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# ENGINE

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## 4G63, 4G64

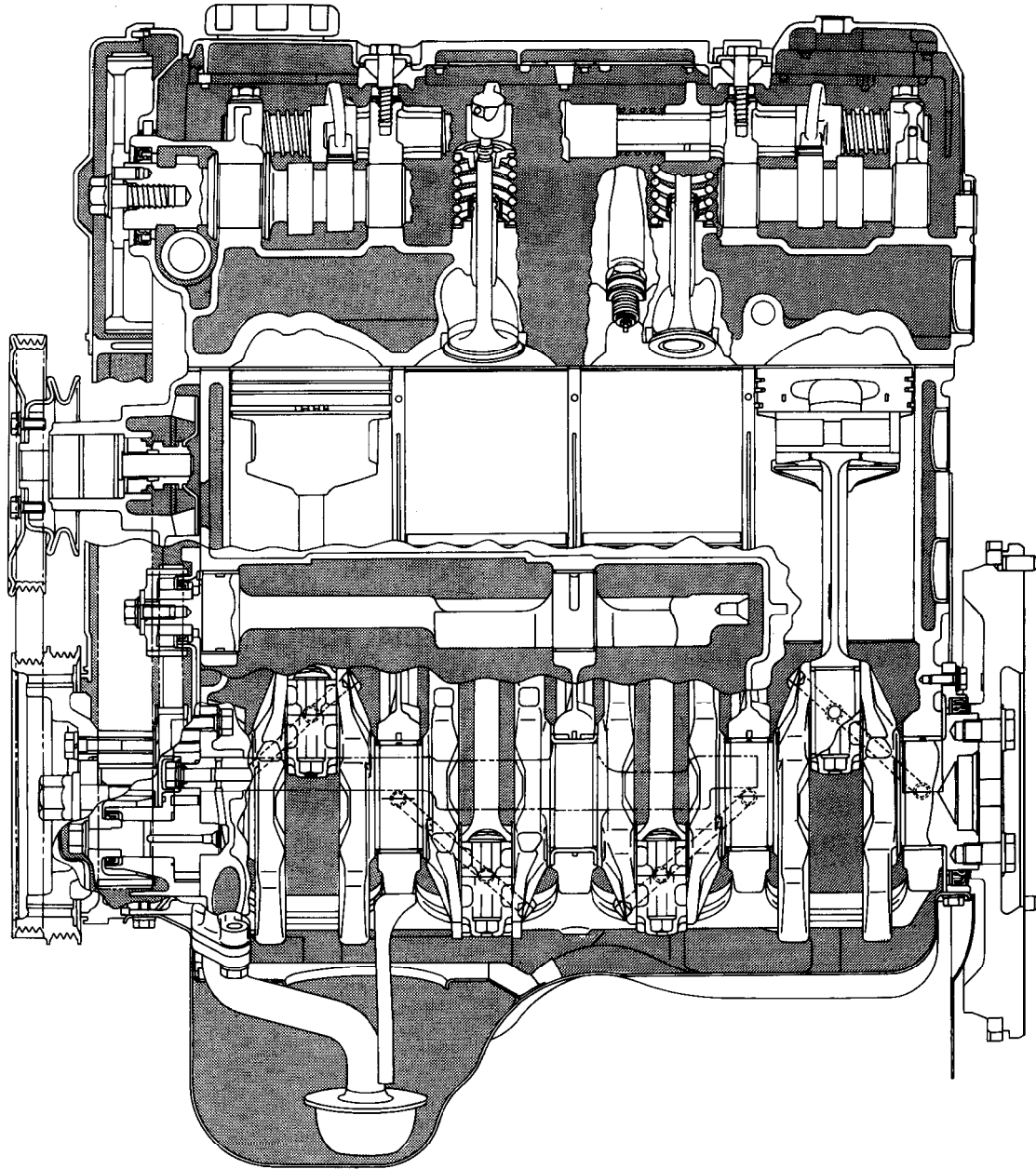
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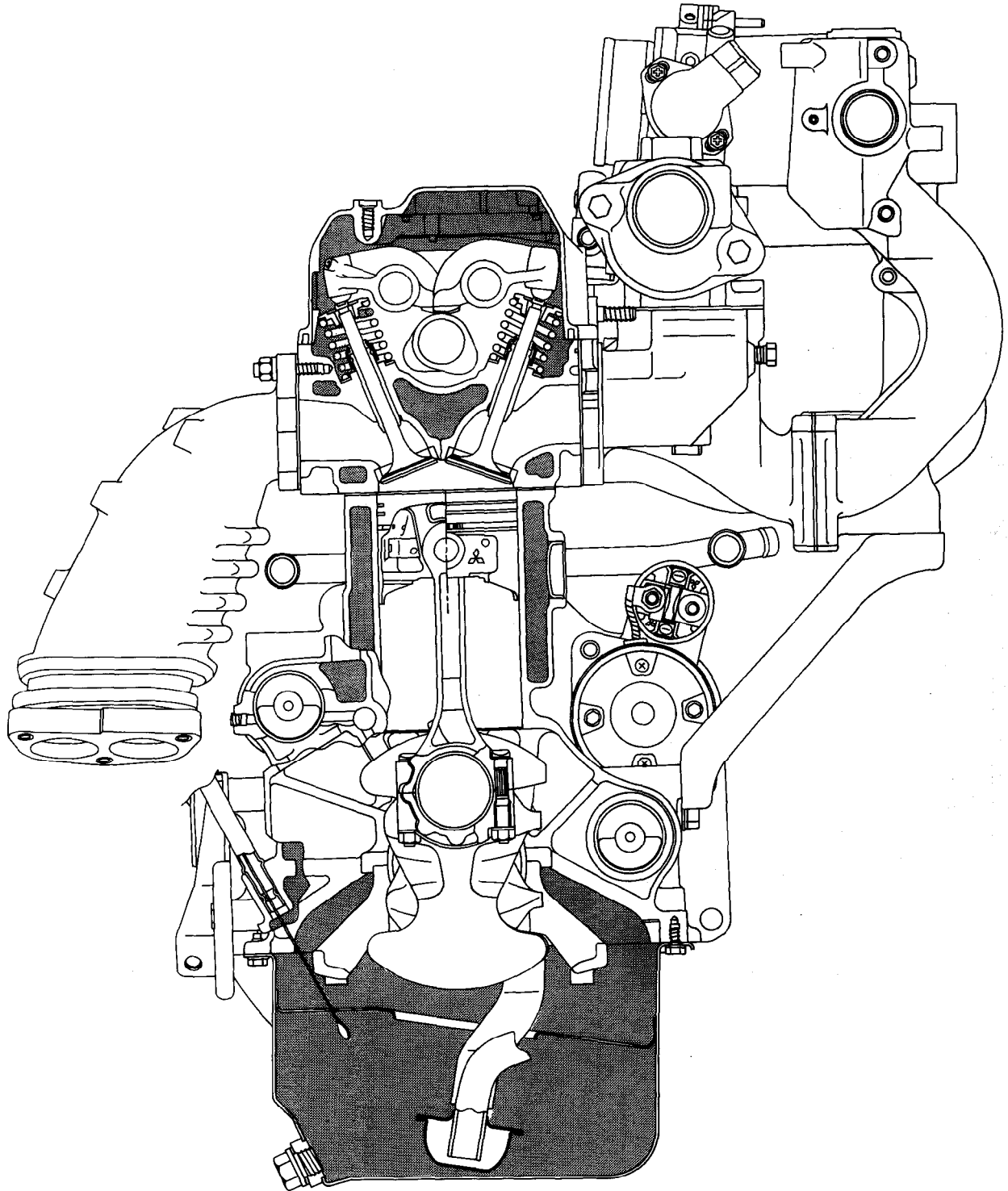
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GENERAL INFORMATION

ENGINE SECTIONAL VIEW – SOHC 8 VALVE

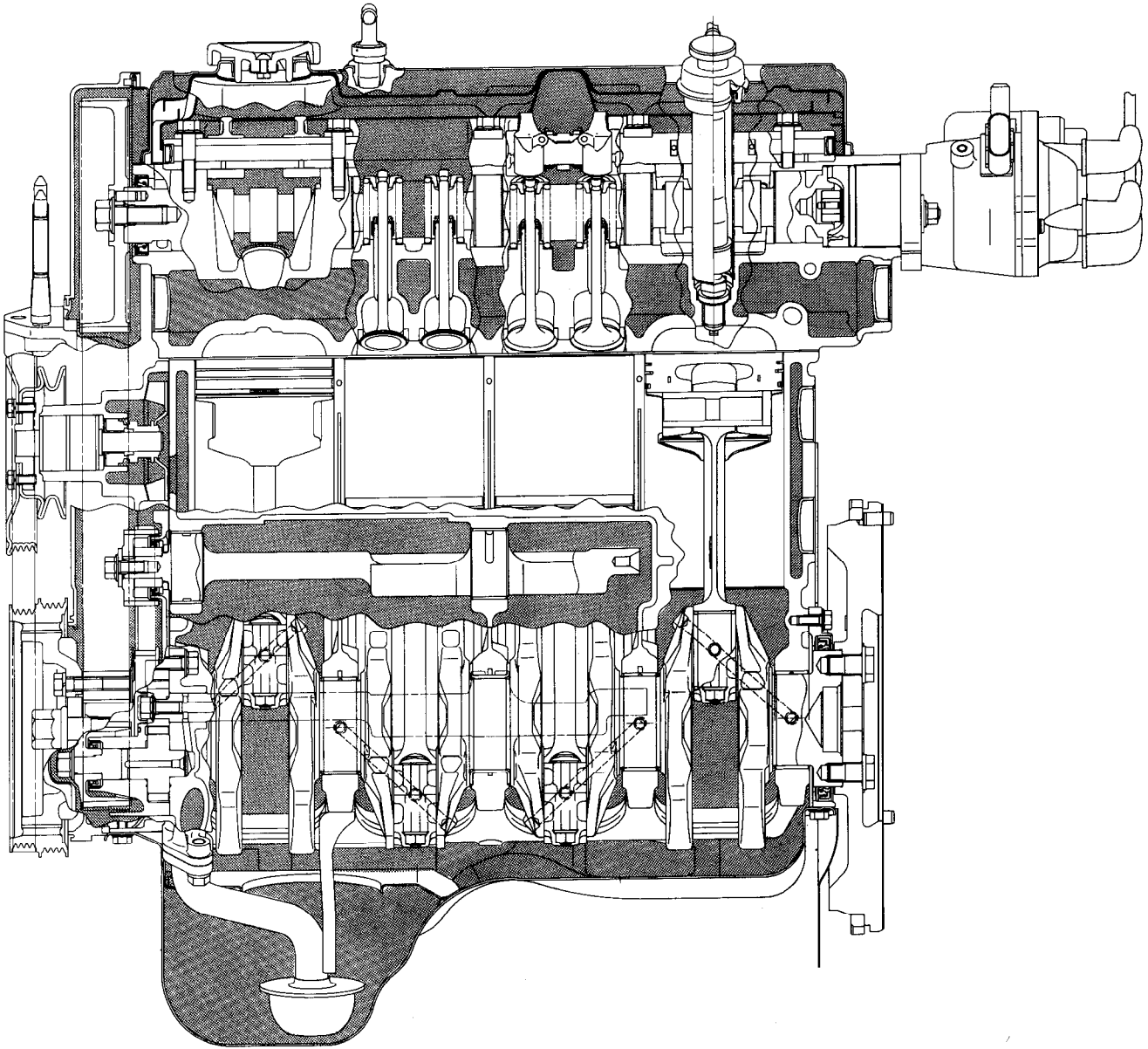




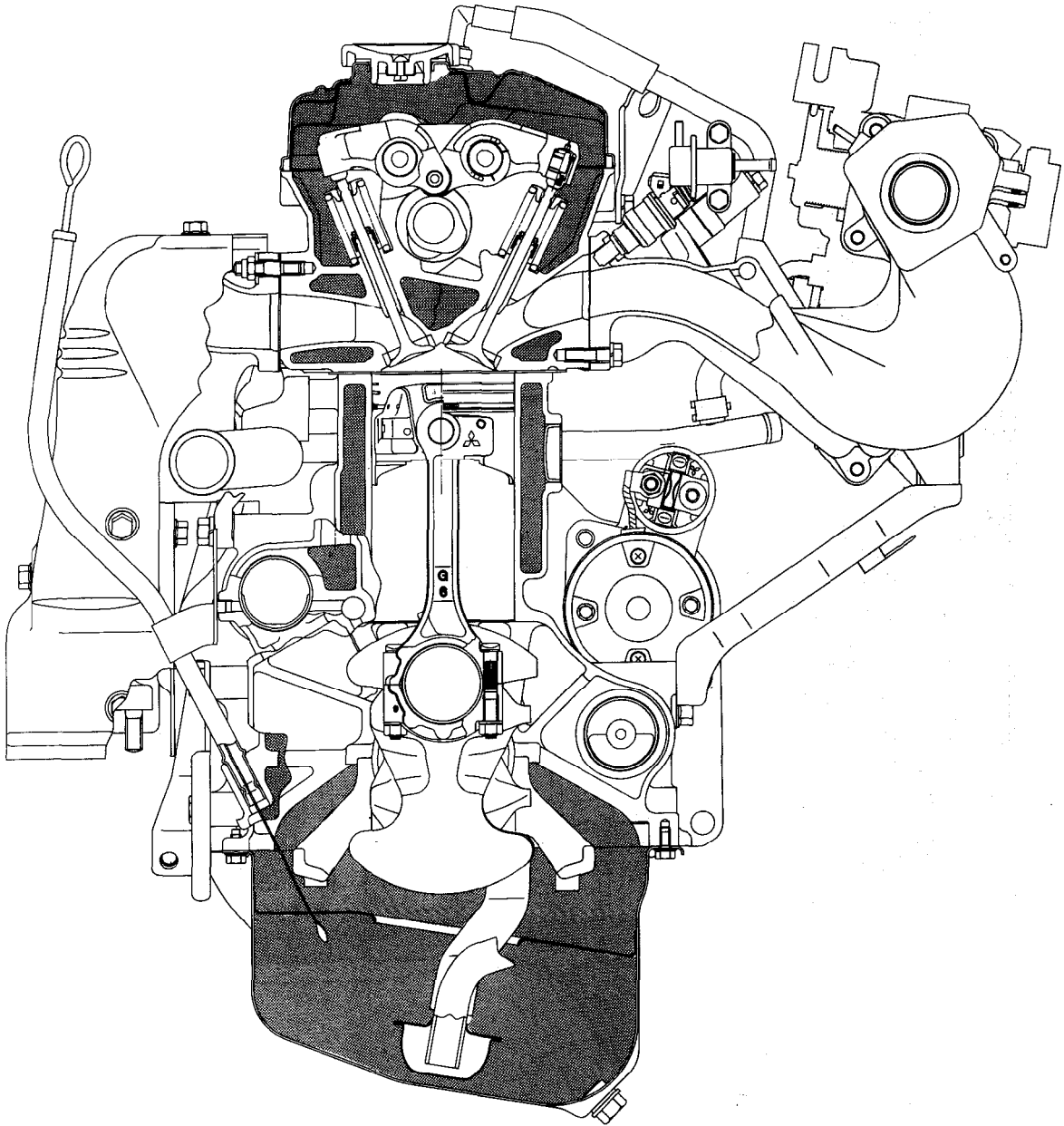
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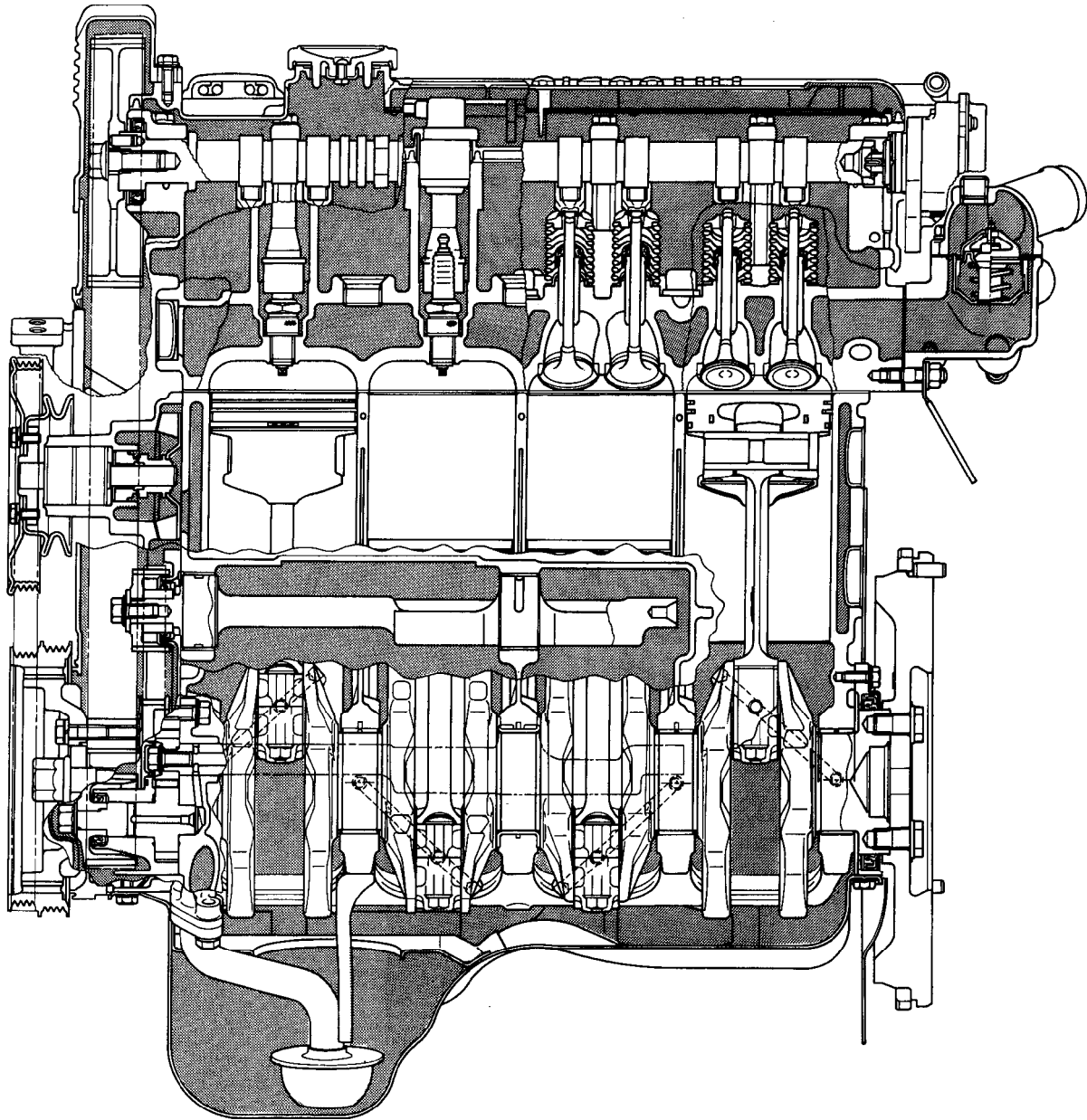
ENGINE SECTIONAL VIEW – SOHC 16 VALVE

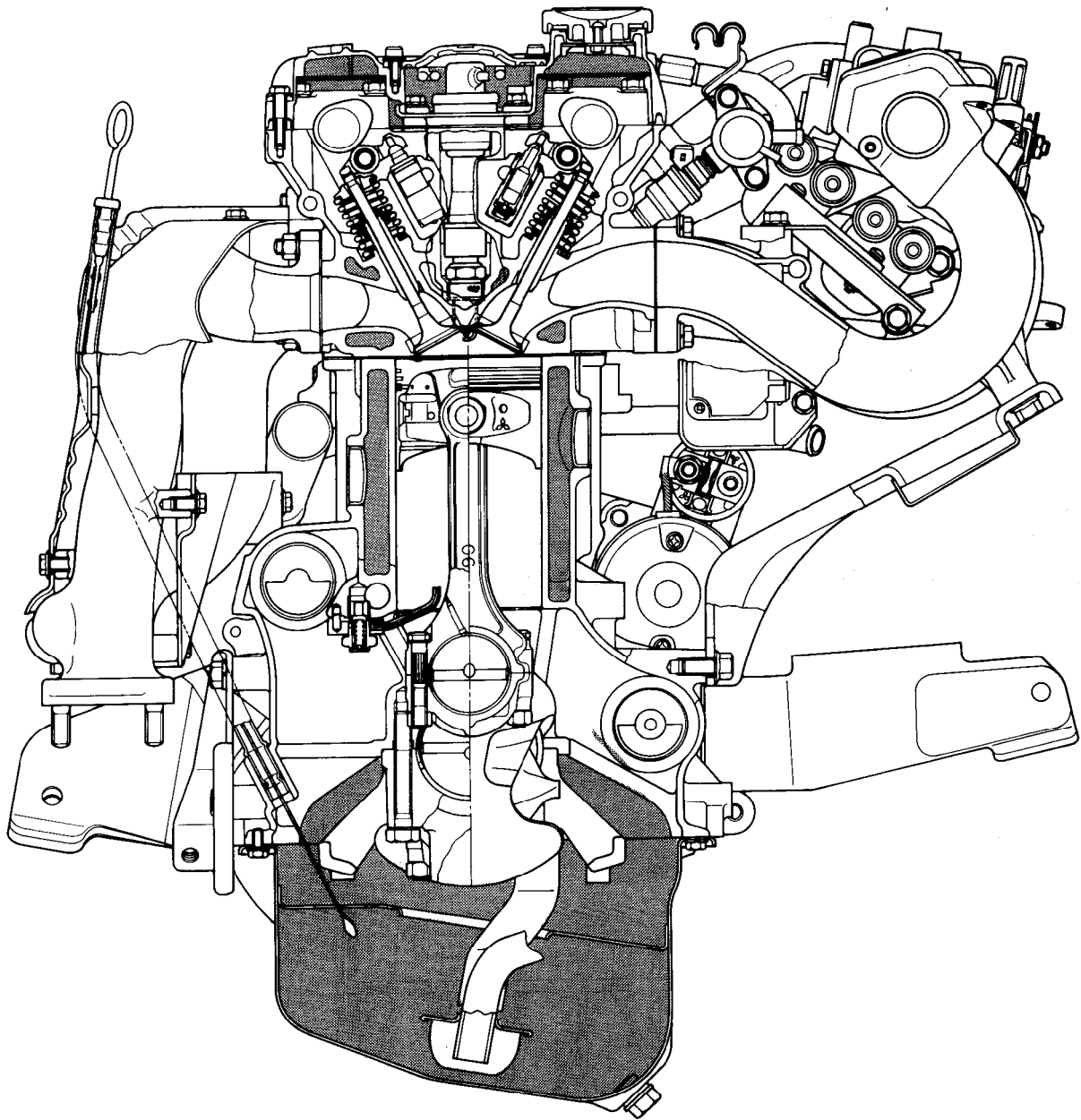


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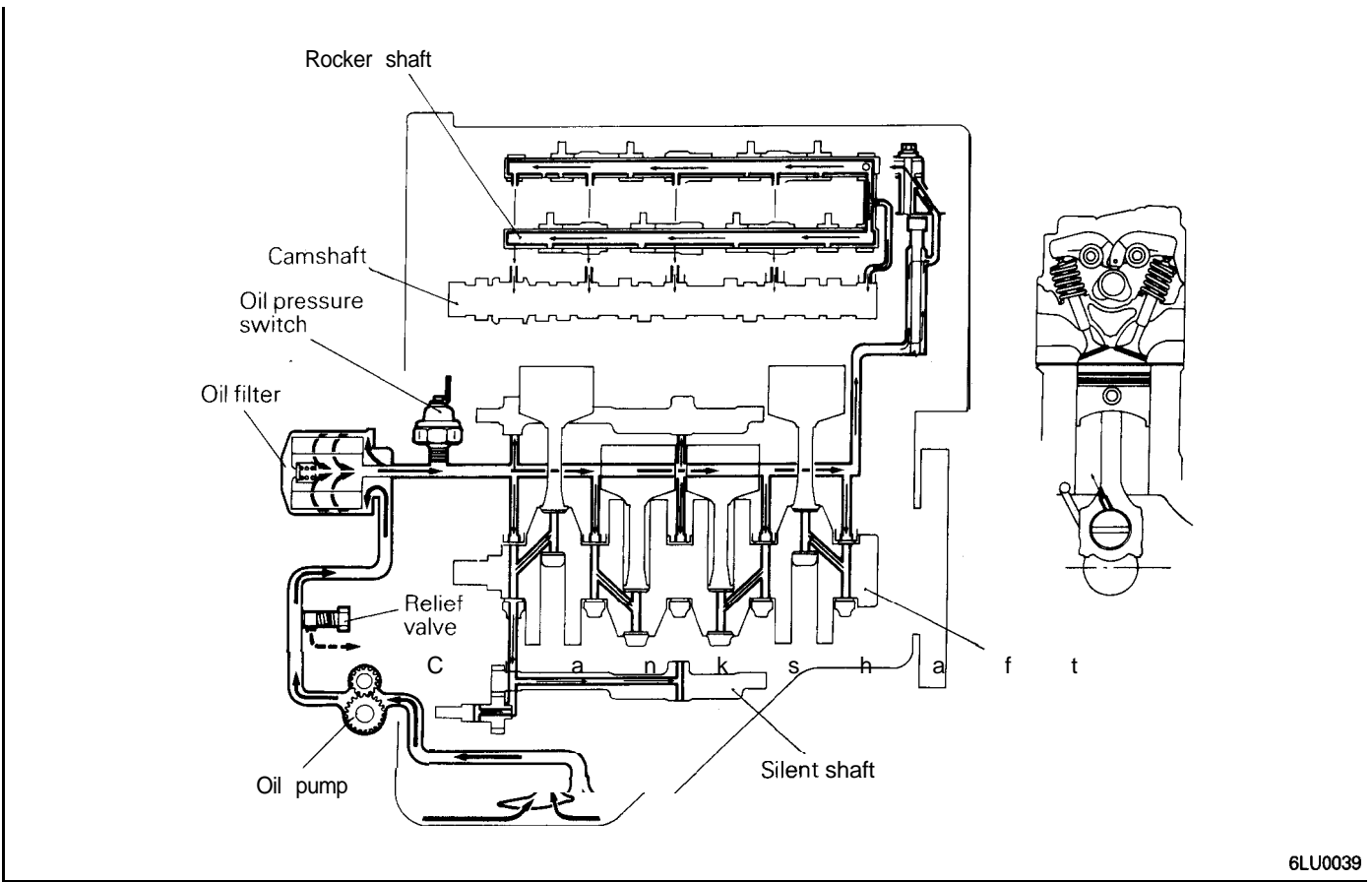
ENGINE SECTIONAL VIEW - DOHC



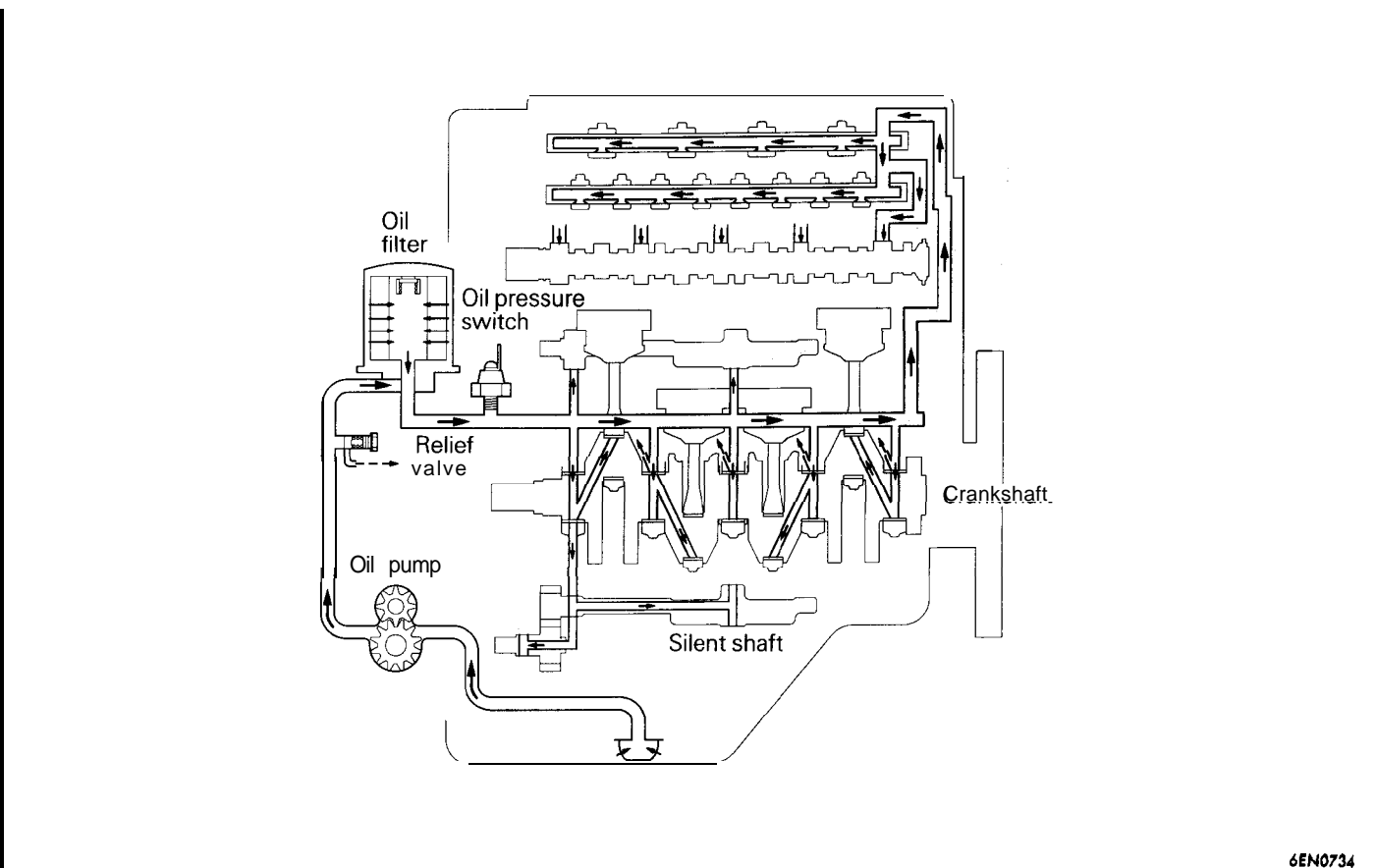


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ENGINE LUBRICATION SYSTEM – SOHC 8 VALVE

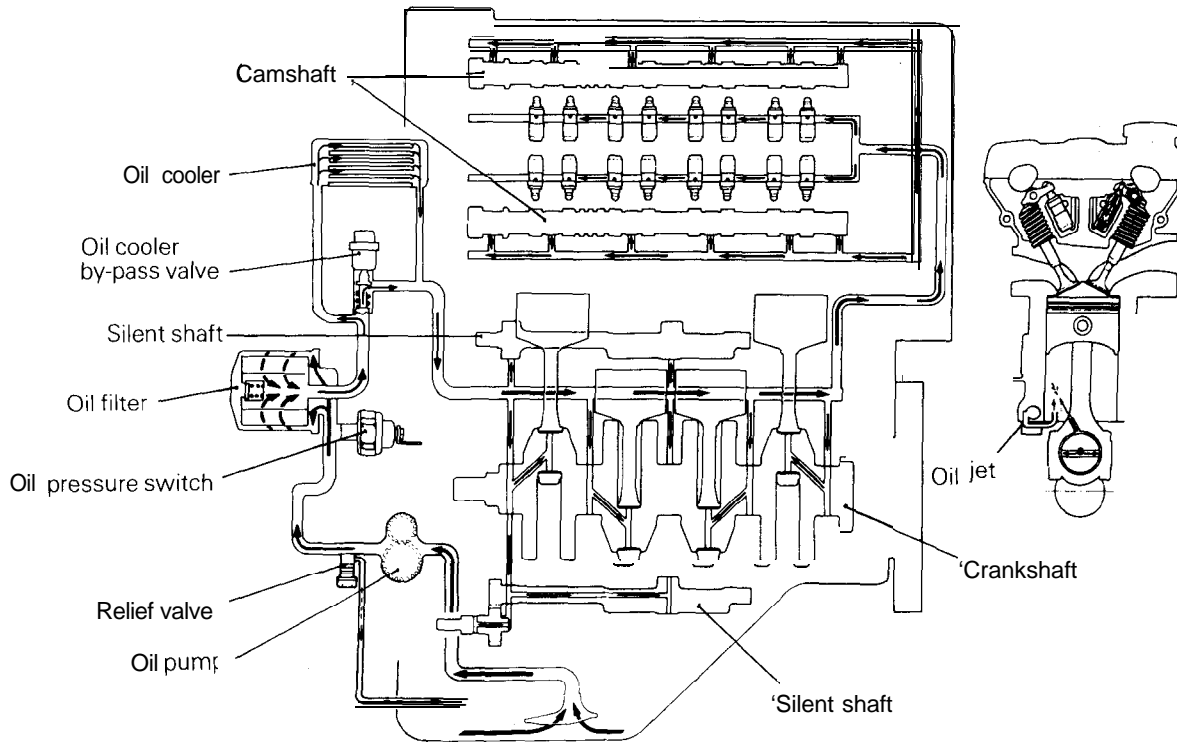


ENGINE LUBRICATION SYSTEM – SOHC 16 VALVE



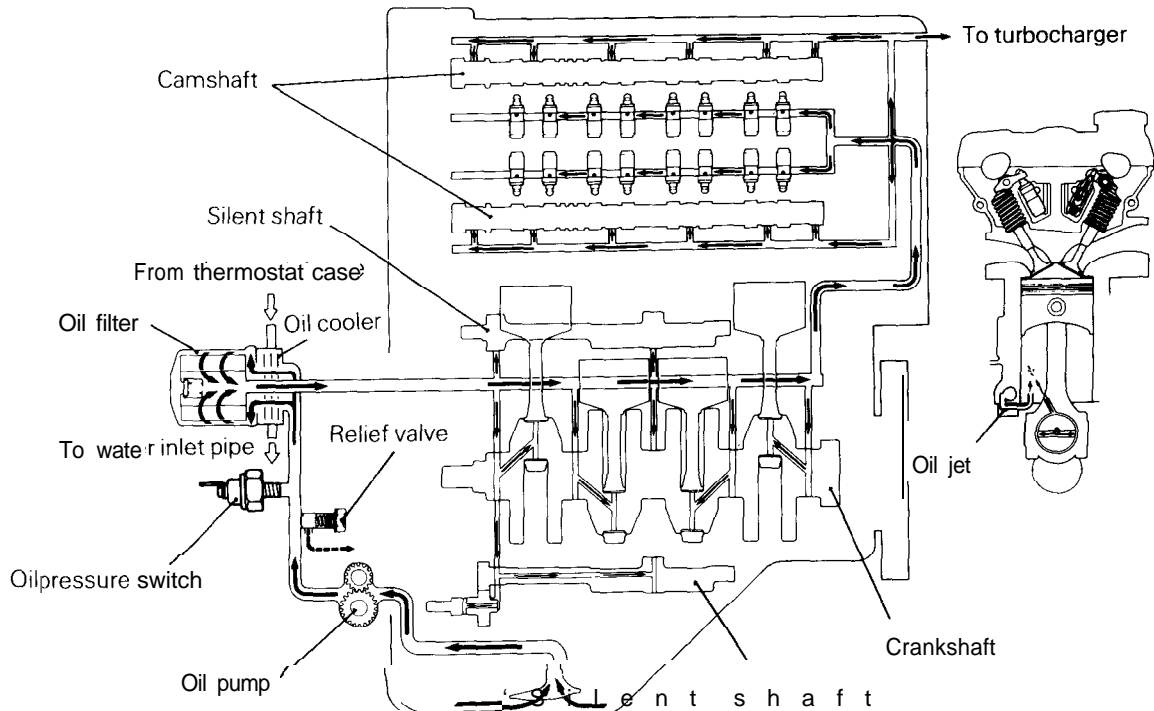


ENGINE LUBRICATION SYSTEM - DOHC



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ENGINE LUBRICATION SYSTEM - DOHC-TURBO



6LU0056

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## GENERAL SPECIFICATIONS

## 4G63 SOHC 16 VALVE

Items	Specifications
Type	In-line OHV, SOHC
Number of cylinders	4
Combustion chamber	Pentroof type
Total displacement cm <sup>3</sup> (cu. in.)	1,997 (121.9)
Cylinder bore mm (in.)	85 (3.35)
Piston stroke mm (in.)	88 (3.46)
Compression ratio	9.5
Valve timing	
Intake valve	
Opens BTDC	11°
Closes ABDC	53°
Exhaust valve	
Opens BBDC	63°
Closes ATDC	21°
Lubrication system	Pressure feed, full-flow filtration
Oil pump type	Involute gear type
Cooling system	Water-cooled forced circulation
Water pump type	Centrifugal impeller type
EGR valve	Single type
Injector type and number	Electromagnetic, 4
Injector identification No.	MDH240
Fuel regulated pressure kpa (psi)	335 (47.6)
Throttle bore mm (in.)	54 (2.13)
Throttle position sensor	Variable resistor type
Closed throttle position switch	Movable contact type within throttle position sensor

**4G64 SOHC 8 VALVE**

Items	Specifications
Type	In-line OHV, SOHC
Number of cylinders	4
Combustion chamber	Pentroof type
Total displacement cm <sup>3</sup> (cu. in.)	2,350 (143.4)
Cylinder bore mm (in.)	86.5 (3.41)
Piston stroke mm (in.)	100 (3.94)
Compression ratio	8.5
Valve timing	
Intake valve	
Opens BTDC	20°
Closes ABDC	64°
Exhaust valve	
Opens BBDC	64°
Closes ATDC	20°
Lubrication system	Pressure feed, full-flow filtration
Oil pump type	Involute gear type
Cooling system	Water-cooled forced circulation
Water pump type	Centrifugal impeller type
EGR valve	Single type
Injector type and number	Electromagnetic, 4
Injector identification No.	N275H
Fuel regulated pressure kpa (psi)	335 (47.6)
Throttle bore mm (in.)	50 (1.97)
Throttle position sensor	Variable resistor type
Closed throttle position switch	Contact type within idle speed control motor

## 4G64 SOHC 16 VALVE

Items	Specifications
Type	In-line OHV, SOHC
Number of cylinders	4
Combustion chamber	Pentroof type
Total displacement cm <sup>3</sup> (cu. in.)	2,350 (143.4)
Cylinder bore mm (in.)	86.5 (3.41)
Piston stroke mm (in.)	100 (3.94)
Compression ratio	9.5
Valve timing	
intake valve	
Opens BTDC	18°
Closes ABDC	58°
Exhaust valve	
Opens BBDC	58°
Closes ATDC	18°
Lubrication system	Pressure feed, full-flow filtration
Oil pump type	Involute gear type
Cooling system	Water-cooled forced circulation
Water pump type	Centrifugal impeller type
EGR valve	Single type
Injector type and number	Electromagnetic, 4
Injector identification No.	MDH275
Fuel regulated pressure kpa (psi)	335 (47.6)
Throttle bore mm (in.)	60 (2.36)
Throttle position sensor	Variable resistor type
Closed throttle position switch	Movable contact type within throttle position sensor

4G63 DOHC

Items	Specifications
Type	In-line OHV, OHC
Number of cylinders	4
Combustion chamber	Pentroof type
Total displacement cm <sup>3</sup> (cu. in.)	1,997 (121.9)
Cylinder bore mm (in.)	85 (3.35)
Piston stroke mm (in.)	88 (3.46)
Compression ratio	
GALANT	9.8
ECLIPCE-Non-turbo	9.0
ECLIPCE-Turbo	7.8
Valve timing	
(): camshaft identification mark	(B,C)                      (A,A)                      (D,C)                      (E,A)
Intake valve	
Opens            BTDC	21"                      26"                      21"                      16"
Closes          ABDC	43"                      46"                      51"                      48"
Exhaust valve	
Opens            BBDC	57"                      55"                      57"                      55"
Closes          ATDC	18"                      9"                        15"                      9"
Lubrication system	Pressure feed, full-flow filtration
Oil pump type	Involute gear type
Cooling system	Water-cooled forced circulation
Water pump type	Centrifugal impeller type
EGR valve	Single type
Injector type and number	Electromagnetic, 4
Injector identification No.	
Non-turbo	N24OH
Turbo	B450L
Fuel regulated pressure kpa (psi)	
Non-turbo	335 (47.6)
Turbo	255 (36.6)
Throttle bore mm (in.)	60 (2.36)
Throttle position sensor	Variable resistor type
Closed throttle position switch	Contact type

## SERVICE SPECIFICATIONS

mm (in.)

	Standard	Limit
Cylinder head – SOHC 8 VALVE		
Flatness of gasket surface	0.05 (.0020)	0.2 (.008)
Grinding limit of gasket surface		*0.2 (.008)
* Total resurfacing depth of both cylinder head and cylinder block.		
Overall height	89.9 – 90.1 (3.508 – 3.547)	
Oversize rework dimensions of valve guide hole (both intake and exhaust)		
0.05 (.002)	13.05 – 13.07 (.5138 – .5146)	
0.25 (.010)	13.25 – 13.27 (.5217 – .5224)	
0.50 (.020)	13.50 – 13.52 (.5315 – .5323)	
Oversize rework dimensions of intake valve seat ring hole		
0.30 (.012)	47.30 – 47.33 (1.8622 – 1.8634)	
0.60 (.024)	47.60 – 47.63 (1.8740 – 1.8752)	
Oversize rework dimensions of exhaust valve seat ring hole		
0.30 (.012)	40.30 – 40.33 (1.5866 – 1.5878)	
0.60 (.024)	40.60 – 40.63 (1.5984 – 1.5996)	
Cylinder head – SOHC 16 VALVE		
Flatness of gasket surface	0.05 (.0020)	0.2 (.008)
Grinding limit of gasket surface		*0.2 (.008)
* Total resurfacing depth of both cylinder head and cylinder block.		
□ Flatness of manifold mounting surface	0.15 (.0059)	0.3 (.012)
Overall height	119.9 – 120.1 (4.720 – 4.728)	
Oversize rework dimensions of valve guide hole (both intake and exhaust)		
0.05 (.002)	11.05 – 11.07 (.435 – .436)	
0.25 (.010)	11.25 – 11.27 (.443 – .444)	
0.50 (.020)	11.50 – 11.52 (.453 – .454)	
Oversize rework dimensions of intake valve seat ring hole		
0.30 (.012)	34.30 – 34.33 (1.3504 – 1.3516)	
0.60 (.024)	34.60 – 34.63 (1.3622 – 1.3634)	
Oversize rework dimensions of exhaust valve seat ring hole		
0.30 (.012)	31.80 – 31.83 (1.2520 – 1.2531)	
0.60 (.024)	32.10 – 32.13 (1.2638 – 1.2650)	

mm (in.)

	Standard	Limit
<b>Cylinder head - DOHC</b>		
Flatness of gasket surface	0.05 (.0020)	0.2 (.008)
Grinding limit of gasket surface		*0.2 (.008)
* Total resurfacing depth of both cylinder head and cylinder block		
Flatness of manifold mounting surface	0.15 (.0059)	0.3 (.012)
Overall height	<b>131.9-132.1</b> (5.193 – 5.201)	
Oversize rework dimensions of valve guide hole (both intake and exhaust)		
<b>0.05</b> (.002)	12.05 – <b>12.07</b> (.4744 – .4752)	
<b>0.25</b> (.010)	12.25 – 12.27 (.4823 – .4831)	
0.50 (.020)	12.50 – 12.52 (.4921 – .4929)	
Oversize rework dimensions of intake valve seat ring hole		
0.30 (.012)	35.30 – 35.33 (1.3898 – 1.3909)	
0.60 (.024)	35.60 – 35.63 (1.4016 – 1.4028)	
Oversize rework dimensions of exhaust valve seat ring hole		
<b>0.30</b> (.012)	33.30 – 33.33 (1.3110 – 1.3122)	
0.60 (.024)	33.60 – 33.63 (1.3228 – 1.3240)	
<b>Camshaft – SOHC 8 VALVE</b>		
Cam height		
Intake	42.40 (1.6693)	<b>41.90 (1.6496)</b>
Exhaust	<b>42.40 (1.6693)</b>	<b>41.90 (1.6496)</b>
Journal diameter	33.94 – 33.95 (1.3362 – 1.3366)	
Oil clearance	0.05 – 0.09 (.0020 – .0035)	
<b>Camshaft – SOHC 16 VALVE</b>		
Cam height		
Intake	37.39 (1.4720)	<b>36.89 (1.4524)</b>
Exhaust	37.47 (1.4752)	<b>36.97 (1.4555)</b>
Journal diameter	44.93 – 44.94 (1.7689 – 1.7693)	
Oil clearance	0.05 – 0.09 (.0020 – .0035)	
<b>Camshaft – DOHC</b>		
Intake		
Identification mark: A, D		
Cam height	35.49 (1.3972)	34.99 (1.3776)
Identification mark: B, E		
Cam height	35.20 (1.3858)	34.70 (1.3661)
Exhaust		
Identification mark: A		
Cam height	35.20 (1.3858)	<b>34.70 (1.3661)</b>
Identification mark: C		
Cam height	35.49 (1.3972)	34.99 ( <b>1.3776</b> )
NOTE: The camshaft identification mark is stamped on the rear end of the camshaft.		
Journal diameter	25.95-25.97 (1.0217 – 1.0224)	
Oil clearance	0.05 – 0.09 (.0020 – .0035)	

mm (in.)

	Standard	Limit
<b>Rocker arm – SOHC 8 VALVE</b> I.D. Rocker arm-to-shaft clearance	18.91 – 18.93 (.7445 – .7453) 0.01 – 0.04 (.0004 – .0016)	0.1 (.004)
<b>Rocker arm – SOHC 16 VALVE</b> I.D. Rocker arm-to-shaft clearance	20.02 – 20.04 (.7882 – .7890) 0.02 – 0.05 (.0008 – .0020)	0.1 (.004)
<b>Lash adjuster</b> <b>Leak down</b> test Remarks: Diesel fuel at 15 – 20°C (59 – 68°F)	4 – 20 seconds/l mm (.04 in.)	
<b>Rocker shaft – SOHC 8 VALVE</b> O.D. Overall length Intake Exhaust	18.89 – 18.90 (.7437 – .7441)  385.5 (15.177) 372.5 (14.665)	
<b>Rocker shaft – SOHC 16 VALVE</b> O.D. Overall length Intake Exhaust	19.99 – 20.00 (.7870 – .7874)  417.25 (16.427) 417.25 (16.427)	
<b>Valve – SOHC 8 VALVE</b> Overall length Intake Exhaust Stem diameter Intake Exhaust Face angle Thickness of valve head (margin) Intake Exhaust Stem-to-guide clearance Intake Exhaust	  106.6 (4.197) 105.2 (4.142)  7.96-7.98 (.3134 – .3142) 7.93 – 7.95 (.3122 – .3130) 45° – 45°30'  1.2 (.047) 2.0 (.079)  0.02 – 0.06 (.0008 – .0024) 0.05 – 0.09 (.0020 – .0035)	      0.7 (.028) 1.5 (.059)  0.10 (.0039) 0.15 (.0059)



mm (in.)

	Standard	Limit
<b>Valve – SOHC 16 VALVE</b>		
Overall length		
Intake	112.3 (4.421)	
Exhaust	114.1 (4.492)	
Stem diameter		
Intake	5.97 – 5.98 (.2350 – .2354)	
Exhaust	5.95 – 5.97 (.2343 – .2350)	
Face angle	45° – 45°30'	
Thickness of valve head (margin)		
Intake	1.0 (.039)	0.5 (.020)
Exhaust	1.2 (.047)	0.7 (.028)
Stem-to-guide clearance		
Intake	0.02 – 0.05 (.0008 – .0020)	0.10 (.004)
Exhaust	0.03 – 0.07 (.0012 – .0028)	0.15 (.006)
<b>Valve – DOHC</b>		
Overall length		
Intake	109.5 (4.311)	
Exhaust	109.7 (4.319)	
Stem diameter		
Intake	6.57 – 6.58 (.2587 – .2591)	
Exhaust	6.53 – 6.55 (.2571 – .2579)	
Face angle	45° – 45°30'	
Thickness of valve head (margin)		
Intake	1.0 (.039)	0.7 (.028)
Exhaust	1.5 (.059)	1.0 (.039)
Stem-to guide clearance		
Intake	0.02 – 0.05 (.0008 – .0020)	0.10 (.004)
Exhaust	0.05 – 0.09 (.0020 – .0035)	0.15 (.006)
<b>Valve spring – SOHC 8 VALVE</b>		
Free height	49.8 (1.961)	48.8 (1.921)
Load/installed height N/mm (lbs./in.)	329/40.4 (73/1.591)	
Out-of-squareness	2" or less	Max. 4°
<b>Valve spring – SOHC 16 VALVE</b>		
Free height	51.0 (2.008)	50.0 (1.969)
Load/installed height N/mm (lbs./in.)	272/44.2 (60/1.740)	
Out-of-squareness	2" or less	Max. 4"
<b>Valve spring – DOHC</b>		
Free height	48.3 (1.902)	47.3 (1.862)
Load/installed height N/mm (lbs./in.)	300/40.0 (66/1.575)	
Out-of-squareness	1.5" or less	Max. 4"

mm (in.)

