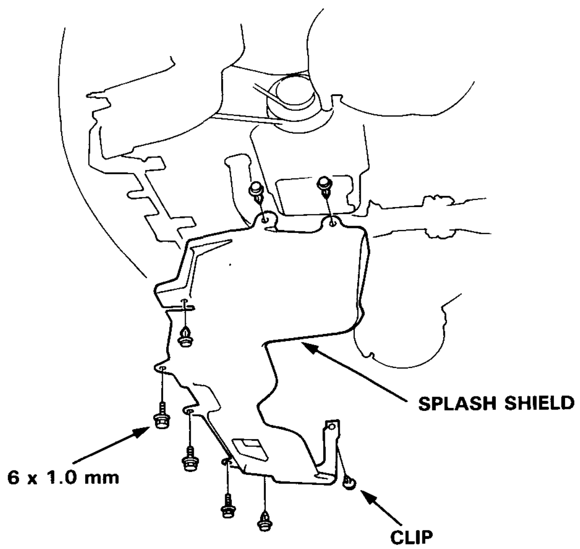
—3. Install the right and left driveshafts (see Section 16).



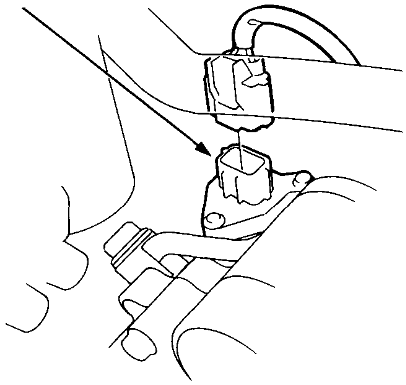
14. Install the damper fork, then install the ball joint to the lower arm with a new castle nuts and cotter pins.



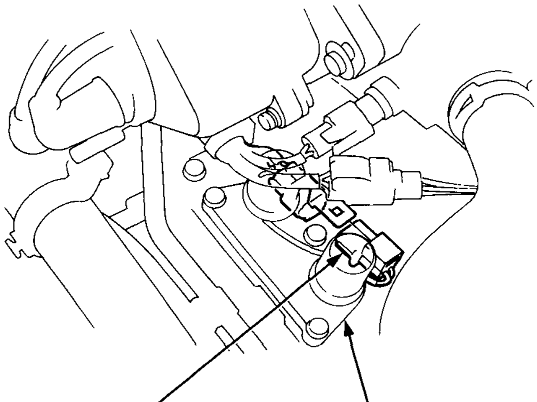
15. Install the splash shield.



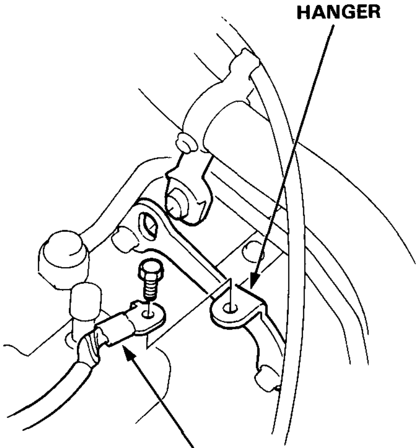
16. Connect the speedometer sensor connector.



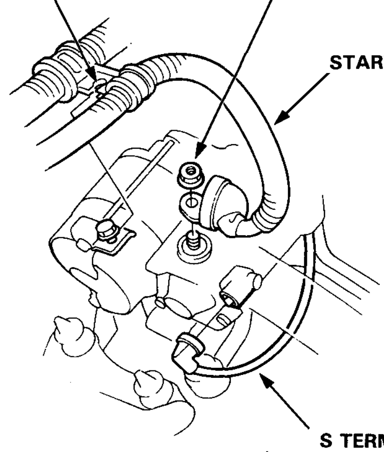
17. Connect the lock-up control solenoid connector, and clamp the harness on the lock-up control solenoid connector stay.



18. Connect the transmission ground cable.



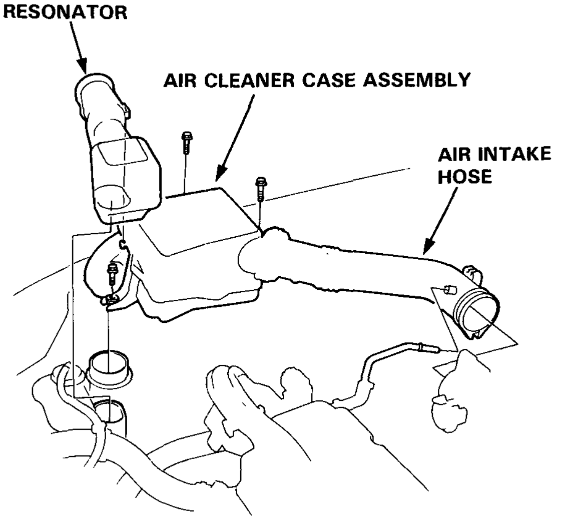
19. Connect the stater motor cable on the stater motor, and install the cable holder.



(cont'd)

Installation (cont'd)

20. Install the air cleaner case, air intake hose and resonator.



21. Refill the transmission with ATF (see page 14-199).

22. Connect the battery positive (+) and negative (−) cables to the battery.

23. Check the ignition timing (see Section 23).

24. Start the engine. Set the parking brake, and shift the transmission through all gear three times. Check for proper shift cable adjustment.

25. Let the engine reach operating temperature with the transmission in Neutral or Park, then turn it off and check fluid level.

26. Road test as described on pages 14-194 and 197.

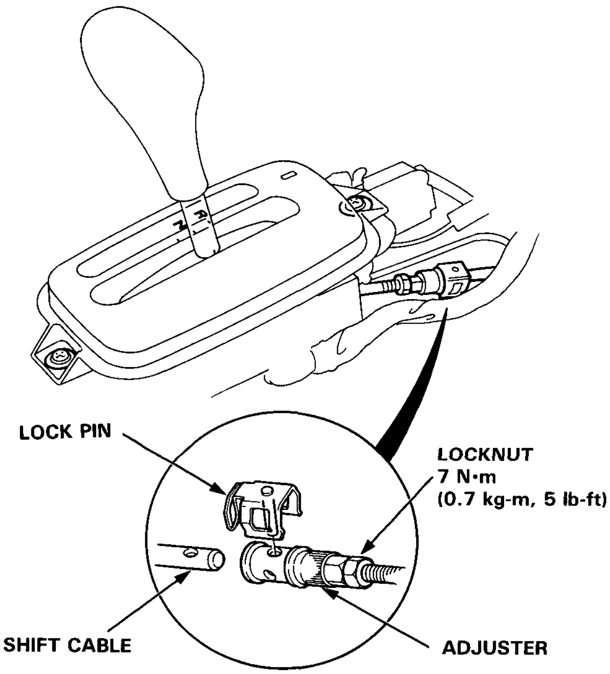
Shift Cable

Removal/Installation

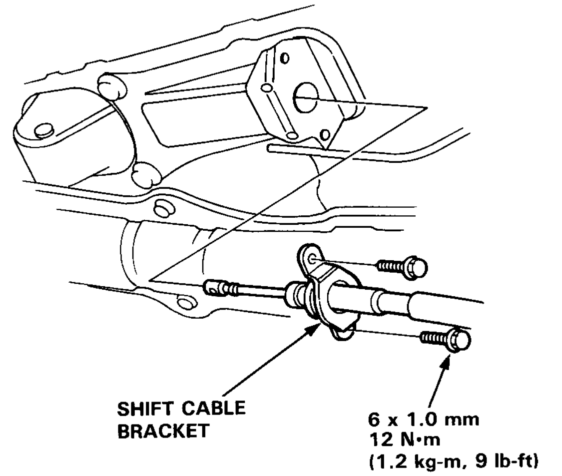
WARNING Make sure lifts are placed properly (see page 1-9 thru 1-11).

NOTE: LHD is shown; RHD is similar.

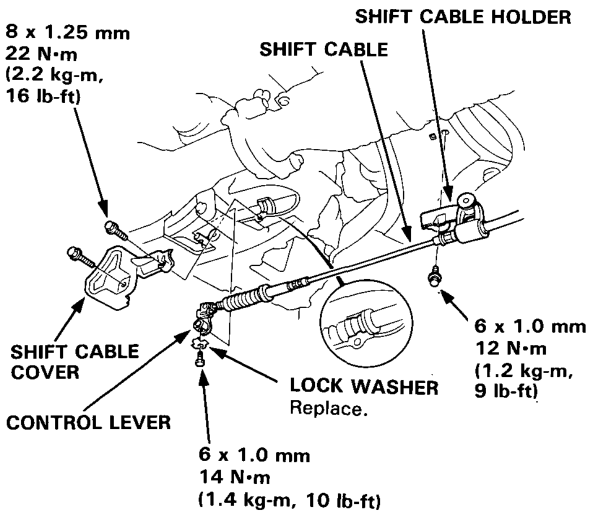
1. Remove the center console (see page 20-80).
2. Shift to [N] position, then remove the lock pin from the cable adjuster.



3. Remove the shift cable bracket.



4. Remove the shift cable holder.
5. Remove the shift cable cover.
6. Remove the control lever from the control shaft, then remove the shift cable. Take care not to bend the cable when removing/installing it.



7. Install the shift cable in the reverse order of removal.
8. Check the cable adjustment on reassembly, on page 14-276.

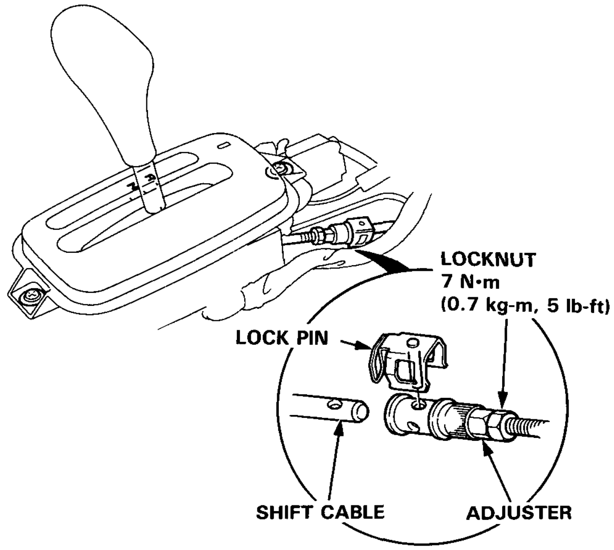
Shift Cable

Adjustment

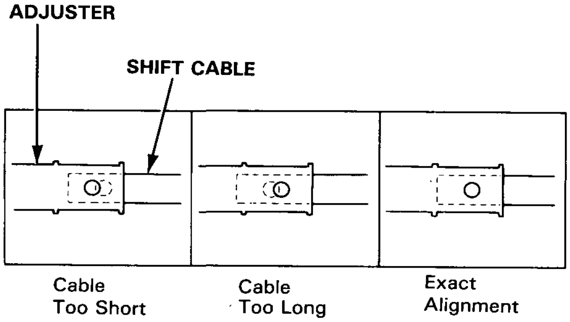
⚠WARNING Make sure lifts are placed properly (see page 1-9 thru 1-11).

NOTE: LHD is shown; RHD is similar.

1. Start the engine. Shift to [P] position to see if the reverse gear engages. If not, refer to troubleshooting on page 14-190 thru 193.
2. With the engine off, remove the center console (see page 20-80).
3. Shift to [N] position, then remove the lock pin from the cable adjuster.



4. Check that the hole in the adjuster is perfectly aligned with the hole in the shift cable. There are two holes in the end of the shift cable. They are positioned 90° agart to allow cable adjustment in 1/4 turn increments.

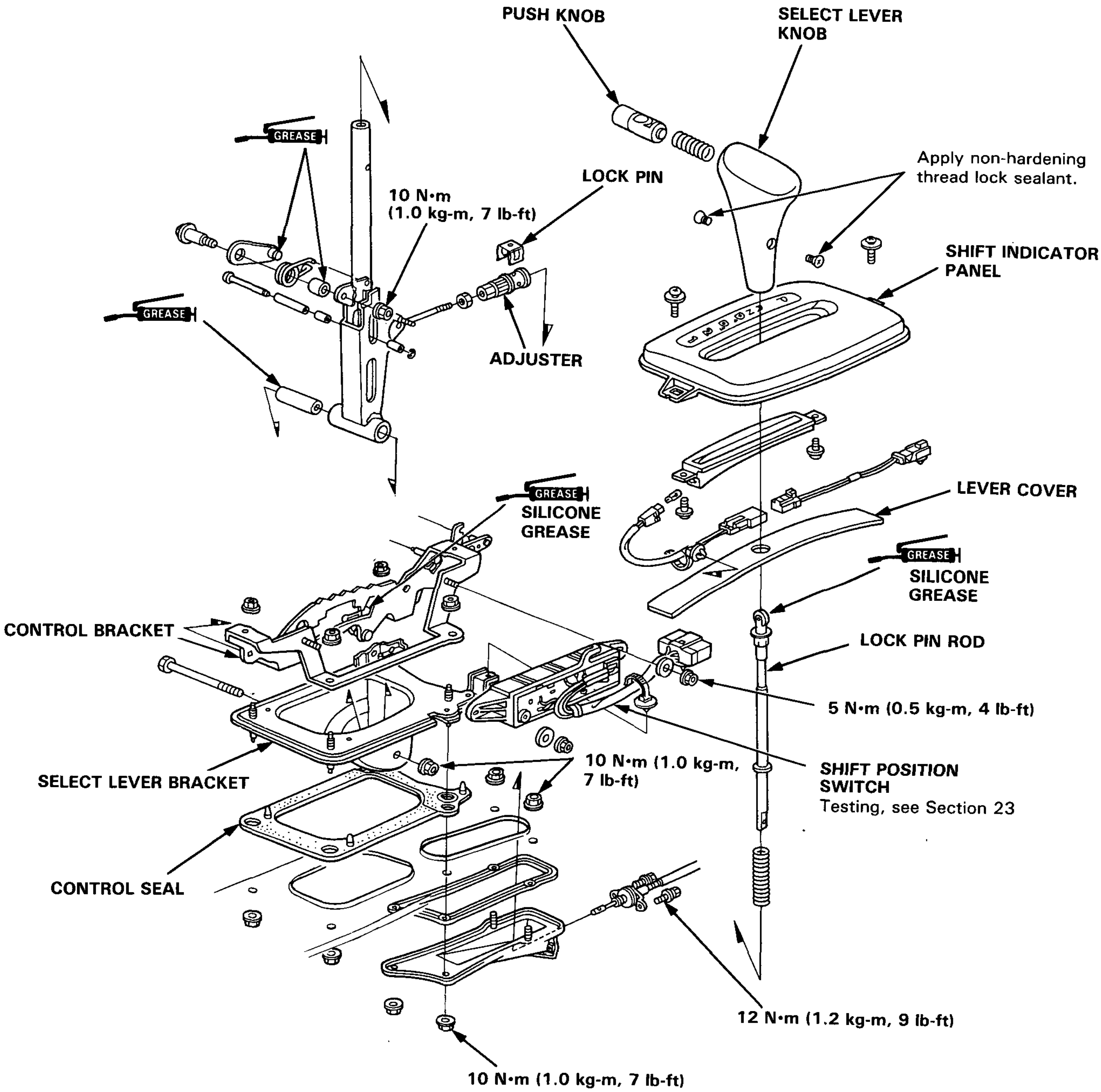


5. If not perfectly aligned, loosen the locknut on shift cable and adjust as required.
6. Tighten the locknut to 7 N•m (0.7 kg-m, 5 lb-ft).
7. Install the lock pin on the adjuster. If you feel the lock pin binding as you reinstall it, the cable is still out of adjustment and must be readjsuted.
8. Move the select to each gear and verify that the shift position indicator follows the shift position console switch.
9. Start the engine and check the shift lever in all gears. If any gear does not work properly, refer to troubleshooting on page 14-190 thru 193.
10. Insert the ignition key into the key cylinder on the shift indicator panel, verify that the shift lock lever is released.

Gearshift Selector

Disassembly/Reassembly

NOTE: LHD is shown; RHD is symmetrical.



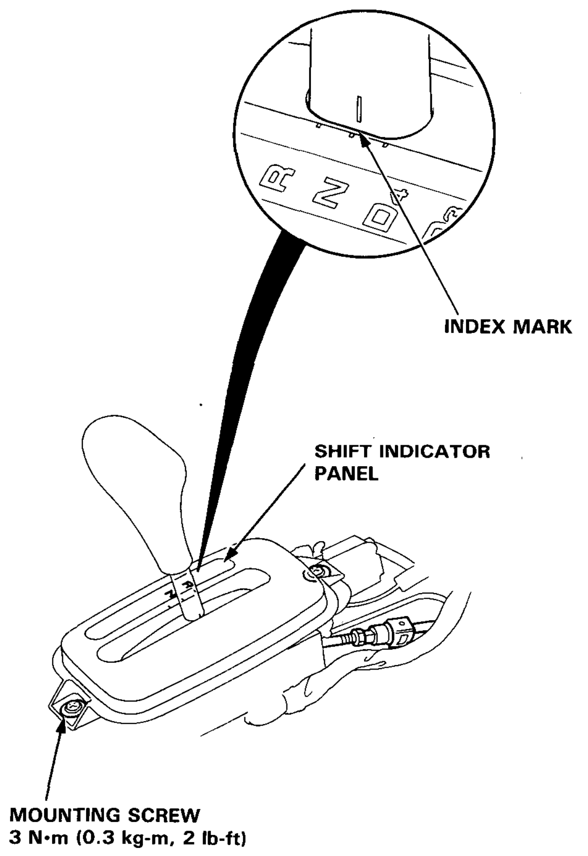
Shift Indicator Panel

Adjustment

NOTE: LHD is shown; RHD is similar.

1. Check that the index mark of the indicator aligns with the [N] mark of the shift indicator panel with the transmission in NEUTRAL.
2. If not aligned,remove the center console. (see page 20-80).
3. Remove the shift indicator panel mounting screws and adjust by moving the panel.

   NOTE: Whenever the shift indicator panel is removed, reinstall the panel as described above.



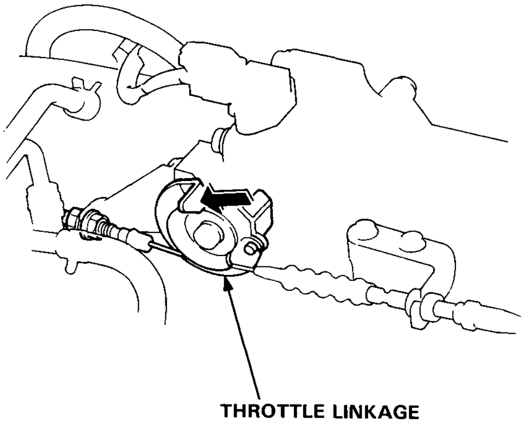
Throttle Control Cable

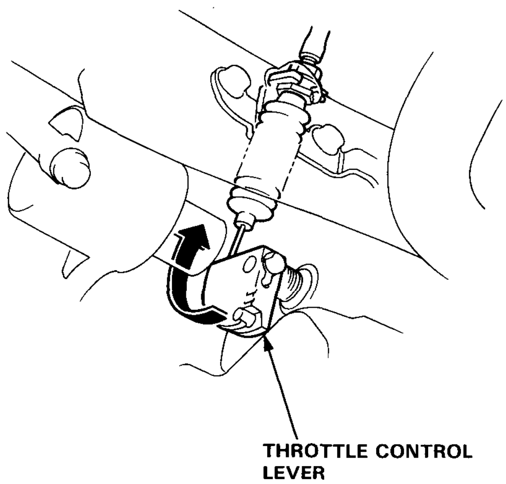
Inspection

NOTE: Before inspecting the throttle control cable, make sure;

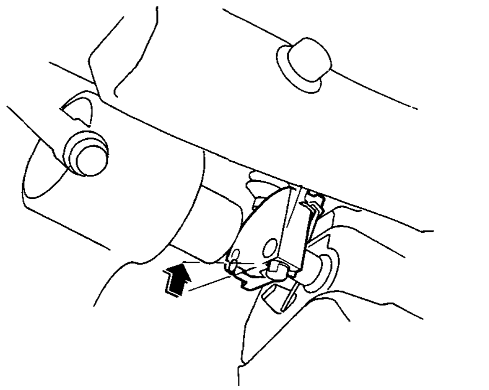
- Throttle cable free play is correct (see Section 11).
- Idle speed is correct (see Section 11).
- To warm up the engine to normal operating temperature (cooling fan comes on).

1. Verify that the throttle control lever is synchronized with the throttle linkage while depressing and releasing the accelerator pedal.
2. If the throttle control lever is not synchronized with the throttle linkage, adjust the throttle control cable.

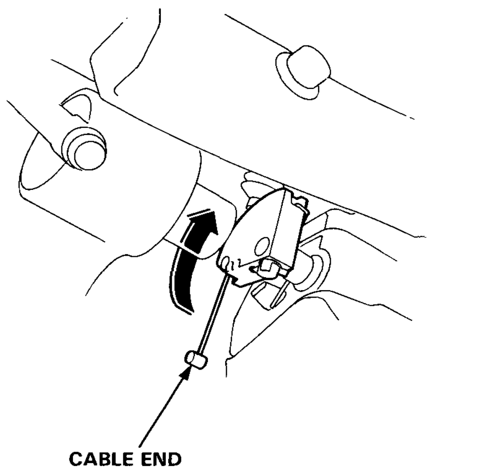




3. Check that there is play in the throttle control lever while depressing the accelerator pedal to the full-throttle position.



4. Remove the cable end of the throttle control cable from the throttle control lever.
5. Check that the throttle control lever moves smoothly.



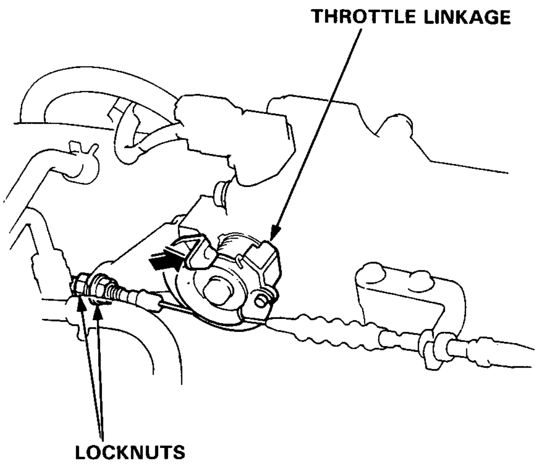
Throttle Control Cable

Adjustment

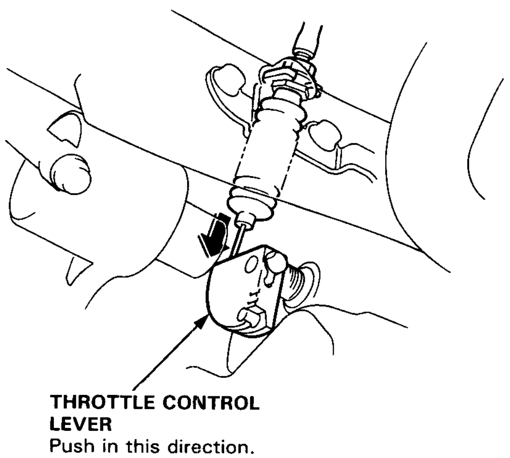
NOTE: Before inspecting the throttle control cable, make sure;

- Throttle cable free play is correct (see Section 11).
- Idle speed is correct (see Section 11).
- To warm up the engine to normal operating temperature (cooling fan comes on).

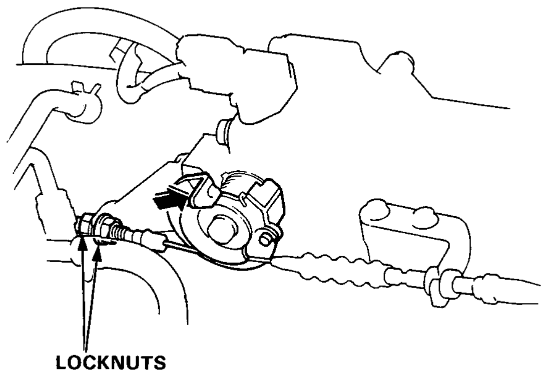
1. Verify that the throttle linkage is in the full-closed position.
2. Loosen the locknut of the throttle control cable at the throttle linkage.



3. Remove the free play of the throttle control cable with the locknut, while pushing the throttle control lever to the full-closed position as shown.



4. Tighten the locknut.



5. After tightening the locknuts, inspect the synchronization and throttle control lever movement.

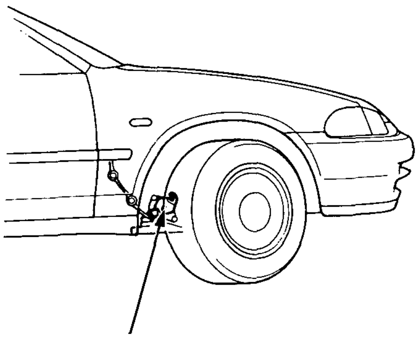
4WD Automatic Transmission

Service Precautions

4WD Disengagement

- For cars equipped without ABS

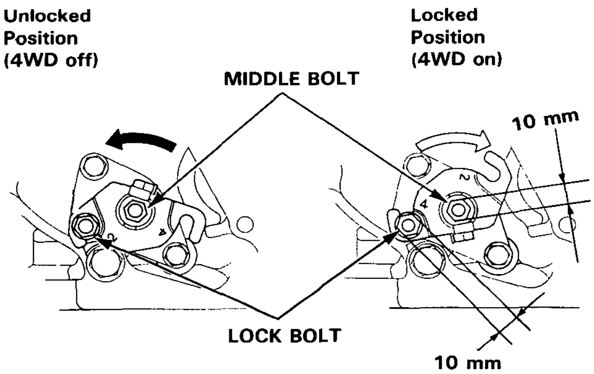
1. Locate the disengagement plate at the rear of the transmission case behind the right front wheel.



2. Loosen the lock bolt in the notch on the plate.

   NOTE: For better accessibility, use a socket and a long extension bar.

   CAUTION: Do not loosen the middle bolt more than 5 — 7tuns. Replacement is extremely difficult.



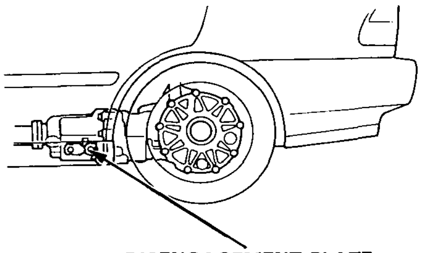
3. Turn the middle bolt counterclockwise until the plate rotates about 150° and is stopped by the lock bolt.

4. Tighten the lock bolt.

   NOTE: After service or towing is completed, return the plate to the normal (4WD on) position and tighten the lock bolt.

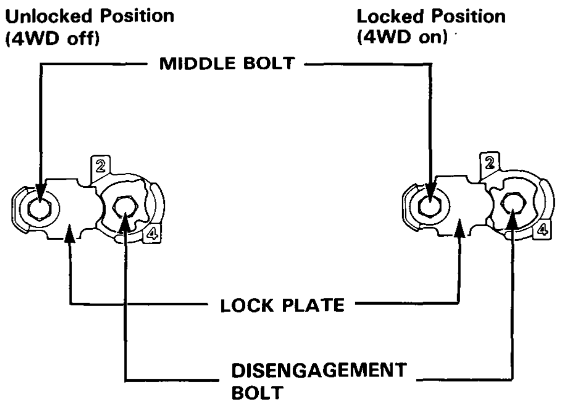
- For cars equipped with ABS

1. Locate the orange disengagement bolt at the front of the rear differential behind the left rear wheel.



2. Loosen the middle bolt fixing the lock plate.

   NOTE: For better accessibility, use a socket and a long extension bar.
   CAUTION: Do not loosen the middle bolt more than 5 — 7 turns. Replacement is extremely difficult.

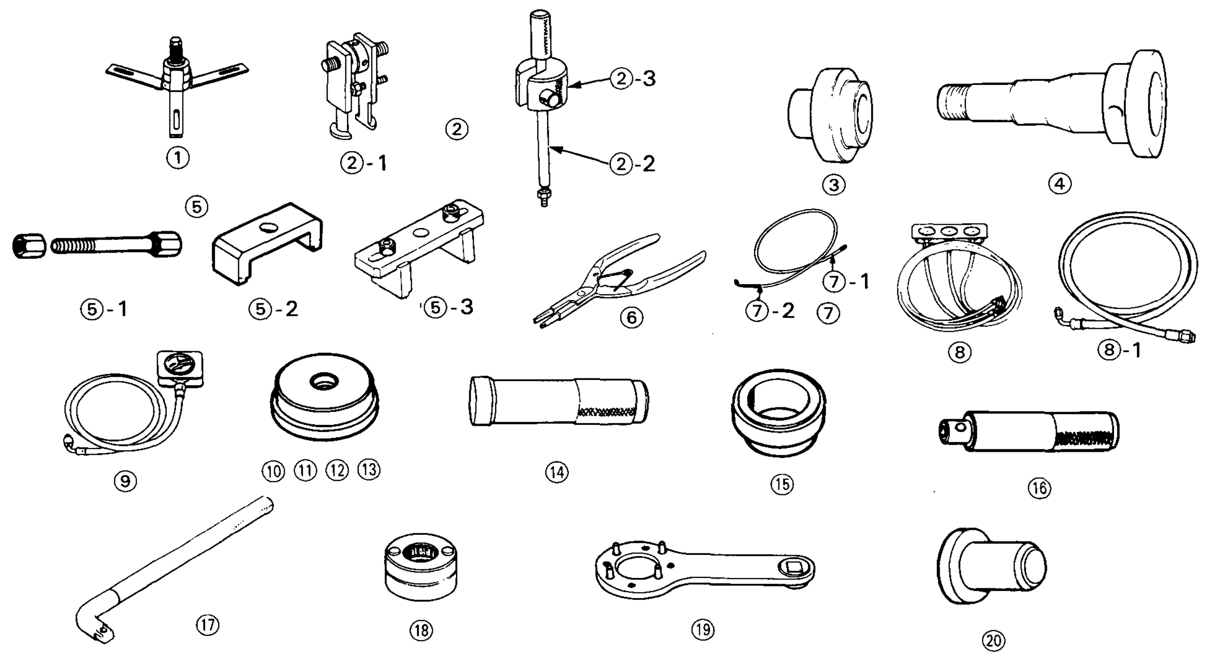


3. Turn the disengagement bolt counterclockwise until the disengagement bolt rotates about 180° and is stopped by the lock plate.

4. Tighten the middle bolt.

   NOTE: After service or towing is completed, return the plate to the normal (4WD on) position and tighten the middle bolt.

Ref. No.	Tool Number	Description	Qty	Page Reference
①	07HAC–PK40101	Housing Puller	1	14-377
②	07JAC–PH80000	Adjustable bearing Remover Set	1	14-411,412,415
②-1	07JAC–PH80100	Bearing Remover Attachment	1	14-411,412,415
②-2	07JAC–PH80200	Remover Handle Assembly	1	14-411,412,415
②-3	07741–0010201	Remover Weight	1	14-411,412,415
③	07JAJ–PH80100	Drive Gear Gauge	1	14-422,423
④	07KAJ–PS50100	Driven Gear Dummy Shaft	1	14-421,422,423,426
⑤	07LAE–PX40000	Clutch Spring Compressor Set	1	14-405,408
⑤-1	07GAE–PG40200	Clutch Spring Compressor Bolt	1	14-405,408
⑤-2	07HAE–PL50100	Clutch Spring Compressor Attachment	1	14-405,408
⑤-3	07LAE–PX40100	Clutch Spring Compressor Attachment	1	14-405,408
⑥	07LGC–0010100	Snap Ring Pliers	1	14-413,414
⑦	07MAJ–PY40100	A/T Oil Pressure Gauge Hose Assembly	1	14-356
⑦-1	07MAJ–PY40110	Oil Pressure Gauge Hose	1	14-356
⑦-2	07MAJ–PY40120	Oil Pressure Joint	1	14-356
⑧	07406–0020300	A/T Oil Pressure Gauge Set	1	14-356
⑧-1	07406–0020201	A/T Oil Pressure Gauge Hose	1	14-356
⑨	07406–0070000	AT Low Pressure Gauge	1	14-356
⑩	07746–0010200	Attachment, 37 x 40 mm	1	14-415
⑪	07746–0010400	Attachment, 52 x 55 mm	1	14-421
⑫	07746–0010500	Attachment, 62 x 68 mm	1	14-411,412,413, 414,419,421
⑬	07746–0010600	Attachment, 72 x 75 mm	1	14-411,412,413
⑭	07746–0030100	Driver 40 mm, I.D.	1	14-424,426
⑮	07746–0030400	Attachment 35 mm, I.D.	1	14-424,426
⑯	07749–0010000	Driver	1	14-411,412,413, 414,415,419,421, 426
⑰	07907–6010300	Socket Wrench Handle	1	14-419,427
⑱	07923–6890202	Mainshaft Holder	1	14-375,438
⑲	07926–SD90000	Flange Holder	1	14-419,427
⑳	07948–SC20200	Oil Seal Driver	1	14-426



Description

The Automatic Transmission is a combination of a 3-element torque converter and triple-shaft automatic transmission which provides 4 speeds forward and 1 speed reverse. The entire unit is positioned in line with the engine.

Torque Converter, Gears and Clutches
The torque converter consists of a pump, turbine and stator, assembled in a single unit.
The torque converter is connected to the engine crankshaft so they turn together as a unit as the engine turns. Around the outside of the torque converter is a ring gear which meshes with the starter pinion when the engine is being started. The entire torque converter assembly serves as a while transmitting power to the transmission mainshaft.
The transmission has three parallel shafts, the mainshaft, countershaft and sub-shaft. The mainshaft is in line with the engine crankshaft.
The mainshaft includes the clutches for 1st, and 2nd/4th, and gears for 3rd, 2nd, 4th, Reverse and 1st (3rd gear is integral with the mainshaft, while reverse gear is integral with 4th gear).
The countershaft includes 3rd clutch and gears for 2nd, 3rd, and 4th, Reverse and 1st.
4th and reverse gears can be locked to the countershaft at its center, providing 4th gear or Reverse, depending on which way the selector is moved.
The sub-shaft includes the low hold clutch.
The gears on the mainshaft are in constant mesh with those on the countershaft. When certain combinations of gears in the transmission are engaged by the clutches, power is transmitted from the mainshaft to the countershaft to provide $\boxed{D_4}$, $\boxed{D_3}$, $\boxed{2}$ and $\boxed{R}$.

Electronic Control
The electronic control system consists of an automatic control unit, sensors, and 4 solenoid valves. Shifting and lock-up are electronically controlled for comfortable driving under all conditions.
The A/T control unit is located under the dashboard.

Hydraulic Control
The valve assembly includes the main valve body, secondary valve body, servo valve body, regulator valve body and lock-up valve body, through the respective separator plates.
They are bolted to the torque converter case as an assembly.
The main valve body contains the manual valve, 1-2 shift valve,2-3 shift valve, 3-4 shift valve, pressure relief valve, orifice control valve, cooler relief valve, and oil pump gear.
The secondary valve body includes the CPC valve, servo control valve, modulator valve, 4-2 kick-down valve, 4-3 kick-down valve, 4th exhaust valve and 2nd orifice control valve.
The servo valve body contains the accumulator pistons, throttle B valve, and the servo valve.
The regulator valve body contains the torque converter check valve, pressure regulator valve and lock-up control valve. Fluid from the regulator passes through the manual valve to the various control valves.
The lock-up valve body contains a lock-up timing valve and lock-up shift valve.

Shift Control Mechanism
Input from various sensors located throughout the car determines which shift control solenoid valve the A/T control unit will activate. Activating a shift control solenoid valve changes modulator pressure, causing a shift valve to move. This pressurizes a line to one of the clutches, engaging that clutch and its corresponding gear.

Lock-up Mechanism
In $\boxed{D_4}$ or $\boxed{D_3}$, in 2nd, 3rd and 4th, pressurized fluid is drained from the back of the torque converter through an oil passage, causing the lock-up piston to be held against the torque converter cover. As this takes place, the mainshaft rotates at the same speed as the engine crankshaft. Together with hydraulic control, an A/T control unit optimizes the timing of the lock-up mechanism.
The lock-up shift valve body controls the range of lock-up according to lock-up control solenoid valves A and B , and throttle valve B. When lock-up control solenoid valves A and B activate, modulator pressure changes. Lcok-up control solenoid valves A and B are mounted on the torque converter housing, and are controlled by the A/T control unit.

Gear Selection

The selector lever has six positions: $\boxed{P}$ PARK, $\boxed{R}$ REVERSE, $\boxed{N}$ NEUTRAL, $\boxed{D_4}$ 1st through 4th gear ranges, $\boxed{D_3}$ 1st through 3rd gear ranges, and $\boxed{2}$ 2nd gear.

Position	Description
$\boxed{P}$ PARK	Front wheels locked; parking pawl engaged with parking gear on countershaft. All clutches released.
$\boxed{R}$ REVERSE	Reverse; reverse selector engaged with countershaft reverse gear and 4th gear clutch locked.
$\boxed{N}$ NEUTRAL	All clutches released.
$\boxed{D_4}$ DRIVE (1 through 4)	General driving; starts off in 1st, shifts automatically to 2nd, 3rd, then 4th, depending on vehicle speed and throttle position. Downshift through 3rd, 2nd and 1st on deceleration to stop. The lock-up mechanism comes into operation in $\boxed{D_4}$.
$\boxed{D_3}$ DRIVE (1 through 3)	For rapid acceleration at highway speeds and general driving; starts off in 1st, shifts automatically to 2nd, then 3rd, depending on vehicle speed and throttle position. Downshifts through 2nd to 1st on deceleration to stop.
$\boxed{2}$ SECOND	For engine braking or better traction starting off on loose or slippery surfaces. LOW switch: OFF; stays in 2nd gear LOW switch: ON and below 30 mph (50 km/h approx.); in 1st gear LOW switch: ON and above 30 mph (50km/h approx.); in 2nd gear

Starting is possible only in $\boxed{P}$ and $\boxed{N}$ through the use of a slide-type, neutral-safety switch.

Position Indicator

A position indicator in the instrument panel shows what gear has been selected without having to look down at the console.

Description

Clutches

The four speed automatic transmission uses hydraulically actuated clutches to engage or disengage the transmission gears. When clutch pressure is introduced into the clutch drum, the clutch piston is applied. This presses the friction discs and steel plates together, locking them so they don't slip. Power is then transmitted through the engaged clutch pack to its hub-mounted gear.

Likewise, when clutch pressure is bled from the clutch pack, the piston releases the friction discs and steel plates, and they are free to slide past each other while disengaged. This allows the gear to spin independently of its shaft, transmitting no power.

[1st Clutch]
The first clutch engages/disengages first gear, and is located at the end of the mainshaft, just behind the R side cover. The first clutch is supplied clutch pressure by its oil feed pipe within the mainshaft.

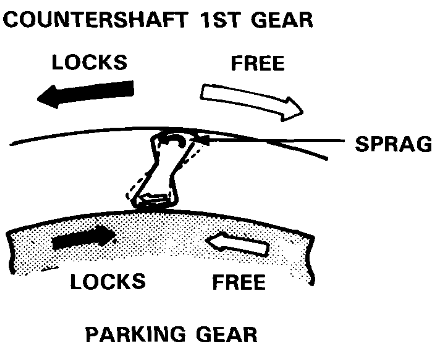
[1st-hold Clutch]
The first hold clutch engages/disengages 1st-hold or 1 position, and is located at the center of the sub-shaft. The 1st-hold clutch is supplied clutch pressure by its oil feed pipe within the sub-shaft.

[2nd Clutch]
The second clutch engages/disengages second gear, and is located at the center of the mainshaft. The second clutch is joined back-to-back to the fourth clutch. The second clutch is supplied clutch pressure through the mainshaft by a circuit connected to the regulator valve body.

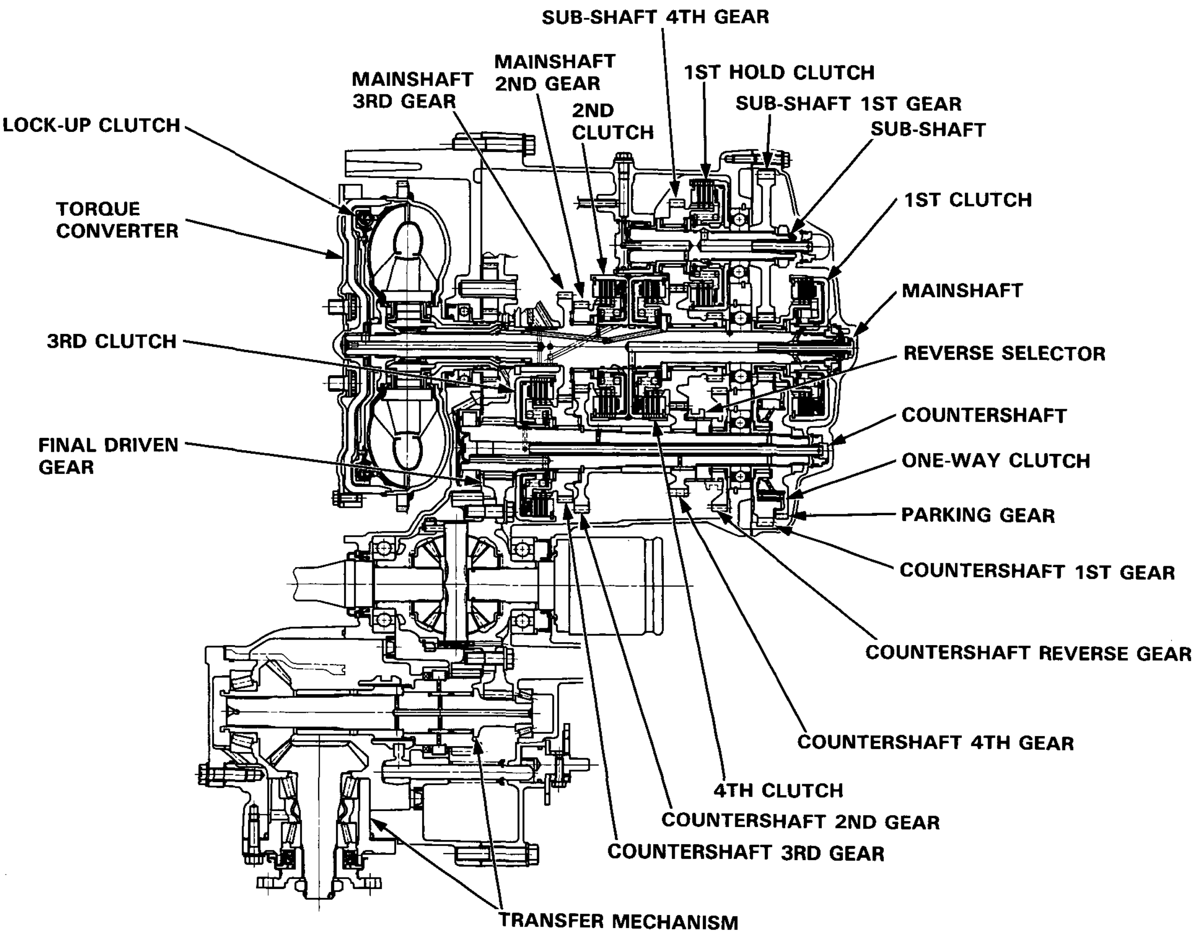
[3rd Clutch]
The third clutch engages disengages third gear, and is located at the end of the countershaft, opposite the R side cover. The third clutch is supplied clutch pressure by bits oil feed pipe within the countershaft.

[4th Clutch]
The fourth clutch engages disengages fourth gear, as well as reverse gear, and is located at the center of the mainshaft. The fourth clutch is joined back-to-back to the second clutch. The fourth clutch is supplied clutch pressure by its oil feed pipe within the mainshaft.

[One-way Clutch]
The one-way clutch is positioned between the parking gear and first gear, with the parking gear splined to the countershaft. The first gear provides the outer race surface, and the parking gear provides the inner race surface. The one-way clutch locks up when power is transmitted from the mainshaft first gear to the countershaft first gear.
The first clutch and gears remain engaged in the 1st, 2nd, 3rd, and 4th gear ranges in the $\boxed{D_4}$, $\boxed{D_3}$ or $\boxed{2}$ position. However, the one-way clutch disengages when the 2nd, 3rd, or 4th clutches gears are applied in the $\boxed{D_4}$, $\boxed{D_3}$ or $\boxed{2}$ position. This is because the increased rotational speed of the gears on the countershaft over-ride the locking "speed range" of the one-way clutch. Thereafter, the one-way clutch free-wheels with the first clutch still engaged.



NOTE: View from R. side cover side.


SUB-SHAFT 4TH GEAR
MAINSHAFT 2ND GEAR
1ST HOLD CLUTCH
MAINSHAFT 3RD GEAR
SUB-SHAFT 1ST GEAR
2ND CLUTCH
LOCK-UP CLUTCH
SUB-SHAFT
1ST CLUTCH
TORQUE CONVERTER
MAINSHAFT
3RD CLUTCH
REVERSE SELECTOR
COUNTERSHAFT
FINAL DRIVEN GEAR
ONE-WAY CLUTCH
PARKING GEAR
COUNTERSHAFT 1ST GEAR
COUNTERSHAFT REVERSE GEAR
COUNTERSHAFT 4TH GEAR
4TH CLUTCH
COUNTERSHAFT 2ND GEAR
COUNTERSHAFT 3RD GEAR
TRANSFER MECHANISM

(cont'd)

Description

Clutches (cont'd)

Lock-up clutch

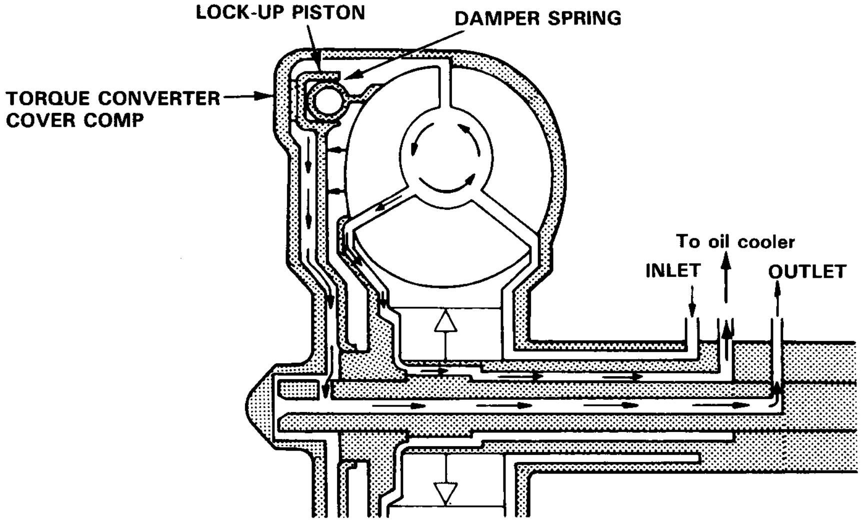
1. Operation (clutch on)

With the lock-up clutch on, the oil in the chamber between the torque converter cover and lock-up piston is discharged, and the converter oil exerts pressure through the piston against the converter cover. As a result, the converter turbine is locked on the converter cover firmly. The effect is to bypass the converter, there by placing the car in direct drive.

Power flow

The power flows by way of:

Engine
↓
Drive plate
↓
Torque converter cover
↓
Lock-up piston
↓
Damper spring
↓
Turbine
↓
Mainshaft

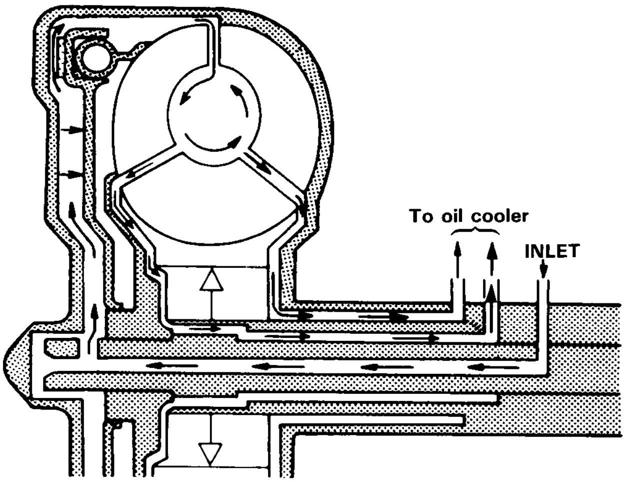


2. Operation (clutch off)

With the lock-up clutch off, the oil flows in the reverse of CLUTCH ON. As a result, the lock-up piston is moved away from the converter cover; that is, the torque converter lock-up is released.

Power flow

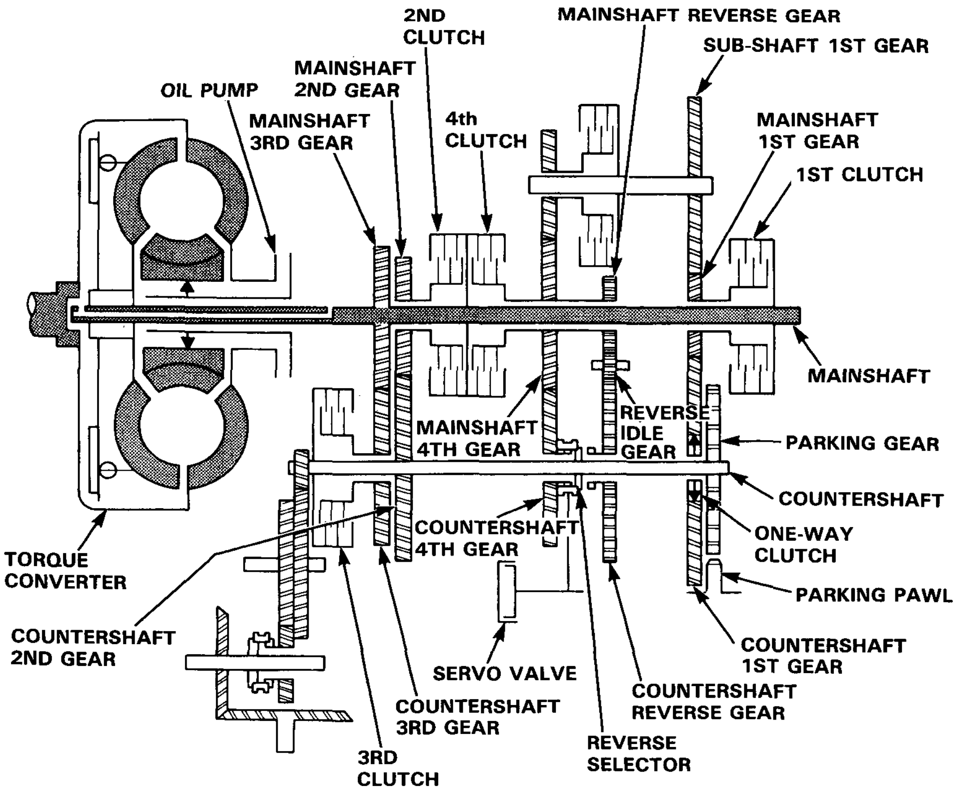
Engine
↓
Drive plate
↓
Torque converter cover
↓
Pump
↓
Turbine
↓
Mainshaft



Power Flow

Position \ Part		Torque Converter	Sub-shaft 1st Gear, Low Hold Clutch	1st Gear 1st Clutch	1st Gear One-way Clutch	2nd Gear 2nd Clutch	3rd Gear 3rd clutch	4th Clutch	4th Gear	Reverse Gear	Parking Gear
P		○	×	×	×	×	×	×	×	×	○
R		○	×	×	×	×	×	○	×	○	×
N		○	×	×	×	×	×	×	×	×	×
D4	1st	○	×	○	○	×	×	×	×	×	×
	2nd	○	×	*○	×	○	×	×	×	×	×
	3rd	○	×	*○	×	×	○	×	×	×	×
	4th	○	×	*○	×	×	×	○	○	×	×
D3	1st	○	×	○	○	×	×	×	×	×	×
	2nd	○	×	*○	×	○	×	×	×	×	×
	3rd	○	×	*○	×	×	○	×	×	×	×
2	2nd	○	×	*○	×	○	×	×	×	×	×
	1st Acceleration	○	○	○	○	×	×	×	×	×	×
	1st Deceleration	○	○	*○	×	×	×	×	×	×	×

○: Engaged
×: Not engaged
*: Also the 1st clutch engaged, power in not transmitted by means of one-way clutch.



Electronic Control System

Electronic Control System

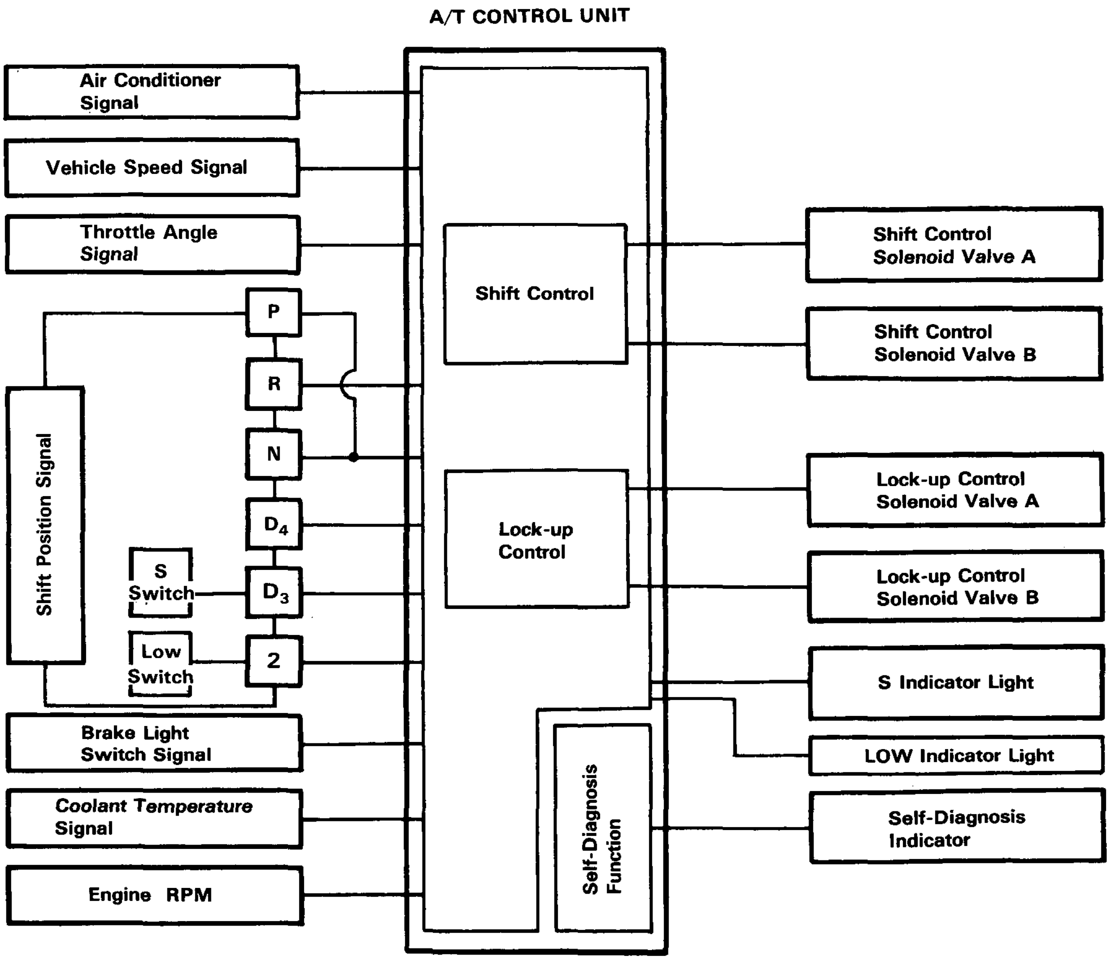
The electronic control system consists of an automatic transmission (A/T) control unit, sensors, and four solenoid valves. Shifting and lock-up are electronically controlled for comfortable driving under all conditions.
The A/T control unit is located under the dashboard.

Shift control
Getting a signal from each sensor, the A/T control unit determines the appropriate shift point and activates shift control solenoid valves A and/or B.
The combination of driving signals to shift control solenoid valves A and B is shown in the table below.

Shift control sol. valve / Range (gear)	A	B
$\boxed{D_4}$ $\boxed{D_3}$ (1ST)	OFF	ON
$\boxed{2}$ $\boxed{D_4}$ $\boxed{D_3}$ (2ND)	ON	ON
$\boxed{D_4}$ $\boxed{D_3}$ (3RD)	ON	OFF
$\boxed{D_4}$ (4TH)	OFF	OFF
$\boxed{2}$ (1ST)	ON	ON
$\boxed{2}$ (2ND)	ON	OFF
$\boxed{R}$ (REVERSE)	OFF	OFF

Lock-up control
From sensor input signals, the A/T control unit determines whether to turn the lock-up ON or OFF and activates lock-up control solenoid valve A and/or B accordingly.
The combination of driving signals to lock-up control solenoid valves A and B is shown in the table below.

Solenoid valve / Lock-up condition	A	B
Lock-up	OFF	OFF
Lock-up, slight	ON	OFF
Lock-up, half	ON	ON
Lock-up, full	ON	ON
Lock-up during deceleration	ON	Duty operation OFF ↔ ON

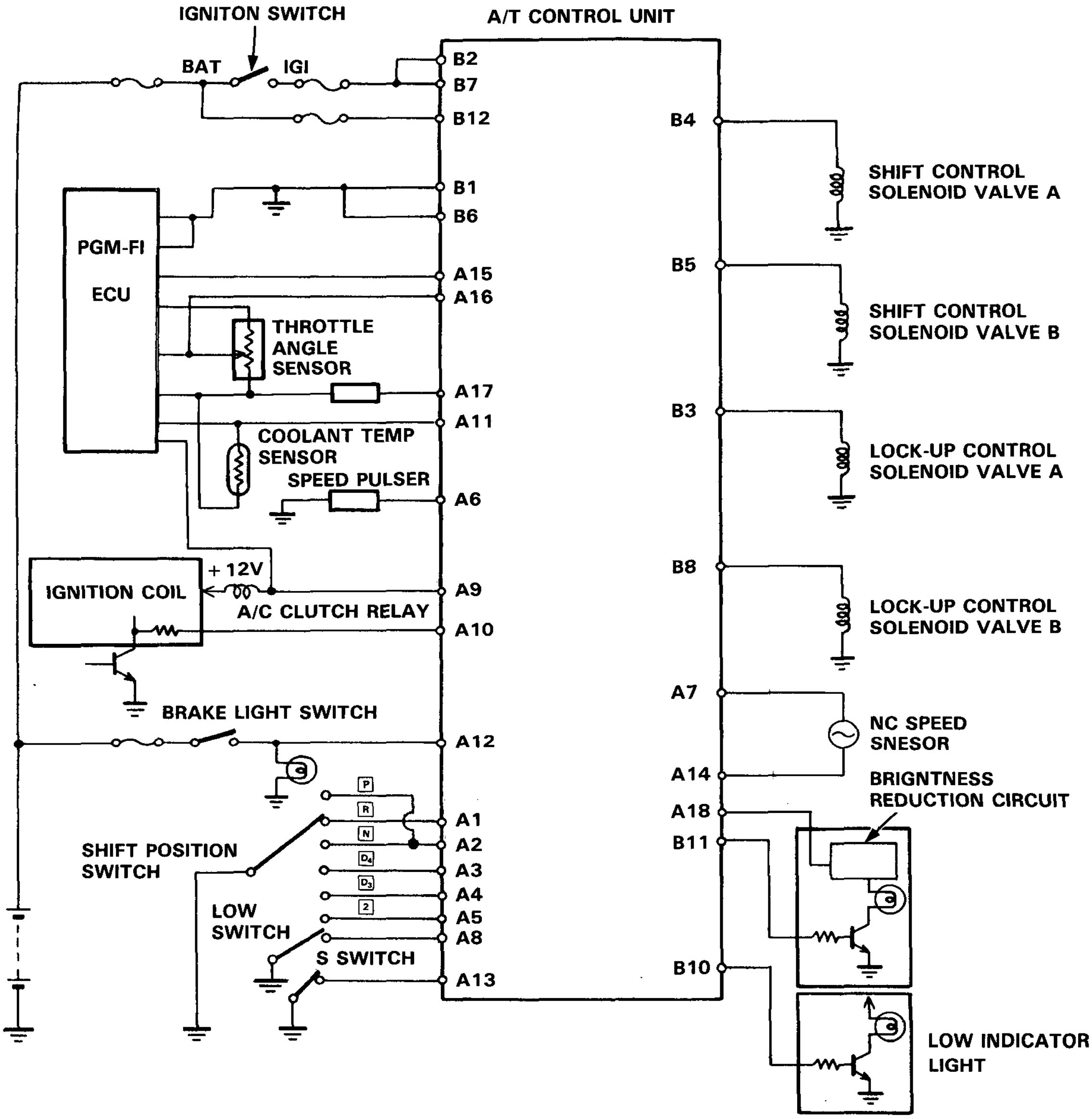

A/T CONTROL UNIT
Air Conditioner Signal
Vehicle Speed Signal
Throttle Angle Signal
Shift Position Signal
P
R
N
D4
D3
2
S Switch
Low Switch
Brake Light Switch Signal
Coolant Temperature Signal
Engine RPM
Shift Control
Lock-up Control
Self-Diagnosis Function
Shift Control Solenoid Valve A
Shift Control Solenoid Valve B
Lock-up Control Solenoid Valve A
Lock-up Control Solenoid Valve B
S Indicator Light
LOW Indicator Light
Self-Diagnosis Indicator

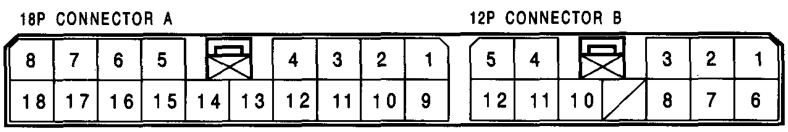
(cont'd)

Description

Electronic Control System (cont'd)

Circuit Diagram and Terminal Location





A/T Control Unit Terminal Location

Hydraulic Flow

General Chart of Hydraulic Pressure

Oil Pump → Regulator Valve → { Line Pressure / Torque Converter Pressure / Lubrication Pressure }

Distribution of Hydraulic Pressure

- Regulator Valve → { Line Pressure / Torque Converter Pressure / Lubrication Pressure }
- Manual Valve → To Select Line Pressure
- Modulator Valve → Modulator Pressure
- 1-2 Shift Valve, 2-3 Shift Valve, 3-4 Shift Valve → Clutch Pressure
- Throttle Valve B → Throttle B Pressure

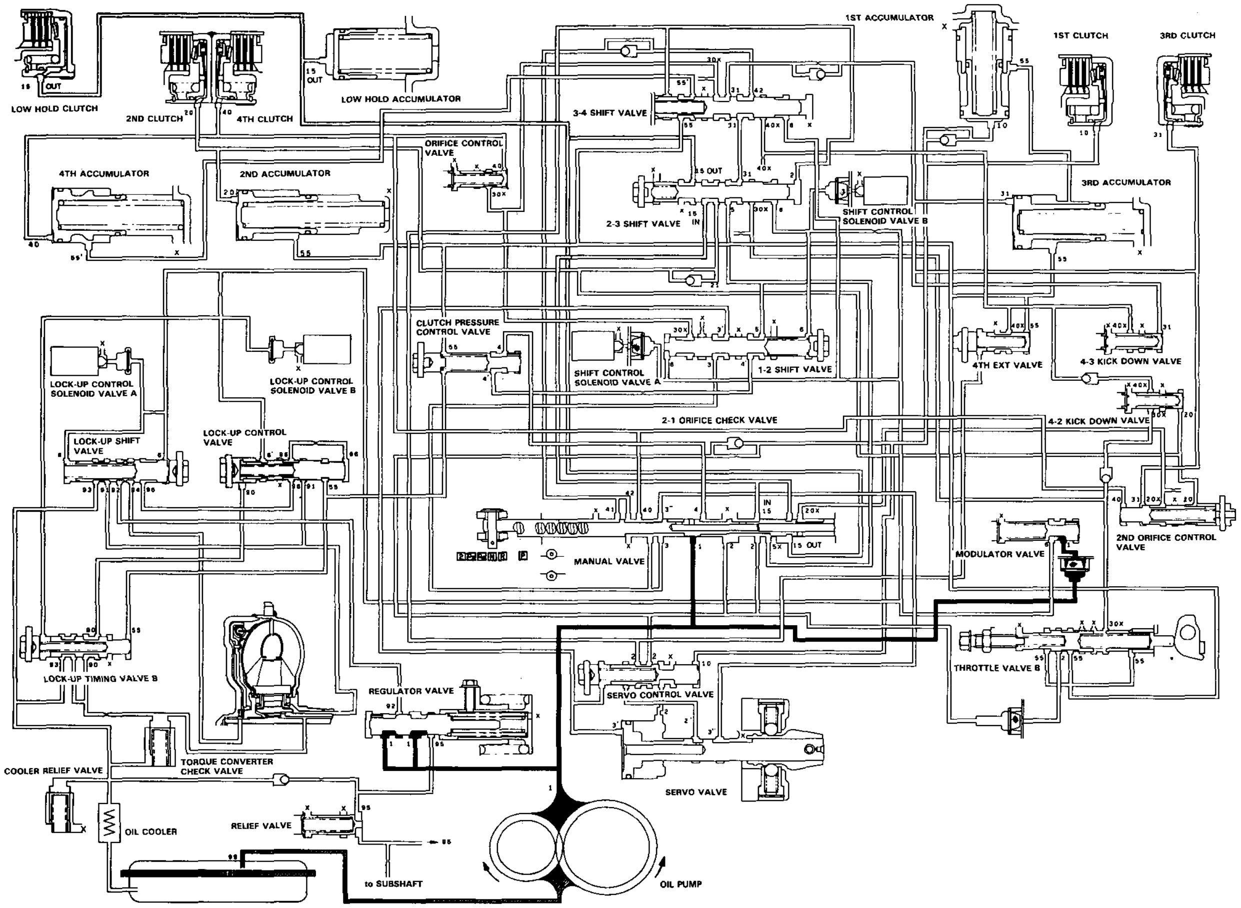
NO.	DESCRIPTION OF PRESSURE	NO.	DESCRIPTION OF PRESSURE	NO.	DESCRIPTION OF PRESSURE
1	LINE	10	1ST CLUTCH	90	TORQUE CONVERTER
2	LINE	15	1ST-HOLD CLUTCH	91	TORQUE CONVERTER
2′	LINE	20	2ND CLUTCH	92	TORQUE CONVERTER
3	LINE	21	2ND CLUTCH	93	OIL COOLER
3′	LINE	22	2ND CLUTCH	94	TORQUE CONVERTER
3″	LINE	30	3RD CLUTCH	95	LUBRICATION
4	LINE	31	3RD CLUTCH	96	TORQUE CONVERTER
4′	LINE	40	4TH CLUTCH	99	SUCTION
5	LINE	41	4TH CLUTCH	X	BLEED
6	MODULATOR	55	THROTTLE B		
6′	MODULATOR	55′	THROTTLE B		

(cont'd)

Hydraulic Flow (cont'd)

N Position

As the engine turns, the oil pump also starts to operate.Automatic Transmission Fluid is drained from (99) and discharged into (1). Then, ATF pressure is controlled by the regulator valve and becomes the line pressure (1). The torque converter inlet pressure (1) enters (94) of torque converter through the orifice and discharges into (90).
the torque converter check valve prevents the torque converter pressure from raising.
Under this condition, the hydraulic pressure is not applied to the clutches as the manual valve stops line pressure (1).



NOTE: When used, "left" or "right" indicates direction on the flow chart.

1st Gear in $\boxed{2}$ Position

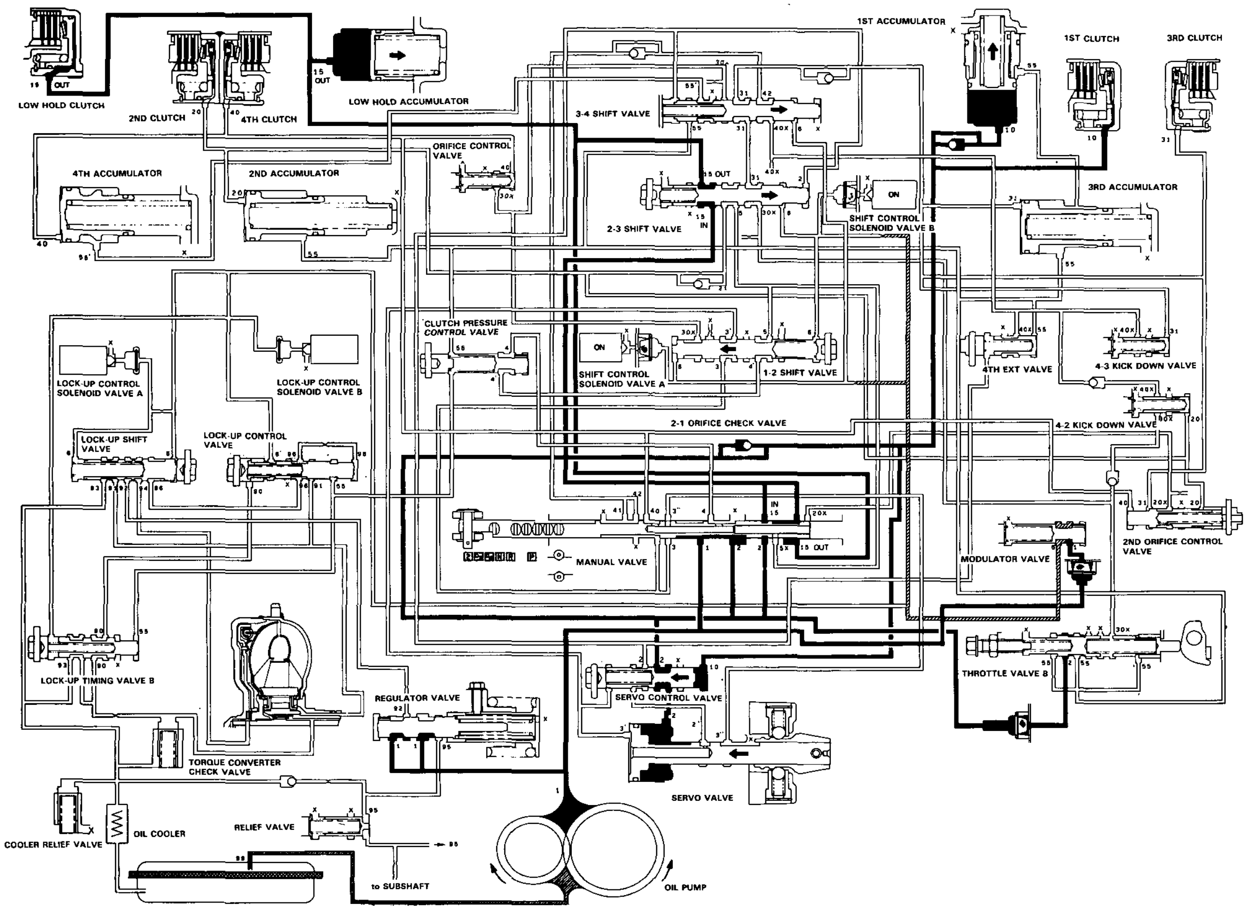
The line pressure (1) becomes the line pressure (2) at the manual valve and passes to the 1st clutch and 1st accumulator.The line pressure (2) goes to the 2-3 shift valve. The 2-3 shift valve is moved to the right by the spring force because the shift control solenoid valves A and B are switched on by the A/T control unit. The valve opens the oil port leading to the low hold clutch and the line pressure (2) passes to the low hold clutch. However the power is transmitted only during deceleration.

Power flows by way of:

Axle Shaft → Front Differential → Countershaft →Countershaft 4th Gear → Mainshaft 4th Gear → Sub Shaft 4th Gear → Low Hold Clutch → Sub Shaft → Sub Shaft 1st Gear → Mainshaft 1st Gear → Mainshaft → Torque Converter

The modulator pressure (6) is supplied to the 1—2, 2—3 and3—4 shift valves.

The line pressure (2) also flows to the throttle valve B.



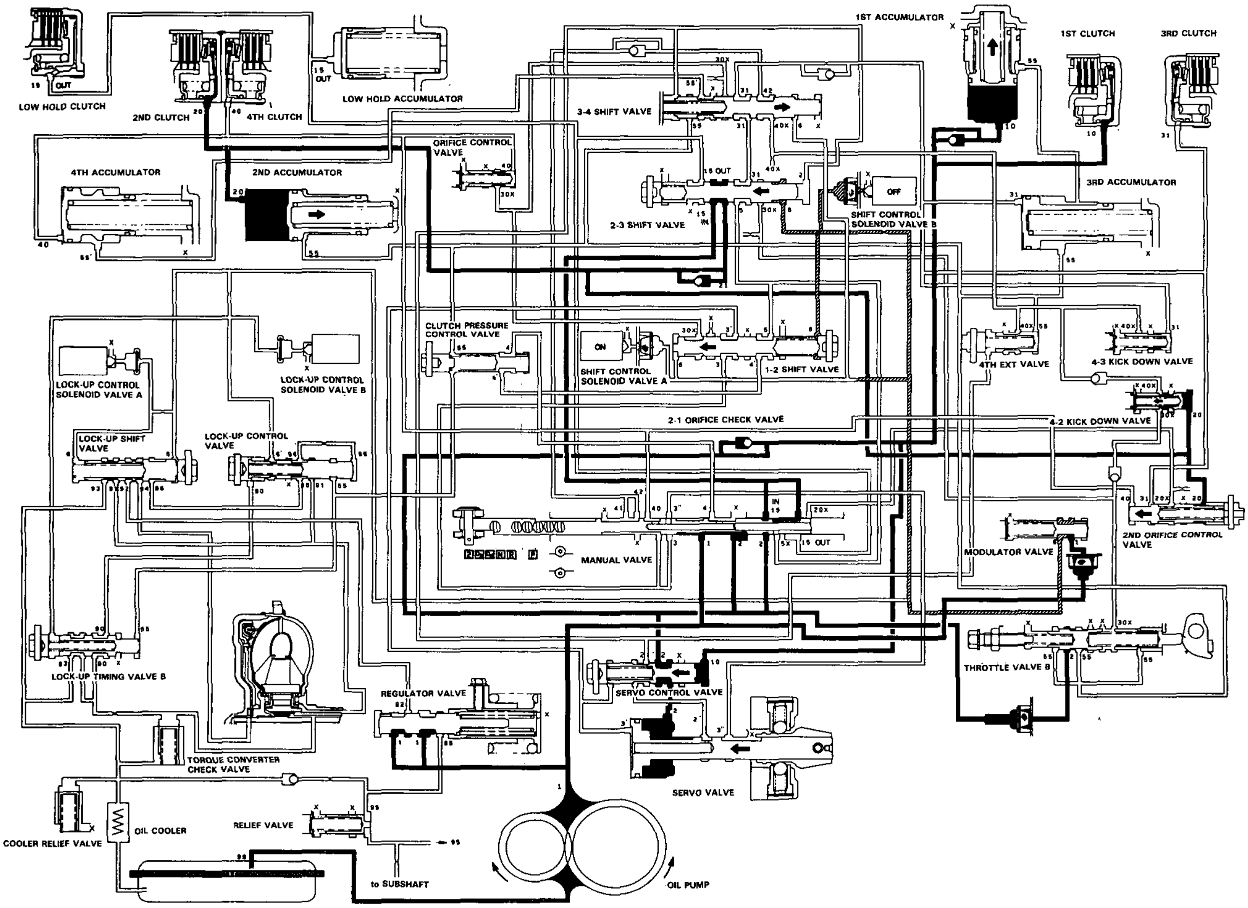
NOTE: When used, "Left" or "right" indicates direction on the flow chart.

(cont'd)

Hydraulic Flow (cont'd)

2nd Gear in [2] Position

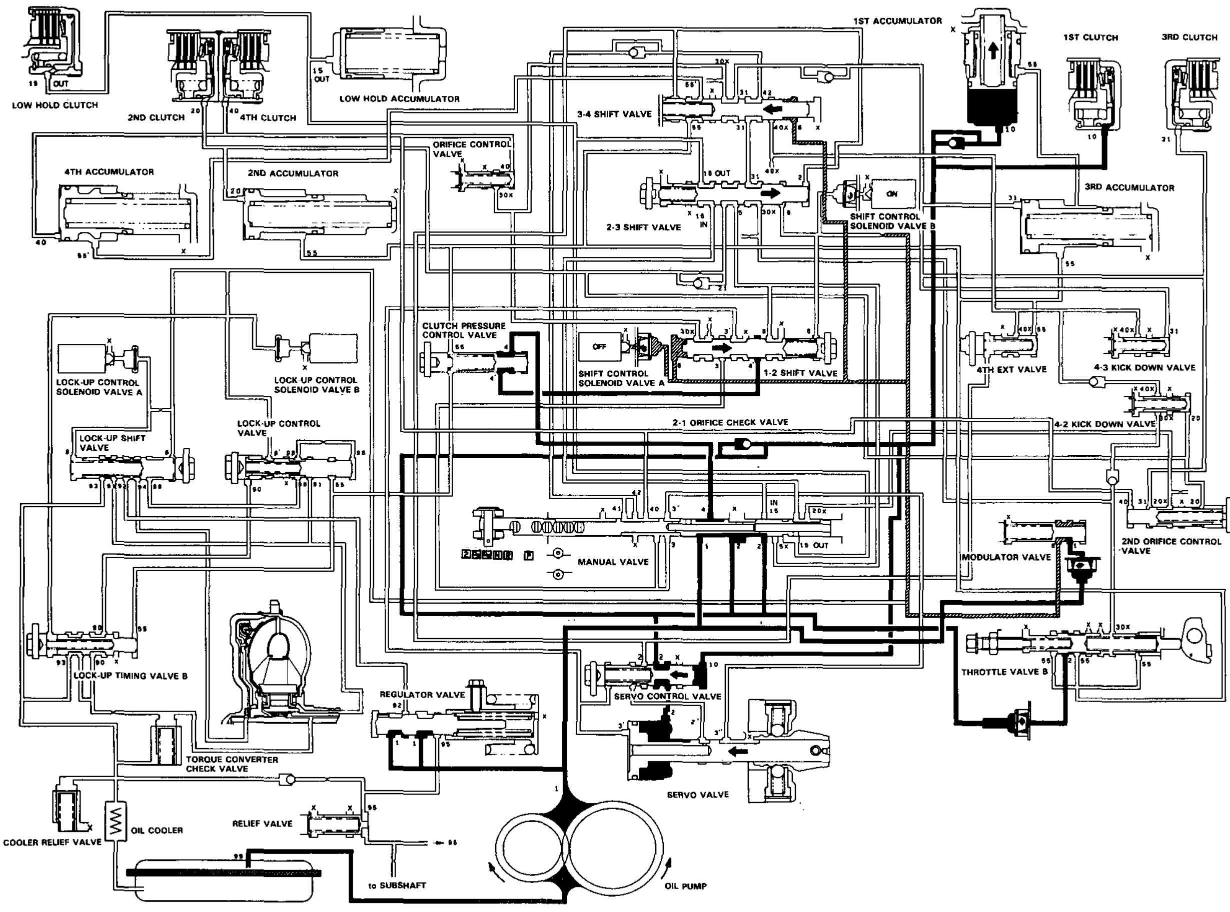
The flow of fluid up to the 2-3 shift valve is same as in the 1st gear. As the speed of the vehicle reaches the prescribed-value, the shift control solenoid valve B is turned off (shiftcontrol solenoid valve A remains on). The 2-3 shift valve is moved to the left, consequently the low hold clutch pressure (15) becomes the 2nd clutch pressure (20) as it passes through the 2-3 shift valve, and passes to the 2nd clutch.
The hydraulic pressure also flows to the 1st clutch. However no power will transmit by means of the one way clutch.



NOTE: When used, ''left'' or ''right'' indicates direction on the flow chart.

1st Gear in $\boxed{D_4}$ or $\boxed{D_3}$ Position

The flow of fluid through the torque converter is the same as in $\boxed{N}$ position.
The line pressure (1) becomes the line pressure (4) and it becomes the 1st clutch pressure (10) through the clutch pressure control valve. The 1st clutch pressure is applied to the 1st clutch and 1st accumulator, consequently the vehicle will move as the engine power is transmitted.
The line pressure (1) becomes the modulator pressure (6) by the modulator valve and it goes to each shift valve. The 1-2 shiftvalve is moved to the right side because the shift control solenoid valve A is turned off and B is on by the A/T control unit. This valve stops 2nd clutch pressure and the power is not transmitted to the 2nd clutch.
The line pressure (2) also flows to the servo valve and throttle valve B.



NOTE: When used, "left" or "right" indicates direction of the flow chart.

(cont'd)

Description

Hydraulic Flow (cont'd)

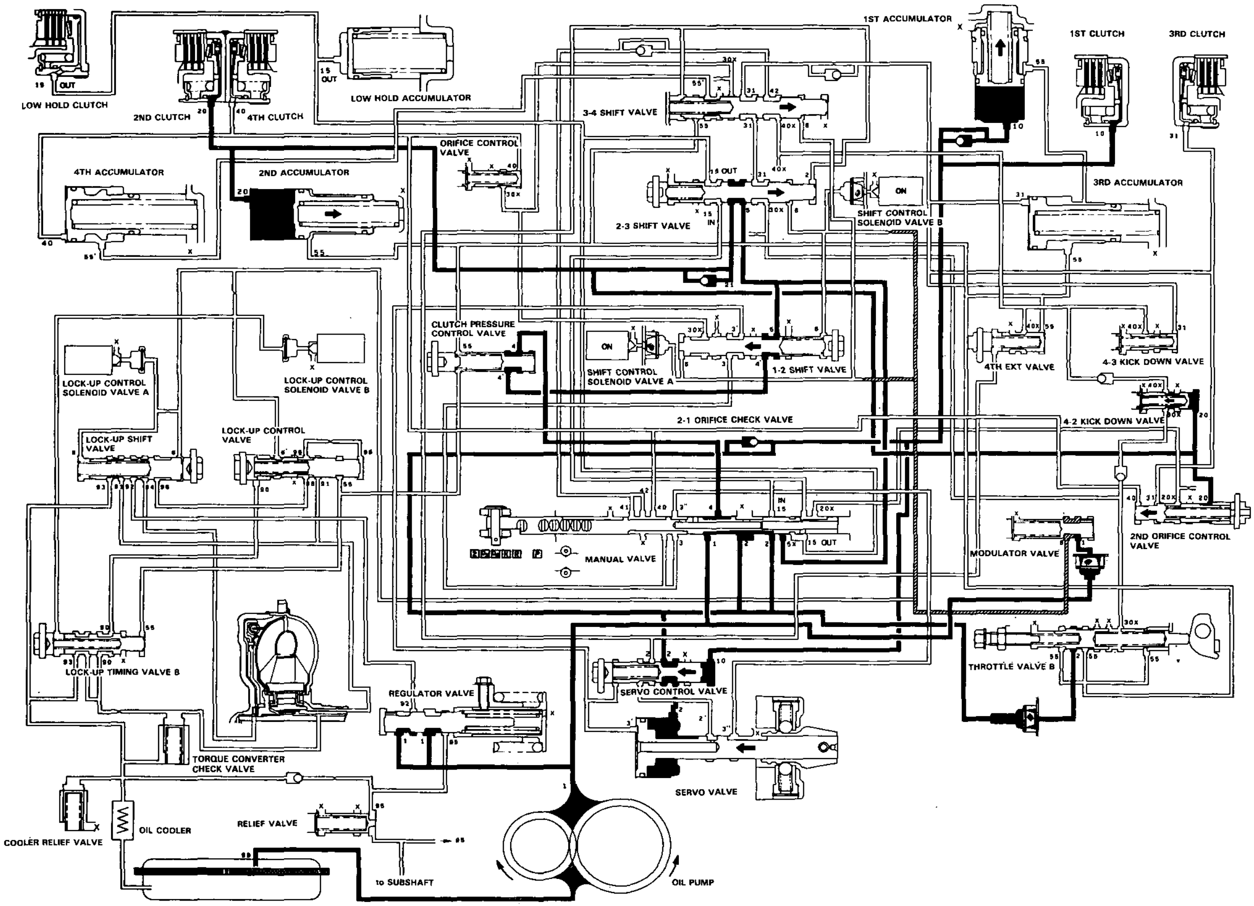
2nd Gear in [D4] or [D3] Position

The flow of fluid up to the 1-2 and 2-3 shift valves is the same as in the 1st speed. When the vehicle speed is increased and reaches the prescribed value, the solenoid valve A is turned on by means of the control unit. As a result, the 1-2 shift valve is moved to the left and uncovers the port leading to the 2nd clutch; the 2nd clutch is engaged.

The fluid flows by way of:

— Line Pressure (4) → Clutch Pressure Control Valve — Clutch Pressure Control Pressure (4') → 1—2 Shift Valve — Clutch Pressure Control Pressure (5) → 2-3 Shift Valve — 2nd Clutch Pressure (22) → Orifice — 2nd Clutch Pressure (20) → 2nd Clutch.

The hydraulic pressure also flows to the 1st clutch. However no power will transmit by means of the one-way clutch.



NOTE: When used, "left" or "right" indicates direction on the flow chart.

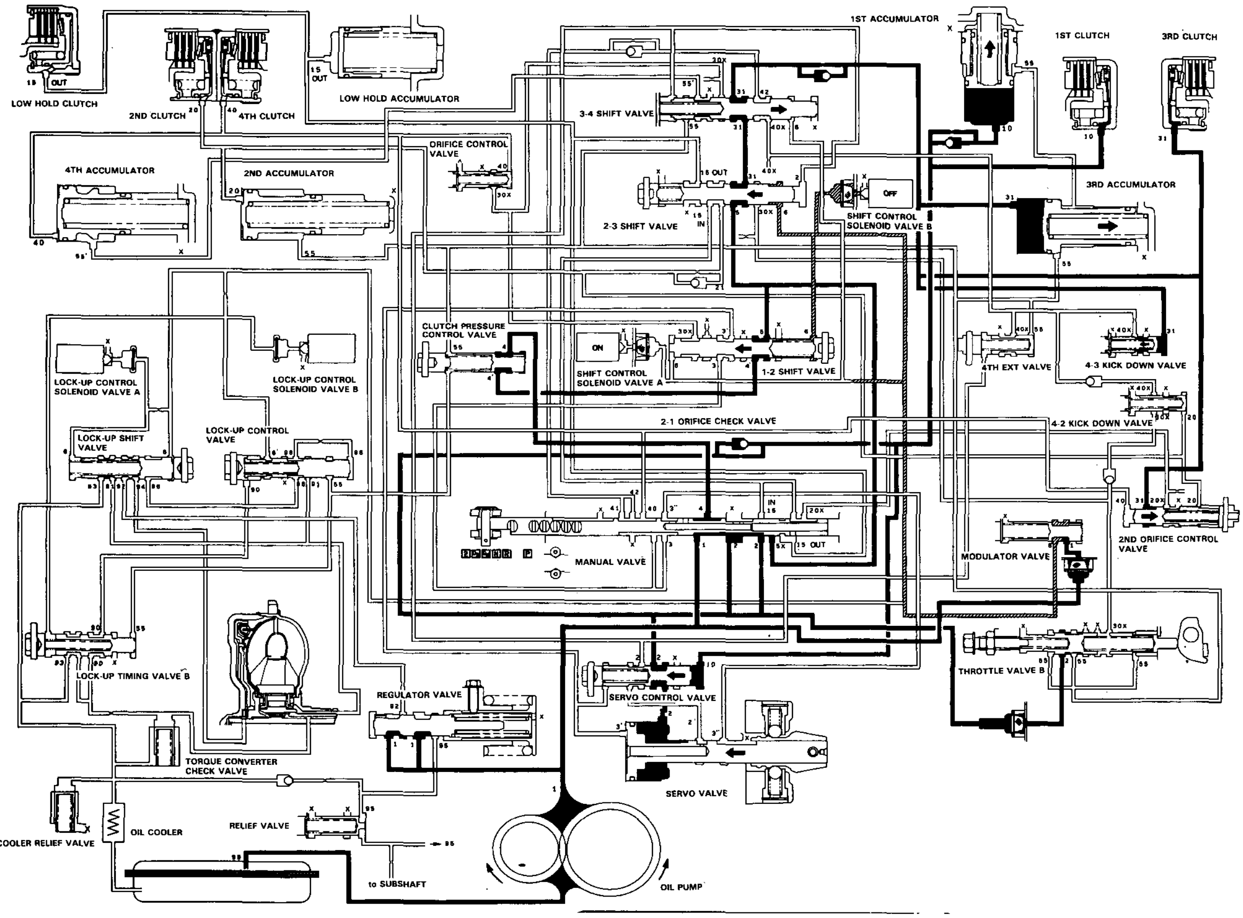
3rd Gear in [D4] or [D3] Position

The flow of fluid up to the 1-2, 2-3 and 3-4 shift valves is the same as in the 2nd speed. As the speed of the car reaches the prescribed value, the shift control solenoid valve B is turned off (shift control valve A remains on). The 2-3 shift valve is then moved to the left, uncovering the oil port leading to the 3rd clutch. Since the 3-4 shift valve is moved to the right to cover the oil port to the 4th clutch, the 3rd clutch is turned on.

Fluid flows by way of:

— Line Pressure (4) → Clutch Pressure Control Valve — Clutch Pressure Control Pressure (4′) → 1-2 Shift Valve — Clutch Pressure Control Pressure (5) → 2-3 ShiftValve — 3rd Clutch Pressure (31) → 3-4 Shift Valve (not controlled) — 3rd Clutch Pressure (31) → 3rd Clutch

The hydraulic pressure also flows to the 1st clutch. However no power will transmit by means of the one-way clutch as in the 2nd gear.



NOTE: When used, "left" or "right" indicates direction on the flow chart.

(cont'd)

Hydraulic Flow (cont'd)

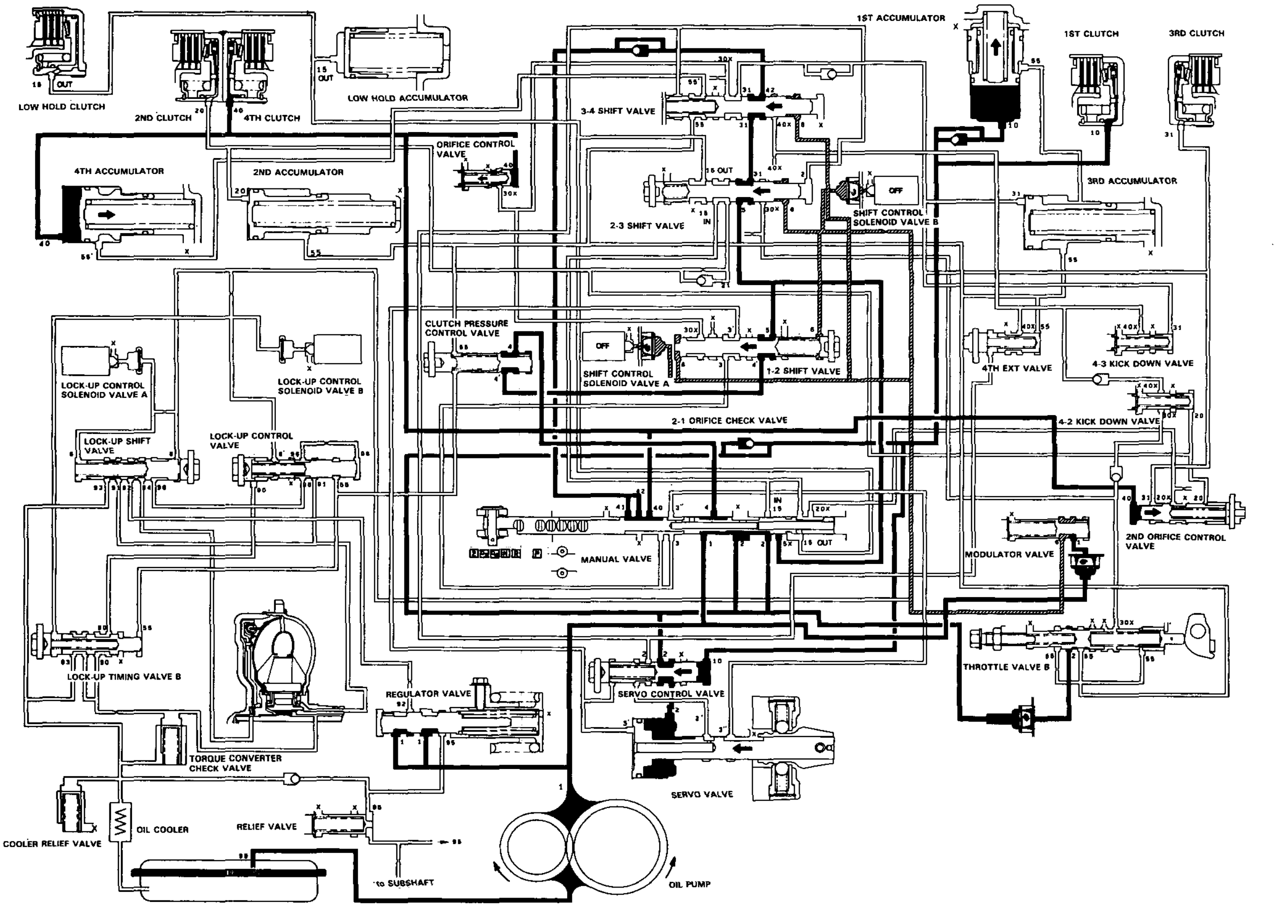
4th Gear in $\boxed{D_4}$ Position

The flow of fluid up to the 1-2, 2-3 and 3-4 shift valves is the same as in the 3rd speed. When the speed of the car reaches the prescribed value, the shift control solenoid valve A is turned off (shift control solenoid valve B remains off). As this takes place, 3-4 shift valve is moved to the left and uncovers the oil port leading to the 4th clutch. Since the 1-2 and 2-3 shift valves are kept on the left side, the fluid flows through the 4th clutch; the power is transmitted through the 4th clutch.

Fluid flows by ways of:

—Line Pressure (4) → Clutch Pressure Control Valve — Clutch Pressure Control Pressure (4') → 1-2 Shift Valve — Clutch Pressure Control Pressure (5) → 2-3 Shift Valve — 3rd Clutch Pressure (31) → 3-4 Shift Valve — 3rd Clutch Pressure (31) → 3-4 Shift Valve — 4th Clutch Pressure (42) → Manual Valve — 4th Clutch Pressure (40) →4th Clutch

The hydraulic pressure also flows to the 1st clutch. However no power will transmit by means of the one-way clutch as in 2nd and 3rd gears.



NOTE: When used, ''left'' or ''right'' indicates direction on the flow chart.

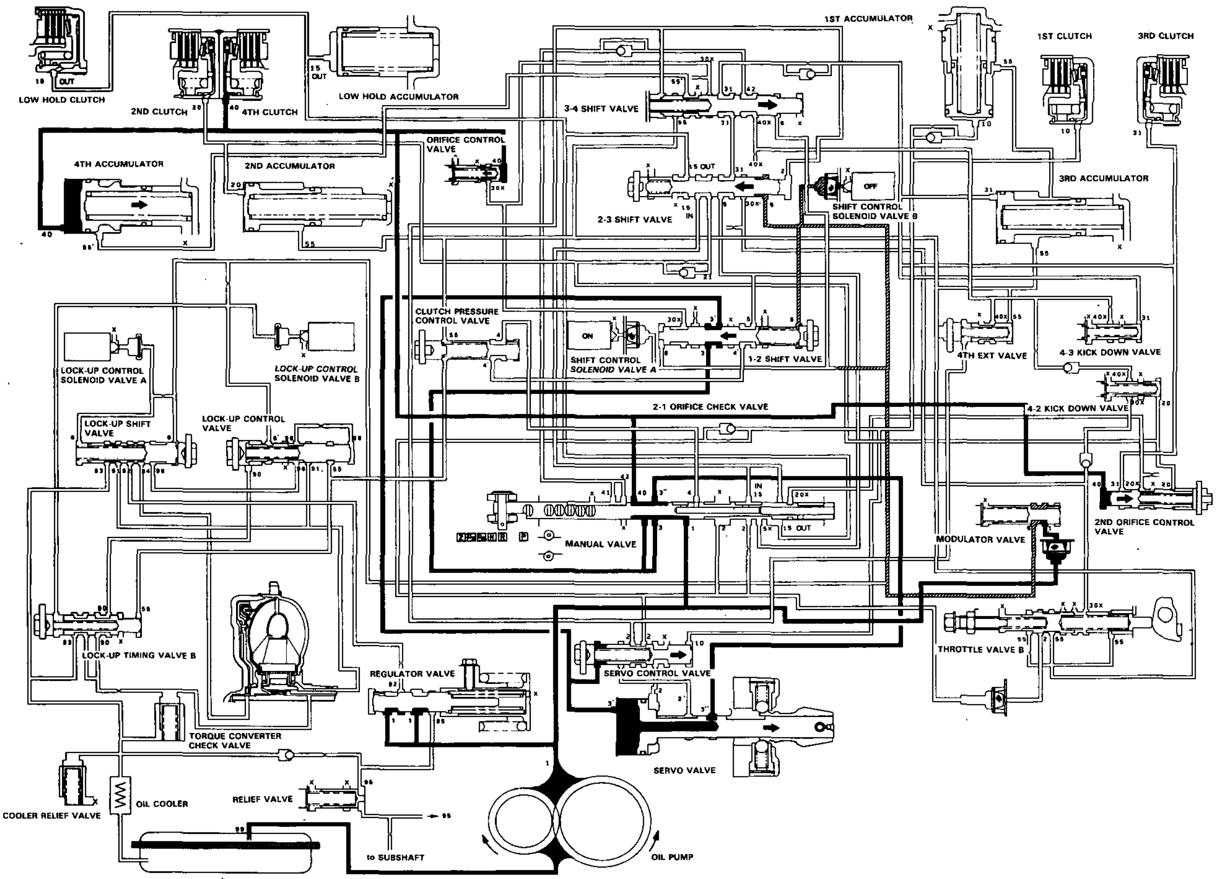
[R] Position

The flow of fluid through the torque converter circuit is the same as in the [N]. The fluid (1) from the oil pump flows through the manual valve and becomes the line pressure (3). It then flows through the 1—2 shift valve to the servo valve (3), *causing the shift fork shaft to be moved in the reverse direction.*
Under this condition, the shift control solenoid valve A on whereas the valve B is turned off as in 3rd. As a result, the1-2 shift valve is also moved to the left. The fluid (3)' will flow through the servo valve and manual valve to the 4th clutch; power is transmitted through the 4th clutch.

Reverse Inhibitor Control

When the [R] position is selected while the vehicle is moving forward at a speed over 10 km/h, the control unit *outputs 1st signal (A: OFF, B: ON), the 1-2 shift valve is moved to the right. The line pressure (3) is intercepted* by the 1-2 shift valve, consequently the power is not transmitted as the 4th clutch and servo valve are not operated.

When the select lever is moved from the [R] position to the [D_4], [D_3] or [2] position, the servo control valve is moved to the left by the 1st or 2nd pressure to move the servo valve.



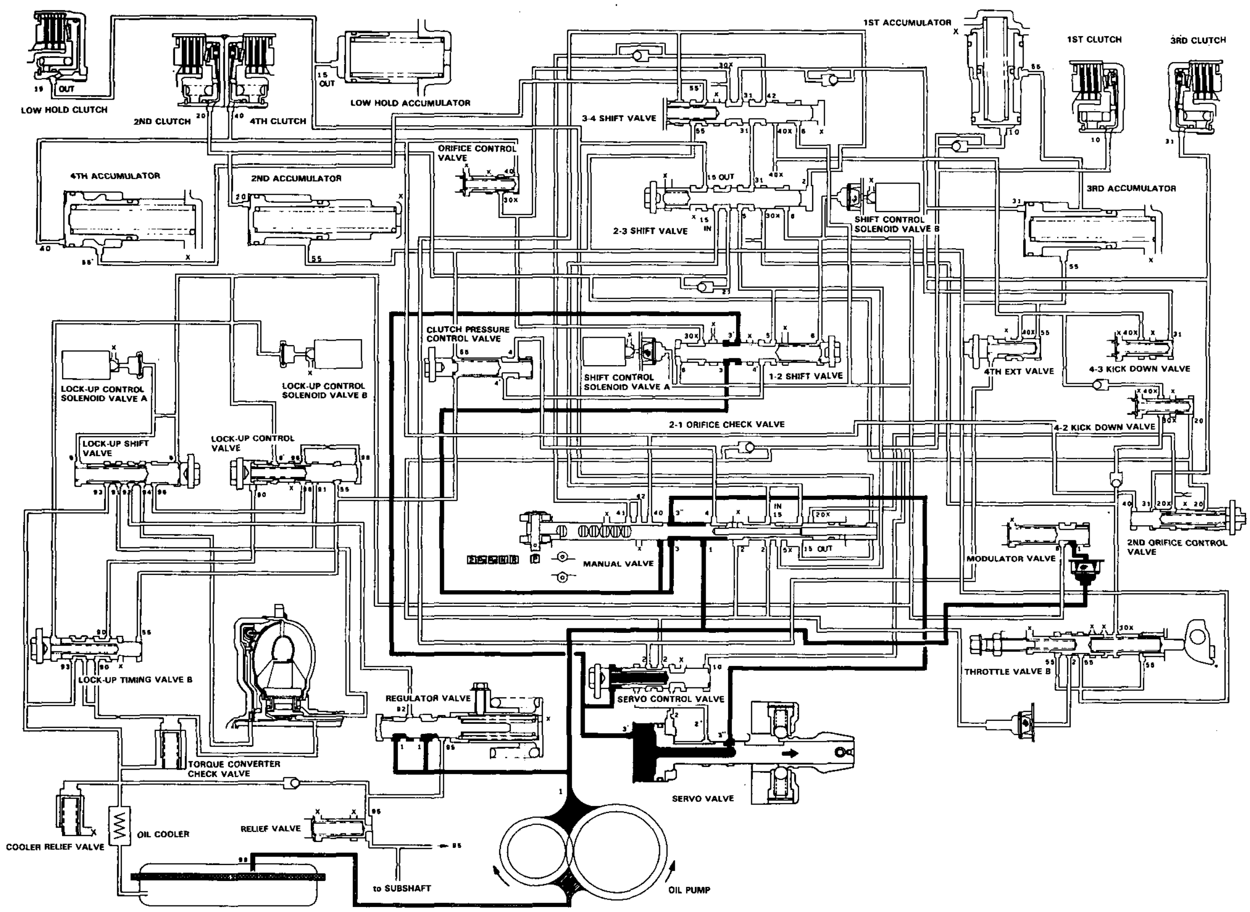
NOTE: When used, "left" or "right" indicates direction on the flow chart.

(cont'd)

Hydraulic Flow (cont'd)

P Position

The flow of fluid through the torque converter is the same in N position.
The line pressure (1) is intercepted by the manual valve, and is not supplied to the clutches. The power is not transmitted.

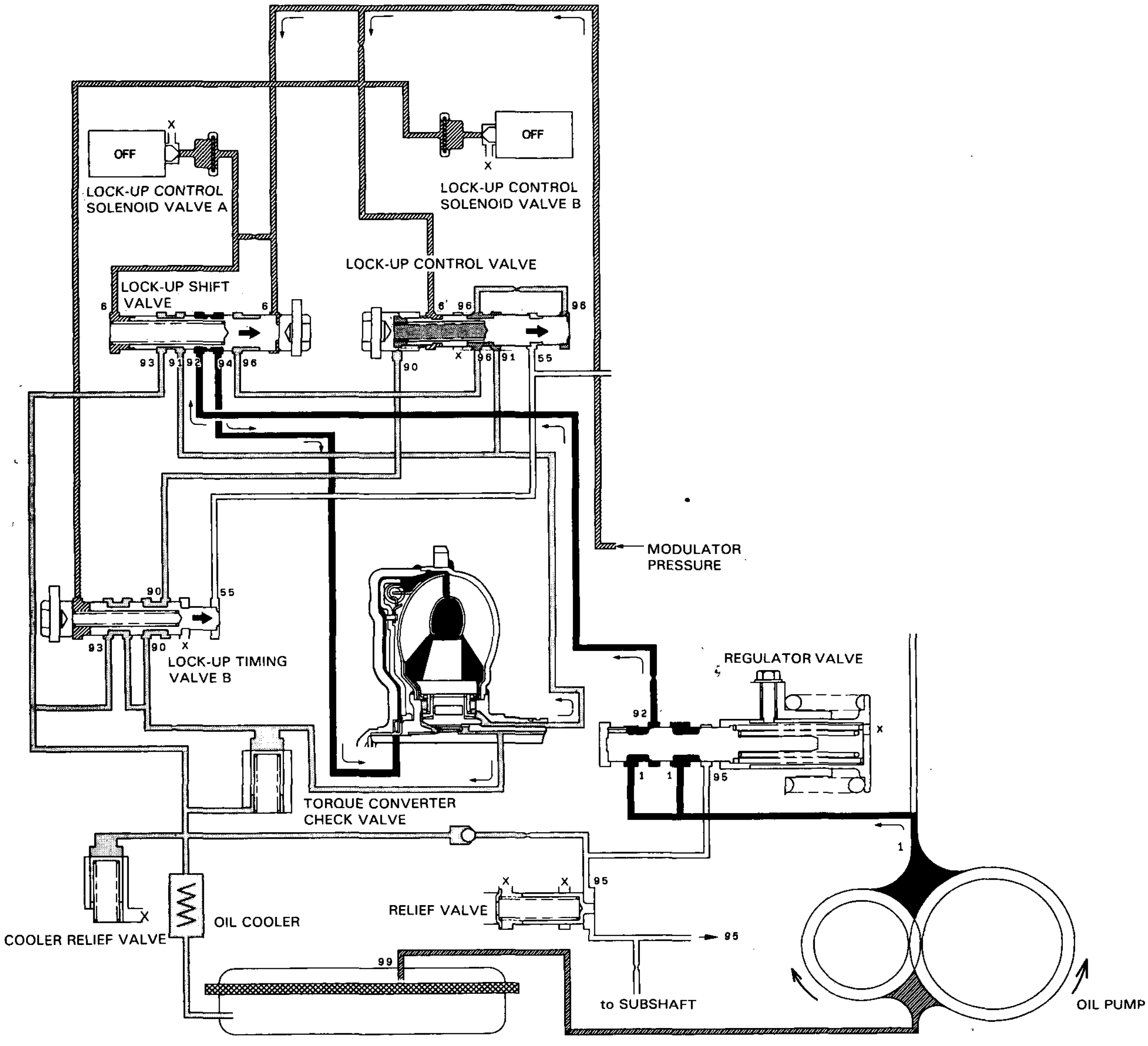


NOTE: When used, "left" or "right" indicats direction on the flow chart.

