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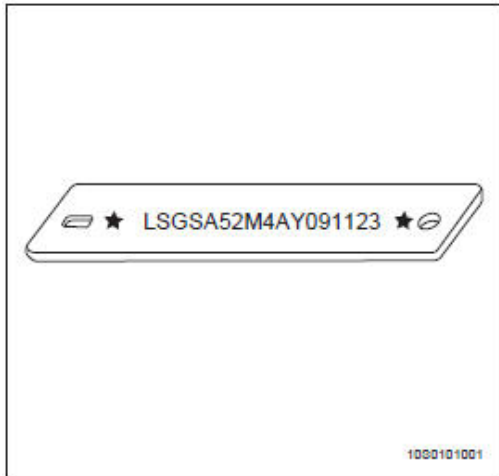
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1 Vehicle Introduction

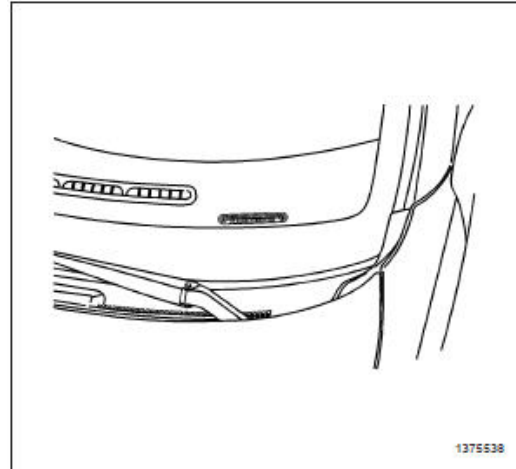
1.1 Vehicle Identification

1.1.1 Vehicle VIN Code

1. VIN Code

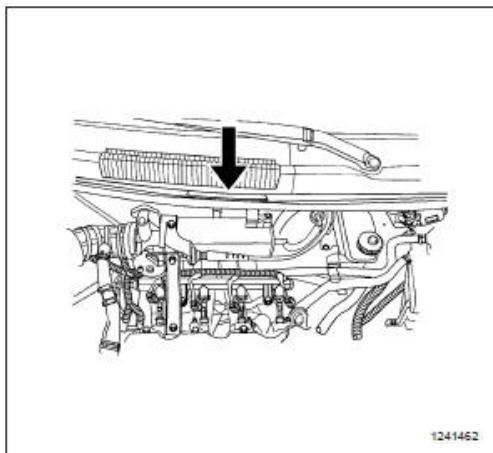


2. Position of VIN Code (1)



The vehicle identification label (1) is in the top left corner of the dashboard, and you can see it from outside through the windscreen.

3. Position of VIN Code (2)



Vehicle Identification Number (VIN) is engraved in the top right side of the bulkhead.

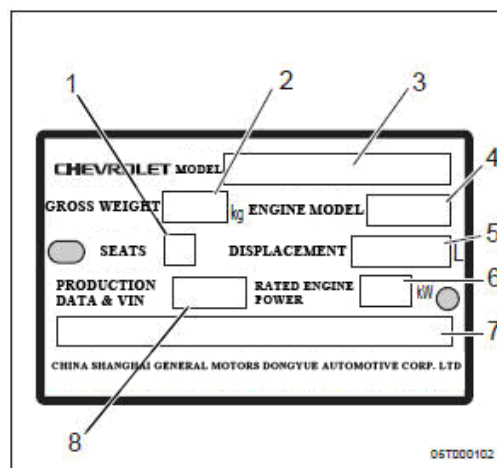
4. VIN Code Identification:

Position	Definition	Character	Description
1-3	Global Manufacturing Identification	LSG	Shanghai General Motors Co., Ltd.
4-5	Brand and Vehicle Model	SA	SGM7120MT, SGM7120AMT, SGM7142MT, SGM7142AMT Passenger Vehicle
6	Vehicle Body Style	5	3-Compartment, 4-Door Passenger Vehicle
		6	2-Compartment, 4-Door Passenger Vehicle
7	Protecting Device System	2	Manual Safety Belt, Driver and Front Passenger Front Airbag
		8	Manual Safety Belt and Driver Front Airbag
8	Engine Type	S	1.2L, 1.4, MFI, DOHC
		M	1.2L, 1.4, MFI, DOHC
9	Check Digit	0-9 o X	Check Code
10	Production Year	A	2010
11	Manufacturing Plant	Y	Shanghai General Motors Yantai Plant
12-17	Manufacturing Plant Serial Number		

1.1.2 Vehicle Nameplate

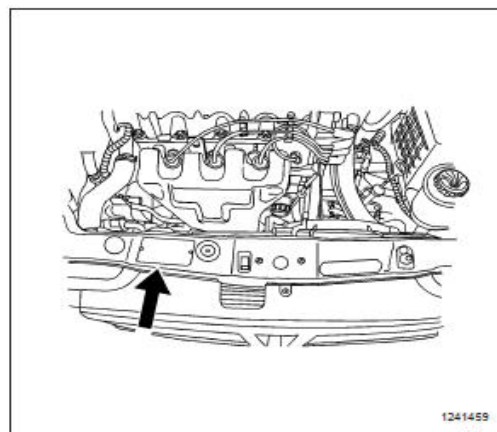
■ Certificate

1. Seats
2. Total Vehicle Weight
3. Vehicle Model
4. Engine Model
5. Engine Displacement
6. Rated Engine Power
7. Vehicle Identification Number (VIN)
8. Production Date



Position of Certificate

The certificate label is on the radiator support.

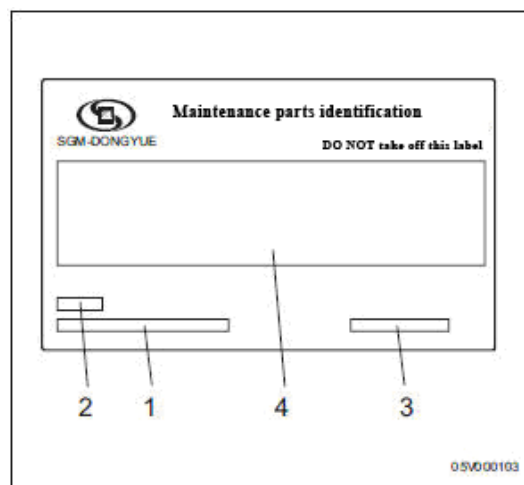


■ Tire Information Label

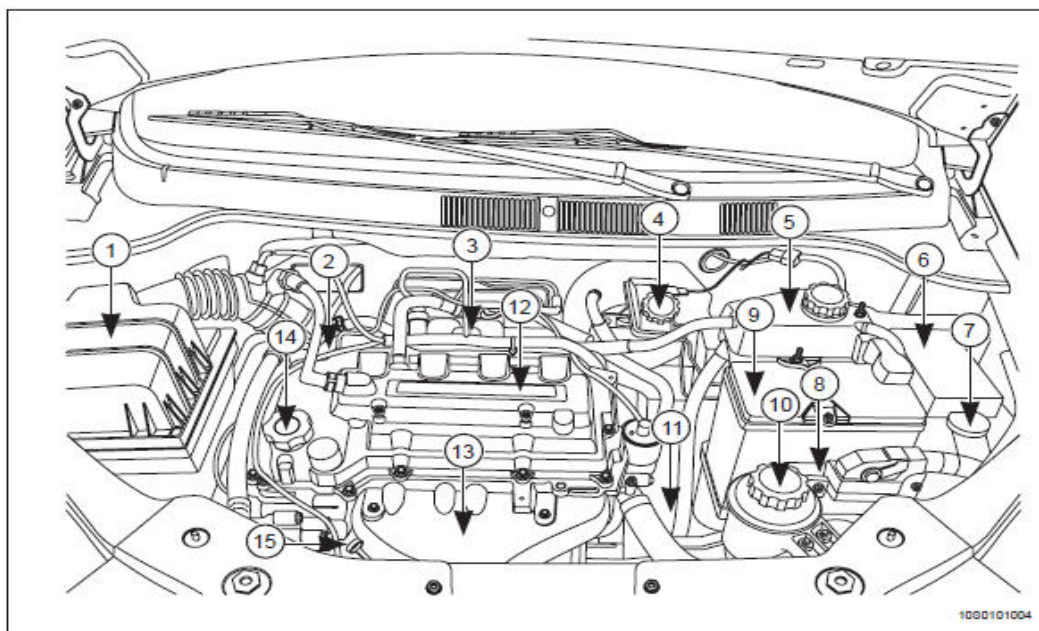
The tire label is permanently posted at the back of the driver left-rear door. Please refer to the label for tire information. The label lists the maximum carrying capacity of the vehicle, tire size (includes spare wheel) and cold inflation pressure (includes spare wheel) .

■ RPO Code Label

1. Vehicle Identification Number
 2. Engineering Design Model
- (Vehicle Classification, Series, and Body Style)
3. Interior Trim Parts and Trim Level
 4. Contents of Optional Vehicle Parts



■ Engine Compartment Positioning



- | | |
|--------------------------------|---------------------------------------|
| 1. Air Filter | 9. Accumulator |
| 2. Electronic Throttle | 10. Power Steering Fluid Storage Tank |
| 3. Intake Manifold | 11. Transmission |
| 4. Brake Oil Tank | 12. Ignition Coil Cap |
| 5. Engine Coolant Storage Tank | 13. Exhaust Manifold |
| 6. Fuse Box | 14. Engine Oil Cap |
| 7. Washing Liquid Storage Tank | 15. Engine Oil Dipstick |
| 8. Engine Control Module | |

1.2 Vehicle Fit-out Table

■ Fit-out Table

	MKT Type	1.2 SL MT	1.2 SE MT	1.2 SE EM T	1.4 SX MT	1.4 SX EM T	1.2 SL MT	1.2S EMT	1.2SE EMT	1.4 SX MT	1.4S X EM T
	Engine Model	1S R 69	1SS69		1ST69		1S R 48	1SS48		1ST48	
	Optional Type	NG S 1	NG S 2	NG S 3	NG S 4	NG S 5	NG S 6	NGS 7	NGS 8	NG S 9	NG S 10
Vehicle Body Color	Exterior: Primary Color, Cool Blue, MET	O	O	O	O	O					
	Exterior: Primary Color , Flame Red	O	O	O	O	O	O	O	O	O	O
	Exterior: Primary Color , Dynamic Orange	O	O	O	O	O	O	O	O	O	O
	Exterior: Primary Color , Bright White	O	O	O	O	O	O	O	O	O	O

		Exterior: Primary Color , Sky Blue	O	O	O	O	O	O	O	O	O
		Exterior: Primary Color , Classic Green	O	O	O	O	O	O	O	O	O
		Exterior: Primary Color , Galaxy Silver	O	O	O	O	O	O	O	O	O
		SCOYellow						O	O	O	O
Engine	LCU	Gasoline Engine, 4 Cylinders, 1.4L,MFI,DOHC,PDA,FAMA/B, GMDAT				X	X			X	X
	LMU	Gasoline Engine, 4 Cylinders, , 1.4,1.2L,MFI,DOHC,GMDAT	X	X	X			X	X	X	
Transmission		Manual 5-Speed, China, Transmission Ratio of First Gear: 3.462, Transmission Ratio of 5th Gear: 0.756, Torque: 140Nm				X	X			X	X
		Manual 5-Speed, China, Transmission Ratio of First Gear: 3.462, Transmission Ratio of 5th Gear: 0.756, Torque: 140Nm	X	X	X			X	X	X	
Exhaust System		Exhaust System EEC 05	X	X	X	X	X	X	X	X	X
Gear Shifting System		Electrically Controlled Gear Shift and Mechanical Transmission			X		X			X	X
Braking System		BRAKE SYSTEM PWR, Front Disc, Rear Drum, Cast Iron, ABS, FRT & RR WHL		X	X	X	X		X	X	X
		BRAKE SYSTEM PWR, Front Disc, Rear Drum, Cast Iron	X					X			
Interior Trim		Interior Trim: Dark Titanium / Light Titanium	X	X	X	X	X	X	X	X	X
Wheels		Wheel Hubs 13 X 5, Steel, Paint	X					X			
		Wheel Hubs 14 X 5.5, Steel, Paint		X	X	X	X		X	X	X
Safety System		Seat Belt, Inflation Protection, Front Driver Seat									
		Seat Belt, Inflation Protection, Two Front Side Seats	X	X	X	X	X	X	X	X	X
Sunroof		Power Sunroof				X	X			X	X
Door Locks		Electrically Controlled Side Door Locks	X	X	X			X	X	X	
		Electrically Controlled and Automatic Side Door Locks				X	X			X	X
Steering System		Power-Assisted Steering - Fixed	X	X	X	X	X	X	X	X	X
Side Windows		Front-Door Power Windows	X	X	X			X	X	X	
		Four-Door Power Windows				X	X			X	X
Audio System		AM/FM Stereophonic Receiver, Automatic Channel Search, Clock and Electronic Tuning	X	X	X			X	X	X	
		AM/FM Stereophonic Receiver, Automatic Channel Search, CD,				X	X			X	X

	Automatic Equalization, Clock, Electronic Tuning and MP3										
Speakers	Two Front Side Speakers	X	X	X			X	X	X		
	Four Speakers				X	X				X	X
Air conditioning	Front Side Manual Air-Conditioning System	X	X	X	X	X	X	X	X	X	X
Miscellaneous	STRAIGHT,CHILE,ONLY										
	Child Seat	X	X	X	X	X	X	X	X	X	X
	External Tail Lamps and Brake Lamps										
	Global License Plate Position										
	Manual Leveling of Headlamps										
	Wax Injection										
	FILM APPLY										

Symbol "X" denotes optional fit-out packages

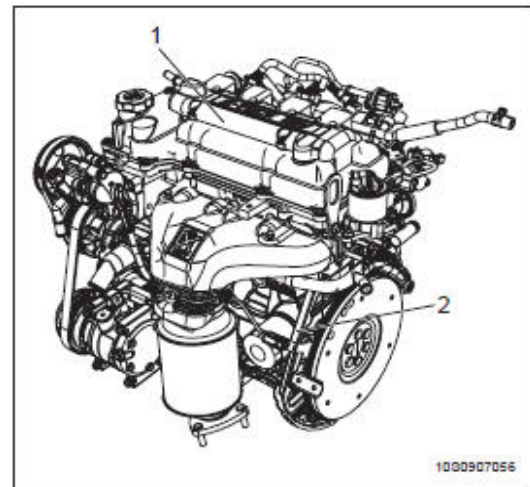
2 Engine

2.1 Engine Identification

2.1.1 Identification of Engine Label

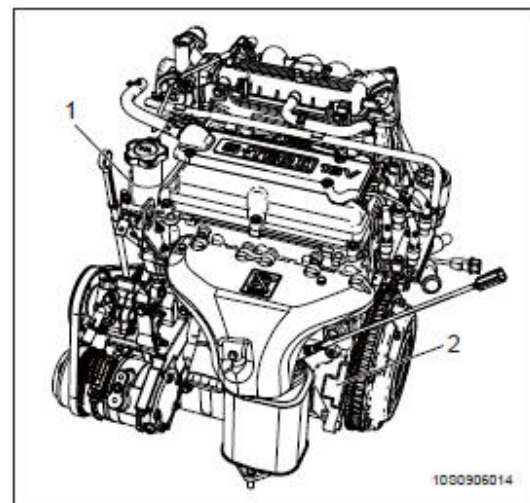
■ 1.4L LCU

The steel seal number (2) of the 1.4L engine is in the left rear side of the engine cylinder block and is impressed or laser engraved on the cylinder block in the assembly plant. In addition, the same serial number label and engine communication code label (1) are on the engine cover.



■ 1.2L LMU

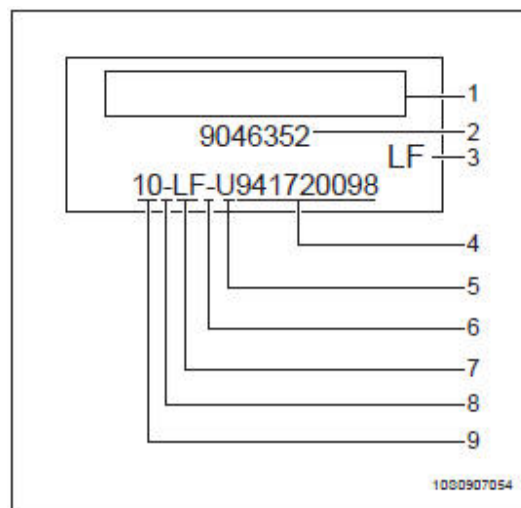
The steel seal number (2) of the 1.2L engine is in the left rear side of the engine cylinder block and is impressed or laser engraved on the cylinder block in assembly plant. In addition, the same serial number label and engine communication code label (1) are on the front engine cover.



■ Identification of Engine Label

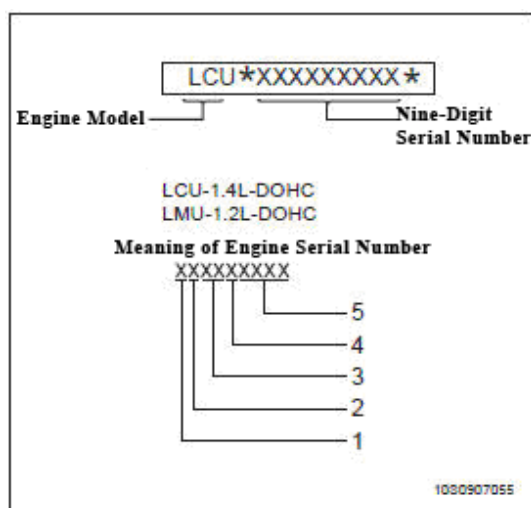
Bar Code

2. Engine Assembly Number
3. Engine Code (1.4L LCU: LF, 1.2L LMU: LL)
4. Nine-Digit Serial Number
5. Engine Factory Code (Fixed Code: U)
6. Separative Sign
7. Engine Code (1.4L LCU: LF, 1.2L LMU: LL)
8. Separative Sign
9. Part identification number: engine number is 10.



2.1.2 Significance of Engine Serial Number

1. Year Code
2. Month Code
 - 1-9: January - September; A: October;
 - B: November; C: December
3. Date Code
4. Engine Production Line Code (Fixed Code:2)
5. Production Sequence Number(From 1 To 9999)



2.2 Engine Parameters

2.2.1 Engine Oil

Recommended Engine Oil		API SM (ILSAC GF-IV) Grade: SAE 5W-30
Volume	1.2L LMU	3.75L
	1.4L LCU	3.75L

2.2.2 Spark plugs

Engine Models	Spark Plug Models	Spark Plug Gap
1.4L Dual Overhead Camshaft	NGK BKR6E-11	1-1.1 mm (0.039-0.043 in.)

1.2L Dual Overhead Camshaft	Tech RA7YC	0.8-0.9 mm (0.031-0.035 in.)
-----------------------------	------------	--------------------------------

2.2.3 Corresponding Temperature and Resistance Values of Engine Coolant Temperature Sensor and Intake Air Temperature Sensor

°C		Engine Coolant Temperature (ECT) Sensor	Intake Air Temperature (IAT) Sensor
		Ohm	
		Temperature And Resistance Values - Approximate Value	
100	212	177	187
90	194	241	246
80	176	332	327
70	158	467	441
60	140	667	603
50	122	973	837
45	113	1188	991
40	104	1459	1180
35	95	1802	1412
30	86	2238	1700
25	77	2796	2055
20	68	3520	2500
15	59	4450	3055
10	50	5670	3760
5	41	7280	4651
0	32	9420	5800
-5	23	12300	7273
-10	14	16180	9200
-15	5	21450	9200
-20	-4	28680	15080
-30	-22	52700	25600
-40	-40	100700	45300

2.2.4 Ignition System Specifications

■ Ignition System Specifications (1.2)

Application	1.2L Dual Over Head Camshaft
Ignition Type	Direct Ignition System
Ignition Timing (Base Timing)	4~5°
Ignition Sequence	1-3-4-2
Spark Plug Gap	0.8-0.9 mm (0.031-0.035 in.)
Spark Plug Manufacturer	Selim Tech

Spark Plug Type	RA7YC
-----------------	-------

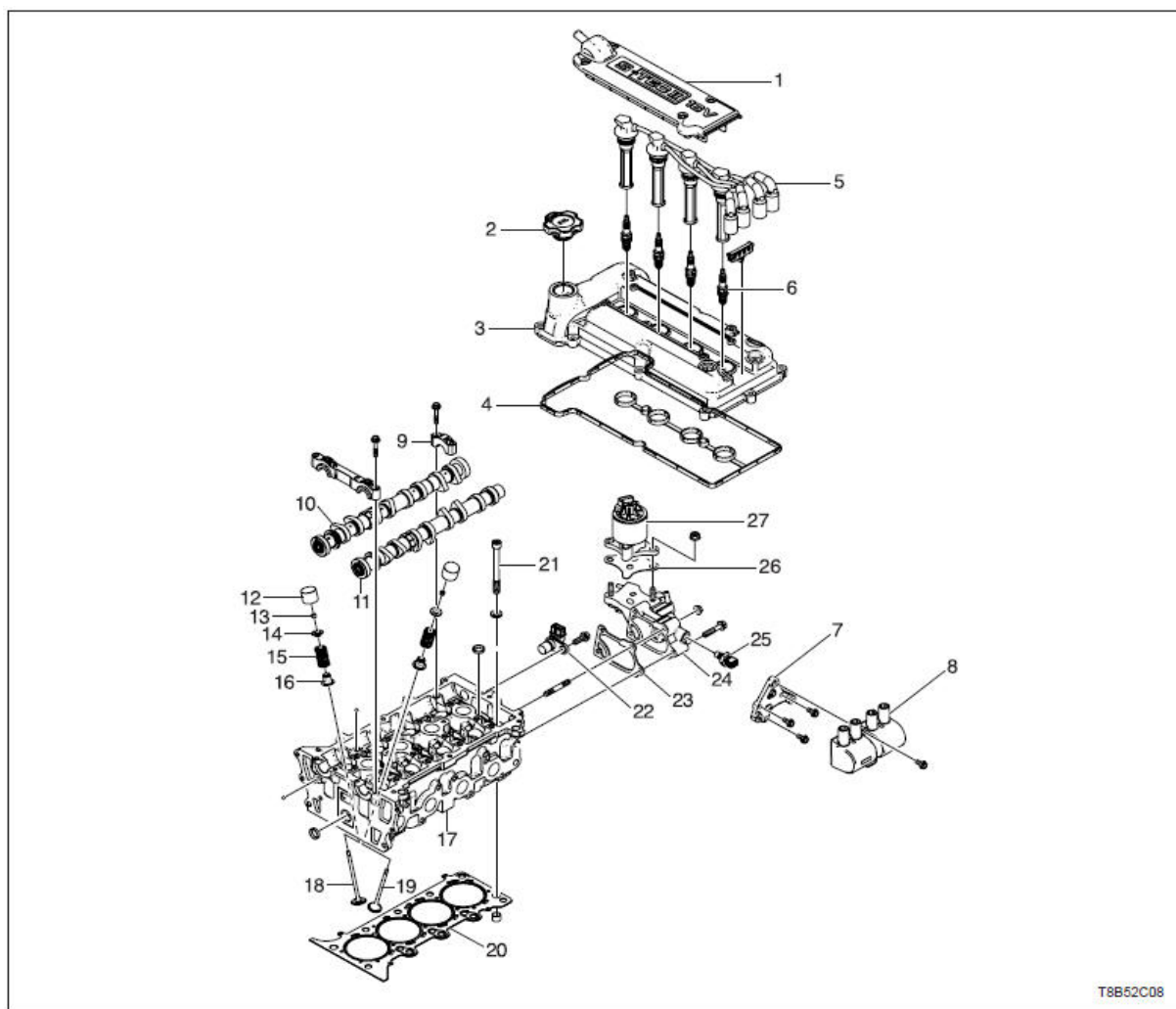
■ Ignition System Specifications (1.4)(Delphi)

Application	Specifications	
	Metric Units	English Units
Ignition Sequence	1-3-4-2	1-3-4-2
Ignition Timing	8° (BTDC)	
Ignition Type	Direct Ignition System	
Spark Plug Gap	1.0 – 1.1 Mm	0.039 – 0.043 in
Spark Plug Manufacturer	TORCH	
Spark Plug Model	K6RF-11	

2.3 Engine Identification Diagram

2.3.1 1.2L LMU

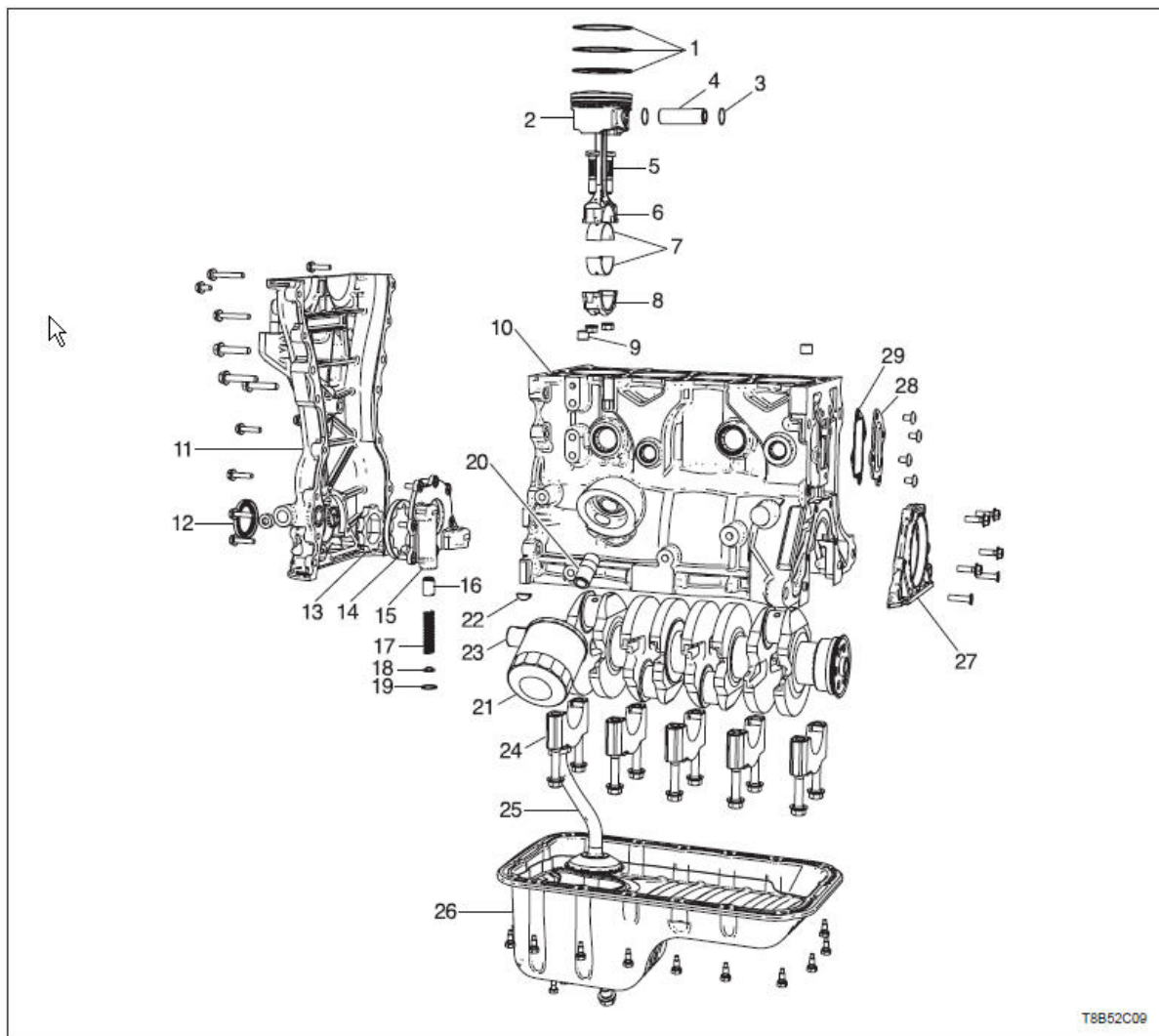
■ Cylinder Head



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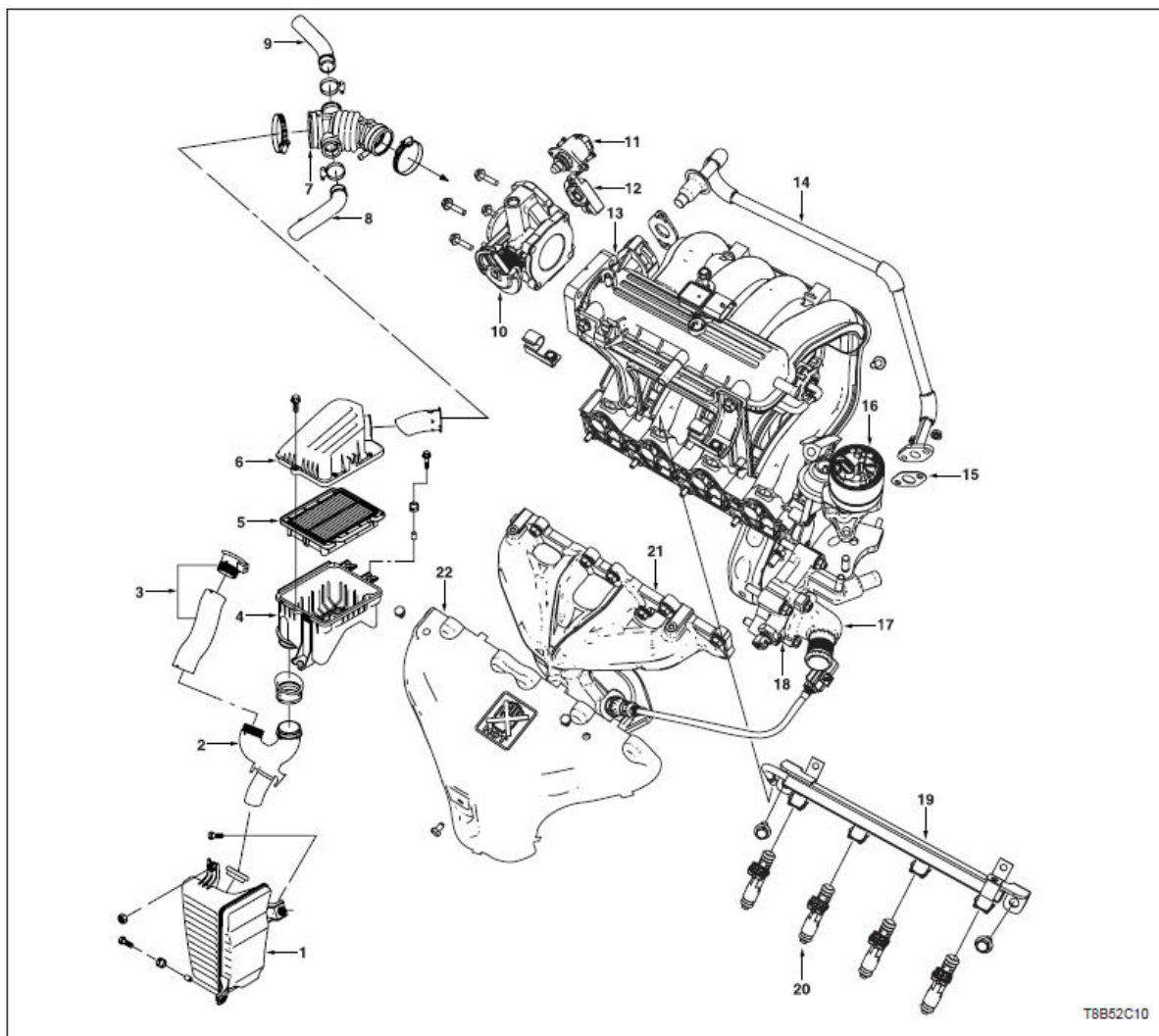
- | | |
|-----------------------------------------------------|--------------------------------------------|
| 1. Spark Plug Cable Cover | 14. Valve Spring Snap Ring |
| 2. Engine Oil Filler Cap | 15. Valve Spring |
| 3. Cylinder Head Cover | 16. Valve Stem Sealing Element |
| 4. Cylinder Head Cover Gasket | 17. Cylinder Head |
| 5. Spark Plug Cable | 18. Valve (Air Intake) |
| 6. Spark Plug | 19. Valve (Exhaust) |
| 7. Ignition Coil (Direct Ignition System) Bracket | 20. Cylinder Head Gasket |
| 8. Ignition Coil (Direct Ignition System) | 21. Cylinder Cover Bolt |
| 9. Camshaft Cover | 22. Camshaft Position Sensor |
| 10. Camshaft (Air Intake) | 23. Coolant Outlet Housing Gasket |
| 11. Camshaft (Exhaust) | 24. Coolant Outlet Housing |
| 12. Valve Tappet | 25. Coolant Temperature Sensor |
| 13. Valve Cotter | 26. Exhaust Gas Recirculation Valve Gasket |
| | 27. Exhaust Gas Recirculation Valve |

■ Cylinder Block



- | | |
|-------------------------------|--------------------------------------|
| 1. Piston Ring | 16. Metering Valve |
| 2. Piston | 17. Metering Valve Spring |
| 3. Piston Pin Fixture | 18. Metering Valve Cap |
| 4. Piston Pin | 19. Metering Valve Fixture |
| 5. Connecting Rod Cap Stud | 20. Oil Cleaner Stud |
| 6. Connecting Rod | 21. Oil Cleaner |
| 7. Connecting Rod Bearing | 22. Keyway |
| 8. Connecting Rod Cap | 23. Crankshaft |
| 9. Alignment Pin | 24. Crankshaft Bearing Cover |
| 10. Cylinder Block | 25. Engine Oil Filter Screen |
| 11. Timing Chain Cover | 26. Oil Pan |
| 12. Crankshaft Front Oil Seal | 27. Rear Crankshaft Oil Seal |
| 13. Oil Pump Inner Rotor | 28. Cylinder Block Plate Plug |
| 14. Oil Pump Outer Rotor | 29. Cylinder Block Plate Plug Gasket |
| 15. Oil Pump Cover | |

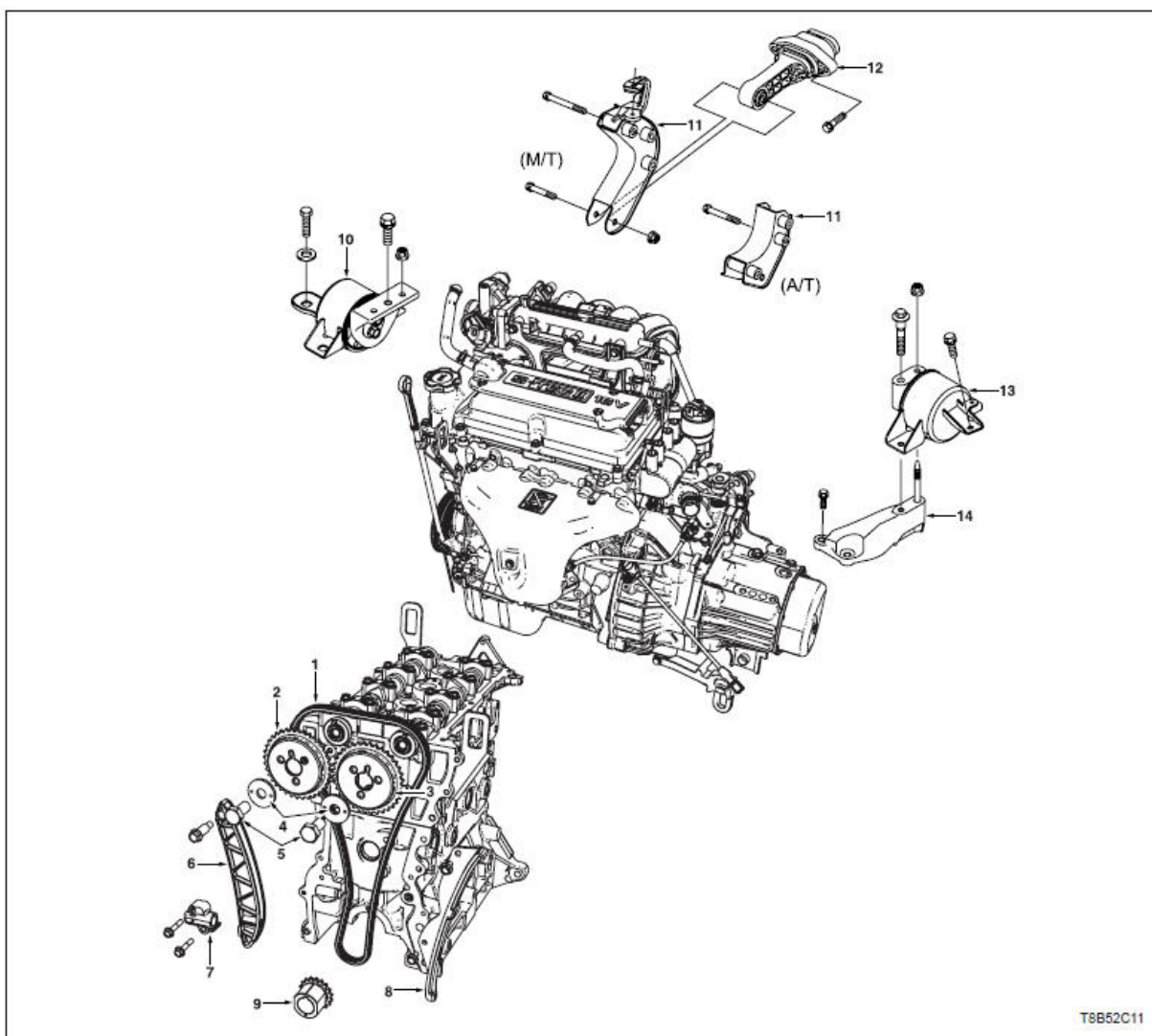
■ Manifold and Air Intake System



1. Resonator
2. Pipeline
3. Air Filter Draft Tube
4. Air Filter Lower Housing
5. Air Filter Cartridge
6. Air Filter Upper Cover
7. Air Exhaust Hose
8. Resonator
9. Resonator
10. Throttle Body
11. Idle Air Control Valve (IACV)

12. Throttle Position Sensor
13. Intake Manifold
14. Exhaust Gas Recirculation Tube
15. Exhaust Gas Recirculation Tube Gasket
16. Exhaust Gas Recirculation Valve
17. Thermostat Housing
18. Coolant Outlet Housing
19. Fuel Distributing Pipe
20. Oil Injector
21. Exhaust Manifold
22. Exhaust Manifold Thermal Baffle

■ Timing System and Support

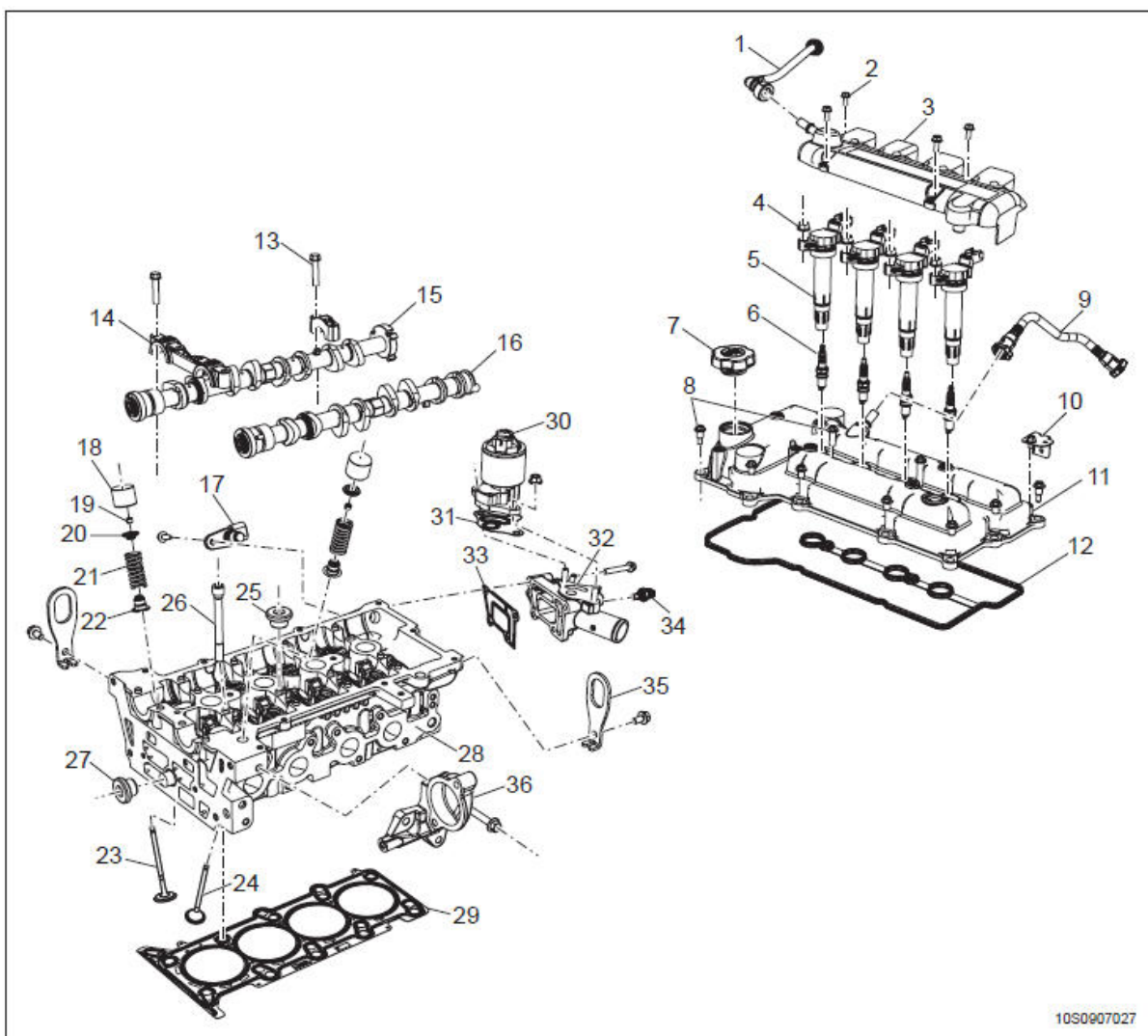


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- | | |
|-------------------------------------|-----------------------------------|
| 1. Timing Chain | 8. Timing Chain Guide Plate |
| 2. Camshaft Sprocket (Air Intake) | 9. Crankshaft Sprocket |
| 3. Camshaft Sprocket (Exhaust) | 10. Engine Support Assembly |
| 4. Lining | 11. Rear Support Bracket |
| 5. Camshaft Sprocket fixing bolt | 12. Transmission Rear Support |
| 6. Timing Chain Rod | 13. Transmission Support Assembly |
| 7. Timing Chain Tensioner | 14. Transmission Support Bracket |