	Standard	Limit
<b>Valve guide- SOHC 8 VALVE</b> Overall length Intake Exhaust I.D. O.D. Service size Press-in temperature	 47 (1.85) 52 (2.05) 8.00 – 8.02 (.3150 – .3157) 13.06 – 13.07 (.5142 – .5146) 0.05 (.002), 0.25 (.010), 0.50 (.020) oversize Room temperature	
<b>Valve guide – SOHC 16 VALVE</b> Overall length Intake Exhaust I.D. O.D. Service size Press-in temperature	 45.5 (1.79) 50.5 (1.99) 6.00 – 6.02 (.236 – .237) 11.06 – 11.07 (.4354 – .4358) 0.05 (.002), 0.25 (.01), 0.50 (.02) over size Room temperature	
<b>Valve guide – DOHC</b> Overall length Intake Exhaust I.D. O.D. Service size Press-in temperature	 45.5 (1.791) 50.5 (1.988) 6.60 – 6.62 (.2598 – .2606) 12.06 – 12.07 (.4748 – .4752) 0.05 (.002), 0.25 (.010), 0.50 (.020) over size Room temperature	
Valve seat Seat angle Valve contact width Sinkage Service size	 43°30' – 44" 0.9 – 1.3 (.035 – .051)  0.3 (.012), 0.6 (.024) over size	  0.2 (.008)
<b>Silent shaft</b> Journal diameter Right (front) (rear) Left (front) (rear) Oil clearance Right (front) (rear) Left (front) (rear)	 41.96 – 41.98 (1.6520 – 1.6528) 10.95 – 40.97 (1.6122 – 1.6130) 18.47 – 18.48 (.7272 – .7276) 10.95 – 40.97 (1.6122 – 1.6130) 0.03 – 0.06 (.0012 – .0024) 0.05 – 0.09 (.0020 – .0036) 0.02 – 0.05 (.0008 – .0020) 0.05 – 0.09 (.0020 – .0036)	
<b>Piston – SOHC</b> I.D. 4G63 4G64 Piston to cylinder clearance Service size	 84.97 – 85.00 (3.3453 – 3.3465) 86.47 – 86.50 (3.404 – 3.4055) 0.02 – 0.04 (.0008 – .0016) 0.25 (.010), 0.50 (.020), 0.75 (.030), 1.00 (.039) over size	

mm (in.)

	Standard	Limit
<b>Piston – DOHC</b> O.D. Non-turbo Turbo Piston to cylinder clearance Non-turbo Turbo Service size	84.97 – 85.00 (3.3453 – 3.3465) 84.96 – 84.99 (3.3449 – 3.3461) 0.02 -0.04 (.0008 – .0016) 0.03 -0.05 (.0012 – .0020) 0.25 (.010), 0.50 (.020), 0.75 (.030), 1.00 (.039) over size	
<b>Piston ring – SOHC</b> End gap No. 1 ring No. 2 ring 8 VALVE 16 VALVE Oil ring 8 VALVE 16 VALVE Ring-to-ring groove clearance 4G63 4G64 Service size	0.25 – 0.35 (.0098 – .0138) 0.45 – 0.60 (.0177 – .0236) 0.40 -0.55 (.0157 – .0217) 0.20 -0.60 (.0079 – .0236) 0.10 – 0.40 (.0039 – .0157) 0.02 -0.06 (.0008 – .0024) 0.03 – 0.07 (.0012 – .0028) 0.25 (.010), 0.50 (.020), 0.75 (.030), 1.00 (.039) over size	0.8 (.031) 0.8 (.031) 0.8 (.031) 1.0 (.039) 1.0 (.039) 0.1 (.004) 0.1 (.004)
<b>Piston ring – DOHC</b> End gap No. 1 ring No. 2 ring Oil ring Ring-to-ring groove clearance No, 1 ring Non-turbo Turbo No. 2 ring Service size	0.25 -0.40 (.0098 – .0157) 0.45 – 0.60 (.0177 – .0236) 0.13 – 0.38 (.0051 – .0150) 0.02 – 0.06 (.0008 – .0024) 0.03 – 0.07 (.0012 – .0028) 0.02 – 0.06 (.0008 – .0024) 0.25 (.010), 0.50 (.020), 0.75 (.030), 1.00 (.039) over size	0.8 (.031) 0.8 (.031) 1.0 (.039) 0.1 (.004) 0.1 (.004) 0.1 (.004)
<b>Piston pin</b> O.D. Press-in Load N (lbs.) Press-in temperature	22.00 – 22.01 (.8661 – .8665) 7,500 – 17,500 (1,653 – 3,858) Room temperature	
<b>Connecting rod</b> Big end center-to-small end center length Bend Twist Big end side clearance	149.9 – 150.0 (5.902 – 5.906) 0.05 (.0020) 0.1 (.004) 0.10 – 0.25 (.0039 – .0098)	0.4 (.016)

mm (in.)

	Standard	Limit
<b>Crankshaft</b> End play Journal O.D. Pin O.D. Out-of-roundness and taper of journal and pin Concentricity of journal Oil clearance of journal Oil clearance of pin	0.05 – 0.25 (.0020 – .0098) 56.98 – 57.00 (2.2433 – 2.2441) 44.98 – 45.00 (1.7709 – 1.7717) Max. 0.01 (.0004) Max. 0.02 (.0008) 0.02 – 0.05 (.0008 – .0020) 0.02 – 0.05 (.0008 – .0020)	0.4 (.016)      0.1 (.004) 0.1 (.004)
<b>Cylinder block</b> Cylinder I.D. 4G63 4G64 Flatness of gasket surface Grinding limit * Total resurfacing depth of both cylinder block and cylinder head. Overall height 4G63 4G64	85.00 – 85.03 (3.3465 – 3.3476) 86.50 – 86.53 (3.4055 – 3.4067) 0.05 (.0020)     283.9-284.1 (11.177 – 11.185) 289.9 – 290.1 (11.413 – 11.421)	0.1 (.004) "0.2 (.008)
<b>Oil pump</b> Side clearance Drive gear Driven gear	0.08 – 0.14 (.0031 – .0055) 0.06 – 0.12 (.0024 – .0047)	
<b>Drive belt</b> Deflection V-ribbed type belt      New belt Used belt V type belt Tension V-ribbed type belt      New belt      N (lbs.) Used belt      N (lbs.)	7.5 – 9.0 (.30 – .35) 8.0 (.32) 7.0 – 10.0 (.28 – .39) 500 – 700 (110 – 154) 400 (88)	
<b>Oil cooler by-pass valve</b> Dimension (L) By-pass hole closing temperature	34.5 (1.358) – normal <b>temperature</b> [97 – 103°C (207 – 217°F) or more]	
<b>Injector</b> Coil resistance Non-turbo Ω Turbo Ω	13 – 16 at 20°C (68°F) 2 – 3 at 20°C (68°F)	
<b>Throttle position sensor</b> Resistance Ω	28 – 33 at 20°C (68°F)	
<b>Idle speed control motor position sensor</b> - SOHC engine for TRUCK Resistance kΩ	4 - 6	

NOTE  
 O.D.: Outer Diameter  
 I.D.: Inner Diameter  
 U.S.: Undersize Diameter

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## TORQUE SPECIFICATIONS

	Nm	ft.lbs.
Generator and ignition system		
Cooling fan	11	8
Fan clutch	11	8
Water pump pulley	11	8
Generator mounting bolt	23	17
Generator brace bolt	24	17
Generator pivot nut	14	10
Crankshaft pulley bolt	25	18
Spark plug	25	18
Ignition coil bolt		
M6	14	10
M8	24	17
Distributor nut	11	8
Center cover bolt	3	2
Power transistor bolt	11	8
Crank angle sensor nut	19	14
Timing belt		
Tensioner spring bolt	49	35
Tensioner pulley bolt	49	35
Tensioner arm bolt	22	16
Auto tensioner bolt	24	17
Idler pulley bolt – SOHC	36	26
Idler pulley bolt – DOHC	38	27
Oil pump sprocket nut	55	40
Crankshaft bolt	120	87
Tensioner “B” bolt	19	14
Silent shaft sprocket bolt	46	33
Camshaft sprocket bolt	90	65
Timing belt rear cover – SOHC 16 VALVE		
M8	14	10
M10	31	22
Engine support bracket bolt	45	33
<b>Fuel and emission parts</b>		
IGR valve -bolt	22	16
Throttle body stay bolt – DOHC	19	14
Throttle body bolt	19	14
Fuel pressure regulator bolt	9	7
<b>Throttle body</b>		
Throttle position sensor bolt	2	1.4
Idle speed control servo bolt	3.5	2.5

	Nm	ft.lbs.
<b>Intake manifold</b>		
Intake manifold bolt and nut	18	13
Intake manifold bolt (M10) and nut (M10) – DOHC	36	26
Intake manifold stay bolt – SOHC	22	16
Intake manifold stay bolt – DOHC	28	20
Intake manifold plenum bolt and nut	18	13
Intake manifold plenum stay bolt	18	13
Water outlet fitting bolt	19	14
Engine coolant temperature gauge unit	11	8
Engine coolant temperature sensor	30	22
Thermostat case nut	18	13
<b>Exhaust manifold and water pump</b>		
Oil level gauge guide bolt		
M8	14	10
M10	60	43
Heat protector bolt		
M6	9	7
M8	14	10
M10	30	22
Exhaust manifold nut – SOHC	18	13
Exhaust manifold nut – DOHC	28	20
Air outlet fitting bolt	19	14
Turbocharger bolt and nut	60	43
Exhaust fitting bolt	60	43
Water inlet pipe bolt	14	10
Water pump bolt	14	10
Water pipe “A” and “B” eye <b>bolt</b>	43	31
Water pipe “A” bolt	11	8
Water pipe “B” flare nut	45	33
Water pipe bolt		
M8	14	10
M6	11	8
Oil return pipe bolt	9	7
Oil pipe		
Cylinder head side	17	12
Turbocharger side	31	22
<b>Turbocharger</b>		
Turbocharger waste gate actuator bolt	12	9

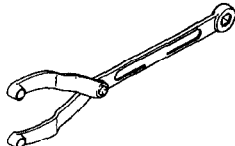
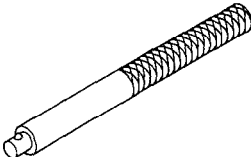

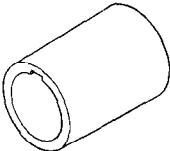
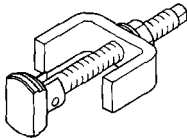
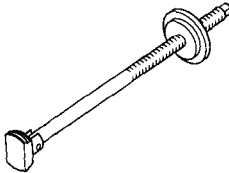
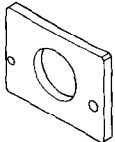
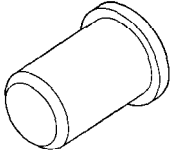
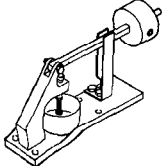
	Nm	ft.lbs.
<b>Rocker arms and camshaft</b>		
Rocker cover bolt – SOHC	6	4
Rocker cover bolt – DOHC	3	2.2
Bearing cap bolt – SOHC		
M8 x 25	24	17
M8 x 65	20	14
Bearing cap bolt – DOHC	20	14
Rocker shaft bolt	32	23
Oil delivery body	11	8
<b>Cylinder head and valves</b>		
Cylinder head bolt	20 + 1/4 turns + 1/4 turns	14.5 + 1/4 turns + 1/4 turns
<b>Front case, silent shaft and oil pan</b>		
Drain plug	40	29
Oil pan bolt	7	5
Oil screen bolt and nut	19	14
Check valve	33	24
Oil cooler bolt	43	31
Oil filter bracket bolt	19	14
Plug	24	17
Left silent shaft flange bolt	37	27
Front case bolt		
M8	24	17
M10	31	22
Oil pressure switch	10	7
Oil cooler by-pass valve	55	40
Relief plug	45	33
Oil pump cover bolt	17	12
Oil pressure gauge unit	55	40
<b>Piston and connecting rod</b>		
Connecting rod cap nut	20 + 1/4 turns	14.5 + 1/4 turn:
<b>Crankshaft, flywheel and drive plate</b>		
Flywheel bolt	135	98
Drive plate bolt	135	98
Oil seal case bolt	11	8
Bearing cap bolt – SOHC	53	38
Bearing cap bolt – DOHC	68	49
<b>Bracket</b>		
Left and right engine support bracket bolt	45	33
Front roll stopper bracket bolt	65	47
Rear roll stopper bracket bolt	120	87
Front engine support bracket bolt	60	43
Exhaust pipe support bracket bolt	36	26

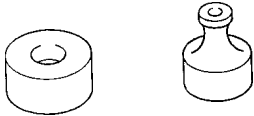
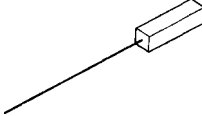

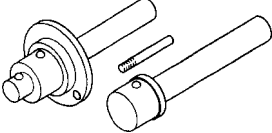
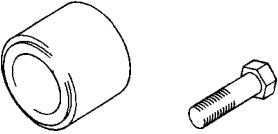
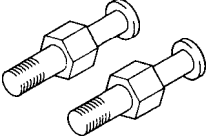
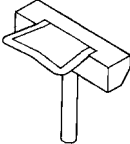
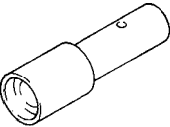
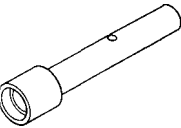
## SEALANT

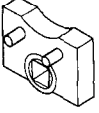
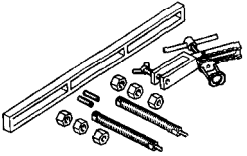
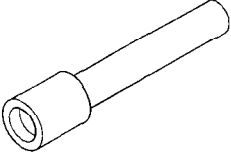
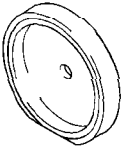
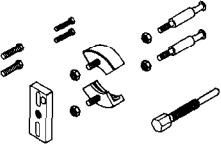
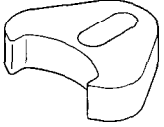
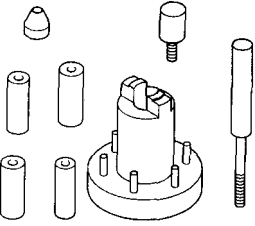
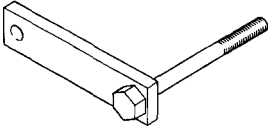
	Specified sealant	Quantity
Rocker cover	3M ATD Part No. 8660 or equivalent	As required
Semi-circular packing	3M ATD Part No. 8660 or equivalent	As required
Engine support bracket bolt	3M ATD Part No. 8660 or equivalent	As required
Oil pan gasket	MITSUBISHI GENUINE PART MD970389 or equivalent	As required
Water outlet fitting	MITSUBISHI GENUINE PART MD970389 or equivalent	As required
Engine coolant temperature gauge unit	3M ATD Part No. 8660 or equivalent	As required
Engine coolant temperature sensor	3M Nut Locking Part No. 4171 or equivalent	As required
Oil pressure switch	3M ATD Part No. 8660 or equivalent	As required
Oil pressure gauge unit	3M ATD Part No. 8660 or equivalent	As required
Rear oil seal case	MITSUBISHI GENUINE PART MD970389 or equivalent	As required



## SPECIAL TOOLS

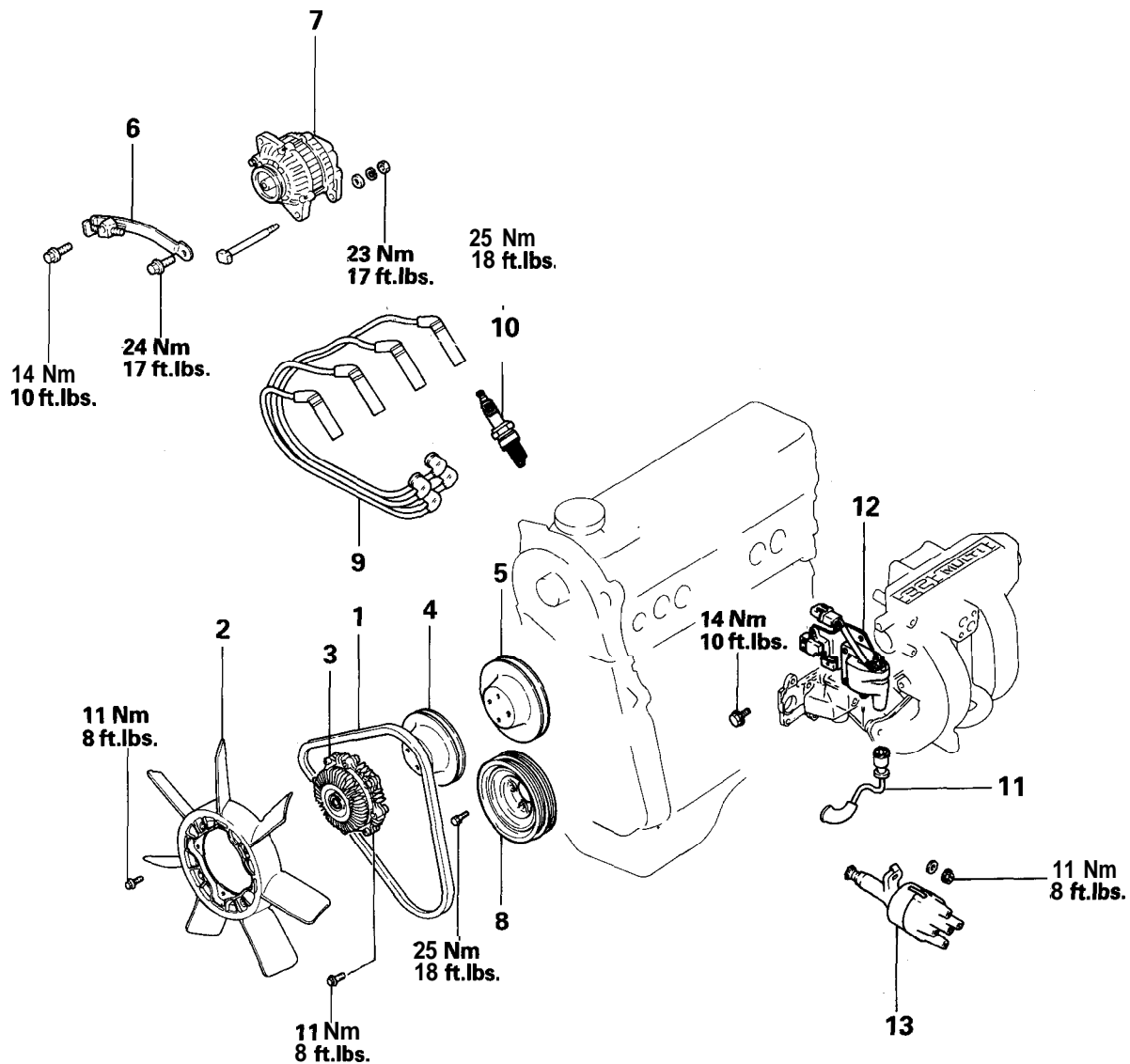
Tool	Number and tool name	Supersession	Application
	MB990767 End yoke holder Use with MD998719	MB990767-01 Use with MIT308239	Holding camshaft sprocket when loosening or torquing bolt. For SOHC engine only
	MB990938 Handle Use with MD998776	MB990938-01	Installation of crankshaft rear oil seal
	MD998162 Plug wrench	MD998162-01	Removal and installation of front case cap plug
	MD998285 Crankshaft front oil seal guide	MD998285-01	Installation of crankshaft front oil seal
	MD998371 Silent shaft bearing puller	MD998371-01 Use with MIT304204	Removal of silent shaft rear
	MD998372 Silent shaft bearing puller	MD998372-01 Use with MIT304204	Removal of silent shaft rear
	MD998374 Bearing installer stopper	MD998374-01	Removal and installation of rear bearing
	MD998375 Crankshaft front oil seal installer	MD998375-01	Installation of crankshaft front oil seal
	MD998440 Leak-down tester		Leak-down test of lash adjuster

Tool	Number and tool name	Supersession	Application
	MD998441 Lash adjuster retainer		Air bleeding of lash adjuster For SOHC engine only
	MD998442 Air bleed wire		Air bleed of lash adjuster
	MD998443 Lash adjuster holder (8)	MD998443-01	Supporting of the lash adjuster to prevent it from falling when rocker shaft assembly is removed or installed For SOHC engine only
	MD998705 Silent shaft bearing installer	MD998373-01	Installation of silent shaft bearing
	MD998713 Camshaft oil seal installer	MD998713-01	Installation of camshaft oil seal
	MD998719 Pulley holding pins (2)	MIT308239	Holding camshaft sprocket when loosening or torquing bolt For SOHC engine only
	MD998727 Oil pan remover		Removal of oil pan
	MD998729 Valve stem seal installer	MD998729-01	Installation of valve stem seal For SOHC 8 valve engine only
	MD998737 Valve stem seal installer	MD998737-01	Installation of valve stem seal For DOHC engine only

Tool	Number and tool name	Supersession	Application
	MD998767 Tension pulley wrench	MD998752-01	Installation of auto tensioner
	MD998772 Valve spring compressor		Compression of valve spring
	MD998774 Valve steam seal installer		Installation of valve steam seal For SOHC 16 valve engine only
	MD998776 Crankshaft rear oil seal installer Use with MB990938	MD998376-01 Use with MB990938-01	Installation of crankshaft rear oil seal
	MD998778 Crankshaft sprocket puller		Removal of crankshaft sprocket
	MD998779 Sprocket stopper		Supporting silent shaft sprocket
	MD998780 Piston pin setting tool	MIT21 6941	Removal and installation of piston pin
	MD998781 Flywheel stopper		Supporting flywheel and drive plate

## GENERATOR AND IGNITION SYSTEM

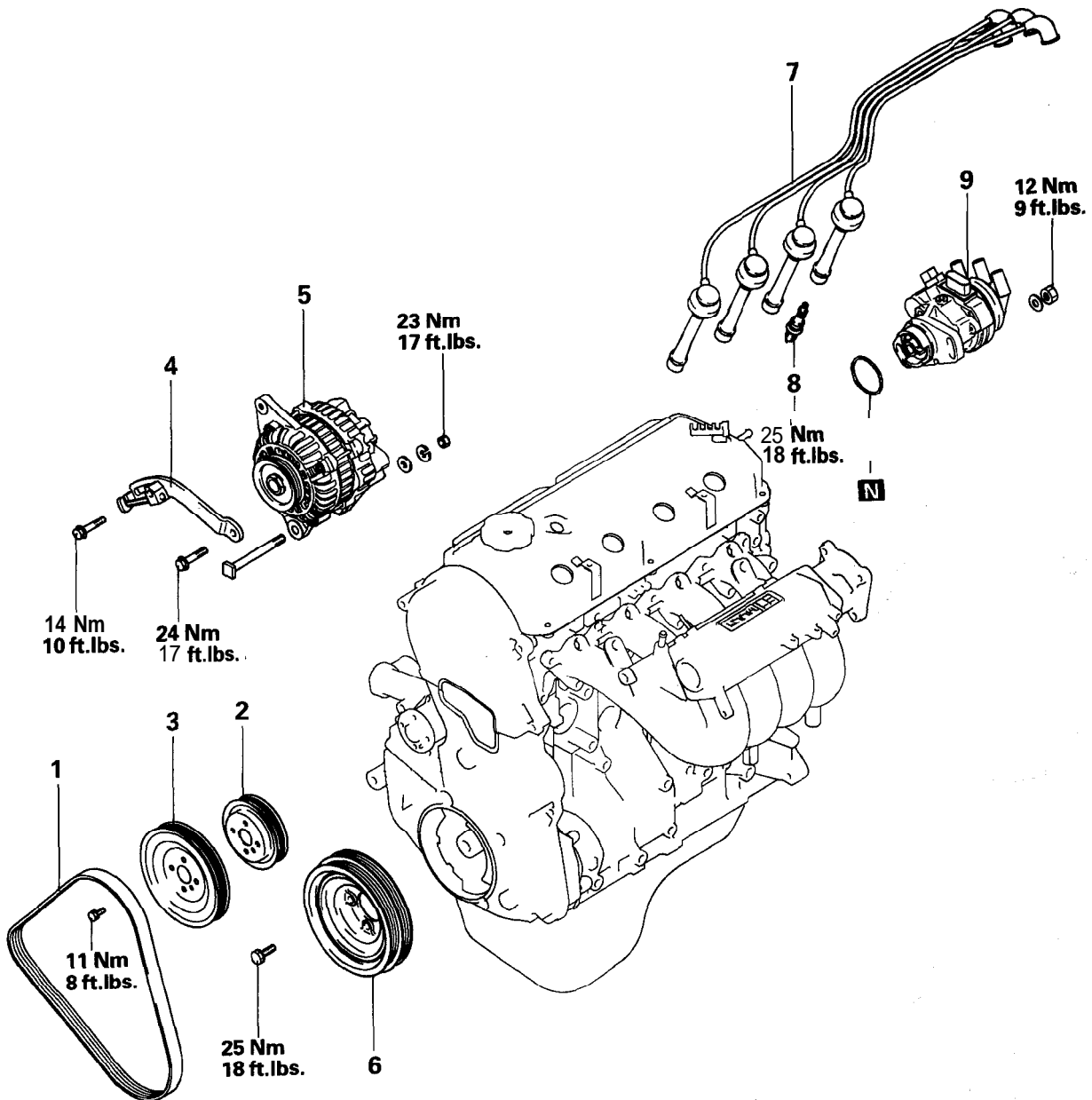
## REMOVAL AND INSTALLATION – SOHC 8 VALVE



## Removal steps

- ◆◆ 1. Drive belt
- 2. Cooling fan
- 3. Fan clutch
- 4. Water pump pulley
- 5. Power steering pump pulley
- 6. Generator brace
- 7. Generator
- 8. Crankshaft pulley
- 9. Spark plug cable
- 10. Spark plug
- 11. High tension cable
- ◆◆ 12. Ignition coil and ignition power transistor
- ◆◆ 13. Distributor

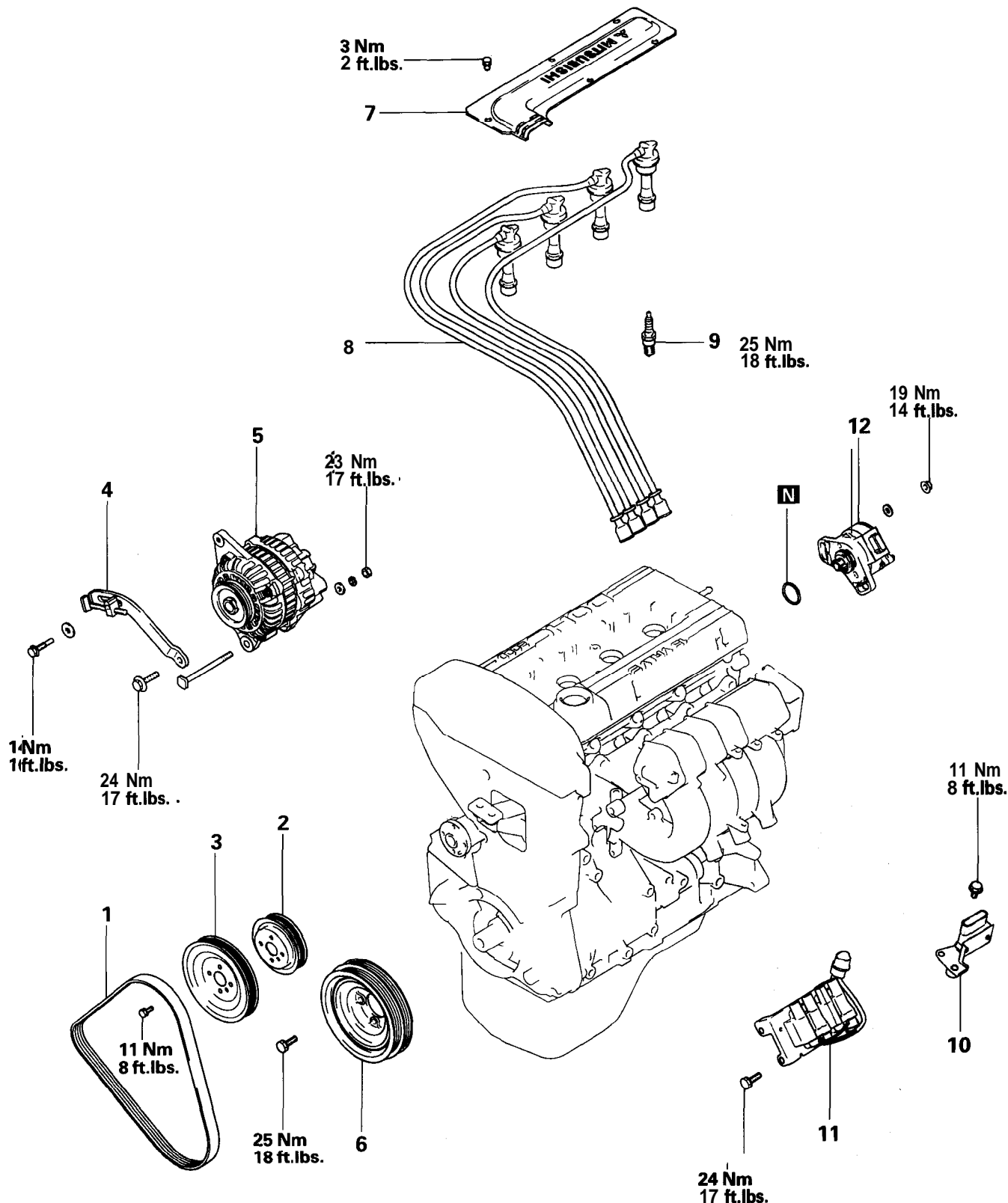
REMOVAL AND INSTALLATION – SOHC 16 VALVE



Removal steps

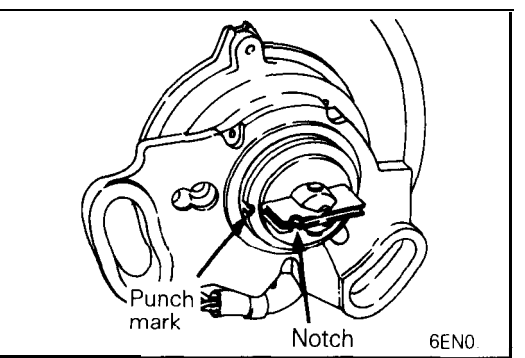
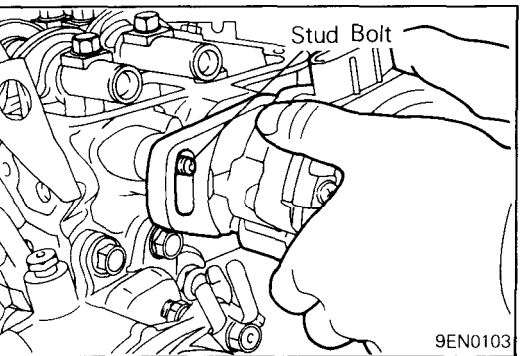
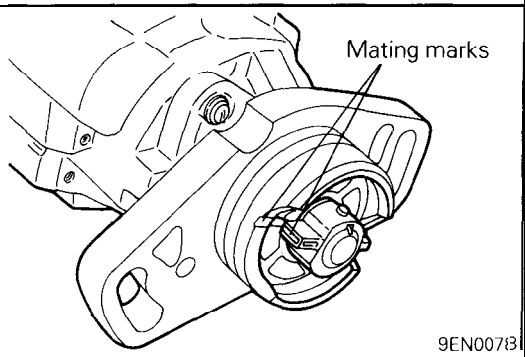
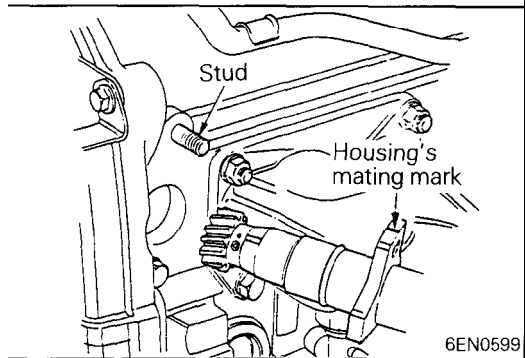
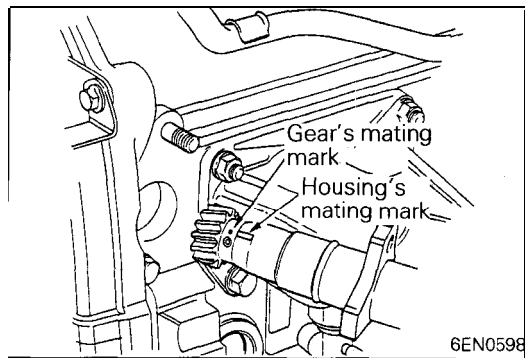
- ◆◆ 1. Drive belt
- 2. Water pump pulley
- 3. Power steering pump pulley
- 4. Generator brace
- 5. Generator
- 6. Crankshaft pulley
- 7. Spark plug cable
- 8. Spark plug
- ◆◆ 9. Distributor

REMOVAL AND INSTALLATION - DOHC



Removal steps

- ▶▶ 1. Drive belt
- 2. Water pump pulley
- 3. Power steering pump pulley
- 4. Generator brace
- 5. Generator
- 6. Crankshaft pulley
- 7. Center cover
- 8. Spark plug cable
- 9. Spark plug
- 10. Ignition power transistor
- 11. Ignition coil
- ▶▶ 12. Crankshaft position sensor



## INSTALLATION SERVICE POINTS

### ◆A◆ DISTRIBUTOR INSTALLATION

- (1) Turn the crankshaft so that the No. 1 cylinder is at top dead center.
- (2) Align the distributor housing and gear mating marks.

- (2) Install the distributor to the engine while aligning the fine cut (groove or projection) of the distributor's installation flange with the center of the distributor installation stud.

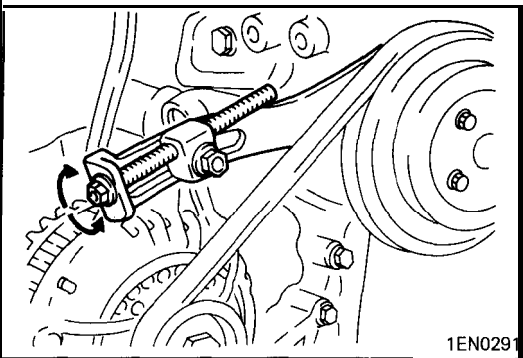
### ◆B◆ DISTRIBUTOR ASSEMBLY INSTALLATION

- (1) Turn the crankshaft to bring No. 1 cylinder to the top dead center on compression stroke.
- (2) Align the mating marks on the distributor housing with that of the coupling key.

- (3) Install the distributor assembly on the engine while aligning the stud bolt used for securing the distributor with the slot in the mounting flange of the distributor.

### ◆C◆ CRANKSHAFT POSITION SENSOR INSTALLATION

- (1) Turn the crankshaft so that the No. 1 cylinder is at top dead center.
- (2) Align the punch mark on the crankshaft position sensor housing with the notch in plate.
- (3) Install the crankshaft position sensor on the cylinder head.



**DRIVE BELT TENSION ADJUSTMENT  
ADJUSTER TYPE**

(1) Adjust belt deflection to standard value. Turn adjusting bolt clockwise to increase the belt tension and turn adjusting bolt counterclockwise to decrease the belt tension.

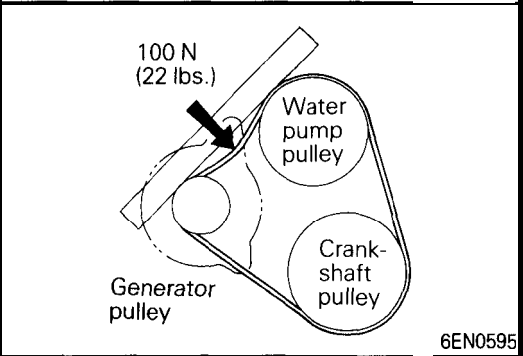
**Standard value:**

**V-ribbed type belt**

**New belt 7.5 – 9.0 mm (.30 – .35 in.)**

**Used belt 8.0 mm (.32 in.)**

**V-type belt 7.0 – 10.0 mm (.28 – .39 in.)**



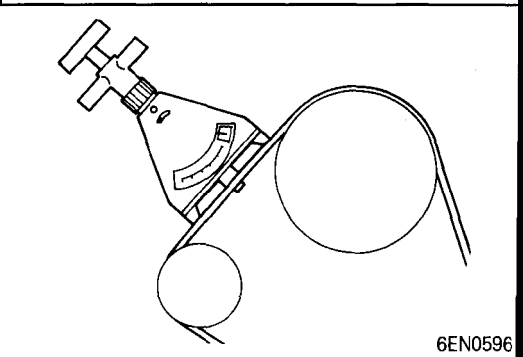
When using tension gauge for V-ribbed belt only.

**Standard value:**

**New belt 500 – 700 N (110 – 154 lbs.)**

**Used belt 400 N (88 lbs.)**

- (2) Tighten the lock bolt to the specified torque.
- (3) Tighten the nut for the pivot bolt to the specified torque.



**BRACE BOLT TYPE**

(1) Move generator to adjust belt deflection to standard value.

**Standard value:**

**V-ribbed type belt**

**New belt 7.5 – 9.0 mm (.30 – .35 in.)**

**Used belt 8.0 mm (.32 in.)**

**V-type belt 7.0 – 10.0 mm (.28 – .39 in.)**

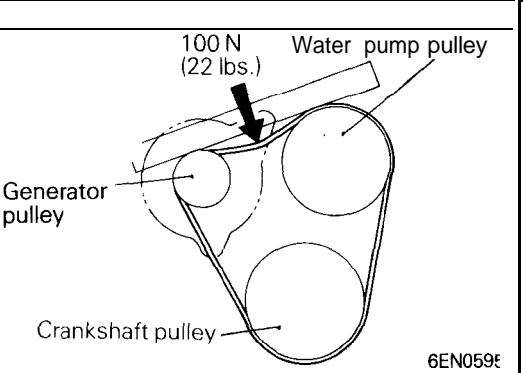
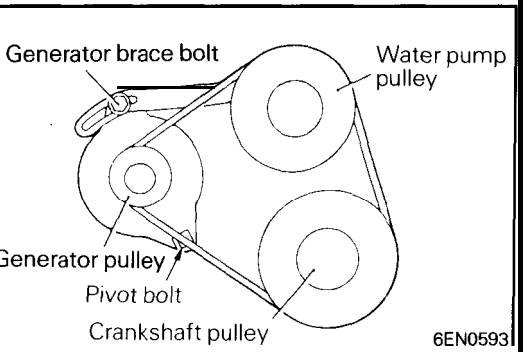
When using tension gauge for V-ribbed belt only.

**Standard value:**

**New belt 500 – 700 N (110 – 154 lbs.)**

**Used belt 400 N (88 lbs.)**

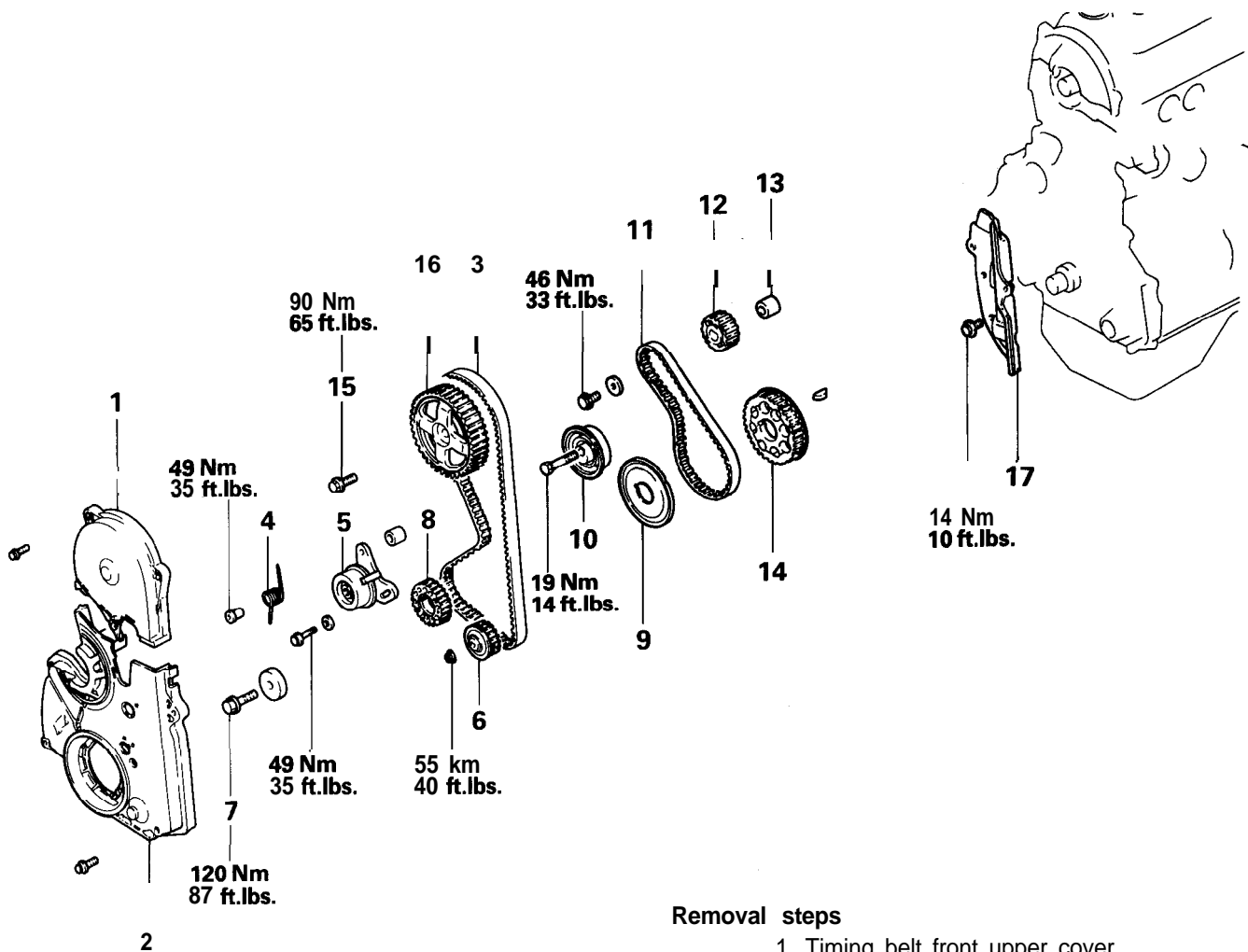
- (2) Tighten the brace bolt to the specified torque.
- (3) Tighten the nut for the pivot bolt to the specified torque.





# TIMING BELT

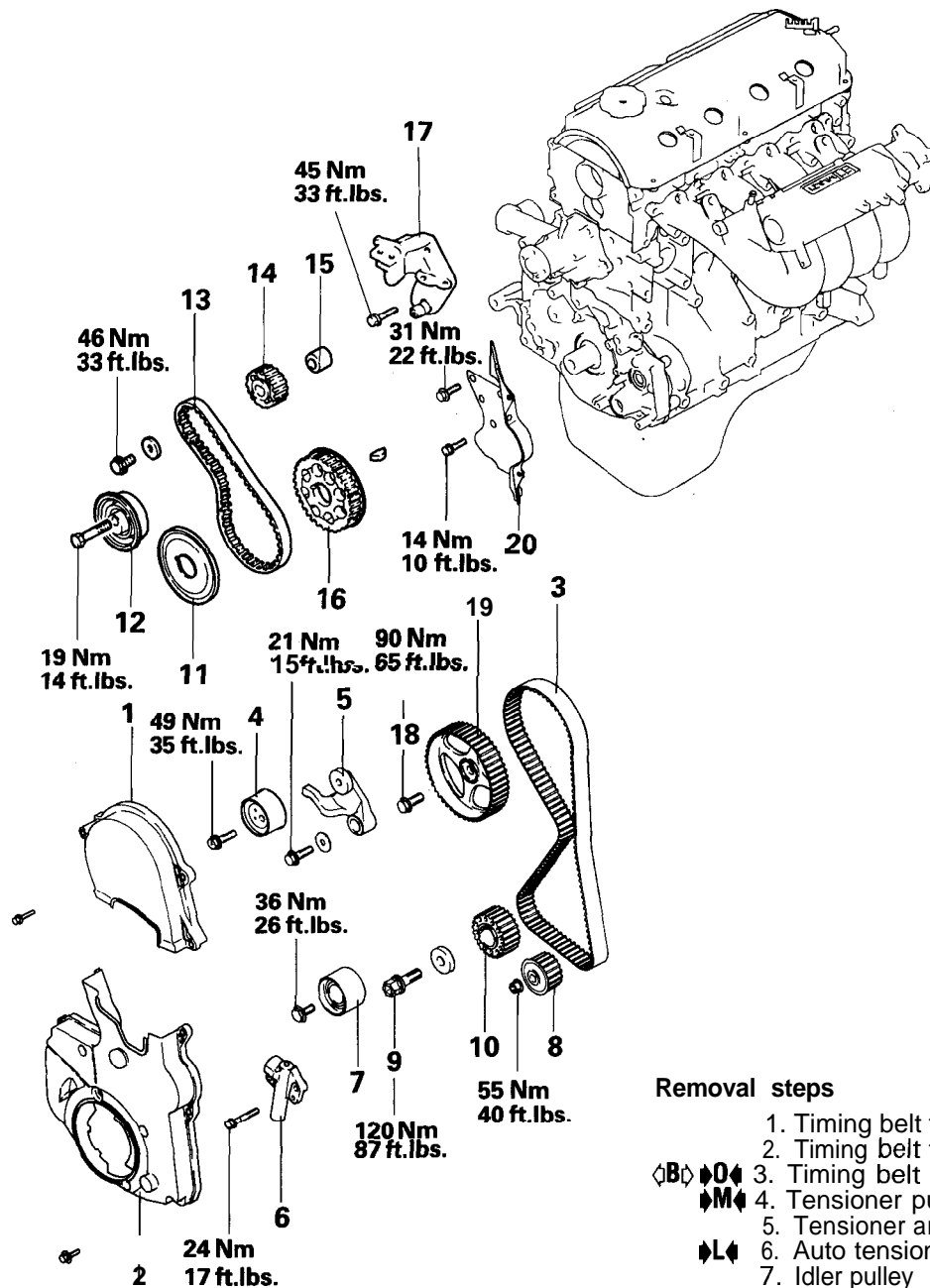
## REMOVAL AND INSTALLATION – SOHC 8 VALVE



### Removal steps

1. Timing belt front upper cover
2. Timing belt front lower cover
3. Timing belt
4. Tensioner spring
5. Tensioner pulley
6. Oil pump sprocket
7. Crankshaft bolt
8. Crankshaft sprocket
9. Flange
10. Tensioner "B"
11. Timing belt "B"
12. Silent shaft sprocket
13. Spacer
14. Crankshaft sprocket "B"
15. Camshaft sprocket bolt
16. Camshaft sprocket
17. Timing belt rear cover

REMOVAL AND INSTALLATION – SOHC 16 VALVE

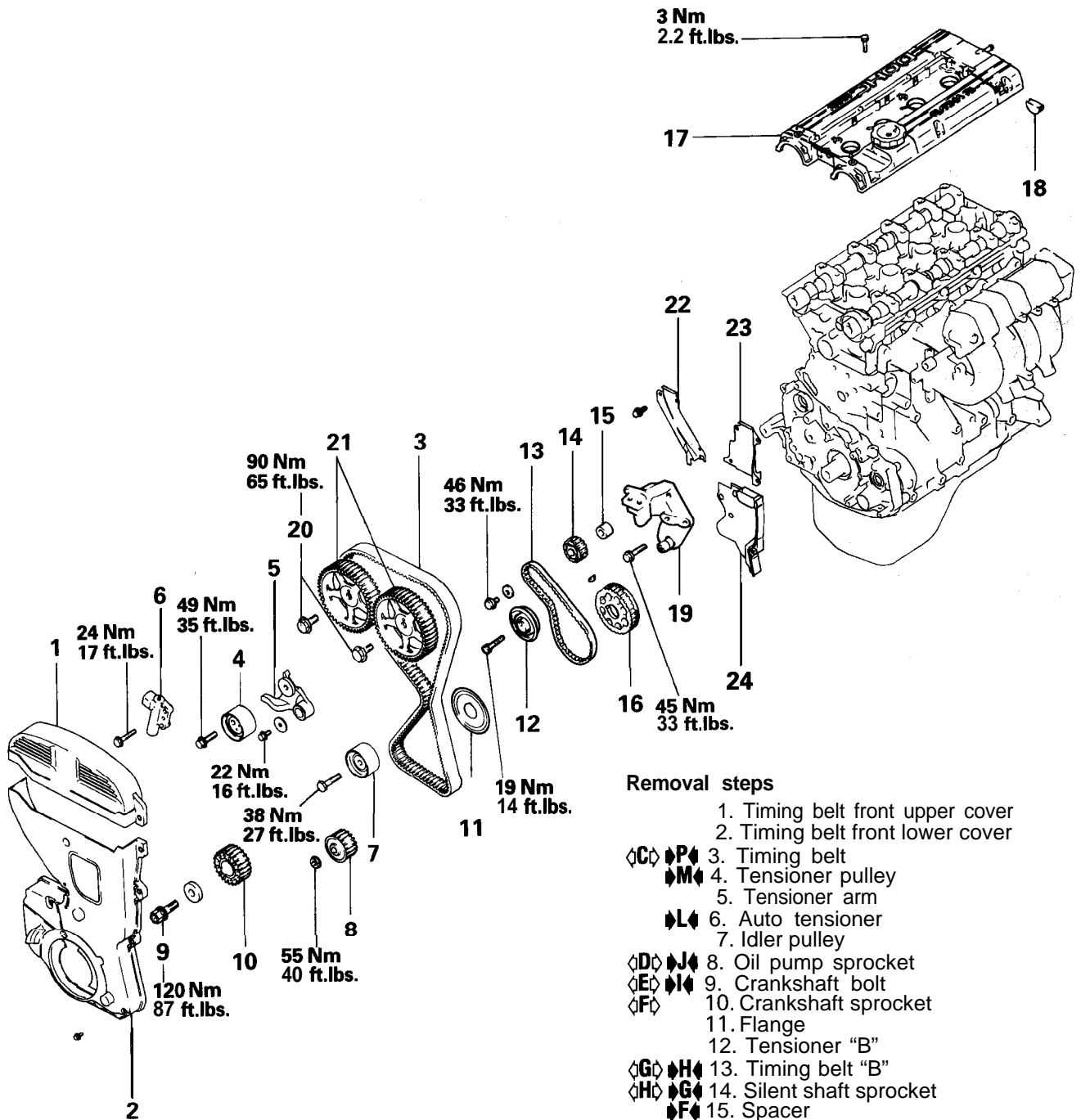


Removal steps

1. Timing belt front upper cover
2. Timing belt front lower cover
- ◁B▷ ▶O▶ 3. Timing belt
- ▶M▶ 4. Tensioner pulley
5. Tensioner arm
- ▶L▶ 6. Auto tensioner
7. Idler pulley
- ◁D▷ ▶J▶ 8. Oil pump sprocket
- ◁E▷ ▶I▶ 10.9. Crankshaft Crankshaft sprocket bolt
- ◁F▷
11. Flange
12. Tensioner "B"
- ◁G▷ ▶H▶ 13. Timing belt "B"
- ◁H▷ ▶G▶ 14. Silent shaft sprocket
- ▶F▶ 15. Spacer
- ◁I▷ 16. Crankshaft sprocket "B"
- ▶C▶ 17. Engine support bracket
- ◁J▷ ▶A▶ 18. Camshaft sprocket bolt
19. Camshaft sprocket,
20. Timing belt rear cover

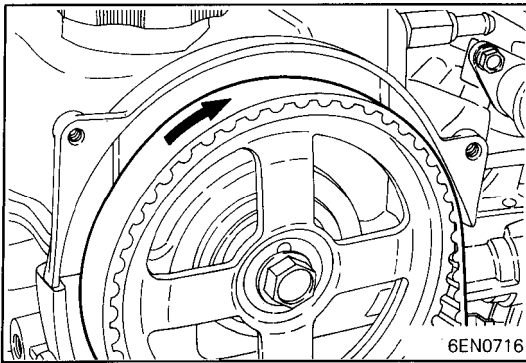
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REMOVAL AND INSTALLATION - DOHC



Removal steps

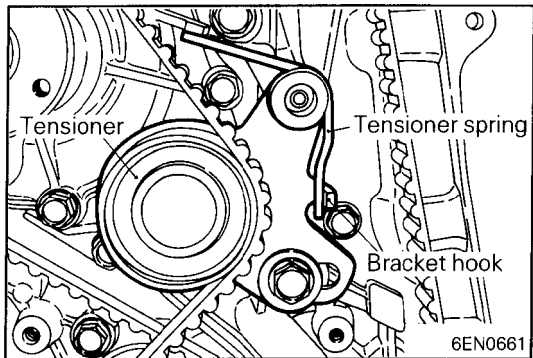
1. Timing belt front upper cover
2. Timing belt front lower cover
- ◁C▷ ▶P▶ 3. Timing belt
- ▶M▶ 4. Tensioner pulley
5. Tensioner arm
- ▶L▶ 6. Auto tensioner
7. Idler pulley
- ◁D▷ ▶J▶ 8. Oil pump sprocket
- ◁E▷ ▶I▶ 9. Crankshaft bolt
- ◁F▷ 10. Crankshaft sprocket
11. Flange
12. Tensioner "B"
- ◁G▷ ▶H▶ 13. Timing belt "B"
- ◁H▷ ▶G▶ 14. Silent shaft sprocket
- ▶F▶ 15. Spacer
- ◁I▷ 16. Crankshaft sprocket "B"
- ▶E▶ 17. Rocker cover
- ▶D▶ 18. Semi-circular packing
- ▶C▶ 19. Engine support bracket
- ◁K▷ ▶B▶ 20. Camshaft sprocket bolt
21. Camshaft sprocket
22. Timing belt rear right cover
23. Timing belt rear left upper cover
24. Timing belt rear left lower cover

**REMOVAL SERVICE POINTS****◊A◊ TIMING BELT REMOVAL**

- (1) Mark the belt running direction for reference in reinstallation.