Lock-up System

In D4 or D3 in 2nd, 3rd and 4th, pressurized fluid is drained from the back of the torque converter through an oil passage, causing the lock-up piston to be held against the torque converter cover. As this takes place, the mainshaft rotates at the same speed as the engine crankshaft. Together with hydraulic control, the A/T control unit optimizes the timing of the lock-up system. Under certain conditions, the lock-up operation is applied during deceleration, in 2nd, 3rd and 4th speed.

The lock-up shift valve controls the range of lock-up according to lock-up control solenoid valves A and B, and the throttle valve. When lock-up control solenoid valves A and B activate, modulator pressure changes. Lock-up control solenoid valves A and B are mounted on the torque converter housing and are controlled by the A/t control unit.



NOTE: When used, "left" or "right" indicates direction on the flow chart.

(cont'd)

Lock-up System (cont'd)

Partial Lock-Up

Lock-Up Control Solenoid Valve A: ON   Lock-Up Control Solenoid Valve B: OFF

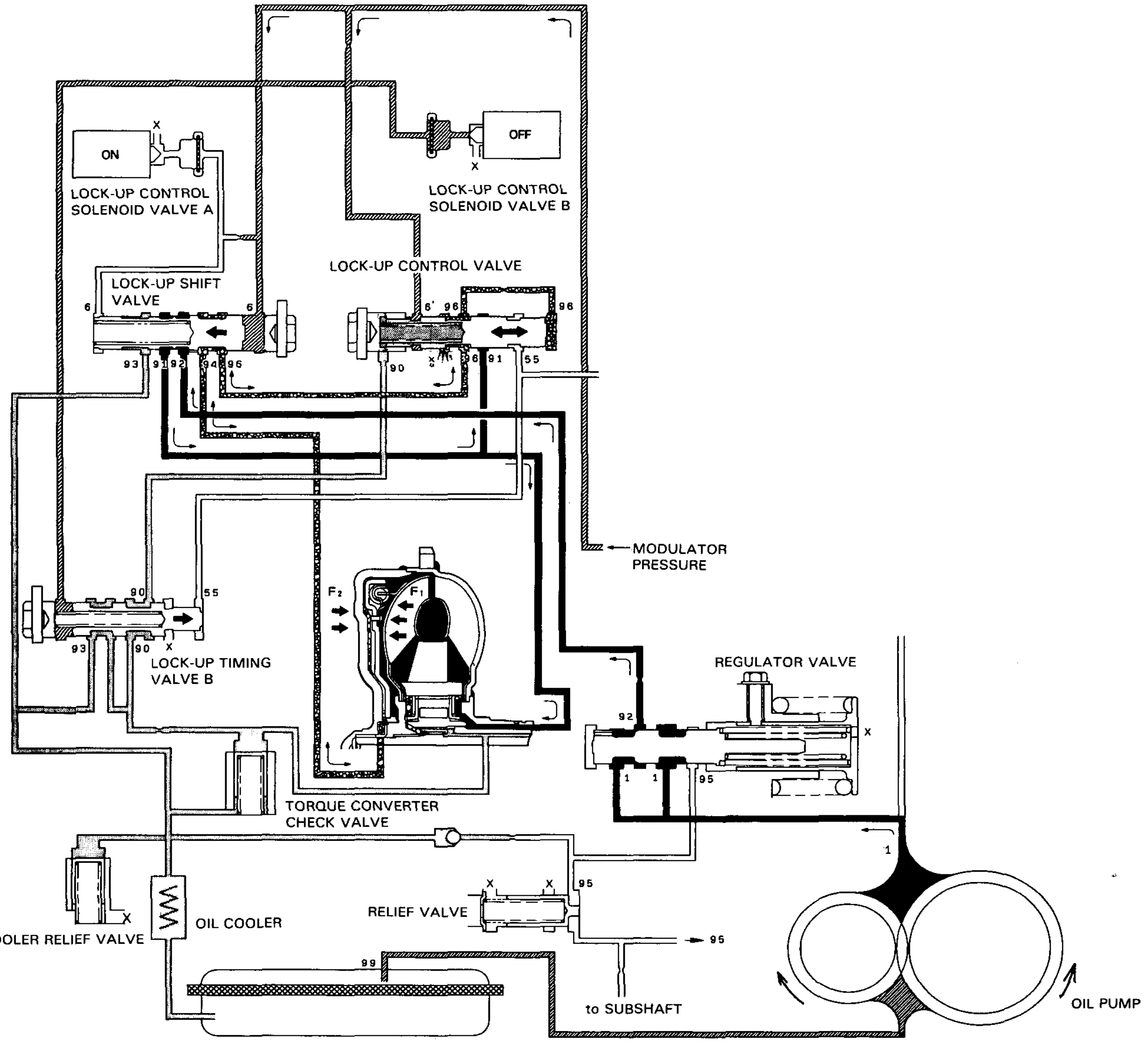
The control unit switches the solenoid valve A to on to releases the modulator pressure in the left cavity of the lock-up shift valve. The modulator pressure in the right cavity of the lock-upshift valve overcomes the spring force, thus the lock-up shift valve is moved to the left side.

The modulator pressure is separated to the two passages:

Torque Converter Inner Pressure: entered into right side— to engage lock-up clutch

Torque Converter Back Pressure: entered into left side —to disengage lock-up clutch

The back pressure (F2) is regulated by the lock-up control valve whereas the position of the lock-up timing valve B is determined by the throttle B pressure, tension of the valve spring and pressure regulated by the modulator. Also the position of the lock-up control valve is determined by the throttle valve B pressure, back pressure of the lock-up control valve and torque converter pressure regulated by the check valve. In low speed range, the throttle B pressure working on the right side of the lock-up control valve is low, causing the valve to be moved to the right. With the lock-up control solenoid valve B kept off, the modulator pressure is maintained in the left end of the lock-up control valve; in other words, the lock-up control valve is moved but slightly to the left side. This slight movement of the lock-up control valve causes the back pressure to be lowered slightly, resulting in partial.

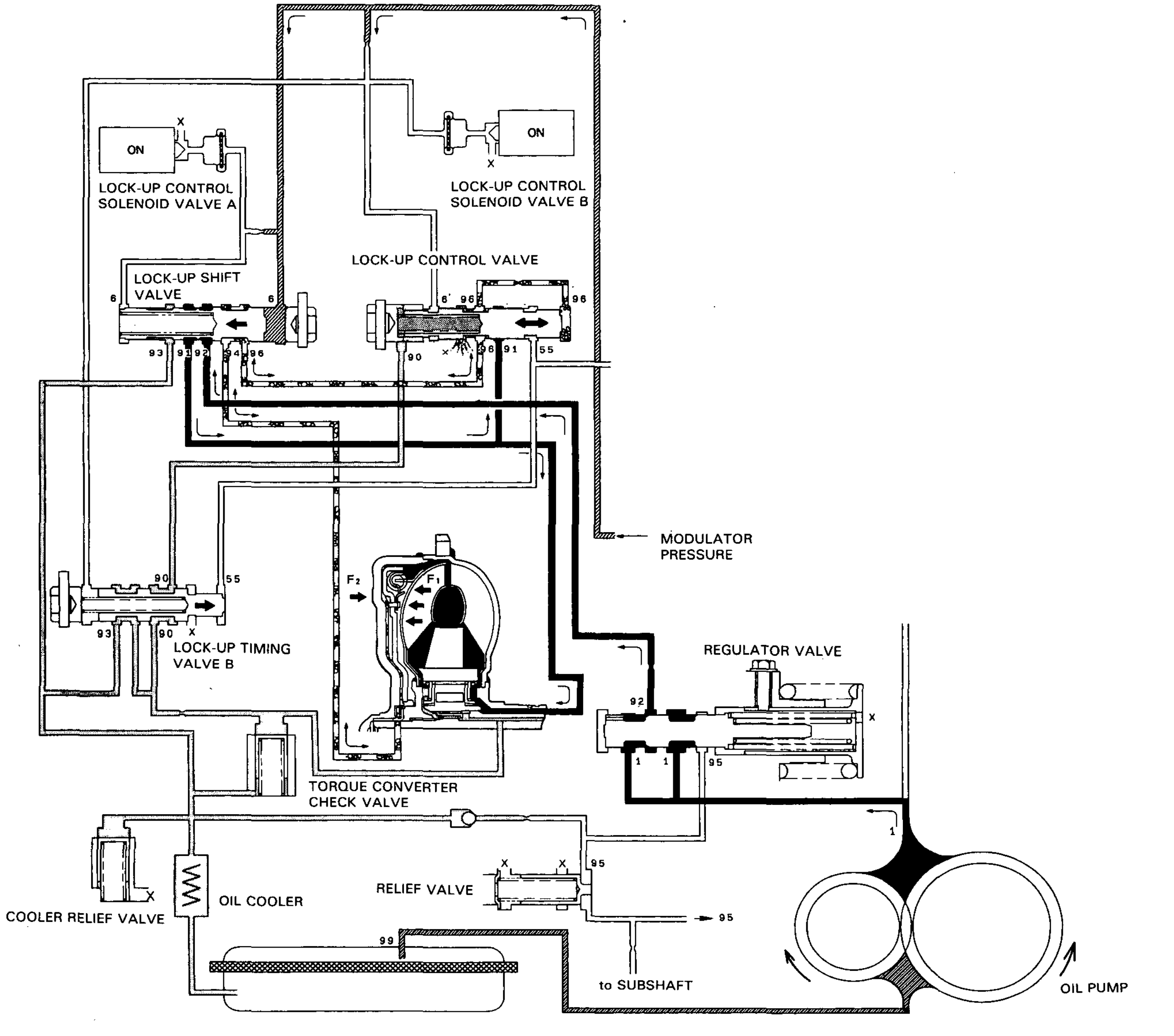


NOTE: When used, "left" or "right" indicates direction on the flow chart.

Half Lock-Up

Lock-Up Control Solenoid Valve A: ON   Lock-Up Control Solenoid Valve B: ON

The modulator pressure is released by the solenoid valve B, causing the modulator pressure in the left cavity of the lock-up control valve to lower.
Also the modulator pressure in the left cavity of the lock-up timing valve B is low. However the throttle B pressure is still low at this time, consequently the lock-up timing valve B is kept on the right side by the spring force.
With the lock-up control solenoid valve B turned on, the lock-up control valve is moved somewhat to the left side, causing the back pressure (F2) to lower. This allows greater amount of the fluid (F1) to work on the lock-up clutch so as to engage the clutch. The back pressure (F2) which still exists prevents the clutch to be engaged fully.



NOTE: When used, "left" or "right" indicates direction on the flow chart.

(cont'd)

Description

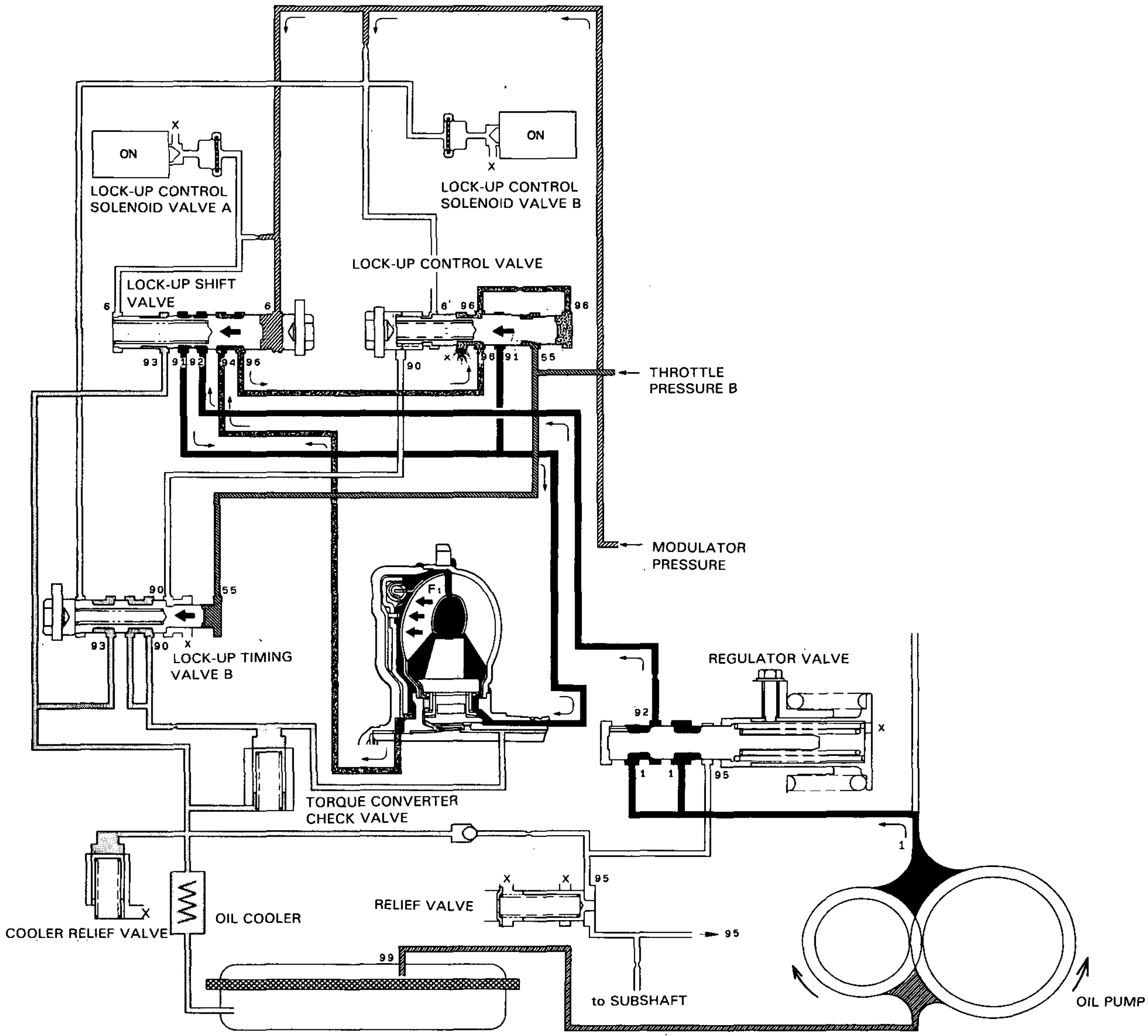
Lock-up System (cont'd)

Full Lock-Up

Lock-Up Control Solenoid Valve A: ON   Lock-Up Control Solenoid Valve B: ON

When the vehicle speed further increases, the throttle valve B pressure is increased in accordance with the throttle opening. The lock-up timing valve B overcomes the spring force and moves to the left side. Also this valve closes the oil port leading to the torque converter check valve.

Under this condition, the throttle B pressure working on the right end of the lock-up control valve becomes grater the lock-up control valve is moved to the left. As this happens, the torque converter back pressure is released fully, causing the lock-up clutch to be engaged fully.

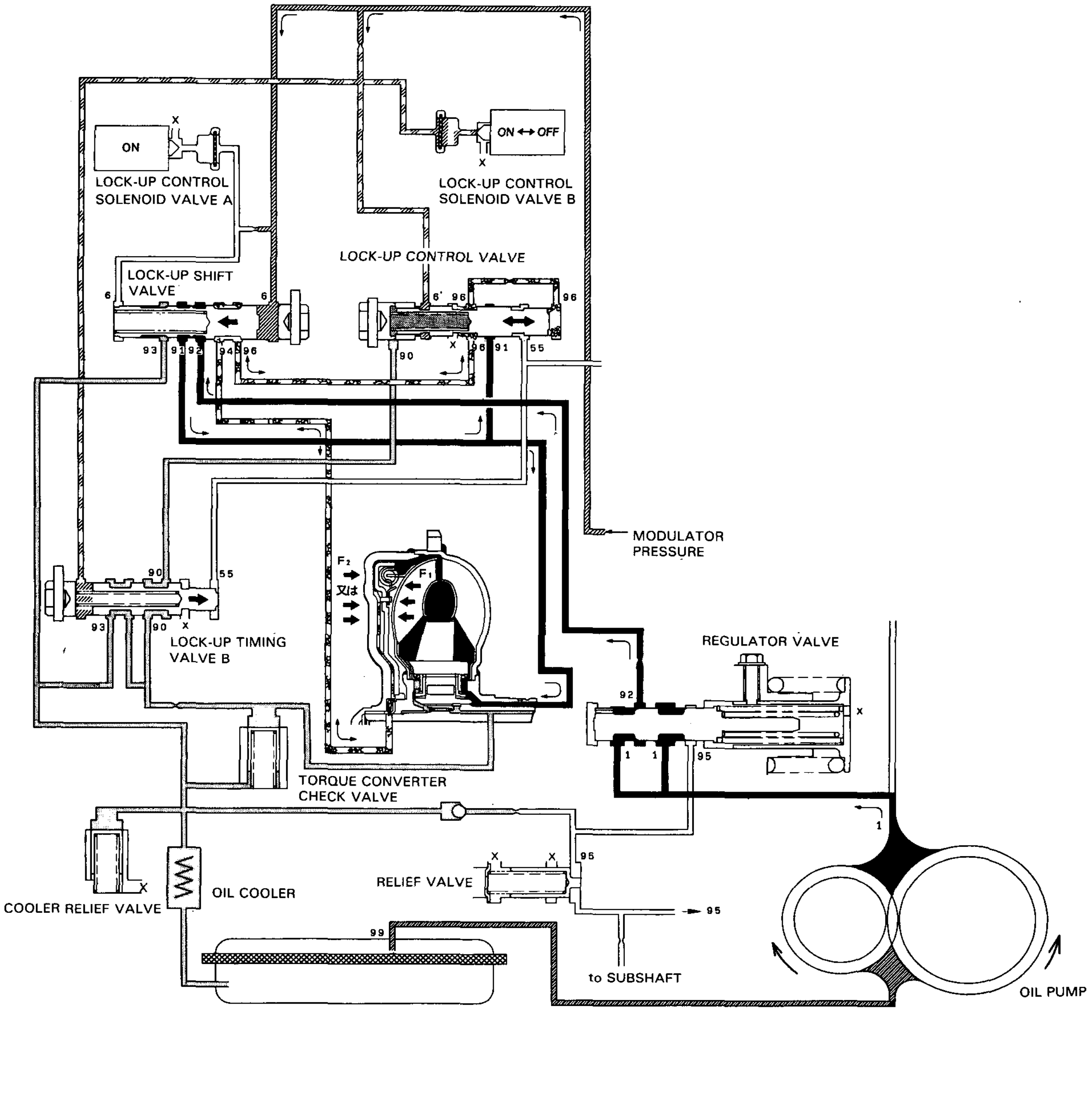


NOTE: When used, ''left'' or ''right'' indicates direction on the flow chart.

Deceleration Lock-Up

Lock-Up Control Solenoid Valve A: ON   Lock-Up Control Solenoid Valve B: Duty Operation (ON ↔ OFF)

The A/T control unit switches the solenoid valve B to on and off alternately in high speed under certain condition. The slight lock-up and half lock-up regions are maintained so as to lock the torque converter properly.

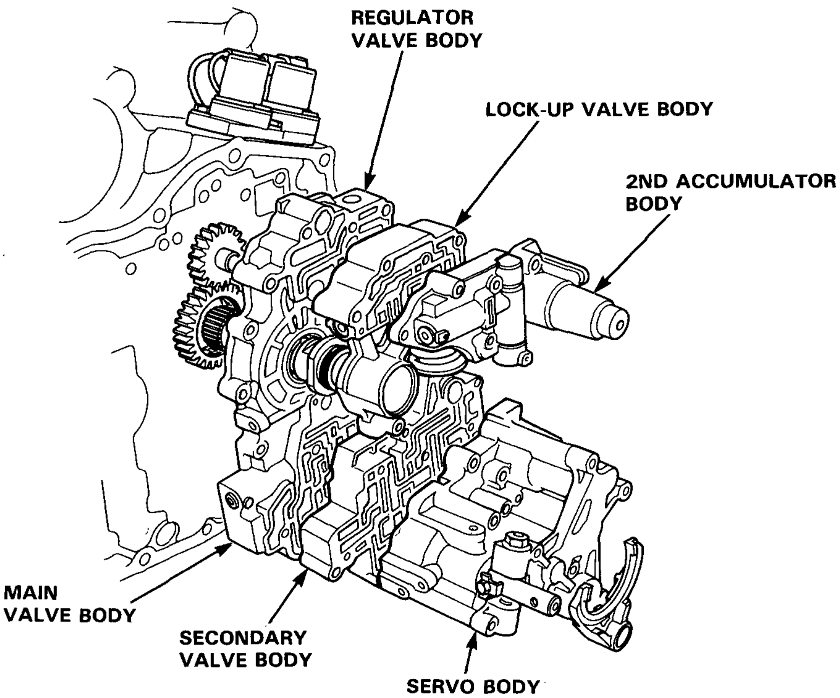


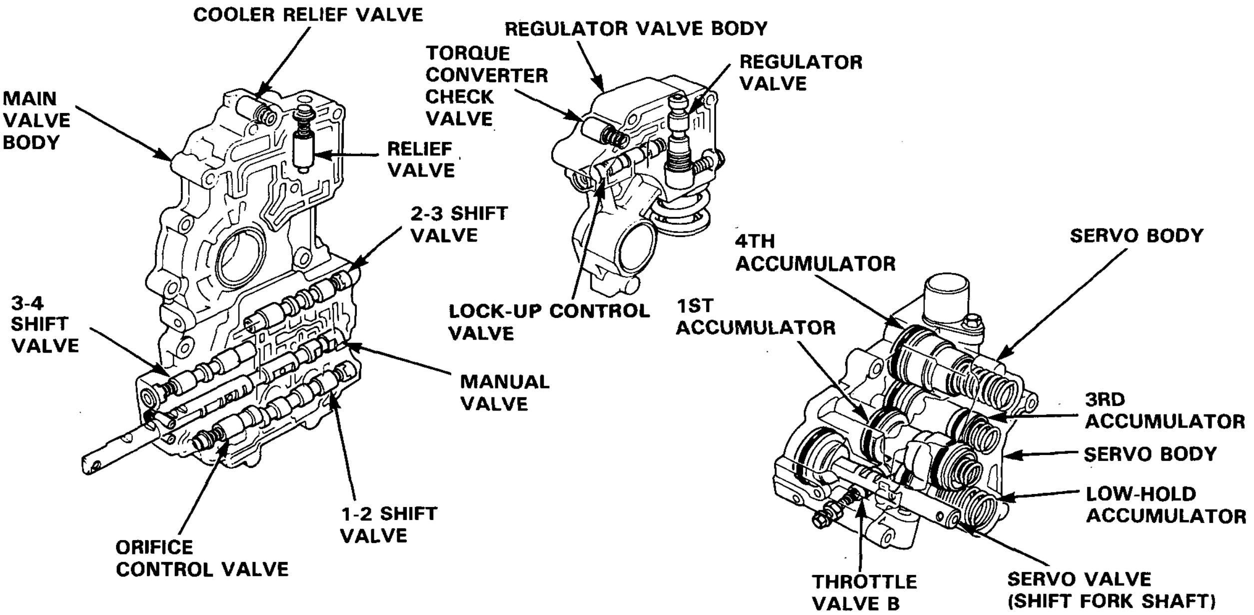
NOTE: When used, "left" or "right" indicates direction on the flow chart.

Description

Hydraulic Control

The valve body includes the main valve body, the second accumulator body, the regulator valve body, the secondary valve body, the servo body, and the lock-up valve body.
The oil pump is driven by splines on the right end of the torque converter which is attached to the engine. Oil flows through the regulator valve, to maintain specified pressure through the main valve body to the manual valve, and servo body, directing pressure to each of the clutches.

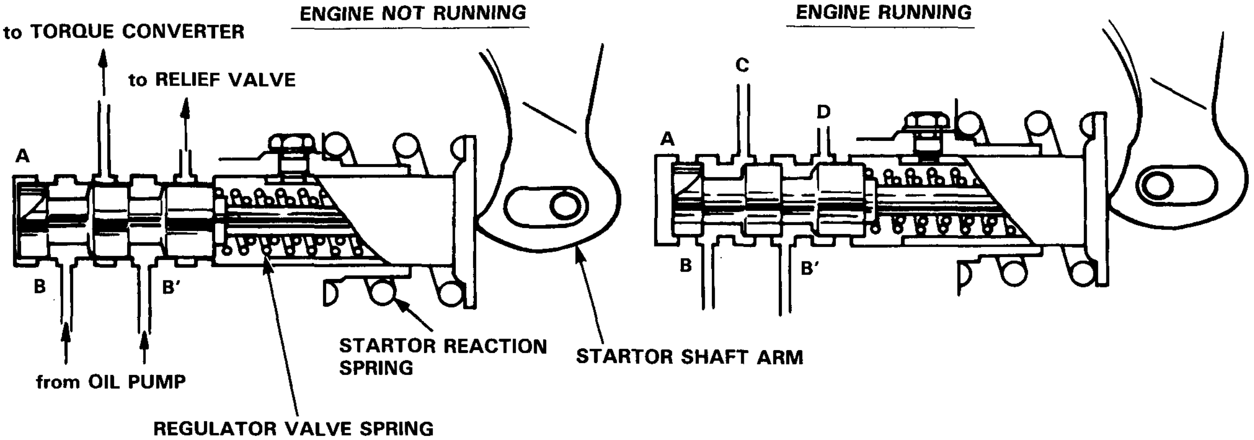




Regulator Valve

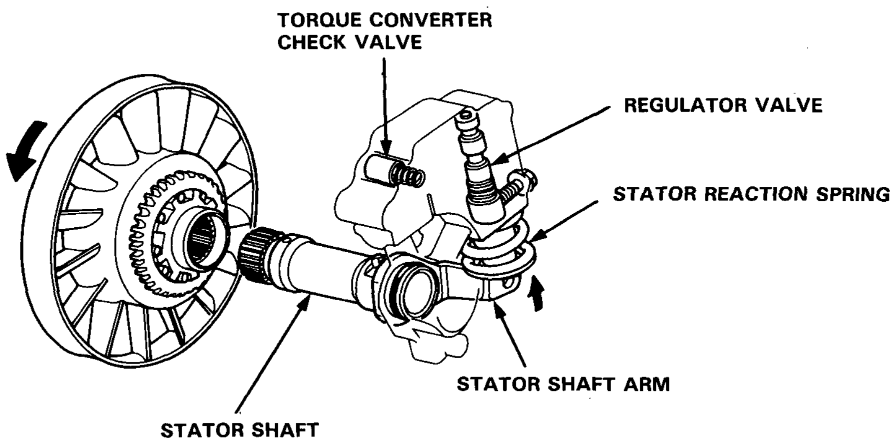
The regulator valve maintains a constant hydraulic pressure sent from the oil pump to the hydraulic control system, while also furnishing oil to the lubricating system and torque converter.

Oil flows through B and B'. The oil which enters through B flows through the valve orifice to A pushing the regulator valve to the right. According to the level of hydraulic pressure through B, the position of the valve changes, and the amount of the oil through B' from D thus changes. This operation is continued, thus maintaining the line pressure.



Stator Reaction Hydraulic Pressure Control

Hydraulic pressure increase according to torque is performed by the regulator valve using stator torque reaction. The stator shaft is splined in the stator and its arm end contacts the regulator spring cap. When the car is accelerating or climbing (Torque Converter Range), stator torque reaction acts on the stator shaft and the stator arm pushes the regulator spring cap → direction in proportion to the reaction. The spring compresses and the valve moves to increase the regulated control pressure or line pressure. Line pressure is maximum when the startor reaction is maximum.



(cont'd)

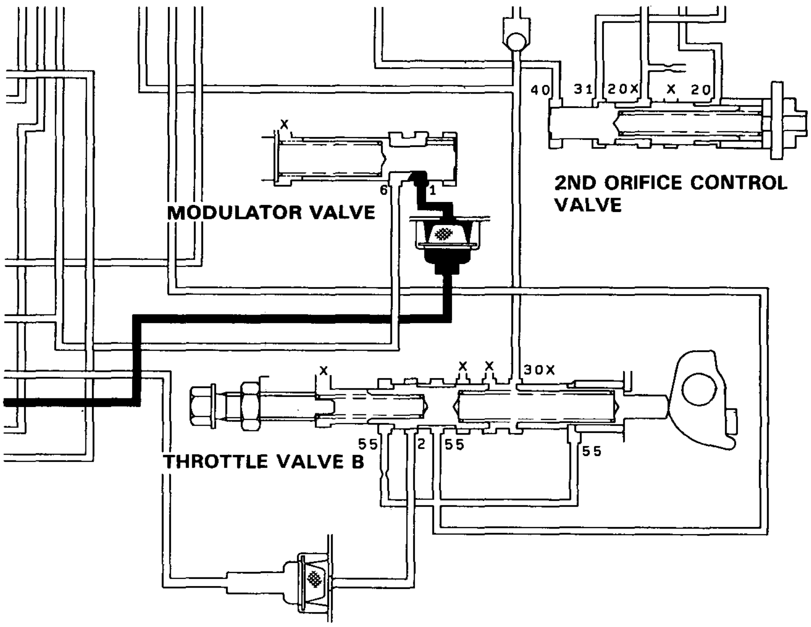
Description

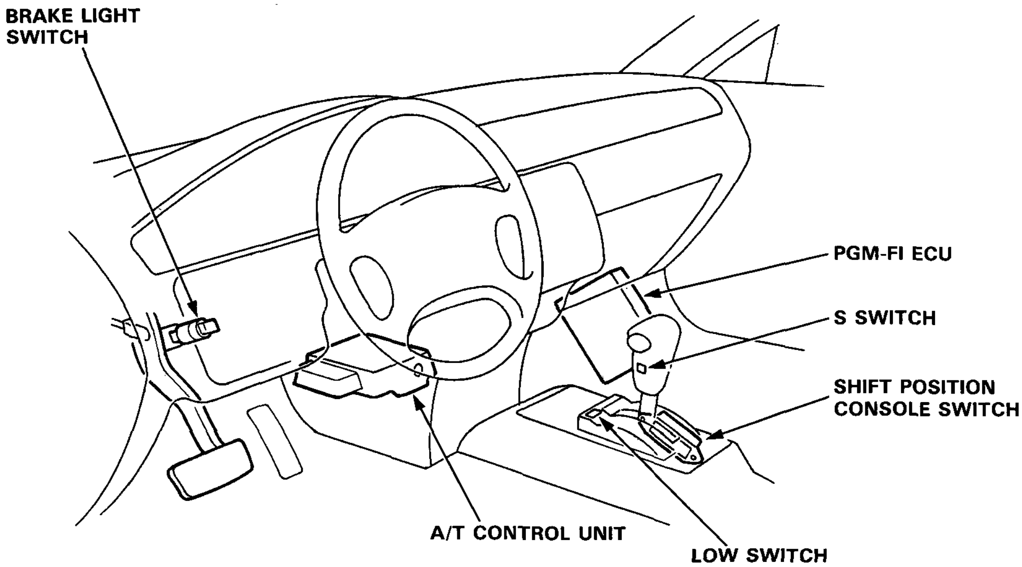
Hydraulic Control (cont'd)

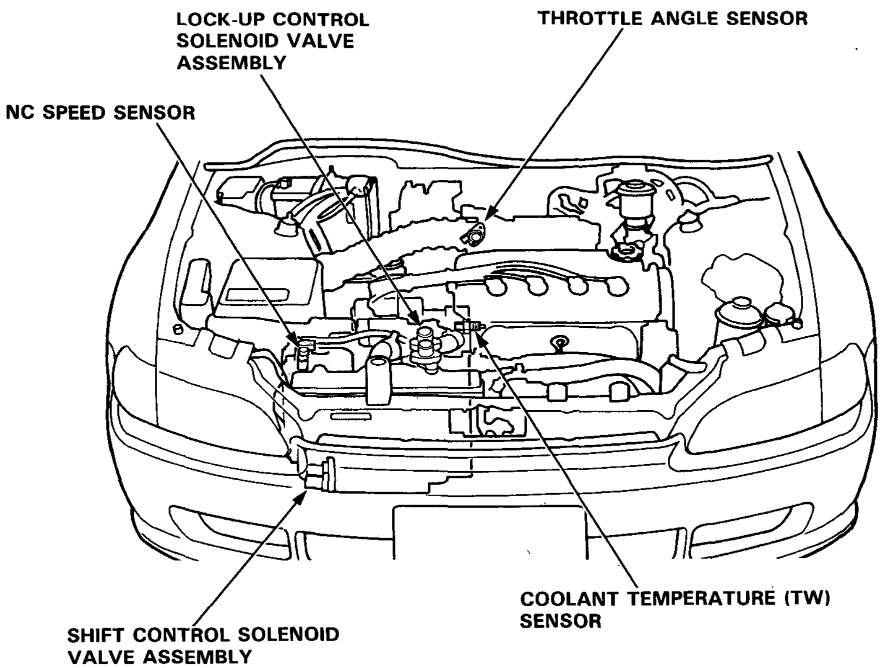
Throttle Valve B
Throttle valve B converts changes in the throttle opening to changes in transmission hydraulic pressure. The end of throttle valve B contacts the throttle cam which is connected by a cable to the throttle body. The cable pulls the cam which, in turn, moves the valve. The valve-to-cam engagement is adjustable for shift smoothness and lock-up. Throttle valve B controls the accumulators, to make smooth changes from one gear to another. An assist function is used to lessen the throttle load.

Modulator Valve
The modulator valve maintains line pressure from the regulator which is supplied to shift control solenoid valves A/B and lock-up control solenoid valves A/B, thus maintaining accurate shift and lock-up characteristics.

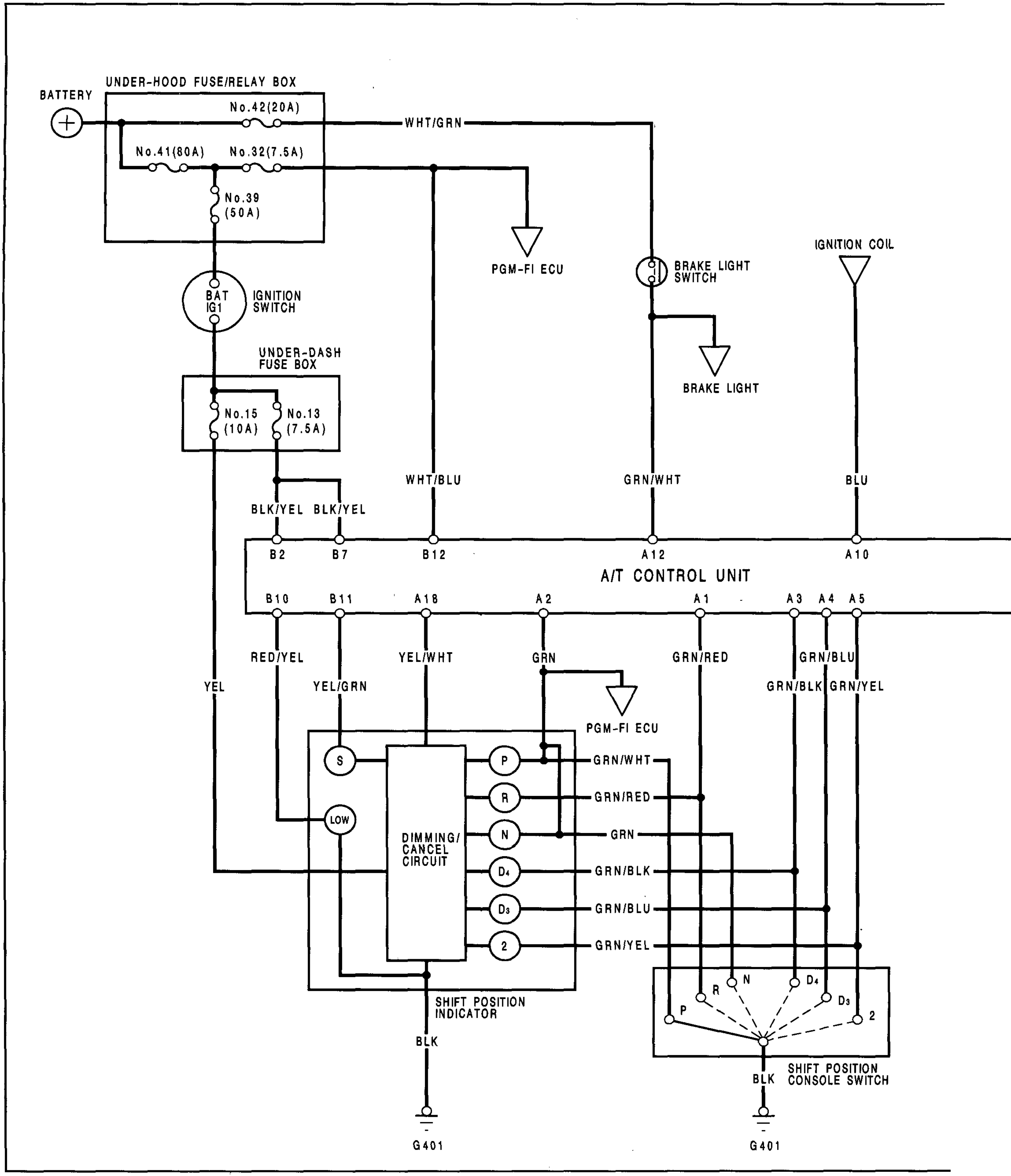
Second Orifice Control Valve
For smooth shifting between second and third, the open pressure on the second gear side is relieved through a fixed orifice. The valve also moves to equalize pressure differences between second and third gears.

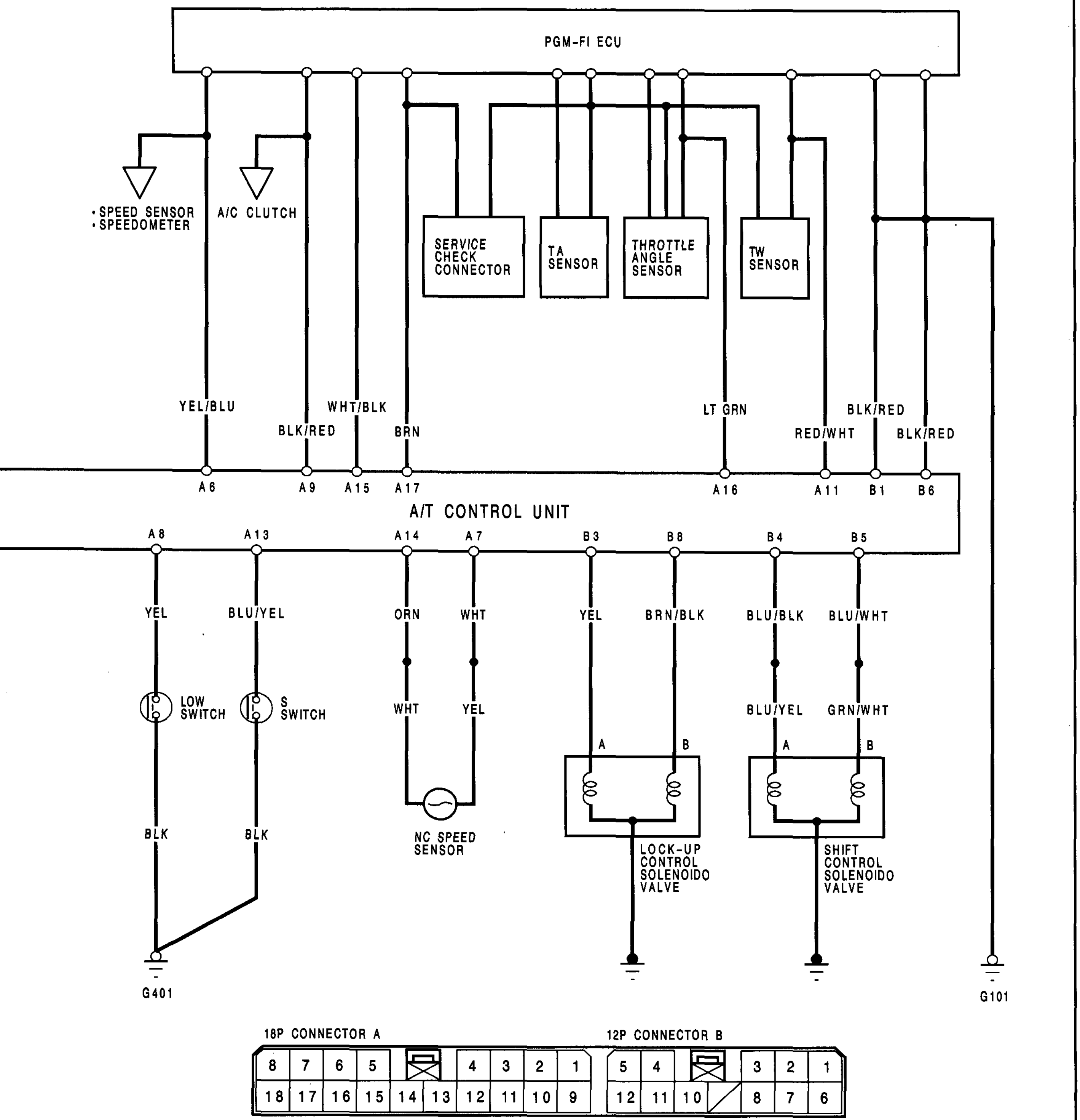



BRAKE LIGHT SWITCH
PGM-FI ECU
S SWITCH
SHIFT POSITION CONSOLE SWITCH
A/T CONTROL UNIT
LOW SWITCH


LOCK-UP CONTROL SOLENOID VALVE ASSEMBLY
THROTTLE ANGLE SENSOR
NC SPEED SENSOR
SHIFT CONTROL SOLENOID VALVE ASSEMBLY
COOLANT TEMPERATURE (TW) SENSOR

Circuit Diagram

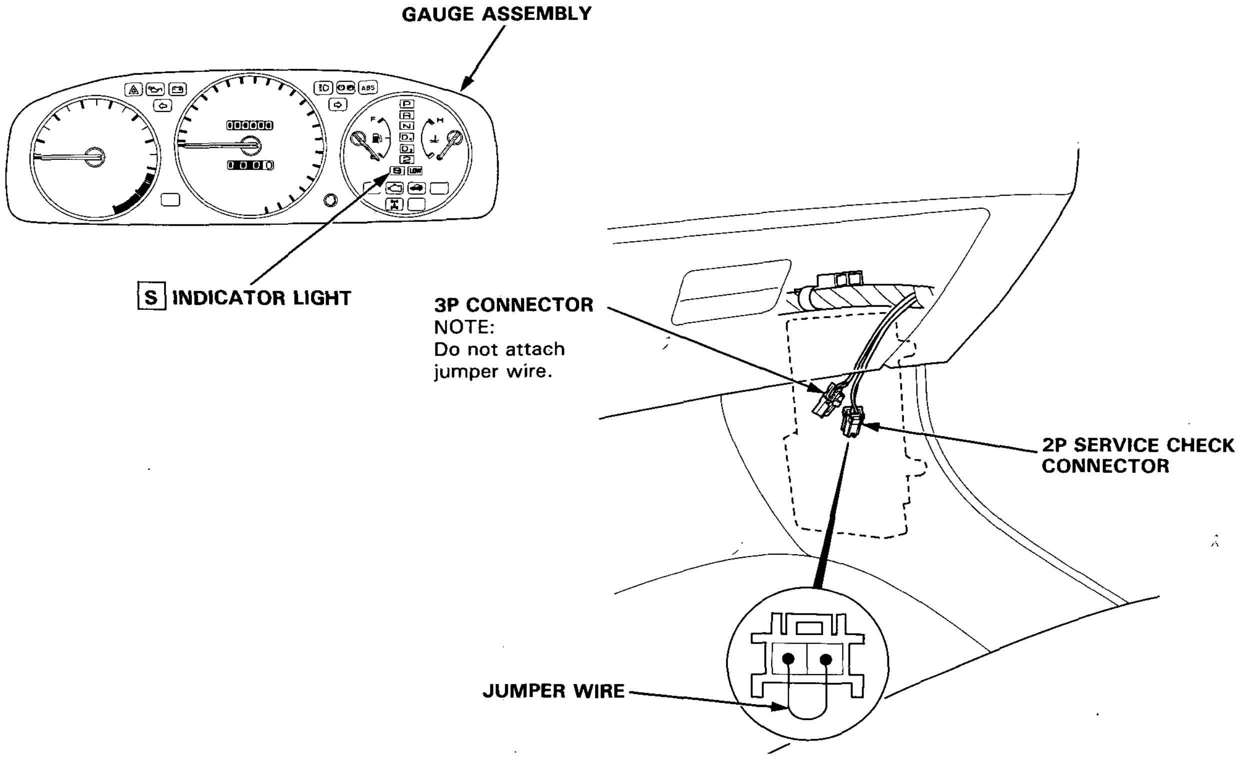




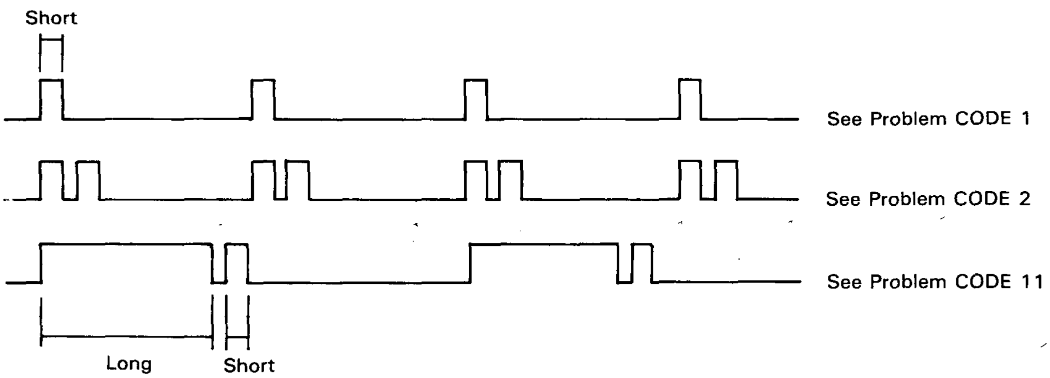
A/T Control Unit Terminal Location

When the A/T control unit senses an abnormality in the input or output systems, the [S] indicator light in the gauge assembly will blink. However, when the Service Check Connector (located under the dash on the passenger side) is connected with a jumperwire, the [S] indicator light will blink the problem code when the ignition switch is turned on.

When the [S] indicator light has been reported on, connect the two terminals of the Service Check Connector together. Then turn on the ignition switch and observe the [S] indicator light.

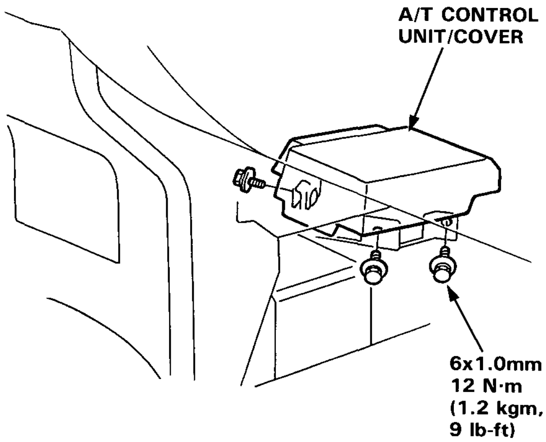


Problem codes 1 thorough 9 are indicated by individual short blinks, Problem codes 10 and 11 are indicated by a series of long and short blinks. One long blink equals 10 short blinks. Add the long and short blinks together to determine the problem code. After determining the problem code, refer to the electrical system Symptom-to-Component Chart on pages 14-316 and 317.



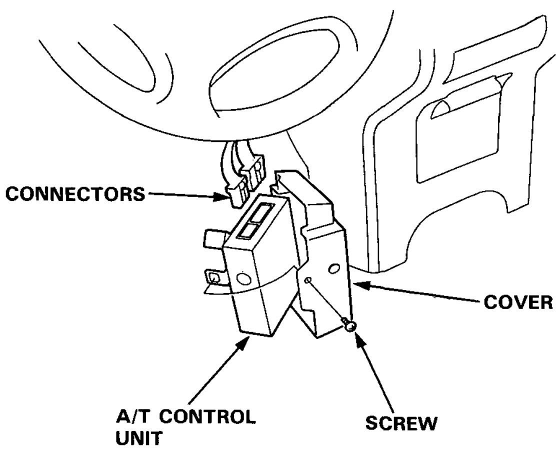
1. Removed the center console (see page 20-80).

2. Remove the 3 bolts securing the A/T control unit, then remove the A/T control unit.



3. Remove the screw then remove the unit cover from the A/T control unit.

4. Troubleshoot according to the number of the S indicatorlight blink(s).

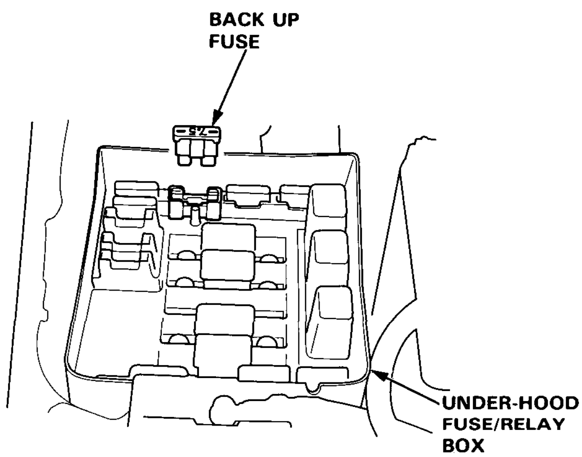


- **A/T control Reset Procedure**

1. Turn the ignition switch off.

2. Remove the No. 32 BACK UP fuse (7.5 A) from the mainrelay box for 10 seconds to reset the A/T control unit.

   NOTE: Disconnecting the No. 32 BACK UP fuse also cancels the radio preset stations and the clock setting. Make note of the radio presets before removing the fuse so you reset them.



- **Final Procedure**

  NOTE: This procedure must be done after any troubleshooting.

1. Remove the Jumper Wire from the Service Check-Connector.

2. Reset the A/T control unit.

3. Set the radio preset stations and clock setting.

Electrical Troubleshooting

Symptom-to-Component Chart

Number of [S] indicator light blinks while Service Check Connector is jumped.	[S] indicator light	Symptom	Probable Cause	Ref. page
1	Blinks	• Lock-up clutch does not engage. • Lock-up clutch does not dis-engage. • Frequent engine stalling. • Low light does not blink.	• Disconnected lock-up control solenoid valve A connector • Open or short in lock-up control solenoid valve A wire. • Faulty lock-up control solenoid valve A	14-318
2	Blinks	• Lock-up clutch does not engage. • Low light does not blik.	• Disconnected lock-up control solenoid valve B connector • Open or short in lock-up control solenoid valve B wire. • Faulty lock-up control solenoid valve B	14-319
3	Blinks or OFF	• Lock-up clutch does not engage. • Low light does not blink.	• Disconnected throttle angle sensor con-nector • Open short in throttle angle sensor wire • Faulty throttle angle sensor	14-320
4	Blinks	• Lock-up clutch does not engage. • Low light does not blink.	• Disconnected speed sensor connector • Open or short in speed sensor wire • Faulty speed sensor	14-321
5	Blinks	• Fails to shift other than 2nd↔4th gear. • Lock-up clutch does not engage. • Low light does not blink.	• Short in shift position console switch wire. • Faulty shift position console switch	14-322
6	OFF	• Fails to shift other than 2nd↔4th gear. • Lock-up clutch does not engage. • Lock-up clutch engages and dis-engages alternately. • Low light does not blink.	• Disconnect shift position console switch connector • Open in shift position console switch wire • Faulty shift position console switch.	14-324
7	Blinks	• Fails to shift other than 1st↔4th, 2nd↔4th, or 2nd↔3rd gears. • Fails to shift (stuck in 4th gear). • Low light does not blink.	• Disconnected shift control solenoid valve A connector • Open or short in shift control solenoid valve A wire • Faulty shift control solenoid valve A	14-326
8	Blinks	• Fails to shift (stuck in 1st gear or 4th gear). • Low light does not blink.	• Disconnected shift control solenoid valve B connector • Open or short in shift control solenoid valve B wire • Faulty shift control solenoid valve B	14-327
9	Blinks	• Lock-up clutch does not engage. • Low light does not blink.	• Disconnected NC speed sensor • Open or short in NC speed snesor wire • Faulty NC speed sensor	14-328
10	Blinks	• Lock-up clutch does not engage. • Lock light does not blink.	• Disconnected coolant temperature sensor connector • Open or short in coolant temperature sen-sor wire • Faulty coolant temperatrue sensor	14-329
11	OFF	• Lock-up clutch does not engage. • Low light does not blink.	• Disconnected ignition coil connector • Open or short in ignition coil wire • Faulty ignition coil	14-330

NOTE:
- If a customer describes the symptoms for codes 3, 6 or 11, yet the LED is not bliking, it will be necessary to recreate the symptom by test driving, and then checking the [S] indicator light with the ignition still ON.
- If the [S] indicator light display blink 12 or more times, the control unit is faulty.

If the self-diagnosis $\boxed{S}$ indicator light does not blink, perform an inspection according to the table listed below.

Sympton	Probable Cause	Ref. page
Do not change S mode	Check S switch signal	14-331
$\boxed{S}$ indicator light is on steady whenever the ignition switch is ON (S switch is OFF).		14-333
$\boxed{S}$ indicator light does not come on with the ignition switch ON.		14-334
Do not change LOW mode	Check LOW switch signal.	14-336
LOW indicator light does not come on with the ignition switch ON.		14-338
LOW indicator light is on steady whenever the ignition switch is ON (LOW switch is OFF).		14-340
Lock-up clutch does not duty operation (ON↔OFF)	Check A/C signal.	14-342
Lock-up clutch does not engage		

Troubleshooting Flowchart

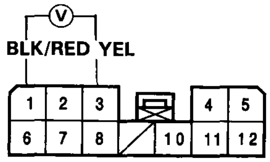
Self-diagnosis [S] indicator light blink once.

Disconnect the 12P connector from the control unit.

Turn the ignition switch ON.

Measure the voltage between the B3 (YEL) and B1 (BLK/RED) terminals.

View from terminal side.



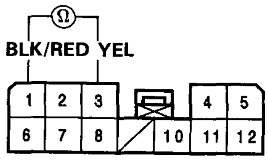
Is there voltage?

YES → **Repair short to power source in YEL wire between the B3 terminal and the lock-up control solenoid valve A.**

NO

Turn the ignition switch OFF.

Measure the resistance between the B3 (YEL) and B1 (BLK/RED) terminals.



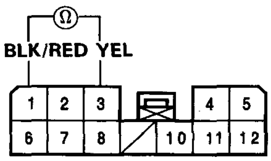
Is the resistance 16.2-19.8Ω? (at 25°C)

NO → **Check for open in YEL wire between the B3 terminal and the lock-up control solenoid valve A. If wire is OK, check the Lock-up Control Solenoid Valve A.**

YES

Dis connect the 2P connector from the lock-up control solenoid valve assembly.

Check for continuity between the B3 (YEL) and B1 (BLK/RED) terminals.



Is there continuity?

YES → **Repair short in YEL wire between the B3 terminal and the lock-up control solenoid valve A.**

NO

Connect the 2P connector to the lock-up control solenoid valve assembly.

Check for loose control unit connectors. If necessary, substitute a known-good control unit and recheck.

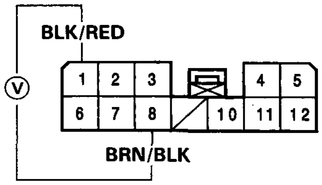
Self-diagnosis [S] indicator light blinks twice.

Disconnect the 12P connector from the control unit.

Turn the ignition switch ON.

Measure the voltage between the B8 (BRN/BLK) and B1 (BLK/RED) terminals.

View from terminal side.

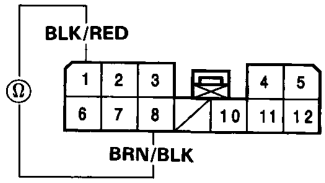


Is there voltage? — YES → **Repair short to power source in BRN/BLK wire between the B8 terminal and the lock-up control solenoid valve B.**

NO

Turn the ignition switch OFF.

Measure the resistance between the B8 (BRN/BLK) and B1 (BLK/RED) terminals.

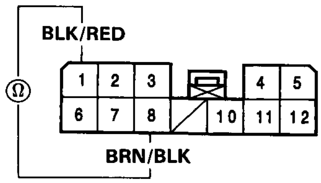


Is the resistance 16.2–19.8Ω? (at 25°C) — NO → **Check for open in BRN/BLK wire between the B8 terminal and the lock-up control solenoid valve B. If wire is OK, replace the Lock-up Control Solenoid Valve B.**

YES

Disconnect the 2P connector from the lock-up control solenoid valve assembly.

Check for continuity between the B8 (GRN/BLK) and B1 (BLK/RED) terminals.



Is there continuity? — YES → **Repair short in BRN/BLK wire between the B8 terminal and the lock-up control solenoid valve B.**

NO

Connect the 2P connector to the lock-up control solenoid valve assembly.

Check for loose control unit connectors. If necessary, substitute a known-good control unit and recheck.

(cont'd)

Troubleshooting Flowchart (cont'd)

Self-diagnosis [S] indicator light blinks three times.

Turn the ignition switch ON.

Does Check Engine light indicates any code? (see page 11-208).

YES → **Inspect the PGM-FI System (see Section 11).**

NO ↓

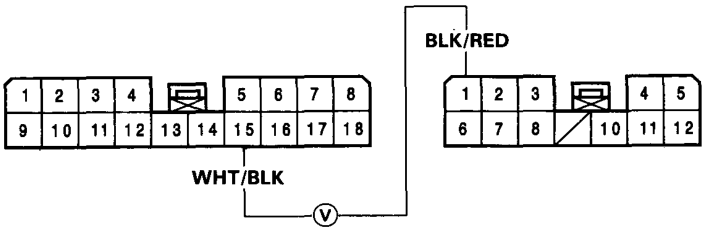
Turn the ignition switch OFF.

Disconnect the 18P and 12P connectors from the control unit.

Turn the ignition switch ON.

Measure the voltage between the A15 (WHT/BLK) and B1 (BLK/RED) terminals.

View from terminal side.



Is the voltage 4.75—5.25V?

NO → **Repair open or short in WHT/BLK wire between the A15 terminal and the PGM-FI ECU.**

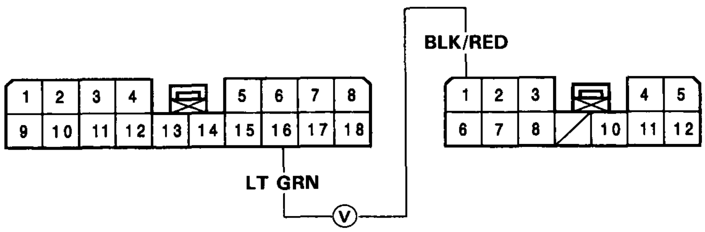
YES ↓

Turn the ignition switch OFF.

Connect the 18P and 12P connectors to the control unit.

Turn the ignition switch ON.

Measure the voltage between the A16 (LT GRN) and B1 (BLK/RED) terminals.



Is the voltage 0.44—0.56V?*

NO → **Repair open or short in LT GRN wire between the A16 terminal and the throttle angle sensor.**

YES ↓

Check for loose control unit connectors. If necessary, substitute a known-good control unit and recheck.

*±10%

Self-diagnosis [S] indicator light blinks four times.

Jack up the four wheels and support with safety stands.

Turn the ignition switch ON and shift transmission to [N].

Rotate the front wheel and measure the voltage between the A6 (YEL/BLU) and B1 (BLK/RED) terminals.

Does the voltage 0—5V appear alternately?

- YES → **Substitute a known-good control unit and recheck.**
- NO → Turn the ignition switch OFF.

Disconnect the 18P and 12P connectors from the control unit.

Turn the ignition switch ON.

Rotate the front wheel and check for voltage between the B1 (BLK/RED) and A6 (YEL/BLU) terminals.

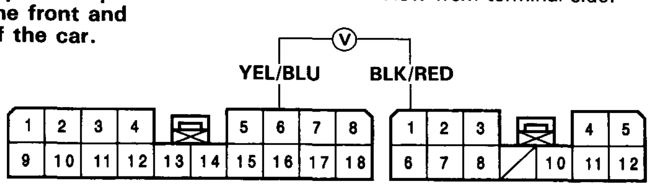
Does the voltage 0—5V appear alternately?

- NO → **Check for short or open in YEL/BLU wire between the A6 terminal and the gauge assembly. If wire is OK, check the Speed Sensor.**
- YES → **Check for loose control unit connectors. If necessary, substitute a known-good control unit and recheck.**

WARNING

- **Make sure jacks and safety stands are placed properly (see page 1—10 thru 12).**
- **Jack up and support the front and rear of the car.**

View from terminal side.



(cont'd)

Troubleshooting Flowchart (cont'd)

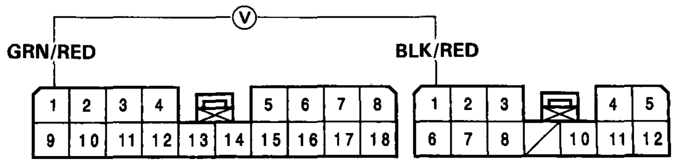
Self-diagnosis [S] indicator light blinks five times.

Turn the ignition switch ON.

Shift to other than [R] position.

Measure the voltage between the A1 (GRN/RED) and B1 (BLK/RED) terminals.

View from terminal side



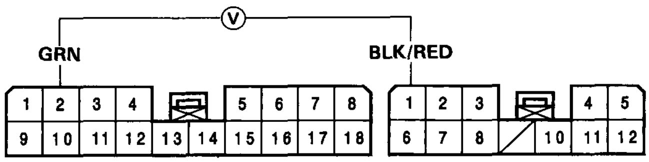
Is there battery voltage?

NO → **Check for short in GRN/RED wire between the A1 terminal and the shift position console switch. If wire is OK, check for loose connectors. If necessary, substitute a known-good control unit and recheck.**

YES ↓

Shift to other than [N] and [P] position.

Measure the voltage between the A2 (GRN) and B1 (BLK/RED) terminals.



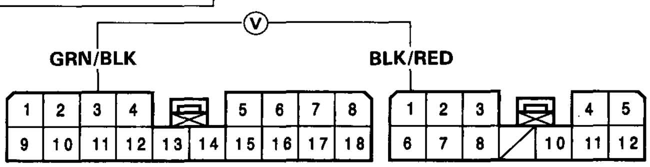
Is there battery voltage?

NO → **Check for short in GRN wire between the A2 terminal and the shift position console switch. If wire is OK, check for loose control unit connectors. If necessary, substitute a known-good control unit and recheck.**

YES ↓

Shift to other than [D_4] position.

Measure the voltage between the A3 (GRN/BLK) and B1 (BLK/RED) terminals.



Is there battery voltage?

NO → **Check for short in GRN/BLK wire between the A3 terminal and the shift position console switch. If wire is OK, check for loose control unit connectors. If necessary, substitute a known-good control unit and recheck.**

YES ↓

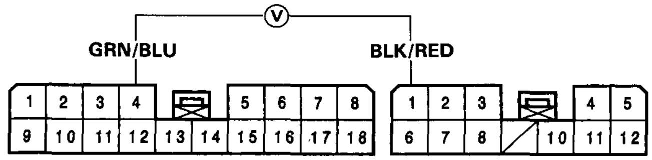
(To page 14–322)

(From page 14—322)

Shift to other than $\boxed{D_3}$ position.

Measure the voltage between the A4 (GRN/BLU) and B1 (BLK/RED) terminals.

View from terminal side.



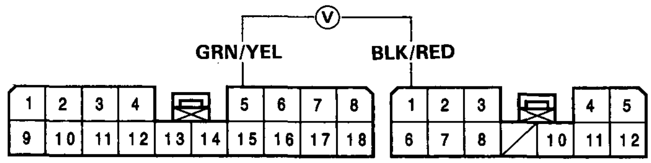
Is there battery voltage?

NO — Check for short in GRN/BLU wire between the A4 terminal and the shift position console switch. If wire is OK, check for loose control unit connectors. If necessary, substitute a known-good control unit and recheck.

YES

Shift to other than $\boxed{2}$ position.

Measure the voltage between the A5 (GRN/YEL) and B1 (BLK/RED) terminals.



Is there battery voltage?

NO — Check for short in GRN/YEL wire between the A5 terminal and the shift position console switch. If wire is OK, check for loose control unit connectors. If necessary, substitute a known-good control unit and recheck.

YES

Substitute a known-good control unit and recheck.

(cont'd)

Troubleshooting Flowchart (cont'd)

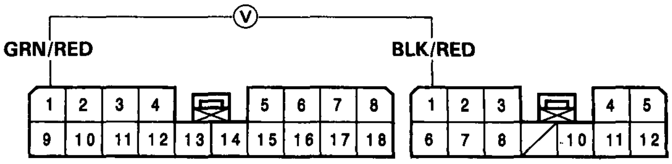
Self-diagnosis [S] indicator light blinks six times.

Turn the ignition switch ON.

Shift to [R] position.

Measure the voltage between the A1 (GRN/RED) and B1 (BLK/RED) terminals.

View from terminal side.



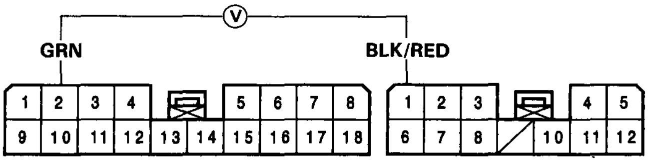
Is there voltage?

YES → **Repair open in GRN/RED wire between the A1 terminal and the shift position console switch.**

NO ↓

Shift to [N] or [P] position.

Measure the voltage between the A2 (GRN) and B1 (BLK/RED) terminals.



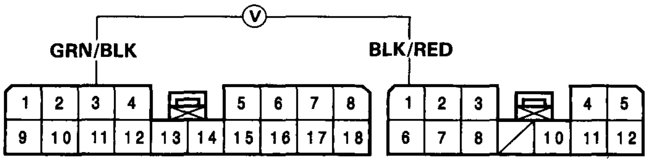
Is there voltage?

YES → **Repair open in GRN wire between the A2 terminal and the shift position console switch.**

NO ↓

Shift to [D_4] position.

Measure the voltage between the A3 (GRN/BLK) and B1 (BLK/RED) terminals.



Is there voltage?

YES → **Repair open in GRN/BLK wire between the A3 terminal and the shift position console switch.**

NO ↓

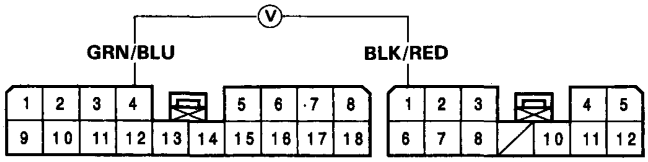
(To page 14–325)

(From page 14—324)

Shift to $\boxed{D_3}$ position.

Measure the voltage between the A4 (GRN/BLU) and B1 (BLK/RED) terminals.

View from terminal side.



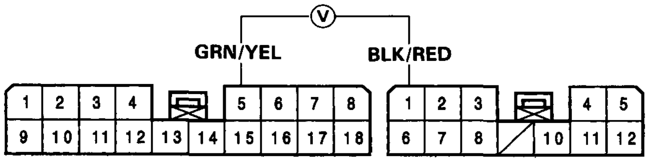
Is there voltage?

YES → **Repair open in GRN/BLU wire between the A4 terminal and the shift position console switch.**

NO

Shift to $\boxed{2}$ position.

Measure the voltage between the A5 (GRN/YEL) and B1 (BLK/RED) terminals.



Is there voltage?

YES → **Repair open in GRN/YEL wire between the A5 terminal and the shift position console switch.**

NO

Check for loose control unit connectors. If necessary, substitute a known-good control unit and recheck.

(cont'd)

Electrical Troubleshooting

Troubleshooting Flowchart (cont'd)

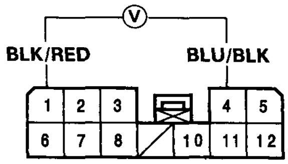
Self-diagnosis [S] indicator light blinks seven times.

Disconnect the 12P connector from the control unit.

Turn the ignition switch ON.

Measure the voltage between the B4 (BLU/BLK) and B1 (BLK/RED) terminals.

View from terminal side.



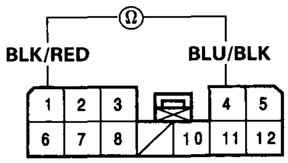
Is there voltage?

YES → **Repair short to power source in BLU/BLK wire between the B4 terminal and the shift control solenoid valve A.**

NO ↓

Turn the ignition switch OFF.

Measure the resistance between the B4 (BLU/BLK) and B1 (BLK/RED) terminals.



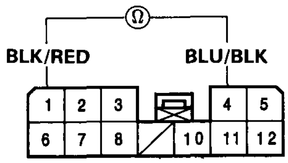
Is the resistance 16.2–19.8Ω? (at 25°C)

NO → **Check for open in BLU/BLK wire between the B4 terminal and the shift control solenoid valve A. If wire is OK, check the shift control solenoid valve A.**

YES ↓

Disconnect the 2P connector from the shift control solenoid valve assembly.

Check for continuity between the B4 (BLU/BLK) and B1 (BLK/RED) terminals.



Is there continuity?

YES → **Repair short in BLU/BLK wire between the B4 terminal and the shift control solenoid valve A.**

NO ↓

Check for loose control unit connectors. If necessary, substitute a known-good control unit and recheck.

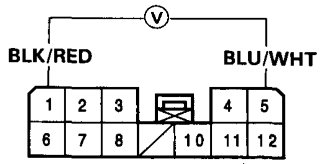
Self-diagnosis [S] indicator light blinks eight times.

Disconnect the 12P connector from the control unit.

Turn the ignition switch ON.

Measure the voltage between the B5 (BLU/WHT) and B1 (BLK/RED) terminals.

View from terminal side.



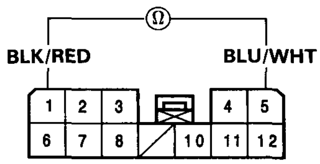
Is there voltage?

YES → **Repair short to power source in BLU/WHT wire between the B5 terminal and the shift control solenoid valve B.**

NO ↓

Turn the ignition switch OFF.

Measure the resistance between the B5 (BLU/WHT) and B1 (BLK/RED) terminals.



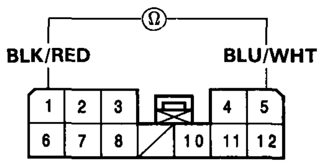
Is the resistance 16.2—19.8Ω? (at 25°C)

NO → **Check for open in BLU/WHT wire between the B5 terminal and the shift control solenoid valve B. If wire is OK, check the shift control solenoid valve B.**

YES ↓

Disconnect the 2P connector from the shift control solenoid valve assembly.

Check for continuity between the B5 (BLU/WHT) and B1 (BLK/RED) terminals.



Is there continuity?

YES → **Repair short in BLU/WHT wire between the B5 terminal and the shift control solenoid valve B.**

NO ↓

Check for loose control unit connectors. If necessary, substitute a known-good control unit and recheck.

(cont'd)

Troubleshooting Flowchart (cont'd)

Self-diagnosis [S] indicator light blinks nine times.

Check the state of installation of the NC speed sensor.

OK? — NO → **Reinstall and recheck.**

YES

Disconnect the 2P connector from the NC speed sensor connector.

Measure the resistance of the NC speed sensor.

Is the resistance 400–600 Ω? (at 20°C) — NO → **Replace the NC speed sensor.**

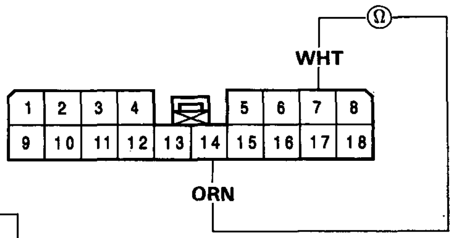
YES

Reconnect the NC speed sensor.

Disconnect the 18P connector from the control unit.

Measure the resistance between A7 (WHT) and A14 (ORN) terminals.

View from terminal side.



Is the resistance 400–600 Ω? (at 20°C) — NO → **Repair open or short in WHT wire between A7 terminal or ORN wire between A14 terminal and NC speed sensor.**

YES

Check for loose control unit connector. If necessary, substitute a known-good control unit and recheck.

Self-diagnosis $\boxed{S}$ indicator light blinks ten times.

Turn the ignition switch ON.

Does Check Engine light indicates any code?

YES → **Inspect the PGM-FI System (see section 11).**

NO

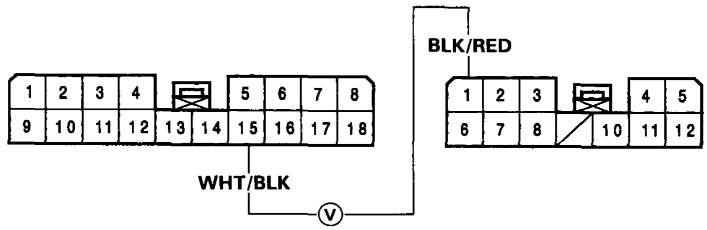
Turn the ignition switch OFF.

Disconnect the 18P and 12P connectors from the control unit.

Turn the ignition switch ON.

Measure the voltage between the A15 (WHT/BLK) and B1 (BLK/RED) terminals.

View from terminal side.



Is the voltage 4.75–5.25V?

NO → **Repair open or short in WHT/BLK wire between the A15 terminal and the PGM-FI ECU.**

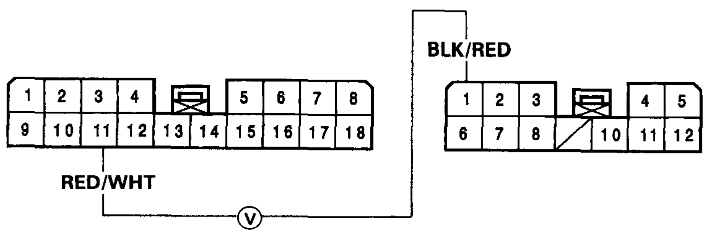
YES

Turn the ignition switch OFF.

Connect the 18P and 12P connectors to the control unit.

Start the engine and warm it up to normal operating temperature.

Measure the voltage between the A11 (RED/WHT) and B1 (BLK/RED) terminals.



Is the voltage 0.50–1.20V?

NO → **Repair open or short in RED/WHT wire between the A11 terminal and the coolant temperature sensor.**

YES

Check for loose control unit connectors. If necessary, substitute a known-good control unit.

(cont'd)

Troubleshooting Flowchart (cont'd)

Self-diagnosis [S] indicator light blinks eleven times.

Disconnect the 18P and 12P connectors from the control unit.

Start the engine.

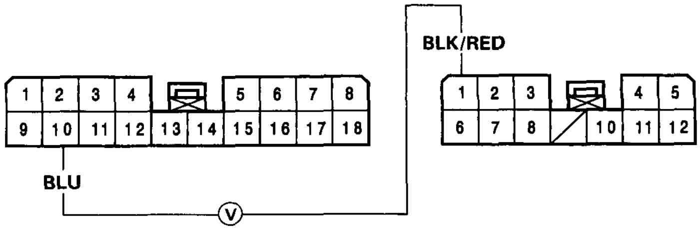
Measure the voltage between the A10 (BLU) and B1 (BLK/RED) terminals.

Is there battery voltage?

NO — **Repair open or short in BLU wire between the A10 terminal and the ignition coil.**

YES — **Check for loose control unit connectors. If necessary, substitute a known-good control unit and recheck.**

View from terminal side.



S switch signal test

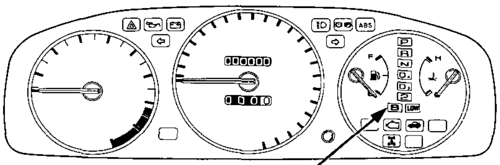
Is the service check connector jumped?

YES → **Disconnect the jumper wire and recheck.**

NO

Push the S switch OFF.

Turn the ignition switch ON.



Does the S indicator light come on for about 2 seconds?

NO → **Test the S indicator light. See page 14-334.**

YES

Does the S indicator light go out?

NO → **Test the S indicator light. See page 14-333.**

YES

Push the S switch ON.

Does the S indicator light come on?

YES → **S switch signal is OK.**

NO

Turn the ignition switch OFF.

(To page 14-332)

(cont'd)

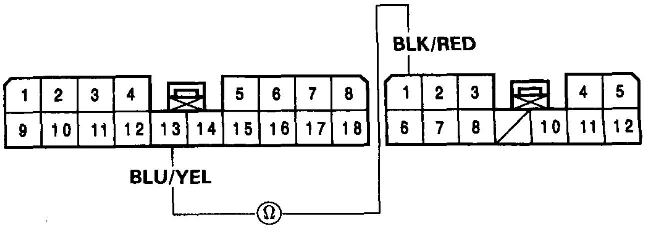
Troubleshooting Flowchart (cont'd)

(From page 14-331)

Disconnect the 18P and 12P connectors from the control unit.

Check for continuity between the A13 (BLU/YEL) and B1 (BLK/RED) terminals while pushing the S switch ON and OFF.

View from terminal side.



Is there continuity while pushing the S switch ON, and is there no continuity while pushing the S switch OFF?

NO → **Check for open or short in BLU/YEL wire between the A13 terminal and S switch. If wire is OK, check the S switch.**

YES ↓

Check for loose control unit connectors. If necessary, substitute a known-good control unit and recheck.

[S] indicator light is on steady whenever the ignition switch is ON. (S switch is OFF.)

Is the service check connector jumped?

- YES → **Disconnect the jumper wire and recheck.**
- NO ↓

Disconnect the 12P connector from the control unit.

Turn the ignition switch ON.

Does the [S] indicator light come on?

- YES → **Check for loose control unit connectors. If necessary, substitute a known-good control unit and recheck.**
- NO ↓

Check for open or short in YEL/GRN wire between the B10 terminal and the gauge assembly. If wire is OK, check the shift position indicator and [S] indicator light bulb.

(cont'd)

Troubleshooting Flowchart (cont'd)

[S] indicator light does not come on with the ignition switch ON. (It should be come on for about 2 seconds.)

Is the service check connector jumped?

- YES → **Disconnect the jumper wire and recheck.**
- NO ↓

Turn the ignition switch ON.

Push the S switch ON.

Does the [S] indicator light come on?

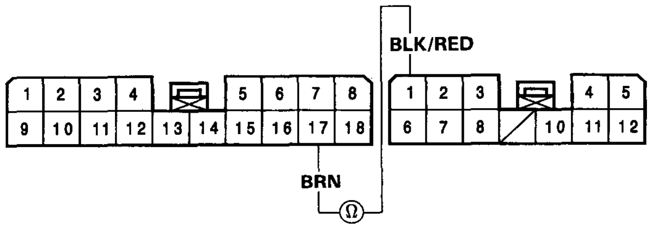
- NO → **Check for loose control unit connectors and S switch. If necessary, substitute a known-good control unit and recheck.**
- YES ↓

Disconnect the 18P and 12P connectors from the cotnrol unit.

Turn the ignition switch OFF.

Check for continuity between the A17 (BRN) and B1 (BLK/RED) terminals.

View from terminal side.



Is there continuity?

- YES → **Repair short in BRN wire between the A17 terminal and the service check connector.**
- NO ↓

Check for continuity between the B1 (BLK/RED) terminal and body ground, and between the B6 (BLK/RED) terminal and body ground.

Is there continuity?

- NO → **Repair open in BLK/RED wire between the B1 terminal and/or B6 terminal and G101.**
- YES ↓

(To page 14-335)

(From page 14-334)

Turn the ignition switch ON.

Measure the voltage between the B2 or B7 (BLK/YEL) and B1 or B6 (BLK/RED) terminals.

Is the battery voltage?

- NO → **Repair open or short in BLK/YEL wire between the B2 and/or B7 terminal and the fuse box.**
- YES ↓

Connect jumper wire between the B2 or B7 (BLK/YEL) and B11 (YEL/GRN) terminals.

Does the [S] indicator light come on?

- NO → **Check for loose control unit connectors and S switch. If necessary, substitute a known-good control unit and recheck.**
- YES ↓

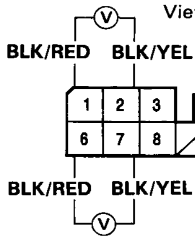
Check for continuity YEL/GRN wire between the B11 terminal and the gauge assembly.

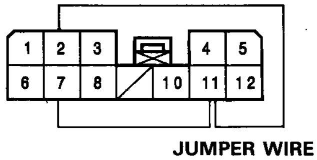
Is there continuity?

- NO → **Repair open in YEL/GRN wire between the B11 terminal and the gauge assembly.**
- YES ↓

Check the shift position indicator and [S] indicator light bulb. If the shift position indicator and [S] indicator light bulb are OK, check for loose control unit connectors. Substitute a known-good control unit and recheck.

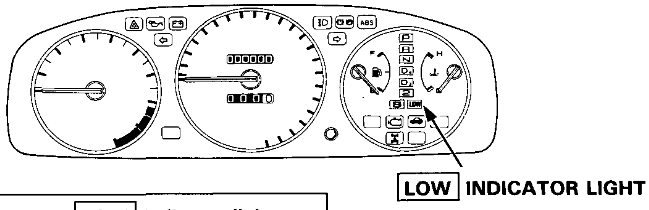
View from terminal side





(cont'd)

Troubleshooting Flowchart (cont'd)



LOW switch signal test.

Turn the ignition switch ON.

Does the LOW indicator light come on for about 2 seconds?
- NO → **Test the LOW indicator light. See page 14-338.**
- YES ↓

Does the LOW indicator light go out?
- NO → **Test the LOW indicator light. See page 14-339.**
- YES ↓

Shift to 2 position.

Push the LOW switch ON.

Does the LOW indicator light come on?
- YES → **LOW switch signal is OK.**
- NO ↓

Check whether the S indicator light blinks.

Does the 2 indicator light come on?
- YES → **Troubleshoot according to the number of the S indicator light blink(s).**
- NO ↓

Turn the ignition switch OFF.

(To page 14-337)

(From page 14-336)

Disconnect the 18P and 12P connectors from the control unit.

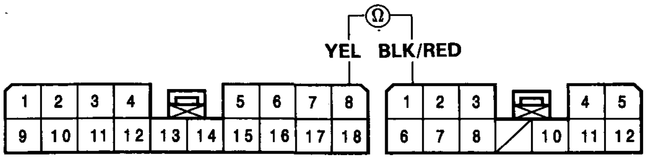
Check for continuity between the A8 (YEL) and B1 (BLK/RED) terminals while pushing the LOW switch ON and OFF.

Is there continuity while pushing the LOW switch ON, and is there no continuity while pushing the LOW switch OFF?

NO → **Check for open or short in YEL wire between the A8 terminal and LOW switch. If wire is OK, check the LOW switch.**

YES → **Check for loose control unit connectors. If necessary, substitute a known-good control unit and recheck.**

View from terminal side



(cont'd)

Troubleshooting Flowchart (cont'd)

LOW indicator light does not come on with the ignition switch ON. (It should be come on for about 2 seconds.)

Shift to 2 position.

Pushing the LOW switch ON.

Does the LOW indicator light come on?

- NO → **Check for loose control unit connectors and S switch. If necessary, substitute a known-good control unit and recheck.**
- YES ↓

Turn the ignition switch OFF.

Disconnect the 18P and 12P connectors from the control unit.

Check for continuity between the B1 (BLK/RED) terminal and body ground, and between the B6 (BLK/RED) terminal and body ground.

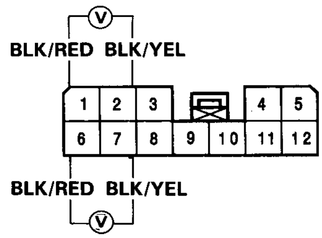
Is there continuity?

- NO → **Repair open in BLK/RED wire between the B1 terminal and/or B6 terminal and G101.**
- YES ↓

(To page 14-339)

(From page 14-338)

View from terminal side



Turn the ignition switch ON.

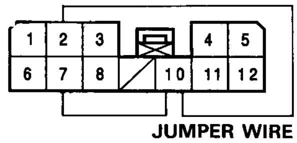
Measure the voltage between the B2 or B7 (BLK/YEL) and B1 or B6 (BLK/RED) terminals.

Is the battery voltage?

NO → **Repair open or short in BLK/YEL wire between the B2 and/or B7 terminal and the fuse box.**

YES ↓

Connect jumper wire between the B2 or B7 (BLK/YEL) and B10 (RED/YEL) terminals.



Does the LOW indicator light come on?

NO → **Check for loose control unit connectors and LOW switch. If necessary, substitute a known-good control unit and recheck.**

YES ↓

Check for continuity RED/YEL wire between the B10 terminal and the gauge assembly.

Is there continuity?

NO → **Repair open in RED/YEL wire between the B10 terminal and the gauge assembly.**

YES ↓

- **Check the shift position indicator and LOW indicator light bulb. If the shift position indicator and LOW indicator light bulb are OK, check for loose control unit connectors.**
- **Substitute a known-good control unit and recheck.**

(cont'd)

Troubleshooting Flowchart (cont'd)

$\boxed{\text{LOW}}$ indicator light is on steady whenever the ignition switch is ON. (LOW switch is OFF.)

Disconnect the 12P connector from the control unit.

Turn the ignition switch ON.

Does the $\boxed{\text{LOW}}$ indicator light come on?

YES

Check for loose control unit connectors. If necessary, substitute a known-good control unit and *recheck*.

NO

Check for open or short in RED/YEL wire between the B10 terminal and the gauge assembly. If wire is OK, check the shift position indicator and $\boxed{\text{LOW}}$ indicator light bulb.

Inspection of brake light signal.

Check the brake lights come on with the brake pedal pushed.

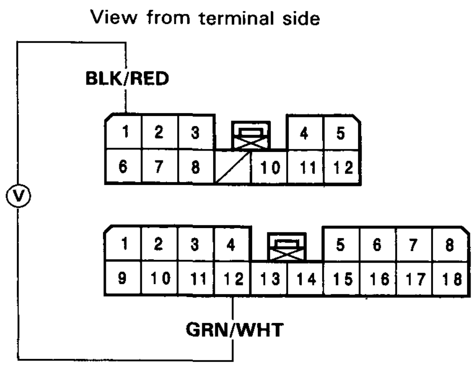
Are brake lights ON?

NO → **Faulty brake light circuit.**

YES

Disconnect the 12P and 18P connectors from the control unit.

Measure the voltage between A12 (GRN/WHT) and B1 (BLK/RED) terminals with the brake pedal pushed.



Is there battery voltage?

NO → **Repair open in GRN/WHT wire between A12 terminal and brake light switch.**

YES

Brake light signal is OK.

(cont'd)

Troubleshooting Flowchart (cont'd)

Inspection of A/C signal.

Start the engine.

Push the A/C switch.

Does A/C compressor clutch engage?

NO → **See Air Conditioner inspection (section 22).**

YES

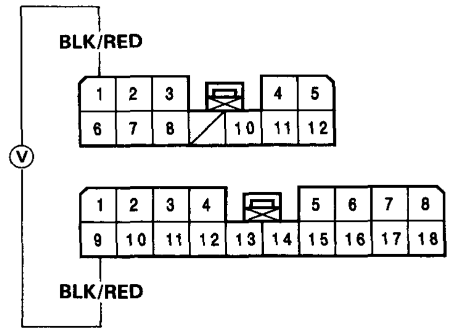
Stop the engine.

Disconnect 12P and 18P connector from the control unit.

Start the engine.

Measure the voltage between A9 (BLK/RED) and B1 (BLK/RED)terminals. (A/C compressor OFF)

View from terminal side.



Is there battery voltage?

NO → **Repair open in BLK/RED wire between A9 terminal and A/C clutch relay.**

YES

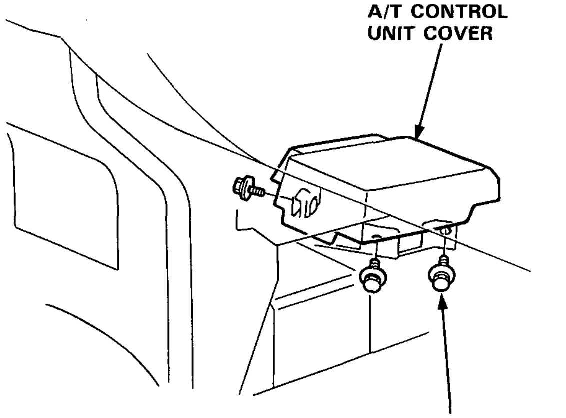
A/C signal is OK.

A/T Control Unit

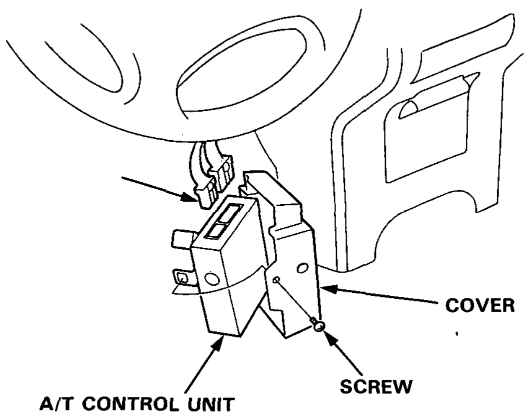
Replacement

NOTE: The A/T control unit is located under the dashboard.

1. Remove the center console (see page 20-80).
2. Remove the 3 bolts securing the A/T control unit, then remove the A/T control unit.



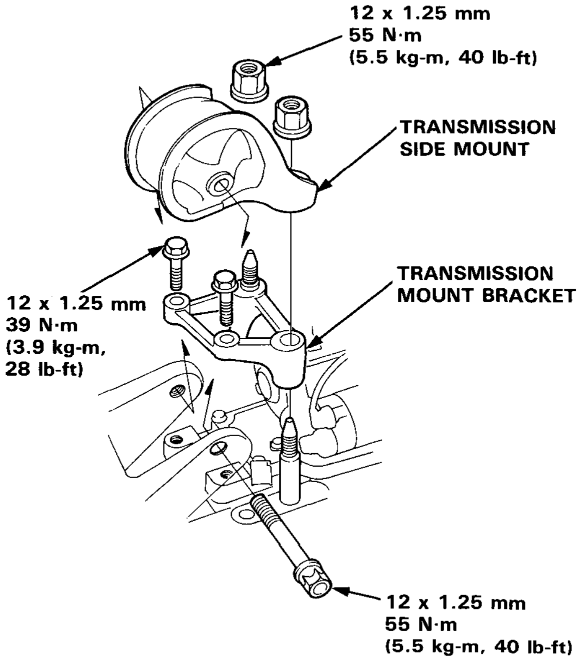
3. Remove the screw then remove the unit cover from the A/T control unit.
4. Troubleshoot according to the number of the S indicator light blink(s).



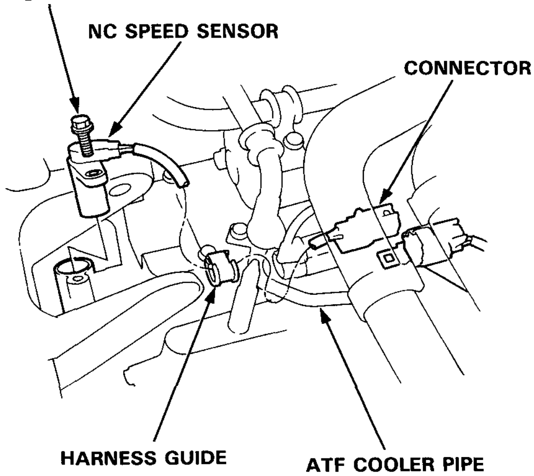
NC Speed Sensor

Replacement

1. Remove the transmission side mount.
2. Remove the transmission mount bracket from the transmission housing.



3. Disconnect the NC speed sensor connector.
4. Install the NC speed sensor in the reverse order of the removal.



Lock-up Control Solenoid Valve A/B

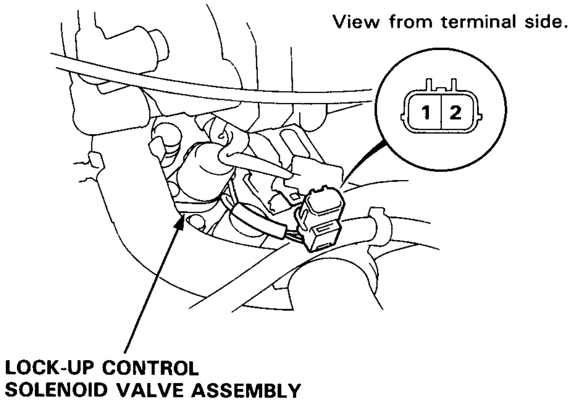
Test

NOTE: Lock-up control solenoid valves A and B must be removed/replaced as an assembly.

1. Disconnect the connector from the lock-up control solenoid valve A/B.

2. Measure the resistance between the No. 1 terminal (SOL.VA) of the lock-up control solenoid valve connector and body ground and between the No. 2 terminal (SOL. V B) and body ground.

   STANDARD: 16.2—19.8Ω (at 25°C)



3. Replace the lock-up control solenoid valve assembly if the resistance is out of specification.

4. Connect the No. 1 terminal of the lock-up control solenoid valve connector to the battery positive terminal and body ground. A clicking sound should be heard. Connect the No. 2 terminal to the battery positive terminal and body ground.
   A clicking sound should be heard.

5. If not, check for continuity between the A/T control unit B3 or B8 harness and body ground (page 14-318, 319).

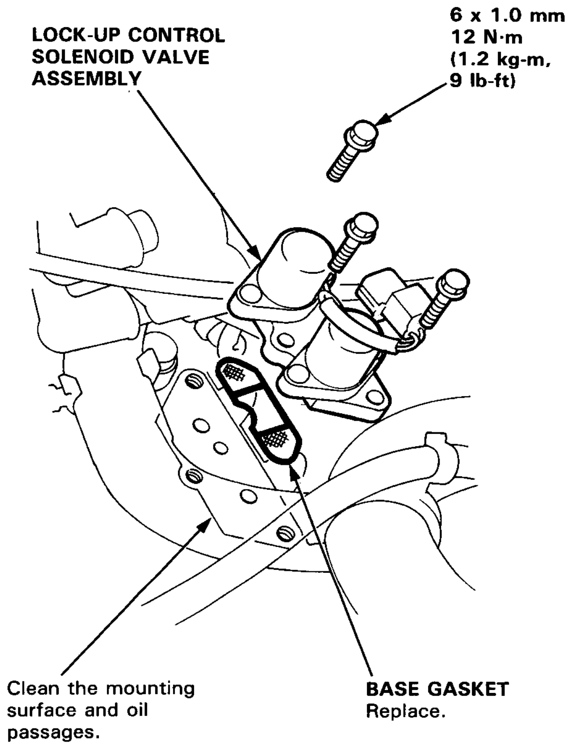
6. Replace the lock-up control solenoid valve assembly if there is continuity between the A/T control unit B3 or B8 harness and body ground (page 14-318, 319).

Replacement

1. Remove the mounting bolts and lock-up control solenoid valve assembly.

   NOTE: Be sure to remove or replace the lock-up control solenoid valves A and B as an assembly.

2. Check the lock-up control solenoid valve oil passages for dust or dirt and replace as an assembly, if necessary.



3. Clean the mounting surface and oil passages of the lock-up control solenoid valve assembly and install a new base gasket.

4. Check the connector for rust, dirt or oil and reconnect it securely.

Shift Control Solenoid Valve A/B

Test

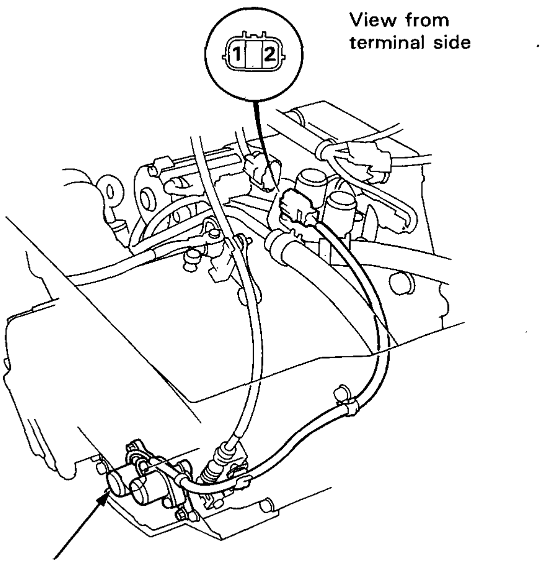
NOTE: Shift control solenoid valves A and B must be removed/replaced as an assembly.

1. Disconnect the connector from the shift control solenoid valve A/B.

   NOTE: Do not remove the shift control solenoid valve A/B stay.

2. Measure the resistance between the No. 1 terminal (SOL.V A) of the solenoid valve connector and body ground and between the No. 2 terminal (SOL. V B) and body ground.

   STANDARD: 16.2–19.8Ω (at 25°C)



3. Replace the shift control solenoid valve assembly if the resistance is out of specification.

4. Connect the No. 1 terminal of the solenoid valve connector to the battery positive terminal and the No. 2 terminal to the battery positive terminal.
   A clicking sound should be heard each time the connection is made.

5. If not, check for continuity between the A/T control unit B4 or B5 harness and body ground. (page 14-326, 327)

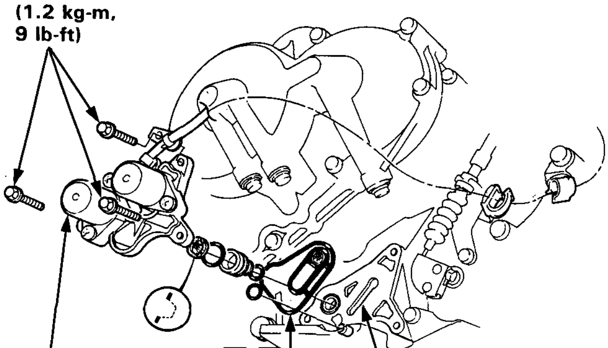
6. Replace the shift control solenoid valve assembly if there is continuity between the A/T control unit B4 or B5 harness and body ground. (page 14-326, 327)

Replacement

1. Remove the mounting bolts and shift control solenoid valve assembly.

   NOTE: Be sure to remove or replace the shift control solenoid valves A and B as an assembly.

2. Check the shift control solenoid valve oil passages for dust or dirt and replace as an assembly, if necessary.



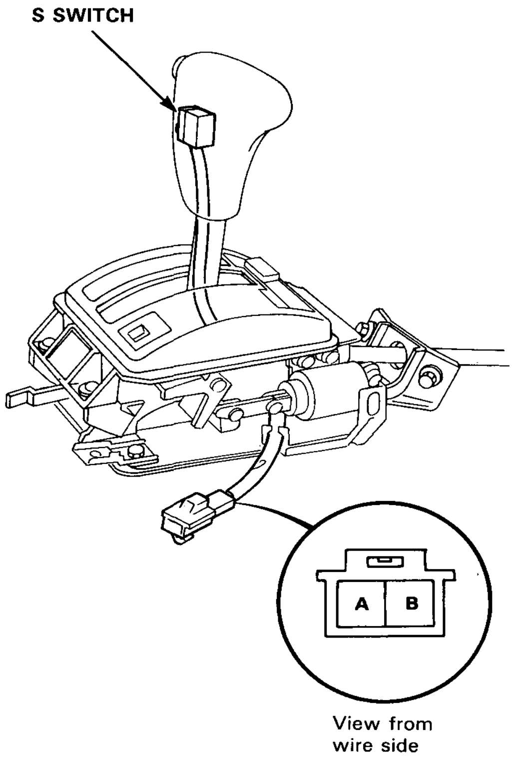
3. Clean the mounting surface and oil passages of the shift control solenoid valve assembly and install a new base gasket.

4. Check the connector for rust, dirt or oil and reconnect it securely.

S Switch

Test

1. Remove the center console. (see page 20-80)
2. Disconnect the switch connector.
3. Check for continuity between A and B terminals. There should be continuity when the switch is pressed.

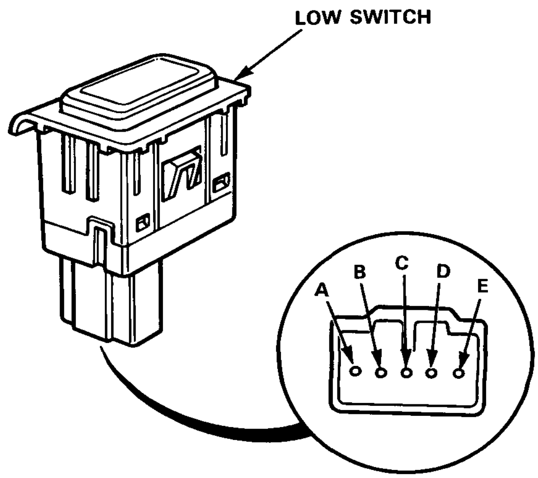


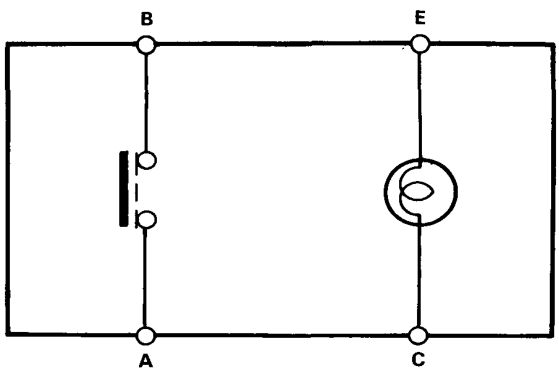
LOW Switch

Test

1. Remove the console.
2. Disconnect the switch connector and remove the LOW switch.
3. Check for continuity between the terminals by pressing and releasing the switch button according to the table below.

POSITION \ TERMINAL	B	A	C	D		E
PRESS	○	○		○		○
RELEASE				○		○





Symptom-to-Component Chart

SYMPTOM	Check these items on the PROBABLE CAUSE LIST	Check these items on the NOTES CHART
Engine runs, but car does not move in any gear.	1, 6, 7,16	K, L, R, S
Car moves in [R] and [2], but not in [D3] or [D4]	8, 29, 44, 48	C, M, O
Car moves in [D3], [D4], [R], but not in [2].	9, 30, 49	C, L
Car moves in [D3], [D4], [2], but not [R].	1, 11, 22, 34, 38, 39, 40	C, L, Q
Car moves in [N].	1, 8, 9, 10, 11, 46, 47	C, D
Excessive idle vibration.	5, 17	B, K, L
Slips in all gears.	6, 7, 16	C, L, U
No engine braking in [2] position.	12	C, D, L
Slips in 1st gear.	8, 29, 44, 48	C, N, O, U
Slips in 2nd gear.	9, 20, 23, 30, 49	C, L, U
Slips in 3rd gear.	10, 21, 23, 31, 44	C, L, U
Slips in 4th gear.	11, 23, 32	C, L, U
Slips in reverse gear.	11, 32, 34	C
Flares on 1—2 upshift.	3, 15	E, L, V
Flares on 2—3 upshift.	3, 15, 24, 44	E, L, V
Flares on 3—4 upshift.	3, 15, 25, 44	E, L, V
No upshift, trans stays in low gear.	14, 19, 23	G, L
No downshift to low gear.	12, 19	G, L
Late upshift.	14	L, V
Erratic shifting.	2, 14, 26	V
Harsh shift (up and down shifting).	2, 4, 15, 23, 24, 27,47	A, E, H, I, L, V
Harsh shift (1—2).	2, 9	C, D, V
Harsh shift (2—3).	2, 10, 23, 24	C, D, H, L, V
Harsh shift (3—4).	2, 11, 23, 25	C, D, I, L, V
Harsh kick-down shifts.	2, 23, 27, 28	L, V, Q
Harsh kick-down shift (2—1).	48	O
Harsh downshift at closed throttle.	15	E, T
Harsh shift when manually shifting to [1].	33	L
Axle(s) slips out of trans on turns.	43, 50	L, P, Q
Axle(s) stuck in trans.	43	L, Q
Ratcheting noise when shifting into [R].	6, 7, 38, 39, 40	K, L, Q
Loud popping noise when taking off in [R].	38, 39, 40	L, Q
Ratcheting noise when shifting from [R] to [P] or from [R] to [N].	38, 39, 40, 45	L, Q
Noise from trans in all selector lever positions.	6, 17	K, L, Q
Noise from trans only when wheels are rolling.	39, 42	L, Q
Gear whine, rpm related (pitch changes with shifts).	8,13, 41	K, L, Q
Gear whine, speed related (pitch changes with speed).	38, 42	L, Q
Trans will not shift into 4th gear in [D4].	1, 21, 28, 32	L
Lock-up clutch does not lock up smoothly.	17, 36, 37	L
Lock-up clutch does not operate properly.	2, 3, 15, 18, 35, 36, 37	E, L, V
Transmission has multitude of problems shifting. At disassembly, large particles of metal are found on magnet.	43	L,Q

PROBABLE CAUSE	
1.	Shift cable broken/out of adjustment.
2.	Throttle cable too short.
3.	Throttle cable too long.
4.	Wrong type ATF.
5.	Idle rpm too low/high.
6.	Oil pump worn or binding.
7.	Regulator valve stuck.
8.	1st clutch defective.
9.	2nd clutch defective.
10.	3rd clutch defective.
11.	4th clutch defective
12.	1st-hold clutch defective.
14.	Modulator valve stuck.
15.	Throttle B valve stuck.
16.	ATF strainer clogged.
17.	Torque convertor defective.
18.	Torque convertor check valve stuck.
19.	1—2 shift valve stuck.
20.	2—3 shift valve stuck.
21.	3—4 shift valve stuck.
22.	Servo control valve stuck.
23.	Clutch pressure control (CPC) valve stuck.
24.	2—3 orifice control valve stuck.
25.	2/3—4 orifice control valve stuck.
26.	3—2 kick-down valve stuck.
27.	4—3 kick-down valve stuck.
28.	4th exhaust valve stuck.
29.	1st accumulator defective.
30.	2nd accumulator defective.
31.	3rd accumulator defective.
32.	4th/reverse accumulator defective.
33.	1st-hold accumulator defective.
34.	Servo valve stuck.
35.	Lock-up timing valve stuck.
36.	Lock-up shift valve stuck.
37.	Lock-up control valve stuck.
38.	Shift fork bent.
39.	Reverse gears worn/damaged (3 gears).
40.	Reverse selector worn.
41.	3rd gears worn/damaged (2 gears).
42.	Final gears worn/damaged (2 gears).
43.	Differential pinion shaft worn.
44.	Feedpipe O-ring broken.
45.	4th gears worn/damaged (2 gears).
46.	Gear clearance incorrect.
47.	Clutch clearance incorrect.
48.	One-way (sprag) clutch defective.
49.	Sealing rings/guide worn.
50.	Axle-inboard joint clip missing.