2.3.2 1.4L LCU

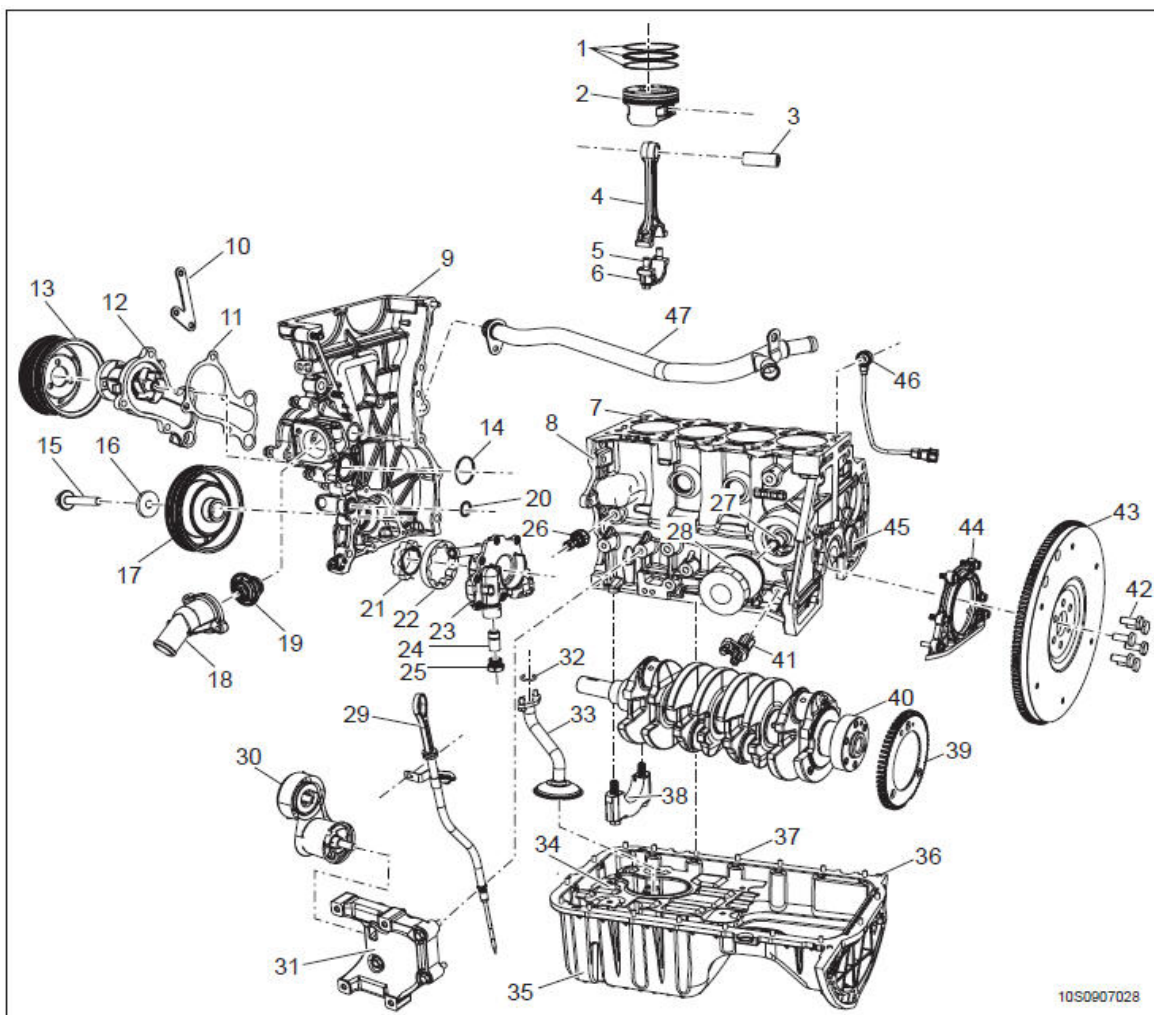
■ Cylinder Head



- | | |
|---------------------------------|----------------------------------------------------|
| 1. Crankshaft Fresh Air Pipe | 19. Valve Cotter |
| 2. Ignition Coil Cap Bolt | 20. Valve Spring Snap Ring |
| 3. Ignition Coil Cap | 21. Valve Spring |
| 4. Ignition Coil Bolt | 22. Valve Tappet Sealing Element |
| 5. Ignition Coil | 23. Valve Tappet (Air Intake) |
| 6. Spark Plug | 24. Valve Tappet (Exhaust) |
| 7. Engine Oil Fill Up Cap | 25. Spout Plug |
| 8. Camshaft Cover Bolt | 26. Cylinder Cover Bolt |
| 9. Forced Crankshaft Draft Tube | 27. Spout Plug |
| 10. Harness Fixing Support | 28. Cylinder Head |
| 11. Camshaft Cover | 29. Cylinder Head Sealing Gasket |
| 12. Camshaft Sealing Gasket | 30. Exhaust Gas Recirculation Valve |
| 13. Camshaft Cover Bolt | 31. Exhaust Gas Recirculation Valve Sealing Gasket |
| 14. Camshaft Cover | 32. Coolant Outlet Housing |
| 15. Air Intake Camshaft | 33. Coolant Outlet Housing Sealing Gasket |
| 16. Exhaust Camshaft | 34. Coolant Temperature Sensor |
| 17. Camshaft Position Sensor | |
| 18. Valve Tappet | |

35. Engine Lifting Lug
36. Power Steering Pump Bracket

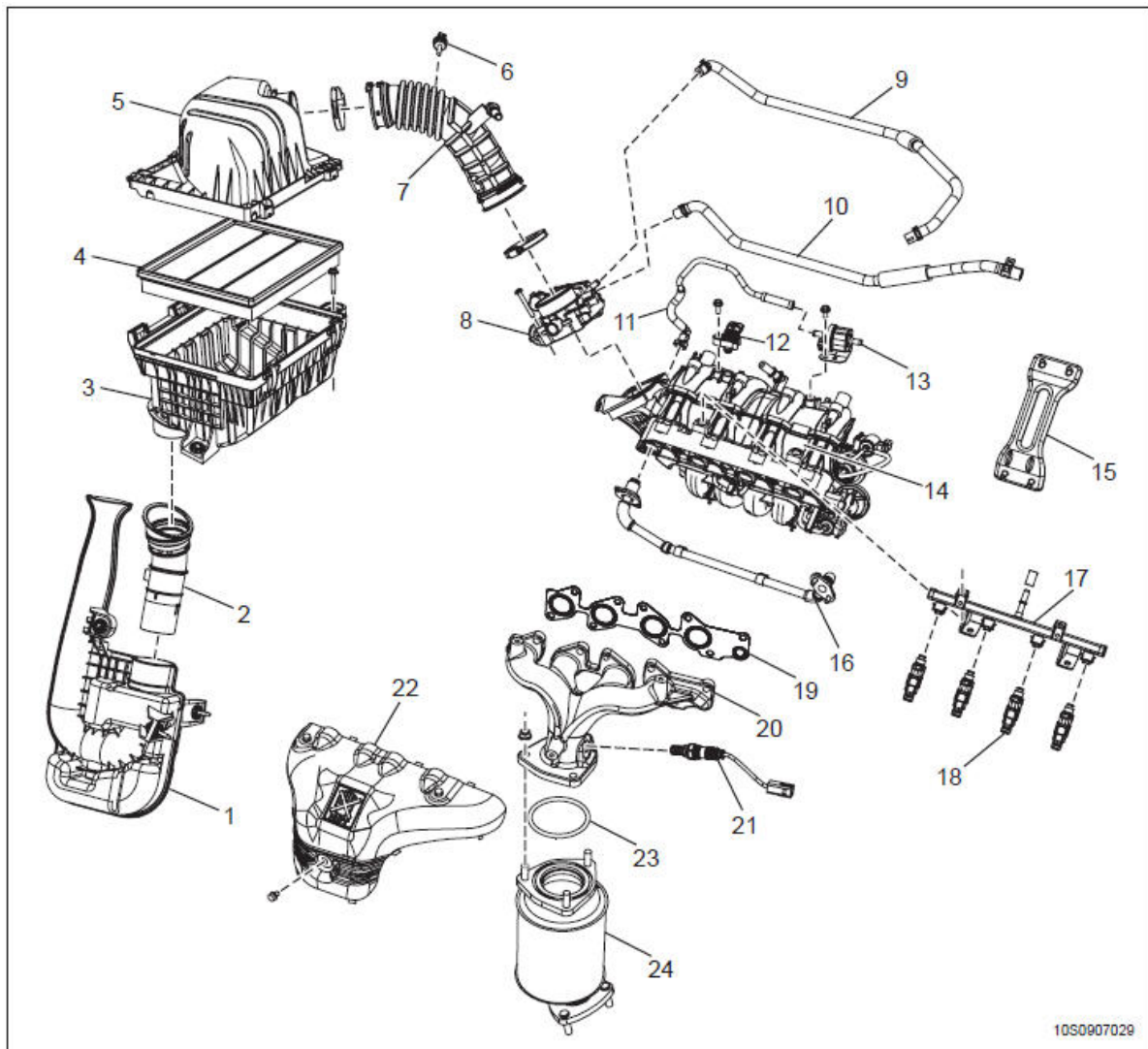
■ Cylinder Block



- | | |
|------------------------------------------|------------------------------------------------------------------|
| 1. Piston Ring | 25. Metering Valve Plug Cover |
| 2. Piston | 26. Engine Oil Pressure Switch |
| 3. Piston Pin | 27. Engine Oil Filter Switch Port |
| 4. Connecting Rod | 28. Engine Oil Filter |
| 5. Connecting Rod Bolt | 29. Engine Oil Dipstick and Conduit |
| 6. Connecting Rod Cap | 30. Driving Belt Tensioner |
| 7. Alignment Pin | 31. Air Conditioning Compressor Bracket |
| 8. Cylinder Block | 32. Oil Suction Pipe Sealing Ring |
| 9. Front Engine Cover | 33. Oil Suction Pipe (Equipped with Oil Suction Filter Screen) |
| 10. Front Support of Power Steering Pump | 34. Oil Baffle Plate |
| 11. Water Pump Gasket | 35. Oil Pan |
| 12. Water Pump | 36. Oil Pan Alignment Pin |
| 13. Water Pump Belt Pulley | 37. Oil Pan Bolt |
| 14. Water Pump Sealing Ring | 38. Crankshaft Bearing Cover |
| 15. Crank Belt Pulley Bolt | 39. Crankshaft Position Sensor Magneto |
| 16. Crank Belt Pulley Washer | |

- | | |
|----------------------------------------------------------------|-----------------------------------------------|
| 17. Crank Belt Pulley | resistive Ring |
| 18. Coolant Inlet Pipe (Equipped with
Thermostat Housing) | 40. Crankshaft |
| 19. Thermostat | 41. Crankshaft Position Sensor |
| 20. Oil Pump Sealing Ring | 42. Flywheel Bolt |
| 21. Oil Pump inner Gear Rotor | 43. Flywheel |
| 22. Oil Pump External Gear Rotor | 44. Rear Crankshaft Oil Seal |
| 23. Oil Pump Housing Cover | 45. Cylinder Block Blank Cover |
| 24. Metering Valve | 46. Knocking Sensor |
| | 47. Heating and Ventilation Return Water Pipe |

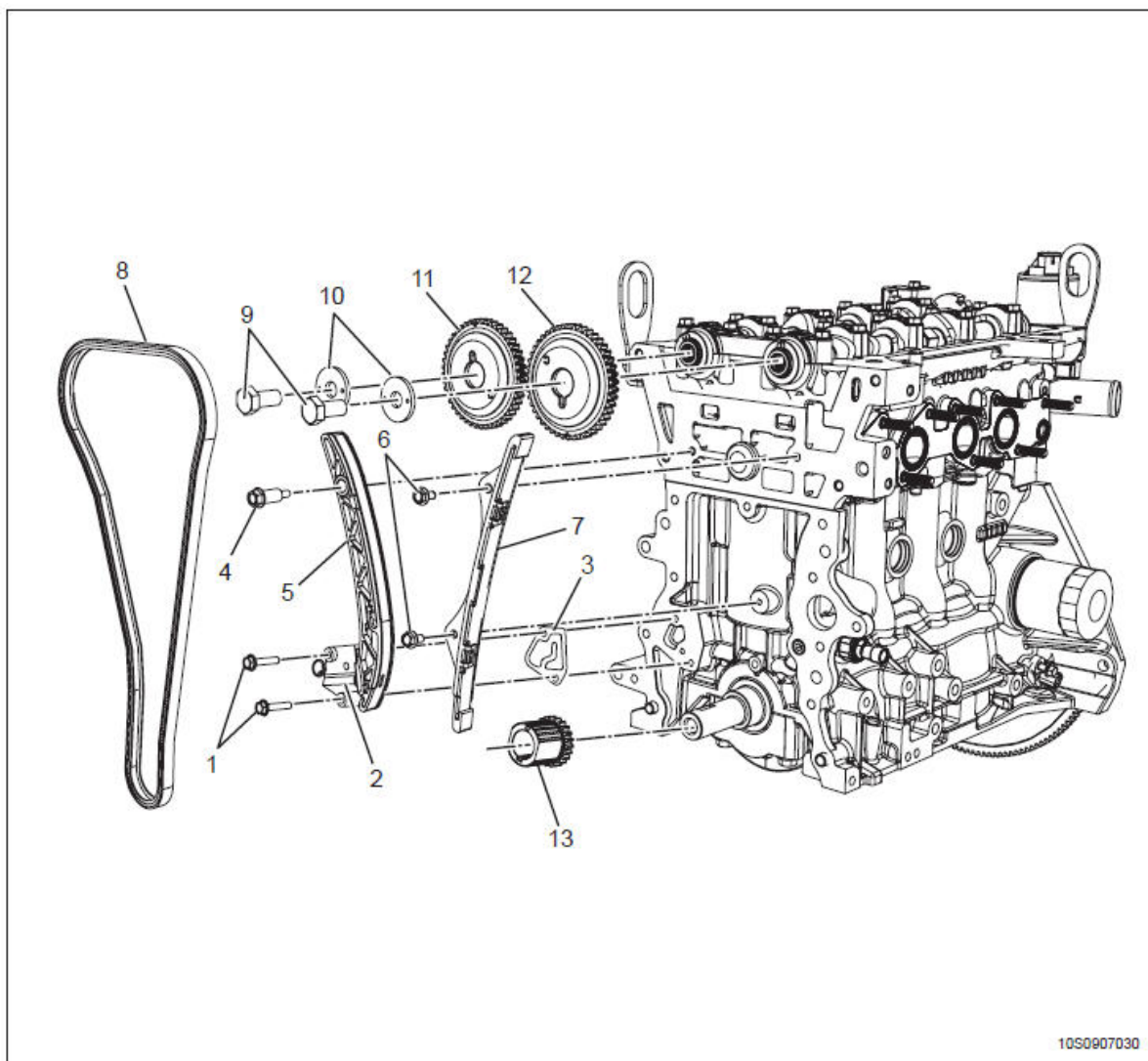
■ Air Intake and Exhaust System



1. Resonator
2. Air Intake Pipe
3. Air Filter Lower Housing
4. Air Filter Cartridge
5. Air Filter Upper Cover
6. Air Temperature Pressure Gauge
7. Air Exhaust Hose
8. Throttle Body
9. Throttle Body Heater Water Inlet Pipe
10. Throttle Body Heater Water Outlet Pipe
11. Fuel Evaporative Emission Solenoid Valve Vacuum Tube
12. Manifold Absolute Pressure Sensor

13. Fuel Evaporative Emission Solenoid Valve
14. Intake Manifold
15. Intake Manifold Bracket
16. Exhaust Gas Recirculation Tube
17. Fuel Distributing Pipe Support
18. Oil Injector
19. Exhaust Manifold Gasket
20. Exhaust Manifold
21. Front Heating-Type Oxygen Sensor
22. Exhaust Manifold Thermal Shroud
23. Three-way Catalytic Converter Sealing Plate
24. Three-way Catalytic Converter

■ Timing System

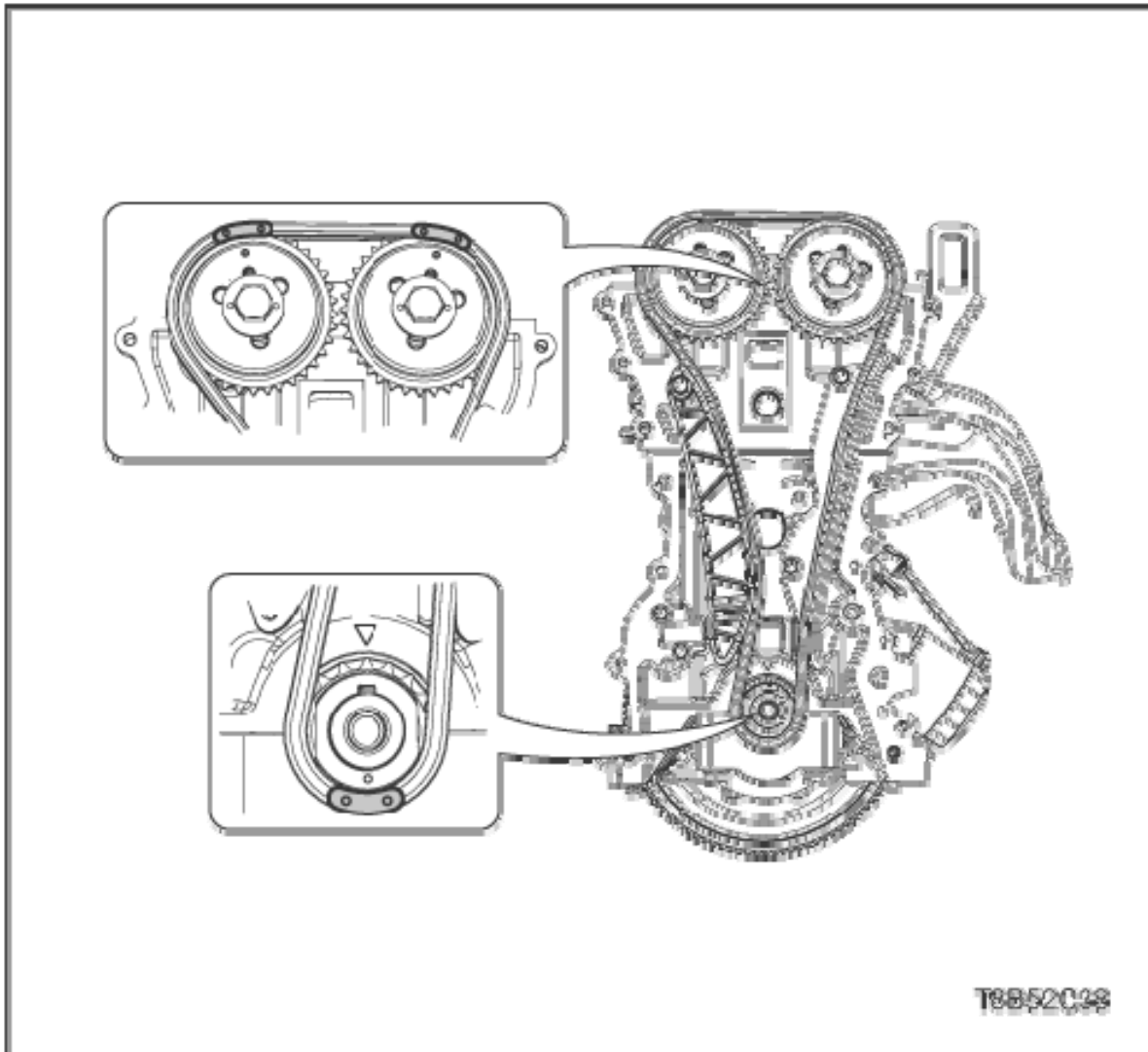


1. Timing Chain Tensioner Bolt
2. Timing Chain Tensioner
3. Timing Chain Tensioner Gasket
4. Timing Chain Main Guide Plate Bolt
5. Timing Chain Main Guide Plate
6. Timing Chain Guide Plate Bolt

7. Timing Chain Guide Plate
8. Timing Chain
9. Camshaft Timing Sprocket Bolt
10. Camshaft Timing Sprocket Washer
11. Intake Camshaft Timing Chain Wheel
12. Exhaust Camshaft Timing Chain Wheel
13. Crankshaft Timing Sprocket

2.4 Engine Maintenance and Service

2.4.1 Timing Calibration



■ 1.2L LMU

1. Align the mark on the camshaft sprocket with the mark on the timing chain, and then mount the timing chain.
2. Align the mark on the crankshaft sprocket with the mark on the timing chain.
3. Push the timing chain tensioner rod, and fix it through mounting the tensioner pin (EN-49073) .
4. Assemble the timing chain guide plate.

Fastening: fasten the fixed bolts of the timing chain guide plate to 12 N.m (106 in.lbf)

5. Assemble the timing chain main guide plate.

Fastening: fasten the fixed bolts of the timing chain rod to 15 N.m (11 foot pound) .

6. Assemble the timing chain tensioner.

Fastening: fasten the fixed bolts of the timing chain tensioner to 12 N.m (106 in.lbf) .

■ 1.4L LCU

1. Align the mark on the camshaft sprocket with the mark on the timing chain, and then mount the timing chain.
2. Align the mark on the crankshaft sprocket with the mark on the timing chain.
3. Push the timing chain tensioner rod, and fix it through mounting the tensioner pin (EN-49073) .
4. Assemble the timing chain guide plate.

Fastening: fasten the fixed bolts of the timing chain guide plate to 10 N.m (7.4 foot pound) .

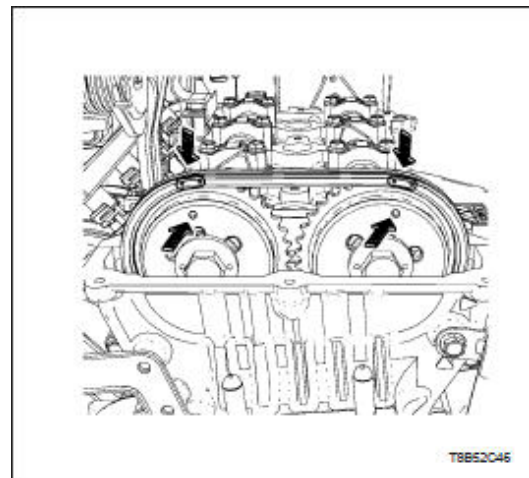
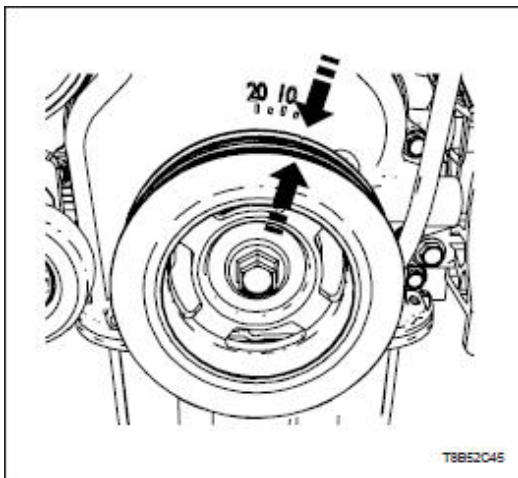
5. Assemble the timing chain main guide plate.

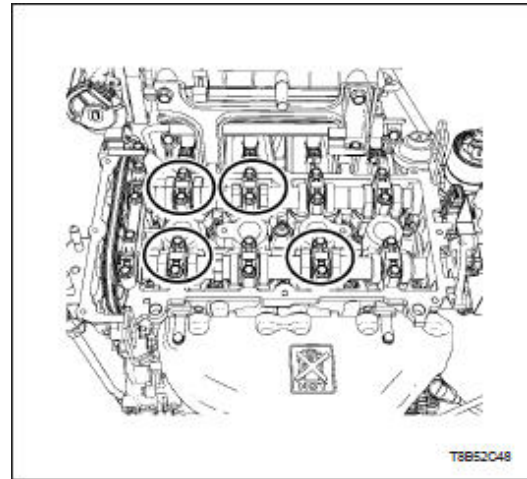
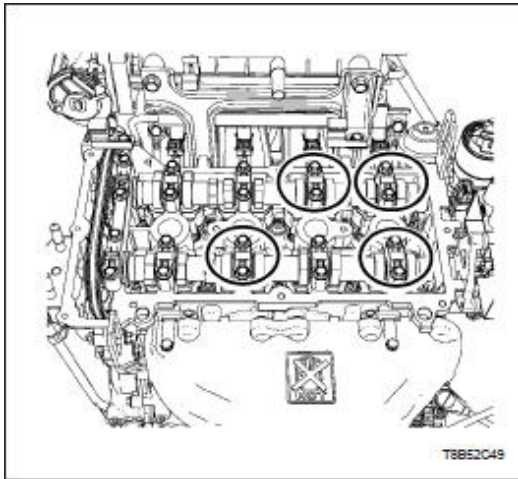
Fastening: fasten the fixed bolts of the timing chain rod to 10 N.m (7.4 foot pound) .

6. Assemble the timing chain tensioner.

Fastening: fasten the fixed bolts of the timing chain tensioner to 12 N.m (8.8 foot pound) .

2.4.2 Valve Clearance Adjustment (1.2&1.4)





■ Valve Clearance Adjustment

Caution: Valve clearance test should be carried out under normal coolant temperature (15- 25°C), and the valve clearance should be measured when cylinder head and cylinder block are assembled together.

1. Dismount the camshaft cover, and please refer to "replacement of camshaft cover".
2. Turn the crank belt pulley according to the diagram and adjust the belt pulley groove to the "0" point. This is in order to adjust #1 cylinder to the top dead center.
3. Check the camshaft sprocket and the timing chain, and align the timing marks respectively.
4. Measure the valve clearance of each point according to the diagram.
5. Turn the crank belt pulley to 360°, and adjust the belt pulley groove to the "0" point.
6. Measure the valve clearance for each point according to the diagram.
 - Intake valve specifications: 0.075-0.125 mm (coolant temperature: 20°C)
 - Exhaust valve specifications: 0.245-0.305 mm (coolant temperature: 20°C)
7. If measured values are beyond the specifications, then valve tappets need to be replaced.

2.5 Engine Management System

2.5.1 ECM Input

- Vehicle Speed Sensor (VSS)
- Crankshaft Position (CKP) Sensor
- Throttle Position Sensor

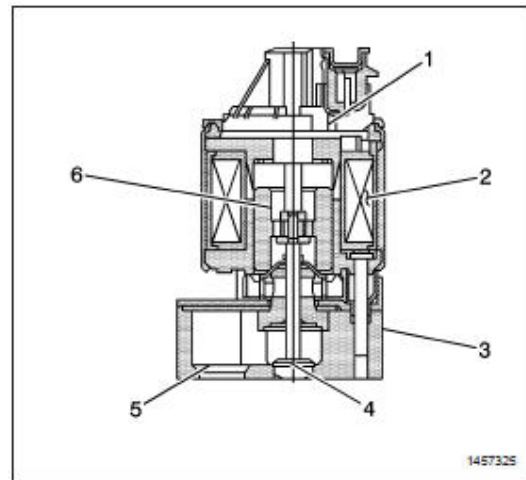
- Engine Coolant Temperature (ECT) Sensor
- Camshaft Position (CMP) Sensor
- Manifold Absolute Pressure (MAP) Sensor

2.5.2 ECM Output

- Idle Air Control (IAC) Motor
- Evaporative Emission (EVAP) Canister Purge Solenoid Valve Controlled by Control Modules
- Air Conditioning Relay
- Cooling Fan Relay
- Vehicle Speed Sensor (VSS) Output
- Malfunction Indicator Lamp (MIL) Control

2.5.3 EGR Valve

1. Position Sensor
2. Coil Assembly
3. Base
4. Pivot
5. Exhaust Entry
6. Armature



2.5.4 Programming and Setting of Engine Control Module

The following servicing programs need to be programmed or set to complete repair.

The replacement of the engine control module: if the engine control module (ECM) is replaced, then the following programs must be executed:

1. Engine Control Module Programming
2. Throttle Read-In Program
3. Anti-Theft System

After receiving an encrypted message, the engine control module will immediately read it and enter the continued fuel supply password. Once an encrypted message is received and read, then the read-in program must be executed again to change this password. Originally mounted in other vehicles, the engine control module might have read other vehicles' continued fuel supply passwords and it needs to execute the read-in program after being programmed in order to read the current vehicle's password.

4. Residual engine oil life: employ a diagnostic instrument (if equipped) to reset "residual engine oil life" to the recorded original percentage before module replacement.
5. Residual life of transmission oil: employ a diagnostic instrument (if equipped) to reset "residual life of transmission oil" to the recorded original percentage before module replacement.

Reprogramming of engine control module

- If the engine control module (ECM) needs to be reprogrammed, please refer to "Service Programming System (SPS) "

Residual engine oil life: employ a diagnostic instrument(if equipped)to reset "residual engine oil life" to the recorded original percentage before module reprogramming.

Component replacement setting

The replacement of some components requires execution of a setting program to complete repair.

If any of the following components needs to be replaced, the "idle read-in program" must be executed.

- Throttle Body Assembly
- Engine Control Module

2.5.5 Idle Read-In Program

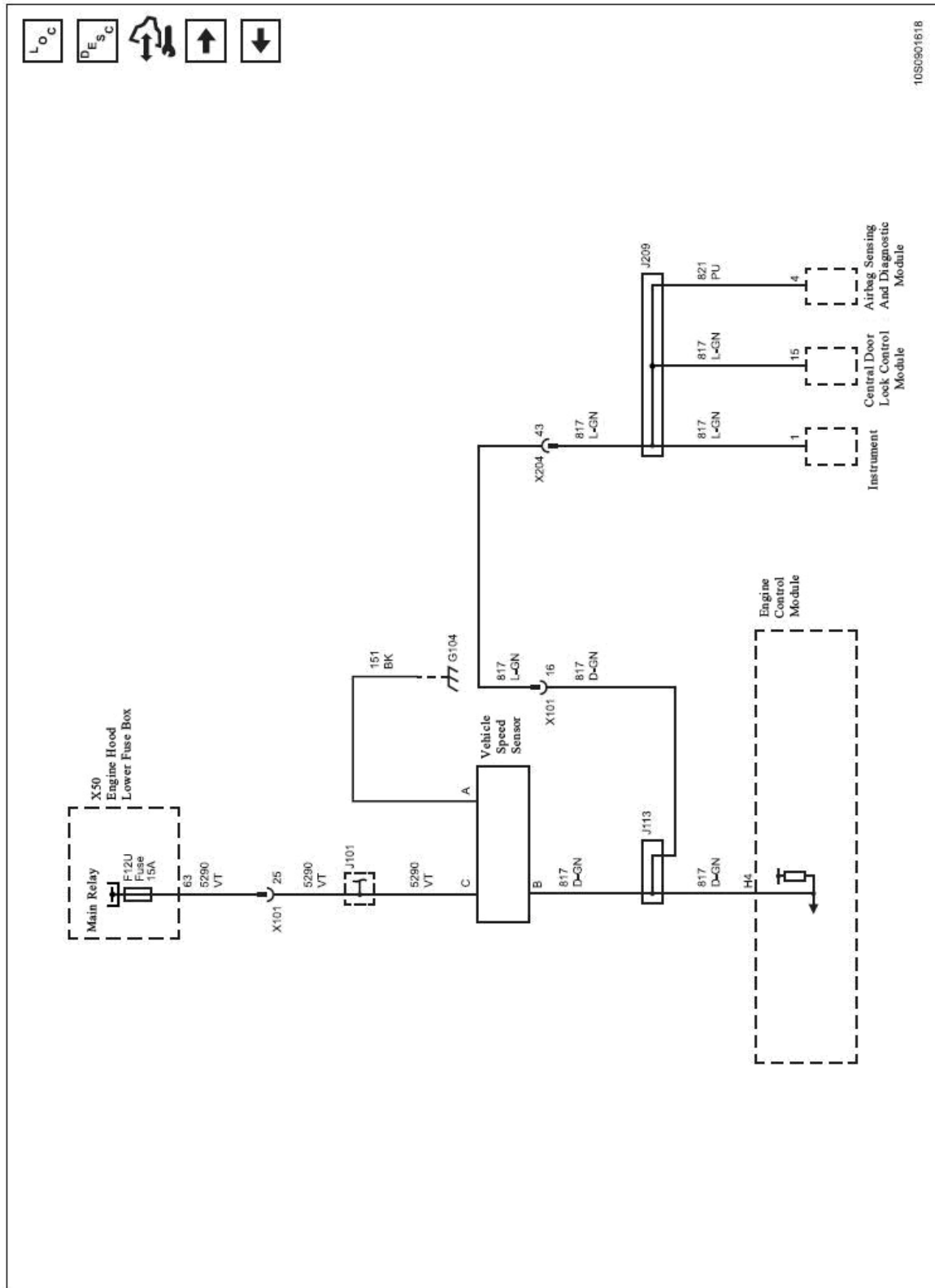
In the case of any of the following situations, program 1 and 2 must be executed:

- Accumulator cable is disconnected.
- Engine control module is disconnected or replaced.
- The fuse, transmitting the ignition 1 or the anode voltage of the accumulator to the engine control module, is dismantled.

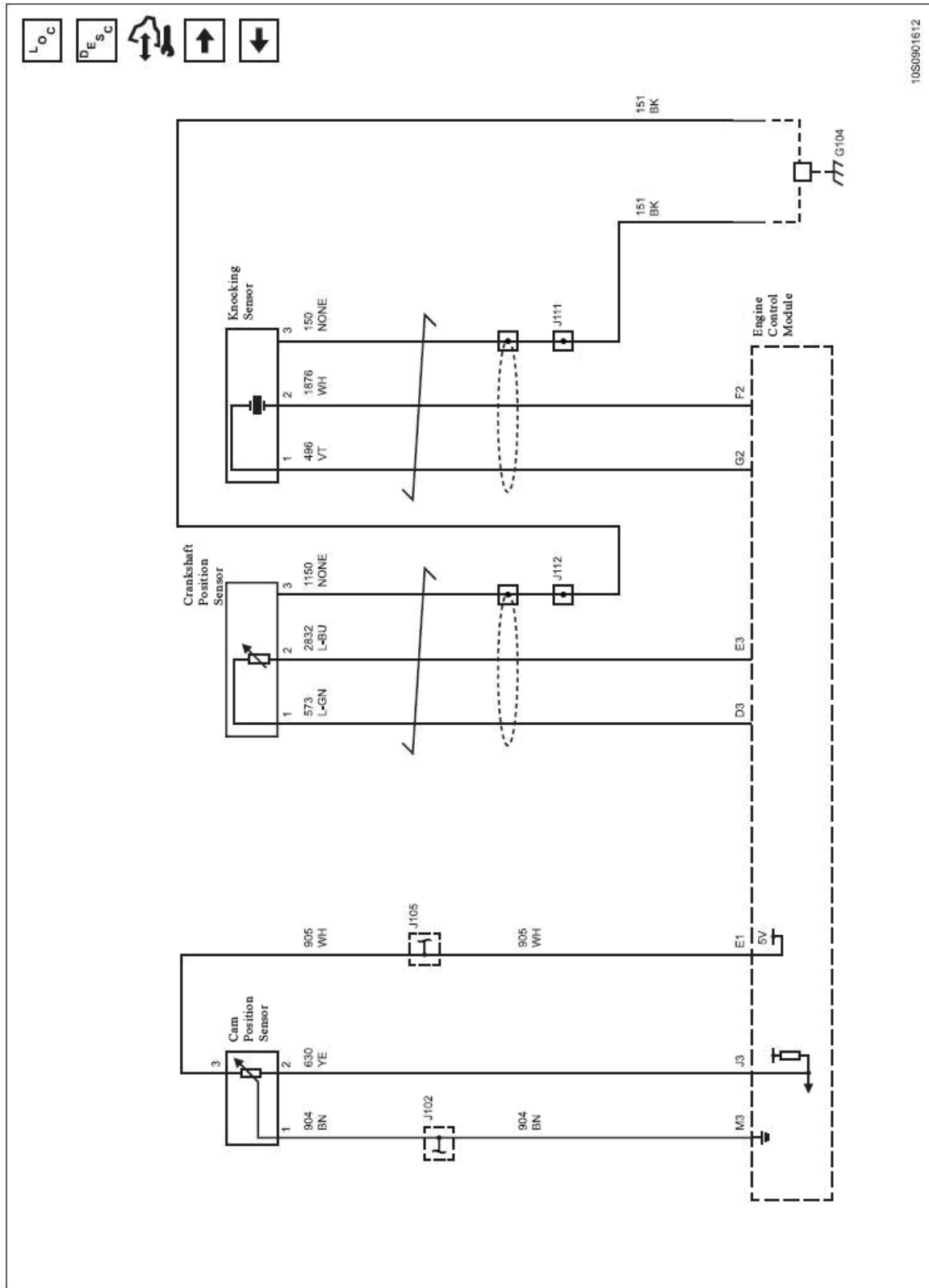
- Idle air control valve is dismounted or replaced.
- Idle air control system encounters trouble.
- Program 1
 1. Shut down all accessories.
 2. Start the engine.
 3. Maintain the engine in idle for 10 seconds.
 4. Shut down the ignition switch for 1 minute.
 5. Execute program 2
- Program 2
 - EMT
 - Run the engine until the engine coolant temperature is above 85°C (185°F) .
 - Maintain the engine in idle for 10 minutes.
 - Switch on the air conditioning (if equipped) for 1 minute.
 - Switch off the air conditioning (if equipped) for 1 minute.
 - Pull the hand brake up and shift the transmission into drive (D) .
 - Maintain the engine in idle for 1 minute.
 - Switch on the air conditioning (if equipped) for 1 minute.
 - Shut down the ignition switch. By now, the idle read-in program is complete.
 - Manual Transmission
 - Run the engine until the engine coolant temperature is above 85°C (185°F) .
 - Maintain the engine in idle for 10 minutes.
 - Switch on the air conditioning (if equipped) for 1 minute.
 - Shut down the ignition switch. By now, the idle read-in program is complete.

2.6 Circuit Diagrams

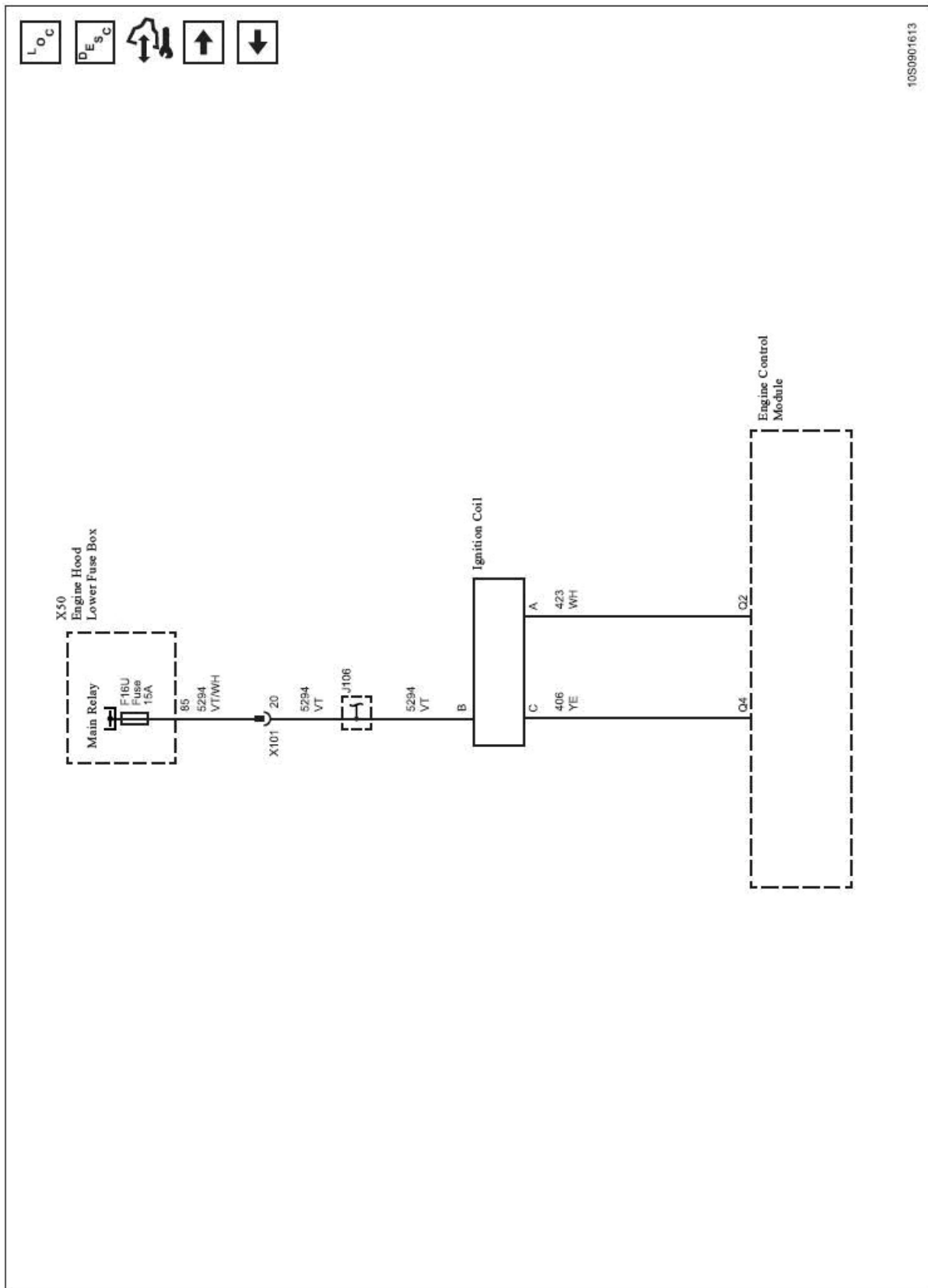
2.6.1 Vehicle Speed Sensor Schematic Diagram (1.2MT)



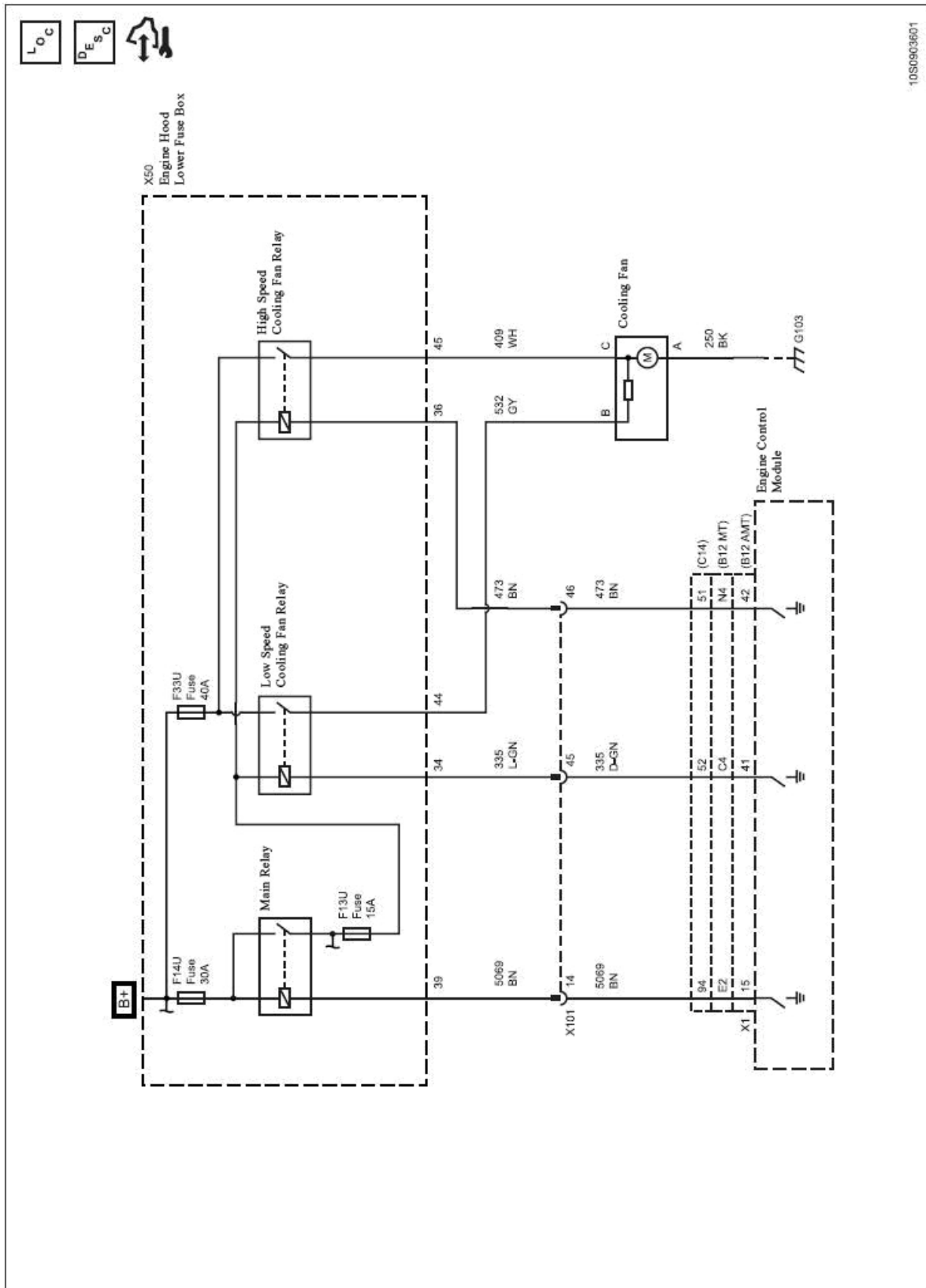
2.6.2 Ignition Control Sensor Schematic Diagram (1.2MT)