**NOTE**

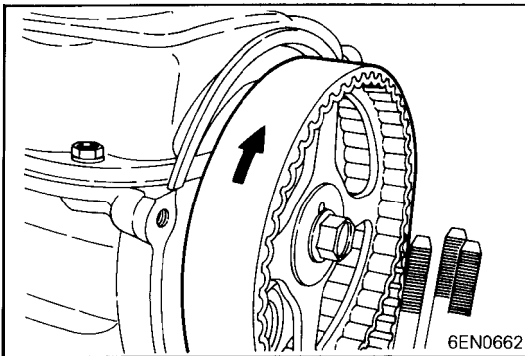
- (1) Water or oil on the belt shorten its life drastically, so the removed timing belt, sprocket, and tensioner must be free from oil and water. These parts should not be washed. Replace parts if seriously contaminated.
- (2) If there is oil or water on each part check front case oil seals, camshaft oil seal and water pump for leaks.
- (2) Back off the tensioner spring mounting bolt three turns.
- (3) Pinching the end of the tensioner spring on the tensioner side with pliers, unhook it from the bracket hook on the tensioner to free the tensioner spring.
- (4) Loosen the tensioner mounting bolt and remove the timing belt.

**◊B◊ TIMING BELT REMOVAL**

- (1) Mark belt running direction for reinstallation.

**NOTE**

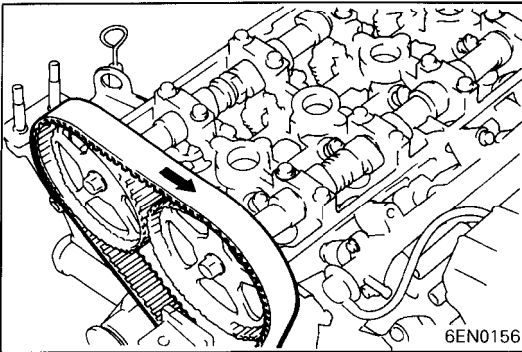
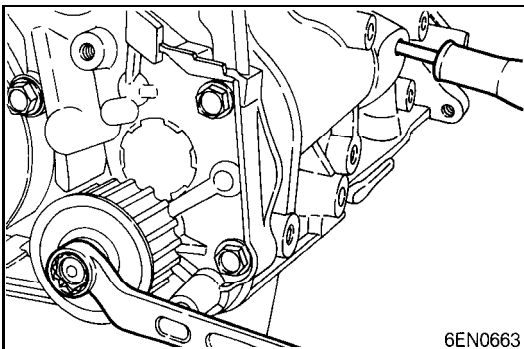
- (1) Water or oil on the belt shorten its life drastically, so the removed timing belt, sprocket, and tensioner must be free from oil and water. These parts should not be washed. Replace parts if seriously contaminated.
- (2) If there is oil or water on each part check front case oil seals, camshaft oil seal and water pump for leaks.

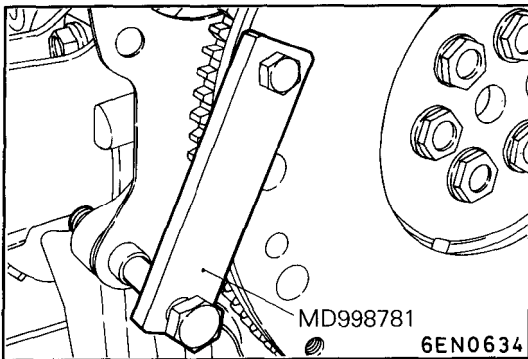
**◊C◊ TIMING BELT REMOVAL**

- (1) Mark the belt running direction for reference in reinstallation.

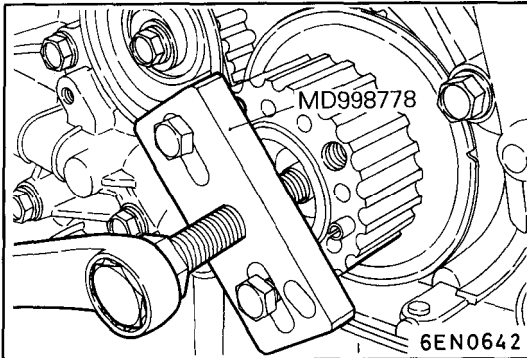
**NOTE**

- (1) Water or oil on the belt shorten its life drastically, so the removed timing belt, sprocket, and tensioner must be free from oil and water. These parts should not be washed. Replace parts if seriously contaminated.
- (2) If there is oil or water on each part check front case oil seals, camshaft oil seal and water pump for leaks.

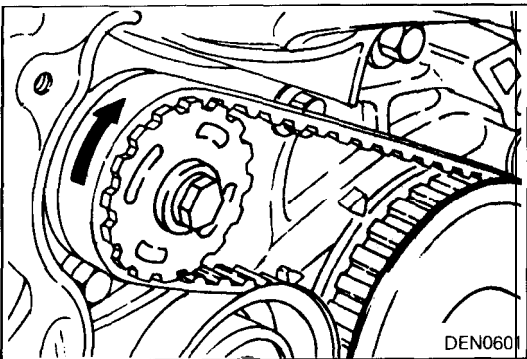
**◊D◊ OIL PUMP SPROCKET REMOVAL**



### ⇨E⇨ CRANKSHAFT BOLT LOOSENING



### ⇨F⇨ CRANKSHAFT SPROCKET REMOVAL

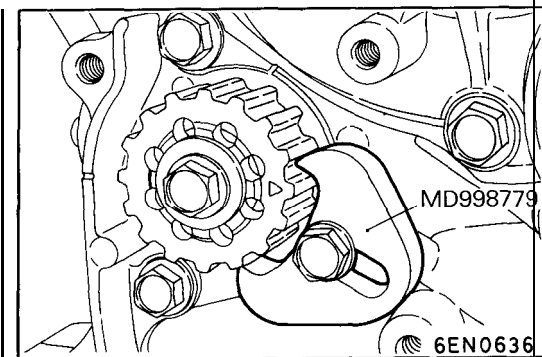


### ⇨G⇨ TIMING BELT "B" REMOVAL

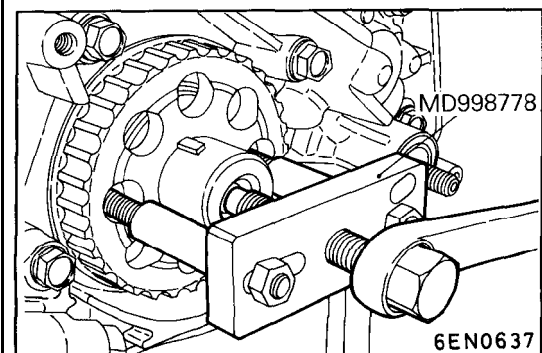
- (1) Make a mark on the back of the timing belt indicating the direction of rotation so it may be reassembled in the same direction if it is to be reused.

#### NOTE

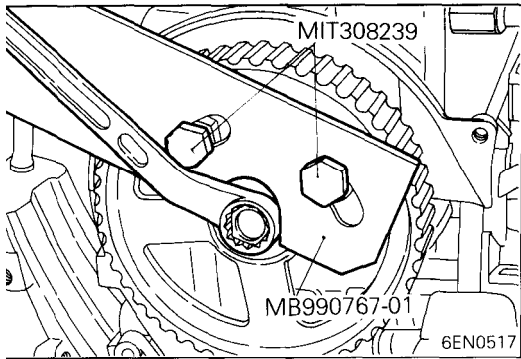
- (1) Water or oil on the belt shortens its life drastically, so the removed timing belt, sprocket, and tensioner must be free from oil and water. These parts should not be washed. Replace parts if seriously contaminated.
- (2) If there is oil or water on each part check front case oil seals, camshaft oil seal and water pump for leaks.



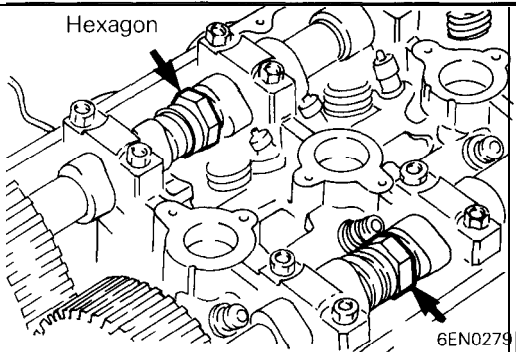
### ⇨H⇨ SILENT SHAFT SPROCKET REMOVAL



### ⇨I⇨ CRANKSHAFT SPROCKET "B" REMOVAL



⇄ CAMSHAFT SPROCKET BOLT LOOSENING



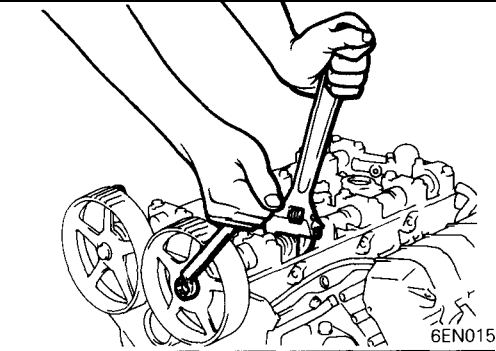
⇄ CAMSHAFT SPROCKET BOLT LOOSENING

- (1) Using a wrench, hold the camshaft at its hexagon (between the No. 2 and No. 3 journals) and remove the camshaft sprocket bolt.

**Caution**

Locking the camshaft sprocket with a tool damages the sprocket.

- (2) Remove the camshaft sprockets.

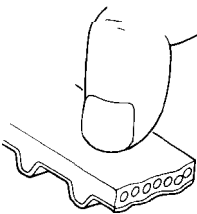


**INSPECTION**

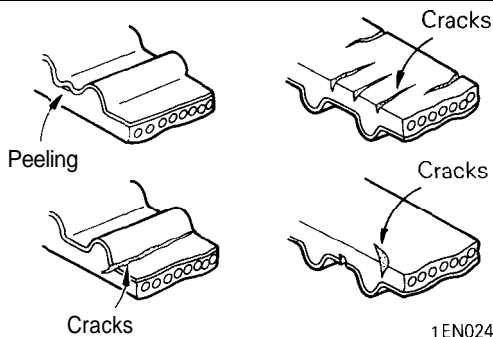
**TIMING BELT**

Replace belt if any of the following conditions exist.

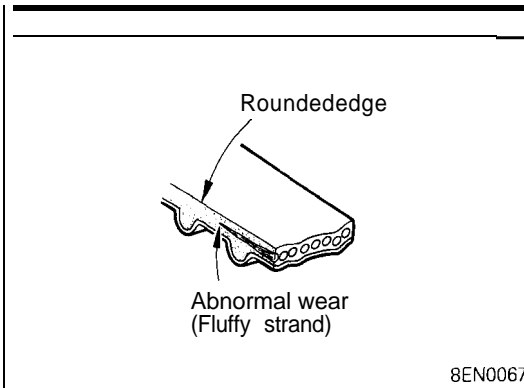
- (1) Hardening of back rubber.  
Back side is glossy without resilience and leaves no indent when pressed with fingernail.



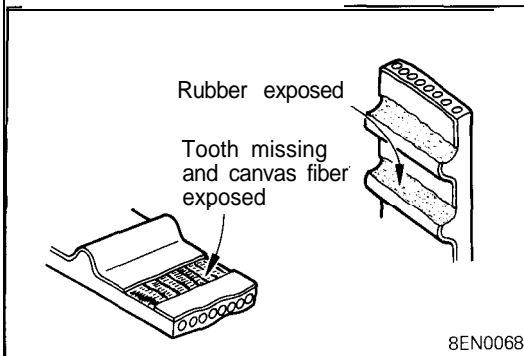
8EN006



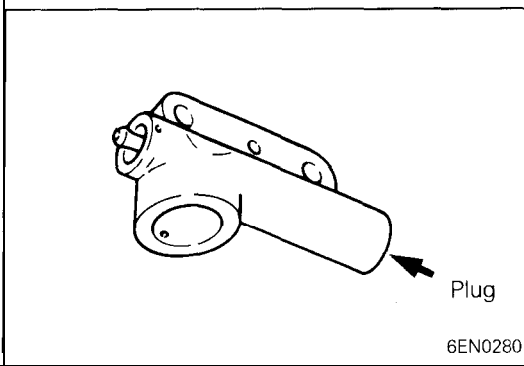
- (2) Cracks on rubber back.
- (3) Cracks or peeling of canvas.
- (4) Cracks on rib root.
- (5) Cracks on belt sides.



(6) Abnormal wear of belt sides. The sides are normal if they are sharp as if cut by a knife.

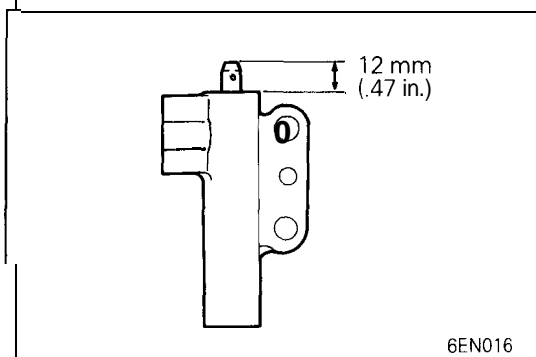


(7) Abnormal wear on teeth.  
(8) Missing tooth.



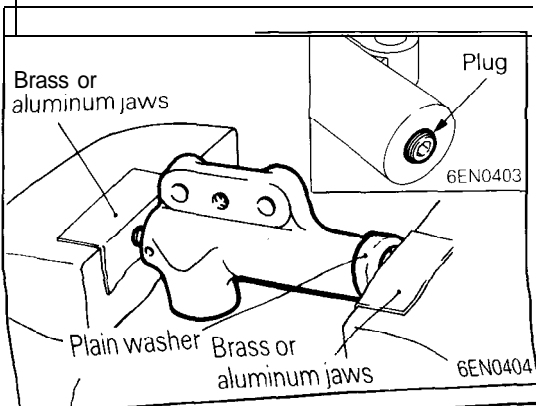
**AUTO TENSIONER**

- (1) Check the auto tensioner for possible leaks and replace as necessary.
- (2) Check the rod end for wear or damage and replace as necessary.



(3) Measure the rod protrusion. If it is out of specification, replace the auto tensioner.

**Standard value: 12 mm (.47 in.)**

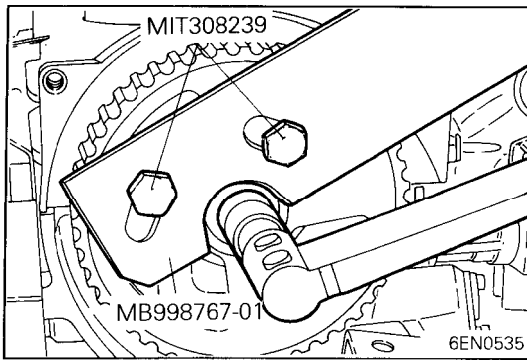
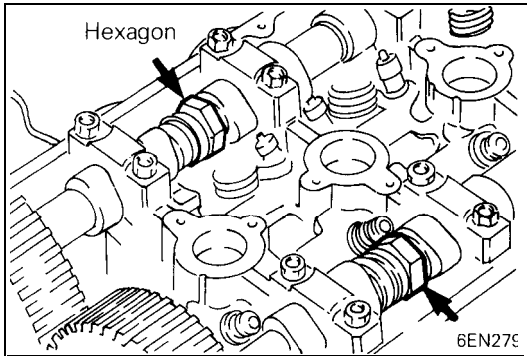


(4) Clamp the auto tensioner in a vise with soft jaws.

**Caution**

**The plug at the bottom of the auto tensioner protrudes. Insert a plain washer as illustrated to prevent the plug from being in direct contact with the vise.**

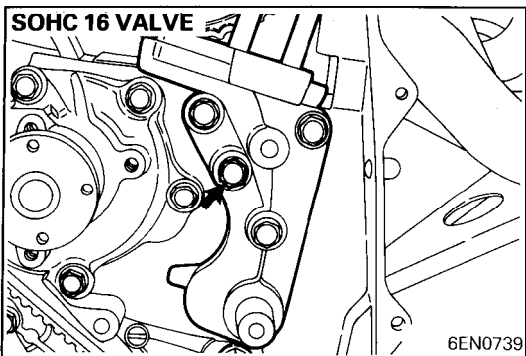
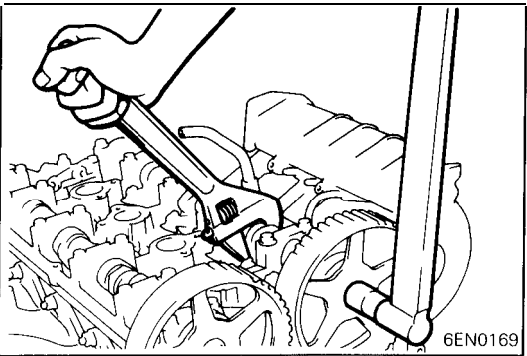
(5) Turning the vise handle, push in the auto tensioner rod. If the rod can be easily retracted, replace the auto tensioner. You should feel a fair amount of resistance when pushing the rod in.

**INSTALLATION SERVICE POINTS****▶A▶ CAMSHAFT SPROCKET TIGHTENING****▶B▶ CAMSHAFT SPROCKETS TIGHTENING**

- (1) Using a wrench, hold the camshaft at its hexagon (between the No. 2 and No. 3 journals) and tighten the bolt to the specification.

**Caution**

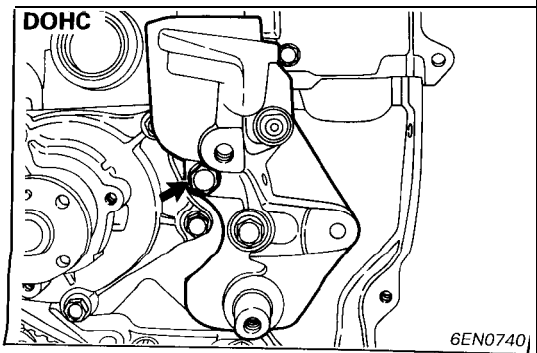
Locking the camshaft sprocket with a tool damages the sprocket.

**▶C▶ ENGINE SUPPORT BRACKET INSTALLATION**

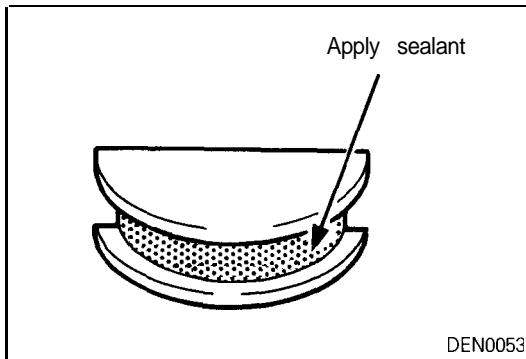
- (1) Coat the bolts illustrated with sealant before tightening.

Specified sealant:

**3M ATD Part No. 8660 or equivalent**

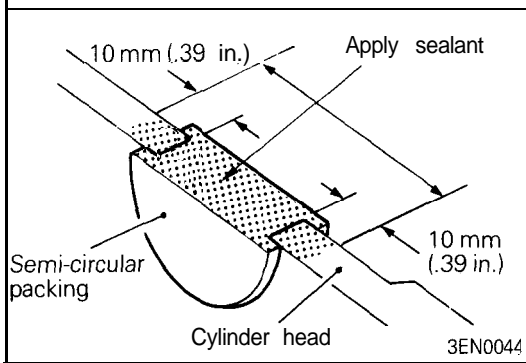






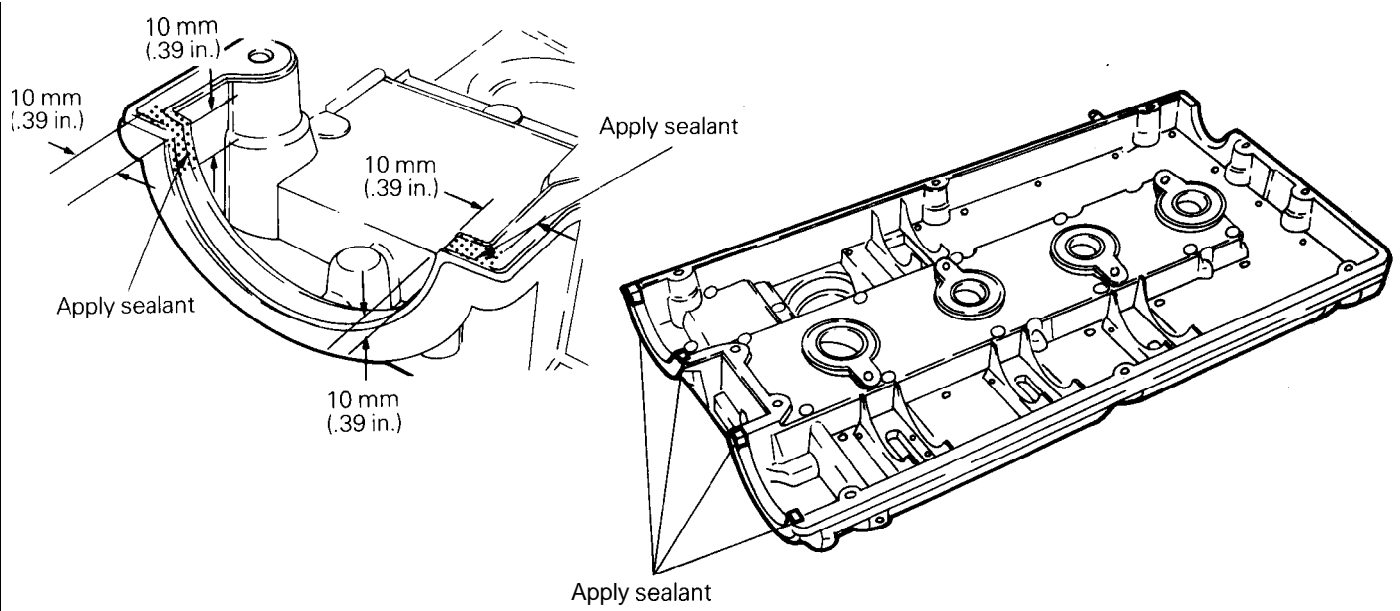
**◆D◆ SEALANT APPLICATION ON SEMI-CIRCULAR PACKING**

**Specified sealant: 3M ATD Part No. 8660 or equivalent**



**▶E▶ SEALANT APPLICATION ON ROCKER COVER**

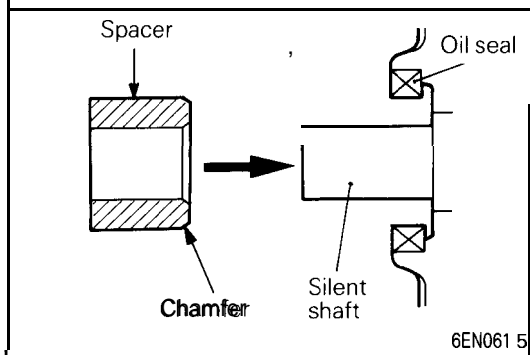
Apply sealant to the areas indicated in the illustration.  
**Specified sealant: 3M ATD Part No. 8660 or equivalent**



6EN0396

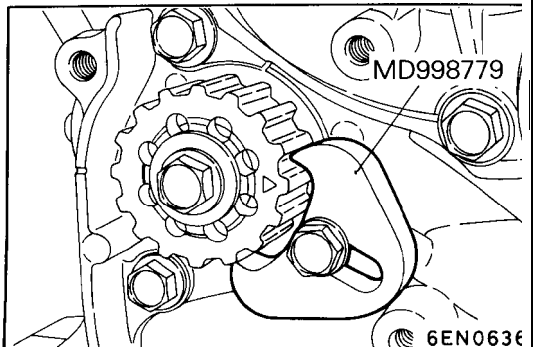
**▶F▶ SPACER INSTALLATION**

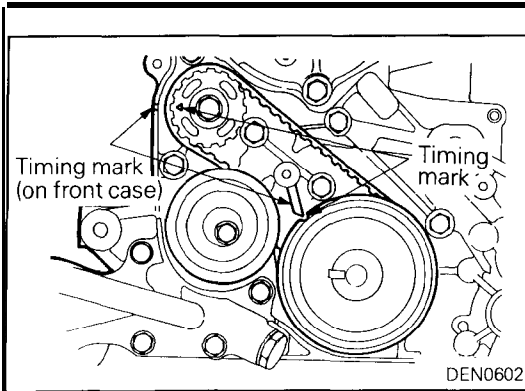
(1) Install the spacer with the chamfered end toward the oil seal.



6EN0615

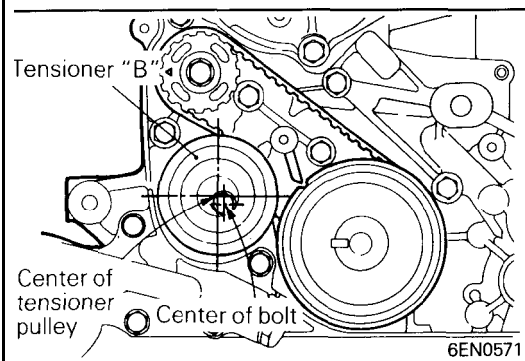
**▶G▶ SILENT SHAFT SPROCKET INSTALLATION**



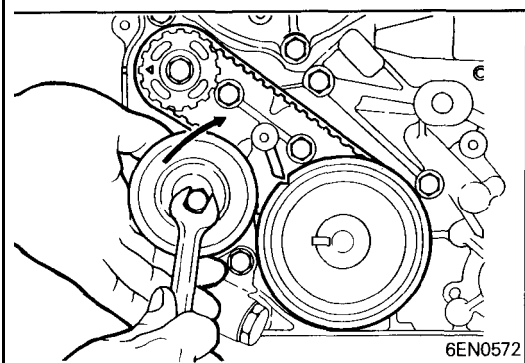


### ◆◆ TIMING, BELT "B" INSTALLATION

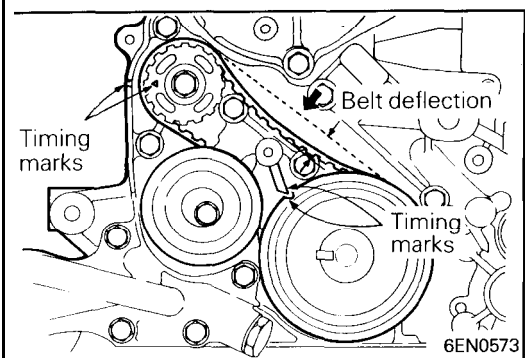
- (1) Align timing marks on the crankshaft sprocket "B" and silent shaft sprocket with the marks on the front case respectively.
- (2) Install the timing belt "B" on the crankshaft sprocket "B" and silent shaft sprocket. There should be no slack on the tension side.



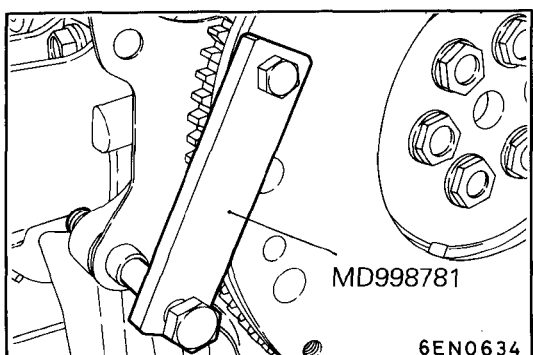
- (3) Make sure that the relationship between the tensioner pulley center and the bolt center is as shown in the illustration.



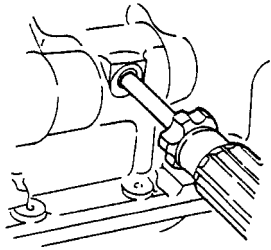
- (4) Move the tensioner "B" in the direction of arrow while lifting with a finger to give a sufficient tension to the tension side of timing belt. In this condition, tighten bolt to secure tensioner "B". When the bolt is tightened, use care to prevent shaft from turning together. If shaft is turned together, belt will be overtensioned.



- (5) Check to ensure that timing marks on sprockets and front case are in alignment.
- (6) Press with index finger the center of span on tension side of timing belt "B". The bolt must deflect 5 – 7 mm (.20 – .28 in.).



### ◆◆ CRANKSHAFT BOLT TIGHTENING

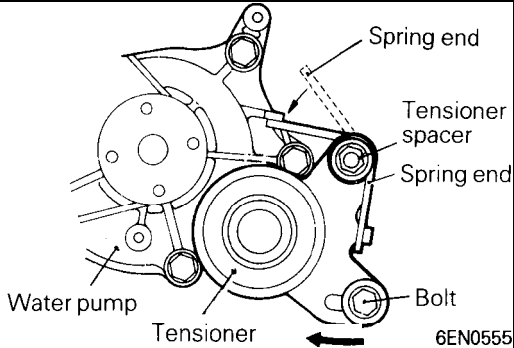


6EN0564

### ◆◆ OIL PUMP SPROCKET INSTALLATION

- (1) Insert a Phillips screwdriver [shank diameter 8 mm (.31 in.) shaft] through the plug hole on the left side of the cylinder block to block the left silent shaft.
- (2) Install the oil pump sprocket.
- (3) Apply a proper amount of engine oil to the bearing surfaces of the nuts.
- (4) Tighten the nuts to the specified torque.

### ◆◆ TENSIONER INSTALLATION



6EN0555

- (1) Hook the tensioner spring ends to the water pump body projection and tensioner bracket.
- (2) Move tensioner fully toward water pump and tighten the bolt and tensioner spacer.

### ◆◆ AUTO TENSIONER INSTALLATION

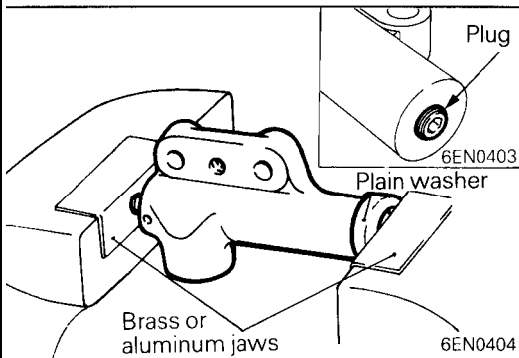
- (1) If the auto tensioner rod is in its fully extended position, reset it as follows.
- (2) Clamp the auto-tensioner in the vise with soft jaws.

#### Caution

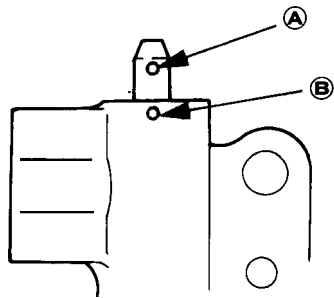
The plug at the bottom of the auto tensioner protrudes. Insert a plain washer as illustrated to prevent the plug from being in direct contact with the vise.

- (3) Push in the rod little by little with the vise until the set hole **A** in the rod is aligned with the hole **B** in the cylinder.

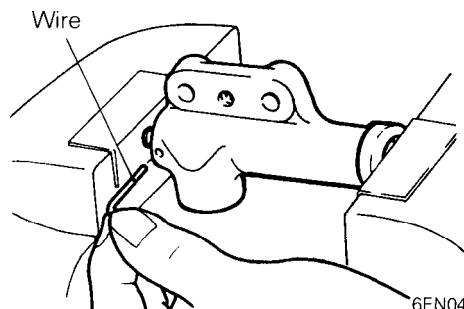
- (4) Insert a wire [1.4 mm (.055 in.) in diameter] into the set holes.
- (5) Unclamp the auto tensioner from the vise.



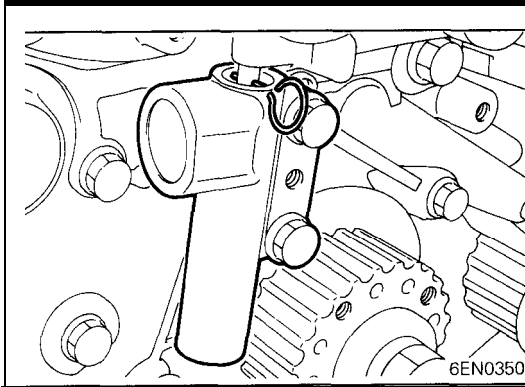
6EN0404



6EN0154



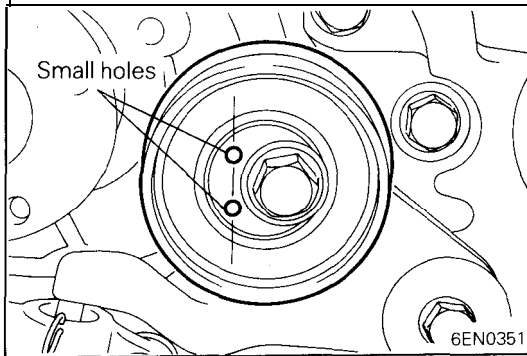
6EN0404



- (6) Install the auto tensioner to front case and tighten to the specified torque.

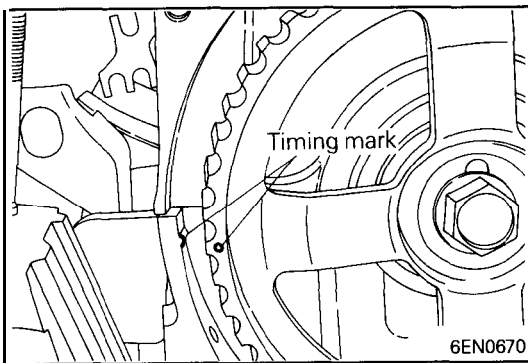
Caution

Leave the wire installed in the auto tensioner.



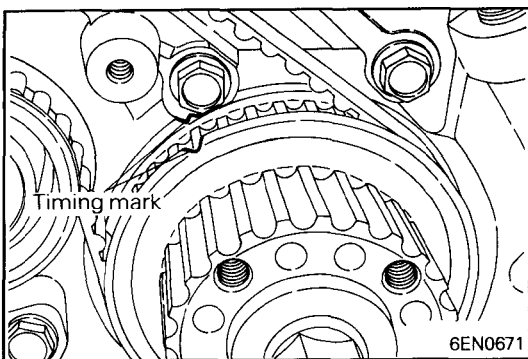
#### ◆M◆ TENSIONER PULLEY INSTALLATION

- (1) Install the tensioner pulley in such direction that its two small holes are arranged vertically.

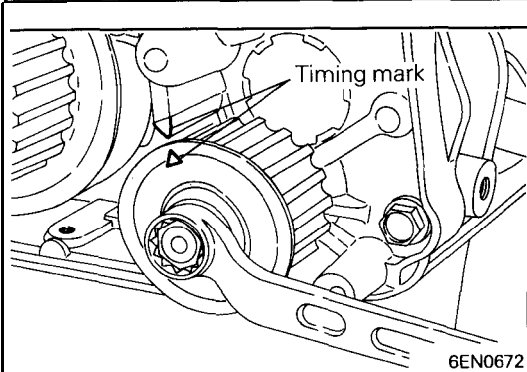


#### ◆N◆ TIMING BELT INSTALLATION

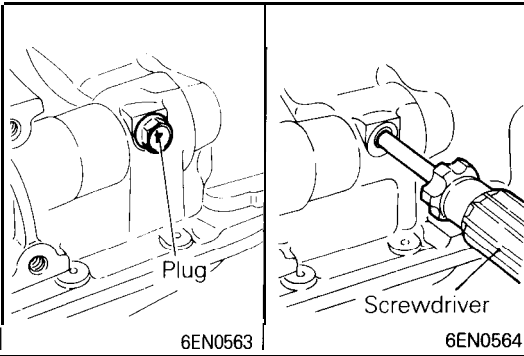
- (1) Check that the timing belt tensioner has been installed in position. (See ◆K◆)  
 (2) Align timing mark on camshaft sprocket with timing mark on cylinder head.



- (3) Align timing mark on crankshaft sprocket with timing mark on front case.



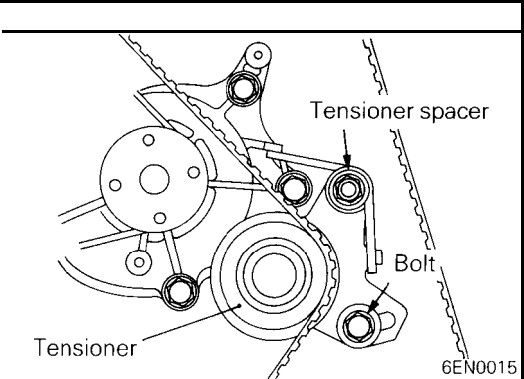
- (4) Align the timing mark on oil pump sprocket with its mating mark.



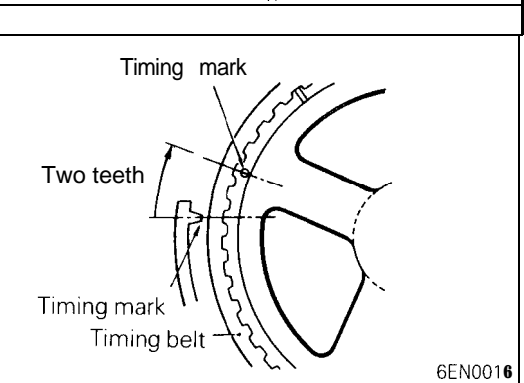
- (5) Remove the plug on cylinder block and insert a Phillips screwdriver [shank diameter 8 mm (.31 in.)] through the hole (Engine with silent shafts).  
If it can be inserted as deep as 60 mm (2.4 in.) or more, the timing marks are correctly aligned. If the inserted depth is only 20 – 25 mm (.8 – 1.0 in.), turn the oil pump sprocket one turn and realign timing marks. Then check to ensure that the screwdriver can be inserted 60 mm (2.4 in.) or more. Keep the screwdriver inserted until installation of timing belt is finished.

- (6) Install the timing belt on the crankshaft sprocket, oil pump sprocket and camshaft sprocket in that order. There should be no slack on the tension side.

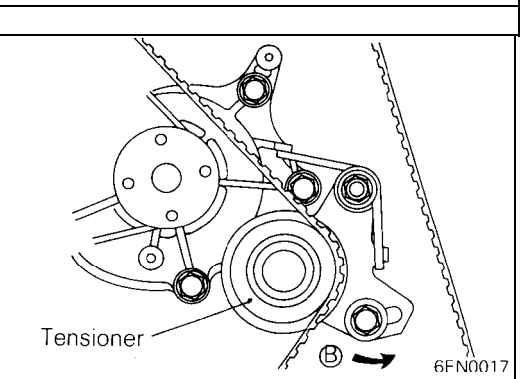
- (7) Loosen the tensioner mounting bolt and tensioner spacer.



- (8) Turn the crankshaft clockwise by two teeth of camshaft sprocket (or crankshaft sprocket).



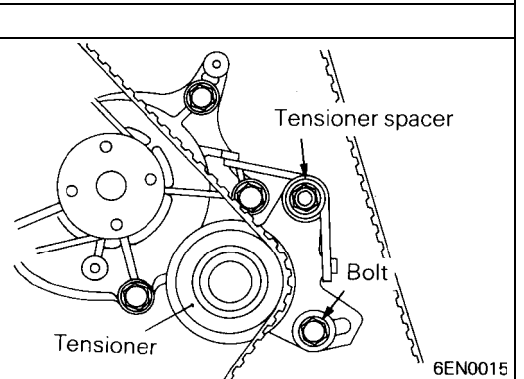
- (9) Apply force to the tensioner in the direction shown by arrow **B** to make the belt engage completely with each sprocket.

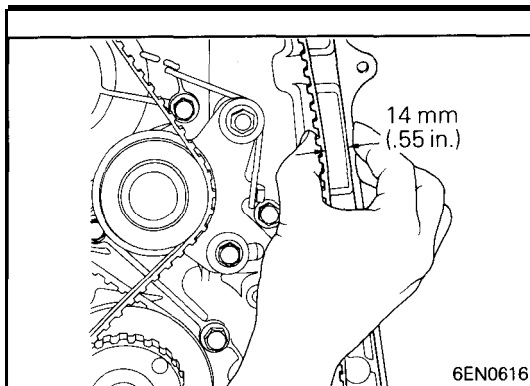


- (10) Tighten the tensioner attaching bolt, then tighten the tensioner spacer.

#### Caution

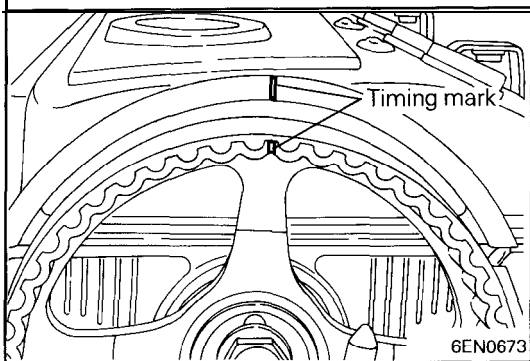
If the tensioner spacer is tightened first, tensioner turns as the tensioner spacer is tightened, resulting in an excessive belt tension.





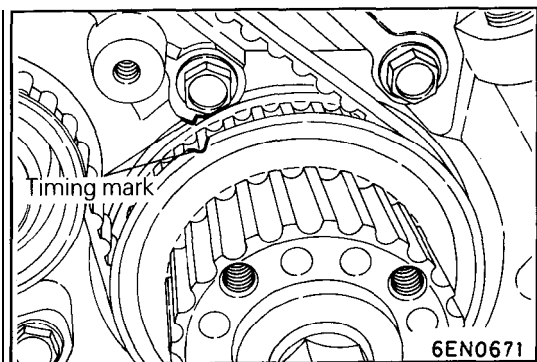
- (11) Hold the center of the tension side span of the timing belt (between the camshaft and oil pump sprockets) between your thumb and index finger as shown. Then, make sure that the clearance between the belt back surface and cover is standard value.

**Standard value: 14 mm (.55 in.)**

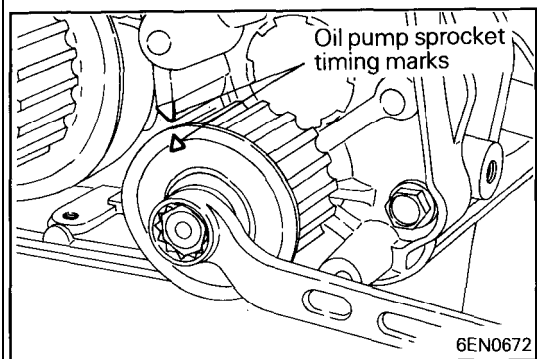


### ◆0◆ TIMING BELT INSTALLATION

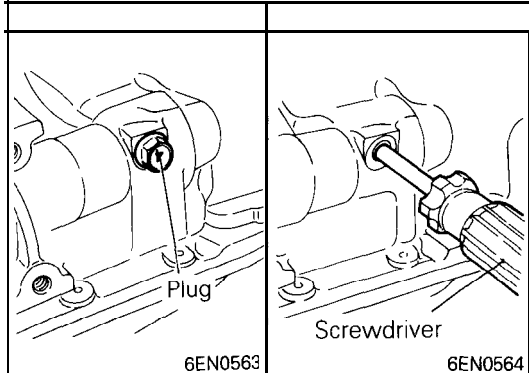
- (1) Check that the timing belt tensioner and spring have been installed in position. (See ◆B◆)
- (2) Align timing mark on camshaft sprocket with timing mark on cylinder head.



- (3) Align timing mark on crankshaft sprocket with timing mark on front case.

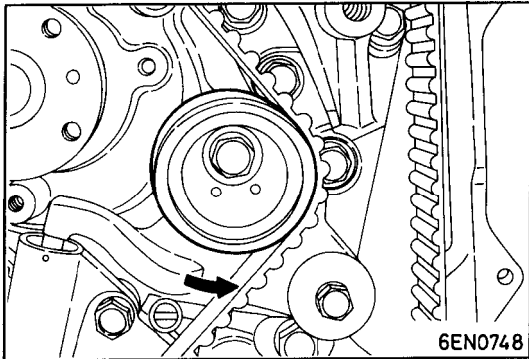


- (4) Align the timing mark on oil pump sprocket with its mating mark.

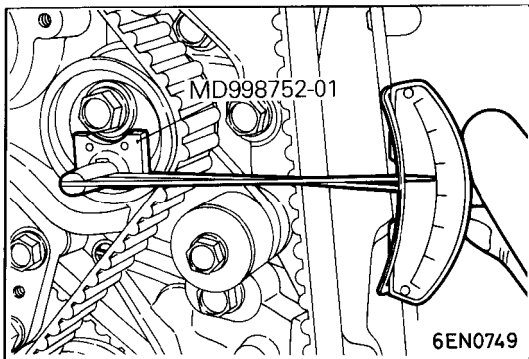


- (5) Remove the plug on cylinder block and insert a Phillips screwdriver [shank diameter 8 mm (.31 in.)] through the hole (Engine with silent shafts). If it can be inserted as deep as 60 mm (2.4 in.) or more, the timing marks are correctly aligned. If the inserted depth is only 20 – 25 mm (.8 – 1.0 in.), turn the oil pump sprocket one turn and realign timing marks. Then check to ensure that the screwdriver can be inserted 60 mm (2.4 in.) -or more. Keep the screwdriver inserted until installation of timing belt is finished.

- (6) Install the timing belt on the crankshaft sprocket, idler pulley, camshaft sprocket, and tensioner pulley in that order.



- (7) Lift up the tensioner pulley in the direction of arrow and tighten the center bolt.  
 (8) Check to see that all timing marks are lined up.  
 (9) Remove the screwdriver inserted in step (5) and fit the plug.  
 (10) Give the crankshaft a quarter counter-clockwise turn. Then, turn it clockwise until the timing marks are lined up again.



- (11) Install the special tools, Socket Wrench and Torque Wrench, on the tensioner pulley, and loosen the tensioner pulley center bolt.

**NOTE**

If the special tool is not available, use a commercially available torque wrench that is capable of measuring 0 – 3 Nm (0 – 2.2 ft.lbs.).

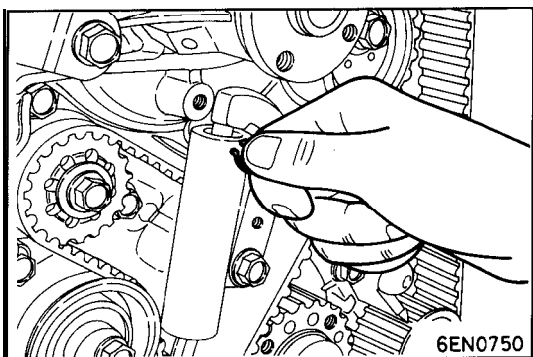
- (12) Torque to 2.6 – 2.8 Nm (1.88 – 2.03 ft.lbs.) with the torque wrench.  
 (13) Holding the tensioner pulley with the special tool and torque wrench, tighten the center bolt to specification.