(cont'd)

Symptom-to-Component Chart (cont'd)

The following symptoms can be caused by improper repair or assembly.	Check these items on the PROBABLE CAUSE DUE TO IMPROPER REPAIR	Items on the NOTES CHART
Car creeps in [N].	R1, R2	
Car does not move in [D3] or [D4].	R4	
Trans locks up in [R].	R3, R12	
Excessive drag in trans.	R6	R, K
Excessive vibration, rpm related.	R7	
Noise with wheels moving only.	R5	
Main seal pops out.	R8	S
Various shifting problems.	R9, R10	
Harsh upshifts.	R11	

PROBABLE CAUSE DUE TO IMPROPER REPAIR	
R1.	Improper clutch clearance.
R2.	Improper gear clearance.
R3.	Parking brake lever installed upside down.
R4.	One-way (sprag) clutch installed upside down.
R5.	Reverse selector hub installed upside down.
R6.	Oil pump binding.
R7.	Torque converter not fully seated in oil pump.
R8.	Main seal improperly installed.
R9.	Springs improperly installed.
R10.	Valves improperly installed.
R11.	Ball check valves not installed.
R12.	Shift fork bolt not installed.

NOTES	
B.	Set idle rpm in gear to specified idle speed. If still no good, adjust motor mounts as outlined in engine section of service manual.
C.	If the large clutch piston O-ring is broken, inspect the piston groove for rough machining.
D.	If the clutch pack is seized or is excessively worn, inspect the other clutches for wear and check the orifice control valves and throttle valves for free movement.
E.	If throttle valve B is stuck, inspect the clutches for wear.
G.	If the 1—2 shift valve is stuck closed, the transmission will not upshift. If stuck open the transmission has no 1st gear.
H.	If the 2—3 orifice control valve is stuck, inspect the 2nd and 3rd clutch packs for wear.
I.	If the 2/3—4 orifice control valve is stuck, inspect the 3rd and 4th clutch packs for wear.
J.	If the clutch pressure control valve (CPC) is stuck closed, the transmission will not shift out of 1st gear.
K.	Improper alignment of main valve body and torque convertor housing may cause oil pump seizure. The symptoms are mostly an rpm-related ticking noise or a high pitched squeek.
L.	If the oil screen is clogged with particles of steel or aluminum, inspect the oil pump and differential pinion shaft. If both are OK and no cause for the contamination is found, replace the torque converter.
M.	If the 1st clutch feedpipe guide in the R. side cover is scored by the mainshaft, inspect the ball bearing for excessive movement in the transmission housing. If OK, replace the R. side cover as it is dented. The O-ring under the guide is probably worn.
N.	Replace the mainshaft if the bushings for the 1st and 4th feedpipe are loose or damaged. If the 1st feedpipe is damaged or out of round, replace it. If the 4th feedpipe is damaged or out of round, replace the R. side cover.
O.	A worn or damaged one-way (sprag) clutch is mostly a result of shifting the trans in $\boxed{D_3}$ or $\boxed{D_4}$ while the wheels rotate in reverse, such as rocking the car in snow.
P.	Inspect the frame for collision damage.
Q.	Inspect for damage or wear: 1. Reverse selector gear teeth chamfers. 2. Engagement teeth chamfers of countershaft 4th and reverse gear. 3. Shift fork for scuff marks in center. 4. Differential pinion shaft for wear under pinion gears. 5. Bottom of 3rd clutch for swirl marks. Replace items 1, 2 and 4 if worn or damaged. If trans makes clicking, grinding or whirring noise, also replace mainshaft 4th gear and reverse idler gear and countershaft 4th gear in addition to 1, 2, 3 or 4. If differential pinion shaft is worn, overhaul differential assembly and replace oil screen and throughly clean trans, flush torque converter, cooler and lines. If bottom of 3rd clutch is swirled and trans makes gear noise, replace the countershaft and ring gear.
R.	Be very careful not to damage the torque converter housing when replacing the main ball bearing. You may also damage the oil pump when you torque down the main valve body. This will result in oil pump seizure if not detected. Use proper tools.
S.	Install the main seal flush with the torque converter housing. If you push it into the torque converter housing until it bottoms out, it will block the oil return passage and result in damage.
T.	Harsh downshifts when coasting to a stop with zero throttle may be caused by a bent-in throttle valve retainer/cam stopper. Throttle cable adjustment may clear this problem.
U.	Check if separator plate is installed. If it was not installed, the servo valve may have been pushed out by hydraulic pressure causing a leak (internal) affecting all forward gears.
V.	Throttle cable adjustment is essential for proper operation of the transmission. Not only does it affect the shift points if misadjusted, but also the shift quality and lock-up clutch operation. A too long adjusted cable will result in throttle pressure being too low for the amount of engine torque input into the transmission and may cause clutch slippage. A too short adjusted cable will result in too high throttle pressures which may cause harsh shifts, erratic shifts and torque converter hunting.

NOTE: Warm up the engine to operating temperature.

1. Apply parking brake and block the wheels. Start the engine, them move the selector lever to $\boxed{D_4}$ position while depressing the brake pedal. Depress the accelerator pedal, and release it suddenly. Engine should not stall.

2. Repeat same test in $\boxed{D_3}$ position.

3. shift the selector lever to $\boxed{D_4}$ position and check that the shift points occur at approximate speeds shown. Also check for abnormal noise and clutch slippage.

$\boxed{D_4}$ or $\boxed{D_3}$ Position: Normal mode (S switch OFF)

- Upshift

NOTE: When the coolant temperature is below normal operating temperature, the shift point is higher than specified vehicle speed.

Throttle Opening	Unit of speed	1st → 2nd	2nd → 3rd	3rd → 4th
1/8 throttle	Km/h	18–20	36–39	53–58
	mph	11–12	22–24	33–36
1/2 throttle	Km/h	39–42	71–77	95–101
	mph	24–26	44–48	59–63
Full-opened throttle	Km/h	65–71	117–123	167–173
	mph	40–44	73–76	104–108

- Downshift

Throttle Opening	Unit of speed	4th → 3rd	3rd → 2nd	2nd → 1st
Full-closed throttle	Km/h	30–34	10–14 (3rd → 1st)	–
	mph	19–21	6–9 (3rd → 1st)	–
Full-opened throttle	Km/h	135–141	89–95	43–49
	mph	84–88	55–59	27–30

- Lock-up

Throttle Opening	Unit of speed	Lock-up control solenoid valve A ON	Lock-up control solenoid valve B ON
1/8 throttle	Km/h	25–29	66–70
	mph	16–18	41–43
Full-opened throttle	Km/h	147–153	147–153
	mph	91–95	91–95

[D4] (or [D3]) Position: Sport mode (S switch ON)

- Upshift

Throttle Opening	Unit of speed	1st → 2nd	2nd → 3rd	3rd → 4th
1/8 throttle	Km/h	21–23	44–47	78–83
	mph	13–14	27–29	48–52
1/2 throttle	Km/h	43–46	82–88	117–123
	mph	27–29	51–55	73–76
Full-opened throttle	Km/h	65–71	117–123	167–173
	mph	40–44	73–76	104–108

- Downshift

Throttle Opening	Unit of speed	4th → 3rd	3rd → 2nd	2nd → 1st
Full-closed throttle	Km/h	30–34	10–14(3rd → 1st)	–
	mph	19–21	6–9 (3rd → 1st)	–
Full-opened throttle	Km/h	135–141	89–95	43–49
	mph	84–88	55–59	27–30

- Lock-up

Throttle Opening	Unit of speed	Lock-up control solenoid valve A ON	Lock-up control solenoid valve B ON
1/8 throttle	Km/h	38–42	84–88
	mph	24–26	52–55
Full-opened throttle	Km/h	147–153	147–153
	mph	91–95	91–95

4. Accelerate to about 35 mph (57 km/h) so the transmission is in 4th, then shift [D4] to [2]. The car should immediately begin slowing down from engine braking.

   CAUTION: Do not shift from [D4] or [D3] to [2] at speeds over 62.5 mph (100 km/h); you may damage the transmission.

5. Check for abnormal noise and clutch slippage in the following positions.
   [2] (2nd Gear) Position
   –1. Accelerate from a stop at full throttle. Check that there is no abnormal noise or clutch slippage.
   –2. Upshifts and downshifts should not occur with the selector in this position.
   [R] (Reverse) Position
   Accelerate from a stop at full throttle, and check for abnormal noise and clutch slippage.

6. Test in [P] (Parking) Position
   Park car on slope (approx. 16°), apply the parking brake, and shift into [P] position. Release the brake; the car should not move.

Stall Speed

Test

CAUTION:
- **To prevent transmission damage, do not test stall speed for more than 10 seconds at a time.**
- **Do not shift the lever while raising the engine speed.**
- **Be sure to remove the pressure gauge before testing stall speed.**

1. Engage the parking brake and block all four wheels.
2. Connect the tachometer, and start the engine.
3. After the engine has warmed up to normal operating temperature, shift into [2] position.
4. Fully depress the brake pedal and accelerator for 6 to 8 seconds, and note engine speed.
5. Allow 2 minutes for cooling, then repeat same test in [D4] and [R] position.

   NOTE:
   - Stall speed test must be made only for checking the cause of trouble.
   - Stall speed in [D4], [2] and [R] must be same, and must also be within limits.

   Stall Speed RPM:
   Specification: 2,750 min^{-1} (rpm)
   Service Limit: 2,300—2,900 min^{-1} (rpm)

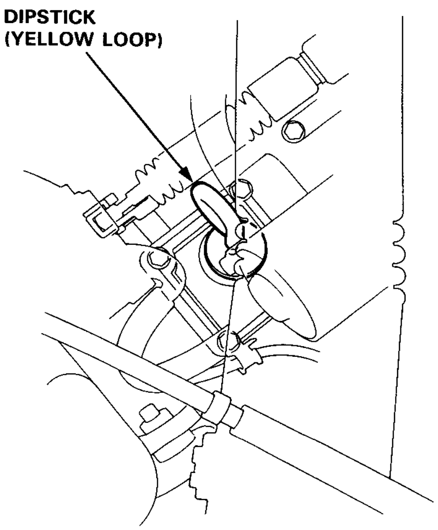
TROUBLE	PROBABLE CAUSE
Stall rpm high in [D4], [2] and [R] position	•Low fluid level or oil pump output •Clogged oil strainer •Pressure regulator valve stuck closed •Slipping clutch
Stall rpm high in [2] position	•Slippage of 1st clutch, 1st-hold clutch or 1st gear one-way clutch
Stall rpm high in [D4] position	•Slippage of 1st clutch, 1st gear one-way clutch
Stall rpm high in [R] position	•Slippage of 4th clutch
Stall rpm low in [D4], [2] and [R] position	•Engine output low •Torque converter one-way clutch slipping

Checking/Changing

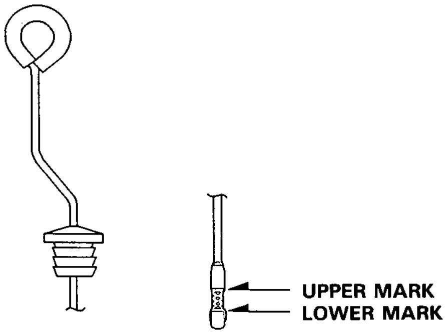
Checking

NOTE: Check the fluid level with the engine at normal operating temperature.

1. Park the car on level ground. Shutt off the engine.
2. Remove the dipstick (yellow loop) from the transmission and wipe it with a clean cloth.
3. Insert the dipstick into the transmission.



4. Remove the dipstick and check the fluid level. It should be between the upper and lower marks.

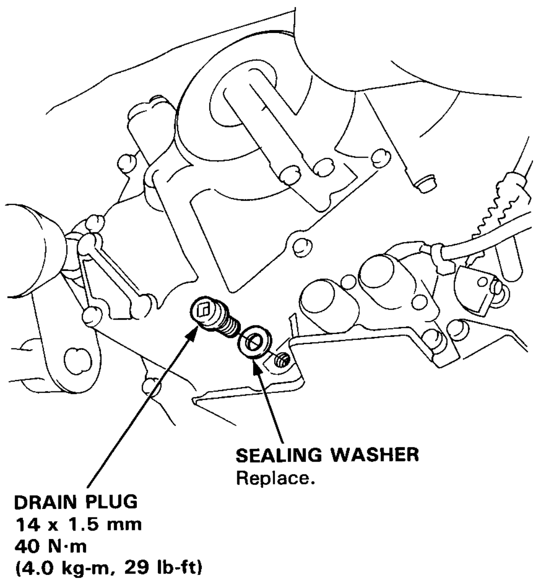


5. If the level is below the lower mark, add fluid into the tube to bring it to the upper mark. Use Honda Premium Formula Automatic Transmission Fluid or an equivalent DEXRON® II Automatic Transmission Fluid (ATF) only.
6. Insert the dipstick back in the transmission.

Changing

1. Bring the transmission up to operating temperature by driving the car. Park the car on level ground, turn the engine off, then remove drain plug.
2. Reinstall the drain plug with a new washer, then refill the transmission to the upper mark on the dipstick.

Automatic Transmission Fluid Capacity:
3.2 ℓ (3.4 US qt., 2.8 Imp qt.) at change
6.4 ℓ (6.8 US qt., 5.6 Imp qt.) after overhaul



Pressure Testing

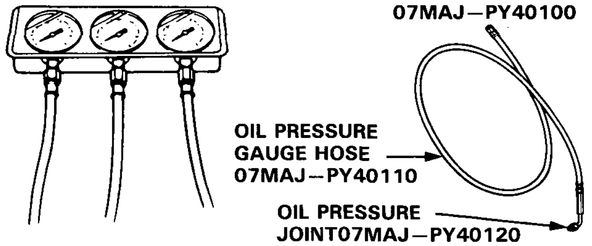
⚠WARNING
- **While testing, be careful of the rotating front wheels.**
- **Make sure lifts, jacks, and safety stands are placed properly. (see page 1—10 thru 1—12).**

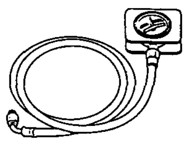
CAUTION:
- **Before testing, be sure the transmission fluid is filled to the proper level.**
- **Warm up the engine before testing.**

1. Raise the car. (see page 1—10 thru 1—12).
2. Warm up the engine, then stop the engine and connect a tachometer.
3. Connect the oil pressure gauge to each inspection hole(s).

   TORQUE: 18 N·m (1.8 kg-m, 12 lb-ft)

   CAUTION: Connect the oil pressure gauge securely, be sure not to allow dust and other foreign particles to enter the inspection hole.





NOTE: Use the A/T Oil Pressure Gauge Set or A/T Low Pressure Gauge replacing the oil pressure gauge hose assembly. The A/T Oil Pressure Gauge Hose (07406—0020201) may also be used.

4. Start the engine and measure the respective pressure as follows.
   - Line Pressure
   - Clutch Pressure
   - Clutch Low/High Pressure
   - Throttle B Pressure
5. Install a new washer and the sealing bolt in the inspection hole and tighten to the specified torque.

   TORQUE: 18 N·m (1.8 kg-m, 12 lb-ft)

   NOTE: Do not reuse old aluminum washers.

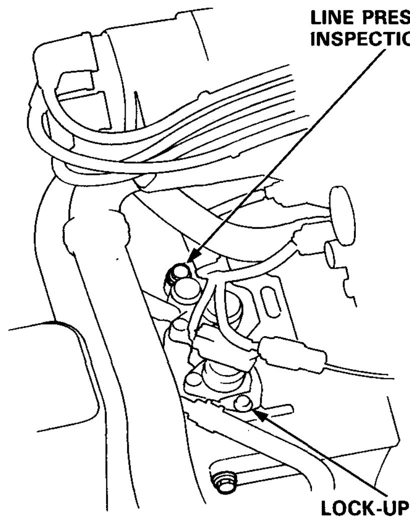
- Line Pressure

—1. Set the parking brake and block both rear wheels securely.

—2. Run the engine at 2,000 min^{-1} (rpm)

—3. Shift the select lever to [N] or [P].

—4. Measure line pressure.



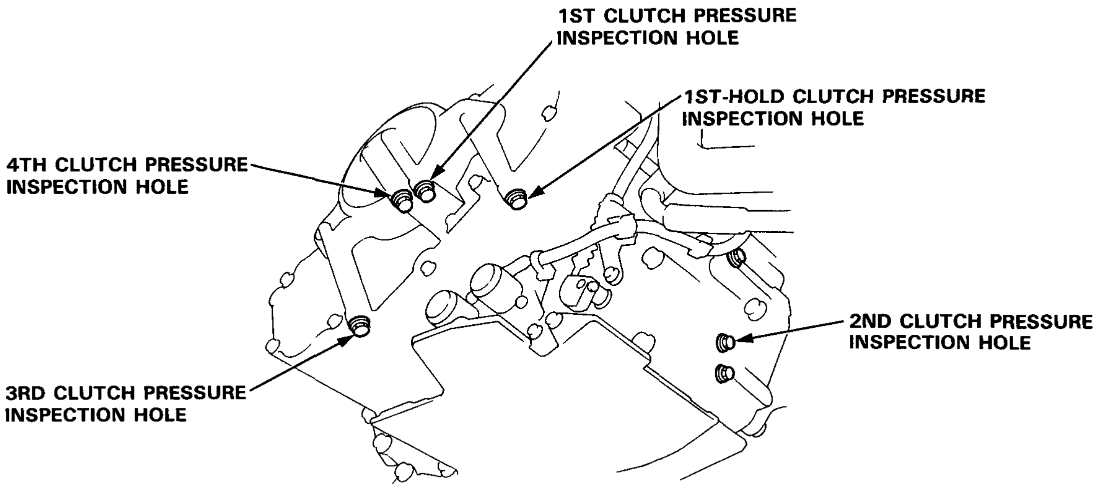
PRESSURE	SELECTOR POSITION	SYMPTOM	PROBABLE CAUSE	FLUID PRESSURE	
				Standard	Service Limit
Line	[N] or [P]	No (or low) line pressure	Torque converter, oil pump pressure regulator, torque converter check valve, oil pump.	850—900 kPa (8.5—9.0 kg/cm^2, 121—128 psi)	800 kPa (8.0 kg&cm^2, 114 psi)

NOTE: Higher pressures may be indicated if measurements are made in selector positions other than [N] or [P].

- Clutch Pressure Measurement

While testing, be careful of the rotating front wheels.

—1.Set the parking brake and block both rear wheels securely.
—2.Raise the front of the car and support with safety stands.
—3.Allow the front wheels to rotate freely.
—4.Run the engine at 2,000 min^{-1} (rpm).
—5.Measure each clutch pressure.



PRESSURE	SELECTOR POSITION	SYMPTOM	PROBABLE CAUSE	FLUID PRESSURE	
				Standard	Service Limit
1st Clutch	$\boxed{1}$ or $\boxed{D_4}$	No or low 1st pressure	1st Clutch	850—900 kPa (8.5—9.0 kg/cm^2, 121—128 psi)	800 kPa (8.0 kg/cm^2, 114 psi)
1st-hold Clutch	$\boxed{1}$	No or low 1st-hold pressure	Clutch		
2nd Clutch	$\boxed{2}$	No or low 2nd pressure	2nd Clutch		
2nd Clutch	$\boxed{D_4}$	No or low 2nd pressure	2nd Clutch	500kPa (5.0 km/cm^2, 71 psi) (throttle fully closed) 850—900 kPa (8.5—9.0 kg/cm^2, 121—128 psi) (throttle more than 3/8 opened)	450 kPa (4.5 kg/cm^2, 61 psi) (throttle fully closed) 800 kPa (8.0 kg/cm^2, 114 psi) (throttle more than 3/8 opened)
3rd Clutch		No or low 3rd pressure	3rd Clutch		
4th Clutch		No or low 4th pressure	4th Clutch		
	$\boxed{R}$		Servo Valve or 4th Clutch	850—900 kPa (8.5—9.0 kg/cm^2 121—128 psi)	800 kPa (8.0 kg/cm^2 114 pai)

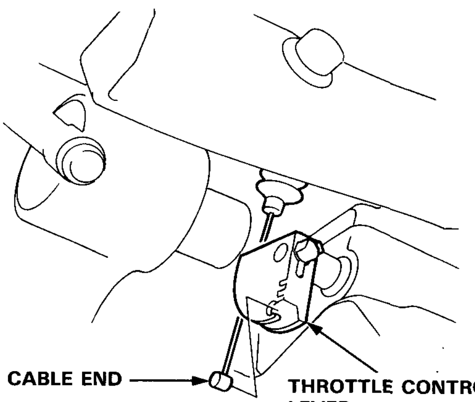
(cont'd)

- Clutch Low/High Pressure Measurement

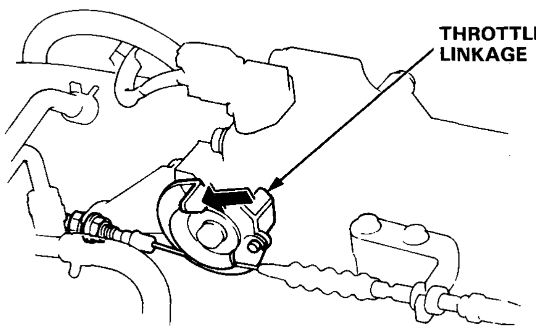
⚠WARNING While testing, be careful of the rotating front wheels.

1. Allow the front wheels to rotate freely.
2. Remove the cable end of the throttle control cable from the throttle control lever.

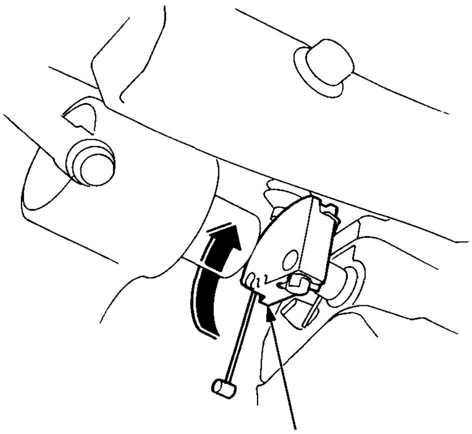
   NOTE: Do not loosen the locknuts, simply unhook the cable end.

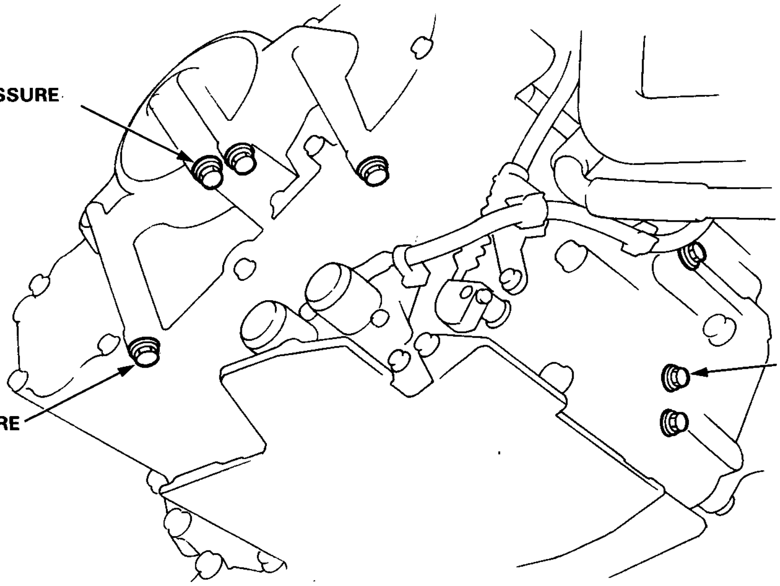


3. Shaft the engine and let it idle.
4. Shift the select lever to $\boxed{D_4}$ position.
5. Slowly move the throttle linkage to increase engine rpm until pressure is indicated on the oil pressure gauge.
   Then release the throttle linkage, allowing the engine to return to an idle, and measure the pressure reading.
6. Repeat step —5. for each clutch pressure being inspected.



7. With the engine idling, lift the throttle control lever up approximately 1/2 of its possible travel and increase the engine rpm until pressure is indicated on the gauge, then measure the highest pressure reading obtained.
8. Repeat step —7. for each clutch pressure being inspected.
   inspected.





PRESSURE	SELECTOR POSITION	SYMPTOM	PROBABLE CAUSE	FLUID PRESSURE	
				Standard	Service Limit
2nd Clutch	$\boxed{D_4}$	No or low 2nd pressure	2nd Clutch	500–900 kPa (5.0–9.0 kg/cm², 71–128 psi) varies with throttle opening	450 kPa (4.5 kg/cm², 61 psi) with throttle control lever released 800 kPa (8.0 kg/cm², 114 psi) with throttle control lever more than 3/8 opened
3rd Clutch		No or low 3rd pressure	3rd Clutch		
4th Clutch		No or low 4th pressure	4th Clutch		

(cont'd)

Pressure Testing

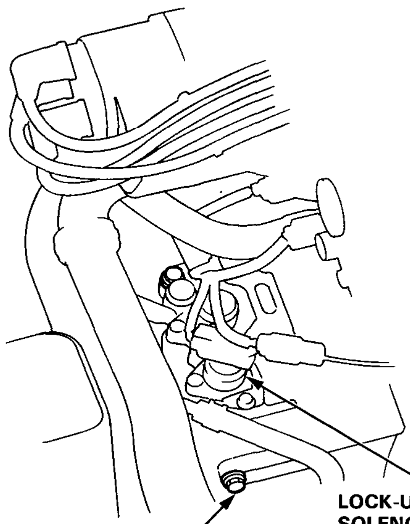
(cont'd)

- Throttle B Pressure Measurement

⚠WARNING While testing, be careful of the rotating front wheels.

1. Allow the front wheels to rotate freely.
2. Remove the cable end of the throttle control cable from the throttle control lever.

   NOTE: Do not loosen the locknuts, simply unhook the cable end.
3. Shift the selector lever to $\boxed{D_4}$ or $\boxed{D_3}$ position.
4. Run the engine at 1,000 min^{-1} (rpm).
5. Measure full-closed throttle B pressure.
6. Move the throttle control lever to full-opened throttle position.
7. Measure full-opened throttle B pressure.



PRESSURE	SELECTOR POSITION	SYMPTOM	PROBABLE CAUSE	FLUID PRESSURE	
				Standard	Service Limit
Throttle B	$\boxed{D_4}$ or $\boxed{D_3}$	Pressure too high	Throttle Valve B	0 kPa (0 kg/cm², 0 psi) throttle full closed	—
		No or low throttle B pressure		850 — 900 kPa (8.5 — 9.0 kg/cm², 121 — 128 psi) throttle full opened	800 kPa (8.0 kg/cm², 114 psi) throttle full opened

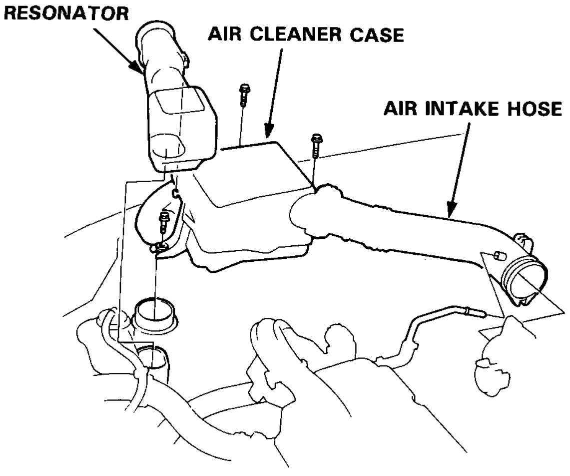
Removal

⚠WARNING

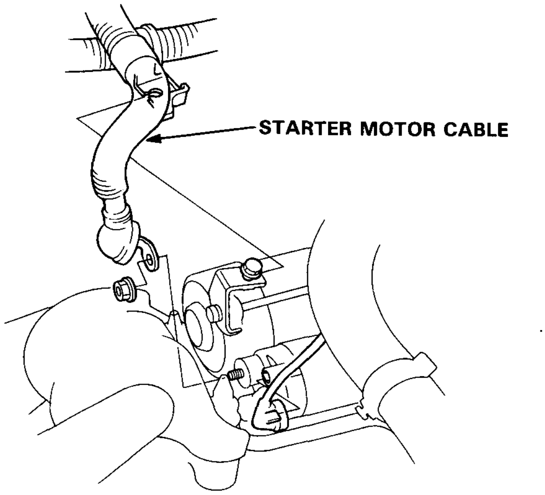
- **Make sure lifts, jacks and safety stands are placed properly, and hoist brackets are attached to the correct position on the engine (see pages 1-6 thru 1-8).**
- **Apply parking brake and block rear wheels, so car will not roll off stands and fall on you while working under it.**

CAUTION: **Use fender covers to avoid damaging painted surfaces.**

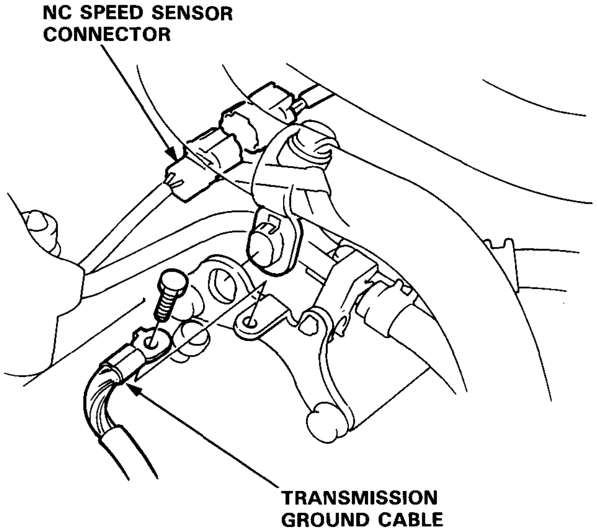
1. Disconnect the battery negative (−) and positive (+) cables from the battery.
2. Remove the resonator, air intake hose and air cleaner case.



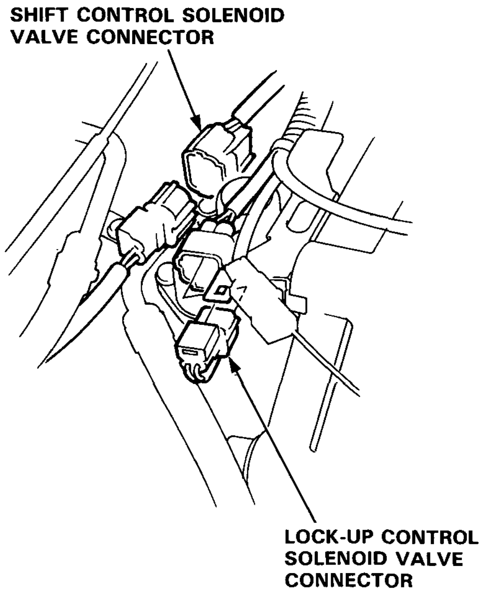
3. Remove the starter motor cable and cable holder from the starter motor.



4. Remove the transmission ground cable from the transmission and disconnect the NC speed sensor connector.



5. Disconnect the lock-up control solenoid valve and shift control solenoid valve connectors.



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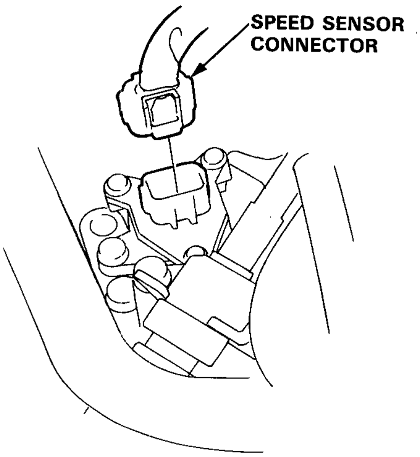
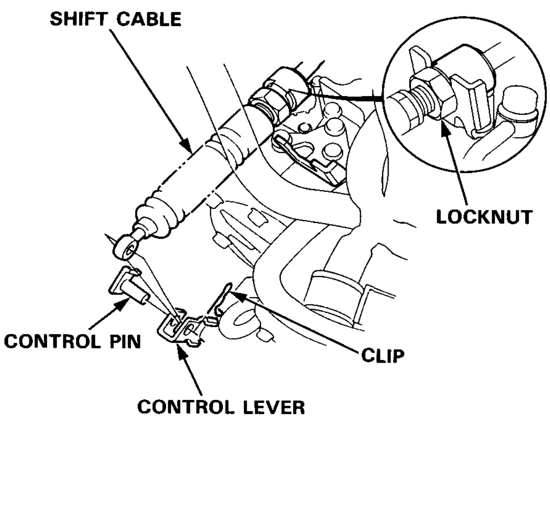
Removal (cont'd)

6. Disconnect the speedometer sensor connector.

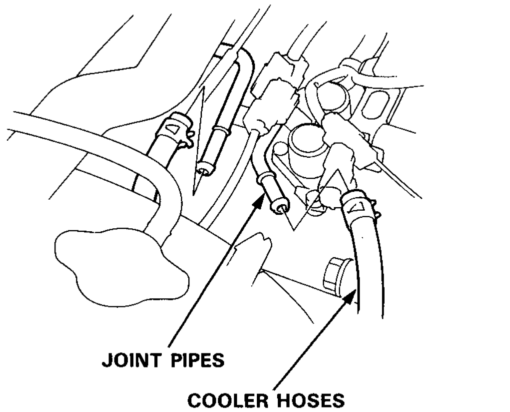


7. Remove the clip from the control pin.
8. Remove the locknut securing the shift cable, then remove the shift cable from the control cable.

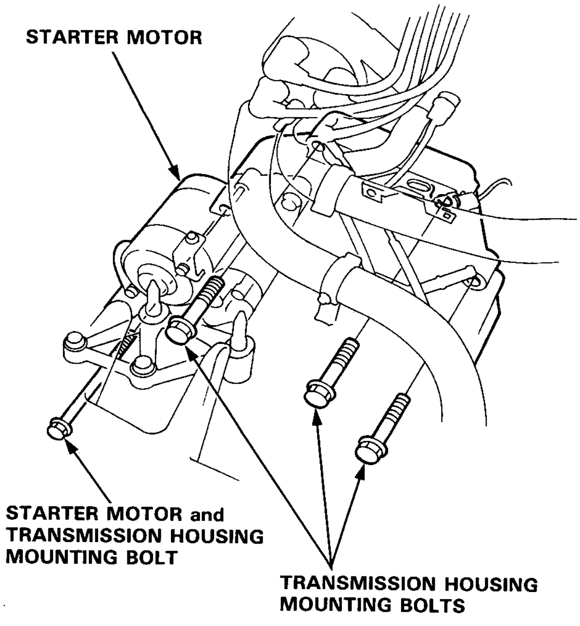


9. Remove the ATF cooler hoses at the joint pipes. Turn the ends of the cooler hoses up to prevent ATF from flowing out, then plug the joint pipes.

   NOTE: Check for any signs of leakage at the hose joints.



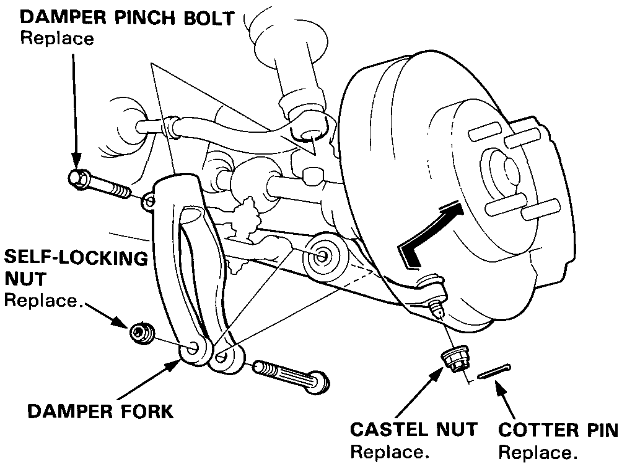
10. Remove the transmission housing mounting bolts and starter motor mounting bolt.



11. Remove the drain plug and drain the automatic transmission fluid (ATF). Reinstall the drain plug with a new sealing washer (see page 14-355).

12. Remove the cotter pins and castle nuts, then separate the ball joints from the lower arm (see Section 18).

13. Remove the damper fork bolts, then separate the damper fork and damper.



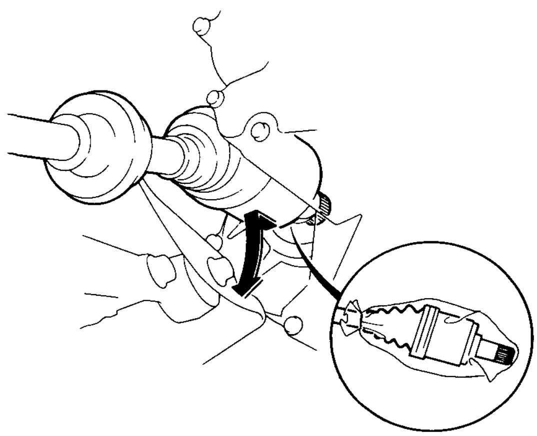
14. Pry the right drivershaft out of the differential.

15. Pry the left drivershaft out of the intermediate shaft.

16. Pull on the inboard joint and remove the right and left driveshafts (see Section 16).

17. The plastic bags over the dirveshaft ends.

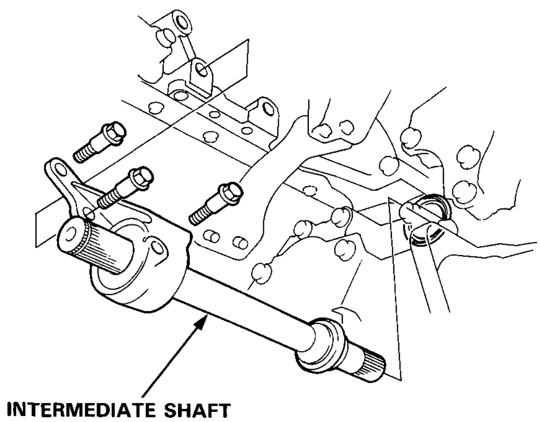
NOTE: Coat all precision finished surfaces with clean engine oil or grese.



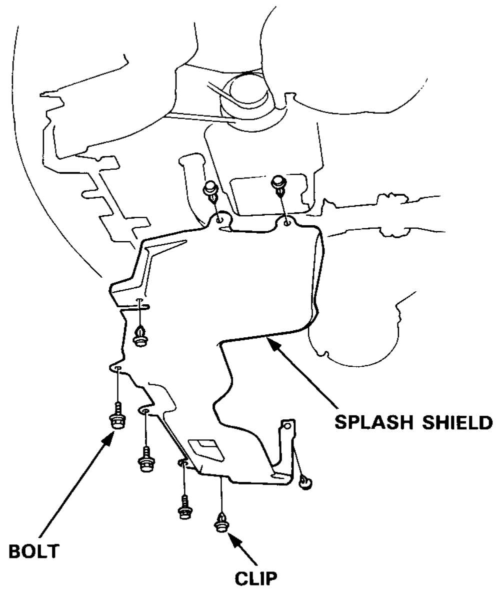
18. Remove the intermediate shaft.

19. The plastic bags over the intermediate shaft end.

NOTE: Coat all precision finished surfaces with clean engine oil or grease.



20. Remove the splash shield.



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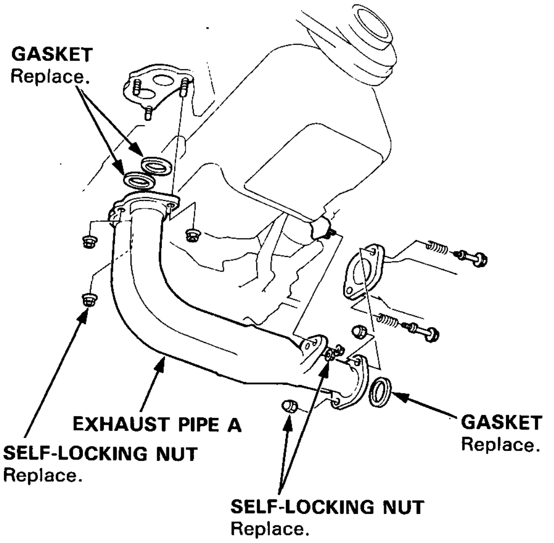
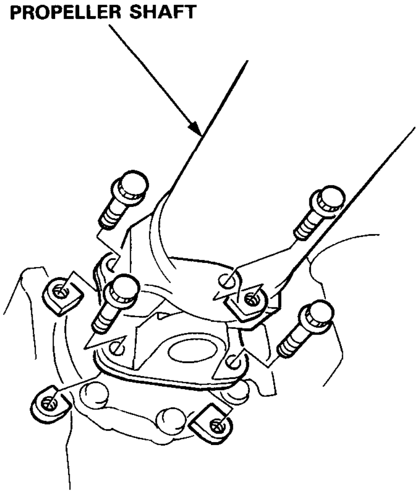
Removal (cont'd)

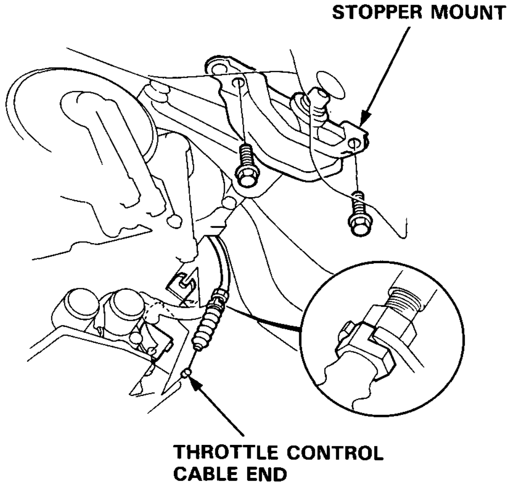
21. Remove the exhaust pipe A.



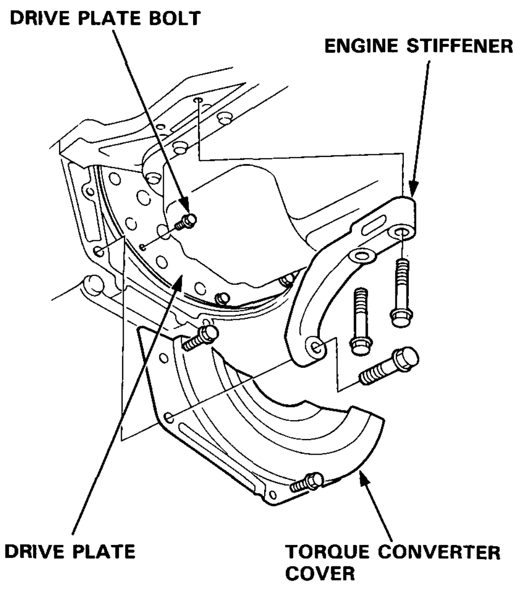
22. Remove the 4 bolts securing the propeller shaft, then separate the propeller shaft from the transfer.



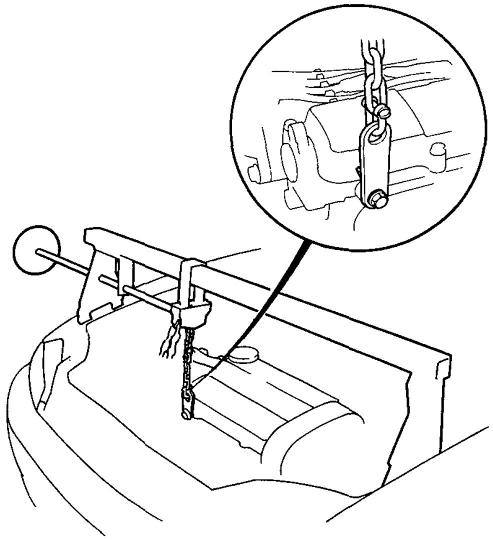
23. Remove the stopper mount bolts.
24. Remove the end of the throttle control cable from the throttle control lever.



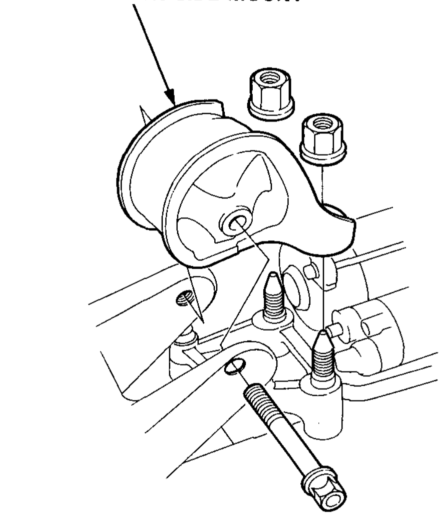
25. Remove the engine stiffener and torque converter cover.
26. Remove the 8 drive plate bolts one at a time while rotating the crankshaft pulley.



27. Attach a hoisting bracket to the engine, then lift the engine slightly.

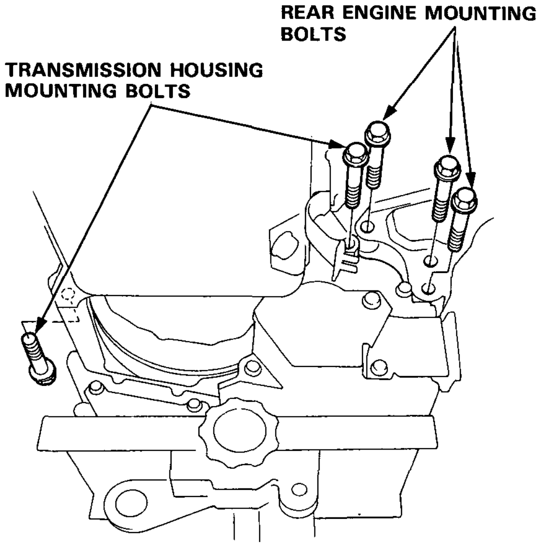


28. Place a jack under the transmission and raise the transmission just enough to take weight off of the mount, then remove the transmission side mount.



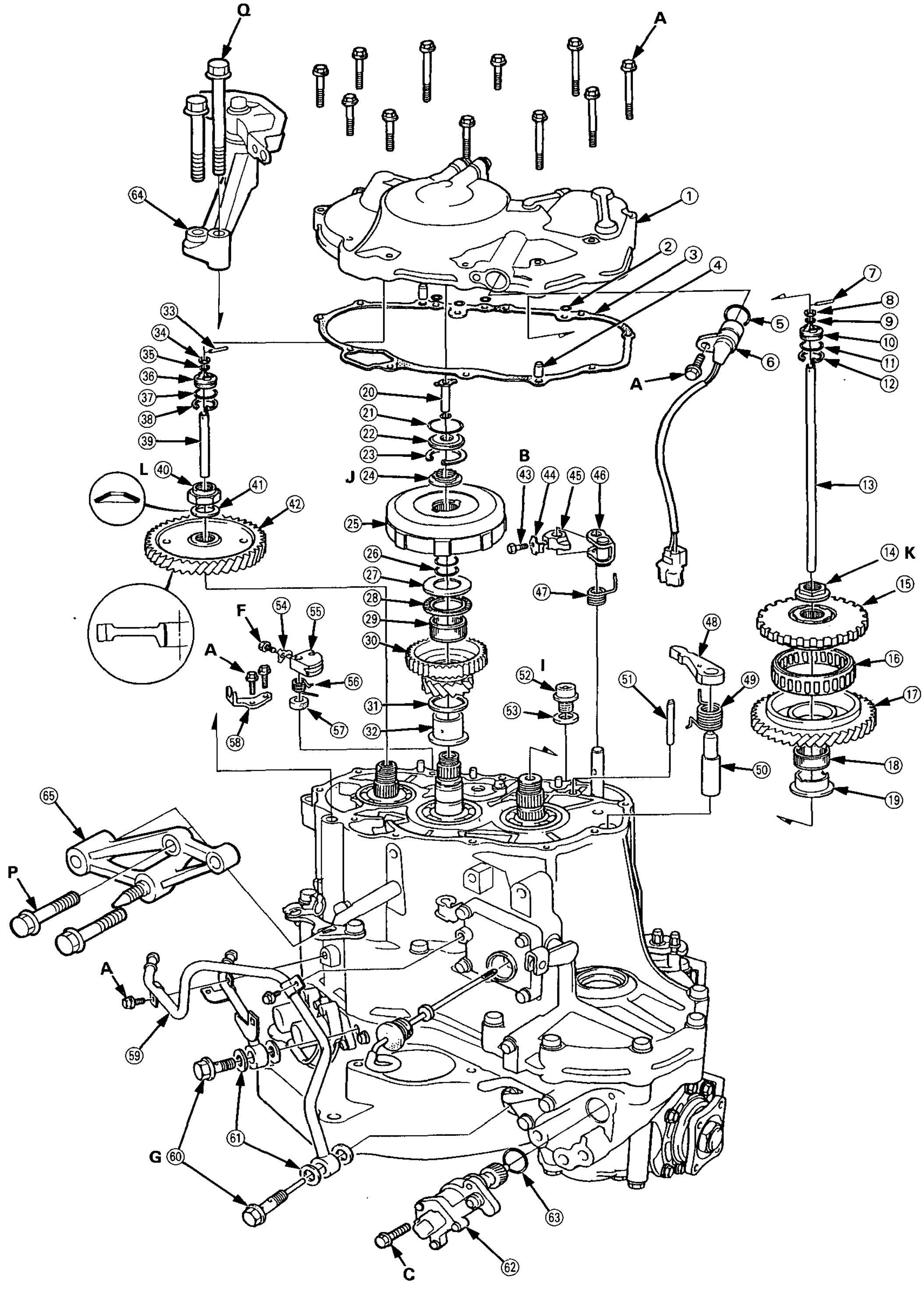
29. Remove the transmission housing mounting bolts and rear engine mounting bolts.

30. Pull the transmission away from the engine until it clears the 14 mm dowel pins, then lower it on the transmission jack.



Illustrated Index

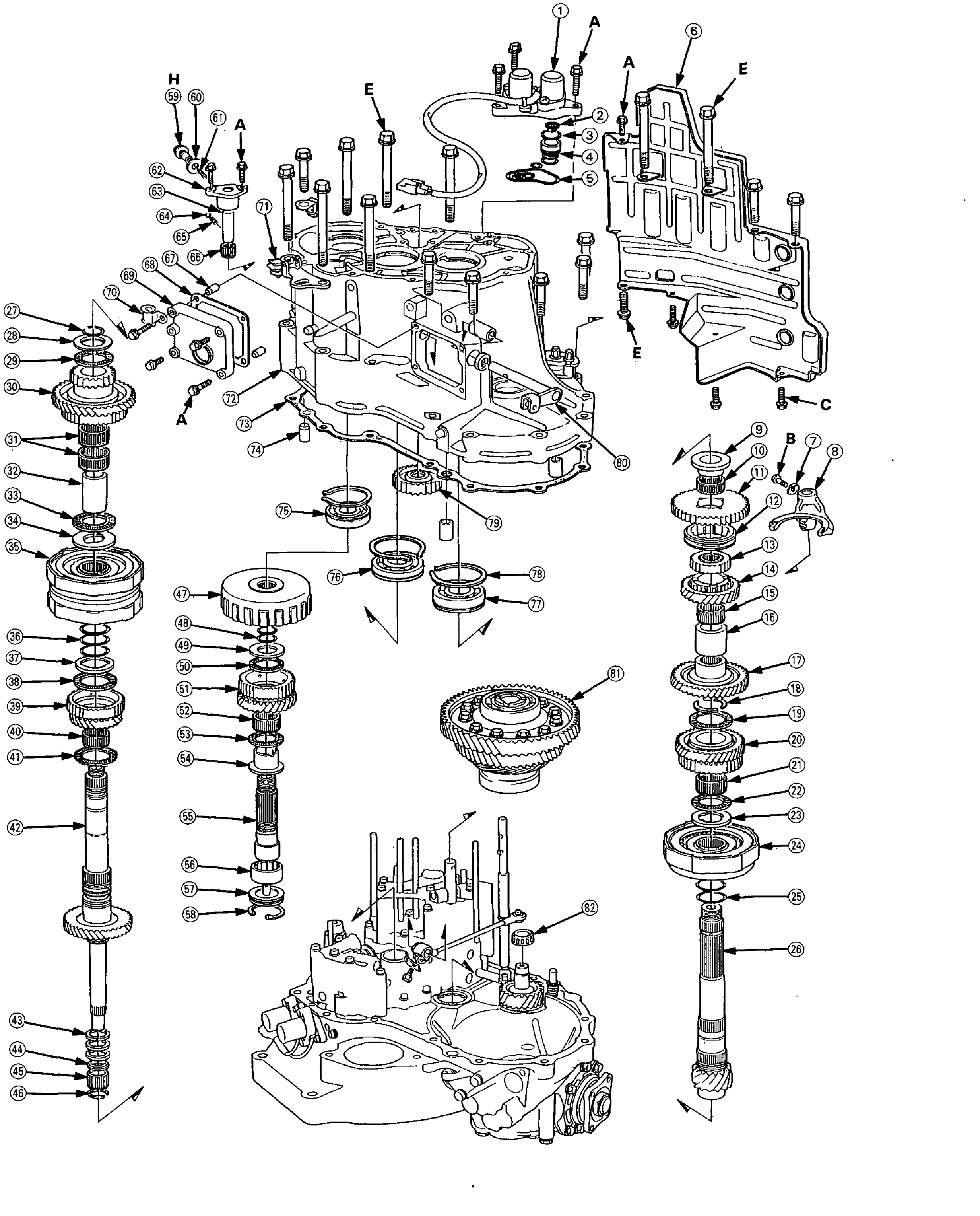
R. Side Cover



1 **R. SIDE COVER**
2 **O-RING** Replace.
3 **R. SIDE COVER GASKET Replace.**
4 **DOWEL PIN**
5 **O-RING** Replace.
6 **NC SPEED SENSOR**
7 **ROLLER**
8 **WASHER**
9 **O-RING** Replace.
11 **FEED PIPE FLANGE**
12 **O-RING** Replace.
13 **SNAP RING**
14 **3RD CLUTCH FEED PIPE**
14 **COUNTERSHAFT LOCKNUT** Replace.
15 **PARKING GEAR**
16 **ONE-WAY CLUTCH**
17 **COUNTERSHAFT 1ST GEAR**
18 **NEEDLE BEARING**
19 **COUNTERSHAFT 1ST GEAR COLLAR**
20 **1ST CLUTCH FEED PIPE**
21 **O-RING** Replace.
22 **FEED PIPE FLANGE**
23 **SNAP RING**
24 **MAINSHAFT LOCKNUT** Replace.
25 **1ST CLUTCH ASSEMBLY**
26 **O-RING** Replace.
27 **THRUST WASHER**
28 **THRUST NEEDLE BEARING**
29 **NEEDLE BEARING**
30 **MAINHSAFT 1ST GEAR**
31 **THRUST WASHER**
32 **MAINSHAFT 1ST GEAR COLLAR**
33 **ROLLER**
34 **WASHER**
35 **O-RING** Replace.
36 **FEED PIPE FLANGE**
37 **O-RING** Replace.
38 **SNAP RING**
39 **1ST-HOLD CLUTCH FEED PIPE**
40 **SUB-SHAFT LOCKNUT** Replace.
41 **SPRING WASHER** Replace.
42 **SUB-SHAFT 1ST GEAR**
43 **LOCK BOLT**
44 **LOCK WASHER** Replace.
45 **PARKING BRAKE STOPPER**
46 **PARKING BRAKE LEVER**
47 **PARKING BRAKE SPRING**
48 **PARKING BRAKE PAWL**
49 **PARKING BRAKE PAWL SHAFT SPRING**
50 **PARKING BRAKE PAWL SHAFT**
51 **PARKING BRAKE PAWL STOPPER**
52 **DRAIN PLUG**
53 **SEALING WASHER** Replace.
54 **LOCK WASHER** Replace.
55 **THROTTLE CONTROL LEVER**
56 **THROTTLE CONTROL LEVER SPRING**
57 **OIL SEAL** Replace.
58 **THROTTLE CONTROL CABLE STAY**
59 **ATF COOLER PIPE**
60 **JOINT BOLT**
61 **SEALING WASHER** Replace.
62 **SPEED SENSOR ASSEMBLY**
63 **O-RING** Replace.
64 **STOPPER MOUNT BRACKET**
65 **TRANSMISSION MOUNT BRACKET**

TORQUE SPECIFICATIONS

Ref. No	Torque Value	Bolt Size	Remarks
A	12 N·m (1.2 kg-m, 9 lb-ft)	6 x 1.0 mm	
B	14 N·m (1.4 kg-m, 10 lb-ft)	6 x 1.0 mm	Specialbolt
C	22 N·m (2.2 kg-m, 16 lb-ft)	8 x 1.25 mm	
F	8 N·m (0.8 kgm, 6 lb-ft)	5 x 0.8 mm	
G	29 N·m (2.9 kg-m, 21 lb-ft)	12 x 1.25 mm	ATF cooler pipe joint bolt
I	40 N·m (4.0 kg-m, 29 lb-ft)	14 x 1.5 mm	Drain plug
J	95 N·m (9.5 kg-m, 69 lb-ft)	19 x 1.25 mm	Mainshaft locknut (flange nut): Left-hand threads
K	140→0→140 N·m (14.0→0→14.0 kg-m, 101→0→101 lb-ft)	23 x 1.25 mm	Countershaft locknut (flange nut)
L	95→0→95 N·m (9.5→0→9.5 kg-m, 69→0→69 lb-ft)	19 x 1.25 mm	Sub-shaft locknut(flange nut)
P	39 N·m (3.9 kg-m, 28 lb-ft)	10 x 1.25 mm	Transmission mount bracket
Q	65 N·m (6.5 kg-m, 47 lb-ft)	12 x 1.25 mm	Stopper mount bracket bolt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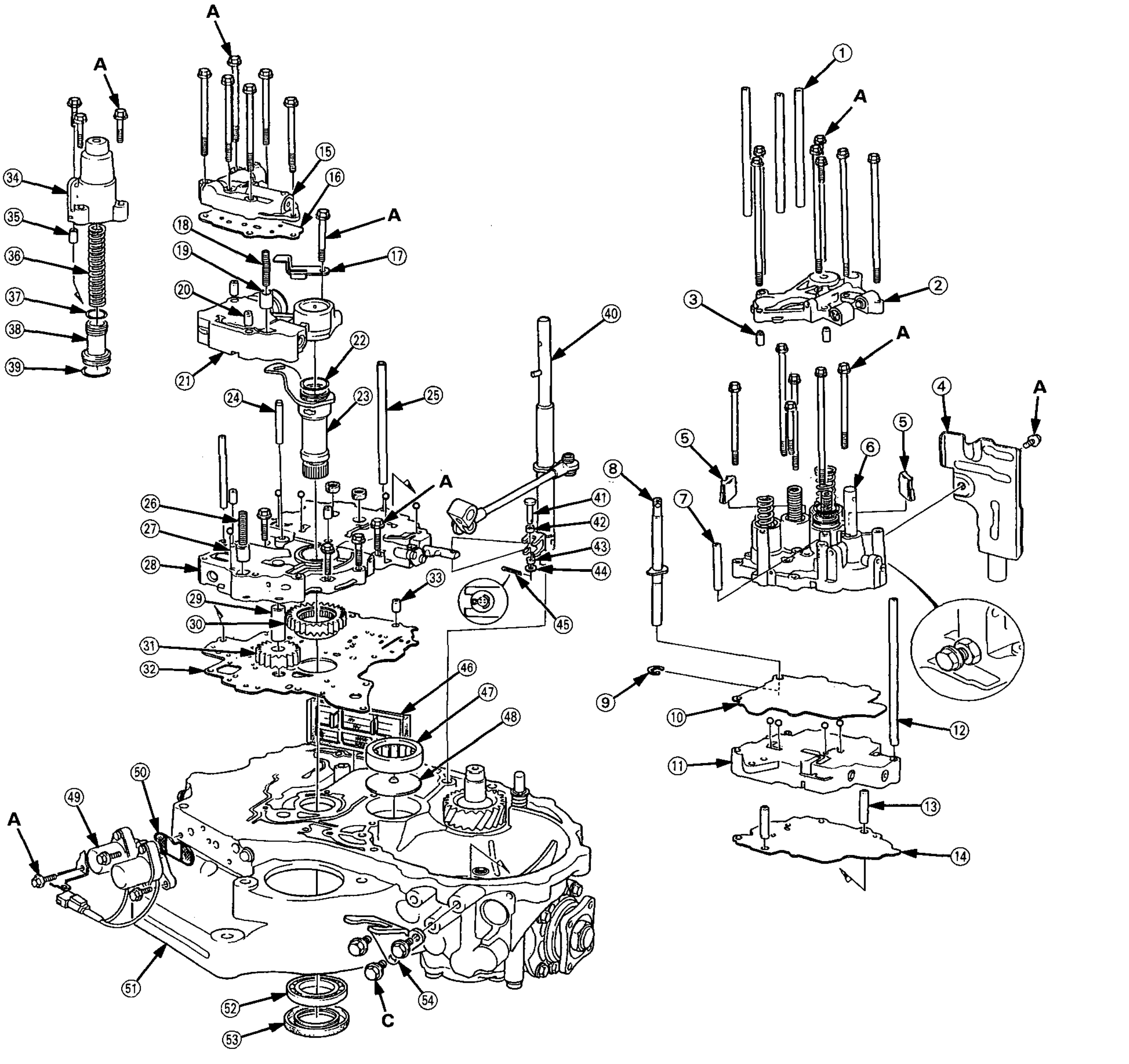
1. SHIFT CONTROL SOLENOID VALVE ASSEMBLY
2. FILTER Replace.
3. O-RING Replace.
4. JOINT COLLAR
5. O-RING Replace.
6. TRANSMISSION UNDER GUARD
7. LOCK WASHER Replace.
8. REVERSE SHIFT FORK
9. REVERSE GEAR COLLAR
10. NEEDLE BEARING
11. COUNTERSHAFT REVERSE GEAR
12. REVERSE SELECTOR
13. REVERSE SELECTOR HUB
14. COUNTERSHAFT 4TH GEAR
15. NEEDLE BEARING
16. DISTANCE COLLAR, 28 mm Selective part
17. COUNTERSHAFT 2ND GEAR
18. COTTER
19. THRUST NEEDLE BEARING
20. COUNTERSHAFT 3RD GEAR
21. NEEDLE BEARING
22. THRUST NEEDLE BEARING
23. SPLINED WASHER Selective part
24. 3RD CLUTCH ASSEMBLY
25. O-RING Replace.
26. COUNTERSHAFT
27. SNAP RING
28. THRUST WASHER
29. THRUST NEEDLE BEARING
30. MAINSHAFT 4TH/REVERSE GEAR
31. NEEDLE BEARING
32. 4TH/REVERSE GEAR COLLAR
33. THRUST NEEDLE BEARING
34. THRUST WASHER
35. 2ND/4TH CLUTCH ASSEMBLY
36. O-RING Replace.
37. THRUST WASHER 36.5 x 51 mm Select part
38. THRUST NEEDLE BEARING
39. MAINSHAFT 2ND GEAR
40. NEEDLE BEARING
41. THRUST NEEDLE BEARING
42. MAINSHAFT
43. SEALING RING, 35 mm
44. SEALING RING, 29 mm
45. NEEDLE BEARING
46. SET RING
47. 1ST-HOLD CLUTCH ASSEMBLY
48. O-RING Replace.
49. THRUST WASHER
50. THRUST NEEDLE BEARING
51. NEEDLE BEARING
52. SUB-SHAFT 4TH GEAR
53. THRUST NEEDLE BEARING
54. SUB-SHAFT 4TH GEAR COLLAR
55. SUB-SHAFT
56. NEEDLE BEARING
57. OIL GUIDE PLATE Replace.
58. SNAP RING
59. HOLDER BOLT
60. WASHER
61. REVERSE IDLER GEAR SHAFT SPRING
62. REVERSE IDLER GEAR SHAFT HOLDER
63. REVERSE IDLER GEAR SHAFT
64. STEEL BALL
65. REVERSE IDLER GEAR SHAFT SPRING
66. NEEDLE BEARING
67. DOWEL PIN
68. CHANGE COVER GASKET Replace.
69. CHANGE COVER
70. HARNESS CLAMP
71. TRANSMISSION HANGER
72. TRANSMISSION HOUSING
73. TRANSMISSION HOUSING GASKET Replace.
74. DOWEL PIN
75. TRANSMISSION HOUSING SUB-SHAFT BEARING
76. TRANSMISSION HOUSING MAINSHAFT BEARING
77. TRANSMISSION HOUSING COUNTERSHAFT BEARING
78. SNAP RING
79. REVERSE IDLER GEAR
80. CONTROL LEVER
81. DIFFERENTIAL ASSEMBLY
82. TAPERED BEARING INNER RACE

TORQUE SPECIFICATIONS

Ref. No	Torque Value	Bolt Size	Remarks
A	12 N·m (1.2 kg-m, 9 lb-ft)	6 x 1.0 mm	
B	14 N·m (1.4 kg-m, 10 lb-ft)	6 x 1.0 mm	Special bolt
C	22 N·m (2.2 kg-m, 16 lb-ft)	8 x 1.25 mm	
E	55 N·m (5.5 kg-m, 40 lb-ft)	10 x 1.25 mm	
H	27 N·m (2.7 kg-m, 20 lb-ft)	10 x 1.25 mm	

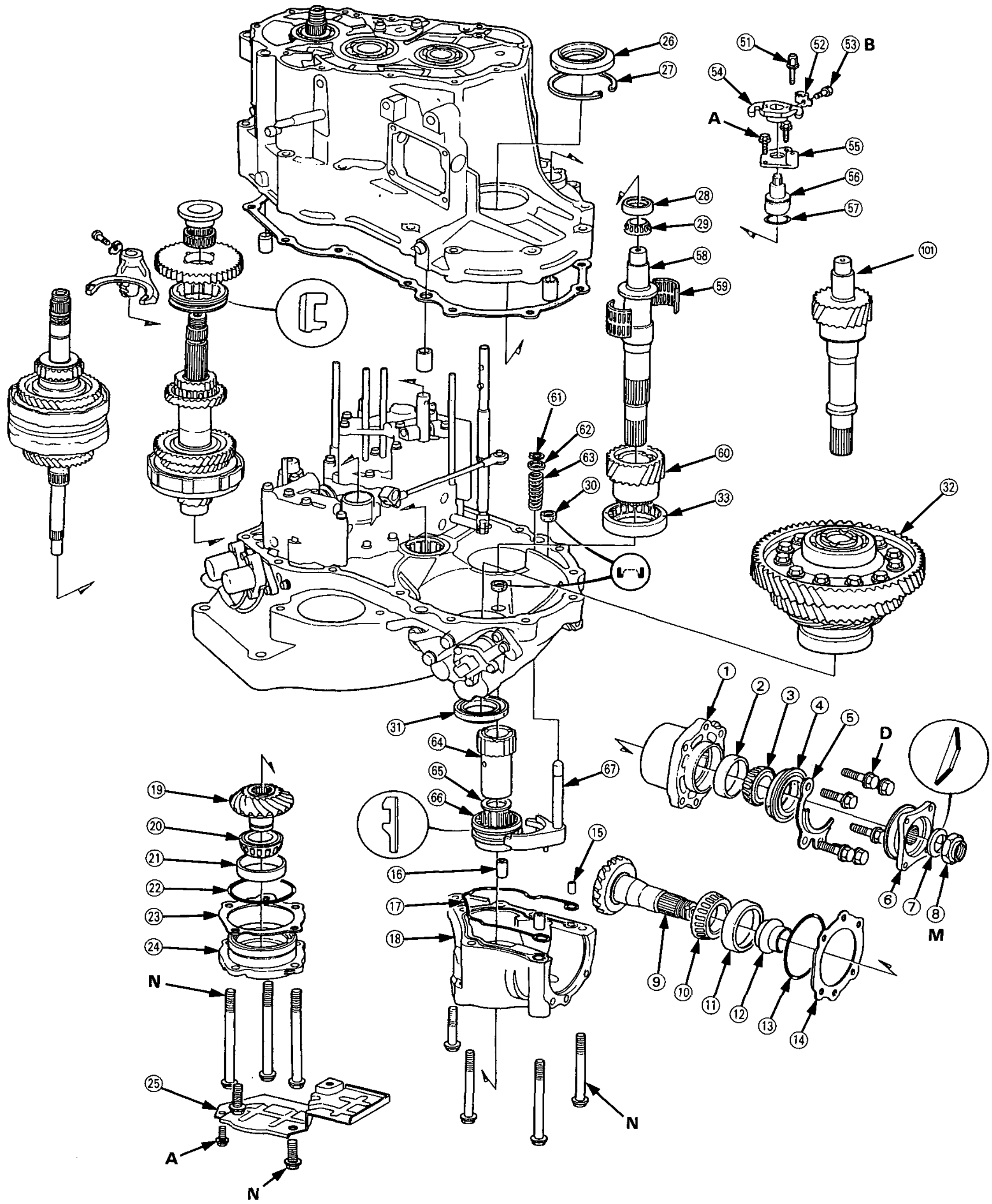
Torque Converter Housing/Valve Body



① OIL FEED PIPE
② DETENT BASE/ACCUMULATOR COVER
③ DOWEL PIN
④ BAFFLE PLATE
⑤ MAGNET
⑥ SERVO BODY
⑦ OIL FEED PIPE
⑧ THROTTLE CONTROL SHAFT
⑨ E-RING
⑩ SERVO SEPARATOR PLATE
⑪ SECONDARY VALVE BODY
⑫ OIL FEED PIPE
⑬ DOWEL PIN
⑭ SECONDARY SEPARATOR PLATE
⑮ LOCK-UP VALVE BODY
⑯ LOCK-UP SEPARATOR PLATE
⑰ STOPPER
⑱ TORQUE CONVERTER CHECK VALVE SPRING
⑲ TORQUE CONVERTER CHECK VALVE
⑳ DOWEL PIN
㉑ REGULATOR VALVE BODY
㉒ O-RING Replace.
㉓ STATOR SHAFT
㉔ STOPPER SHAFT
㉕ OIL FEED PIPE
㉖ COOLER RELIEF VALVE SPRING
㉗ COOLER RELIEF VALVE
㉘ MAIN VALVE BODY
㉙ OIL PUMP DRIVEN GEAR SHAFT
㉚ OIL PUMP DRIVE GEAR
㉛ OIL PUMP DRIVEN GEAR
㉜ MAIN SEPARATOR PLATE
㉝ DOWEL PIN
㉞ 2ND ACCUMULATOR BODY
㉟ DOWEL PIN
㊱ 2ND ACCUMULATOR SPRING
㊲ O-RING Replace.
㊳ 2ND ACCUMULATOR PISTON
㊴ O-RING Replace.
㊵ CONTROL SHAFT
㊶ ROLLER PIN
㊷ ROLLER
㊸ ROLLER
㊹ WASHER
㊺ COTTER PIN Replace
㊻ ATF STRAINER Clean.
㊼ TORQUE CONVERTER HOUSING COUNTERSHAFT NEEDLE BEARING
㊽ OIL GUIDE PLATE Replace.
㊾ LOCK-UP CONTROL SOLENOID VALVE ASSEMBLY
㊿ LOCK-UP CONTROL SOLENOID VALVE FILTER/GASKET Replace.
(51) TORQUE CONVERTER HOUSING
(52) MAINSHAFT BEARING
(53) OIL SEAL Replace.
(54) SHIFT CONTROL CABLE STAY

TORQUE SPECIFICATIONS

Ref. No	Torque Value	Bolt Size	Remarks
A	12 N•m (1.2 kg-m, 9 lb-ft)	6 x 1.0 mm	
C	22 N•m (2.2 kg-m, 16 lb-ft)	8 x 1.25 mm	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NOTE: The part composition of the transfer differs in the models without ABS and with ABS.

- Common use:
  Model without ABS and model with ABS

① **TRANSFER REAR COVER**
② **BEARING OUTER RACE**
③ **BEARING INNER RACE**
④ **OIL SEAL** Replace.
⑤ **COMPANION FLANGE**
⑥ **DUST COVER**
⑦ **DISC SPRING** Replace
⑧ **DRIVEN SHAFT LOCKNUT** Replace.
⑨ **TRANSFER DRIVEN GEAR SHAFT**
⑩ **BEARING INNER RACE**
⑪ **BEARING OUTER RACE**
⑫ **TRANSFER SPACER**
⑬ **O-RING** Replace.
⑭ **DRIVEN GEAR THRUST SHIM** Selective part
⑮ **DOWEL PIN**
⑯ **DOWEL PIN**
⑰ **SPECIAL SEAL** Replace.
⑱ **TRANSFER HOUSING**
⑲ **TRANSFER DRIVE GEAR**
⑳ **BEARING INNER RACE**
㉑ **BEARING OUTER RACE**
㉒ **O-RING** Replace.
㉓ **TRANSFER THRUST SHIM** Selective part
㉔ **TRANSFER L. SIDE COVER**
㉕ **L. SIDE COVER PROTECTOR**
㉖ **OIL SEAL Replace.**
㉗ **SET RING, 80 mm** Selective part
㉘ **BEARING OUTER RACE**
㉙ **BEARING INNER RACE**
㉚ **OIL SEAL** Replace.
㉛ **OIL SEAL** Replace.
㉜ **NEEDLE BEARING**
㉝ **DIFFERENTIAL ASSEMBLY**

- Model without ABS

(51) **LOCK BOLT**
(52) **LOCK WASHER** Replace.
(53) **SPECIAL BOLT**
(54) **2WD ↔ 4WD SELECTOR LEVER**
(55) **SELECTOR LEVER STAY**
(56) **2WD ↔ 4WD SELECTOR CAM**
(57) **O-RING Replace.**
(58) **TRANSFER SHAFT**
(59) **NEEDLE BEARING** Separate type
(60) **TRANSFER SHAFT DRIVEN GEAR**
(61) **SNAP RING**
(62) **SPRING RETAINER**
(63) **RETURN SPRING**
(64) **TRANSFER SHAFT DRIVEN GEAR DISTANCE COLLAR**
(65) **DRIVE GEAR THRUST SHIM** Selective part
(66) **2WD ↔ 4WD SELECTOR**
(67) **2WD ↔ 4WD SELECTOR FORK**

- Model with ABS

(101) **TRANSFER SHAFT/DRIVEN GEAR**

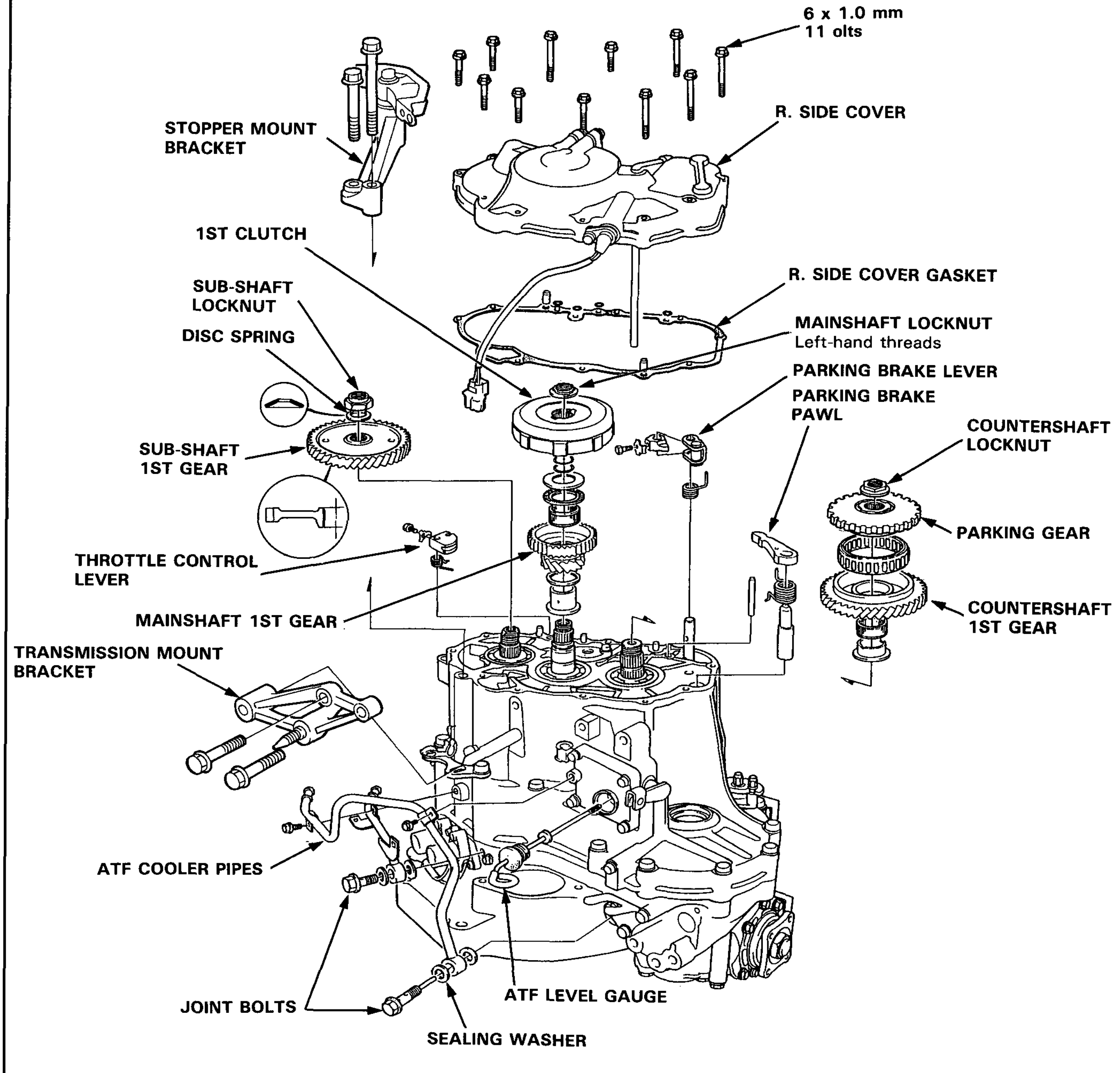
TORQUE SPECIFICATIONS

Ref. No	Torque Value	Bolt Size	Remarks
A	12 N·m (1.2 kg-m, 9 lb-ft)	6 x 1.0 mm	
B	14 N·m (1.4 kg-m, 10 lb-ft)	6 x 1.0 mm	Special Bolt
D	26 N·m (2.6 kg-m, 19 lb-ft)	8 x 1.25 mm	
N	45 N·m (4.5 kg-m, 33 lb-ft)	10 x 1.25 mm	
M	120-230 N·m (12.0—23.0 kg-m, 87-166 lb-ft)		Driven Gear Shaft Locknut

R. Side Cover

Removal

NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- When removing the transmission R. side cover, replace the following:
  - R. side cover gasket
  - Lock washers
  - O-rings
  - Each shaft locknut
  - Sealing washers
- Clean the old countershaft and sub-shaft locknuts, they are used when installing the parking gear and sub-shaft 1st gear.

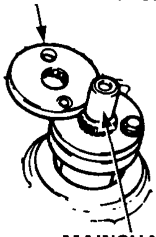


1. Remove the transmission mount bracket and stopper mount.

2. Remove the 11 bolts securing the R. side cover, then remove the cover.

3. Slip the special tool onto the mainshaft.

4. Engage the parking brake pawl with the parking gear.



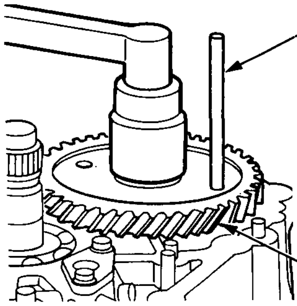
5. Pry the lock tabs of the mainshaft and countershaft locknuts.

   NOTE: Clean the old countershaft locknut, it is used when installing to press the parking gear on the countershaft.

6. Cut the lock tab of the sub-shaft lock-nut using a chisel as shown.

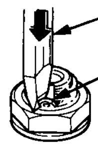
   CAUTION: Keep all of the chiseled particles out of the transmission.

   NOTE: Clean the old sub-shaft locknut, it is used when installing to press the parking gear on the sub-shaft.



7. Align the hole of the sub-shaft 1st gear with the hole of the transmission housing, then insert a pin to lock the sub-shaft while removing the sub-shaft locknut.

8. Remove the each shaft locknut.



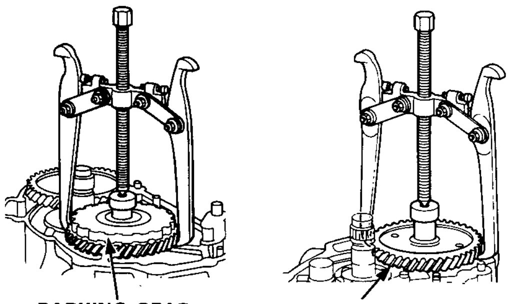
9. Remove the special tool from the mainshaft after removing the locknuts.

10. Remove the 1st clutch, thrust washer, thrust needle bearing, needle bearing and 1st gear from the mainshaft.

11. Remove the parking brake pawl.

12. Remove the parking gear using a puller from the countershaft as shown. Then remove the countershaft 1st gear, needle bearing and 1st gear collar.

13. Remove the sub-shaft 1st gear using a puller from the sub-shaft as shown.



14. Remove the thrust washer and 1st gear collar from the mainshaft, and needle bearing and 1st gear collar from the countershaft.

15. Remove the parking brake pawl, spring, shaft, and stopper from the housing.

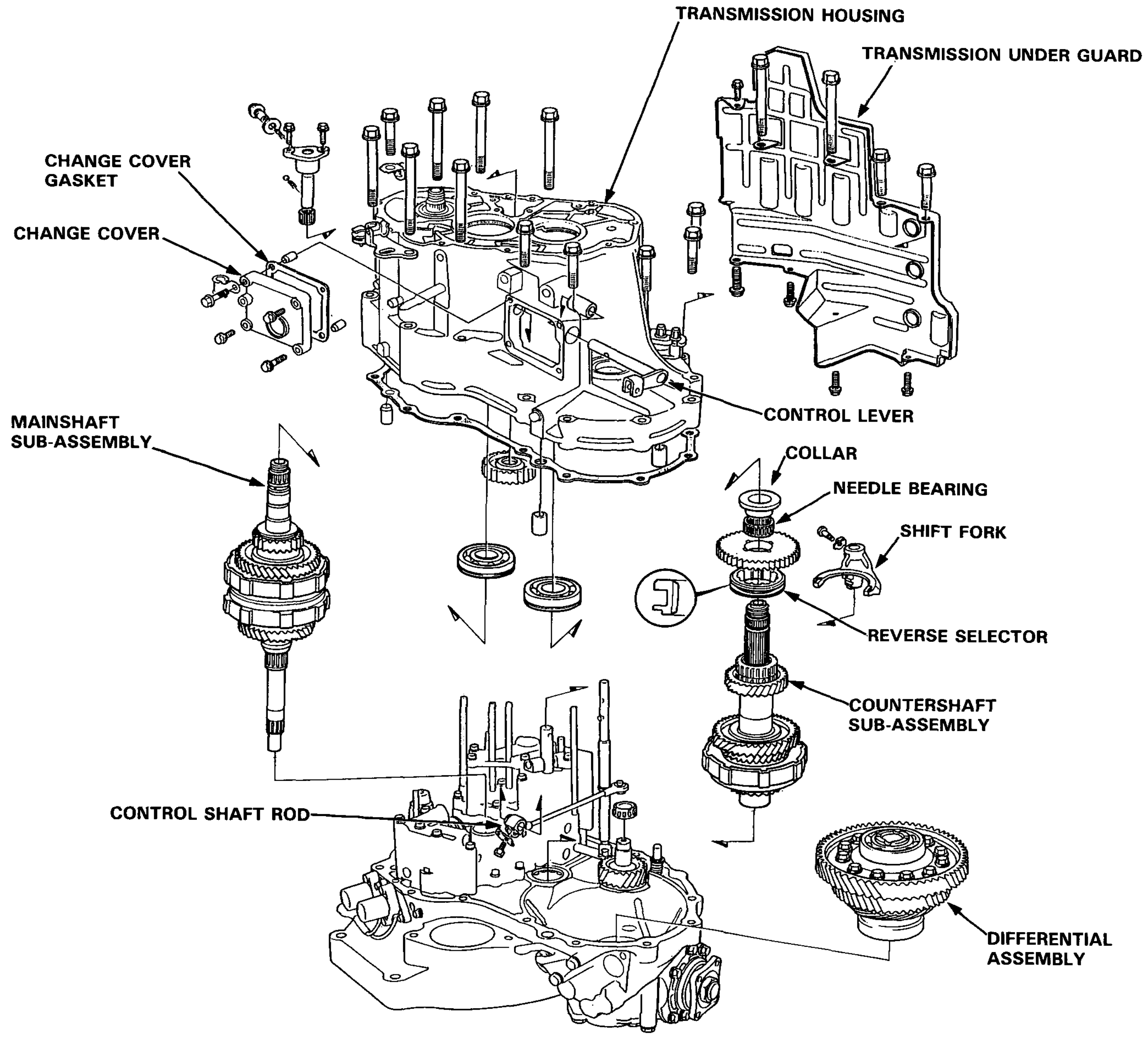
16. Remove the parking brake lever from the control shaft.

17. Remove the throttle control lever and spring from the throttle control shaft.

18. Remove the ATF cooler pipes and ATF level gauge.

Transmission Housing

Removal



NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- When removing the transmission housing, replace the following:
  - Transmission housing gasket
  - Change cover gasket
  - Lock washer

1. Remove the transmission under guard.

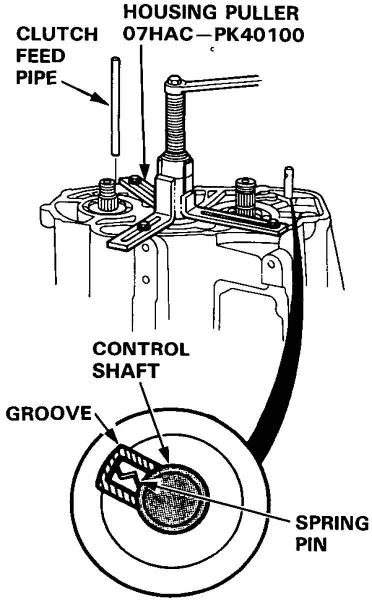
2. Remove the change cover.

3. Remove the 1 bolt securing the control shaft rod, then remove the control lever from the transmission housing.

4. Remove the transmission housing mounting bolts.

5. Align the spring pin with the transmission housing groove by turning the control shaft.

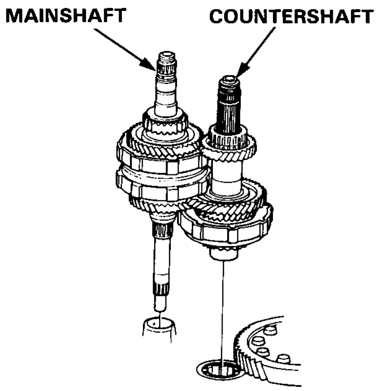
6. Install the special tool on the transmission housing, then remove the housing as shown.



7. Remove the reverse gear collar and needle bearing-from the countershaft.

8. Remove the lock bolt securing the shift fork, then remove the fork with the reverse selector from the countershaft.

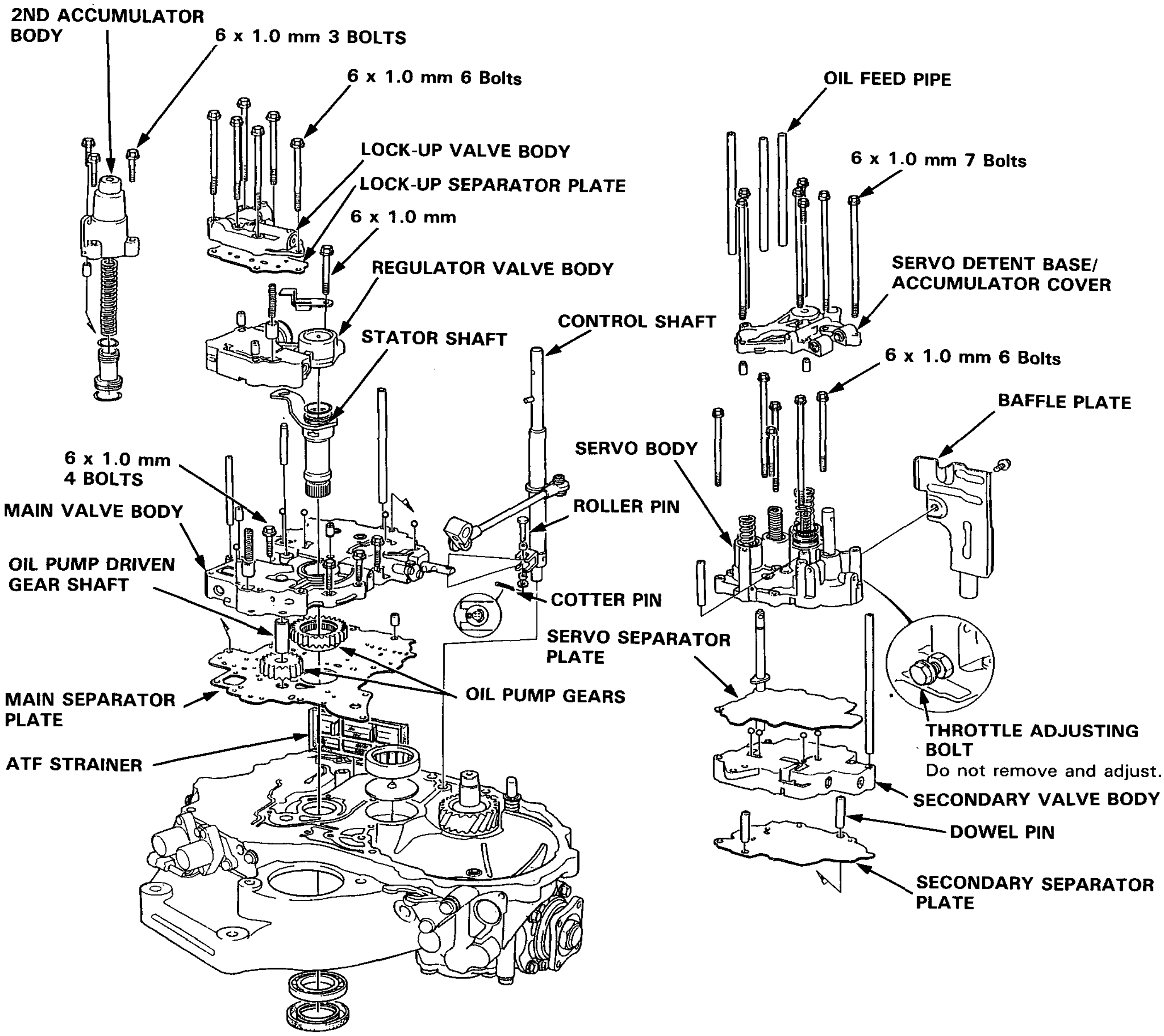
9. Remove the mainshaft and countershaft together.



10. Remove the differential assembly.

Torque Converter Housing/Valve Body

Removal



NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- When removing the valve body replace the following:
  - O-rings
  - Lock washers
  - Filter
  - Cotter pin

1. Remove the oil feed pipes.

2. Remove the baffle plate.

3. Remove the 7 bolts securing the servo detent base/accumulator cover, then remove the servo detente base/accumulator cover.

4. Remove the 6 bolts securing the servo body, then remove the servo body and separator plate.

5. Remove the secondary valve body and separator plate.

6. Remove the 6 bolts securing the lock-up valve body, then remove the lock-up valve body and separator plate.

7. Remove the 1 bolt securing the regulator valve body, then remove the regulator valve body and stopper.

8. Remove the stator shaft and stopper shaft.

9. Remove the cotter pin from the control shaft.

10. Remove the roller pin from the manual valve, then remove the control shaft.

11. Remove the 3 bolts securing the 2nd accumulator body, then remove the 2nd accumulator body.

12. Remove the 4 bolts securing the main valve body, then remove the main valve body.

13. Remove the oil pump driven gear shaft, then remove the oil pump gears.

14. Remove the main separator plate with the 1 dowel pin.

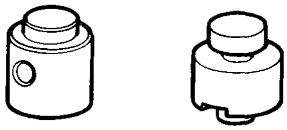
15. Remove the ATF strainer.

Valve Caps

Description

- Caps with one projected tip and one flat end are installed with the flat end toward the spring.
- Caps with a projected tip on each end are installed *with the smaller tip toward the spring. The small tip* is a spring guide.

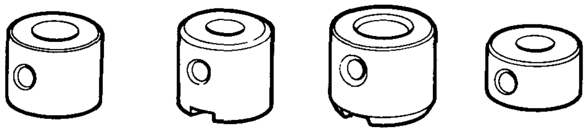
Toward outside of valve body.



Toward spring.

- Caps with hollow ends are installed with the hollow end away from the spring.
- Caps with notched ends are installed with the notch *toward the spring.*
- Caps with flat ends and a hole through the center are installed with the smaller hole toward the spring.

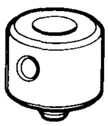
Toward outside of valve body.



Toward spring.

- Caps with one projected tip and hollow end are installed with the tip toward the spring. The tip is a spring guide.

Toward outside of valve body.



Toward spring.

- Caps with flat ends and a groove around cap are installed with the groove side toward the spring.

Toward outside of valve body.

Toward spring.

Valve Body

Repair

NOTE: This repair is only necessary if one or more of the valves in a valve body do not slide smoothly in their bores. You may use this procedure to free the valves in the valve bodies.

1. Soak a sheet of #600 abrasive paper in ATF for about 30 minutes.

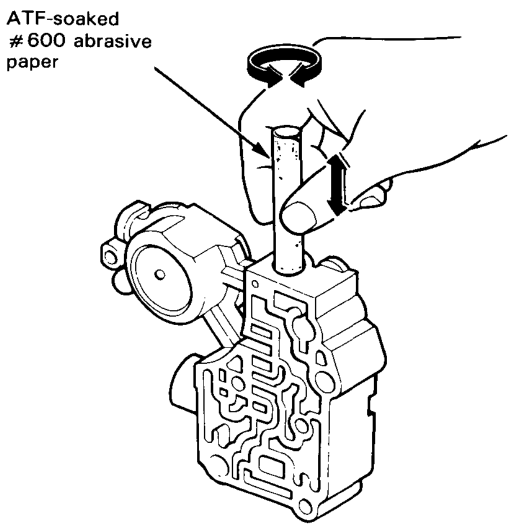
2. Carefully tap the valve body so the sticking valve drops out of its bore.

   CAUTION: It may be necessary to use a small screwdriver to pry the valve free. Be careful not to scratch the bore with the screwdriver.

3. Inspect the valve for any scuff marks. use the ATF-soaked #600 paper to polish off any burrs that are on the valve, then wash the valve in solvent and dry it with compressed air.

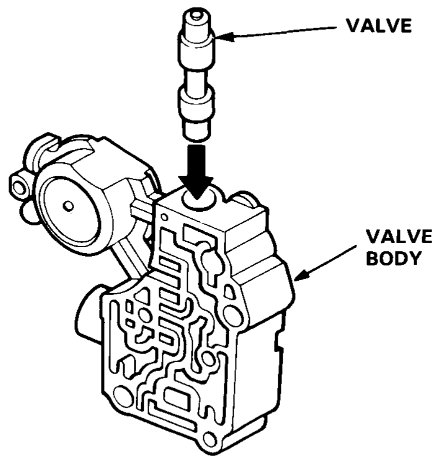
4. Roll up half a sheet of ATF-soaked paper and insert it in the valve bore of the sticking valve.
   Twist the paper slightly, so that it unrolls and fits the bore tightly, then polish the bore by twisting the paper as you push it in and out.

   CAUTION: The valve body is aluminum and doesn't require much polishing to remove any burrs.



5. Remove the #600 paper and thoroughly wash the entire valve body in solvent, then dry with compressed air.

6. Coat the valve with ATF then drop it into its bore. It should drop to the bottom of the bore under its own weight. If not, repeat step 4, then retest.



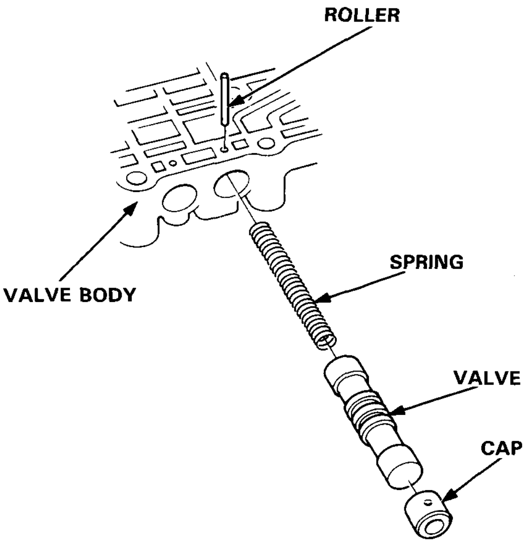
7. Remove the valve and thoroughly clean it and the valve body with solvent. Dry all parts with compressed air, then reassemble using ATF as a lubricant.

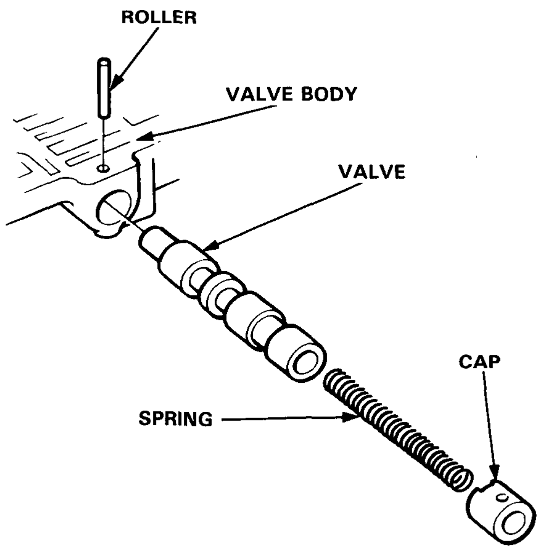
Valve

Assembly

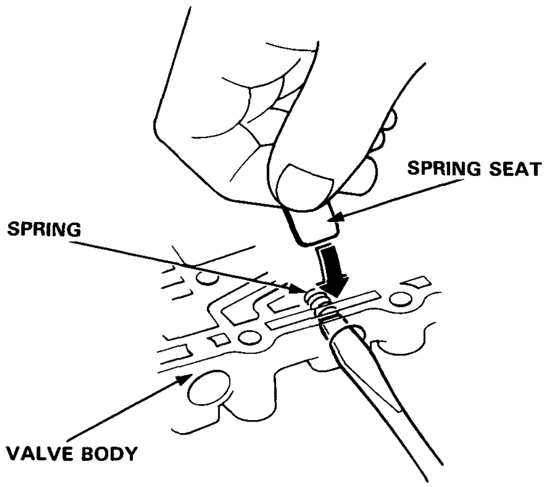
NOTE: Coat all parts with ATF before assembly.

- Install the valve, valve spring and cap in the valve body and secure with the roller.

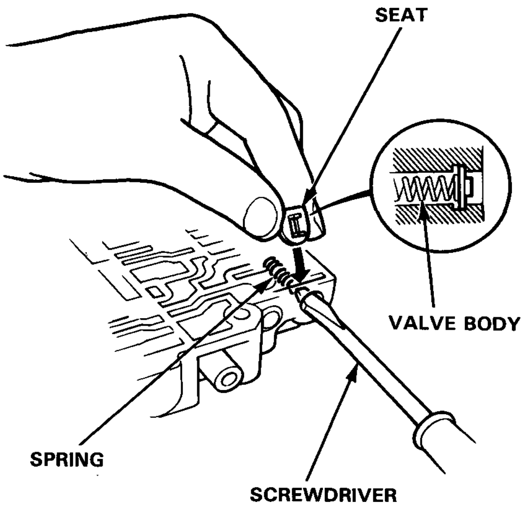




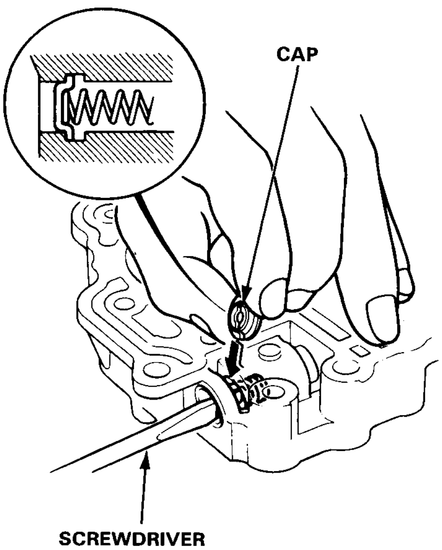
- Set the spring in the valve and install it in the valve body. Push the spring in with a screwdriver, then install the spring seat.



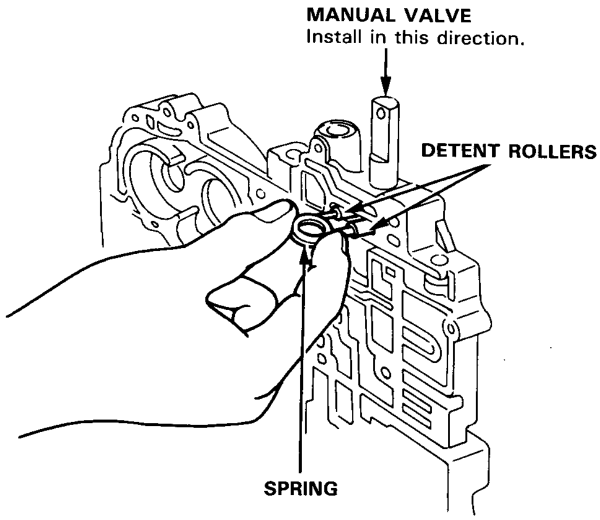
- Set the valve spring in the valve and install it in the valve body. Push the spring in with a screwdriver, then install the spring seat.



- Set the spring in the valve and install in the valve body.
Install the spring with a screwdriver, then install the valve cap with the cutout aligned with the screwdriver.



- Install the manual valve in the direction shown, then install the spring with the detent rollers.