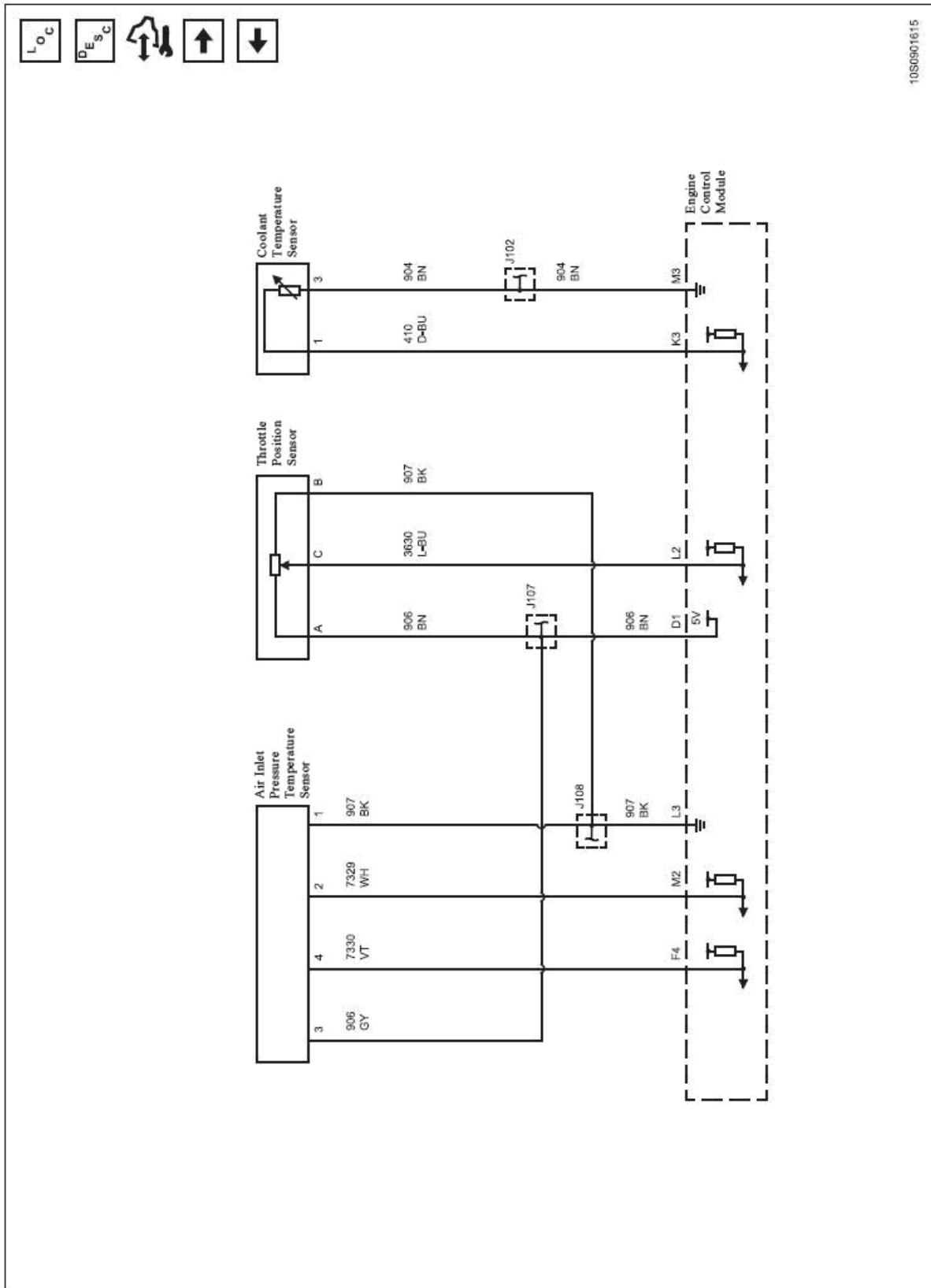
2.6.3 Ignition Control - Ignition System Schematic Diagram (1.2MT)



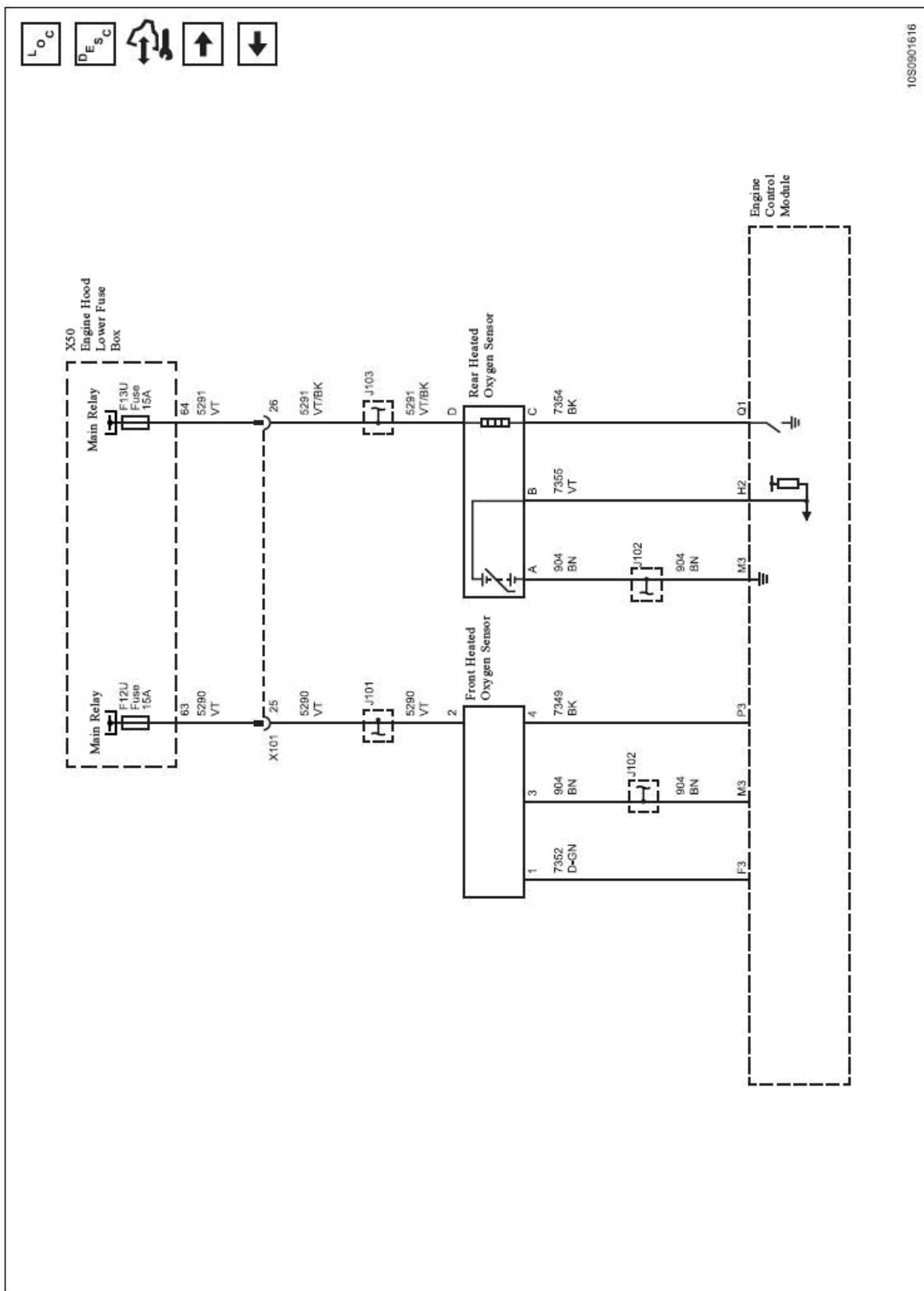
2.6.4 Engine Cooling System Schematic Diagram (1.2MT)



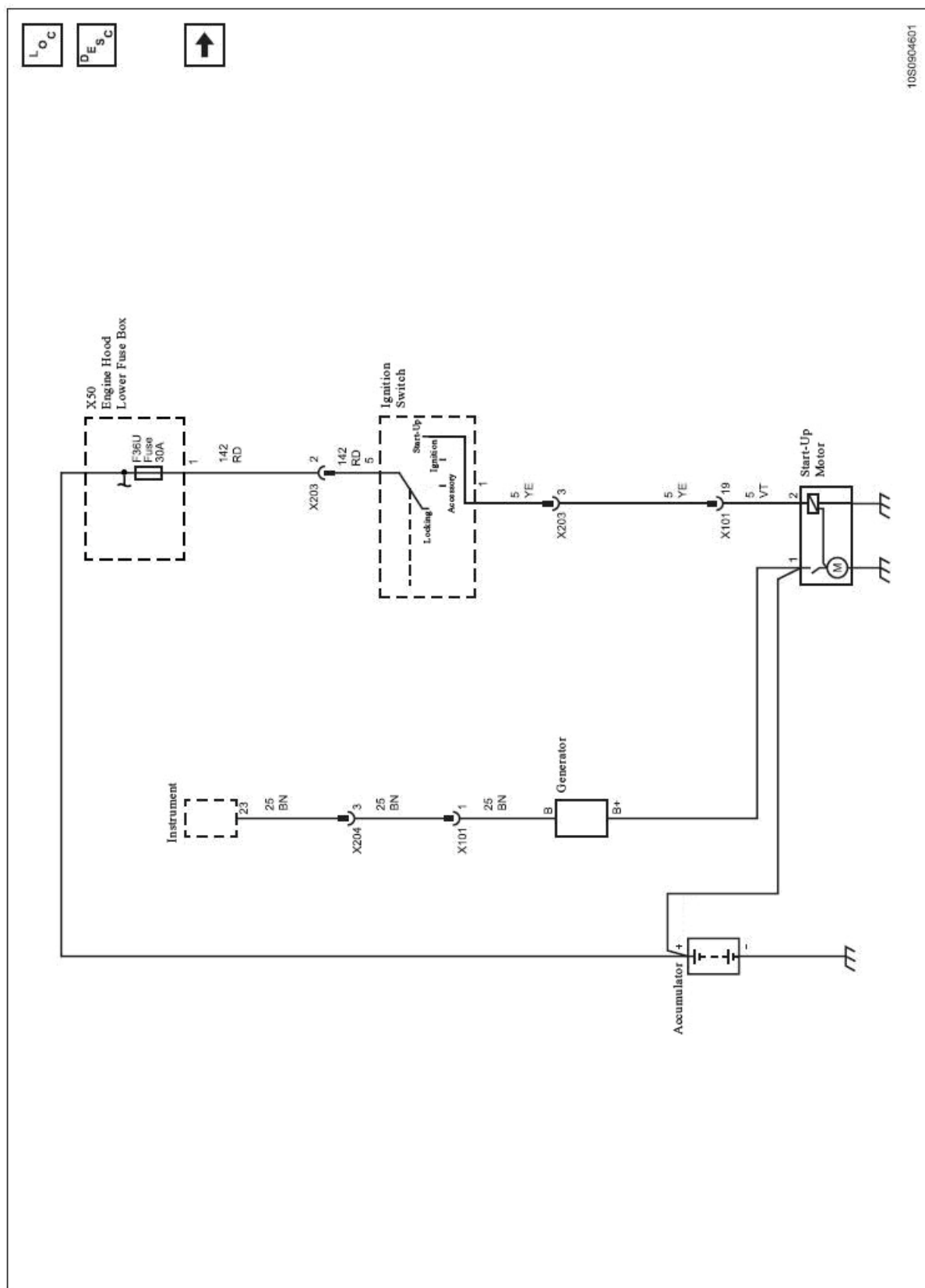
2.6.5 Engine Data Sensor - Pressure and Temperature Schematic Diagram (1.2MT)



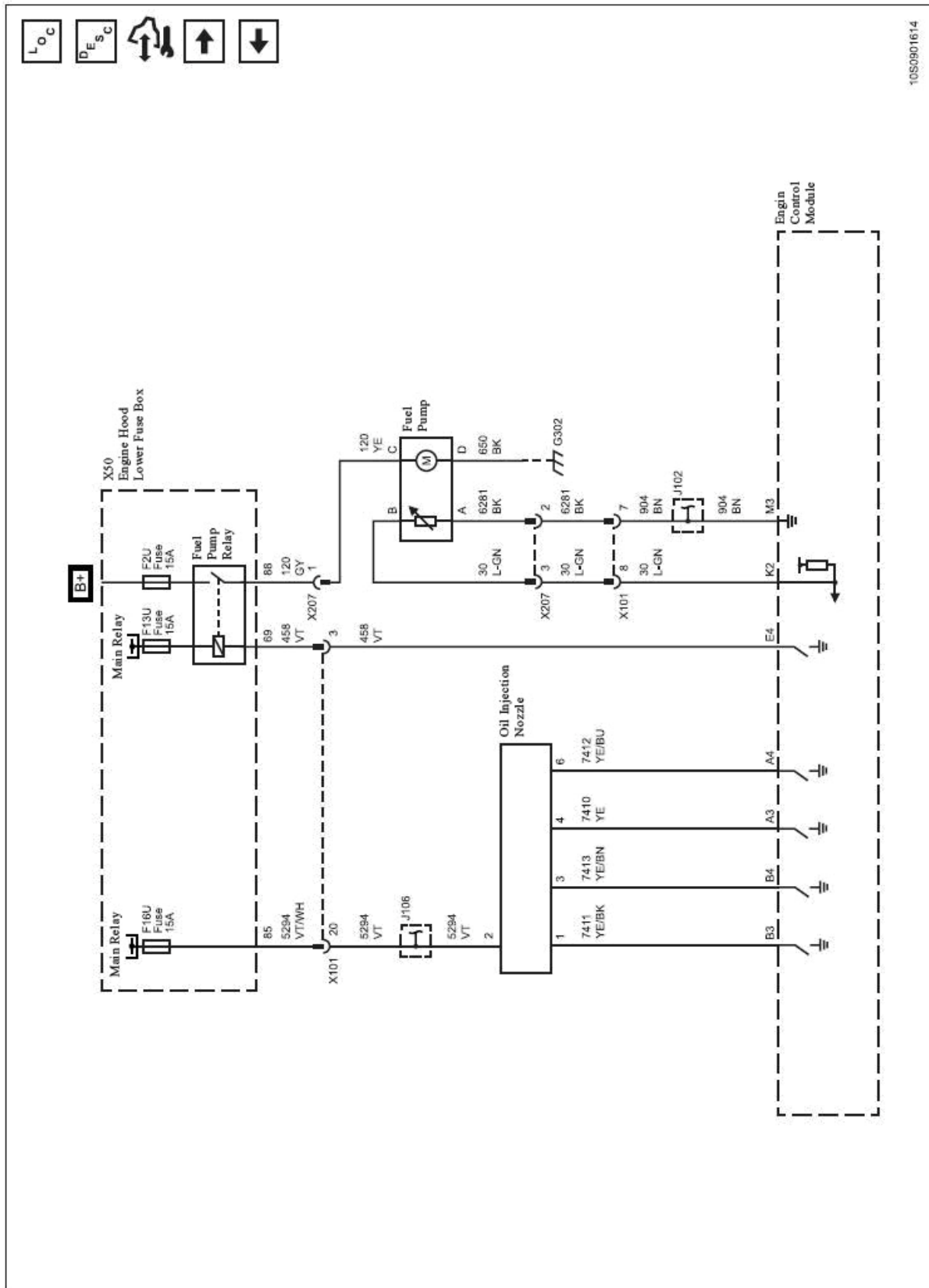
2.6.6 Engine Data Sensor - Oxygen Sensor Schematic Diagram (1.2MT)



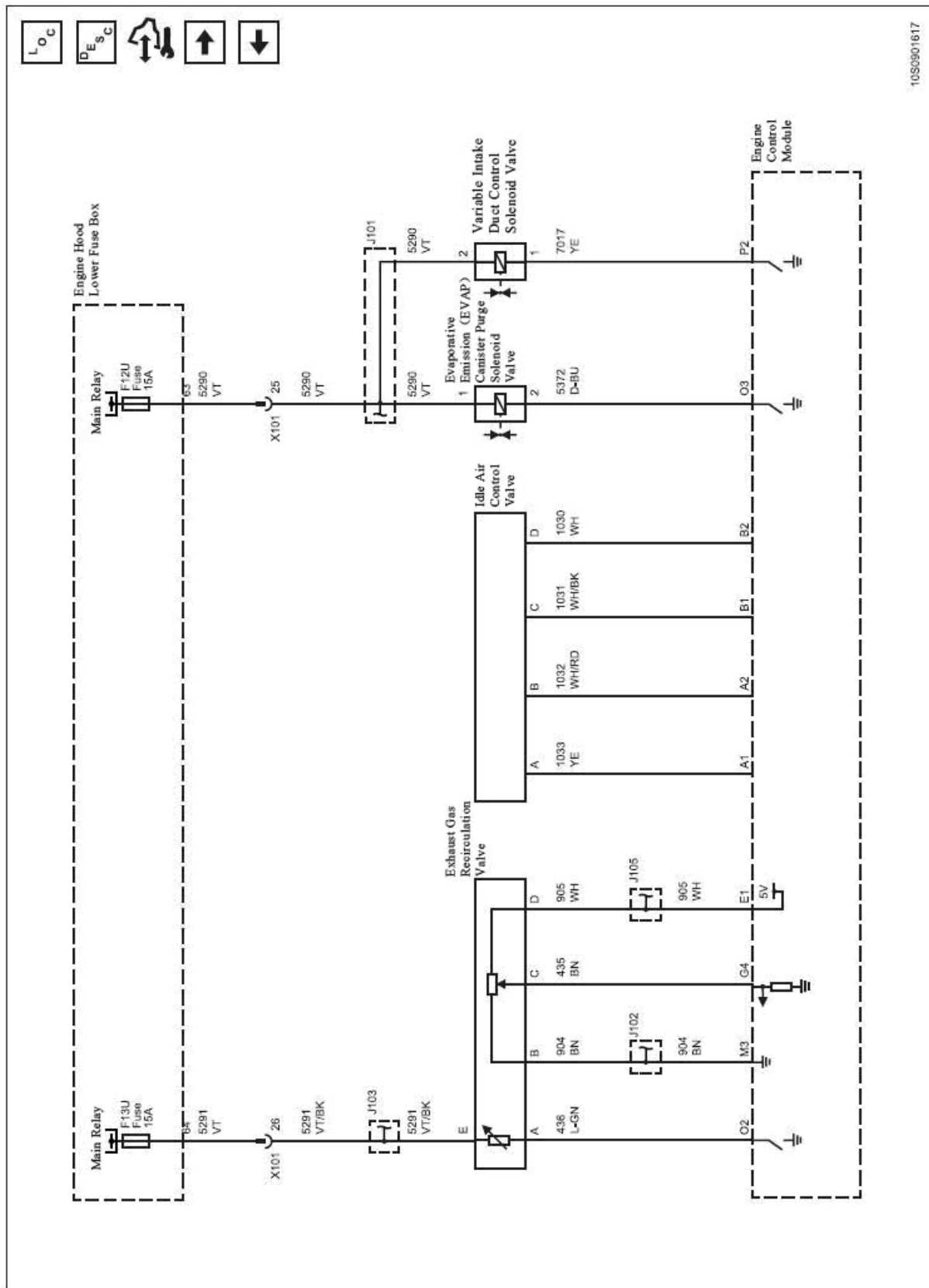
2.6.8 Startup and Charging Schematic Diagram (1.2MT)



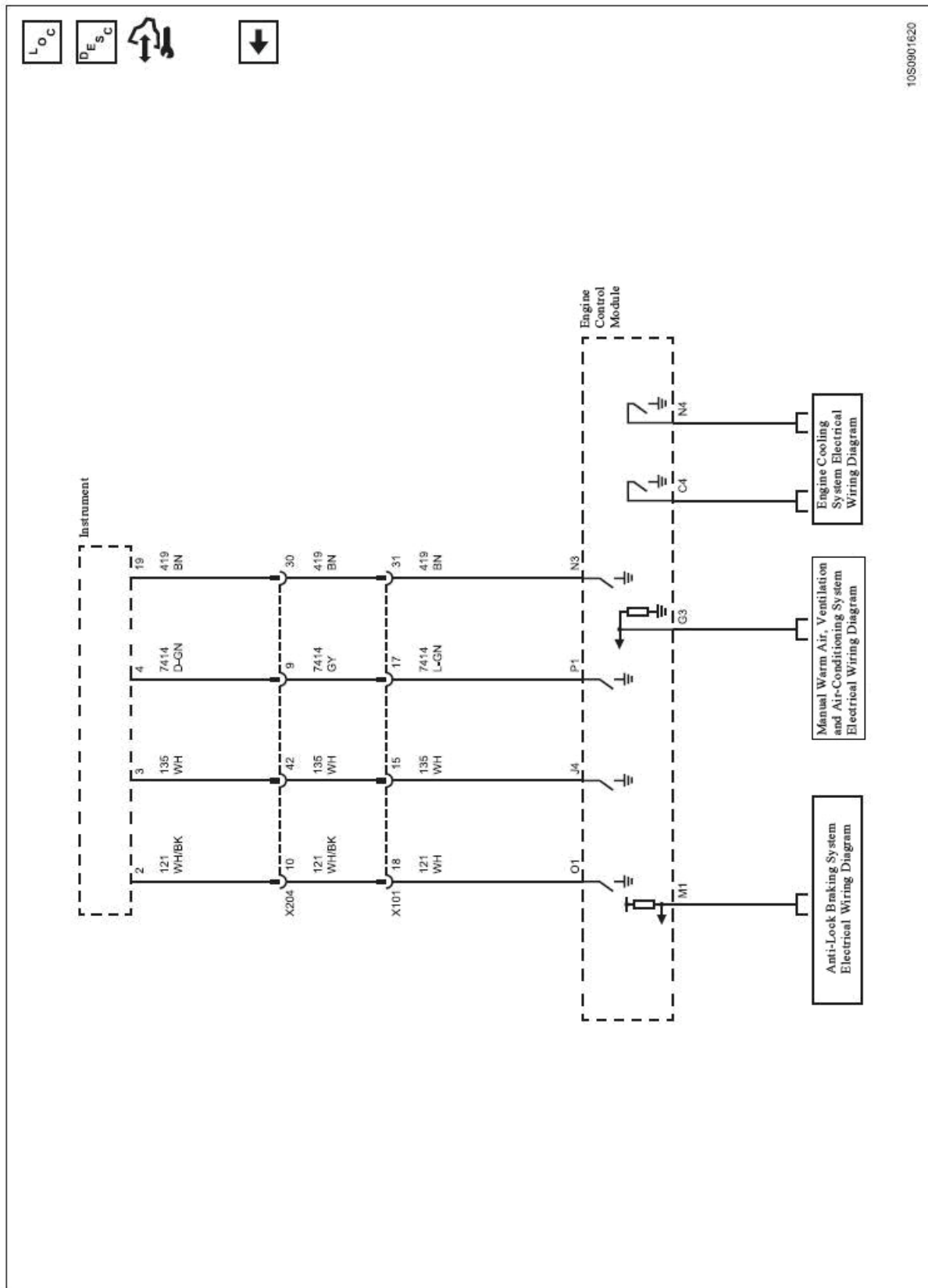
2.6.9 Fuel Control System - Fuel Pump Control System and Oil Injector Schematic Diagram (1.2MT)



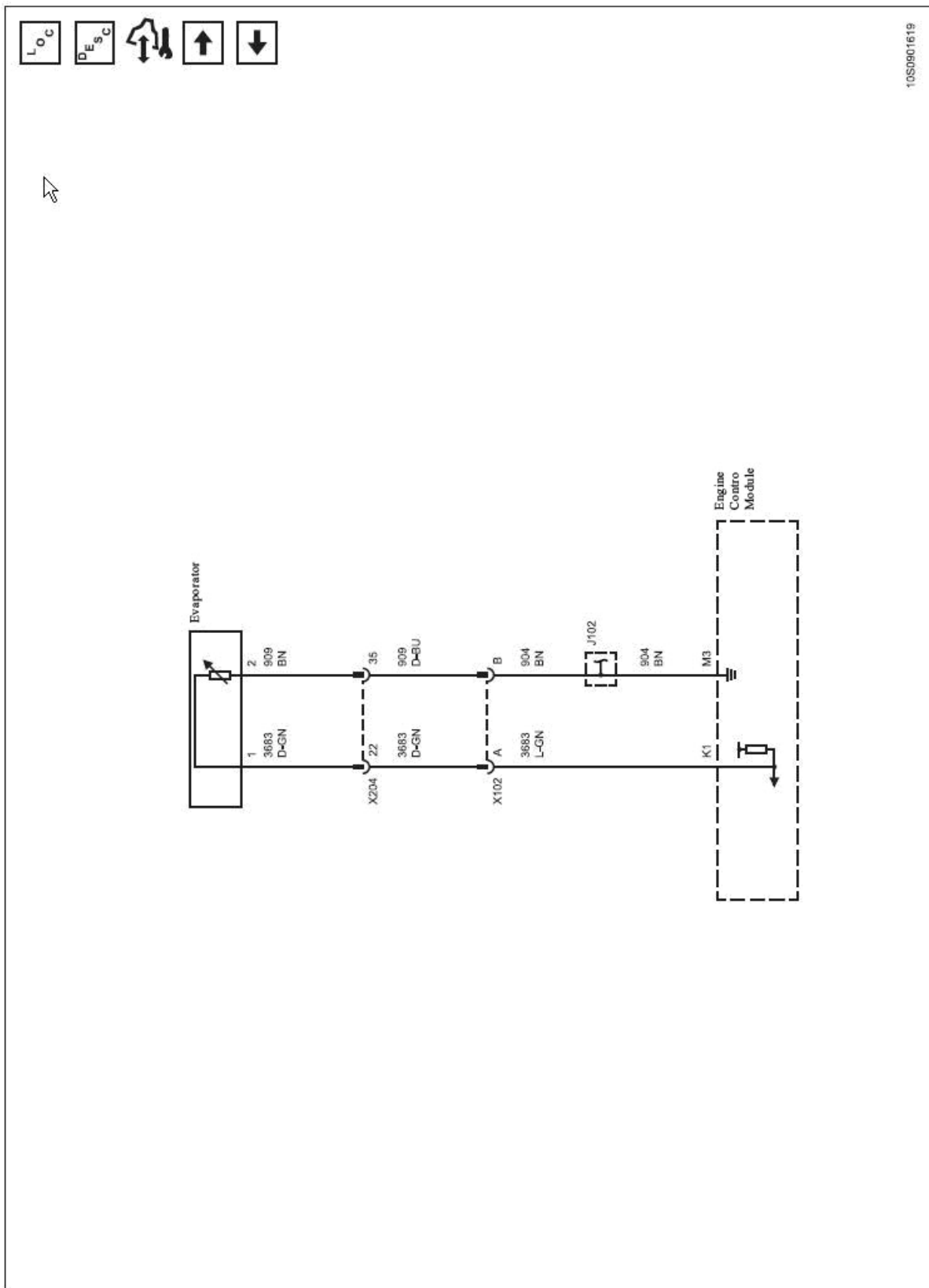
2.6.10 Equipment Control Schematic Diagram (1.2MT)



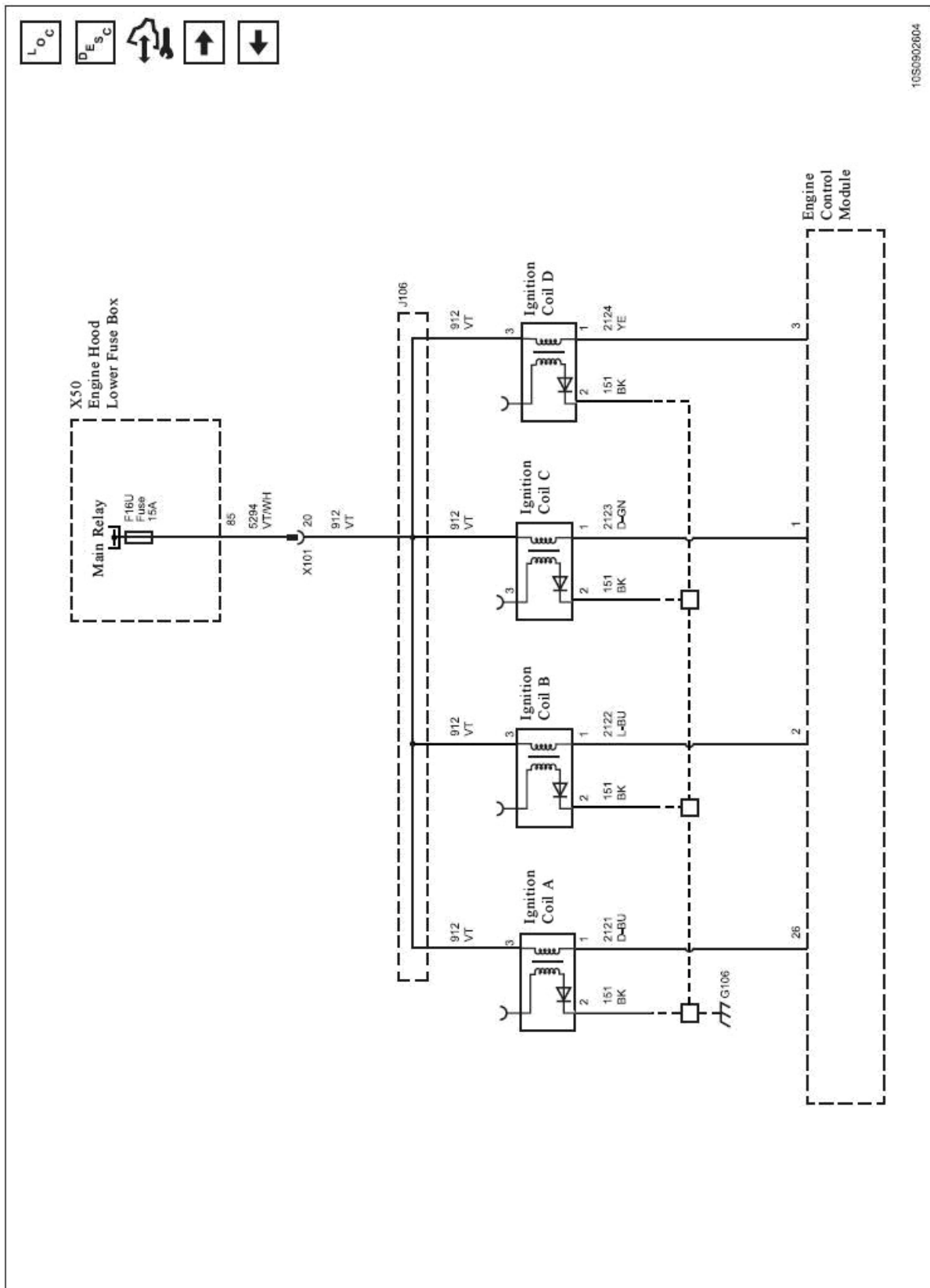
2.6.11 Controlled and Monitored Parts Schematic Diagram (1.2MT)



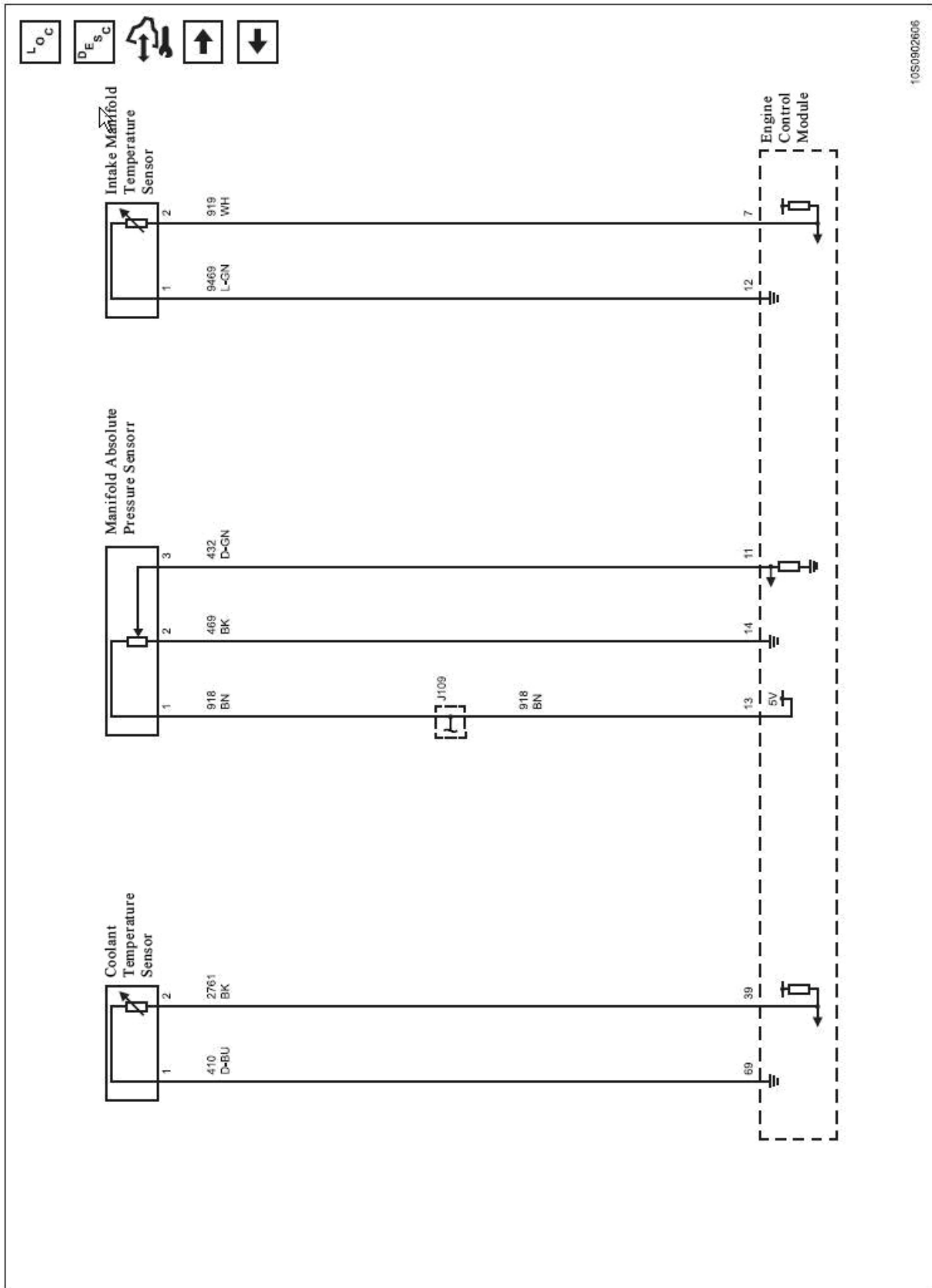
2.6.12 Evaporator Schematic Diagram (1.2MT)



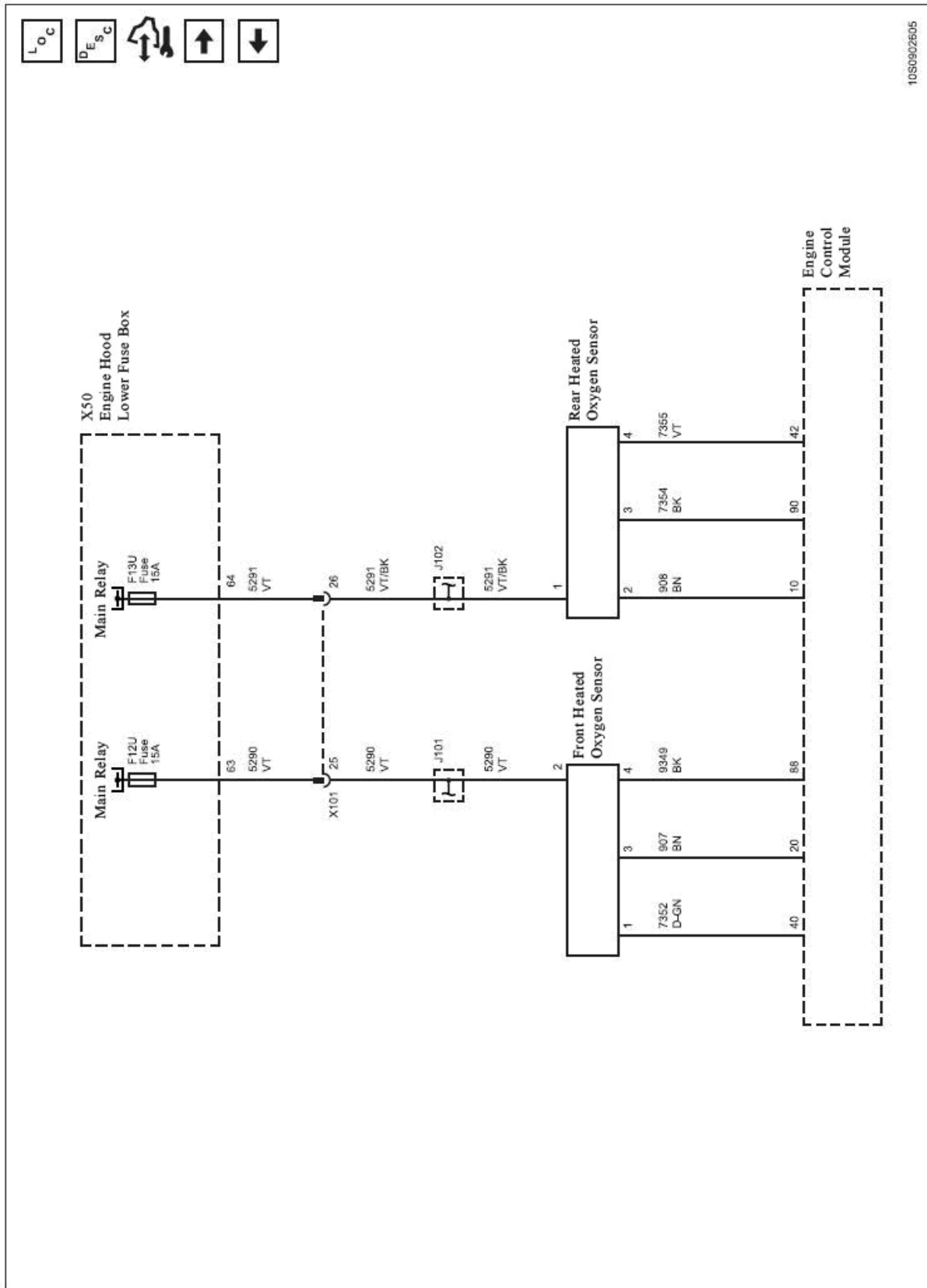
2.6.14 Ignition Control - Ignition System Schematic Diagram (1.4)



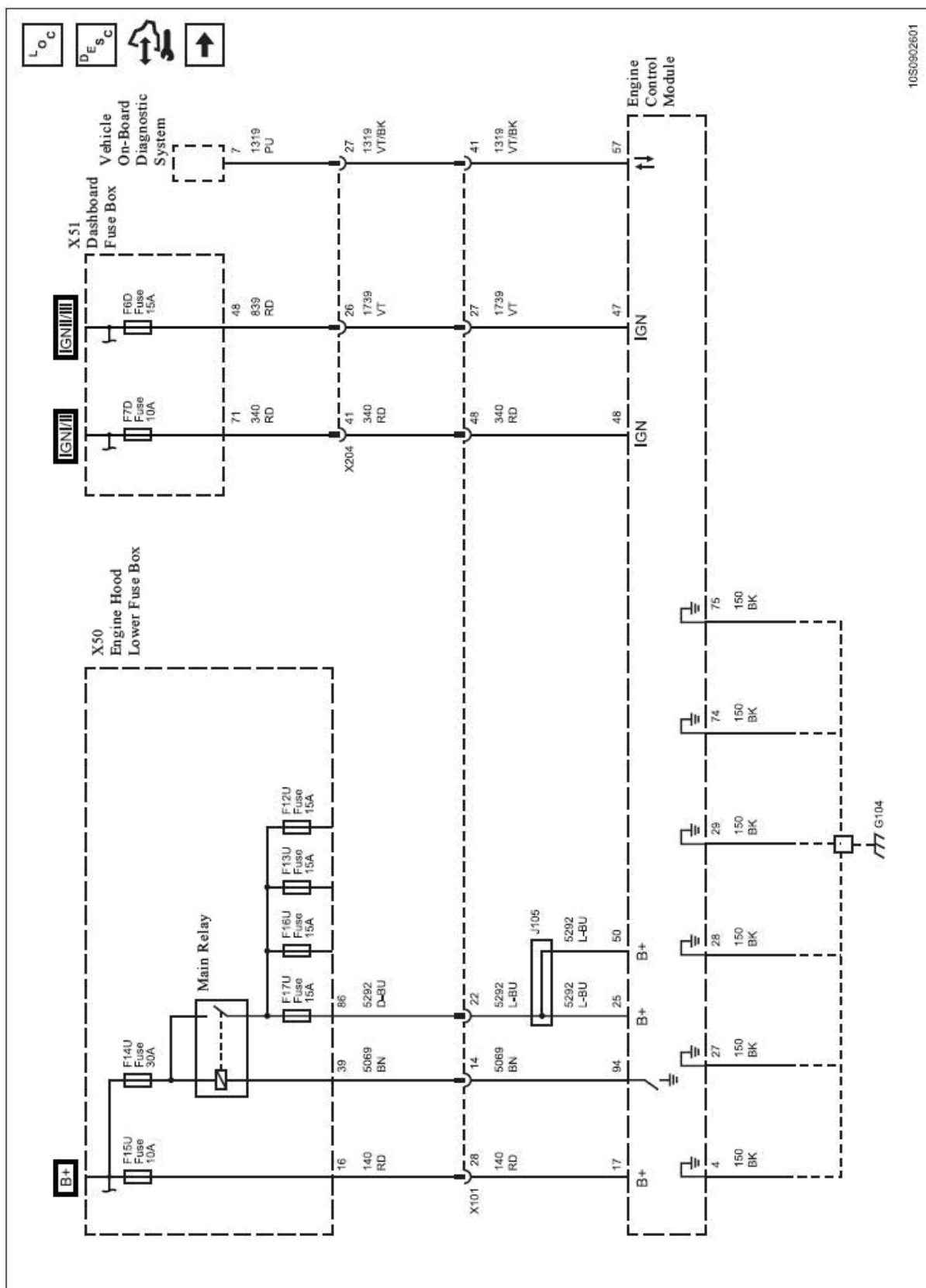
2.6.15 Engine Data Sensor - Pressure and Temperature Schematic Diagram (1.4)