- (14) After giving two clockwise turns to the crankshaft, let it alone for approx. 15 minutes. Then, make sure that the auto tensioner setting wire moves freely.

**NOTE**

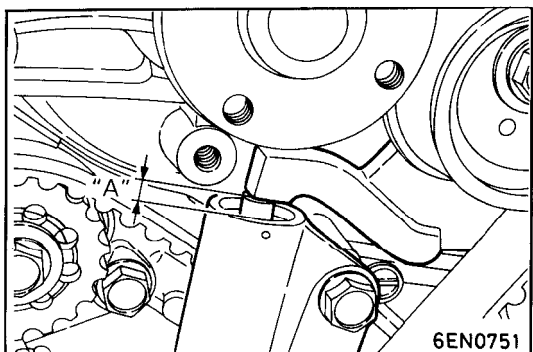
If the wire does not move freely, repeat step (10) above until it moves freely.

- (15) Remove the auto tensioner setting wire.

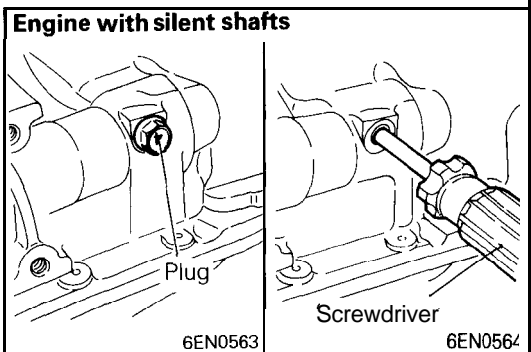
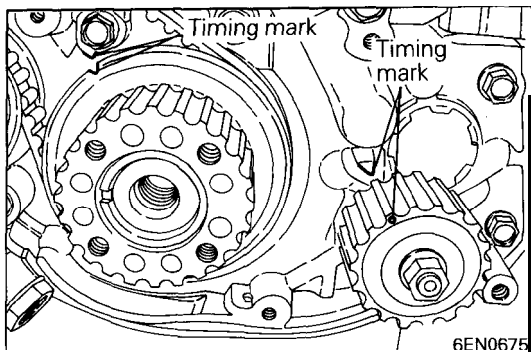
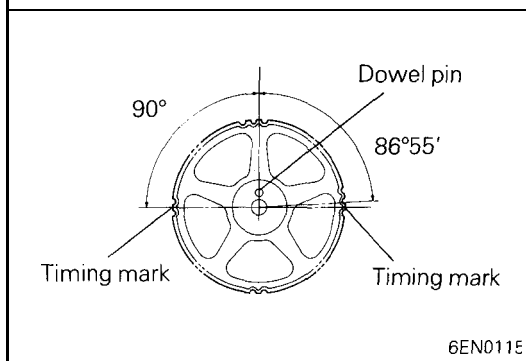
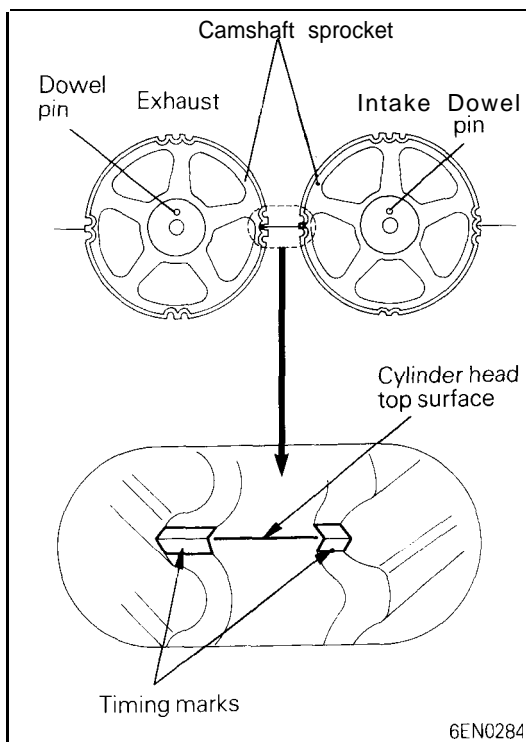


- (16) Measure the distance "A" (between the tensioner arm and auto tensioner body).

**Standard value: 3.8 – 4.5 mm (.15 – .18 in.)**







**▶P◀ TIMING BELT INSTALLATION**

- (1) Turn the two sprockets so that their dowel pins are located on top. Then, align the timing marks facing each other with the top surface of the cylinder head. When you let go of the exhaust camshaft sprocket, it will rotate one tooth in the counterclockwise direction. This should be taken into account when installing the timing belt on the sprockets.

**NOTE**

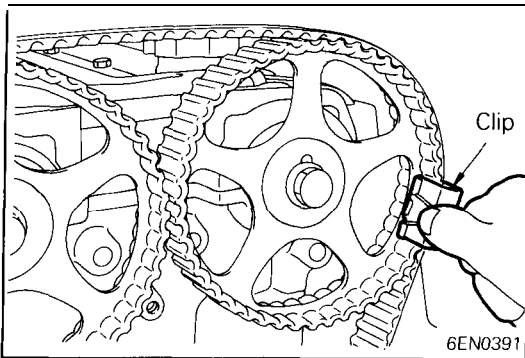
The same camshaft sprocket is used for the intake and exhaust camshafts and is provided with two timing marks. When the sprocket is mounted on the exhaust camshaft, use the timing mark on the right with the dowel pin hole on top. For the intake camshaft sprocket, use the one on the left with the dowel pin hole on top.

- (2) Align the crankshaft sprocket timing mark.
- (3) Align the oil pump sprocket timing mark (Engine with silent shafts).

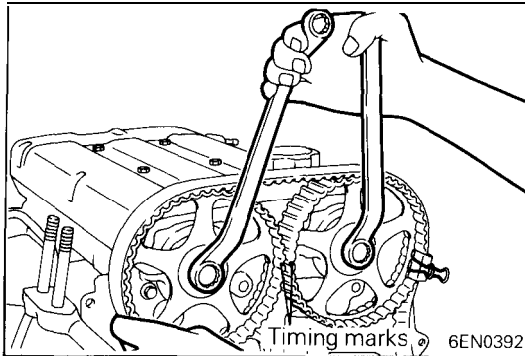
- (4) Insert a Phillips screwdriver [shank diameter 8 mm (.31 in.)] through the 'hole (Engine with silent shafts). If it can be inserted as deep as 60 mm (2.4 in.) or more, the timing marks are correctly aligned. If the inserted depth is only 20 – 25 mm (.8 – 1.0 in.), turn the oil pump sprocket one turn and realign timing marks. Then check to ensure that the screwdriver can be inserted 60 mm (2.4 in.) or more. Keep the screwdriver inserted until the installation of the timing belt is finished.

**NOTE**

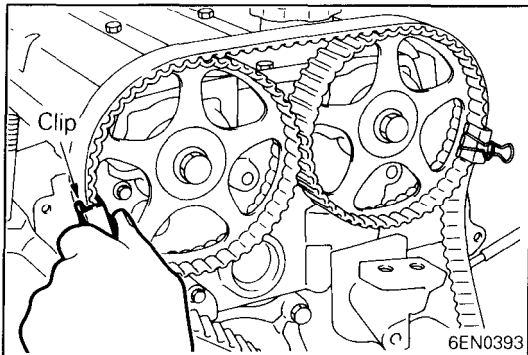
Step (4) is performed to ensure that the oil pump sprocket is correctly positioned with reference to the silent shafts.



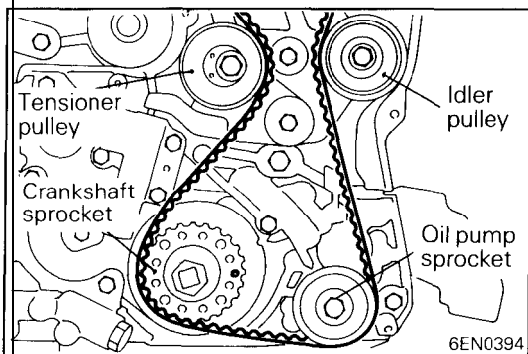
- (5) Thread the timing belt over the intake side camshaft sprocket and fix it at indicated position by a clip.



- (6) Thread the timing belt over the exhaust side sprocket, aligning the timing marks with the cylinder head top surface using two wrenches.

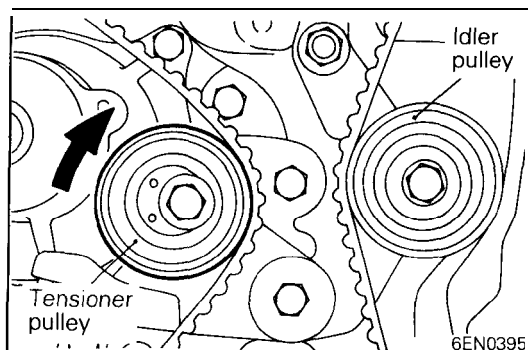


- (7) Fix the belt at indicated position by a clip.



- (8) Thread the timing belt over the idler pulley, the oil pump sprocket, the crankshaft sprocket and the tensioner pulley in the order shown.

- (9) Remove the two clips.

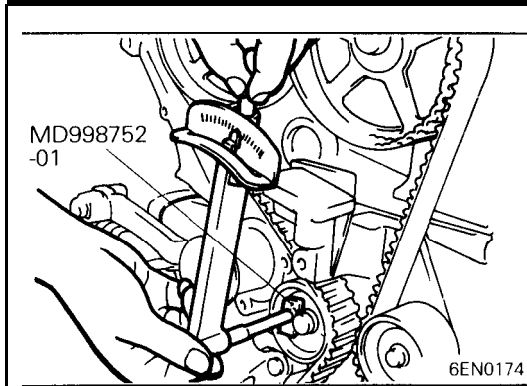


- (10) Lift up the tensioner pulley in the direction of arrow and tighten the center bolt.

- (11) Check to see that all timing marks are lined up.

- (12) Remove the screwdriver inserted in step (4) and fit the plug. (Engine with silent shafts)

- (13) Give the crankshaft a quarter counter-clockwise turn. Then, turn it clockwise until the timing marks are lined up again.



(14) Install the special tools, Socket Wrench and Torque Wrench, on the tensioner pulley, and loosen the tensioner pulley center bolt.

**NOTE**

If the special tool is not available, use a commercially available torque wrench that is capable of measuring 0 – 3 Nm (0 – 2.2 ft.lbs.).

(15) Torque to 2.6 – 2.8 Nm (1.88 – 2.03 ft.lbs.) with the torque wrench.

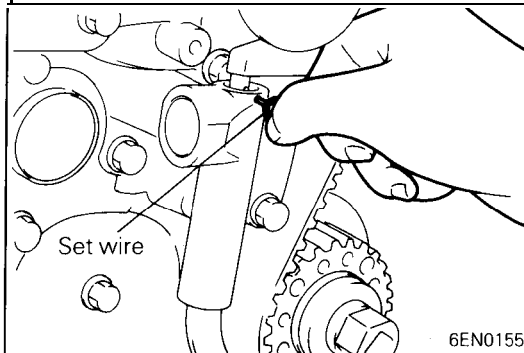
(16) Holding the tensioner pulley with the special tool and torque wrench, tighten the center bolt to specification.

(17) After giving two clockwise turns to the crankshaft, let it alone for approx. 15 minutes. Then, make sure that the auto tensioner setting wire moves freely.

**NOTE**

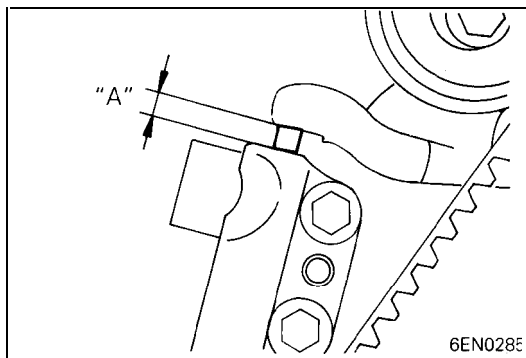
If the wire does not move freely, repeat step (13) above until it moves freely.

(18) Remove the auto tensioner setting wire.



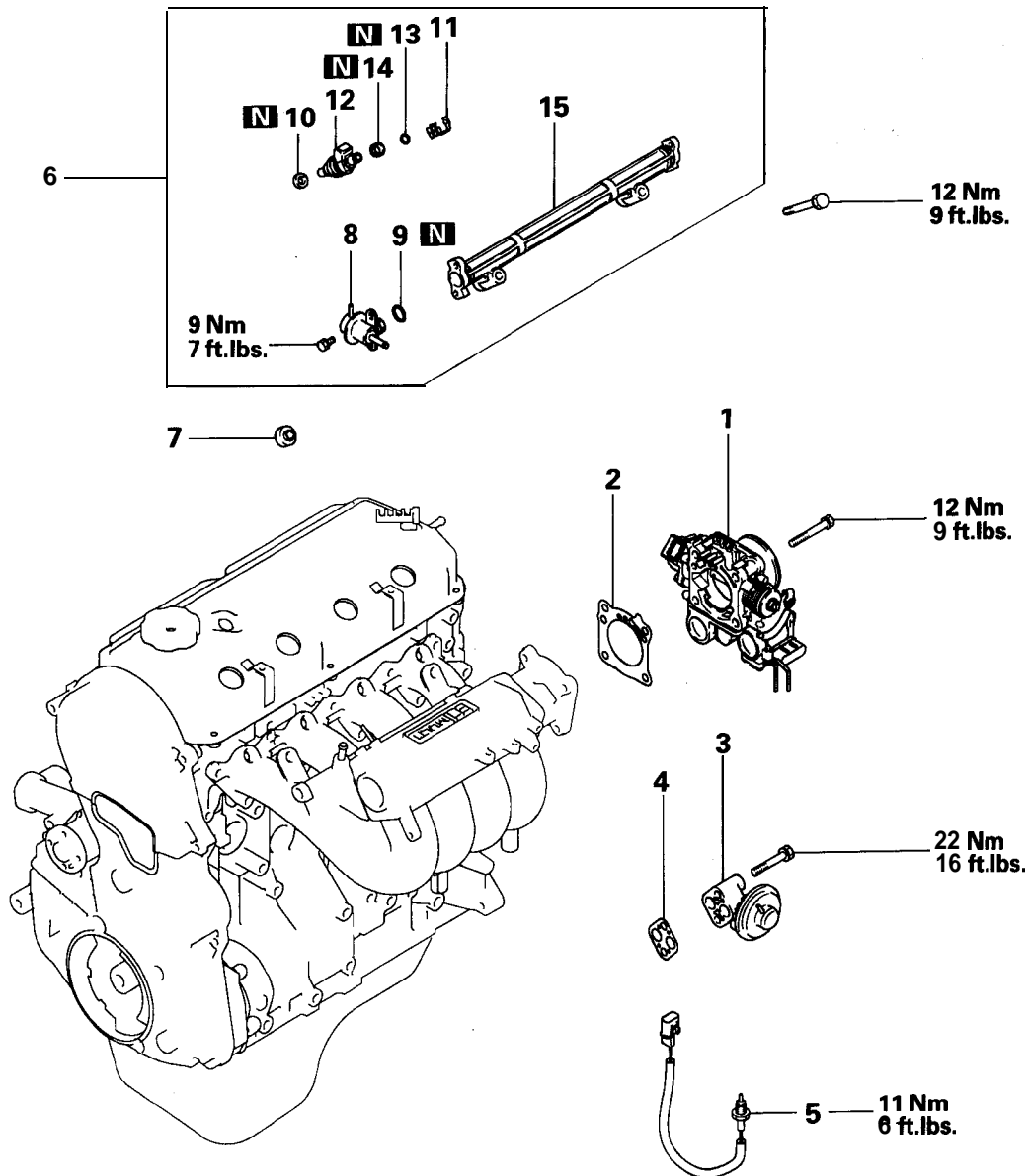
(19) Measure the distance "A" (between the tensioner arm and auto tensioner body).

**Standard value: 3.8 – 4.5 mm (.15 – .18 in.)**



# FUEL AND EMISSION CONTROL PARTS

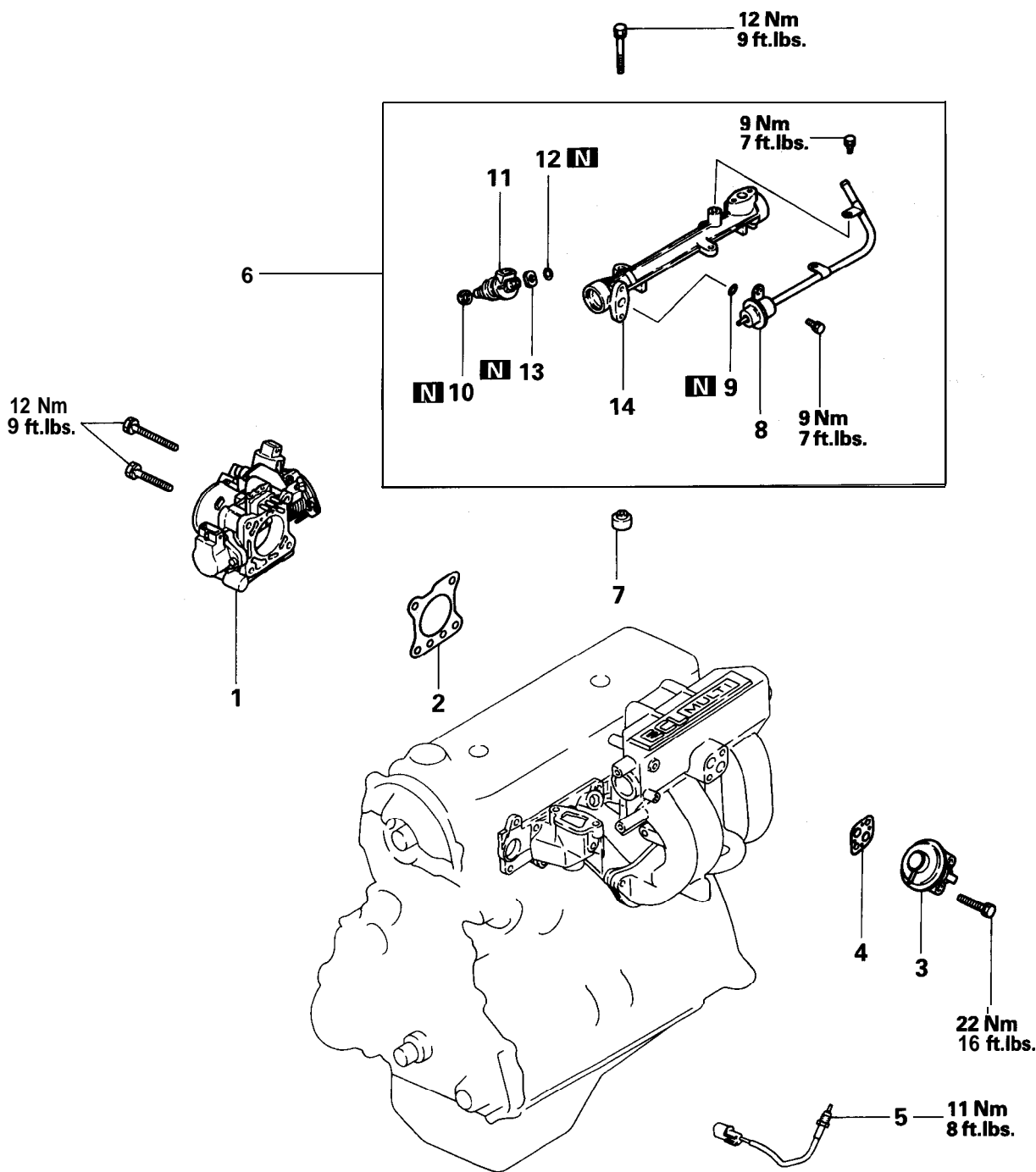
## REMOVAL AND INSTALLATION – SOHC for GALANT/EXPO/EXP LRV



**Removal steps**

1. Throttle body
2. Throttle body gasket
3. EGR valve
4. EGR valve gasket
5. EGR temp sensor – For California
6. Injectors and delivery pipe
7. Insulator
8. Fuel pressure regulator
9. O-ring
10. Insulator
11. Injector clip
12. Injectors
13. O-ring
14. Grommet
15. Fuel rail

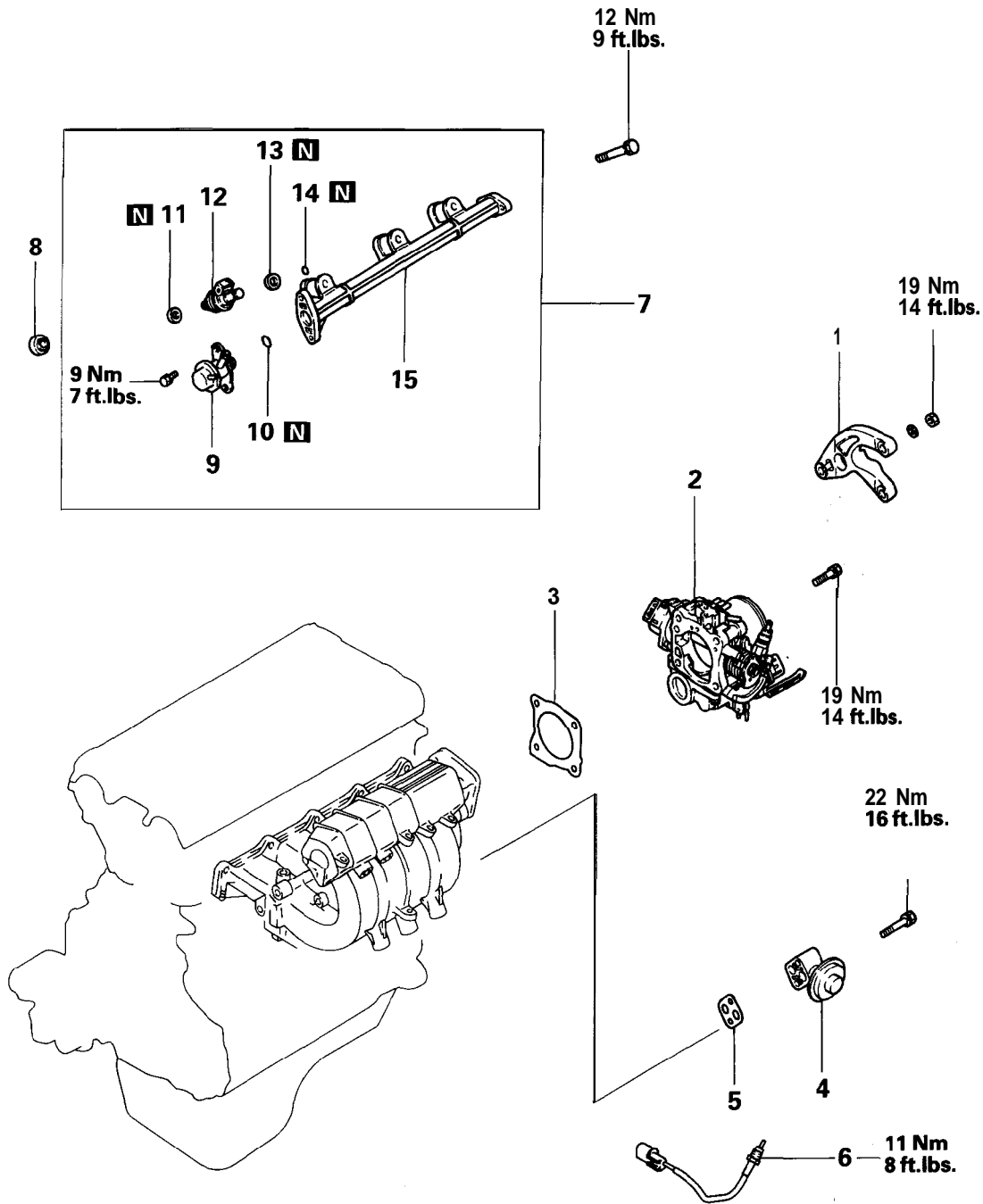
REMOVAL AND INSTALLATION – SOHC for TRUCK



Removal steps

1. Throttle body
2. Throttle body gasket
3. EGR valve
4. EGR valve gasket
5. EGR temp sensor- For California
6. Injectors and fuel rail
7. Insulator
8. Fuel pressure regulator
9. O-ring
10. Insulator
11. Injectors
12. O-ring
13. Grommet
14. Fuel rail

REMOVAL AND INSTALLATION – DOHC

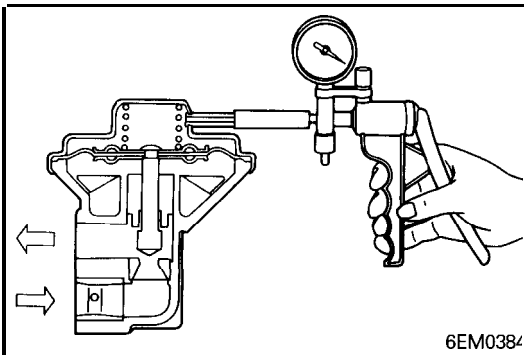


Removal steps

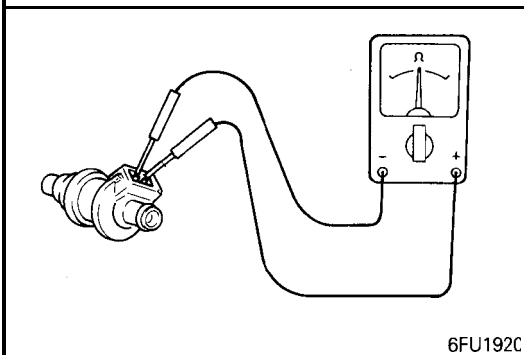
1. Throttle body stay
2. Throttle body
3. Throttle body gasket
4. EGR valve
5. EGR valve gasket
6. EGR temp sensor – For California
7. Injectors and fuel rail
8. Insulator
9. Fuel pressure regulator
10. O-ring
11. Insulator
12. Injectors
13. O-ring
14. Grommet
15. Fuel rail

▶C▶

▶B▶

**INSPECTION****EGR VALVE**

- (1) Check EGR valve for sticking or carbon deposits. If such conditions exist, clean or replace EGR valve.
- (2) Connect a hand vacuum pump to the nipple of EGR valve and plug other nipple.
- (3) Apply a vacuum of 500 mmHg (19.7 in. Hg) to make sure that a vacuum is maintained. If there is a leak, replace the EGR valve. In addition, check the valve for its opening and closing by applying and removing a vacuum.

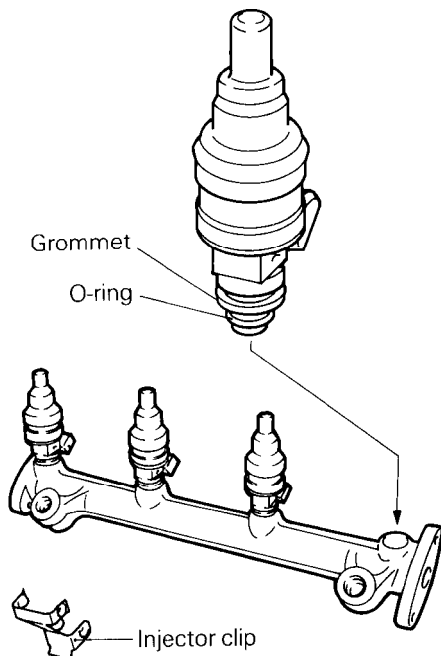
**INJECTORS**

- (1) Using an ohmmeter (circuit tester), test for continuity between terminals of injector; the circuit should be closed. If failure is detected, replace the injector.

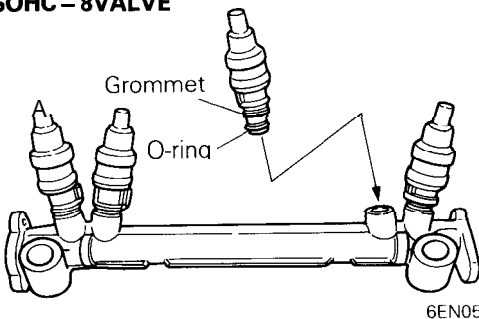
**Standard value:**

Non-turbo 13 – 16  $\Omega$  [at 20°C (68°F)]

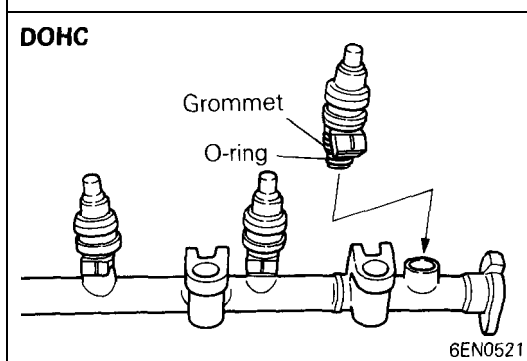
Turbo 2 – 3  $\Omega$  [at 20°C (68°F)]

**SOHC – 16VALVE****INSTALLATION SERVICE POINTS****◆A◆ INJECTORS / INJECTOR CLIP INSTALLATION**

- (1) Before installing an injector the rubber O-ring must be lubricated with a drop of clean engine oil to aid in installation.
- (2) Install injector top end into fuel rail. Be careful not to damage O-ring during installation.
- (3) Install injector clip by sliding open end onto injector and onto the fuel rail.

**SOHC – 8VALVE****◆B◆ INJECTOR INSTALLATION**

- (1) Before installing an injector the rubber O-ring must be lubricated with a drop of clean engine oil to aid in installation.



- (2) Install injector top end into fuel rail.  
Be careful not to damage the O-ring during installation.

#### ⚡ C ⚡ FUEL PRESSURE REGULATOR INSTALLATION

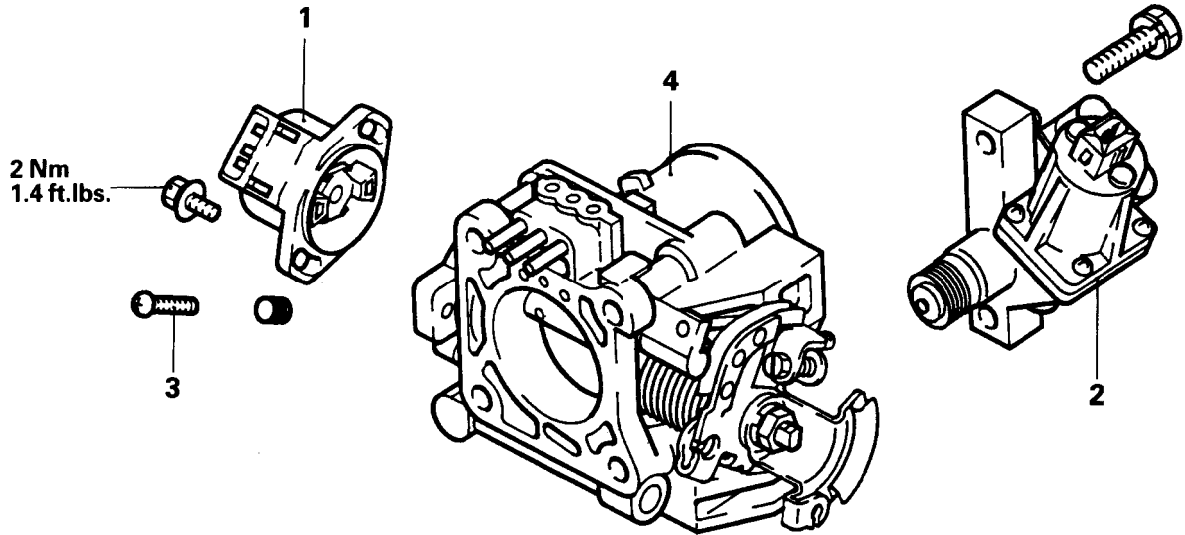
- (1) Before installing pressure regulator the O-ring must be lubricated with a drop of clean engine O-ring to aid in installation.



# THROTTLE BODY

## DISASSEMBLY AND REASSEMBLY

SOHC – TRUCK – Federal

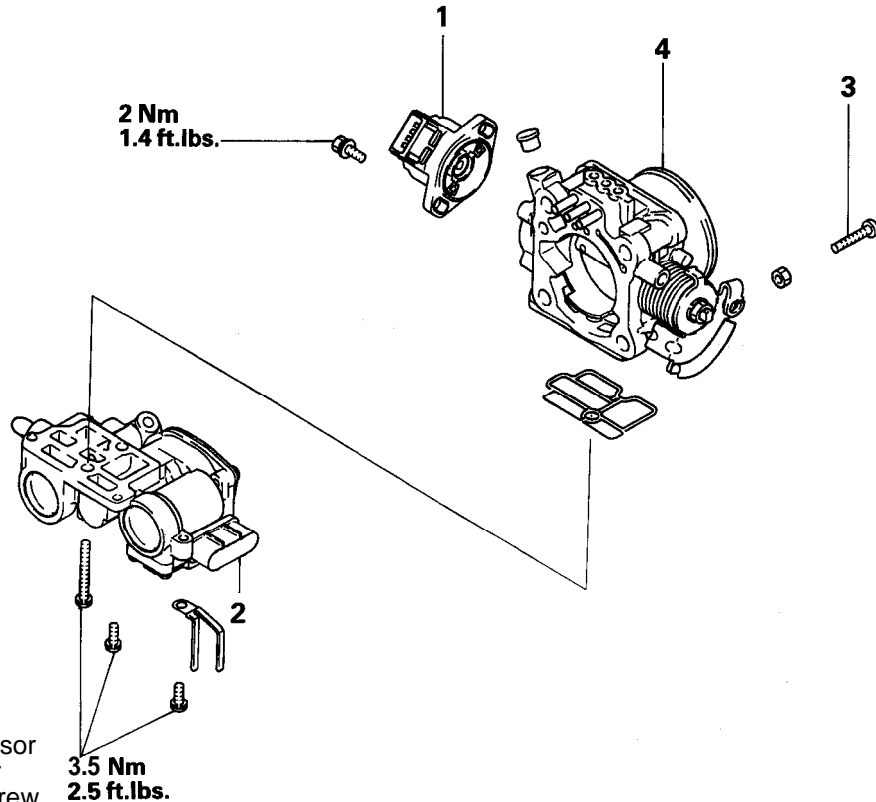


### Disassembly steps

- ◁A▷ ▷A▷ 1. Throttle position sensor
- ◁A▷ 2. Speed control motor
- 3. Throttle valve set screw
- ▷B▷ 4. Throttle body

6FU1292

SOHC – TRUCK – California  
SOHC – GALANT



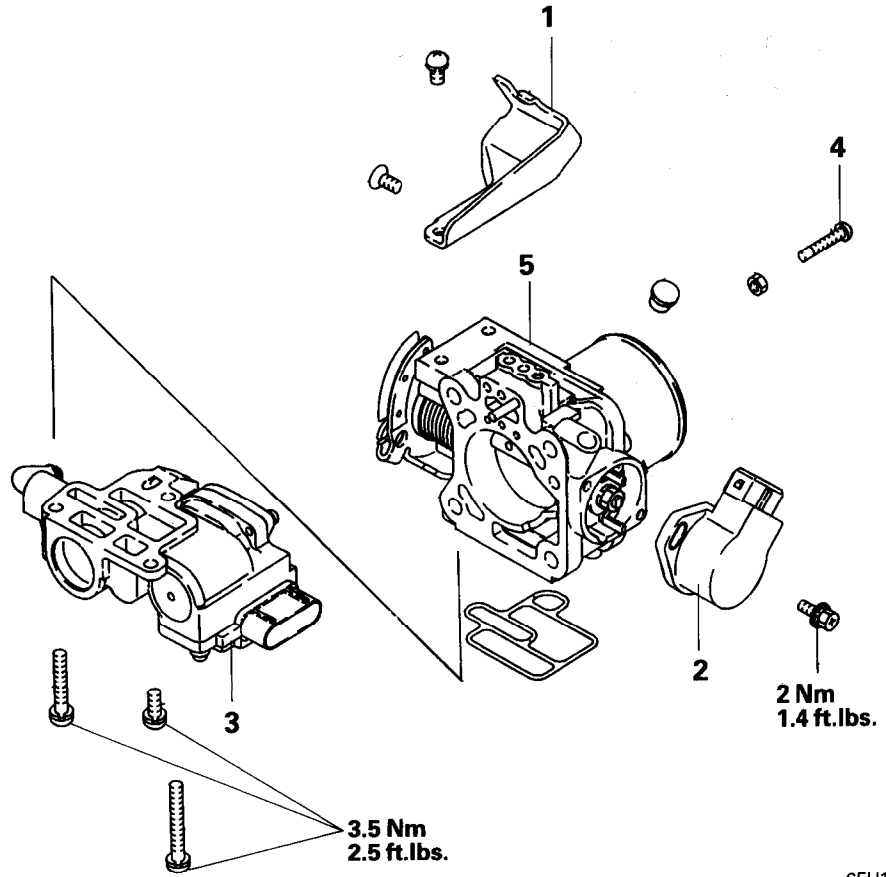
### Disassembly steps

- ◁A▷ ▷A▷ 1. Throttle position sensor
- ◁A▷ 2. Idle air control motor
- 3. Throttle valve set screw
- ◁B▷ 4. Throttle body

3.5 Nm  
2.5 ft.lbs.

6EN0711

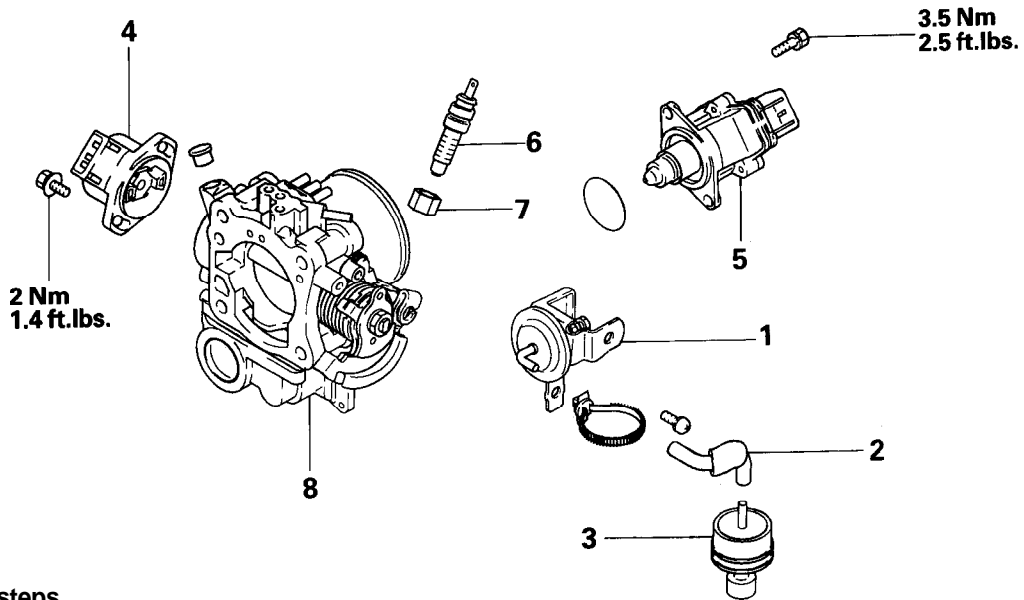
SOHC – EXPO/EXPO LRV



**Disassembly steps**

- 1. Accelerator wire bracket  
-EXPO/EXP LRV
- ◁A▷ ▷A◁ 2. Throttle position sensor
- ◁A▷ 3. Idle air control motor
- ◁B▷ 4. Throttle valve set screw
- 5. Throttle body

6FU1857



**Disassembly steps**

- 1. Dash pot
- 2. Hose
- 3. Vacuum valve
- ◁A▷ ▷A◁ 4. Throttle position sensor
- ◁A▷ 5. Idle air control motor
- 6. Idle position switch
- 7. Adjusting nut
- ◁B▷ 8. Throttle body

} GALANT

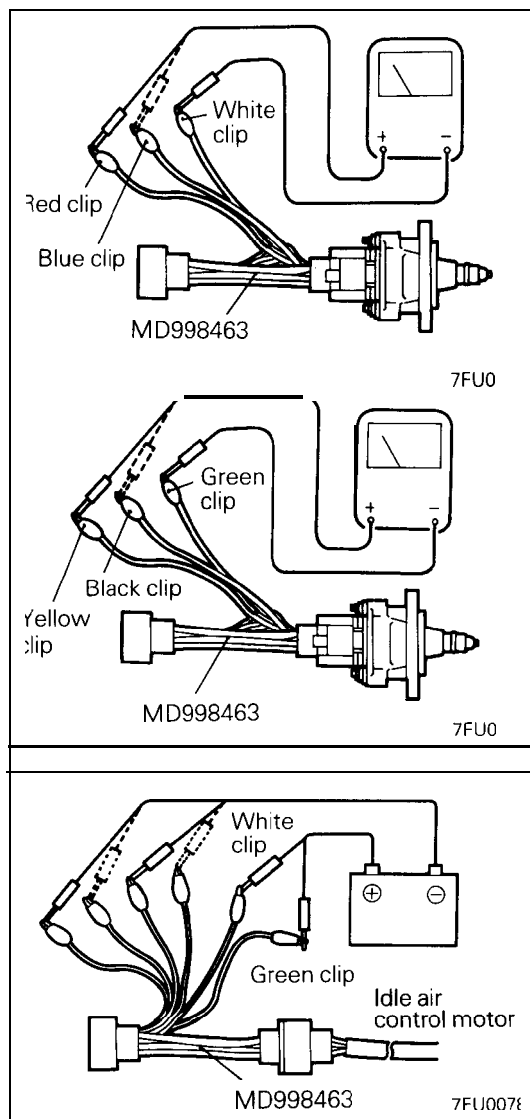
6EN0712

**DISASSEMBLY SERVICE POINTS****◁A▷ THROTTLE POSITION SENSOR AND IDLE AIR CONTROL MOTOR REMOVAL**

- (1) Do not disassemble the sensor and motor.
- (2) Do not immerse solvent to clean the sensor and motor. Clean them with shop towel.

**◁B▷ THROTTLE BODY REMOVAL**

- (1) Do not remove the throttle valve.
- (2) Check if the vacuum port or passage is clogged. Use compressed air to clean the vacuum passage.

**INSPECTION****IDLE AIR CONTROL MOTOR – DOHC****Checking the Coil Resistance**

- (1) Connect Test Harness to the motor connector.
- (2) Measure the resistance between white clip of Test Harness and red clip or blue clip.

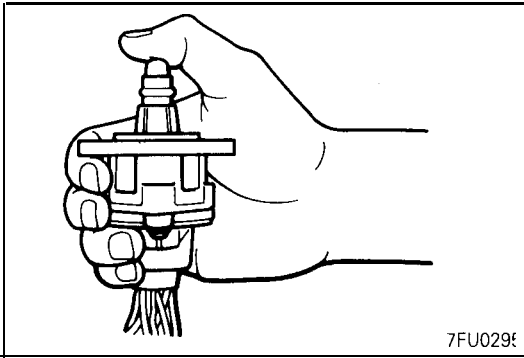
**Standard value: 28 – 33  $\Omega$  at 20°C (68°F)**

- (3) Measure the resistance between green clip of the Test Harness and yellow clip or black clip.

**Standard value: 28 – 33  $\Omega$  at 20°C (68°F)**

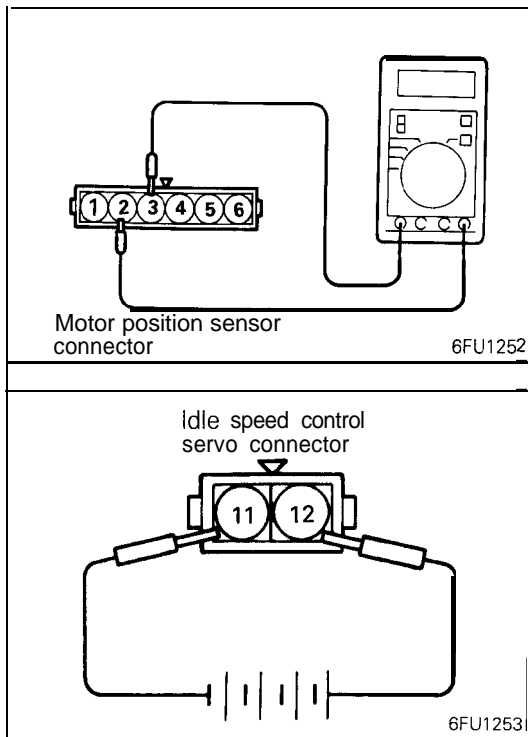
**Operational Check**

- (1) Connect Test Harness to the idle air control motor connector.
- (2) Connect the positive  $\oplus$  terminal of 6 volt battery to white clip and green clip of Test Harness.



(3) Holding the idle air control motor as shown in the illustration, connect the negative  $\ominus$  terminal of the power supply to each clip as described in the following steps, and check whether or not a vibrating feeling (a feeling of very slight vibration of the stepper motor) is generated as a result of the activation of the stepper motor.

- ① Connect the negative  $\ominus$  terminal of the power supply to the red and black clip.
  - ② Connect the negative  $\ominus$  terminal of the power supply to the blue and black clip.
  - ③ Connect the negative  $\ominus$  terminal of the power supply to the blue and yellow clip.
  - ④ Connect the negative  $\ominus$  terminal of the power supply to the red and yellow clip.
  - ⑤ Connect the negative  $\ominus$  terminal of the power supply to the red and black clip.
  - ⑥ Repeat the tests in sequence from ⑤ to ①.
- (4) If, as a result of these tests, vibration is detected, the stepper motor can be considered to be normal.



#### MOTOR POSITION SENSOR – SOHC for TRUCK

(1) Measure the resistance between terminals ② and ③

**Standard value: 4 – 6 k $\Omega$**

(2) Disconnect the idle-speed control motor connector.

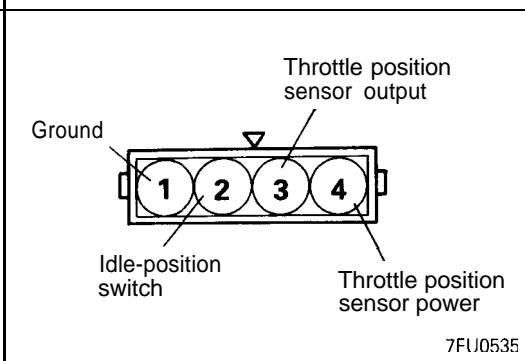
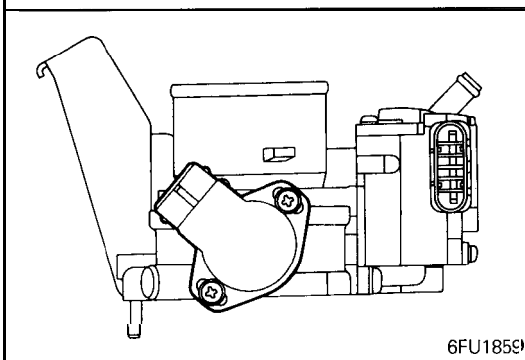
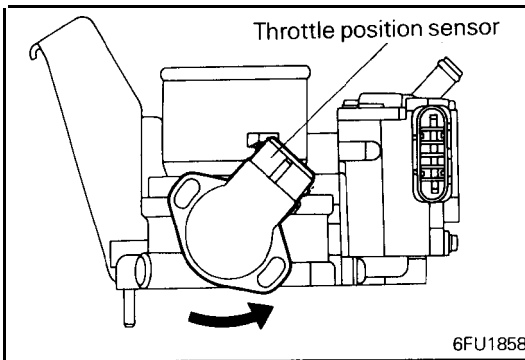
(3) Connect 6V DC between terminals ⑪ and ⑫ of the idle-speed control motor connector, and then measure the resistance between terminals ③ and ⑤ of the motor position sensor connector when the idle-speed control motor is activated (caused to expand and contract).

**Standard value: It should decrease smoothly as the idle speed control motor plunger contracts.**

#### Caution

**Apply only a 6V DC or lower voltage. Application of higher voltage could cause locking of the motor gears.**

(4) If there is a deviation from the standard value, or if the change is now smooth, replace the idle speed control motor assembly.



**REASSEMBLY SERVICE POINTS**

**◆◆ THROTTLE POSITION SENSOR INSTALLATION – SOHC FOR EXPO**

(1) Install the throttle position sensor to the throttle body as shown in the illustration.

(2) Turn the throttle position sensor 90° counterclockwise to set it in position and tighten the screws.

(3) Connect the circuit tester between ① (ground) and ③ (output), or between ③ (output) and ④ (power). Then make sure that the resistance changes smoothly when the throttle valve is slowly moved to the fully open position.

(4) Check for continuity between terminals ② (closed throttle position switch) and ① (ground) with the throttle valve both fully closed and fully open.

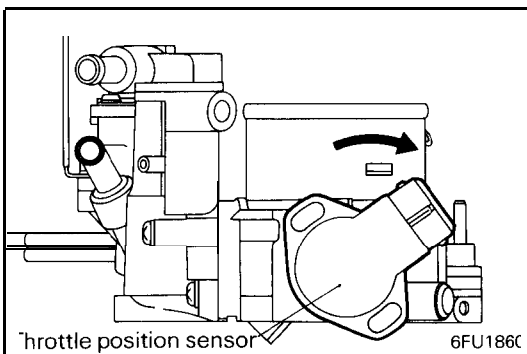
Throttle valve position	Continuity
Fully closed	Conductive
Fully open	Non-conductive

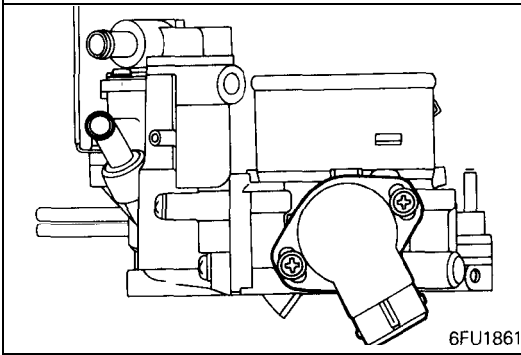
If there is not continuity with the throttle valve fully closed, turn the throttle position sensor clockwise direction, and then check again.

(5) If the above specifications are not met, replace TPS.