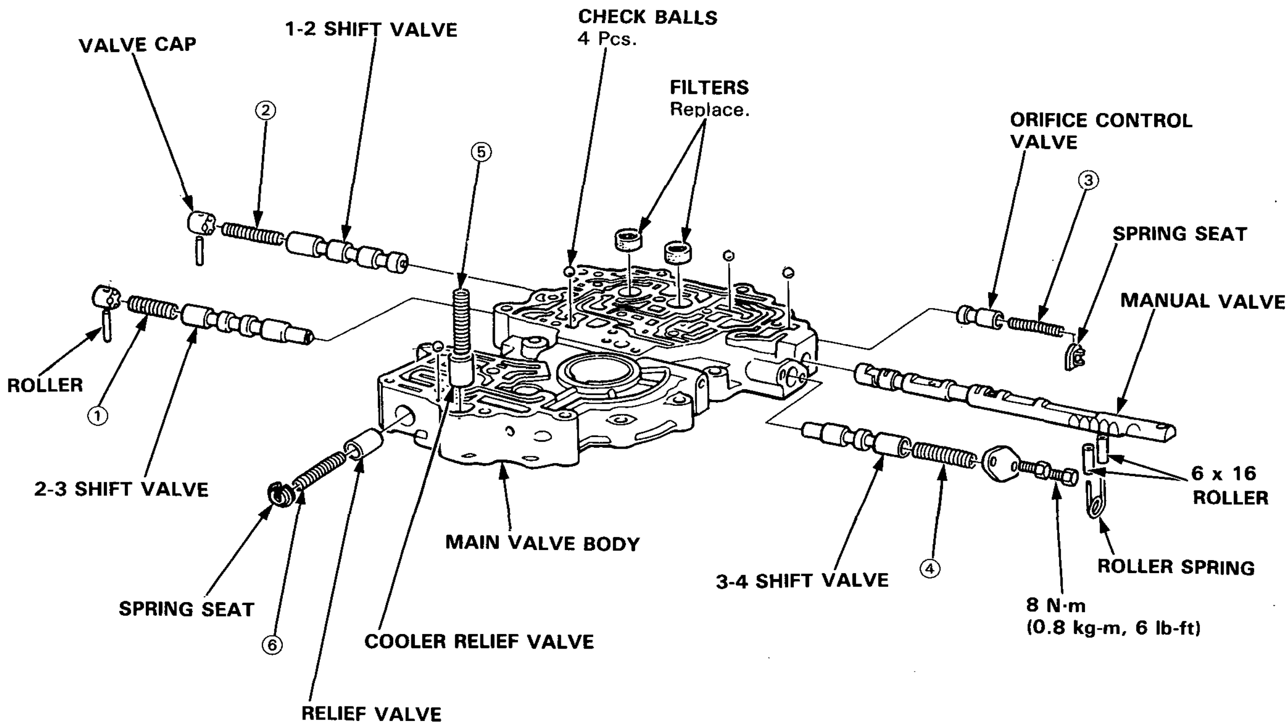


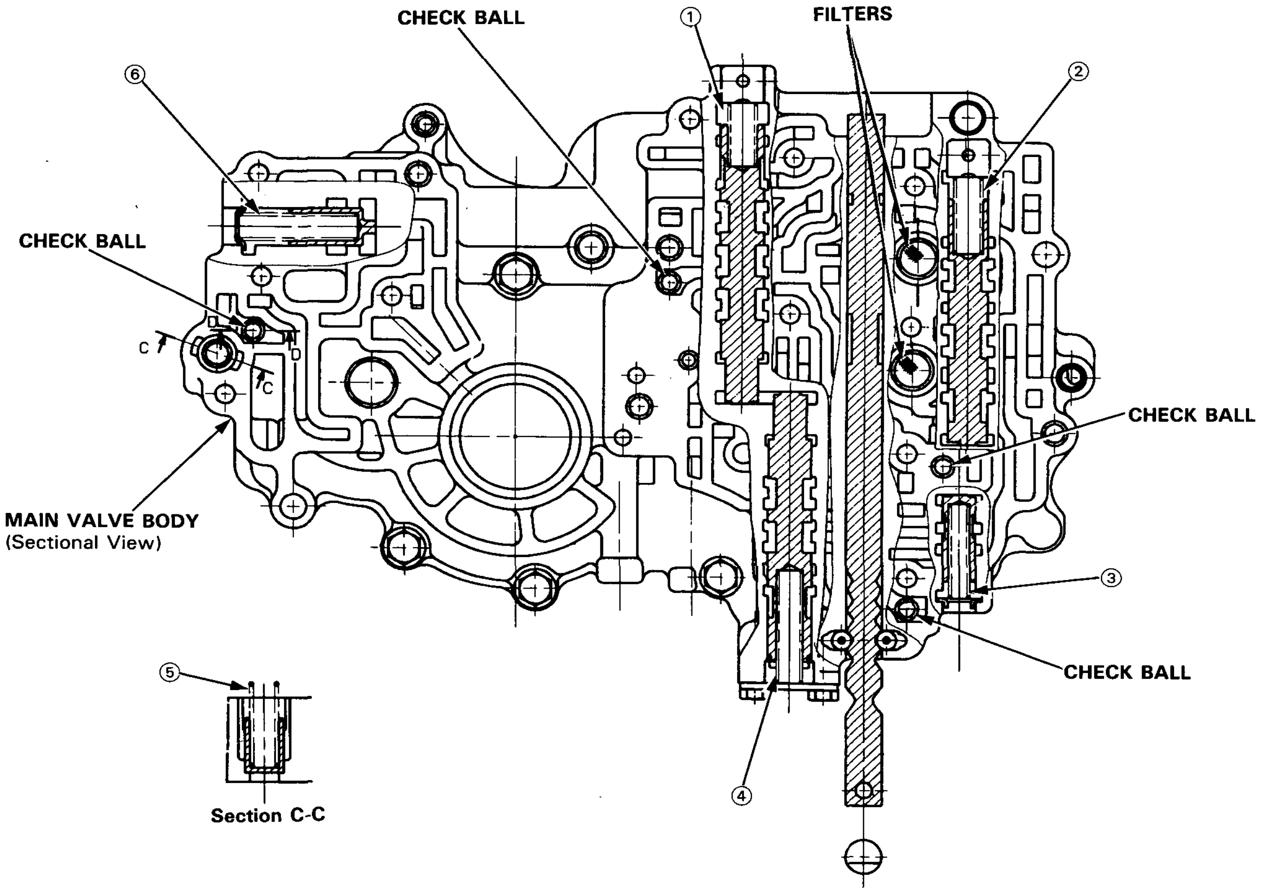
Main Valve Body

Disassembly/Inspection/Reassembly

NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- Replace valve body as an assembly if any parts are worn or damaged.
- Check all valves for free movement. If any fail to slide freely, see Valve Body Repair on page 14-381.
- Coat all parts with ATF before reassembly.

CAUTION: Do not use a magnet to remove the check balls, it may magnetize the balls.





SPRING SPECIFICATIONS

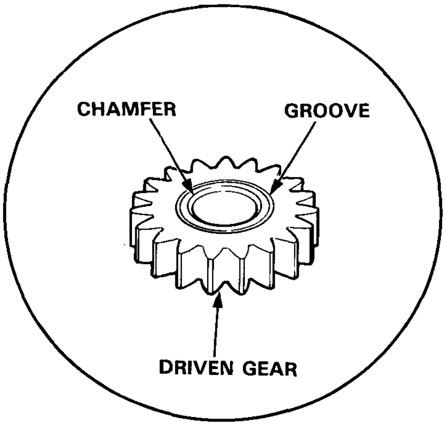
Unit of length: mm (in)

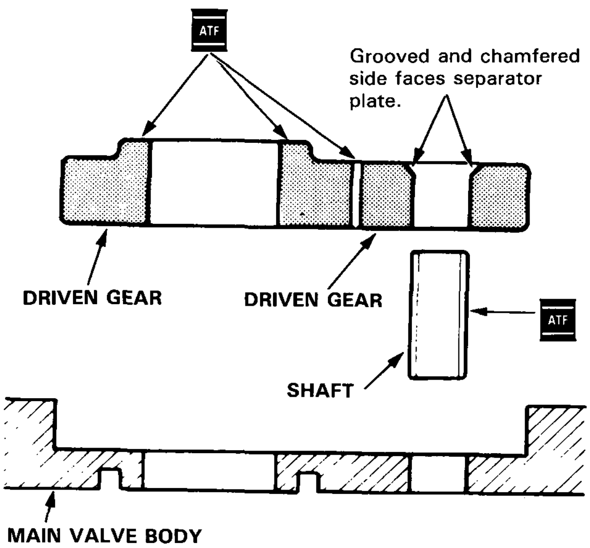
No	Spring	Standard (New)			
		Wire Dia.	O.D.	Free Length	No. of Coils
①	2−3 shift valve spring	0.8 (0.031)	8.6 (0.339)	35.8 (1.409)	10.6
②	1−2 shift valve spring	0.9 (0.028)	8.6 (0.339)	40.4 (1.591)	14.5
③	Orifice control valve spring	0.9 (0.028)	6.1 (0.240)	35.9 (1.413)	20.0
④	3−4 shift valve spring	0.8 (0.031)	7.6 (0.299)	59.7 (2.350)	22.7
⑤	Cooler relief valve spring	1.1 (0.043)	8.4 (0.331)	36.4 (1.433)	12.0
⑥	Relief valve spring	1.0 (0.039)	8.4 (0.331)	52.0 (2.047)	23.0

Oil Pump

Inspection

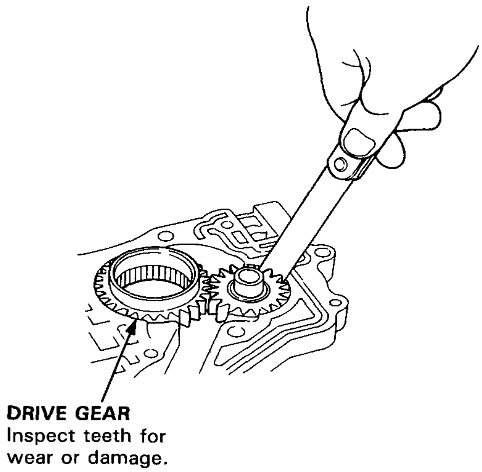
1. Install the pump gears and shaft in the main valve body.





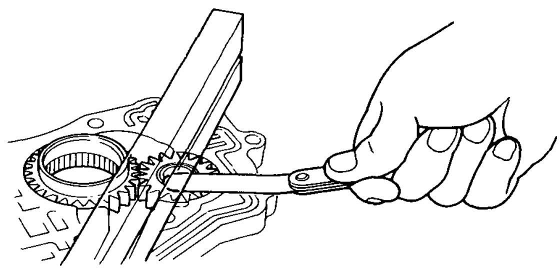
2. Install the oil pump shaft and measure the side clearance of the drive and driven gears.

Pump Gears Side (Radial) Clearance:
Standard (New): Drive gear
0.240–0.266 mm
(0.009–0.010 in)
Driven gear
0.063–0.088
(0.002–0.003 in)



3. Measure the thrust clearance of the driven gear-to-main valve body.

Drive/Driven Gear thrust (Axial) Clearance:
Standard (New): 0.03–0.05 mm
(0.001–0.002 in)
Service Limit: 0.07 mm (0.0028 in)



Regulator Valve Body

Disassembly/Inspection/Reassembly

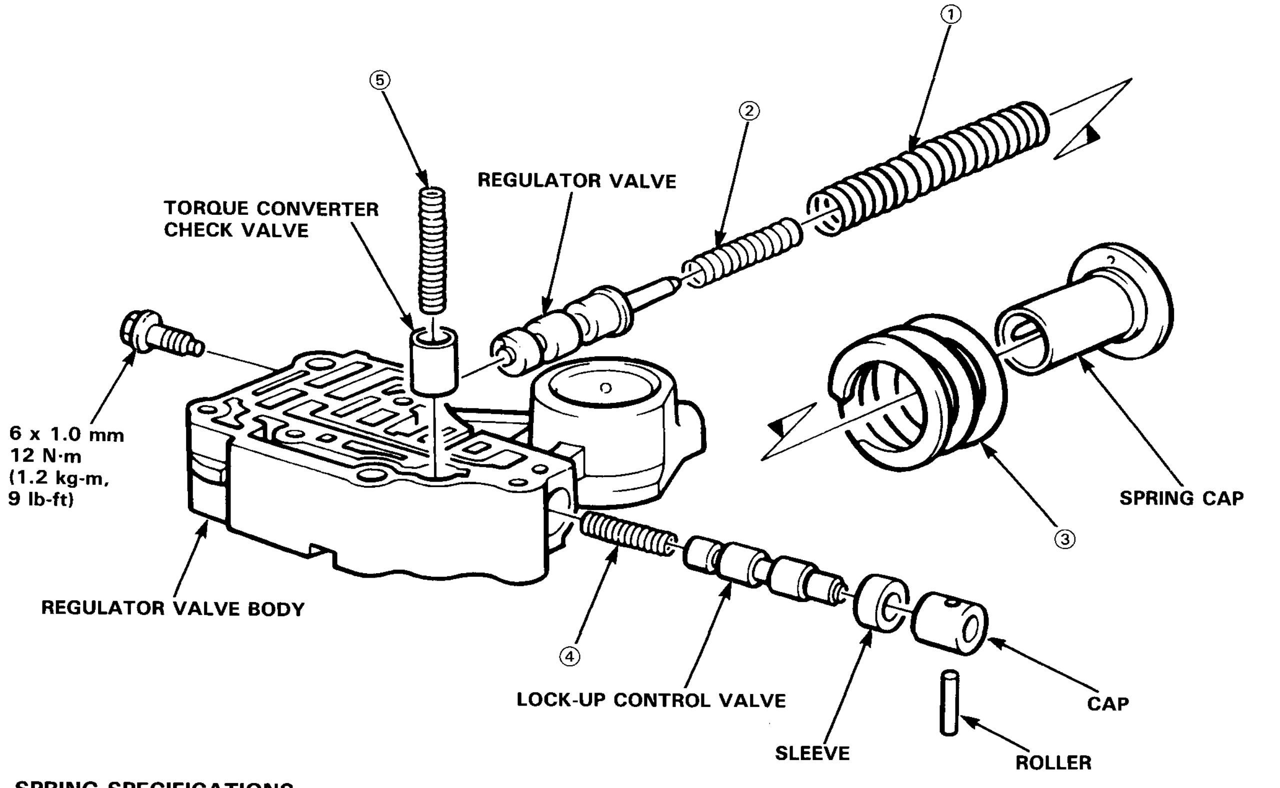
NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- Replace valve body as an assembly if any parts are worn or damaged.
- Check all valves for free movement. If any fail to slide freely, see Valve Body Repair on page 14-381.

1. Hold the regulator spring cap in place while removing the lock bolt. Once the bolt is removed, release the spring cap slowly.

   CAUTION: The regulator spring cap can pop out when the lock bolt is removed.

2. Reassembly is in the reverse order of disassembly.

   NOTE:
   - Coat all parts with ATF.
   - Align the hole in the regulator cap with the hole in the valve body, press the spring cap into the body and tighten the lock bolt.



SPRING SPECIFICATIONS

Unit of length: mm (in)

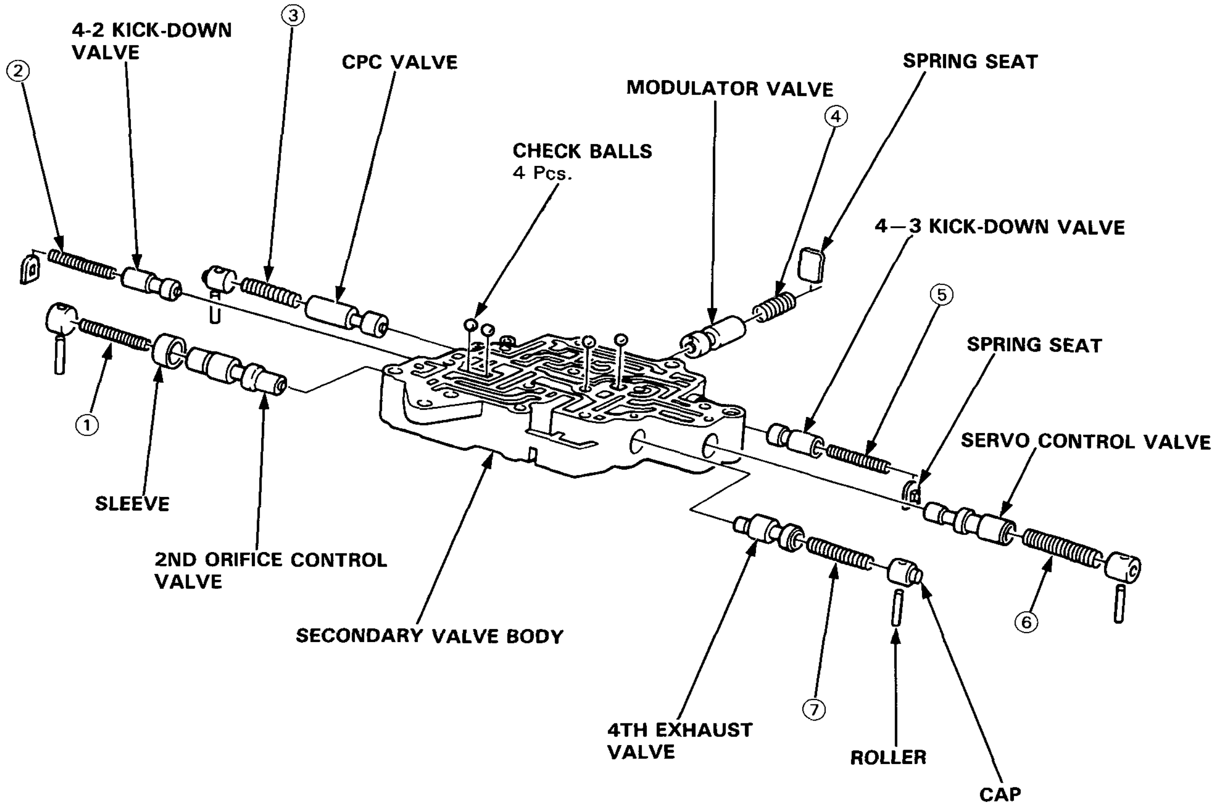
No	Spring	Standard (New)			
		Wire Dia.	O.D.	Free Length	No. of Coils
①	Regulator valve spring A	1.8 (0.071)	14.7 (0.579)	86.5 (3.406)	16.5
②	Regulator valve spring B	1.8 (0.071)	9.6(0.378)	44.0 (1.732)	7.5
③	Stator reaction spring	5.5 (0.217)	31.9 (1.256)	30.3 (1.193)	2.1
④	Lock-up control valve spring	0.8 (0.031)	6.6 (0.260)	47.9 (1.886)	25.1
⑤	Torque converter check valve spring	1.1(0.043)	8.4 (0.331)	36.4 (1.433)	12.0

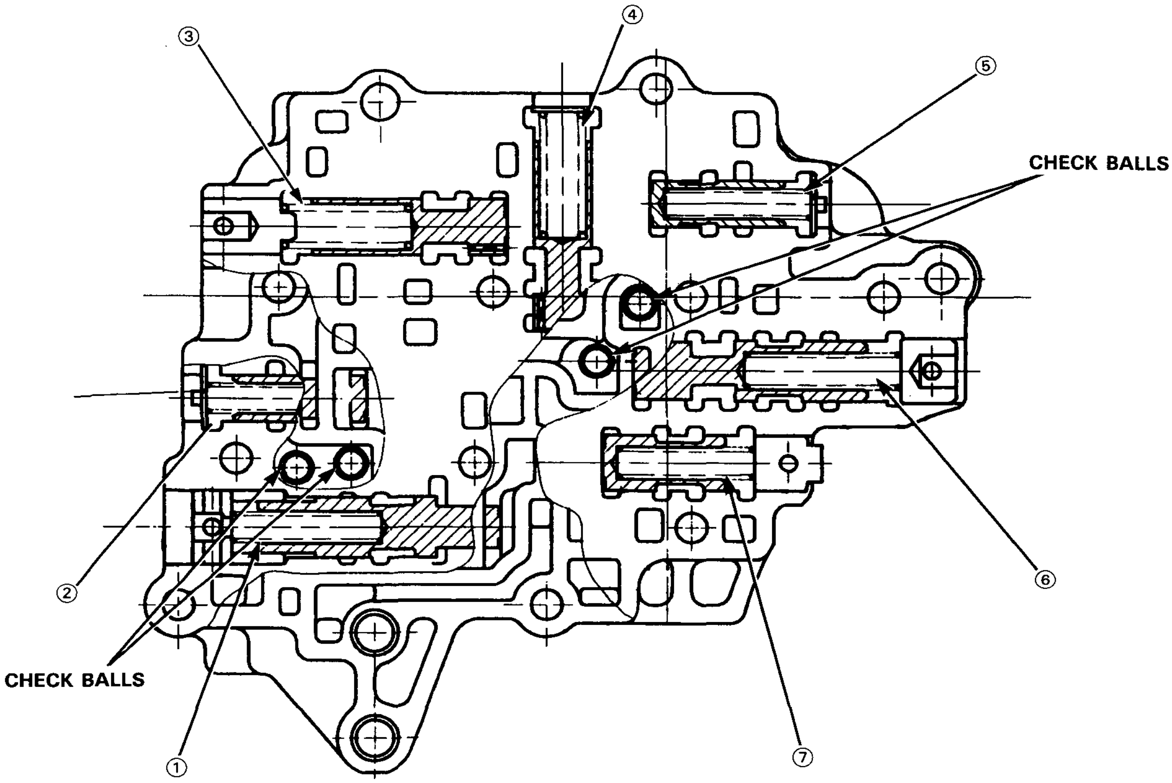
Secondary Valve Body

Disassembly/Inspection/Reassembly

NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- Replace valve body as an assembly if any parts are worn or damaged.
- Check all valves for free movement. If any fail to slide freely, see Valve Body Repair on page 14-381.
- Coat all parts with ATF before reassembly.

CAUTION: Do not use a magnet to remove the check balls; it may magnetize the balls.





SPRING SPECIFICATIONS

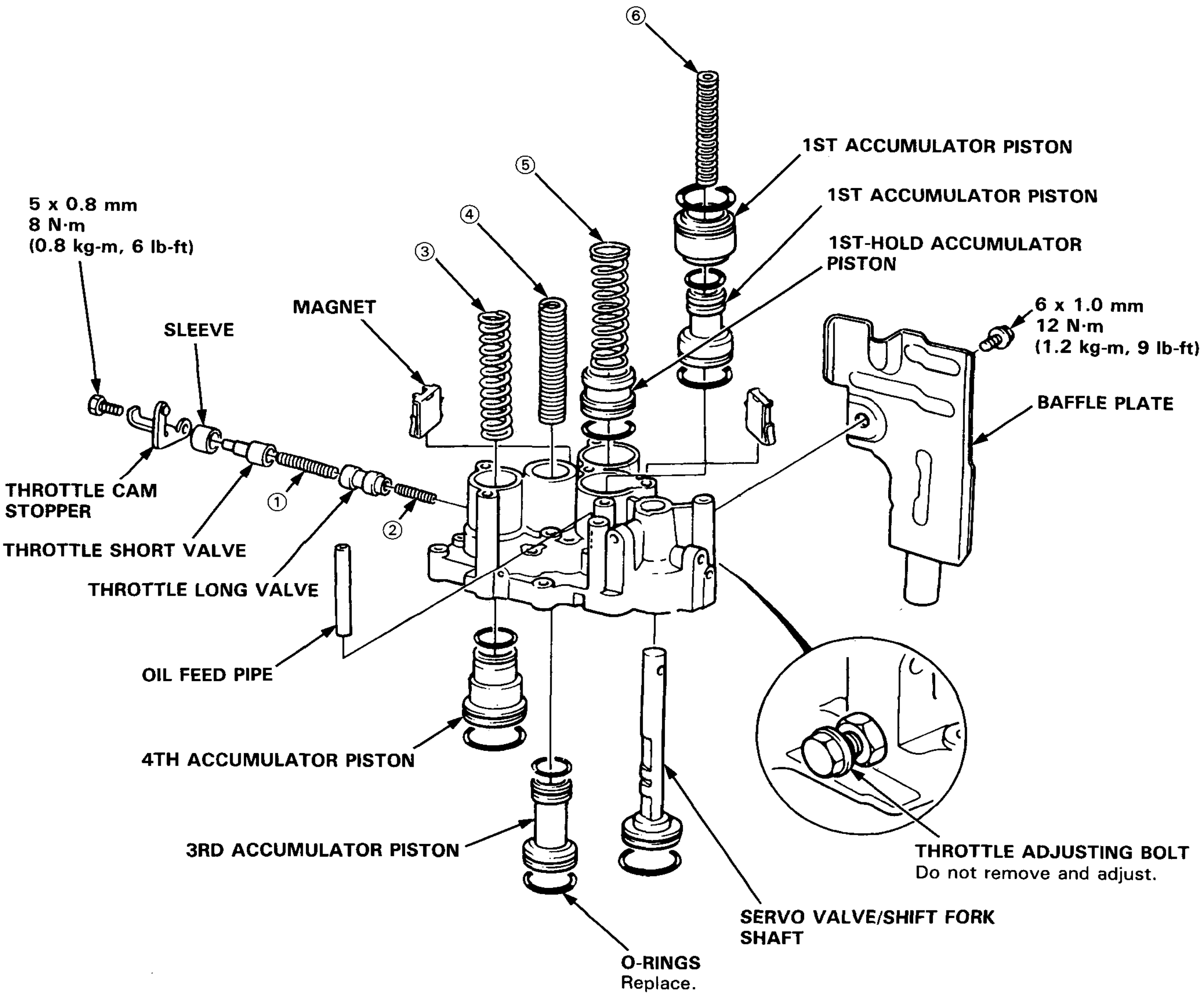
Unit of length: mm (in)

No	Spring	Standard (New)			
		Wire Dia.	O.D.	Free Length	No. of Coils
①	2nd orifice control valve spring	0.8 (0.031)	6.6 (0.260)	38.5 (1.516)	28.0
②	4–2 kick-down valve spring	0.9 (0.035)	6.4 (0.252)	42.7 (1.681)	20.8
③	CPC valve spring	1.4 (0.055)	9.4 (0.370)	31.6 (1.244)	10.9
④	Modulator valve spring	0.9 (0.035)	8.6 (0.339)	18.2 (0.717)	5.54
⑤	4–3 kick-down valve spring	0.9 (0.035)	6.4 (0.252)	42.7 (1.681)	20.8
⑥	Servo control valve spring	1.0 (0.039)	8.1 (0.319)	42.0 (1.654)	16.5
⑦	4th exhaust valve spring	0.9 (0.035)	6.6 (0.260)	37.0 (1.457)	18.7

Servo Body

Disassembly/Inspection/Reassembly

NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- Replace valve body as an assembly if any parts are worn or damaged.
- Coat all parts with ATF before reassembly.
- Replace the O-rings and filters.



SPRING SPECIFICATIONS

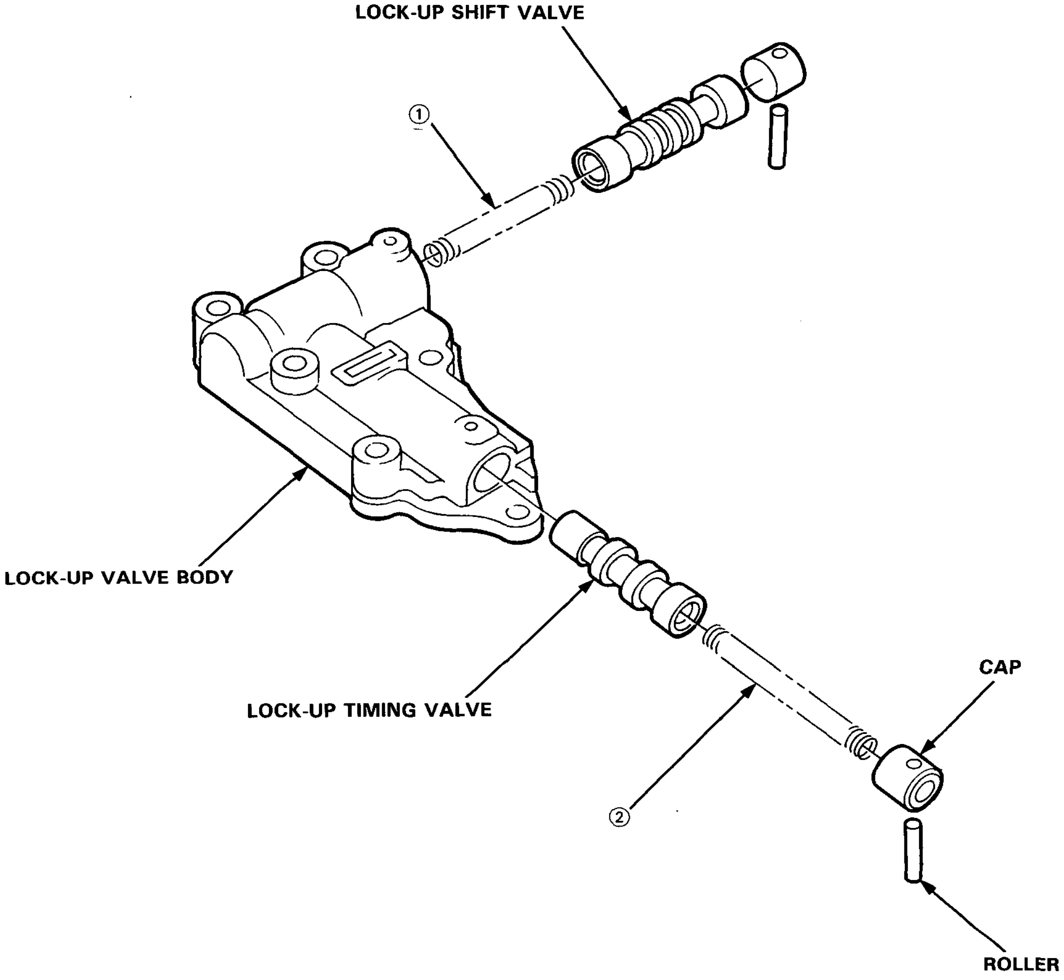
Unit of length: mm (in)

No.	Spring	Standard (New)			
		Wire Dia.	O.D.	Free Length	No. of Coils
①	Throttle valve B spring	1.6 (0.063)	8.5 (0.335)	41.3 (1.626)	13.9
②	Throttle valve B adjusting spring	0.8 (0.031)	6.2 (0.244)	30.0 (1.181)	8.0
③	4th accumulator spring	3.5 (0.138)	18.6 (0.732)	77.0 (3.031)	11.0
④	3rd accumulator spring	2.8 (0.110)	15.5 (0.610)	78.7 (3.098)	15.0
⑤	1st-hold accumulator spring	3.2 (0.126)	24.3 (0.957)	59.5 (2.343)	5.8
⑥	1st accumulator spring	2.0 (0.079)	13.7 (0.539)	71.3 (2.807)	11.0/8.0

Lock-up Valve Body

Disassembly/Inspection/Reassembly

NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- Replace vaLve body as an assembly if any parts are worn or damaged.
- Check all valves for free movement. If any fail to slide freely, see Valve Body repair on page 14-381.
- Coat all parts with ATF before reassembly.



SPRING SPECIFICATIONS

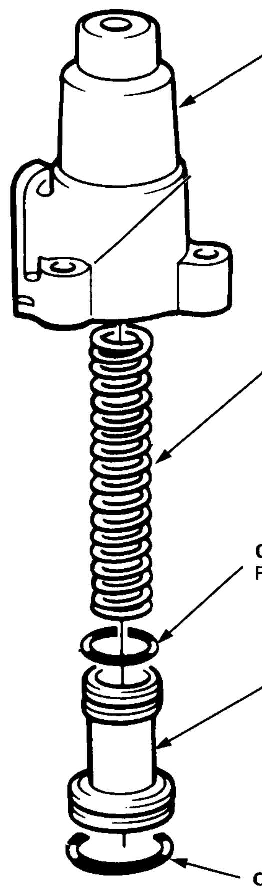
Unit of length: mm (in)

No.	Spring	Standard (New)			
		Wire Dia.	O.D.	Free Length	No. of Coils
①	Lock-up shift valve spring	1.1 (0.043)	8.1 (0.319)	51.0 (2.001)	21.3
②	Lock-up timing valve spring	0.9 (0.035)	5.6 (0.220)	43.6 (1.717)	30.1

2nd Accumulator Body

Disassembly/Inspection/Reassembly

NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner and dry with compressed air.
- Blow out all passages.
- Coat all parts with ATF before reassembly.



SPRING SPECIFICATIONS

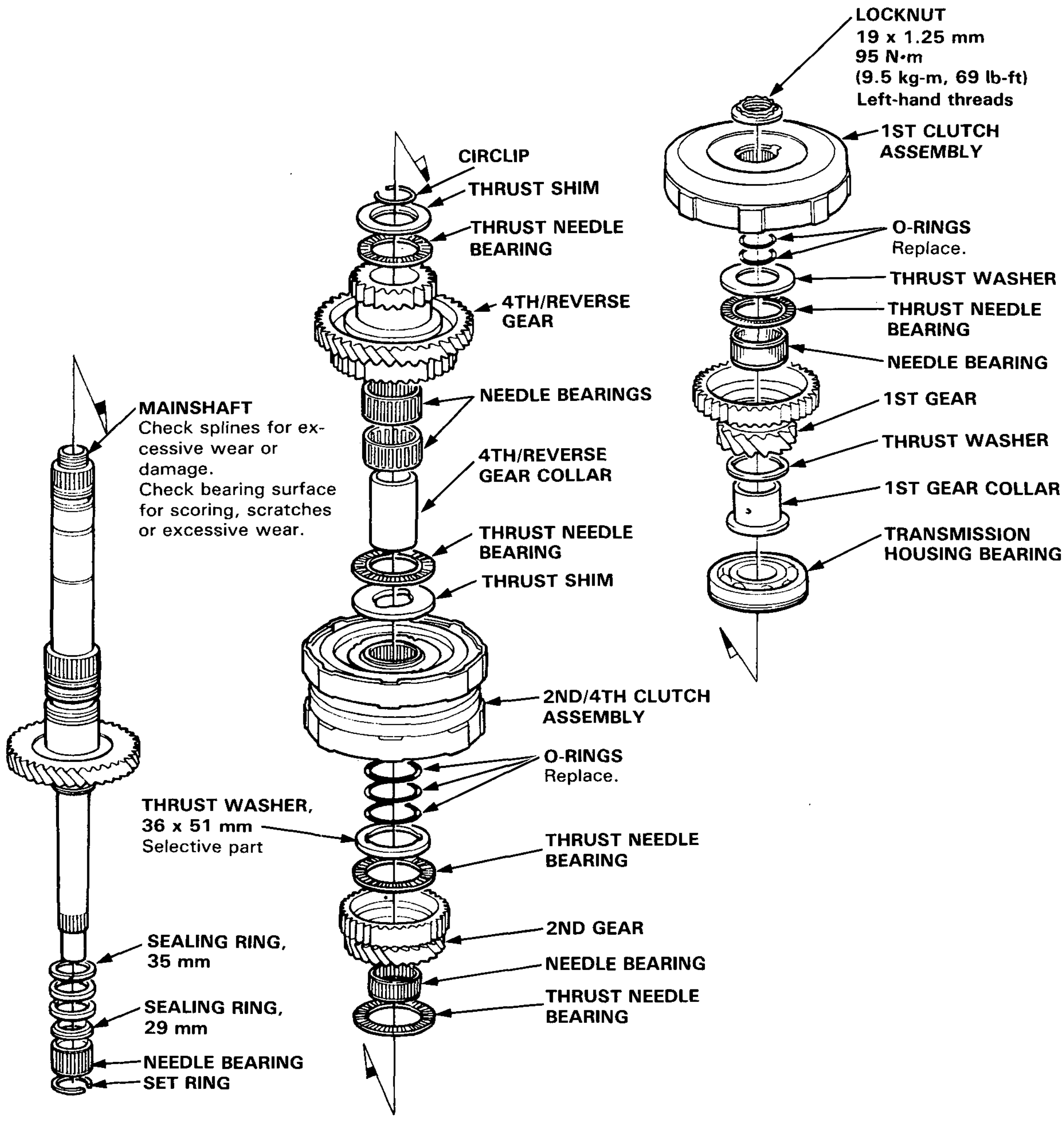
Unit of length: mm (in)

No.	Spring	Standard (New)			
		Wire Dia.	O.D.	Free Length	No. of Coils
①	2nd accumulator spring	2.7 (0.106)	16.1 (0.634)	88.4 (3.480)	16.0

Mainshaft

Disassembly/Inspection/Reassembly

NOTE:
- Lubricate all parts with ATF during reassembly.
- Install thrust needle bearings with unrolled edge of bearing retainer facing washer.
- Inspect thrust needle and needle bearings for galling and rough movement.
- Before installing the O-rings, wrap the shaft splines with tape to prevent damaging the O-rings.
- Locknut has left-hand threads.



Inspection

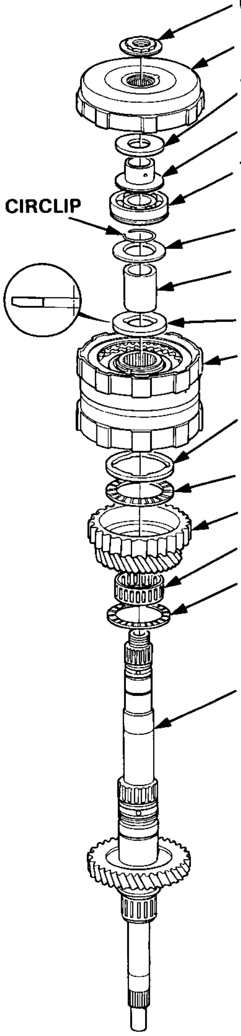
- Clearance Measurement

NOTE: Lubricate all parts with ATF during assembly.

1. Remove the mainshaft bearing from the transmission housing (see page 14-413).

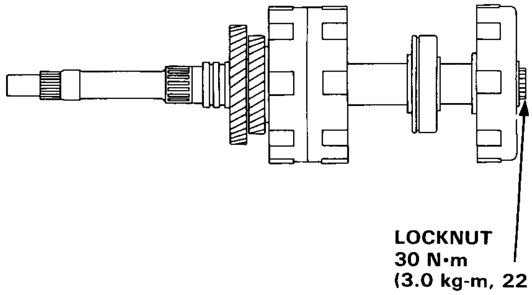
2. Assemble the parts below on the mainshaft.

   NOTE: Do not assemble the O-rings while inspecting.



3. Torque the mainshaft locknut to 30 N•m (3.0 kg-m, 22 lb-ft).

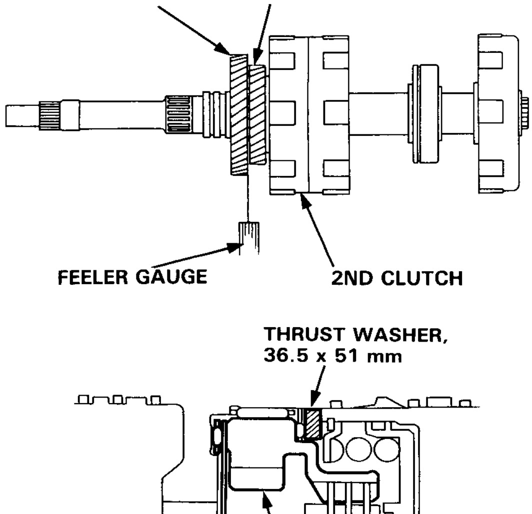
   NOTE: Mainshaft locknut has left-hand threads.

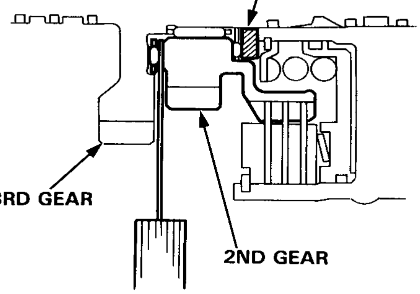


4. Hold the 2nd gear against the 2nd clutch. Measure the clearance between the 2nd gear and the 3rd gear with a feeler gauge.

   NOTE: Take measurements in at least three places and take the average as the actual clearance.

   STANDARD: 0.05–0.13 mm (0.002–0.005 in)



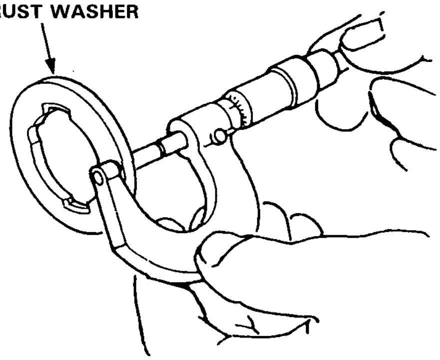


(cont'd)

Mainshaft

Inspection (cont'd)

5. If the clearance is out of tolerance, remove the thrust washer and measure the thickness.



6. Select and install a new washer then recheck.

THRUST WASHER 36.5 x 51 mm

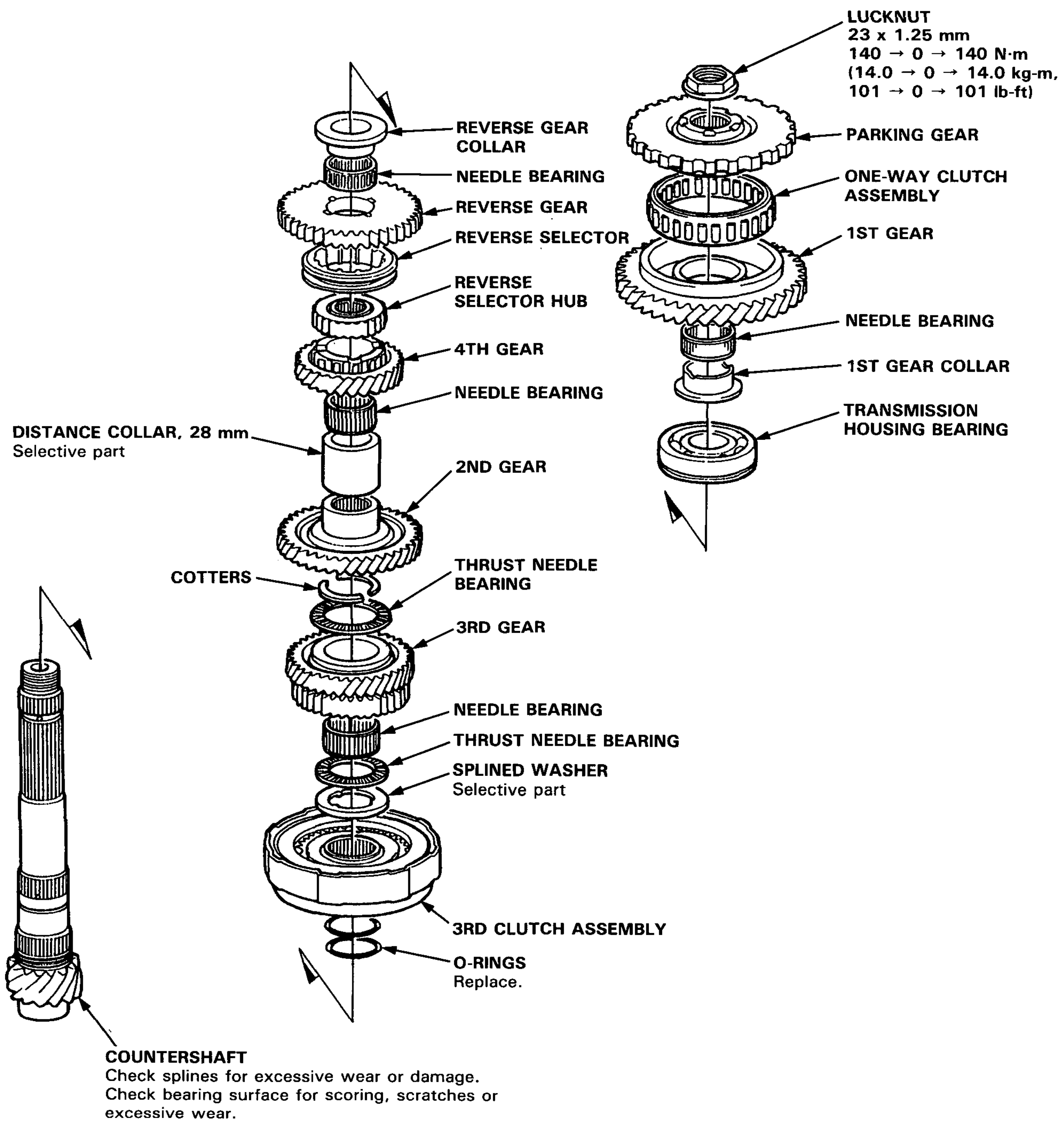
No.	Part Number	Thickness
1	90441-PC9-010	3.50 mm (0.138 in)
2	90442-PC9-010	3.55 mm (0.140 in)
3	90443-PC9-010	3.60 mm (0.142 in)
4	90444-PC9-010	3.65 mm (0.144 in)
5	90445-PC9-010	3.70 mm (0.146 in)
6	90446-PC9-010	3.75 mm (0.148 in)
7	90447-PC9-010	3.80 mm (0.150 in)
8	90448-PC9-010	3.85 mm (0.152 in)
9	90449-PC9-010	3.90 mm (0.154 in)

7. After replacing the thrust washer, make sure the clearance is within tolerance.

Countershaft

Disassembly/Inspection/Reassembly

NOTE:
- Lubricate all parts with ATF before reassembly.
- Install thrust needle bearings with unrolled edge ofbearing retainer facing washer.
- Inspect thrust needle and needle bearings for gallingand rough movement.
- Before installing the O-rings, wrap the shaft splineswith tape to prevent damaging the O-rings.



Countershaft

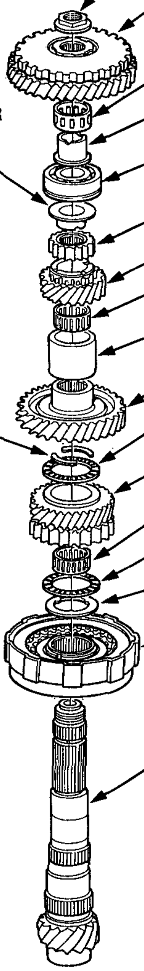
Inspection

- Clearance Measurement

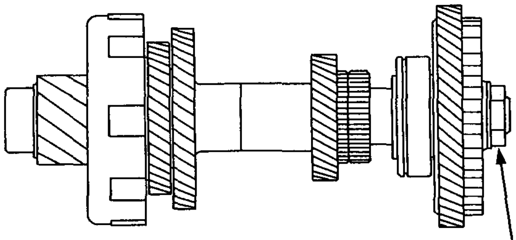
NOTE: Lubricate all parts with ATF during assembly.

1. *Remove the countershaft bearing from the transmission housing* (see page 14-413).
2. Assemble the parts below on the countershaft.

   NOTE: Do not assemble the O-rings while inspecting.



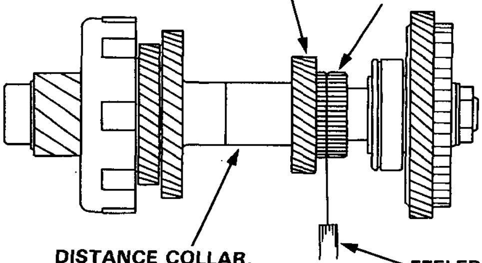
3. Torque the countershaft locknut to 30 N·m (3.0 kg-m, 22lb-ft).

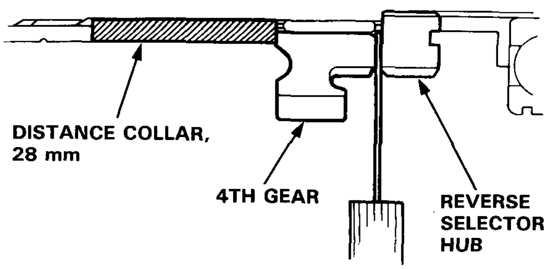


4. Measure the clearance between the 4th gear and the reverse selector hub with a feeler gauge.

   NOTE: Take measurements in at least three places and take the average as the actual clearance.

STANDARD: 0.05–0.13 mm (0.002–0.005 in)





5. Measure the clearance between the 3rd gear and 2nd gear with a feeler gauge, with the feeler gauge from step 4 between the 4th gear and reverse selector hub.

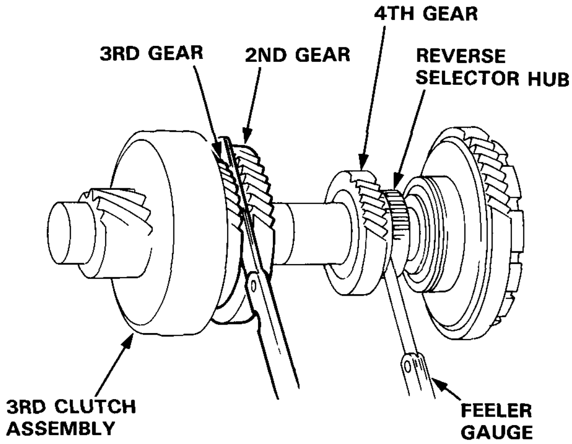
   —1. Measure the clearance with the 3rd gear pushed towards the 3rd clutch.

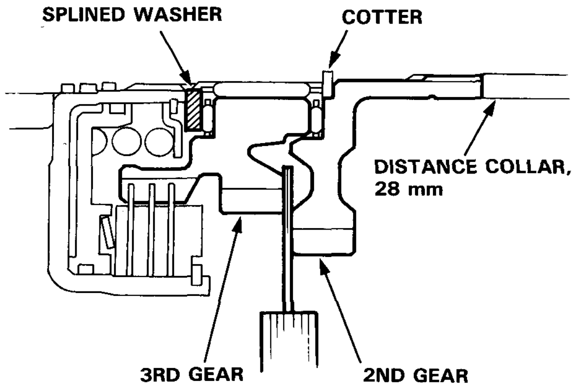
   —2. Measure the clearance with the 3rd gear pushed towards the 2nd gear.

   NOTE: Take measurements in at least three places and take the average as the actual clearance.

   —3. Subtract the measurements of step 2 from step 3 and you have the clearance between the 3rd gear and 2nd gear.

   STANDARD: 0.05—0.13 mm (0.002—0.005 in)





6. If the clearance is out of tolerance, remove the splined washer and/or distance collar and measure the thickness and/or the width.

7. Select and install a new distance collar then recheck.

DISTANCE COLLAR 28 mm

No.	Part Number	Thickness
1	90503—PC9—000	39.00 mm (1.535 in)
2	90504—PC9—000	39.10 mm (1.539 in)
3	90505—PC9—000	39.20 mm (1.543 in)
4	90507—PC9—000	39.30 mm (1.547 IN)
5	90508—PC8—000	38.05 mm (1.537 in)
6	90509—PC9—000	39.15 mm (1.541 in)
7	90510—PC9—000	39.25 mm (1.545 in)
8	90511—PC9—000	38.90 mm (1.531 in)
9	90512—PC9—000	38.95 mm (1.533 in)

8. After replacing the distance collar, make sure the clearance is within tolerance.

9. Select and install a new splined washer then recheck.

SPLINED WASHER 35 x 52 mm

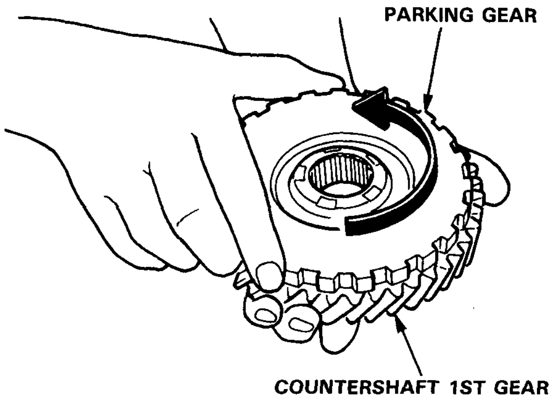
No.	Part Number	Thickness
1	90411—PA9—010	3.00 mm (0.118 in)
2	90412—PA9—010	3.05 mm (0.120 in)
3	90413—PA9—010	3.10 mm (0.122 in)
4	90413—PA19—010	3.10 mm (0.122 in)
5	90415—PA9—010	3.20 mm (0.126 in)
6	90418—PA9—000	3.25 mm (0.128 in)
7	90419—PA9—000	3.30 mm (0.130 in)
8	90420—PA9—000	3.35 mm (0.132 in)
9	90421—PA9—000	3.40 mm (0.134 in)
10	90423—PA9—000	2.90 mm (0.114 in)
11	90424—PA9—000	2.95 mm (0.116 in)

10. After replacing the splined washer, make sure the clearance is within tolerance.

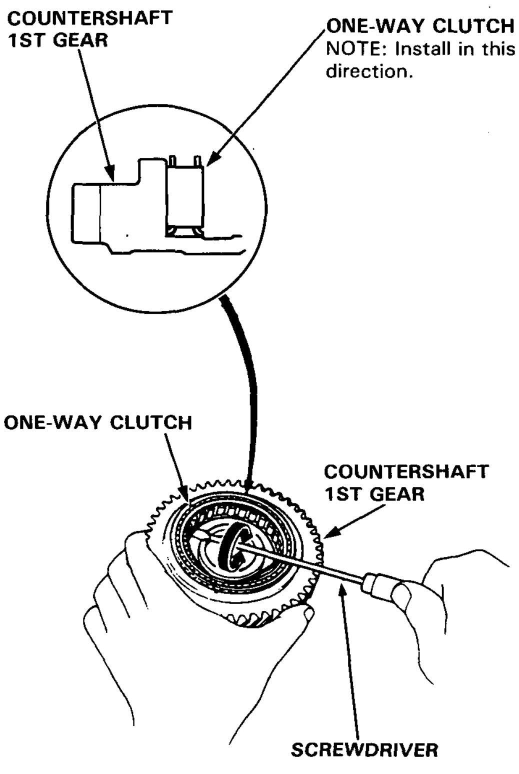
One-way Clutch/Parking Gear

Disassembly and Inspection

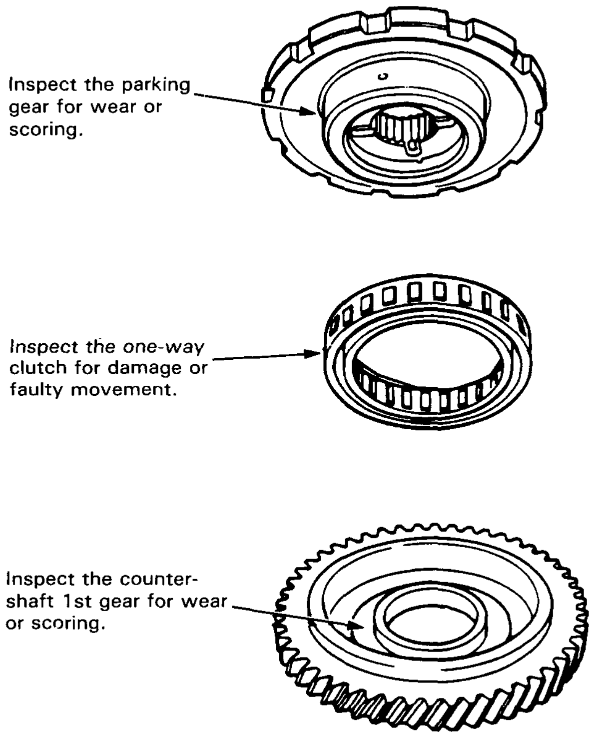
1. Separate the countershaft 1st gear from the parking gear by turning the parking gear in the direction shown.



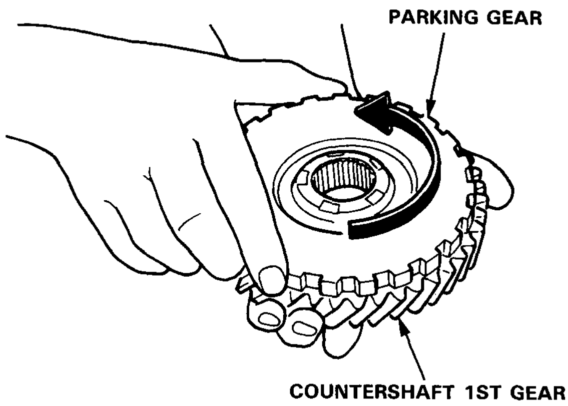
2. Remove the one-way clutch by prying it up with the end of a screwdriver.



Inspect the parts as follows:



3. After the parts are assembled, hold the countershaft 1st gear and turn the parking gear in direction shown to be sure it turns freely.

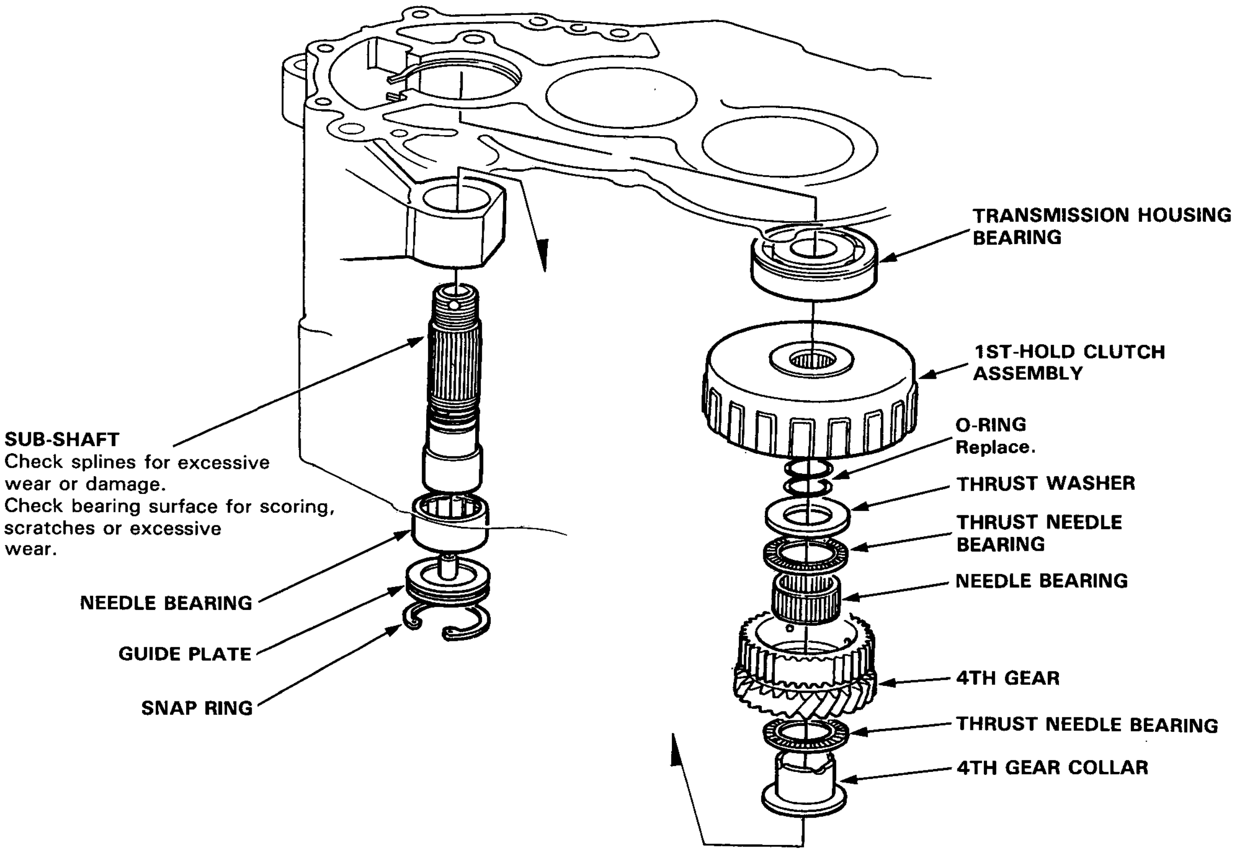


Sub-shaft

Disassembly/Inspection/Reassembly

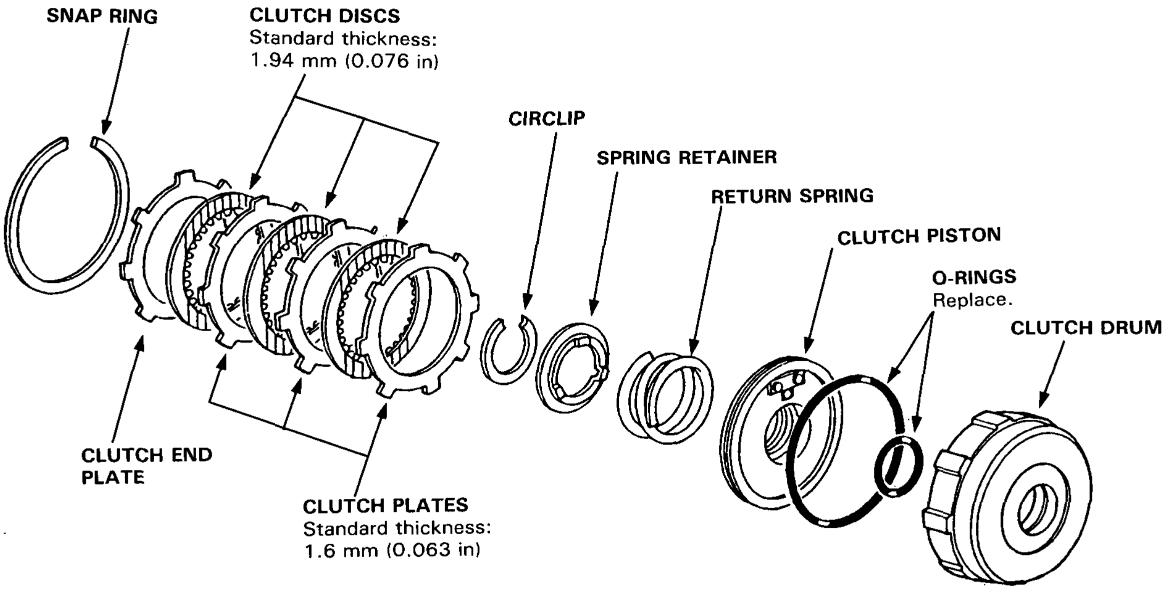
NOTE:
- Lubricate all parts with ATF before reassembly.
- Install thrust needle bearings with unrolled edge of bearing retainer facing washer.
- Inspect thrust needle and needle bearings for galling and rough movement.
- Before installing the O-rings, wrap the shaft splines with tape to prevent damaging the O-rings.

1. Remove the snap ring and guid plate.
2. Remove the sub-shaft, 1st-hold clutch assembly and 4th gear assembly.
3. Assemble the sub-shaft in the reverse order of removal.

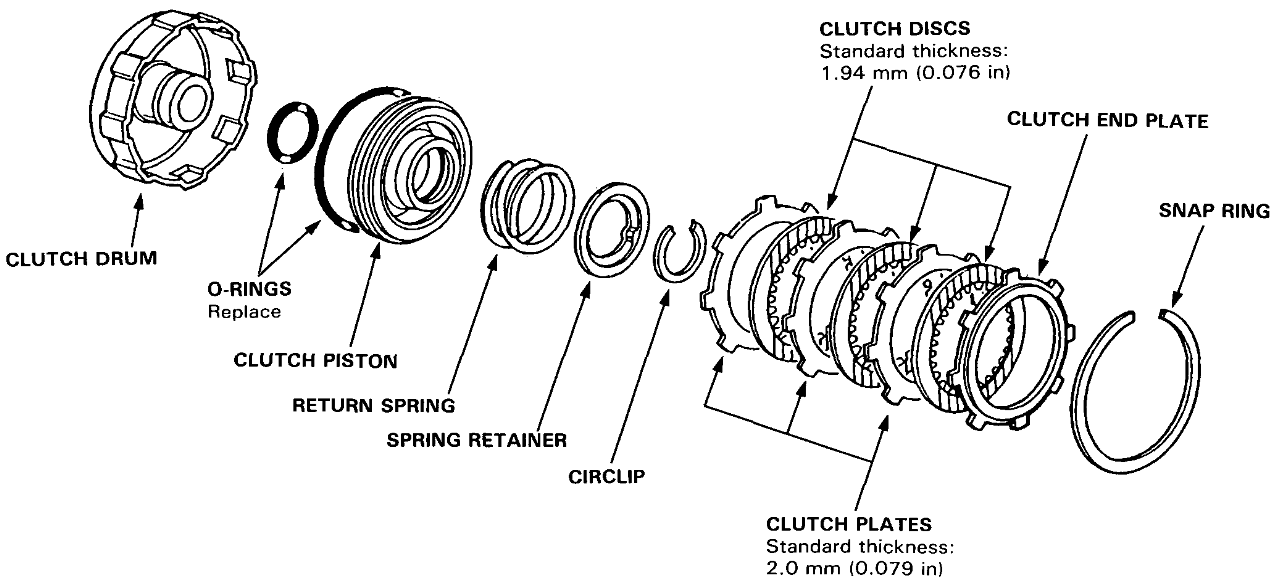


Illustrated Index

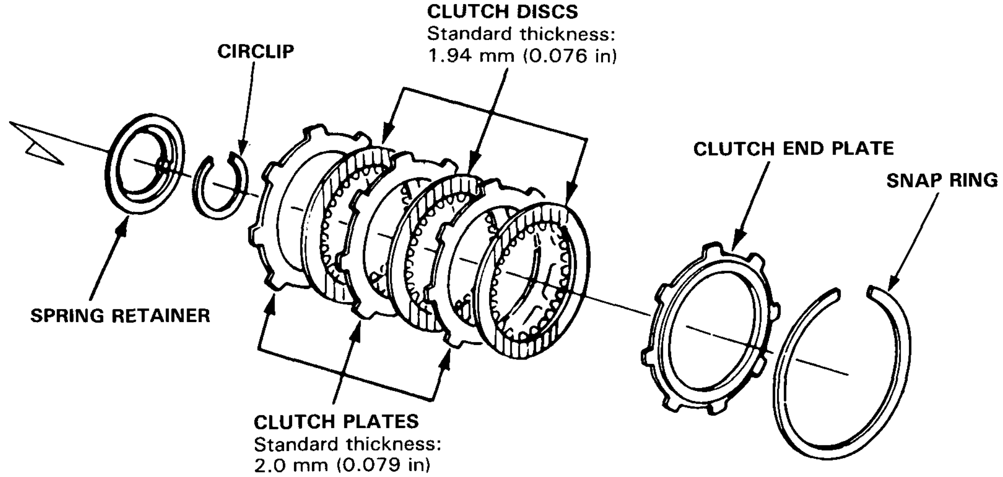
1ST CLUTCH

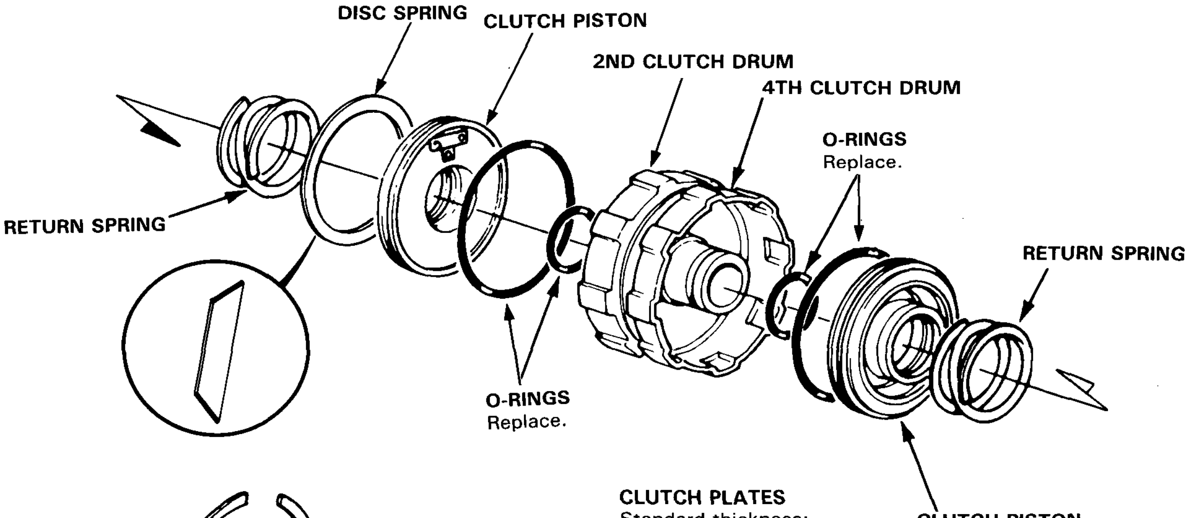


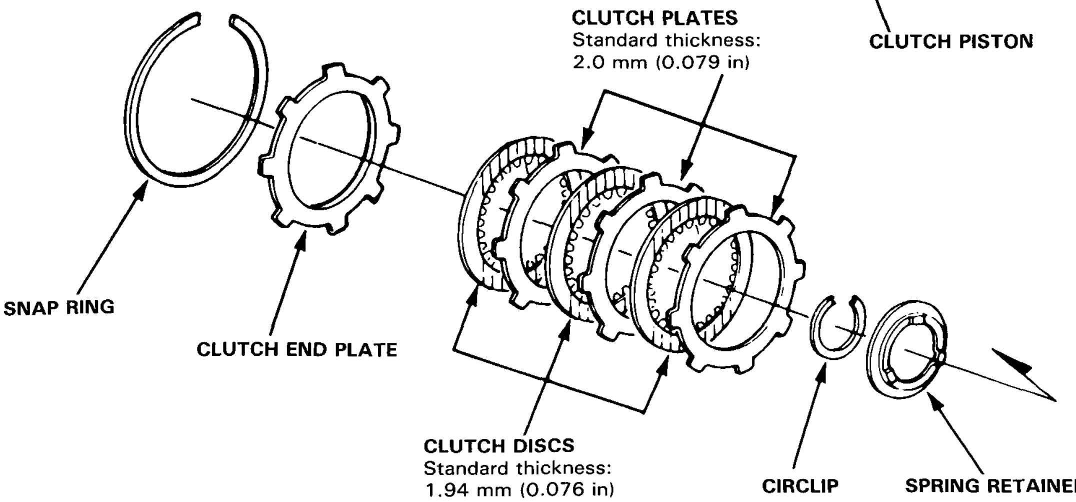
3RD CLUTCH



2ND/4TH CLUTCH







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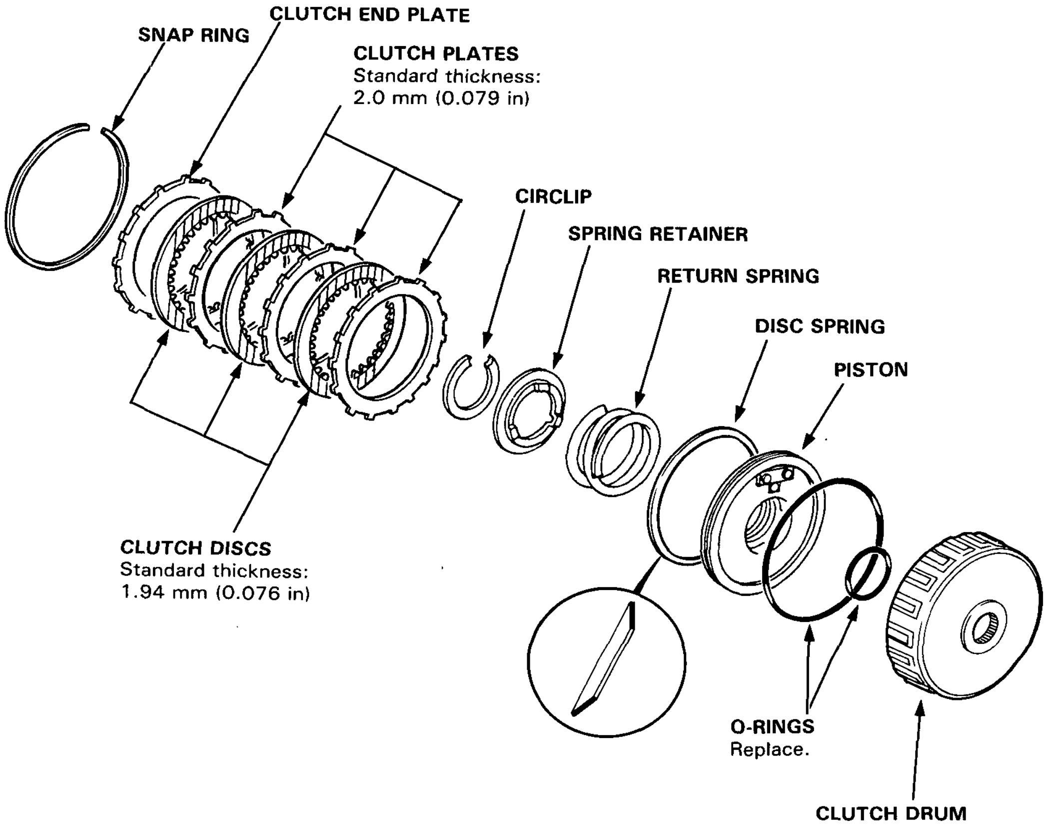
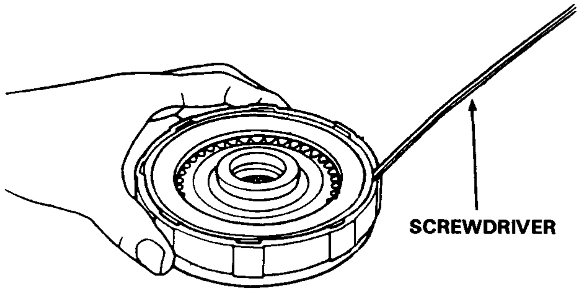
Illustrated Index (cont'd)

1ST-HOLD CLUTCH



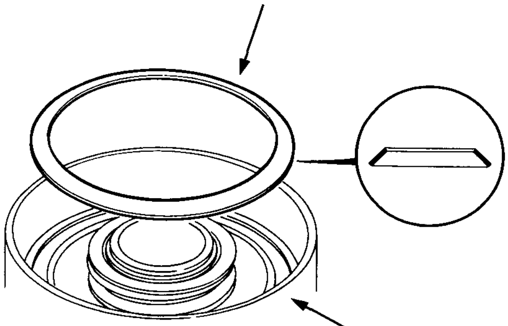
Disassembly

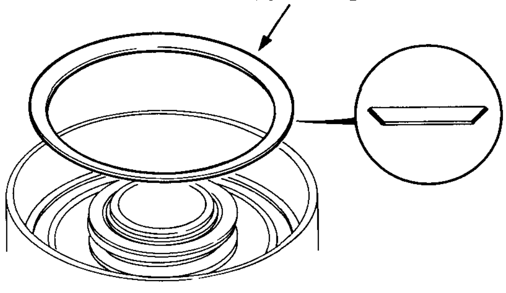
1. Remove the snap rings, then remove the clutch end plate, clutch discs and plates.



2. Remove the disc spring.

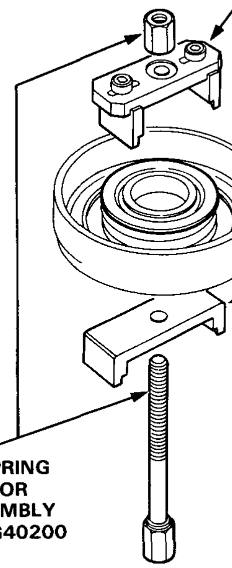
NOTE: For 1st-hold, and 2nd clutches

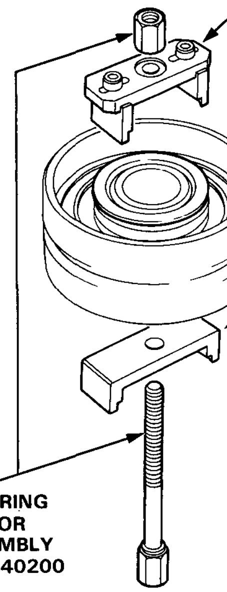




3. Install the special tools as shown.

CLUTCH SPRING COMPRESSOR SET 07LAE–PX40000

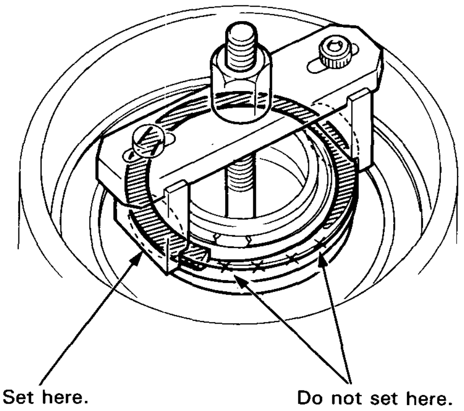




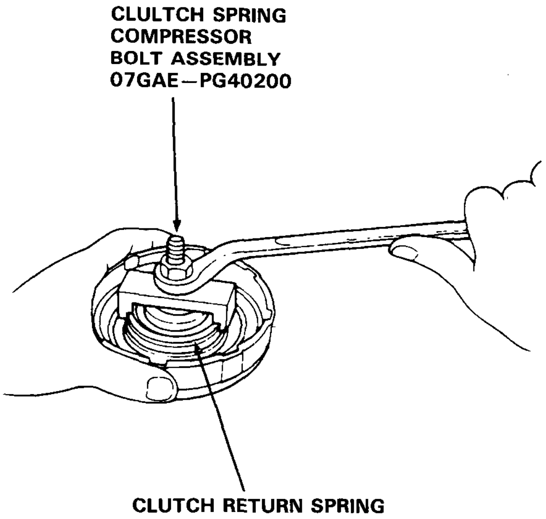
(cont'd)

Disassembly (cont'd)

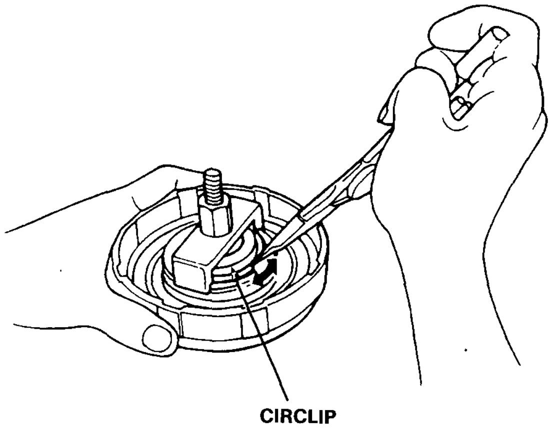
CAUTION: If either end of the compressor attachment is set over an area of the spring retainer which is unsupported by the return spring, the retainer may be damaged.



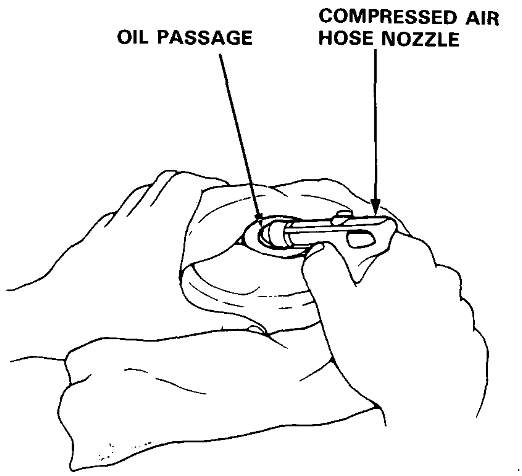
4. Compress the clutch return spring.



5. Remove the circlip. Then remove the special tools, spring retainer and return spring.



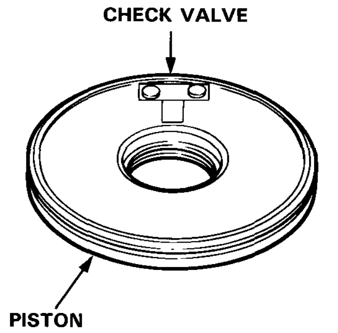
6. Wrap a shop towel around the clutch drum and apply air pressure to the oil passage to remove the piston. Place a finger tip on the other end while applying air pressure.



Reassembly

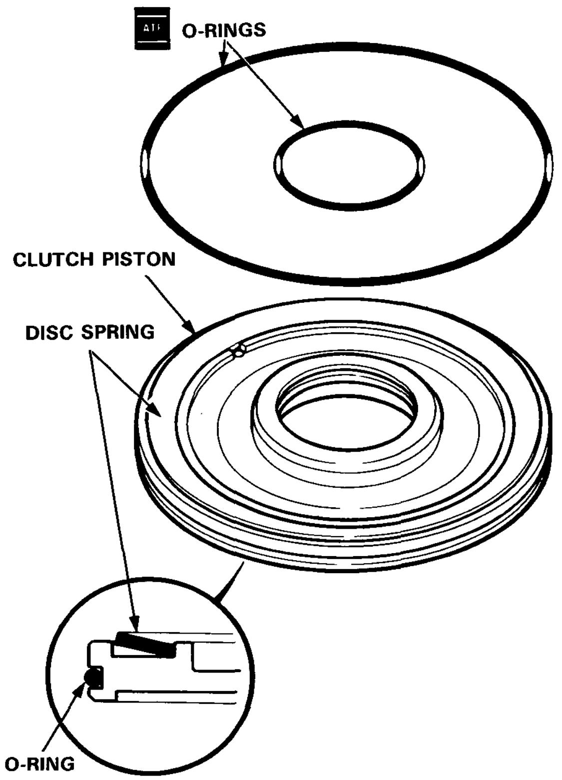
NOTE:
- Clean all parts thoroughly in solvent or carburetor cleaner, and dry with compressed air.
- Blow out all passages.
- Lubricate all parts with ATF before reassembly.

1. Inspect for a loose check valve.



2. Install a new O-ring on the clutch piston.
3. Be sure that the disc spring is securely staked.

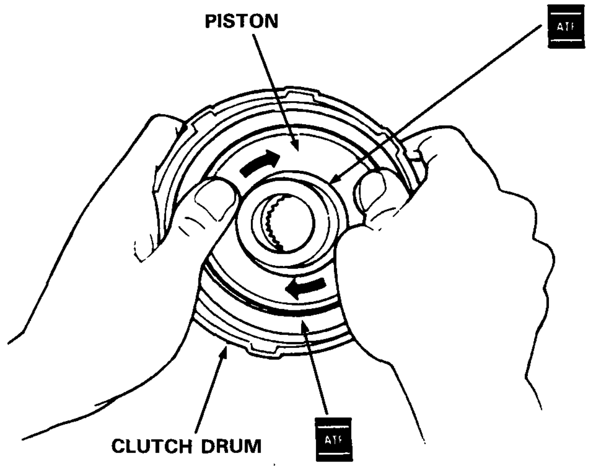
   NOTE: For 1st, 3rd and 4th clutches.



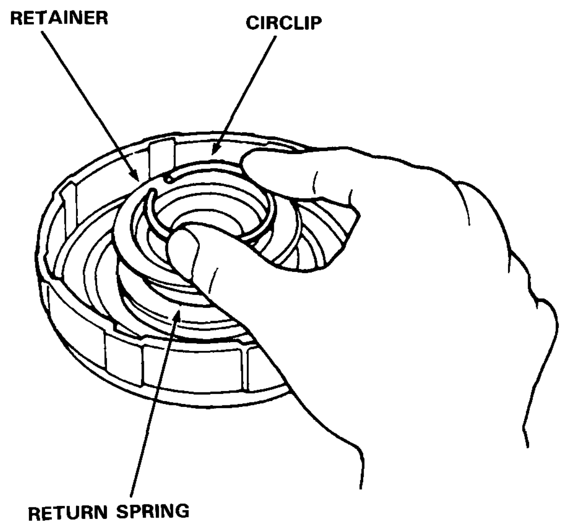
4. Install the piston in the clutch drum. Apply pressure and rotate to ensure proper seating.

   NOTE: Lubricate the piston O-ring with ATF before installing.

   CAUTION: Do not pinch O-ring by installing the piston with force.



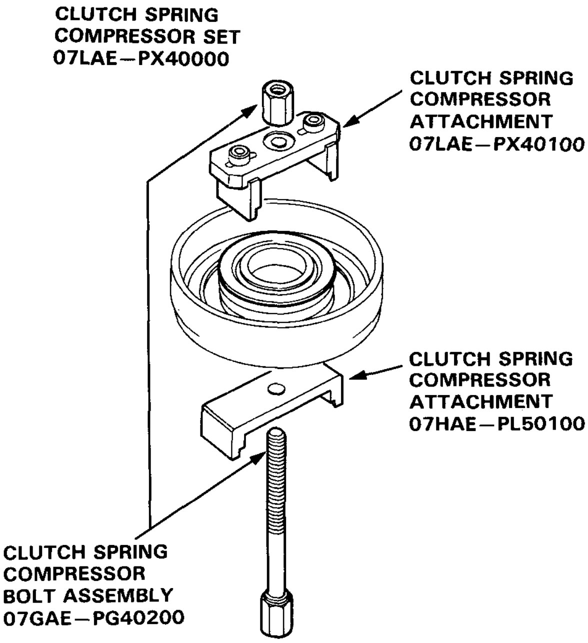
5. Install the return spring and spring retainer and position the circlip on the retainer.

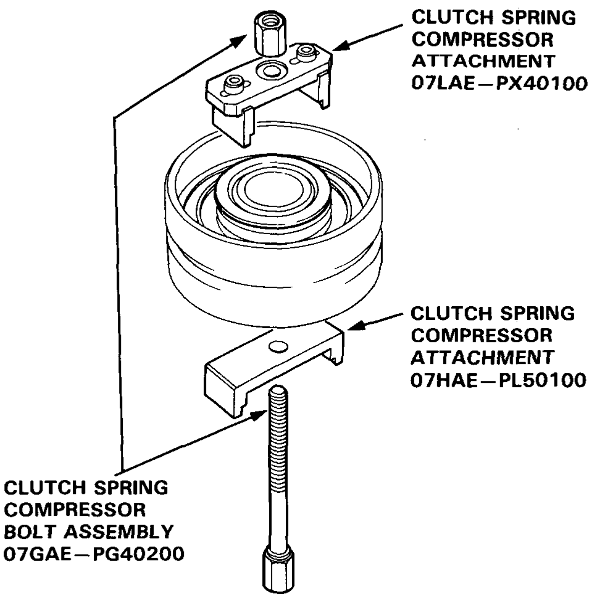


(cont'd)

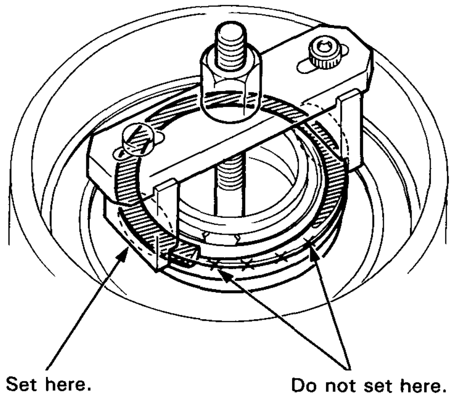
Reassembly (cont'd)

6. Install the special tools as shown.

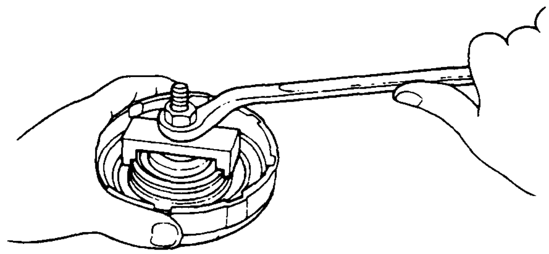




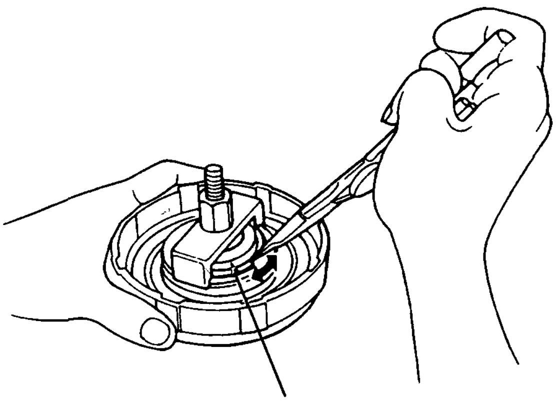
CAUTION: If either end of the compressor attachment is set over an area of the spring retainer which is unsupported by the retainer spring, the retainer may be damaged.



7. Compress the clutch return spring.



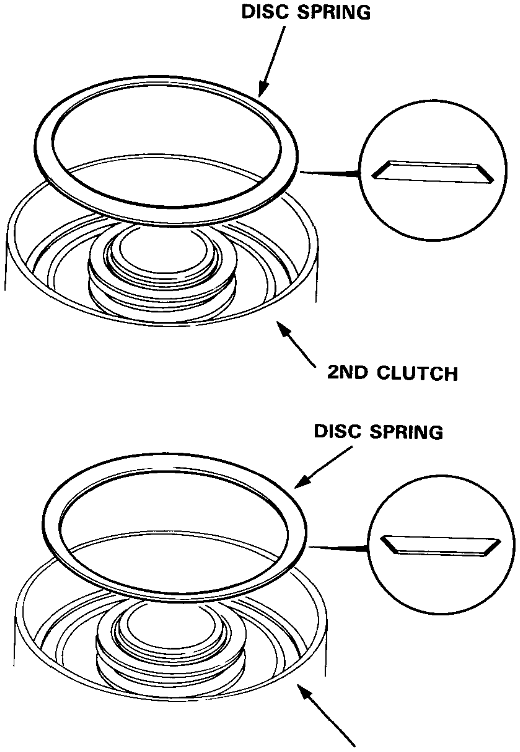
8. Install the circlip.



9. Remove the special tools.

10. Install the disc spring.

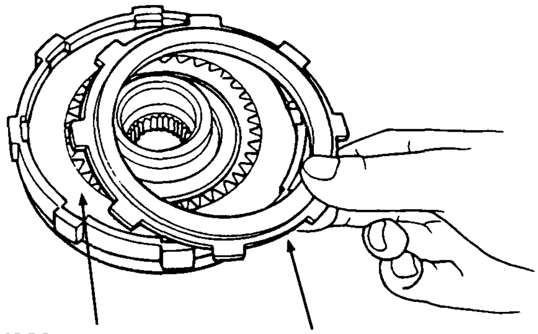
NOTE:
- For 1st-hold and 2nd clutches.
- Install the disc spring in the direction shown.



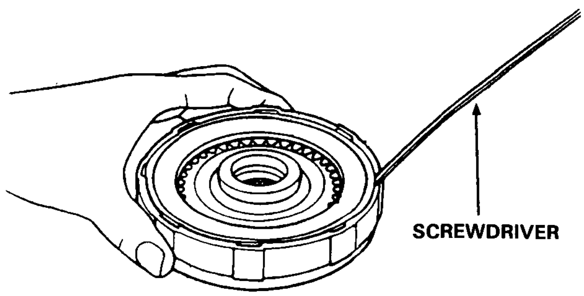
11. Soak the clutch discs thoroughly in ATF for a minimum of 30 minutes.

12. Starting with a clutch plate, alternately install the clutch plates and discs. Install the clutch end plate with flat side toward the disc.

NOTE: Before installing the plates and discs, make sure the inside of the clutch drum is free of dirt or other foreign matter.



13. Install the snap ring.



(cont'd)

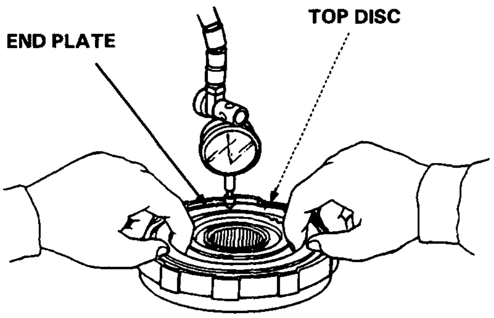
Reassembly (cont'd)

14. Measure the clearance between the clutch end plate and top disc with a dial indicator. Zero the dial indicator with the clutch end plate lowered and lift it up to the snap ring. The distance that the clutch end plate moves is the clearance between the clutch end plate and top disc.

    NOTE: Measure at three locations.

End Plate-to-Top Disc Clearance:

Clutch	Service Limit
1st	0.65—0.85 mm (0.026—0.033 in)
2nd	0.65—0.85 mm (0.026—0.033 in)
3rd	0.40—0.60 mm (0.016—0.024 in)
4th	0.40—0.60 mm (0.016—0.024 in)
1st-Hold	0.50—0.80 mm (0.020—0.031 in)



15. If the clearance is not within the service limits, select a new clutch end plate from the following table.

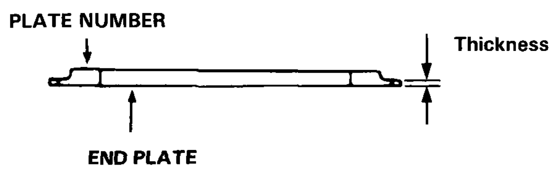
    NOTE: If the thickest clutch and plate is installed, but the clearance is still over the standard, replace the clutch discs and clutch plates.

1ST, 2ND, 3RD and 4TH CLUTCH

Plate No.	Part Number	Thickness
1	22551—PC9—000	2.4 mm (0.094 in)
2	22552—PC9—000	2.5 mm (0.098 in)
3	22553—PC9—000	2.6 mm (0.102 in)
4	22554—PC9—000	2.7 mm (0.106 in)
5	22555—PC9—000	2.8 mm (0.110 in)
6	22556—PC9—000	2.9 mm (0.114 in)
7	22557—PC9—000	3.0 mm (0.118 in)
8	22558—PC9—000	3.1 mm (0.122 in)
9	22559—PC9—000	3.2 mm (0.126 in)
10	22560—PC9—000	3.3 mm (0.130 in)
11	22561—PC9—000	2.1 mm (0.082 in)
12	22562—PC9—000	2.2 mm (0.086 in)
13	22563—PC9—000	2.3 mm (0.090 in)

1ST-HOLD CLUTCH

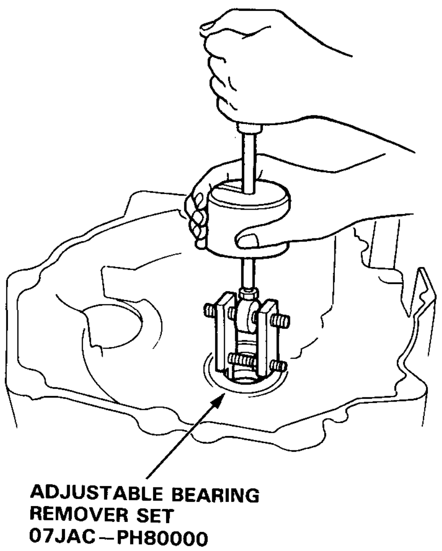
Plate No.	Part Number	Thickness
1	22551—PS5—003	2.1 mm (0.082 in)
2	22552—PS5—003	2.2 mm (0.086 in)
3	22553—PS5—003	2.3 mm (0.090 in)
4	22554—PS5—003	2.4 mm (0.094 in)
No Mark	22555—PS5—003	2.5 mm (0.098 in)
6	22556—PS5—003	2.6 mm (0.102 in)
7	22557—PS5—003	2.7 mm (0.106 in)



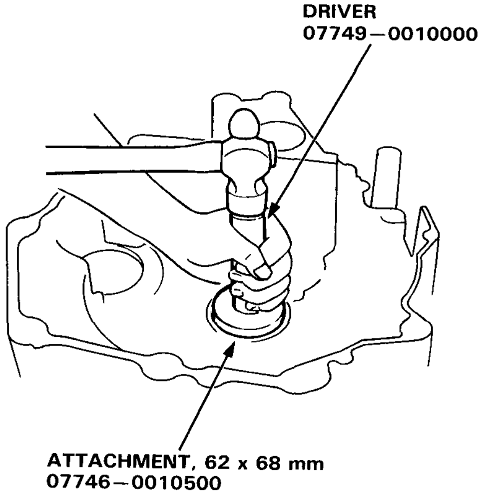
Torque Converter Housing Bearings

Mainshaft Bearing Replacement

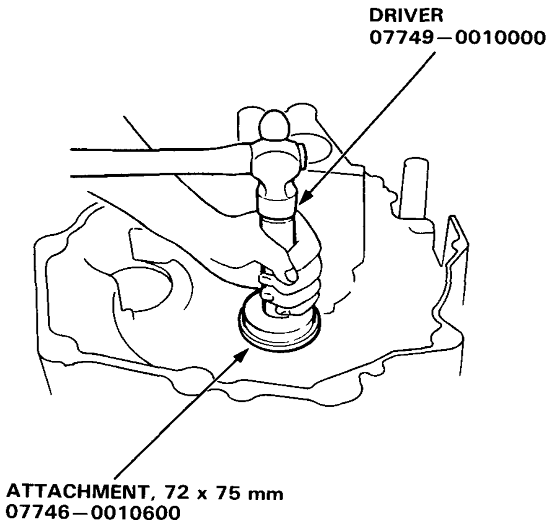
1. Remove the mainshaft bearing and oil seal using the special tools as shown.



2. Drive in the new mainshaft bearing until it bottoms in the housing, using the special tools as shown.



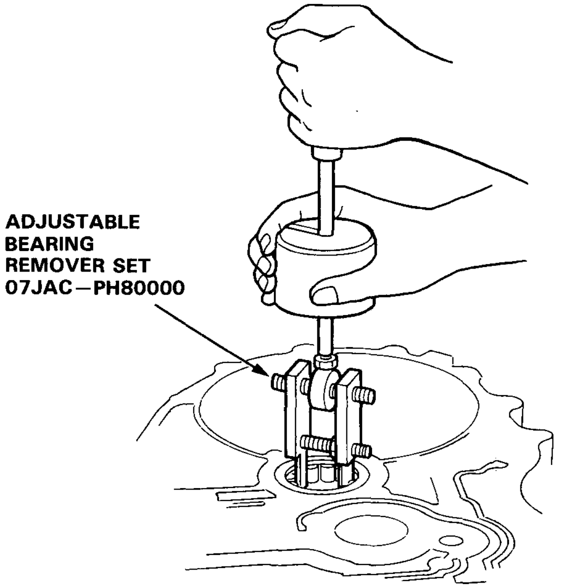
3. Install the new oil seal flush with the housing using the special tools as shown.



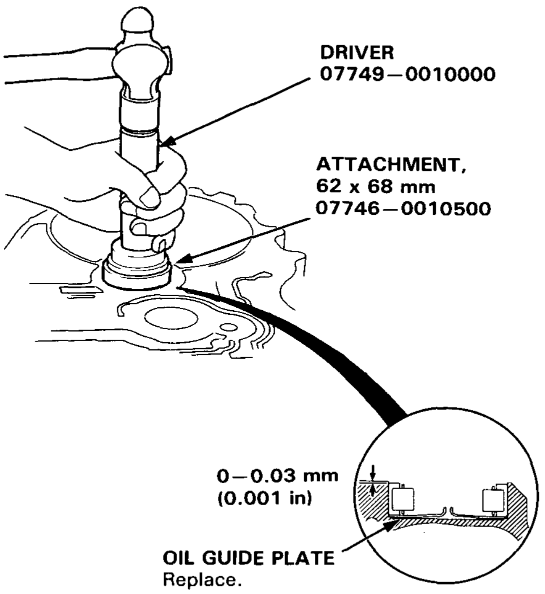
Torque Converter Housing Bearings

Countershaft Bearing Replacement

1. Remove the countershaft bearing using the special tool.

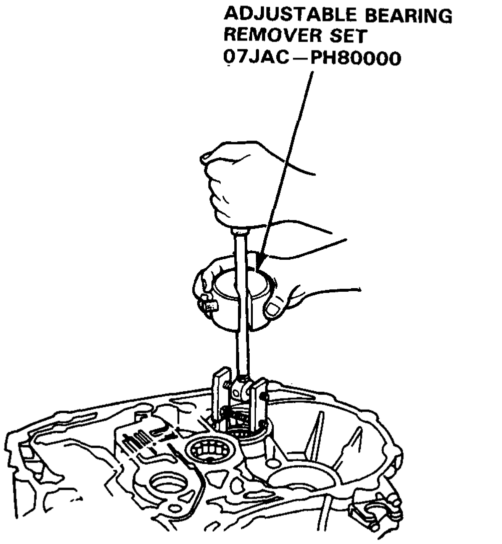


2. Replace the oil guide plate.
3. Drive the new bearing into the housing using the special tools as shown.

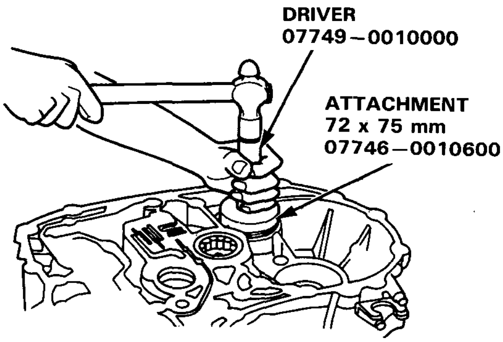


Transfer Shaft Bearing Replacement

1. Remove the transfer shaft bearing.



2. Drive the new bearing flush with the housing.

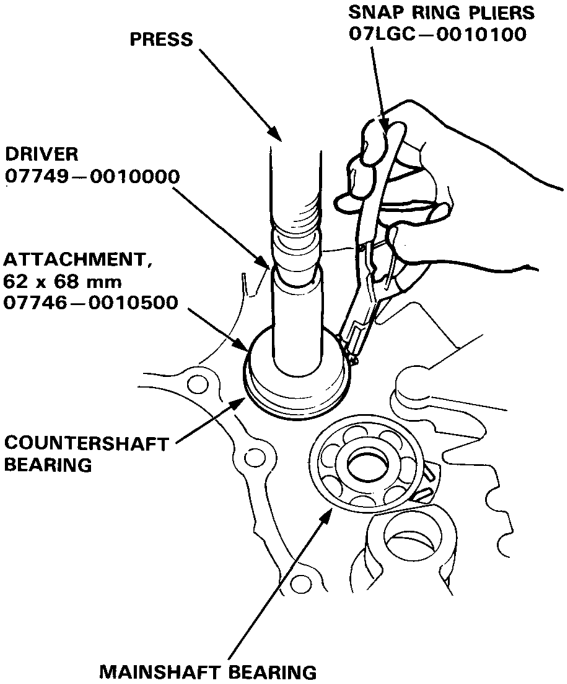


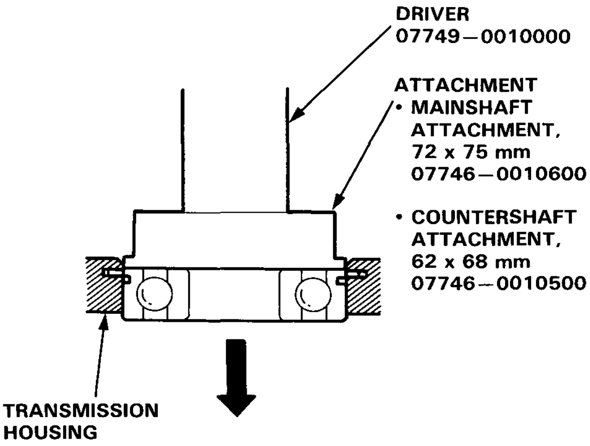
Transmission Housing Bearings

Mainshaft/Countershaft Bearing Replacement

1. To remove the mainshaft and countershaft bearings from the transmission housing, expand each snap ring with snap ring pliers, then push the bearing out using the special tools and a press as shown.

   NOTE: Do not remove the snap rings unless it's necessary to clean the grooves in the housing.

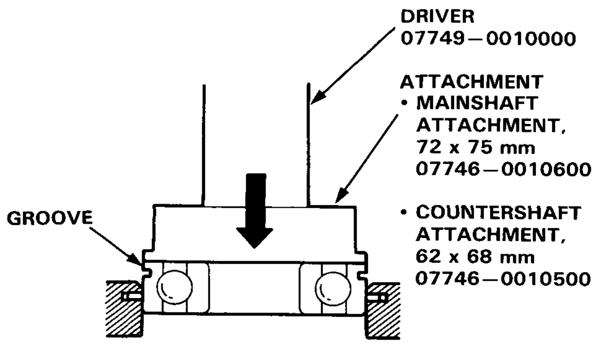




2. Expand each snap ring with snap ring pliers, insert the new bearing part-way into the housing using the special tools and a press as shown. Install the bearing with the groove facing outside the housing.

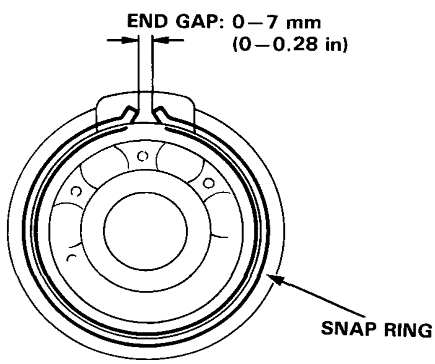
   NOTE: Coat all parts with ATF.

3. Release the pliers, then push the bearing down into the housing until the ring snaps in place around it.



4. After installing the bearing verify the following:

   - The snap ring is seated in the bearing and housing grooves.
   - The snap ring operates.
   - The ring end gap is correct.

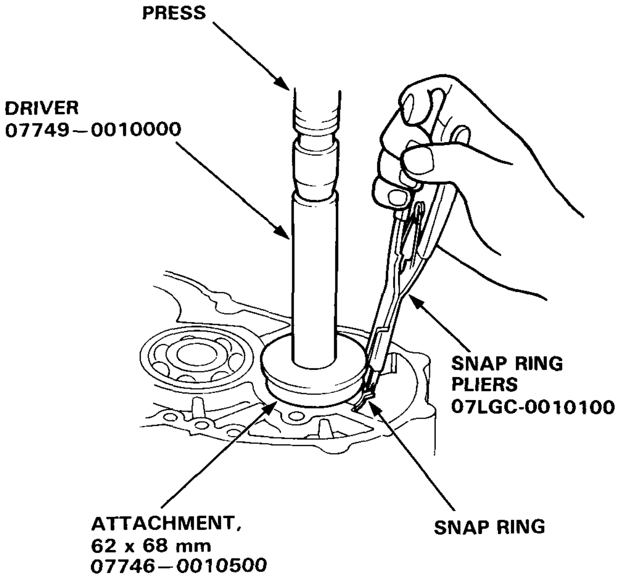


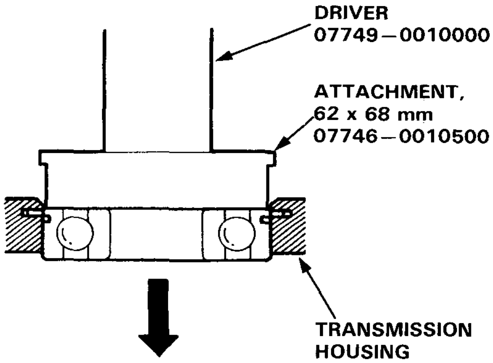
Transmission Housing Bearing

Sub-shaft Bearing Replacement

1. To remove the sub-shaft bearing from the transmission housing, expand the snap ring with snap ring pliers, then push the bearing out using the special tools and a press as shown.

   NOTE: Do not remove the snap ring unless it's necessary to clean the groove in the housing.

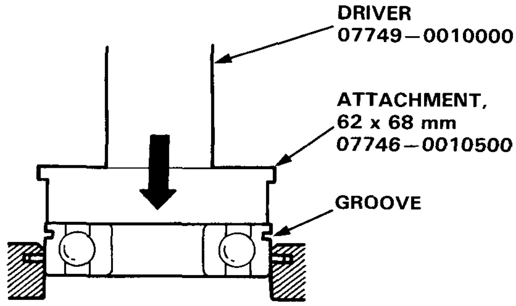




2. Expand the snap ring with snap ring pliers, insert the new bearing part-way into the housing using the special tools and a press as shown. Install the bearing with the groove facing outside the housing.

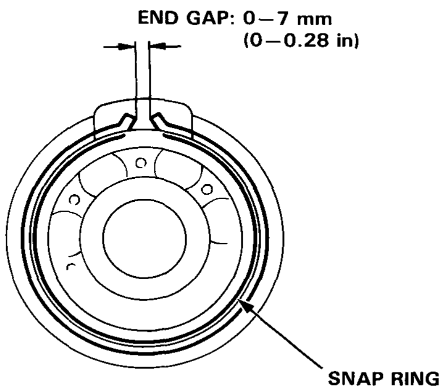
   NOTE: Coat all parts with ATF.

3. Release the pliers, then push the bearing down into the housing until the ring snaps in place around it.



4. After installing the bearing verify the following:

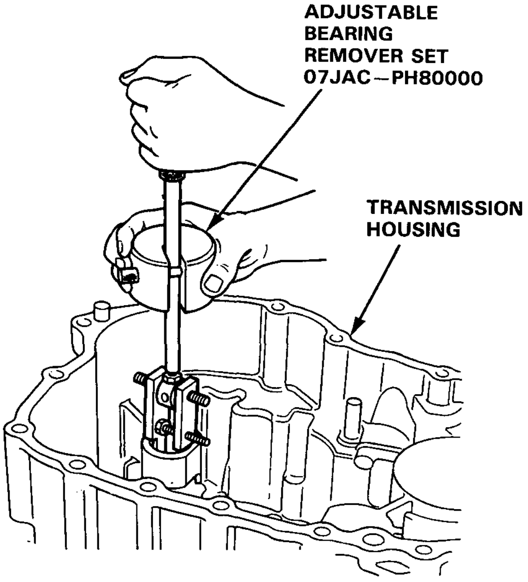
   - The snap ring is seated in the bearing and housing grooves.
   - The snap ring operates.
   - The ring end gap is correct.



