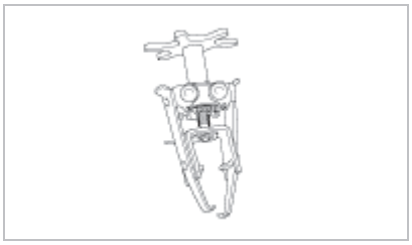
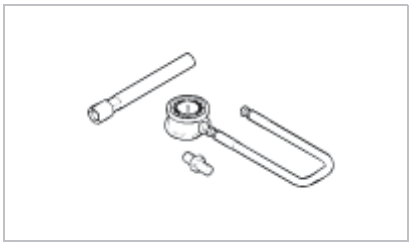
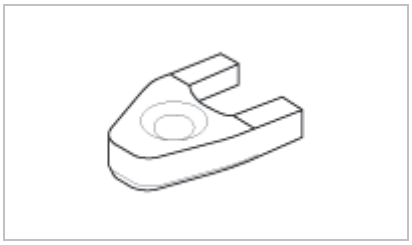
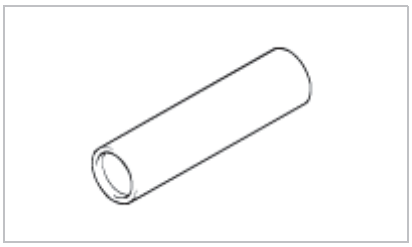
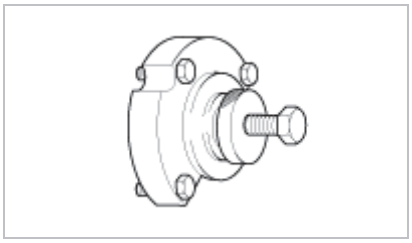
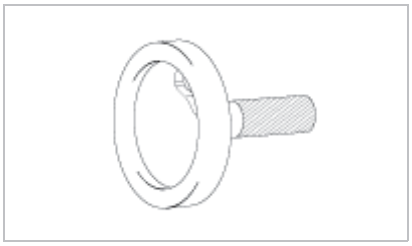
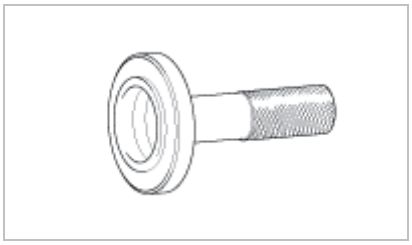
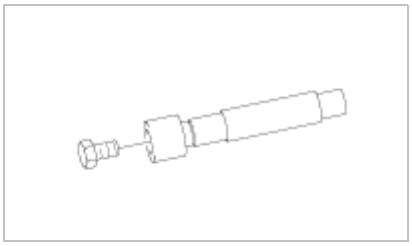
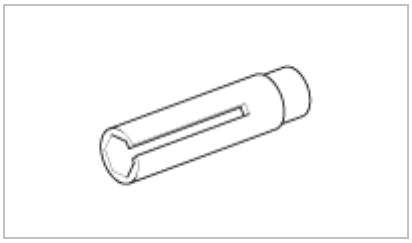
KIA MOTORS

Engine Mechanical System

General Information

SPECIAL TOOLS

Tool (Number and Name)	Illustration	Use
Torque angle adapter (09221-4A000)		Installation of bolts & nuts needing an angular method
Valve spring compressor (09222-22100)		Removal and installation of intake and exhaust valves
Compression gauge & adapter (09351-27000) (09351-4A100)		Checking engine compression pressure
Compression gauge adapter clamp (09351-4A110)		Checking engine compression pressure
Valve stem seal installer (09222-4A000)		Installation of valve stem oil seals
Injector remover (09351-4A000)		Removal of injectors

High pressure pump sprocket remover (09331-4A000)		Removal of high pressure pump sprockert
Crank shaft rear oil seal installer (09231-4A100)		Installation of crank shaft rear oil seals
Timing chain lower front cover oil seal installer (09214-4A000)		Installation of timing chain lower front cover oil seal
Balance shaft drive gear bearing (bush) installer/remover (09231-4A000)		Removal and installation of LH balance shaft drive gear bearing (bush)
Water temperature sensor socket wrench (09221-25100)		Removal and installation of water temperature sensor

TROUBLESHOOTING

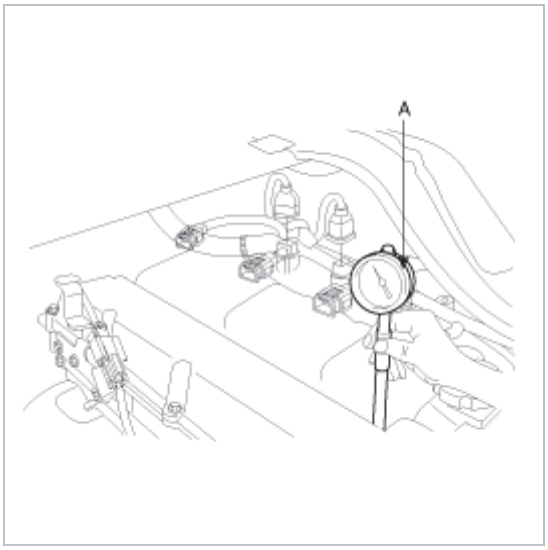
Symptom	Probable cause	Remedy
Low compression	Damaged cylinder head gasket	Replace gasket
	Worn or damaged piston rings	Replace rings
	Worn piston or cylinder	Repair or replace piston and/or cylinder block
	Worn or damaged valve seat	Repair or replace valve and/or seat ring
Oil pressure drop	Low engine oil level	Check engine oil level
	Faulty oil pressure switch	Replace
	Clogged oil filter	Replace
	Worn oil pump gears or cover	Replace
	Thin or diluted engine oil	Change and find out cause
	Oil relief valve stuck (open)	Repair
	Excessive bearing clearance	Replace
High oil pressure	Oil relief valve stuck (closed)	Repair
Excessive engine vibration	Loose engine mounting bolt	Retighten
	Loose transmission mounting bolt	Retighten
	Loose cross member bolt	Retighten
	Broken transmission mounting rubber	Replace
	Broken engine mounting rubber	Replace
Noisy valves	Thin or diluted engine oil (low oil pressure)	Change
	Worn or damaged valve stem or valve guide	Replace
Connecting rod and/main beaing noise	Insufficient oil supply	Check engine oil level
	Thin or diluted engine oil	Change and find out cause
	Excessive bearing clearance	Replace
Low coolant level	Leakage of coolant	
	Damaged radiator core joint	Replace
	Corroded or cracked hoses (radiator hose, heater hose, etc)	Replace
	Faulty radiator cap valve or setting of spring	Replace
	Faulty thermostat	Replace
	Faulty engine coolant pump	Replace
Clogged radiator	Foreign material in coolant	Replace
Abnormally high coolant temperature	Faulty thermostat	Replace
	Faulty radiator cap	Replace
	Restricted of flow in cooling system	Replace
	Loose or missing drive belt	Adjust or replace

	Faulty engine coolant pump	Replace
	Faulty temperature sensor wiring	Repair or replace
	Faulty electric fan	Repair or replace
	Faulty thermo-sensor on radiator	Replace
	Insufficient coolant	Refill coolant
Abnormally low coolant temperature	Faulty thermostat	Replace
	Faulty temperature sensor wiring	Repair or replace
Leakage from oil cooling system	Loose hose and pipe connection	Retighten
	Blocked or collapsed hose and pipe	Replace
Inoperative electrical cooling fan	Damaged, fuse	Replace or repair
Exhaust gas leakage	Loose connections	Retighten
	Broken pipe or muffler	Repair or replace
Abnormal noise	Detached baffle plate in muffler	Replace
	Broken rubber hanger	Replace
	Pipe or muffler contacting vehicle body	Correct
	Broken pipe or muffler	Repair or replace

CHECKING COMPRESSION PRESSURE

1. Before checking engine compression, check the engine oil level. Also check that the starter motor and battery are all in normal operating condition.
2. Start the engine and wait until the engine coolant temperature reaches 80-95°C (176-205°F).
3. Turn "OFF" the engine and remove the aircleaner element.
4. Remove the Electric Control Unit(ECU) fuse.
5. Remove the injectors.
6. Crank the engine to remove any foreign material in the cylinders.
7. Insert the compression gauge (A) into the injector hole.
8. Crank the engine and read the gauge.

Standard value :
2942 kpa (30 kg/cm², 426 psi)



9. Repeat steps 7 to 8 for all cylinders, ensuring that the pressure difference for each of the cylinders is within the specified limit.

Limit :
Max. 98.07 kpa (1.0 kg/cm², 14.22 psi) between cylinders

10. If a cylinder's compression or pressure differential is outside the specification, add a small amount of oil through the injector hole, and repeat steps 6 to 8.
    (1) If the addition of oil causes the compression to rise, it is likely that there may be wear between the piston ring and cylinder wall.
    (2) If compression remains the same, valve seizure, poor valve seating or a compression leak from the cylinder head gasket are all possible causes.

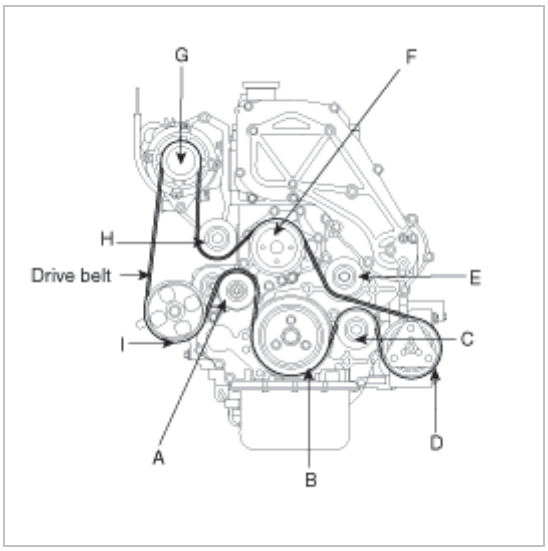
ADJUSTING DRIVE BELT AND TENSIONER

1. Check that the belts are not damaged and are properly placed for the pulley grooves.

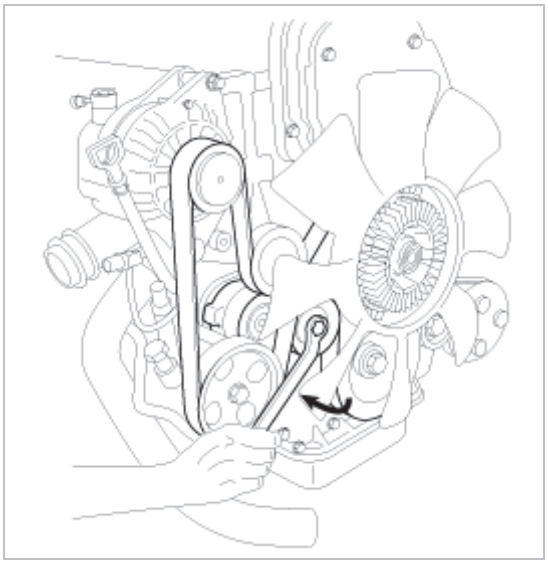
CAUTION

- When installing the V-ribbed belt, check that the V-ribs are properly aligned.
- If noise or slippage is detected, check the belt for wear, damage, or breakage on the pulley contact surface, and check the pulley for scoring. Also check the amount that the belt is deflected.

2. Install the belt in the following order.



A. Install the belt in RH side of the auto-tensioner pulley.
   Auto-tensioner pulley(A) → Crankshaft pulley(B) → Idler(C) → Air conditioner compressor pulley (D)→ Idler(E) → Water pump pulley(F)
B. Install the belt in LH side of the auto-tensioner pulley.
   Auto-tensioner pulley(A) → Power steering pump pulley(I) → Alternator pulley(G)
C. Loosen the belt tension by turning the auto-tensioner clockwise (about 39°), and then install the belt on the idler between the alternator pulley and the water pump pulley.



3. The tensioner mark should be between the " * " position.
   If not, replace the belt.

SPECIFICATIONS

DESCRIPTION	SPECIFICATION	LIMIT
General		
Type	In-line, DOHC	
Number of cylinders	4	
Bore	91 mm (3.58 in)	
Stroke	96 mm (3.78 in)	
Total displacement	2497 cc (121.5 cu.in)	
Compression ratio	17.7 : 1	
Firing order	1-3-4-2	
Valve timing		
Intake valve		
Opens (BTDC)	8°	
Closes (ABDC)	38°	
Exhaust valve		
Opens (BBDC)	52°	
Closes (ATDC)	8°	
Cylinder head		
Flatness of gasket surface	0.15 mm (0.0059 in)	
Camshaft		
Cam height (LH)		
Intake	40.163 mm (1.5812 in)	
Exhaust	40.043 mm (1.5765 in)	
Cam height (RH)		
Intake	39.782 mm (1.5662 in)	
Exhaust	40.456 mm (1.5928 in)	
Journal outer Diameter	29.964 ~ 29.980 mm (1.1797 ~ 1.1803 in)	
End play	0.10 ~ 0.20 mm (0.0039 ~ 0.0079 in)	
Valve		
Valve length		
Intake	110.55 mm (4.352 in)	
Exhaust	110.55 mm (4.352 in)	
Stem outer diameter		
Intake	6.965 ~ 6.980 mm (0.2742 ~ 0.2748 in)	
Exhaust	6.935 ~ 6.950 mm (0.2730 ~ 0.2736 in)	
Face angle	45°	
Thickness of valve head (margin)		
Intake	1.8 ~ 2.0 mm (0.071 ~ 0.079 in)	
Exhaust	1.8 ~ 2.0 mm (0.071 ~ 0.079 in)	

Valve stem to valve guide clearance		
Intake	0.020 ~ 0.050 mm (0.0008 ~ 0.0020 in)	0.1mm (0.0039in)
Exhaust	0.050 ~ 0.080 mm (0.0020 ~ 0.0031 in)	0.15mm (0.0059in)
Valve guide		
Length		
Intake	43.3 mm (1.705 in)	
Exhaust	39.4 mm (1.551 in)	
Valve seat		
Width of seat contact		
Intake	1.5 mm (0.059 in)	
Exhaust	1.7 mm (0.067 in)	
Seat angle		
Intake	45°	
Exhaust	45°	
Valve spring		
Free length	48.2 mm (1.898 in)	
Load	258 ± 12 N/38 mm (26.3 ± 1.2 kg/38 mm, 569 ± 26 lb/1.496 in) 505.5 ± 24 N/28.8 mm (51.5 ± 2.4 kg /28.8 mm, 1114.4 ± 53 lb/1.134 in)	
Cylinder block		
Cylinder bore	91.000 ~ 91.030 mm (3.5827 ~ 3.5839 in)	
Flatness of gasket surface	0.05 mm (0.0020 in)	
Piston		
Piston outer diameter	90.910 ~ 90.940 mm (3.5791 ~ 3.5803 in)	
Piston to cylinder clearance	0.080 ~ 0.100 mm (0.0031 ~ 0.0039 in)	
Ring groove width		
No. 1 ring groove	2.378 ~ 2.398 mm (0.0936 ~ 0.0944 in)	
No. 2 ring groove	2.04 ~ 2.06 mm (0.0803 ~ 0.0811 in)	
Oil ring groove	3.03 ~ 3.05 mm (0.1193 ~ 0.1201 in)	
Piston ring		
Side clearance		
No. 2 ring	0.05 ~ 0.09 mm (0.0020 ~ 0.0035 in)	
Oil ring	0.04 ~ 0.08 mm (0.0016 ~ 0.0031 in)	
End gap		
No. 1 ring	0.25 ~ 0.40 mm (0.0098 ~ 0.0157 in)	
No. 2 ring	0.50 ~ 0.70 mm (0.0197 ~ 0.0276 in)	
Oil ring	0.20 ~ 0.40 mm (0.0079 ~ 0.0157 in)	
Piston pin		

Piston pin outer diameter	32.993 ~ 32.998 mm (1.2989 ~ 1.2991 in)	
Piston pin hole inner diameter	33.014 ~ 33.019 mm (12.998 ~ 1.3000 in)	
Piston pin hole clearance	0.016 ~ 0.026 mm (0.0006 ~ 0.0010 in)	
Connecting rod small end hole inner diameter	33.020 ~ 33.033 mm (1.3000 ~ 1.3005 in)	
Connecting rod small end hole clearance	0.022 ~ 0.040 mm (0.0009 ~ 0.0016 in)	
Connecting rod		
Connecting rod big end inner diameter	60.000 ~ 60.018 mm (2.3622 ~ 2.3629 in)	
Connecting rod bearing oil clearance	0.024 ~ 0.042 mm (0.0009 ~ 0.0016 in)	0.1mm(0.0039in)
Crankshaft		
Main journal outer diameter	66.982 ~ 67.000 mm (2.6371 ~ 2.6378 in)	
Pin journal outer diameter	56.982 ~ 57.000 mm (2.2434 ~ 2.2441 in)	
Main bearing oil clearance	0.030 ~ 0.054 mm (0.0012 ~ 0.0021 in)	0.1mm(0.0039in)
End play	0.05 ~ 0.25 mm (0.0020 ~ 0.0098 in)	
Flywheel		
Runout		0.13mm(0.0051in)
Oil pump		
Side clearance		
Inner rotor	0.040 ~ 0.085 mm (0.0016 ~ 0.0033 in)	
Outer rotor	0.050 ~ 0.100 mm (0.0020 ~ 0.0039 in)	
Body clearance	0.100 ~ 0.176 mm (0.0039 ~ 0.0069 in)	
Relief valve opening pressure	784.5 ± 78.4 Kpa	
Balance shaft		
Front journal outer diameter	48.975 ~ 49.000 mm (1.9281 ~ 1.9291 in)	
Rear journal outer diameter	47.965 ~ 47.990 mm (1.8884 ~ 1.8894 in)	
Front bush inner diameter	49.050 ~ 49.080 mm (1.9311 ~ 1.9323 in)	
Rear bush inner diameter	48.050 ~ 48.080 mm (1.8917 ~ 1.8929 in)	
Fornt bush oil clearance	0.050 ~ 0.105 mm (0.0020 ~ 0.0041 in)	
Rear bush oil clearance	0.060 ~ 0.115 mm (0.0024 ~ 0.0045 in)	
Engine oil		
Oil quantity (Total)	9.0L (9.51 US qt, 7.91 lmp qt)	
Oil quantity (Oil pan)	7.4L (7.82 US qt, 6.50 lmp qt)	
Oil quantity (Drain and refill including oil filter)	8.2L(8.66 US qt, 7.21 lmp qt)	
Oil quality	ABOVE API CF-4 (VGT:CH-4) or ACEA B4	
Cooling method		
Cooling system	Forced circulation with cooling fan	
Coolant quantity	10L	
Thermostat		
Type	Wax pellet type	
Opening temperature	82°C (180°F)	
Closing temperature	77°C (171°F)	
Pull opening temperature	95°C (203°F)	

Radiator cap		
Main valve opening pressure	107.9±14.7 Kpa	
Main valve closing pressure		
Vaccum valve opening pressure		
Water temperature sensor		
Type	Thermister type	
Resistance		
20°C (68°F)	2.45 ± 0.14 kΩ	
80°C (176°F)	0.3222 kΩ	

TIGHTENING TORQUE

* Bolt size = Diameter x Length

ITEM	Quantity	Tightening torque		
		N.m	kgf.m	lb-ft
Main bearing cap bolt	10	127.5 ~ 137.3	13 ~ 14	94.0 ~ 101.3
Connecting rod cap nut	8	58.8 → Loosen → (32.4~36.3) + (60~64°)	6.0 → Loosen → (3.3~3.7) + (60~64°)	43.4 → Loosen → (23.9~26.8) + (60~64°)
Oil jet bolt	4	29.4 ~ 34.3	3.0 ~ 3.5	21.7 ~ 25.3
Crank shaft pulley bolt	1	274.6 ~ 294.2	28 ~ 30	202.5 ~ 217.0
Rear oil seal case bolt	5	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Rear plate bolt	2	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Flywheel bolt	8	127.5 ~ 137.3	13 ~ 14	94.0 ~ 101.3
Water pump bolt (8 x 30)	5	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Water pump bolt (8 x 45)	2	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Oil cooler fixing nut	4	17.7 ~ 24.5	1.8 ~ 2.5	13.0 ~ 18.1
Oil cooler cover bolt (8 x 35)	8	19.6 ~ 25.5	2.0 ~ 2.6	14.5 ~ 18.8
Oil cooler cover bolt (8 x 60)	3	19.6 ~ 25.5	2.0 ~ 2.6	14.5 ~ 18.8
Oil pump bolt (8 x 22)	2	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Oil pump bolt (10 x 35)	1	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Oil pump bolt (10 x 60)	1	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Oil screen bolt	2	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Oil feed pipe bolt	3	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Oil filter assembly	1	21.6 ~ 24.5	2.2 ~ 2.5	15.9 ~ 18.1
Oil pan bolt	2	2 9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil level gauge bolt	1	11.8 ~ 14.7	1.2 ~ 1.5	8.7 ~ 10.8
Bed plate bolt (6 x 18)	3	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Bed plate bolt (6 x 30)	1	3 7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Bed plate bolt (8 x 45)	8	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Bell housing cover bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pressure switch	1	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9