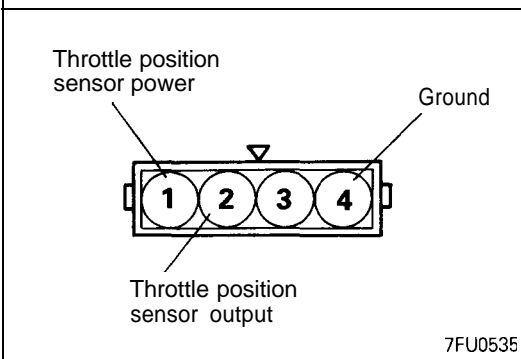
**◆◆ THROTTLE POSITION SENSOR INSTALLATION – GALANT, ECLIPSE, TRUCK**

(1) Install the throttle position sensor to the throttle body as shown in the illustration.





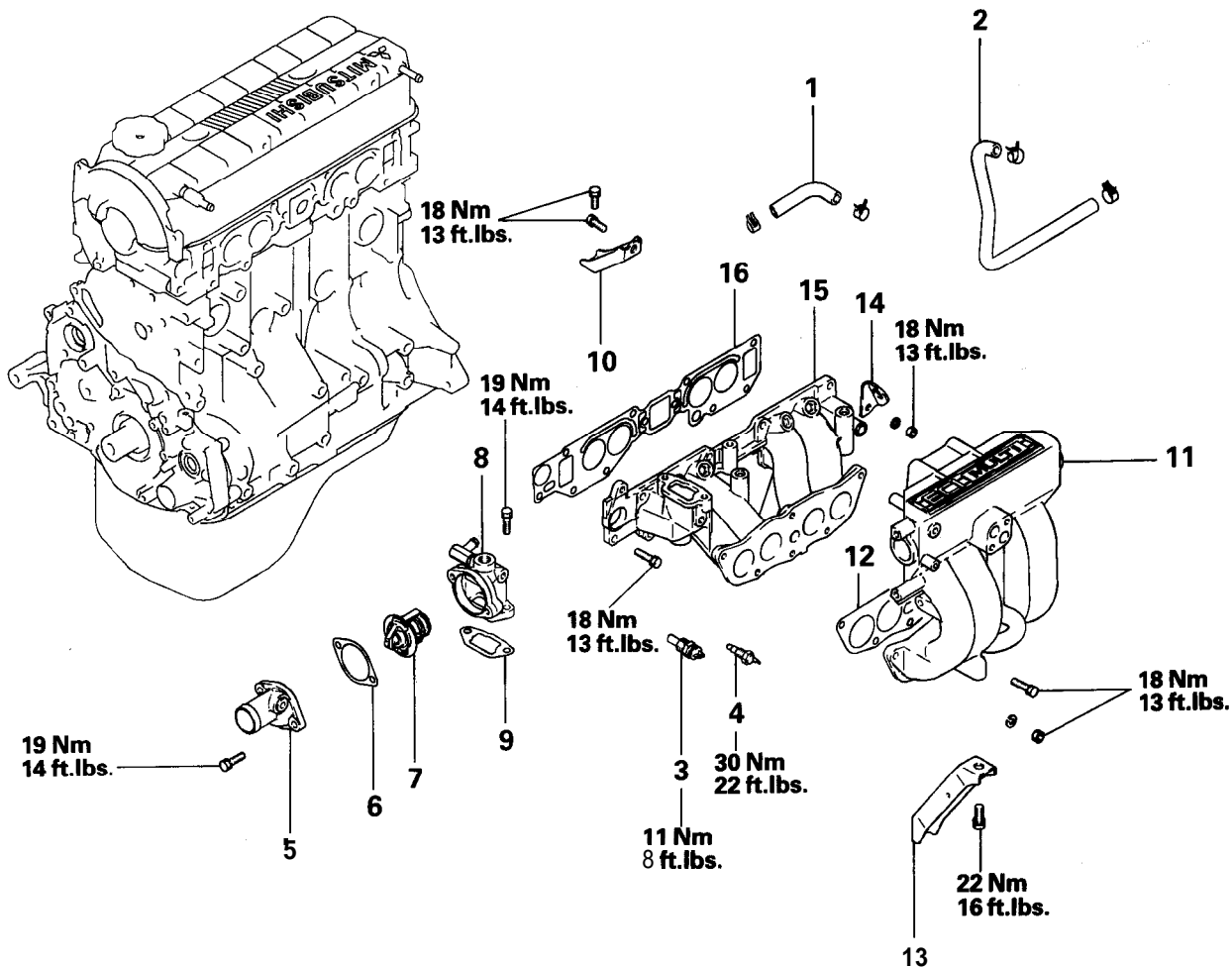
- (2) Turn the throttle position sensor 90° in the clockwise direction to set it and tighten the screws.



- (3) Connect the circuit tester between ④ (ground) and ② (output), or between ② (output) and ① (power). Then, make sure that the resistance changes smoothly when the throttle valve is slowly moved to the fully open position.

## INTAKE MANIFOLD

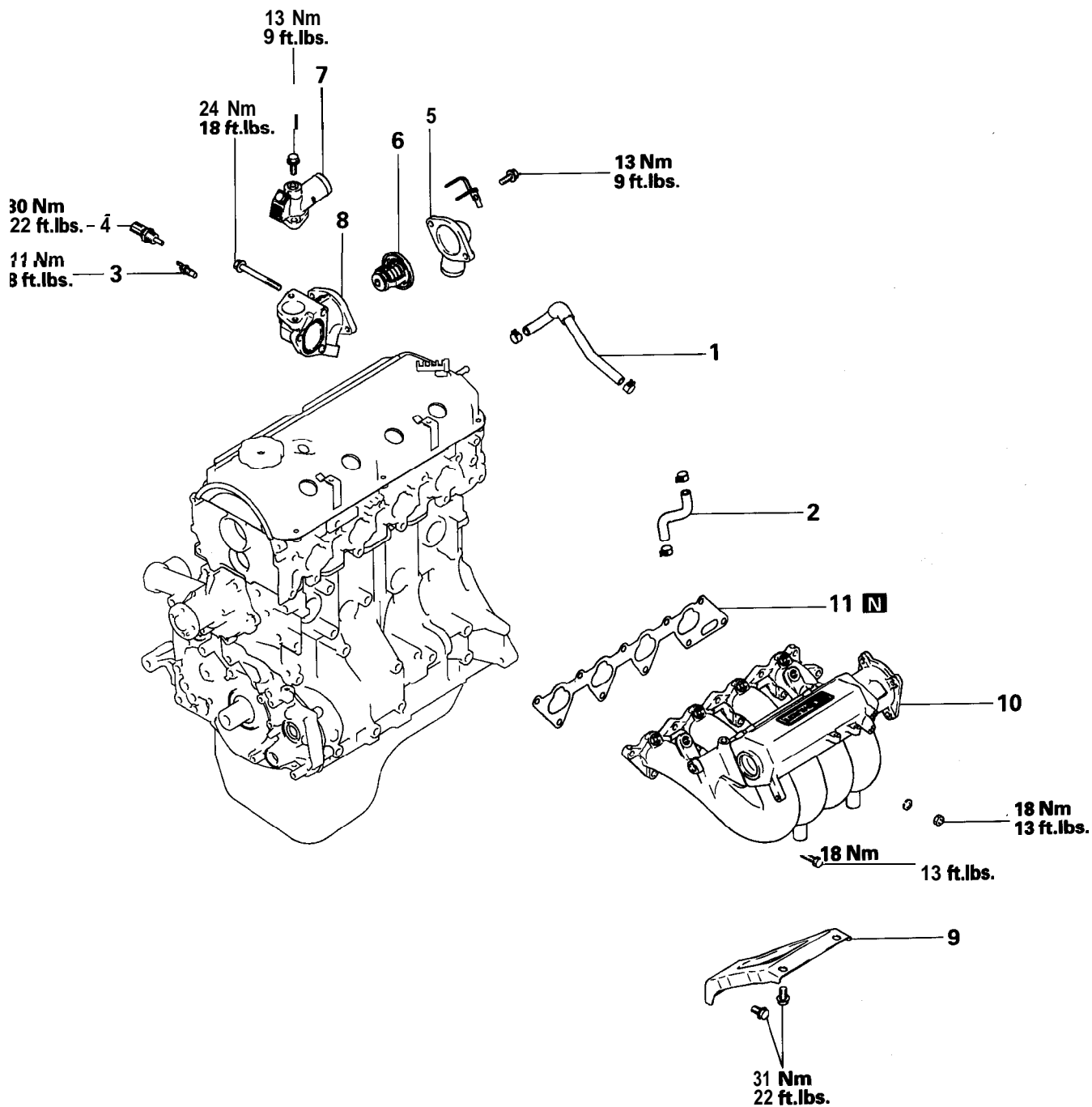
## REMOVAL AND INSTALLATION – SOHC – 8 VALVE



## Removal steps

1. Water hose
2. Water hose
- ↗F↖ 3. Engine coolant temperature gauge unit
- ↗E↖ 4. Engine coolant temperature sensor
- ↗B↖ 5. Water outlet fitting
6. Gasket
7. Thermostat
8. Thermostat housing
9. Gasket
10. Intake manifold plenum stay
11. Intake manifold plenum
12. Intake manifold plenum gasket
13. Intake manifold stay
14. Engine hanger
15. Intake manifold
16. Intake manifold gasket

## REMOVAL AND INSTALLATION - SOHC - 16 VALVE

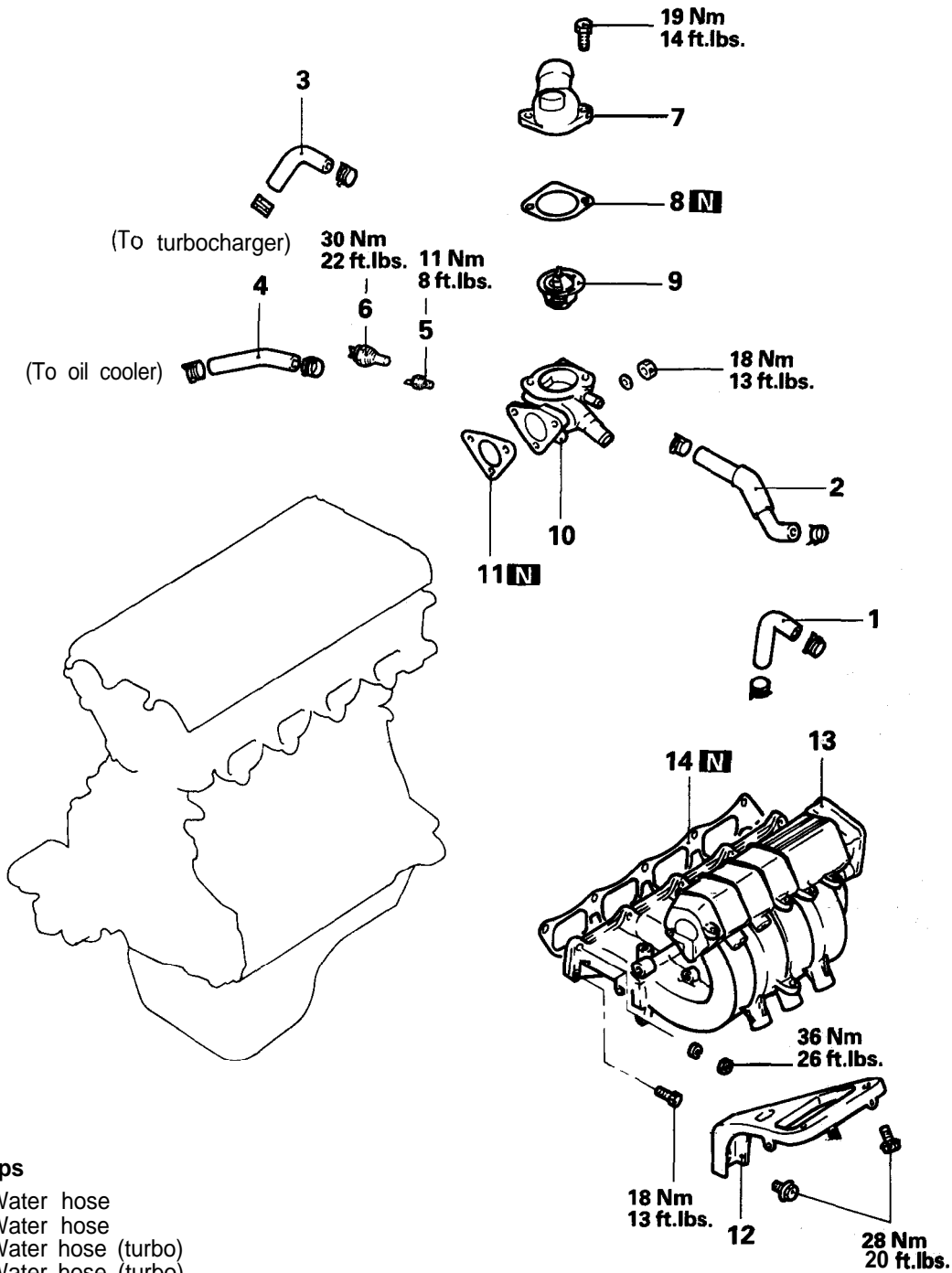


## Removal steps

1. Water hose
2. Water hose
- ▶F▶ 3. Engine coolant temperature sensor
- ▶E▶ 4. Engine coolant temperature gauge unit
- ▶D▶ 5. Water inlet fitting
6. Thermostat
7. Water outlet fitting
- ▶C▶ 8. Thermostat housing
9. Intake manifold stay
10. Intake manifold
11. Intake manifold gasket

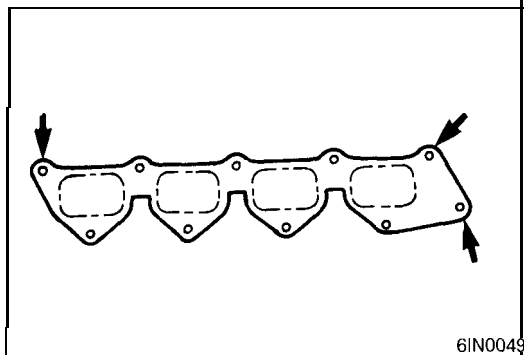


REMOVAL AND INSTALLATION – DOHC

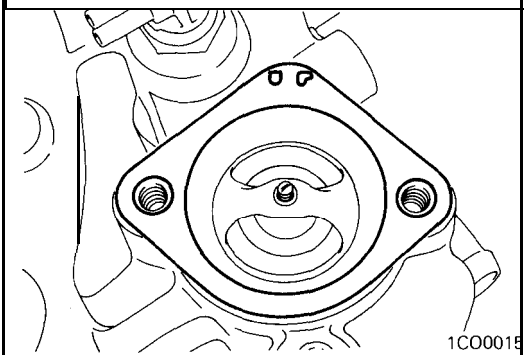


Removal steps

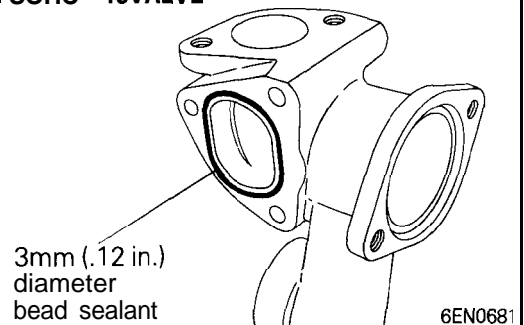
1. Water hose
2. Water hose
3. Water hose (turbo)
4. Water hose (turbo)
- ◆F◆ 5. Engine coolant temperature gauge unit
- ◆E◆ 6. Engine coolant temperature sensor
7. Water outlet fitting
8. Gasket
9. Thermostat
- ◆C◆ 10. Thermostat case
11. Gasket
12. Intake manifold stay
- ◆A◆ 13. Intake manifold
14. Intake manifold gasket

**INSTALLATION SERVICE POINTS****▶A◀ INTAKE MANIFOLD INSTALLATION – DOHC**

- (1) Tighten the intake manifold bolts, noting that the bolts installed at the locations indicated in the illustration are tightened to a different torque.

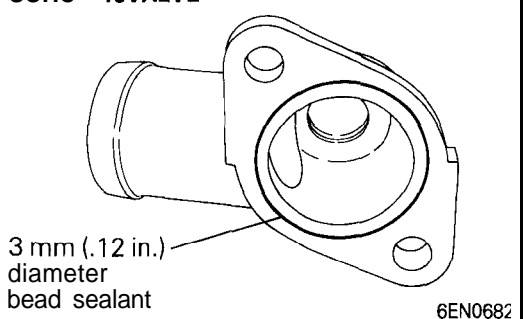
**▶B◀ WATER OUTLET FITTING GASKET INSTALLATION (FOR RUBBER COATED METAL GASKET ONLY)**

- (1) install the water outlet fitting gasket with its “UP” mark facing up (toward the water outlet fitting side).

**SOHC – 16VALVE****▶C◀ SEALANT APPLICATION TO THERMOSTAT HOUSING**

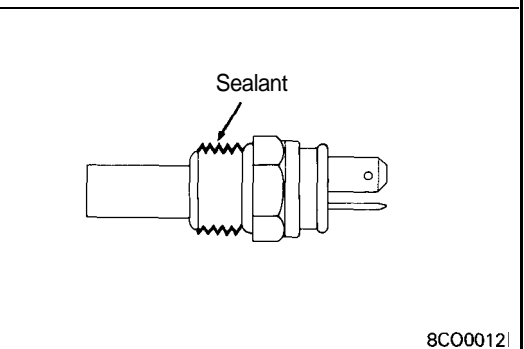
Specified sealant:

**Mitsubishi Genuine Part No. MD970389 or equivalent**

**SOHC – 16VALVE****▶D◀ SEALANT APPLICATION TO WATER OUTLET FITTING**

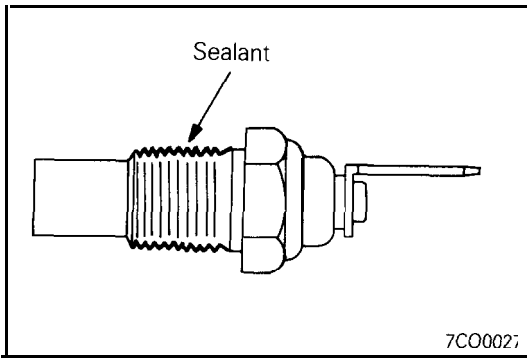
Specified sealant:

**Mitsubishi Genuine Part No. MD970389 or equivalent**

**▶E◀ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE SENSOR**

Specified sealant:

**3M Nut Locking Part No. 4171 or equivalent**

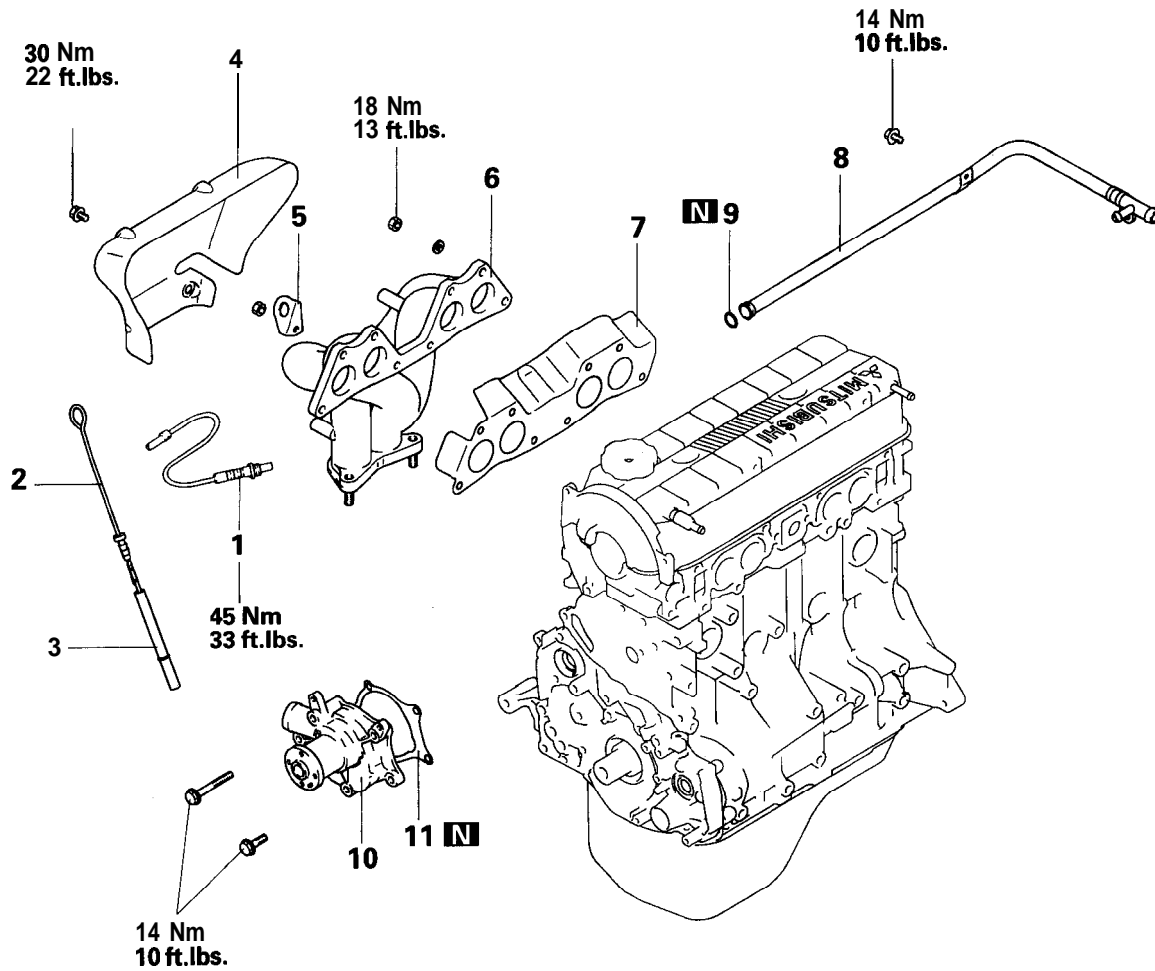


◆F◆ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE GAUGE UNIT

Specified sealant: **3M** ATD Part No. 8660 or equivalent

# EXHAUST MANIFOLD AND WATER PUMP

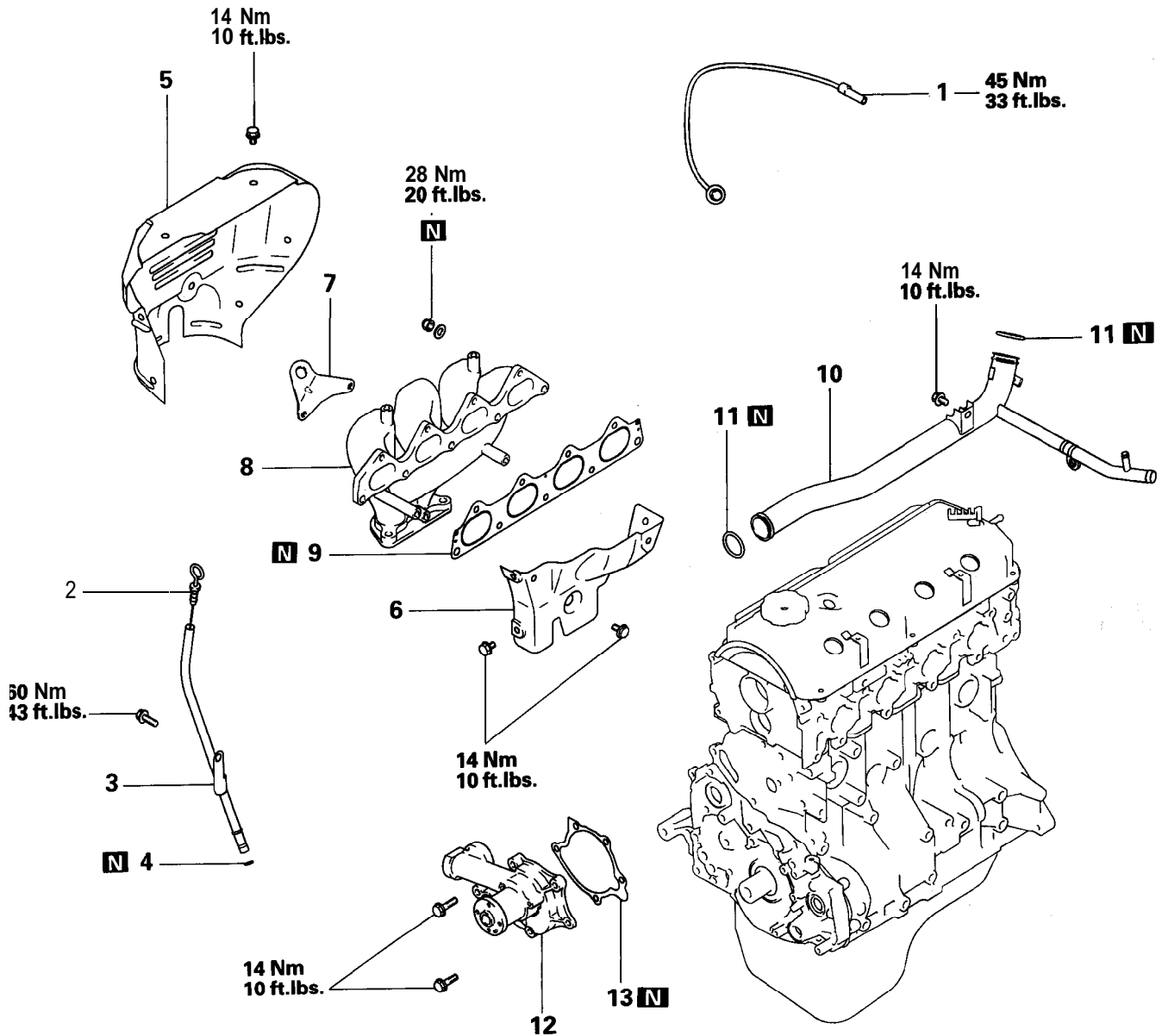
## REMOVAL AND INSTALLATION – SOHC 8 VALVE



### Removal steps

1. Oxygen sensor-Federal
2. Oil level gauge
3. Oil level gauge guide
4. Heat protector
5. Engine hanger
6. Exhaust manifold
7. Exhaust manifold gasket
- ▶▶▶ 8. Water inlet pipe
- ▶▶▶ 9. O-ring
10. Water pump
11. Water pump gasket

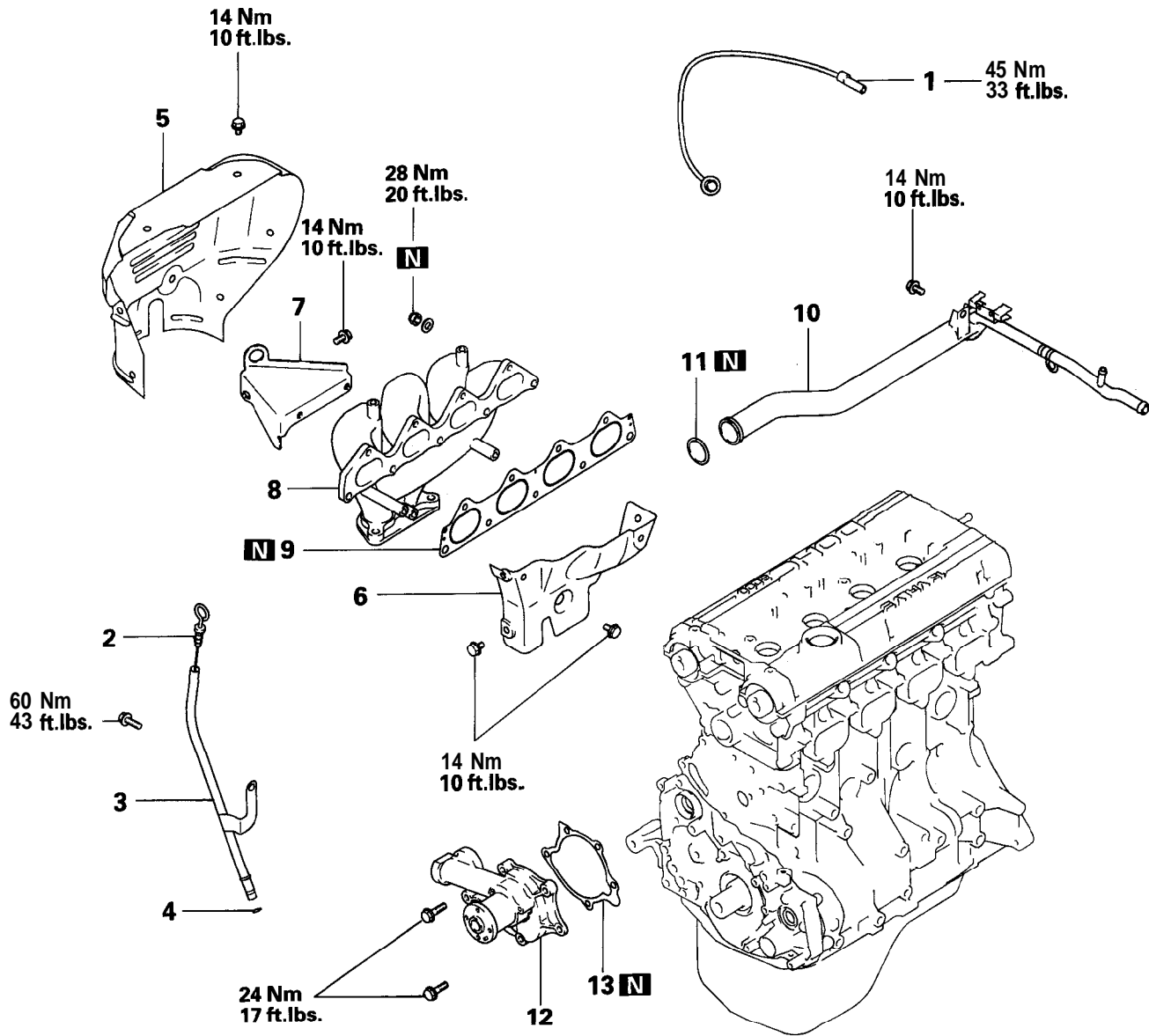
REMOVAL AND INSTALLATION – SOHC – 16 VALVE



Removal steps

1. Oxygen sensor-GALANT/EXPO Federal
2. Oil level gauge
3. Oil level gauge guide
4. O-ring
5. Heat protector
6. Heat protector  
-GALANT/EXPO.EXP LRV -Federal
7. Engine hanger
8. Exhaust manifold
9. Exhaust manifold gasket
- ▶▶▶ 10. Water inlet pipe
- ▶▶▶ 11. O-ring
12. Water pump
13. Water pump gasket

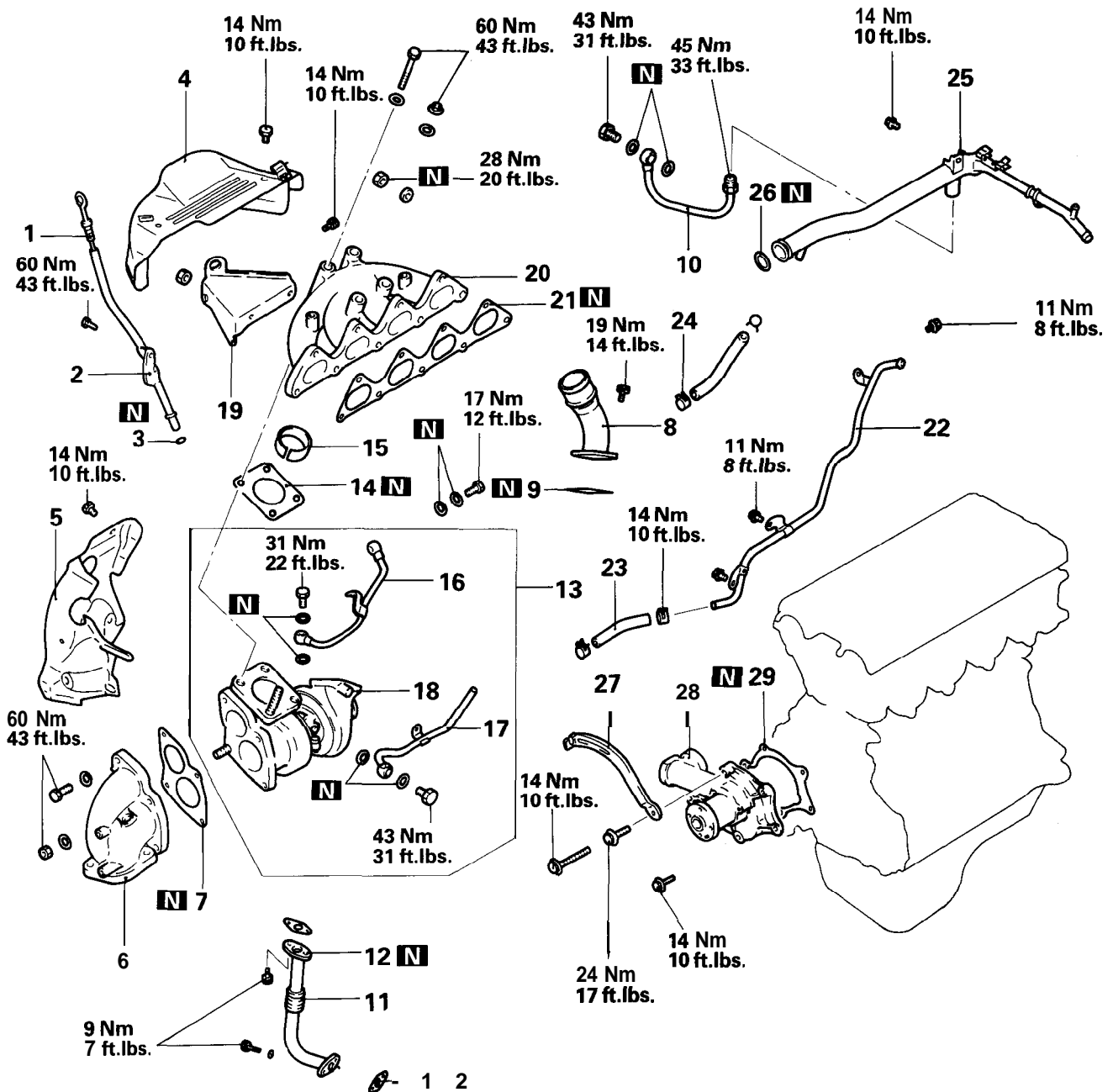
REMOVAL AND INSTALLATION – DOHC FOR NON-TURBO



Removal steps

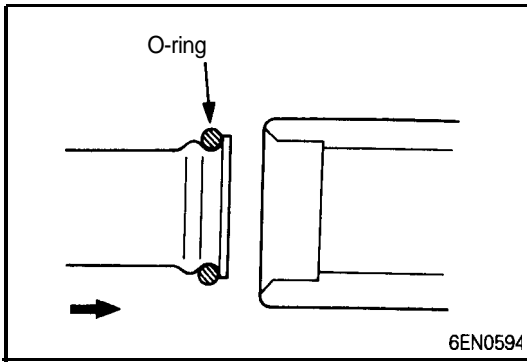
1. Oxygen sensor
2. Oil level gauge
3. Oil level gauge guide
4. O-ring
5. Heat protector "A"
6. Heat protector "B"
7. Engine hanger
8. Exhaust manifold
9. Exhaust manifold gasket
- ▶▶ 10. Water inlet pipe
- ▶▶ 11. O-ring
- ▶▶ 12. Water pump
13. Gasket

REMOVAL AND INSTALLATION – DOHC TURBO



Removal steps

- |  |   |
|--|---|
| <ol style="list-style-type: none"> <li>1. Oil level gauge</li> <li>2. Oil level gauge guide</li> <li>3. O-ring</li> <li>4. Heat protector "A"</li> <li>5. Heat protector "B"</li> <li>6. Exhaust fitting</li> <li>7. Gasket</li> <li>8. Air outlet fitting</li> <li>9. Gasket</li> <li>10. Water pipe "B"</li> <li>11. Oil return pipe</li> <li>12. Gasket</li> <li>13. Turbocharger assembly</li> <li>14. Gasket</li> <li>15. Ring</li> </ol> | <ol style="list-style-type: none"> <li>16. Oil pipe</li> <li>17. Water pipe "A"</li> <li>18. Turbocharger</li> <li>19. Engine hanger</li> <li>20. Exhaust manifold</li> <li>21. Exhaust manifold gasket</li> <li>22. Water pipe</li> <li>23. Water hose</li> <li>24. Water hose</li> <li>25. Water inlet pipe</li> <li>26. O-ring</li> <li>27. Generator brace</li> <li>28. Water pump</li> <li>29. Gasket</li> </ol> |
|--|---|

**INSTALLATION SERVICE POINT****▶A▶ WATER PIPE/O-RING INSTALLATION**

(1) Wet the O-ring (with water) to facilitate assembly.

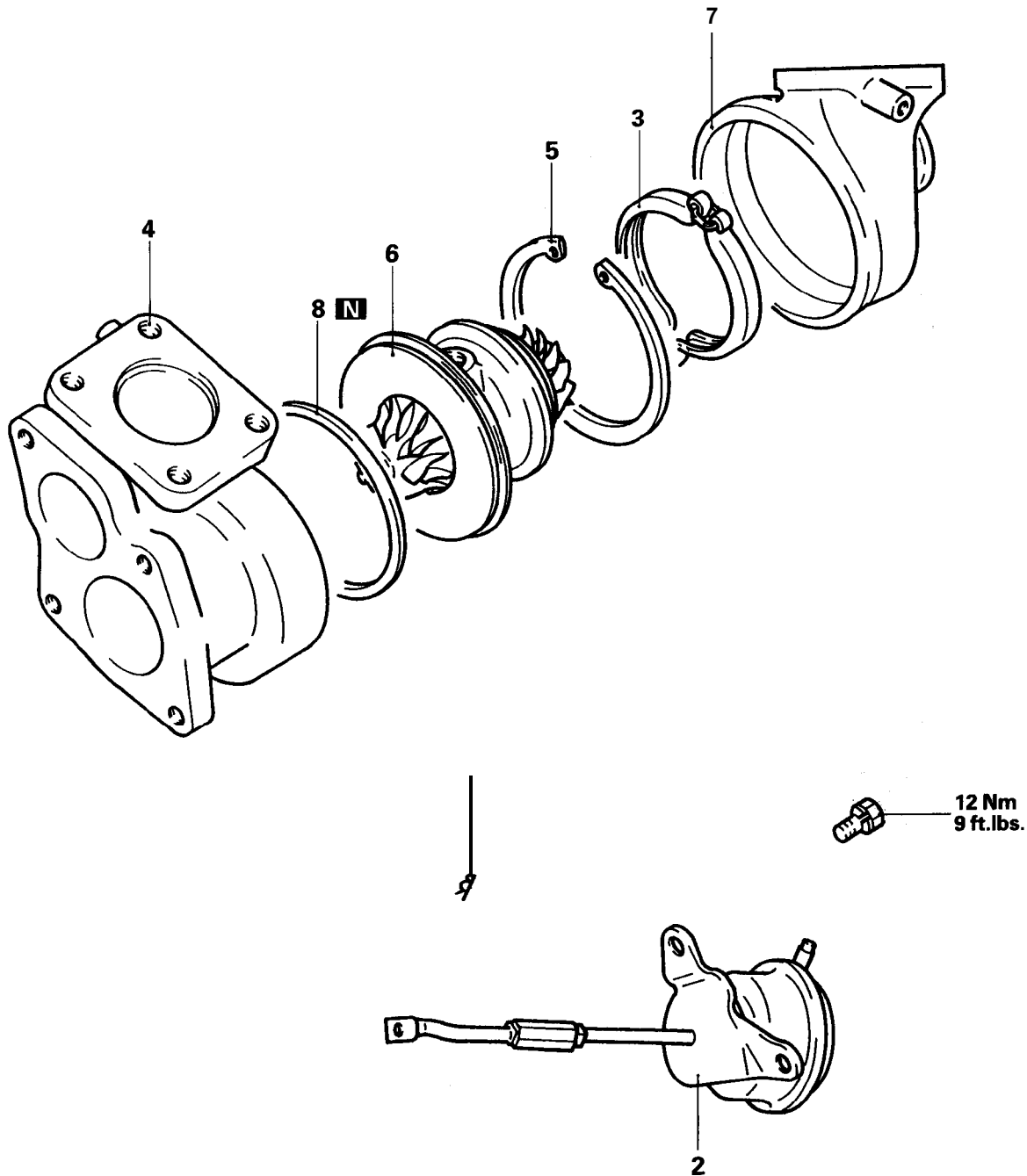
**Caution**

**Keep the O-ring free of oil or grease.**



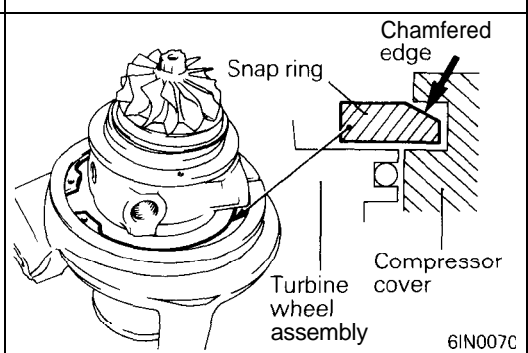
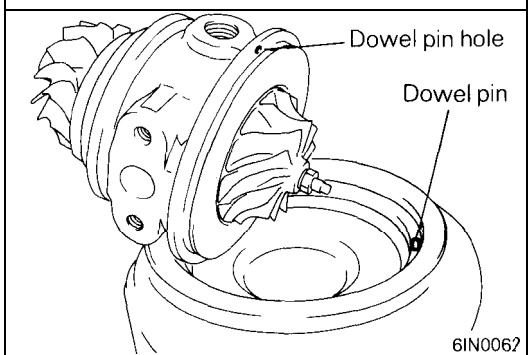
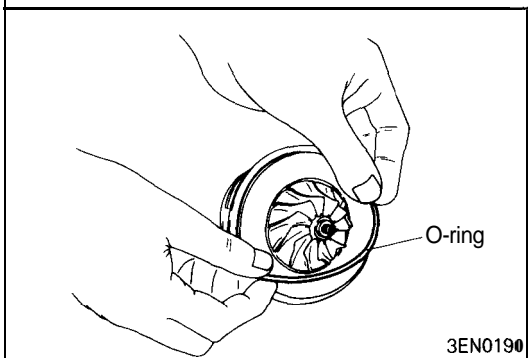
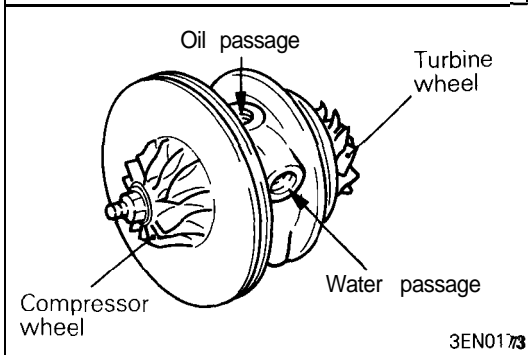
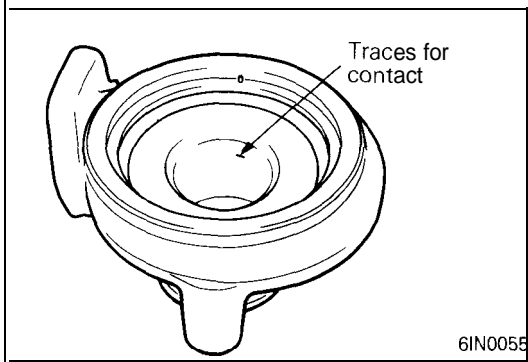
# TURBOCHARGER

## DISASSEMBLY AND REASSEMBLY



### Disassembly steps

- ◆F◆ Inspection of turbocharger waste gate actuator operation
  1. Snap pin
  2. Turbocharger waste gate actuator
- ◆E◆ 3. Coupling
- ◆D◆ 4. Turbine housing
- ◆C◆ 5. Snap ring
- ◆B◆ 6. Turbine wheel assembly
  7. Compressor cover
- ◆A◆ 8. O-ring



## INSPECTION

### TURBINE HOUSING

- (1) Check the housing for traces of contact with the turbine wheel, cracks due to overheating, pitching, deformation and other damage. Replace with a new turbine housing if cracked.
- (2) Operate the turbocharger waste gate valve lever manually to check that the gate can be opened and closed smoothly.

### COMPRESSOR COVER

- (1) Check the compressor cover for traces of contact with the compressor wheel and other damage.

### TURBINE WHEEL ASSEMBLY

- (1) Check the turbine and compressor wheel blades for bend, burr, damage, corrosion and traces of contact on the back side and replace if defective.
- (2) Check the oil passage of the turbine wheel assembly for deposit and clogging.
- (3) In the case of water cooled type, check also the water passage for deposit and clogging.
- (4) Check the turbine wheel and compressor wheel for light and smooth turning.

## REASSEMBLY SERVICE POINTS

### ◆A◆ O-RING INSTALLATION

- (1) Apply a light coat of engine oil to a new O-ring and fit in the turbine wheel assembly groove.

### ◆B◆ TURBINE WHEEL ASSEMBLY INSTALLATION

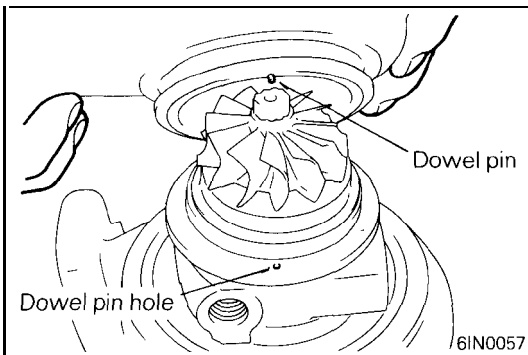
- (1) Install the turbine wheel assembly to the compressor cover in relation to the dowel pin.

#### Caution

Use care not to damage the blades of turbine wheel and compressor wheel.

### ◆C◆ SNAP RING INSTALLATION

- (1) Fit the snap ring with its chamfered side facing up.

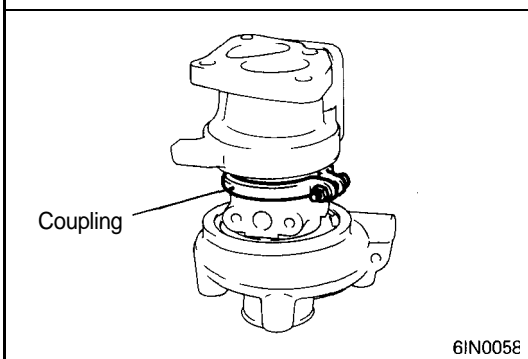


### ◆D◆ TURBINE HOUSING INSTALLATION

- (1) Install the turbine housing in relation to the dowel pin.

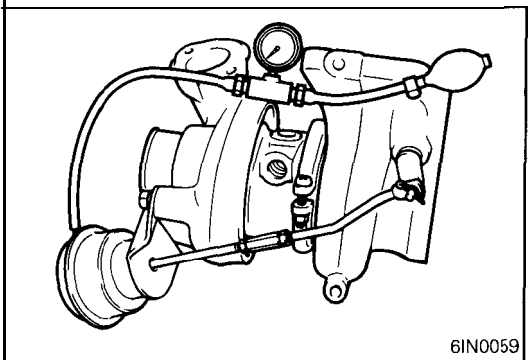
#### Caution

Use care not to damage the blades of turbine wheel.



### ◆E◆ COUPLING INSTALLATION

- (1) Install the coupling and tighten to specified torque.



### ◆F◆ TURBOCHARGER WASTE GATE ACTUATOR OPERATION INSPECTION

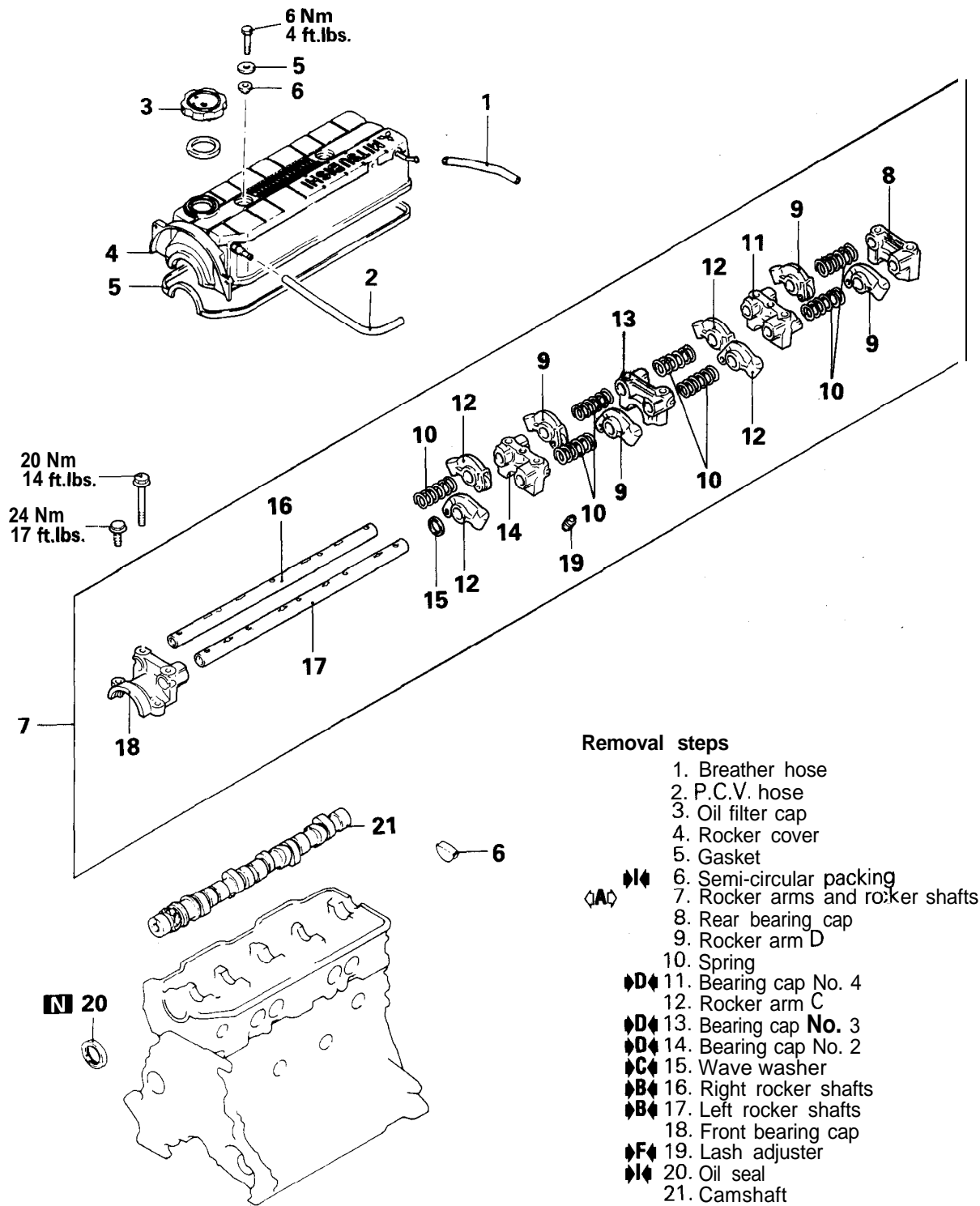
- (1) Using a tester, apply a pressure of approx. 72 kPa (10.3 psi) to the actuator and make sure that the rod moves.