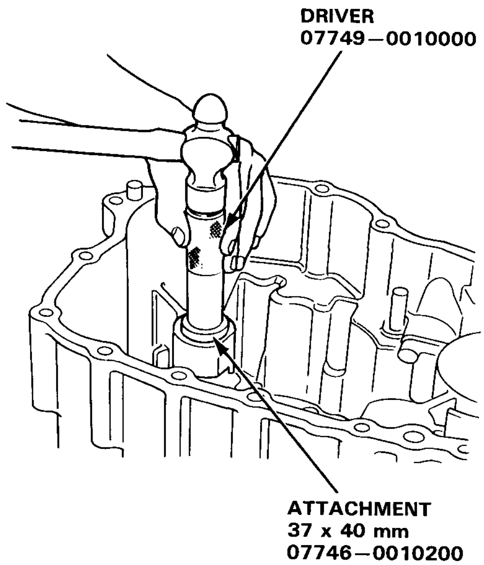
Sub-shaft Bearing

Replacement

1. Remove the subshaft bearing



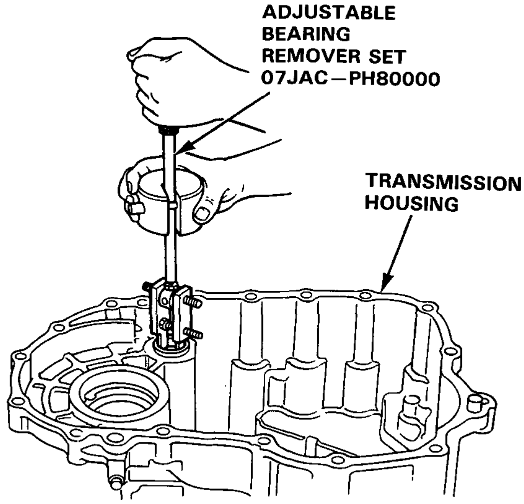
2. Drive in the new bearing until it bottoms in the housing.



Transfer Shaft Bearing Outer Race

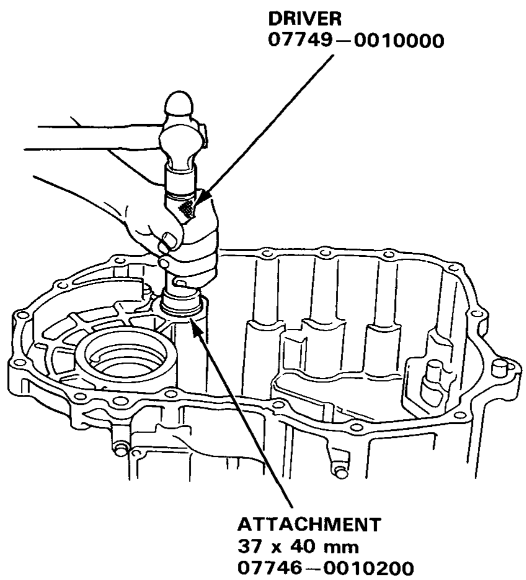
Replacement

1. Remove the transfer bearing outer race.



2. Drive in the new bearing outer race until it bottoms in the housing.

   NOTE: The bearing inner race and outer race should be replaced as a pair.

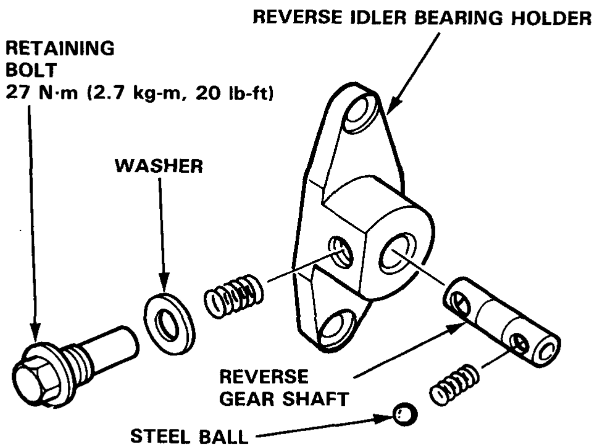


Reverse Idler Gear

Installation

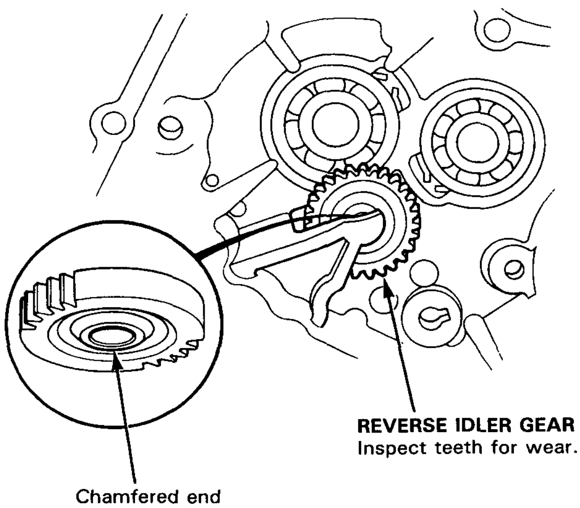
1. *Assemble the reverse idle bearing holder.*

   NOTE: Align the hole in the shaft with the spring.

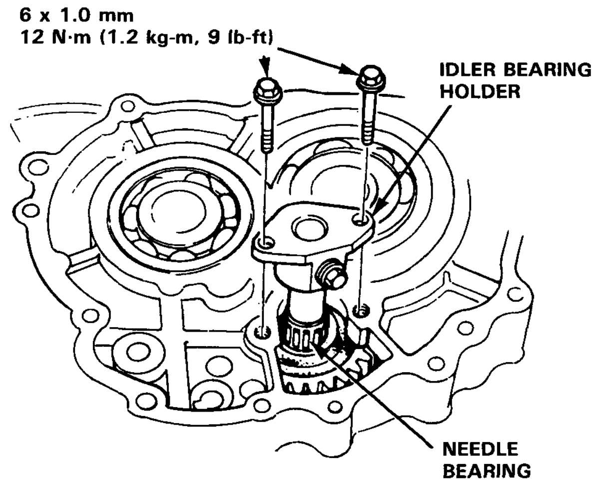


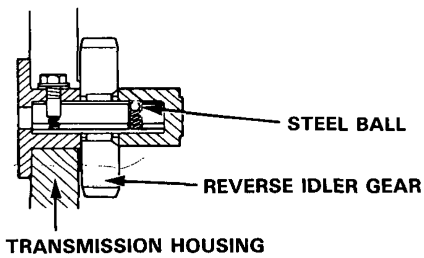
2. Install the reverse idler gear.

   NOTE: Install the reverse idler gear so that the larger chamfer on the shaft bore faces the torque converter housing.



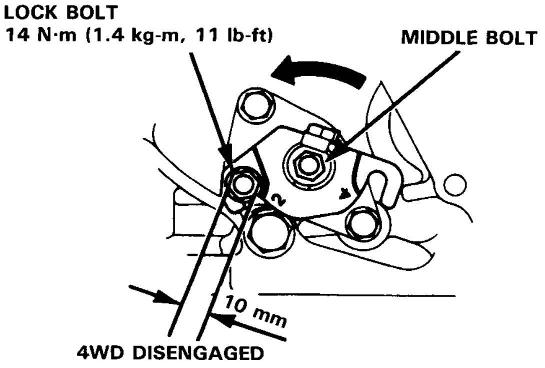
3. Install the needle bearing into the idle gear.
4. Install the reverse idler bearing holder into the transmission housing.
5. Tighten the reverse idler bearing holder bolts.
6. Install the spring and the tighten the retaining bolt and washer.





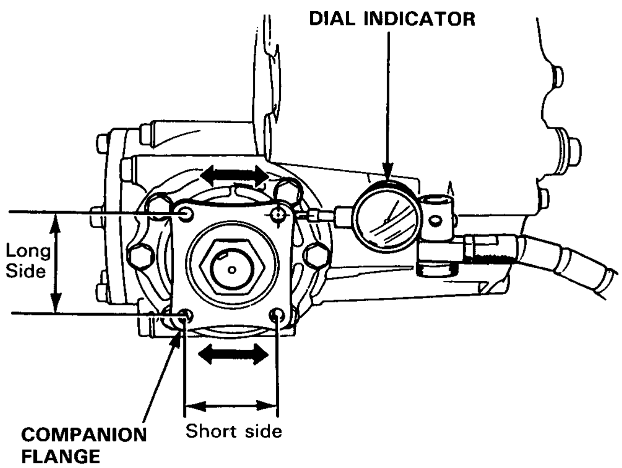
Inspection

1. Shift the disengagement lever to 2WD.



2. Check the backlash at the companion flange with a dial indicator; measure as shown, them rotate the flange 180° and measure again.

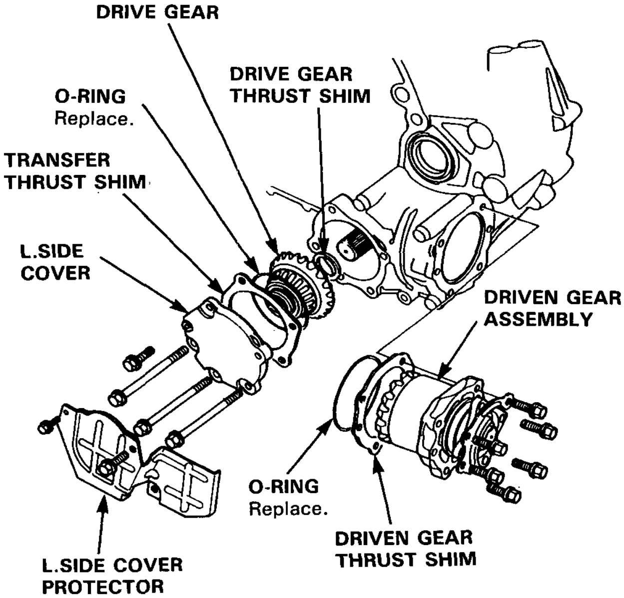
   Standard: 0.10—0.15 mm (0.004—0.006 in.)



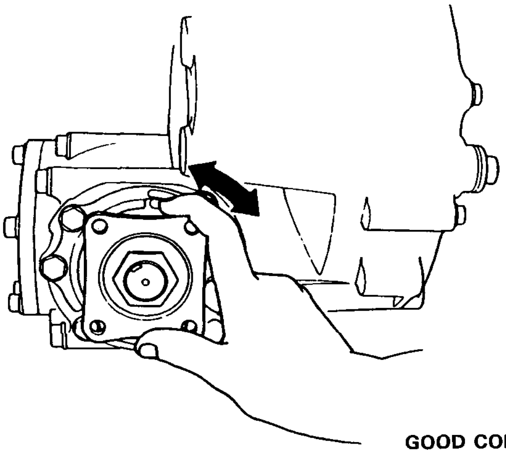
3. If the backlash is outside the specifications, adjust as per the instruction described on page 14-430.

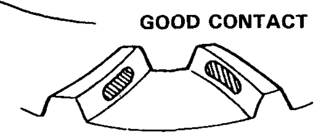
Gear Tooth Contact

1. Shift the disengagement lever to 2WD.
2. Remove the transfer drive and driver gear assembly.



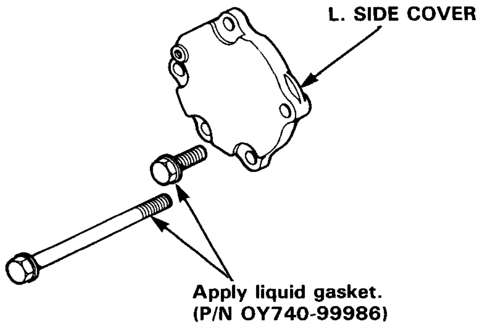
3. Apply Prussian Blue evenly to the driven gear teeth.
4. Reinstall the gear and tighten the mouting bolts to the correct torque.
5. Turn the companion flange back and forth several times, then remove the driven gear assembly and inspect the pattern on the gear's teeth.

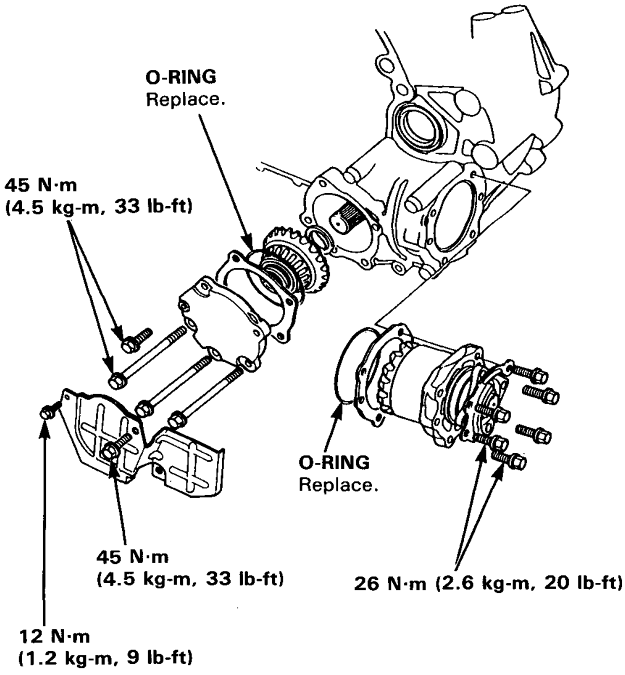




6. If the contact pattern is not as shown, correct it according to the instructions on page 14-430.
7. If the tooth contact is correct, reassemble the drive and driven gear as follows.

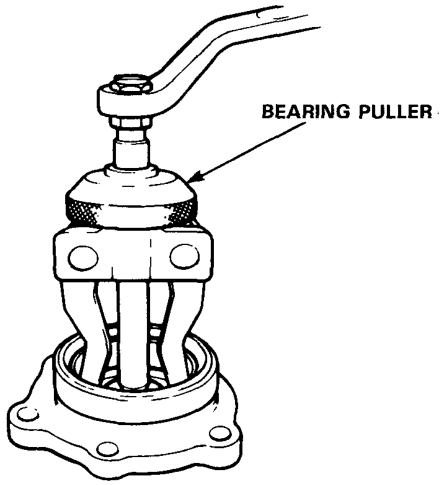
NOTE:
- Replace the O-ring with a new one.
- Coat the O-ring with oil.
- Apply liquid gasket (P/N OY740-99986) to threads of L. side cover attaching bolts.



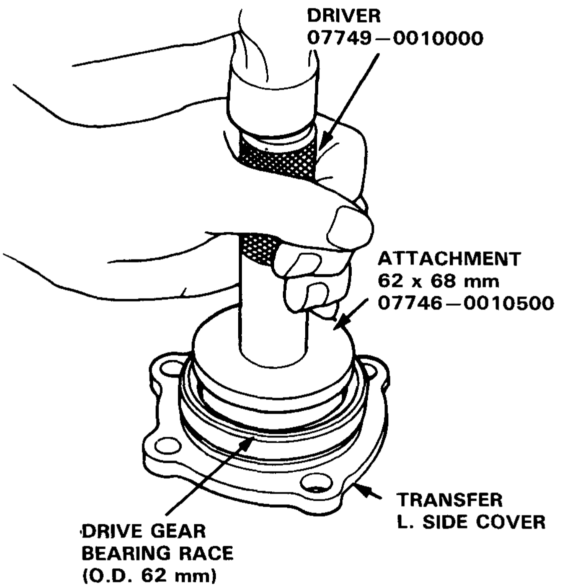


L. Side Cover Race Replacement

1. Remove the drive gear bearing race with a bearing puller as shown.

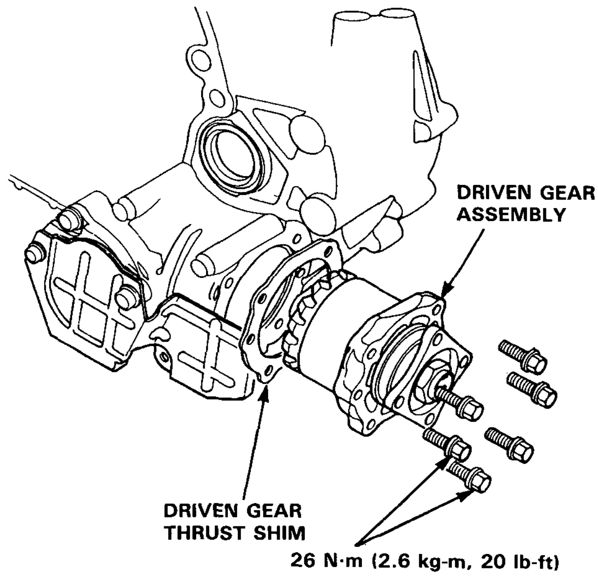


2. Install the new race with the special tools as shown.



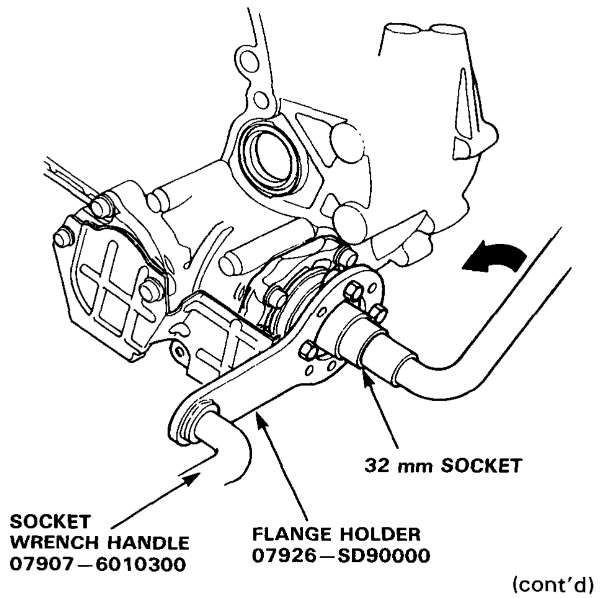
Transfer Drive Gear Disassembly

1. Slide the driven gear assembly into the torque converter housing and secure with the six bolts.



2. Raise the locknut tab from the groove of the driven gear shaft.

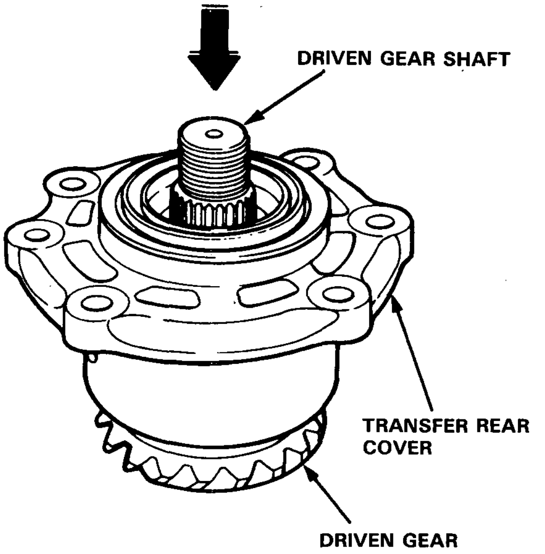
3. Hold the companion flange with the special tool and remove the locknut with a 32 mm socket.



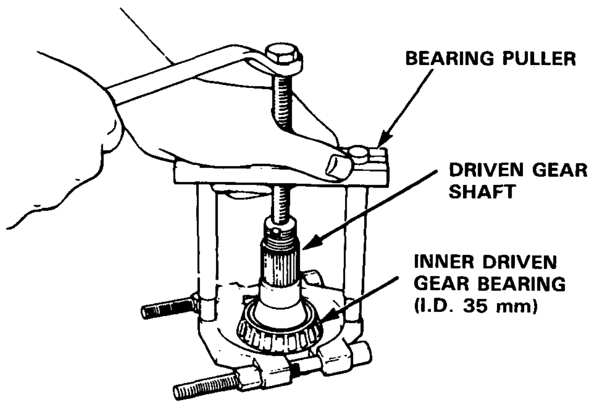
(cont'd)

Transfer Driven Gear Disassembly (cont'd)

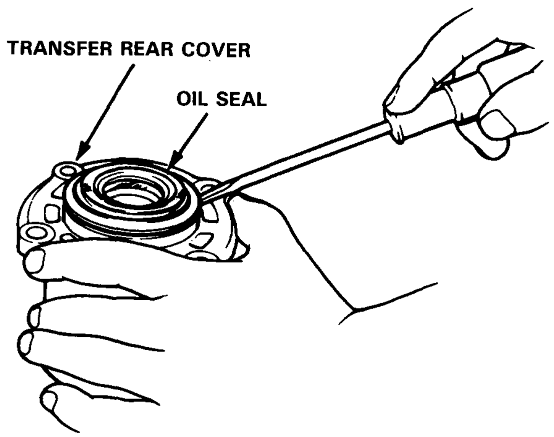
4. Remove the driven gear from the transfer rear cover by tapping the driven gear shaft



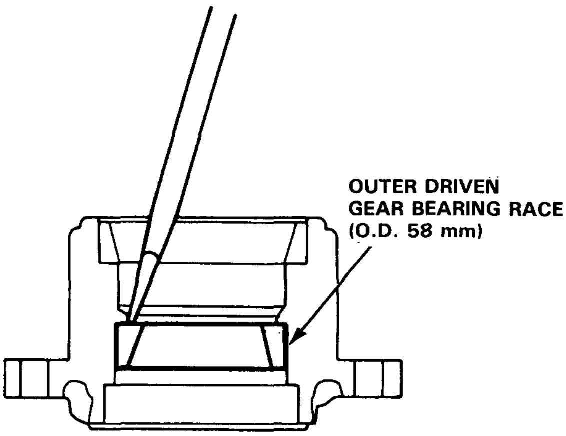
5. Remove the inner driven gear bearing from the driven gear shaft.



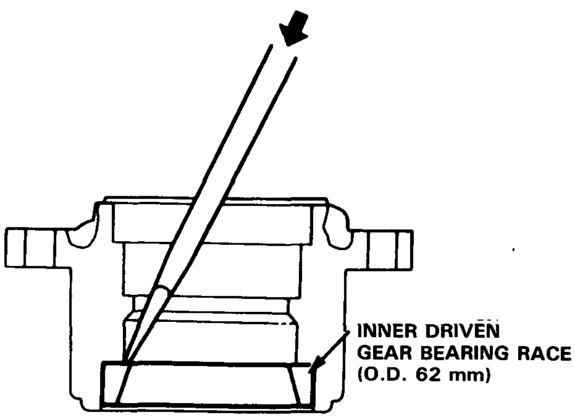
6. Pry the oil seal off the transfer rear cover.



7. Remove the bearing race from the transfer rear cover.



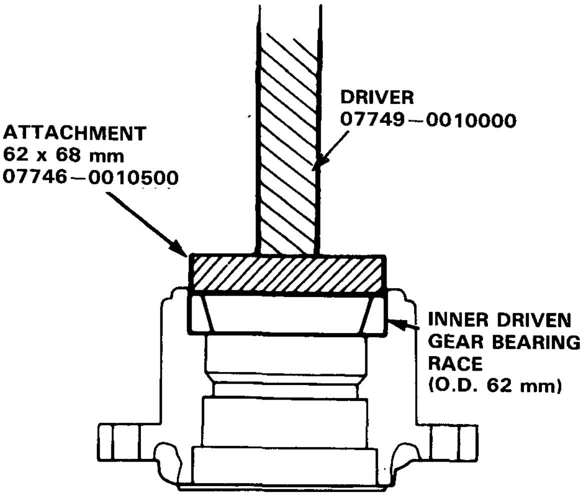
8. Remove the bearing race from the transfer rear cover.



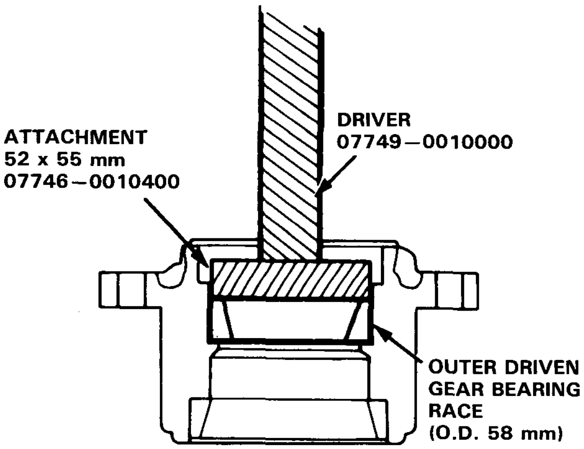
Driven Gear Pre-load

NOTE: Clean all tools and parts thoroughly in solvent and dry with compressed air.

1. Press the inner driven gear bearing race into the transfer rear cover with the special tools as shown.

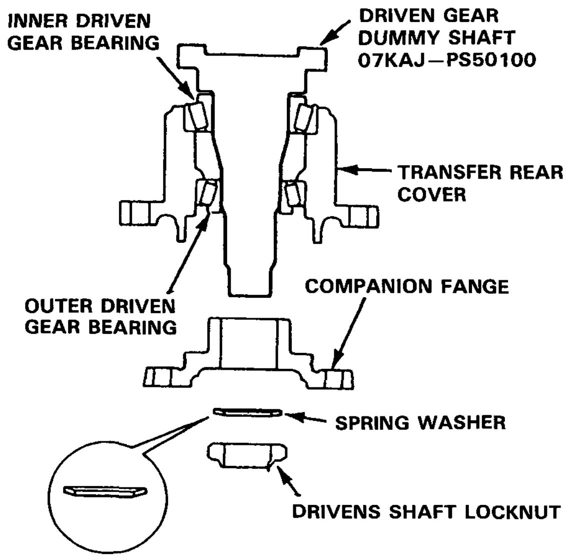


2. Press the outer driven gear bearing race into the transfer rear cover with the special tools as shown.



3. Coat the races with clean oil.

4. Slide the inner driven gear bearing onto the special tools.
   Install the special tools with bearing into the rear cover.

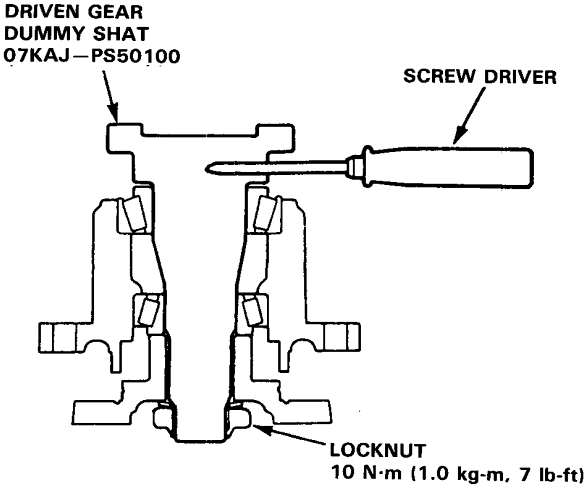


5. Install the outer driven gear bearing, companion flange, spring washer and driven shaft locknut.
   NOTE:
   - Use a new driven shaft locknut.
   - Do not assemble the oil seal.
   - Take care the spring washer direction.

(cont'd)

Driven Gear Pre-load (cont'd)

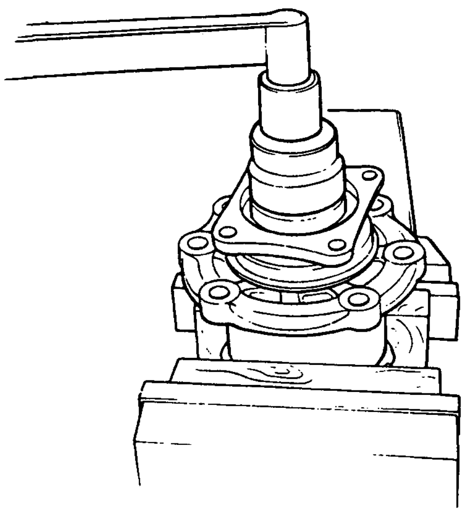
6. Install a screw driver into the special tool and then torque the locknut to 10 N·m (1.0 kg-m, 7 lb-ft).



7. Measure the driven pinion preload.

   NOTE: Before measuring the preload, turn the threaded shaft several times to seat the bearing.

   Standard: 0.5–0.8 N·m (5.0–8.0 kg-cm, 4.3–6.9 lb-in)



8. If the preload is outside the above limits, re-adjust by turning the locknut.

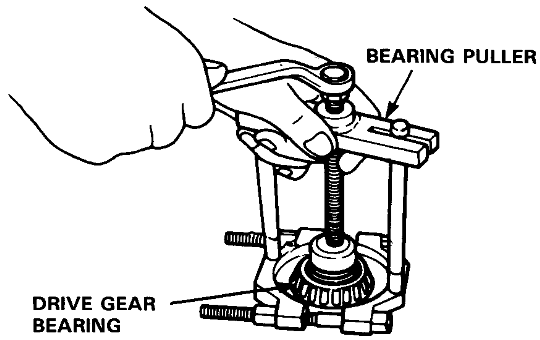
   NOTE: Do not overtighten the locknut.

Adjustment/Reassembly, (Thrust Shim Selection)

1. Insert the threaded shaft/driven gear rear cover assembly into the transfer housing.

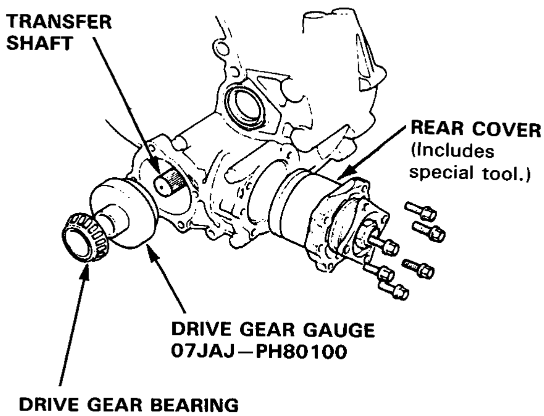
   NOTE: The pre-load must be properly adjusted before selecting shims. See page 14-421.

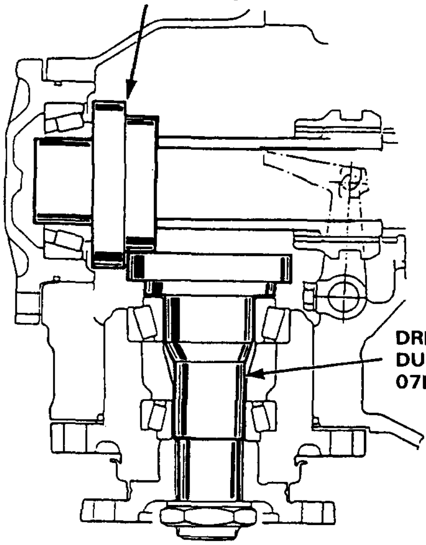
2. Remove the drive gear bearing with a bearing puller.



3. Lubricate the drive gear bearing with clean oil then install it on the Drive Gear Gauge. Slide the bearing and gauge onto the transfer shaft.

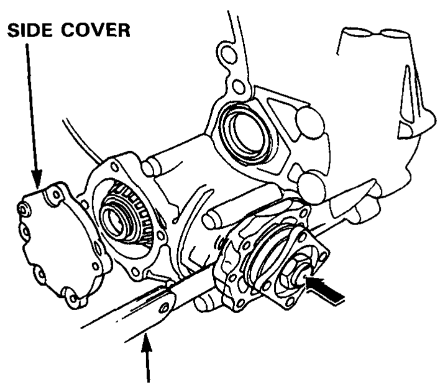
   NOTE:
   - Do not install the drive gear thrust shim.
   - Pull the Rear cover assembly out slightly to allow the drive gear gauge to seat.





4. Install L. side cover without the bolts.
5. To determine driven gear thrust shim thickness, *measure the clearance between the transfer rear cover and transfer case with a feeler gauge, then record the clearance.*

   NOTE: The clearance should be taken while pressing the dummy shaft all the way in.



6. The correct rear cover shim thickness is determined by recording the clearance between the transfer rear cover and the transfer case, then adding or sub tracting the machining tolerance, which is etched in to the driven gear.

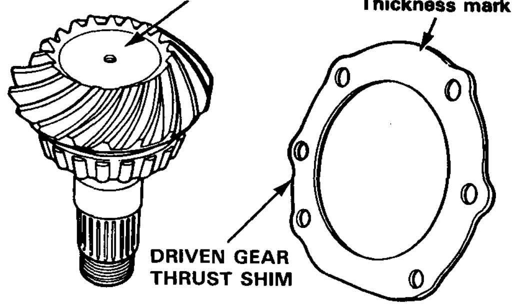
   NOTE: The plus (+) or minus (–) number given as machining tolerance represents hundredths of a millimeter.

   Example:
   - Clearance measured in Step 5: 1.08 mm
   - Machining tolerance etched in the driven gear: (+2)

   Corrected driven gear thrust shim thickness:
   1.08 + 0.02 mm = 1.10 mm

   Example:
   - Clearance measured in Step 5: 1.08 mm
   - Machining tolerance etched in the driven gear: (–3)

   Corrected driven gear rear cover shim thickness:
   1.08 – 0.03 mm = 1.05 mm



DRIVEN GEAR THRUST SHIM:

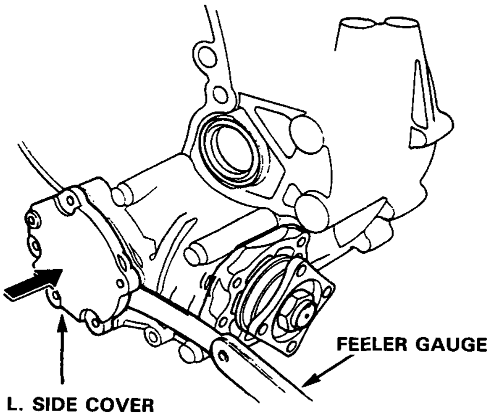
Part No.	Thickness
29481–PH8–000	0.50 mm (0.020 in.)
29482–PH8–000	0.85 mm (0.033 in.)
29483–PH8–000	0.90 mm (0.035 in.)
29484–PH8–000	0.95 mm (0.037 in.)
29485–PH8–000	1.00 mm (0.039 in.)
29486–PH8–000	1.05 mm (0.041 in.)
29487–PH8–000	1.10 mm (0.043 in.)
29488–PH8–000	1.15 mm (0.045 in.)
29489–PH8–000	1.20 mm (0.047 in.)
29491–PH8–000	1.25 mm (0.049 in.)
29492–PH8–000	1.30 mm (0.051 in.)

(cont'd)

Adjustment/Reassembly (Thrust Shim Selection) (cont'd)

7. To determine the left side cover shim thickness measure the clearance between the transfer L. side cover and transfer case with a feeler gauge, and record the clearance.

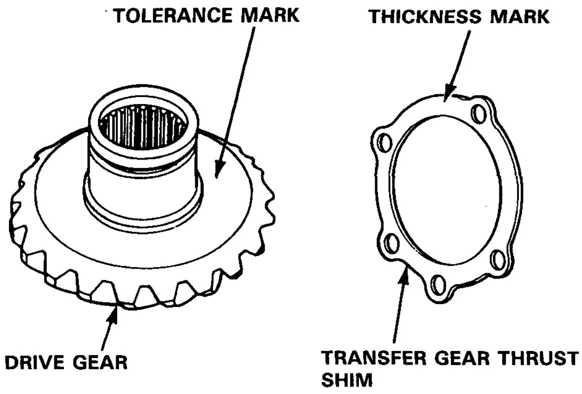
   NOTE: The clearance should be measured while pressing the L. side cover all the way against the transfer case.



8. The correct shim thickness is determined by recording the clearance between the transfer case and the left side cover, then adding or subtracting the machining tolerance, which is etched into the drive gear.

Example:
- Clearance measured in Step 7: 1.04 mm
- Machining tolerance etched on drive gear: (+2)
  Corrected transfer thrust shim thickness:
  1.04 + 0.02 mm = 1.06 mm

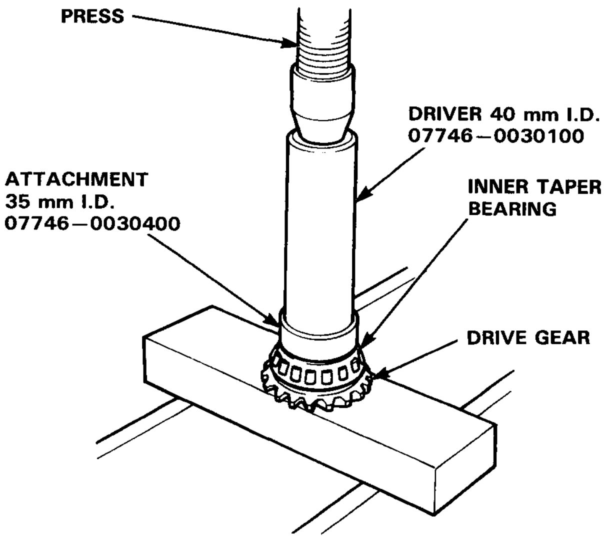
Example:
- Clearance measured in Step 7: 1.04 mm
- Machining tolerance etched on drive gear: (−)
  Corrected transfer thrust shim thickness:
  1.04 − 0.01 mm = 1.03 mm



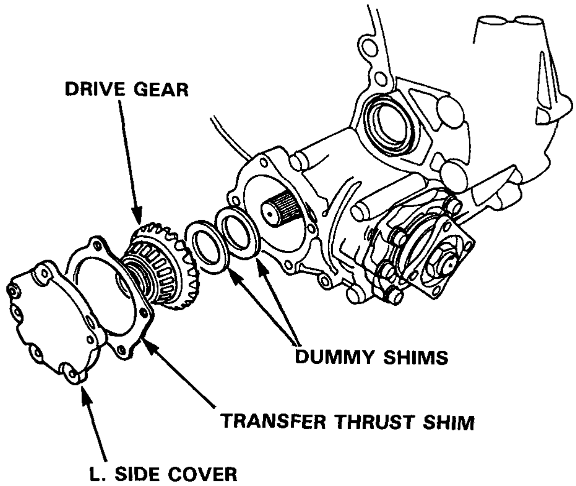
TRANSFER GEAR THRUST SHIM:

Part No.	Thickness
29461–PS5–000	0.30 mm (0.012 in.)
29462–PS5–000	1.00 mm (0.033 in.)
29463–PS5–000	1.03 mm (0.041 in.)
29464–PS5–000	1.06 mm (0.042 in.)
29465–PS5–000	1.09 mm (0.043 in.)
29466–PS5–000	1.12 mm (0.044 in.)
29467–PS5–000	1.15 mm (0.045 in.)
29468–PS5–000	1.18 mm (0.046 in.)
29469–PS5–000	1.21 mm (0.048 in.)
29471–PS5–000	1.24 mm (0.049 in.)
29472–PS5–000	1.27 mm (0.050 in.)
29473–PS5–000	1.30 mm (0.051 in.)
29474–PS5–000	1.33 mm (0.052 in.)

9. Press the drive gear bearing on the drive gear.

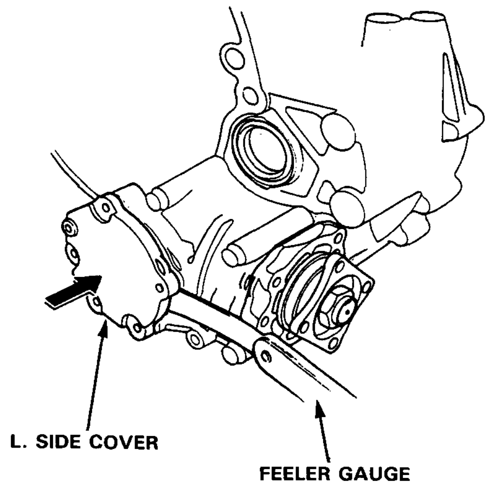


10. *Install two 1.75 mm "dummy shim"* (P/N 29415–PH8000) on the transfer shaft.
Slide the drive gear onto the transfer shaft.



11. Place the shim selected in Step 7 on the L. side cover, and install the cover on the transfer case without bolt.

12. Measure the clearance between the L. side cover and transfer case while pushing against the L. side cover, and record the clearance.



13. *Subtract the clearance measured in Step 13 from 3.5* mm (2 dummy shims) to obtain the corrected shim thickness.

Example:
- Clearance measured in Step 13:
  1.57 mm
- Thickness of dummy shims:
  3.5 mm

Corrected drive gear thrust shim:
3.5–1.57 mm
Thickness: 1.93 mm

DRIVE GEAR THRUST SHIM:

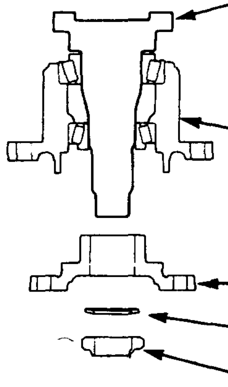
Part No.	Thickness
29411–PH8–000	0.48 mm (0.019 in.)
29412–PH8–000	1.57 mm (0.062 in.)
29413–PH8–000	1.63 mm (0.064 in.)
29414–PH8–000	1.69 mm (0.067 in.)
29415–PH8–000	1.75 mm (0.069 in.)
29416–PH8–000	1.81 mm (0.071 in.)
29417–PH8–000	1.87 mm (0.074 in.)
29418–PH8–000	1.93 mm (0.076 in.)
29419–PH8–000	1.99 mm (0.078 in.)

14. Remove "dummy shim" and install L. side cover.

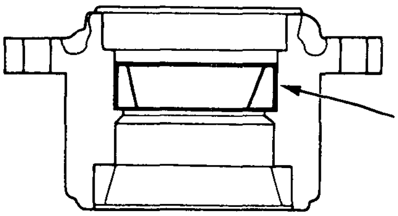
NOTE: After the thrust shim selection check the proper backlash and tooth contact pattern. See pages 14-429 through 14-431.

Driven Gear Reassembly

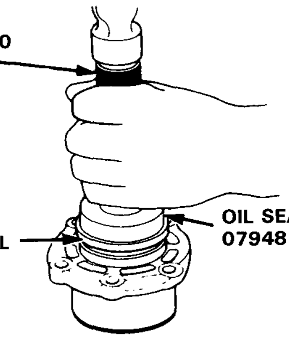
1. Remove the special tool from the transfer rear cover.



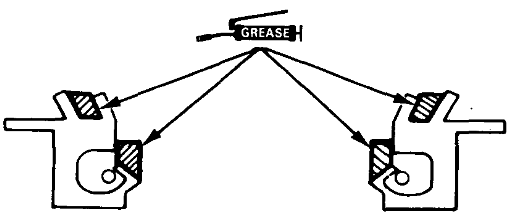
2. Install the outer driven gear bearing in the transfer rear cover.



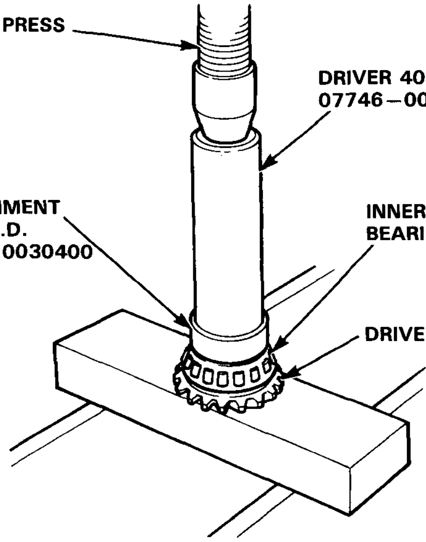
3. Press the oil seal into the transfer rear cover.



4. Coat the main and side sealing lips of the oil seal with grease.

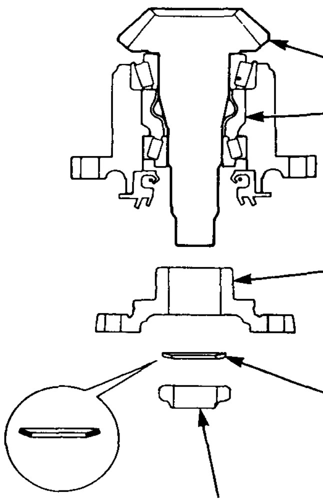


5. Press the inner driven gear bearing on the driven gear.

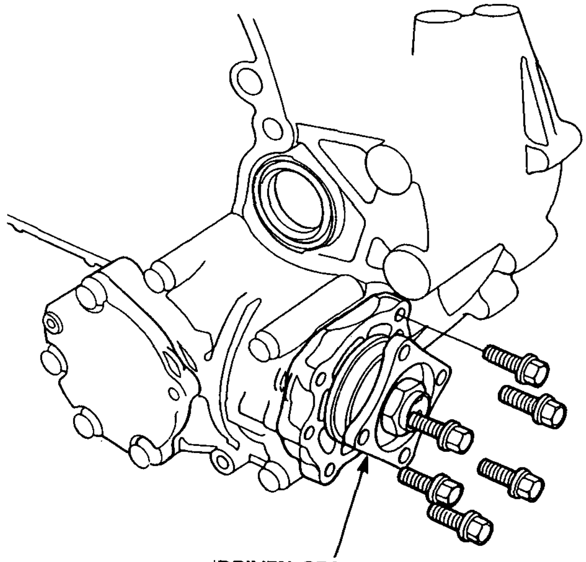


6. Install the following parts in the transfer rear cover:
   - Driven gear
   - Transfer spacer (new spacer)
   - Companion flange
   - Spring washer
   - Driven gear locknut

NOTE: Install the spring washer with the dished side toward the companion flange.

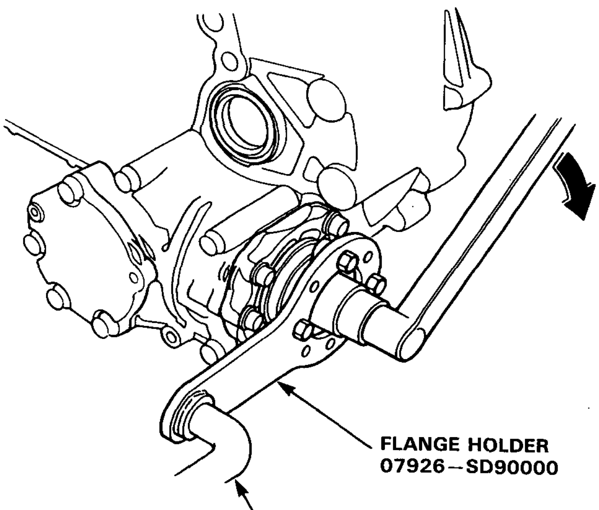


7. Temporarily install the driven gear assembly and mounting bolts in the transfer case.



8. To measure preload, tighten the locknut to the specified torque.

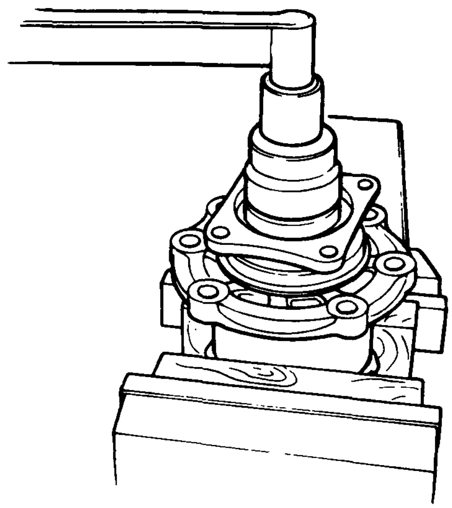
Torque: 120 N·m (12 kg-m, 87 lb-ft)



9. Remove the driven gear assembly from the transfer case, and measure the preload.

   NOTE: Before measuring the preload, rotate the companion flange several times to assure normal bearing contact.

   Preload: 0.8–1.1 N·m
   (8.0–11.0 kg-cm, 6.9–9.5 lb-in)



   NOTE: If the preload exceeds 1.1 N·m (11.0 kg-cm, 9.5 lb-in), replace the transfer spacer with a new one and readjust. Do not try to adjust the preload by loosening the locknut.

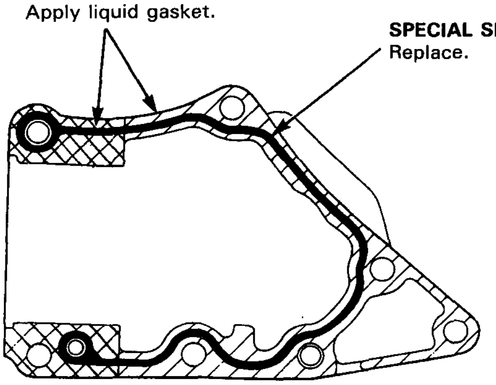
10. If the preload is less than 0.5 N·m (5 kg-cm, 4.3 lb-in), adjust by turning the lock nut in a little at a time.

    NOTE: Replace the transfer spacer with a new one if the preload is still outside the above limits when the lock nut is tightened to 230 N·m (23 kg-m, 166 lb-ft)

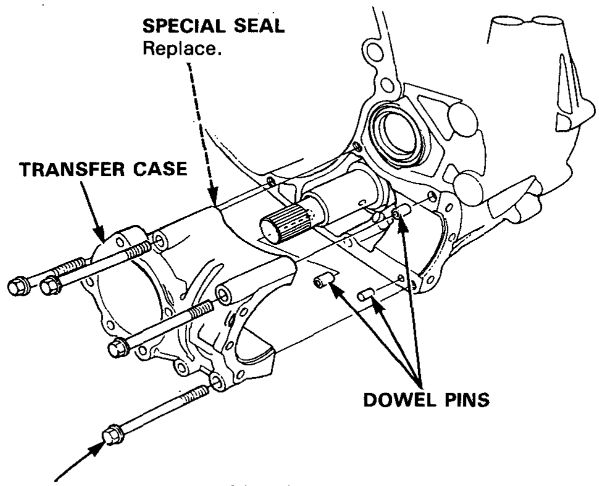
Driven/Drive Gear Reassembly

1. Apply liquid gasket to the torque converter housing mating surface of the transfer case and install the special seal as shown. Use liquid gasket Part No. OY740-99986.

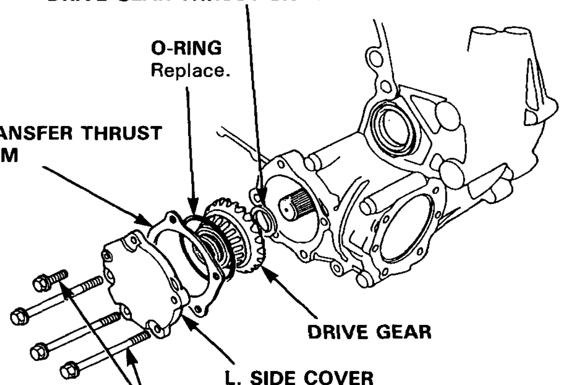
   NOTE:
   - Check that the mating surface are clean and dry before applying liquid gasket. Degrease the mating surfaces if necessary.
   - Apply liquid gasket evenly, being careful to cover all the mating surface.
   - To prevent leakage of all, apply liquid gasket to inner threads of bolt holes.
   - Do not install the parts 20 minutes or more have elapsed since applying gasket. In that case, reapply liquid gasket after removing the old residue.
   - Wait at least 30 minutes before filling with oil.



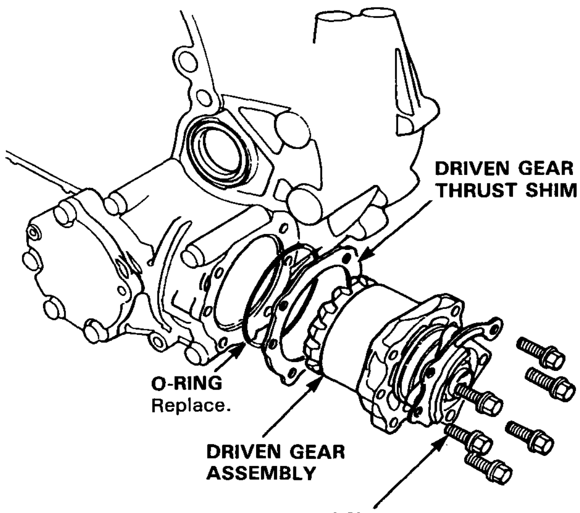
2. Install the transfer case on the torque converter housing.



3. Install the following parts in and on the transfer case and shaft:
   - Transfer thrust shim
   - Drive gear (coat with clean oil)
   - O-ring (replace)
   - Drive gear thrust shim
   - L. side cover bolts.



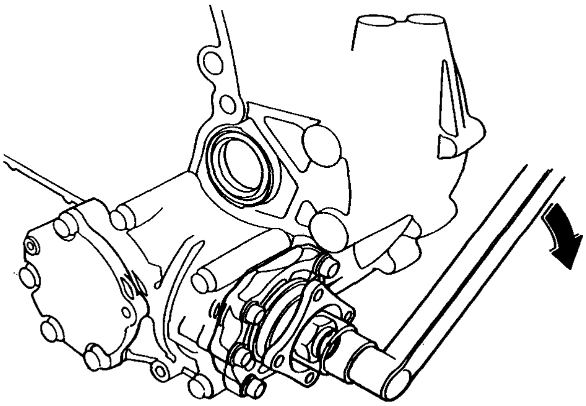
4. Install the following parts:
   - Driven gear thrust shim
   - Driven gear assembly
   - Driven gear assembly bolts



5. Measure the total bearing preload:
   - Rotate the companion flange several times to assure normal bearing contact.
   - Set the disengagement lever in 2WD position.
   - Measure the preload with a torque wrench.

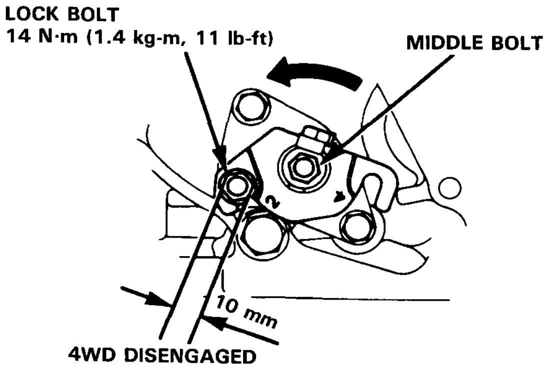
   The total bearing preload should be 0.7—1.0 N·m (7.0—10.0 kg-cm, 6.1—8.75 lb-in) greater than the preload on the driven gear assembly alone (see page 14-427. step 9).

   Example:
   If the preload of the driven gear assembly alone was 0.9 N·m (9 kg-cm, 7.8 lb-in), the total bearing preload should be between 1.6 N·m (16 kg-cm, 13.9 lb-in), and 1.9 N·m (19 kg-cm, 16.5 lb-in).



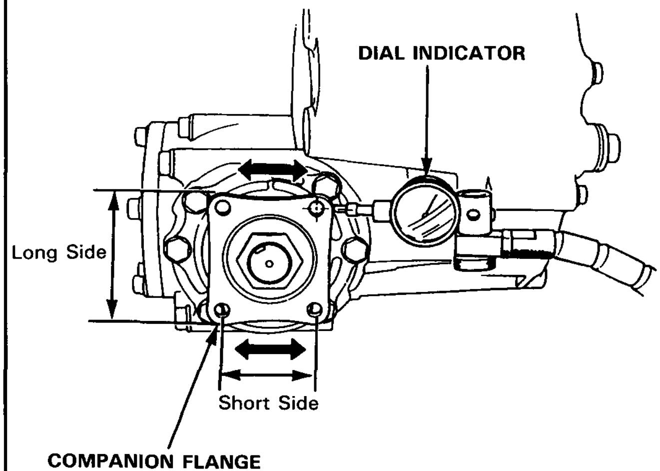
6. If the preload is outside the specifications, adjust it by replacing the transfer thrust shim.
   - If the total bearing preload is less than the specification, reduce the size of the transfer thrust shim.
   - If the total bearing preload is more than the specification, increase the size of the transfer thrust shim.

7. After the bearing preload has been adjusted properly, measure the gear backlash.
   - Place the disengagement lever in 2WD.



   - Using a dial indicator, measure the backlash at the top of the companion flange, then rotate the companion flange 180° and measure again.

   Backlash: 0.09—0.14 mm (0.004—0.006 in.)



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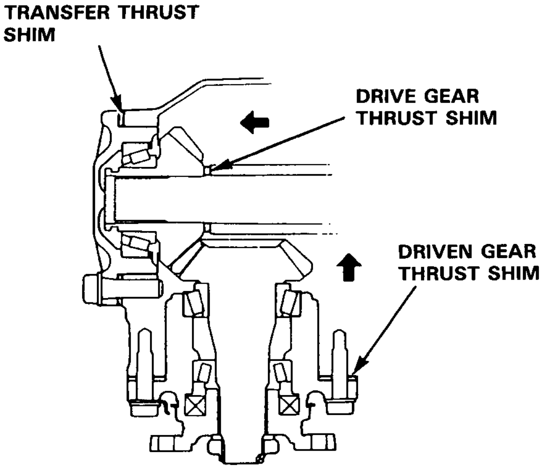
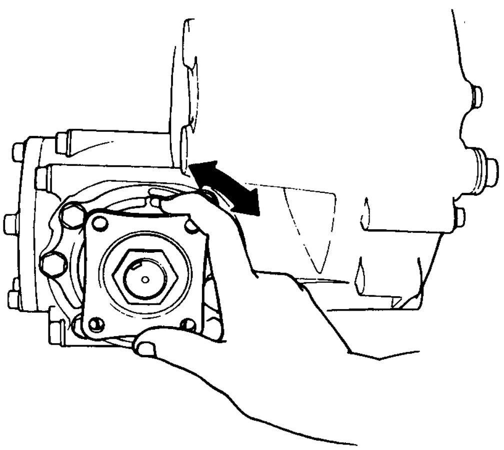
Driven/Drive Gear Reassembly (cont'd)

- If the backlash is outside the specifications, adjust by changing the driven gear thrust shim.

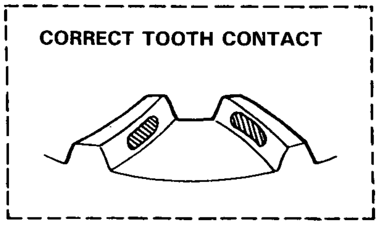


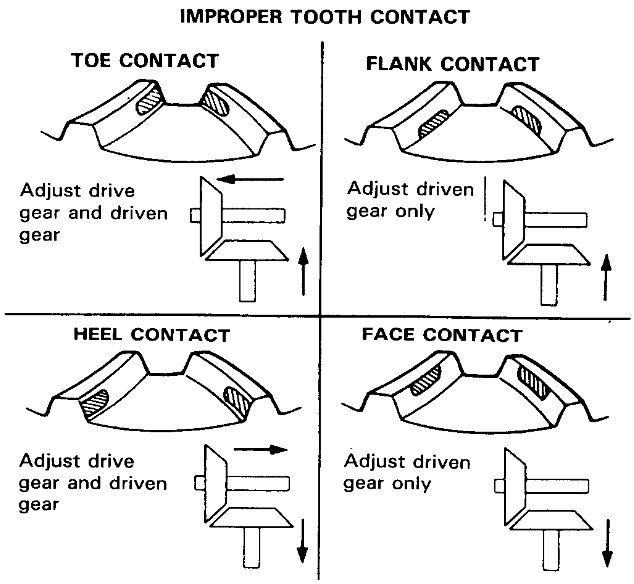
8. Check for proper tooth contact after the backlash adjustment has been completed.
   - Remove the driven gear assembly from the transfer case, and paint the driven gear teeth evenly with Prussian Blue.
   - Reinstall the driven gear assembly in the transfer case and tighten the bolts to the specified torque.
   - With the disengagement lever in 2WD, rotate the companion flange one full turn in both directions.



- Remove the driven gear assembly from the transfer case and note the tooth impression on the gear.

  NOTE: Compare the tooth impression the gear with the examples below and follow the apropriate adjustment instructions.
  Continue the check/adjustment procedure until the tooth contact is correct.

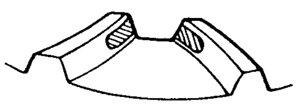


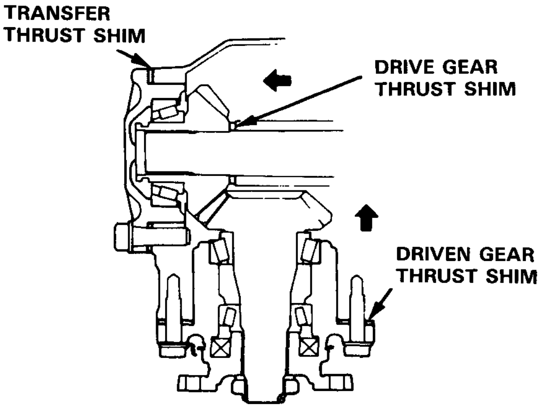


TOE CONTACT

If the pattern shows toe contact, use a thicker drive gear thrust shim for and increase the thickness of the transfer thrust shim an egual amount.

TOE CONTACT



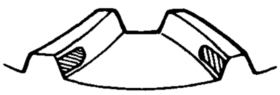


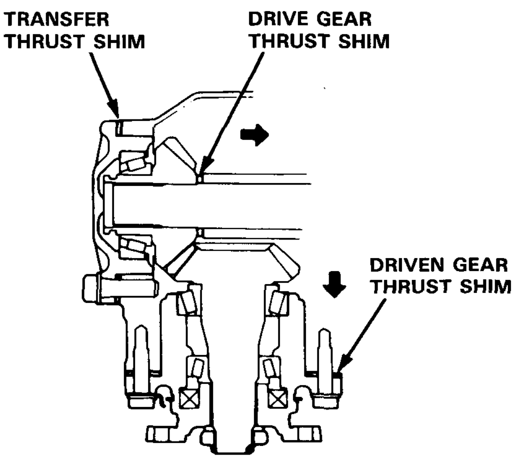
HEEL CONTACT

If the pattern shows heel contact, it indicates too much backlash. To correct, reduce the thickness of the drive gear thrust shim. The thickness of the transfer thrust shim must also be reduced by the amount by which the drive gear thrust shim thickness is reduced.

NOTE: The driven gear thrust shim will have to be changed also to compensate for the change in backlash.

HEEL CONTACT



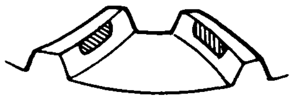


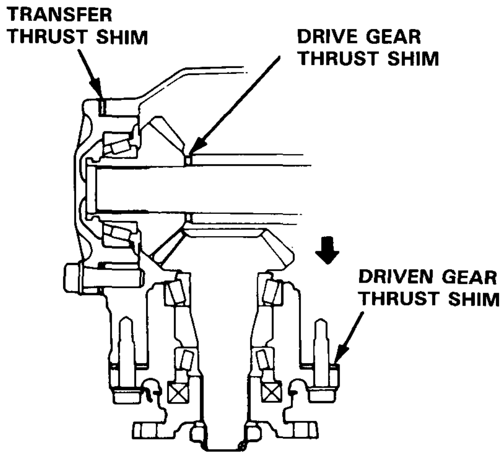
FACE CONTACT

To correct face contact, use a thicker drive gear thrust shim to move the driven gear away from the drive gear. The backlash should remain within the limits.

If the backlash cannot be held within the limits (page 14-429), make correction in the same manner as for HEEL CONTACT.

FACE CONTACT



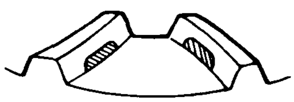


FLANK CONTACT

If the pattern shows flank contact, move the driven gear in toward the drive gear by using a thinner shim for the driven gear.
The backlash must remain within the limits.

If the backlash exceeds the limits (page 14-429), make correction in the same maner as for TOE CONTACT.

FLANK CONTACT



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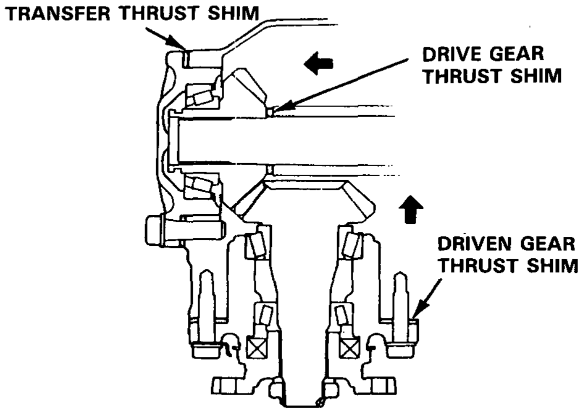
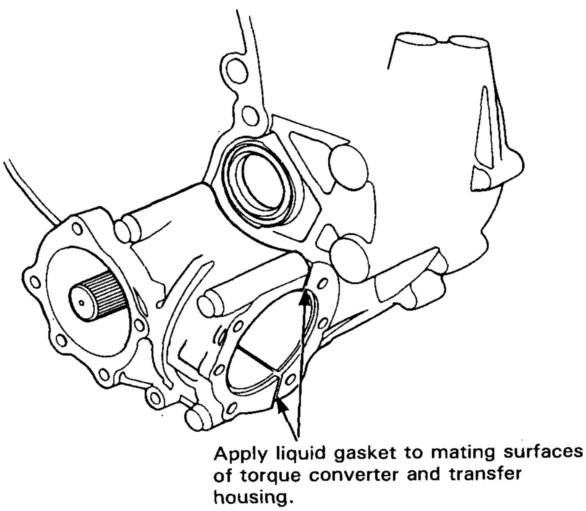
Driven/Drive Gear Reassembly (cont'd)



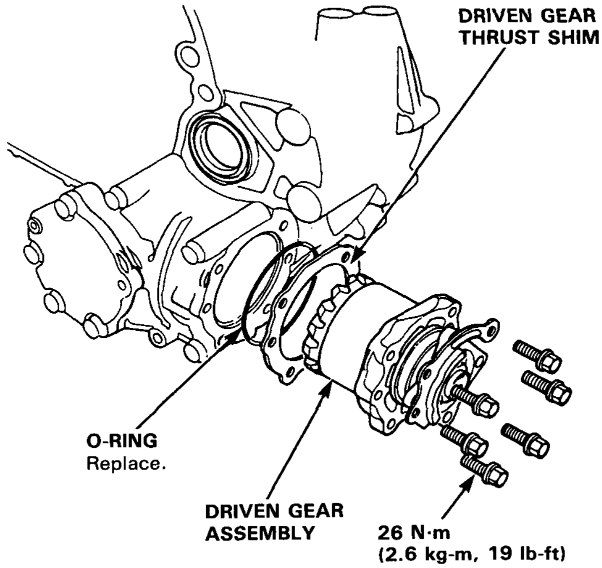
9. When gear tooth contact is correct, install the new special seal, apply liquid gasket to the mating surfaces of the torque converter and transfer housing. Use liquid gasket part No. OY740−99986.

   NOTE:
   - Check that the mating surface are clean and dry before applying liquid gasket.
     Degrease the mating surfaces if necessary.
   - Apply liquid gasket evenly, being careful to cover all the mating surface.
   - To prevent leakage of all, apply liquid gasket to inner threads of bolt holes.
   - Do not install the parts 20 minutes or more have elapsed since applying gasket.
     In that case, reapply liquid gasket after removing the old residue.
   - Wait at least 30 minutes before filling with oil.



10. Stake the locknut into the driven gear shaft.

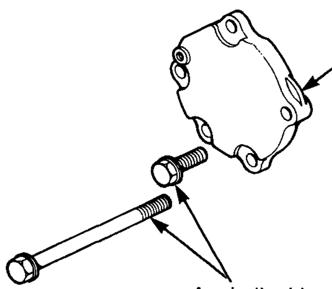
11. Install the thrust shim and O-ring on the driven gear assembly, then install the assembly in the transfer case.

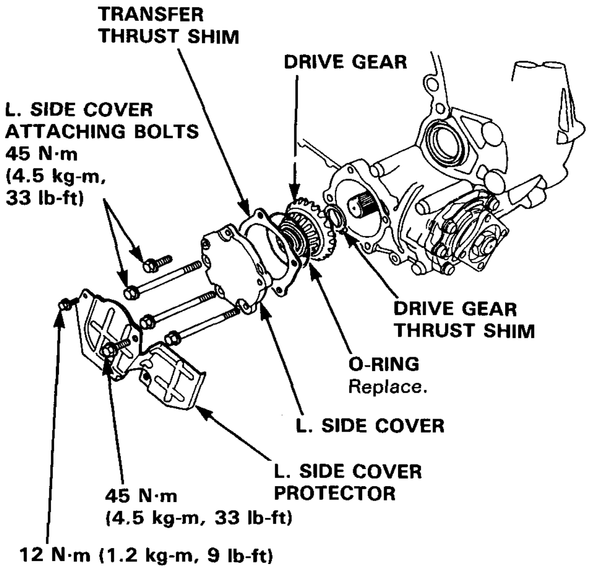


12. Slide the drive gear thrust shim and drive gear onto the transfer shaft.

13. Place the transfer thrust shim and O-ring (74.5 x 2.5 mm) on the L. side cover and install the cover on the transfer case. Tighten the L. side cover attaching bolts, and then install the L. side cover protector.

NOTE:
- Coat the O-ring with oil.
- Apply liquid gasket (P/N OY740—99986) to threads of L. side cover attaching bolts.

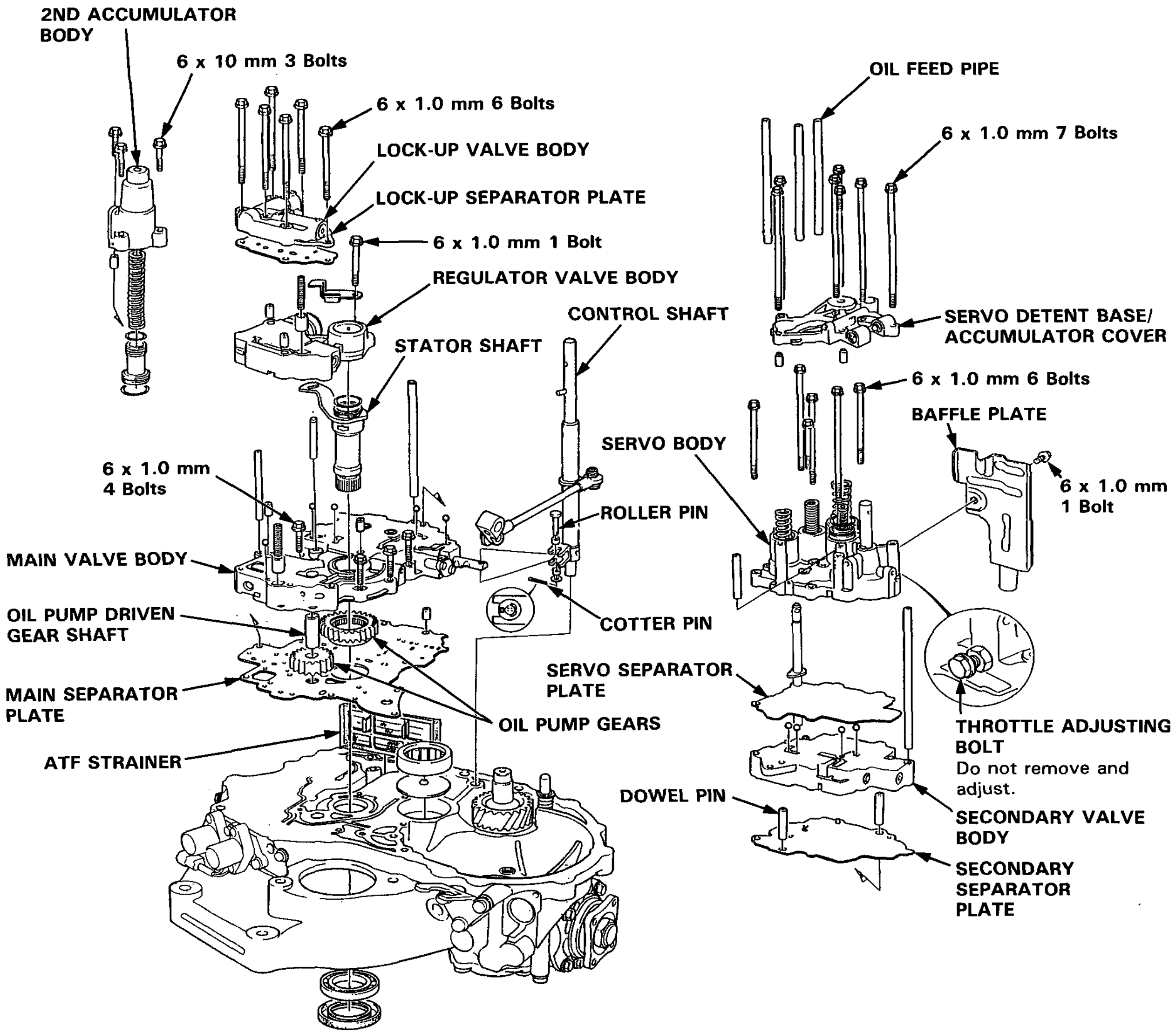




14. Measure the total bearing preload after assembly.

Reassembly

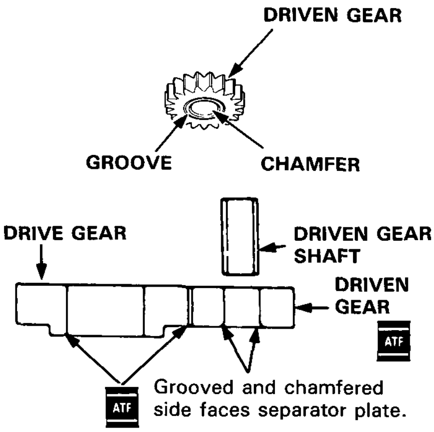
NOTE:
- Coat all parts with ATF.
- Replace the below parts:
  - O-rings
  - Lock washers
  - Gaskets
  - Locknuts
  - Sealing washer



1. Install the ATF strainer in the torque converter housing.

2. Install the main separator plate with 1 dowel pin, then install the oil pump gears and oil pump driven gear shaft.

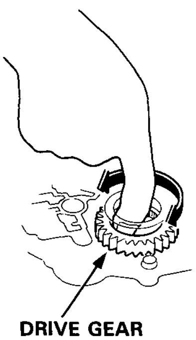
   NOTE: Install the oil pump driven gear with its grooved and chamfered side facing down.

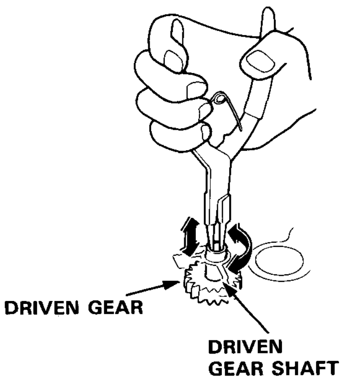


3. Install the main valve body with 4 bolts. And make sure the pump drive gear rotates smoothly in the normal operating direction and pump shaft moves smoothly in the axial and normal operating directions.

4. If the pump gear and pump shaft do not move freely, loosen the valve body bolts, realign the shaft, and then retighten to the specified torque.

   CAUTION: Failure to align the pump shaft correctly will result in seized pump gear or pump shaft.





5. Install the 2nd accumulator piston and spring in the 2nd accumulator body, then install the 2nd accumulator body with 1 dowel pin and 3 bolts on the torque converter housing.

6. Install the stator shaft and stopper shaft.

7. Install the 2 dowel pins, cooler relief valve and spring in the main valve body.

8. Install the regulator valve body with 1 bolt with stopper on the main valve body.

9. Install the torque converter check valve and spring in the regulator valve body.

10. Install the 2 dowel pins and separator plate on the regulator valve body, then install the lock-up valve body with 6 bolts.

11. Install the secondary separator plate with 2 dowel pins on the secondary valve body, then install the secondary valve body on the main valve body.

12. Install the servo separator plate and servo body on the secondary valve body with 6 bolts.

13. Install the oil feed pipe in the servo body, then install the servo detent base/accumulator cover with 2 dowel pins and 7 bolts.

14. Install the baffle plate on the servo body with 1 bolt.

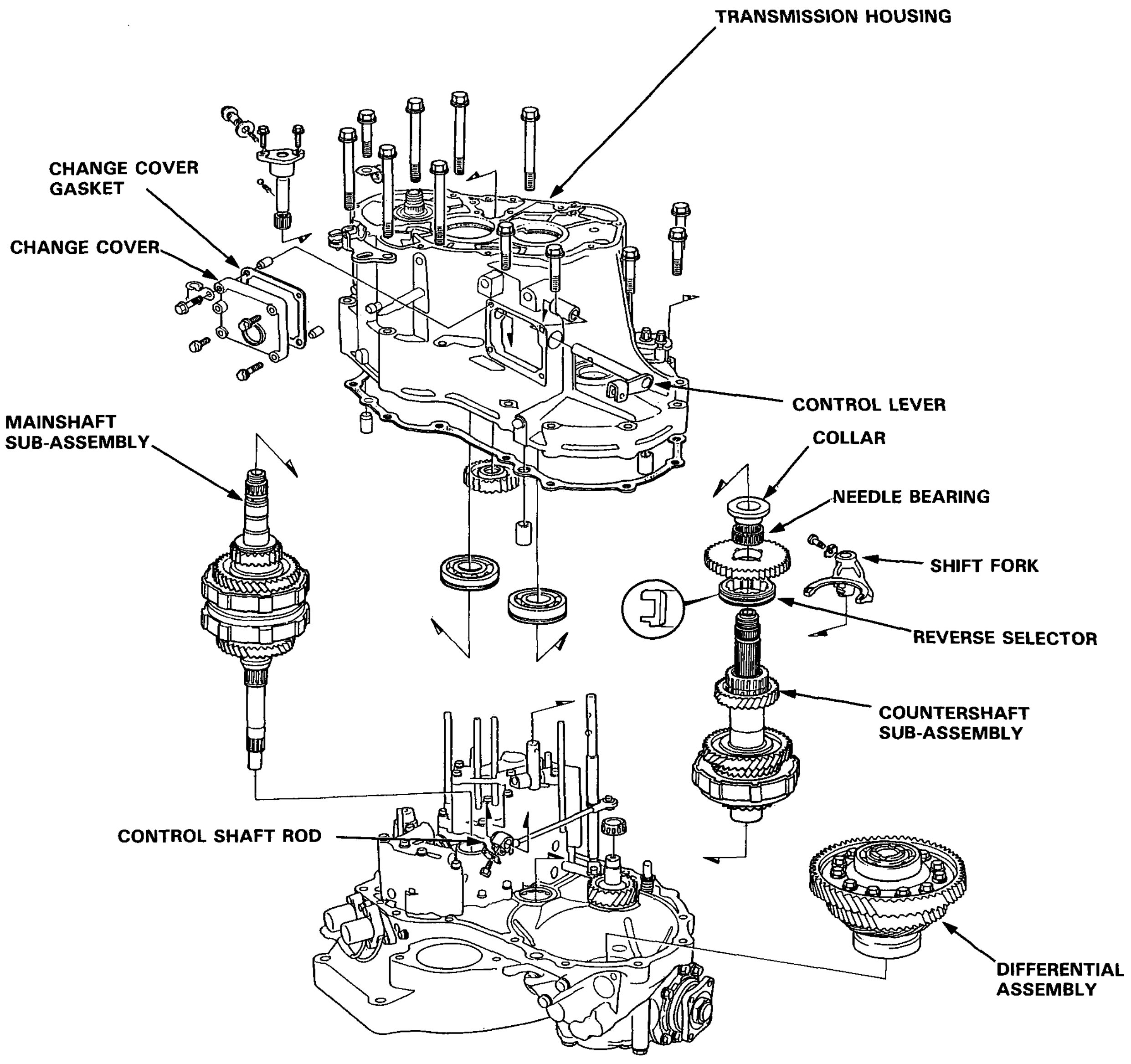
15. Install the control shaft in the torque converter housing, then install the roller pin through the manual valve.

16. Install new cotter pin into the roller pin, then bend the cotter pin.

17. Install 3 oil feed pipes int he servo body, 1 pipe in the secondary valve body and 2 pipes in the main valve body.

(cont'd)

Reassembly (cont'd)

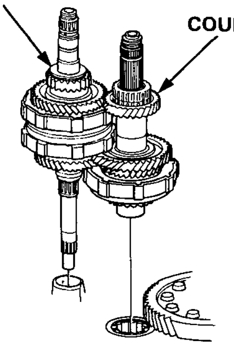


18. Install the sub-shaft assembly in the transmission housing (14-401).

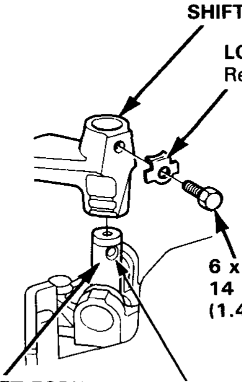
19. Install the reverse idler gear and gear shaft holder in the transmission housing (page 14-416).

20. Install the differential assembly in the torque converter housing.

21. Install the mainshaft sub-assembly and the countershaft sub-assembly together.



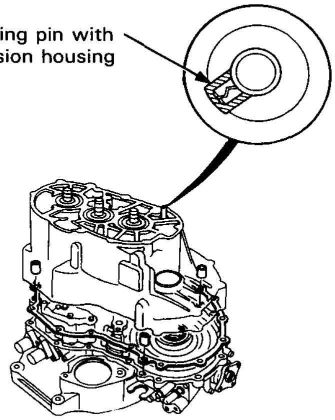
22. Turn the shift fork shaft so large chamfered hole facing fork bolt hole. Then install the shift fork and torque the lock bolt. Bend the lock tab against the bolt head.



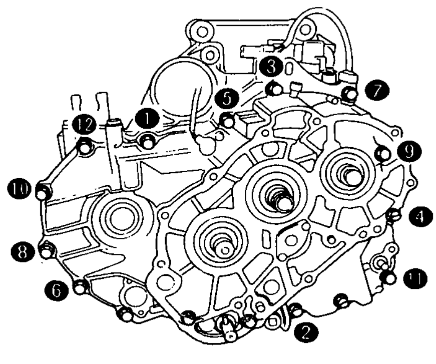
23. Install the reverse gear, needle bearing and reverse gear collar on the countershaft.

24. Align the spring pin with the transmission housing groove by turning the control shaft.

25. Place the transmission housing on the torque converter housing.



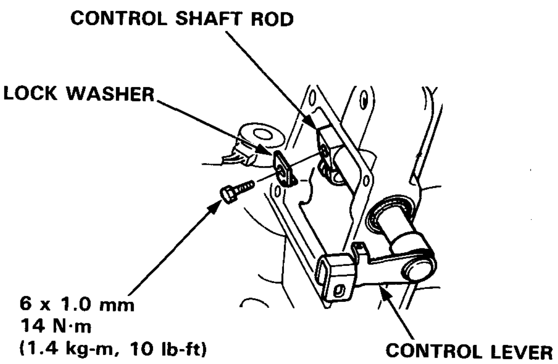
26. Install the transmission housing bolts and transmission hanger, then torque bolts to 55 N·m (5.5 kg-m, 40 lb-ft) in two or more steps as shown.



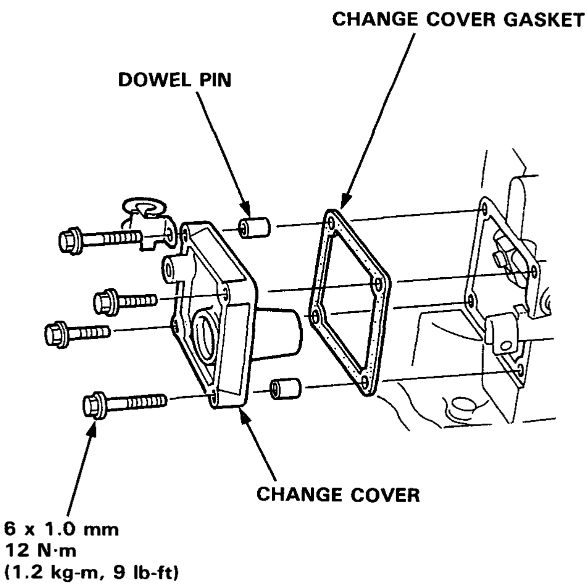
(cont'd)

Reassembly (cont'd)

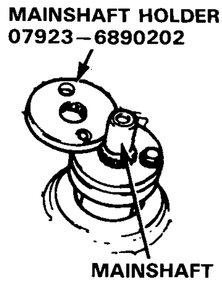
27. Insert the control lever into the control shaft rod through the housing, then torque the bolt with a new lock washer. Bend the lock tab against the bolt head.



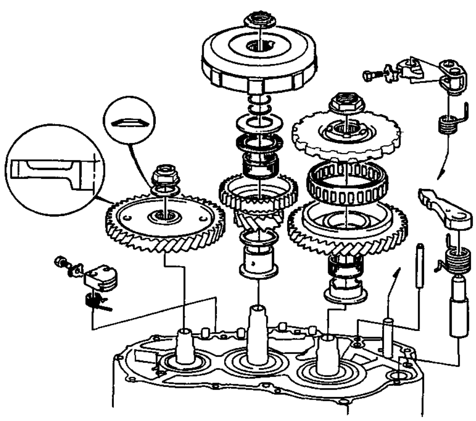
28. Install the change cover.



29. Slip the special tool onto the mainshaft.

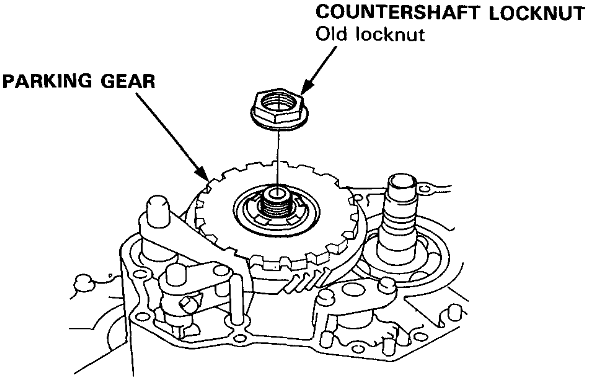


30. Install the parking brake lever on the control shaft.
31. Assemble the one-way clutch and parking gear with the countershaft 1st gear.
32. Install the 1st gear collar, needle bearing and parking gear/1st gear assembly on the countershaft.
33. Install the parking brake pawl with shaft and spring, then engage the parking brake pawl to the parking gear.



34. Tighten the old locknut to press the parking gear to specified torque, then loosen it.

TORQUE: 140 N·m (14.0 kg-m, 101 lb-ft)

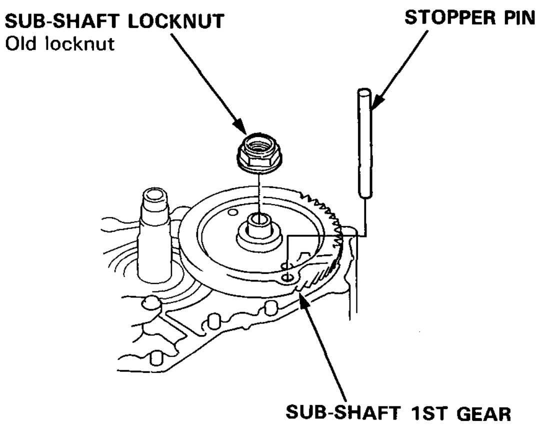


35. Install the 1st gear on the sub-shaft.

36. Align the hole of the subshaft 1st gear with the hold of the transmission housing, then insert a pin to lock the subshaft while tightening the sub-shaft locknut.

37. Tighten the old locknut to press the 1st gear to the specified torque, then loosen it.

TORQUE: 95 N·m (9.5 kg-m, 69 lb-ft)



38. Install the 1st gear collar and thrust washer on the mainshaft.

39. Install new O-rings on the mainshaft.

NOTE: Before installing the O-rings, wrap the shaft splines with tape to prevent damaging the O-rings.

40. Install the thrust washer, thrust needle bearing, needle bearing and 1st gear on the 1st clutch, then install them on the mainshaft.

41. Install new disc spring on the sub-shaft and new locknuts on each shaft.

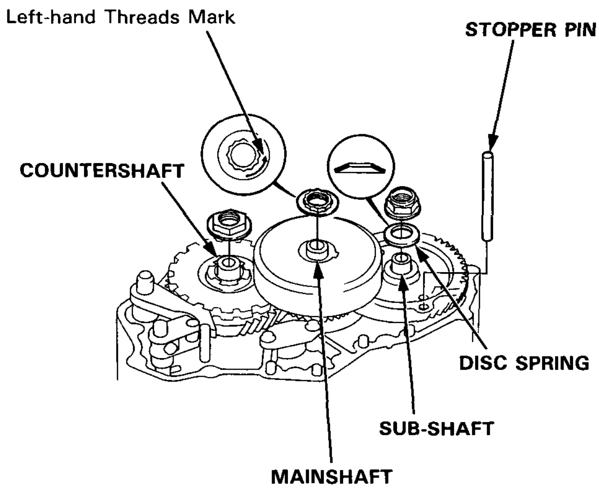
CAUTION: Install the disc spring in the direction shown.

42. Tighten the locknuts to specified torque.

TORQUE:

Mainshaft	**95 N·m (9.5 kg-m, 69 lb-ft)**
Countershaft	**140 N·m (14.0 kg-m, 101 lb-ft)**
Sub-shaft	**95 N·m (9.5 kg-m, 69 lb-ft)**

NOTE: Mainshaft locknut had left-hand threads.

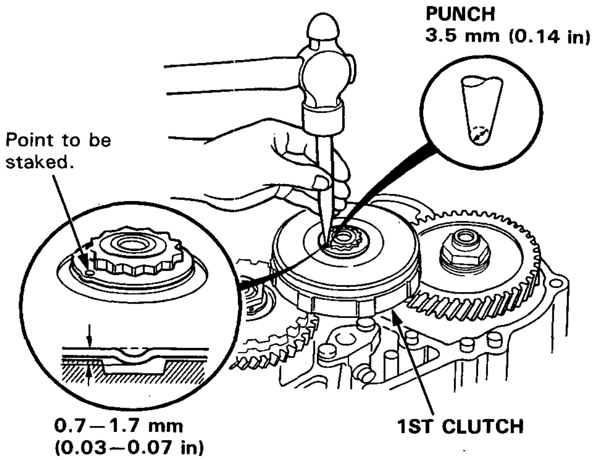


(cont'd)

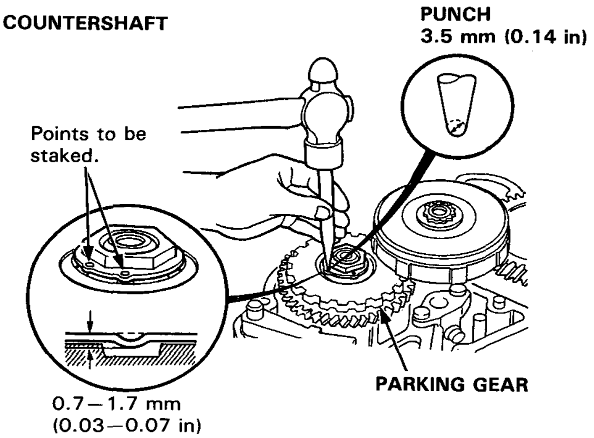
Reassembly (cont'd)

43. Stake each clocknut using a 3.5 mm punch.

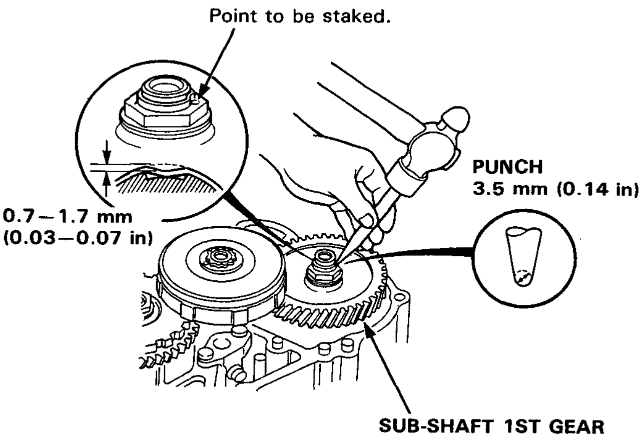
MAINSHAFT



COUNTERSHAFT



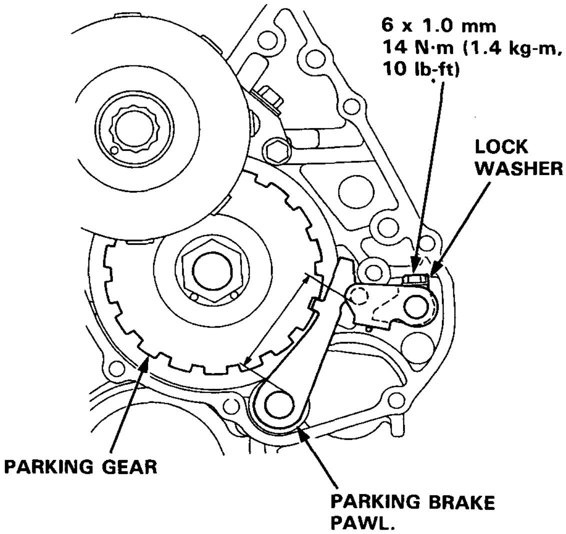
SUB-SHAFT



44. Set the parking breake lever in the PARK position, then verify that the parking brake pawl engageds the parking gear.

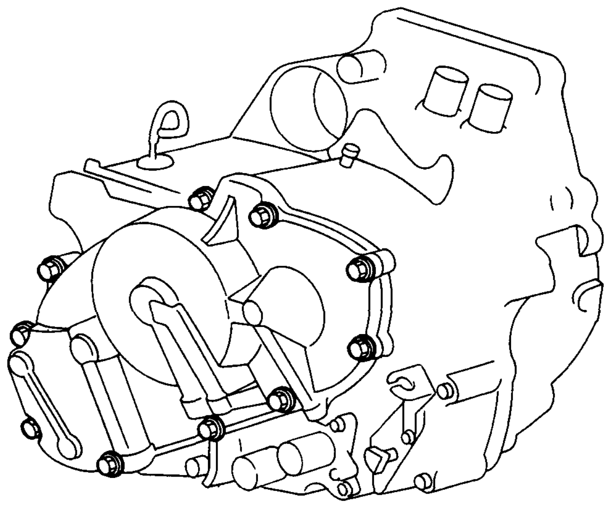
45. If the pawl does not engage fully, check the parking brake pawl stopper clearance as described on page 14-442.

46. Tighten the lock bolt and bend over the lock tab.



47. Install the R. side cover.

TORQUE: 12 N·m (1.2 kg-m, 9 lb-ft)



48. Install the throttle control lever with a new lock washer on the end of the throttle control shaft. Tighten the lock bolt and bend the lock tab.

TORQUE: 8 N·m (0.8 kg-m, 6 lb-ft)

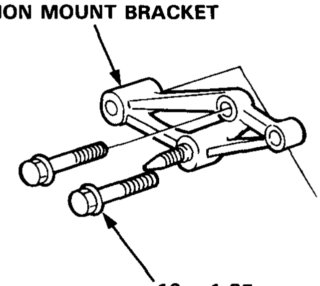
49. Install the ATF cooler pipes with new sealing washers.

TORQUE: 29 N·m (2.9 kg-m, 21 lb-ft)

50. Install the ATF level gauge.

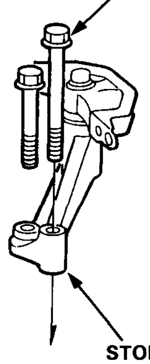
51. Install the transmission mount bracket ont he transmission housing.

TORQUE: 39 N·m (3.9 kg-m, 28 lb-ft)

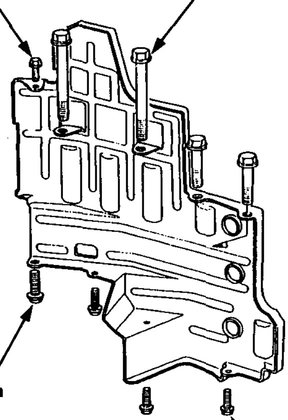


52. Install the stopper mount bracket on the transmission housing.

TORQUE: 65 N·m (6.5 kg-m, 47 lb-ft)



53. Install the transmission under guard.

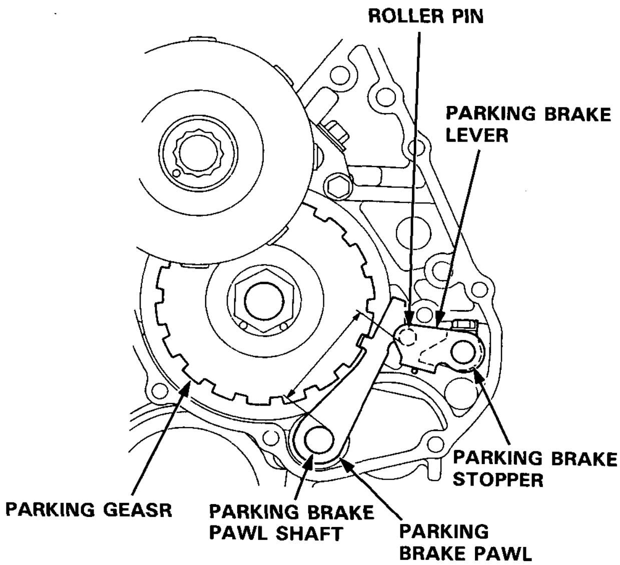


Parking Brake Stopper

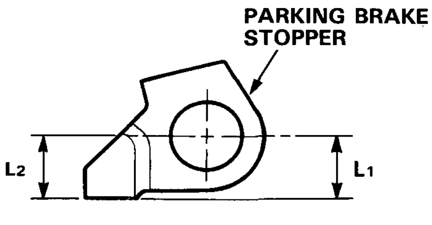
Inspection/Adjustment

1. Set the parking brake lever in the PARK position.
2. Measure the distance between the face of the parking brake pawl shaft and face of the parking brake lever roller pin as shown.

   STANDARD: 57.2—58.2 mm (2.25—2.29 in)



3. If the measurment is out of tolerance, select and install the appropriate parking brake stopper from the table below.



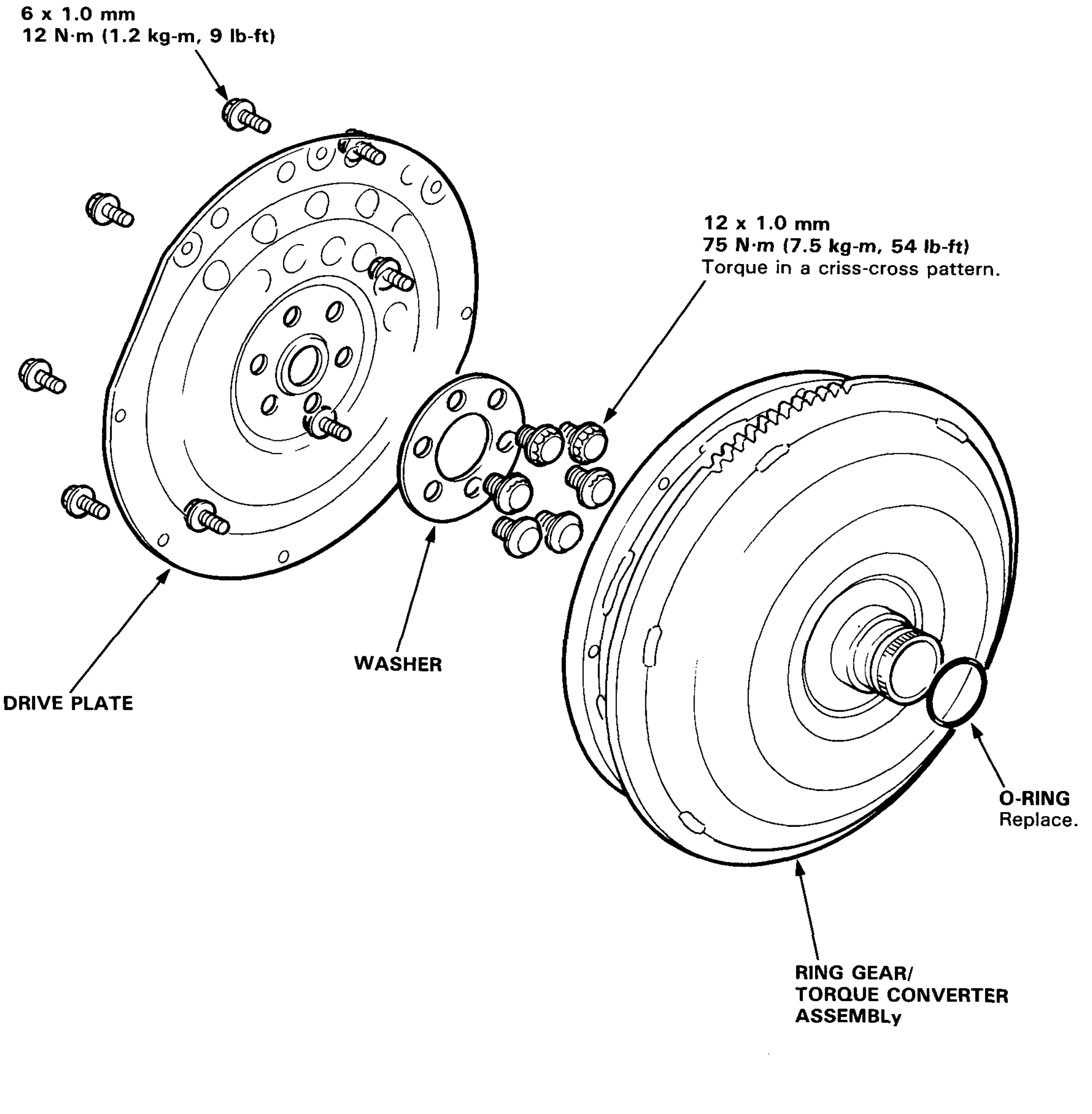
PARKING BRAKE STOPPER

Mark	Part Number	L_1	L_2
1	24537—PA9—003	11.00 mm (0.433 in)	11.00 mm (0.433 in)
2	24538—PA9—003	10.80 mm (0.425 in)	10.65 mm (0.419 in)
3	24539—PA9—003	10.60 mm (0.417 in)	10.30 mm (0.406 in)

4. After replacing the parking brake stopper, make sure the distance is within torelance.

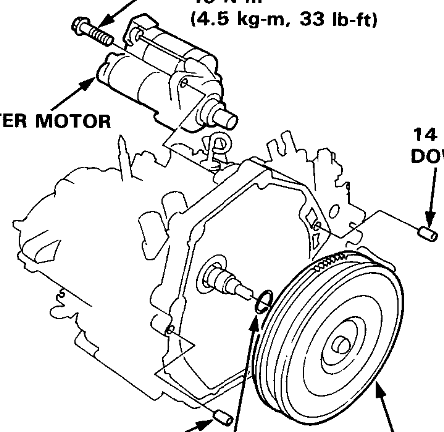
Torque Converter

Disassembly



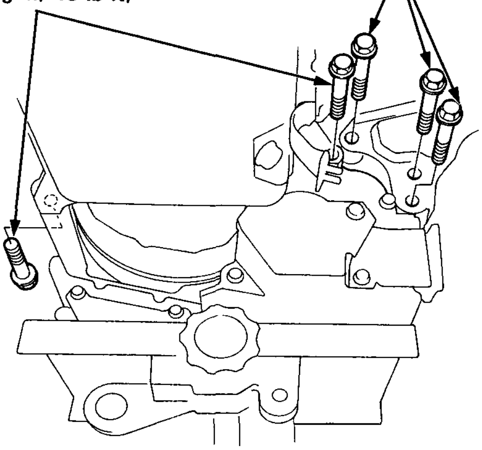
Installation

1. Install the starter motor on the torque converter housing, and install the 14 mm dowel pins in the torque converter housing.

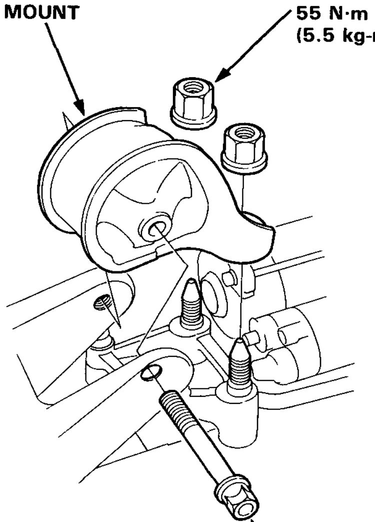


2. Place the transmission on a jack, and raise to the engine level.

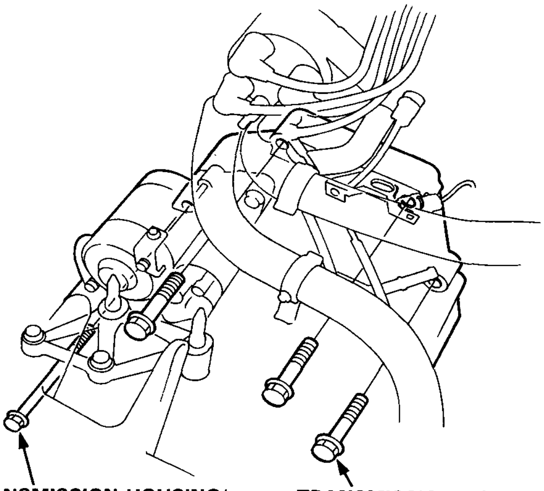
3. Attach the transmission on the engine, then install the transmission housing mounting bolts and rear engine mounting bolts.



4. Install the transmission side mount.



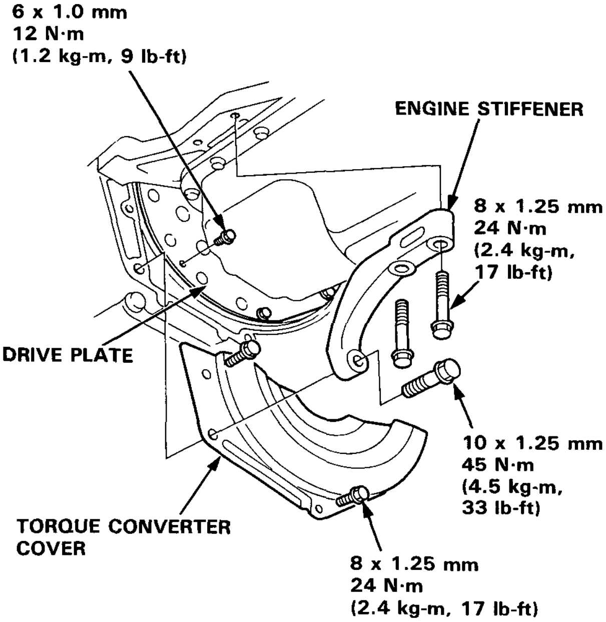
5. Install the transmission housing mounting bolts and starter motor mounting bolt.