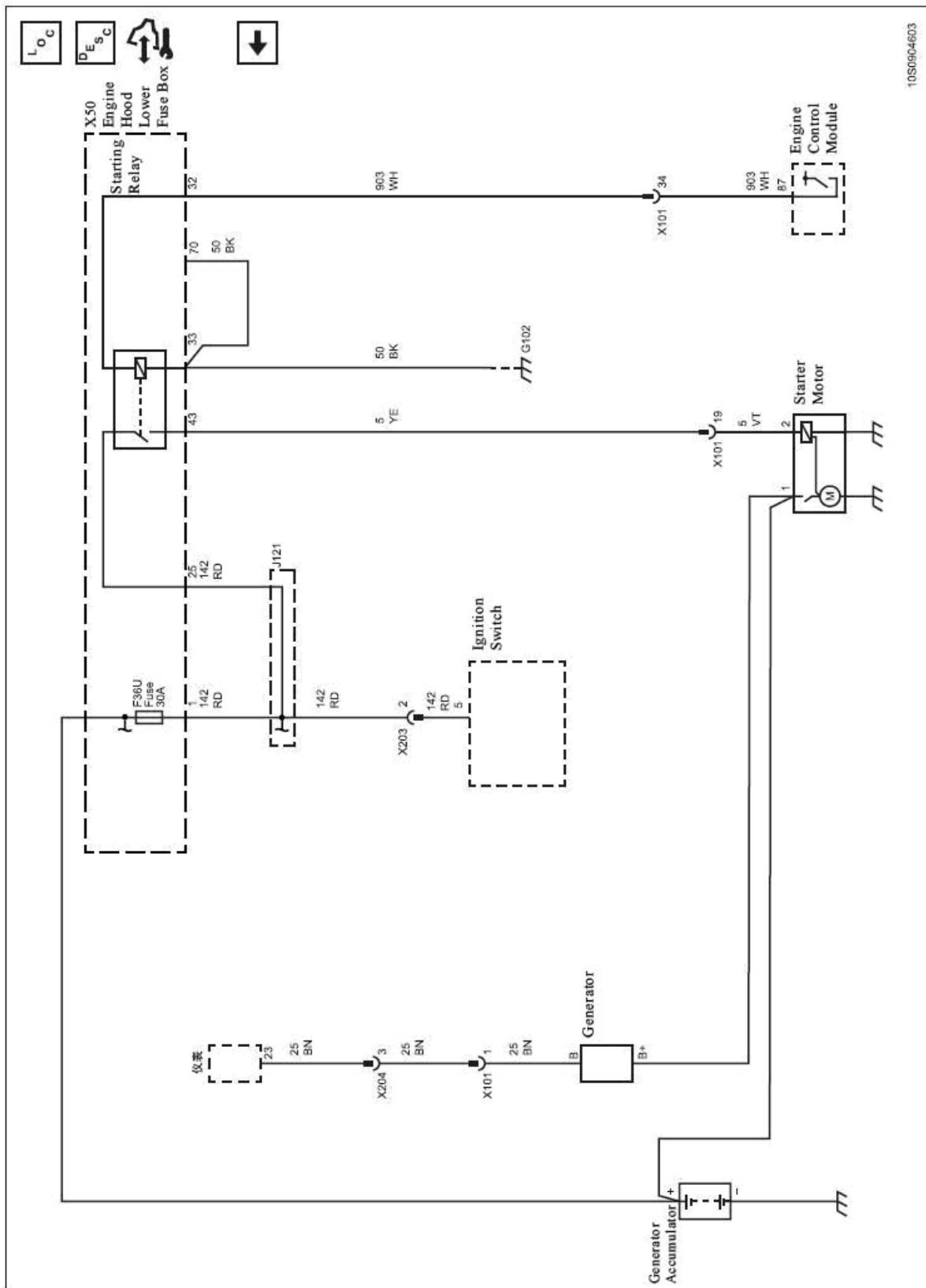
2.6.16 Engine Data Sensor - Oxygen Sensor Schematic Diagram (1.4)



2.6.17 Module Power, Grounding and Serial Data Schematic Diagram (1.4)

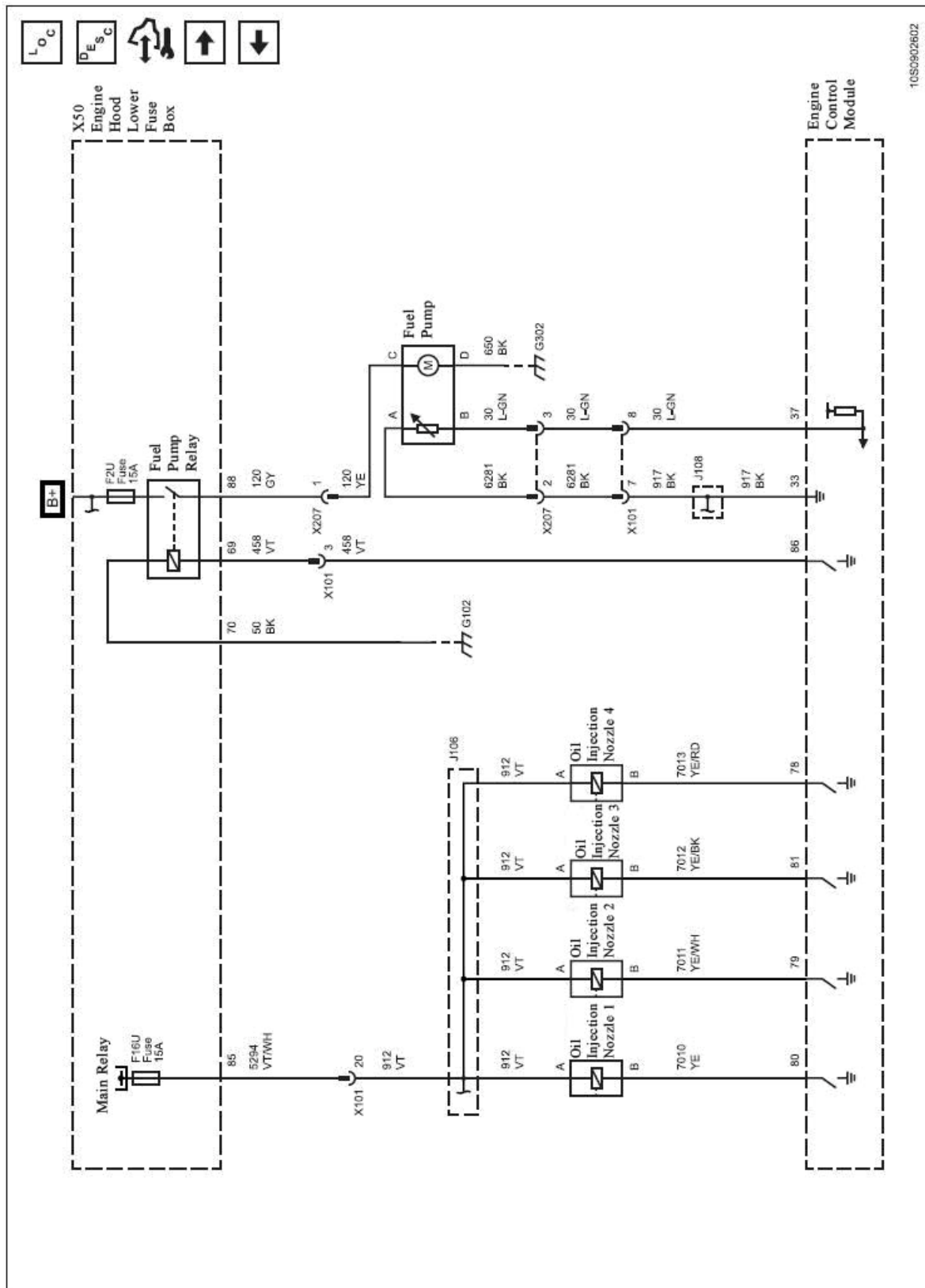


2.6.18 Startup and Charging Schematic Diagram (1.4)

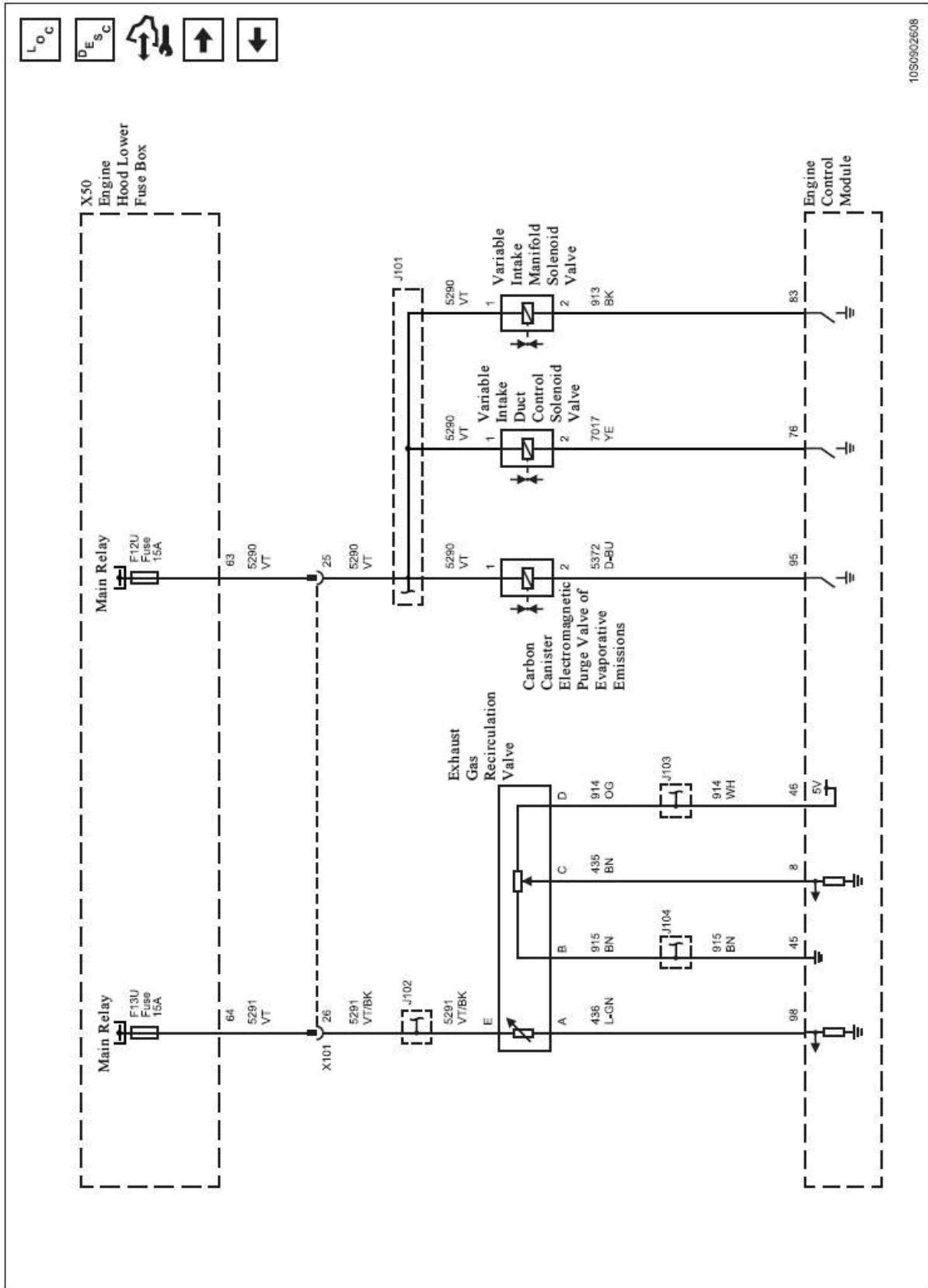


2.6.19 Fuel Control System - Fuel Pump Control System and Oil Injector Schematic Diagram

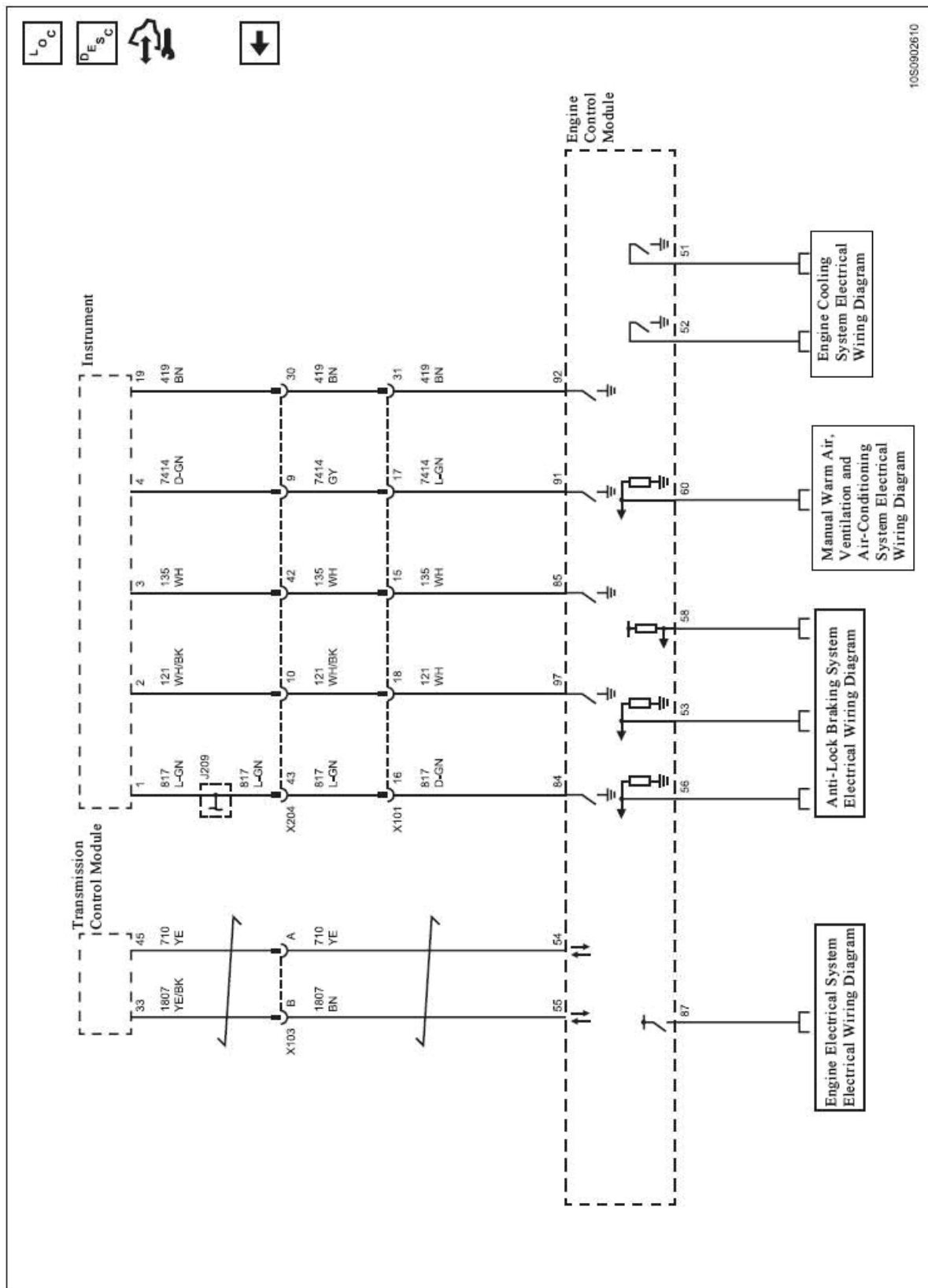
(1.4)



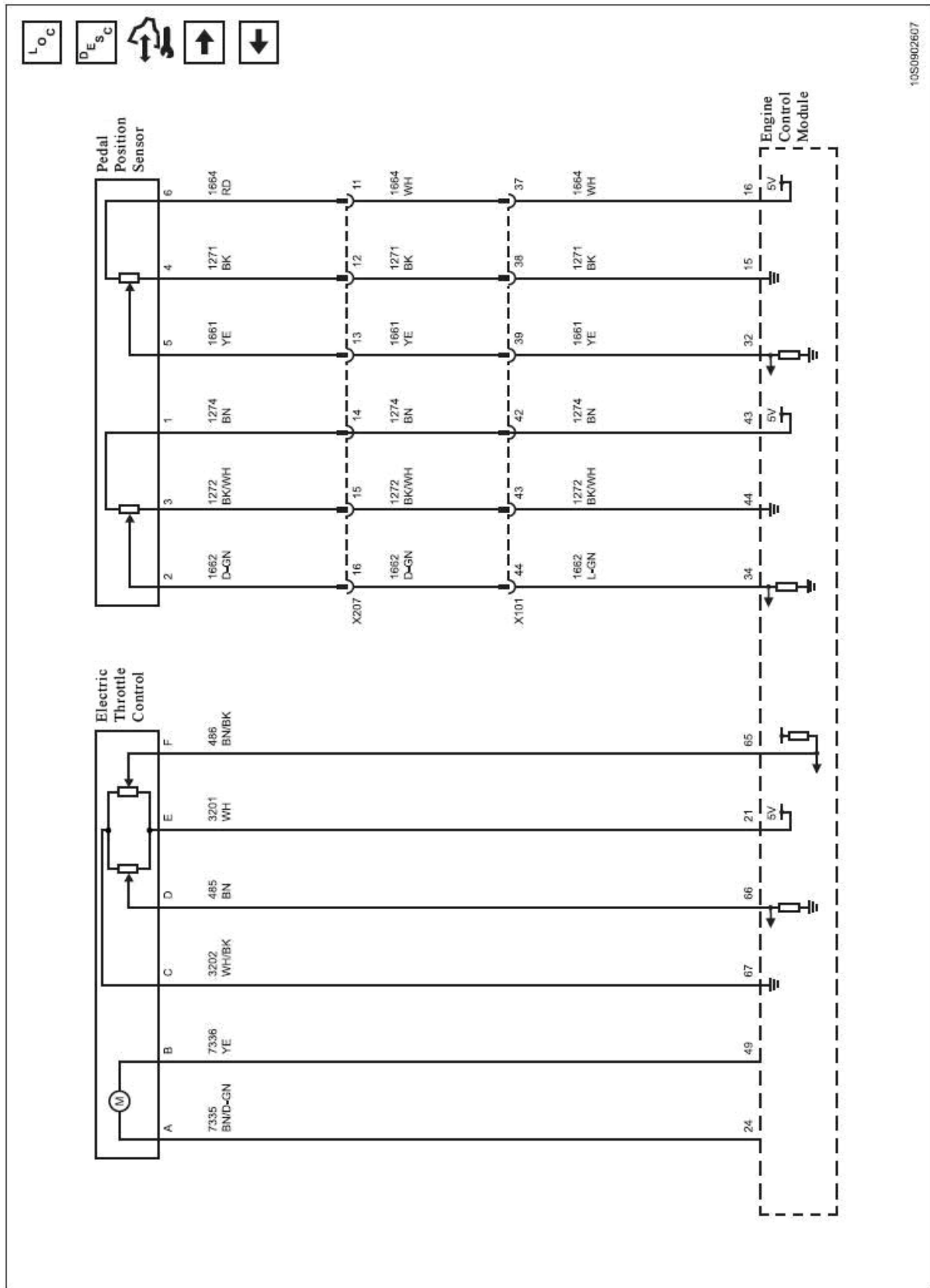
2.6.20 Equipment Control Schematic Diagram (1.4)



2.6.21 Controlled and Monitored Parts Schematic Diagram (1.4)



2.6.22 Pedal Position - Throttle Schematic Diagram (1.4)

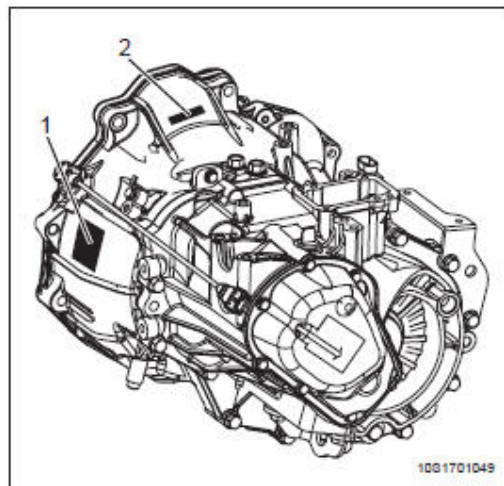


3 Transmission

3.1 Transmission Identification

■ Position of Transmission Label

The Identification Code label (1) and the steel seal (2) of the transmission are on the top front of the transmission housing and close to the engine.



■ Transmission label identification

1. Transmission Assembly Code
 - Sh63 Manual Transmission Assembly HM
 - Sh63a Automatic Transmission Assembly AM
2. Part Number
3. Transmission Code (61 denotes transmission assembly)
4. Last 4-Digits of Part Number
5. Supplier Code
6. Year

For instance, 9: 2009; A: 2010; B: 2011;
C: 2012
7. Month

A: October ; B: November ; C: December
8. Date
9. Production Serial Number



3.2 Transmission Oil

Recommended oil		Transaxle	API Grade: GL-4 (SAE75W/85)
		EMT Gear Shift Actuator	TUTELA CS Speed Oil
Volume of Use	Transaxle	1.2L LMU	1.6L
		1.4L LCU	1.8L
	EMT Gear Shift Actuator		550ml

Replaced Parts	Service 1	Service 2	Service 3	Service 4	Service 5	Service 6
Velocity Selector	—	—	√	√	—	—
Low-Pressure Oil Pipe	—	—	—	—	—	—
Pressure Sensor	√	√	—	√	—	—
Accumulator	√	√	—	√	—	—
Harness	—	—	√	√	—	—
Clutch Position Sensor	—	—	√	—	—	—
Gear Shifting Position Sensor	—	—	—	√	—	—
Oil Can	—	√	—	—	—	—
Clutch Performer	—	√	√	√	—	—
Oil Pump Motor	—	√	—	—	—	—
High Pressure Oil Pipe	—	√	—	—	—	—
Transmission Control Module	—	—	√	√	—	—
Clutch Assembly	—	—	√	2	—	√
Solenoid Valve	√	√	√	√	—	—
Gear Box	—	—	—	√	√	—
Oil Pump Relay	—	—	—	—	√	—
Gear Shift Lever	—	—	—	—	√	—

3.3 Transmission Specifications

3.3.1 SH63-MT Specifications

Application	Specifications	
	Metric Units	English Units
Gear Ratio		
1 Gear	3.538	
2 Gear	1.952	
3 Gear	1.323	
4Gear	0.974	
5 Gear	0.78	
Reverse Gear	3.454	
Main Reduction Ratio	3.765	
Engine Oil Capacity	1.6L	1.7Quart

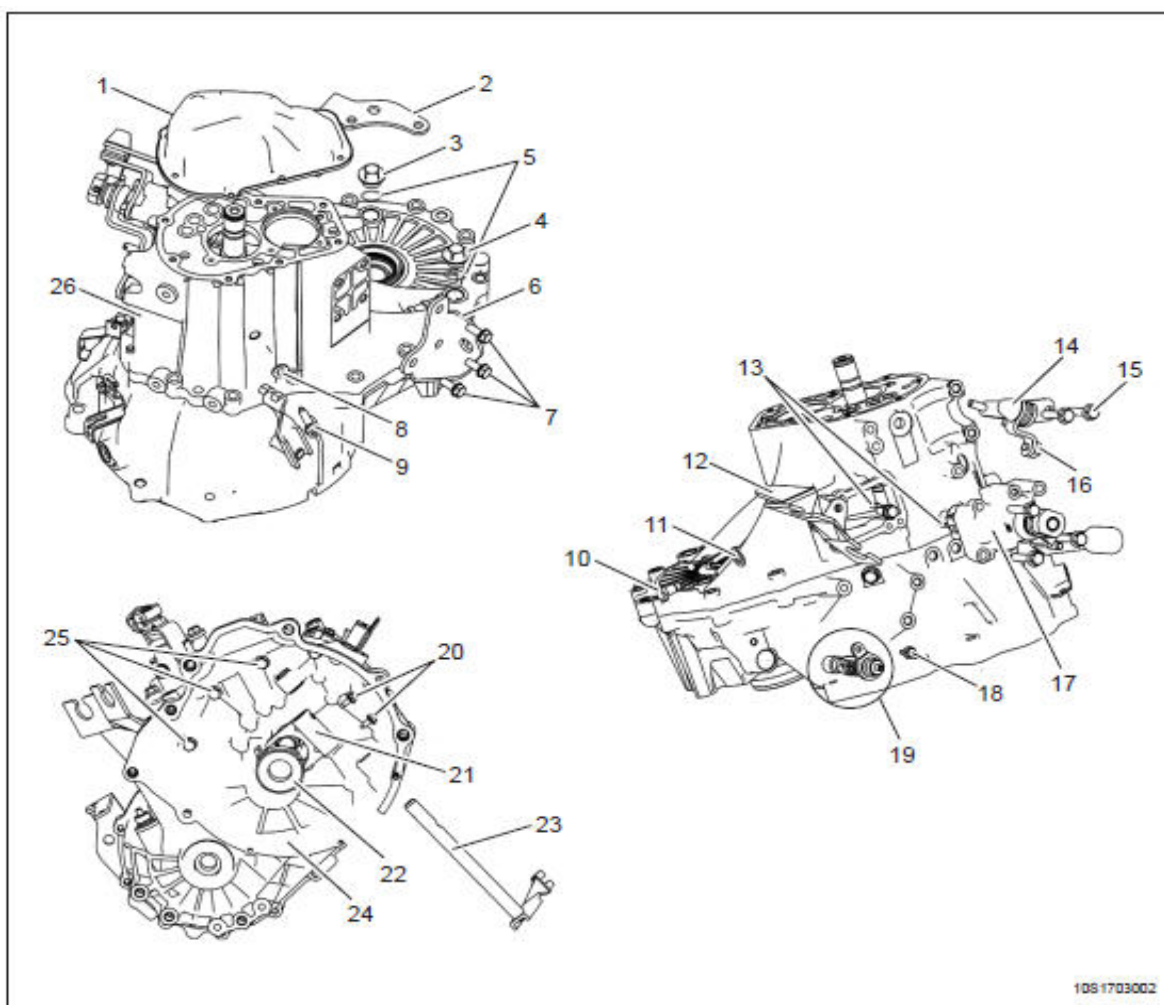
Style or Model	SH63-MT
----------------	---------

3.3.2 SH63A-MT Specifications

Application	Specifications	
	Metric Units	English Units
Gear Ratio		
1Gear		3.462
2Gear		1.952
3Gear		1.323
4Gear		0.943
5Gear		0.743
Reverse Gear		3.454
Main Reduction Ratio	3.684	
Engine Oil Capacity	1.8L	1.9Quart
Style or Model	SH63A-MT	

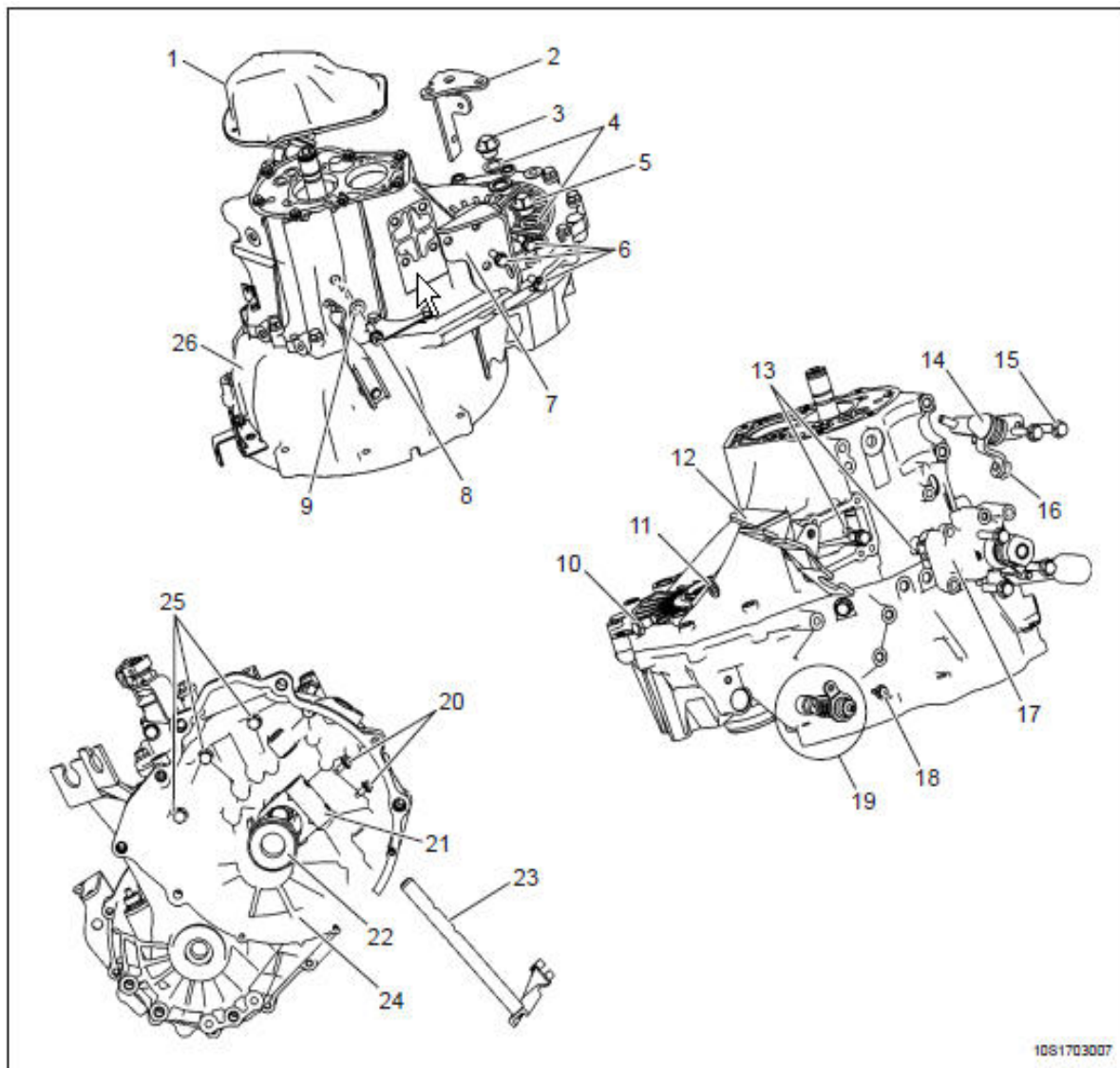
3.4 Transmission Identification

3.4.1 SH63 Housing



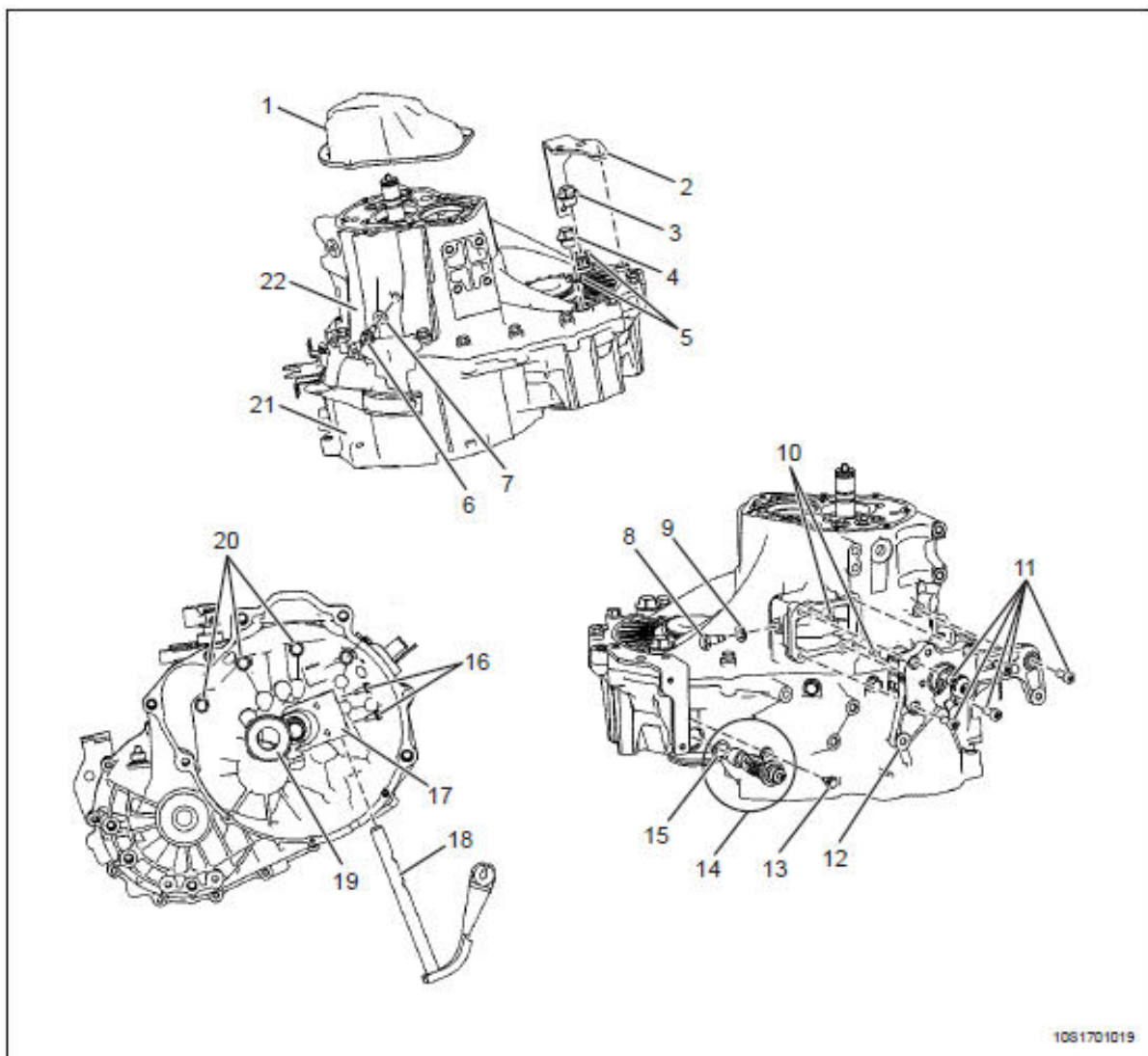
- | | |
|---------------------------------|--------------------------------------------|
| 1. Rear Cover Assembly | 14. Gear Shift Rocker and Bracket Assembly |
| 2. Rear Harness Bracket | 15. Bolt |
| 3. Oil Charging Plug Screw | 16. Gear Shift Paddle |
| 4. Oil Discharging Plug Screw | 17. Control Cover Assembly |
| 5. Washer | 18. Odometer Bolt |
| 6. Clutch Cable Bracket | 19. Odometer Driven Gear Assembly |
| 7. Clutch Cable Bracket Bolt | 20. Release Shift Fork Positioning Bolt |
| 8. Washer | 21. Clutch Release Shift Fork |
| 9. Reverse Shaft Lock Bolt | 22. Release Bearing Assembly |
| 10. Gear Shift Stop Bolt | 23. Clutch Release Rocker Component |
| 11. Gear Shift Stop Bolt Washer | 24. Front Housing |
| 12. Gear Shift Bracket | 25. Housing Bolt |
| 13. Control Cover Alignment Pin | 26. Rear Housing |

3.4.2 SH63A Housing



- | | |
|---------------------------------|--------------------------------------------|
| 1. Rear Cover Assembly | 14. Gear Shift Rocker and Bracket Assembly |
| 2. Rear Harness Bracket | 15. Bolt |
| 3. Oil Charging Plug Screw | 16. Gear Shift Paddle |
| 4. Oil Discharging Plug Screw | 17. Control Cover Assembly |
| 5. Washer | 18. Odometer Bolt |
| 6. Clutch Cable Bracket | 19. Odometer Driven Gear Assembly |
| 7. Clutch Cable Bracket Bolt | 20. Positioning Bolt of Release Shift Fork |
| 8. Washer | 21. Clutch Release Shift Fork |
| 9. Reverse Shaft Lock Bolt | 22. Release Bearing Assembly |
| 10. Gear Shift Stop Bolt | 23. Clutch Release Rocker Component |
| 11. Gear Shift Stop Bolt Washer | 24. Front Housing |
| 12. Gear Shift Bracket | 25. Housing Bolt |
| 13. Control Cover Alignment Pin | 26. Rear Housing |

3.4.3 EMT Housing



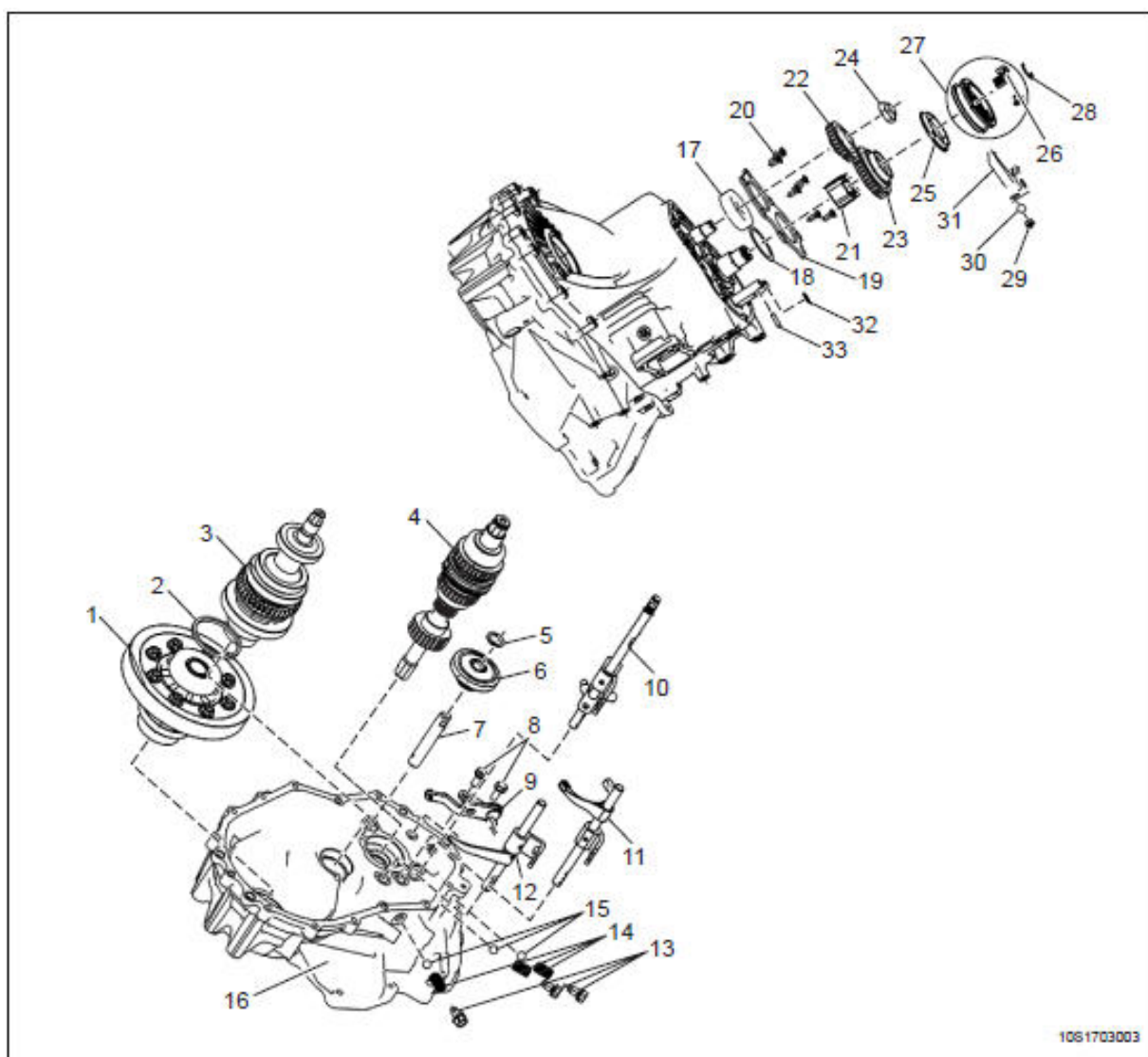
1. Rear Cover Assembly

12. Control Cover Assembly

2. Rear Harness Bracket
3. Oil Charging Port Plug
4. Oil Discharging Port Plug
5. Washer
6. Reverse Shaft Lock Bolt
7. Washer
8. Interlocking Baffle Stop Bolt
9. Gear Shift Stop Bolt Washer
10. Control Cover Alignment Pin
11. Control Cover Socket Head Cap Screw

13. Odometer Bolt
14. Odometer Driven Gear
15. Seal Ring
16. Positioning Bolt of Release Shift Fork
17. Clutch Release Shift Fork
18. Clutch Release Rocker Component
19. Clutch Throw out Bearing Assembly
20. Housing Bolt
21. Front Housing Assembly
22. Rear Housing Assembly

3.4.4 SH63 Gear Unit

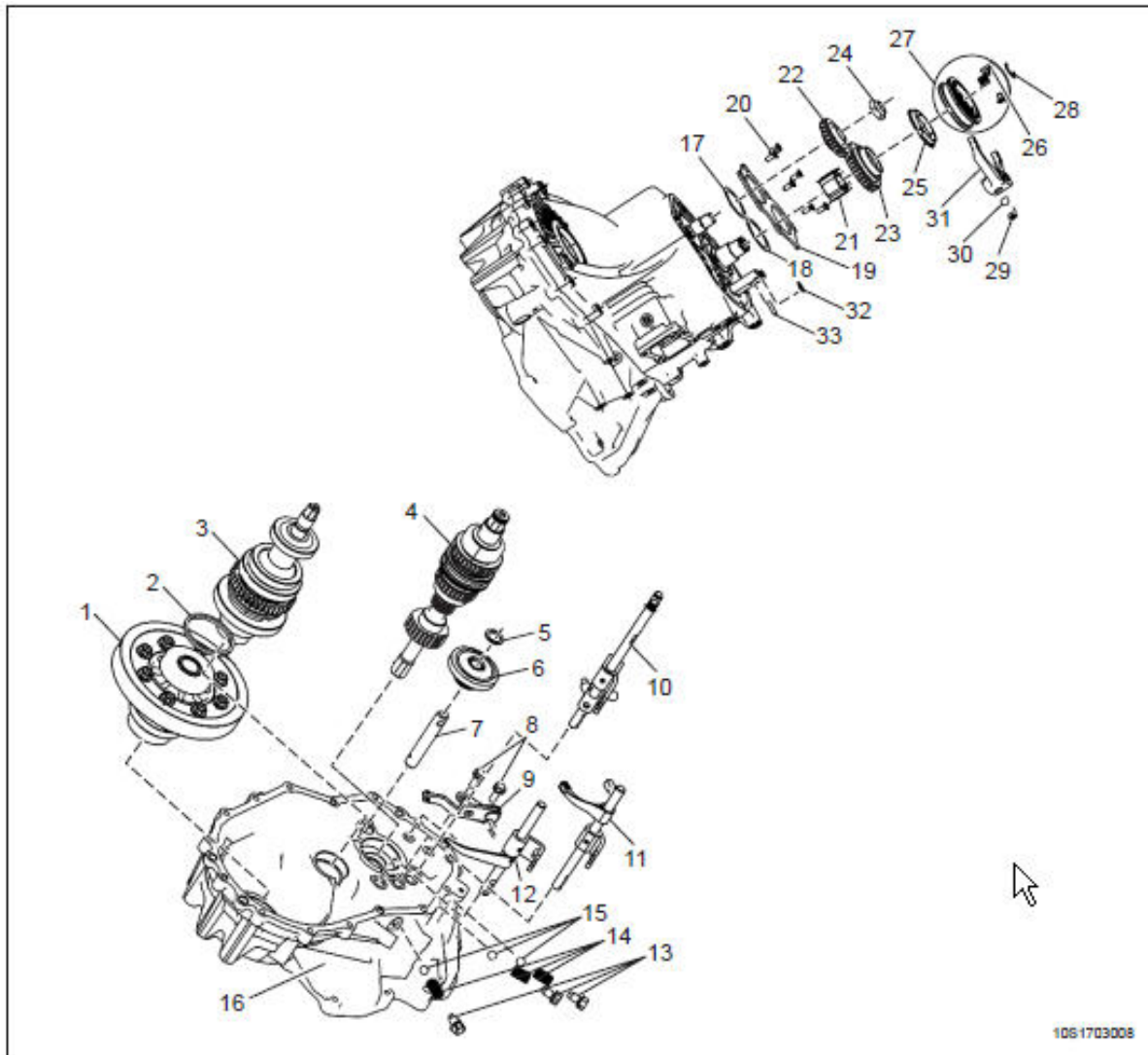


1. Differential Assembly
2. Differential Rear Bearing Adjusting Gasket (If Equipped)
3. Output Shaft Assembly

17. Output Shaft Rear Bearing
18. Input Shaft Rear Bearing Adjusting Gasket (If Equipped)

- | | |
|-------------------------------------------|------------------------------------------------|
| 4. Input Shaft Assembly | 19. Rear Bearing Baffle |
| 5. Reverse Gear Idler Nylon Washer | 20. Rear Bearing Baffle Screw |
| 6. Reverse Gear Idler Assembly | 21. 3rd-4th-5th Gear Needle Bearing |
| 7. Reverse Shaft | 22. 5th Driven Gear |
| 8. Reverse Gear Rocker Bolt | 23. 5th Driving Gear |
| 9. Reverse Gear Rocker Component | 24. Output Shaft Locknut |
| 10. 5th-Reverse Gear Shift Fork Component | 25. 3rd-4th-5th Gear Synchronizer Toothed Ring |
| 11. 3rd-4th Gear Shift Fork Component | 26. 3rd-4th-5th Gear Synchronizer Slide Block |
| 12. 1st-2nd Gear Shift Fork Component | 27. 5th Gear Synchronizer Assembly |
| 13. Self-Locking Bolt | 28. Axle Retainer Ring (If Equipped) |
| 14. Self-Locking Spring | 29. 5th Gear Shift Fork Plug Screw |
| 15. Steel Ball | 30. Steel Ball |
| 16. Front Housing Assembly | 31. 5th Gear Shift Fork |