#### Caution

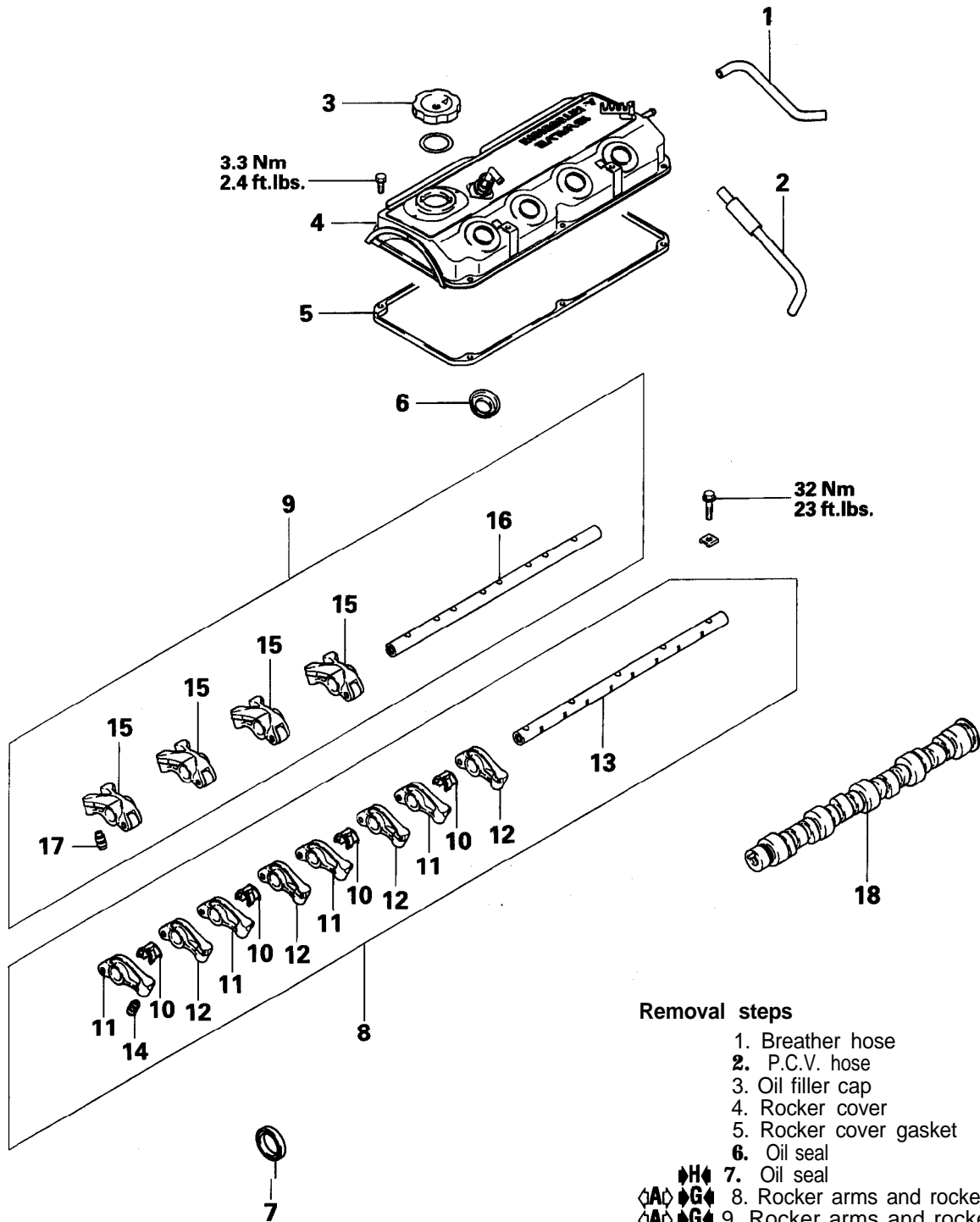
Do not apply a pressure of more than 85 kPa (12.4 psi) to the actuator. Otherwise, the diaphragm may be damaged. Never attempt to adjust the turbocharger waste gate valve.

# ROCKER ARMS AND CAMSHAFT

## REMOVAL AND INSTALLATION - SOHC 8 VALVE



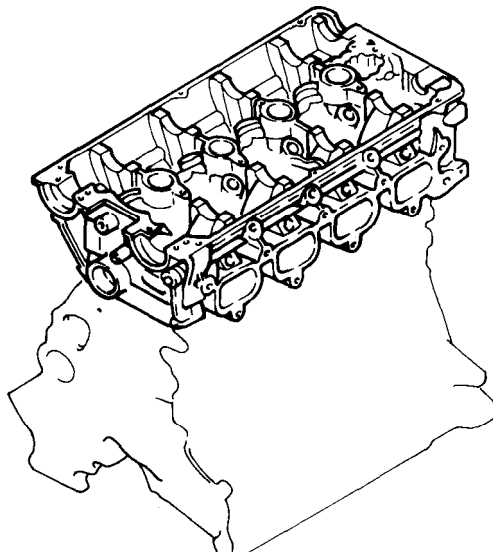
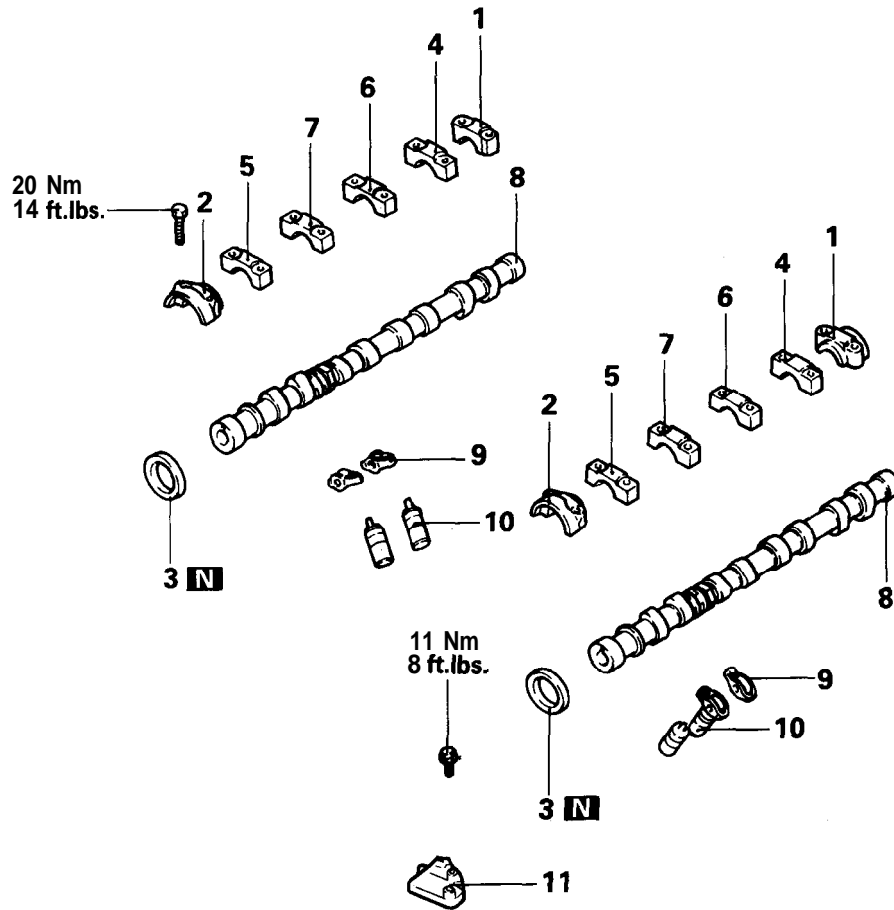
REMOVAL AND INSTALLATION – SOHC 16 VALVE



Removal steps

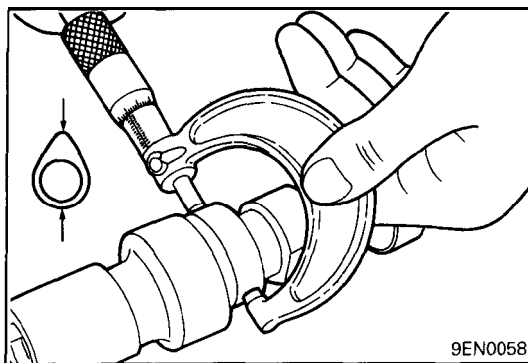
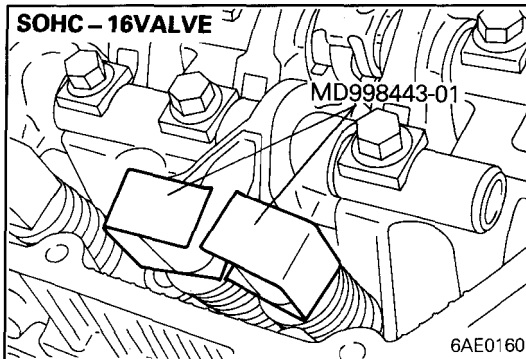
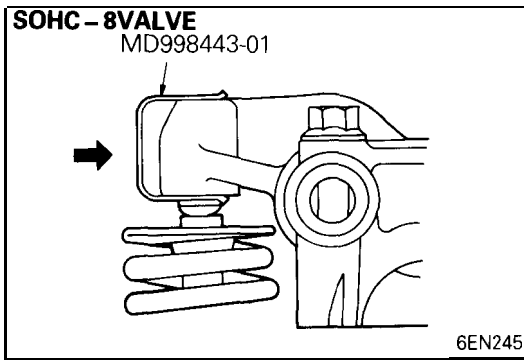
1. Breather hose
2. P.C.V. hose
3. Oil filler cap
4. Rocker cover
5. Rocker cover gasket
6. Oil seal
7. Oil seal
8. Rocker arms and rocker arm shaft
9. Rocker arms and rocker arm shaft
10. Rocker shaft spring
11. Rocker arm A
12. Rocker arm B
13. Rocker arm shaft (Intake side)
14. Lash adjuster
15. Rocker arm C
16. Rocker arm shaft (Exhaust side)
17. Lash adjuster
18. Camshaft

REMOVAL AND INSTALLATION – DOHC



Removal steps

- ◆E◆ 1. Bearing cap rear
- ◆E◆ 2. Bearing cap front
- ◆H◆ 3. Camshaft oil seal
- ◆E◆ 4. Bearing cap No. 5
- ◆E◆ 5. Bearing cap No. 2
- ◆E◆ 6. Bearing cap No. 4
- ◆E◆ 7. Bearing cap No. 3
- ◆A◆ 8. Camshaft
- ◆A◆ 9. Rocker arm
- ◆F◆ 10. Lash adjuster
- ◆ 11. Oil delivery body



**REMOVAL SERVICE POINT**

**ROCKER ARMS AND ROCKER ARM SHAFTS REMOVAL**

- (1) Before removing rocker arms and shafts assembly, install the special tool as illustrated to prevent adjuster from dropping.

**INSPECTION**

**CAMSHAFT**

- (1) Measure the cam height.

**SOHC**

mm (in.)

Identification mark	Standard value	Limit
Intake		
D	42.40 (1.6693)	41.90 (1.6496)
1.2	37.39 (1.4720)	36.89 (1.4524)
Exhaust		
D	42.40 (1.6693)	41.90 (1.6496)
1.2	37.47 (1.4752)	36.97 (1.4555)

**DOHC**

mm (in.)

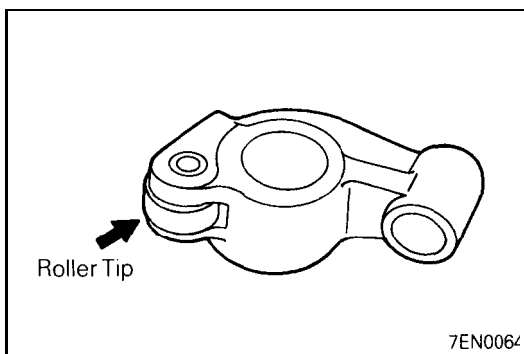
Identification mark	Standard value	Limit
Intake		
A, D	35.49 (1.3972)	34.99 (1.3776)
B, E	35.20 (1.3858)	34.70 (1.3661)
Exhaust		
A	35.20 (1.3858)	34.70 (1.3661)
C	35.49 (1.3972)	34.99 (1.3776)

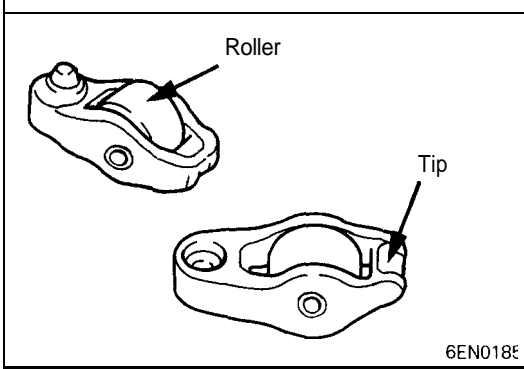
**NOTE**

The camshaft identification mark is stamped on the opposite end of the camshaft sprocket side.

**ROCKER ARM**

- (1) Check the roller surface. If any dents, damage or seizure is evident, replace the rocker arm.
- (2) Check rotation of the roller. If it does not rotate smoothly or if looseness is evident, replace the rocker arm.
- (3) Check the inside diameter. If damage or seizure is evident, replace the rocker arm.

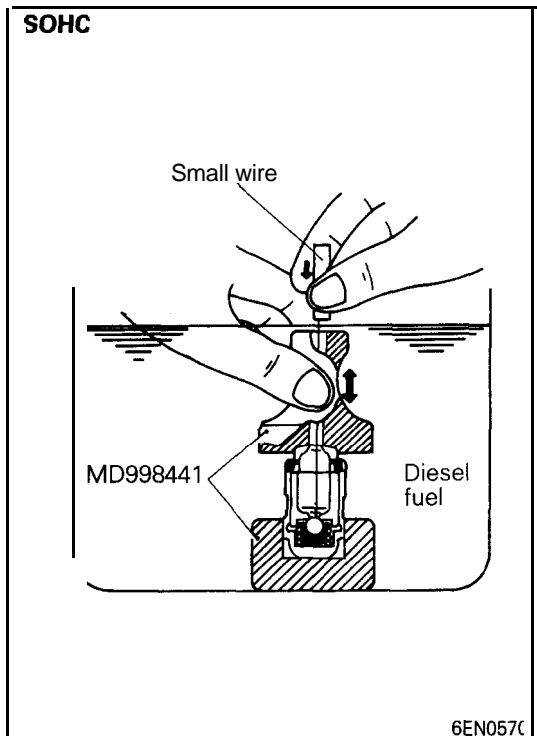




### LASH ADJUSTER LEAK DOWN TEST

#### Caution

1. The lash adjuster is a precision part. Keep it free from dust and other foreign matter.
2. Do not disassemble lash adjuster.
3. When cleaning lash adjuster, use clean diesel fuel only.



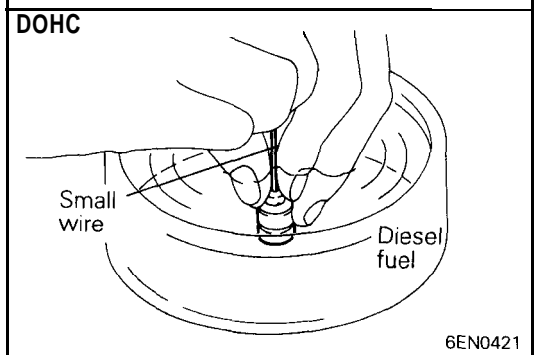
- (1) immerse the lash adjuster in clean diesel fuel.
- (2) While lightly pushing down inner steel ball using the small wire, move the plunger up and down four or five times to bleed air.

Use of the retainer helps facilitate the air bleeding of the rocker arm mounted type lash adjuster.

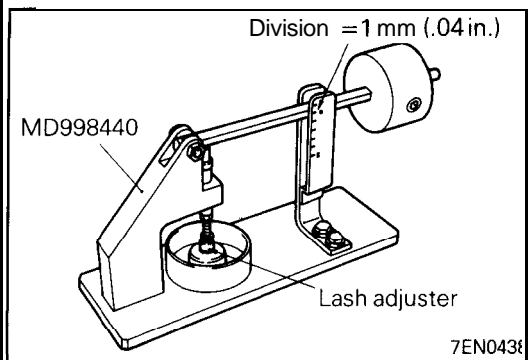
- (3) Remove the small wire and press the plunger. If the plunger is hard to be pushed in, the lash adjuster is normal. If the plunger can be pushed in all the way readily, bleed the lash adjuster again and test again. If the plunger is still loose, replace the lash adjuster.

#### Caution

Upon completion of air bleeding, hold lash adjuster upright to prevent inside diesel fuel from spilling.

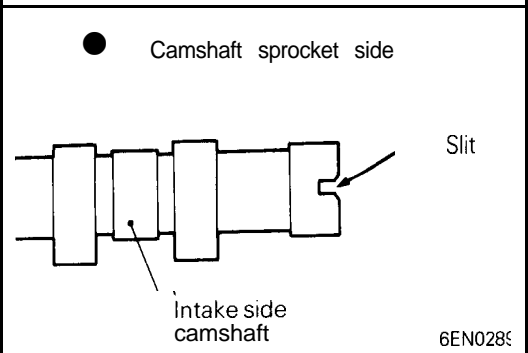
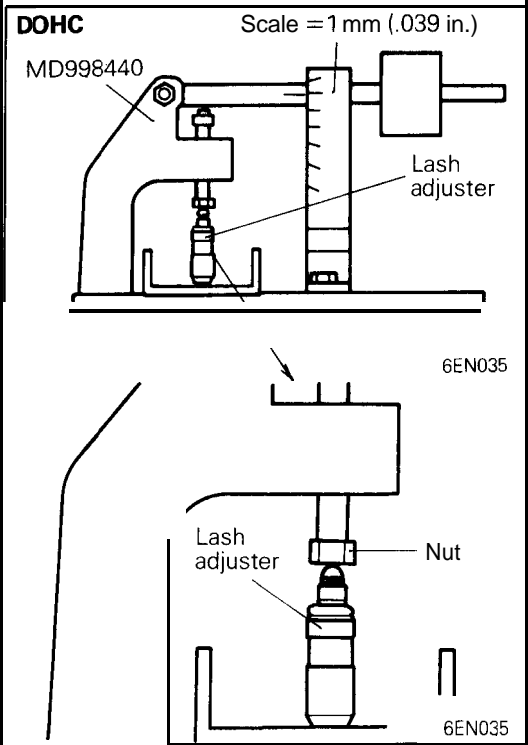






- (4) After air bleeding, set lash adjuster on the special tool (Leak down tester MD998440).
- (5) After plunger has gone down somewhat (.2 – .5 mm), measure time taken for it to go down 1 mm. Replace if measured time is out of specification.

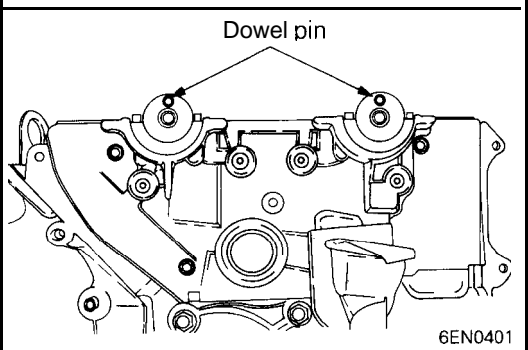
**Standard value: 4 – 20 seconds / 1 mm (.04 in.)**  
**[Diesel fuel at 15 – 20°C (59 – 68°F)]**

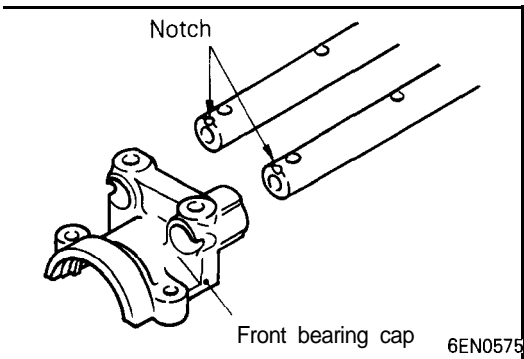


## REASSEMBLY SERVICE POINTS

### ▶▶ CAMSHAFT INSTALLATION

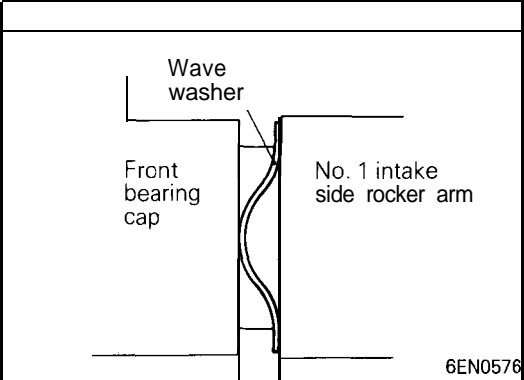
- (1) Apply engine oil to journals and cams of the camshafts.
- (2) Install the camshafts on the cylinder head.  
 Use care not to confuse the intake camshaft with the exhaust one. The intake camshaft has a slit on its rear end for driving the crankshaft position sensor.
- (3) Install the crankshaft sprocket B or spacer and flange to an end of the crankshaft, and turn the crankshaft until the timing marks are lined up, setting No. 1 cylinder to the TDC.
- (4) Set the camshafts so that their dowel pins are positioned at top.





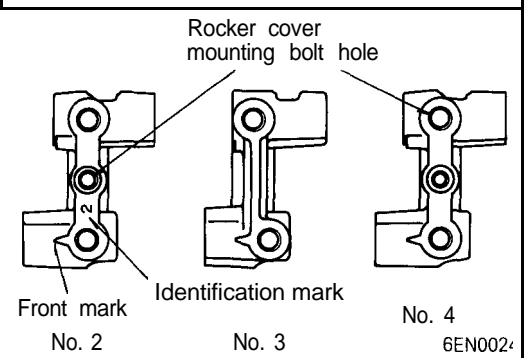
**B** ROCKER SHAFTS INSTALLATION

- (1) Insert the rocker arm shaft into the front bearing cap so that the notch on the shaft faces up, and insert the installation bolt without tightening it.



**C** WAVE WASHER INSTALLATION

- (1) Install the wave washer in correct direction as shown.



**D** CAMSHAFT BEARING CAPS IDENTIFICATION

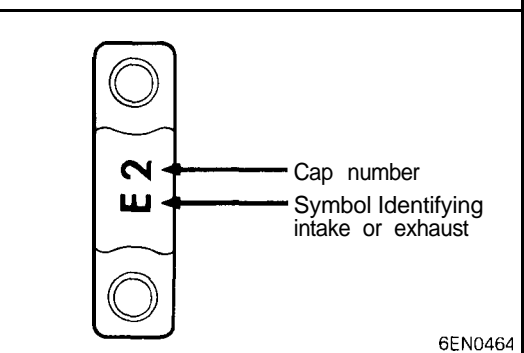
- (1) No. 3 bearing cap looks very similar to No. 2 and No. 4 bearing caps.

Use the identification marks shown at left for identification.

**NOTE**

No. 2 bearing cap is the same as No. 4 bearing cap.

- (2) Install the bearing caps with their front marks pointing to camshaft sprocket side.

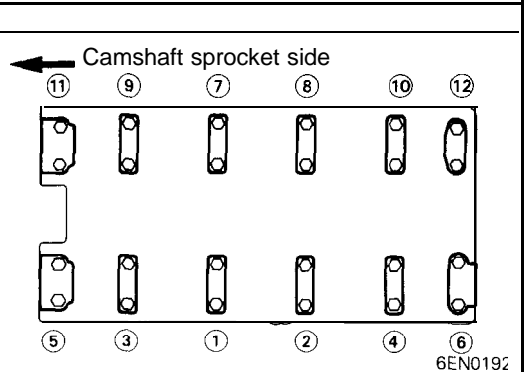


**E** BEARING CAPS INSTALLATION

- (1) According to the identification mark stamped on top of each bearing cap, install the caps to the cylinder head. Only "L" or "R" is stamped on No. 1 bearing cap. Cap No. is stamped on No. 2 to No. 5 bearing caps. No. 6 bearing cap has no stamping.

I: For intake camshaft side

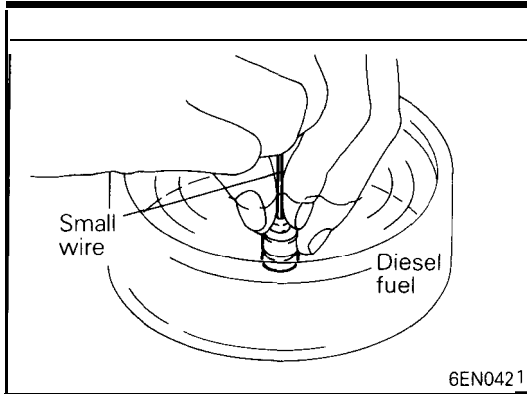
E: For exhaust camshaft side



- (2) Tighten the bearing caps in the order shown two to three times by torquing progressively.

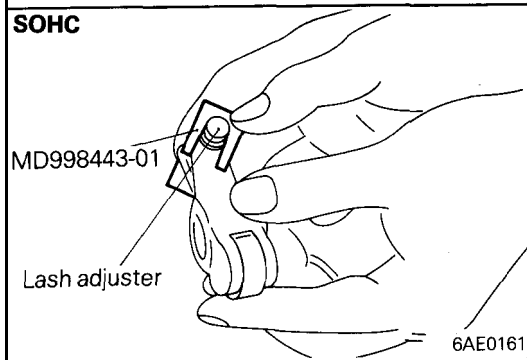
Tighten to specification in the final sequence.

- (3) Check to ensure that the rocker arm is held in position on the lash adjuster and valve stem end.

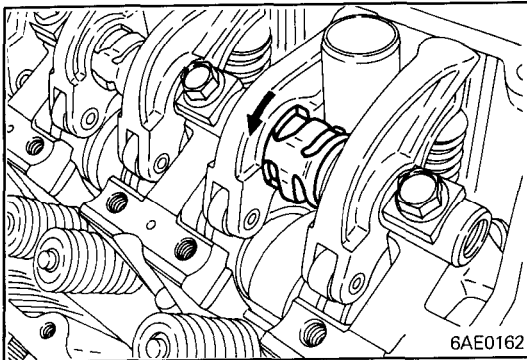


### ◆F◆ LASH ADJUSTER INSTALLATION

- (1) Immerse the lash adjuster in clean diesel fuel.
- (2) Using a small wire, move the plunger up and down 4 or 5 times while pushing down lightly on the check ball in order to bleed out the air.



- (3) Insert the lash adjuster to rocker arm, being careful not to spill the diesel fuel. Then use the special tool to prevent adjuster from falling while installing it.

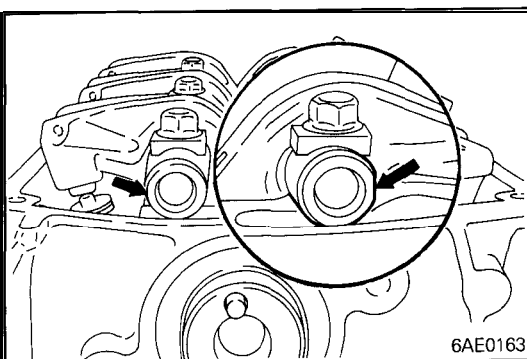


### ◆G◆ ROCKER SHAFT SPRING INSTALLATION ROCKER ARMS AND ROCKER ARM **SHAFT**

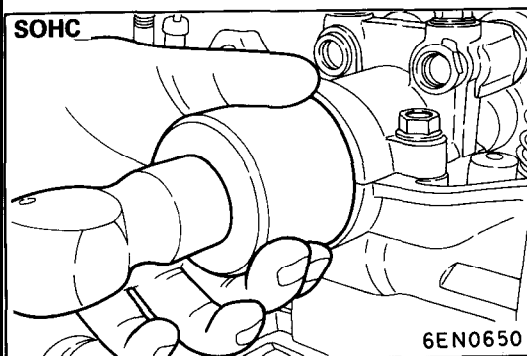
- (1) Temporarily tighten the rocker shaft with the bolt so that all rocker arms on the inlet valve side do not push the valves.
- (2) Fit the rocker shaft spring from the above and position it so that it is right angles to the plug guide.

#### NOTE

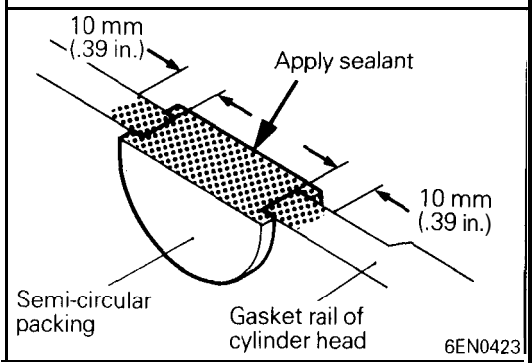
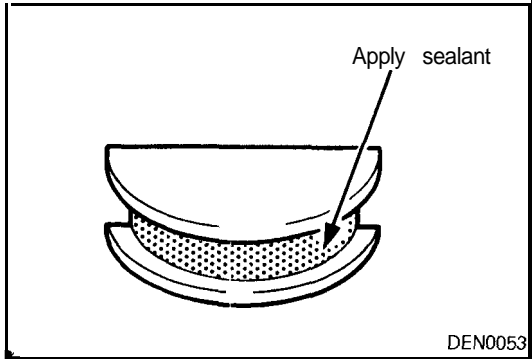
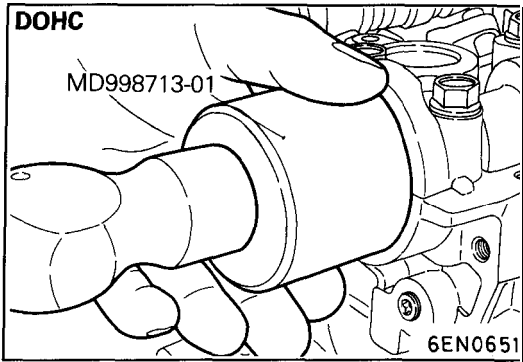
Install the rocker shaft spring before installing the exhaust side rocker arms and rocker arm shaft.



- (3) Remove the special tool for securing the lash adjuster.
- (4) Make sure that the notch in the rocker arm shaft is in the direction as illustrated.



### ◆H◆ CAMSHAFT OIL SEAL INSTALLATION



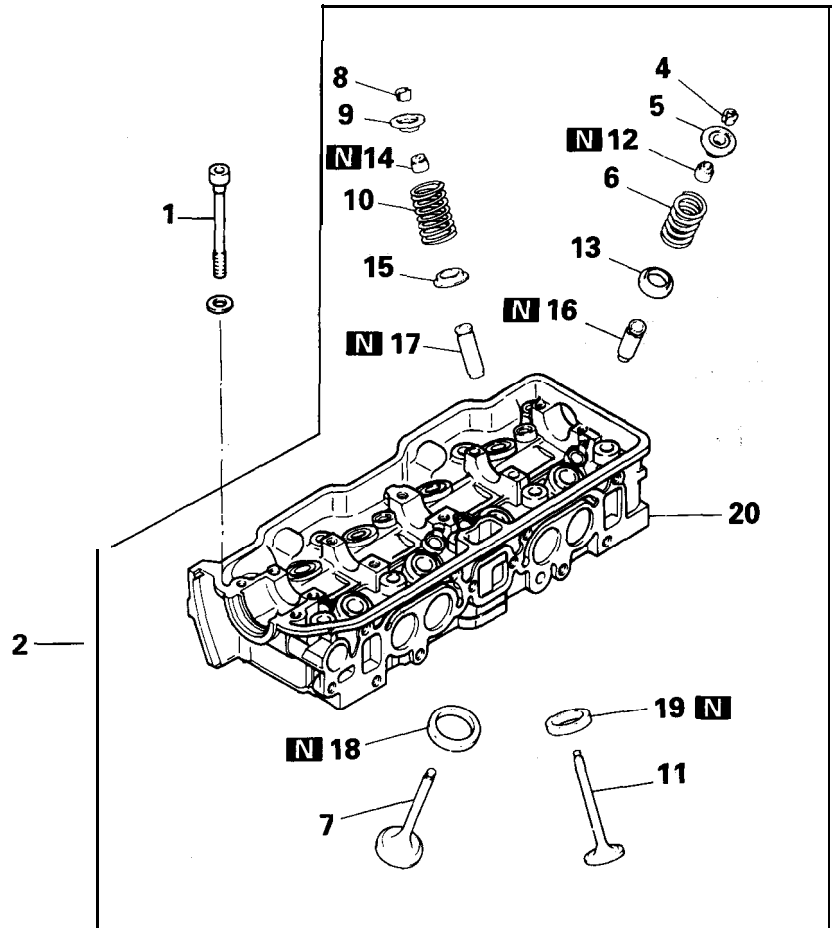
SEMI-CIRCULAR PACKING INSTALLATION

Specified sealant:

3M ATD Part No. 8660 or equivalent

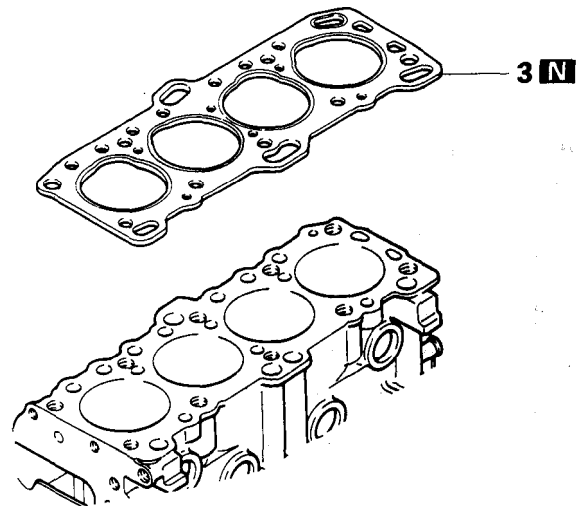
# CYLINDER HEAD AND VALVES

## REMOVAL AND INSTALLATION – SOHC – 8VALVE

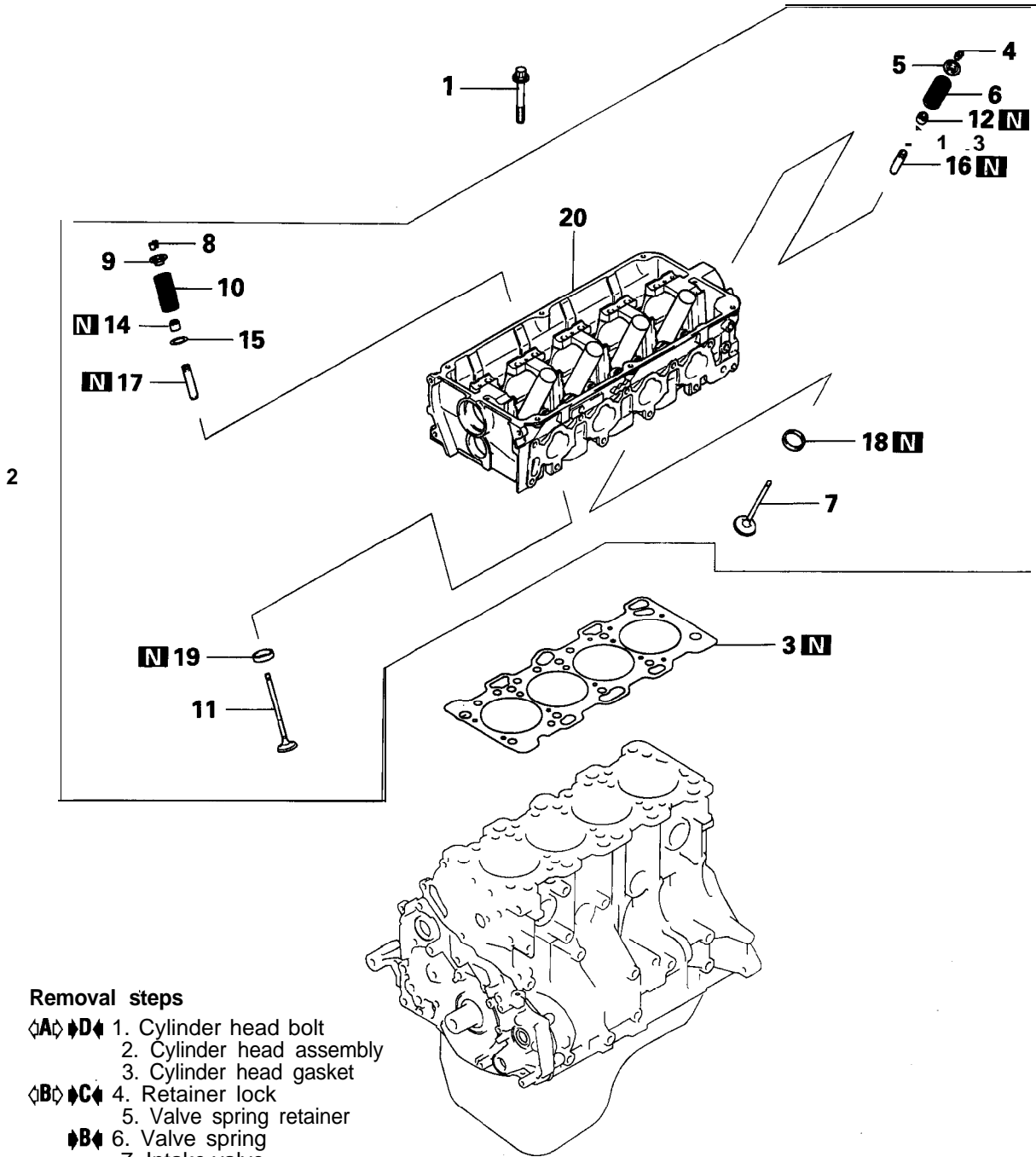


### Removal steps

- ◀A▶ ▶D▶ 1. Cylinder head bolt
- 2. Cylinder head assembly
- ▶C▶ 3. Gasket
- 4. Retainer lock
- 5. Valve spring retainer
- ▶B▶ 6. Valve spring
- 7. Intake valve
- 8. Retainer lock
- 9. Valve spring retainer
- ▶B▶ 10. Valve spring
- 11. Exhaust valve
- ▶B▶ ▶A▶ 12. Valve stem seal
- 13. Valve spring seat
- ▶B▶ ▶A▶ 14. Valve stem seal
- 15. Valve spring seat
- 16. Intake valve guide
- 17. Exhaust valve guide
- 18. intake valve seat
- 19. Exhaust valve seat
- 20. Cylinder head



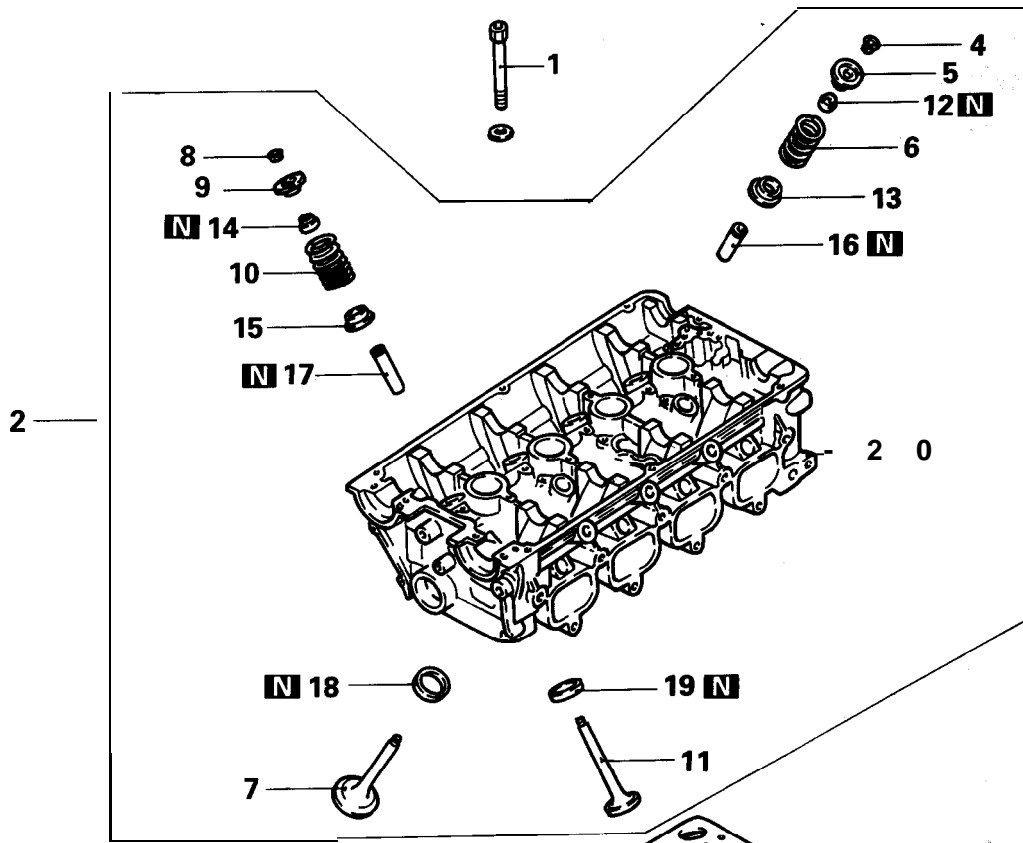
REMOVAL AND INSTALLATION – SOHC – 16VALVE



Removal steps

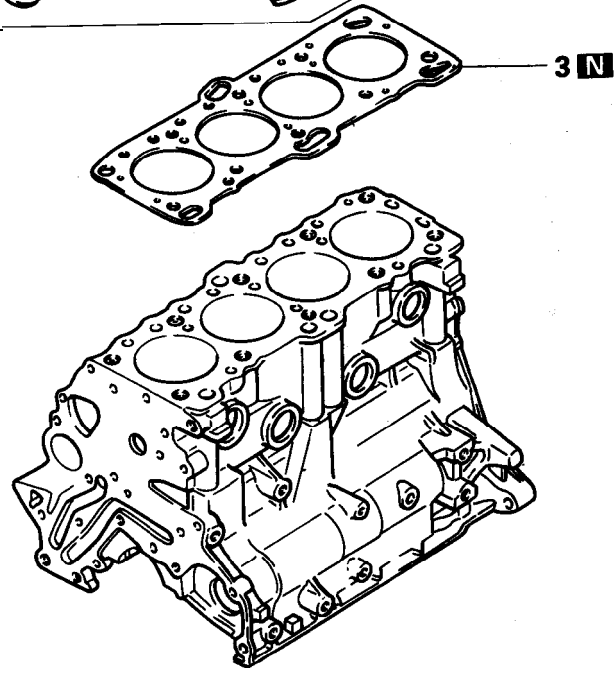
- ◊A◊▶D◊ 1. Cylinder head bolt
- 2. Cylinder head assembly
- 3. Cylinder head gasket
- ◊B◊▶C◊ 4. Retainer lock
- 5. Valve spring retainer
- ▶B◊ 6. Valve spring
- 7. Intake valve
- ◊B◊▶C◊ 8. Retainer lock
- 9. Valve spring retainer
- ▶B◊ 10. Valve spring
- 11. Exhaust valve
- ◊C◊▶A◊ 12. Valve stem seal
- 13. Valve spring seat
- ◊C◊▶A◊ 14. Valve stem seal
- 15. Valve spring seat
- 16. Intake valve guide
- 17. Exhaust valve guide
- 18. Intake valve seat
- 19. Exhaust valve seat
- 20. Cylinder head

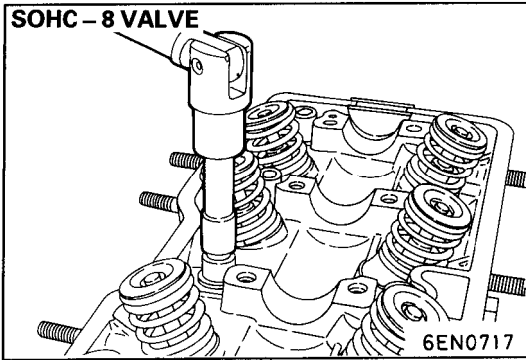
REMOVAL AND INSTALLATION – DOHC



Removal steps

- ◊A◊▶E◊ 1. Cylinder head bolt
- 2. Cylinder head assembly
- ▶D◊ 3. Gasket
- ◊B◊▶C◊ 4. Retainer lock
- 5. Valve spring retainer
- ▶B◊ 6. Valve spring
- 7. Intake valve
- ◊B◊▶C◊ 8. Retainer lock
- 9. Valve spring retainer
- ▶B◊ 10. Valve spring
- 11. Exhaust valve
- ◊C◊▶A◊ 12. Valve stem seal
- 13. Valve spring seat
- ◊C◊▶A◊ 14. Valve stem seal
- 15. Valve spring seat
- 16. Intake valve guide
- 17. Exhaust valve guide
- 18. Intake valve seat
- 19. Exhaust valve seat
- 20. Cylinder head

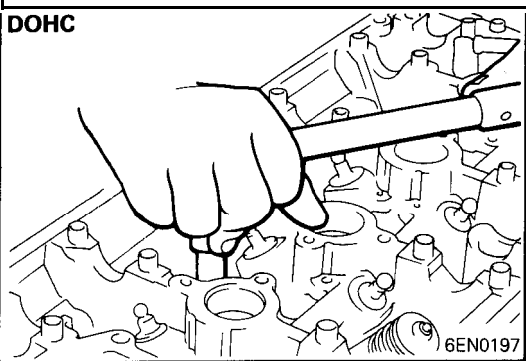
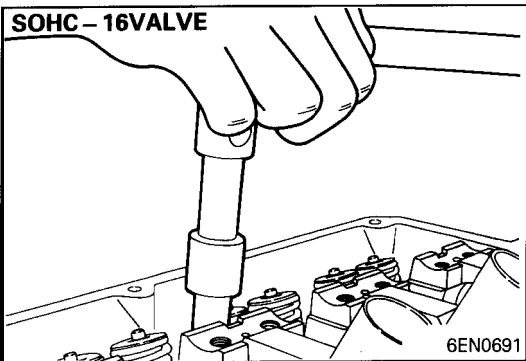


**REMOVAL SERVICE POINTS****PRECAUTION FOR REMOVED PARTS**

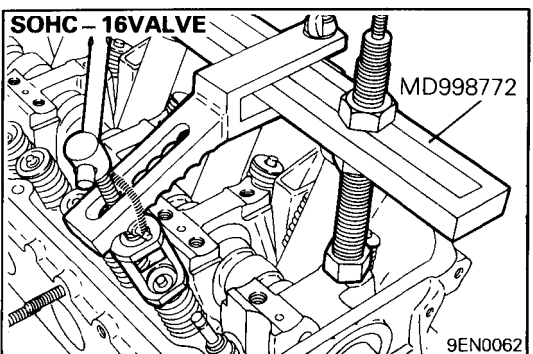
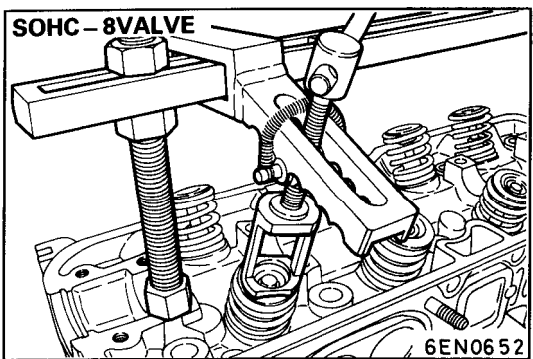
- (1) Keep removed parts in order according to the cylinder number and intake/exhaust.