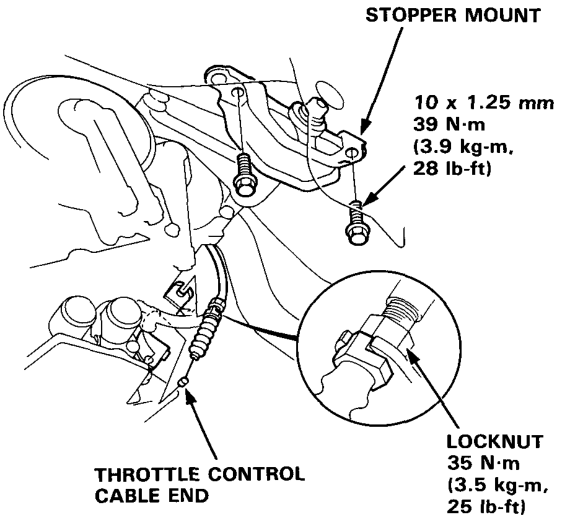
6. Remove the transmission jack and the hoist from the engine

7. Attach the torque converter to the drive plate with 8 bolts and torque to 12 N·m (1.2 kg-m, 9 lb-ft). Rotate the crank-shaft as necessary to tighten the bolts to 1/2 of the specified torque, then final torque, in a criss-cross pattern. Check for free rotation after tightening the last bolt.

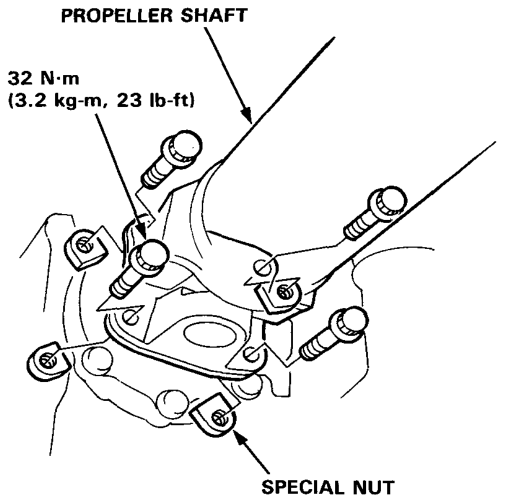
8. Install the torque converter cover and engine stiffener.



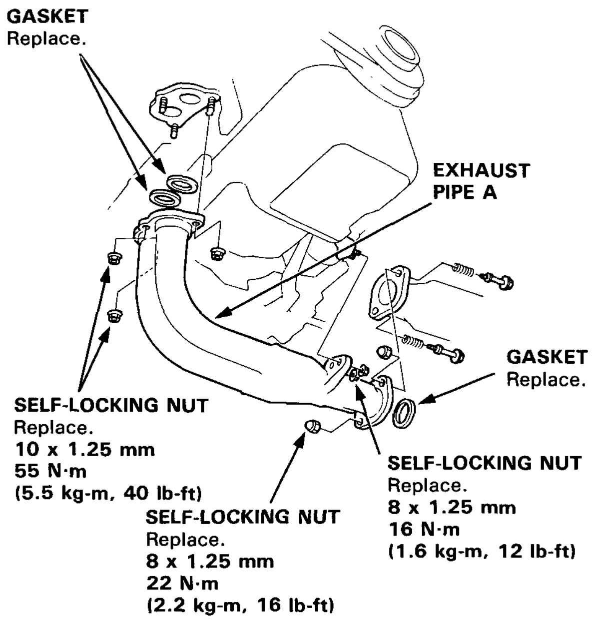
9. Connect the throttle control cable and install the stopper mount bolts.



10. Install the propeller shaft on the transfer.



11. Install the exhaust pipe A.



(cont'd)

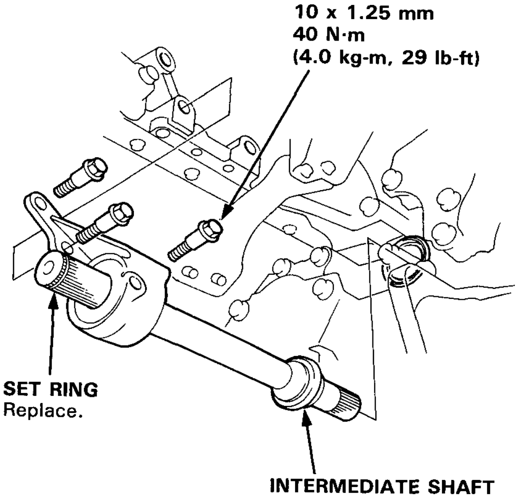
Installation (cont'd)

12. Install a new set ring on the end of the right driveshaft and intermediate shaft.

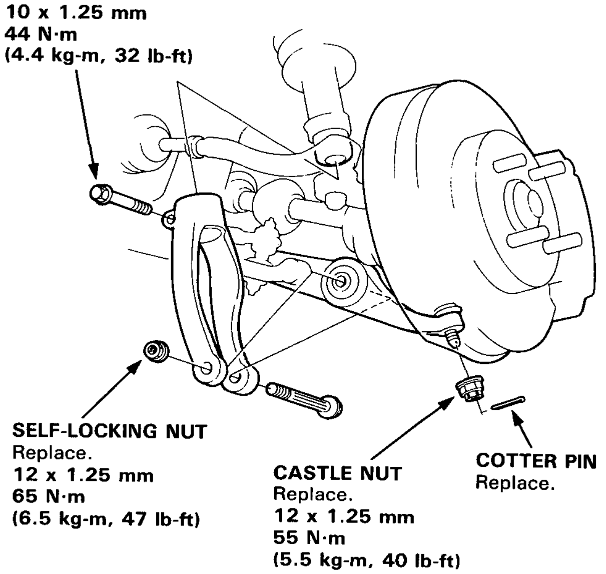
13. Install the intermediate shaft.

14. Install the right and left driveshafts.

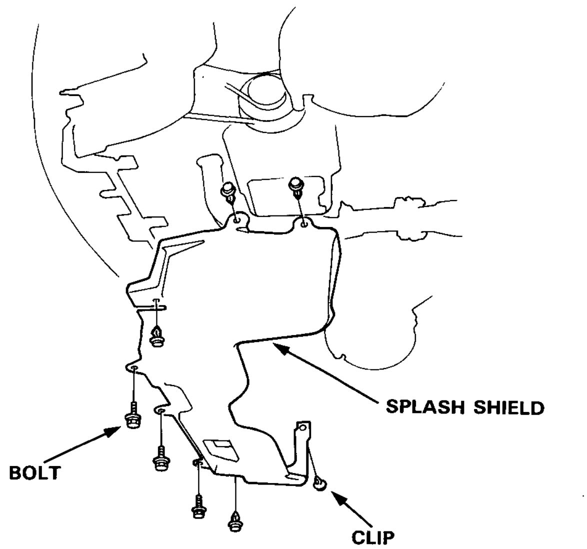
NOTE: Turn the right and left steering knuckle fully outward, and axial into the differential until you feel its spring clip engage the side gear.



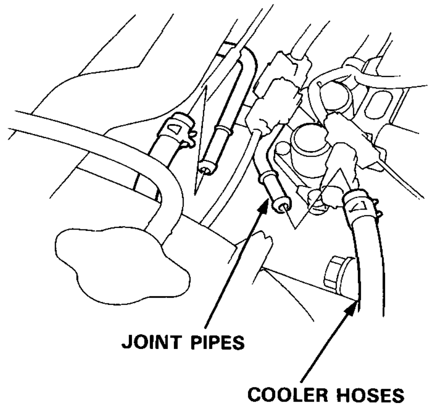
15. Install the damper fork. And install the boll joint to the lower arm with a new castle nuts and cotter pins.



16. Install the splash shield.

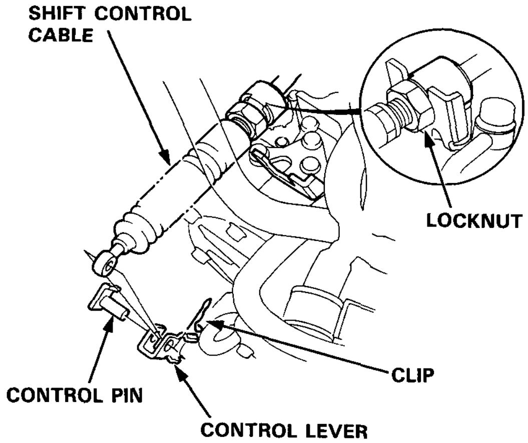


17. Connect the ATF cooler houses to the joint pipes.

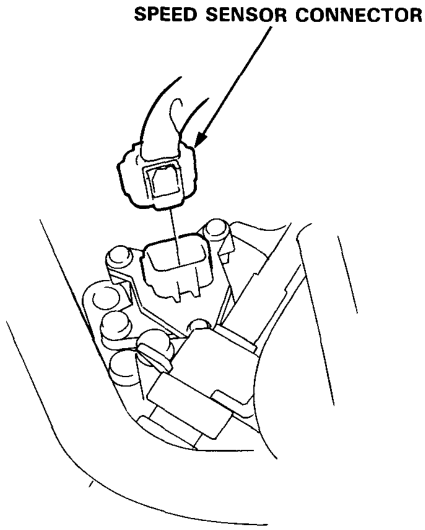


18. Install the shift cable with the control pin to the control lever, then install the clip.

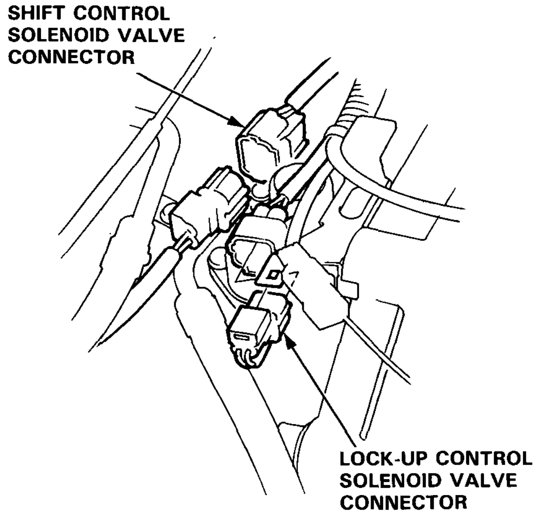
19. Install the shift cable on the shift cable stay, then torque the locknut to 35 N·m (3.5 kg-m, 25 lb-ft).



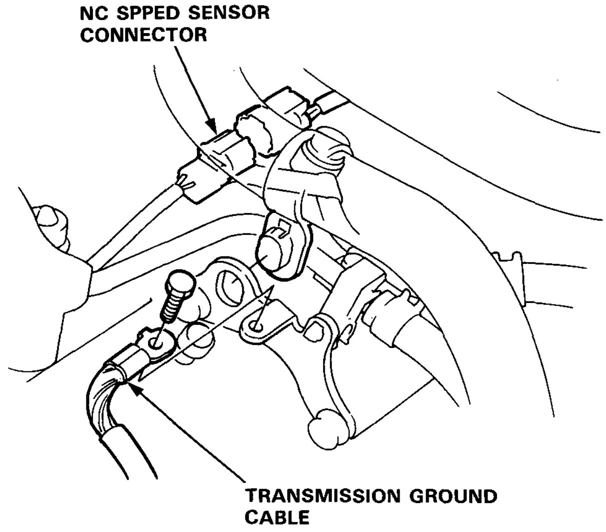
20. Connect the speed sensor connector.



21. Connect the lock-up control solenoid valve and shift control solenoid valve connectors.



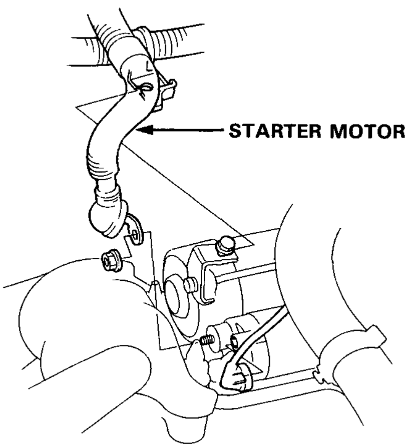
22. Connect the transmission ground cable and the NC speed sensor connector.



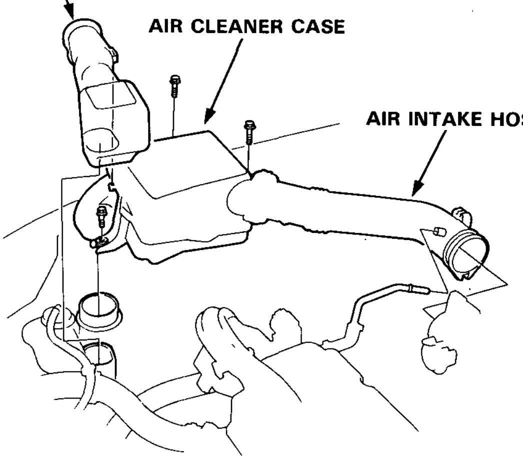
(cont'd)

Installation (cont'd)

23. Connect the starter motor cable.



24. Install the air cleaner case, air intake hose and resonator.



25. Refill the transmission with ATF (see page 14-355).

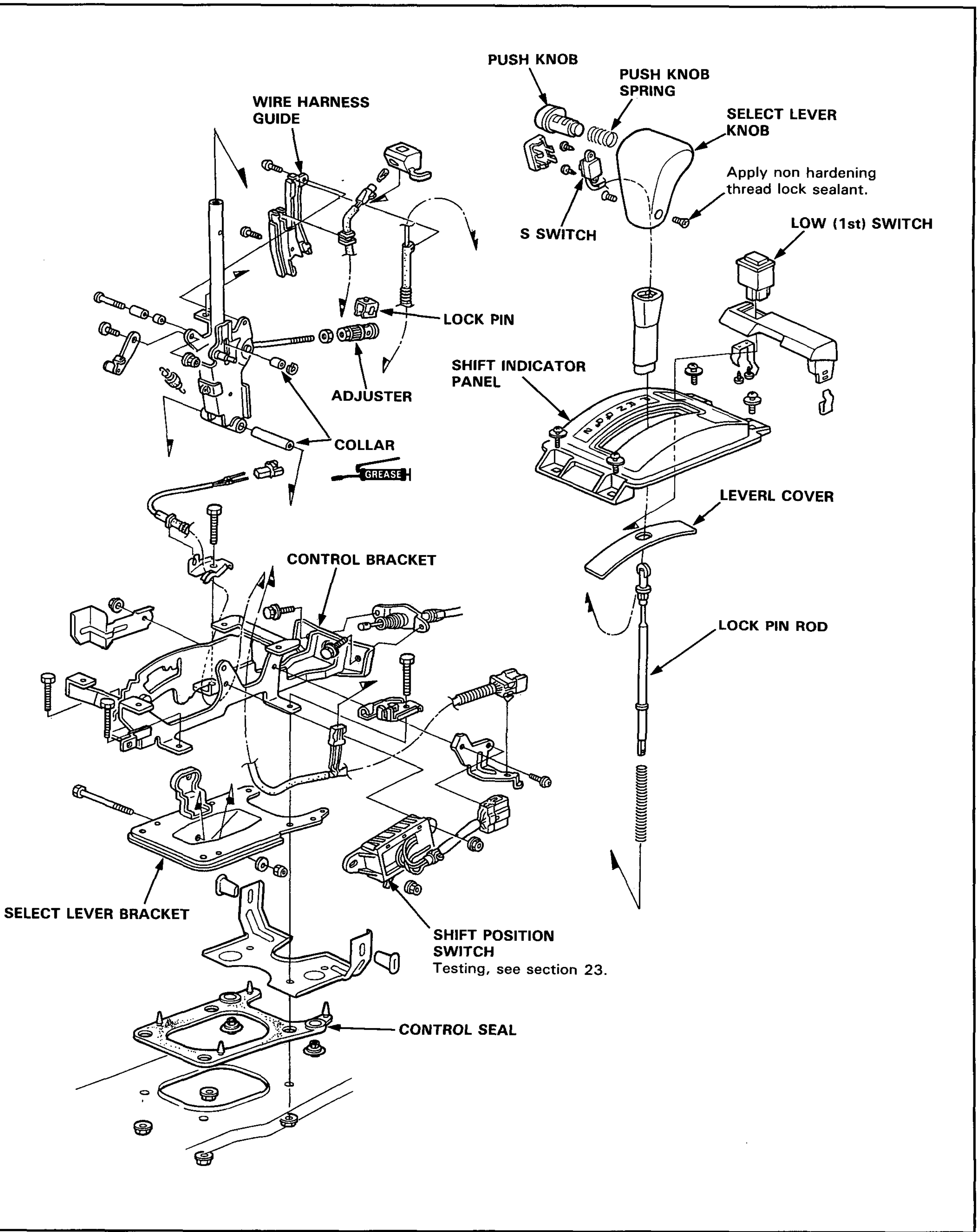
26. Connect the battery positive (+) and negative (−) cables to the battery.

27. Start the engine. Set the parking brake, and shift the transmission through all geara three times. Check for proper shift cable adjustment.

28. Let the engine reach operating temperature with the transmission in Neutral or Park, then turn it off and check fluid level.

29. Road test as described on page 14-352 and 353.

Gear Shift Selector



Shift Cable

Removal/Installation

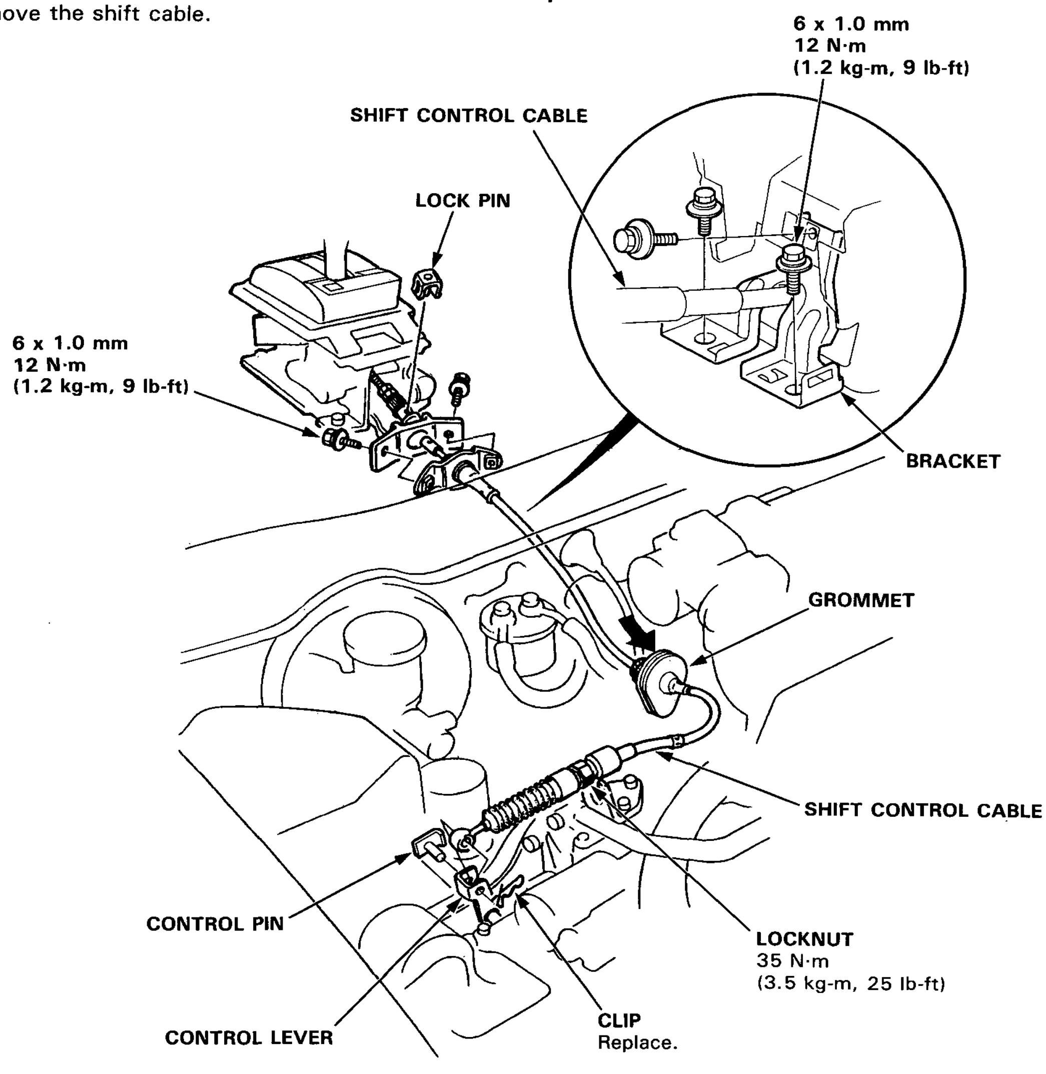
⚠WARNING

- **Make sure jacks and safety stands are placed properly and hoist brackets are attached to correct positions on the engine.**
- **Apply parking brake and block rear wheels, so car will not roll off stands and fall on you while working under it.**

1. Remove the shift cable by removing the cotter pin, control pin, control lever roller and loosening the locking nut.
2. Remove the center console (see page 20-80).
3. Remove the lock pin from the cable adjuster, then remove the shift cable.
4. Remove the shift cable bracket.
5. Remove the grommet.
6. Pull the shift cable out from the engine compartment.

   CAUTION: Take care not to bend the cable when removing it.
7. Install the shift cable in the reverse order of removal.

   NOTE: On reassembly, check the cable adjustment (page 14-449).

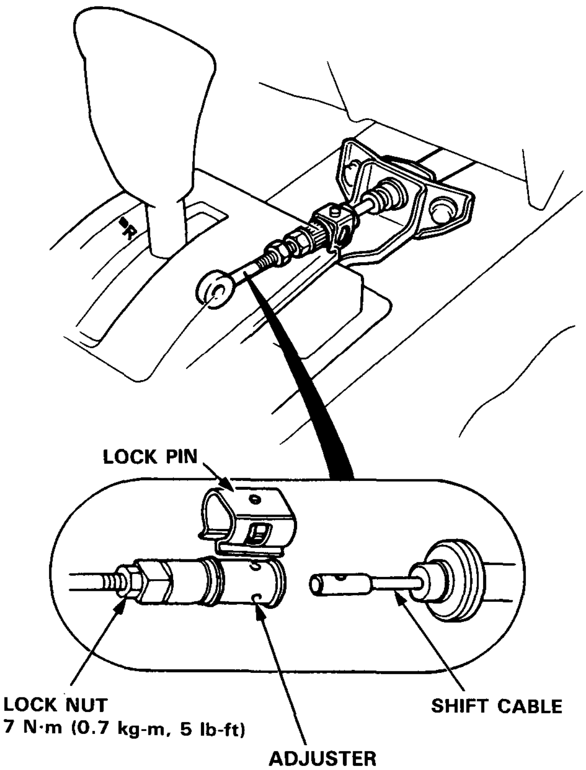


Adjustment

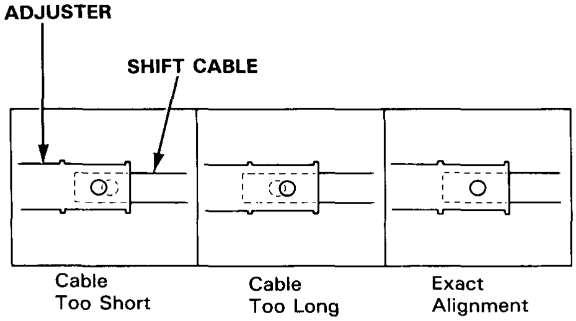
1. Start the engine. Shift to reverse to see if the reverse gear engages. If not, refer to troubleshooting on page 14-348 thru 351.

2. With the engine off, remove the center console (see page 20-80).

3. Shift to [N] or [R] position, then remove the lock pin from the cable adjuster.



4. Check that the hole in the adjuster is perfectly aligned with the hole in the shift cable. There are two holes in the end of the shift cable. They are positioned 90° agart to allow cable adjustment in 1/4 turn increments.



5. If not perfectly aligned, loosen the locknut on shift cable and adjust as required.

6. Tighten the locknut to 7 N·m (0.7 kg-m, 5 lb-ft).

7. Install the lock pin on the adjuster. If you feel the lock pin binding as you reinstall it, the cable is still out of adjustment and must be readjusted.

8. Move the select to each gear and verify that the shift position indicator follows the shift position console switch.

9. Start the engine and check the shift lever in all gears. If any gear does not work properly, refer to troubleshooting on page 14-42 thru 45.

Throttle Control Cable

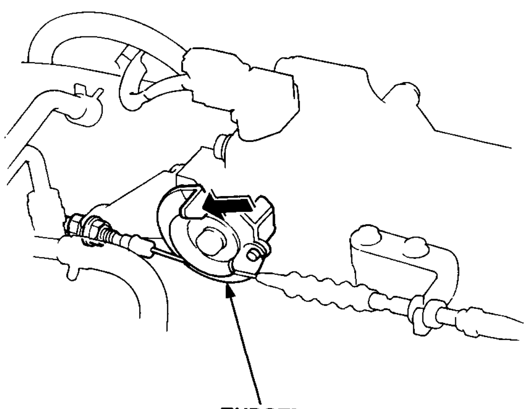
Inspection

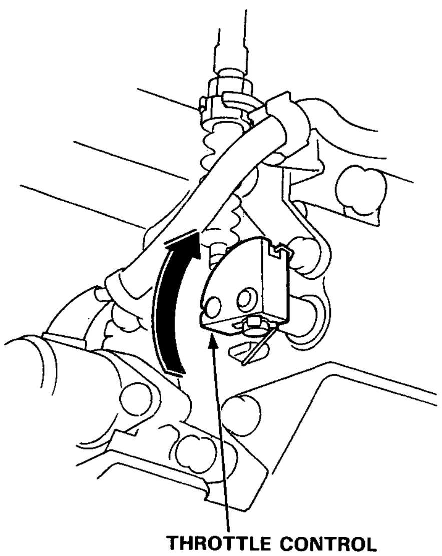
NOTE: Before inspecting the throttle control cable, make sure;

- Throttle calber free play is correct (see page 11-364).
- Idle speed is correct (see page 11-326).
- To warm up the engine to normal operating temperature (cooling fan comes on).

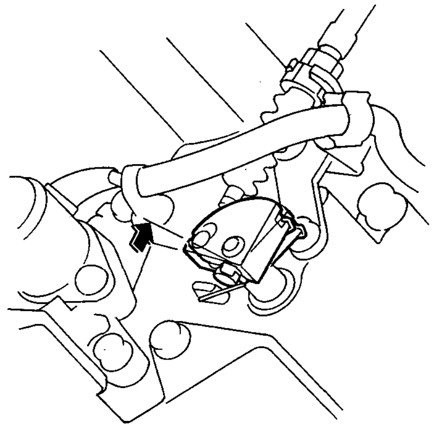
1. Verify that the throttle control lever is synchronized with the throttle linkage while depressing and releasing the accelerator pedal.

2. If the throttle control lever is not synchronized with the throttle linkage, adjust the throttle control cable.



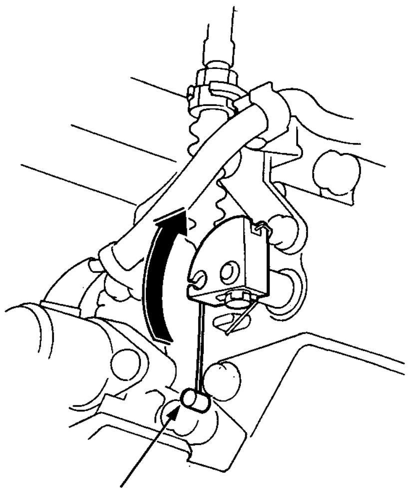


3. Check that there is play in the throttle control lever while depressing the accelerator pedal to the full-throttle position.



4. Remove the cable end of the throttle control cable from the throttle control lever.

5. Check that the throttle control lever moves smoothly.

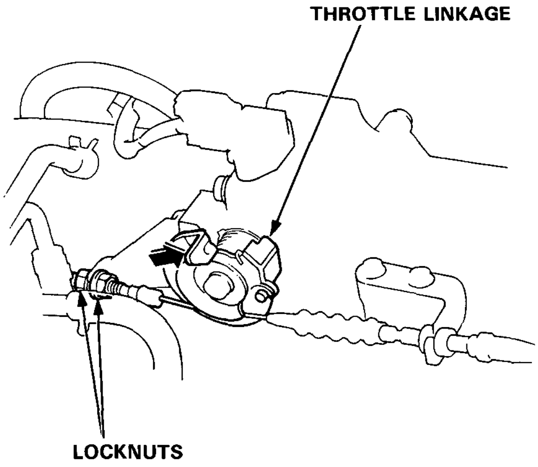


Adjustment

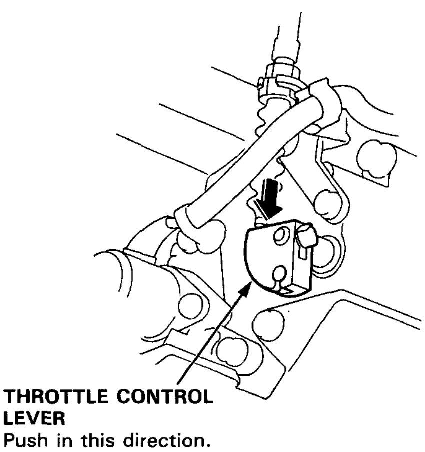
NOTE: Before inspecting the throttle control cable, make sure;

- Throttle calber free play is correct (see page 11-364).
- Idle speed is correct (see page 11-326).
- To warm up the engine to normal operating temperature (cooling fan comes on).

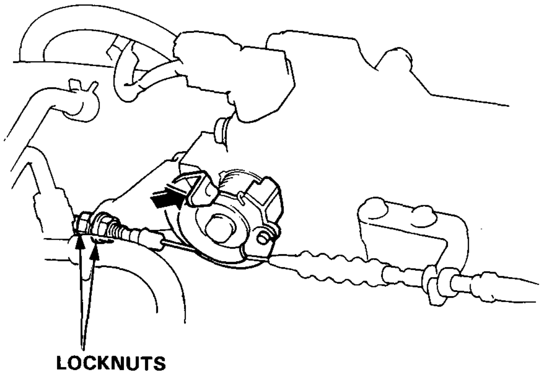
1. Verify that the throttle linkage is in the full-closed position.
2. Loosen the locknut of the throttle control cable at the throttle linkage.



3. Remove the free play of the throttle control cable with the locknut, while pushing the throttle control lever to the full-closed position as shown.



4. Tighten the locknut.



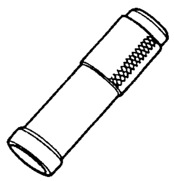
5. After tightening the locknuts, inspect the synchronization and throttle control lever movement.

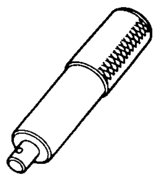
Differential

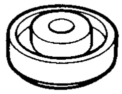
2WD Manual Transmission Differential

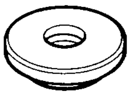
Special Tools

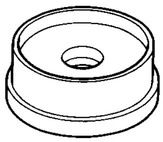
Ref. No.	Tool Number	Description	Qty	Remarks
①	07746–0030100	Inner Handle C	1	
②	07749–0010000	Outer Handle A	1	
③	07946–SD90200	Oil Seal Driver	1	
④	07947–6110501	Oil Seal Driver	1	
⑤	07NAD–P200100	Oil Seal Driver	1	

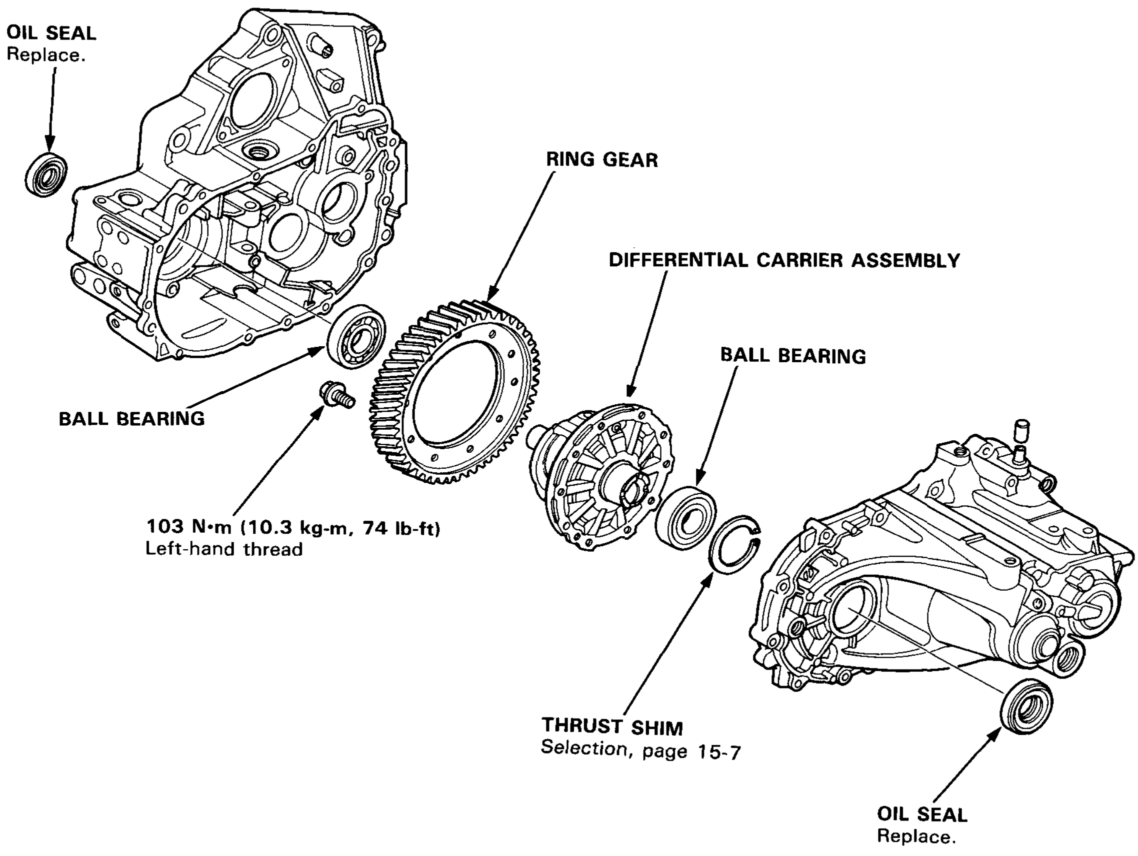

①


②


③


④


⑤



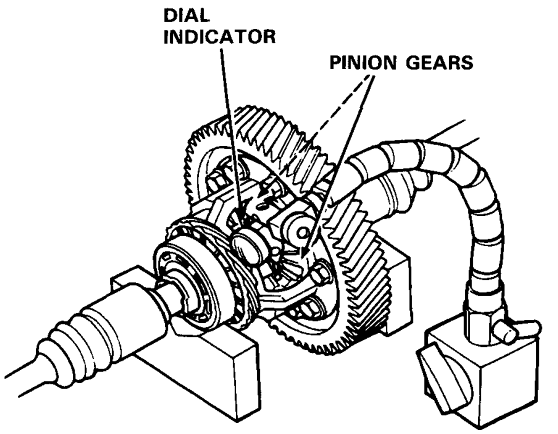
OIL SEAL
Replace.
RING GEAR
DIFFERENTIAL CARRIER ASSEMBLY
BALL BEARING
BALL BEARING
103 N•m (10.3 kg-m, 74 lb-ft)
Left-hand thread
THRUST SHIM
Selection, page 15-7
OIL SEAL
Replace.

Differential

Backlash Inspection

1. Place differential assembly on V-blocks and install both axles.
2. Check backlash of both pinion gears.

   Standard (New): 0.05–0.15 mm (0.002–0.006 in)

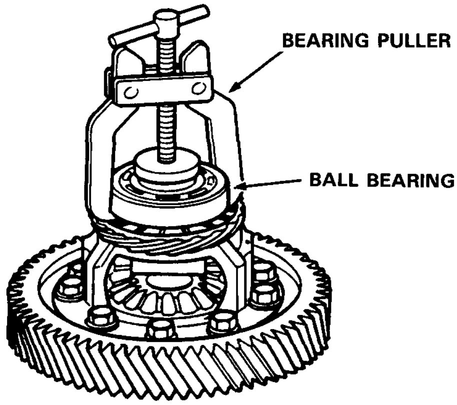


3. If the backlash is not within the standard, replace the differential carrier assembly.

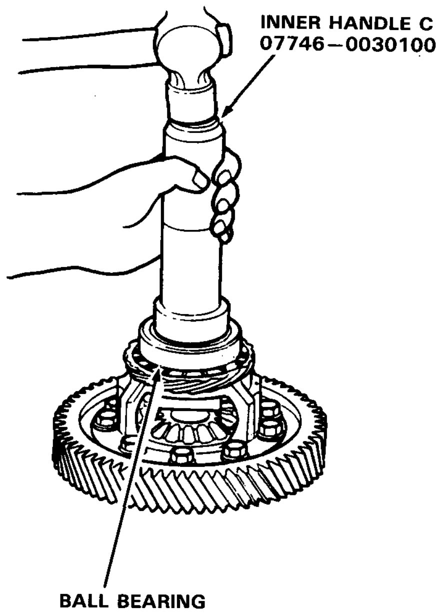
Bearing Replacement

NOTE: Check bearings for wear and rough rotation. If bearings are OK, removal is not necessary.

1. Remove bearings using a standard bearing puller.



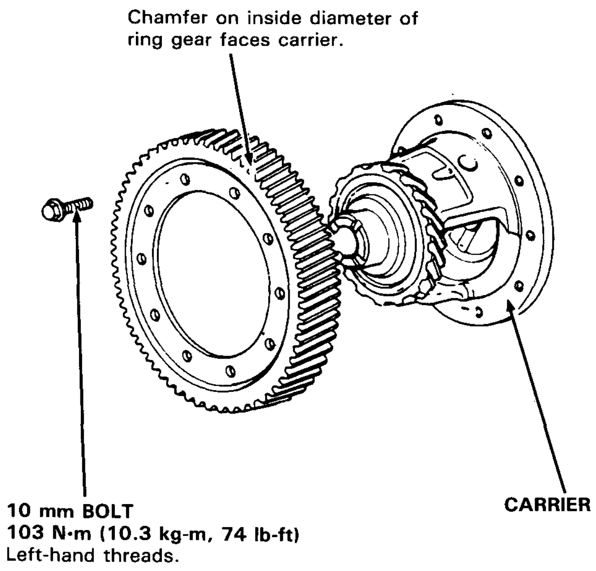
2. Install new bearings.



Ring Gear Replacement

1. Remove the ring gear from the differential carrier.

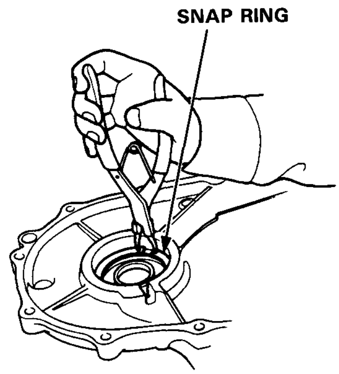
   NOTE: The ring gear bolts has left-hand threads.



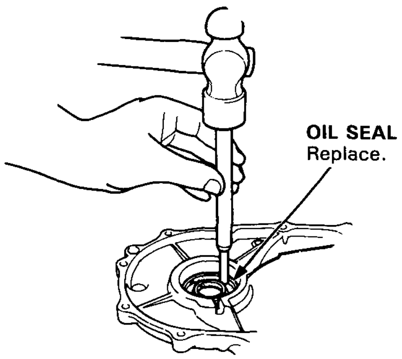
2. Install the ring gear.

Oil Seal Removal

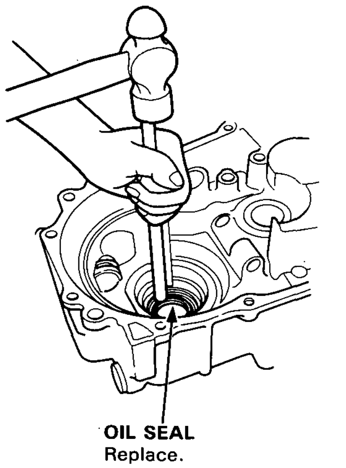
1. Remove the differential assembly.
2. Remove the snap ring from the transmission housing.



3. Remove the oil seal from the transmission housing.



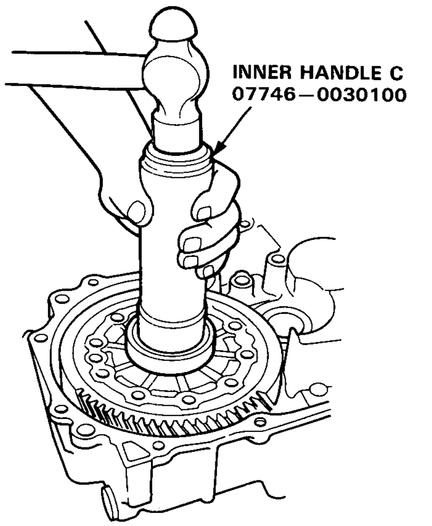
4. Remove the oil seal from the clutch housing.



Differential

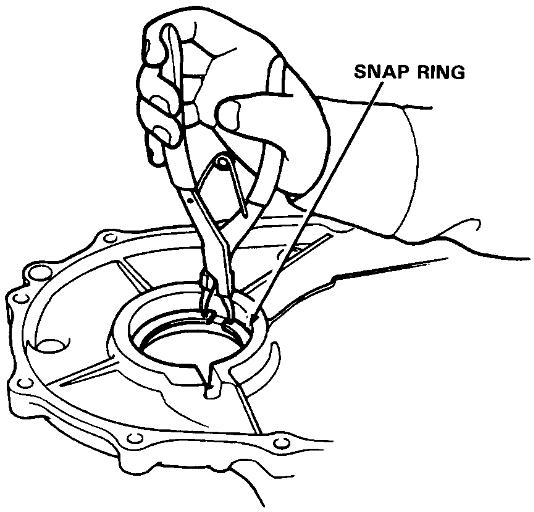
Installation

1. Install the differential assembly in the clutch housing.



2. Install the thrust shim.

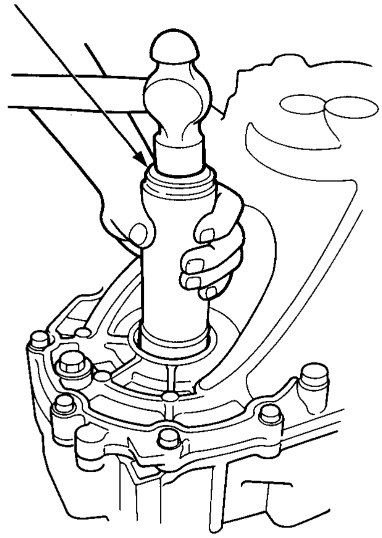
   NOTE: Install the snap ring that was removed.



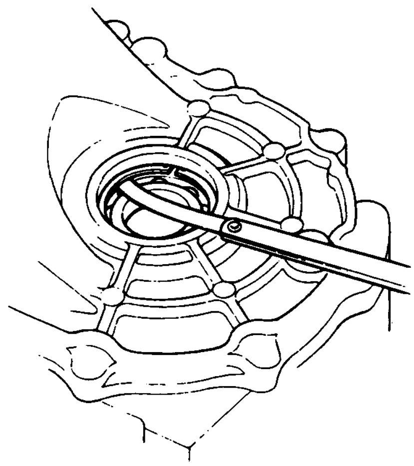
3. Install the transmission housing (see section 13).

   NOTE: Do not apply liquid gasket to the mating surface of the clutch housing.

4. Tighten the transmission bolts (see section 13).
5. Use special tools to bottom differential assembly in clutch housing.



6. Measure clearance between snap ring and outer race of bearing in transmission housing.



7. If out of limits, select a new snap ring from following table and install.

   Side Clearance: 0–0.10 mm (0.03937 in)

72 mm Snap Ring: Except D16Z6, D16Z7, D16A7, D16A8, D16A9, B16A2

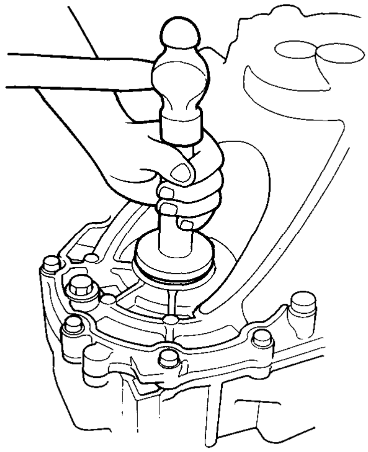
PART NUMBER	THICKNESS
41441–PL3–A00	1.0 mm (0.03937 in)
41442–PL3–A00	1.1 mm (0.04331 in)
41443–PL3–A00	1.2 mm (0.04724 in)
41444–PL3–A00	1.3 mm (0.05118 in)
41445–PL3–A00	1.4 mm (0.05512 in)
41446–PL3–A00	1.5 mm (0.05906 in)
41447–PL3–A00	1.6 mm (0.06299 in)
41448–PL3–A00	1.7 mm (0.06693 in)
41449–PL3–A00	1.8 mm (0.07087 in)
41450–PL3–A00	1.05 mm (0.04134 in)
41451–PL3–A00	1.15 mm (0.04528 in)
41452–PL3–A00	1.25 mm (0.04921 in)
41453–PL3–A00	1.35 mm (0.05315 in)
41454–PL3–A00	1.45 mm (0.05709 in)
41455–PL3–A00	1.55 mm (0.06102 in)
41456–PL3–A00	1.65 mm (0.06496 in)
41457–PL3–A00	1.75 mm (0.06890 in)

80 mm Snap Ring: D16Z6, D16Z7, D16A7, D16A8, D16A9, B16A2

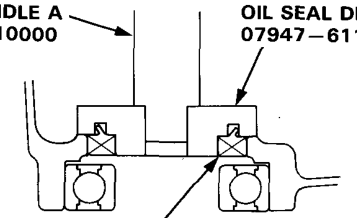
PART NUMBER	THICKNESS
41441–PL3–B00	1.0 mm (0.03937 in)
41442–PL3–B00	1.1 mm (0.04331 in)
41443–PL3–B00	1.2 mm (0.04724 in)
41444–PL3–B00	1.3 mm (0.05118 in)
41445–PL3–B00	1.4 mm (0.05512 in)
41446–PL3–B00	1.5 mm (0.05906 in)
41447–PL3–B00	1.6 mm (0.06299 in)
41448–PL3–B00	1.7 mm (0.06693 in)
41449–PL3–B00	1.8 mm (0.07087 in)
41450–PL3–B00	1.05 mm (0.04134 in)
41451–PL3–B00	1.15 mm (0.04528 in)
41452–PL3–B00	1.25 mm (0.04921 in)
41453–PL3–B00	1.35 mm (0.05315 in)
41454–PL3–B00	1.45 mm (0.05709 in)
41455–PL3–B00	1.55 mm (0.06102 in)
41456–PL3–B00	1.65 mm (0.06496 in)
41457–PL3–B00	1.75 mm (0.06890 in)

NOTE: If snap ring-to-bearing outer race clearance measured in step 6 is less than the specification, it is not necessary to perform steps 8 and 9.

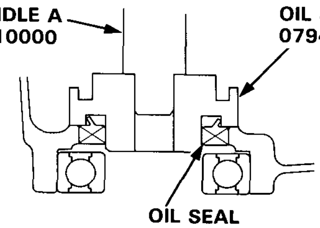
8. Remove the bolts and transmission housing.
9. Replace the snap ring with the one of the correct thickness selected in stop 6.
10. Reassemble the transmission and install the transmission housing (see section 13).
11. Install the oil seal in the transmission housing.



Except D16Z6, D16Z7, D16A7, D16A8, D16A9, B16A2:



D16Z6, D16Z7, D16A7, D16A8, D16A9, B16A2:

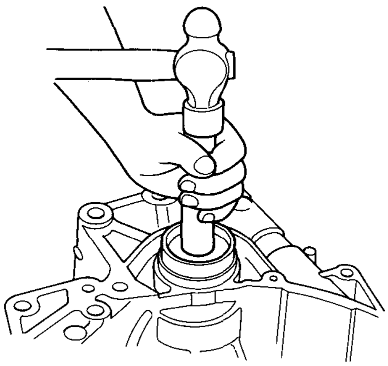


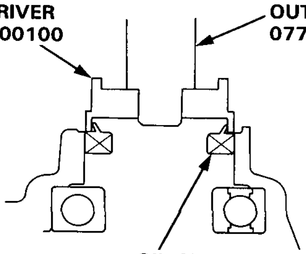
(cont'd)

Differential

Installation (cont'd)

12. Install the oil seal in the clutch housing using the special tools.

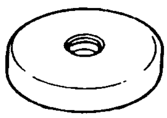




2WD Automatic Transmission Differential

Special Tools

Ref. No.	Tool Number	Description	Q'ty	Page Reference
①	07JAD–PH80101	Attachment	1	15-16
②	07JAD–PH80200	Pilot, 26 x 30 mm	1	15-16
③	07NAD–P200100	Attachment, 52 x 55 mm	1	15-16
④	07746–0030100	Driver, 40 mm I.D.	1	15-12, 14, 15
⑤	07749–0010000	Driver	1	15-16
⑥	07944–SA00000	Pin Driver, 4.0 mm	1	15-13
⑦	07947–6110501 or 07947–6110500	Attachment	1	15-16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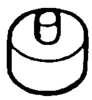
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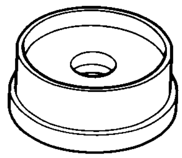
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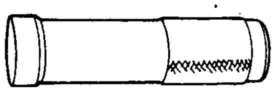
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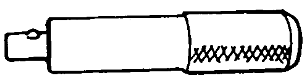
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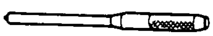
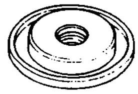
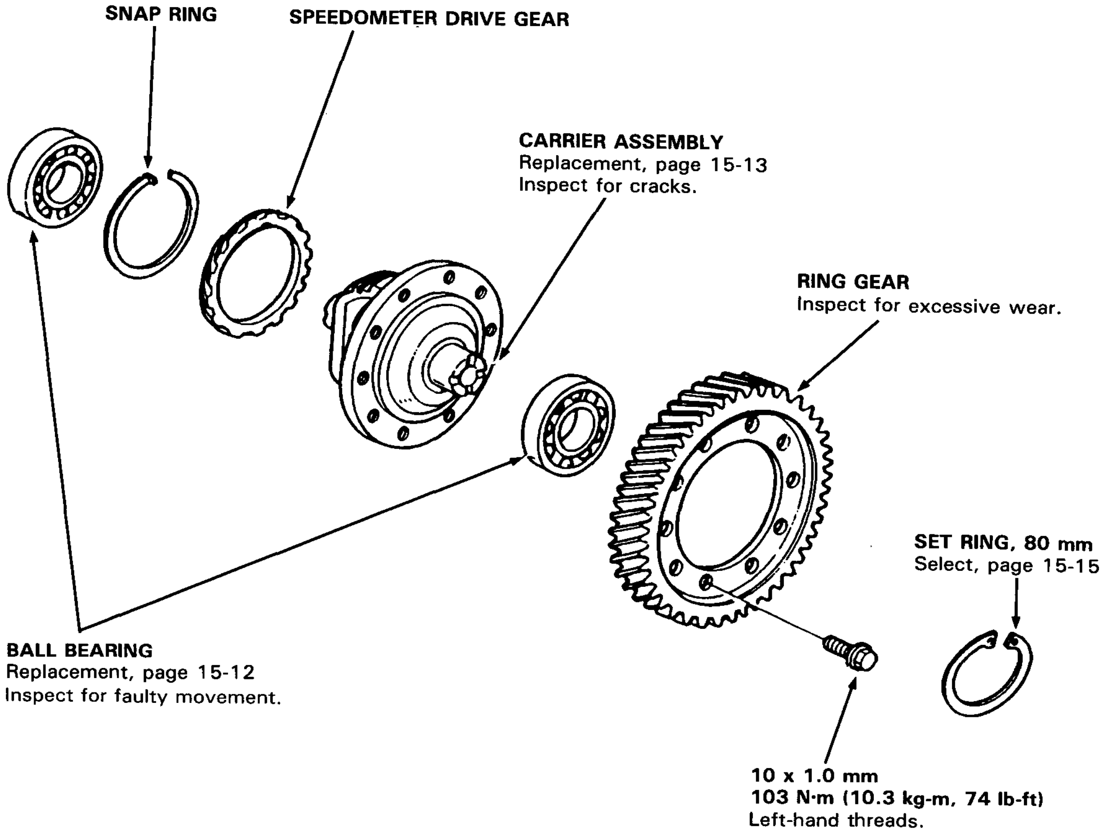

⑥


⑦

Illustrated Index

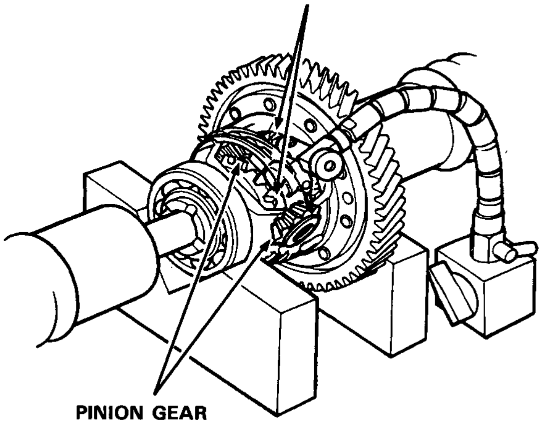


Differential (2WD Automatic Transmission)

Backlash Inspection

1. Place differential assembly on V-blocks and install both axles.
2. Check backlash of both pinion gears.

   Standard (New): 0.05—0.15 mm (0.002—0.006 in)

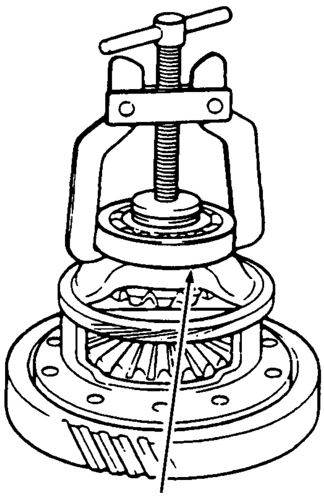


3. If backlash is out of tolerance, replace the differential carrier assembly.

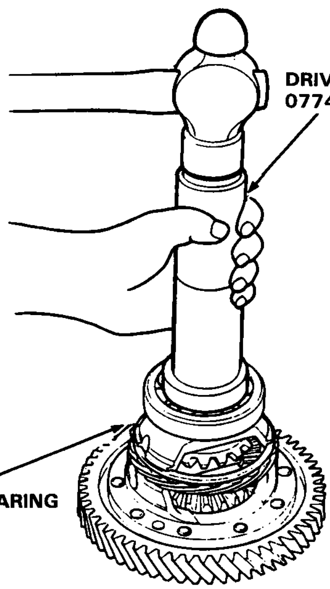
Bearing Replacement

NOTE: Check bearings for wear and rough rotation. If bearings are OK, removal is not necessary.

1. Remove bearings using a standard bearing puller.

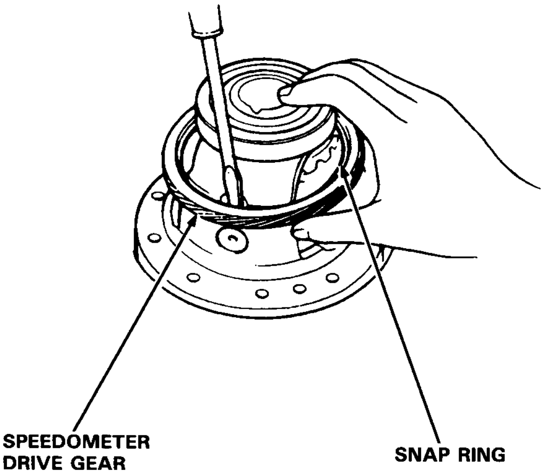


2. Install new bearings using the special tool as shown.

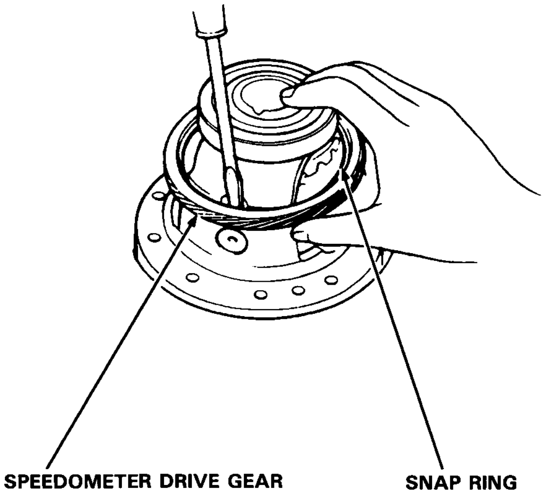


Carrier Assembly Replacement

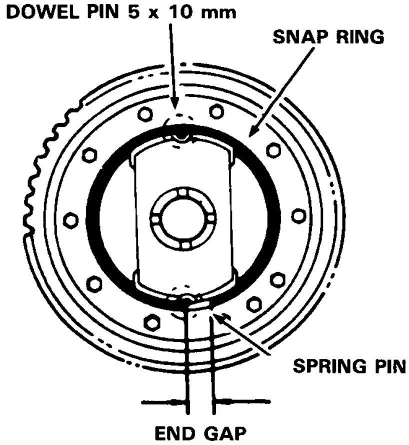
1. Remove the ring gear from the carrier.
2. Pry snap ring off carrier, then remove speedometer drive gear and dowel pin using the special tool (07944–SA00000 PIN DRIVER, 4.0 mm).

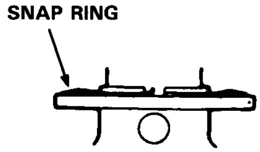


3. Install speedometer drive gear with its chamfer (on inside diameter) facing carrier and secure with snap ring.



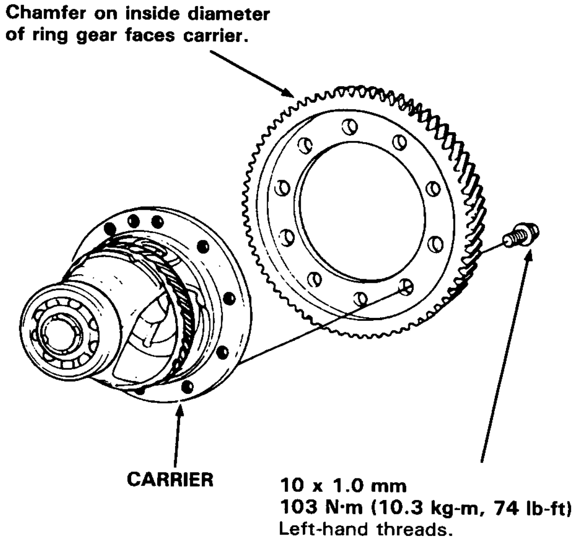
4. Align snap ring on carrier as shown.





5. Install the ring gear.

CAUTION: The ring gear bolts have left-hand threads.

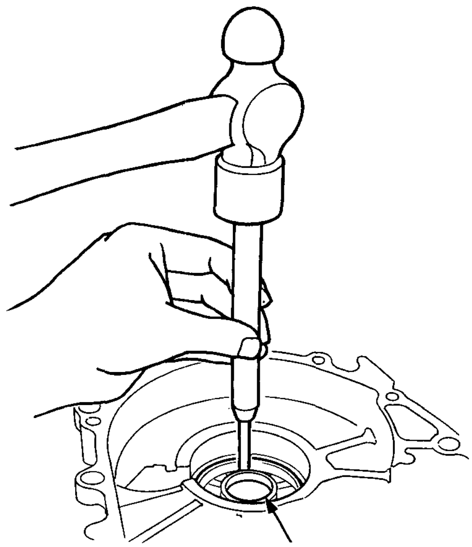


6. Install the ball bearings (15-12).

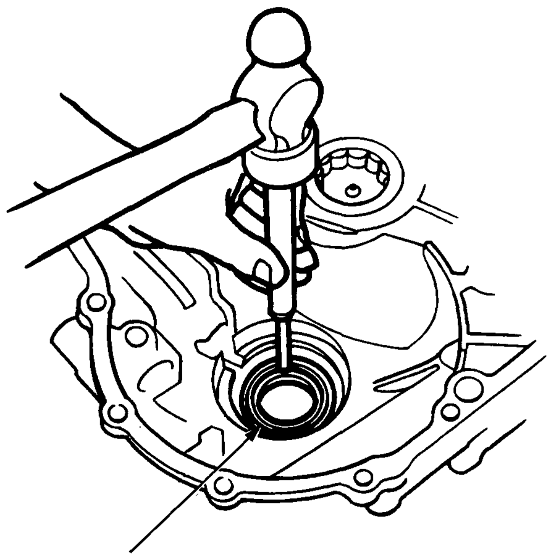
Differential (2WD Automatic Transmission)

Oil Seal Removal

1. Remove the differential assembly.
2. Remove the oil seal from the transmission housing.

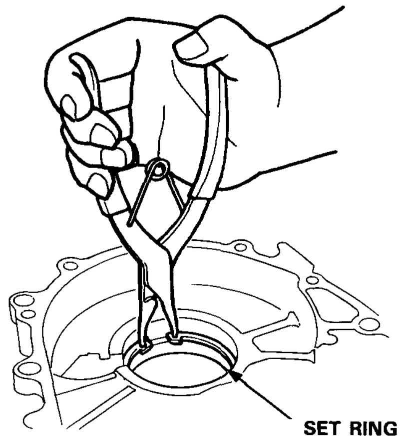


3. Remove the oil seal from the torque converter housing.

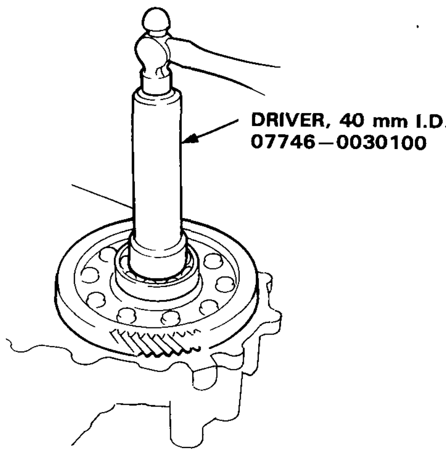


Oil Seal Installation/Side Clearance

1. Install a 2.50 mm (0.09843 in) set ring in transmission housing.
   Do not install the oil seal yet.

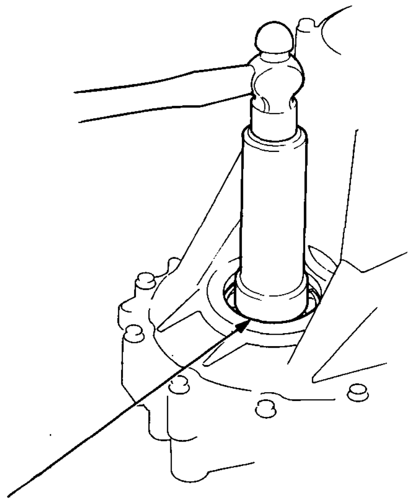


2. Install the differential assembly into the torque converter housing using the special tool as shown.

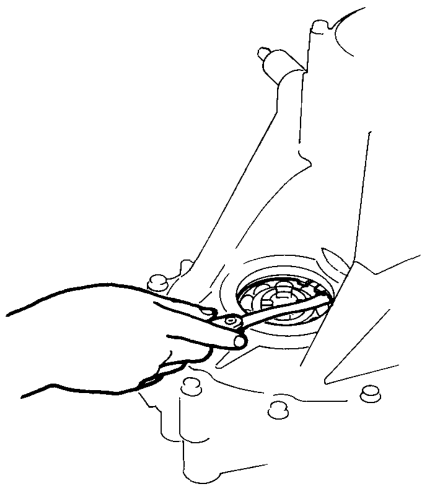


3. Assemble the transmission (See Section 14).
   Install the transmission housing and tighten the bolts (See Section 14).

4. Tap on transmission housing side of differential assembly with driver and attachment to seat the assembly in torque converter housing.



5. Measure clearance between the set ring and outer race of bearing in transmission housing.



If out of limits, select new set ring from following table and install:

Side Clearance:
MAX: 0.15 mm (0.006 in)
SET RING 80 mm

PART NUMBER	THICKNESS
90414–689–000	2.50 mm (0.09843 in)
90415–689–000	2.60 mm (0.10236 in)
90416–689–000	2.70 mm (0.10630 in)
90417–689–000	2.80 mm (0.11024 in)
90418–689–000	2.90 mm (0.11417 in)
90419–PH8–000	3.00 mm (0.11811 in)

NOTE: If the set ring-to-bearing outer race clearance measured in step 5 is less than the specification, it is not necessary to perform steps 6 and 7.

6. Remove the transmission housing.

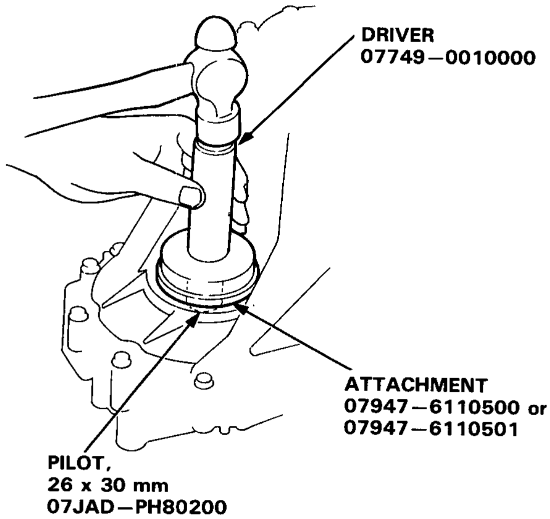
7. Replace the 2.50 mm (0.09843 in) set ring with that of the correct thickness selected in step 5.

8. Install the transmission housing (See Section 14).

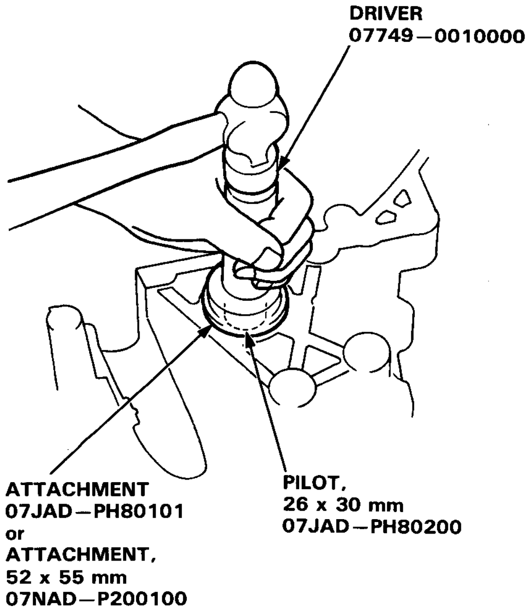
(cont'd)

Oil Seal Installation/Side Clearance (cont'd)

9. Install the oil seal in the transmission housing using the special tools as shown.



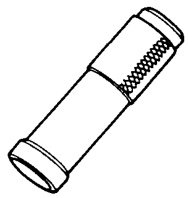
10. Install the oil seal in the torque converter housing using the special tools as shown.



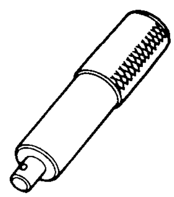
4WD Manual Transmission
Front Differential

Special Tools

Ref. No.	Tool Number	Description	Qty	Remarks
①	07746–0030100	Inner Handle C	1	
②	07749–0010000	Outer Handle A	1	
③	07946–SD90200	Oil Seal Driver	1	
④	07NAD–P200100	Oil Seal Driver	1	



①



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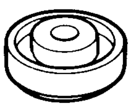

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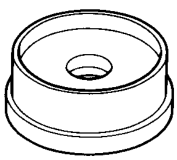

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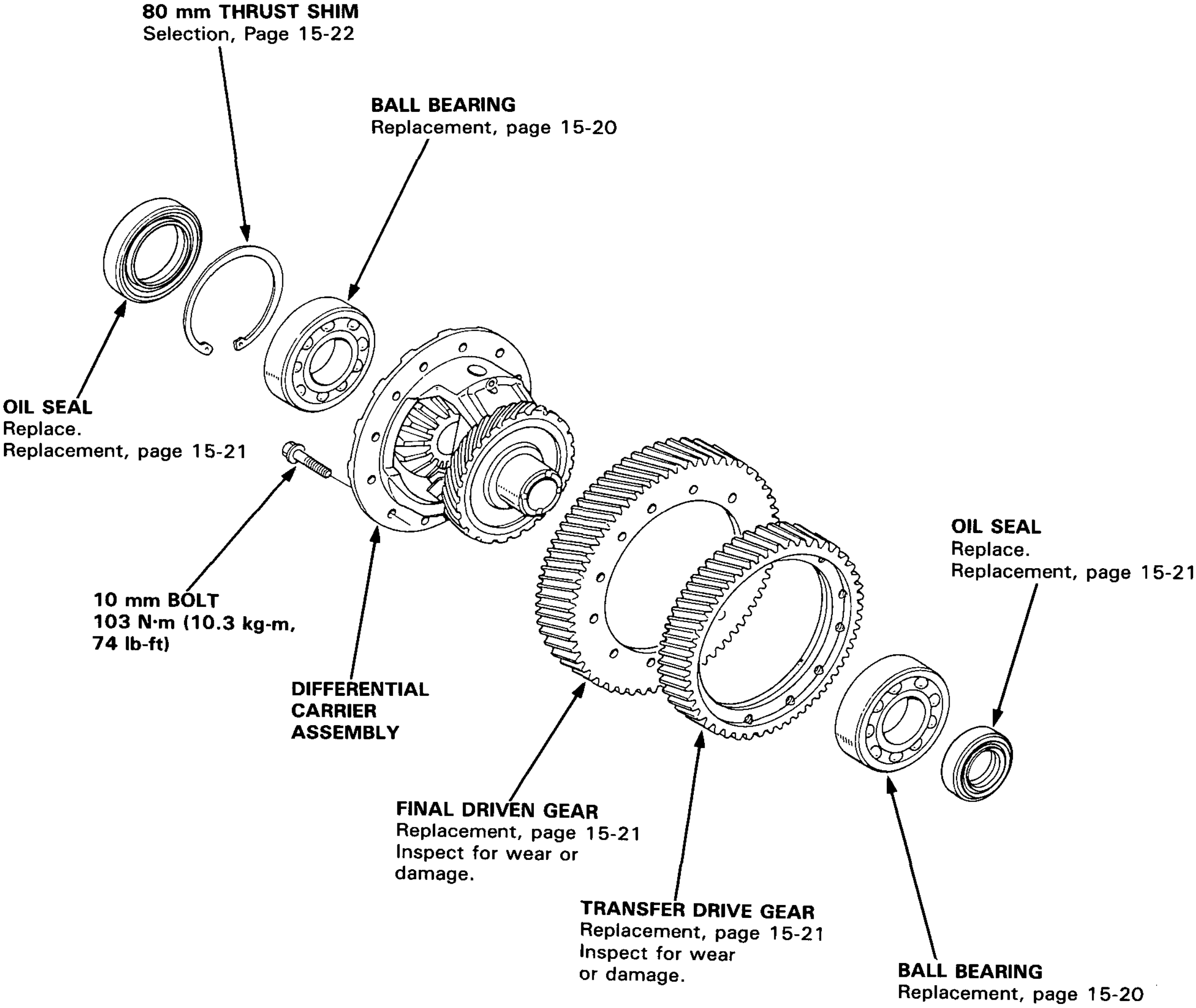
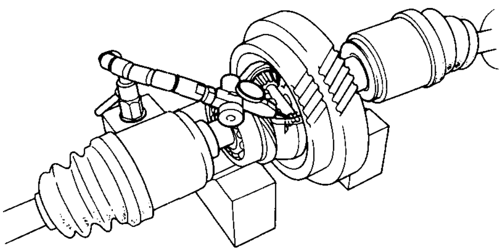


80 mm THRUST SHIM
Selection, Page 15-22
BALL BEARING
Replacement, page 15-20
OIL SEAL
Replace.
Replacement, page 15-21
10 mm BOLT
103 N·m (10.3 kg-m, 74 lb-ft)
DIFFERENTIAL CARRIER ASSEMBLY
FINAL DRIVEN GEAR
Replacement, page 15-21
Inspect for wear or damage.
TRANSFER DRIVE GEAR
Replacement, page 15-21
Inspect for wear or damage.
OIL SEAL
Replace.
Replacement, page 15-21
BALL BEARING
Replacement, page 15-20

Differential

Backlash Inspection

1. Place differential assembly on V-blocks and install the both driveshafts.
2. Check backlash of both pinion gear.

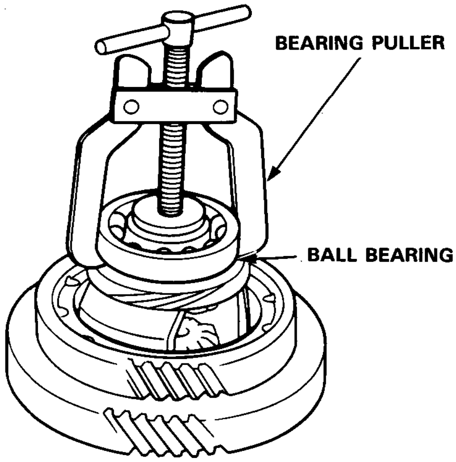


3. If the backlash is without the standard, replace the differential carrier assembly.

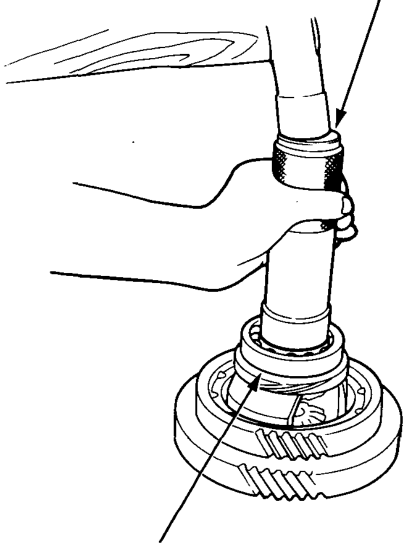
Bearing Replacement

NOTE: Check bearings for wear or rough rotation. If bearings are OK, removal is not necessary.

1. Remove bearings using a standard bearing puller.



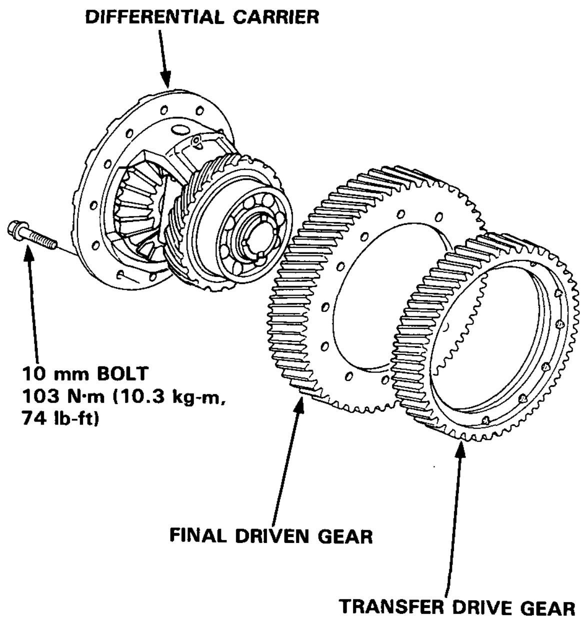
2. Install new bearings.



Ring Gear Replacement

1. Remove the final driven gear and transfer drive gear from the differential carrier.

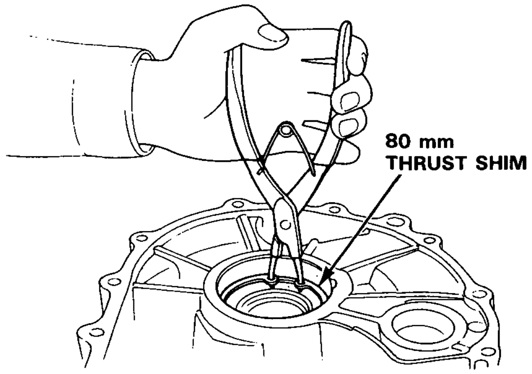
   NOTE: The ring gear bolts has right-hand thread.



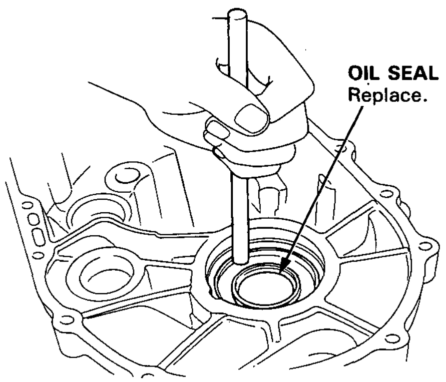
2. Install the final driven gear and transfer drive gear.

Oil Seal Removal

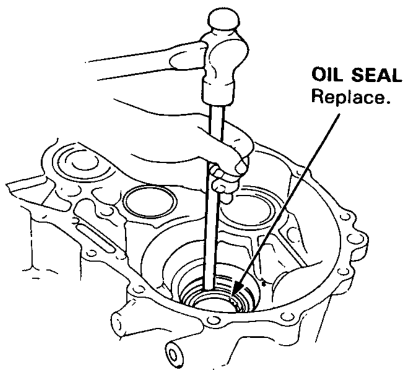
1. Remove the differential assembly.
2. Remove the thrust shim from the transmission housing.



3. Remove the oil seal from the transmission housing.



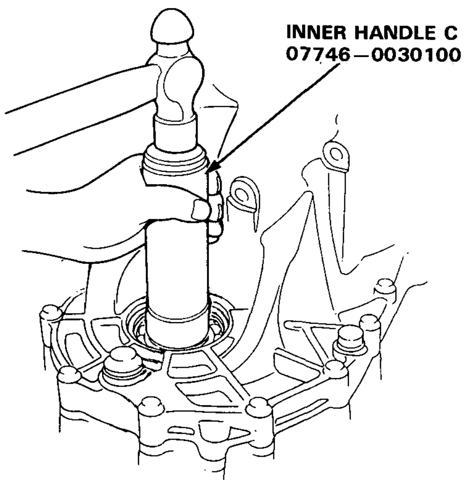
4. Remove the oil seal from the clutch housing.



Installation

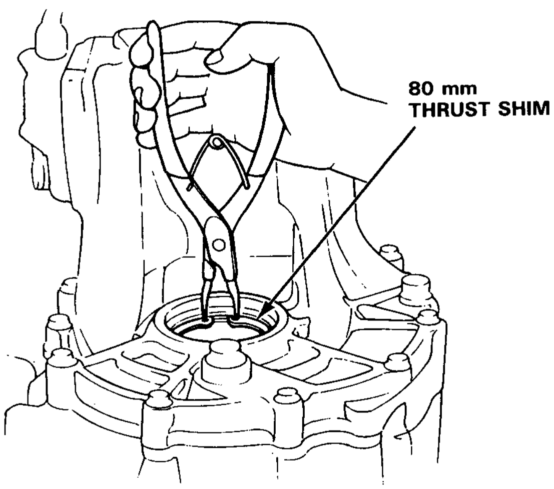
1. Install the differential assembly in the clutch housing.
2. Install the transmission housing (see section 13).

   NOTE: Do not apply liquid gasket to the mating surface of the clutch housing.
3. Tighten the transmission bolts (see section 13).
4. Use special tools to bottom differential assembly in clutch housing.



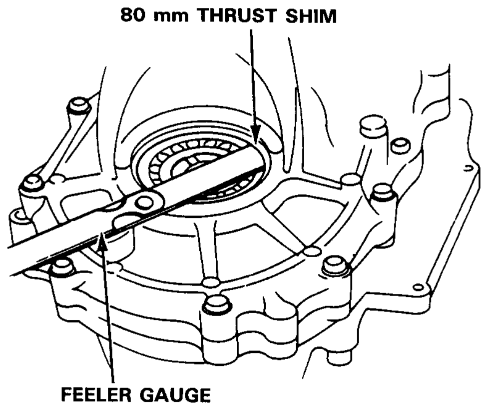
5. Install the thrust shim.

   NOTE: Install the thrust shim that was removed.



6. Measure clearance between thrust shim and outer race of bearing in transmission housing.

   Side Clearance: 0 — 0.10 mm (0 — 0.0394 in)



7. If out of limits, select new thrust shim from following table and install.

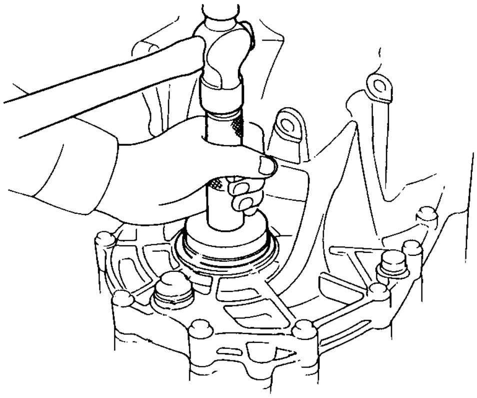
   80 mm thrust shim

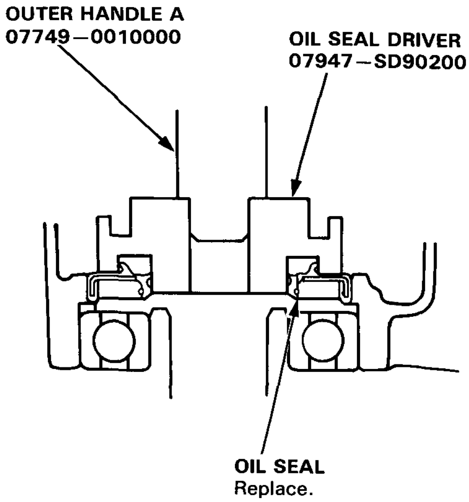
PART NUMBER	THICKNESS
90414–689–000	2.5 mm (0.0984 in)
90415–689–000	2.6 mm (0.1024 in)
90416–689–000	2.7 mm (0.1063 in)
90417–689–000	2.8 mm (0.1102 in)
90418–689–000	2.9 mm (0.1142 in)
90419–PH8–000	3.0 mm (0.1181 in)

8. Remove the bolts and transmission housing.
9. Replace the thrust shim with the one of the correct thickness selected the step 6.

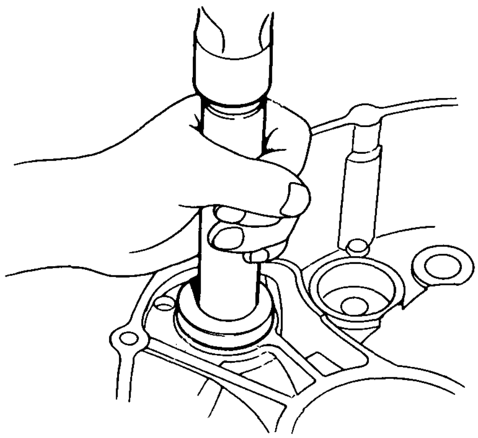
   NOTE: If the shim -to-bearing clearance calculated in step 6 is less than the thrust shim.
10. Reassemble the transmission and install the transmission housing.

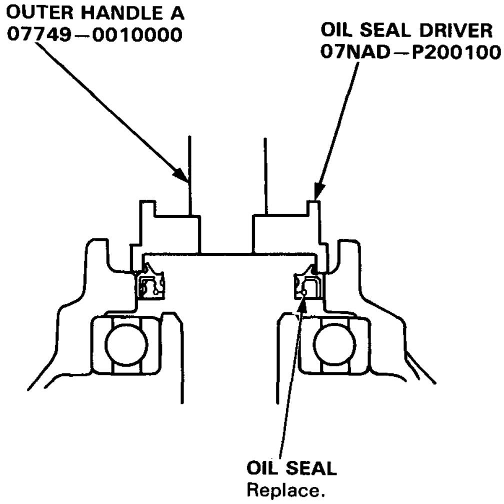
11. *Install the oil seal in the transmission housing.*





12. *Install the oil seal in the clutch housing.*

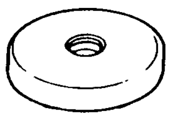




4WD Automatic Transmission Front Differential

Special Tools

Ref. No.	Tool Number	Description	Q'ty	Page Reference
①	07JAD−PH80101	Attachment	1	15-31
②	07JAD−PH80200	Pilot, 26 x 30 mm	1	15-31
③	07NAD−P200100	Attachment, 52 x 55 mm	1	15-31
④	07746−0030100	Driver, 40 mm I.D.	1	15-28, 31
⑤	07749−0010000	Driver	1	15-31
⑥	07944−SA00000	Pin Driver, 4.0 mm	1	15-29
⑦	07947−6110501 or 07947−6110500	Attachment	1	15-31



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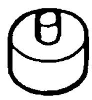

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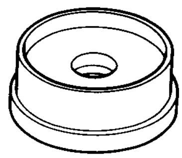

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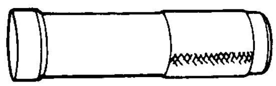

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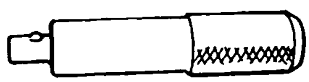

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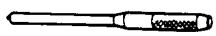

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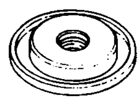

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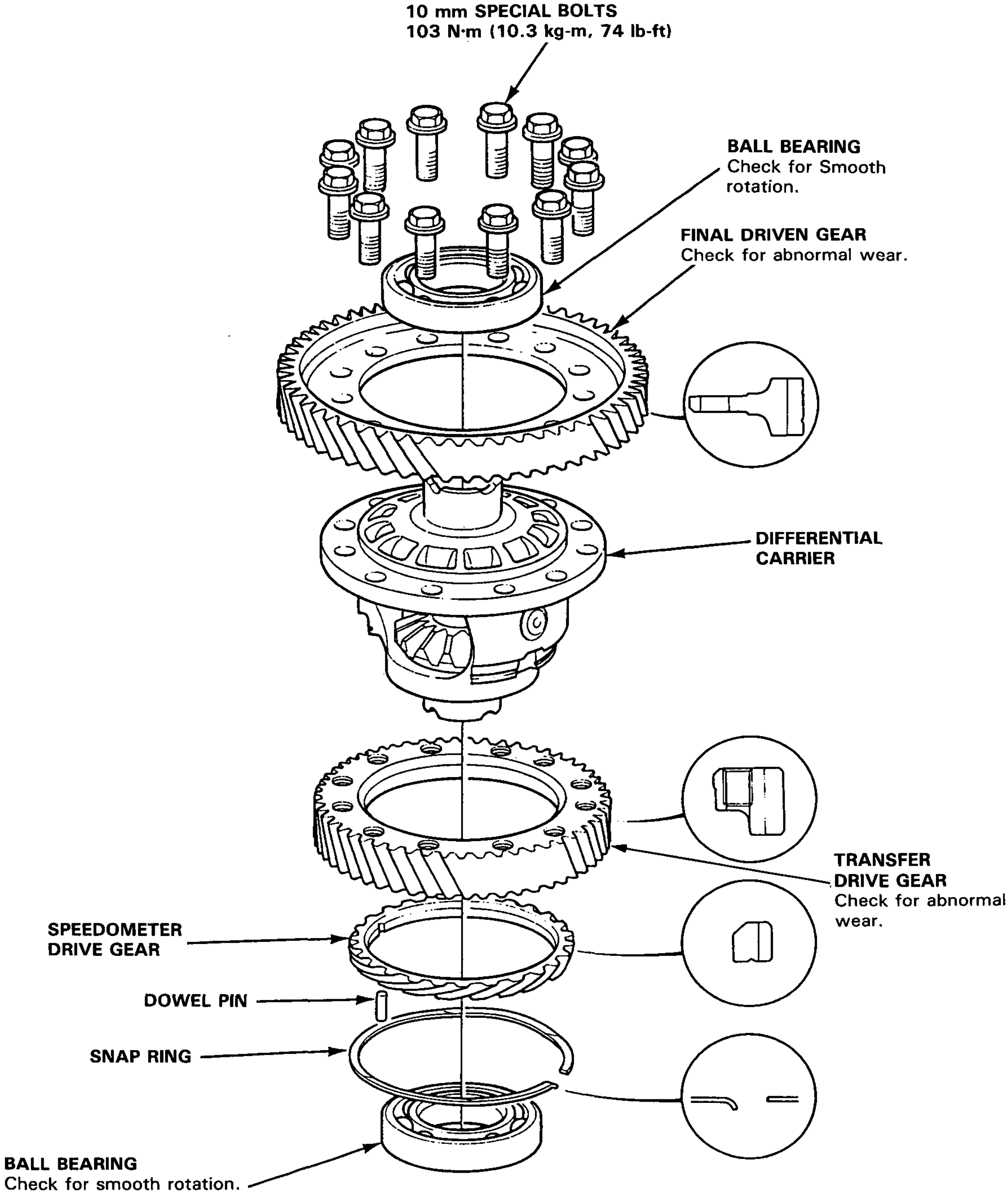


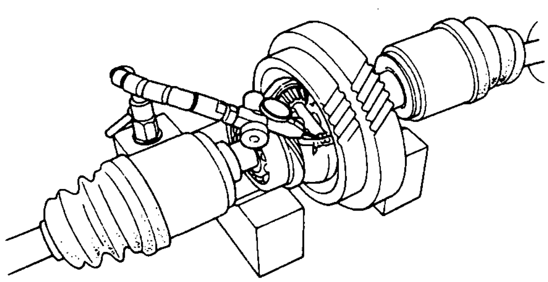
10 mm SPECIAL BOLTS
103 N·m (10.3 kg-m, 74 lb-ft)
BALL BEARING
Check for Smooth rotation.
FINAL DRIVEN GEAR
Check for abnormal wear.
DIFFERENTIAL CARRIER
TRANSFER DRIVE GEAR
Check for abnormal wear.
SPEEDOMETER DRIVE GEAR
DOWEL PIN
SNAP RING
BALL BEARING
Check for smooth rotation.

Differential (4WD Automatic Transmission)

Backlash Inspection

1. Place differential assembly on V-blocks and install both axles.
2. Check backlash of both pinion gears.

   Standard (New): 0.05—0.15 mm (0.002—0.006 in)

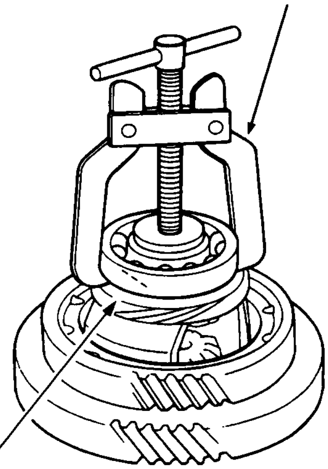


3. If backlash is out of torelance, replace the differential carrier assembly.

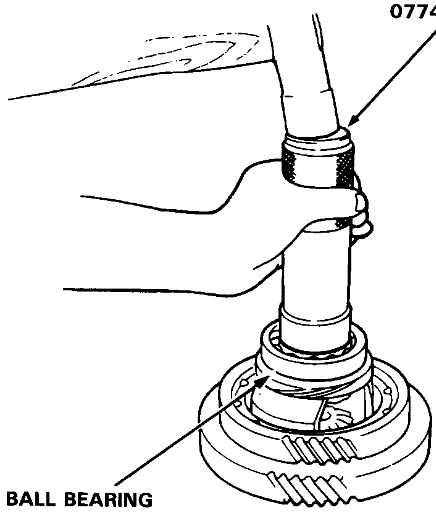
Bearing Replacement

NOTE: Check bearings for wear and rough rotation. If bearings are OK, removal is not necessary.

1. Remove bearings using a standard bearing puller.

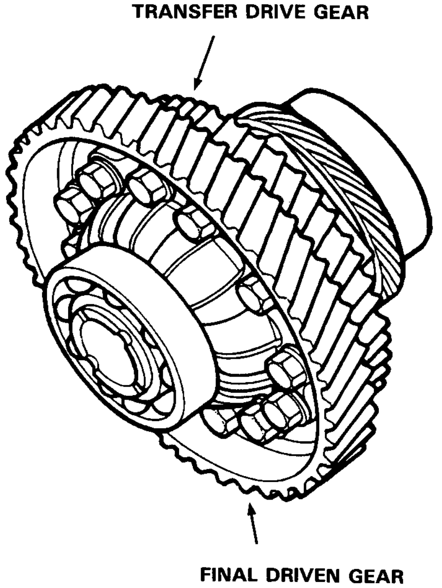


2. Install new bearings using the special tool as shown.

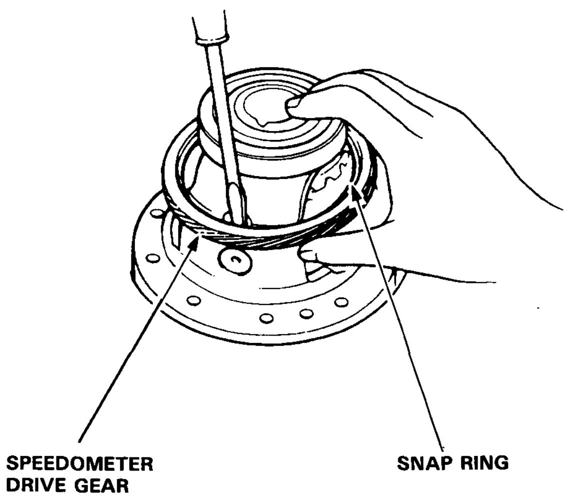


Carrier Assembly Replacement

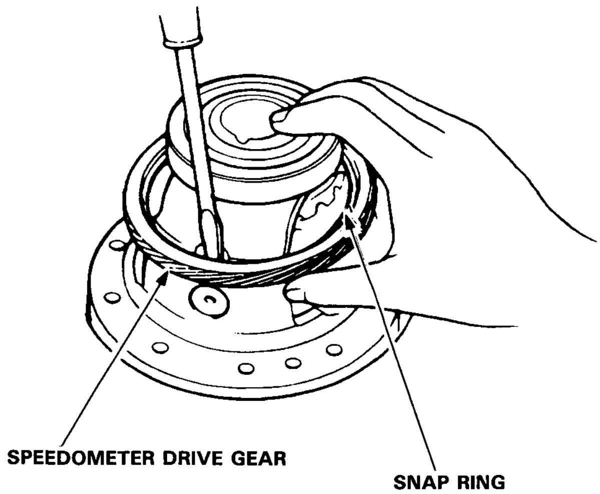
1. Remove the final driven gear and transfer drive gear. Inspect teeth for wear or damage.



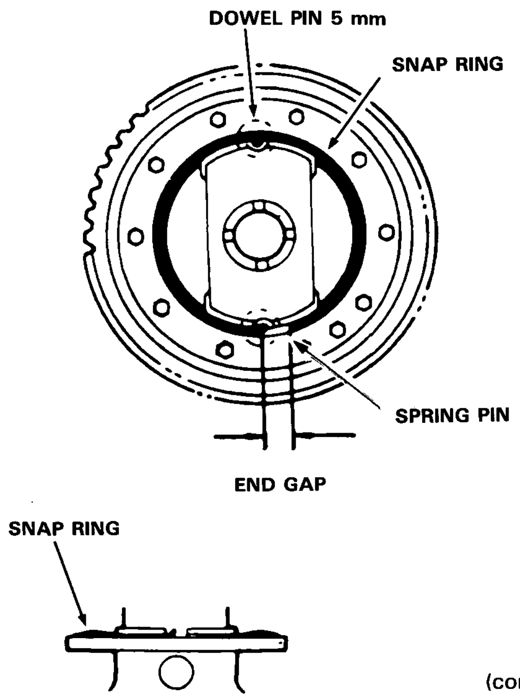
2. Pry snap ring off carrier, then remove speedometer drive gear and dowel pin using the special tool (07944–SA00000 PIN DRIVER, 4.0 mm).



3. Install speedometer drive gear with its chamfer (on inside diameter) facing carrier and secure with snap ring.



4. Align snap ring on carrier as shown.

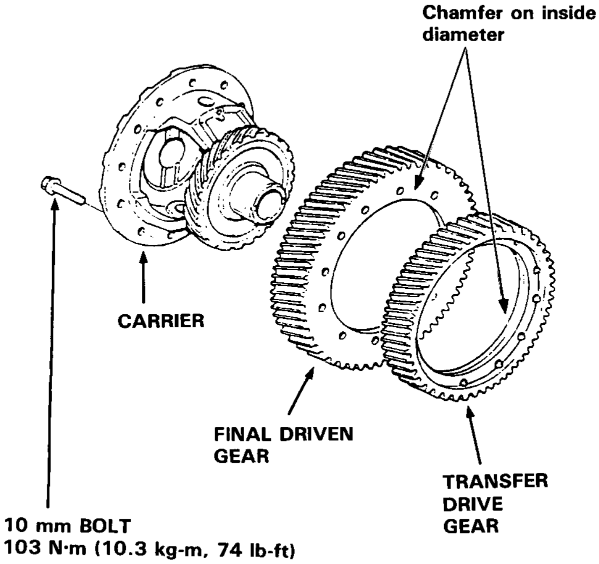


(cont'd)

Differential (4WD Automatic Transmission)

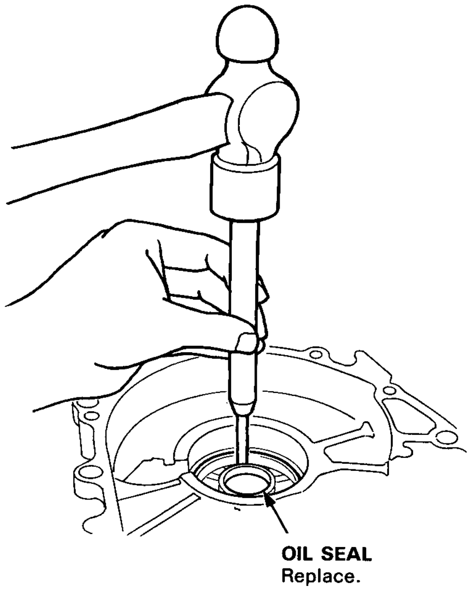
Carrier Assembly Replacement (cont'd)

5. Install the final driven gear and transfer drive gear.

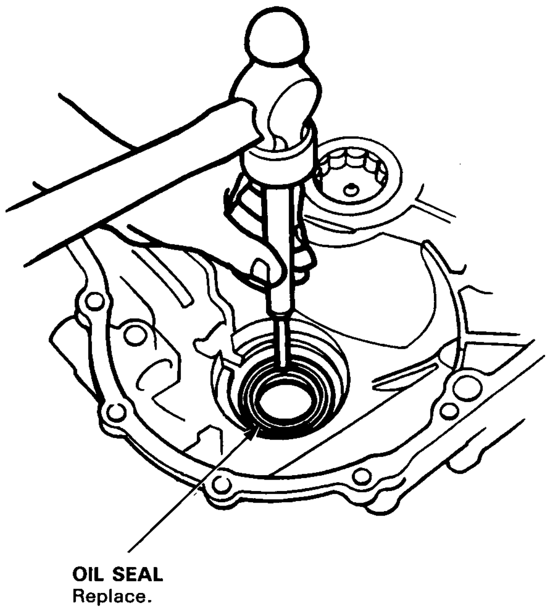


Oil Seal Removal

1. Remove the differential assembly.
2. Remove the oil seal from the transmission housing.

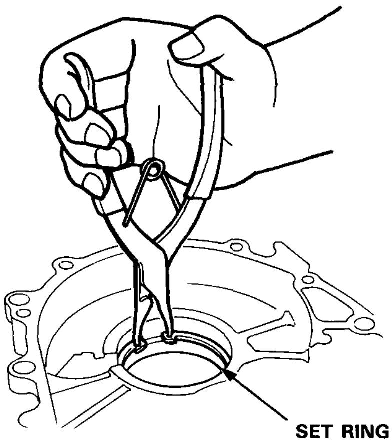


3. Remove the oil seal from the torque converter housing.

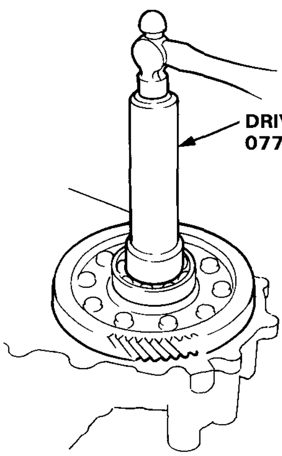


Oil Seal Installation/Side Clearance

1. Install a 2.50 mm (0.09843 in) set ring in transmission housing.
   Do not install the oil seal yet.

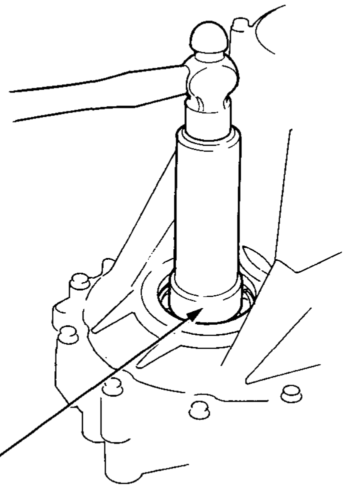


2. Install the differential assembly into the torque converter housing using the special tool as shown.



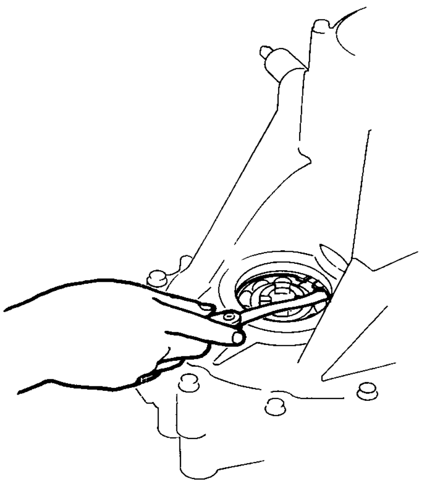
3. Assemble the transmission (See Section 14).
   Install the transmission housing and tighten the bolts (See Section 14).

4. Tap on transmission housing side of differential assembly with driver and attachment to seat the assembly in torque converter housing.



(cont'd)

5. Measure clearance between the set ring and outer race of bearing in transmission housing.



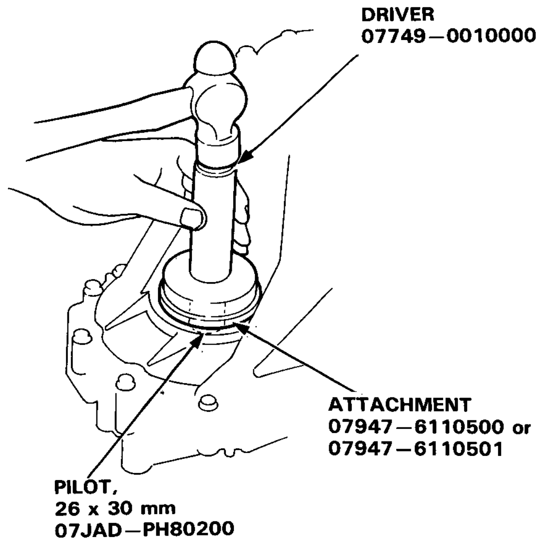
If out of limits, select new set ring from following table and install:

Side Clearance:
MAX: 0.15 mm (0.006 in)
SET RING 80 mm

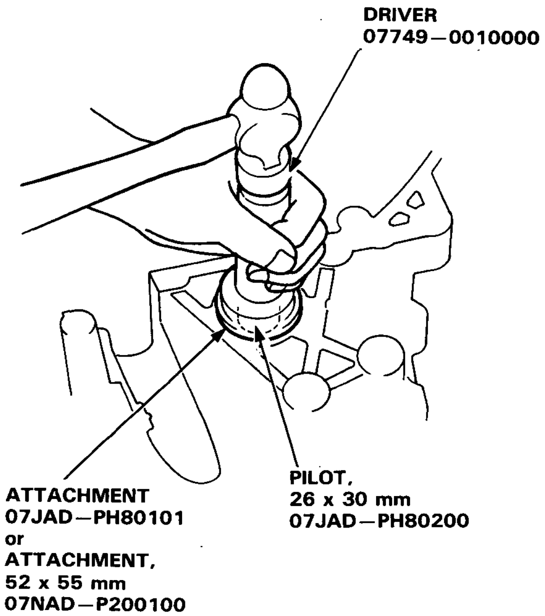
PART NUMBER	THICKNESS
90414–689–000	2.50 mm (0.09843 in)
90415–689–000	2.60 mm (0.10236 in)
90416–689–000	2.70 mm (0.10630 in)
90417–689–000	2.80 mm (0.11024 in)
90418–689–000	2.90 mm (0.11417 in)
90419–PH8–000	3.00 mm (0.11811 in)

NOTE: If the set ring-to-bearing outer race clearance measured in step 5 is less than the specification, it is not necessary to perform steps 6 and 7.

6. Remove the transmission housing.
7. Replace the 2.50 mm (0.09843 in) set ring with that of the correct thickness selected in step 5.
8. Install the transmission housing (See Section 14).
9. Install the oil seal in the transmission housing using the special tools as shown.