3.4.5 SH63 Gear Unit



- | | |
|--------------------------|-----------------------------------------------|
| 1. Differential Assembly | 18. Input Shaft Rear Bearing Adjusting Gasket |
|--------------------------|-----------------------------------------------|

2. Differential Rear Bearing Adjusting Gasket

(If Equipped)

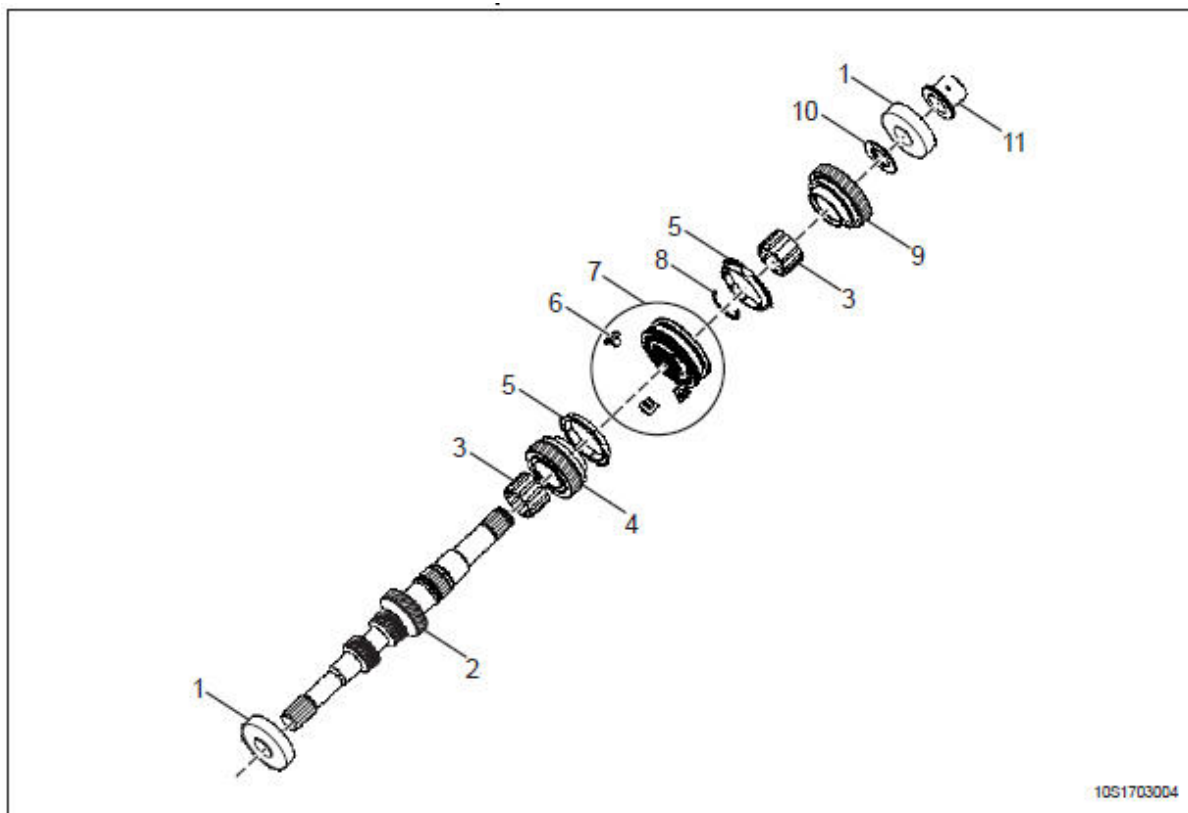
(If Equipped)

3. Output Shaft Assembly
4. Input Shaft Assembly
5. Reverse Gear Idler Nylon Washer
6. Reverse Gear Idler Assembly
7. Reverse Shaft
8. Reverse Gear Rocker Bolt
9. Reverse Gear Rocker Component
10. 5th-Reverse Gear Shift Fork Component
11. 3rd-4th Gear Shift Fork Component
12. 1st-2nd Gear Shift Fork Component
13. Self-Locking Bolt
14. Self-Locking Spring
15. Steel Ball
16. Front Housing Assembly
17. Output Shaft Rear Bearing Adjusting Gasket

19. Rear Bearing Baffle
20. Rear Bearing Baffle Screw
21. 3rd-4th-5th Gear Needle Bearing
22. 5th Driven Gear
23. 5th Driving Gear
24. Output Shaft Locknut
25. 3rd-4th-5th Gear Synchronizer Toothed Ring
26. 3rd-4th-5th Gear Synchronizer Slide Block
27. 5th Gear Synchronizer Assembly
28. Axle Retainer Ring (If Equipped)
29. Plug Screw Of The 5th Gear Shift Fork
30. Steel Ball
31. 5th Gear Shift Fork
32. Fixing Circlip
33. Spring Pin

(If Equipped)

3.4.6 SH63 Input Shaft



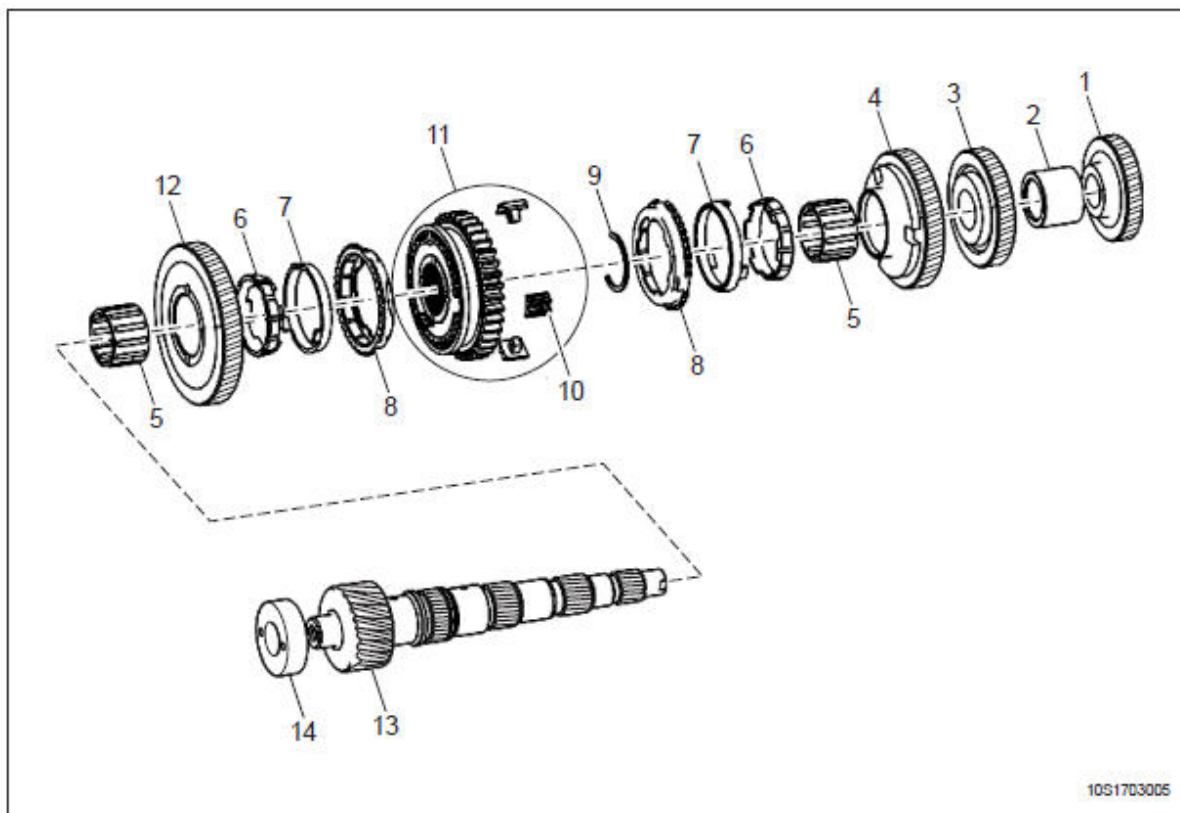
1. Input Shaft Bearing

7. Synchronizer Assembly

2. Input Shaft
3. Needle Bearing
4. 3rd Driving Gear
5. Synchronizer Toothed Ring
6. Synchronizer Slide Block

8. Retainer Ring (If Equipped)
9. 4th Driving Gear
10. Washer
11. 5th Gear Bush

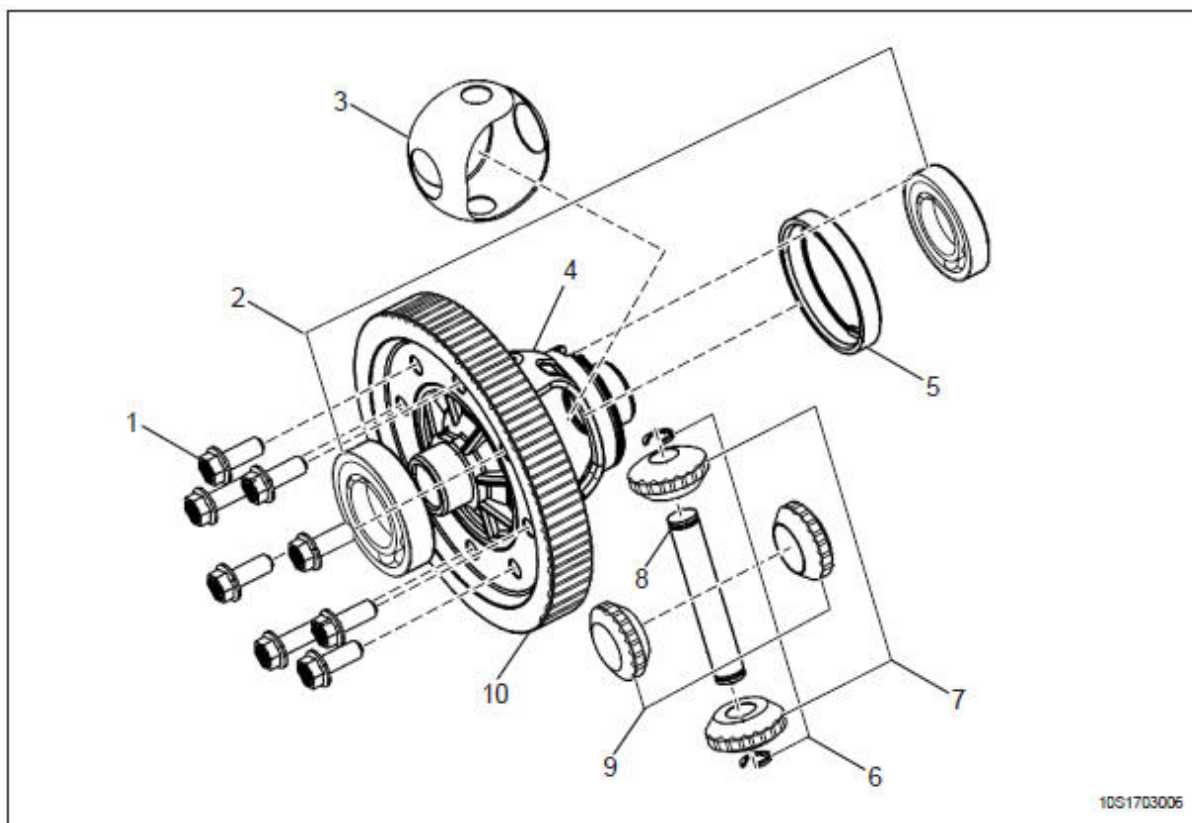
3.4.7 Output Shaft



1. 4th Driven Gear
2. 3rd-4th Gear Spacing Ring
3. 3rd Driven Gear
4. 2nd Driven Gear
5. 1st-2nd Driven Gear Needle Bearing
6. 1st-2nd Gear Synchronizer Inner Cone Ring
7. 1st-2nd Gear Synchronizer Adapter Ring

8. 1st-2nd Gear Synchronizer Outer Cone Ring
9. Retainer Ring (If Equipped)
10. 1st-2nd Gear Synchronizer Slide Block
11. 1st-2nd Gear Synchronizer Assembly
12. 1st Driven Gear
13. Output Shaft
14. Output Shaft Front Bearing

3.4.8 Differential

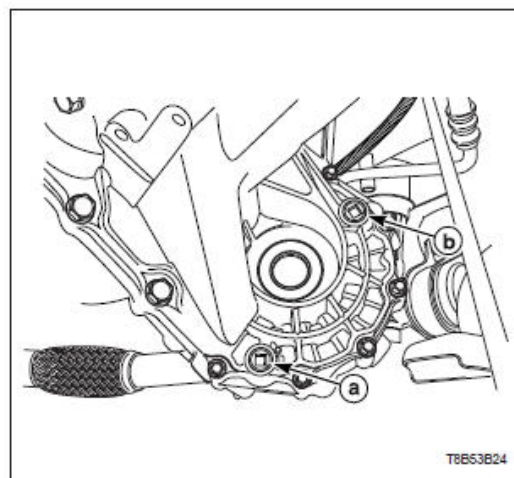


- | | |
|------------------------------|---------------------------------|
| 1. Differential Housing Bolt | 6. Circlip |
| 2. Differential Bearing | 7. Planet Gear |
| 3. Differential Washer | 8. Planet Gear Shaft |
| 4. Differential Housing | 9. Half Axle Gear |
| 5. Odometer Driving Gear | 10. Main Reduction Driven Wheel |

3.5 Oil Level Inspection

Inspect the transaxle housing and its sealing area for any leakage, dismount the oil level plug screw, and inspect the oil level and the oil situation.

1. Run the engine until it reaches its normal working temperature (coolant temperature: 80-90°C (176-194°F)) .
2. Stop the engine and lift the vehicle.
3. Dismount the engine oil level plug screw and inspect the oil level.
4. Oil should be able to spill a little from the engine oil level plug screw hole.
5. If the oil level is too low, then recommended oil should be filled in from the engine oil level plug screw hole until oil starts to spill.
6. If oil is contaminated or discolored, then it should

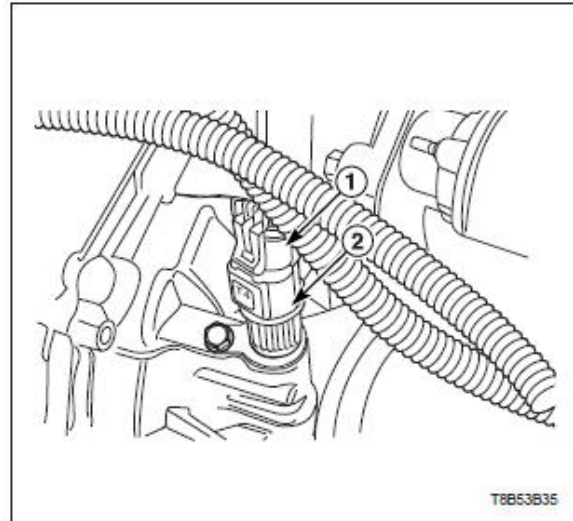


- be replaced with recommended oil.
7. Mount new engine oil level plug screw.
 - a. Engine oil discharging plug screw
 - b. Engine oil level plug screw.

Fastening: fasten the engine oil level plug screw to
 $25 \sim 35 \text{ N.m}$ ($18 \sim 26$ foot pound) .

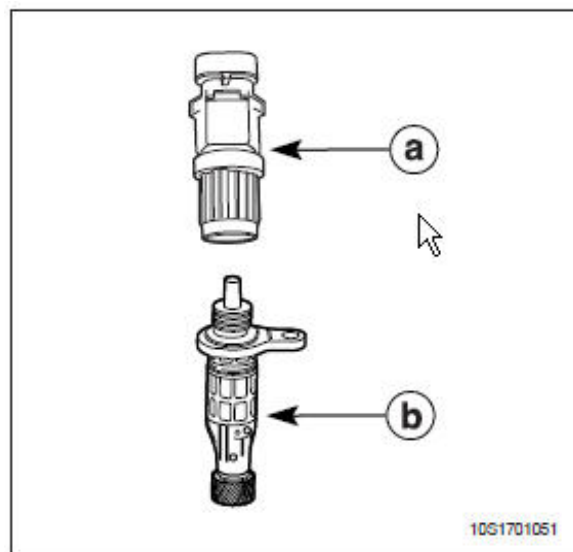
3.6 Vehicle Speed Sensor

■ Position



■ Assembly

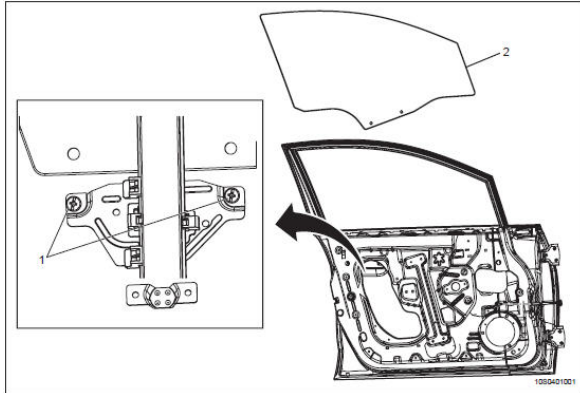
- a. Vehicle Speed Sensor.
- b. Speedometer Driven Gear.



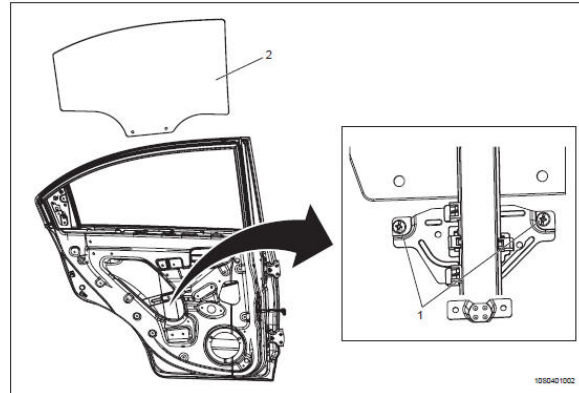
4 Electrical System

4.1 Windows Adjustment

Front side windows



Rear side windows

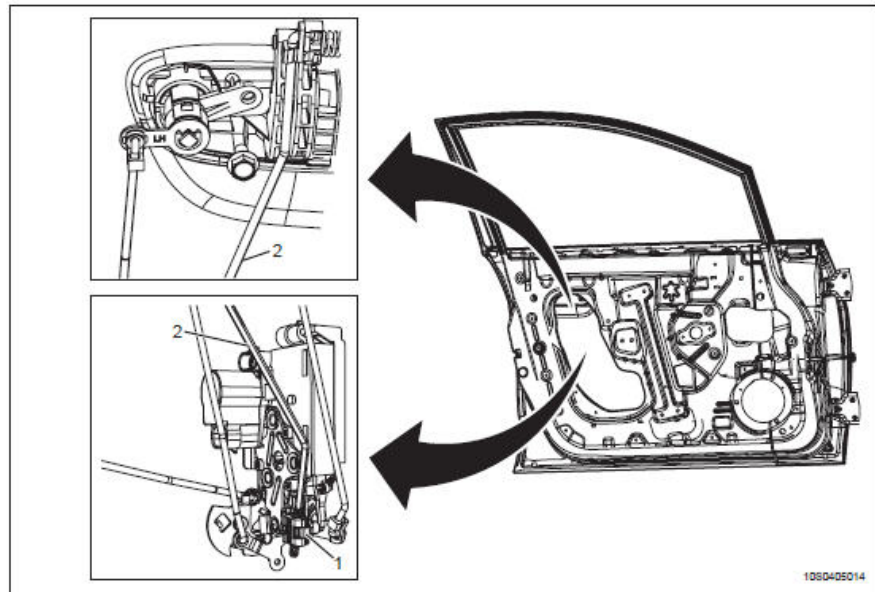


Process of adjustment:

1. Unscrew the side window screw.
2. Start the vehicle.
3. Close the side windows completely.
4. Fasten the side window screw.
5. Shut down the vehicle.

4.2 Adjustment of Outer Front Door Handle Lever

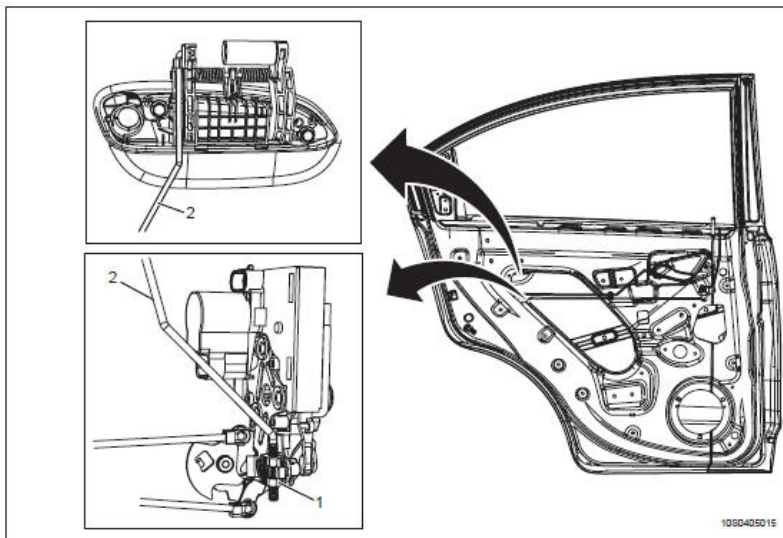
1. Place the outer front door handle lever (2) in the middle of the buckle clamp (1), and clear up any clearance on the outer door handle.
2. Move the outer front door handle lever thread in the buckle clamp to adjust the handle stroke.
3. Close the buckle clamp and firmly fix the threaded portion of the outer front door handle lever into the buckle clamp.
4. Inspect the operation of



the door lock system.

4.3 Adjustment of Outer Rear Door Handle Lever

1. Place the outer rear door handle lever (2) in the middle of the buckle clamp (1), and clear up any obstruction on the outer door handle.
2. Move the outer rear door handle lever thread in the buckle clamp to adjust the handle stroke.
3. Close the buckle clamp and firmly fix the threaded portion of the outer rear door handle lever into the buckle clamp.
4. Inspect the operation of the door lock system.



4.4 Description and Operation of Data Link Communication

The configuration of the data link connector (DLC) is negotiated and set by vehicle manufacturers. The connector is necessary when employing a diagnostic instrument to communicate with a vehicle and to program a vehicle communication system.

This connector must have the following characteristics:

- Able to connect with all trouble diagnostic instruments as a 16-pin connector
- Should always supply accumulator power for the trouble diagnostic instrument through its 16th pin.
- Should always provide ground point for the trouble diagnostic instrument through its 4th pin.
- Should always provide a clean signal ground point through its 5th pin.

Its rest pins are used to communicate with the serial data of the vehicle system. The module of the vehicle is controlled by a microprocessor and carries out intercommunication and communicates with a diagnostic instrument through a serial data circuit.

This vehicle employs 2 different types of communication protocols:

- Universal Asynchronous Receiver Transmitter (UART)
- Keyword 2000 Data Circuit

The diagnostic instrument visits the following module data circuits:

- Electronic Brake Control Module (EBCM) (UART)
- Engine Control Module (ECM) (Keyword 2000)

- Transmission Control Module (TCM) (UART)
- Airbag Sensing and Diagnostic Module (SDM) (UART)
- Anti-Theft Locking System Control Module (UART)
- Anti-Theft Module (UART)

4.4.1 Universal Asynchronous Receiver Transmitter (UART) Data Circuit

The communication system based on the universal asynchronous receiver transmitter has a main serial data circuit and a long-distance transceiver. The main serial data circuit in turn visits all the long-distance control modules to control the information flow of the serial data circuit. The main serial data circuit then waits for appropriate responses.

The universal asynchronous receiver transmitter (UART) serial data circuit allows the following components to communicate with the diagnostic instrument:

- Electronic Brake Control Module (EBCM)
- Transmission Control Module (TCM)
- Airbag Sensing and Diagnostic Module (SDM)
- Anti-Theft Locking System Control Module
- Anti-Theft Module

The universal asynchronous receiver transmitter (UART) serial data circuit allows the diagnostic instrument to communicate with these modules in diagnosing and testing.

4.4.2 Keyword 2000 data circuit

The keyword protocol employs a single two-way data line between the module and the diagnostic instrument to communicate. The message structure is a request & response arrangement. The keyword serial data is only for the diagnosis of the diagnostic instrument. Neither module exchanges data through these systems.

Keyword 2000 Serial Data Circuit:

- The Keyword 2000 serial data circuit allows the following component to communicate with the diagnostic instrument: engine control module.
- The Keyword 2000 serial data circuit allows the diagnostic instrument to communicate with the module in diagnosing and testing.

4.5 Audio Security System

When the audio system circuit is disconnected from the accumulator, then the audio security system is activated. A 4-digit security code must be entered in order to restore the functions of the audio system. The security code is impressed on a card generally located inside the glove box of the vehicle.

The following security code entering procedure must be followed in order to decode the audio security system:

1. Place the ignition switch to the ACC (accessory) position, and switch on the radio. At this time, the radio display screen shows "CODE" accompanied with buzz.
2. Press the radio preset buttons 1 to 6 or 1 to 8 (if equipped) to enter the 4-digit security code.
3. After being entered, these 4 digits flicker three times, and then the radio is restored to its normal functionality.

Error Code

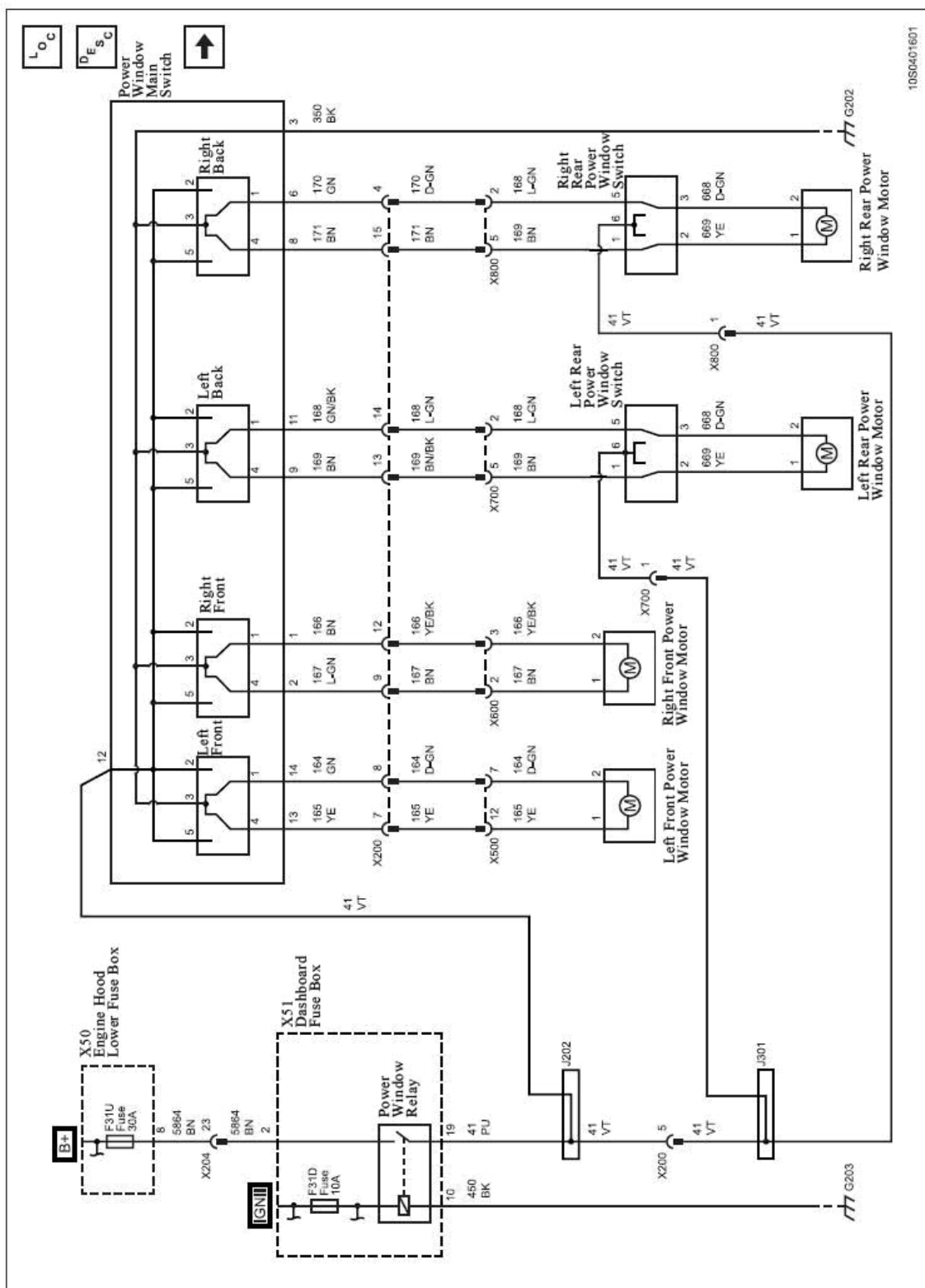
If an incorrect code is entered, the screen will temporarily show "ERR". After that, the screen will show "CODE", and the code entering procedure can be carried out again. If there is no correct code entered within 10 minutes, the radio will disconnect from the accumulator. At this point, the radio must be connected to the accumulator prior to carrying out the code entering procedure in order to restore the audio system.

4.6 Area Code of Audio System

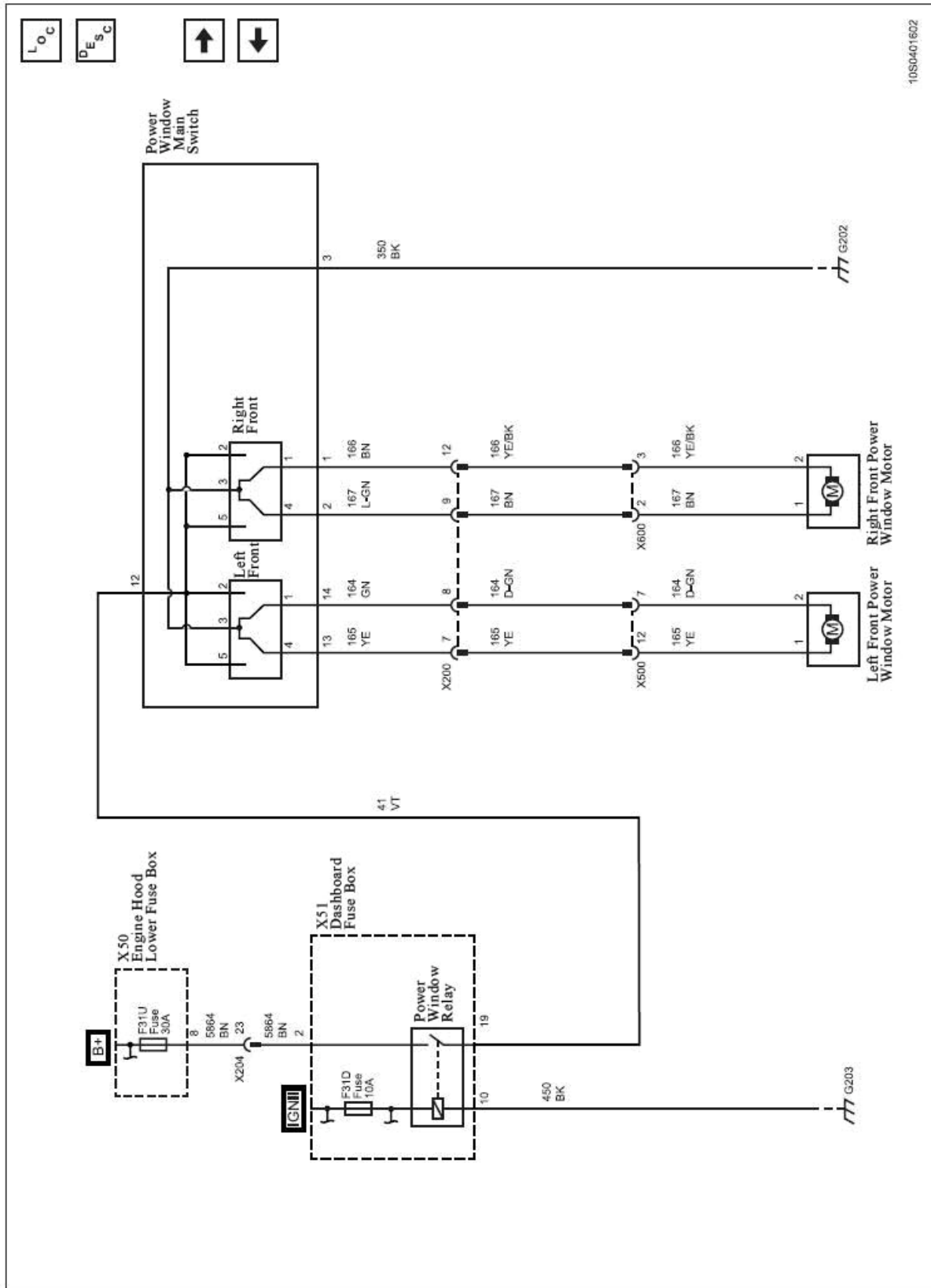
"AF" will be displayed when pressing the power button. Users must select the area code according to the map in the user's manual. If a wrong code is selected, the audio connector must be reinstalled (or the audio fuse might need to be dismantled) . For details about the area code, please refer to the audio system operation manual.