Cylinder head cover bolt	1	6 9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Camshaft cap bolt	20	13.7 ~ 14.7	1.4 ~ 1.6	10.1 ~ 10.8
Cylinder head bolt	18	49.0+120°+90°	5.0 + 120°+90°	36.2+120°+90°
TDC sensor bolt	1	6.9-10.8	0.7-1.1	5.1-8.0
Water temperature sensor	1	29.4 ~ 39.2	3.0 ~ 4.0	21.7 ~ 28.9
Glow plug	4	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Glow plug plate nut	4	0.8 ~ 1.5	0.08 ~ 0.15	0.6 ~ 1.1
Engine hanger bolt	4	18.6 ~ 28.4	1.9 ~ 2.9	13.7 ~ 21.0
Thermostat housing bolt	2	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Exhaust manifold lock nut	8	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Exhaust manifold heat protector bolt	3	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9
Turbo charger nut	3	49.0 ~ 68.6	5.0 ~ 7.0	36.2 ~ 50.6
Turbo charger fitting nut	4	26.5 ~ 31.4	2.7 ~ 3.2	19.5 ~ 23.1
Turbo charger oil return pipe bolt	2	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Turbo charger oil inlet pipe bolt	2	13.7 ~ 18.6	1.4 ~ 1.9	10.1 ~ 13.7
Turbo charger water inlet pipe bolt	2	34.3 ~ 49.0	3.5 ~ 5.0	25.3 ~ 36.2
Turbo charger heat protector bolt	3	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9
Intake manifold bolt (8 x 112)	4	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Intake manifold bolt (8 x 32)	2	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Intake manifold nut	4	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
EGR valve bolt	2	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
EGR pipe nut	4	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Timing chain lower under cover bolt (6 x 14)	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain lower under cover bolt (8 x 22)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain lower under cover bolt (8 x 30)	3	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain lower under cover bolt (8 x 40)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
LH balance shaft driven gear bolt	1	33.3 ~ 39.2	3.4 ~ 4.0	24.6 ~ 28.9
LH balance shaft sprocket nut	1	49.0 ~ 58.8	5.0 ~ 6.0	36.2 ~ 43.4
RH balance shaft sprocket bolt	1	33.3 ~ 39.2	3.4 ~ 4.0	24.6 ~ 28.9
Timing chain guide "A" bolt (upper)	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain guide "A" bolt (lower)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain lever "A" bolt	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain auto tensioner "A" bolt	2	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain guide "B" (1) bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain guide "B" (2) bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain auto tensioner "B" bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain lower front cover bolt (8 x 22)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain lower front cover bolt (8 x 40)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain lower front cover bolt (8 x 50)	6	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain lower front cover bolt (8 x 70)	6	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain lower front cover bolt (8 x 80)	4	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5

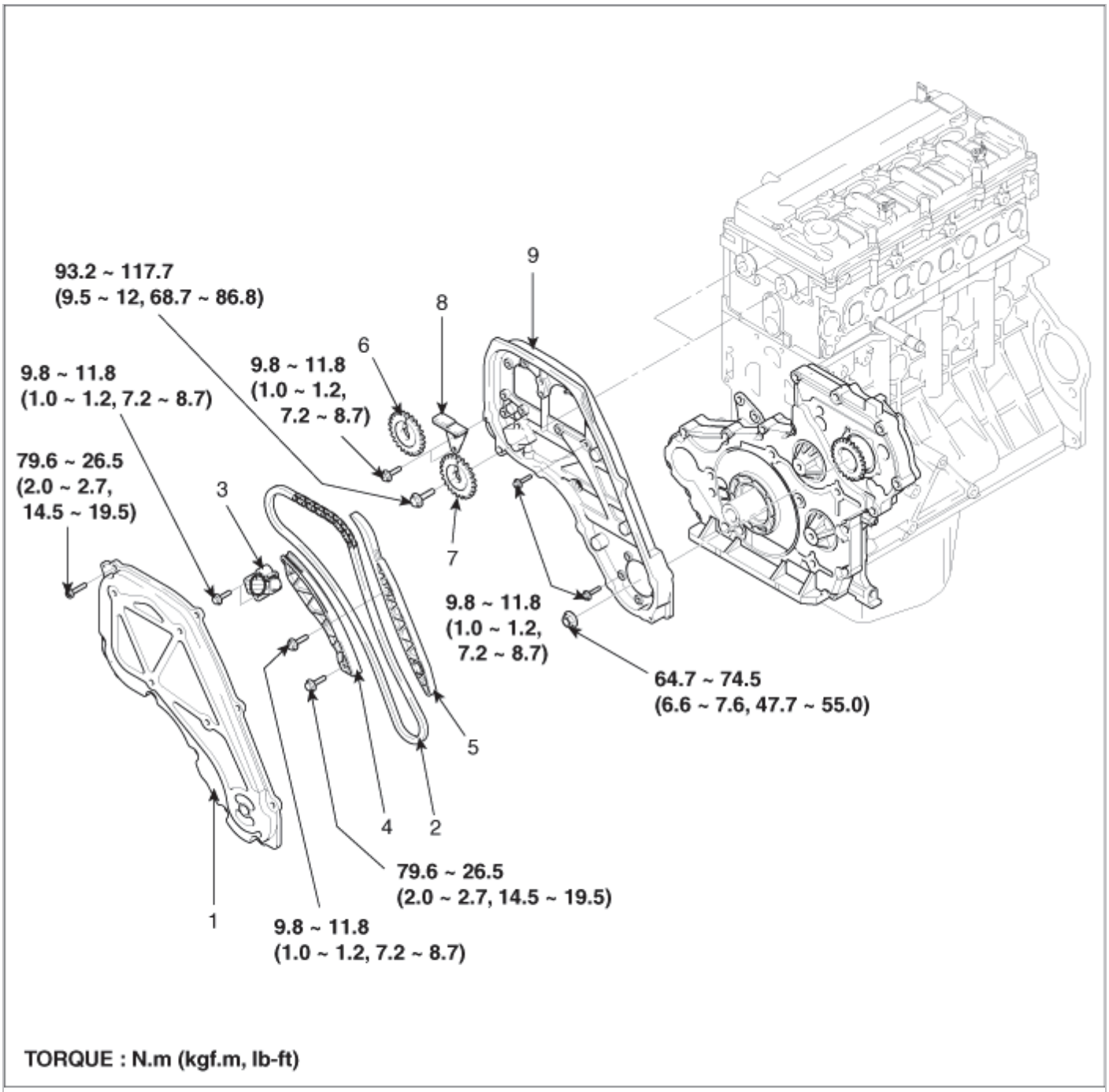
Timing chain upper front cover bolt (6 x 14)	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain upper front cover bolt (6 x 22)	9	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain upper front cover bolt (8 x 22)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain upper front cover bolt (8 x 40)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain upper under cover nut	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain guide "C" (1) bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain guide "C" (2) bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain lever "C" bolt	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain auto tensioner "C" bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
High pressure pump sprocket nut	1	64.7 ~ 74.5	6.6 ~ 7.6	47.7 ~ 55.0
Camshaft sprocket bolt	2	93.2 ~ 117.7	9.5 ~ 12	68.7 ~ 86.8
Timing chain upper front cover bolt	9	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
High pressure pump bracket bolt (8 x 35)	2	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
High pressure pump bracket bolt (8 x 38)	2	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
High pressure pump fixing nut	3	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Common rail fixing bolt	3	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9
Injector clamp bolt	4	27.5 ~ 33.3	2.8 ~ 3.4	20.3 ~ 24.6
High pressure pipe (pump to rail)	1	24.5 ~ 28.4	2.5 ~ 2.9	18.1 ~ 21.0
High pressure pipe (injector to rail)	4	24.5 ~ 28.4	2.5 ~ 2.9	18.1 ~ 21.0
Water pump pulley nut	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Alternator bracket bolt (8 x 60)	2	18.6 ~ 27.5	1.9 ~ 2.8	13.7 ~ 20.3
Alternator bracket bolt (8 x 35)	2	18.6 ~ 27.5	1.9 ~ 2.8	13.7 ~ 20.3
Alternator fixing bolt nut (upper)	1	18.6 ~ 27.5	1.9 ~ 2.8	13.7 ~ 20.3
Alternator fixing bolt nut (lower)	1	18.6 ~ 27.5	1.9 ~ 2.8	13.7 ~ 20.3
Power steering pump bracket bolt (8 x 30)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Power steering pump bracket bolt (8 x 40)	3	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Power steering pump bracket bolt (8 x 75)	2	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Power steering pump fixing bolt (upper)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Power steering pump fixing bolt (lower)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Air conditioner compressor fixing bolt	4	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Drive belt pulley fixing bolt	3	47.1 ~ 53.0	4.8 ~ 5.4	34.7 ~ 39.1
Drive belt auto tensioner fixing bolt	1	47.1 ~ 53.0	4.8 ~ 5.4	34.7 ~ 39.1
Starter fixing bolt	2	26.5 ~ 33.3	2.7 ~ 3.4	14.5 ~ 24.6
Engine support bracket bolt	2	47.1 ~ 51.0	4.8 ~ 5.2	34.7 ~ 37.6

KIA MOTORS

Engine Mechanical System

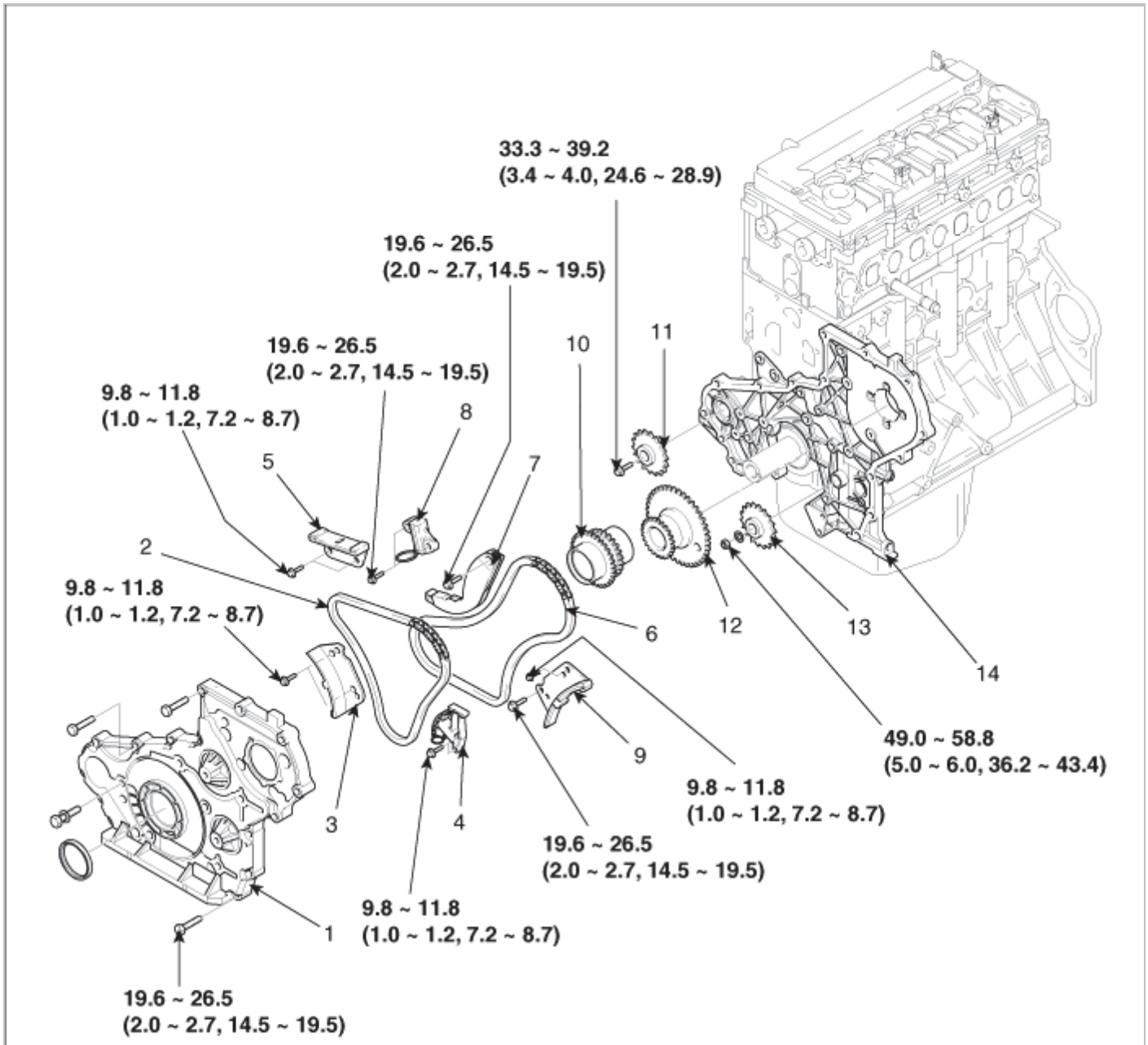
Timing System - Timing Chain

COMPONENTS



TORQUE : N.m (kgf.m, lb-ft)

1. Timing chain upper front cover
2. Timing chain "C"
3. Auto-tensioner "C"
4. Lever "C"
5. Guide "C"
6. RH Camshaft sprocket
7. LH Camshaft sprocket
8. Guide "C2"
9. Timing chain upper under cover



TORQUE : N.m (kgf.m, lb-ft)

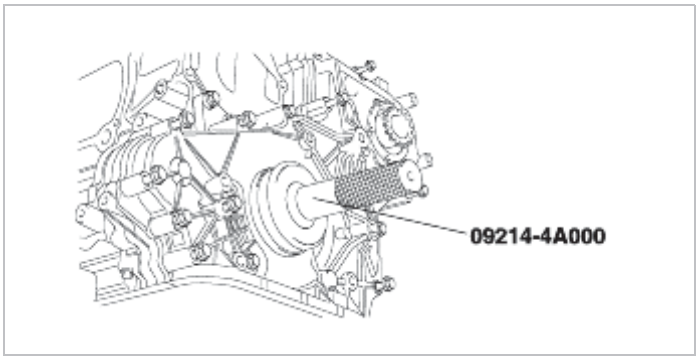
1. Timing chain lower front cover
2. Timing chain "B"
3. Guide "B2"
4. Auto tensioner "B"
5. Guide "B1"
6. Timing chain "A"
7. Lever "A"
8. Auto tensioner "A"
9. Guide "A"
10. Crankshaft sprocket
11. RH Balance shaft sprocket
12. High pressure pump sprocket
13. LH Balance shaft sprocket
14. Timing chain lower under cover

REPLACEMENT

TIMING CHAIN LOWER FRONT COVER OIL SEAL

1. With the timing chain lower front cover oil seal installed, install the oil seal using the special tool (09214-4A000).

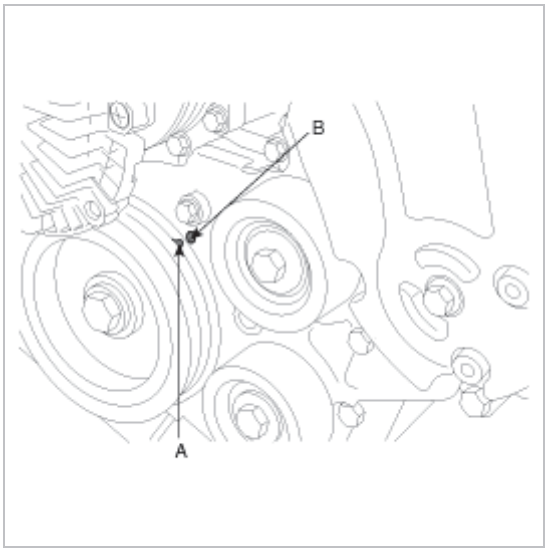
> NOTICE
>
> Apply engine fluid to the circumference of oil seal lip.



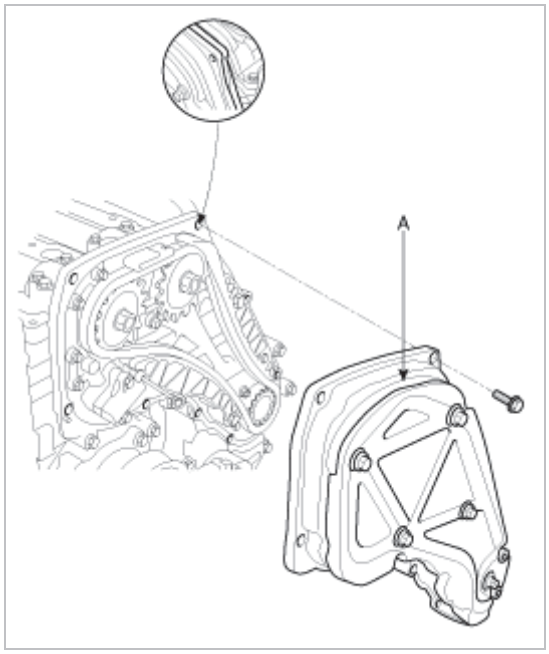
DISASSEMBLY

TIMING CHAIN "C"

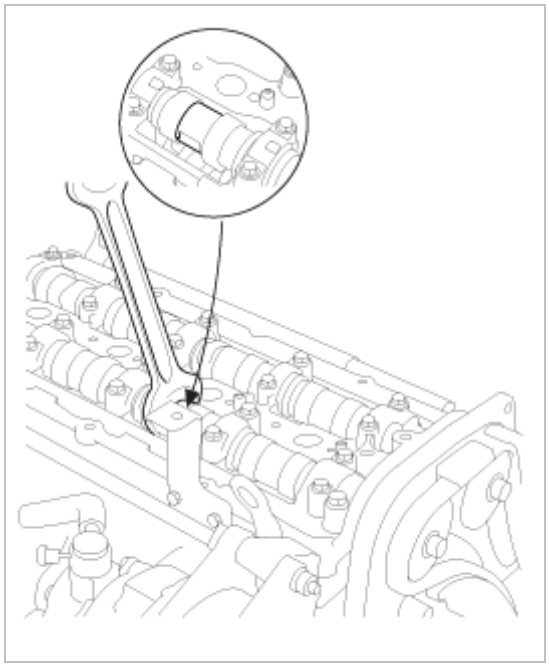
1. Rotate the crankshaft pulley to align the timing mark(A) with TDC(B), in which No.1 piston locates at the top dead center of compression stroke.



2. Remove the timing chain upper front cover(A).

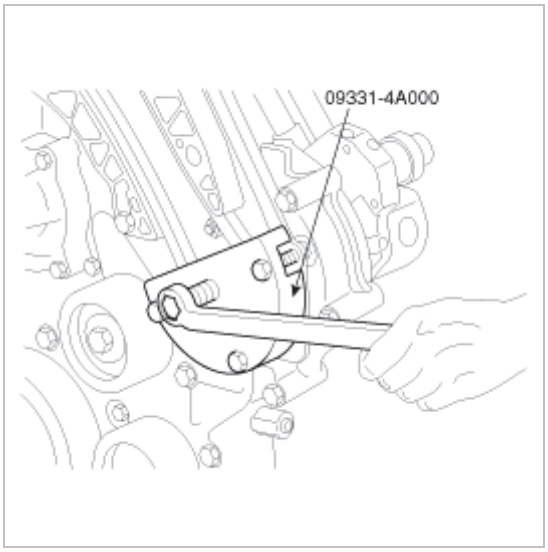


3. Remove the cylinder head cover.
4. Holding the slot of the camshaft with the spanner, loosen the bolts for the high-pressure pump sprocket and camshaft sprocket.

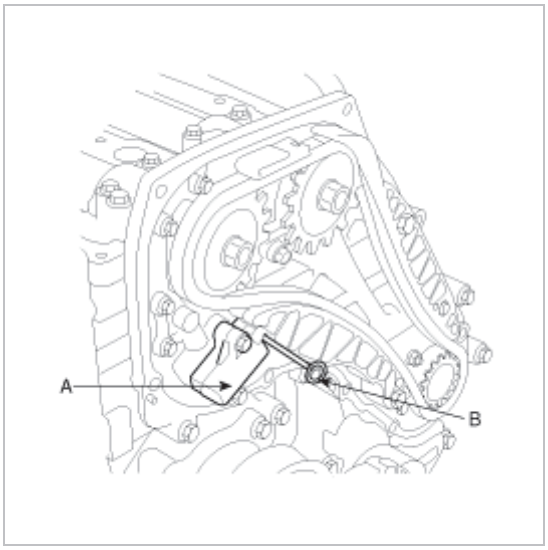


5. Insert the SST(09311-4A00) into timing chain upper cover.
   And then remove the high pressure pump and sprocket.

> **NOTICE**
>
> Loosen the high pressure pump fixing bolts first working.



6. Remove the timing chain auto-tensioner "C"(A).



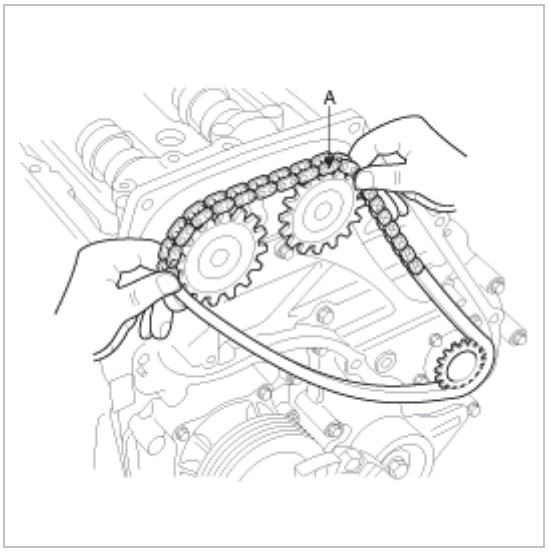
NOTICE

Before removing auto-tensioner "C", install a set pin(B) (Ø2.5mm steel wire) after compressing the tensioner so that inner parts are not missing during disassembly.

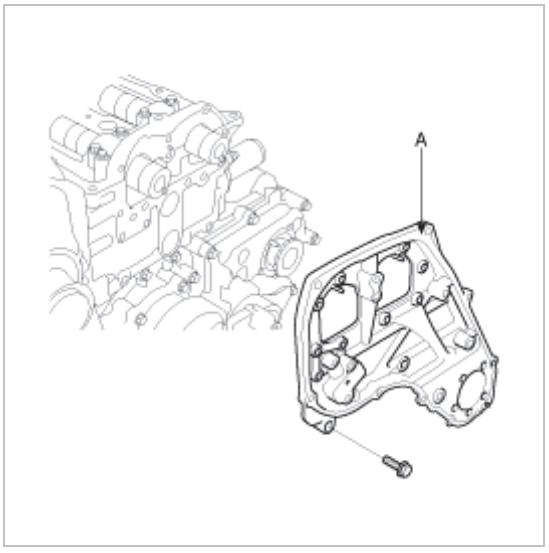
7. Remove the timing chain lever "C"(A).