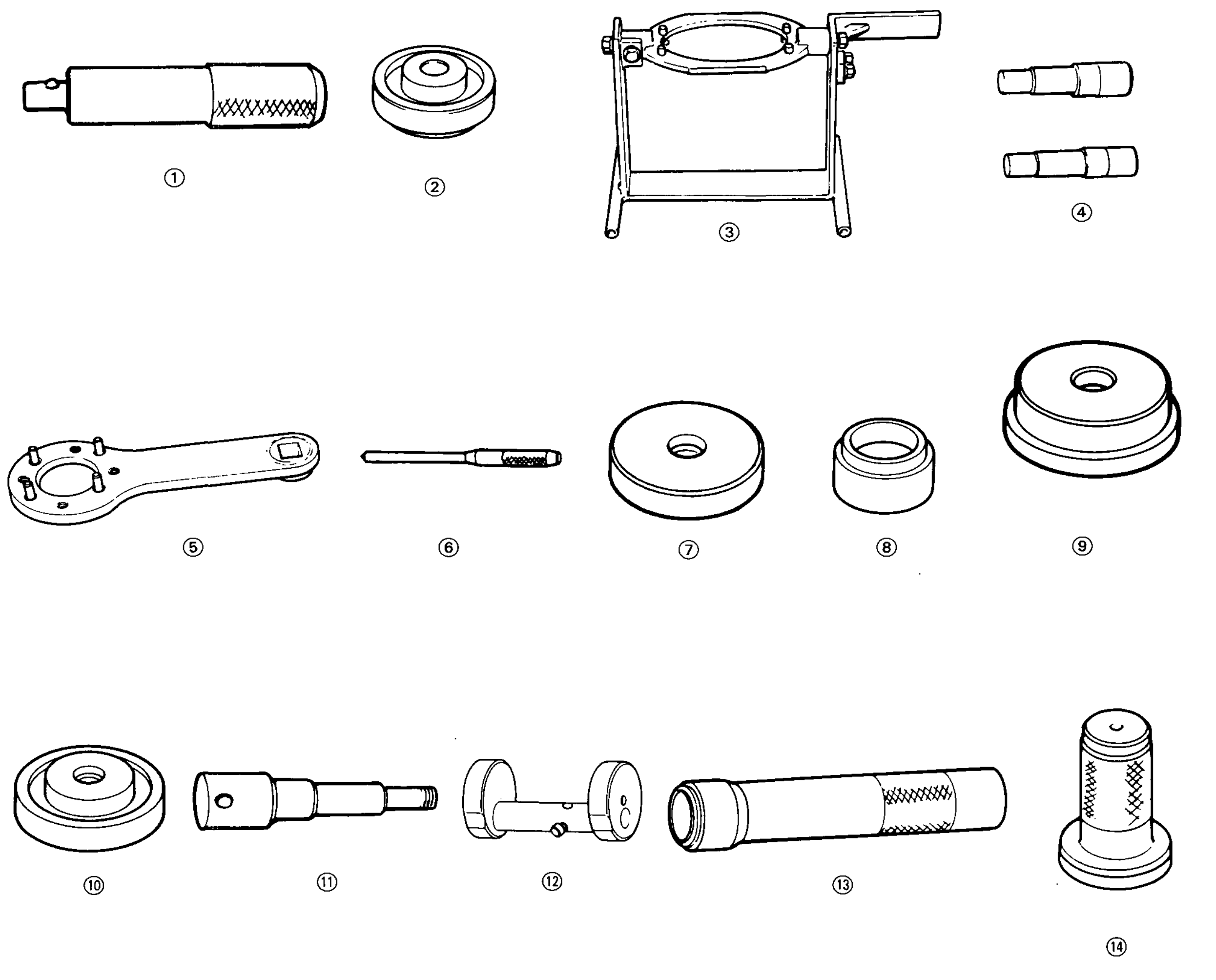
10. Install the oil seal in the torque converter housing using the special tools as shown.



Differential (without viscous coupling)

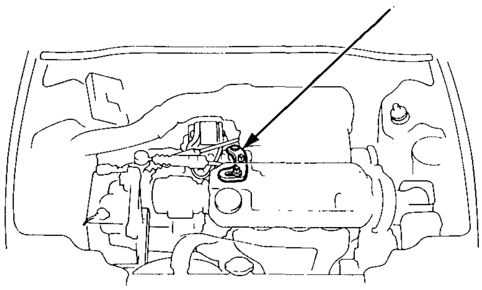
Special Tools

Ref. No.	Tool Number	Description	Qty	Remarks
①	07749–0010000	Outer Handle A	1	
②	07JAD–PH80100	Oil Seal Driver	1	
③	07966–SD90000	Differential Carrier Stand	1	
④	07973–SD90300	Differential Pinion Center Pin	1	
⑤	07926–SD90000	Companion Flange Holder	1	
⑥	07946–SA00000	Pin Driver, 4.0 mm	1	
⑦	07GAF–SE00300	Driver Attachment	1	
⑧	07LAD–PW50601	Bearing Driver Attachment	1	
⑨	07746–0010600	Outer Driver, 72 x 75 mm	1	
⑩	07947–SD90101	Oil Seal Driver	1	
⑪	07973–SD90100	Pinion Dummy Shaft	1	
⑫	07973–SD90200	Pinion Height Block	1	
⑬	07946–MB00000	Driver	1	
⑭	07974–SB00200	Oil Seal Driver	1	



The Real Time 4WD system allows instantaneous shift from 2WD to 4WD automatically when greater traction is needed. To prevent accidents or injuries, the system must be released before performing any services on the differential unit.

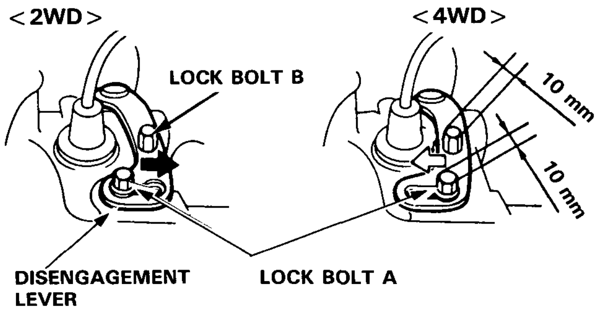
To release 4WD
With the engine stopped, turn the shift bolt (painted orange) as described below.



1. Loosen the lock bolt A.
2. Move the lever by turning the lock bolt A counterclockwise.
3. Confirm that the lever is in the fully disengaged position by rocking the cat back and forth while placing slight counterclockwise pressure on the lock bolt A.
4. Tighten the lock bolt A.

   Torque: 12 N·m (1.2 kg-m, 9 lb-ft)

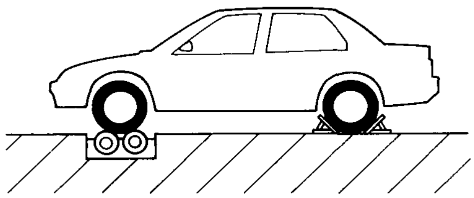
   NOTE: When the engine starts with the 4WD system disengaged, the rear differential clutch warning light should come on.



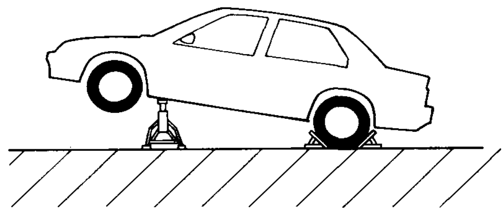
Operations Requiring 4WD Disengagement

- When using test appliances;
  Speedometer tester, brake tester, chassis dynamometer, etc.

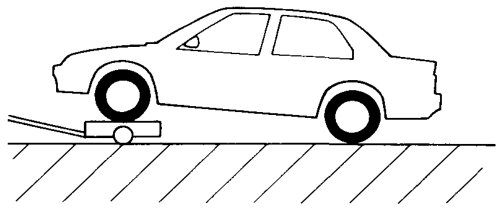
  CAUTION: Apply the parking brake and block the rear wheels before using a speedometer tester. When you use a chassis dynamometer, fix the car body with a rope to prevent it from moving.



- When running the engine with the car jacked up.



- When towing with raised front or rear wheels.



Differential

Troubleshooting

NOTE:
- Most problems in the unit are to be diagnosed by identifying noises from the gears or bearings.
- Care should be taken during diagnosis not to confuse rear differential noises with those from other drive train components.

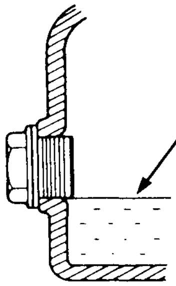
<Noise symptoms will be most prominent when 4WD is engaged.>

Symptom	Probable Cause	Remedy
Consistent noise during cruising	• Lack of oil • Foreign matter stuck in gears, etc. • Improper tooth contact between ring gear and drive pinion • Worn or damaged side bearing • Deformed ring gear or carrier	• Replenish oil • Clean and inspect • Replace any damaged or faulty parts • Adjust or replace
Gear noises while accelerating	• Lack of oil • Foreign matter stuck in gears, etc. • Improper drive pinion preload • Chipped or damaged gears	• Replenish oil • Clean and inspect • Replace
Gear noises while coasting of accelerating	• Improper drive pinion preload • Damaged or chipped gears	• Adjust or replace
Bearing noises while accelerating or coasting/deceleration	• Cracked or damaged drive pinion bearing or side bearing	• Replace
Abnormal noises when rounding a curve	• Worn (excessive play) or damaged side bearing • Damaged side gear, pinion, or pinion shaft	• Replace
Abnormal noises during acceleration or when first driving away from a stop	• Excessive backlash between ring gear and drive pinion • Improper ring gear or drive pinion preload • Excessive pinion backlash • Worn differential splines • Loose companion flange nuts and other fasteners	• Adjust • Replace the carrier assembly • Recheck torque or replace
Oil leak	• Oil level too high • Clogged breather hole • Loose carrier or inadequate sealing • Worn or damaged oil seal	• Lower to proper level • Clean or replace • Recheck torque or apply sealant • Replace
Overheating	• Lack of oil • Insufficient ring gear-to-pinion backlash • Excessive ring gear or drive pinion preload	• Replenish • Adjust • Adjust or replace

Transmission Oil

NOTE: Check the oil at operating temperature, engine OFF, and the cot on level ground.

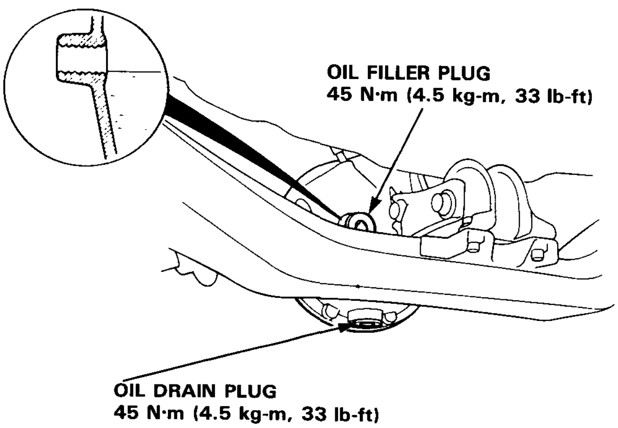
1. Remove the oil filler plug, then check the level and condition of the oil.



2. The oil level must be up to the fill hole. If it is below the hole, add oil until it runs out, then reinstall the oil filler plug.
3. If the oil is dirty, remove drain plug and drain transmission.
4. Reinstall the drain plug with a new washer, and refill to proper level.
5. Reinstall the oil filler plug with a new washer.

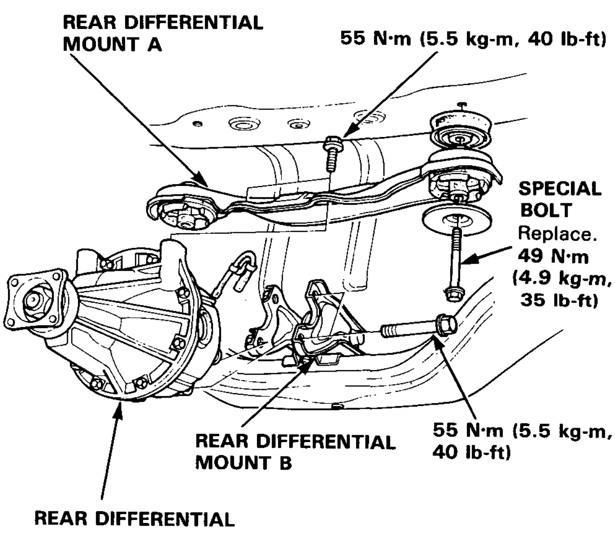
Oil Capacity
2.2 (2.3 U.S. qt.) after drain.
2.3 (2.4 U.S. qt.) after overhaul.

Use only SEA 10W-30 or 10W-40, SF or SG grade.



Removal/Installation

1. Drain the differential oil.
2. Remove the propeller shaft (see section 16).
3. Remove the rear drive shafts (see section 16).
4. Remove the mounting bolts from the rear differential mount B.
5. Remove the mounting bolts, then remove the differential and rear differential mount A assembly.
6. Remove the differential from the mount A.

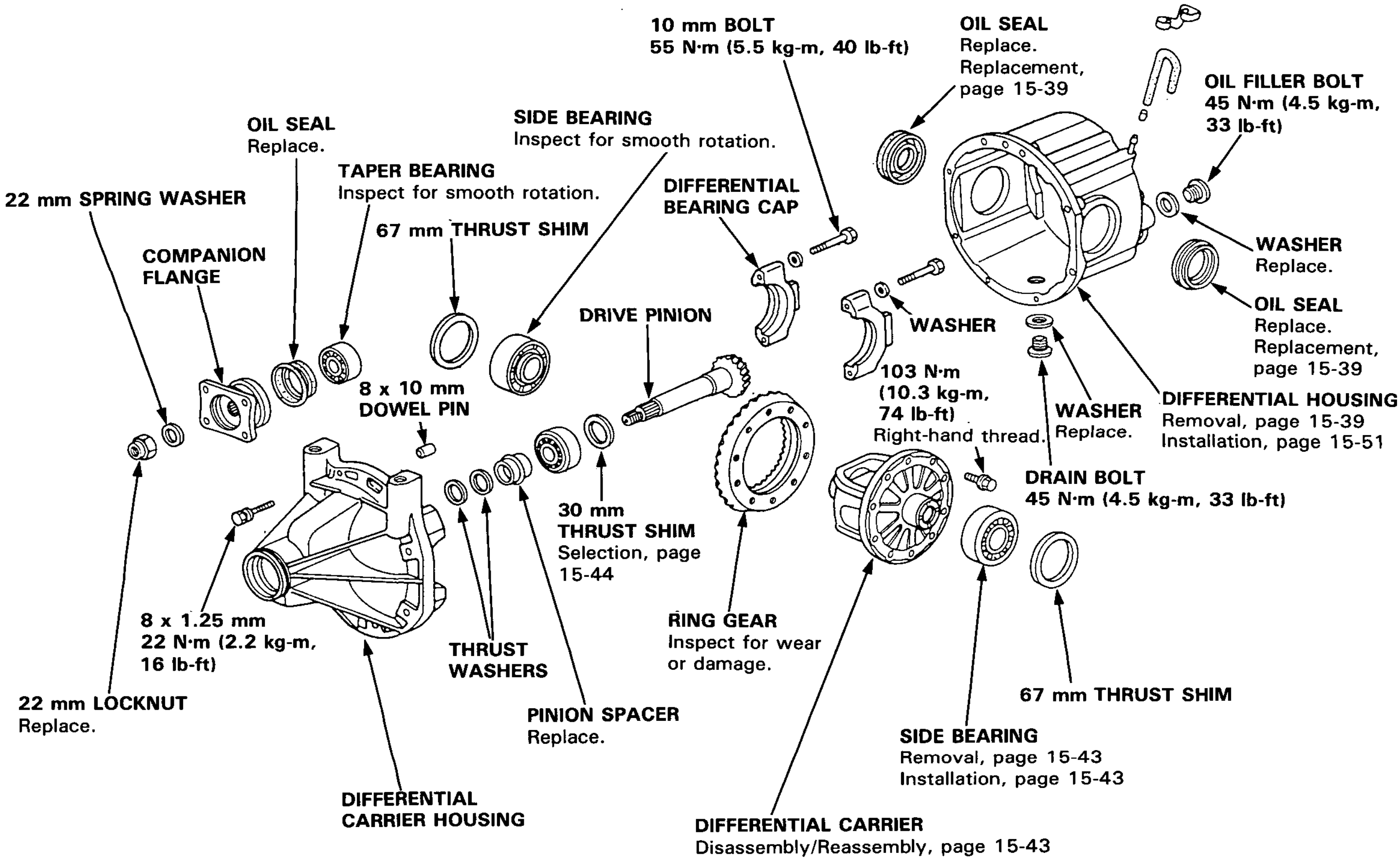


Illustrated Index

Refer to the drawing below for the differential disassembly.
Clean all parts thoroughly in solvent and dry with compressed air.

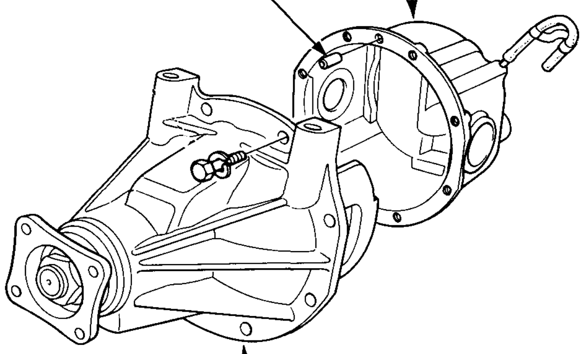
Lubricate all parts with oil before reassembly.

NOTE: This differential uses no gaskets between the major housings; use Honda Genuine Liquid Gasket (P/N 08718—0001). Assemble the housings within 20 minutes after applying the liquid gasket and allow it to cure at least 30 minutes after assembly before filling the differential with oil.



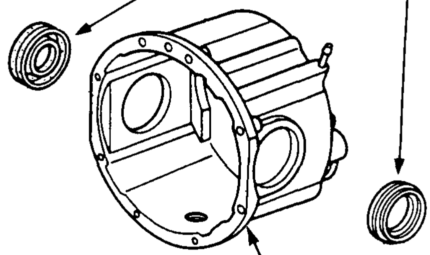
Housing Removal

1. Remove the differential carrier housing and dowel pins.

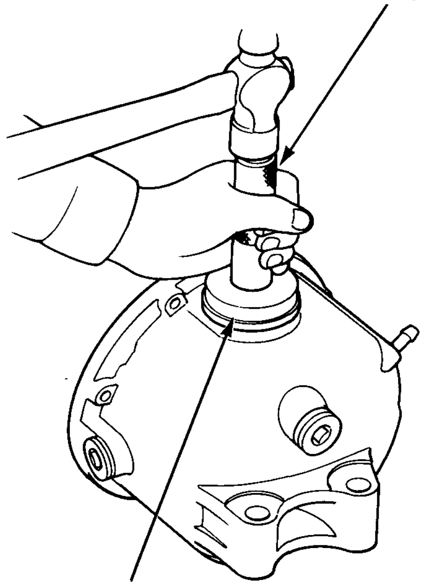


Oil Seal Replacement

1. Remove the oil seal from the differential housing.



2. Drive the new oil seal in the differential housing.

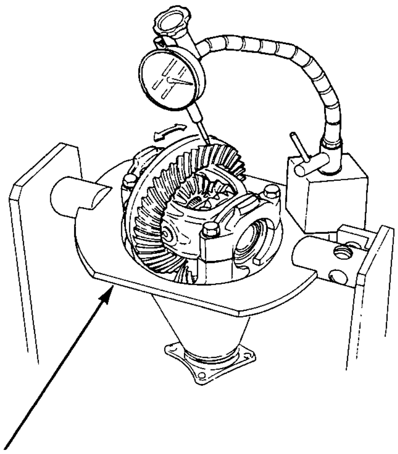


Inspection

Ring Gear Backlash

1. Place the differential carrier assembly on the Differential Carrier Stand and check backlash at four equally spaced locations around the gear.

   Standard: 0.11 – 0.16 mm (0.004 – 0.006 in)



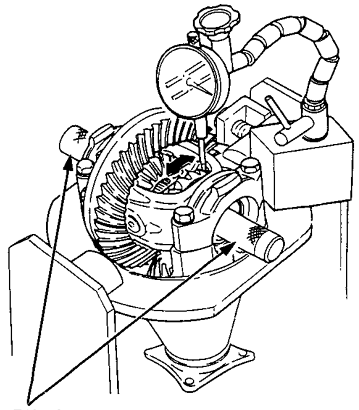
DIFFERENTIAL CARRIER STAND
07973–SD90300

2. If out of tolerance, adjust as described on page 15-AV.

Pinion Gear-to-Side Gear Backlash

1. Install the pinion center pin in the differential side gear. Measure the backlash with a dial indicator.

   Standard: 0.05 – 0.15 mm (0.002 – 0.006 in)



PINION CENTER PIN
07973–SD90300

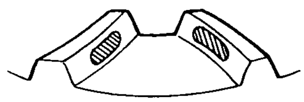
2. If out of tolerance, replace the differential carrier assembly.

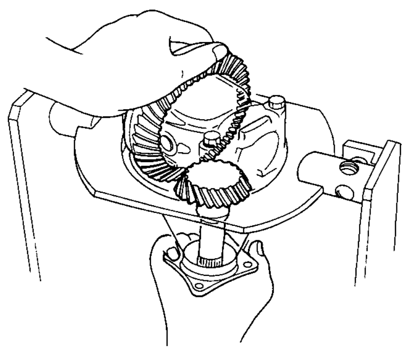
Tooth Contact (Ring Gear and Drive Pinion)

1. Thoroughly clean the ring gear and drive pinion teeth, and paint the ring gear teeth lightly and evenly with Prussian Blue.

2. Rotate the pinion one full turn both forward and backlash.

GOOD CONTACT PATTERN

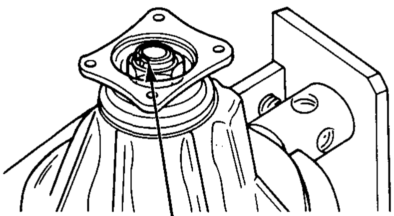




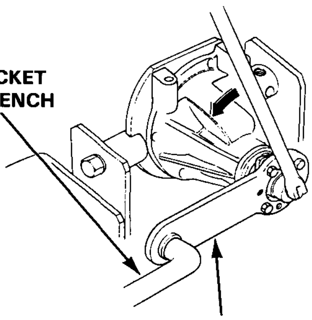
3. Inspect the contact pattern on the ring gear. If the pattern is abnormal, adjust as instructed on page 15-48.

Disassembly

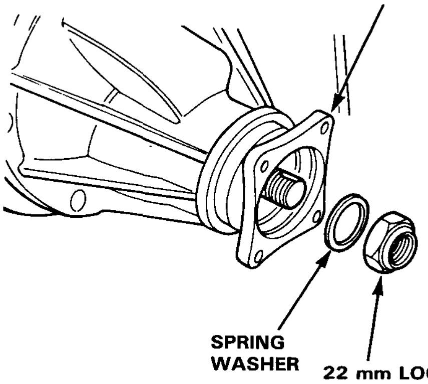
1. Raise the locknut tab from the groove of the shaft.



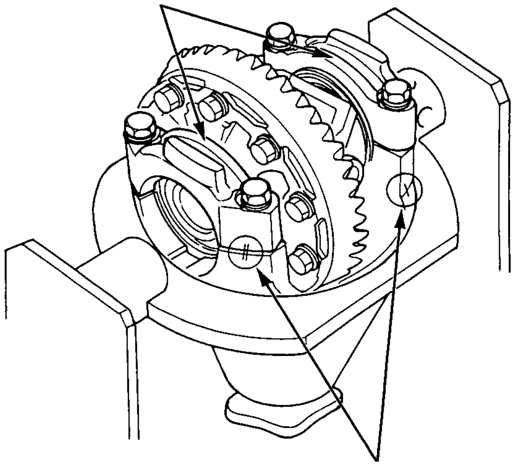
2. Hold the companion flange with the Companion Flange Holder then loose the locknut.



3. Remove the locknut, spring washer, and companion flange.

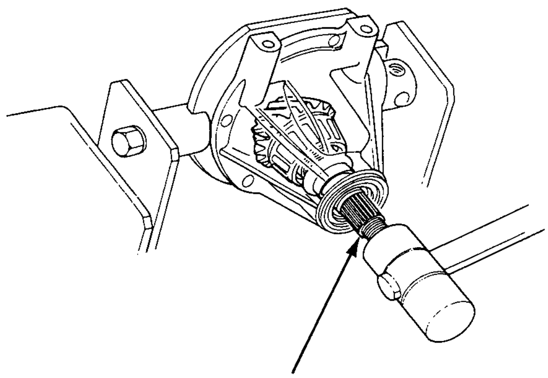


4. Mark the bearing caps and differential carrier, then remove bearing caps.



5. Remove the differential carrier from the differential carrier housing.

6. Remove the drive pinion from the differential carrier housing.

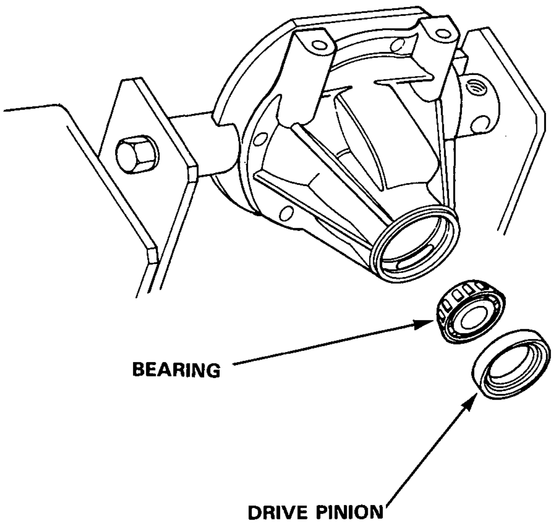


(cont'd)

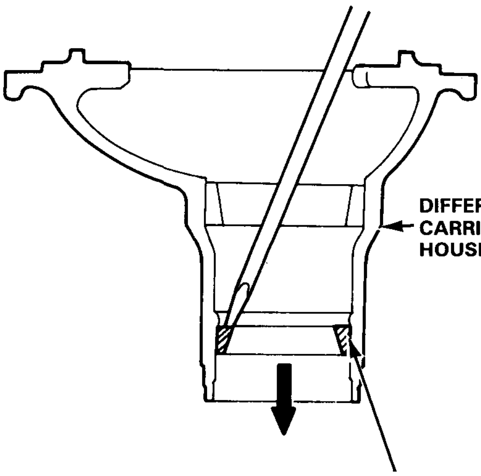
Differential

Disassembly (cont'd)

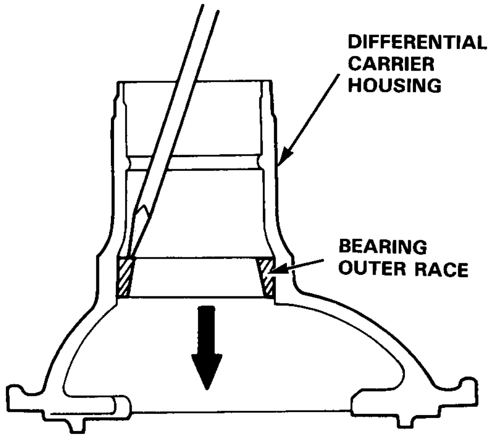
7. Remove the drive pinion oil seal and the taper roller bearing.



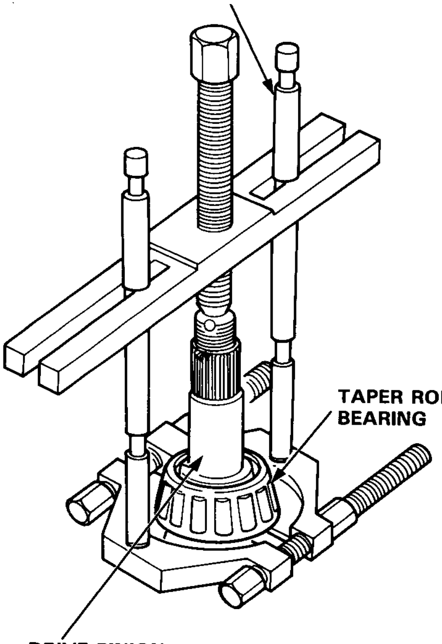
8. Remove the bearing outer race from the differential carrier housing.



9. Remove the bearing outer race from the differential carrier housing.



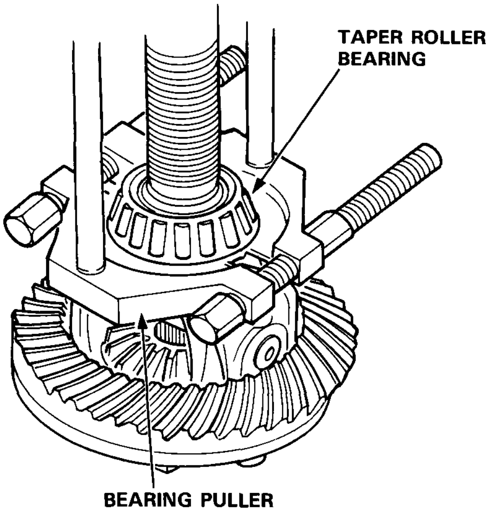
10. Remove the taper roller bearing from the drive pinion.



Differential Carrier

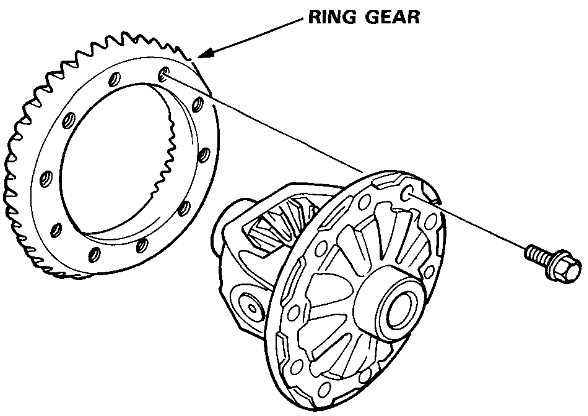
Disassembly/Reassembly

1. Remove the both differential side bearings using a bearing puller.



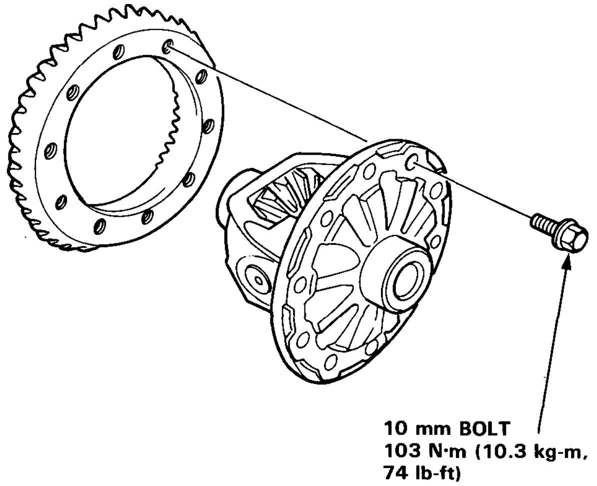
2. Remove the ring gear bolts, then remove the final driven gear from the differential carrier.

   NOTE:
   - The final driven gear bolts has right-hand threads.
   - Loosen the bolts in a criss-cross pattern in 2—3 steps.

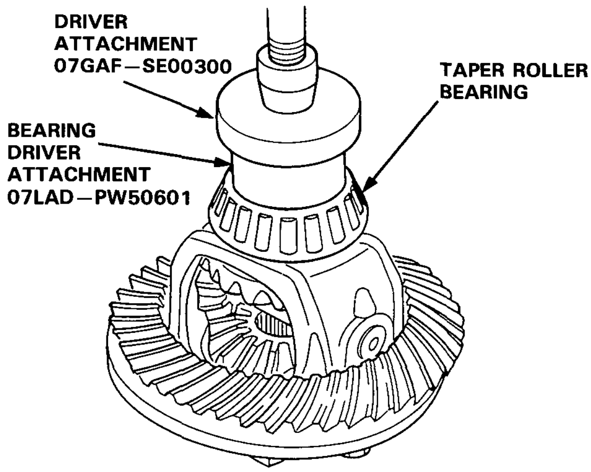


3. Install the ring gear on the differential carrier.

   NOTE: Tighten the bolts in a criss-cross pattern in 2—3 steps.

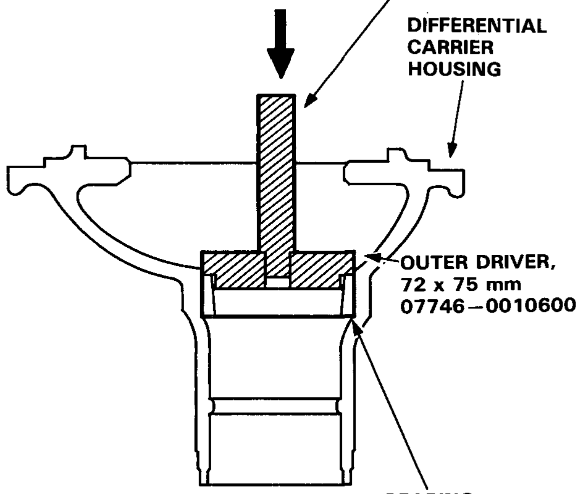


4. Drive the taper roller bearing onto the differential carrier.

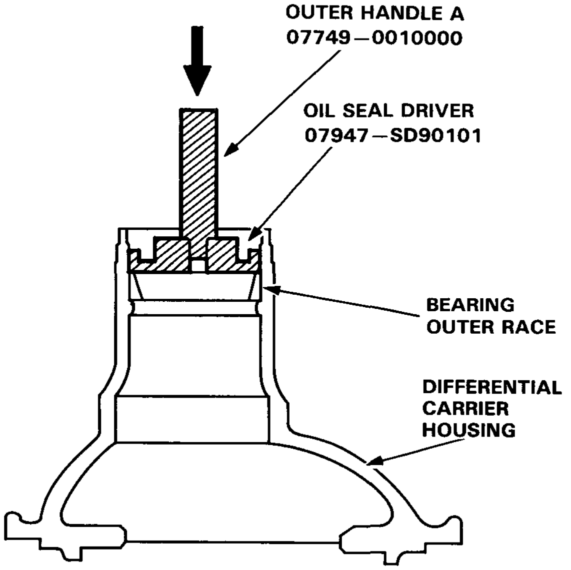


Height Adjustment

1. Install the rear pinion bearing race into the differential carrier housing using the special tools.



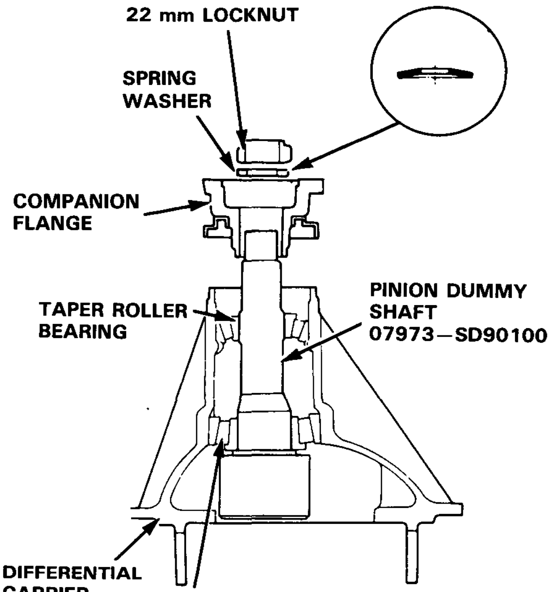
2. Install the front pinion bearing race into the differential carrier housing using the special tools.



3. Adjust drive pinion height as follows;

   NOTE: Clean all parts and tools in solvent thoroughly before adjusting the pinion height.

   a. Install the taper roller bearing on the Pinion Dummy Shaft, then install the shaft in the differential carrier housing.



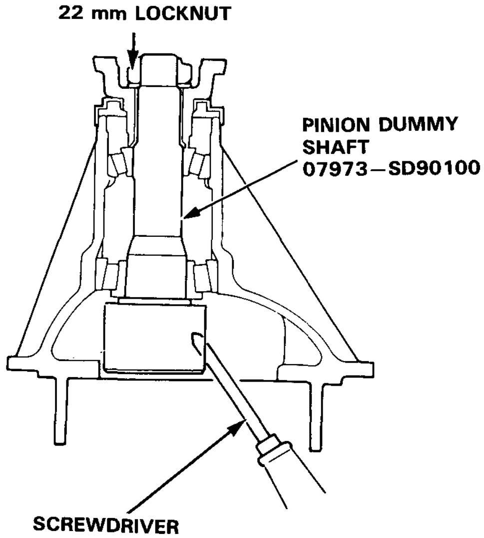
   b. Slide the taper roller bearing onto the dummy shaft.

   c. Install the companion flange, spring washer and locknut on the dummy shaft.

   NOTE:
   - Replace the locknut with a new one.
   - Do not install the drive pinion oil seals and pinion spacer at this time.
   - Install the spring washer with the dished end facing the carrier.

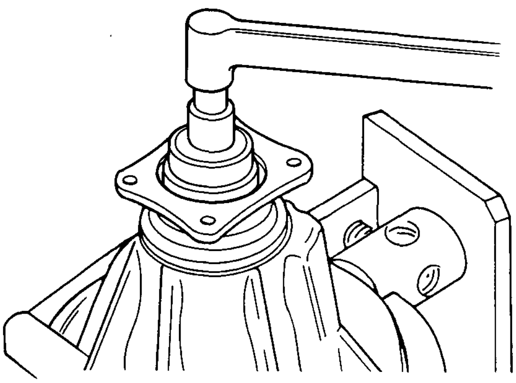
d. Hold the dummy shaft by inserting the end of a screwdriver in its hole, and torque the locknut to 10 N·m (1.0 kg-m, 8 lb-ft).

NOTE:
- The locknut has right-hand threads.
- Do not overtighten the locknut.



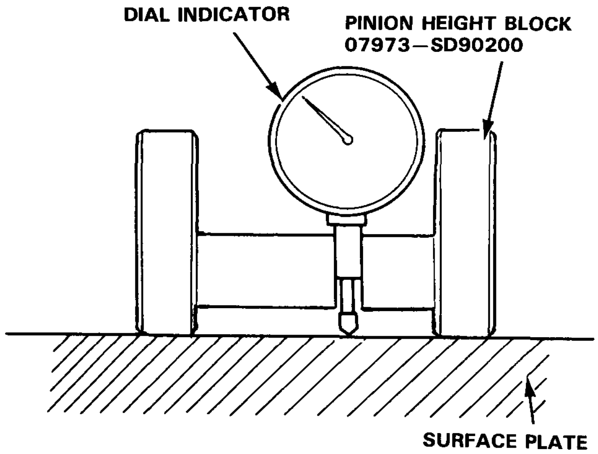
e. Measure drive pinion preload.

Standard: 0.9 – 1.2 N·m (9.0 – 12.0 kg-cm, 7.8–10.8 lb-in)



f. If out of tolerance, turn the locknut in or out until the correct preload is obtained.

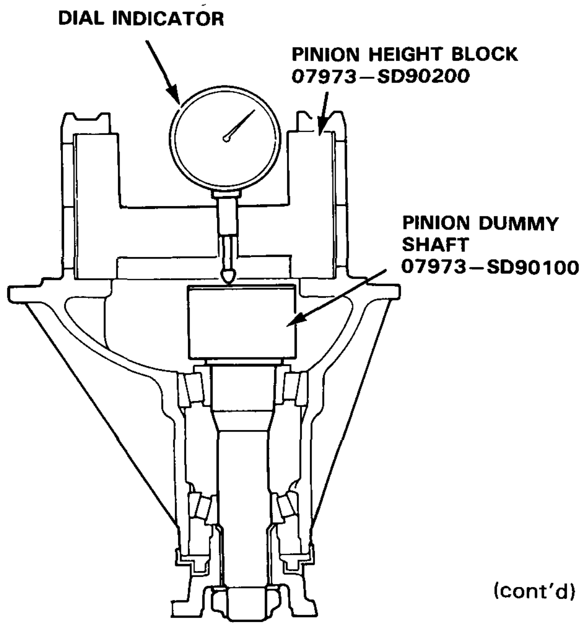
g. Place the Pinion Height Block on a surface plate; set the dial indicator needle to "0".



h. Move the pinion height block onto the differential housing with the indicator needle over the end of the dummy shaft as shown.

NOTE: Install the bearing caps, then tighten the bolts to 55 N·m (5.5 kg-m, 44 lb-ft) to assure proper tool contact.

i. *Remove the bearing caps, and measure the pinion height.* Take the least reading to determine the pinion height by rotating the pinion height block on the differential housing.



(cont'd)

Height Adjustment (cont'd)

j. To determine the proper 30mm thrust shim thickness, subtract the value etched on the pinion from the value obtained in step 3-i.

NOTE: Make etched on the pinion are a plus (+) or minus (−) figure representing machining tolerance in hundredths of a mm.

Example 1:
- Value measured in Step 3-i: 0.85 mm
- Mark etched on pinion: +2

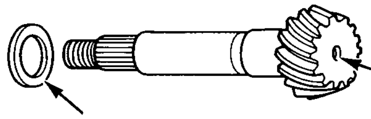
Shim Thickness required:

Shim to be selected from chart: 0.84 mm (0.033 in)

Example 2:
- Value measured in Step 3-i: 0.85 mm
- Mark etched on pinion: −1

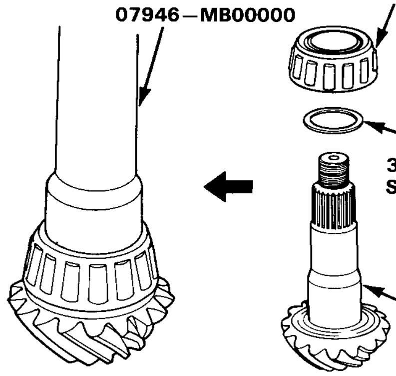
Shim Thickness required:

Shim to be selected from chart: 0.87 mm (0.034 in)

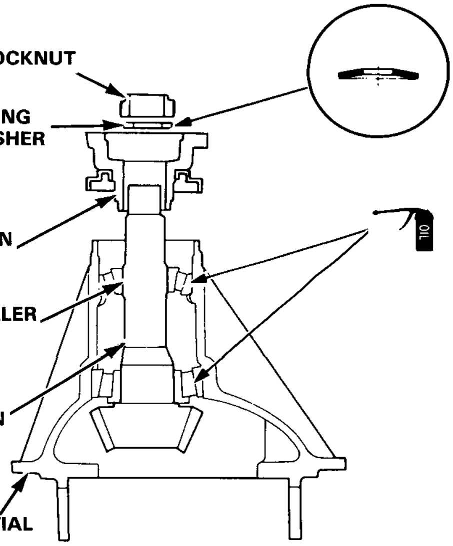


	PART NUMBER	THICKNESS
1	41361–PH8–000	0.75 mm (0.030 in)
2	41362–PH8–000	0.78 mm (0.031 in)
3	41363–PH8–000	0.81 mm (0.032 in)
4	41364–PH8–000	0.84 mm (0.033 in)
5	41365–PH8–000	0.87 mm (0.034 in)
6	41366–PH8–000	0.90 mm (0.035 in)
7	41367–PH8–000	0.93 mm (0.036 in)
8	41368–PH8–000	0.96 mm (0.037 in)
9	41369–PH8–000	0.99 mm (0.038 in)
10	41370–PH8–000	1.02 mm (0.039 in)
11	41371–PH8–000	1.05 mm (0.030 in)
12	41372–PH8–000	1.08 mm (0.030 in)
13	41373–PH8–000	1.11 mm (0.030 in)
14	41374–PH8–000	1.14 mm (0.030 in)
15	41375–PH8–000	1.17 mm (0.030 in)
16	41376–PH8–000	1.20 mm (0.030 in)

4. Drive the rear drive pinion and 30 mm thrust shim selected onto the drive pinion.



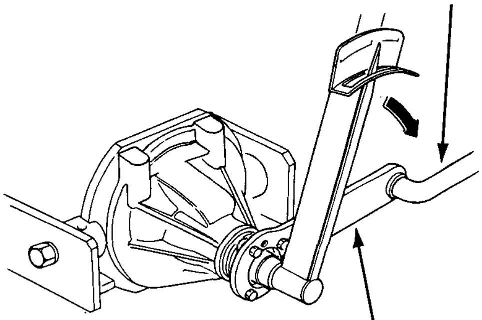
5. Install the drive pinion in the carrier.



6. Install the front drive pinion bearing, companion flange, spring washer, and locknut.

NOTE:
- Do not install the drive pinion oil seals and pinion spacers.
- Install the spring washer with the dished end facing the carrier.

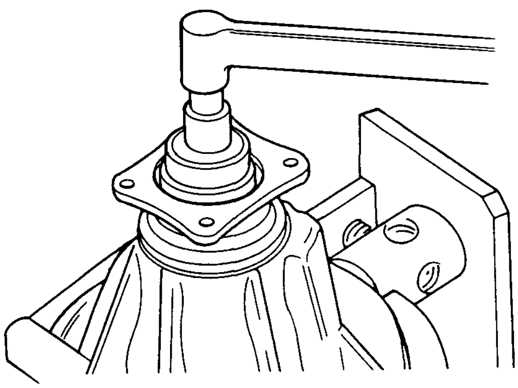
7. Hold the companion flange with the Companion Flange Holder, and tighten the locknut to about 10 N·m (1.0 kg-m, 8 lb-ft).



8. Check the drive pinion bearing preload.

NOTE:
- Do not overtighten the locknut.
- Rotate the pinion several times to assure proper bearing contact.

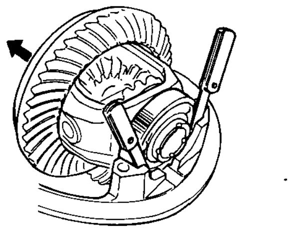
Preload: 0.9 — 1.2 N·m (9.0 — 12.0 kg-cm, 0.7 — 0.9 lb-ft)



9. If out of specification, turn the locknut in or out until the correct preload is obtained.

Reassembly

1. Fit the assembled differential case into the carrier.
2. Insert the one 2.20 mm (0.087 in) shim between the side bearing and carrier at the ring gear side, then push the differential assembly to move the ring gear away from the drive pinion. Measure the clearance between the side bearing and carrier at the opposite side of the ring gear.



3. To determine the shim thickness, add 2.23 to 2.26 mm to the clearance measured (to compensate for bearing tightening), then divide by 2.

Example:
Clearance measured with thickness gauge:
Allowance for taper bearing

$$\begin{array}{r} 3.32\ \text{mm} \\ 2.20\ \text{mm} \\ +0.06\ \text{mm} \\ \hline 5.58\ \text{mm} \end{array} \qquad \frac{5.58\ \text{mm}}{2} = 2.79\ \text{mm}$$

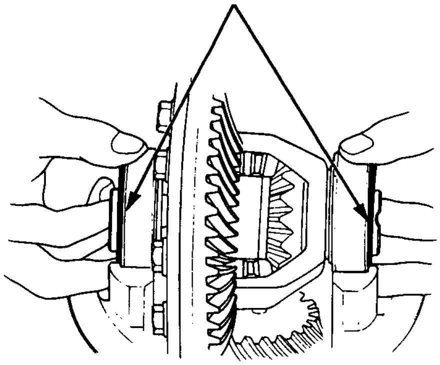
Insert a 2.77 mm shim in each side.

	PART NUMBER	THICKNESS
1	41411–PH8–000	2.20 mm (0.087 in)
2	41412–PH8–000	2.23 mm (0.088 in)
3	41413–PH8–000	2.26 mm (0.089 in)
4	41414–PH8–000	2.29 mm (0.090 in)
5	41415–PH8–000	2.32 mm (0.091 in)
6	41416–PH8–000	2.35 mm (0.093 in)
7	41417–PH8–000	2.38 mm (0.094 in)
8	41418–PH8–000	2.41 mm (0.095 in)
9	41419–PH8–000	2.44 mm (0.096 in)
10	41420–PH8–000	2.47 mm (0.097 in)
11	41421–PH8–000	2.50 mm (0.098 in)
12	41422–PH8–000	2.53 mm (0.100 in)
13	41423–PH8–000	2.56 mm (0.101 in)
14	41424–PH8–000	2.59 mm (0.101 in)
15	41425–PH8–000	2.62 mm (0.103 in)
16	41426–PH8–000	2.65 mm (0.104 in)
17	41427–PH8–000	2.68 mm (0.106 in)
18	41428–PH8–000	2.71 mm (0.107 in)
19	41429–PH8–000	2.74 mm (0.108 in)
20	41430–PH8–000	2.77 mm (0.109 in)
21	41431–PH8–000	2.80 mm (0.110 in)
22	41432–PH8–000	2.83 mm (0.111 in)
23	41433–PH8–000	2.86 mm (0.113 in)
24	41434–PH8–000	0.50 mm (0.020 in)

(cont'd)

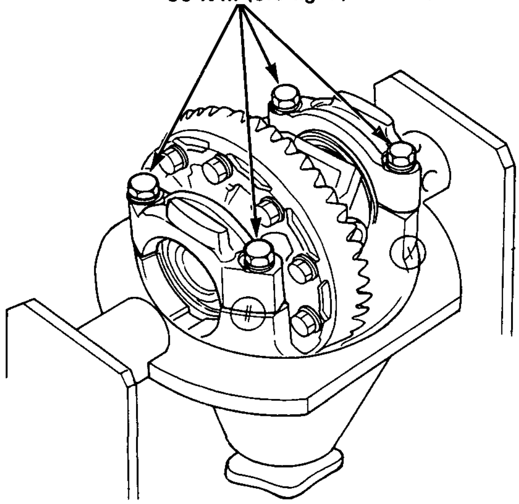
Reassembly (cont'd)

4. Install the shims selected between the side bearing and carrier on both sides.



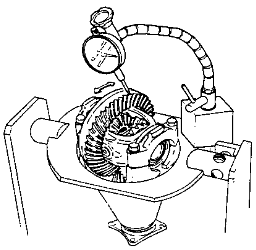
5. Position the bearing caps in place and tighten the bolts.

   NOTE: Align the marks made during disassembly.



6. Measure the backlash between the ring gear and drive pinion.

   Backlash: 0.11 – 0.16 mm (0.0043 – 0.0063 in)



7. If out of tolerance, correct by decreasing the shim thickness on one side and increasing the thickness of other shim the same amount.

   NOTE:
   - The total of both shims must still equal the calculation you made in step 3.
   - If there is too much backlash, move the ring gear toward the drive pinion. If there is not enough backlash, move the ring gear away from the drive pinion.

8. When you obtain correct backlash, check the total bearing preload.

Drive pinion preload: 0.9–1.2 N·m (9.0–12.0 kg-m, 7.8–10.4 lb-in)

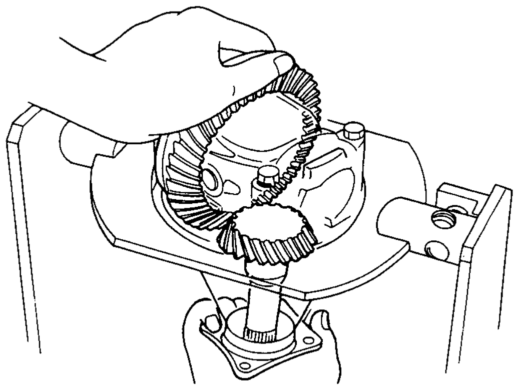
+

Diff housing preload: 0.4–0.6 N·m (4.0–6.0 kg-m, 3.4–5.2 lb-in)

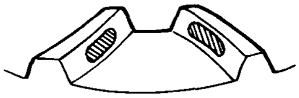
If the preload is not within the limit, change the 67 mm thrust shim on both sides of the differential case. The backlash must remain within tolerance.

9. Check the contact between the ring gear and drive pinion.

   NOTE:
   - Paint the ring gear teeth lightly and evenly with Prussian Blue (on both sides of each tooth).
   - Rotate the pinion one full turn forward and backward while applying pressure the ring gear.



1) CORRECT TOOTH CONTACT

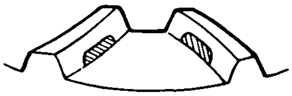


2) TOE CONTACT
- Use a thinner pinion shim to move the drive pinion away from the ring gear.

3) HEEL CONTACT
- Use a thinner pinion shim to move the drive pinion toward the ring gear.

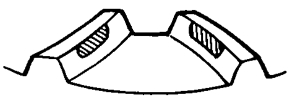
4) FLANK CONTACT
- Use a thinner side bearing shim on the drive pinion side and a thicker one on the ring gear side to move the ring gear toward the drive pinion. The total of both shims must still equal the calculation you made on page 15-47, step 3.

NOTE: Recheck backlash after replacing the side bearing shims. If out of specification, adjust as described under TOE CONTACT.



5) FACE CONTACT
- Use a thinner side bearing shim on the drive pinion side and a thinner one on the ring gear away from the drive pinion. The total of both shims must still equal the calculation you made on page on 15-47, step 3.

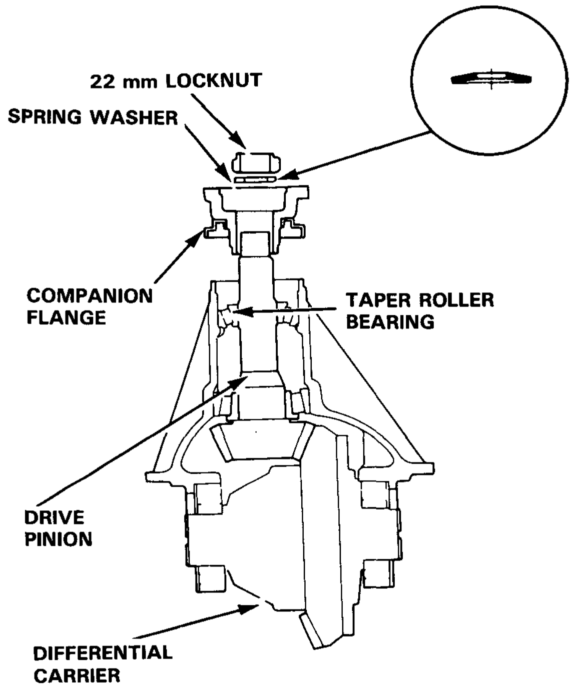
NOTE: Recheck backlash after replacing the side bearing shims.
If out of specification, adjust as described under HEEL CONTACT.



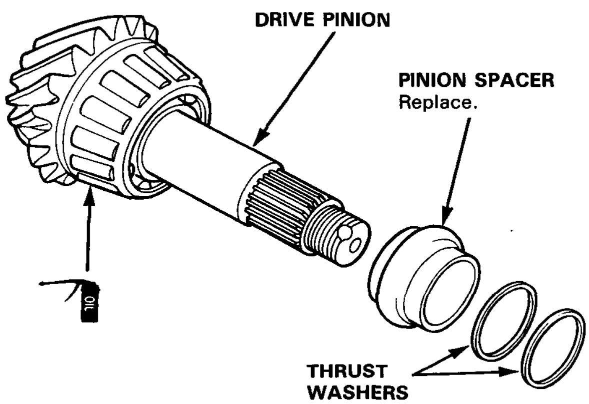
10. Remove the differential carrier from the housing.

11. Remove the following parts from the carrier.

- 22 mm locknut
- Spring washer
- Companion flange
- Drive pinion
- Front drive pinion bearing



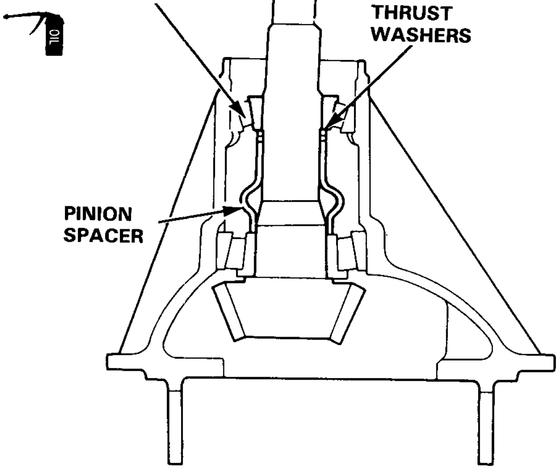
12. Install a new pinion spacer onto the drive pinion.



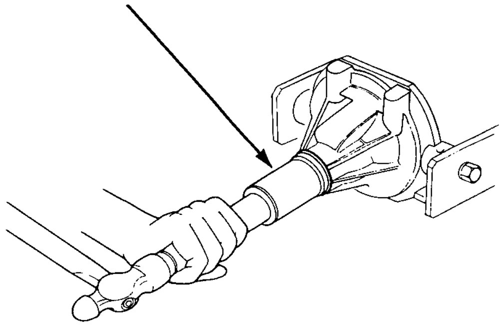
(cont'd)

Reassembly (cont'd)

13. Install the drive pinion in the differential carrier housing, then install the two thrust washers and taper roller bearing on the drive pinion.

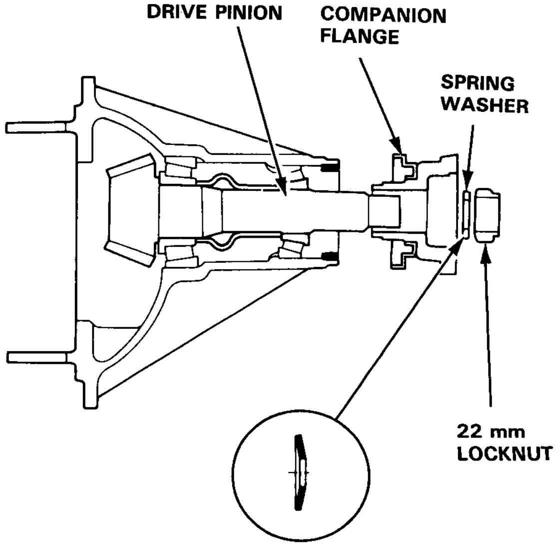


14. Drive the oil seal into the differential carrier housing using a special tool.



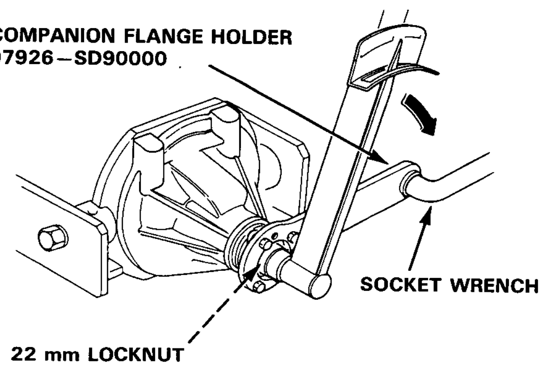
15. Install the following parts on the drive pinion.

- Companion flange
- Spring washer
- 22 mm Locknut



16. Hold the companion flange with the Companion Flange Holder and tighten the 22 mm locknut to 120 — 230 N·m (12 — 23 kg-m, 86 — 166 lb-ft). The preload should be 1.2 — 1.5 N·m (12.0 — 15.0 kg-m, 10 — 13 lb-ft).

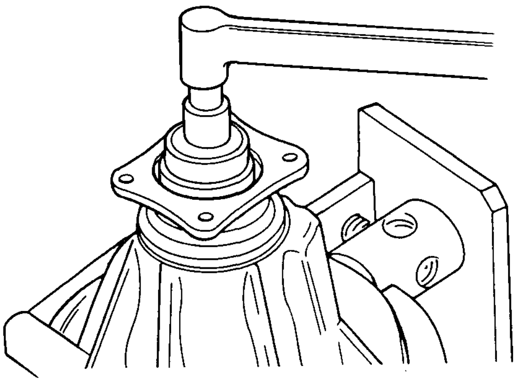
NOTE:
- If the preload exceeds 1.5 N·m (15 kg-cm, 13 lb-in), replace the spacer; Do not adjust by loosening the 22 mm locknut.
- Also replace the pinion spacer if the preload is not within the limit even when the locknut is tightened over 230 N·m (23 kg-m, 166 lb-ft).



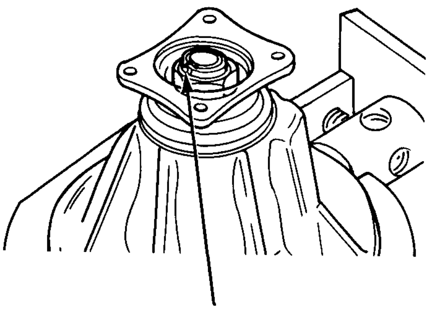
17. Check the preload.

NOTE: Before measuring the preload, rotate the pinion several times to assure proper bearing contact.

Preload: 1.2 — 1.5 N·m (12.0 — 15.0 kg-m, 10 — 13 lb-in)



18. Stake the 22 mm locknut.



19. Install the differential assembly on the carrier (page 15-47).

20. Check the total preload.

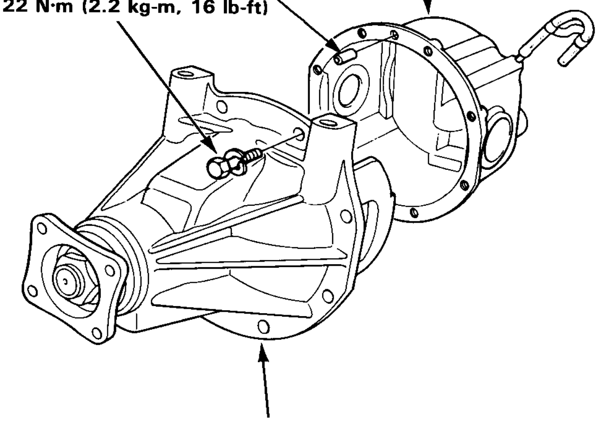
Drive Pinion Preload:		**Differential Carrier Preload:**
1.2 — 1.5 N·m (12.0 — 15.0 kg-cm, 10 — 13 lb-in)	+	0.4 — 0.6 N·m (4.0 — 6.0 kg-cm, 3.4 — 5.2 lb-in)

Housing Installation

1. Apply liquid gasket to the carrier housing mating surface of the differential housing.

   NOTE: This differential uses no gasket between the major housing; use Honda Genuine Liquid Gasket (P/N 08718—0001). Assemble the housing within 20 minutes after applying the liquid gasket and allow it to cure at least 30 minutes after assembly before filling it with oil.

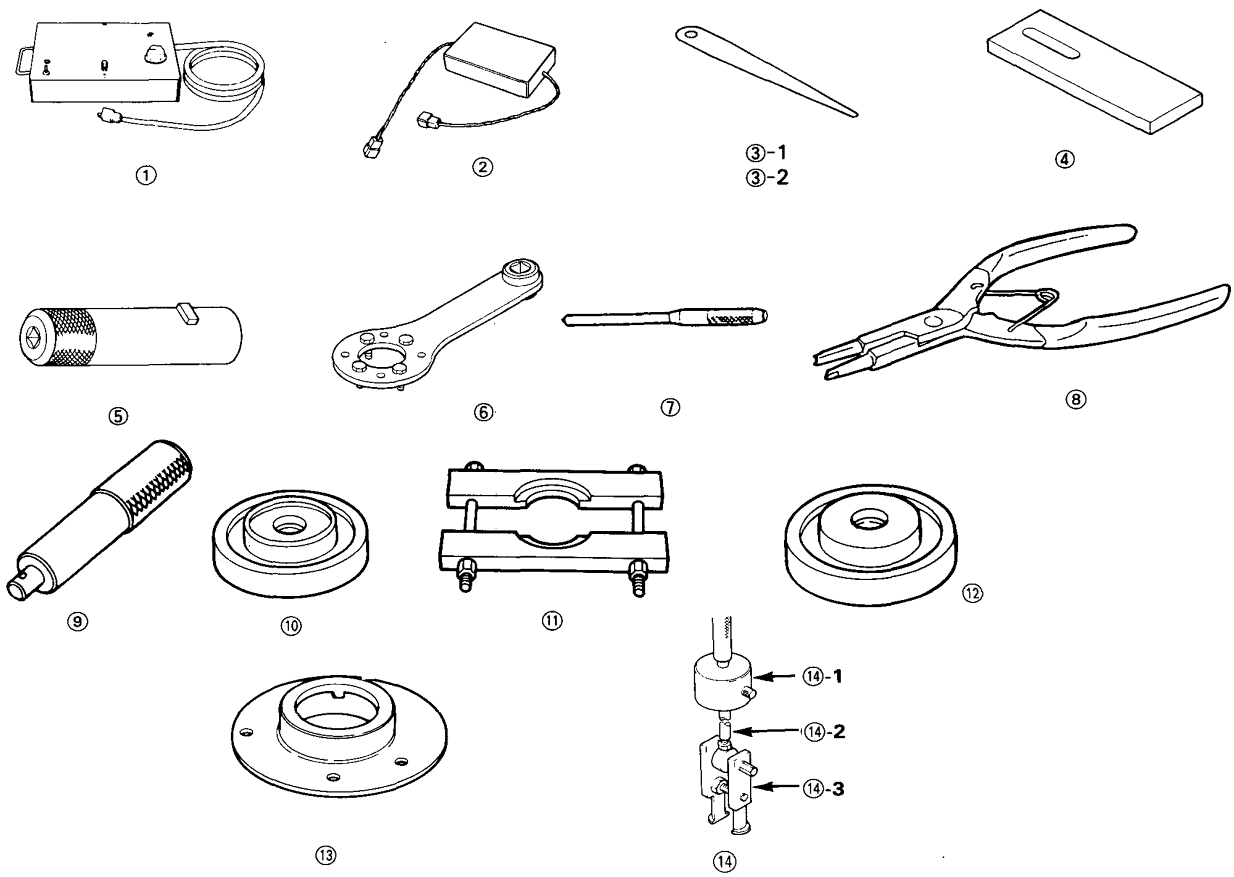
2. Install the carrier on the differential housing.



Differential
(with viscous coupling)

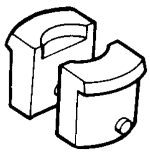
Special Tools

Ref. No.	Tool Number	Description	Remarks
①	07HAJ–SG00602	ALB Checker	07HAJ–SG00601 or 07508–SB00000
②	07HAJ–SG00400	Frequency Convert Adapter	
③	07KAJ–PS30100	Feeler Gauge Set	
③-1	07KAJ–PS30110	Feeler Gauge 0.05 mm	
③-2	07KAJ–PS30120	Feeler Gauge 0.25 mm	
④	07979–PJ40001	Magnet Stand Base	
⑤	07KAZ–PS30100	Viscous Shaft Adapter	
⑥	07926–SD90000	Companion Flange Holder	
⑦	07744–0010400	Pin Driver 5 mm	
⑧	07LGC–0010100	Snap Ring Plier	
⑨	07749–0010000	Outer Handle A	
⑩	07GAD–PG40100	Driver Attachment	
⑪	07KAF–PS30200	Inner Race Remover Base	
⑫	07JAD–SH30100	Oil Seal Driver	
⑬	07KAB–PS30100	Dog Piece Holder	
⑭	07JAC–PH80000	Adjustable Bearing Remover Set	
⑭-1	07JAC–PH80100	Bearing Remover Attachment	
⑭-2	07JAC–PH80200	Remover Handle	
⑭-3	07JAC–PH80300	Rmover Weight	

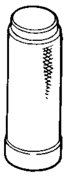


Special Tools

Ref. No.	Tool Number	Description	Remarks
⑮	07KAD–PS30100	Taper Bearing Remover	
⑯	07746–0030100	Inner Handle C	
⑰	07746–0030400	Inner Driver 35 mm	
⑱	07KAF–PS30100	Bearing Installer Tool Set	
⑱-1	07JAF–SJ80110	Shaft	
⑱-2	07JAF–SJ80120	Nut	
⑱-3	07KAF–PS30110	Taper Bearing Installer	
⑱-4	07KAF–PS30120	Taper Bearing Installer	
⑱-5	07KAF–PS30130	Taper Bearing Installer	
⑱-6	07KAF–PS30140	Taper Bearing Installer	
⑲	07KAF–PS30400	Pinion Oil Seal Driver	
⑳	07KAF–PS30500	Inner Race Driver	
㉑	07JAD–PN00100	Oil Seal Driver	
㉒	07KAJ–PS30200	Height Inspection Gauge	



⑮



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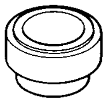
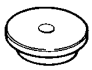


⑰

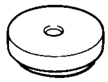
⑱-1

⑱-2

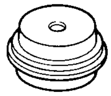
⑱-3



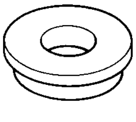
⑱-4



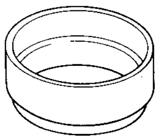
⑱-5



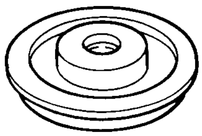
⑱-6



⑲



⑳



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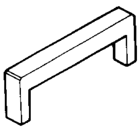

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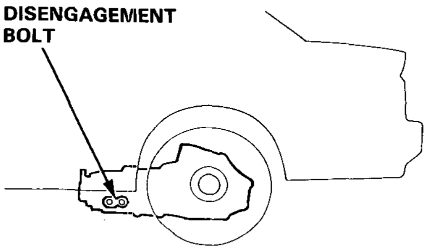
Service Precautions

The Real Time 4WD system allows instantaneous shift from FWD to 4WD automatically when greater traction is needed. To prevent accidents or injuries, the system must be released before performing any services on the differential unit.

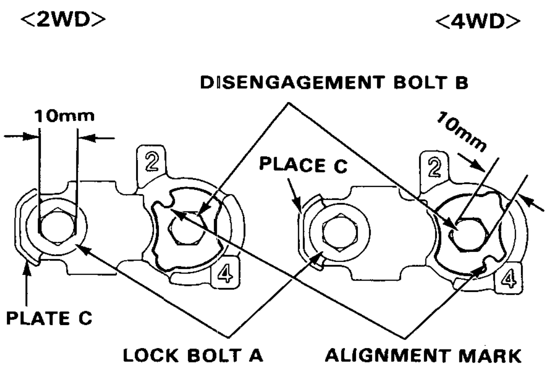
To release 4WD
With the engine *stopped, turn* the shift bolt (painted orange) as described below.



1. Loosen the lock bolt A.
2. Align the mark on the disengagement bolt B with "2" to disengage the 4WD system.
3. Align the plate C with the cutout in the disengagement bolt B and tighten the lock bolt A to the specified torque.

TORQUE: 17N·m (1.7kg-m, 12lb-ft)

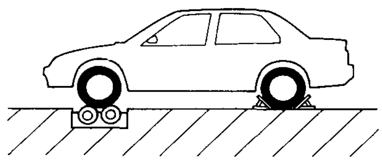
NOTE: When the engine starts with the 4WD system disengaged, the rear differential clutch warning light should come on.



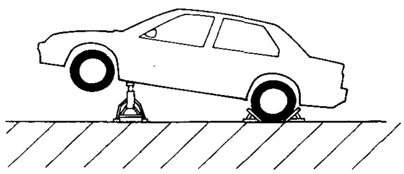
Operations Requiring 4WD Disengagement

- When using test appliances:
  Speedometer tester, brake tester, chassis dynamometer, etc.

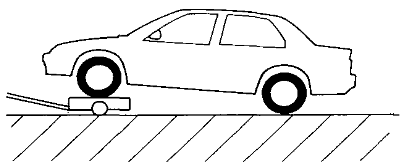
CAUTION: Apply the parking brake and block the rear wheels before using a speedometer tester. When you use a chassis dynamometer, fix the car body with a rope to prevent it from moving.



- When running the engine with the car jacked up.



- When towing with raised front or rear wheels.



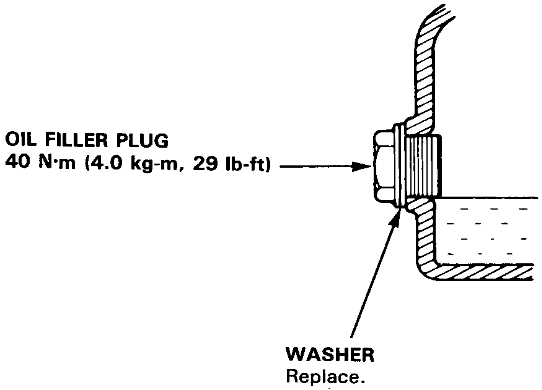
CAUTION: After servicing, be sure to engage the 4WD system (align the alignment mark with "4") and tighten the lock bolt A securely.
Stop the engine and disconnect the ABS B2 fuse in the engine compartment for more than 3 seconds.
The self-diagnosis lamp of the ABS control unit should stop blinking.

Differential Oil

Oil Level Check

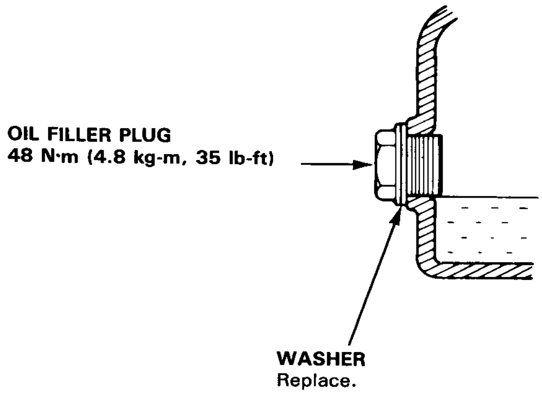
Clutch Housing

1. Check with oil at operating temperature, engine OFF, and car on level ground.
2. Remove oil filler plug and check level with finger.
3. Oil level must be up to filler hole. If it is below the hole, add oil until it runs out, then reinstall plug.



Differential Carrier

1. Check with oil at operating temperature, engine OFF, and car on level ground.
2. Remove oil filler plug and check level with finger.
3. Oil level must be up to filler hole. If it is below the hole, add oil until it runs out, then reinstall plug.



Oil Change

Clutch Housing

1. Change oil only when disassembling the clutch housing.

   NOTE: The clutch housing has no drain bolt.

   Capacity: 0.31 ℓ (0.33 US qt., 0.26 Imp. qt.) after overhaul.
   Recommended oil: Genuine Honda ATF

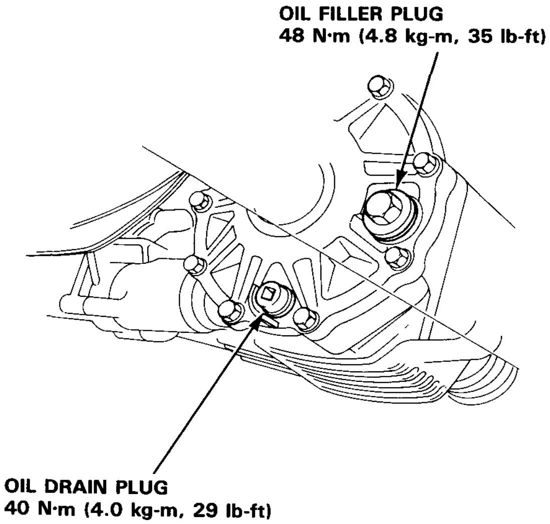
Differential Carrier

1. Drain with transmission oil at operating temperature, engine OFF, and car on level ground.
2. Remove the oil filler plug, then remove the drain plug and drain transmission.
3. Reinstall drain plug with a new washer, and refill to proper level.

   NOTE: Drain plug and filler plug washers should be replaced at every oil change.

Oil Capacity

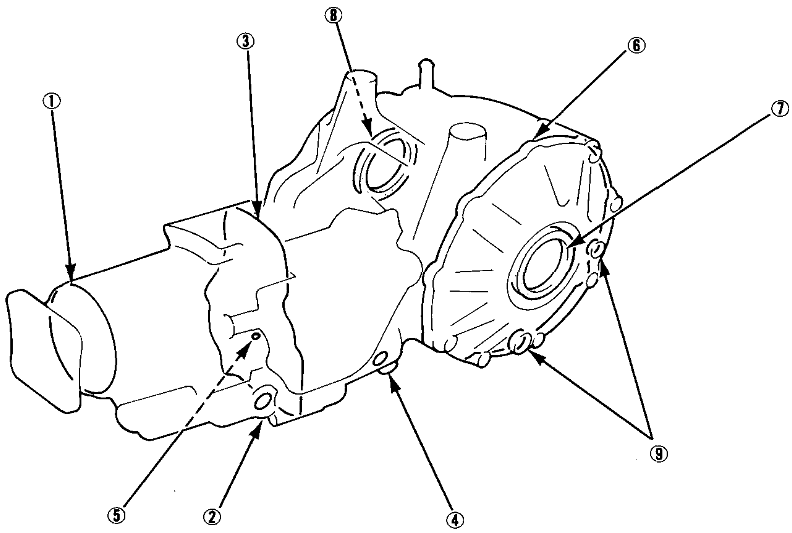
0.93 ℓ (1.0 US qt., 0.8 Imp. qt.) after drain.
1.0 ℓ (1.1 US qt., 0.9 Imp. qt.) after overhaul.
Recommended oil: Hypoid gear oil (API Classification GL5 or equivalent)
Viscosity SAE #90 above 5°C (41°F)
SAE #80 below 5°C (41°F)



Oil Leak

Inspection

CAUTION:
- **Use Honda Genuine Liquid Gasket (P/N 08718–0001).**
- **Clean the sealing surfaces before inspection.**
- **Apply sealant evenly to the whole area of the sealing surfaces.**
- **If more than 20 minutes have passed after applying the sealant, apply it again before assembling.**



① Check the area around the companion flange for oil leaks or seepage. If oul is leaking or seeping out, check for damaged companion flange oil seal.

② Check the area around 2 – 4 shift column for oil leaks or seepage. If oil is leaking or seeping out, check for damaged 2 – 4 shift column O-ring.

③ Check the area around the intermediate plate for oil leaks or seepage. If oil is leaking or seeping out, remove the intermediate plate and apply Honda Genuine Liquid Gasket (P/N 08718–0001) again.

④ Remove the check bolt and check for oil leaks or seepage. If oil is leaking or seeping out, check for damaged 2 – 4 shift shaft oil seal.

⑤ Check the check hole for oil leaks or seepage. If oil is leaking or seeping out, check for damaged two-liquid separator oil seals.

⑥ Check the area around the carrier cover for oil leaks or seepage. Remove the carrier cover and apply Honda Genuine Liquid Gasket (P/N 08718–0001) again, if necessary.

⑦ Check the area around the carrier cover oil seal for oil leaks or seepage. If oil is leaking or seeping out, check for damaged carrier cover oil seal.

⑧ Check the area around the differential carrier side oil seal for oil leaks or seepage.
Check for damaged differential carrier side oil seal if necessary.

⑨ Check the areas around the oil filler plug and the drain plug for oil leaks or seepage.
Replace the washers if necessary.

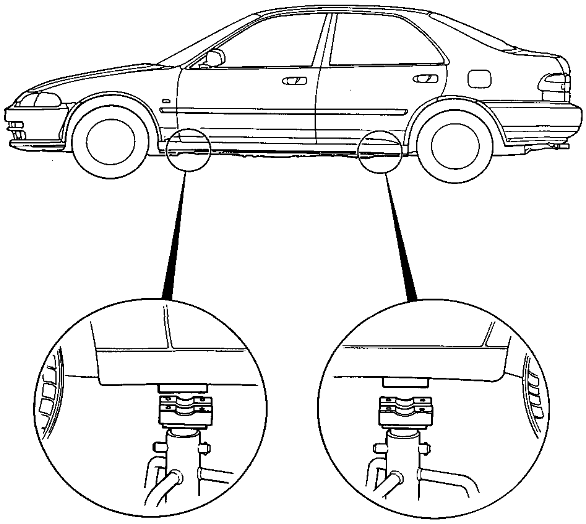
CAUTION: Clean the differential; this will make it easy to identify the oil leak/seepage point.

NOTE: Refer to "Disassembly" and "Reassembly" of the differential.

Inspection

MT

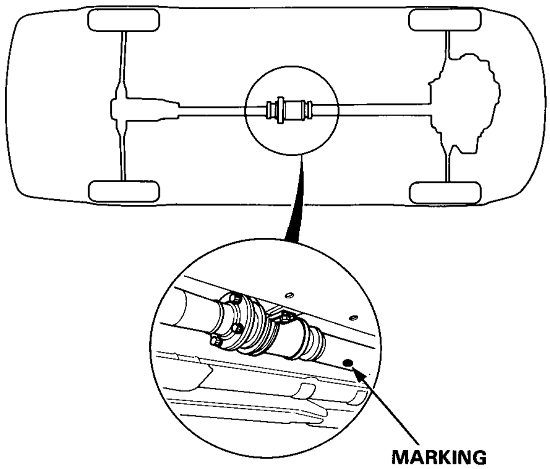
1. Raise the car off the ground and place safety stands under the side sill reinforcement sections.



2. Start the engine and keep the engine speed at idle.
3. Shift into low gear and gradually release the clutch.
4. Apply the parking brake firmly.
   - Viscous coupling is OK if the engine stalls.
   - Viscous coupling is faulty if the engine continues to run.

AT

1. Raise the car off the ground and place safety stands under the side sill reinforcement sections (see left drawing).
2. Mark either the No. 1 or No. 2 propeller shaft.



3. Start the engine and keep the engine speed at idle.
4. Fix the engine speed at low gear by moving the shift lever to the 2nd gear range and pressing the LOW switch.
5. Apply the parking brake firmly and hold the engine idling for 5 minutes.

   NOTE: Both the front and rear wheels should be spinning before the parking brake is applied, while the rear wheels should lock and the front wheels should turn slowly when the parking brake is applied.

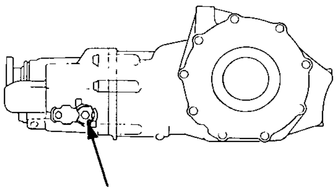
6. After the engine has idled for 5 minutes, measure the time during which the marked propeller shaft rotates 10 times.
   - Viscous coupling is OK if the time for 10 turns is 18 seconds or more.
   - Viscous coupling is faulty if the time for 10 turns is less than 18 seconds.

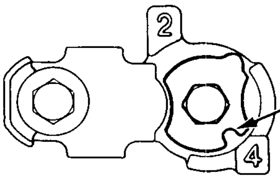
CAUTION: Release the parking brake lever immediately after measuring. Otherwise, the temperature of the viscous coupling rises causing damage.

Differential Clutch

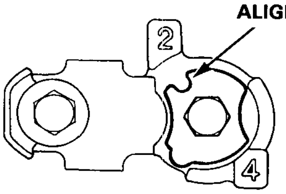
Operation Check (Mechanical)

1. Check for operation with the engine OFF.
2. Block the front wheels securely. Jack up the rear of the car and place safety stands under the side sill reinforcement sections.
3. Make sure that the 4WD system is engaged.



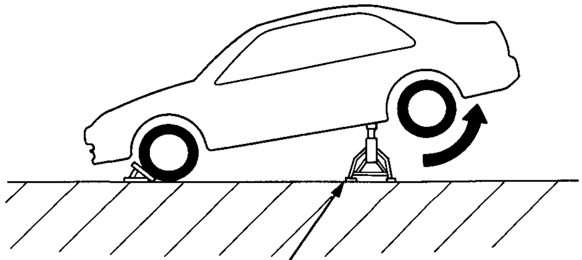


4. Make sure that the rear wheels cannot be turned by hand.
5. Disengage the 4WD system.



6. Make sure that the rear wheels can be turned by hand.
7. If the rear wheels turn in step 4, or if they do not turn in step 6, check the differential for damage.

   CAUTION: Do not forget to engage the 4WD system after checking the differential clutch for operation.

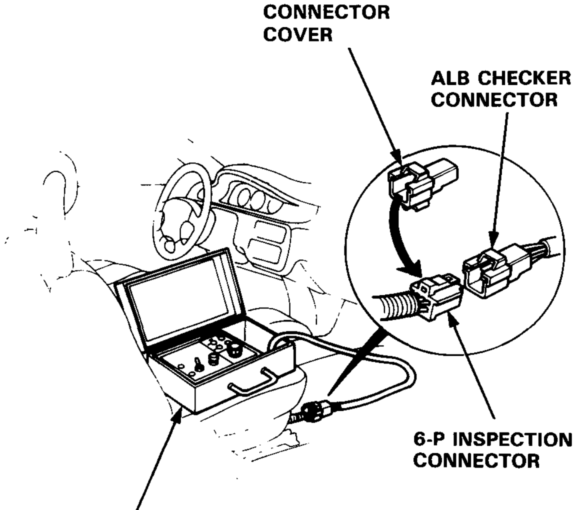


Operation Check (With ALB Checker)

1. Perform the ABS function test with ALB checker to check that there are no problems or abnormalities.

2. Turn the ignition switch ON and check that the rear differential clutch warning light comes on. If it does not come on, go to troubleshooting, page 19-66.

3. With the ignition switch OFF, disconnect the 6-P inspection connector (ORN) from the connector cover located on the cross-member under the passenger's seat and connect the 6-P inspection connector to the ALB checker.



4. Block the front wheels, raise the rear of the car and support on safety stands.

5. Shift the transmission in neutral for manual transmission models, and in P for automatic transmission models.

6. Short the brake light switch terminal with a jumper wire.

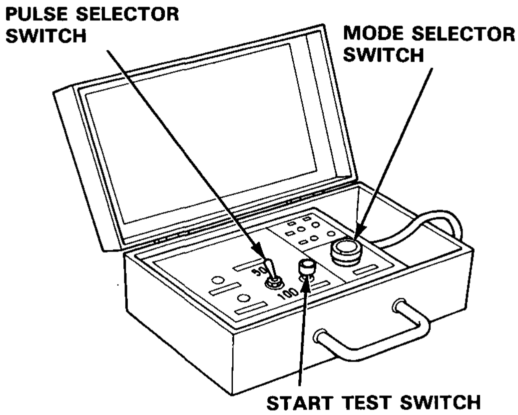
   NOTE: Although it is acceptable for assistant to depress the brake pedal instead of performing step 6, the wheels cannot be rotated in step 10 if the pedal is depressed firmly.

7. Start the engine and release the parking brake.

8. Turn the Mode Selector switch to 4 or 5.

9. Push the Start Test switch.

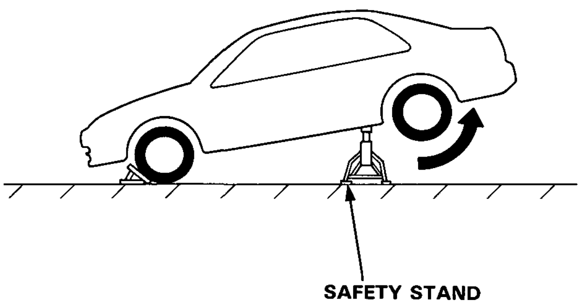
   CAUTION: When the test in progress indicator light is ON, don't turn the Mode Selector switch.



10. Check if the rear wheels can be rotated by hand while solenoid operating sound is heard.
    If the rear wheels cannot be rotated, there is an open circuit in the related wire harness or the solenoid is faulty.

    CAUTION: Do not use Mode 6 while testing.

    ⚠ WARNING Disconnect the ALB checker before driving the car A collision can result from a reduction, or complete loss of braking ability causing severe personal injury or death.

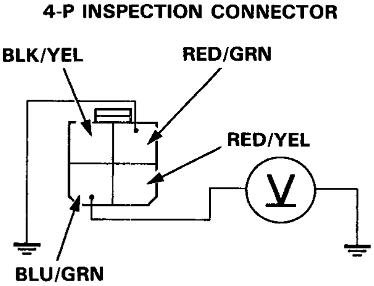


Differential Clutch

Operation Check (With Jumper Wire)

CAUTION: To prevent the rear differential clutch solenoids from damage, do not leave the ignition switch on for more than 5 minutes and do not ground the RED/YEL wire (pulling solenoid) for more than 5 seconds while testing.

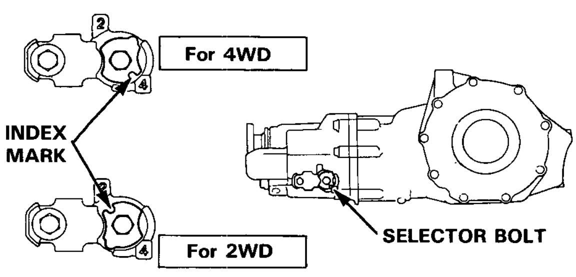
1. With the ignition switch OFF, disconnect the 4-P inspection connector (ORN) from the connector cover located on the cross-member under the passenger's seat. Ground the RED/GRN terminal (holding solenoid) to the body with a jumper wire and connect the voltmeter between the BLUE/GRN terminal and body ground.



View from terminal side.

2. Block the front wheels, raise the rear of the car and support on safety stands.

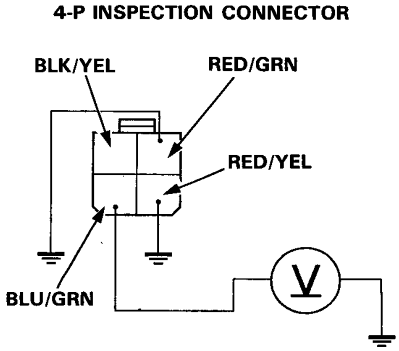
3. Make sure that the selector bolt of the rear differential is set to 4WD.



4. Turn the ignition switch ON.

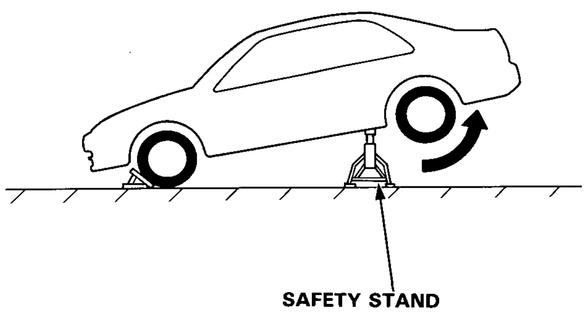
5. Check that the voltmeter shows the battery voltage. If it shows 0V, the stroke switch circuit is defective or the dog clutch is faulty (2WD position).

6. Ground the RED/YEL terminal to the body with a different jumper wire for an instant (less than 5 seconds).



View from terminal side.

7. Check that the voltmeter shows 0V and that the rear wheels can be rotated by hand.
   - If the rear wheels cannot be rotated, there is an open circuit in the related wire harness or the solenoid is faulty.
   - If the rear wheels can be rotated but the voltmeter does not show 0V, the stroke switch is faulty.



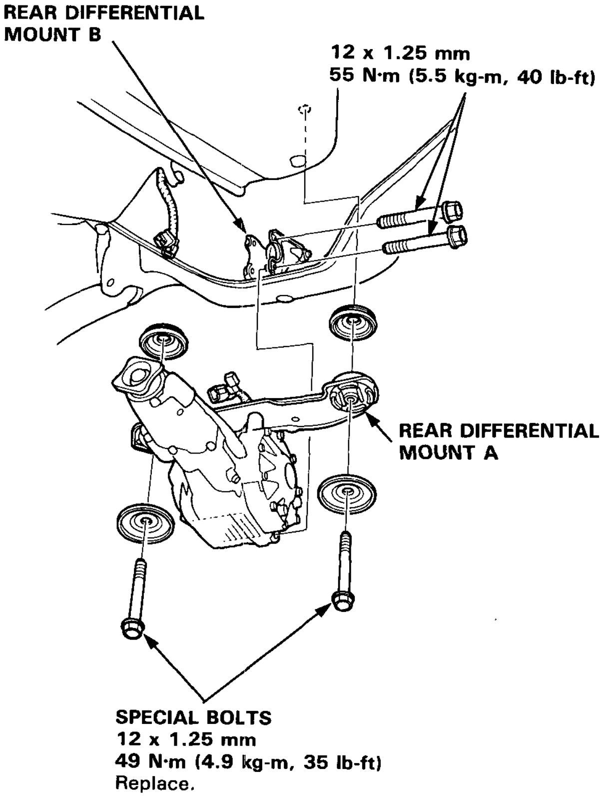
CAUTION: Most problems in the unit are to be diagnosed by identifying noises from the gears or bearings. Care should be taken during diagnosis not to confuse the differential noises with those from other drive train components.

Symptom	Probable Cause	Remedy
Consistent noise during cruising	• Lack of oil	• Replenish oil
	• Foreign matter stuck in gears, etc.	• Clean and inspect • Replace any damaged or faulty parts
	• Improper tooth contact between ring gear and hypoid pinion • Worn or damaged side bearing • Worn or damaged hypoid pinion taper bearing	• Adjust or replace
	• Worn ring gear or hypoid pinion • Deformed ring gear or differential carrier • Damaged gears, etc.	• Replace
Gear noises while accelerating	• Lack of oil	• Replenish oil
	• Foreign matter stuck in gears, etc.	• Clean and inspect • Replace damaged parts
	• Gears not engaged properly or misadjusted • Improper hypoid pinion preload	• Clean and inspect • Replace damaged parts
	• Chipped or damaged gears	• Replace
Gear noises while coasting	• Improper hypoid pinion preload • Chipped or damaged gears	• Adjust or replace
Bearing noises while accelerating or coasting/decelerating	• Cracked or damaged hypoid pinion taper bearing or side bearing	• Replace
Abnormal noises while starting or accelerating	• Excessive backlash between ring gear and hypoid pinion gear • Improper ring gear or hypoid pinion preload	• Adjust
	• Worn viscous side spline	• Replace
Oil leak	• Oil level too high	• Lower to proper level
	• Clogged breather hole	• Clean or replace
	• Loose differential carrier or inadequate sealing	• Recheck torque or apply sealant
	• Worn or damaged oil seal	• Replace
Overheating	• Lack of oil	• Replenish
	• Insufficient backlash between ring gear and hypoid pinion gear	• Adjust
	• Excessive ring gear or hypoid pinion preload	• Adjust
Shock noises from the rear when starting	• Excessive backlash between ring gear and hypoid pinion gear	• Adjust
Shock noises from rear differential when rouding a curve in reverse gear at full speed	• Dog clutch out of engagement	• Adjust or replace

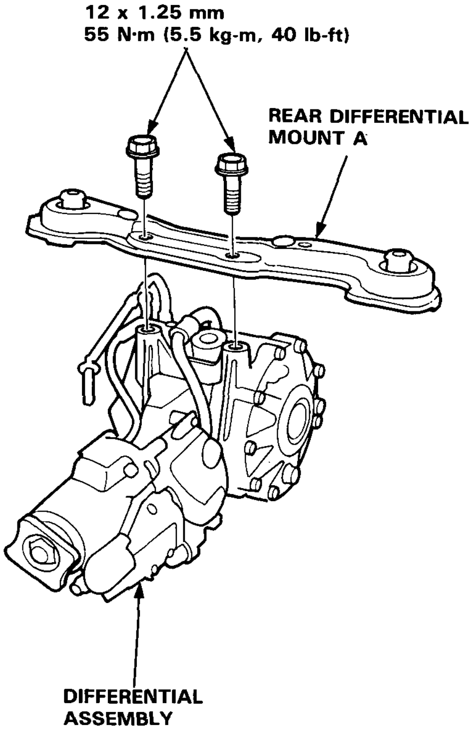
Differential Assembly

Removal/Installation

1. Disconnect the battery negative (–) and positive (+) cables from the battery.
2. Disconnect the differential harness connectors.
3. Drain oil from the differential.
4. Remove the breather tube joint.
5. Remove the propeller shaft (see section 16).
6. Remove the driveshafts (see section 16).
7. Remove the mount bolts from the rear differential mount B.
8. Remove the rear differential mount A attaching bolts, then remove the differential assembly and mount A.



9. Remove the rear differential mount A from the differential assembly.



10. Install the differential assembly in the reverse order of removal.

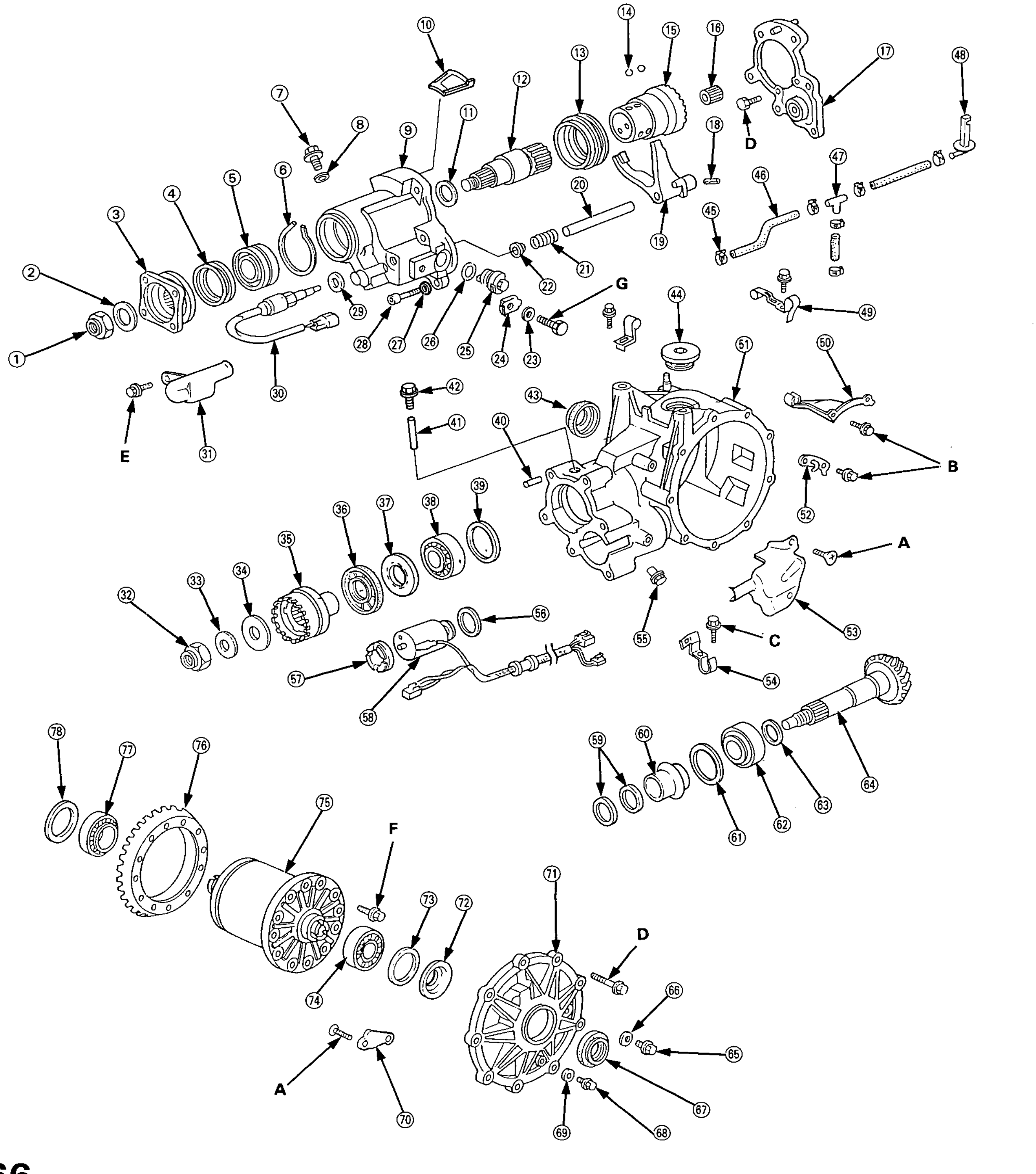
    NOTE: After installing the rear differential, pour the specified amount of the ATF oil into the clutch housing and the gear oil into the differential carrier (see page 15-57).

Differential

Illustrated Index

CAUTION: Coat the clutch housing side parts with ATF and the differential carrier side parts with hypoid gear oil.

NOTE:
- Clean the parts (except solenoid) thoroughly in cleaning solvent and dry them with compressed air. Blow out all passages.
- Coat the rotating or sliding sections of the parts with oil before reassembly.



① **20 mm LOCKNUT**
Replace.
99 N·m (9.9 kg-m, 72 lb-ft)
② **SPRING WASHER**
③ **COMPANION FLANGE**
④ **40 x 62 x 8 mm OIL SEAL**
Replace.
⑤ **BALL BEARING**
⑥ **SNAP RING**
⑦ **14 mm FILLER BOLT**
⑧ **WASHER**
Replace.
⑨ **CLUTCH HOUSING**
⑩ **BREATHER PLATE**
⑪ **30 mm WASHER**
Selection, page 15-91
⑫ **2-4 INPUT SHAFT**
⑬ **2-4 SLEEVE**
⑭ **STEEL BALL**
⑮ **DOG CLUTCH HUB**
⑯ **20 x 26 x 17 mm NEEDLE BEARING**
⑰ **INTERMEDIATE PLATE**
⑱ **5 x 25 mm SPRING PIN**
Replace.
⑲ **2-4 SHIFT FORK**
⑳ **2-4 SHIFT FORK SHAFT**
㉑ **2-4 SHIFT SPRING**
㉒ **2-4 SHIFT SPACER**
㉓ **SPRING WASHER**
㉔ **LOCK WASHER**
Replace.
㉕ **2-4 SHIFT COLUMN**
㉖ **15.8 x 2.4 mm O-RING**
Replace.
㉗ **SPRING WASHER**
㉘ **SOCKET BOLT**
24 N·m (2.4 kg-m, 17 lb-ft)
㉙ **14 mm SHIM**
Selection, page 15-96
㉚ **STROKE SWITCH**
25 N·m (2.5 kg-m, 18 lb-ft)
㉛ **SWITCH HARNESS PROTECTOR**
㉜ **26 mm LOCKNUT**
Replace.
㉝ **SPRING WASHER**
㉞ **HUB WASHER**
㉟ **DOG PIECE**
㊱ **39 x 68 x 7 mm OIL SEAL**
Replace.
㊲ **39 x 64 x 7 mm OIL SEAL**
Replace.
㊳ **TAPER ROLLER BEARING**
㊴ **62 mm OUTER SPACER**
㊵ **10 x 24 mm DOWEL PIN**
㊶ **SPECIAL PIPE C**
㊷ **SEALING LOW BOLT**
㊸ **35 x 66 x 8 mm OIL SEAL**
Replace.
㊹ **34 mm SEALING BOLT**
㊺ **TUBE CLAMP**
㊻ **BREATHER TUBE**
㊼ **3-WAY JOINT**
㊽ **BREATHER TUBE JOINT**
㊾ **HARNESS CLAMP**
㊿ **OIL GUTTER PLATE**
(51) **DIFFERENTIAL HOUSING**
(52) **BREATHER CHAMBER PLATE**
(53) **HARNESS PROTECTOR**
(54) **STROKE SWITCH CLAMP**
(55) **12 mm CHECK BOLT**
17 N·m (1.7 kg-m, 12 lb-ft)
(56) **SOLENOID SPACER**
(57) **SOLENOID MOUNTING SPACER**
(58) **2-4 SOLENOID ASSEMBLY**
(59) **30 mm SHIM**
(60) **PINION SPACER**
(61) **72 mm OUTER SPACER**
(62) **TAPER ROLLER BEARING**
(63) **35 mm SHIM**
Selection, page 15-92
(64) **HYPOID PINION**
(65) **20 mm FILLER BOLT**
48 N·m (4.8 kg-m, 35 lb-ft)
(66) **WASHER**
Replace.
(67) **35 x 66 x 8 mm OIL SEAL**
Replace.
(68) **14 mm DRAIN BOLT**
40 N·m (4.0 kg-m, 29 lb-ft)
(69) **WASHER**
Replace.
(70) **OIL CHAMBER PLATE**
(71) **HOUSING COVER**
(72) **OIL GUIDE PLATE**
(73) **68 mm SHIM**
Selection, page 15-93
(74) **TAPER ROLLER BEARING**
(75) **VISCOUS COUPLING ASSEMBLY**
(76) **HYPOID RING GEAR**
(77) **TAPER ROLLER BEARING**
(78) **66 mm SHIM**
Selection, page 15-93

	Bolt Size	Torque Value
A	6 x 1.0 mm	10 N·m (1.0 kg-m, 7.2 lb-ft)
B	6 x 1.0 mm	11 N·m (1.1 kg-m, 8.0 lb-ft)
C	6 x 1.0 mm	12 N·m (1.2 kg-m, 8.7 lb-ft)
D	8 x 1.25 mm	24 N·m (2.4 kg-m, 17 lb-ft)
E	8 x 1.25 mm	26 N·m (2.6 kg-m, 19 lb-ft)
F	10 x 1.25 mm	103 N·m (10.3 kg-m, 74 lb-ft)
G	LOCK BOLT	17 N·m (1.7 kg-m, 12 lb-ft)

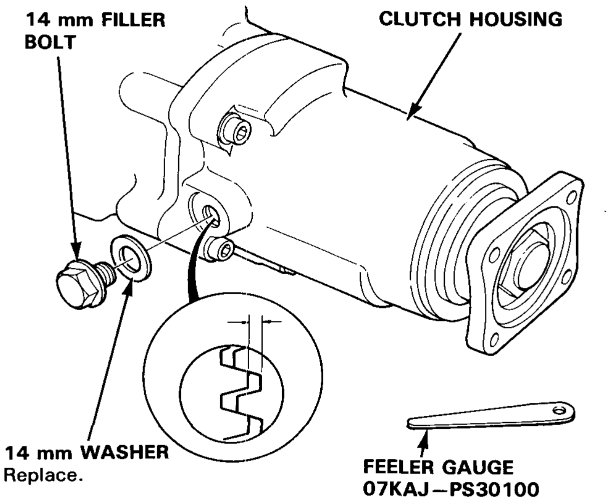
Inspection

Inspection before Disassembly

1. Remove the 14 mm filler plug from the clutch housing. Measure the dog clutch clearance using the feeler gauge.

   CAUTION: Measure the clearance at four diagonally opposed points.

   Standard: 0.05 mm (0.002 in) feeler gauge can be inserted, while 0.25 mm (0.01 in) cannot.

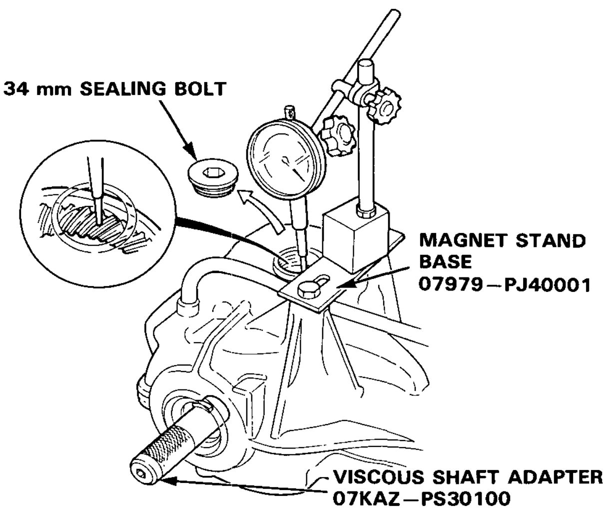


2. Remove the 34 mm sealing bolt from the differential carrier and measure the ring gear backlash.

   CAUTION: Measure the backlash at four diagonally opposed points.