4.7 Electrical Appliances Circuit Diagrams

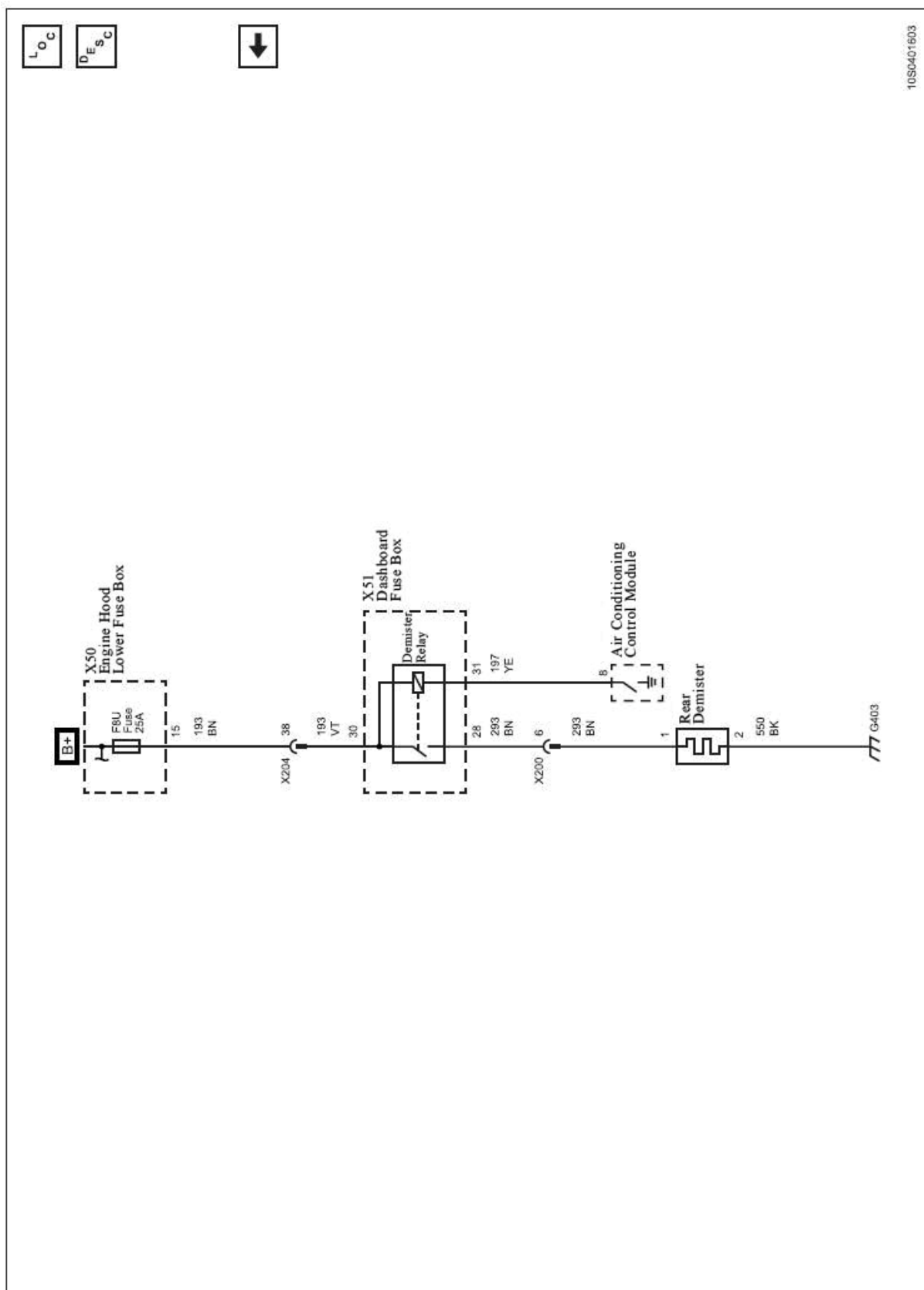
4.7.1 Power Windows Circuit Diagram 1



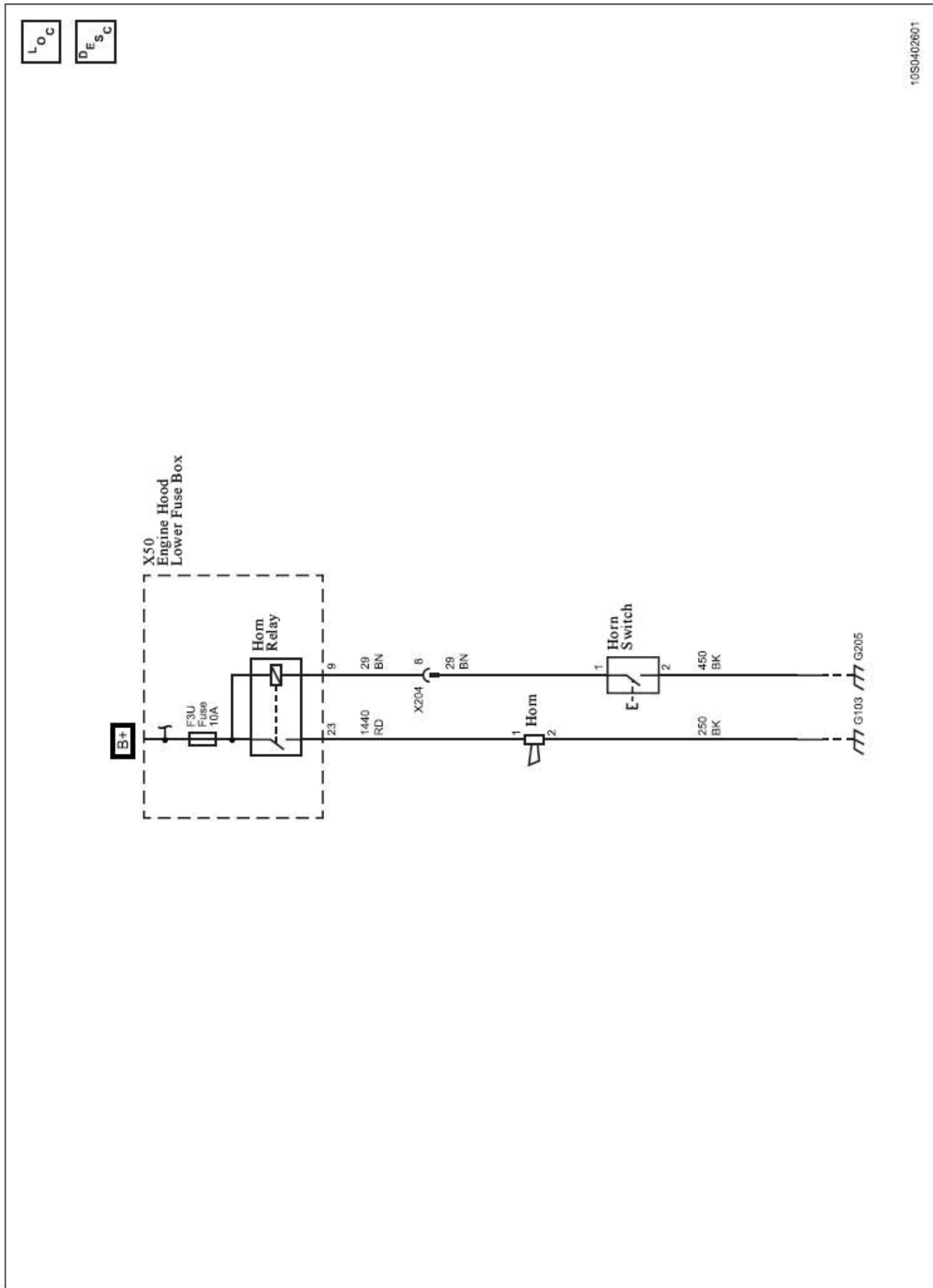
4.7.2 Power Windows Circuit Diagram 2



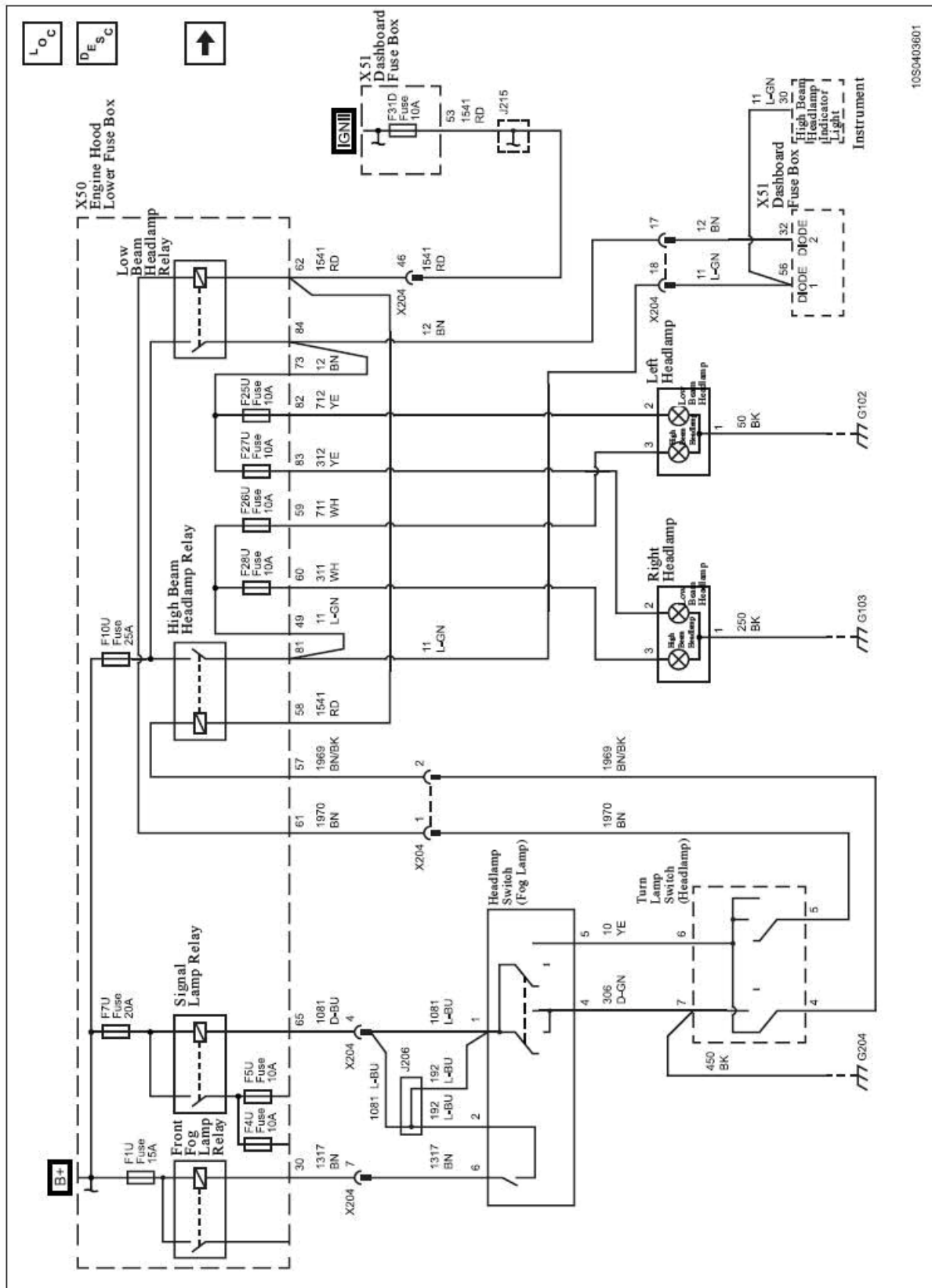
4.7.3 Demister Circuit Diagram



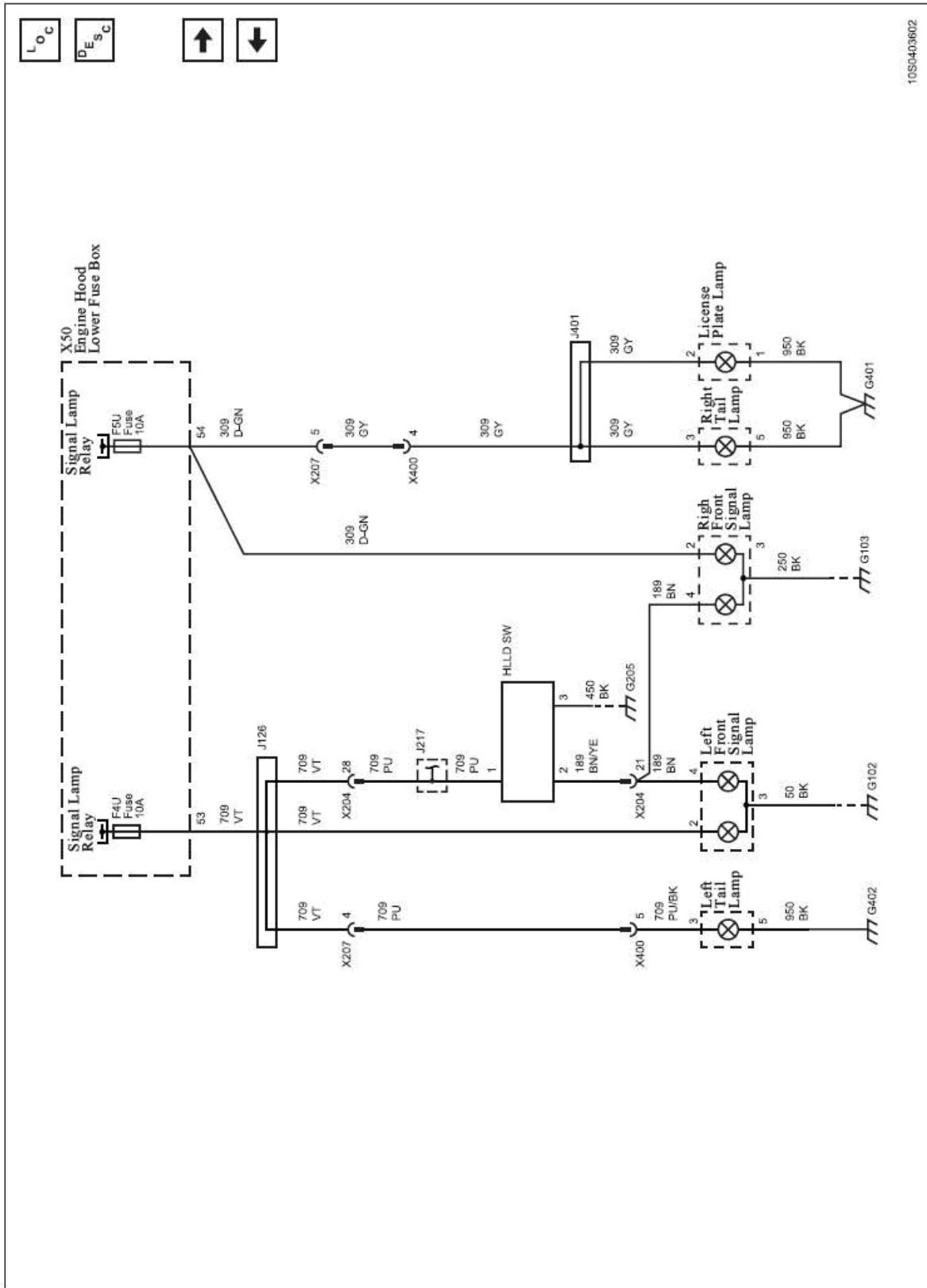
4.7.4 Horn Circuit Diagram



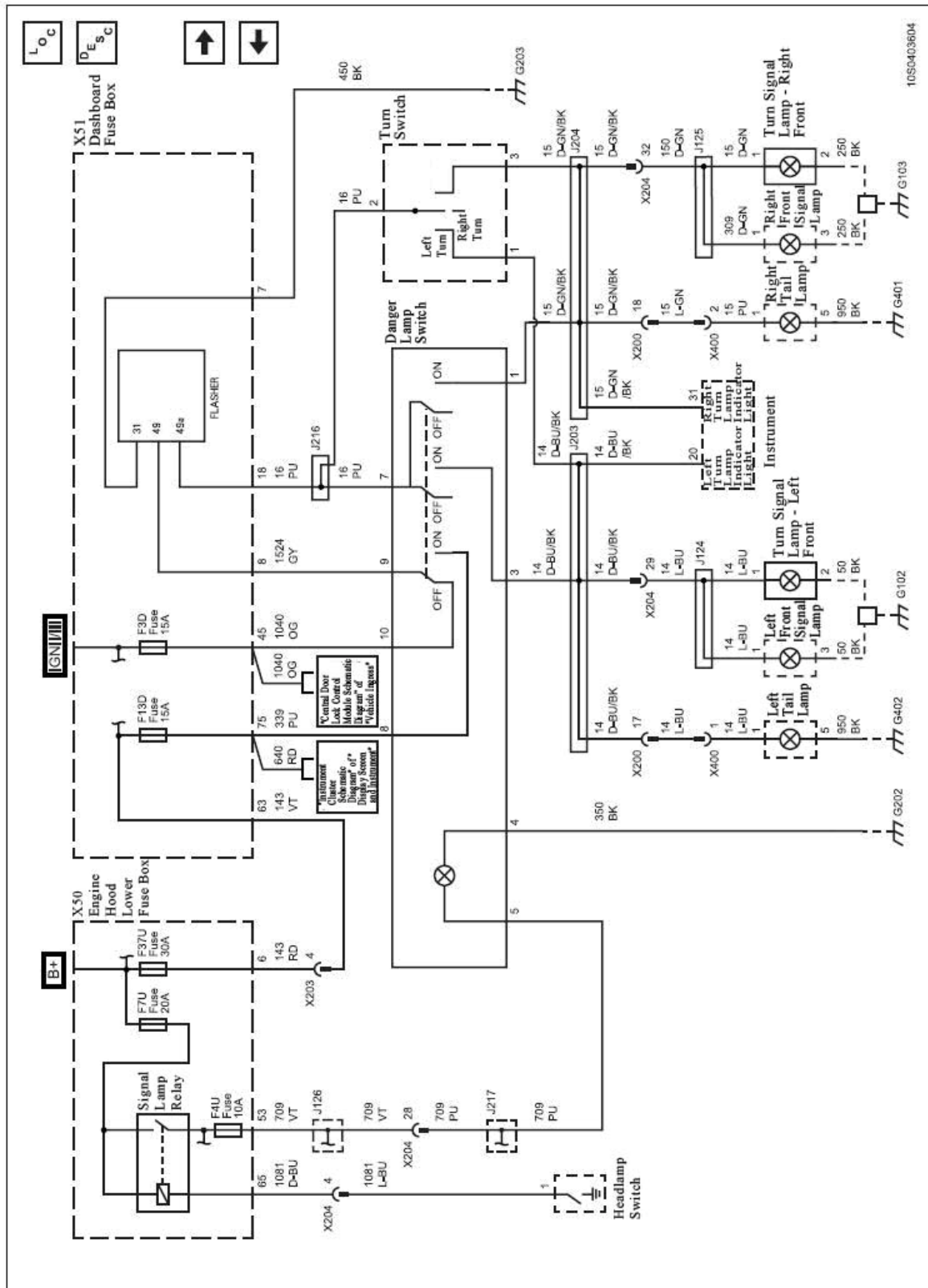
4.7.5 Headlamps Circuit Diagram



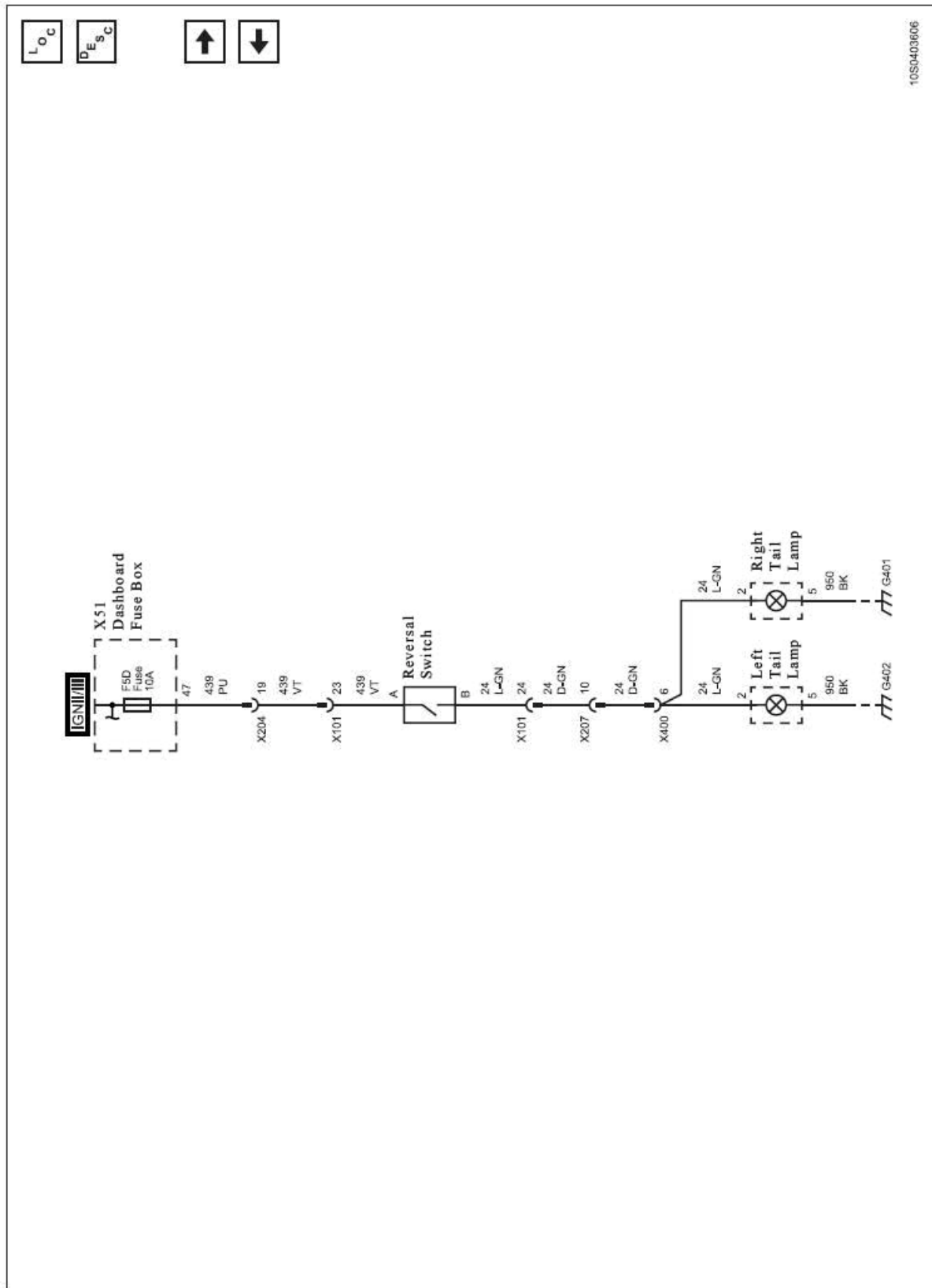
4.7.6 Signal and License Plate Lamps Circuit Diagram



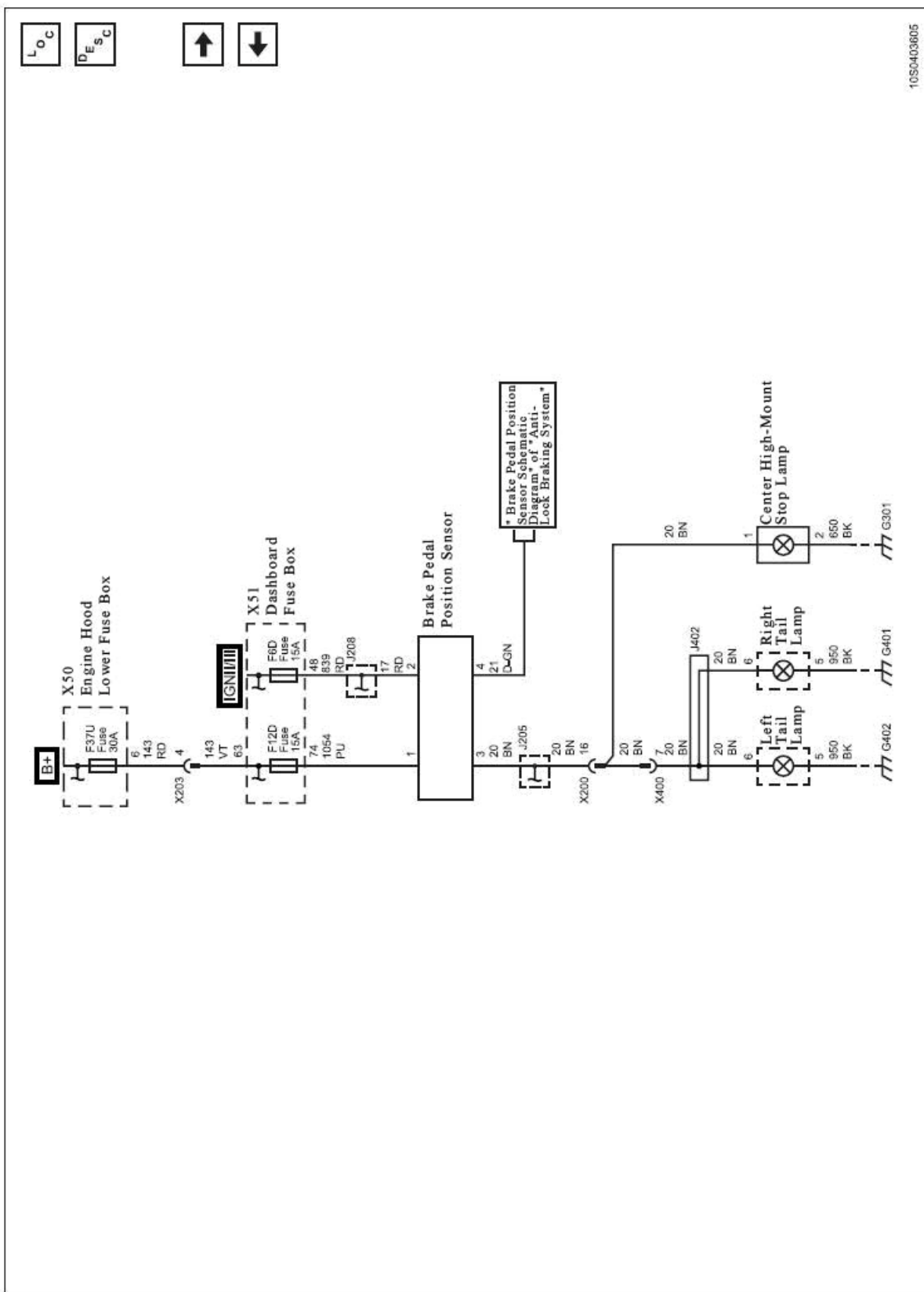
4.7.7 Turn Lamps and Hazard Warning Lights Circuit Diagram



4.7.8 Reverse Lamps Circuit Diagram

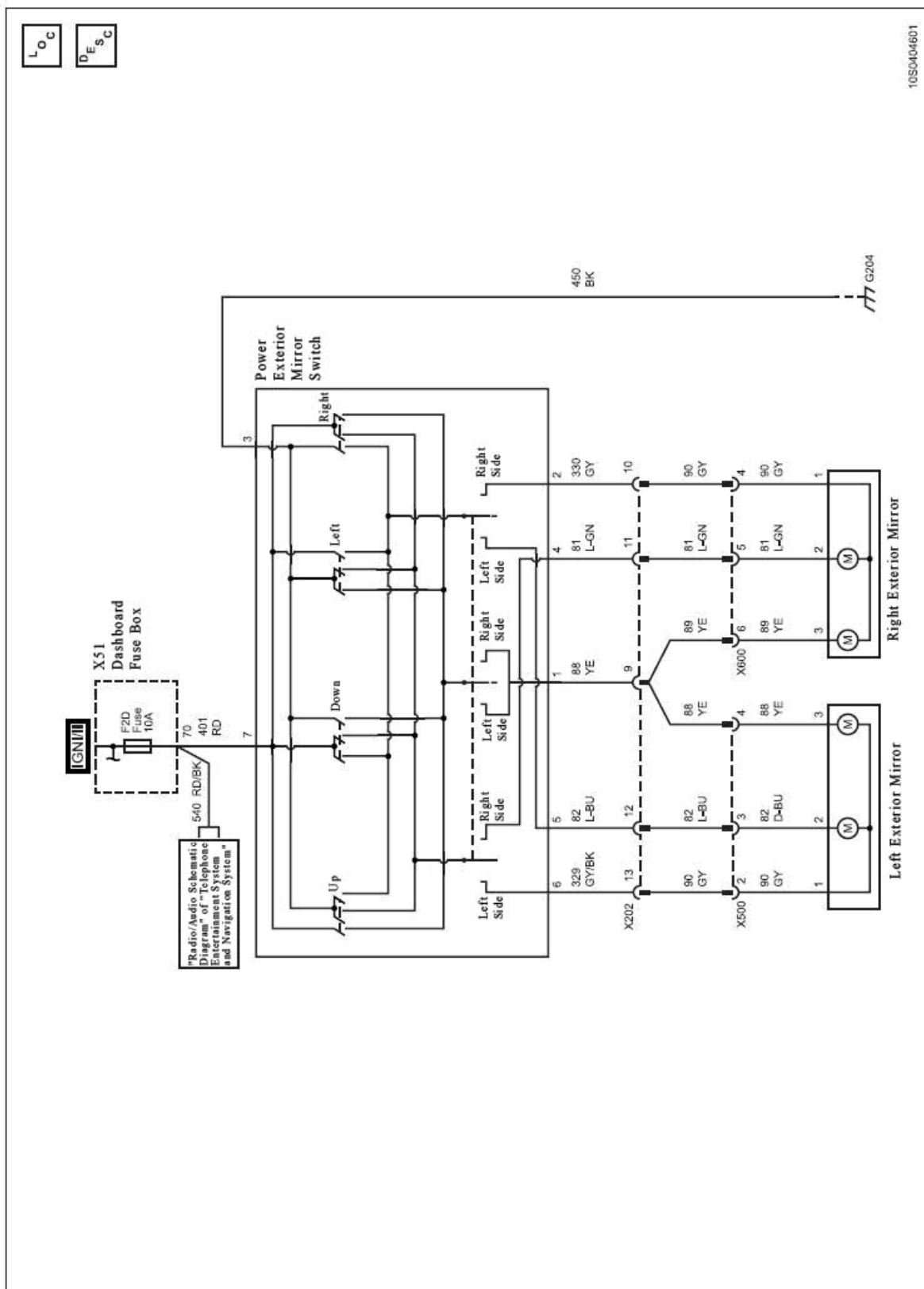


4.7.9 Brake Lamps Circuit Diagram

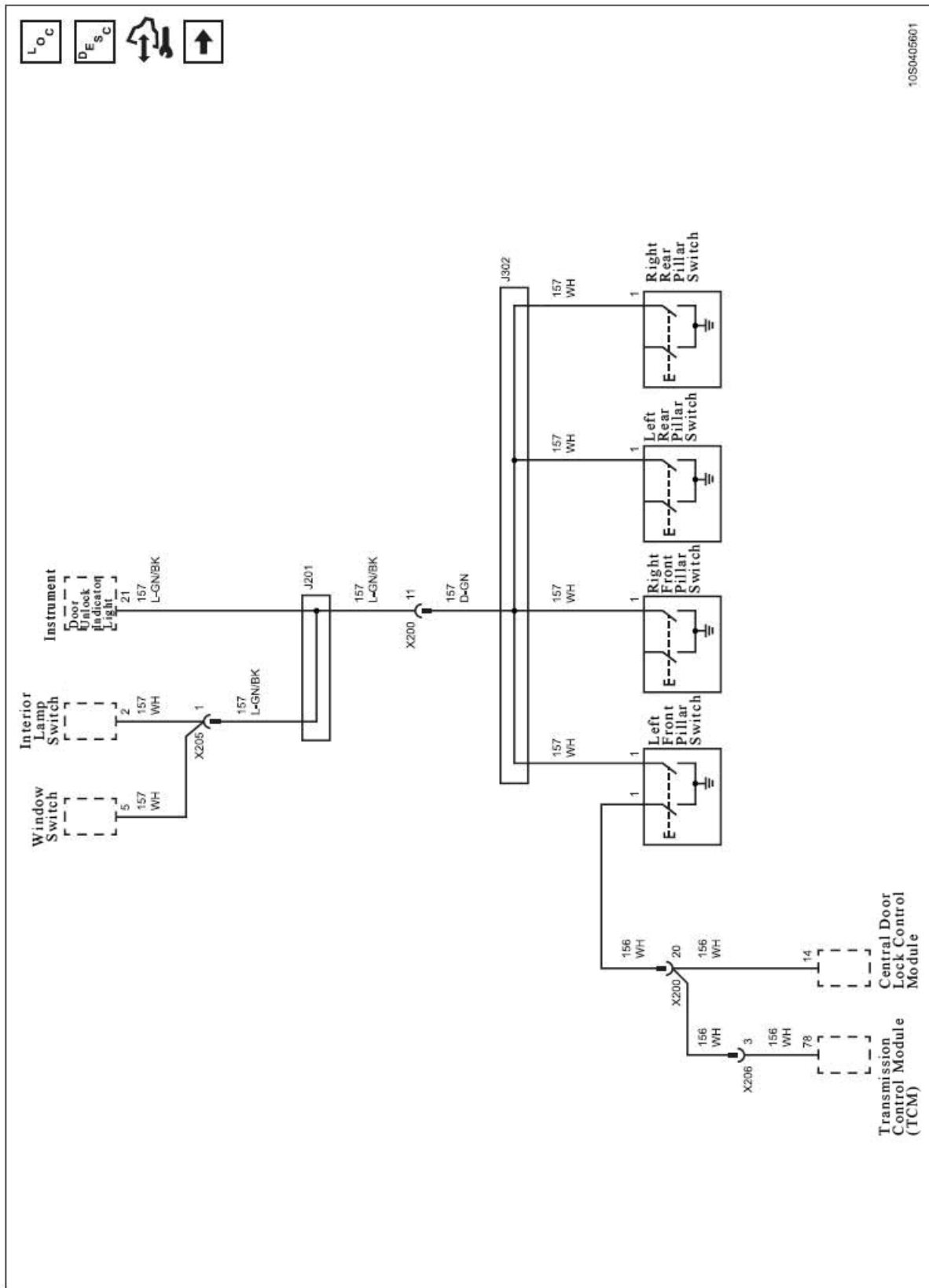


[illegible]

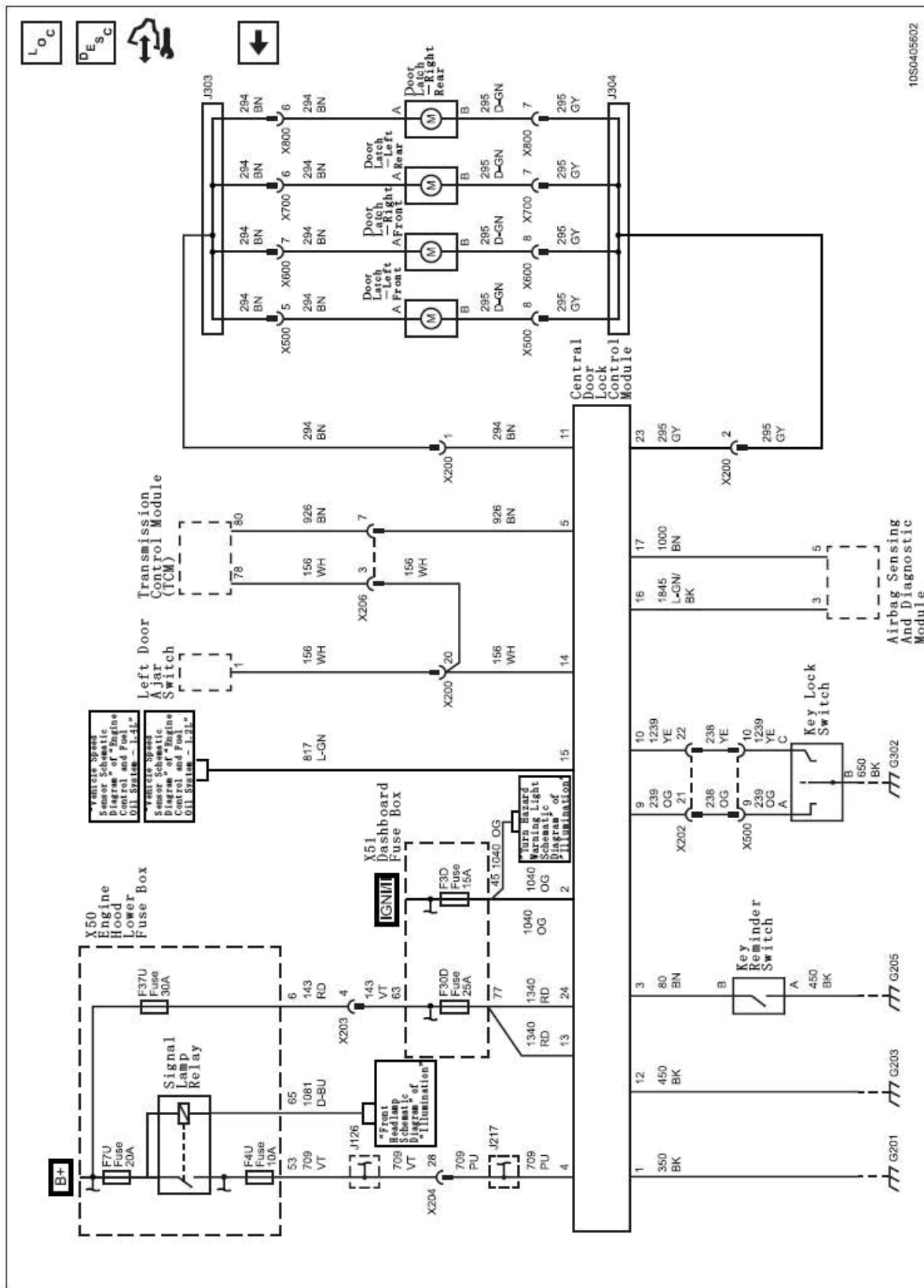
4.7.11 Exterior Mirrors Circuit Diagram



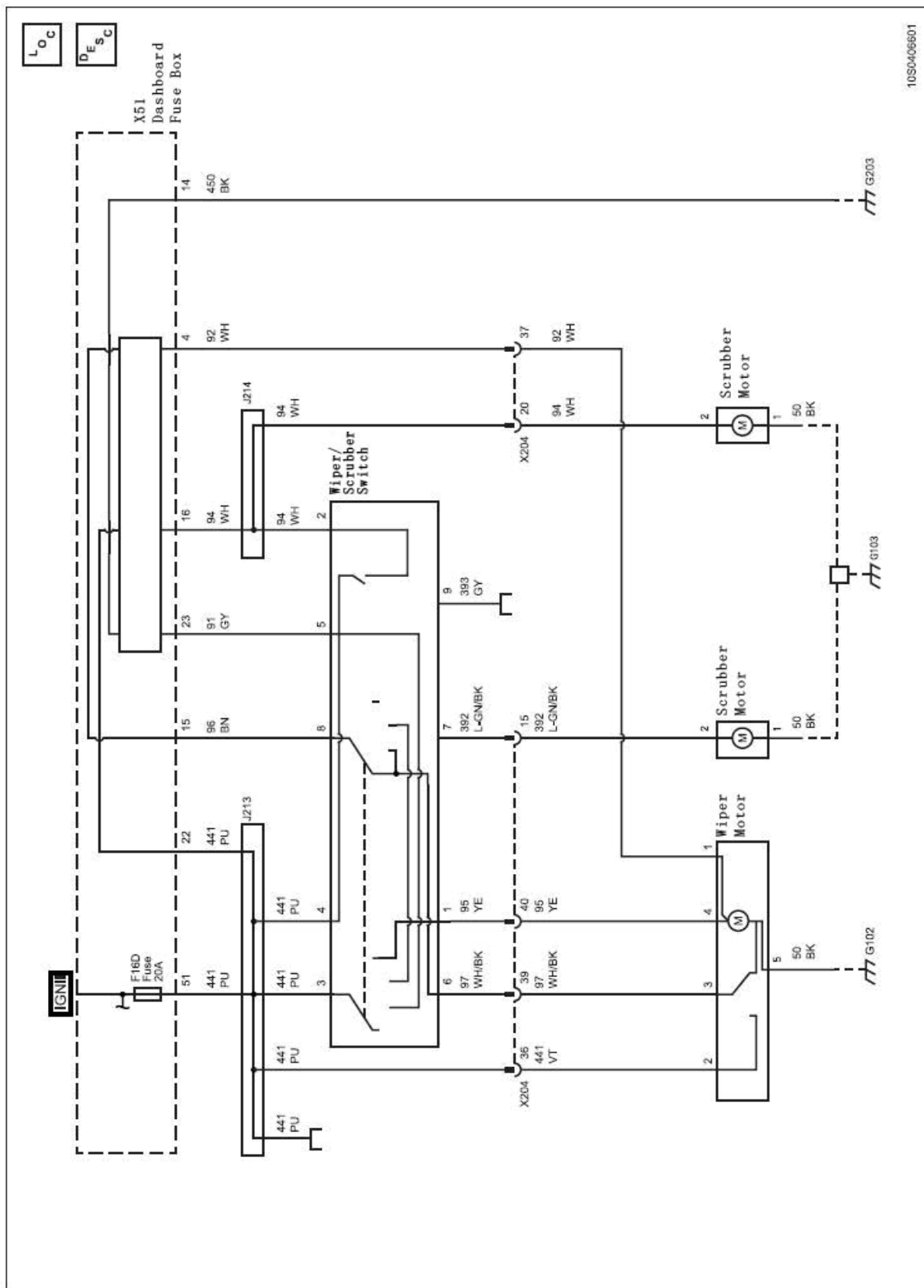
4.7.12 Door Pillar Switch Circuit Diagram



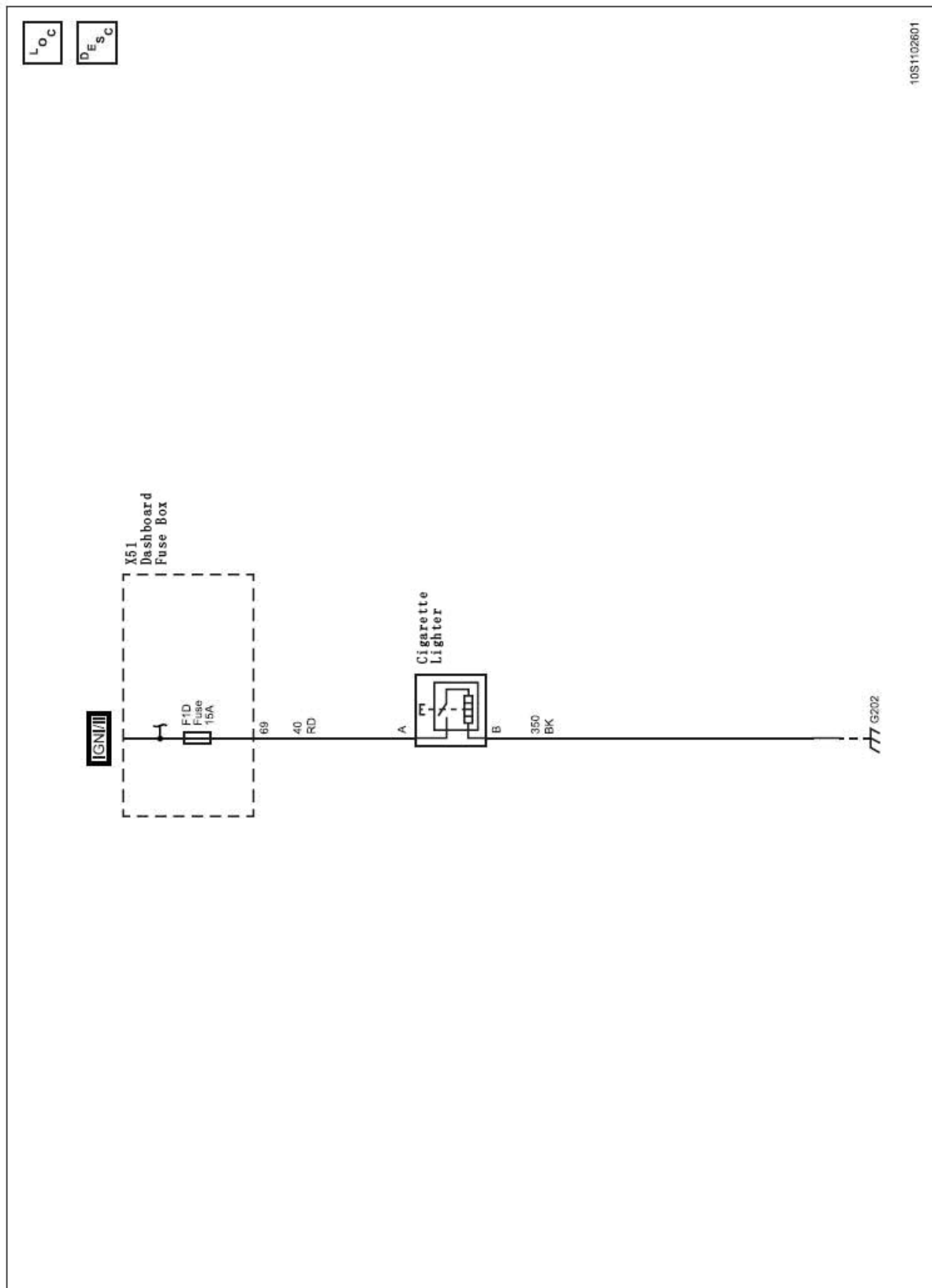
4.7.13 Central Door Lock Control Module Circuit Diagram



4.7.14 Wiper & Scrubber Circuit Diagram



4.7.16 Cigarette Lighter Circuit Diagram

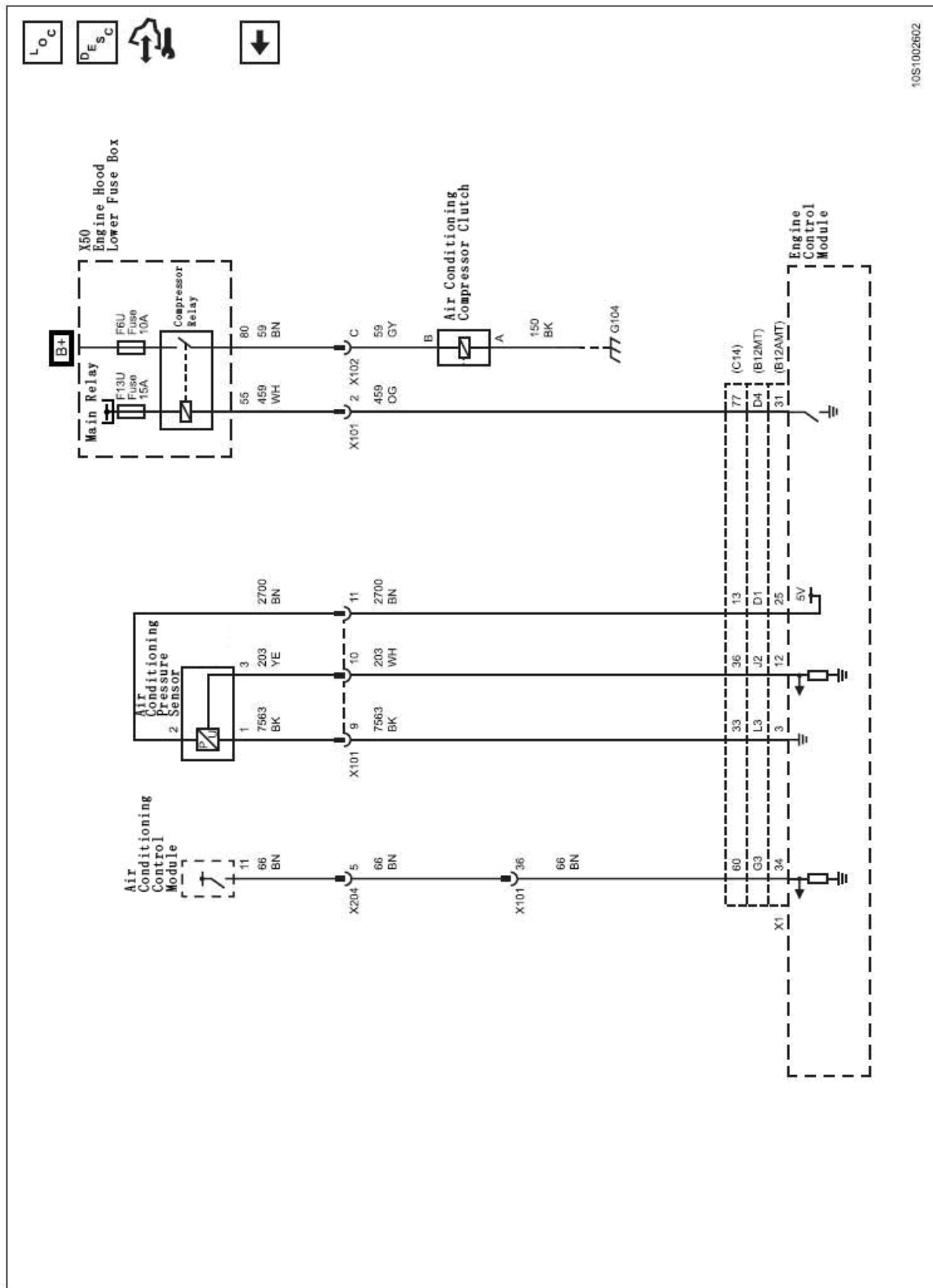


The diagram illustrates the electrical connections for the Sunroof Control Module. It shows the module's internal wiring and its connection to external components. Key components include:

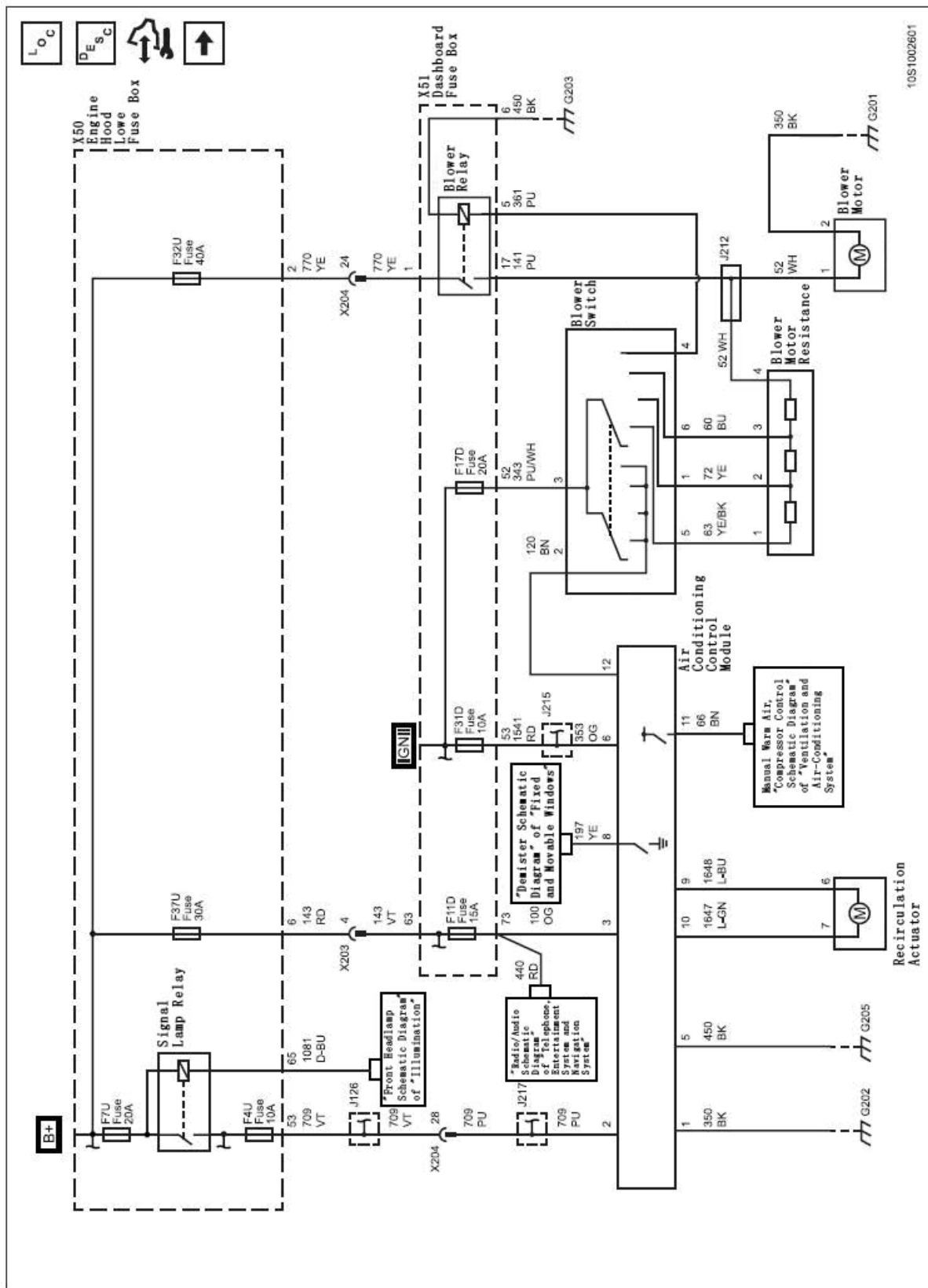
- Engine Hood Lower Fuse Box (X50):** Contains fuses F37U (30A) and F31D (10A).
- Dashboard Fuse Box (X51):** Contains fuses F18D (15A) and F31D (10A).
- Sunroof Switch:** A switch that controls the sunroof's operation.
- Interior Lamps:** Lamps for the vehicle's interior, including the "Data Communication" lamp, "Interior Lamp" (Illumination), and "Pillar Switch" (Vehicle Ingress).
- Connectors:** X203, X205, and X206 are used to connect the module to other components.
- Relays:** J215 and J216 are relays that control the sunroof's operation.

The diagram is labeled with "B+", "INGII", and "G204".