8. Remove the timing chain guide "C(1)(A), C(2)(B)".

9. Remove the LH and RH camshaft sprocket bolts.
10. Remove the timing chain "C"(A) with the camshaft sprocket.

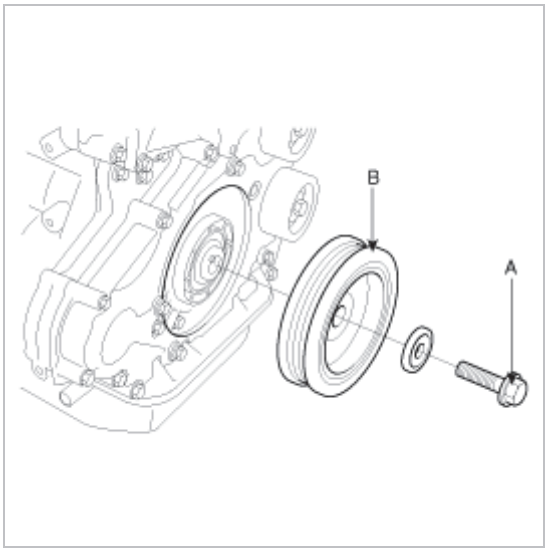


11. Remove the timing chain upper under cover(A).

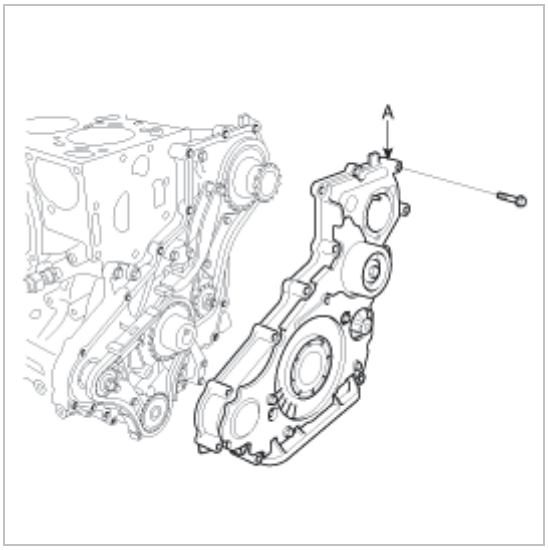


TIMING CHAIN "B"

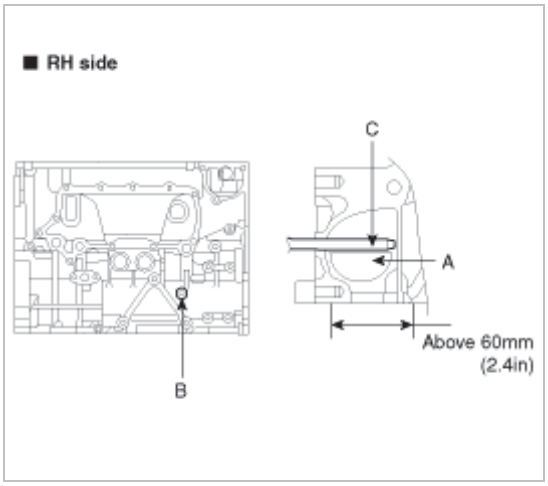
1. Remove the timing chain "C".
2. Remove the crankshaft pulley(B).



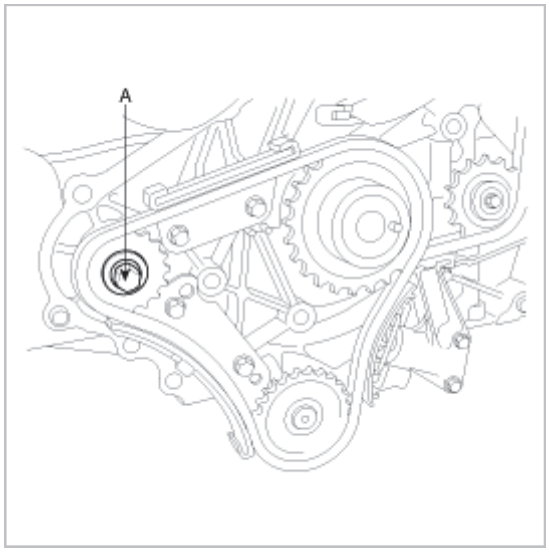
3. Remove the oil pan.
4. Remove the timing chain lower front cover(A).



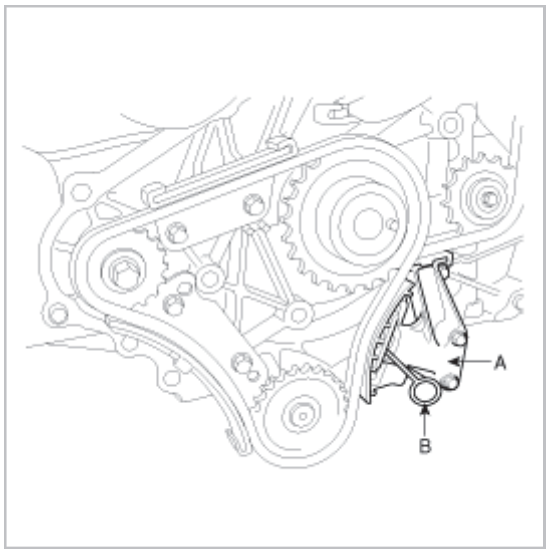
5. To prevent the rotation of RH balance shaft(A), remove the plug(B) at the side of cylinder block and insert the screwdriver(C) (or bolt) with an 8 mm(0.32in) diameter into the plughole more than 60 mm (2.4in).



6. Loosen the RH balance shaft sprocket bolt(A).



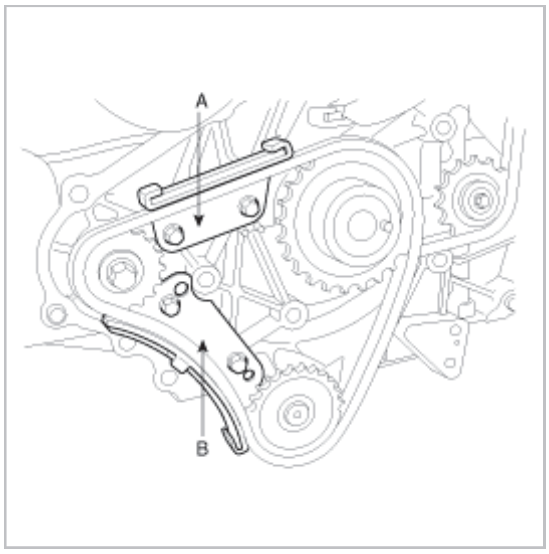
7. Remove the timing chain auto-tensioner "B"(A).



NOTICE

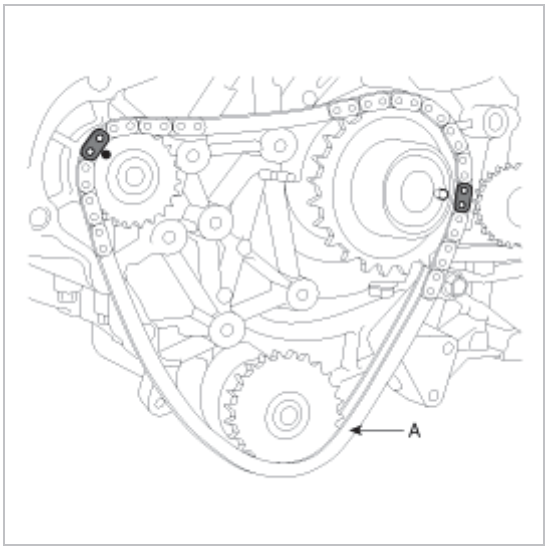
Before removing auto-tensioner "B", install a set pin (Ø2.5mm wire) after compressing the tensioner.

8. Remove the timing chain guide "B(1)(A), B(2)(B)".



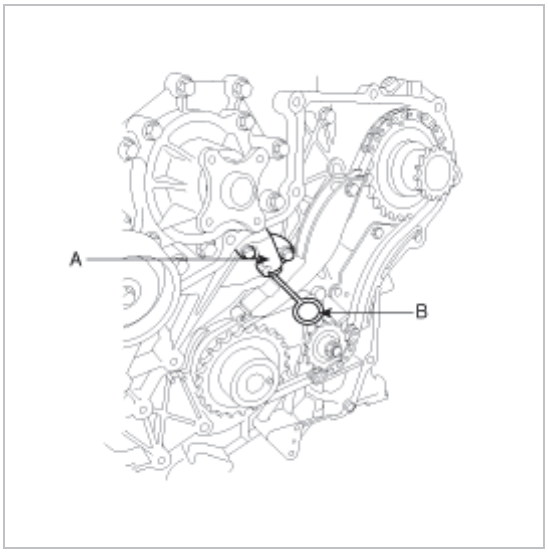
9. Remove the RH balance shaft sprocket bolt.

10. Remove the timing chain "B"(A) with the RH balance shaft sprocket.



TIMING CHAIN "A"

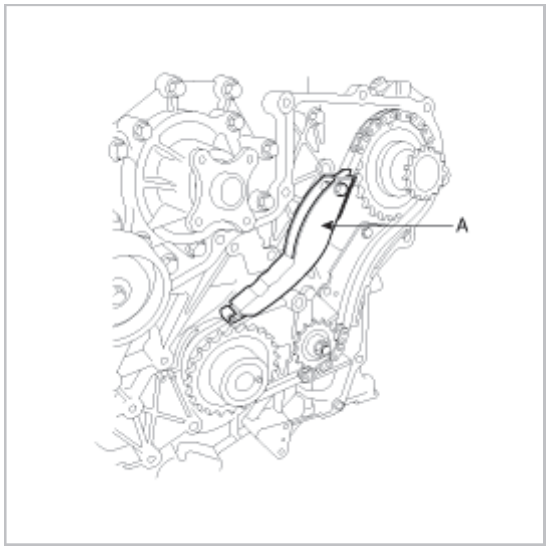
1. Remove the timing chain "C" and "B".
2. Loosen the high-pressure pump sprocket.
3. Remove the timing chain auto-tensioner "A"(A).



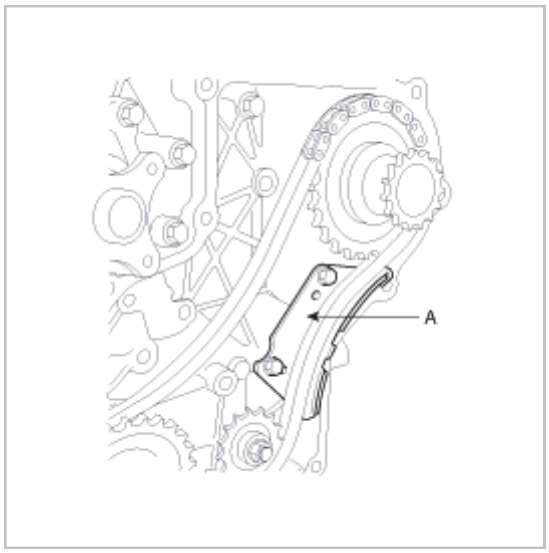
NOTICE

Before removing auto-tensioner "A", install a set pin (Ø2.5mm wire) after compressing the tensioner.

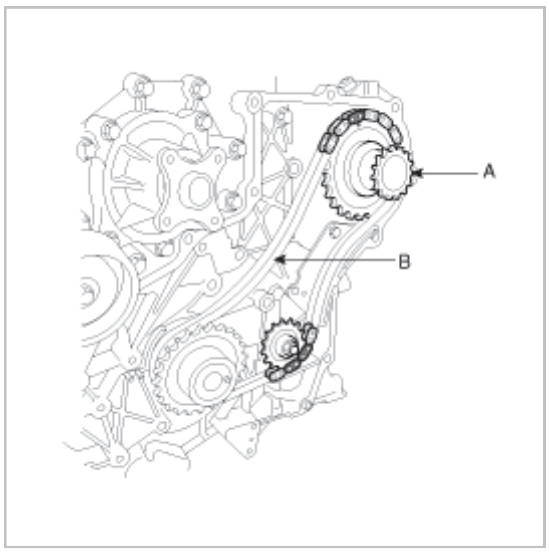
4. Remove the timing chain lever "A"(A).



5. Remove the timing chain guide "A"(A).



6. Remove the timing chain "A"(B) with the high-pressure pump sprocket(A).



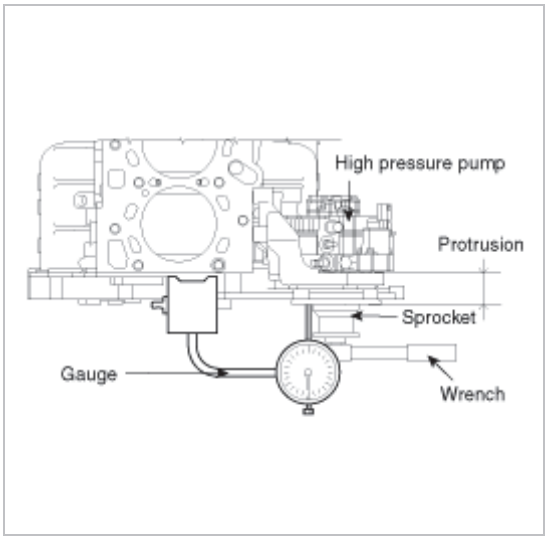
CAUTION

Remove thoroughly sealant and oil etc left at the sealing surface after remove the chain cover and oil pan. (If any impurities are left at the sealing face, oil may leak after reassembly even with the sealant application.)

REASSEMBLY

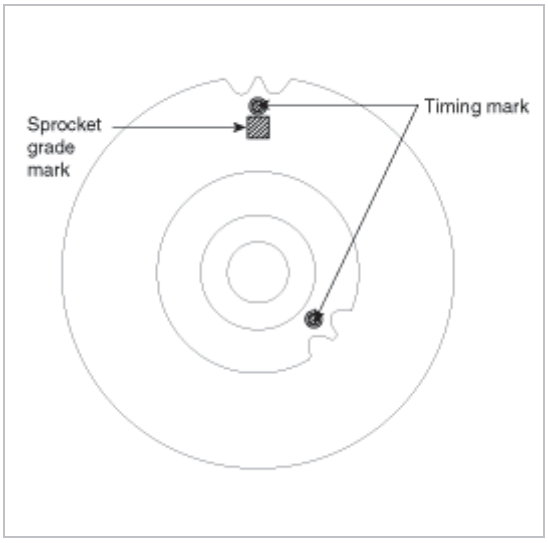
TIMING CHAIN "A"

1. Check the worn of timing chain, lever, guide and sprocket and replace them if necessary.
2. Choose proper high pressure pump sprocket after measuring protrusion of sprocket
   A. Assemble a high-pressure pump sprocket (Grade A) tentatively to high-pressure pump.
   B. Install a gauge to the cylinder block as shown illustration. And then turn the high pressure pump sprocket once by using a wrench.



   C. Choose proper sprocket grade according to average of maximum and minimum value of gauge.

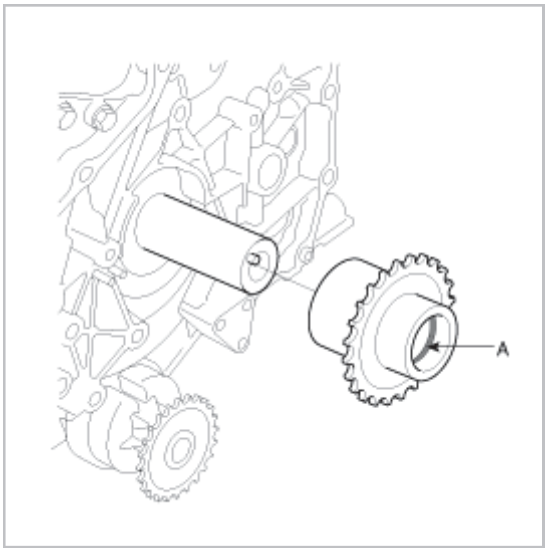
Grade	Color	Protrusion (mm(in))
A	Blue	34.2-35.0 (1.3465-1.3780)
B	White	33.4-34.2 (1.3150-1.3465)
C	Red	35.0-35.8 (1.3780-1.4094)



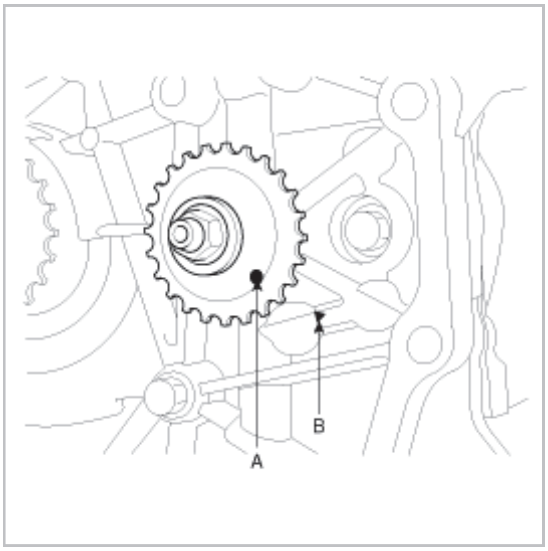
3. Install the crankshaft sprocket as the timing mark of crankshaft sprocket aligns with the timing mark(A) of lower under cover(B), at which No.1 piston locates at the top dead center of compression stroke.

NOTICE

In installing crankshaft sprocket, apply oil to the O ring inside the sprocket.



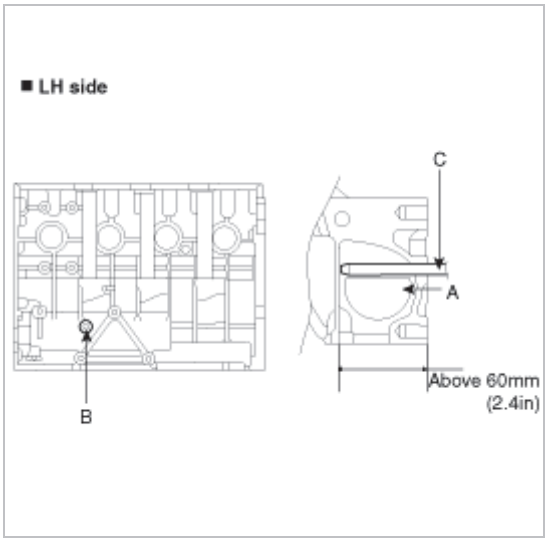
4. Align the timing mark of LH balance sprocket(A) with the timing mark of timing chain lower under cover(B).



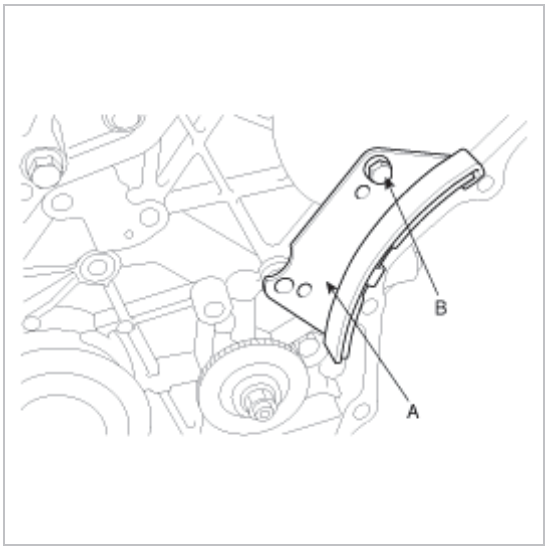
5. Check the LH balance shaft(A) whether it is located at the right position. To prevent the rotation of balance shaft, remove plug(B) at the side of cylinderblock. Insert screwdriver(C) (or bolt) with an 8 mm (0.32in) diameter into the plughole and check whether it slides more than 60 mm(2.4in).

NOTICE

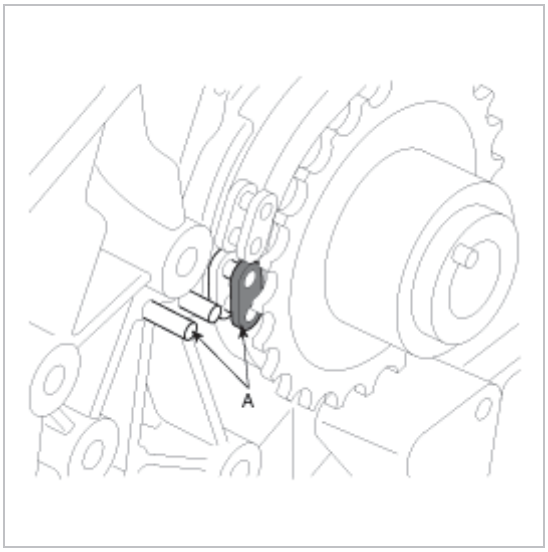
When the screwdriver (or bolt) depth is about 25-30mm(1-1.2in), rotate LH balance shaft sprocket 1 revolution. And insert the screwdriver (or bolt) again to check whether it slides more than 60mm(2.4in).

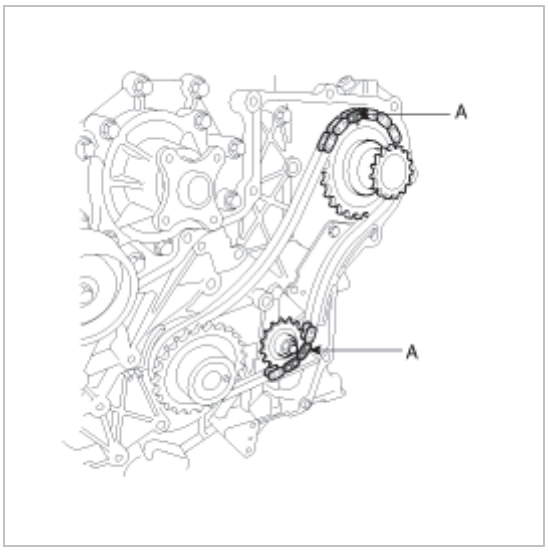


6. Assemble the upper bolt of timing chain guide "A"(A) tentatively.



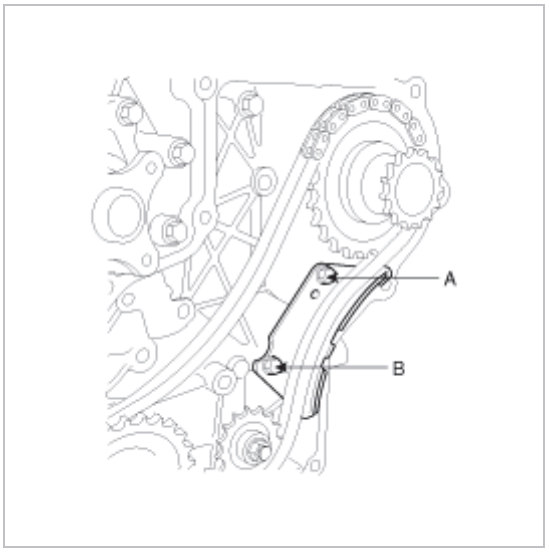
7. Align the timing marks of sprocket and chain when high-pressure pump sprocket is not installed to pump.
8. Using the chain connected to the high-pressure pump sprocket, install as the timing marks of LH balance shaft sprocket(A) and crankshaft sprocket align with each other.