   Standard: 0.10 – 0.15 mm (0.004 – 0.006 in)

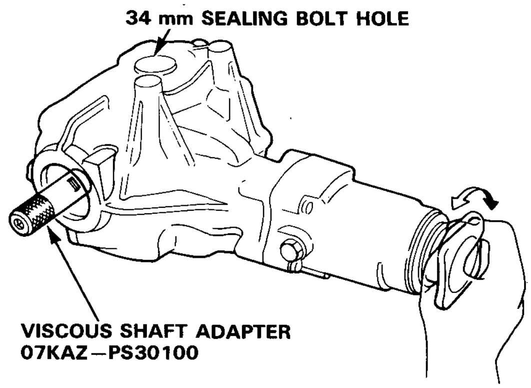
   NOTE: Measure the backlash by holding the dog piece and moving the viscous shaft adapter.



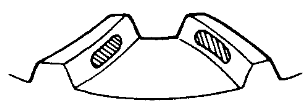
3. Check the tooth contact between the ring gear and hypoid pinion through the 34 mm sealing bolt hole.

   NOTE: Paint the ring gear teeth (on both sides of each tooth) lightly and evenly with Prussian Blue. Applying load to the ring gear, rotate the companion flange one full turn both forward and backward.

   CAUTION: Check at three equally spaced point.

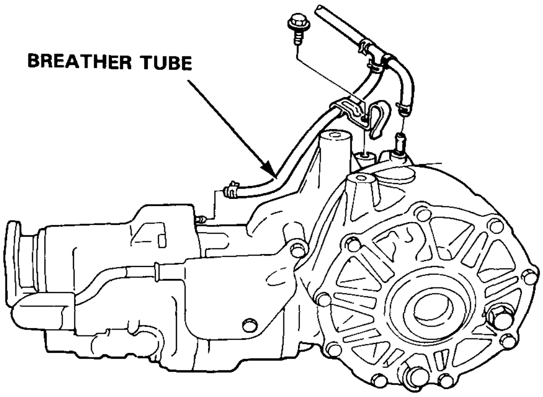


GOOD TOOTH CONTACT PATTERN

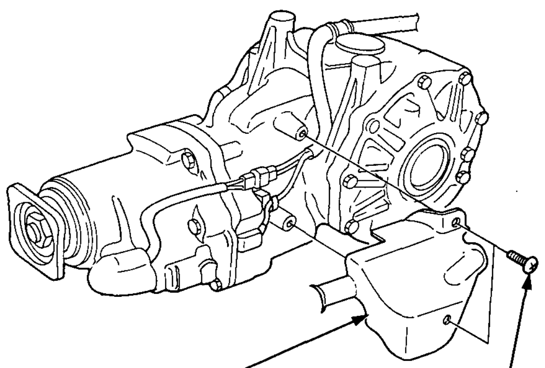


Disassembly

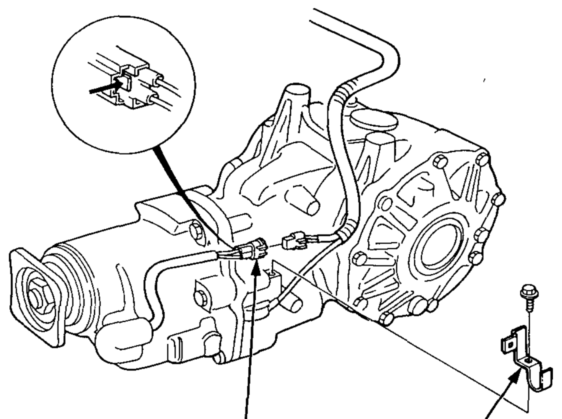
1. Disconnect the breather tube.



2. Remove the flat screws and the harness protector.

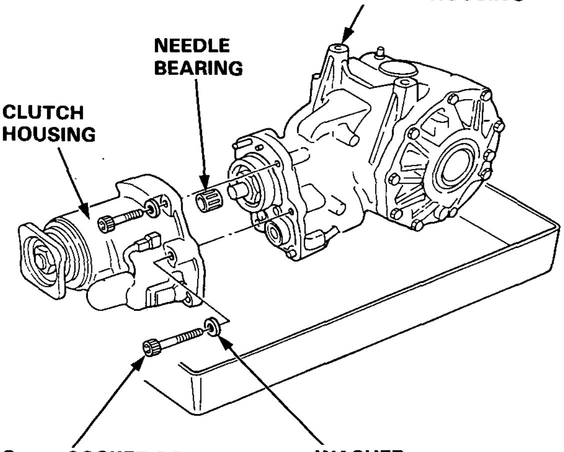


3. Remove the harness clamps and disconnect the stroke switch connector.



4. Remove the 8 mm socket bolt and remove the clutch housing from the differential housing.

NOTE:
- Put a pan under the clutch housing and differential housing when separating them, because ATF will flow out.
- Separate the clutch housing from the differential housing by tapping lightly on the companion flange with a plastic hammer.

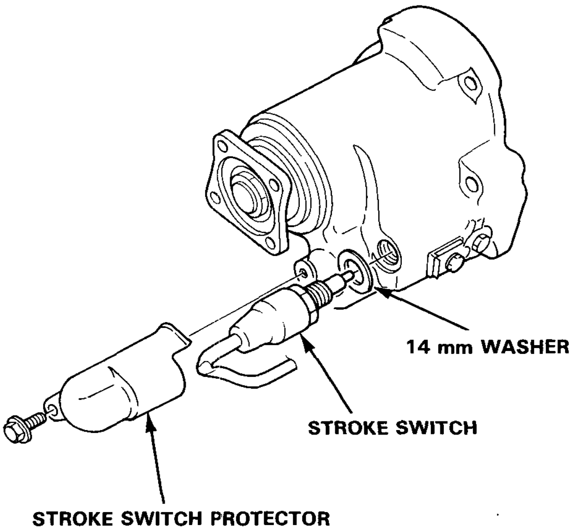


(cont'd)

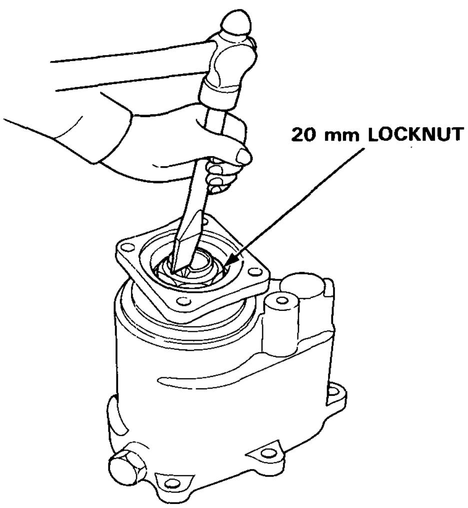
Disassembly (cont'd)

Clutch Housing

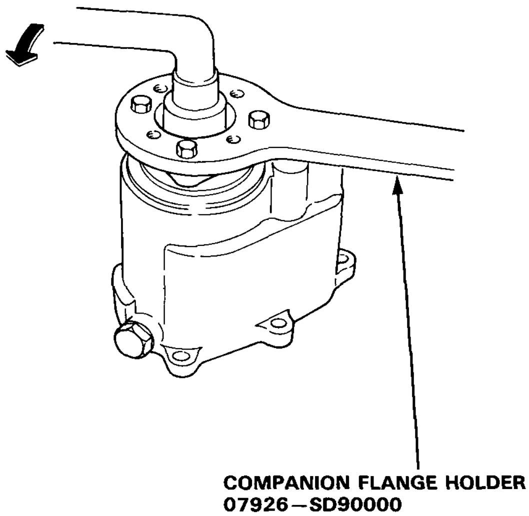
5. Remove the stroke switch protector and stroke switch.



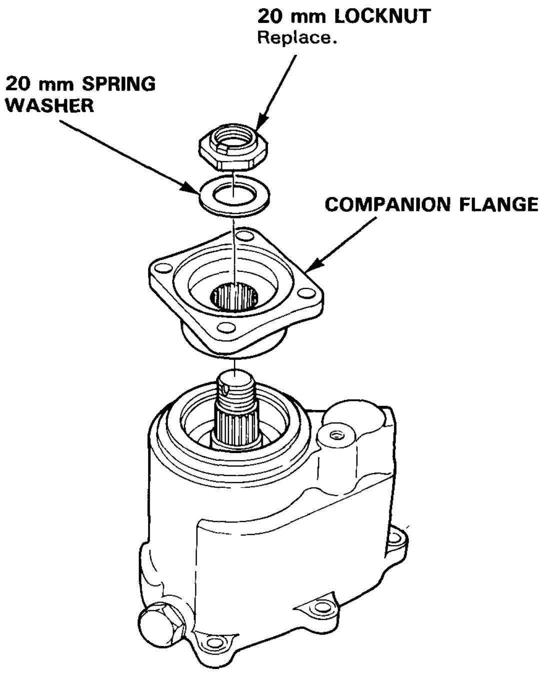
6. Pry off the staked area of the 20 mm locknut.



7. Hold the companion flange with the Companion Flange Holder and loosen the 20 mm locknut.

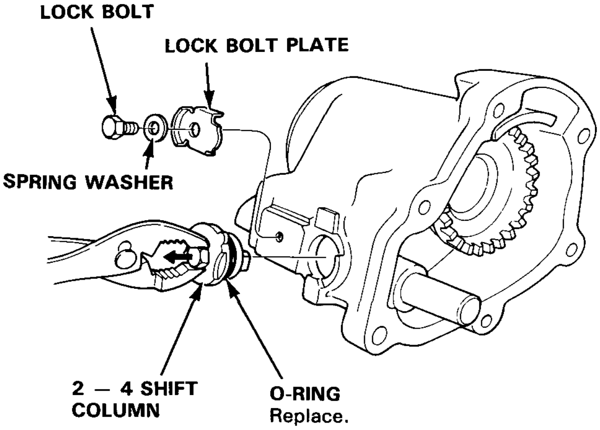


8. Remove the 20 mm locknut, 20 mm spring washer, and the companion flange.



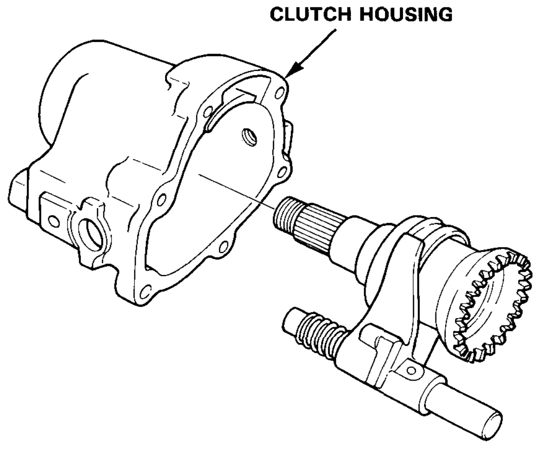
9. Remove the locknut and lock bolt plate, then pull out the 2 — 4 shift column.

NOTE: Use a pair of pliers to remove the 2 — 4 shift column.



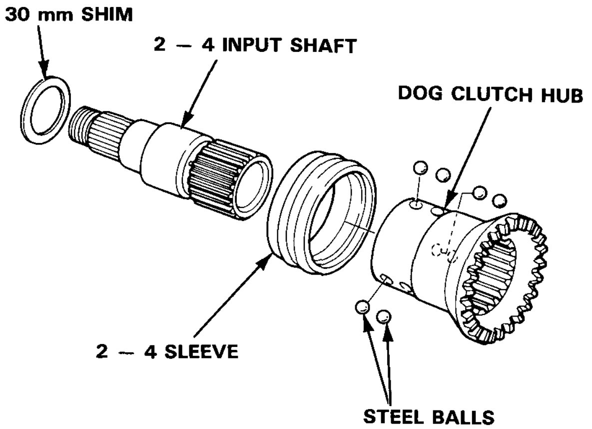
10. Remove the 2 — 4 input shaft, dog clutch hub, 2 — 4 sleeve, steel balls, 30 mm shim, 2 — 4 shift shaft, 2 — 4 shift fork, 2 — 4 shift spring, and the 2 — 4 shift spacer as a set.

NOTE:
- Put the clutch housing in a pan and remove the parts with care in order not to loose the steel balls.
- Remove the parts by tapping lightly on the 2 — 4 input shaft with a plastic hammer.

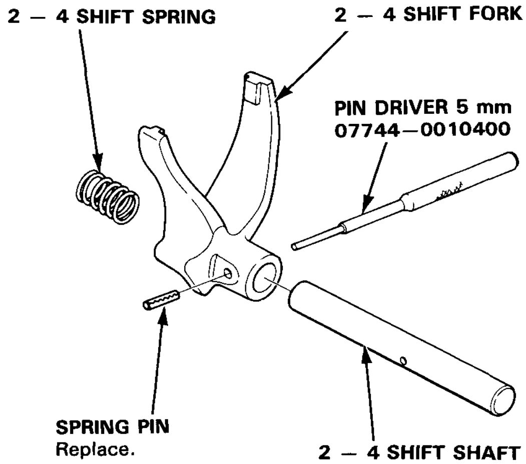


1) Disassemble the 2 — 4 input shaft, dog clutch hub, 2 — 4 sleeve, steel balls, and the 30 mm shim.

CAUTION: Before disassembly, mark the 2 — 4 input shaft and dog clutch hub to ensure correct reassembly.



2) Disassemble the 2 — 4 shift shaft, 2 — 4 shift fork, 2 — 4 shift spring, and the 2 — 4 shift spacer.



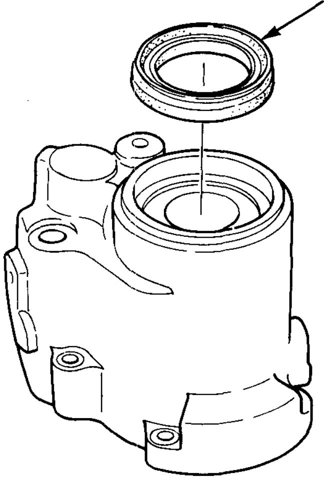
(cont'd)

Differential

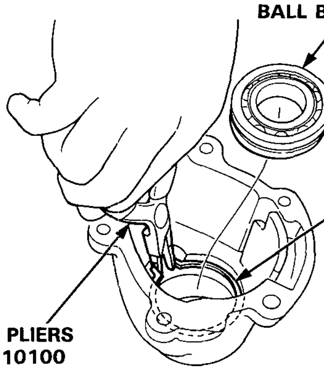
Disassembly (cont'd)

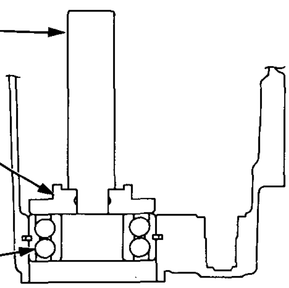
11. Remove the oil seal.

    CAUTION: Do not damage the oil seal surface.

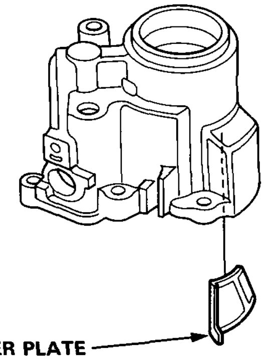


12. Expand the snap ring and remove the ball bearing.





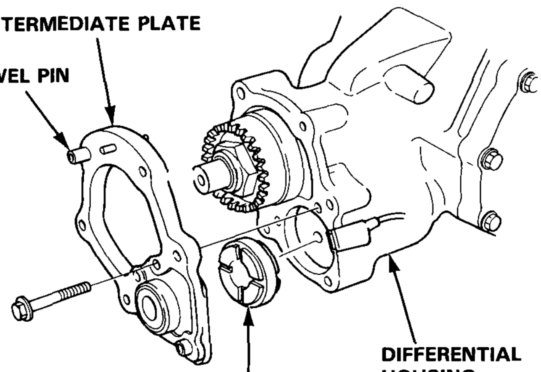
13. Remove the breather plate.



Intermediate Plate

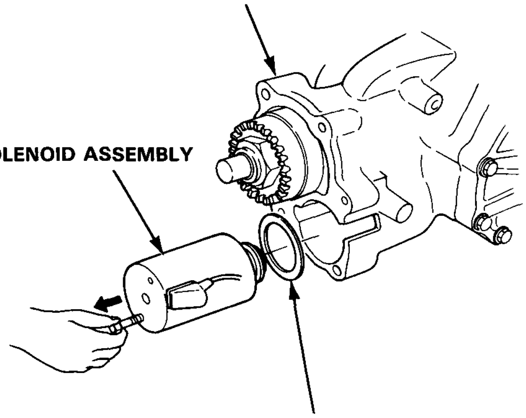
14. Remove the bolts and remove the intermediate plate and solenoid mounting spacer from the differential housing.

    NOTE: Remove the intermediate plate by tapping it lightly with a plastic hammer.



15. Screw the 6 mm bolt into the solenoid assembly, and remove the solenoid assembly and solenoid spacer from the differential housing.

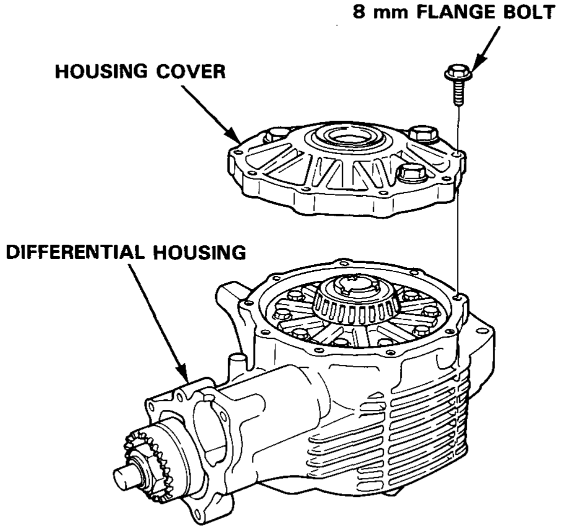
CAUTION: Do not remove by pulling the harness.



Carrier Cover

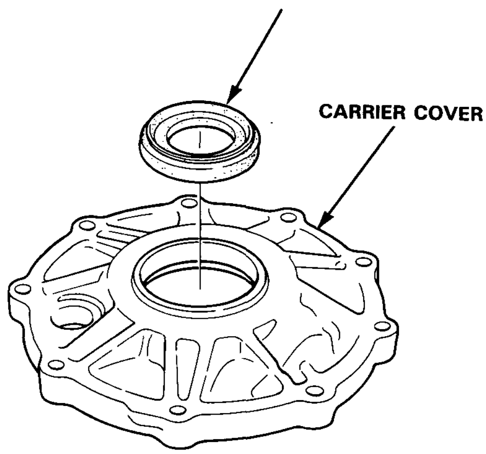
16. Remove the 8 mm flange bolts from the housing cover and the housing cover from the differential housing.

NOTE: Remove the housing cover by tapping it lightly with a plastic hammer.



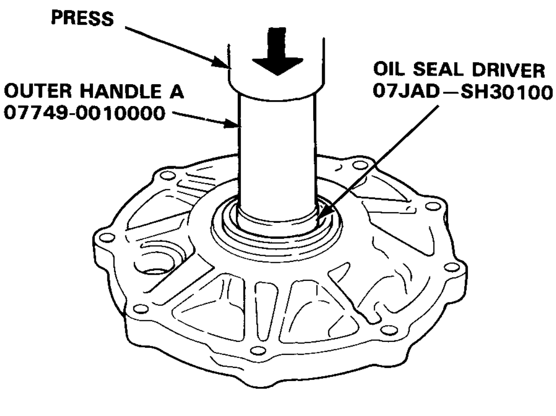
17. Remove the oil seal.

CAUTION: Do not damage the oil seal surface.



18. Drive out the oil plate, 66.5 mm shim, and the taper bearing outer race using the Oil Seal Driver Attachment.

CAUTION:
- **Take care not to damage the carrier cover sealing surface.**
- **Replace the oil guide plate if it is deformed.**

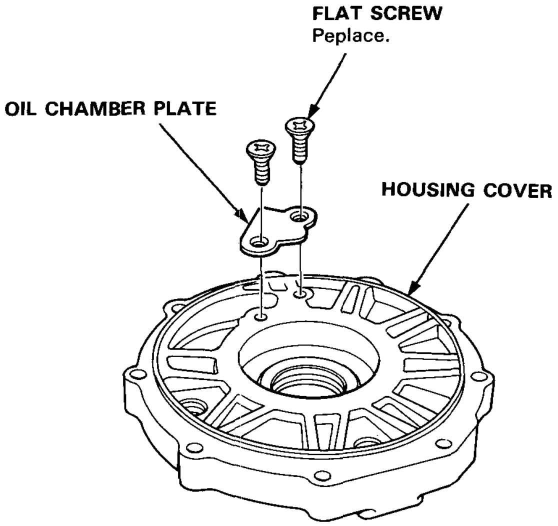


(cont'd)

Differential

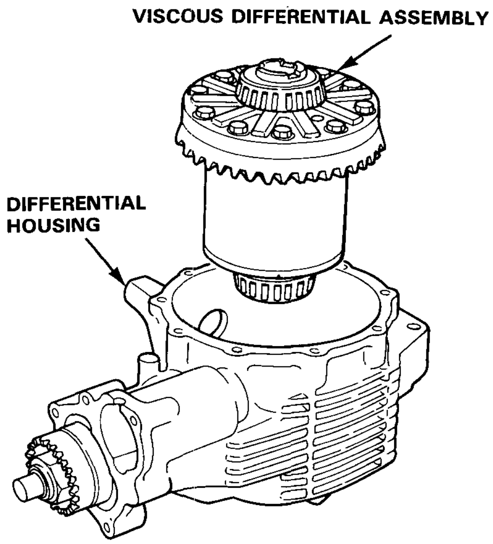
Disassembly (cont'd)

19. Straighten the staked area, then remove the flat screws and oil chamber plate.

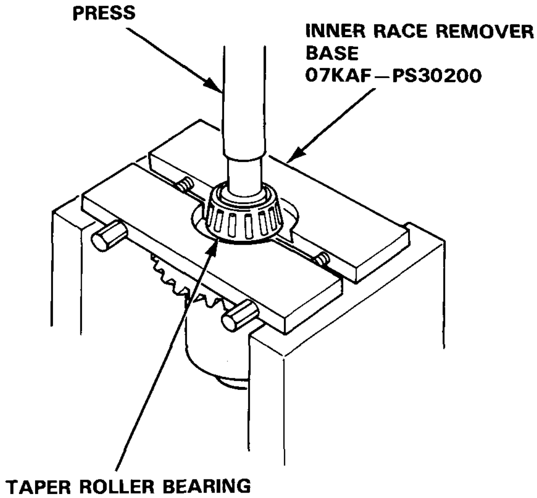


Viscous Differential Assembly

20. Remove the viscous differential assembly, ring gear, and the taper bearing inner from the differential housing as an assembly.

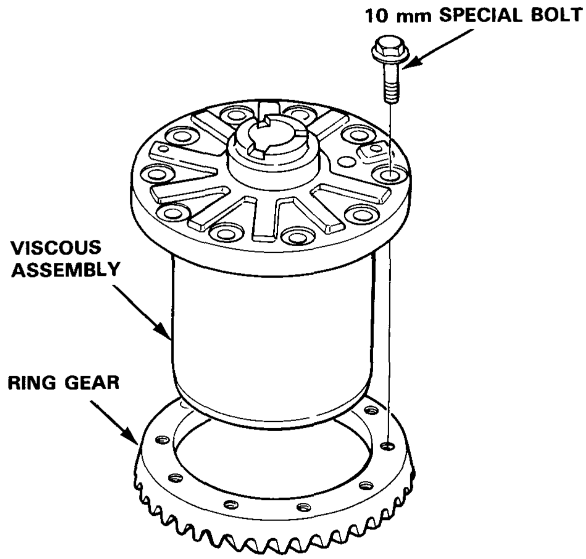


21. Pull off the taper roller bearing using the press and the Inner Race Remover Base.



22. Remove the 10 mm special bolts and the ring gear.

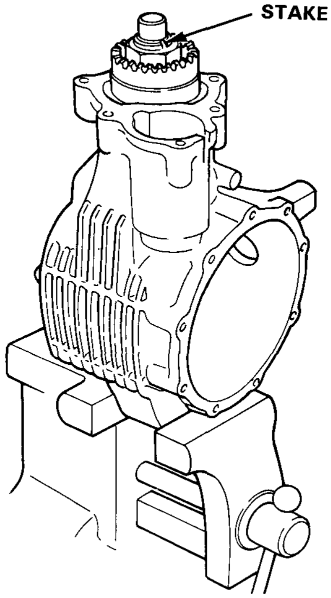
CAUTION:
- **Remove the 10 mm special bolts by loosening them in a criss-cross pattern in several steps.**
- **Do not remove the torx bolts from the viscous coupling.**



Differential Carrier

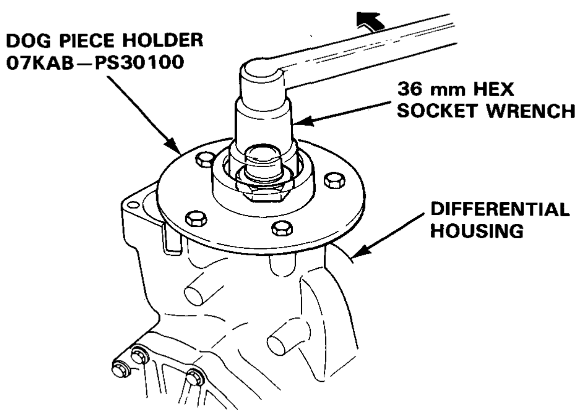
23. Straighten the staked area of the 26 mm locknut.

    CAUTION: Make sure the staked area gets completely straightened.

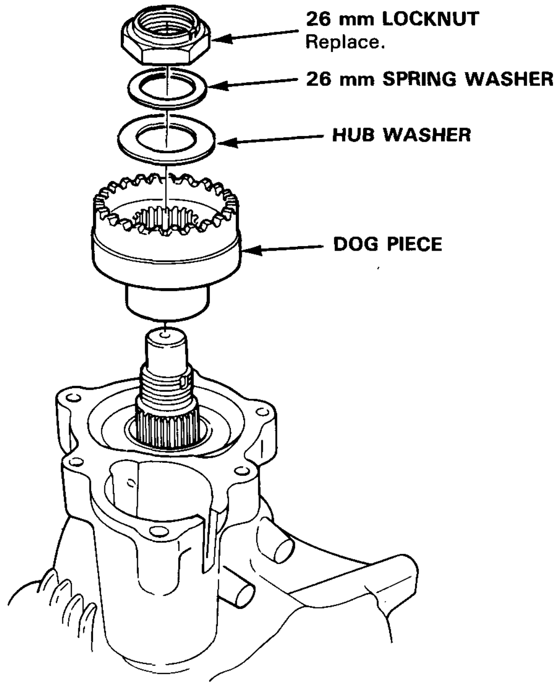


24. Attach the Dog Piece Holder to the differential housing and loosen the 26 mm locknut.

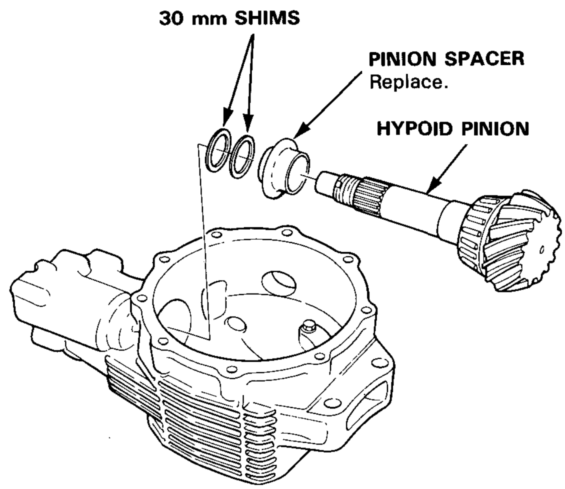
    CAUTION:
    - **Attach the Dog Piece Holder securely to the differential housing.**
    - **Make sure that the housing cover is installed on the differential housing.**
    - **Use an appropriate socket wrench that can reach the locknut.**



25. Remove the 26 mm locknut, 26 mm spring washer, hub washer, and the dog piece.



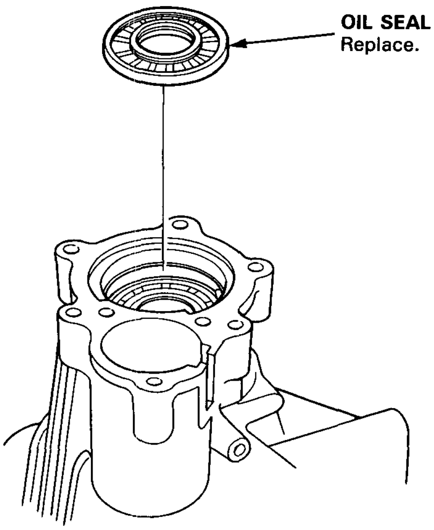
26. Remove the hypoid pinion, 35 mm shim, taper bearing inner, pinion spacer, and the two 30 mm shims.



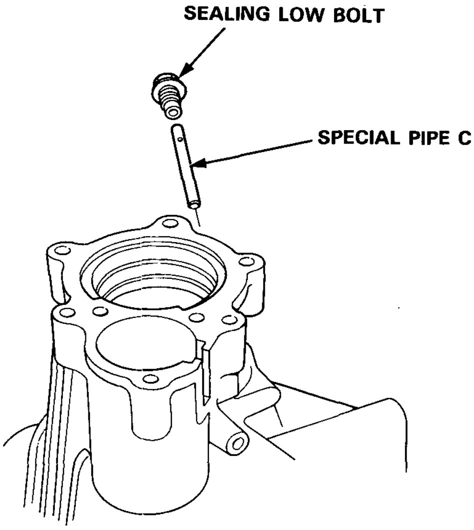
(cont'd)

Disassembly (cont'd)

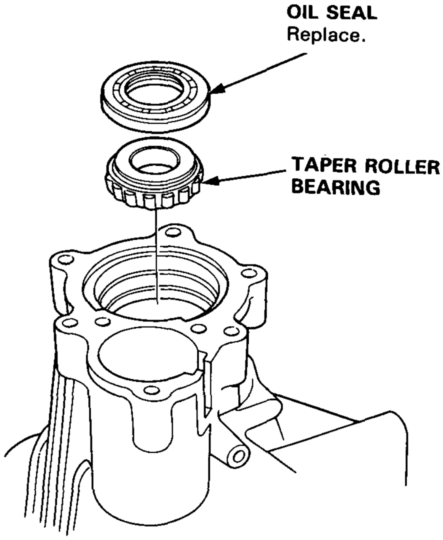
27. Remove the outer oil seal.



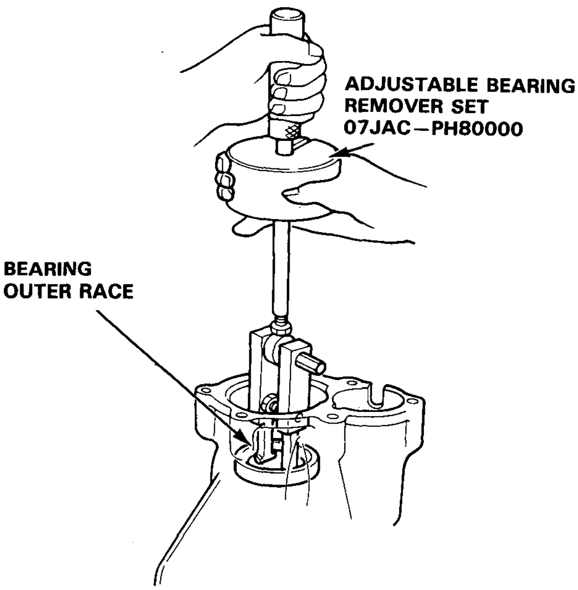
28. Remove the sealing low bolt and special pipe C.



29. Remove the inner oil seal, then remove the taper roller bearing.

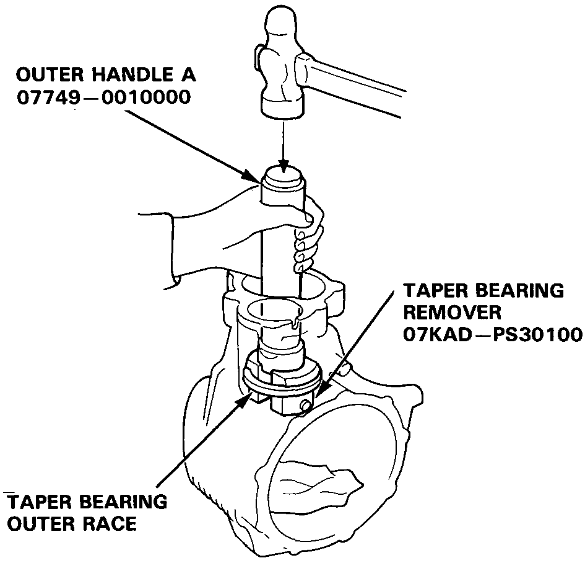


30. Remove the bearing outer race and 62 mm outer spacer using the special tools.



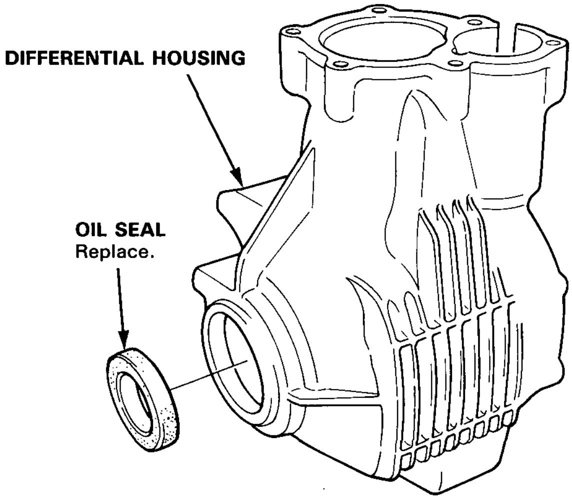
31. Drive out the taper bearing outer race and 72 mm outer spacer using the Outer Driver and Taper Bearing Remover.

CAUTION: To prevent damage to the differential housing, place a shop towel or equivalent material into the differential housing.



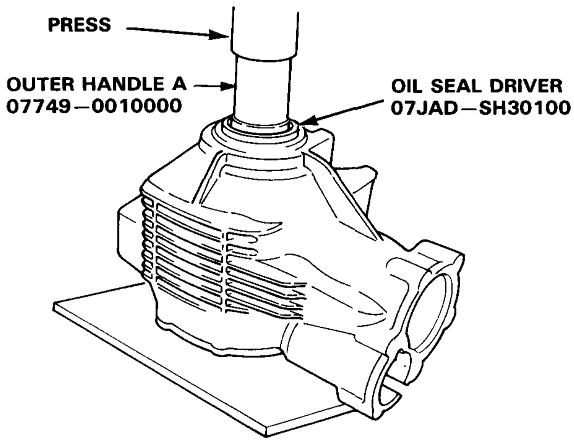
32. Remove the oil seal from the differential housing.

CAUTION: Do not damage the oil surface.

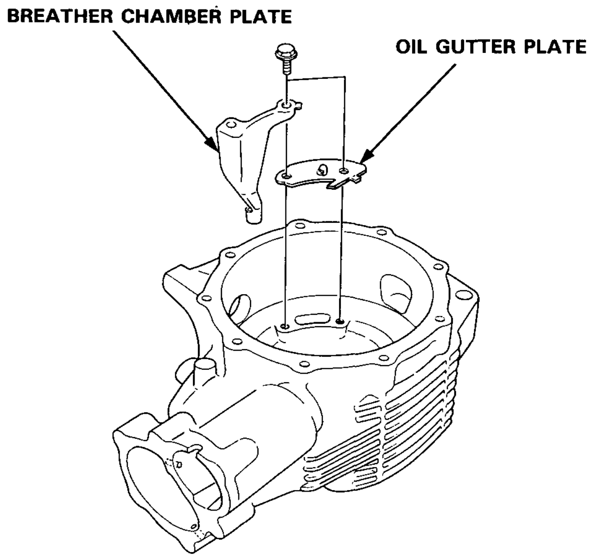


33. Drive out the taper bearing outer race and 66 mm shim using the Oil Seal Driver Attachment.

CAUTION: To prevent damage to the differential housing, place a shop towel or equivalent material into the differential housing and remove the parts with the housing cover mounted on the differential housing.



34. Raise the lock tab and remove the bolts, then remove the oil gutter plate and breather chamber plate.

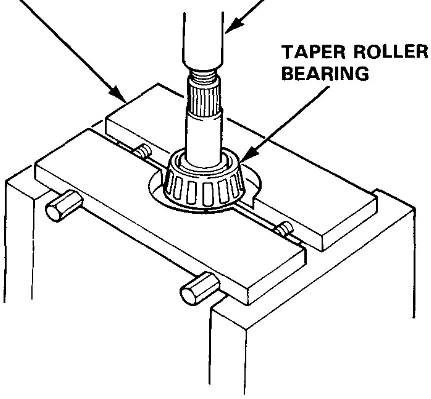


(cont'd)

Disassembly (cont'd)

Hypoid Pinion

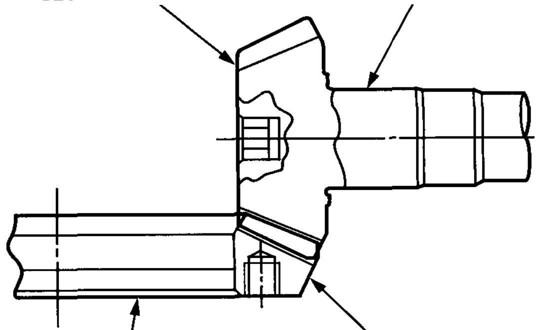
35. Remove the taper roller bearing and 35 mm shim using a special tool.



Reassembly

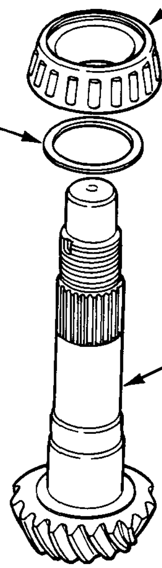
NOTE:

- If replacement is required, always replace the drive pinion and ring gear as set.
- If necessary, check the height adjustment, see page 15-92.

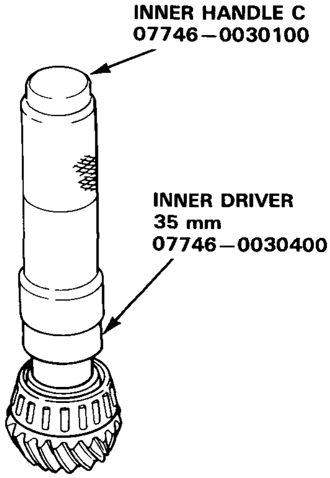


Hypoid Pinion

1. Install the 35 mm shim and taper roller bearing.

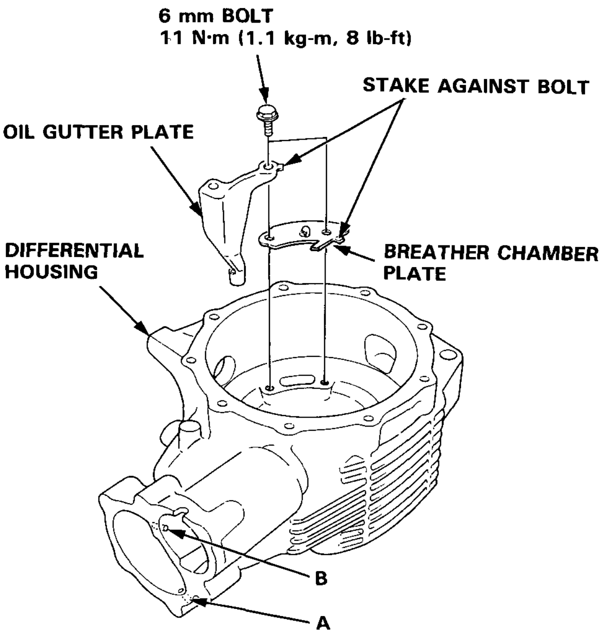


2. Drive the taper roller bearing using the special tools.



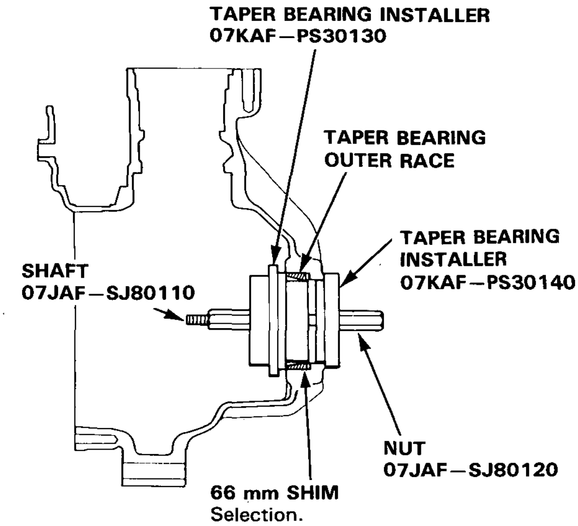
Differential Housing

3. Check A and B of the differential housing for clogging. Install the breather chamber plate and oil gutter plate in the differential housing and stake the ends of the plates against the bolts.



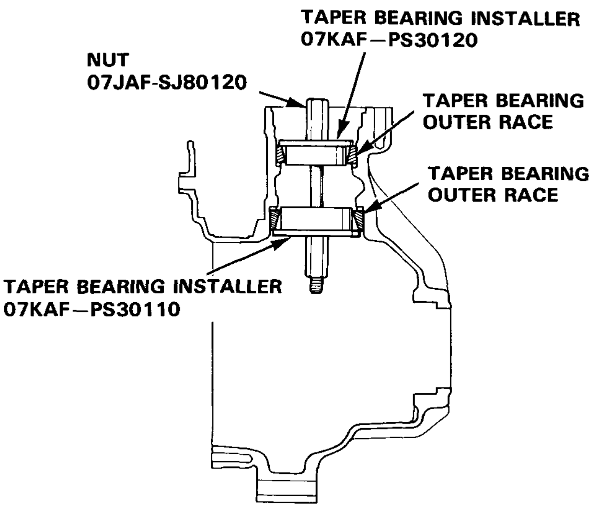
4. Install the 66 mm shim. Press the taper bearing outer race into place using the Taper Bearing Installers, Shaft, and Nut.

CAUTION: Do not install the oil seal.



5. Install the 72 mm and 62 mm outer spacers, and press the taper bearing outer races simultaneously into place using the Taper Bearing Installers and Nut.

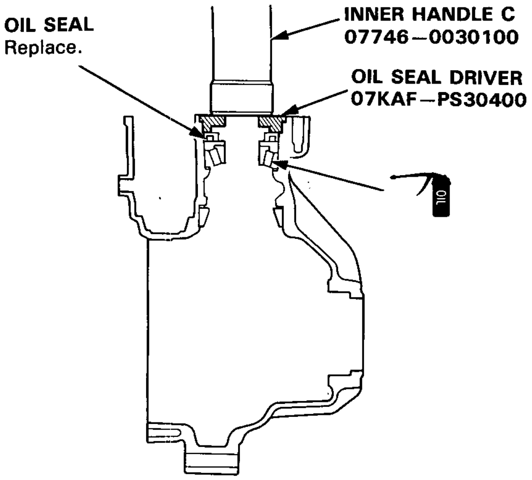
NOTE: Insert the taper bearing outer races lightly before pressing them into place using the special tools.



(cont'd)

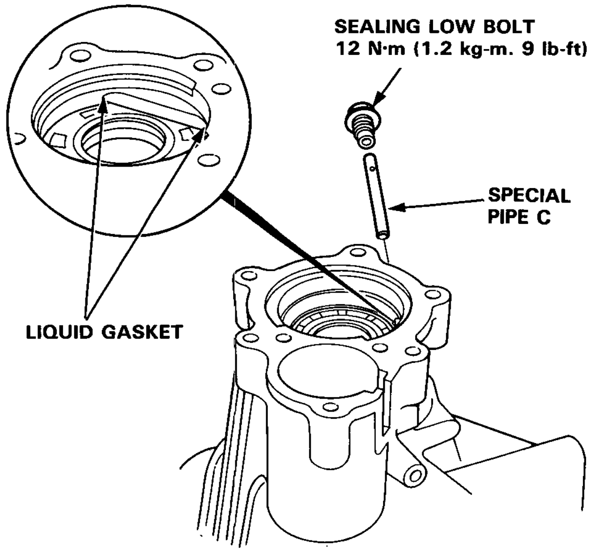
6. Lubricate the gear oil to the taper roller bearing and install the bearing, then install the inner oil seal using the special tools.

NOTE:
- Drive the oil seal in the proper position shown in the drawing.
- Note the installation direction of the oil seal.



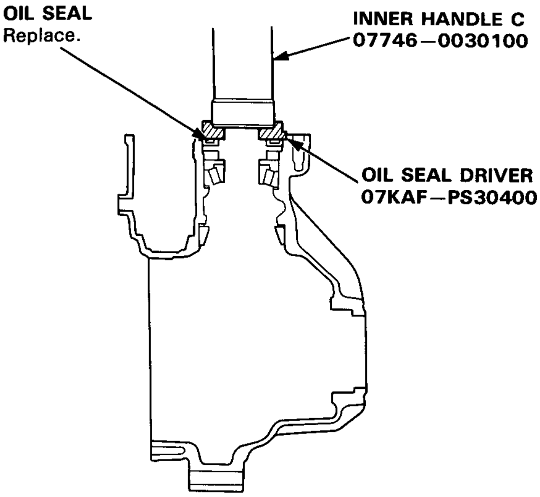
7. Install the special pipe C and sealing low bolt.

NOTE:
- Apply liquid gasket to the clearance between the pipe C and differential housing.
- Apply liquid gasket to the threads of the sealing low bolt.



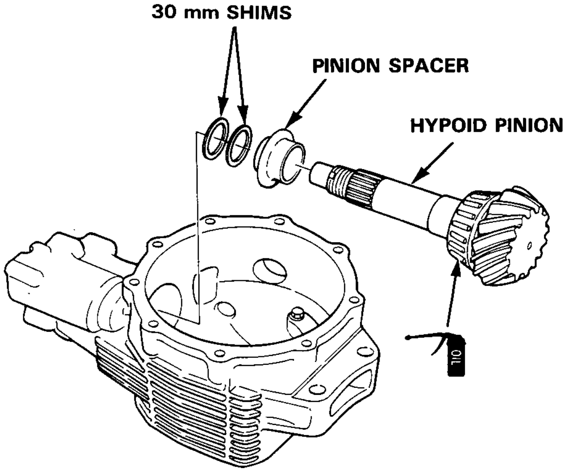
8. Install the outer oil seal using the special tools.

NOTE:
- Drive the oil seal in the proper position shown in the drawing.
- Note the installation direction of the oil seal.



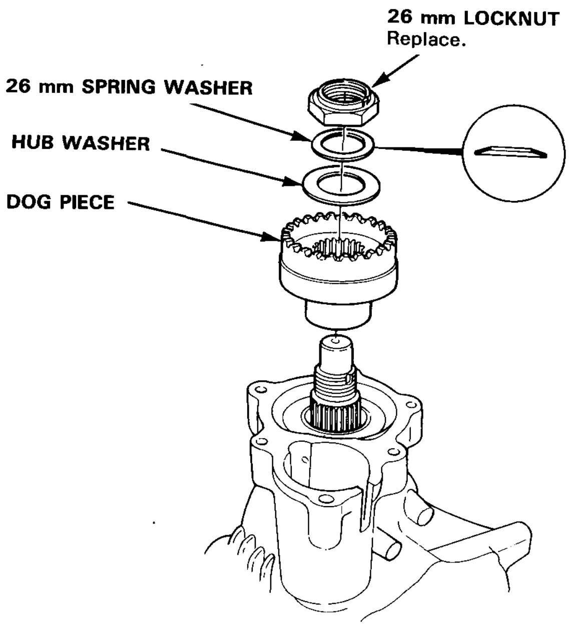
9. Install the hypoid pinion assembled in step 2, the pinion spacer, and the 30 mm shims as a set.

CAUTION: Be sure to replace the pinion spacer with a new one.



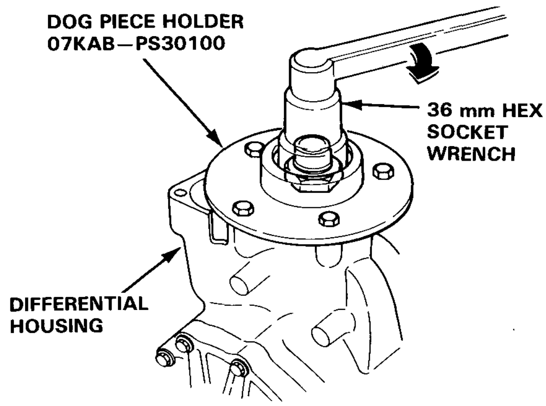
10. Install the dog piece, hub washer, 26 mm spring washer, and the 26 mm locknut.

CAUTION:
- **Be sure to replace the 26 mm locknut with a new one.**
- **Note the installation direction of the 26 mm spring washer.**
- **Lubricate the threads of the locknut and shaft.**

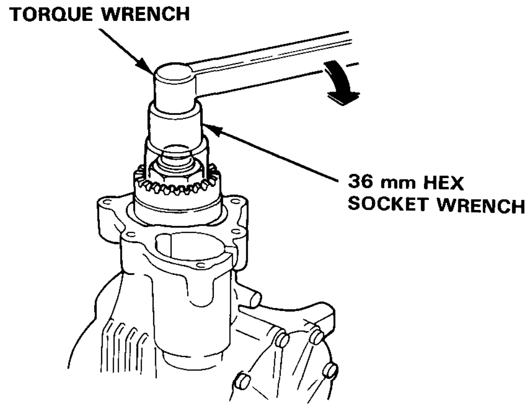


11. Attach the Dog Piece Holder to the differential housing Adjust the hypoid pinion preload to 10.0—16.3 kg-cm by tightening the 26 mm locknut gradually to a torque between 15.0 and 30.0 kg-m.

CAUTION:
- **If the hypoid pinion preload exceeds 16.3 kg-cm when tightening the 26 mm locknut to the torque of 15.0 kg-m, replace the pinion spacer (do not adjust the preload by loosening the 26 mm locknut).**
- **Replace the spacer if the preload is below the specification even when tightening the 26 mm locknut to a torque of more than 30 kg-m.**
- **Before measuring the preload, rotate the hypoid pinion bearing several times to assure proper bearing contact.**

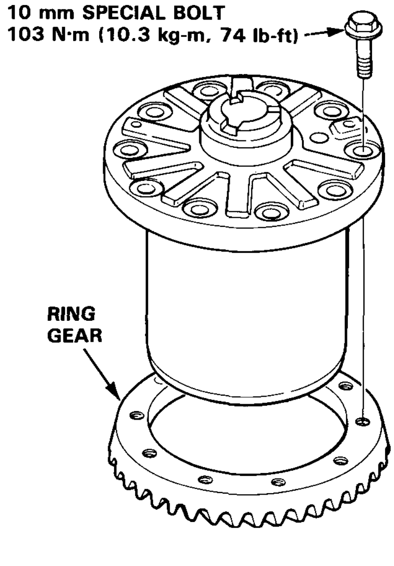


Preload: 1.0—1.63 N·m (10.0—16.3 kg-cm, 9—14 lb-in)



Viscous Differential Assembly

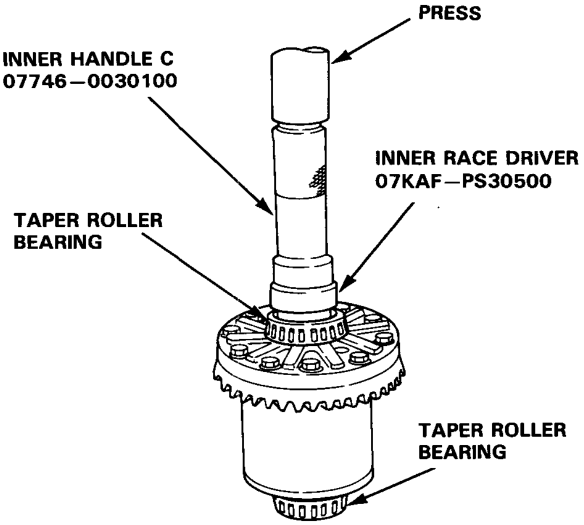
12. Install the ring gear by tightening the bolts in a criss-cross pattern in several steps.



(cont'd)

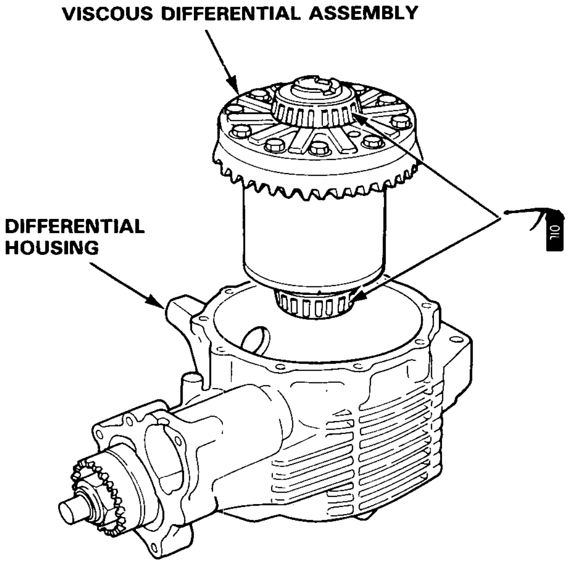
Reassembly (cont'd)

13. Press the taper roller bearing into place using the Inner Driver C and Inner Race Driver.



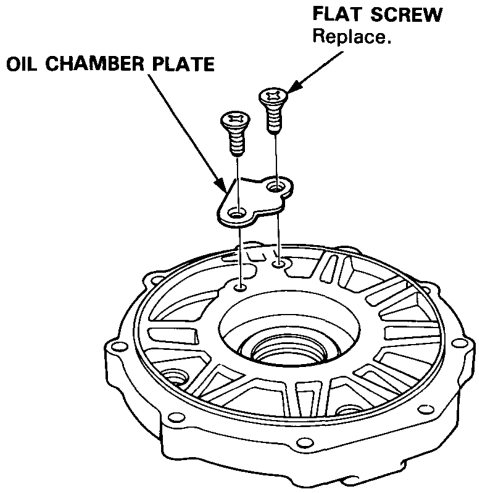
14. Install the viscous differential assembly in the differential housing.

    NOTE: Lubricate the gear oil to the taper roller bearing.



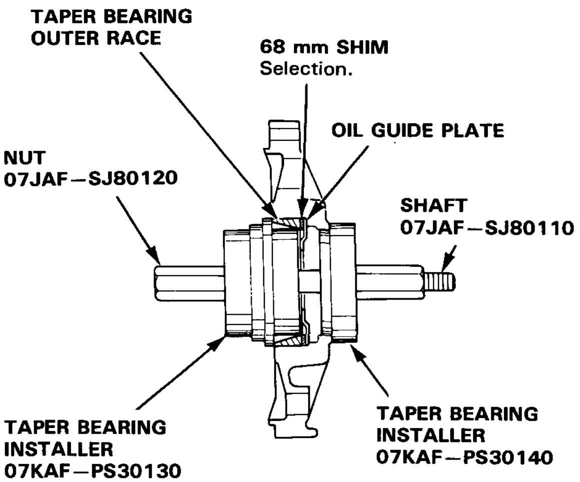
Housing Cover

15. Install the oil chamber plate and stake it against the flat screws.



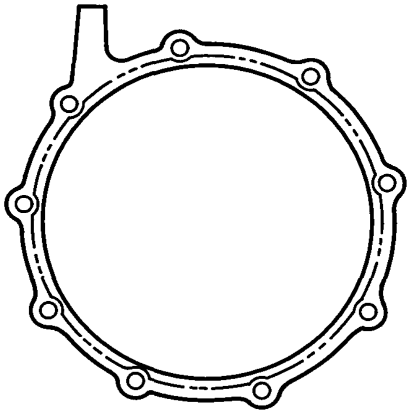
16. Install the oil guide plate, 68 mm shim, and taper bearing outer race using the Taper Bearing Installer, Nut, and Shaft.

    CAUTION: Do not install the oil seal.



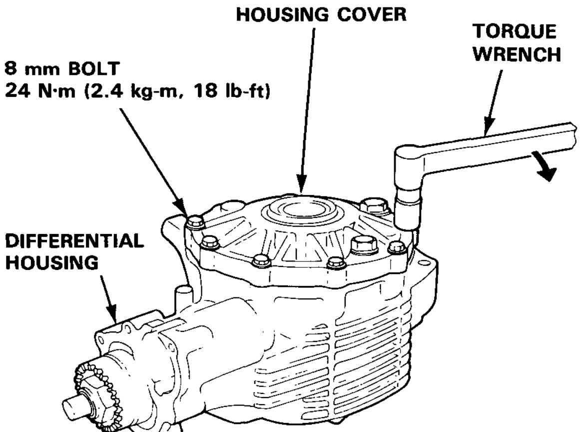
17. Apply liquid gasket to the differential housing cover.

NOTE: This differential uses no gasket between the major housing; use Honda Genuine liquid gasket (P/N 08718—0001). Assemble the housing within 20 minutes after applying the liquid gasket and allow it to cure at least 30 minutes after assembly before filling it with oil.



18. Install the differential housing cover.

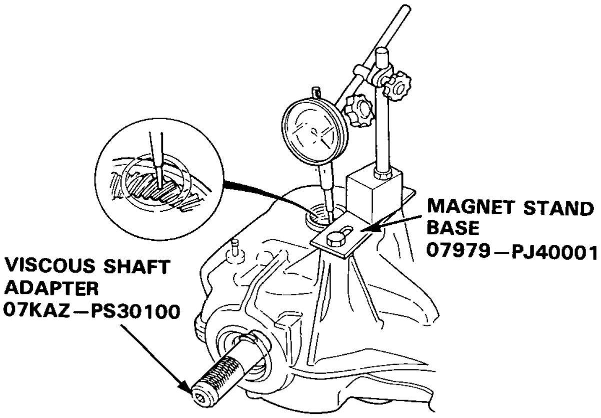
NOTE: Tighten the bolts in a criss-cross pattern in several steps.



19. Measure the ring gear backlash through the sealing bolt hole.

NOTE:
- Measure the backlash at four diagonally opposed points.
- Measure the backlash by holing the dog piece and moving the viscous shaft adapter.

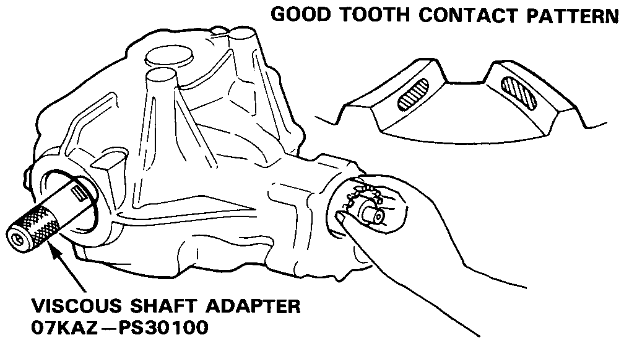
Standard: 0.10—0.15 mm (0.004—0.006 in)



20. If the backlash is out of tolerance, adjust it (see page 15-93).

21. Check the tooth contact between the ring gear and hypoid pinion through the sealing bolt hole.

NOTE:
- Paint the ring gear teeth (on both sides of each tooth) lightly and evenly with Prussian Blue. Applying load to the ring gear, rotate the hypoid pinion one full turn both forward and backward.
- Check at three equally spaced points.



22. If the contact pattern shows incorrect contact, adjust it (see page 15-94).

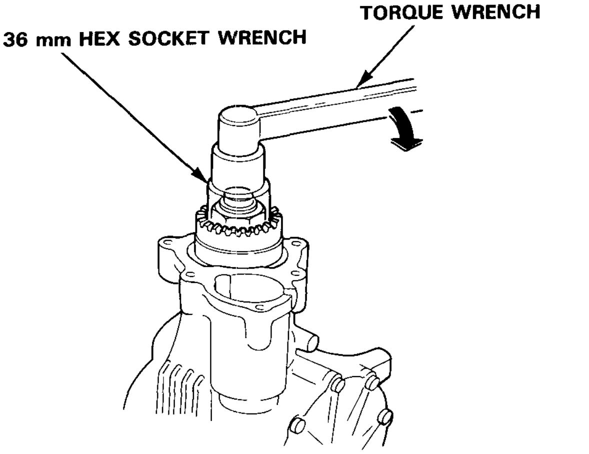
(cont'd)

Reassembly (cont'd)

23. If the contact pattern shows incorrect contact, adjust it (see page 15—94).

24. Measure the total preload.

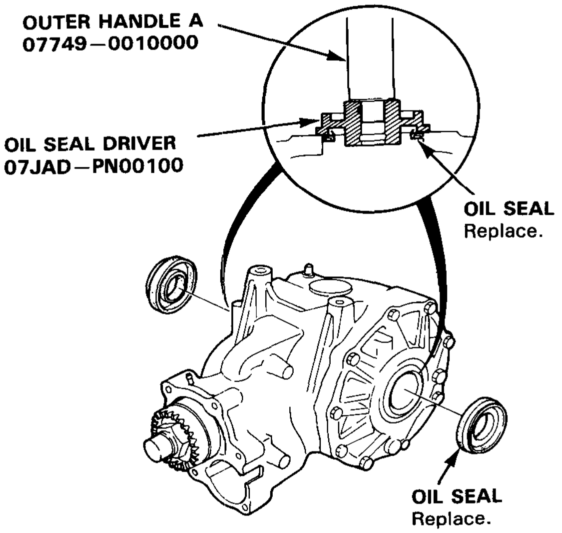
Preload: 1.11 — 1.78 N·m (11.1 — 17.8 kg-cm, 10 — 15 lb-in)



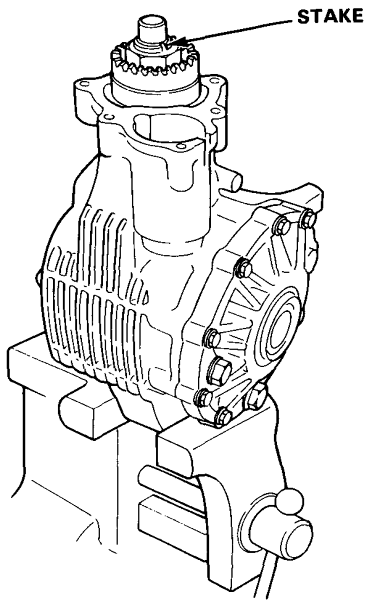
25. If the total preload is out of tolerance, adjust it by changing the 66 mm shim and 66.5 mm shim to shims of proper thickness. The backlash must remain within tolerance (see page 15-93).

26. Attach the Outer Driver A and Oil Seal Driver Attachment to the differential housing and housing cover and press the oil seals into place.

CAUTION: Press-fit the oil seals into the correct position shown in the drawing.



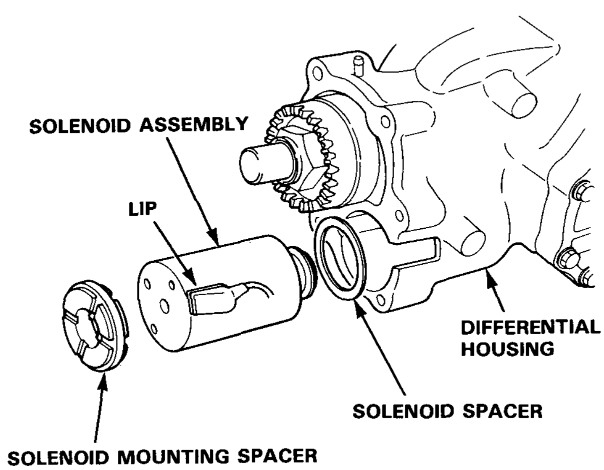
27. Stake the 26 mm locknut.



28. Check the solenoid assembly for operation (see page 15-94).

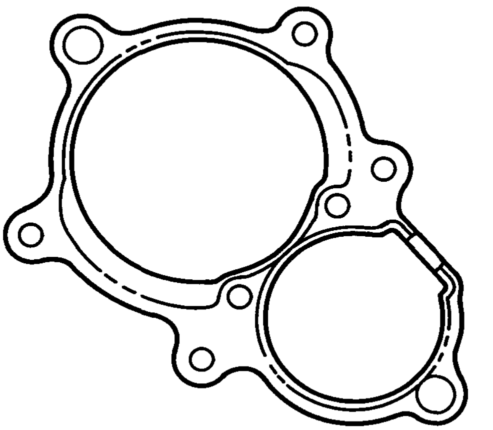
29. Install the solenoid spacer, solenoid assembly, and the solenoid mounting spacer in the differential housing.

CAUTION: Coat the entire circumference of the lip with the sealant (Cemedain 366E or equivalent).



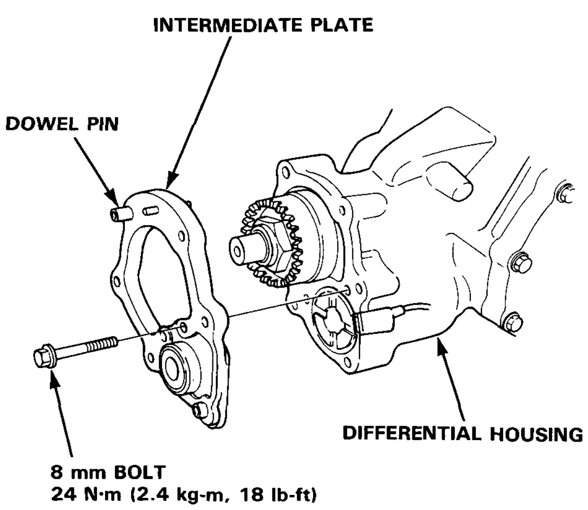
30. Apply liquid gasket to the differential housing cover.

NOTE: This differential uses no gasket between the major housing; use Honda Genuine liquid gasket (P/N 08718–0001). Assemble the housing within 20 minutes after applying the liquid gasket and allow it to cure at least 30 minutes after assembly before filling it with oil.



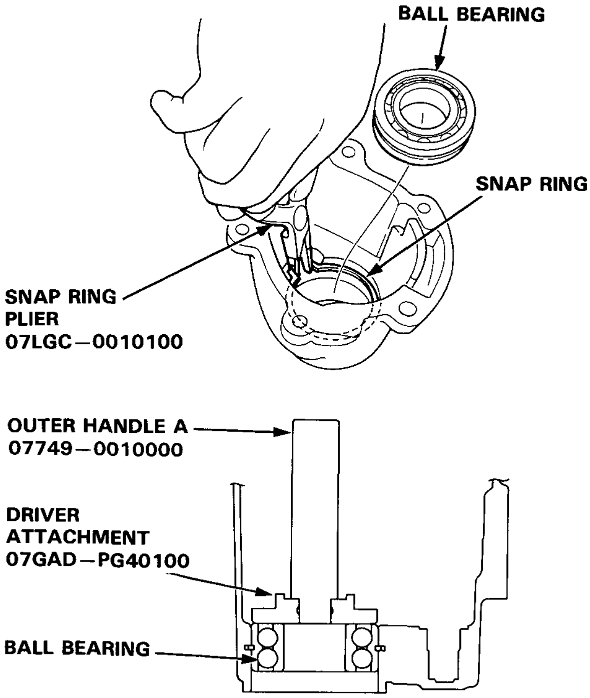
Intermediate Plate

31. Install the intermediate plate on the differential housing.



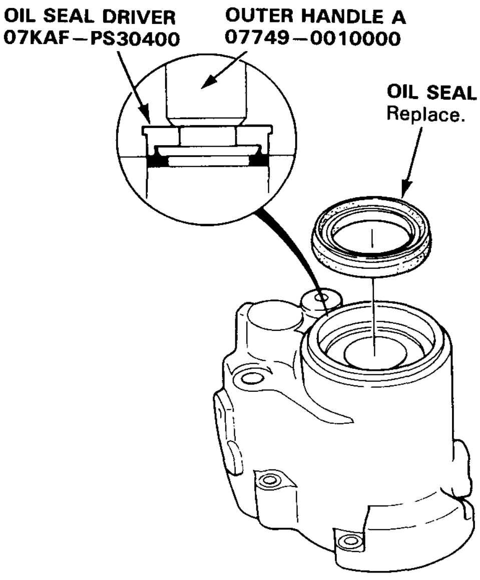
Clutch Housing

32. Expand the snap ring and install the ball bearing using the special tools.



33. Install the oil seal using the special tools.

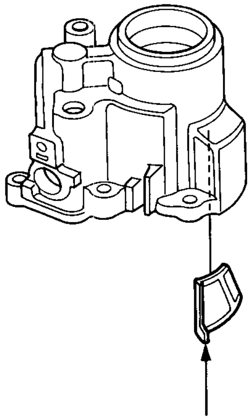
NOTE: Drive the oil seal into the correct position shown in the drawing.



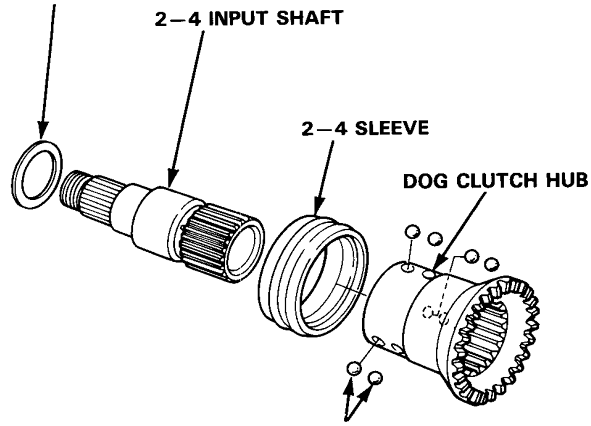
(cont'd)

Reassembly (cont'd)

34. Install the breathe plate in the clutch housing.

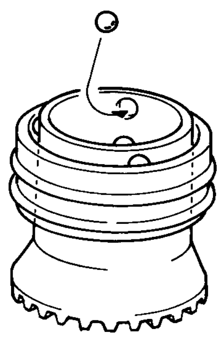


35. Assemble the 2–4 input shaft, steel balls, dog clutch hub, 2–4 sleeve, and the 30 mm shim.



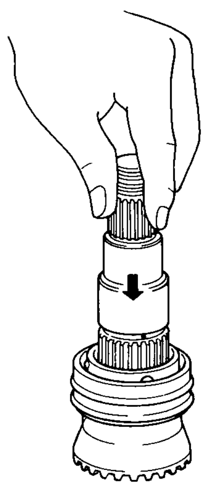
1) Install the 2–4 sleeve over the dog clutch hub and insert the steel balls into the dog clutch hub.

CAUTION: To prevent the steel balls from dropping out of the dog clutch hub, multi-purpose grease may be applied to the holes in the hub. Be sure not to apply more grease than to the half of each hole.

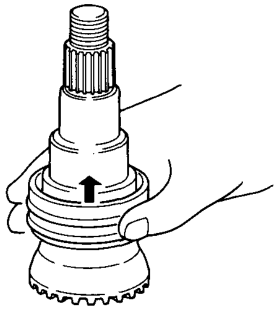


2) Insert the 2–4 input shaft into the dog clutch hub until the shaft contacts the steel balls.

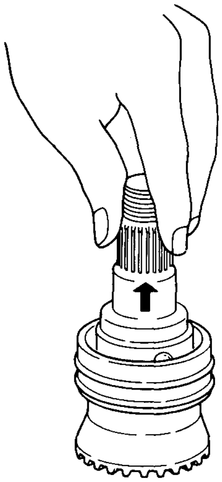
CAUTION: Be sure that the alignment mark on the 2–4 input shaft aligns with the alignment mark on the dog clutch hub.



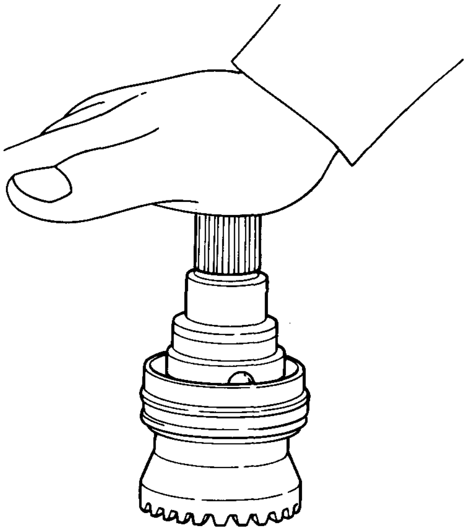
3) Pull up the 2–4 sleeve. The 2–4 input shaft should drop.



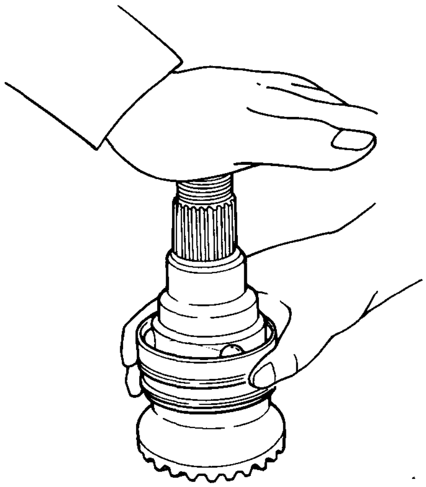
4) Pull up the 2–4 input shaft.



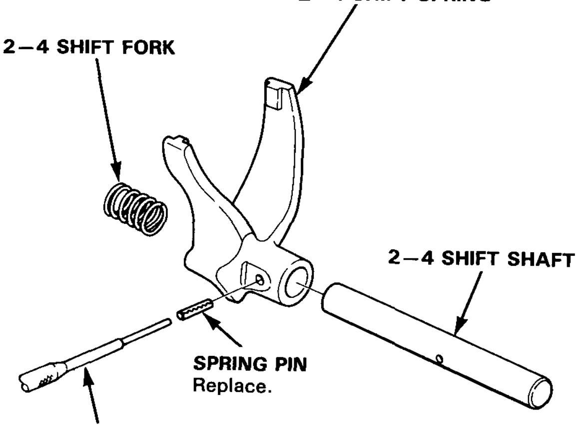
5) Set the 2–4 sleeve in the 4WD position. Push the 2–4 input shaft firmly with the palm and make sure that it does not move.



6) Pushing the 2–4 input shaft with the palm, make sure that the 2–4 sleeve can be lifted by little force.



36. Assemble the 2–4 shift shaft, 2–4 shift fork, 2–4 shift spring, and the 2–4 shift spacer.

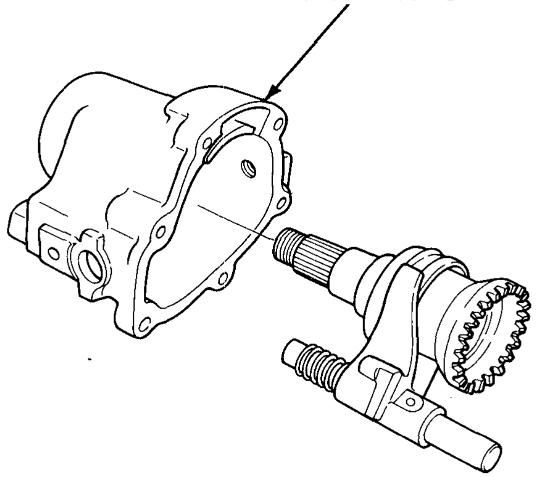


(cont'd)

Reassembly (cont'd)

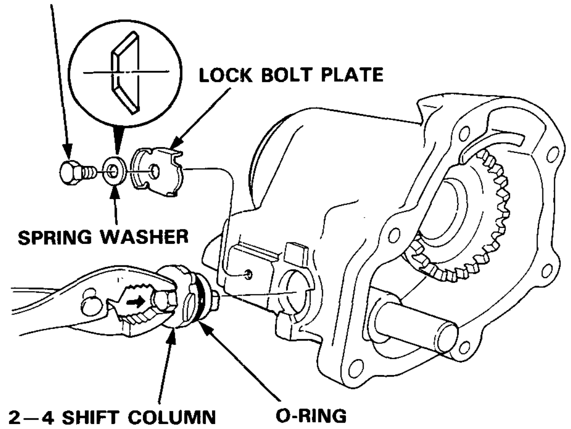
37. Assemble the 2–4 input shaft and dog clutch hub assembled in step 29 with the 2–4 shift fork and 2–4 shift shaft assembled in step 30, then install the assembly in the clutch housing.

    CAUTION: Look if the 2–4 shift spring is on the 2–4 shift spacer.



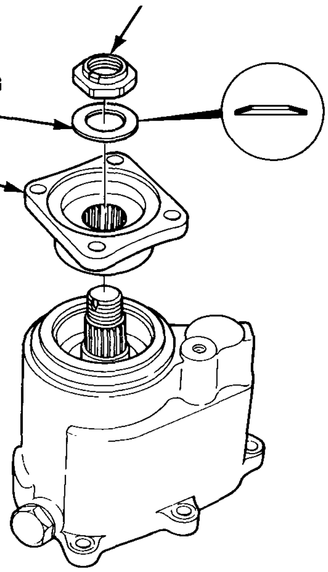
38. Install the 2–4 shift column in the clutch housing. Check that it shifts smoothly from "4" to "2" and vice versa. Install the lock bolt washer and tighten the lock bolt.

    NOTE: Push the 2–4 shift column into the clutch housing using a pair of pliers or equivalent tool.

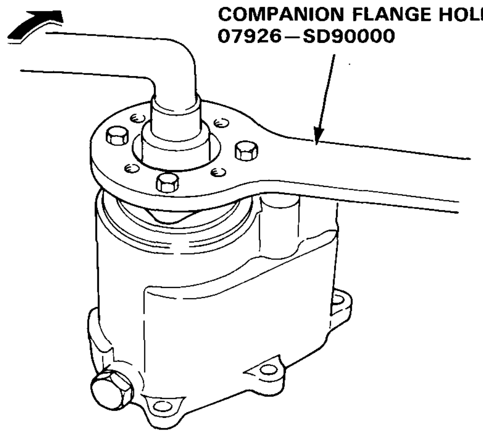


39. Install the companion flange, 20 mm spring washer, and the 20 mm locknut.

    CAUTION:
    - **Replace the 20 mm locknut with a new one.**
    - **Note the installation direction of the 20 mm spring washer.**

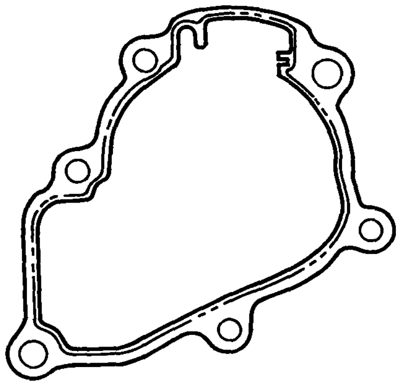


40. Attach the Companion Flange Holder to the companion flange and tighten the 20 mm locknut.



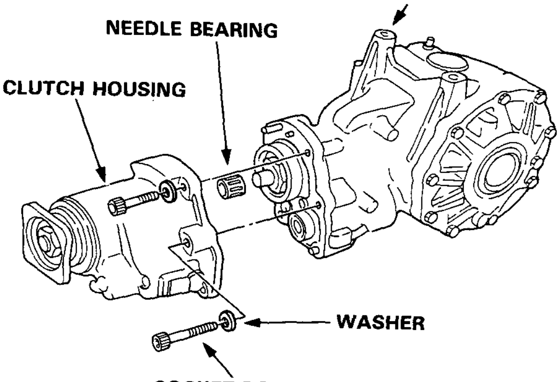
41. Apply liquid gasket to the clutch housing.

NOTE: This differential uses no gasket between the major housing; use Honda Genuine liquid gasket (P/N 08718–0001). Assemble the housing within 20 minutes after applying the liquid gasket and allow it to cure at least 30 minutes after assembly before filling it with oil.



42. Install the assembled clutch housing on the differential housing.

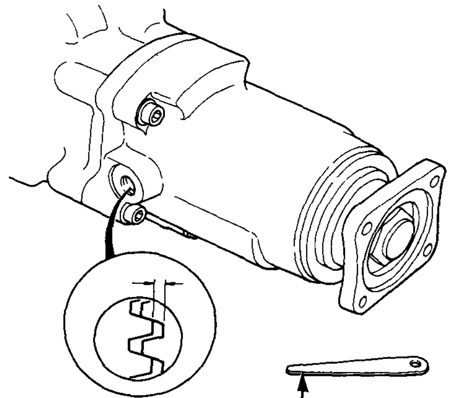
NOTE: Tighten the bolts in a crisscross pattern in several steps.



43. Using the feeler gauge, measure the dog clutch clearance through the 14 mm filler bolt hole in the clutch housing.

NOTE: Measure at four diagonally opposed points.

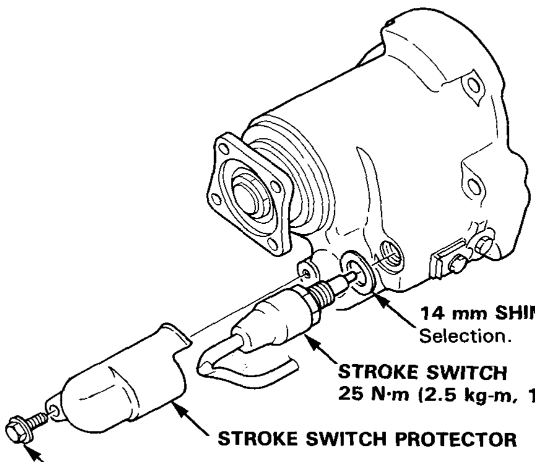
Standard: 0.05 mm (0.02 in) feeler gauge can be inserted, while 0.25 mm (0.01 in) cannot.



44. Inspect the stroke switch (see page 15-95).

45. Adjustment the 14 mm shim (see page 15-96).

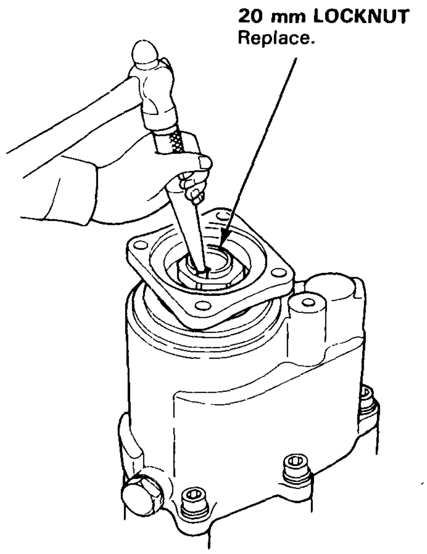
46. Install the stroke switch and stroke switch protector.



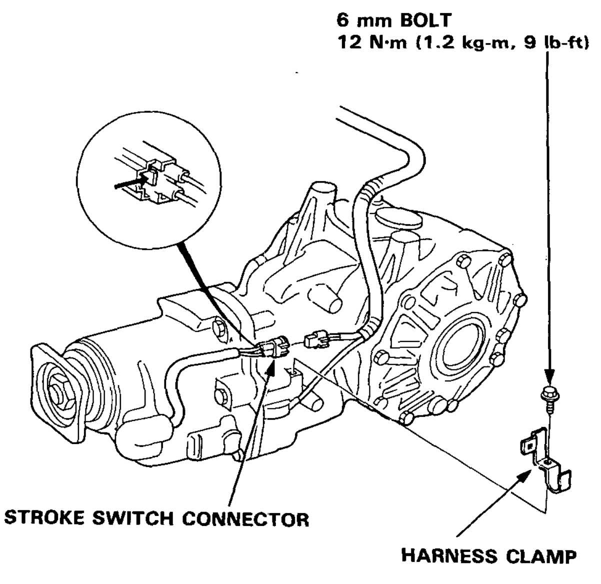
(cont'd)

Reassembly (cont'd)

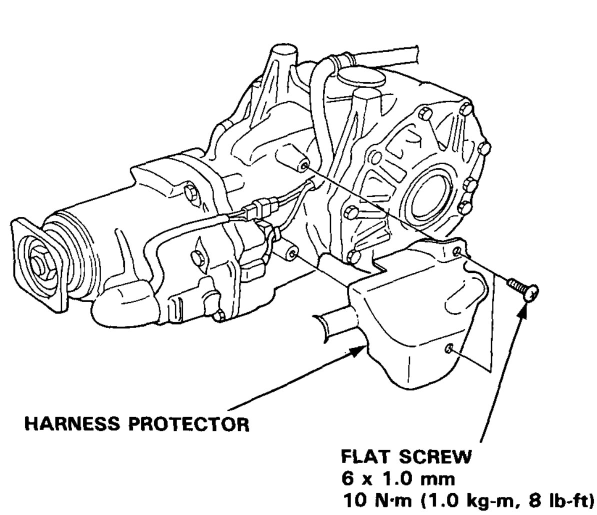
47. Stake the 20 mm locknut.



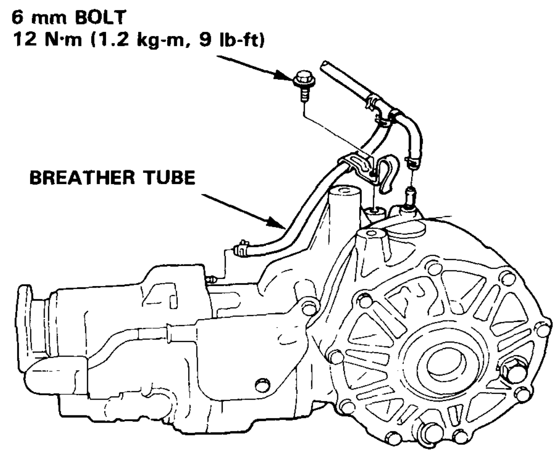
48. Install the harness clamp and stroke switch connector.



49. Install the harness protector.



50. Install the breather tube.



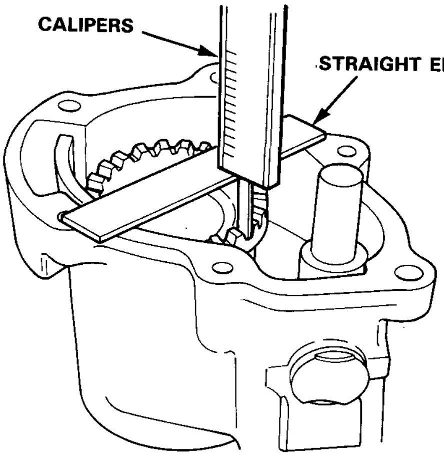
51. With the solenoid mounted on the differential assembly, check the solenoid for operation (see page 15-95).

52. After installation, test-drive and make sure that the ABS warning light does not come on when the ABS is ON.

Adjustment

Dog Clutch Hub Side

1. Place a straight edge on the clutch housing end as shown and measure the dog clutch hub depth using the calipers. Measure the depth at many points. Dog clutch hub depth is calculated by subtracting the thickness of the straight edge from the calipers reading.

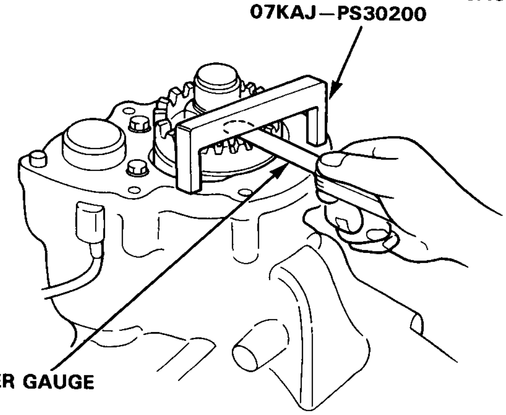


Dog Piece Side

2. With the intermediate plate mounted on the differential carrier, attach the Height Inspection Gauge to the differential carrier. Measure the clearance to the dog piece ridge at many points using a feeler gauge.

   CAUTION: Make sure that the dog piece inclination is within 0.1 mm (0.004 in).

   Clearance to the dog piece ridge can be calculated by subtracting the feeler gauge reading from the dimension of 19.8 mm (0.78 in), which is the inner height of the Height Inspection Gauge.



3. Calculate the dog clutch clearance from the results obtained in steps 1 and 2.
   Dog clutch clearance can be calculated by subtracting the clearance to the dog piece ridge from the dog clutch hub depth.

4. Select the appropriate 30 mm shim using the table below.

   CAUTION: Be sure that the calculation results obtained at all measuring points are within the tolerance.

   Clearance: 0.05–0.25 mm (0.002–0.01 in)

   30 mm SHIM

	PART NUMBER	THICKNESS
A	42380–PS3–010	1.00 mm (0.0394 in)
B	42381–PS3–010	1.20 mm (0.0472 in)
C	42382–PS3–010	1.40 mm (0.0551 in)
D	42383–PS3–010	1.60 mm (0.0630 in)
E	42384–PS3–010	1.80 mm (0.0709 in)
F	42385–PS3–010	2.00 mm (0.0787 in)
G	42386–PS3–010	1.50 mm (0.0591 in)
H	42387–PS3–000	1.10 mm (0.0433 in)
I	42388–PS3–000	1.30 mm (0.0512 in)
J	42389–PS3–000	1.70 mm (0.0670 in)
K	42390–PS3–000	1.90 mm (0.0748 in)

5. Using a feeler gauge, check the dog clutch clearance through the 14 mm filler bolt hole in the clutch housing.

   CAUTION: Check the clearance at four diagonally opposed points.

   Standard: 0.05 mm (0.002 in) feeler gauge can be inserted, while 0.25 mm (0.01 in) cannot.

Hypoid Pinion Height

Adjustment

Adjustment Is Required

1. When the hypoid pinion and ring gear are replaced. Calculate the 35 mm shim thickness and select the appropriate shim.

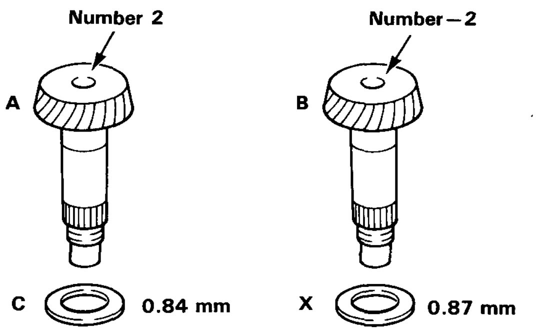
   NOTE: Replace the hypoid pinion and gear as a set.

   X: *Calculated thickness of the replacement shim*
   A: Number on top of the existing hypoid pinion
   B: Number on top of the replacement hypoid pinion
   C: Thickness of the existing shim

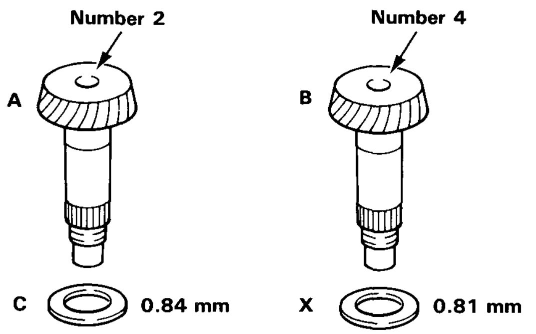
   $$X = \frac{A}{100} - \frac{B}{100} + C$$

   NOTE: Number on top of the hypoid pinion is shown in $\frac{1}{100}$ mm.

Example 1) X = 0.02 − (−0.02) + 0.84
X = 0.04 + 0.84
X = 0.88
Use the 35 mm shim which is 0.87 mm in thickness.



Example 2) X = 0.02 − 0.04 + 0.84
X = − 0.02 + 0.84
X = 0.82
Use the 35 mm shim which is 0.81 mm in thickness.



2. When the hypoid pinion bearing is replaced. Measure the thickness of the new and the existing bearing and calculate the difference in thickness between the two bearings.
   Select the shim whose thickness is equal to the calculated difference in thickness between the two bearings.
   For selecting the appropriate shim use the table below.

35 mm SHIM

	PART NUMBER	THICKNESS
A	41361−PS3−010	0.72 mm (0.0283 in)
B	41362−PS3−010	0.75 mm (0.0295 in)
C	41363−PS3−010	0.78 mm (0.0307 in)
D	41364−PS3−010	0.81 mm (0.0319 in)
E	41365−PS3−010	0.84 mm (0.0331 in)
F	41366−PS3−010	0.87 mm (0.0343 in)
G	41367−PS3−010	0.90 mm (0.0354 in)
H	41368−PS3−010	0.93 mm (0.0366 in)
I	41369−PS3−010	0.96 mm (0.0378 in)
J	41370−PS3−010	0.99 mm (0.0390 in)
K	41371−PS3−010	1.02 mm (0.0402 in)
L	41372−PS3−010	1.05 mm (0.0413 in)
M	41373−PS3−010	1.08 mm (0.0425 in)
N	41374−PS3−010	1.11 mm (0.0437 in)
O	41375−PS3−010	1.14 mm (0.0499 in)

Adjustment Is Not Required

1. When you replace the differential housing, ring gear, hypoid pinion, and the 35 mm shim as a set.

2. When the viscous assembly is replaced.

Ring Gear Backlash

Adjustment

1. Adjust the ring gear backlash by selecting the proper 66 mm shim for the differential housing and 68 mm shim for the housing cover using the tables shown.

   CAUTION:
   - **If the backlash is excessive, move the ring gear toward the hypoid pinion.**
   - **If the backlash is too small, move the ring gear away from the hypoid pinion.**
   - **Do not change the total thickness of the shims.**

2. After adjustment, measure the ring gear backlash through the 34 mm sealing bolt hole.

   CAUTION: Measure at four diagonally opposed points.

   Standard: **0.10—0.15 mm (0.004—0.006 in)**

66 mm SHIM

	PART NUMBER	THICKNESS
A	41411—PS3—010	1.40 mm (0.0551 in)
B	41412—PS3—010	1.43 mm (0.0563 in)
C	41413—PS3—010	1.46 mm (0.0575 in)
D	41414—PS3—010	1.49 mm (0.0587 in)
E	41415—PS3—010	1.52 mm (0.0598 in)
F	41416—PS3—010	1.55 mm (0.0610 in)
G	41417—PS3—010	1.58 mm (0.0622 in)
H	41418—PS3—010	1.61 mm (0.0634 in)
I	41419—PS3—010	1.64 mm (0.0646 in)
J	41420—PS3—010	1.67 mm (0.0657 in)
K	41421—PS3—010	1.70 mm (0.0669 in)
L	41422—PS3—010	1.73 mm (0.0681 in)
M	41423—PS3—010	1.76 mm (0.0693 in)
N	41424—PS3—010	1.79 mm (0.0705 in)
O	41425—PS3—010	1.82 mm (0.0717 in)
P	41426—PS3—010	1.85 mm (0.0728 in)
Q	41427—PS3—010	1.88 mm (0.0740 in)
R	41428—PS3—010	1.91 mm (0.0752 in)
S	41429—PS3—010	1.94 mm (0.0764 in)
T	41430—PS3—010	1.97 mm (0.0776 in)
U	41431—PS3—010	0.60 mm (0.0236 in)

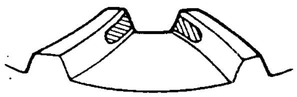
68 mm SHIM

	PART NUMBER	THICKNESS
A	41449—PS3—010	1.40 mm (0.0551 in)
B	41450—PS3—010	1.43 mm (0.0563 in)
C	41451—PS3—010	1.46 mm (0.0575 in)
D	41452—PS3—010	1.49 mm (0.0587 in)
E	41453—PS3—010	1.52 mm (0.0598 in)
F	41454—PS3—010	1.55 mm (0.0610 in)
G	41455—PS3—100	1.58 mm (0.0622 in)
H	41456—PS3—010	1.61 mm (0.0634 in)
I	41457—PS3—010	1.64 mm (0.0646 in)
J	41458—PS3—010	1.67 mm (0.0657 in)
K	41459—PS3—010	1.70 mm (0.0669 in)
L	41460—PS3—010	1.73 mm (0.0681 in)
M	41461—PS3—010	1.76 mm (0.0693 in)
N	41462—PS3—010	1.79 mm (0.0705 in)
O	41463—PS3—010	1.82 mm (0.0717 in)
P	41464—PS3—010	1.85 mm (0.0728 in)
Q	41465—PS3—010	1.88 mm (0.0740 in)
R	41466—PS3—010	1.91 mm (0.0752 in)
S	41467—PS3—010	1.94 mm (0.0764 in)
T	41468—PS3—010	1.97 mm (0.0776 in)
U	41469—PS3—010	0.60 mm (0.0236 in)

Ring Gear & Hypoid Pinion Tooth Contact

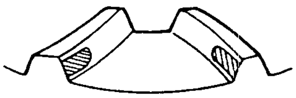
Adjustment

1. TOE CONTACT



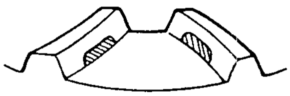
- Use a thinner 35 mm shim to move the drive pinion away from the ring gear.

2. HEEL CONTACT



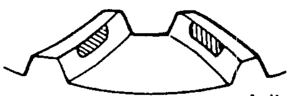
- Use a thicker 35 mm shim to move the drive pinion toward the ring gear.

3. FLANK CONTACT



- Adjust within the range of the standard backlash (move the ring gear away from the drive pinion).
- If adjustment cannot be made within the range of the standard backlash, adjust in the same way as TOE CONTACT.

4. FACE CONTACT

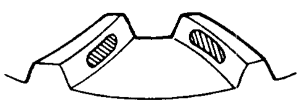


- Adjust in the range of the standard backlash (move the ring gear toward the drive pinion).
- If adjustment cannot be made in the range of the standard backlash, adjust in the same way as HEEL CONTACT.

5. After adjusting check the tooth contact between the ring gear and hypoid pinion through the 34 mm sealing bolt hole.

   NOTE: Paint the ring gear teeth (on both sides of each tooth) lightly and evenly with Prussian Blue. Applying load to the ring gear, rotate the companion flange one full turn both forward and backward.
   CAUTION: Check at three equally spaced points.

6. CORRECT TOOTH CONTACT

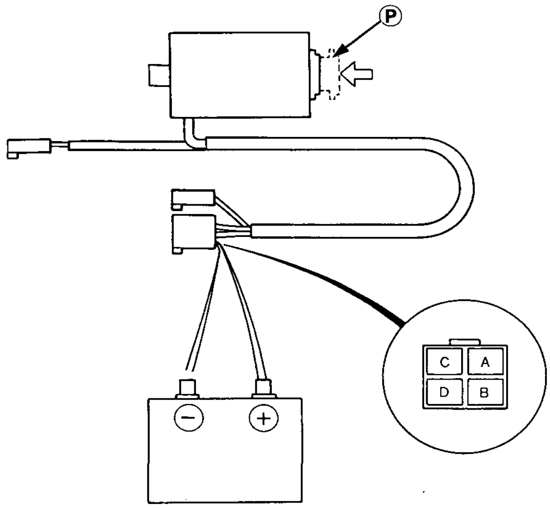


Solenoid Assembly

Inspection

1. Connect the A and C terminals of the solenoid assembly 4-P connector to the battery positive (+) terminal.

   NOTE: Take care not to pinch your finger during inspection.



2. Connect the B terminal of the 4-P connector to the battery negative (−) terminal. Make sure that "P" is drawn in quickly and does not return when its end is pushed firmly with a finger.

   NOTE: Align the end of "P" with the end of the solenoid.

   CAUTION: Do not connect to the battery for more than 5 seconds. The solenoid could get damaged.

3. Connect the D terminal of the 4-P connector to the battery negative (−) terminal. Make sure that "P" is kept up in quickly and does not return when its end is pushed firmly with a finger.

   NOTE: Align the end of "P" with the end of the solenoid.

   CAUTION: Do not connect to the battery for more than 5 minutes. The solenoid could get damaged.

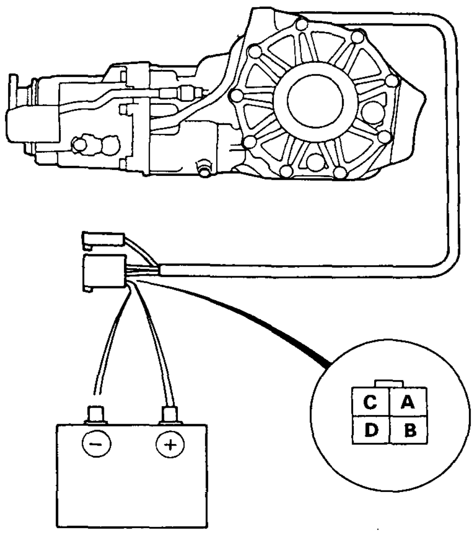
4. If "P" is not drawn and kept up in quickly in the above steps 2 and 3, check for continuity between the A and B terminals, and between the C and D terminals of the 4-P connector.

Solenoid-On-Differential Assembly

Inspection

1. Connect the A and C terminals of the solenoid assembly 4-P connector to the battery positive (+) terminal.

   NOTE: Make sure that the 2—4 shift column is at "4".



2. Rotate the companion flange by hand. You must feel resistance.

3. Connect the B and D terminals of the 4-P connector simultaneously to the battery negative (−) terminal, then immediately disconnect the B terminal.

   CAUTION: Do not connect the B terminal of the 4-P connector to the battery for more than 5 seconds and the D terminal for more than 5 minutes. The solenoid could get damaged.

   1) Check if the solenoid sound can be heard.

   2) Rotate the companion flange by hand and make sure that it rotates smoothly and lightly.

4. Disconnect the 4-P connector D terminal from the battery.

   1) Check if the solenoid sound can be heard.

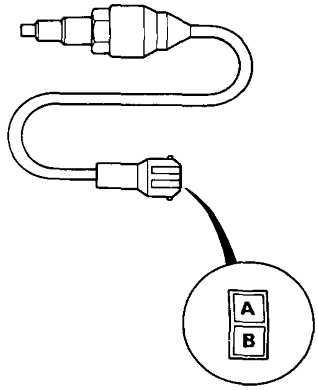
   2) Rotate the companion flange by hand. You must feel resistance.

5. If the solenoid sound cannot be heard and resistance is felt while rotating the companion flange by hand in step 3, check for continuity between the A and B terminals and between the C and D terminals of the 4-P connector. If there is continuity, check each part in the clutch housing for operation.

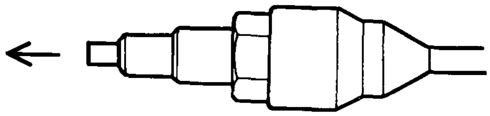
Stroke Switch

Inspection

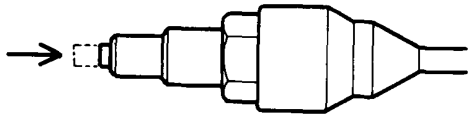
Check for continuity between the terminals of the stroke switch connector.



1. There must be continuity between the A and B terminals (with 4WD engaged).



2. There must be no continuity between A and B terminals (with 4WD disengaged).



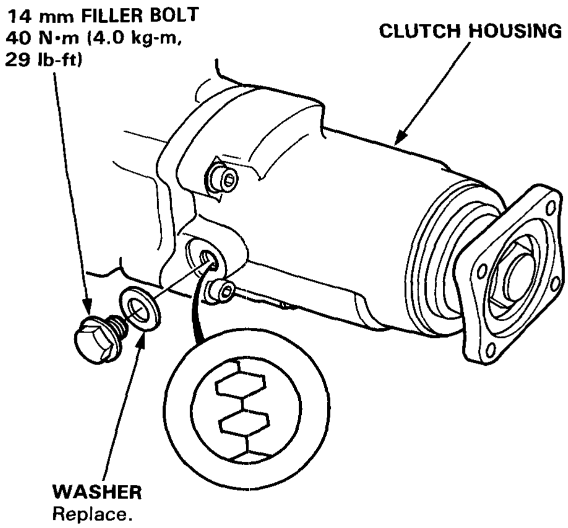
3. The stroke switch is faulty if there are any abnormalities at the above checks 1 and 2.

Stroke Switch

Adjustment

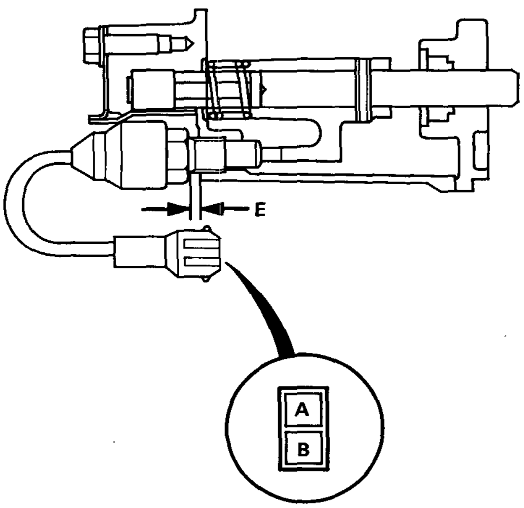
1. Align the mark on the disengagement bolt B with "2" and disengage the dog clutch.

2. Turn the companion flange so that the teeth of the dog clutch hub and dog piece touch each at the tips, then turn the disengagement bolt B.



3. Check for continuity between the A and the B terminal of the stroke switch.

4. With the shim removed, screw in the stroke switch, and measure the distance E at with continuity between terminals A and B will disappear.



5. Compare the measured value of E with the table below and select the proper 14 mm shim.

14 mm Shim

	PART NUMBER	THICKNESS	CLEARANCE	
			E	*E
A	40731–PS3–000	1.00mm(0.0394 in)	—	—
B	40732–PS3–000	1.85mm(0.0728 in)	1.3mm	2.3mm
C	40733–PS3–000	1.95mm(0.0768 in)	1.4mm	2.4mm
D	40734–PS3–000	2.05mm(0.0807 in)	1.5mm	2.5mm
E	40735–PS3–000	2.15mm(0.0846 in)	1.6mm	2.6mm
F	40736–PS3–000	2.25mm(0.0886 in)	1.7mm	2.7mm
G	40737–PS3–000	2.35mm(0.0925 in)	1.8mm	2.8mm
H	40738–PS3–000	2.45mm(0.0965 in)	1.9mm	2.9mm
I	40739–PS3–000	2.55mm(0.1004 in)	2.0mm	3.0mm
J	40740–PS3–000	2.65mm(0.1043 in)	2.1mm	3.1mm
K	40741–PS3–000	2.75mm(0.1083 in)	2.2mm	—

*: Use a shim together with shim A (1.00 mm).

6. Install the 14 mm shim(s) and the stroke switch, turn the disengagement bolt B, and check the correct opening and closing of the switch.