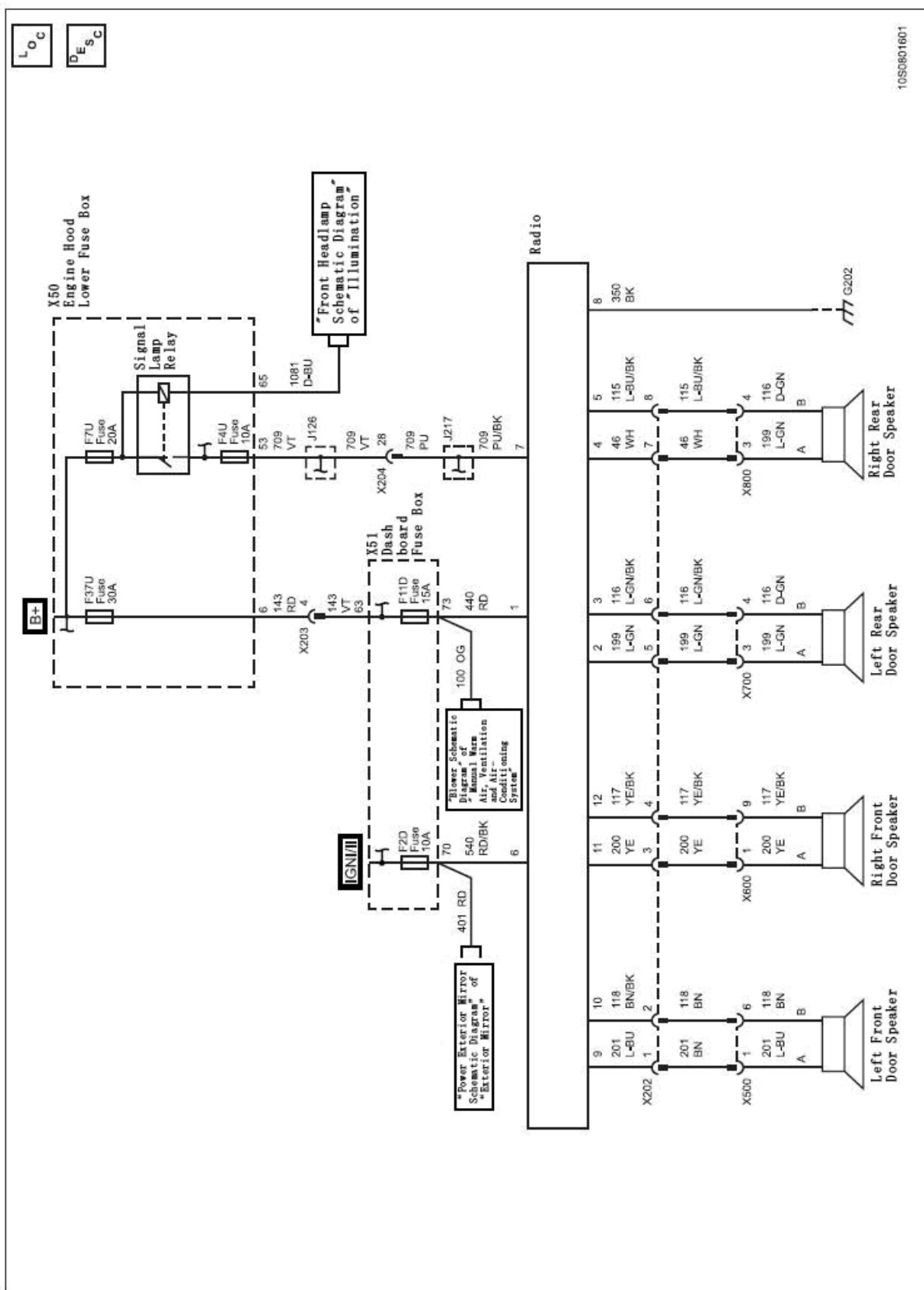
4.7.18 Air Conditioning Compressor Control



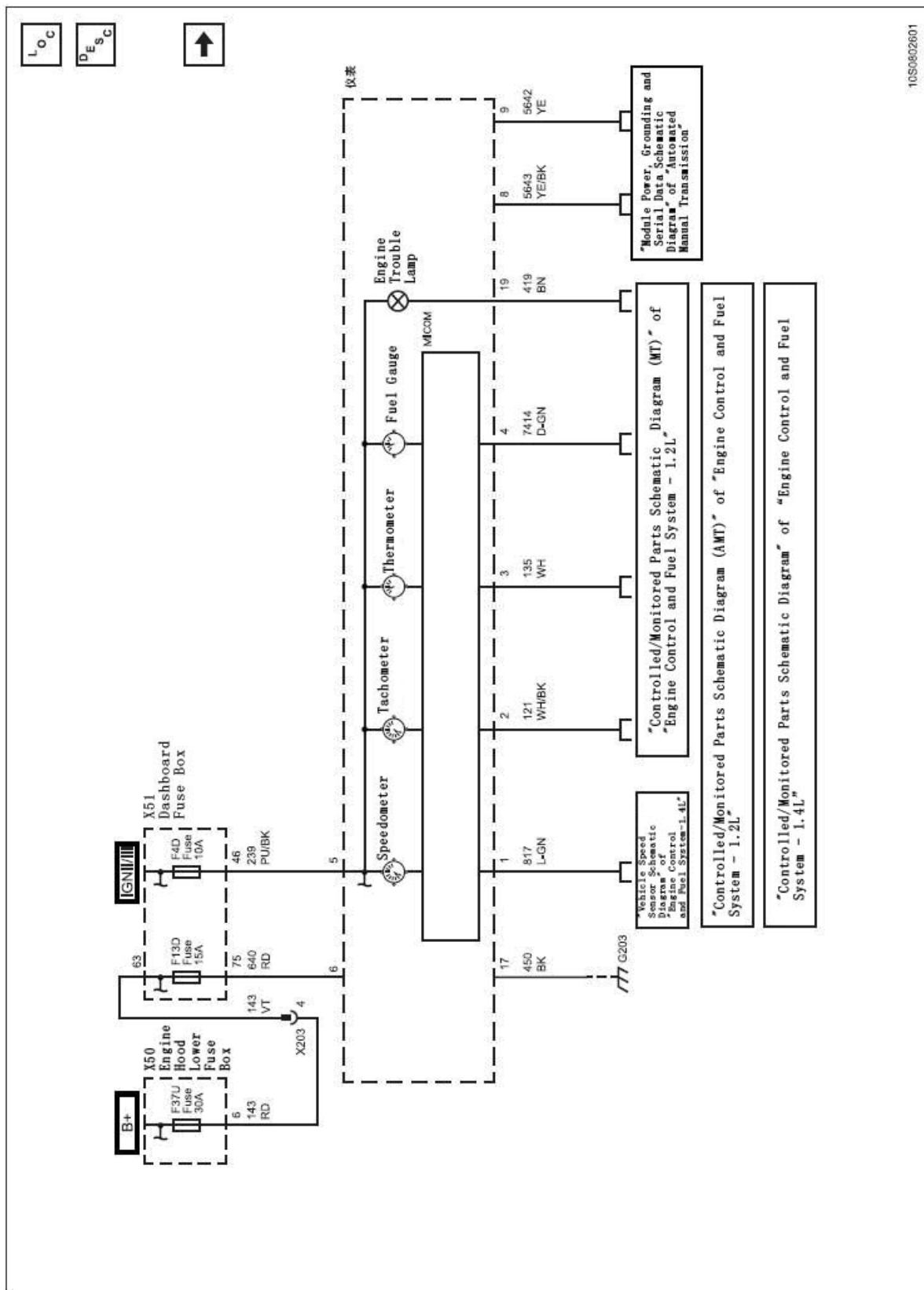
4.7.19 Air Conditioning Blower Control



LOC	DESC
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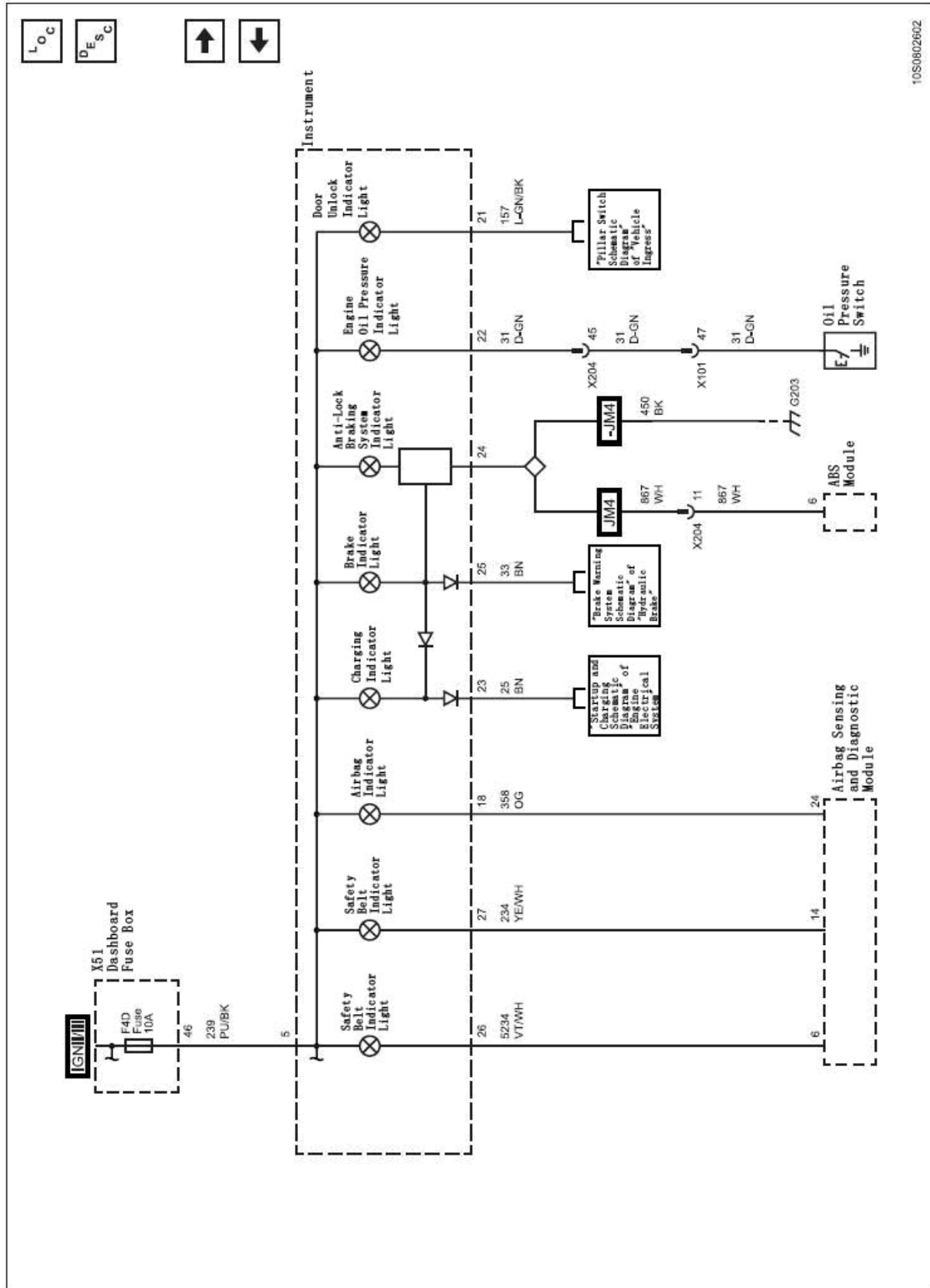


4.7.21 Instrument Circuit Diagram

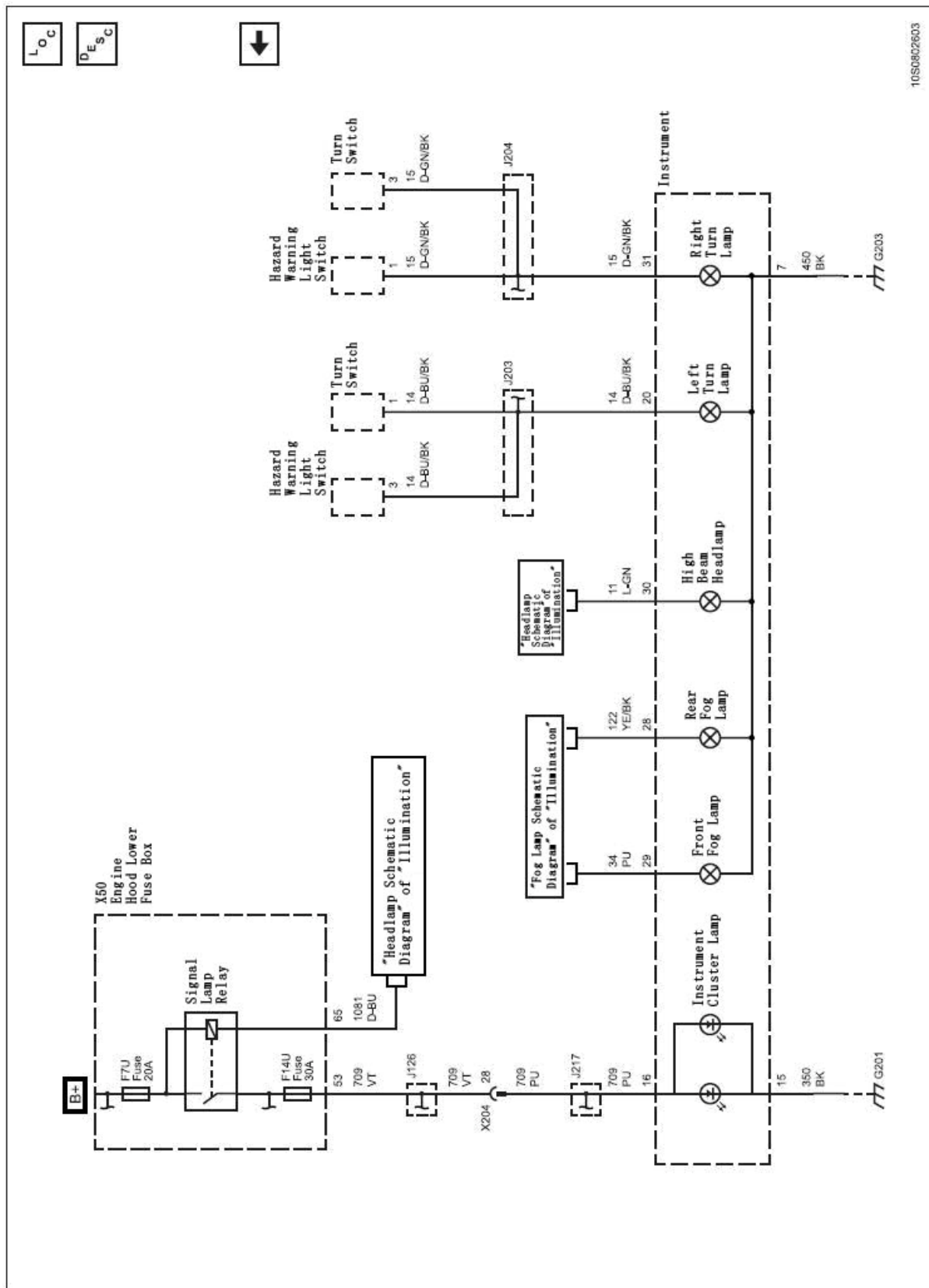


10S0602601

4.7.22 Instrument & Alarm Indicator Light

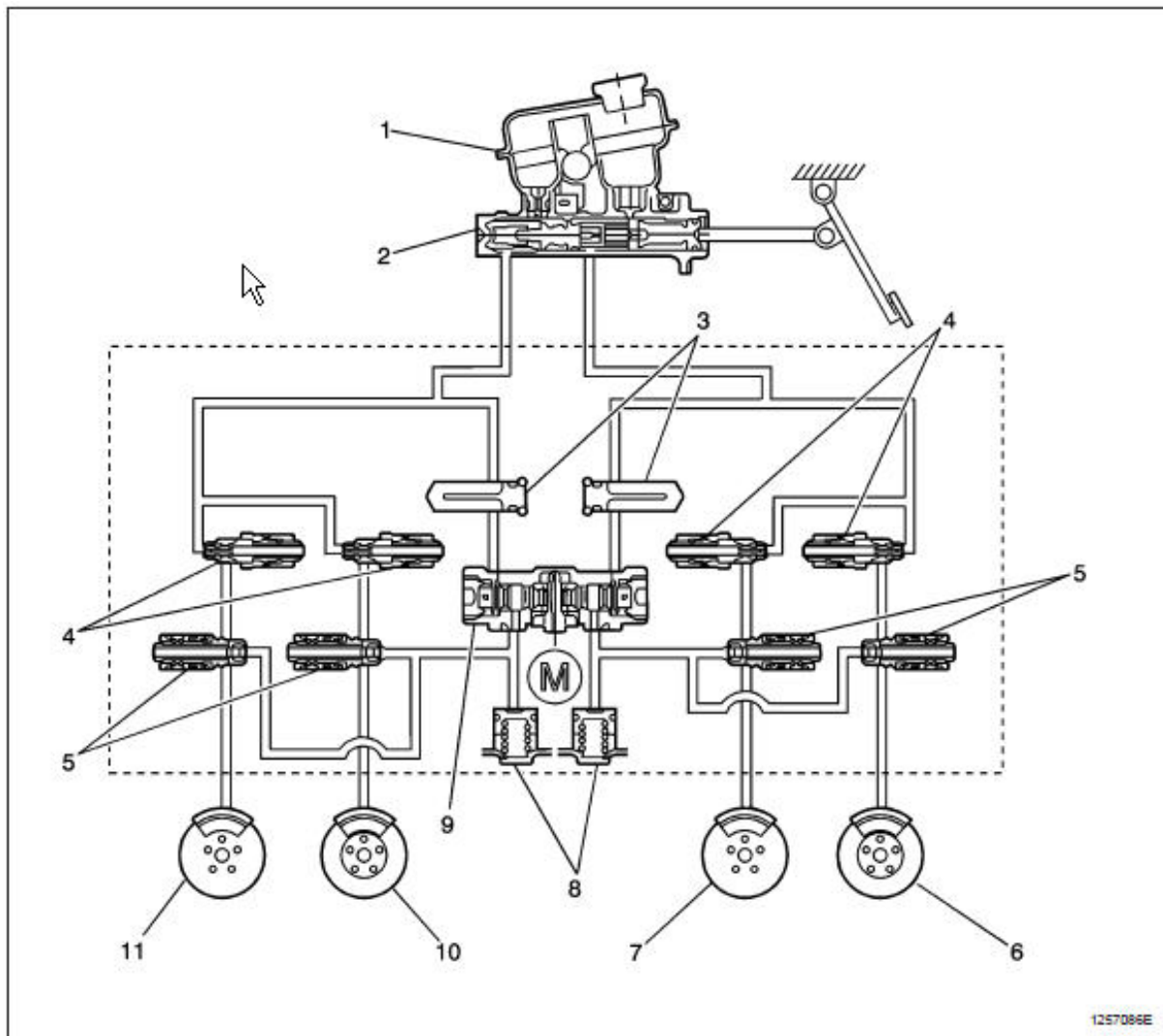


4.7.23 Instrument Indicator Lights and Illumination



5 Braking System

5.1 MGH-25 ABS Oil Circuit Diagram



1. Fluid Storage Tank

2. Master Cylinder

3. Damper

4. Intake Valve

5. Outlet Valve

6. Left Front

7. Right Rear

8. Pressure Pump

9. Energy Storage

10. Left Rear

11. Right Front

5.2 System Introduction

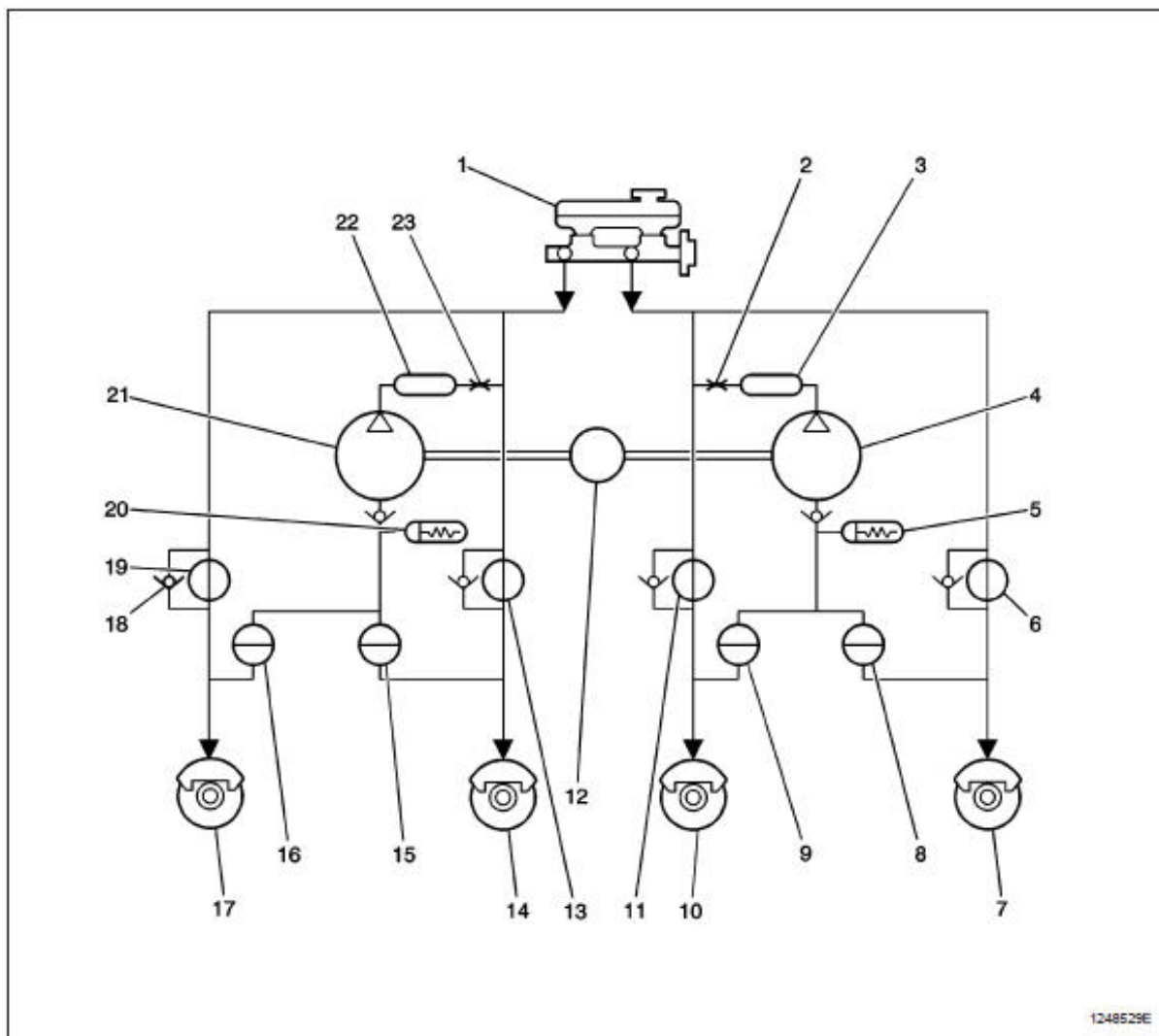
The MGH-25 anti-lock braking system (ABS) consists of a normal hydraulic braking system and anti-lock components. The normal braking system consists of a vacuum booster, a Master Cylinder, front and rear disc brakes, rear drum brakes, hydraulically interconnected brake oil pipe and hose, a brake fluid level sensor, and a brake warning light. The anti-lock braking system consists of a hydraulic unit, an electronic brake control module

(EBCM), a system fuse, four wheel speed sensors (one for each wheel), interconnecting leads, anti-lock braking system indicator lights, a decoupled dynamic rear proportioning (DDRP) indicator light (connected with the parking brake lamps), and rear drum brakes. The hydraulic unit and the electronic brake control module connected with it are located between the left fluid storage tank and the bulkhead. The configuration of the basic hydraulic unit consists of a hydraulic non-return valve, two solenoid valves of each wheel, a hydraulic pump, two power accumulators and two dampers. The hydraulic unit controls the front brake calipers and the oil pressure of the rear brake wheel cylinders through regulating the oil pressure to prevent wheel lockup.

5.3 Operation mode

5.3.1 Normal Braking Mode

The normal braking mode of the MGH-25 anti-lock braking system (ABS) adopted by this vehicle is a diagonally shunted braking system. In this system, an oil circuit of the Master Cylinder supplies pressure to the right front and left rear brakes. Another oil circuit supplies pressure to the left front and right rear brakes. All valves of the hydraulic regulator are in normal state, i.e. positions with no pressure supplied as shown in the hydraulic circuit diagram.



1. Master Cylinder

2. Orifice

3. Damper

12. Motor

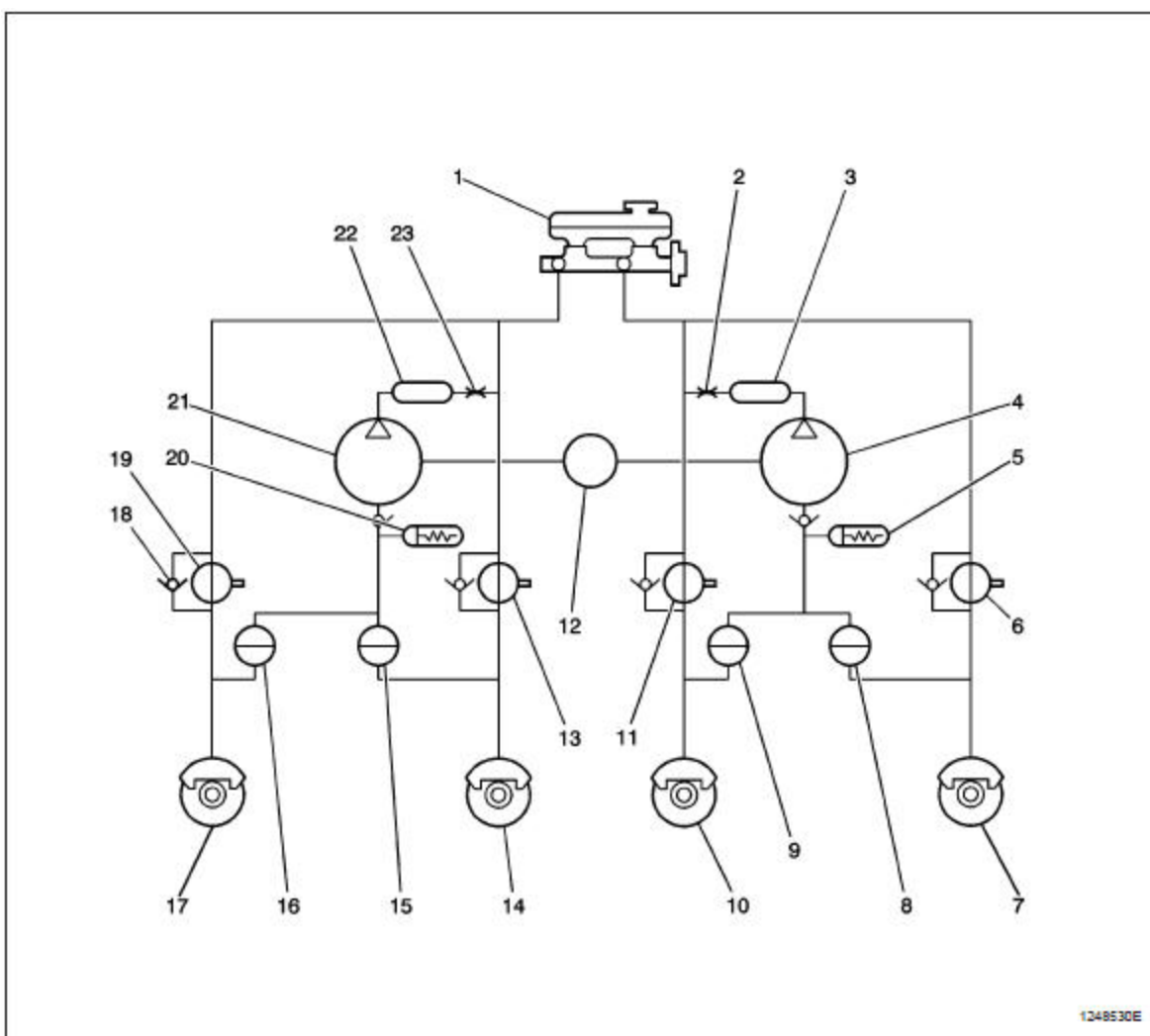
13. Intake Valve

14. Right Front Brake Caliper

- | | |
|------------------------------|-----------------------------|
| 4. Displacement Pump | 15. Outlet Valve |
| 5. Power Accumulator | 16. Outlet Valve |
| 6. Intake Valve | 17. Left Rear Brake Caliper |
| 7. Right Rear Brake Caliper | 18. Non-Return Valve |
| 8. Outlet Valve | 19. Intake Valve |
| 9. Outlet Valve | 20. Power Accumulator |
| 10. Left Front Brake Caliper | 21. Displacement Pump |
| 11. Intake Valve | 22. Damper |
| | 23. Orifice |

5.3.2 Anti-Lock Braking Mode - Connection

If, in pressure maintaining or pressure drop mode, the electronic brake control module detects that the wheel slip rate has been reduced, then the electronic brake control module will increase the brake fluid pressure of the corresponding wheel through applying the Master Cylinder pressure. At this point, the intake valve is open and the outlet valve is closed so that the pressure of the normal brake Master Cylinder can be applied to the wheels.



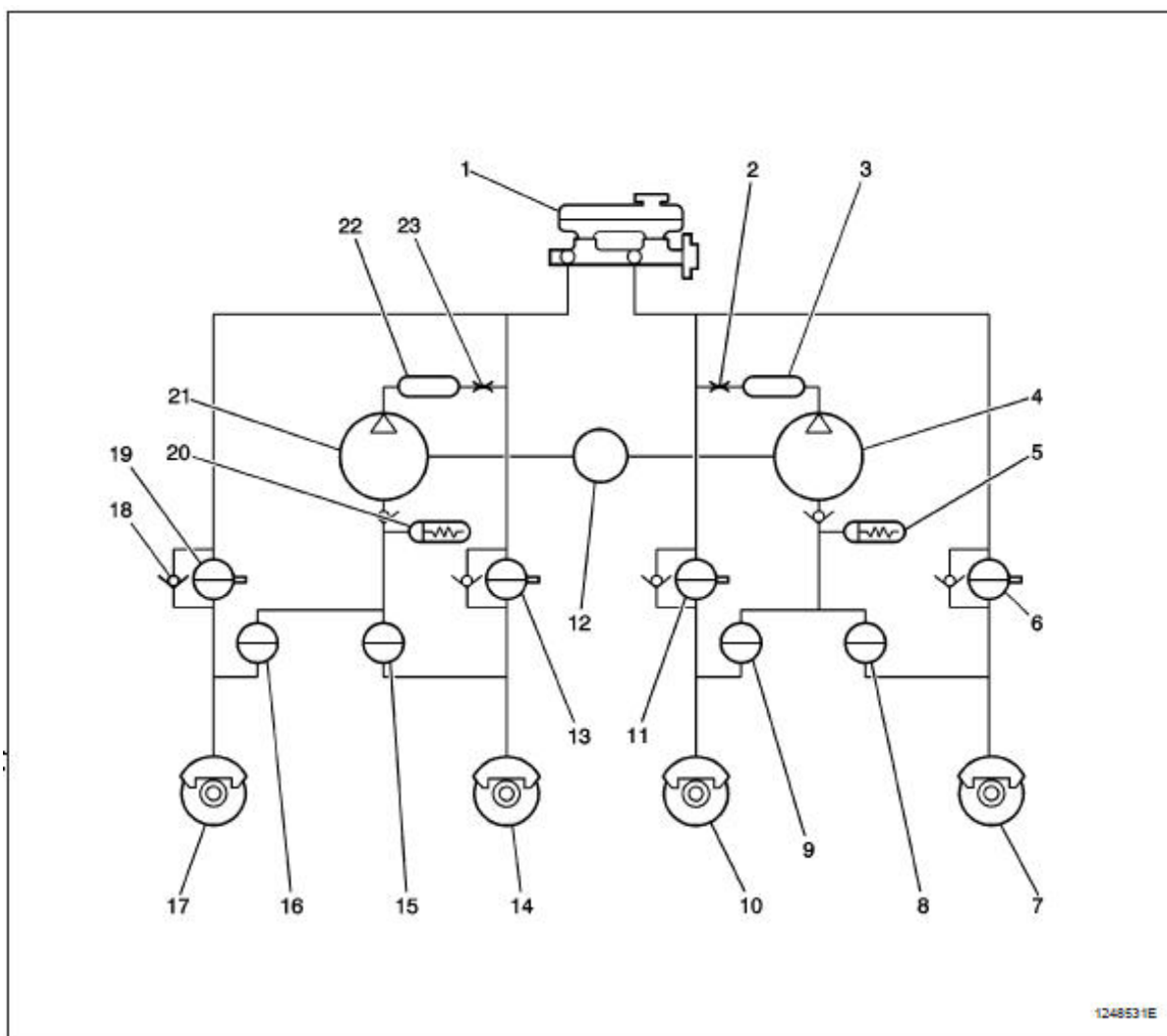
- | | |
|--------------------|-------------------------------|
| 1. Master Cylinder | 13. Intake Valve |
| 2. Orifice | 14. Right Front Brake Caliper |
| 3. Damper | 15. Outlet Valve |

4. Displacement Pump
5. Power Accumulator
6. Intake Valve
7. Right Rear Brake Caliper
8. Outlet Valve
9. Outlet Valve
10. Left Front Brake Caliper
11. Intake Valve
12. Motor

16. Outlet Valve
17. Left Rear Brake Caliper
18. Non-Return Valve
19. Intake Valve
20. Power Accumulator
21. Displacement Pump
22. Damper
23. Orifice

5.3.3 Anti-Lock Braking Mode - Maintenance

When the electronic brake control module detects wheel slip, it will close the intake valve and maintain the outlet valve in the brake pressure regulator valve as closed to isolate the system. In this way, the stability of the oil pressure in the brakes can be maintained so that there is no oil pressure rise and drop.



1. Master Cylinder
2. Orifice
3. Damper

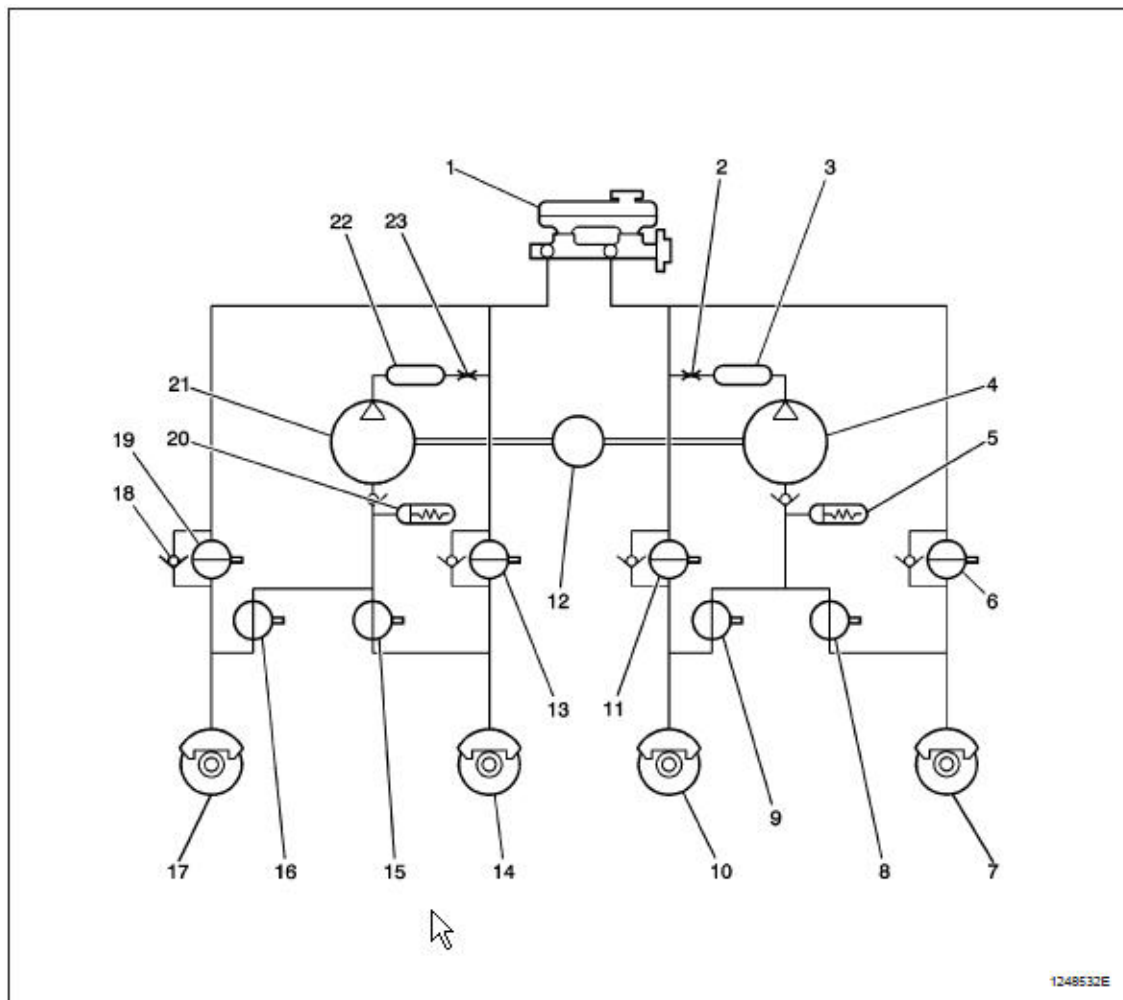
13. Intake Valve
14. Right Front Brake Caliper
15. Outlet Valve

- 4. Displacement Pump
- 5. Power Accumulator
- 6. Intake Valve
- 7. Right Rear Brake Caliper
- 8. Outlet Valve
- 9. Outlet Valve
- 10. Left Front Brake Caliper
- 11. Intake Valve
- 12. Motor

- 16. Outlet Valve
- 17. Left Rear Brake Caliper
- 18. Non-Return Valve
- 19. Intake Valve
- 20. Power Accumulator
- 21. Displacement Pump
- 22. Damper
- 23. Orifice

5.3.4 Anti-Lock Braking Mode - Separation

If the electronic brake control module still detects wheel slip in the pressure maintaining mode, then the electronic brake control module will decline the brake fluid pressure of the corresponding wheel. The intake valve remains closed and the outlet valve is open. Redundant oil and pressure are temporarily stored in the power accumulator inside the brake pressure regulator valve until the oil pump is able to return oil to the fluid storage tank of the Master Cylinder.



- 1. Master Cylinder
- 2. Orifice
- 3. Damper

- 12. Motor
- 13. Intake Valve
- 14. Right Front Brake Caliper

- | | |
|------------------------------|-----------------------------|
| 4. Displacement Pump | 15. Outlet Valve |
| 5. Power Accumulator | 16. Outlet Valve |
| 6. Intake Valve | 17. Left Rear Brake Caliper |
| 7. Right Rear Brake Caliper | 18. Non-Return Valve |
| 8. Outlet Valve | 19. Intake Valve |
| 9. Outlet Valve | 20. Power Accumulator |
| 10. Left Front Brake Caliper | 21. Displacement Pump |
| 11. Intake Valve | 22. Damper |
| | 23. Orifice |

5.4 Decoupled Dynamic Rear Proportioning (DDRP)

The DDRP (decoupled dynamic rear proportioning) system is a proportioning system, which is used for maintaining vehicle stability during braking. Under normal braking conditions, the braking force of the rear wheels is on the small side because the vehicle's center of gravity moves forward. DDRP maintains the brake pressure required by the rear wheels through the rear intake and outlet valves of the anti-lock braking system (ABS) to provide effective braking effect and vehicle stability. In the DDRP system, the power of the rear maintaining solenoid valve is supplied by the ignition circuit.

If one of the following malfunctions occurs, the red brake warning light will be illuminated.

- The two wheel speed sensors on the same axle are out of service.
- The rear intake solenoid valve is out of service.
- The accumulator 2 and the motor input are short-circuited against the ground.
- The accumulator 1 and the electronic brake control module are open-circuited or short-circuited against the ground.
- The motor ground circuit is open-circuited or short-circuited against the accumulator.
- The ground circuit of the electronic brake control module is open-circuited or short-circuited against the accumulator.
- The ignition circuit is open-circuited or short-circuited against the ground.

Parts	Assumed Malfunctions	Decoupled Dynamic Rear Proportioning		
		ABS Warning Light	Brake Warning Light	DDRP Mode
Right Front Sensor	Short-Circuited or Open-Circuited	Connected	-	Performance Reduction
Left Front Sensor	Short-Circuited or Open-Circuited	Connected	-	Performance Reduction
Right Rear Sensor	Short-Circuited or Open-Circuited	Connected	-	Performance Reduction
Left Rear Sensor	Short-Circuited or Open-Circuited	Connected	-	Performance Reduction
Two Sensors On The Same Axle	Short-Circuited or Open-Circuited	Connected	Connected	Closed
A Front Axle Sensor And A Rear Axle Sensor	Short-Circuited or Open-Circuited	Connected	-	Performance Reduction
Motor	Short-Circuited Against The Ground - Low Side	Connected	-	Performance Reduction
	Short-Circuited Against The Ground - High Side	Connected	-	Performance Reduction
	Short-Circuited Against The Accumulator - Low Side	Connected	-	Performance Reduction
	Short-Circuited Against The Accumulator - High Side	-	-	-
	Open-Circuited Motor	Connected	-	Performance Reduction
	Motor Speed Loss	Connected	-	Performance Reduction
Front Connected Solenoid Valve	Short-Circuited or Open-Circuited	Connected	-	Performance Reduction
Front Separate Solenoid Valve	Short-Circuited or Open-Circuited	Connected	-	Performance Reduction
Rear Connected Solenoid Valve	Short-Circuited or Open-Circuited	Connected	-	Performance Reduction
Rear Separate Solenoid Valve	Short-Circuited or Open-Circuited	Connected	-	Performance Reduction
System Relay	Open-Circuited (Cannot Be Connected)	Connected	-	Performance Reduction
	Short-Circuited (Connected At All Time And Cannot Be Disconnected)	Connected	Connected	-
Accumulator 2 (Motor)	Short-Circuited Against The Ground	Connected	-	Performance Reduction
	Open-Circuited	-	-	Too Low Voltage
Grounding (Motor)	Short-Circuited or Short-Circuited against the Accumulator	Connected	-	Activated
Accumulator 1, Electronic Brake Control Module, Solenoid Valve	Open-Circuited or Short-Circuited against the Ground	-	-	Closed
Grounding, Electronic Brake Control Module,	Short-Circuited or Short-Circuited against the Accumulator	Connected	Connected	Closed

Solenoid Valve				
Ignition	Open-Circuited or Short-Circuited against the Ground	Connected	ConnectedConnected	Closed
Brake Switch	Not Applicable	Connected	-	Activated
Serial Communication	Open-Circuited or Short-Circuited	Connected	Connected	Activated

5.5 Electronic Brake Control Module (EBCM)

The electronic brake control module (EBCM) carries out the following major functions to accomplish effective braking and vehicle stability. In the DDRP(decoupled dynamic rear proportioning)system, the power of the rear maintaining solenoid valve is supplied by the ignition circuit.

If one of the following malfunctions occurs, the red brake warning light will be illuminated.

- Wheel speed sensor input malfunction.
- Detection of wheel slip.
- Control braking system in anti-lock control mode malfunction.
- Electrical system operation malfunction.

The electronic brake control module continuously detects the rotation speed of each wheel to determine whether there is a wheel that starts to slip. Provided that a wheel slip is detected, the electronic brake control module will require the control valve to move to an appropriate position in order to regulate the pressure of part of the oil circuit or the entire oil circuit so that the wheel slip is prevented and the best braking effect is obtained. The electronic brake control module continuously controls the pressure of each oil circuit until the slip disappears. The electronic brake control module (EBCM) also continuously monitors whether the operation of the anti-lock braking system (ABS) is proper. If a malfunction is detected, the electronic brake control module will shut down the functions of the anti-lock braking system and illuminate the ABS warning light on the dashboard. In diagnostic mode, the electronic brake control module also controls the display of the fault diagnosis code of the anti-lock braking system.