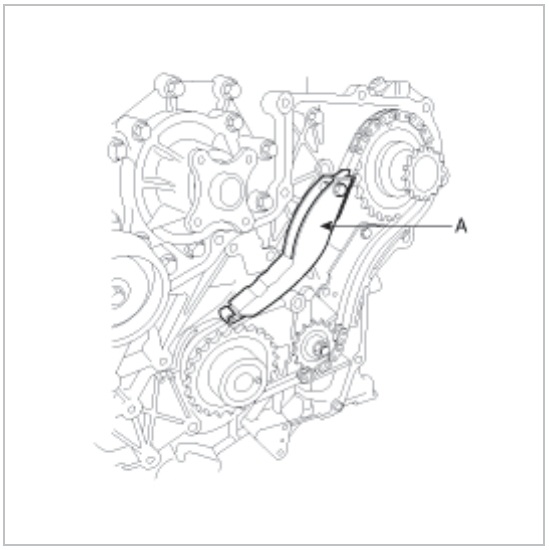
9. Assemble the high-pressure pump sprocket to the high-pressure pump tentatively.
10. Install the other bolt of the timing chain guide "A" at the lower side and tighten it.

Tightening torque :
Upper bolt(A) :
9.8-11.8 N.m(1.0-1.2 kgf.m, 7.2-8.7 lb-ft)
Lower bolt(B) :
19.6-26.5N.m(2.0-2.7 kgf.m, 14.5-19.5 lb-ft)



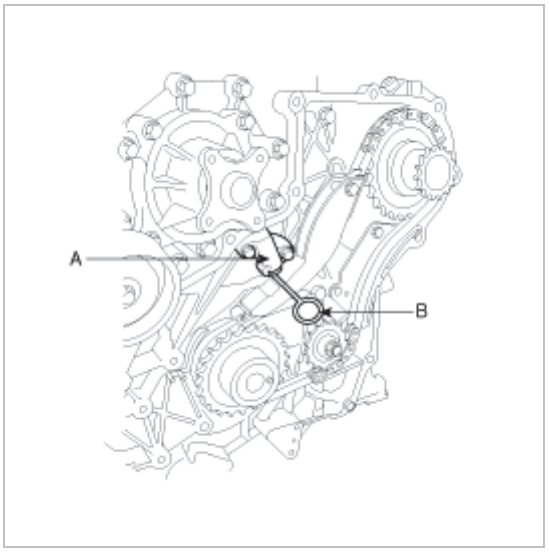
11. Install the timing chain lever "A"(A).

Tightening torque :
19.6-26.5 N.m(2.0-2.7 kgf.m, 14.5-19.5 lb-ft)



12. Install the timing chain auto-tensioner "A"(A), and remove a set pin(B) from the auto-tensioner.

Tightening torque :
19.6-26.5 N.m(2.0-2.7 kgf.m, 14.5-19.5 lb-ft)

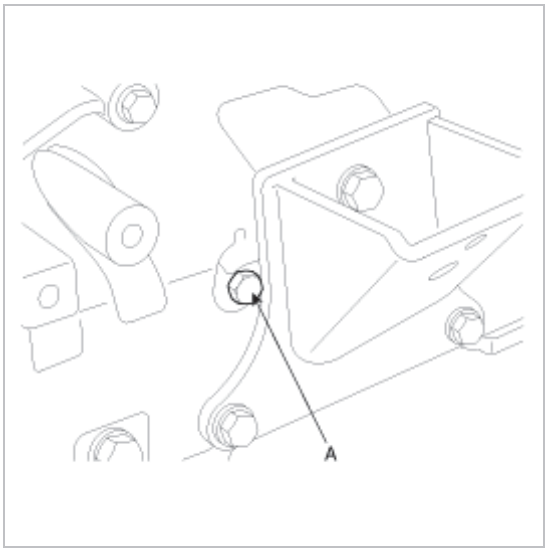


NOTICE

After assembling timing chain, check whether chain is assembled within the rail at both sides.

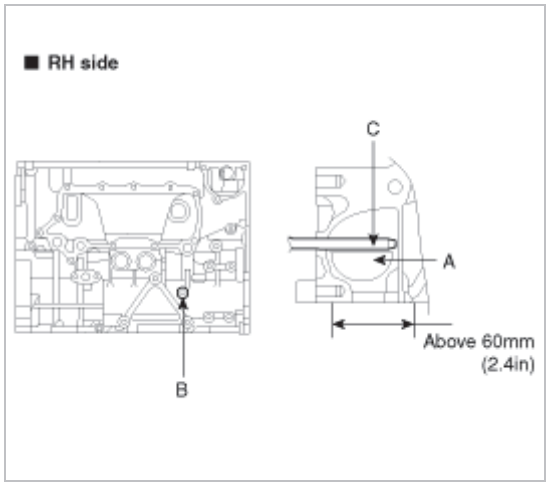
13. Remove the screwdriver (or bolt) from the plughole and install the plug(A).

Tightening torque :
14.7-21.6 N.m(1.5-2.2 kgf.m, 10.8-15.9 lb-ft)

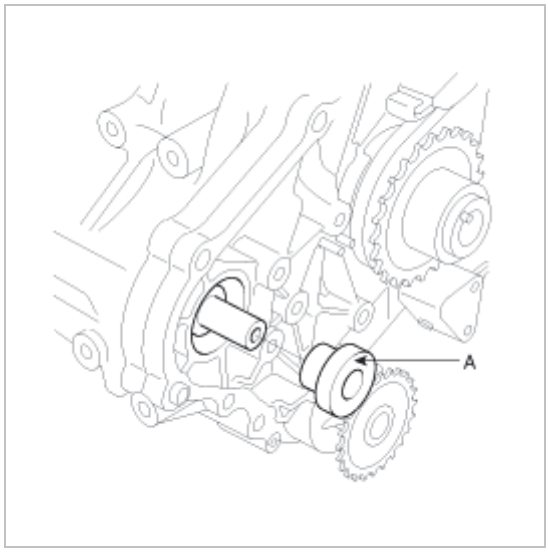


TIMING CHAIN "B"

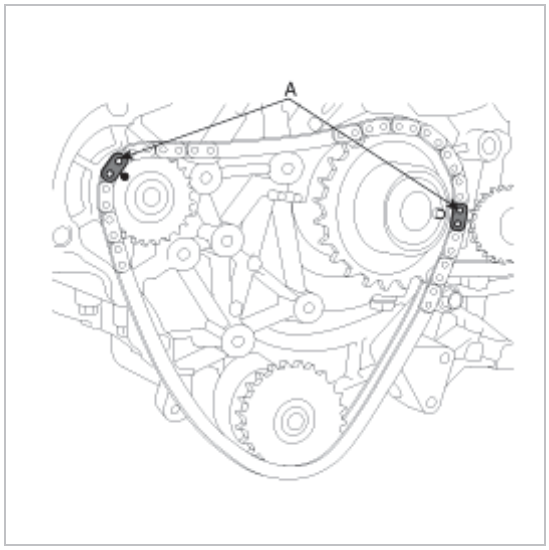
1. Check the worn of timing chain, lever, guide and sprocket and replace them if necessary.
2. Install the timing chain "A".
3. Check the RH balance shaft(A) whether it is located at the right position. To prevent the rotation of balance shaft, insertthe screwdriver(C) (or bolt) intothe plughole(B) at the side of cylinder block and check whether it slides more than 60 mm(2.4in).



4. Install the space washer(A) from RH balance shaft.

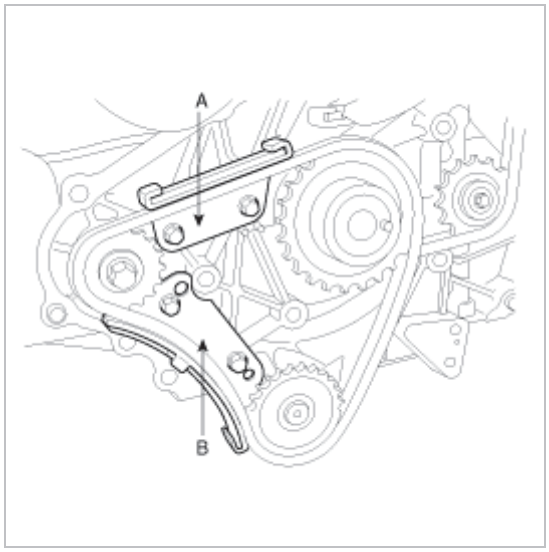


5. Using the chain connected to RH balance shaft sprocket, install as the timing marks(A) of crankshaft sprocket and oil pump sprocket align with each other.



6. Assemble the RH balance shaft sprocket to the balance shaft tentatively.
7. Install the timing chain guide "B(1)(A), B(2)(B)".

Tightening torque :
9.8-11.8 N.m(1.0-1.2 kgf.m, 7.2-8.7 lb-ft)

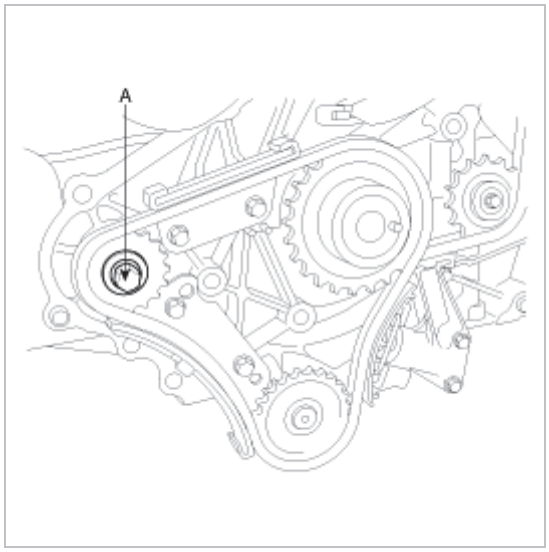


8. Install the timing chain auto-tensioner "B"(A), and remove the set pin(B) from the auto-tensioner.

Tightening torque :
9.8-11.8 N.m(1.0-1.2 kgf.m, 7.2-8.7 lb-ft)

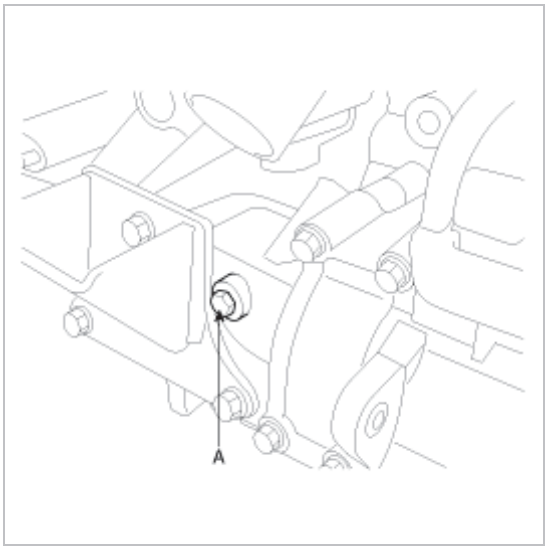
9. Assemble the RH balance shaft sprocket bolt(A).

Tightening torque :
33.3-39.2 N.m(3.4-4.0 kgf.m, 24.6-28.9 lb-ft)



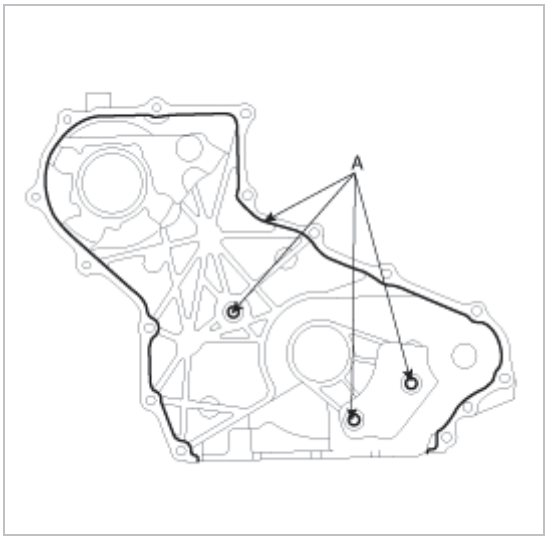
10. Remove the screwdriver (or bolt) from the plughole(A) and install the plug.

Tightening torque :
14.7-21.6 N.m(1.5-2.2 kgf.m, 10.8-15.9 lb-ft)



11. Apply the sealant(A) at the timing chain lower front cover.

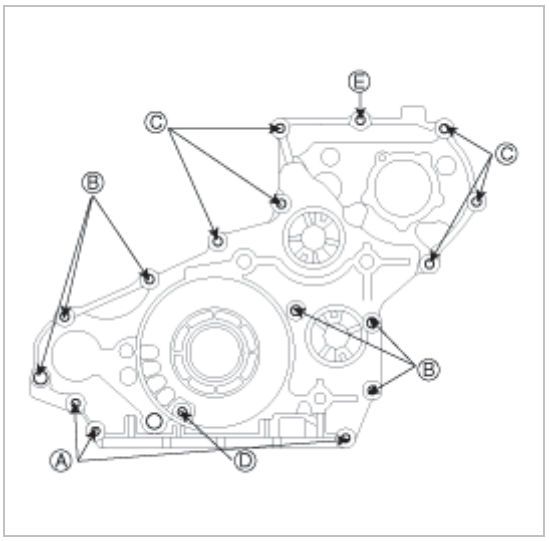
Sealant type : Lotite #5902
Bead width : 2-4 mm(0.08-0.16 in)

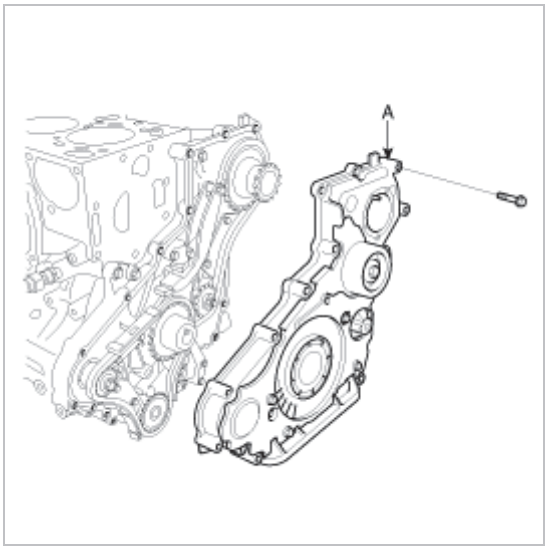


12. Install the timing chain lower front cover(A).

Bolt	Size	Quantity	Tightening torque N-m (kg-m, lb-ft)
A	8 x 80	4 EA	9.8-11.8 (1.0-1.2, 14.5-19.5)
B	8 x 70	1 EA	19.6-26.5 (2.0-2.7, 14.5-19.5)
C	8 x 50	3 EA	19.6-26.5 (2.0-2.7, 14.5-19.5)
D	8 x 40	1 EA	19.6-26.5 (2.0-2.7, 14.5-19.5)
E	8 x 22	1 EA	19.6-26.5 (2.0-2.7, 14.5-19.5)

* Bolt Size = Diameter x Length





13. Install the oil pan.

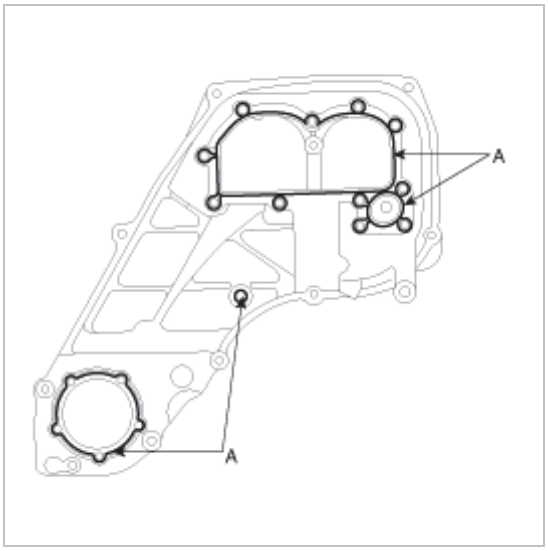
> **CAUTION**
>
> Then apply the sealant additionally to prevent the oil leak to the overlapping part (T-joint: 4 points right and left ofthe engine), where bed plate, timing chain lower under cover, timing chain lower front cover and oil pan overlap.

TIMING CHAIN "C"

1. Check the worn of the timing chain, lever, guide and sprocket and replace them if necessary.
2. Install the timing chain "A" and "B".
3. Apply the sealant(A) at the timing chain upper under cover.

Sealant type : Lotite #5902
Bead width : 2-4 mm (0.08-0.16 in)

> **CAUTION**
>
> Then apply the sealant additionally to prevent the oil leak to the overlapping part (T-joint : 2 points right and left of the engine), where cylinder head, timing chain cover plate and timing chain upper under cover overlap.

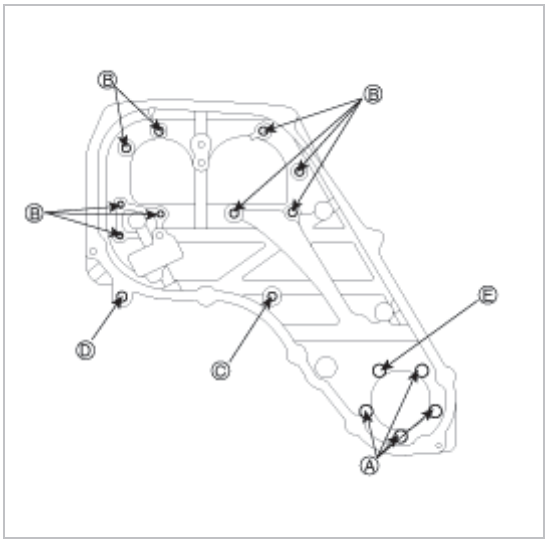


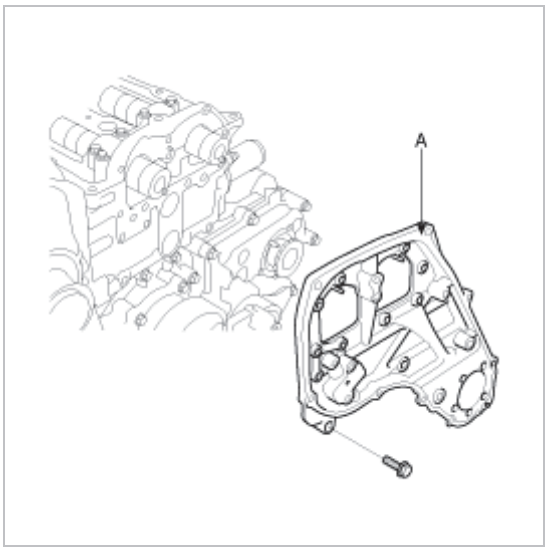
4. Install the timing chain upper under cover(A).

Bolt	Size	Quantity	Tightening torque

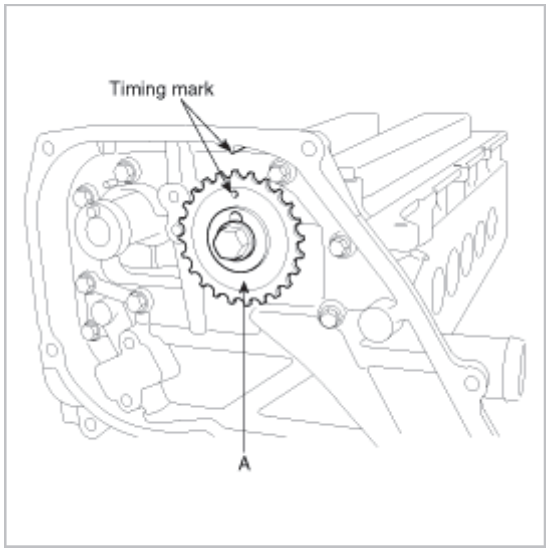
Bolt	Size	Quantity	N-m (kg-m, lb-ft)
A	6 x 14	4 EA	9.8-11.8 (1.0-1.2, 14.5-19.5)
B	6 x 22	9 EA	19.6-26.5 (2.0-2.7, 14.5-19.5)
C	8 x 22	1 EA	19.6-26.5 (2.0-2.7, 14.5-19.5)
D	8 x 40	1 EA	19.6-26.5 (2.0-2.7, 14.5-19.5)
E	Nut	1 EA	9.8-11.8 (1.0-1.2, 7.2-8.7)

* Bolt Size = Diameter x Length

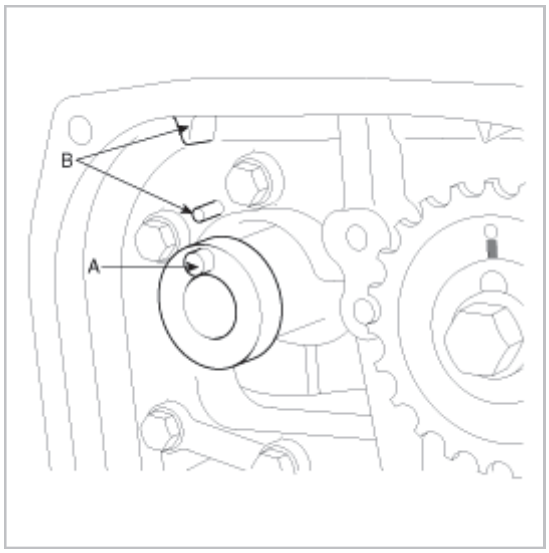




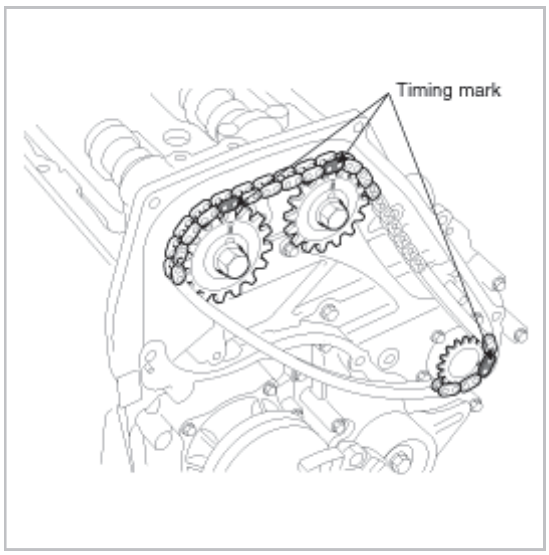
5. Assemble the LH camshaft sprocket(A) tentatively, and align the timing mark with that of timing chain upper under cover.