**◁A▷ CYLINDER HEAD BOLTS REMOVAL**

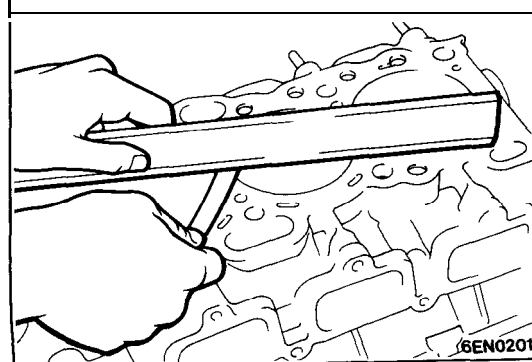
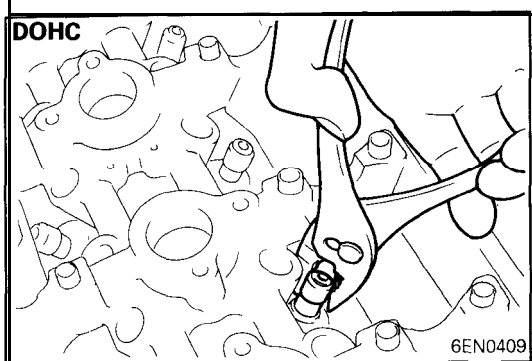
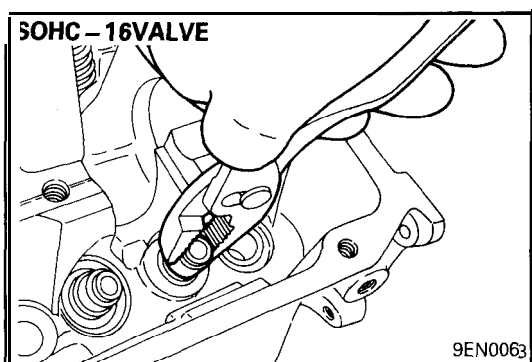
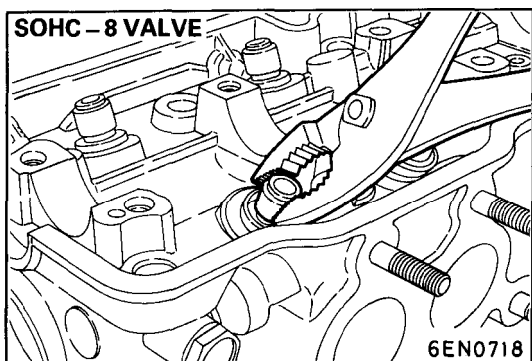
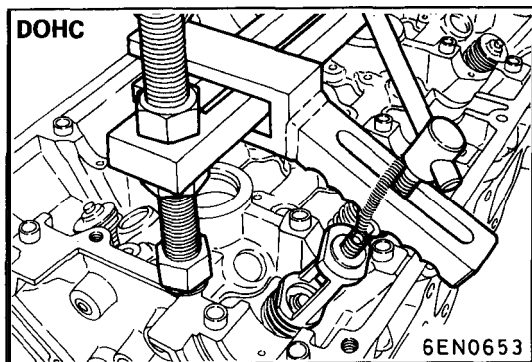
- (1) Using the 12 mm – 12 points socket wrench, loosen the cylinder head bolts. Loosen evenly, little by little.

**◁B▷ RETAINER LOCK REMOVAL**

- (1) Store removed valves, springs and other parts, tagged to indicate their cylinder No. and location for reassembly.







**⦿ VALVE STEM SEAL REMOVAL**

(1) Do not reuse valve stem seal.

**INSPECTION  
CYLINDER HEAD**

(1) Check the cylinder head gasket surface for flatness by using a straightedge and thickness gauge.

**Standard value: 0.05 mm (.0020 in.)  
Limit: 0.2 mm (.008 in.)**

(2) If the service limit is exceeded, correct to meet specification.

Grinding limit: \*0.2 mm (.008 in.)

\* Includes combined with cylinder block grinding.

Cylinder head height (Specification when new):

SOHC – 8VALVE

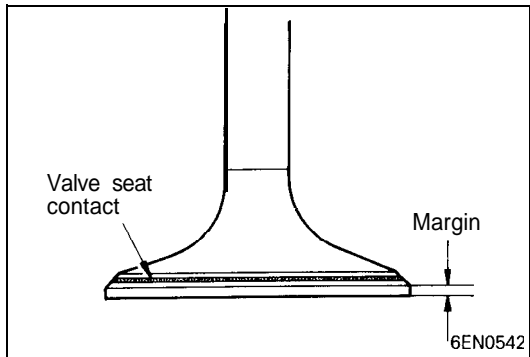
89.9 – 90.1 mm (3.539 – 3.547 in.)

SOHC – 16VALVE

119.9 – 120.1 mm (4.720 – 4.728 in.)

DOHC

131.9 – 132.1 mm (5.193 – 5.201 in.)



#### VALVE

- (1) Check the valve face for correct contact. If incorrect, reface using valve refacer. Valve seat contact should be maintained uniform at the center of valve face.
- (2) If the margin exceeds the service limit, replace the valve.

Standard value:

SOHC – 8VALVE

Intake 1.2 mm (.047 in.)

Exhaust 2.0 mm (.079 in.)

SOHC – 16VALVE

Intake 1.0 mm (.039 in.)

Exhaust 1.2 mm (.047 in.)

DOHC

Intake 1.0 mm (.039 in.)

Exhaust 1.5 mm (.059 in.)

Limit:

SOHC – 8VALVE

Intake 0.7 mm (.028 in.)

Exhaust 1.5 mm (.059 in.)

SOHC – 16VALVE

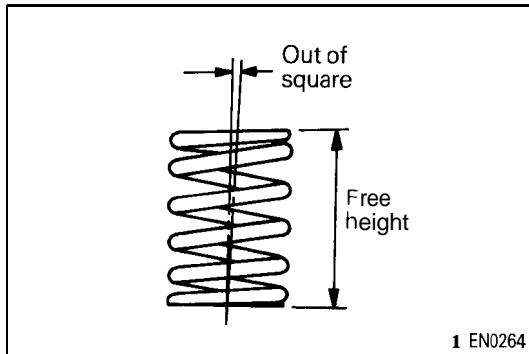
Intake 0.5 mm (.020 in.)

Exhaust 0.7 mm (.028 in.)

DOHC

Intake 0.7 mm (.028 in.)

Exhaust 1.0 mm (.039 in.)



#### VALVE SPRING

- (1) Measure the free height of spring and, if it is smaller than the limit, replace.

SOHC – 8VALVE

Identification color: White

Standard value: 49.8 mm (1.961 in.)

Limit: 48.8 mm (1.921 in.)

SOHC – 16VALVE

Identification color: White

Standard value: 51.0 mm (2.008 in.)

Limit 50.0 mm (1.969 in.)

DOHC

Identification color: Blue

Standard value: 48.3 mm (1.902 in.)

Limit: 47.3 (1.862 in.)

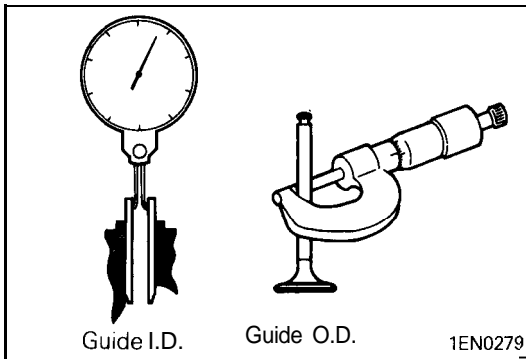
- (2) Measure the squareness of the spring and, if the limit is exceeded, replace.

**Standard value:**

**SOHC 2° or less**

**DOHC 1.5° or less**

**Limit: Max. 4°**



**VALVE GUIDE**

- (1) Measure the clearance between the valve guide and valve stem. If the limit is exceeded, replace the valve guide or valve, or both.

**Standard value:**

**SOHC – 8VALVE**

**Intake 0.02 – 0.06 mm (.0008 – .0024 in.)**

**Exhaust 0.05 – 0.09 mm (.0020 – .0035 in.)**

**SOHC – 16VALVE**

**Intake 0.02 – 0.05 mm (.0008 – .0020 in.)**

**Exhaust 0.03 – 0.07 mm (.0012 – .0028 in.)**

**DOHC**

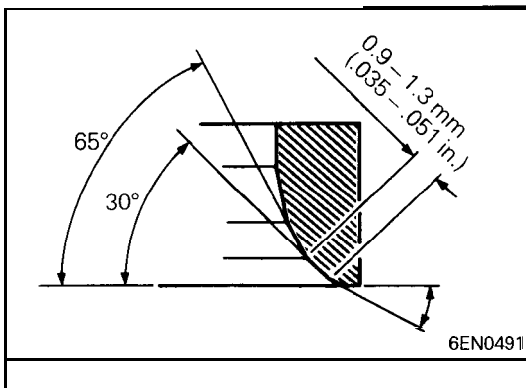
**Intake 0.02 – 0.05 mm (.0008 – .0020 in.)**

**Exhaust 0.05 – 0.09 mm (.0020 – .0035 in.)**

**Limit:**

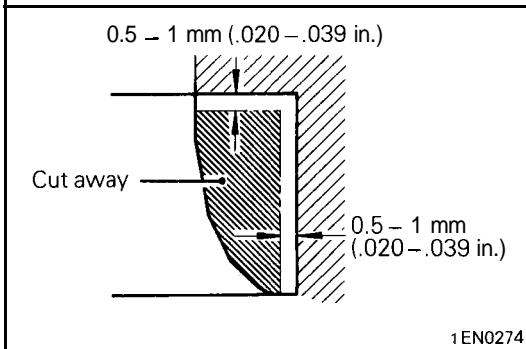
**Intake 0.10 mm (.004 in.)**

**Exhaust 0.15 mm (.006 in.)**



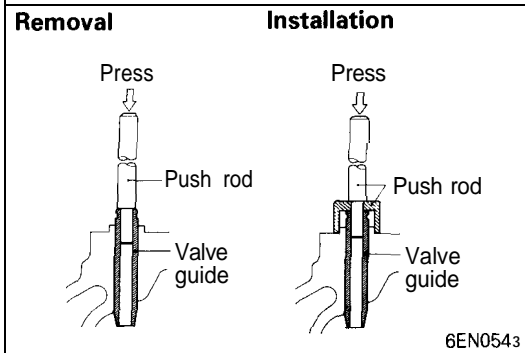
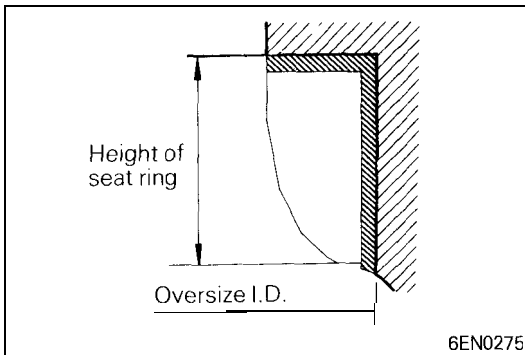
**VALVE SEAT RECONDITIONING PROCEDURE**

- (1) Before correcting the valve seat, check for clearance between the valve guide and valve and, if necessary, replace the valve guide.
- (2) Using the special tool or seat grinder, correct to obtain the specified seat width and angle.
- (3) After correction, valve and valve seat should be lapped with a lapping compound.



**VALVE SEAT REPLACEMENT PROCEDURE**

- (1) Cut the valve seat to be replaced from the inside to thin the wall thickness. Then, remove the valve seat.



- Rebore the valve seat hole in the cylinder head to a selected oversize valve seat diameter.

**Seat ring hole diameter: See “Service Specifications” on page 11F-14.**

- Before fitting the valve seat, either heat the cylinder head up to approximately 250°C (482°F) or cool the valve seat in liquid nitrogen, to prevent the cylinder head bore from galling.
- Using a valve seat cutter, correct the valve seat to the specified width and angle.  
See “VALVE SEAT RECONDITIONING PROCEDURE”.

### VALVE GUIDE REPLACEMENT PROCEDURE

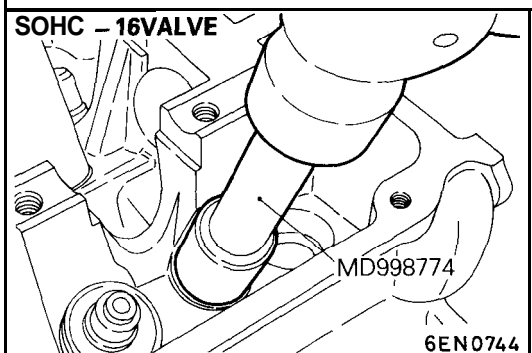
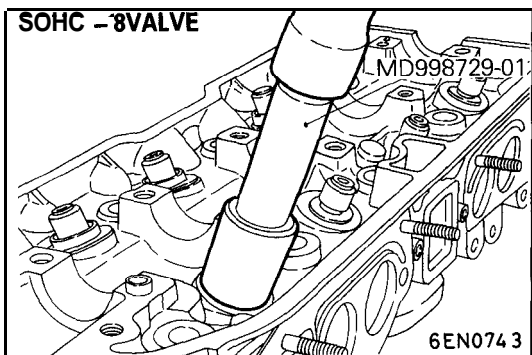
- Using the special tool and a press, remove the valve guide toward cylinder head gasket surface.
- Rebore valve guide hole to the new oversize valve guide outside diameter.

**Valve guide hole diameter: See “Service Specifications” on page 11F-14.**

#### NOTE

Do not install a valve guide of the same size again.

- Using the special tool, press-fit the valve guide, working from the cylinder head top surface.
- After installing valve guides, insert new valves in them to check for sliding condition.
- When valve guides have been replaced, check for valve contact and correct valve seats as necessary.



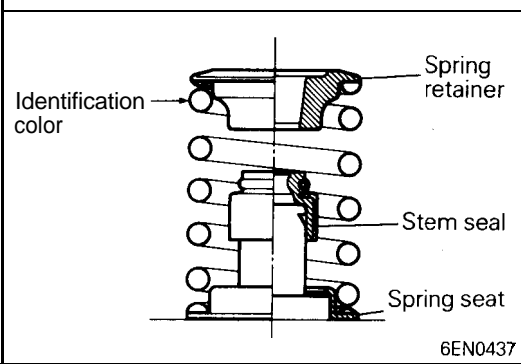
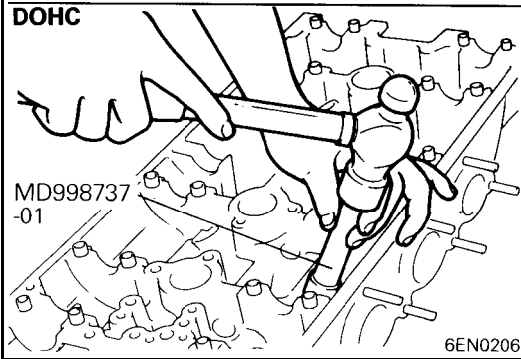
### INSTALLATION SERVICE POINTS

#### ◆A◆ VALVE STEM SEAL INSTALLATION

- Install the valve spring seat.
- The special tool must be used to install the valve stem seal. Improper installation could result in oil leaking past the valve guide.

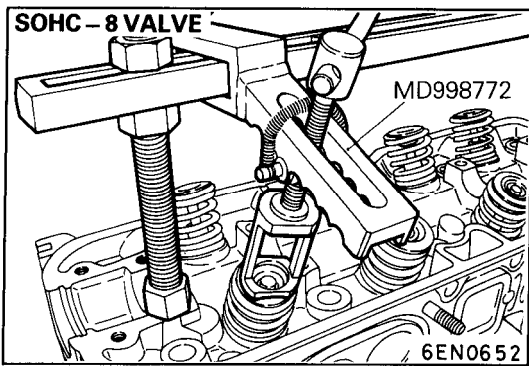
#### Caution

Do not reuse the valve stem seal.



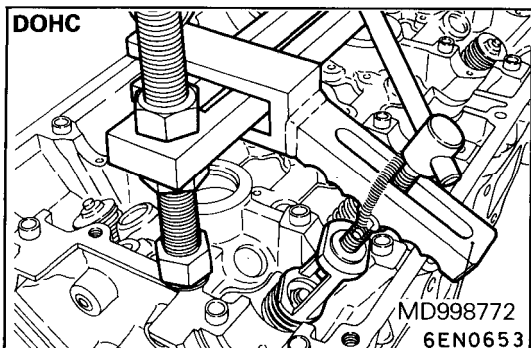
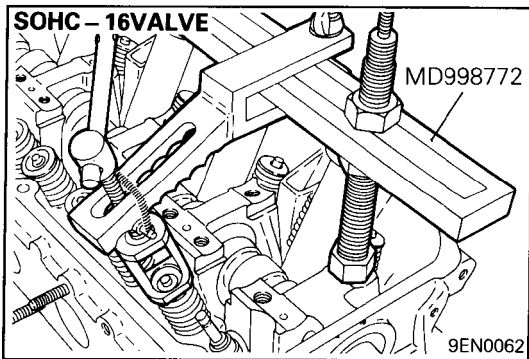
**◆B◆ VALVE SPRINGS INSTALLATION**

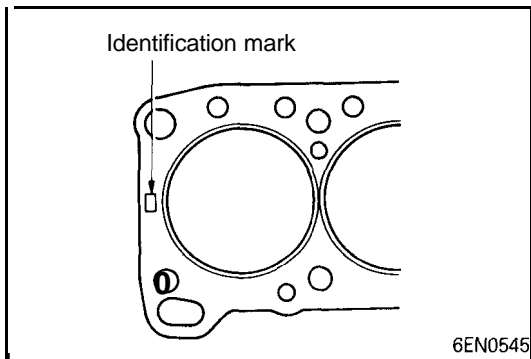
- (1) Direct the valve spring end with identification color end toward the spring retainer.



**◆C◆ RETAINER LOCK INSTALLATION**

- (1) The valve spring, if excessively compressed, causes the bottom end of retainer to be in contact with, and damage, the stem seal.





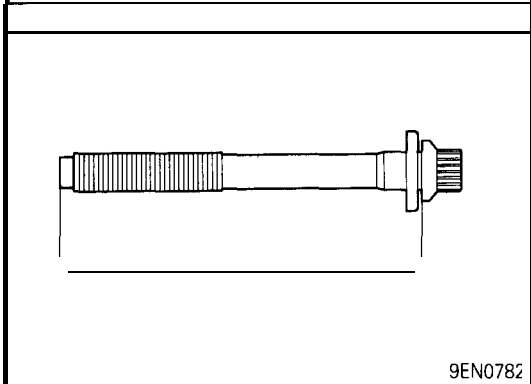
**◆D◆ CYLINDER HEAD GASKET IDENTIFICATION**

Identification mark:

<b>4G63</b> .....	<b>63</b>
<b>4G64</b> .....	<b>64</b>

**Caution**

Do not apply sealant to cylinder head gasket.



**◆E◆ CYLINDER HEAD BOLT INSTALLATION**

- (1) When installing the cylinder head bolts, check that the shank length of each bolt meets the limit. If the limit is exceeded, replace the bolt.

**Limit: Max.**

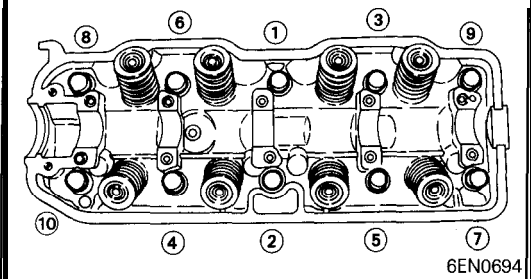
**SOHC – 8VALVE 120.4 mm (4.74 in.)**

**SOHC – 16VALVE 99.4 mm (3.91 in.)**

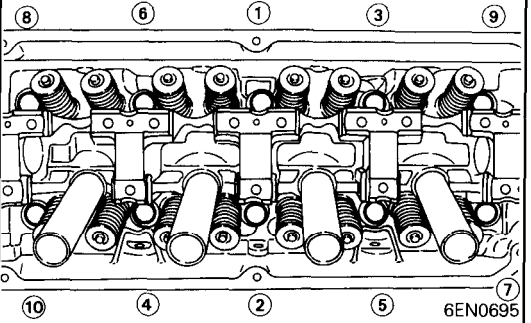
**DOHC 99.4 mm (3.91 in.)**

- (2) Apply engine oil to the threaded portions of bolts and to the washers.
- (3) According to the tightening sequence, tighten the bolts to the specified torque 80 Nm (58 ft.lbs.) use with 12 mm – 12 points socket wrench.
- (4) Loosen bolts completely.
- (5) Torque bolts to 20 Nm (14.5 ft.lbs.)
- (6) Tighten bolts 1/4 turns (90°) more.
- (7) Tighten bolts 1/4 turns (90°) additionally.

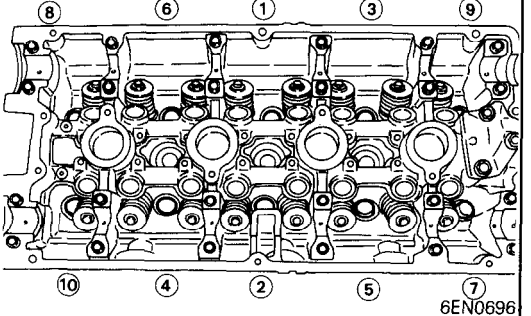
**SOHC – 8VALVE**



**SOHC – 16VALVE**

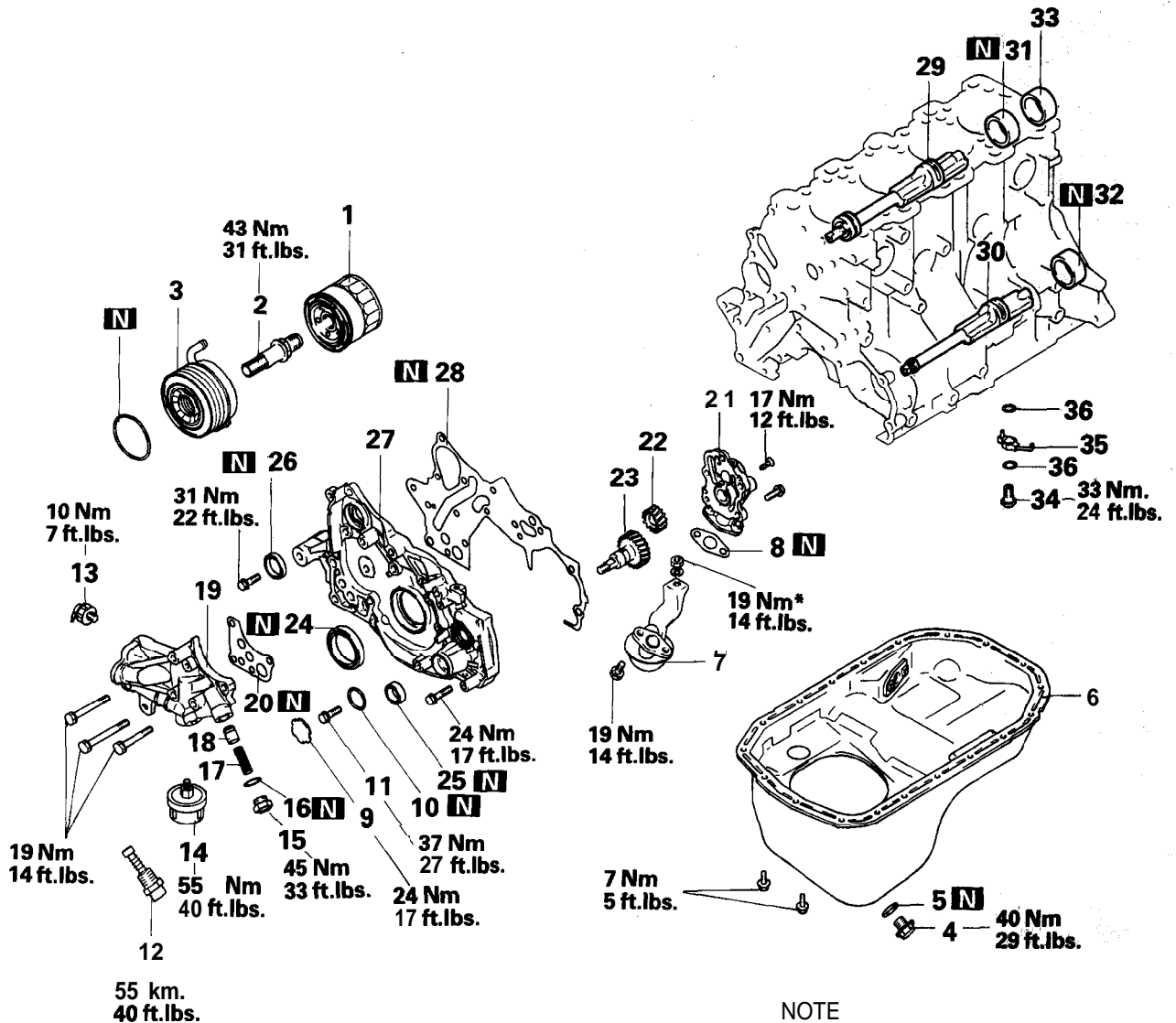


**DOHC**



# FRONT CASE, SILENT SHAFT AND OIL PAN

## REMOVAL AND INSTALLATION



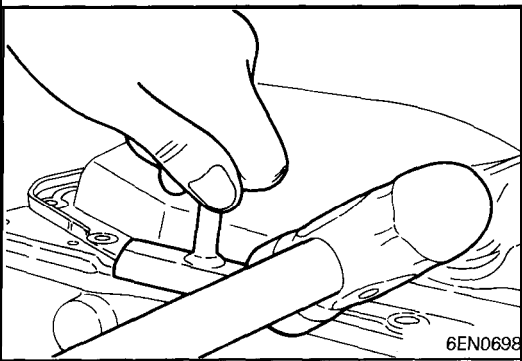
**NOTE**

\*: DOHC

\*\* : Engine with turbocharger

**Removal steps**

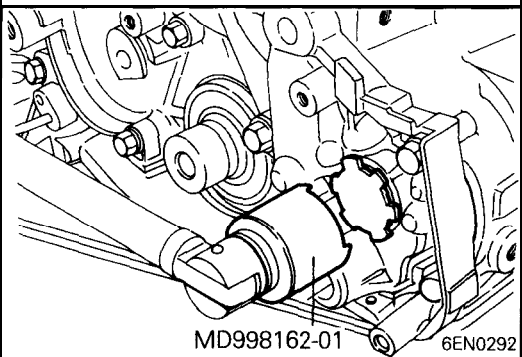
- |                              |                                       |
|------------------------------|---------------------------------------|
| 1. Oil filter                | 19. Oil filter bracket                |
| 2. Oil cooler bolt**         | 20. Oil filter bracket gasket         |
| 3. Oil cooler**              | 21. Oil pump cover                    |
| 4. Drain plug                | 22. Oil pump driven gear              |
| 5. Drain plug gasket         | 23. Oil pump drive gear               |
|                              | 24. Crankshaft front oil seal         |
| 7. Oil screen                | 25. Oil pump oil seal                 |
| 8. Oil screen gasket         | 26. Silent shaft oil seal             |
| 9. Plug                      | 27. Front case                        |
| 10. O-ring                   | 28. Front case gasket                 |
| 11. Flange bolt              | 29. Silent shaft, left                |
| 12. Oil cooler by-pass valve | 30. Silent shaft, right               |
| 13. Oil pressure switch      | 31. Silent shaft, front bearing       |
| 14. Oil pressure gauge unit  | 32. Silent shaft, rear bearing, left  |
| 15. Relief plug              | 33. Silent shaft, rear bearing, right |
| 16. Gasket                   | 34. Check valve*                      |
| 17. Relief plunger           | 35. Oil jet*                          |
| 18. Relief plunger           | 36. Gasket*                           |

**REMOVAL SERVICE POINTS****◊A◊ OIL PAN REMOVAL**

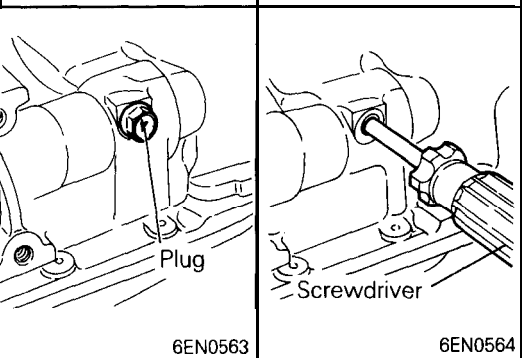
- (1) Remove all oil pan bolts.
- (2) Drive in the service tool between the cylinder block and oil pan.

**NOTE**

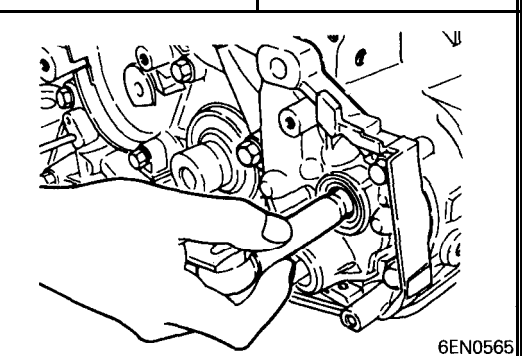
Never use a screwdriver or chisel, instead of the service tool, as a deformed oil pan flange will result in oil leakage.

**◊B◊ PLUG REMOVAL**

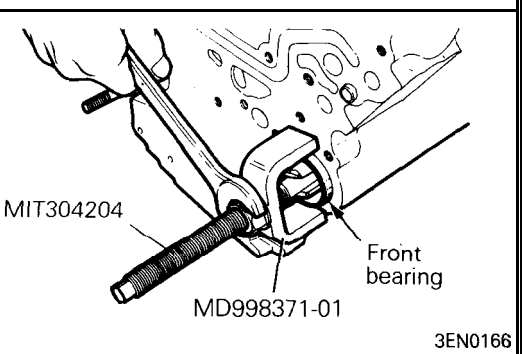
- (1) If the plug is too tight, hit the plug head with a hammer two to three times, and the plug will be easily loosened.

**◊C◊ FLANGE BOLT REMOVAL**

- (1) Remove the plug on the side of cylinder block.
- (2) Insert a Phillips screwdriver [shank diameter 8 mm (.32 in.)] into the plug hole to lock the silent shaft.



- (3) Loosen the flange bolt.

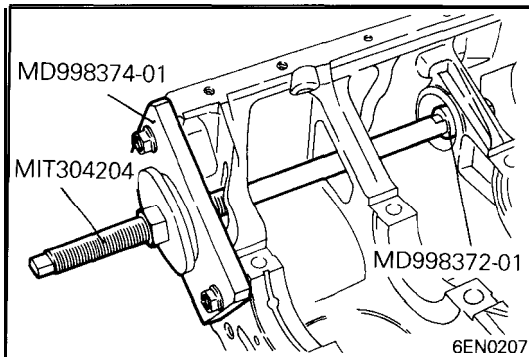
**◊D◊ SILENT SHAFT FRONT BEARING REMOVAL**

Using the special tool, remove the silent shaft front bearing from the cylinder block.

**NOTE**

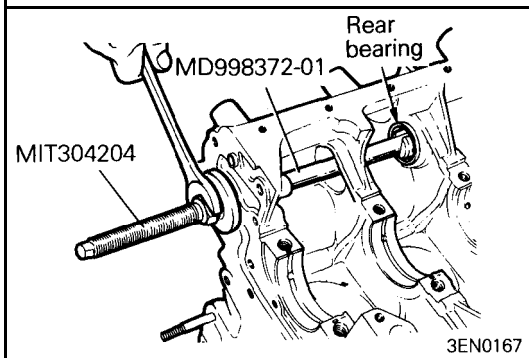
Be sure to remove the front bearing first. If it has not been removed, the Rear Bearing Puller cannot be used.





#### ◁E▷ LEFT SILENT SHAFT REAR BEARING REMOVAL

Using the special tool, remove the left silent shaft rear bearing from the cylinder block.



#### ◁F▷ REAR BEARING REMOVAL

Using the special tool, remove the right silent shaft rear bearing from the cylinder block.

## INSPECTION

### FRONT CASE

- (1) Check oil holes for clogging and clean if necessary.
- (2) Check left silent shaft front bearing section for wear, damage and seizure. If there is anything wrong with the section, replace the front case.
- (3) Check the front case for cracks and other damage. Replace cracked or damaged front case.

### OIL SEAL

- (1) Check the oil seal lip for wear and damage. Replace oil seal if necessary.
- (2) Check the oil seal lip for deterioration. Replace oil seal if necessary.

### SILENT SHAFT

- (1) Check oil holes for clogging.
- (2) Check journal for seizure, damage and contact with bearing. If there is anything wrong with the journal, replace silent shaft, bearing or front case assembly.
- (3) Check the silent shaft oil clearance. If the clearance is excessively due to wear, replace the silent shaft bearing, silent shaft or front case assembly.

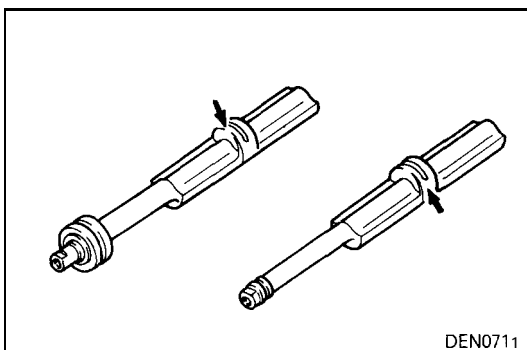
#### Standard value:

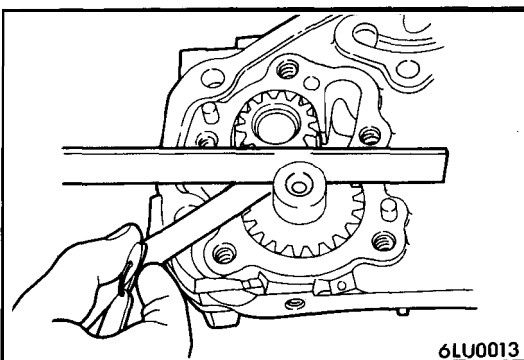
##### Front

Right 0.03 – 0.06 mm (.0012 – .0024 in.)  
Left 0.02 – 0.05 mm (.0008 – .0020 in.)

##### Rear

Right 0.05 – 0.09 mm (.0020 – .0036 in.)  
Left 0.05 – 0.09 mm (.0020 – .0036 in.)



**OIL PUMP**

- (1) Assemble the oil pump gear to the front case and rotate it to ensure smooth rotation with no looseness.
- (2) Ensure that there is no ridge wear on the contact surface between the front case and the gear surface of the oil pump cover.
- (3) Check the side clearance

**Standard value:**

Drive gear	0.06 – 0.14 mm (.0031–.0055 in.)
Driven gear	0.06 – 0.12 mm (.0024 – .0047 in.)

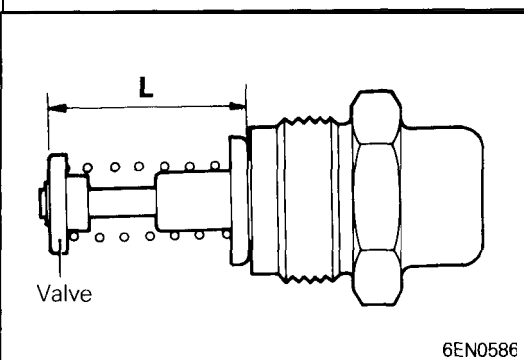
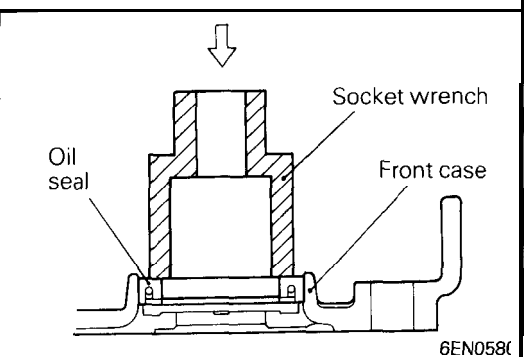
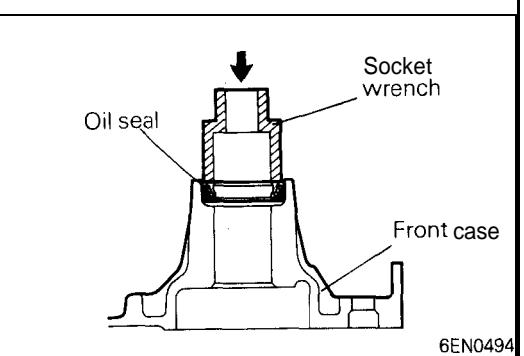
**OIL COOLER BYPASS VALVE  
(ENGINE WITH AIR COOLING TYPE OIL COOLER)**

- (1) Make sure that the valve moves smoothly.
- (2) Ensure that the dimension (L) measures the standard value under normal temperature and humidity.

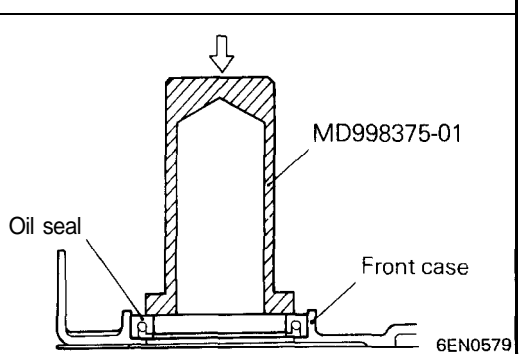
**Standard value (L): 34.5 (1.356 in.)**

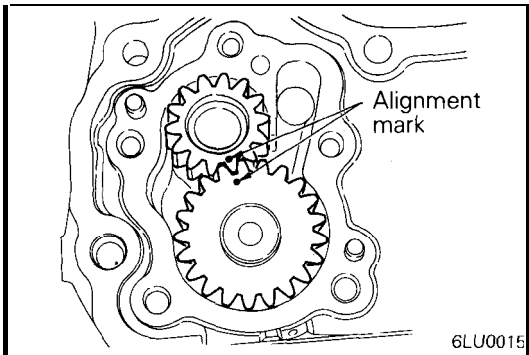
- (3) The dimension must be the standard value when measured after the valve has been dipped in 100°C (212°F) oil.

**Standard value (L): 40 mm (1.57 in.) or more**

**INSTALLATION SERVICE POINTS****▶▶ SILENT SHAFT OIL SEAL INSTALLATION****▶▶ OIL PUMP OIL SEAL INSTALLATION****▶▶ CRANKSHAFT FRONT OIL SEAL INSTALLATION**

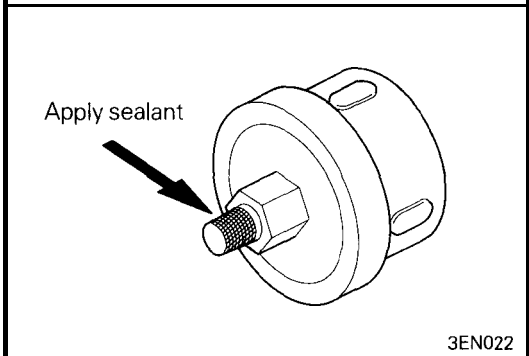
- (1) Using the special tool, install the crankshaft front oil seal into the front case.





**◆D◆ OIL PUMP DRIVEN GEAR / OIL PUMP DRIVE GEAR INSTALLATION**

- (1) Apply engine oil to the gears and line up the alignment marks.



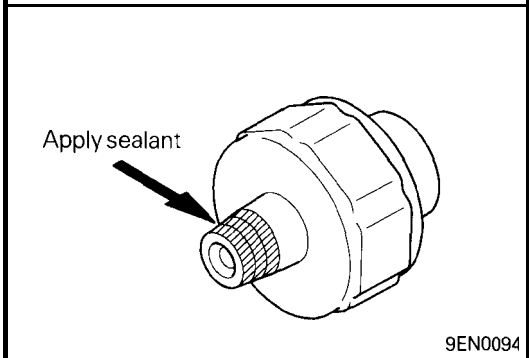
**◆E◆ SEALANT APPLICATION TO OIL PRESSURE GAUGE UNIT**

- (1) Coat the threads of switch with sealant and install the switch using the special tool.

**Specified sealant: 3M ATD Part No. 8660 or equivalent**

**Caution**

- 1. Keep the end of threaded portion clear of sealant.
- 2. Avoid an overtightening.



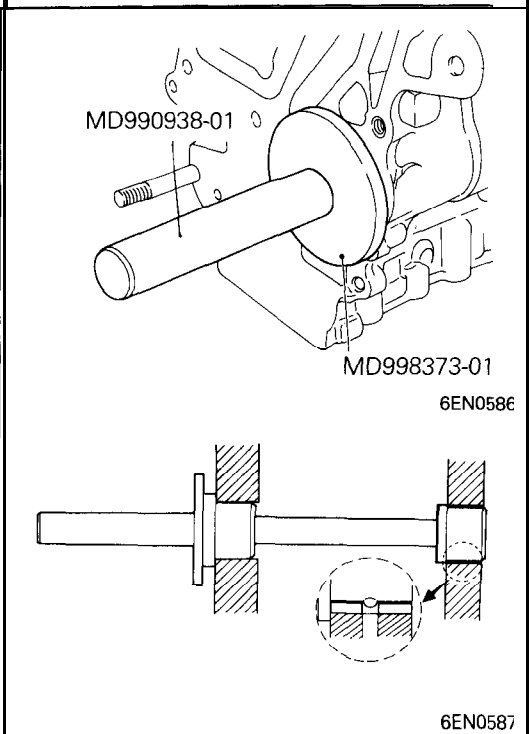
**◆F◆ SEALANT APPLICATION TO OIL PRESSURE SWITCH**

- (1) Coat the threads of switch with sealant and install the switch using the special tool.

**Specified sealant: 3M ATD Part No.8660 or equivalent**

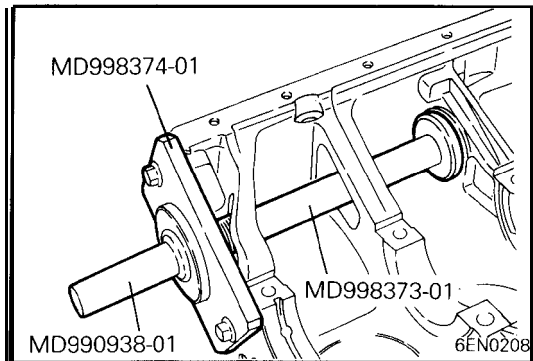
**Caution**

- 1. Keep the end of threaded portion clear of sealant.
- 2. Avoid an overtightening.



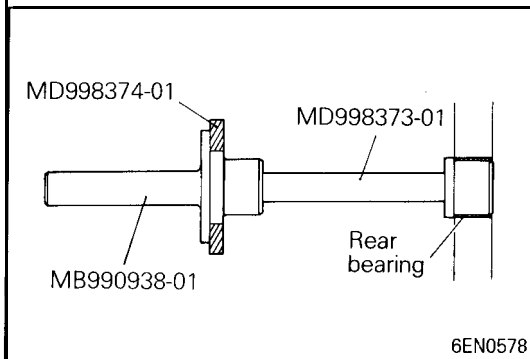
**◆G◆ RIGHT SILENT SHAFT REAR BEARING INSTALLATION**

- (1) Apply engine oil to the outer surface of bearing.
- (2) Using special tools, install right rear bearing. Make sure that oil hole of bearing is aligned with oil hole of cylinder block.



### LEFT SILENT SHAFT REAR BEARING INSTALLATION

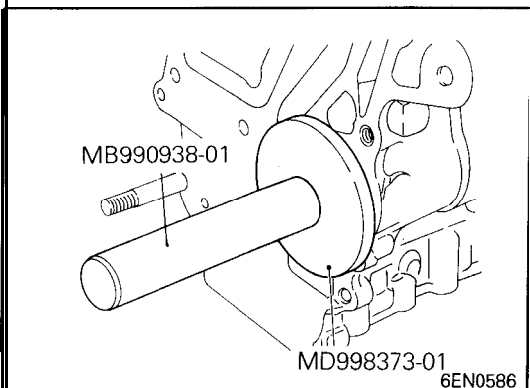
- (1) Install the special tool (GUIDE PLATE) tool to the cylinder block.
- (2) Apply engine oil to the rear bearing outer circumference and bearing hole in cylinder block.



- (3) Using the special tool, install the rear bearing.

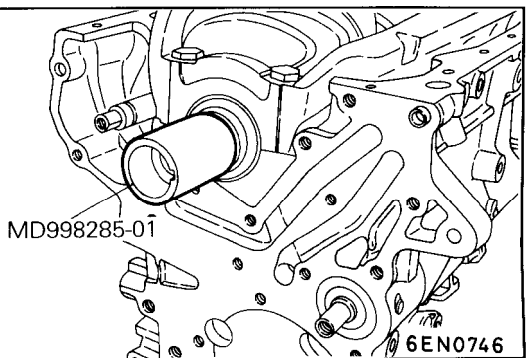
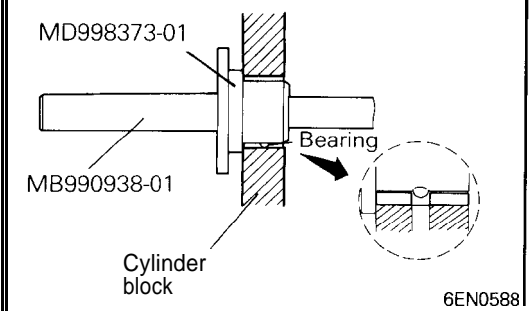
#### NOTE

The left rear bearing has no oil holes.



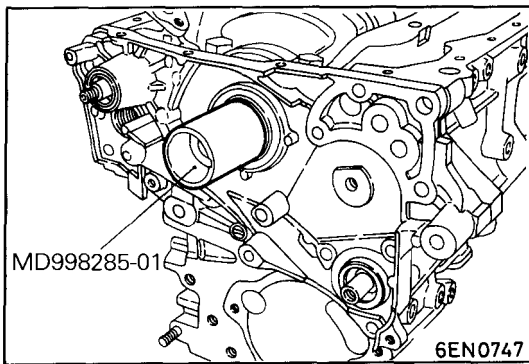
### SILENT SHAFT FRONT BEARING INSTALLATION

- (1) Using special tools, install front bearing.

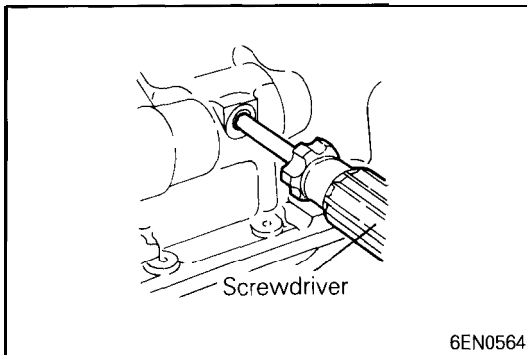


### FRONT CASE INSTALLATION

- (1) Set the special tool on the front end of crankshaft and apply a thin coat of engine oil to the outer circumference of the special tool to install the front case.

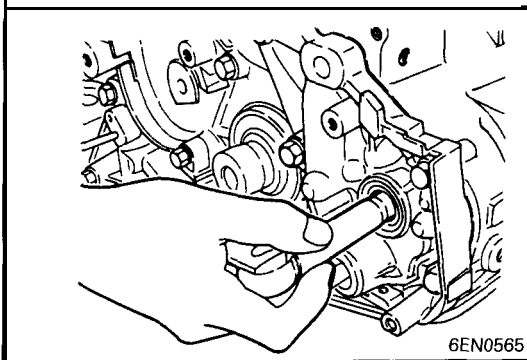


- (2) Install the front case assembly through a new front case gasket and temporarily tighten the flange bolts (other than those for tightening the filter bracket).

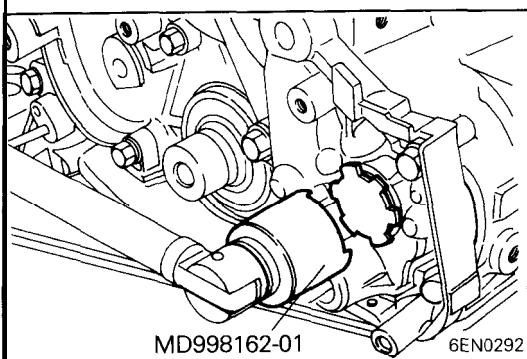


#### ◆K◆ FLANGE BOLT INSTALLATION

- (1) Insert a Phillips screwdriver into a hole in the left side of the cylinder block to lock the silent shaft.



- (2) Secure the oil pump driven gear onto the left silent shaft by tightening the flange bolt to specified torque.



#### ◆L◆ PLUG INSTALLATION

- (1) Install a new O-ring to the groove of front case.
- (2) Using the special tool, install the plug and tighten to specified torque.

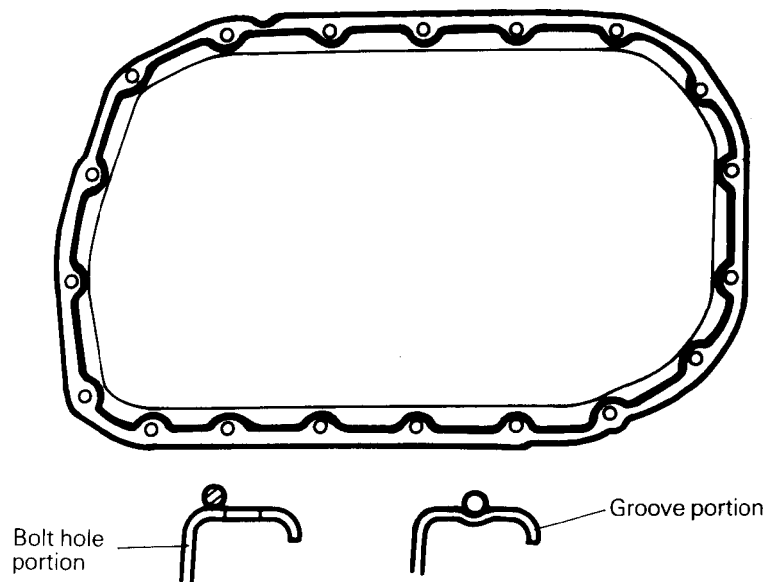
**◆M◆ OIL PAN INSTALLATION**

- (1) Clean both mating surfaces of oil pan and cylinder block.
- (2) Apply a 4 mm (.16 in.) wide bead of sealant to the entire circumference of the oil pan flange.

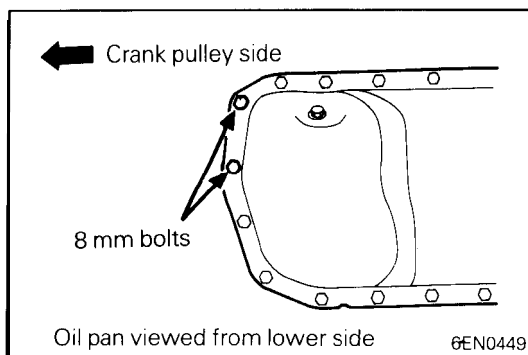
**Specified sealant:**

**MITSUBISHI GENUINE PART No. MD997110 or equivalent**

- (3) The oil pan should be installed in 15 minutes after the application of sealant.