5.6 Solenoid Valve Relay

The solenoid valve relay supplies power for the pump motor and the solenoid valve. The relay switch is normally open, and must be closed during initialization. As long as the fault diagnosis code that requires the switch to be open is not set, then the relay switch will remain closed at all times. If the fault diagnosis code is set to require the relay to be open, then the accumulator voltage of the pump motor and the solenoid valve will be cut off and the anti-lock braking system (ABS) won't function. The relay and the electronic brake control module are incorporated together and cannot be repaired individually.

5.7 Wheel Speed Sensor and Toothed Ring

Each wheel has a wheel speed sensor, and the sensor transmits the rotation speed of the wheel to the electronic brake control module in the form of a low AC voltage signal through an interface. This interface might input a false wheel speed sensor signal, or a wheel speed sensor signal input that contains noise into the electronic brake control module.

5.8 Anti-Lock Braking System (ABS) Warning Light

The anti-lock braking system warning light is mounted in the instrument cluster and is illuminated when the electronic brake control module detects any malfunction in the anti-lock braking system. The anti-lock braking system (ABS) warning light informs the driver that there is a malfunction resulting in the shut-down of the anti-lock braking system. If only the anti-lock braking system warning light is illuminated, then normal braking function with full brake assist will still work.

The conditions for activating the anti-lock braking system warning light are as follows:

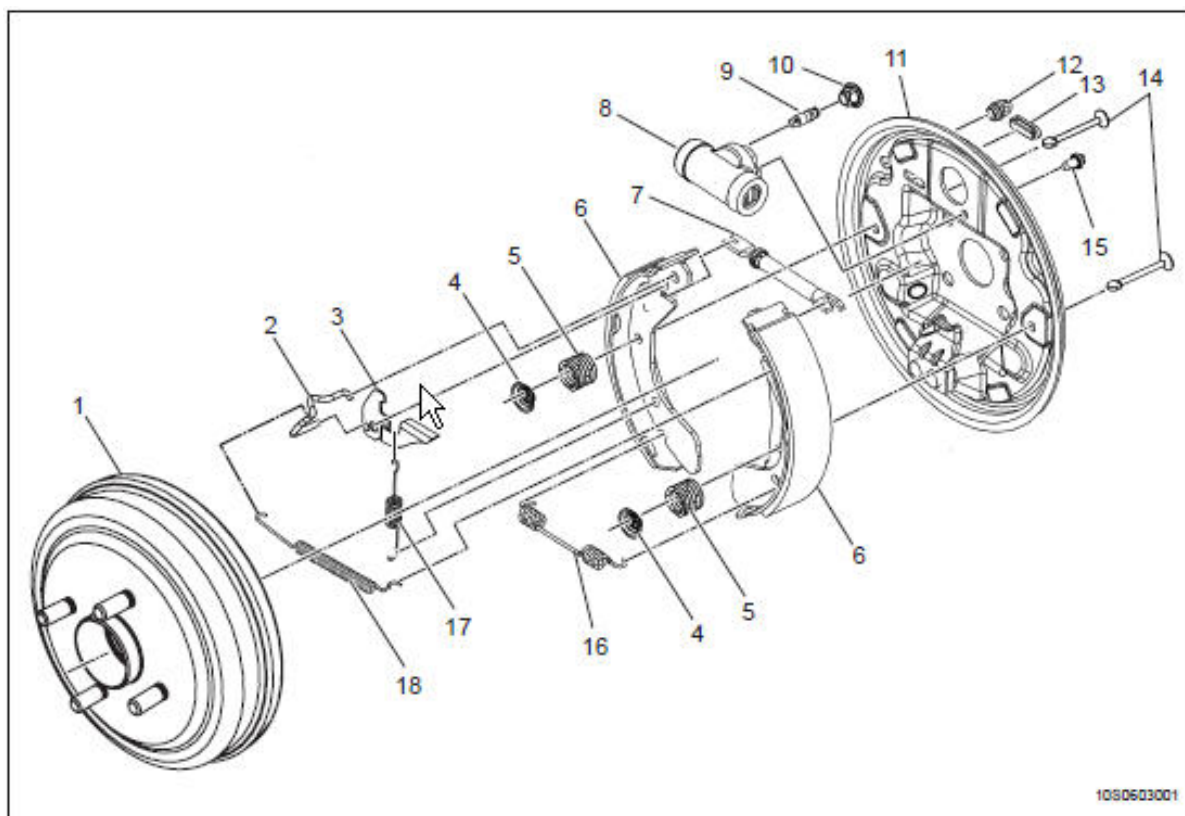
- As stated above, when a malfunction is found in the anti-lock braking system, the anti-lock braking system warning light will be illuminated.
- During a lamp test of the dashboard instrument cluster: the anti-lock braking system (ABS) warning light will be illuminated approximately for 3 seconds and then go out when the ignition switch is closed.

5.9 Brake Warning Light

The red brake warning light in the instrument cluster is illuminated to warn the driver that there is a (are) malfunction condition(s) in the braking system and the braking effect is therefore reduced. When the hand brake is pulled up, not completely loose, or the brake fluid level switch is closed (the switch will be closed when the brake fluid level in the fluid storage tank of the Master Cylinder is too low) , the warning light will also be illuminated. When the brake level switch is closed, the indicating fluid level is too low. At this point, the malfunction (s) must be repaired, otherwise the brake warning light won't go out. Some malfunctions in the MGH-25 system will also illuminate the warning light to inform the driver that the DDRP (decoupled dynamic rear proportioning) is shut down.

5.10 Rear Drum Brake

The drum brake assembly employs the design of a leading trailing shoe brake. The two brake shoes are firmly compressed on the brake wheel cylinder piston by the lower return spring and the fixed anchor plate next to it. When the brake pedal is pressed, the brake wheel cylinder piston moves the two brake shoes outwards to allow them to touch the brake drums. When wheels are advancing, the front brake shoes will stretch out inside the brake drums and generate energizing effort. When wheels are reversing, the rear brake shoes will generate self energizing effort. The force from the brake shoes is passed to the anchor plate, and then passed to the axle flange through the bottom plate. Adjustment is automatically carried out, and it happens every time the brake pedal is pressed. The positions of used shoe plates shall not be exchanged, otherwise the self-adjustment function will disable and the pedal stroke will be increased.



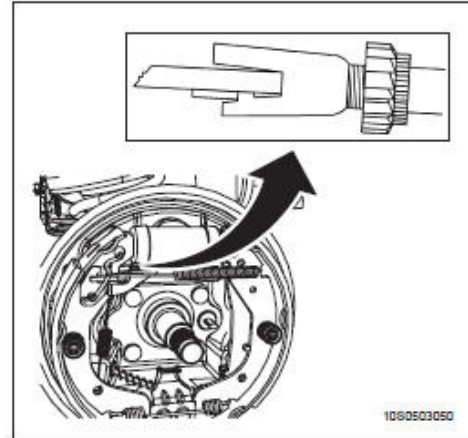
- | | |
|------------------------------------------|---------------------------------------------------|
| 1. Brake Drum | 10. Brake Wheel Cylinder Air Outlet Valve Nut Cap |
| 2. Torsion Spring | 11. Brake Backing Plate |
| 3. Adjusting Bracket | 12. Brake Shoe Inspection Hole |
| 4. Brake Shoe Alignment Pin Nut Cap | 13. Dust Cap |
| 5. Brake Shoe Locating Pin Spring | 14. Brake Wheel Cylinder Fixing Screw |
| 6. Brake Shoe | 15. Brake Shoe Alignment Pin |
| 7. Regulating Stem | 16. Brake Shoe Lower Tense Return Spring |
| 8. Brake Wheel Cylinder | 17. Adjusting Bracket Spring |
| 9. Brake Wheel Cylinder Air Outlet Valve | 18. Brake Shoe Upper Tense Return Spring |

5.11 Drum Brakes Adjustment

- For brake drum dismounting, please refer to "brake drum replacement".
- Screw a rear brake adjusting nut into the regulator assembly until adequate elongation is generated on the brake drums.
- Employ a stop block of the parking brake bar to support the edge of the web plate. If necessary, loosen the hand brake cable at the balance arm. Please refer to "parking brake bar assembly replacement".
- Mount brake drums.

Important precautions: if the “click” sound of the regulator assembly cannot be heard from the two brake drums, then the clearance between the brake shoe and the brake drum has already been adjusted.

- Press the brake pedal at least 10 times, and confirm that the “click” sound of the regulator assembly cannot be heard in the two brake drums.
- For hand brake adjustment, please refer to "hand brake adjustment".



5.12 The Wear-in Of Brake Shoes and Brake Drums

- Once a brake shoe is replaced, wear-in shall be carried out for the new braking surface.
- Once sizing is implemented or a brake drum is replaced, wear-in shall be carried out for the new braking surface.
- Brake 20 times at the speed of 48 km/h in order to carry out wear-in for the new braking surface.
- Step down the brake pedal with a varying force from moderate to heavy. Do not cause the brake to become overheated.

Special precautions: Emergency brake should be avoided within 200 km driving distance after the brake lining is replaced.

5.13 Hydraulic Braking System Exhaust

1. When the engine is stopped, continuously press the brake pedal several times until the reserved pressure in the booster is completely eliminated.
2. Disconnect the electrical connector of the Master Cylinder storage tank.
3. Dismount the Master Cylinder storage tank cover.
4. Connect the outlet valve to the Master Cylinder storage tank through an adapter.
5. Tighten and loosen the brake pressure control and air release valves respectively to carry out exhaustion for vehicles equipped with anti-lock braking system (ABS) .
6. Fill the pressure exhaust device to 140-172 kpa (20-25 bar /square inch) .
7. Pour brake fluid into the Master Cylinder storage tank. During the exhaust process, the brake fluid in the Master Cylinder should be maintained as half-full.

8. Disconnect the front brake line of the Master Cylinder.
9. Pour brake fluid into the storage tank until brake fluid starts to spill from the front pipe head.
10. Connect the front brake line to the Master Cylinder, and fasten the brake line to 10 N.m (13 pound foot) .
11. Slowly press the pedal and hold it.
12. Loosen the front brake line at the Master Cylinder, and release all air in the Master Cylinder.
13. Fasten the brake line (as stated in step 5), and slowly release the brake pedal. Wait for 15 seconds, and then go to the next step.
14. Repeat this procedure and the 15 seconds waiting time until all air is exhausted from the master cylinder hole.
15. After all air is exhausted from the front joint, repeat the same procedure for front joint exhaustion to exhaust all air in the Master Cylinder from the rear joint. **Important precautions:** the following exhaust sequence should be followed for vehicles without an anti-lock braking system: right back, left front, left rear and right front.

Important precautions: quickly pressing and releasing the brake pedal in a back and forth manner will cause the Master Cylinder sub-piston to be pressed down along the oil cylinder. This will result in the air in the system becoming harder to be exhausted.

16. Connect a hyaline tube to the air outlet valve of the right back brake wheel cylinder, and dip the tube into the brake fluid in the hyaline vessel.
17. Slowly press the pedal and hold it.
18. Unscrew the air outlet valve screw to exhaust the air in the pipeline.
19. Screw in the air outlet valve.
20. Slowly release the brake pedal. Wait for 15 seconds and repeat step 17 ~ 19.
21. When the exhausted brake fluid is free of bubbles, then screw in the exhaust screw. Fasten in the exhaust screw to 9 N.m (80 poundinch) .
22. Connect the hoses to the left front, left rear and right front brake air outlet valves, and carry out steps 17 ~ 21, respectively.
23. Wait for 15 seconds and repeat this procedure. Inspect the brake pedal to see if it is firm. If it is still soft, the

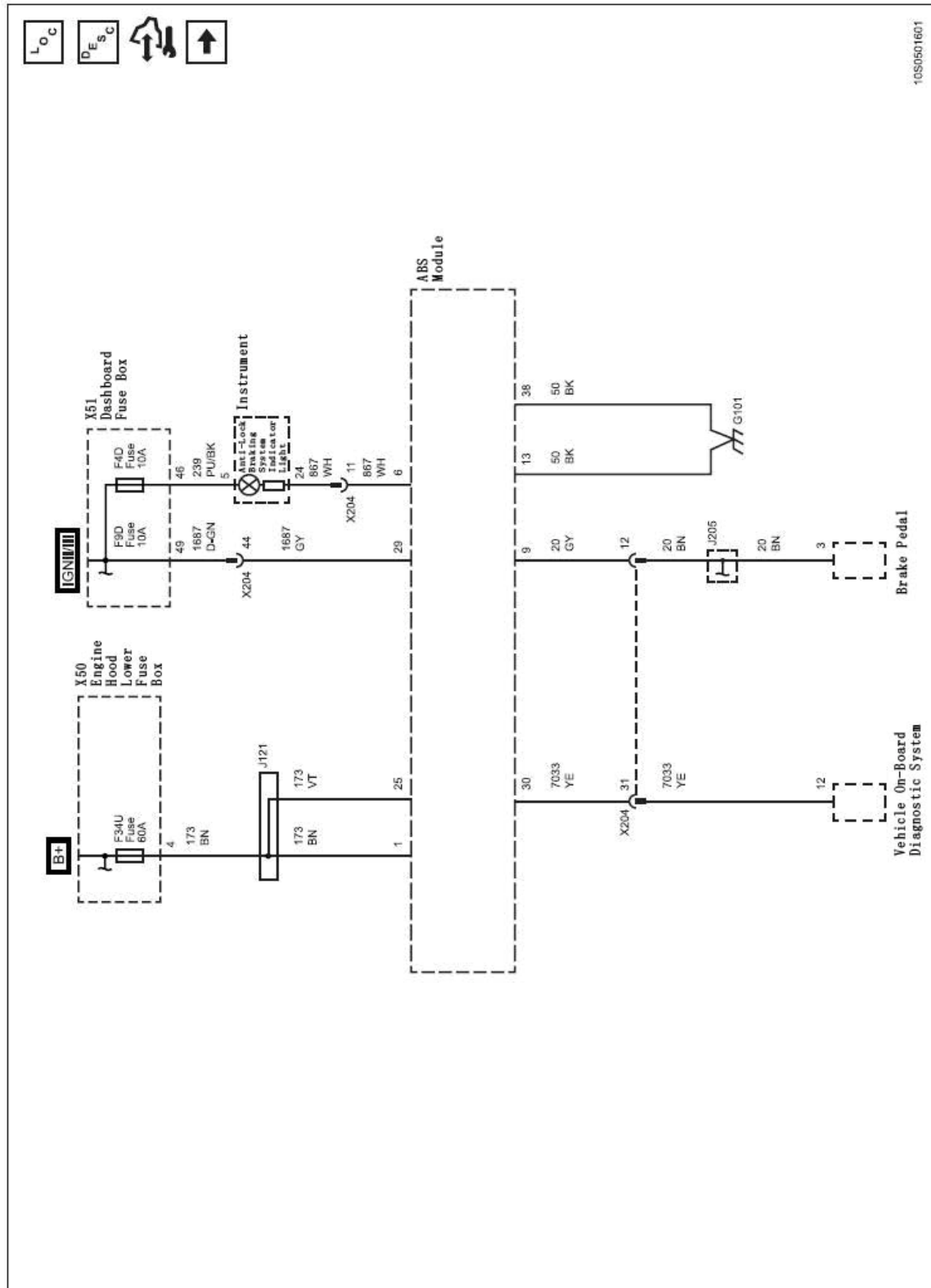
above procedures need to be repeated in order to exhaust all air.

5.14 Hand Brake Adjustment

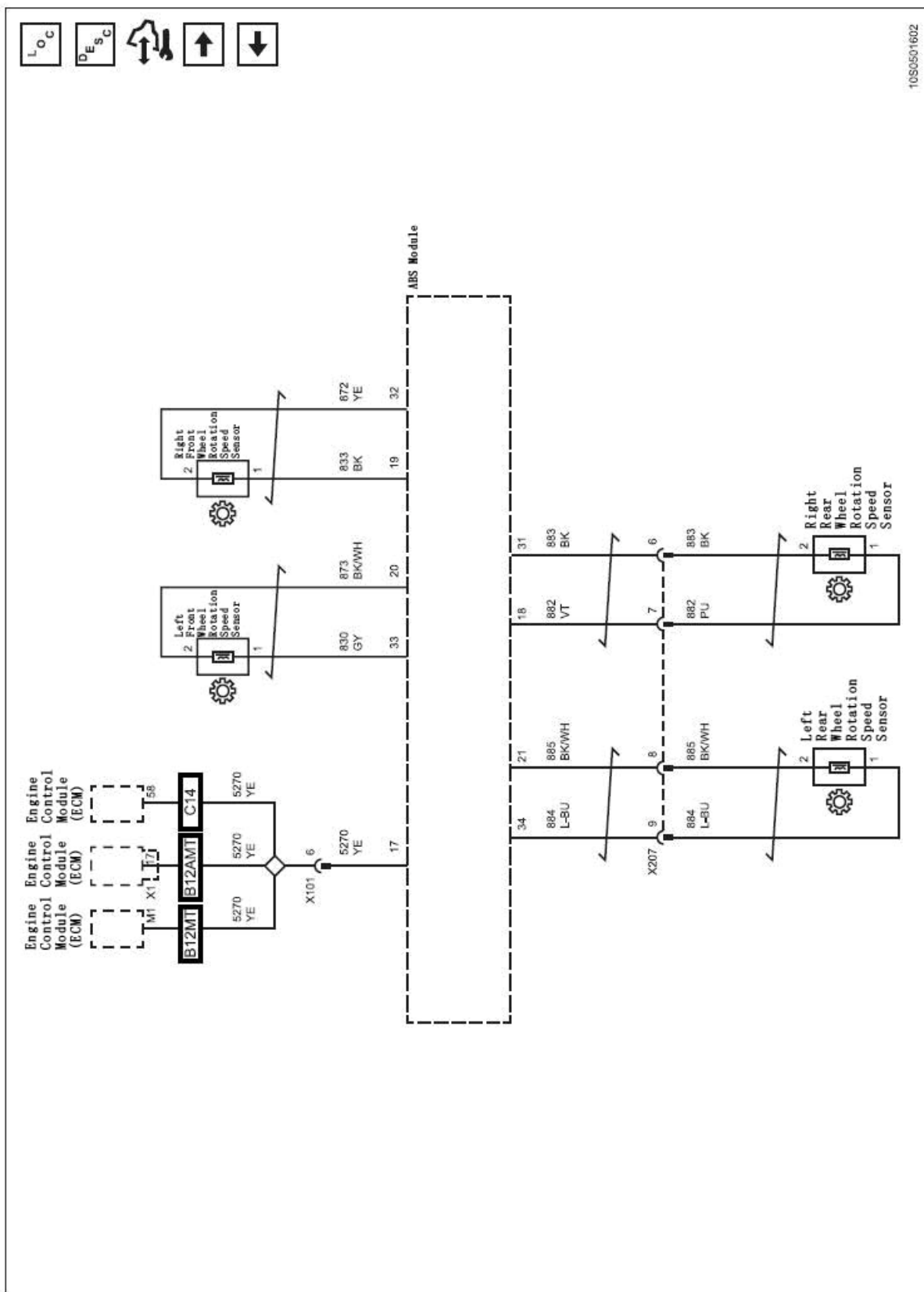
1. For the rear brake adjustment, please refer to "rear brake adjustment".
2. Release the hand brake.
3. Lift and properly support the vehicle.
4. Inspect whether the hand brake cable is free to move.
5. Turn the adjusting nut (1) in the brake bar assembly until wheels are hard to move.
6. Unscrew the nut (1) until the rear wheel is just able to be free to rotate.
7. Lower the vehicle.

5.15 Braking System Circuit Diagrams

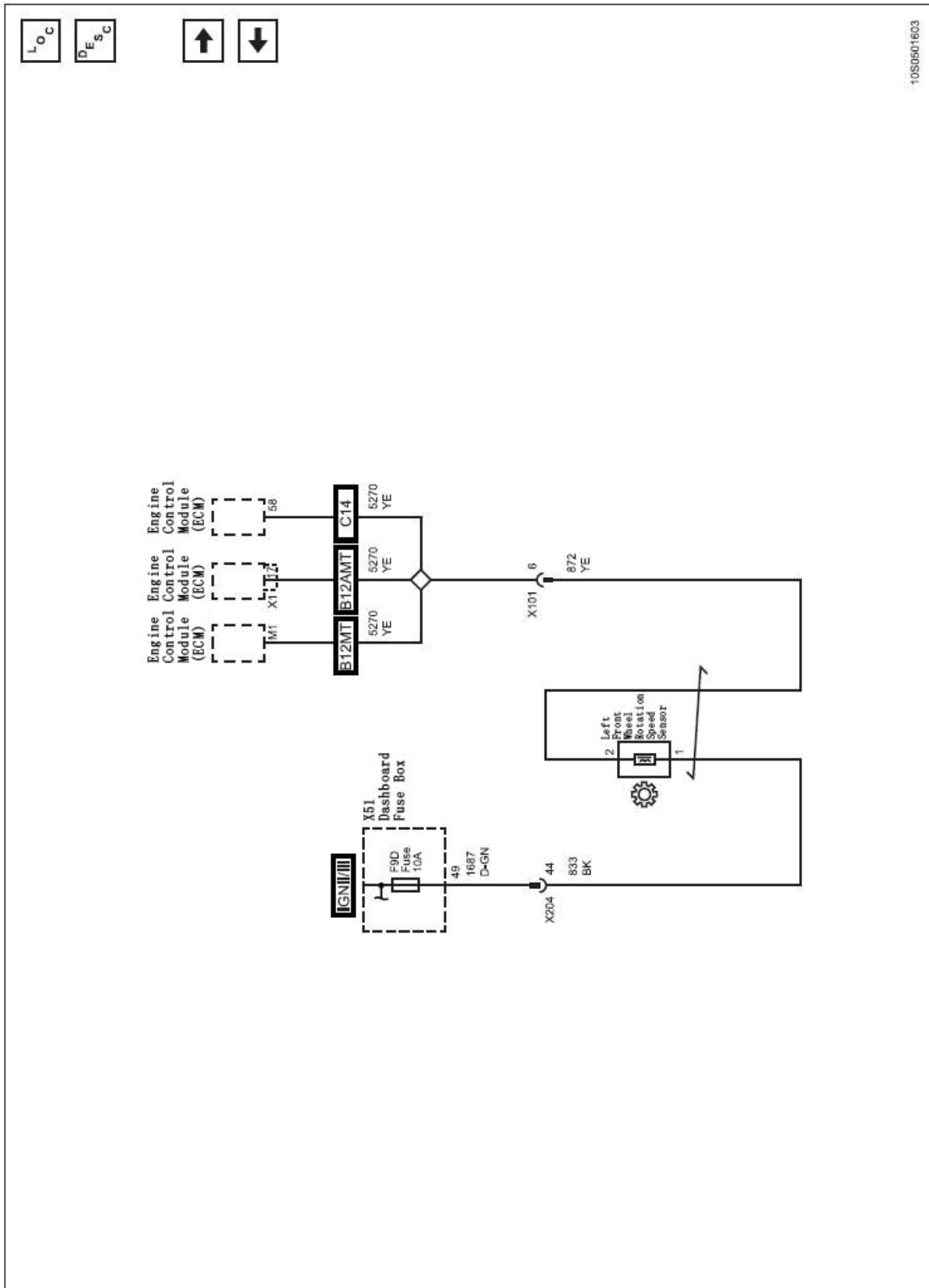
5.15.1 Power and Ground Circuit Diagram of Braking System



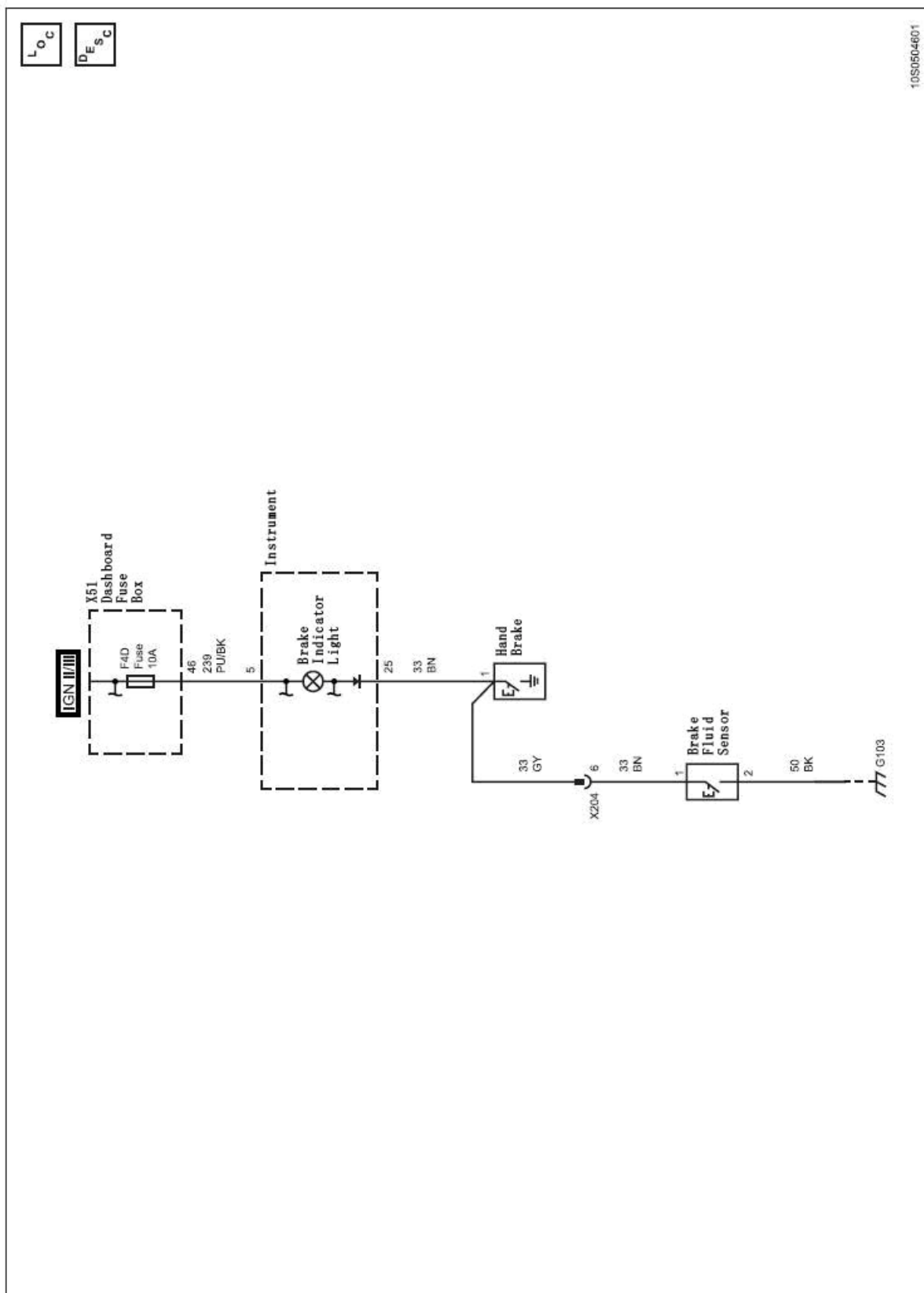
5.15.2 ABS Wheel Speed Sensor Circuit Diagram



5.15.3 ABS Circuit Diagram



5.15.4 Braking Warning System Circuit Diagram



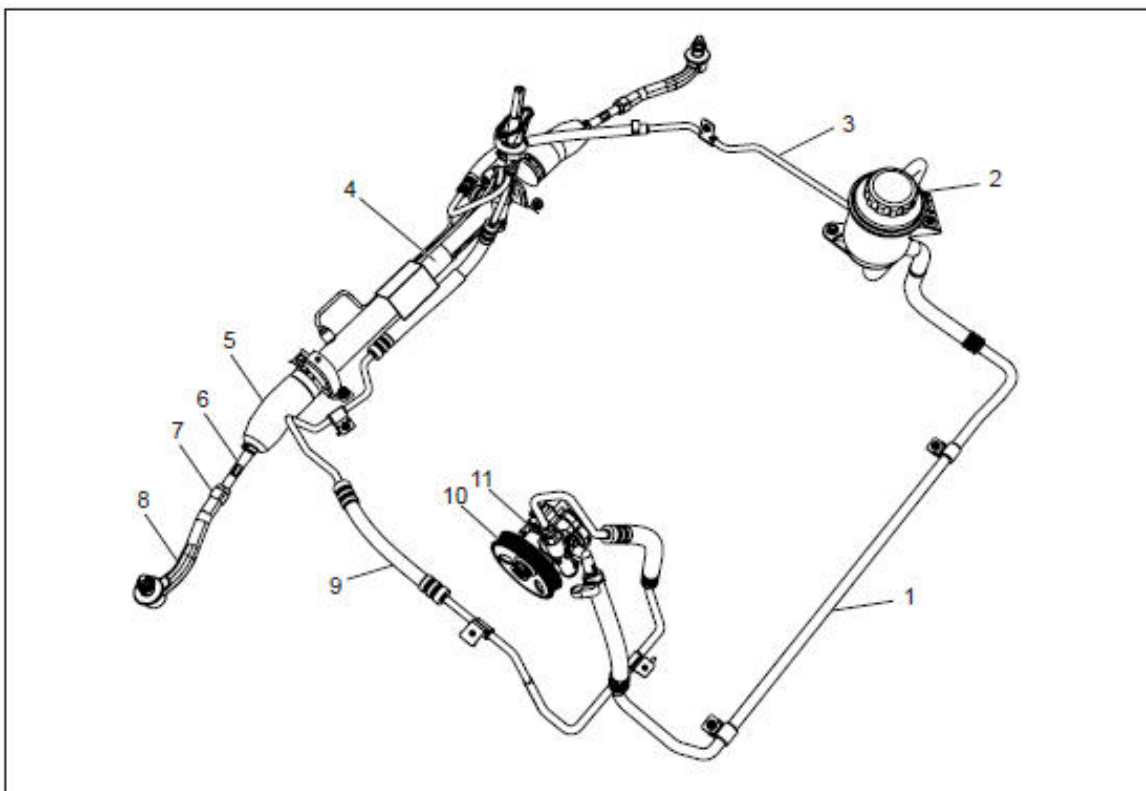
6 Steering System

6.1 Power Steering System Specifications

Application		Specifications	
		Metric Units	English Units
Steering System			
Oil Capacity			
Oil Type		DEXRON® III	
Oil		12378494 (4L) 或 12378495 (1L)	
Steering Gear			
Style		Rack-And-Pinion	
Transmission Ratio		42.3 Mm/Rev	
Steering Pump			
High Flow Capacity		Pressure of Relief	
L/Min	Gal/Min	KPa	LBF/ Sq In
5.5	1.45	6350 ~ 7150	921 ~ 1037

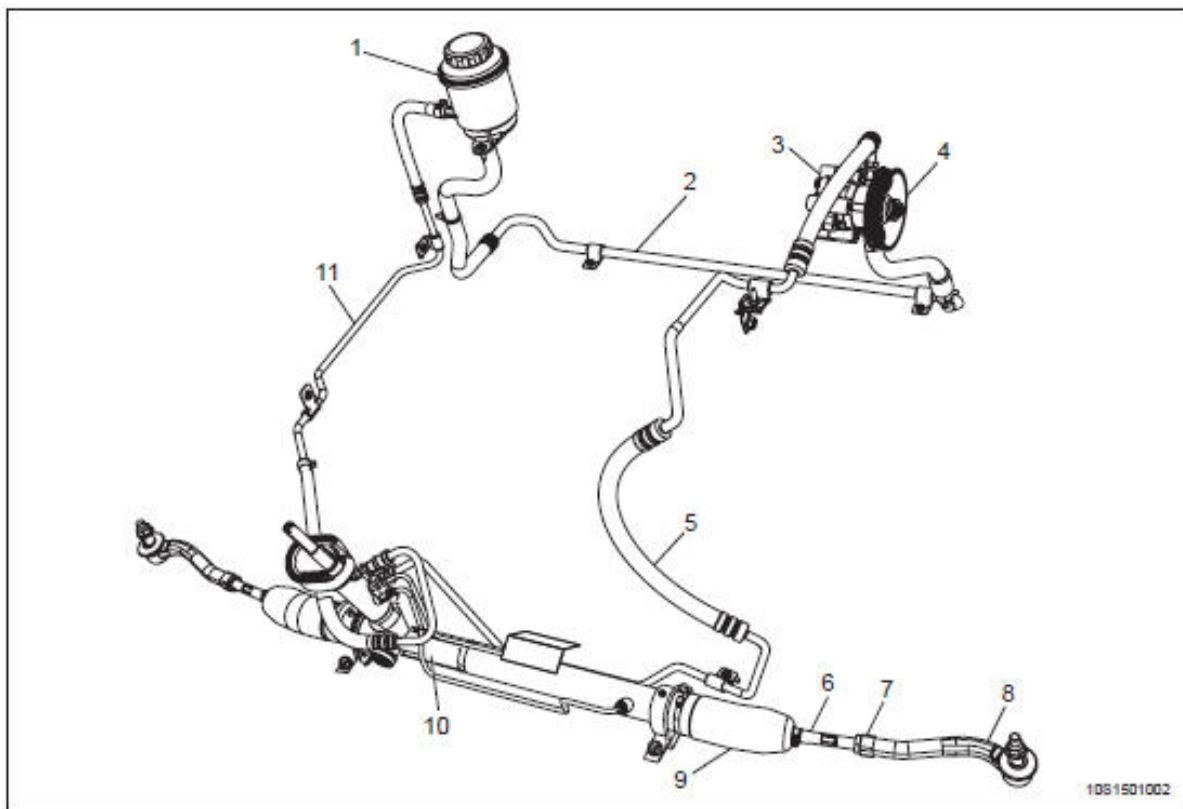
6.2 Component Identification

6.2.1 Component Diagram (1.2L)



- | | |
|-------------------------------------------------------|------------------------------------------------|
| 1. Power Steering Pump Fluid Storage Tank Outlet Pipe | 6. Steering Gear Inner Tie Rod |
| 2. Power Steering Pump Fluid Storage Tank | 7. Steering Gear Outside Link Self-Locking Nut |
| 3. Power Steering Machine Oil Return Pipe | 8. Steering Gear Outer Tie Rod |
| 4. Steering Gear | 9. Power Steering High Pressure Pipe |
| 5. Steering Gear Inner Tie Rod Shield | 10. Steering Pump Belt Pulley |
| | 11. Power Steering Pump |

6.2.2 Component Diagram (1.4L)



- | | |
|-------------------------------------------------------|------------------------------------------------|
| 1. Power Steering Pump Fluid Storage Tank | 6. Steering Gear Inner Tie Rod |
| 2. Power Steering Pump Fluid Storage Tank Outlet Pipe | 7. Steering Gear Outside Link Self-Locking Nut |
| 3. Power Steering Pump | 8. Steering Gear Outer Tie Rod |
| 4. Steering Pump Belt Pulley | 9. Steering Gear Inner Tie Rod Shield |
| 5. Power Steering High Pressure Pipe | 10. Steering Gear |
| | 11. Power Steering Oil Return Pipe |

6.3 Power Steering System Exhaust

Special Precautions:

- Please refer to "special precautions of the inlet air in the power steering system" in the "cautions and precautions" of the maintenance manual.
 - Every time when adding steering fluid or completely replacing it, make sure to use power steering fluid meeting the SGM specifications or power steering fluid with equivalent quality, and please refer to "power steering system specifications". If improper power steering fluid is used, the power steering hose and sealing parts might be damaged, the steering fluid might leak and the steering fluid pump might undergo malfunction (s) .
 - Do not fully turn the steering wheel in any direction for a long time, otherwise the steering pump might be damaged early.
1. Fully turn the steering wheel to the left without starting the engine. Add the power steering fluid and fill to the MIN (minimum) mark on the fluid level indicator.
 2. Start the engine. Run the engine in fast idle, and recheck the fluid level. If necessary, add more fluid to fill to

the MIN (minimum) mark on the fluid level indicator.

Please Follow the Steps Below:

- Do not run the steering fluid pump without steering fluid. Slowly turn the steering wheel to the left and right by 45 degrees two to three times, and then fully turn it twice. Adjust the liquid level of the steering fluid in the fluid storage tank.
 - Stop the engine and check the fluid level. Maintain the fluid level at the MIN (minimum) mark.
 - Do not reuse exhausted steering fluid.
3. Return the steering wheel to the middle position. Run the engine for 2 - 3 minutes.
 4. Test the vehicle on the road, and make sure that the steering function operates properly without noise.
 5. Recheck the fluid level according to step 1 and step 2. Make sure that the fluid level is at MAX (maximum) mark after the system reaches normal working temperature and becomes stable on that temperature. Add more steering fluid if necessary.

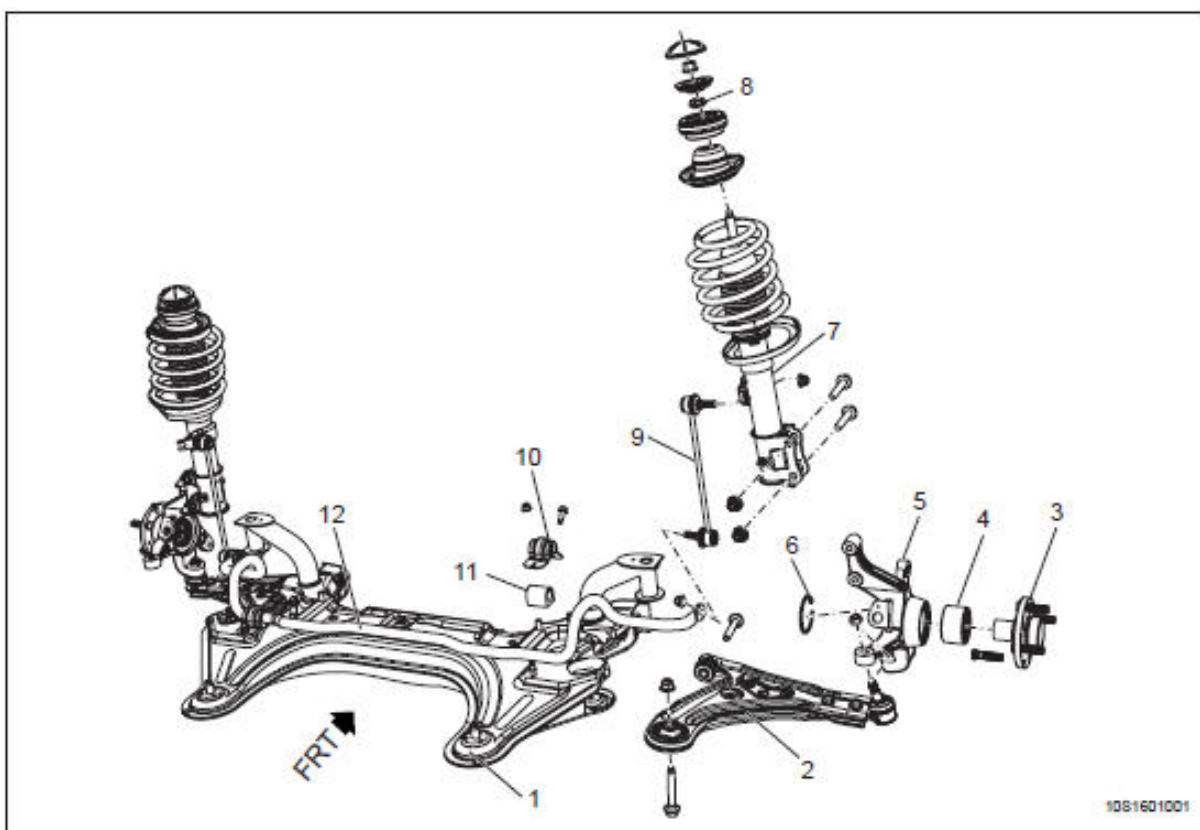
7 Suspension System

7.1 Suspension System Specifications

Application	Type
Front	Macpherson Strut
Rear	Torsion Beam

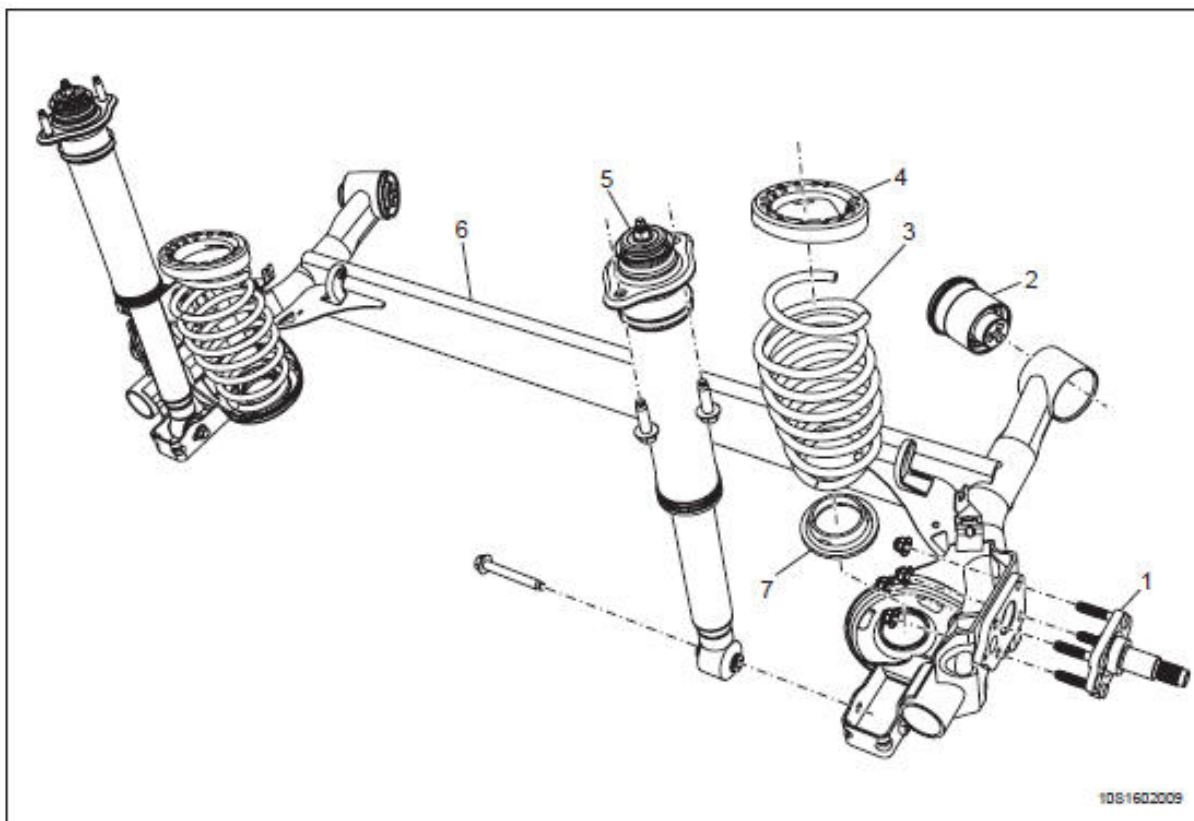
7.2 Component Identification of Suspension System

7.2.1 Front Suspension



- | | |
|----------------------------------|------------------------------------------|
| 1. Front Beam | 7. Front Shock Strut |
| 2. Front Control Arm | 8. Front Shock Absorber Self-Locking Nut |
| 3. Front Wheel Hub | 9. Stabilizer Bar Connecting Rod |
| 4. Front Wheel Bearing | 10. Stabilizer Bar Bracket |
| 5. Steering Knuckle | 11. Stabilizer Bar Vibration Isolator |
| 6. Front Wheel Bearing Snap Ring | 12. Stabilizer Bar |

7.2.2 Rear Suspension



- | | |
|-----------------------------------|-----------------------------------|
| 1. Rear Wheel Pivot | 5. Rear Vibration Absorber |
| 2. Rear Cross Beam Lining | 6. Rear Cross Beam |
| 3. Rear Coil Spring | 7. Rear Coil Spring Lower Stopper |
| 4. Rear Coil Spring Upper Stopper | |

8 MDI/RDS and Programming

8.1 MDI

8.1.1 MDI Identification