6. Align the RH camshaft dowel pin(A) with the timing mark(B) of the timing chain upper under cover.

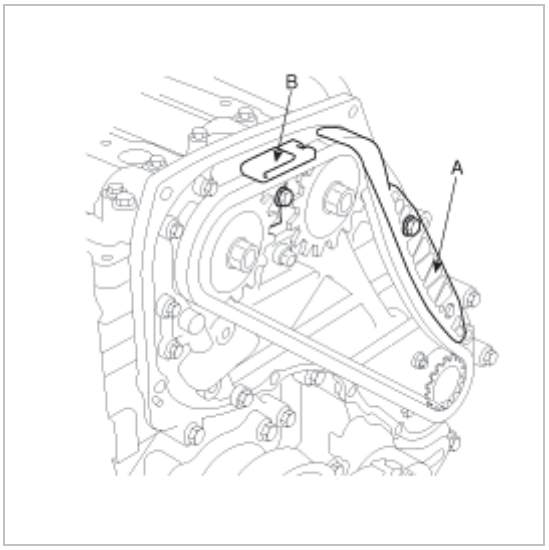


7. Align the timing marks of sprocket and chain when RH camshaft sprocket is not installed to the camshaft.
8. Using the chain connected to the RH camshaft sprocket, install as the timing marks of high-pressure pump sprocket and LH camshaft sprocket align with each other.



9. Assemble the RH camshaft sprocket to the RH camshaft tentatively.
10. Install the timing chain guide "C(1)(A), C(2)(B)".

Tightening torque :
9.8-11.8 N.m(1.0-1.2 kgf.m, 7.2-8.7 lb-ft)

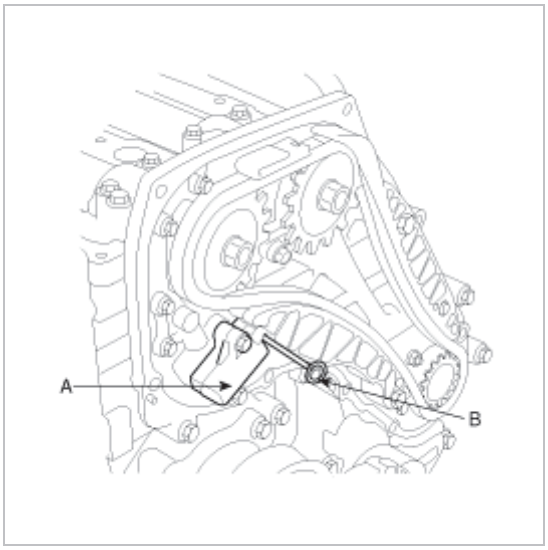


11. Install the timing chain lever "C"(A).

Tightening torque :
19.6-26.5 N.m(2.0-2.7 kgf.m, 14.5-19.5 lb-ft)

12. Install the timing chain auto-tensioner "C"(A), and remove the set pin(B) from the auto-tensioner.

Tightening torque :
9.8-11.8 N.m(1.0-1.2 kgf.m, 7.2-8.7 lb-ft)



13. Assemble the high-pressure pump sprocket bolt.

Tightening torque :
64.7-74.5 N.m (6.6-7.6 kgf.m, 47.7-55.0 lb-ft)

14. Assemble camshaft sprocket bolt.

Tightening torque :
93.2-117.7 N.m (9.5-12 kgf.m, 68.7-86.8 lb-ft)

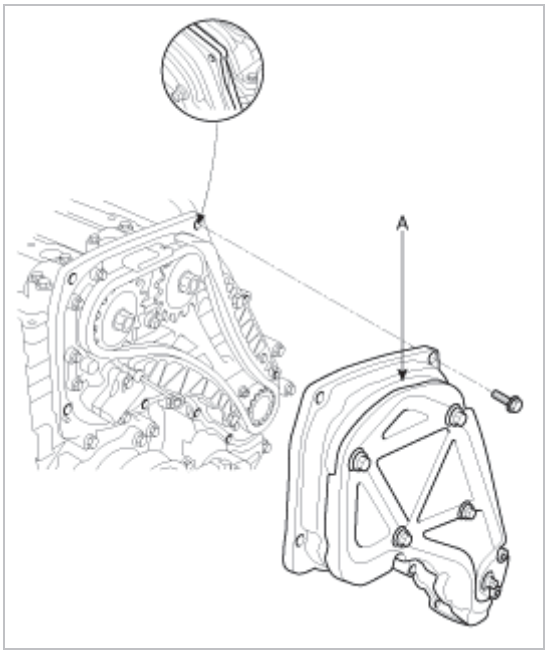
> NOTICE
>
> Then assemble the damper pulley to the crankshaft tentatively and align the timing mark of the damper pulley to that of chain cover. And check whether timing mark of the camshaft positions at the right place finally.

15. Apply the sealant(A) at the timing chain upper front cover.

Sealant type : Lotite #5902
Bead width : 2-4 mm (0.08-0.16 in)

16. Install the timing chain upper front cover(A).

Tightening torque :
19.6-26.5 N.m(2.0-2.7 kgf.m, 14.5-19.5 lb-ft)

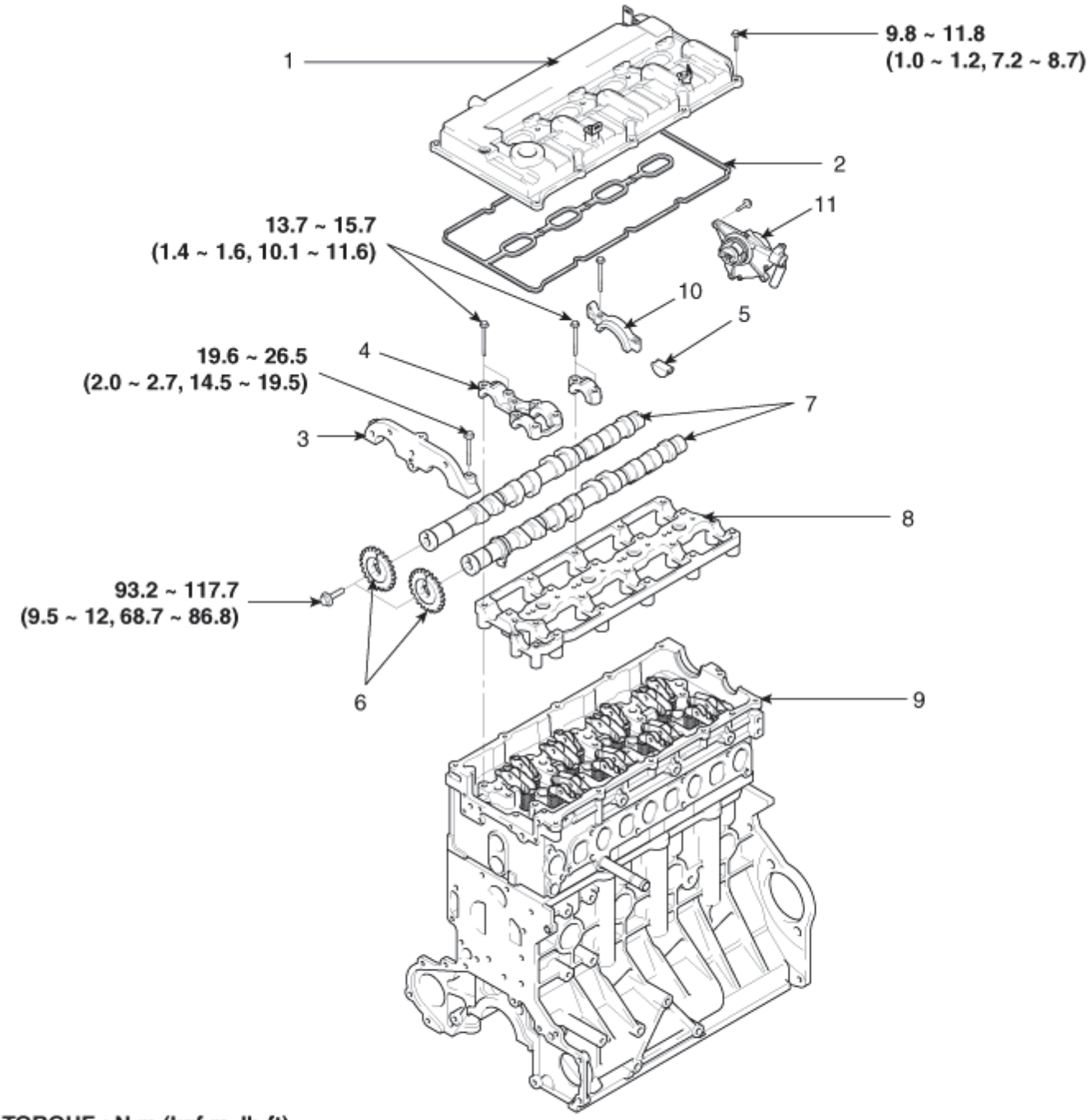

A

KIA MOTORS

Engine Mechanical System

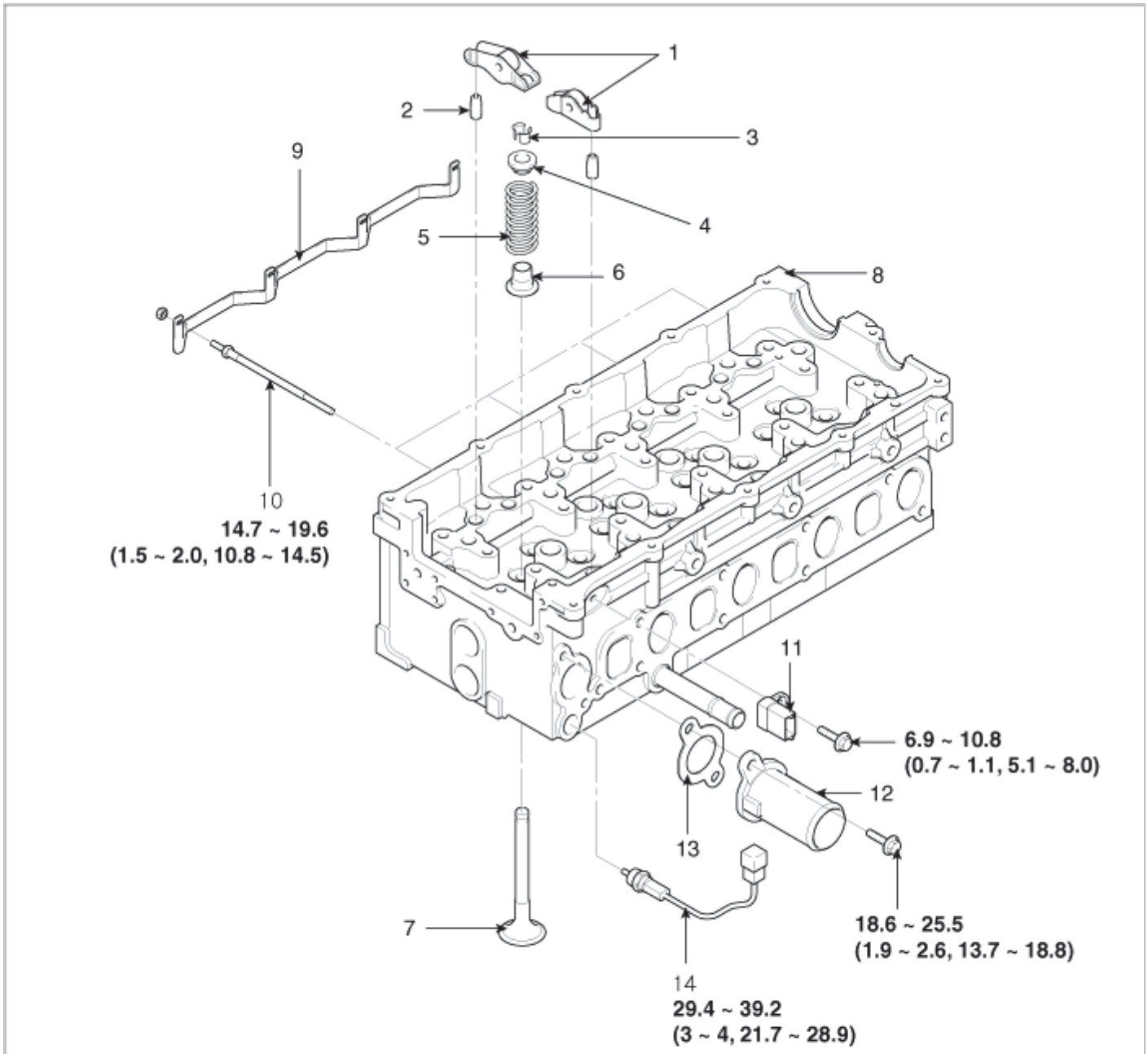
Cylinder Head Assembly - Cylinder Head

COMPONENTS



TORQUE : N.m (kgf.m, lb-ft)

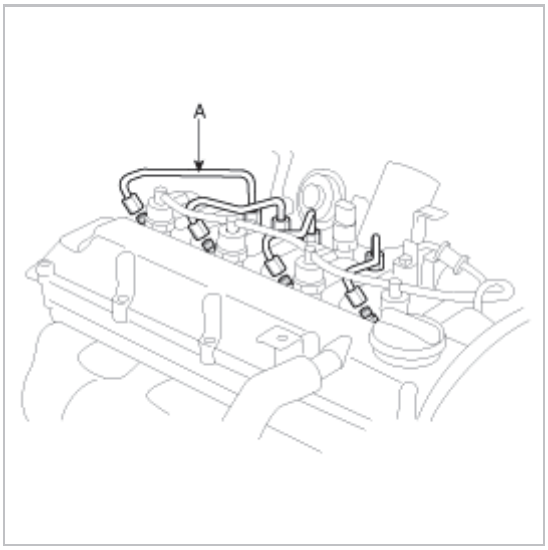
1. Cylinder head cover
2. Cylinder head cover gasket
3. Timing chain cover plate
4. Camshaft bearing cap
5. Semicircle packing
6. Camshaft sprocket
7. Camshaft
8. Camshaft carrier
9. Cylinder head
10. Vacuum pump bracket
11. Vacuum pump

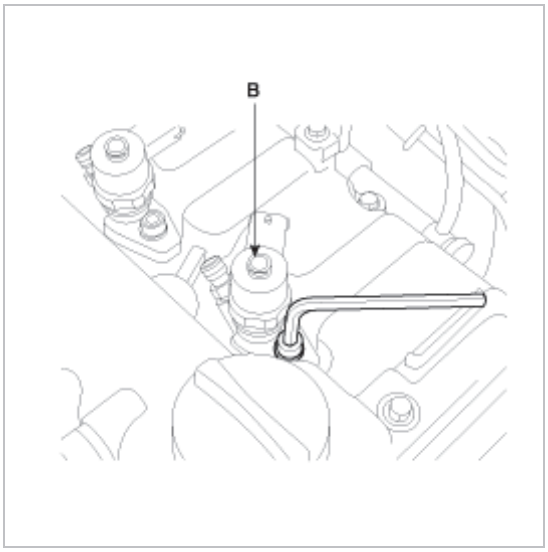


1. Cylinder follow
2. HLA
3. Retainer lock
4. Valve retainer
5. Valve spring
6. Valve stem seal
7. Valve
8. Cylinder head
9. Glow plug plate
10. Glow plug
11. TDC sensor
12. Water outlet fitting
13. Gasket
14. Water temperature sensor

REMOVAL

1. Remove the timing chain "C"
2. Remove the high pressure pipe(A) and the injector(B).(See "FL" group)





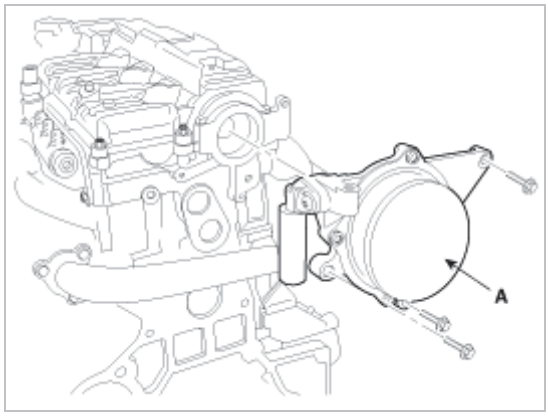
CAUTION

- Never perform any work on injection system with engine running or within 30 seconds after stopping the engine.
- Always pay attention to safety precautions.

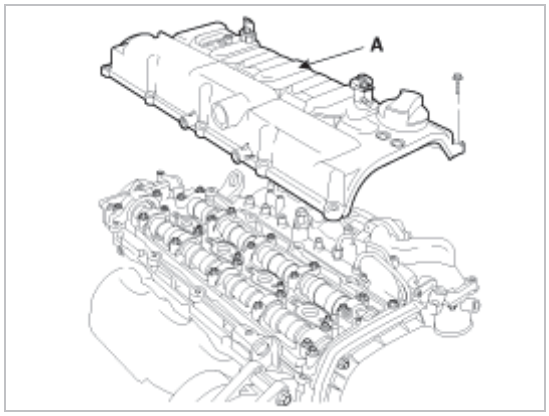
NOTICE

When remove the injectors, set the special tool (09351-4A000) to where the injector holder removed, install a slide hammer on the special tool, using the hammer, tap upward to remove the injector.

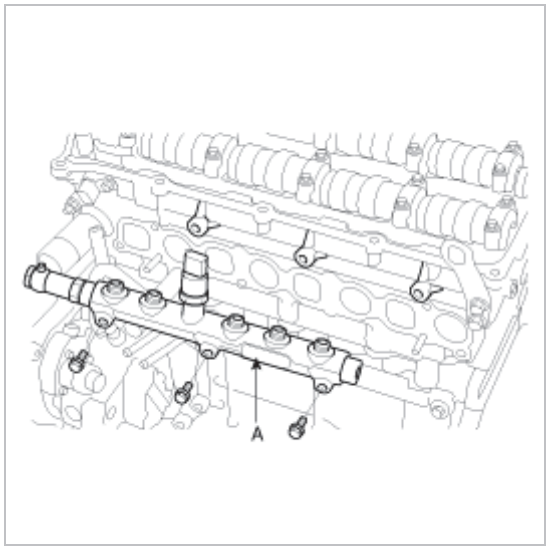
3. Remove the vacuum pump(A).



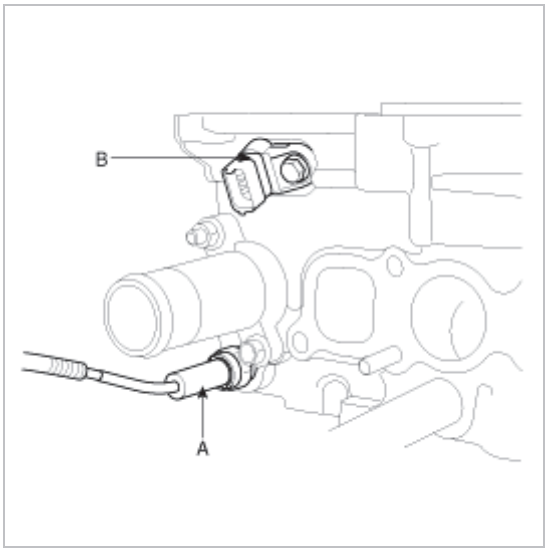
4. Remove the cylinder head cover(A).



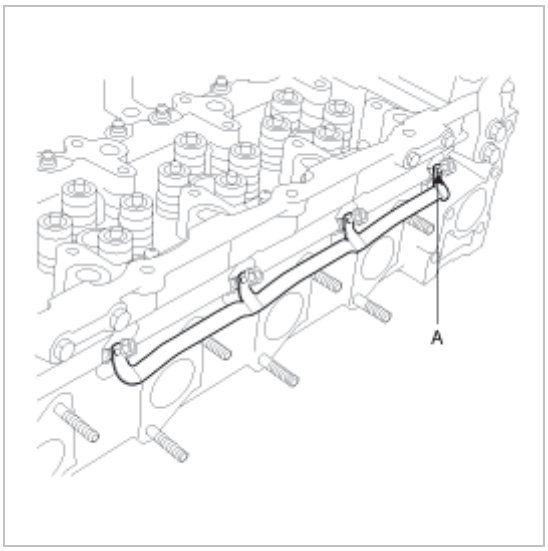
5. Remove the exhaust manifold.
6. emove the intake manifold.
7. Remove the delivery pipe(A).



8. Remove the water temperature sensor(A) and TDC sensor(B).



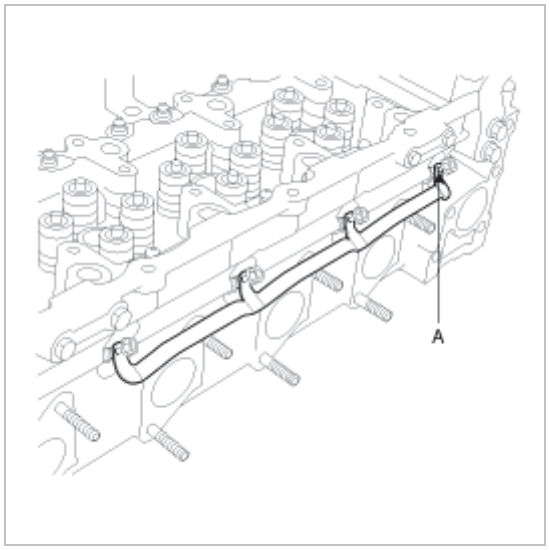
9. Remove the glow plug(A).