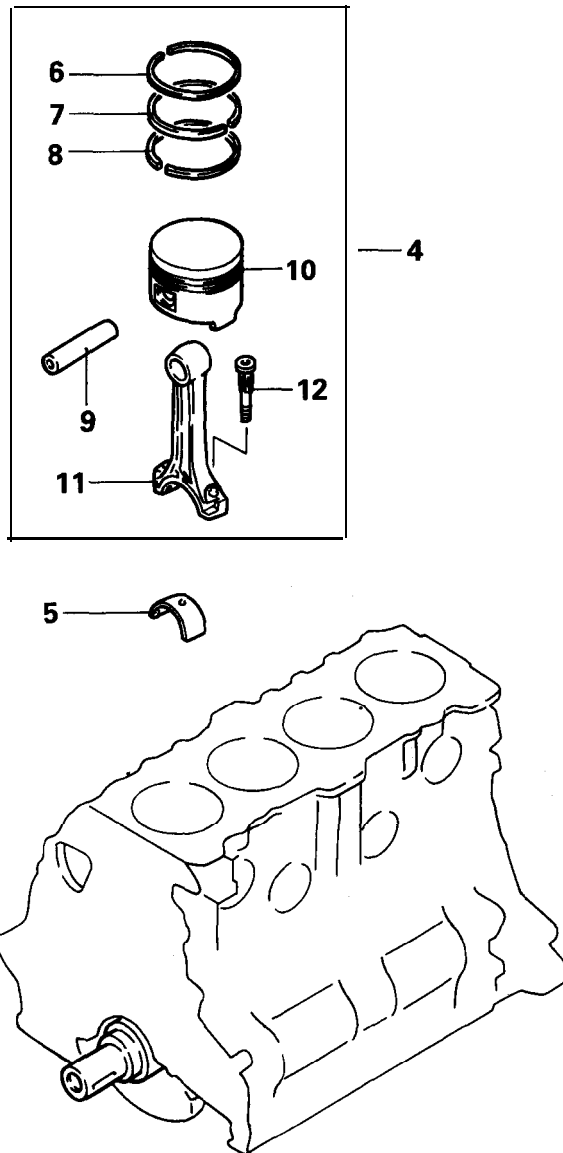
6EN0213



- (4) Note the difference in bolt lengths at the location shown.

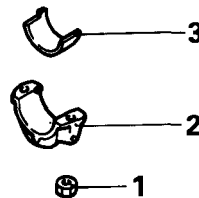
PISTON AND CONNECTING ROD

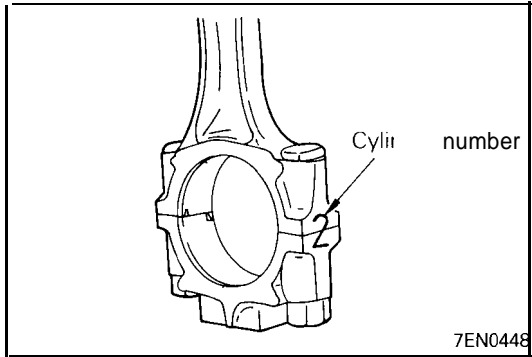
REMOVAL AND INSTALLATION



Removal steps

- ▶G▶ 1. Nut
- ◀A▶ ▶F▶ 2. Connecting rod cap
- ▶E▶ 3. Connecting rod bearing
- ▶D▶ 4. Piston and connecting rod assembly
- ▶E▶ 5. Connecting rod bearing
- ▶C▶ 6. Piston ring No. 1
- ▶C▶ 7. Piston ring No. 2
- ▶B▶ 8. Oil ring
- ◀B▶ ▶A▶ 9. Piston pin
- 10. Piston
- 11. Connecting rod
- 12. Bolt



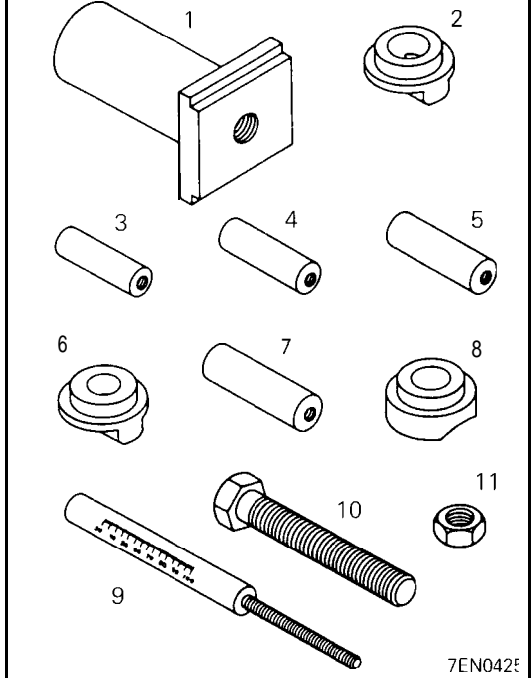


**REMOVAL SERVICE POINTS**

**◊A◊ CONNECTING ROD CAP REMOVAL**

- (1) Mark the cylinder number on the side of the connecting rod big end for correct reassembly.
- (2) Keep the removed connecting rods, caps, and bearings in order according to the cylinder number.

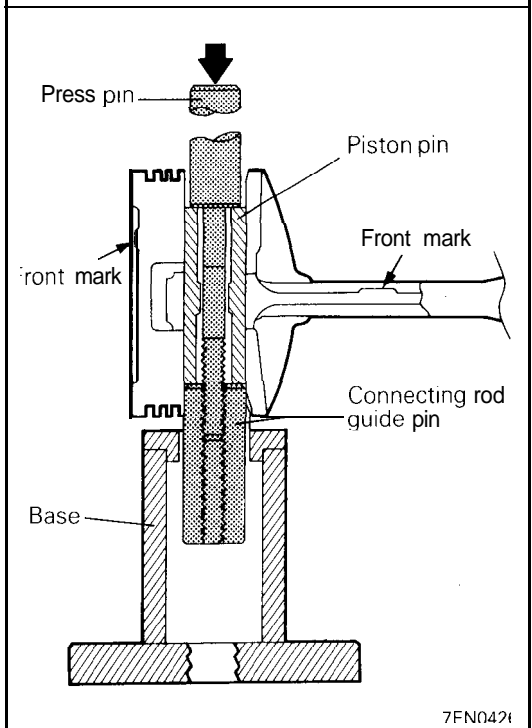
Piston pinsetting tool MIT216941



**◊B◊ PISTON PIN REMOVAL**

Item No.	Part No.	Description
1	MIT310134	Base
2	MIT310136	Piston Support
3	MIT310137	Connecting Rod Guide Pin
4	MIT310138	Connecting Rod Guide Pin
5	MIT310139	Connecting Rod Guide Pin
6	MIT310140	Piston Support
7	MIT310141	Connecting Rod Guide Pin
8	MIT310142	Piston Support
9	MIT48143	Press Pin
10	216943	Stop Screw
11	10396	Nut

- (2) Select the correct piston support for your application (See above). Fit the piston support onto the base. Place the base on press support blocks.



- (3) Insert the press pin through the piston pin hole. Select the correct connecting rod guide pin (See above). Thread the guide pin onto the threaded portion of the press pin.
- (4) Position the piston assembly on the piston support in the press. With the press pin up as shown in Figure 4, insert the guide pin through the hole in the piston and through the hole in the piston support.
- (5) Press the piston pin out of the assembly.

**IMPORTANT: To avoid piston damage,**

1. The piston support must seat squarely against the piston.
2. Verify that the piston pin will slide through the hole in the piston support.

- (6) Remove the piston pin from the press pin.



**INSPECTION****PISTON**

- (1) Replace the piston if scratches or seizure is evident on its surfaces (especially the thrust surface). Replace the piston if it is cracked.

**PISTON PIN**

- (1) Insert the piston pin into the piston pin hole with a thumb. You should feel a slight resistance. Replace the piston pin if it can be easily inserted or there is an excessive play.
- (2) The piston and piston pin must be replaced as an assembly.

**PISTON RING**

- (1) Check the piston ring for damage, excessive wear, and breakage and replace if defects are evident. If the piston has been replaced with a new one, the piston rings must also be replaced with new ones.
- (2) Check for the clearance between the piston ring and ring groove. If the limit is exceeded, replace the ring or piston, or both.

**Standard value:****No. 1****SOHC 4G63, DOHC Non-turbo**

0.02 – 0.06 mm (.0008 – .0024 in.)

**SOHC 4G64, DOHC Turbo**

0.03 – 0.07 mm (.0017 – .0028 in.)

**No. 2****SOHC 4G63, DOHC**

0.02 – 0.06 mm (.0008 – .0024 in.)

**SOHC 4G64**

0.03 – 0.07 mm (.0017 – .0028 in.)

**Limit: 0.1 mm (.004 in.)**

- (3) Install the piston ring into the cylinder bore. Force it down with a piston, its crown being in contact with the ring, to correctly position it at right angles to the cylinder wall. Then, measure the end gap with a feeler gauge. If the ring gap is excessive, replace the piston ring.

**Standard value:****No. 1****SOHC**

0.25 – 0.35 mm (.0098 – .0138 in.)

**DOHC**

0.25 – 0.40 mm (.0098 – .0157 in.)

**No. 2****SOHC – 8VALVE, DOHC**

0.45 – 0.60 mm (.0177 – .0236 in.)

**SOHC – 16VALVE**

0.40 – 0.55 mm (.0157 – .0217 in.)

**Oil ring****SOHC – 8VALVE**

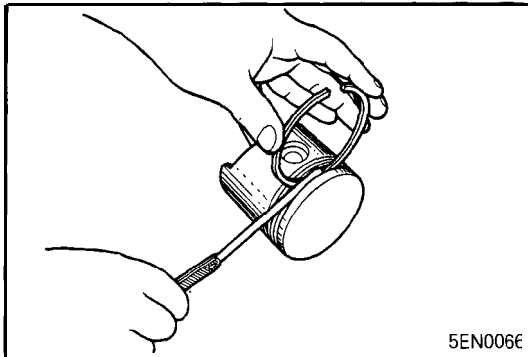
0.20 – 0.60 mm (.0079 – .0236 in.)

**SOHC – 16VALVE**

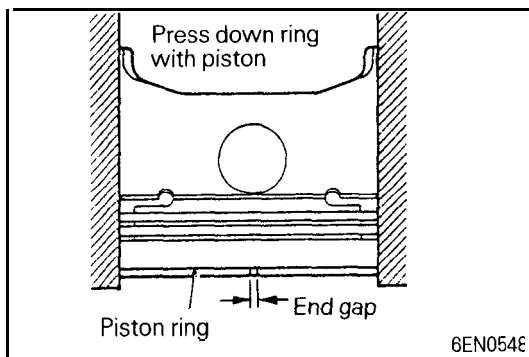
0.10 – 0.40 mm (.0039 – .0157 in.)

**DOHC**

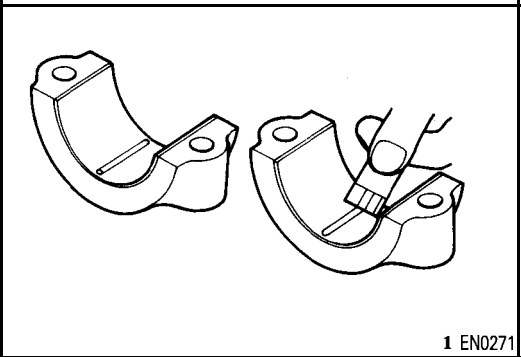
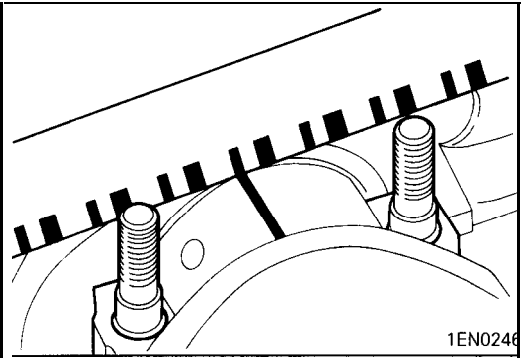
0.13 – 0.38 mm (.0051 – .0150 in.)

**Limit:****No. 1, No. 2 0.8 mm (.031 in.)****Oil 1.0 mm (.039 in.)**

5EN006E



6EN054E



### CRANKSHAFT PIN OIL CLEARANCE (PLASTIC GAUGE METHOD)

- (1) Remove oil from crankshaft pin and connecting rod bearing.
- (2) Cut the plastic gauge to the same length as the width of bearing and place it on crankshaft pin in parallel with its axis.

- (3) Install the connecting rod cap carefully and tighten the bolts to specified torque.
- (4) Carefully remove the connecting rod cap.
- (5) Measure the width of the plastic gauge at its widest part by using a scale printed on the plastic gauge package.

**Standard value: 0.02 – 0.05 mm (.0008 – .0020 in.)**  
**Limit: 0.1 mm (.004 in.)**

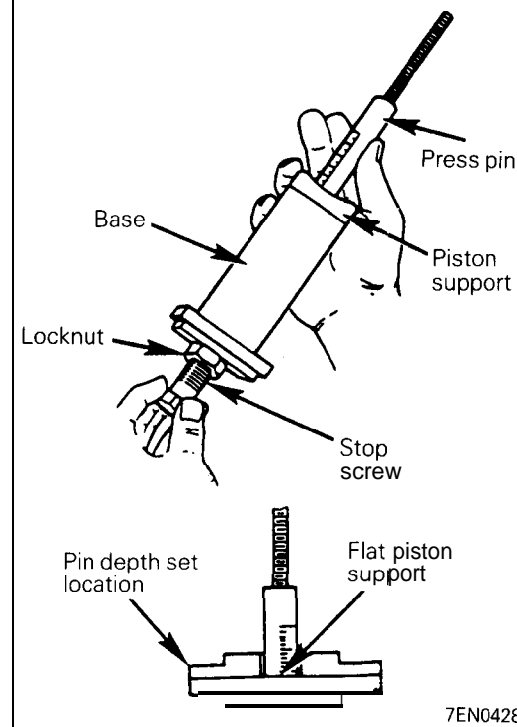
### INSTALLATION SERVICE POINTS

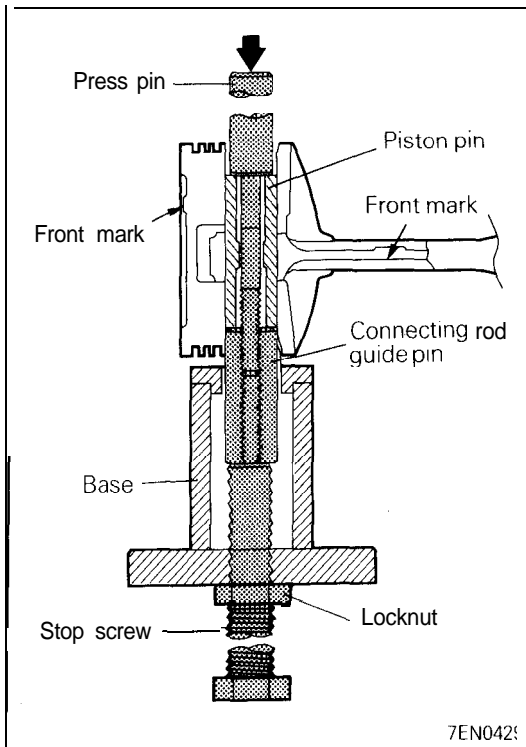
#### ◆◆ PISTON PIN INSTALLATION

- (1) Thread the stop screw and lock nut assembly into the base. Fit the correct piston support on top of the base. Insert the press pin, threaded end up, into the hole in the piston support until the press pin touches the stop screw.
- (2) Using the markings on the press pin, adjust the stop screw to the depth as shown below.

#### Depth:

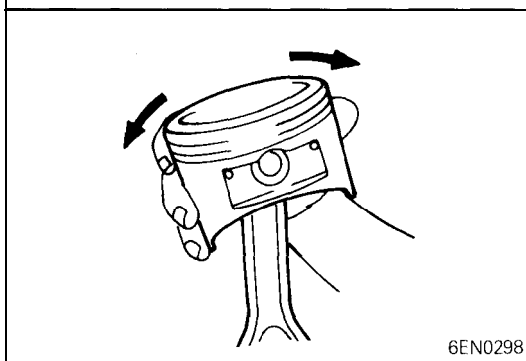
**Refer to the operating instructions on the special tool.**



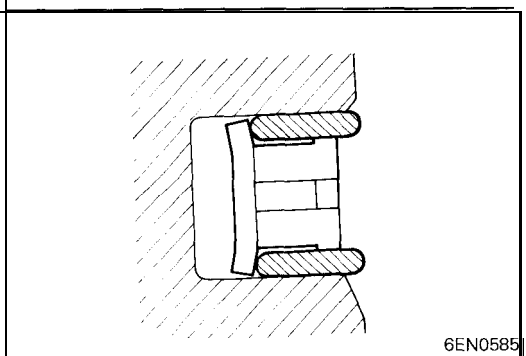


- (3) Place the base on press support blocks.
- (4) Slide the piston pin over the threaded end of the press pin, and thread the correct guide pin up against it.
- (5) Coat the piston pin with oil, and with the connecting rod held in position, slide the guide pin through the piston and connecting rod.
- (6) Press the piston pin through the connecting rod until the guide pin contacts the stop screw.
- (7) Remove the piston assembly from the base. Remove the guide pin and press pin from the assembly.

**IMPORTANT: Due to production tolerance variations, it is necessary to visually inspect the piston pin depth after installation to verify that the piston pin is centered. Adjust if necessary.**



- (8) Check that the piston moves smoothly.

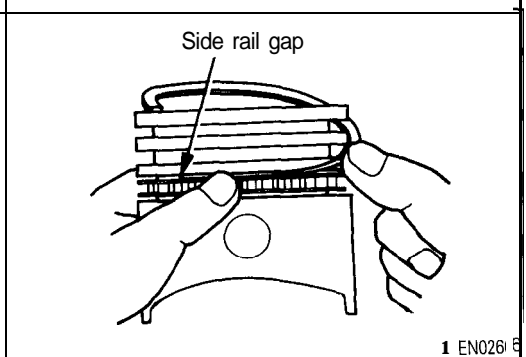


### ◆B◆ OIL RING INSTALLATION

- (1) Fit the oil ring spacer into the piston ring groove.

#### NOTE

The side rails and spacer may be installed in either direction.

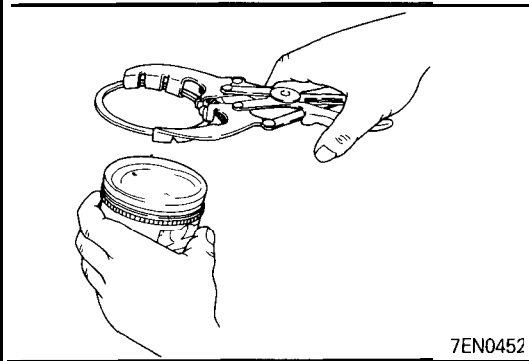


- (2) Install the upper side rail.  
To install the side rail, first fit one end of the rail into the piston groove, then press the remaining portion into position by finger. See illustration.

#### Caution

**Do not use piston ring expander when installing side rail.**

- (3) Install the lower side rail in the same procedure as described in step (2).
- (4) Make sure that the side rails move smoothly in either direction.



7EN0452

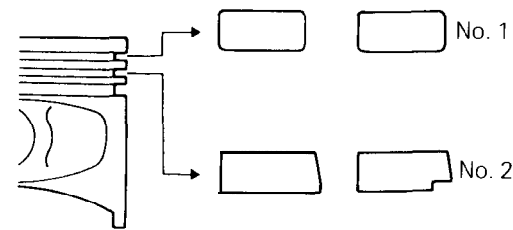
### ❖C❖ PISTON RING NO. 2 / PISTON RING NO. 1 INSTALLATION

- (1) Using piston ring expander, fit No. 2 and then No. 1 piston ring into position.

#### NOTE

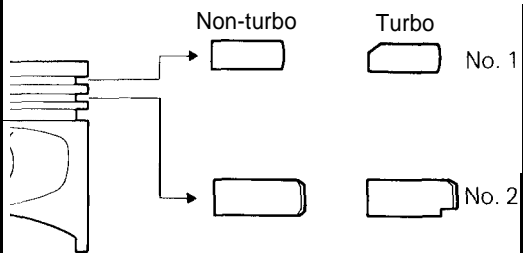
- (1) Note the difference in shape between No. 1 and No. 2 piston rings.
- (2) Install piston rings No. 1 and No. 2 with their side having marks facing up (on the piston crown side).

#### SOHC



6EN0527

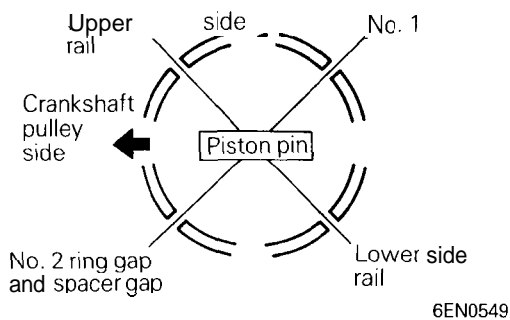
#### DOHC



6EN0497

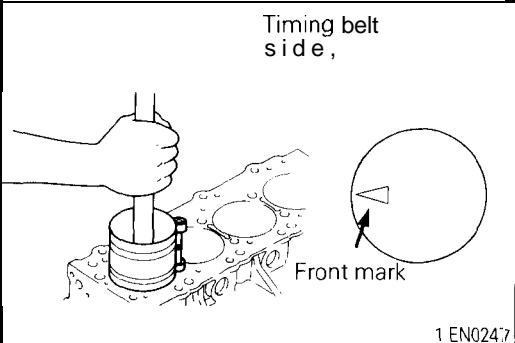
### ❖D❖ PISTON AND CONNECTING ROD INSTALLATION

- (1) Liberally coat engine oil on the circumference of the piston, piston ring, and oil ring.
- (2) Arrange the piston ring and oil ring gaps (side rail and spacer) as shown in the figure.
- (3) Rotate crankshaft so that crank pin is on center of cylinder bore.

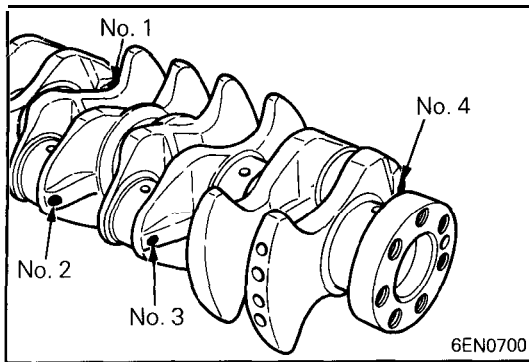


6EN0549

- (4) Rotate crankshaft so that the crank pin is on the center of the cylinder bore.
- (5) Use suitable thread protectors on the connecting rod bolts before inserting piston and connecting rod assembly into the cylinder block. Care must be taken not to nick the crank pin.
- (6) Using a suitable piston ring compressor tool, install the piston and connecting rod assembly into the cylinder block.



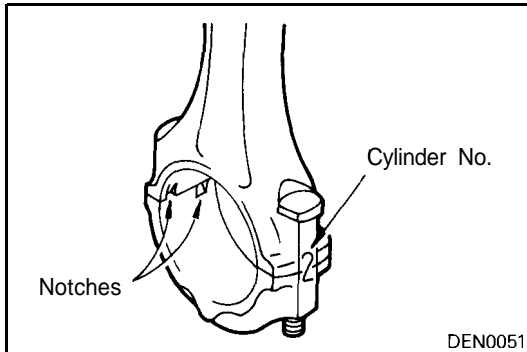
1 EN0247



### ◆E◆ CONNECTING ROD BEARINGS INSTALLATION

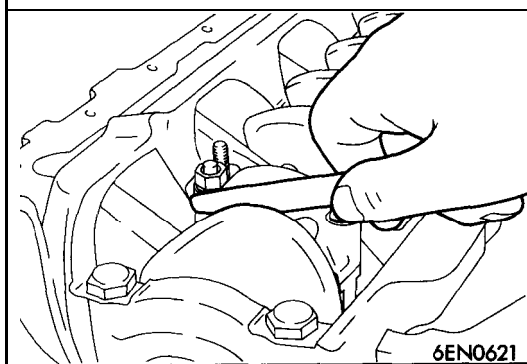
- (1) When the bearings are to be replaced, select appropriate bearings for assembly according to identification colors for the crankshaft.

Crank pin O.D. identification color	Connecting rod bearing identification mark
Yellow	1
None	2
White	3



### ◆F◆ CONNECTING ROD CAP INSTALLATION

- (1) Verifying the mark made during disassembly, install the bearing cap to the connecting rod. If the connecting rod is new with no index mark, make sure that the bearing locking notches come on the same side as shown.



- (2) Make sure that the connecting rod big end side clearance meets the specification.

**Standard value: 0.10 – 0.25 mm (.0039 – .0098 in.)**

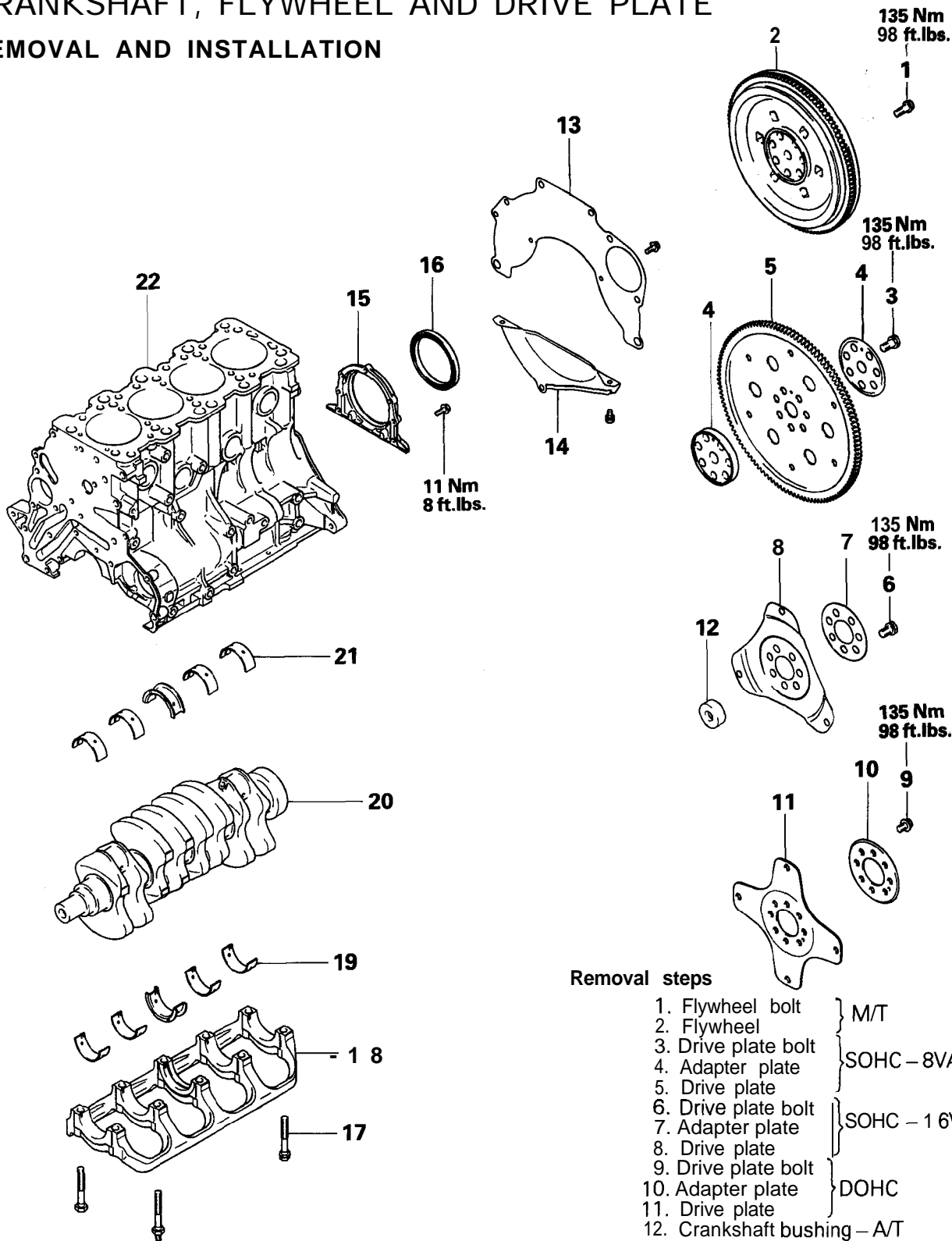
**Limit: 0.4 mm (.016 in.)**

### ◆G◆ CONNECTING ROD CAP NUT INSTALLATION

- (1) Since the connecting rod bolts and nuts are torqued using a new procedure they should be examined BEFORE reuse. If the bolt threads are “necked down” the bolts should be replaced.  
Necking can be checked by running a nut with fingers to the full length of the bolt’s thread. If the nut does not run down smoothly the bolt should be replaced.
- (2) Install the connecting rod cap on the big end of connecting rod.
- (3) Before installing the nuts the threads should be oiled with engine oil.
- (4) Install both nuts on each bolt finger tight, then alternately torque each nut to assemble the cap properly.
- (5) Tighten the nuts to 20 Nm (2 kgm, 14.5 ft.lbs.) and plus 1/4 (90°) turn.

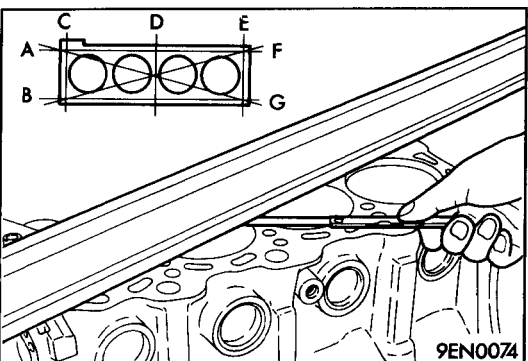
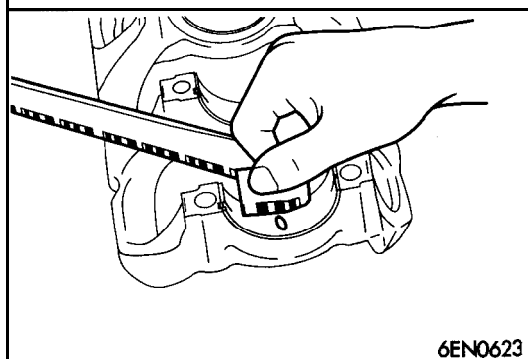
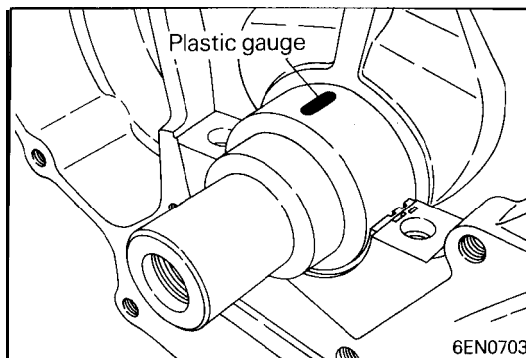
CRANKSHAFT, FLYWHEEL AND DRIVE PLATE

REMOVAL AND INSTALLATION



Removal steps

- |                                |                      |
|--------------------------------|----------------------|
| 1. Flywheel bolt               | } M/T                |
| 2. Flywheel                    |                      |
| 3. Drive plate bolt            | } SOHC – 8VALVE A/T  |
| 4. Adapter plate               |                      |
| 5. Drive plate                 | } SOHC – 1 6VALVE AA |
| 6. Drive plate bolt            |                      |
| 7. Adapter plate               | } DOHC               |
| 8. Drive plate                 |                      |
| 9. Drive plate bolt            | } DOHC               |
| 10. Adapter plate              |                      |
| 11. Drive plate                | } DOHC               |
| 12. Crankshaft bushing – A/T   |                      |
| 13. Rear plate                 |                      |
| 14. Bell housing cover         |                      |
| 15. Oil seal case              |                      |
| 16. Oil seal                   |                      |
| 17. Bearing cap bolt           |                      |
| 18. Bearing cap                |                      |
| 19. Crankshaft bearing (lower) |                      |
| 20. Crankshaft                 |                      |
| 21. Crankshaft bearing (upper) |                      |
| 22. Cylinder block             |                      |



## INSPECTION

### CRANKSHAFT OIL CLEARANCE (PLASTIC GAUGE METHOD)

- (1) Remove oil from the crankshaft journal and crankshaft bearing.
- (2) Install the crankshaft.
- (3) Cut the plastic gauge to the same length as the width of bearing and place it on journal in parallel with its axis.
- (4) Install the crankshaft bearing cap carefully and tighten the bolts to specified torque.
- (5) Carefully remove the crankshaft bearing cap.
- (6) Measure the width of the plastic gauge at its widest part by using a scale printed on the plastic gauge package.

**Standard value: 0.02 – 0.05 mm (.0008 – .0020 in.)**  
**Limit: 0.1 mm (.004 in.)**

### CYLINDER BLOCK

- (1) Visually check for scratches, rust, and corrosion. Use also a flaw detecting agent for the check. If defects are evident, correct, or replace.
- (2) Using a straightedge and feeler gauge, check the block top surface for warpage. Make sure that the surface is free from gasket chips and other foreign matter.

**Standard value: 0.05 mm (.0020 in.)**  
**Limit: 0.1 mm (.004 in.)**

- (3) If the distortion is excessive, correct within the allowable limit or replace.

**Grinding limit: 0.2 mm (.008 in.)**

The total thickness of the stock allowed to be removed from cylinder block and mating cylinder head is 0.2 mm (.008 in.) at maximum.

**Cylinder block height (when new):**

**4G63** 283.9 – 284.1 mm  
 (11.177 – 11.185 in.)

**4G64** 289.9 – 290.1 mm  
 (11.413 – 11.421 in.)

- (4) Check cylinder walls for scratches and seizure. If defects are evident, correct (bored to oversize) or replace.
- (5) Using cylinder gauge, measure the cylinder bore and cylindricity. If worn badly, correct cylinder to an oversize and replace piston and piston rings. Measure at the points shown in illustration.

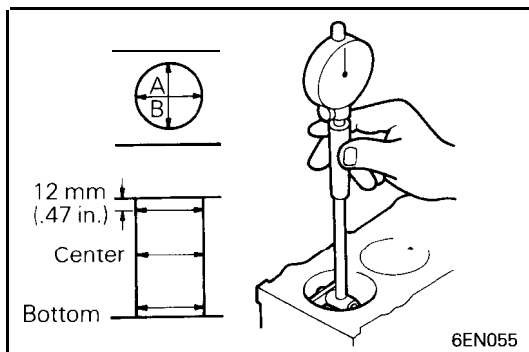
**Standard value:**

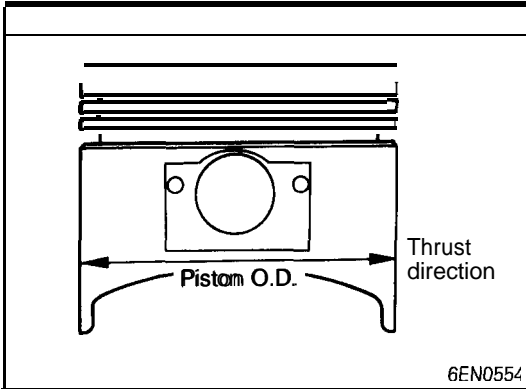
**Cylinder I.D.**

**4G63** 85.00 – 85.03 mm (3.3465 – 3.3476 in.)

**4G64** 86.50 – 86.53 mm (3.4055 – 3.4067 in.)

**Cylindricity** 0.01 mm (.0004 in.)





**BORING CYLINDER**

- (1) Oversize pistons to be used should be determined on the basis of the largest bore cylinder.

**Piston size identification**

Size	Identification mark
0.25 mm (0.01 in.) O.S.	0.25
0.50 mm (0.02 in.) O.S.	0.50
0.75 mm (0.03 in.) O.S.	0.75
1.00 mm (0.04 in.) O.S.	1.00

**NOTE**

Size mark is stamped on piston top.

- (2) Measure outside diameter of piston to be used. Measure it in thrust direction as shown.  
 (3) Based on measured piston O.D. calculate boring finish dimension.

$$\text{Boring finish dimension} = \text{Piston O.D.} + (\text{clearance between piston O.D. and cylinder}) - 0.02 \text{ mm (.0008 in.) (honing margin)}$$

- (4) Bore all cylinders to calculated boring finish dimension.

**Caution**

To prevent distortion that may result from temperature rise during honing, bore cylinders, working from No. 2 to No. 4 to No. 1 to No. 3.

- (5) Hone to final finish dimension (piston O.D. + clearance between piston O.D. and cylinder),  
 (6) Check clearance between piston and cylinder.

**Clearance between piston and cylinder:**

**Non-T/C**

0.02 – 0.04 mm (.0008 – .0016 in.)

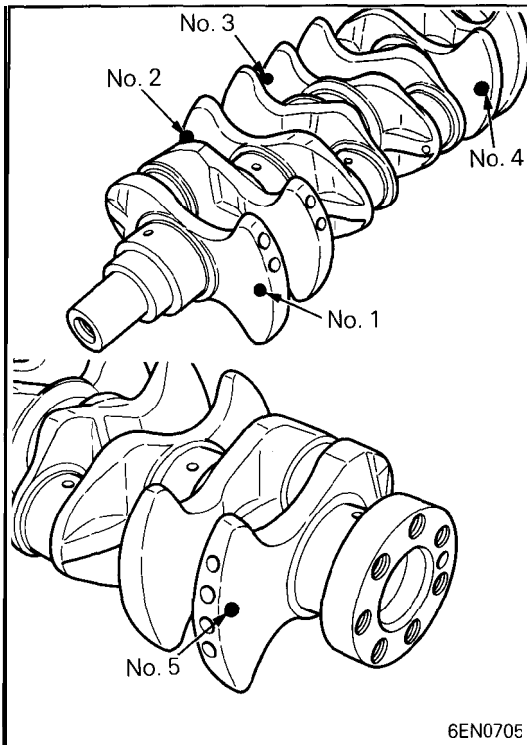
**T/C**

0.03 – 0.05 mm (.0012 – .0020 in.)

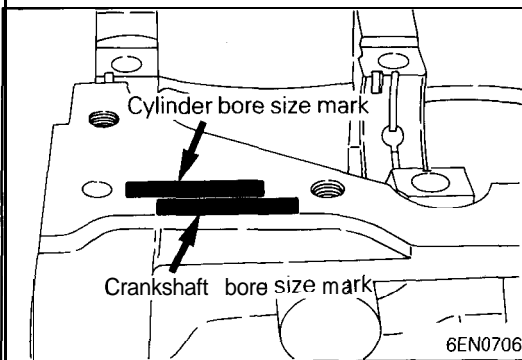
**NOTE**

When boring cylinders, finish all of four cylinders to same oversize. Do not bore only one cylinder to an oversize.

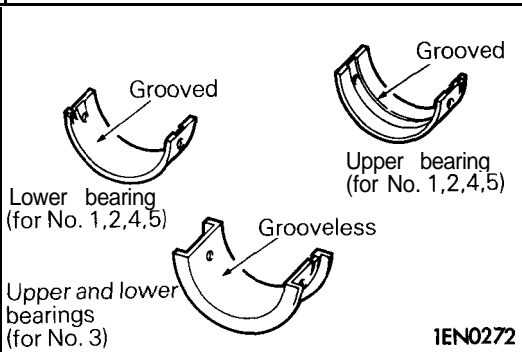




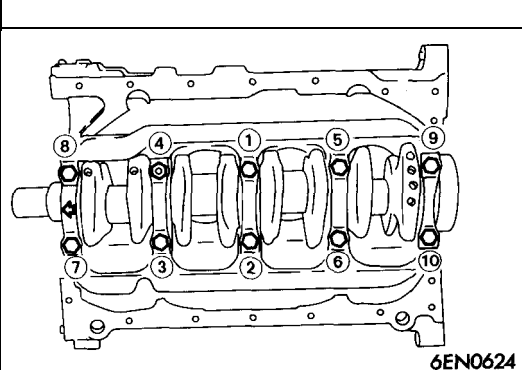
6EN0705



6EN0706



1EN0272



6EN0624

## REASSEMBLY SERVICE POINTS

### ▶▶ CRANKSHAFT BEARING INSTALLATION

(1) When the bearing is to be replaced, select the appropriate bearing for assembly according to the identification color for the crankshaft and the identification mark stamped on the cylinder block.

Journal OD identification color	Identification mark for cylinder block bearing support section ID	Crankshaft bearing identification mark
Yellow	0	1
	1	2
	2	3
None	0	2
	1	3
	2	4
White	0	3
	1	4
	2	5

- (2) Install the upper crankshaft bearings to the cylinder block. There is an oil groove in the upper crankshaft bearing. There is no difference between upper and lower bearings for the center (with flange).
- (3) Install the lower crankshaft bearings to bearing cap and apply engine oil to bearing surface.

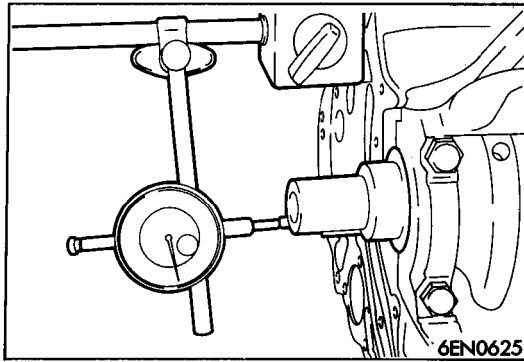
### ▶▶ BEARING CAP / BEARING CAP BOLT INSTALLATION

- (1) Install the bearing caps so that their arrows are positioned on the timing belt side.
- (2) When installing the bearing cap bolts, check that the shank length of each bolt meets the limit. If the limit is exceeded, replace the bolt.

**Limit: Max. 71.1 mm (2.79 in.)**

- (3) Torque the bearing cap bolts to 25 Nm (18 ft.lbs.) and, from that position, retighten them 1/4 (90°) turns more.

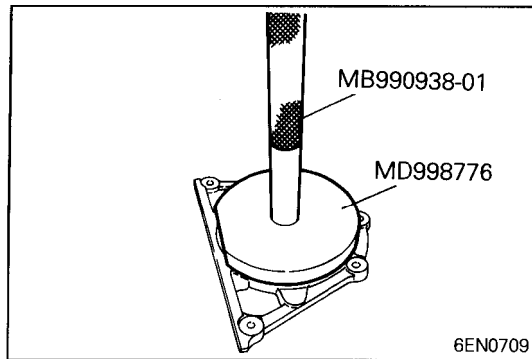
# 1 1F-114 4G6 ENGINE <1993> – Crankshaft, Flywheel and Drive Plate



- (4) After installing the bearing caps, make sure that the crankshaft turns smoothly and the end play is correct. If the end play exceeds the limit, replace crankshaft bearings.

**Standard value: 0.05 – 0.25 mm (.0020 – .0098 in.)**  
**Limit: 0.4 mm (.016 in.)**

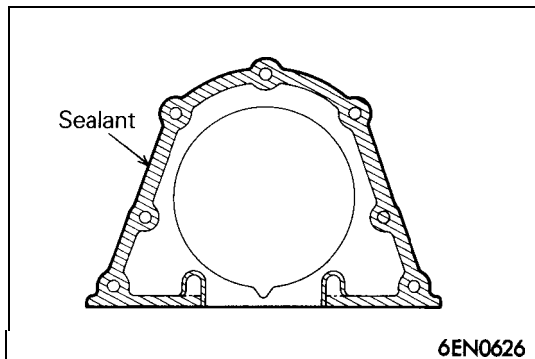
## ▶◀ OIL SEAL INSTALLATION



## ▶◀ SEALANT APPLICATION TO OIL SEAL CASE

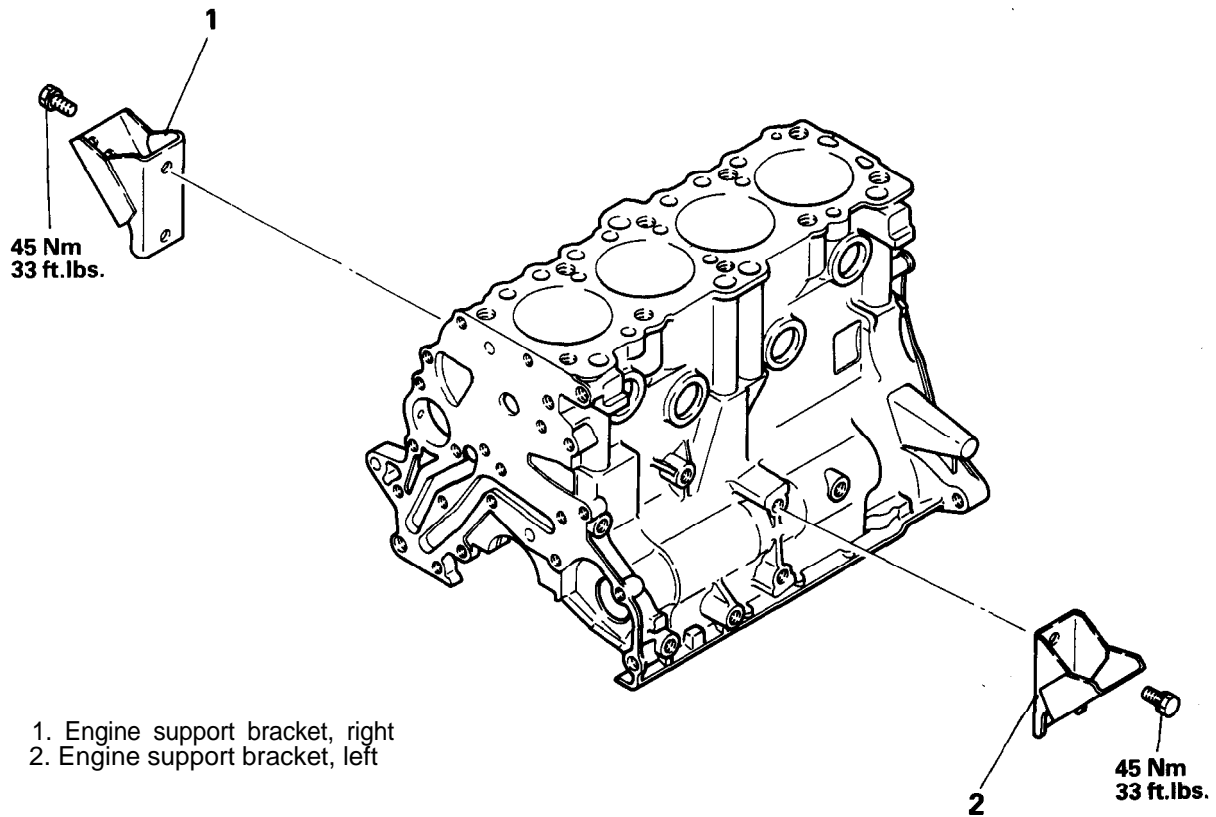
Specified sealant:

**Mitsubishi Genuine Part No. MD970389 or equivalent**



BRACKET

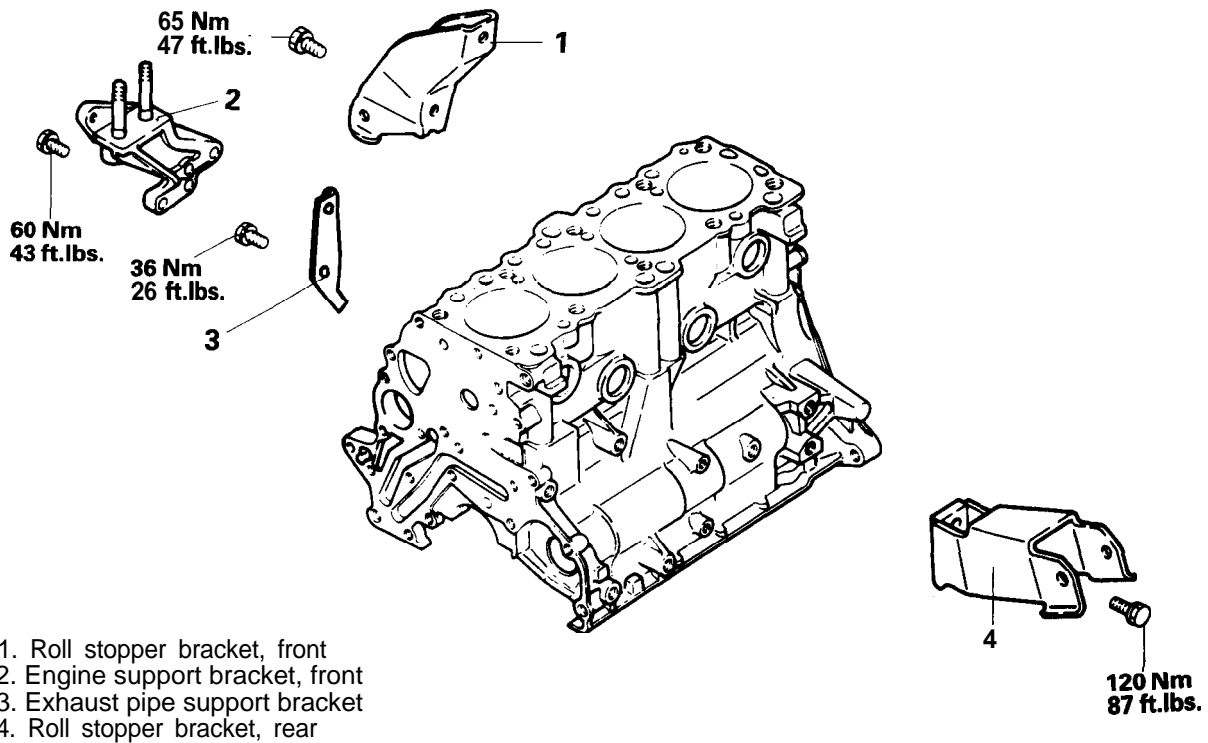
Rear wheel drive and four wheel drive



- 1. Engine support bracket, right
- 2. Engine support bracket, left

6EN350

Front wheel drive and all wheel drive



- 1. Roll stopper bracket, front
- 2. Engine support bracket, front
- 3. Exhaust pipe support bracket
- 4. Roll stopper bracket, rear

6EN0722

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NOTES