INSTALLATION

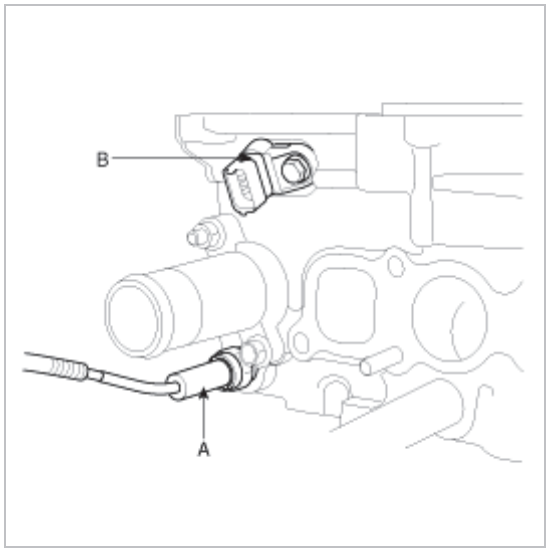
1. Install the glow plug (A).

Tightening torque :
Glow plug :
15-20 N.m (1.5-2.0 kgf.m, 11-15 lb-ft)
Glow plug plate nut :
0.8-1.5 N.m (8-15 kgf.m, 0.6-1.1 lb-ft)



2. Install the TDC sensor (B).

Tightening torque :
6.9-10.8 N.m (0.7-1.1 kgf.m, 5.1-8.0 lb-ft)

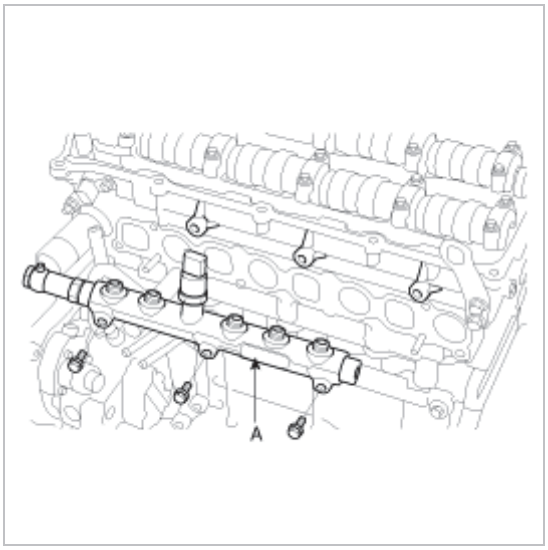


3. Install the water temperature sensor (A).

Tightening torque :
29.4-39.2 N.m (3-4 kgf.m, 21.7-28.9 lb-ft)

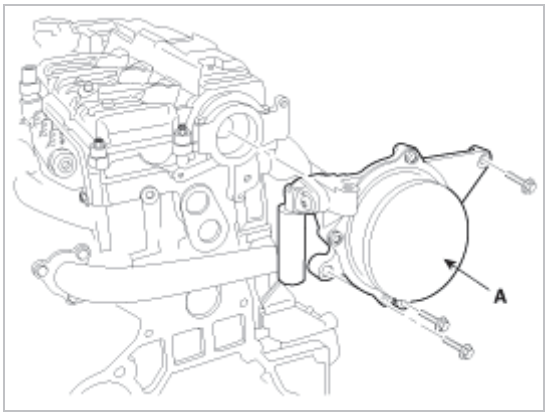
4. Install the delivery pipe (A).

Tightening torque :
14.7-21.6 N.m (1.5-2.2 kgf.m, 6.8-15.9 lb-ft)



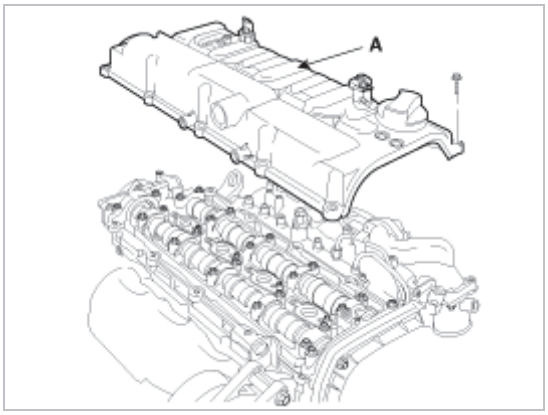
5. Install the exhaust manifold and intake manifold.
6. Install the vacuum pump (A).

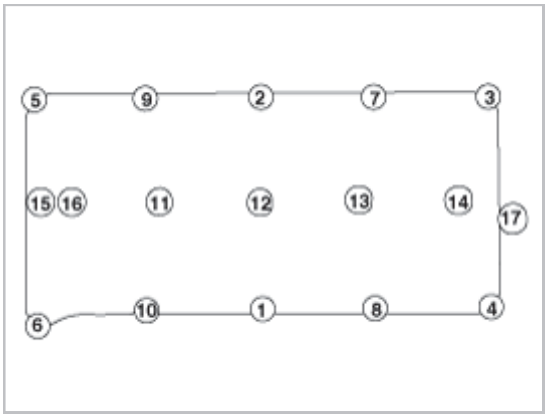
Tightening torque :
9.8-11.8 N.m (1.0-1.2 kgf.m, 7.2-8.7 lb-ft)



7. Install the cylinder head cover (A).

Tightening torque :
9.8-11.8 N.m (1.0-1.2 kgf.m, 7.2-8.7 lb-ft)

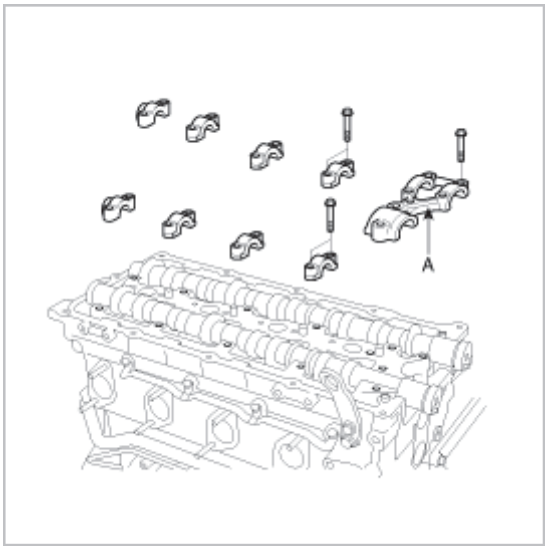




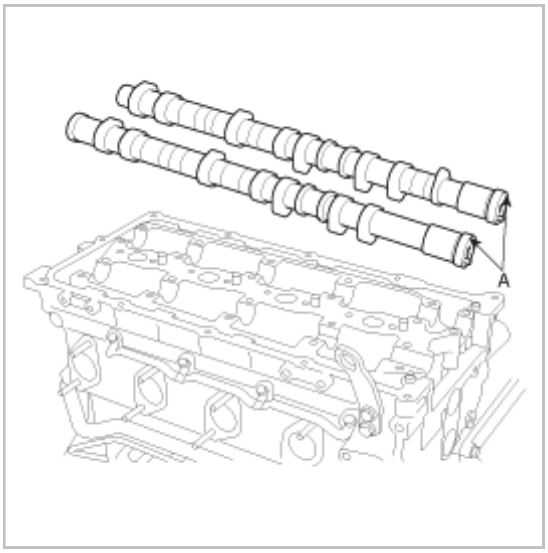
8. Install the injector and high pressure pipe.
9. Install the timing chain "C".

DISASSEMBLY

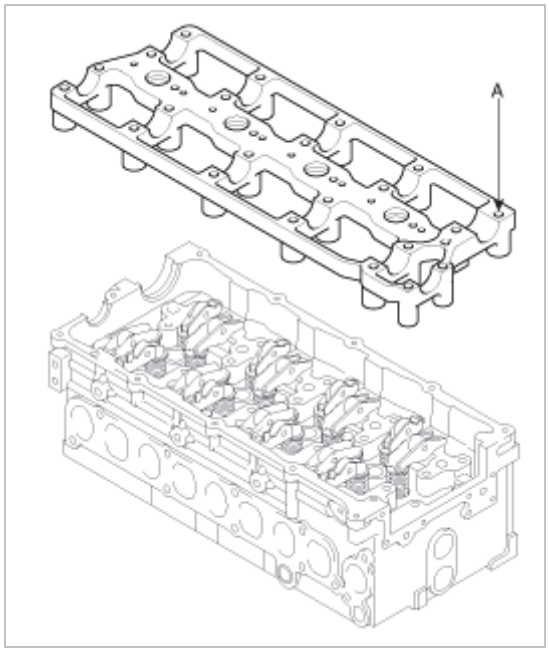
1. Remove the cam shaft sprocket.
2. Remove the cam shaft bearing cap(A).



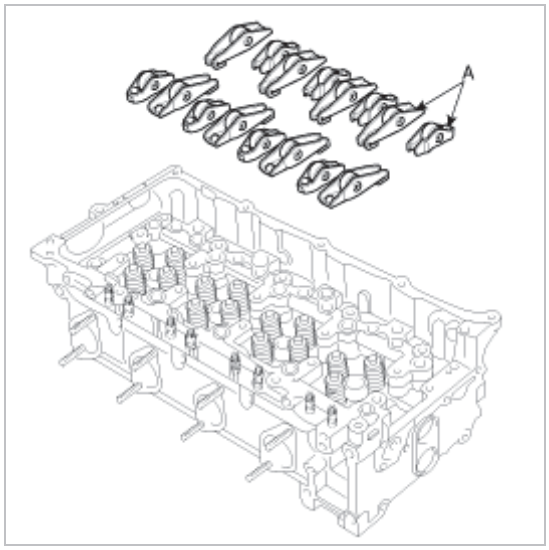
3. Remove the cam shaft(A).



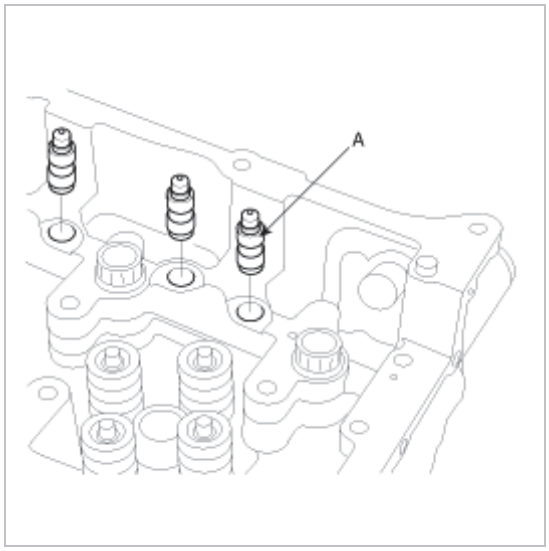
4. Remove the cam shaft carrier(A).



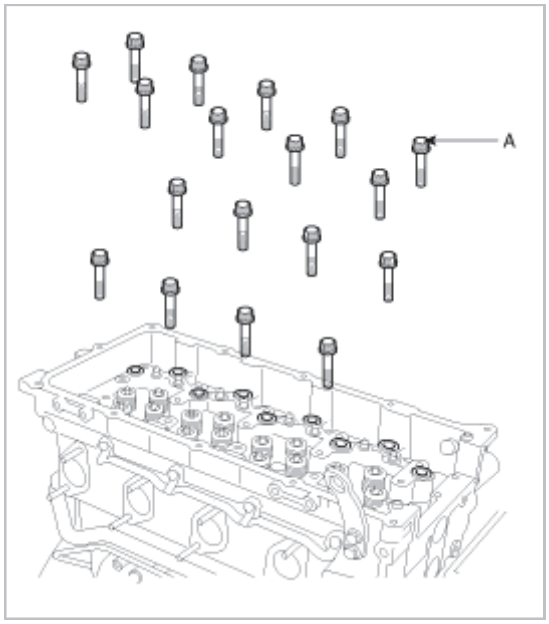
5. Remove the cam follow(A).



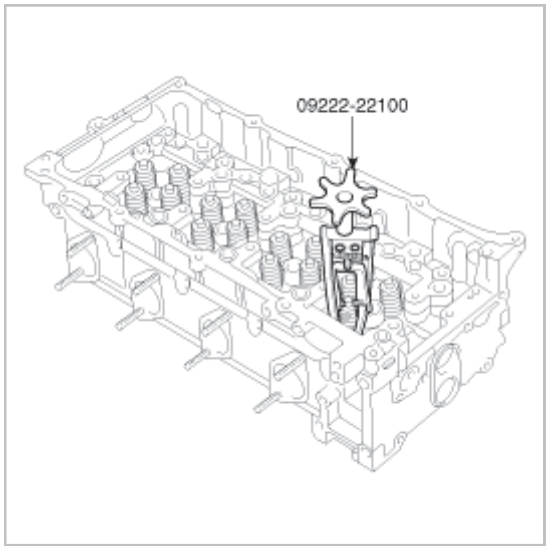
6. Remove the HLA(A).



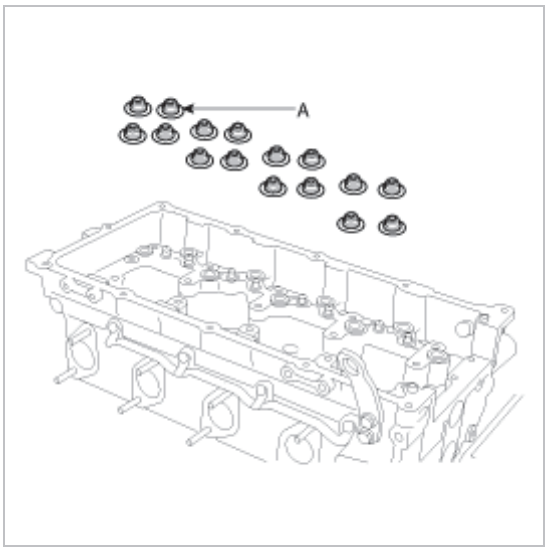
7. Remove the cylinder head bolts(A).



8. Remove the cylinder block.
9. Using the special tool(09222-22100), remove the valve.



10. Remove the valve stem seal(A).



INSPECTION

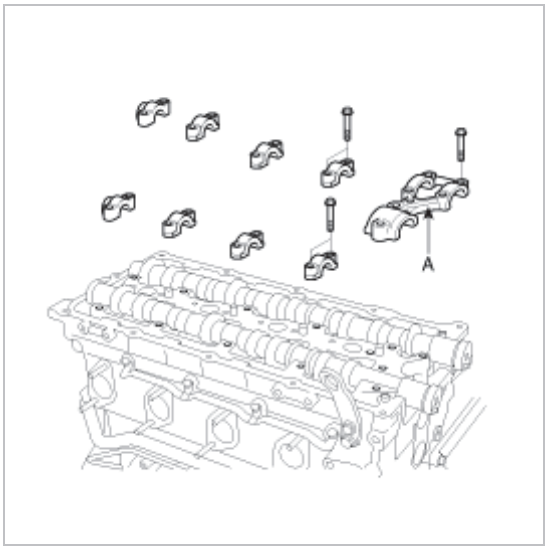
CAMSHAFT

NOTICE

Do not rotate the camshaft during inspection.

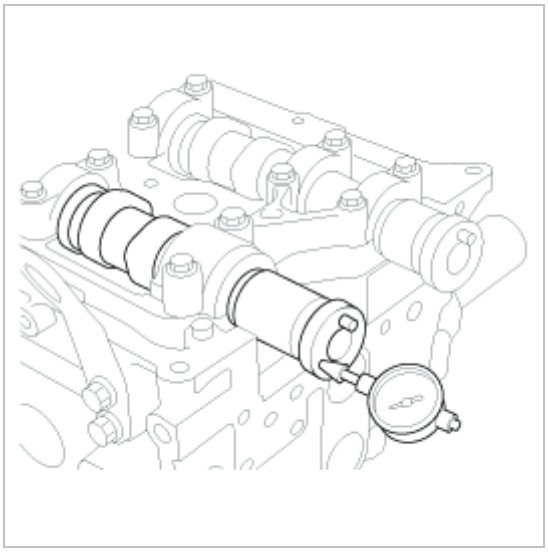
1. Put the cam shaft and the camshaft bearing caps(A) on the cylinder head, and then tighten the bolts to the specified torque with the following sequence below.

Specified torque
13.7 ~ 15.7 N.m(1.4 ~ 1.6 kgf.m,10.1~11.6 lb-ft)

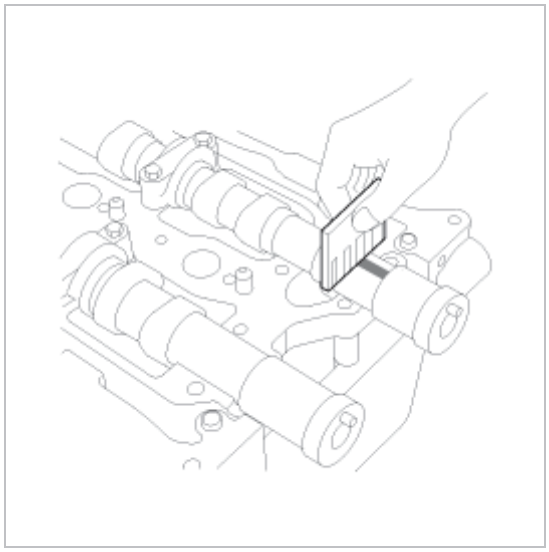


2. Check the camshaft journals for wear. If the journals are badly worn, replace the camshaft.

End play: 0.10 - 0.20 mm (0.0039 - 0.0079 in)

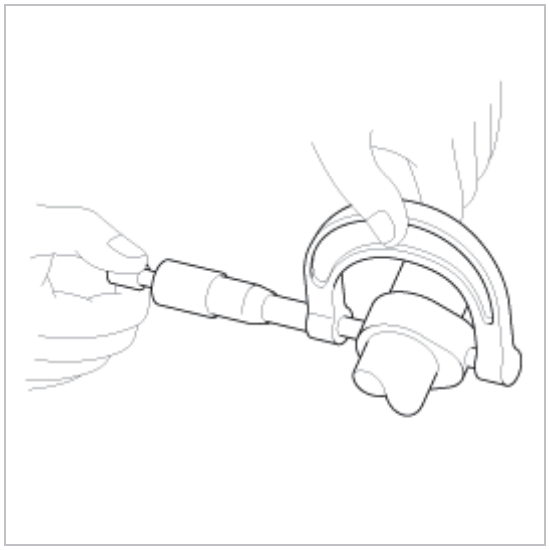


3. Clean the camshaft bearing surfaces in the cylinder head then set the camshaft back in place.
4. Install the camshaft bearing caps and tighten the bolts to the specified torque.
5. Remove the camshaft bearing caps, and then measure the widest portion of the plastic gage on each journal.



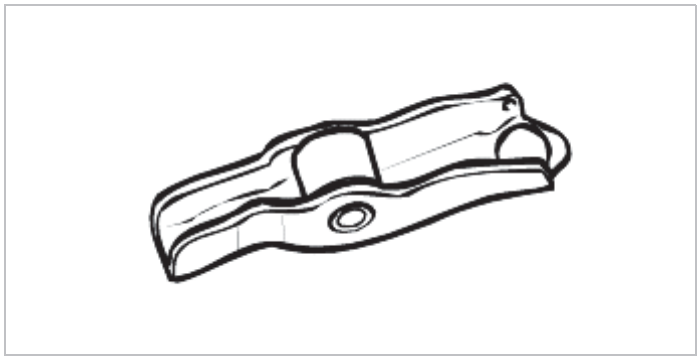
6. Check the cam lobes for damage. If the lobe is damaged or worn excessively, replace the camshaft.

Cam height (LH) :
Intake : 40.163 mm (1.5812 in)
Exhaust : 40.043 mm (1.5765 in)
Cam height (RH) :
Intake : 39.782 mm (1.5662 in)
Exhaust : 40.456 mm (1.5928 in)



CAM FOLLOW (ROCKER ARM)

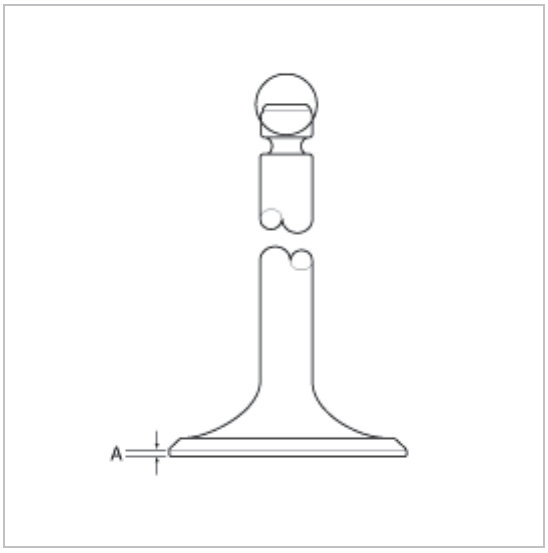
1. Check rotation of the roller. If they do not rotate smoothly or are loose, replace them.
2. Check the roller surface. Replace if there is any dent, damage or evidence of seizure.
3. Check the valve contact surface for possible damage or evidence of seizure. Replace if necessary.



VALVE AND VALVE GUIDE

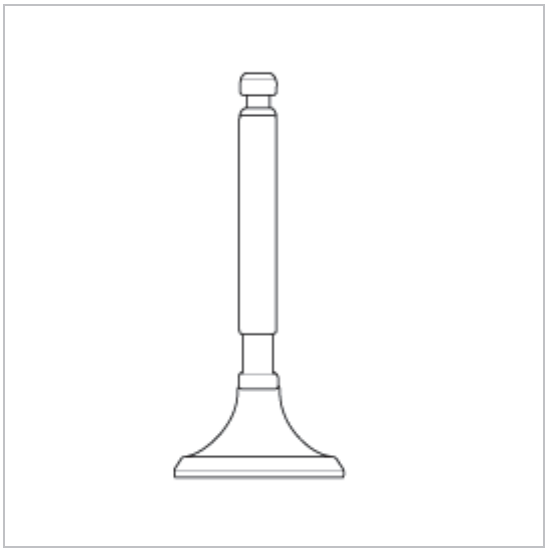
1. Inspect each valve for following. Replace of resurface if necessary.
   A. Damage or bent stem.
   B. Roughness or damage to face.
   C. Roughness or damage to face.
2. Check valve head margin thickness(A). Replace if necessary.

Margin thickness :
Intake, Exhaust: 1.8-2.0 mm (0.071-0.079 in)



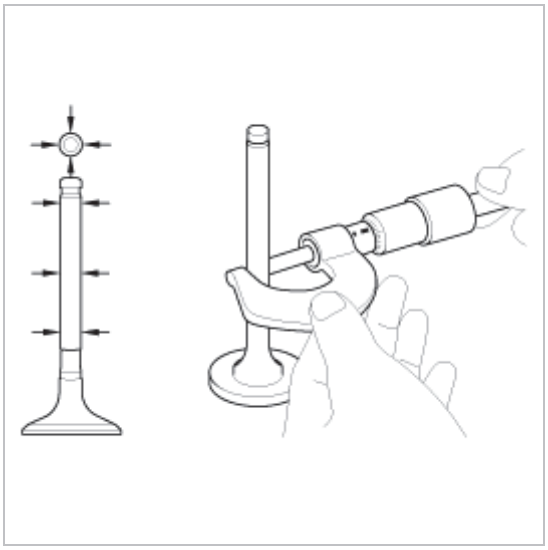
3. Measure valve length.

Valve length :
Intake, Exhaust : 110.55 mm (4.352 in)



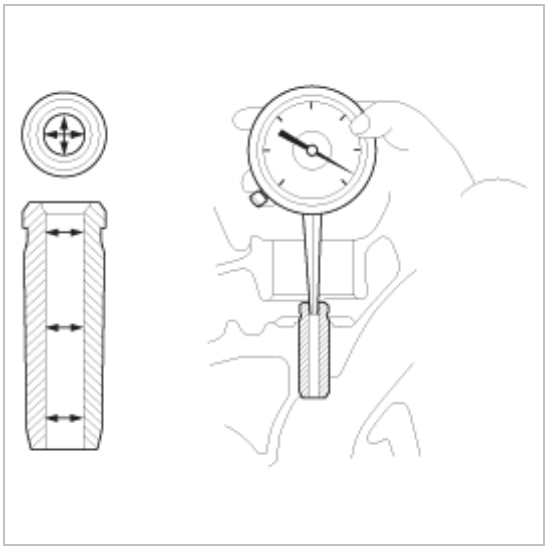
4. Measure valve stem diameter.

Valve stem diameter :
Intake : 6.965-6.980 mm (0.2742-0.2748 in)
Exhaust : 6.935-6.950 mm (0.2730-0.2736 in)



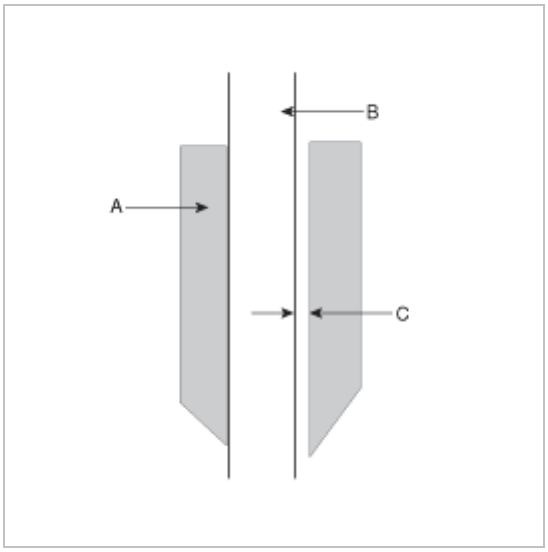
5. Measure valve guide inner diameter.

Inner diameter
Intake, Exhaust :
7.000-7.015 mm (0.2756-0.2762 in)



6. Measure valve stem to guide clearance(C) by subtract outer diameter of valve stem(B) from inner diameter of corresponding valve guide(A).

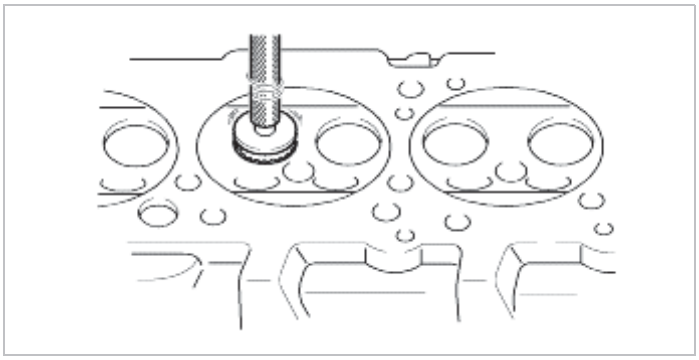
Clearance :
Intake : 0.020-0.050 mm (0.0008-0.0020 in)
Exhaust : 0.050-0.080 mm (0.0020-0.0031 in)



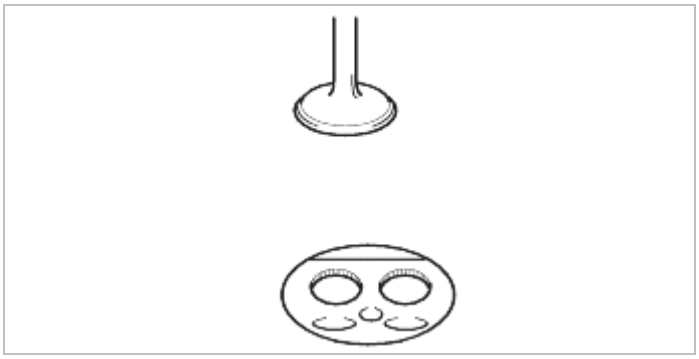
7. If clearance exceeds maximum, replace valve and/or cylinder head

VALVE SEAT

1. Inspect contact surface of valve seat and valve face for following.
   A. Roughness
   B. Damage
2. If necessary, resurface valve seat with a 45°(Intake), 45°(Exhaust) valve seat cutter and/or resurface valve face.

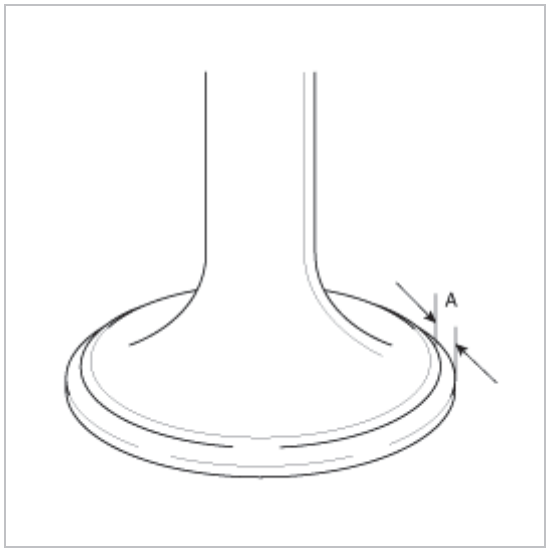


3. Apply a thin coat of Prussian blue to valve face.
4. Check valve seating by rotating valve against seat.
   A. If blue does not appear 360° around valve face, replace valve.
   B. If blue does not appear 360° around valve seat, resurface valve seat.

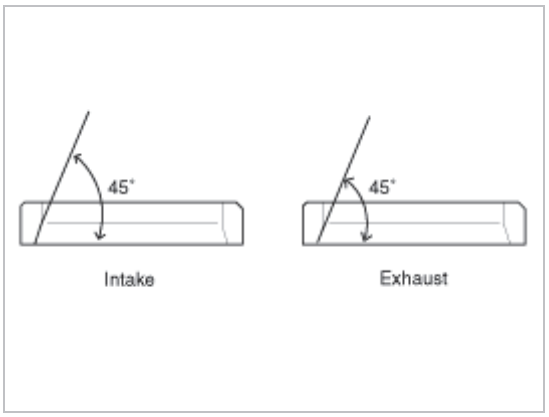


5. Check seat contact width (A).

Seat contact width :
Intake: 1.3-1.7 mm (0.0512-0.0669 in)
Exhaust: 1.5-1.9 mm (0.0591-0.0748 in)



6. Check that valve seating position is at center of valve face.
   A. If seating position is too high (low), correct valve seat with a 45° (Intake), 45° (Exhaust) cutter.

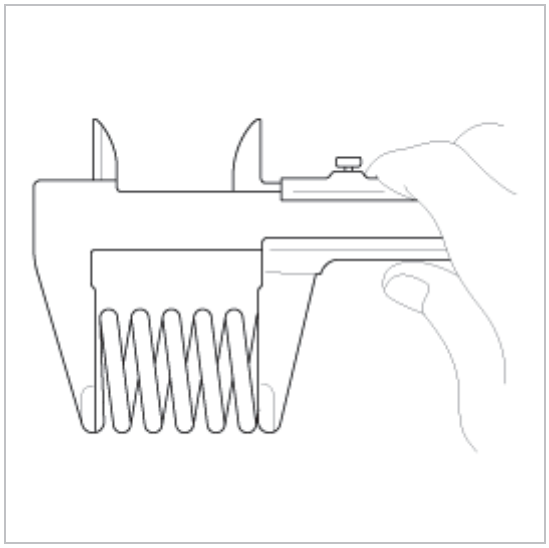


7. Seat the valve to the valve seat with a lapping compound.

VALVE SPRING

1. Inspect each valve spring for cracks or damage.
2. Check free length and out-of-square. Replace if necessary.

Free length: 48.2 mm (1.898 in)
Out-of-square: Below 1.5°



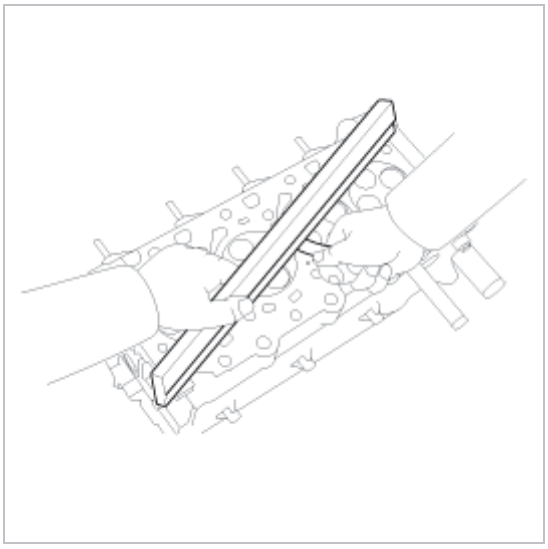
3. Check spring pressure, and replace it if necessary.

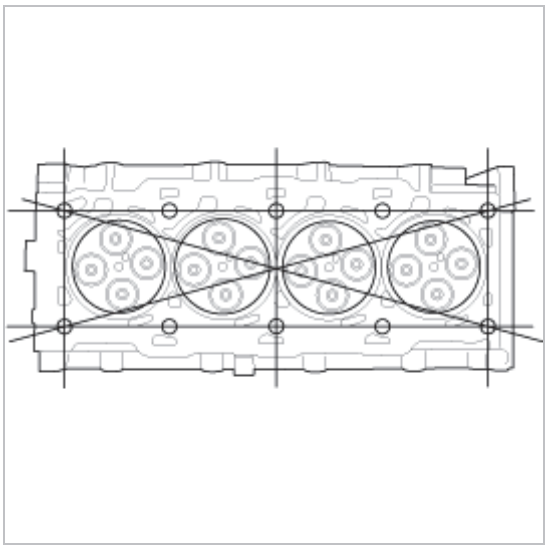
Spring pressure :
258 ± 12 N / 38 mm
(26.3±1.2 kg/38 mm, 569 ± 26 lb / 1.496 in)
505.5 ± 24 N/ 28.8 mm
(51.5±2.4 kg/28.8 mm, 1114.4 ± 53 lb / 1.134 in)

CYLINDER HEAD

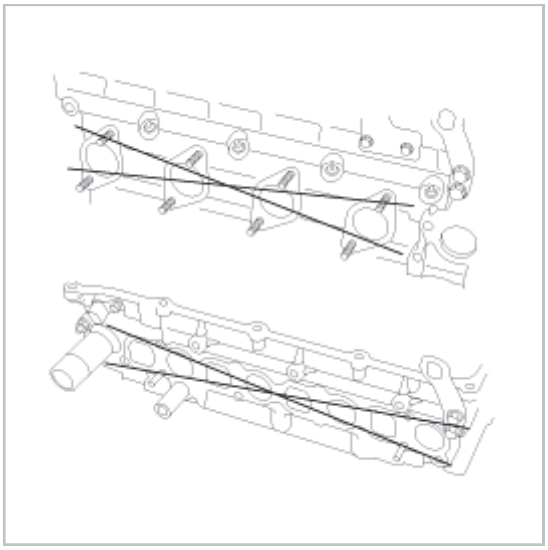
1. Inspect the cylinder head for damage, cracks and leakage of water and oil. Replace the cylinder head if necessary.
2. Measure cylinder head distortion in seven directions shown in figure.

Distortion : 0.15 mm (0.0059 in)





3. Measure manifold contact surface distortion in four directions shown in figure.

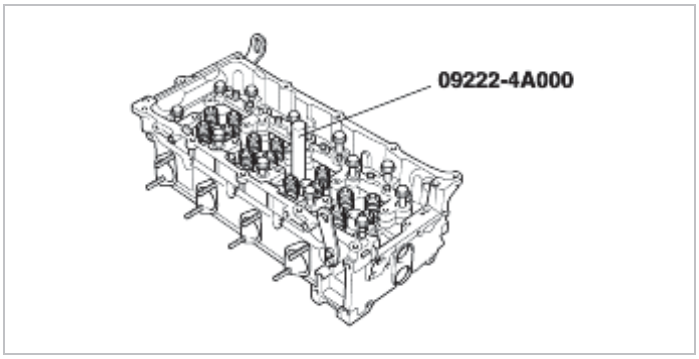


4. If distortion exceeds specification, grind surface or replace cylinder head.

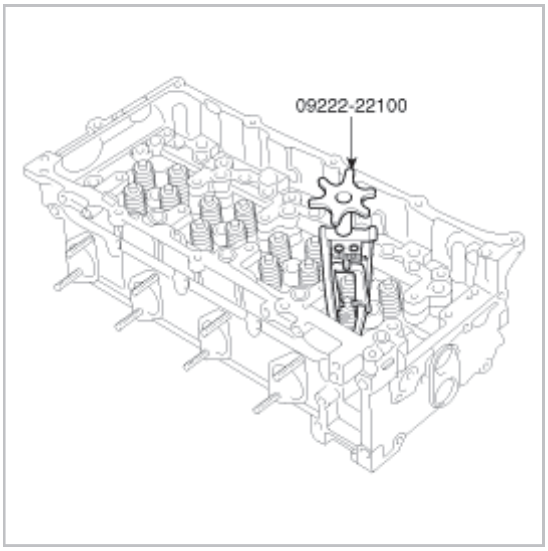
REASSEMBLY

1. Install a new valve stem seal to the valve guide using the special tool (09222-4A000).

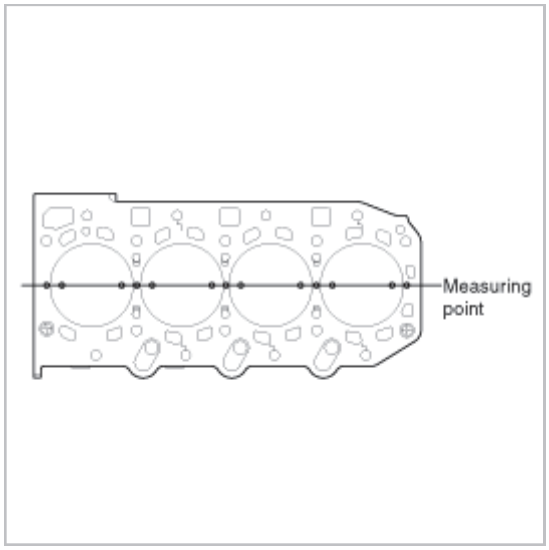
> **CAUTION**
>
> • Do not reuse the used valve stem seal.
> • When installing the valve stem seal, using the special tool is needed, not to leak the fluid.

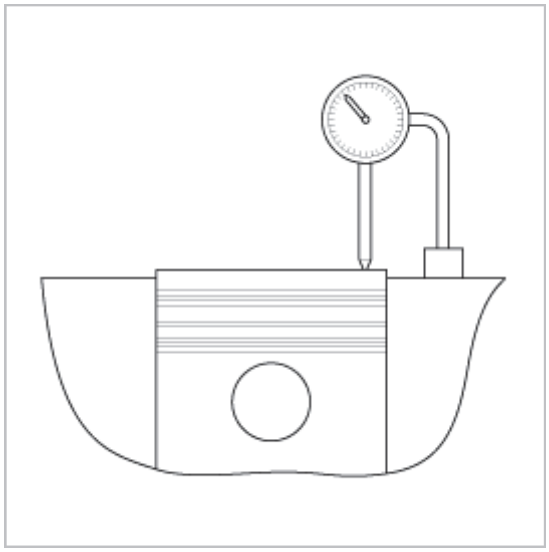


2. Using the special tool (09222-4A000), remove the valve.



3. Select the cylinder head gasket.
   (1) Measure the piston protrusion (8 places) from the upper face of the cylinder block and calculate the average of the 8 piston protrusion.

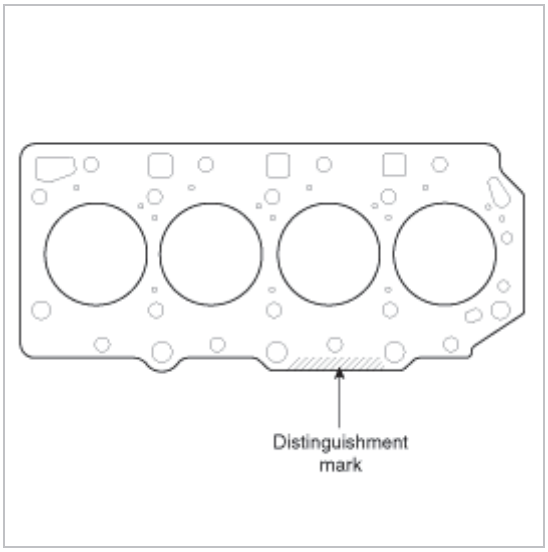


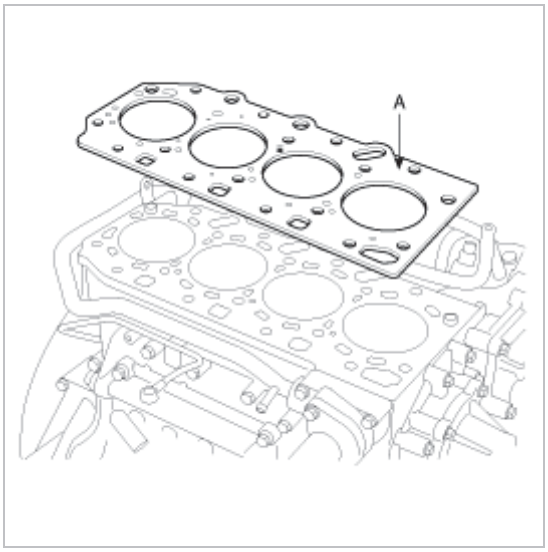


(2) Select the gasket from the grade A to C in the table below using the average of the 8 piston protrusion.Even if only 1 point is over than the limit of piston protrusion at each grade, 1 grade upper gasket than specified below.

CYLINDER HEAD GASKET mm (in)

Gasket grade	A	B	C
Piston Protrusion	0.056-0.117 (0.0022-0.0046)	0.117-0.178 (0.0046-0.0070)	0.178-0.240 (0.0070-0.0094)
Limit of piston protrusion	0.167 (0.0066)	0.228 (0.0090)	–
Gasket Thickness	0.92-0.98 (0.0362-0.0386)	0.97-1.03 (0.0382-0.0406)	1.02-1.08 (0.0402-0.0425)
Mark for distinguishment			



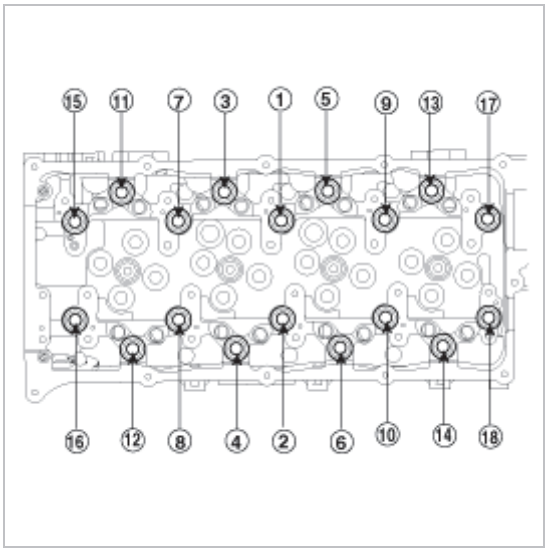


4. Install the cylinder head assembly with the cylinder head gasket.

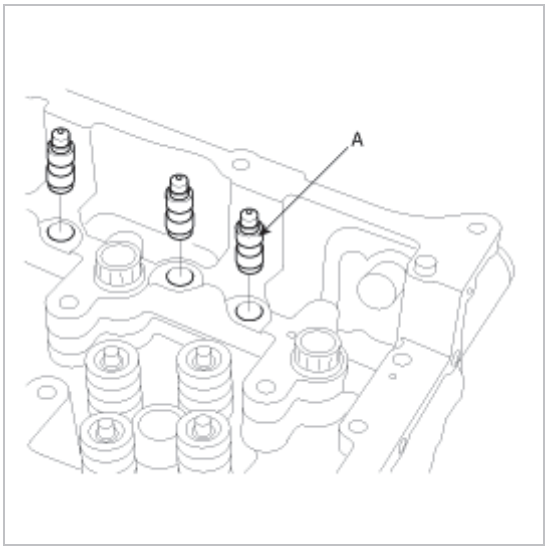
Tightening torque :
49.0 N.m (5.0 kgf.m, 36.2 lb-ft) + 120° + 90°

CAUTION

Always use new cylinder head bolts.

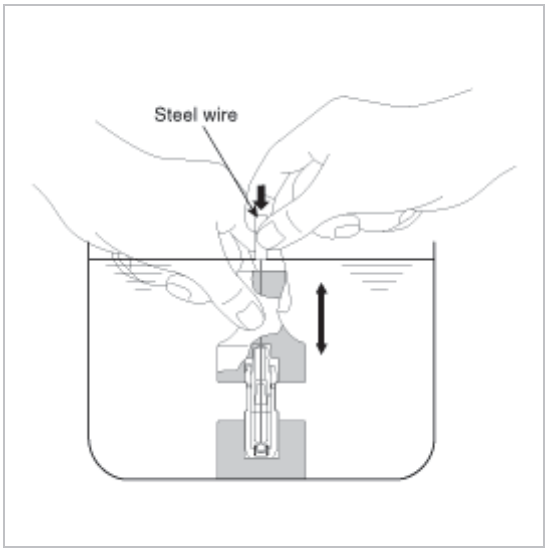


5. Install the HLA(A) to the cylinder head.

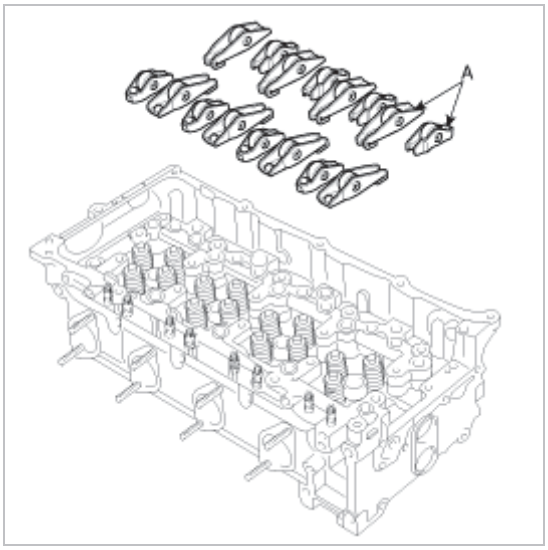


(1) Until installing HLA shall be held upright so that diesel oil in HLA should not spill and assured that dust does not adhere to HLA.

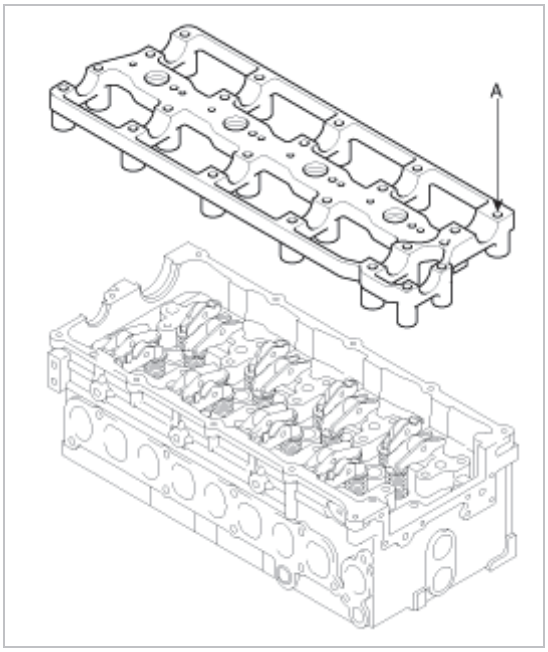
(2) HLA shall be inserted tenderly to the cylinder head not to spill diesel oil from HLA. In case of spilling, air bent shall be done in accordance with the air bent procedure.



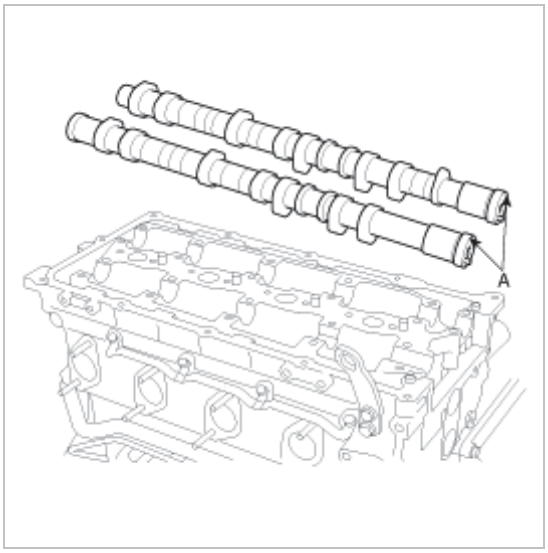
6. Install the cam follow(A) (rocker arm) on the HLA and valve.



7. Install the camshaft carrier (A) on the cylinder head.



8. Install the camshaft (A) on the camshaft carrier.



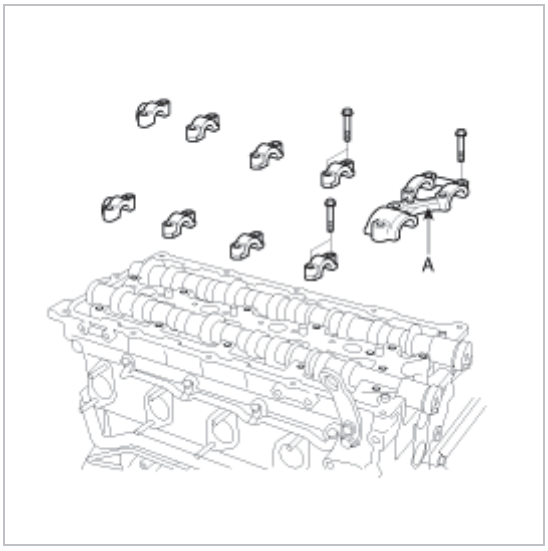
CAUTION

In assembling camshaft cap, all pistons to be in the middle position between TDC and BDC not to interfere

with valves.

9. Install the camshaft caps (A).

Tightening torque :
13.7-15.7 N.m (1.4-1.6 kgf.m, 10.1-11.6 lb-ft)



10. Install the camshaft sprocket.

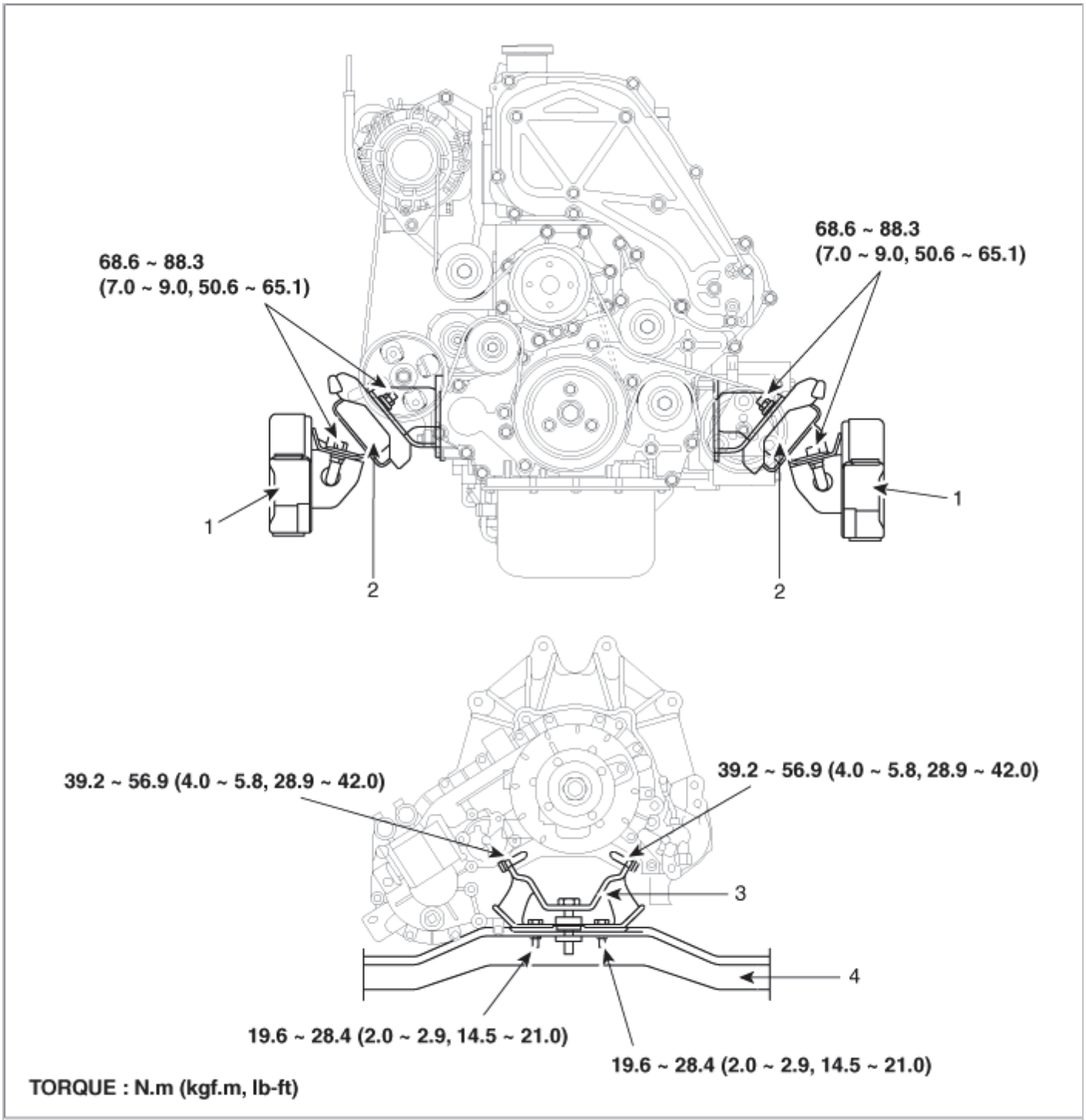
Tightening torque :
93.2-117.7 N.m (9.5-12.0 kgf.m, 68.7-86.8 lb-ft)

KIA MOTORS

Engine Mechanical System

Engine & Transaxle Assembly

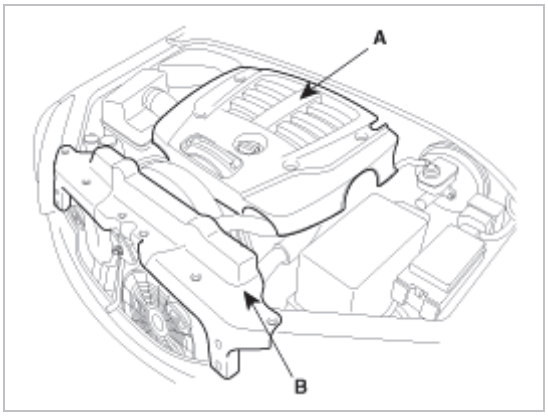
COMPONENTS



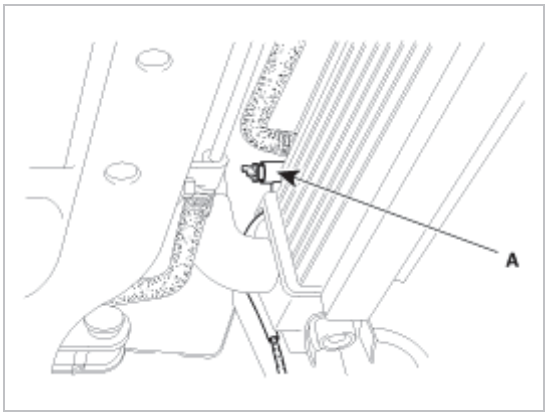
1. Frame
2. Engine mounting
3. Transmission mounting
4. Cross member

REMOVAL (A/T EQUIPPED VEHICLE)

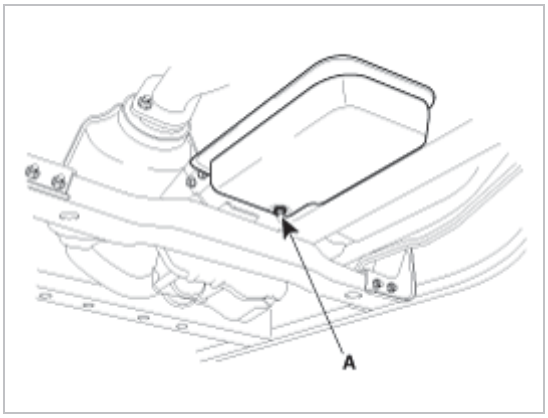
1. Remove the engine hood.
2. Remove the engine cover(A) and seal board(B).



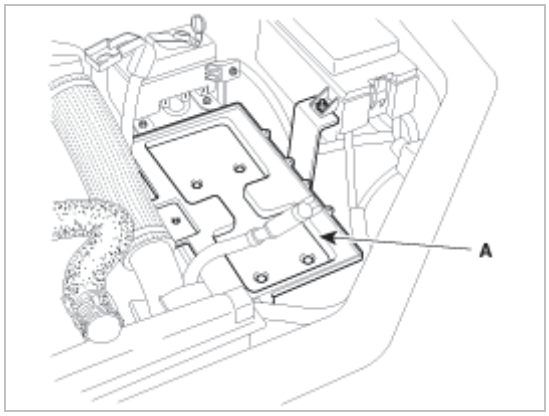
3. Drain the engine coolant after removing drain plug(A).
   Remove the radiator cap to speed draing.



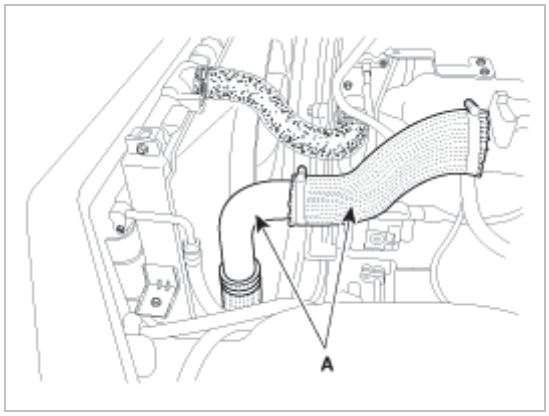
4. Remove the transmission oil drain plug(A).



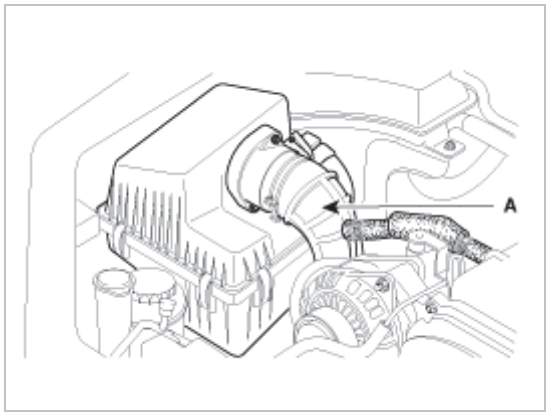
5. Remove the battery and battery tray(A).



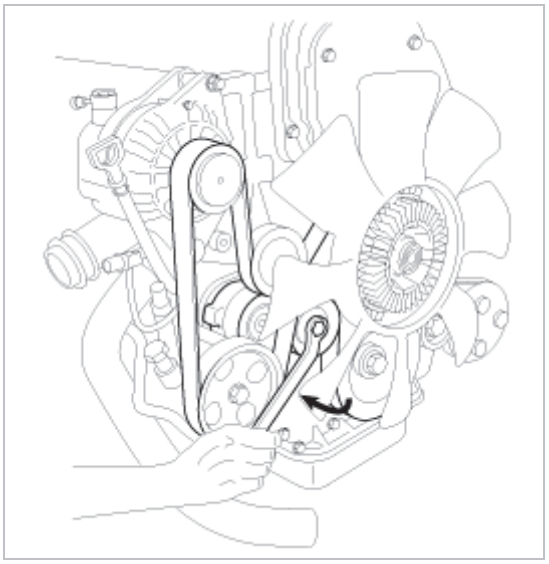
6. Remove the inter cooler hose and pipe on the intake manifold side(A).



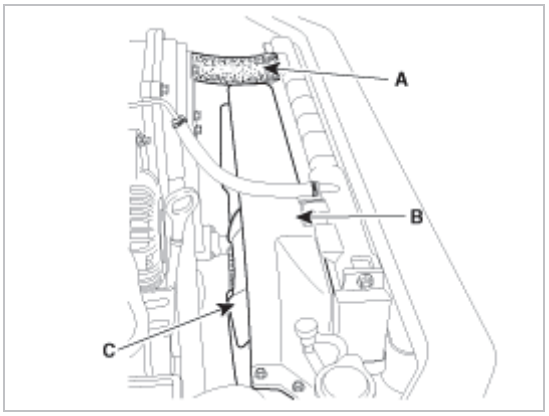
7. Disconnect the air cleaner hose(A).



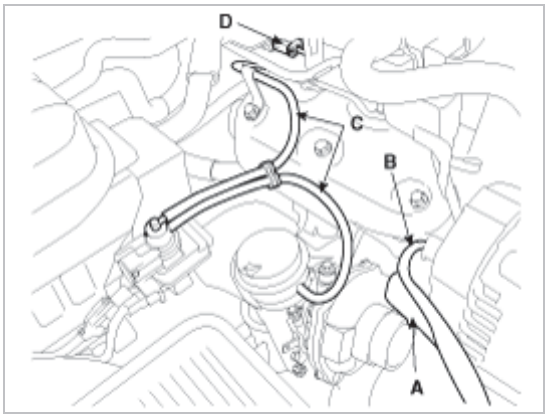
8. Disconnect the engine coolant reservoir tank hose and the heater hose.
9. Remove the inter cooler hose on the turbo charger side.
10. Loosen the drive belt tension by turning auto-tensioner with spanner, and then remove the drive belt.



11. Disconnect the radiator upper hose(A) and lower hose.
12. Remove the radiator cowl upper cover(B).

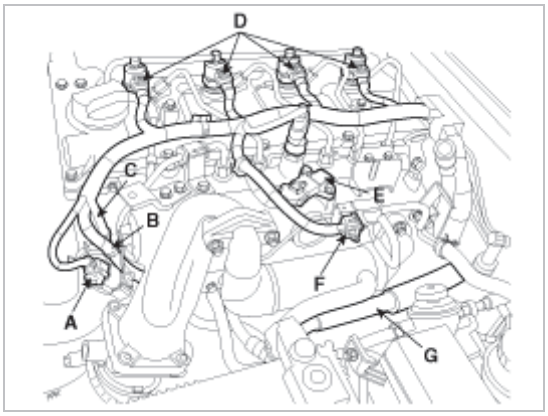


13. Remove the cooling fan(C).
14. Remove the radiator cowl lower cover.
15. Remove the fixing bolt of air-con condenser and ATF oil cooler bracket from the radiator assembly.
16. Disconnect the ATF oil hoses.
17. Remove the radiator assembly from engine room, after remove the radiator assembly bracket fixing nut.
18. Drain the power steering oil.
19. Disconnect the power steering pump hose and pipe.
20. Disconnect the alternator "B" terminal(A) and connector(B).
21. Remove the vacuum hose(C).

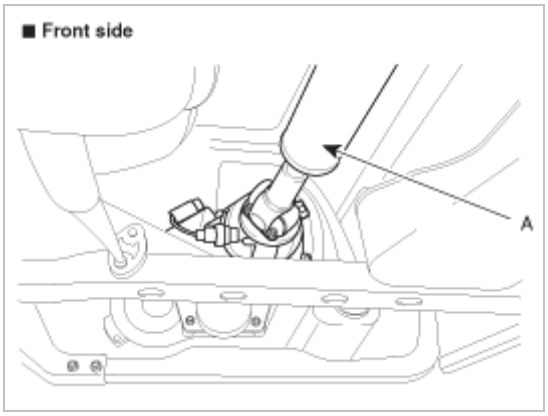


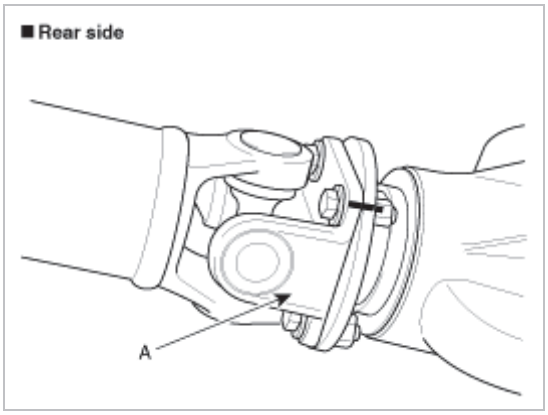
22. Disconnect the earth terminal and the glow plug connector(D).

23. Disconnect the water temperature sensor connector.
24. Disconnect the high pressure connector(B).
25. Disconnect the TDC sendor connector(C).
26. Disconnect the inject connector(D).
27. Disconnect the map sensor connector(E).
28. Disconnect the thorought flat funtion valve connector(F).
29. Remove the EGR cooler water hose(G).

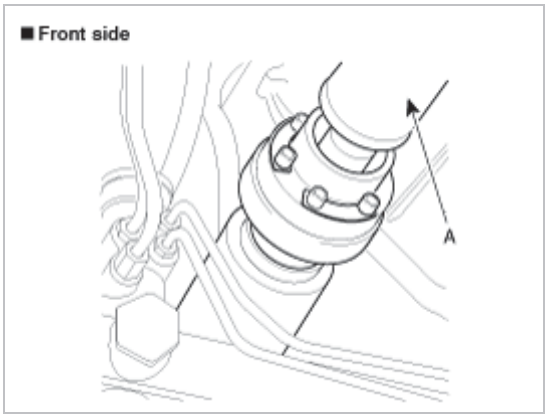


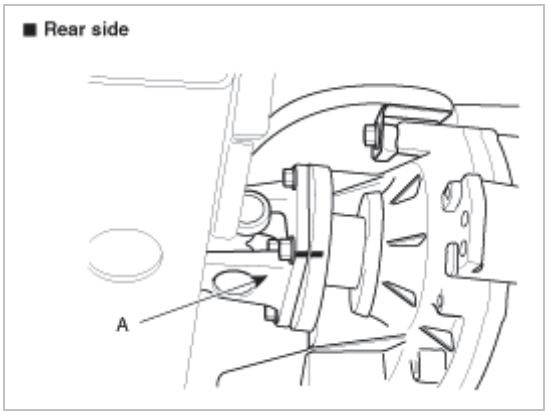
30. Remove the fuel hose from the high pressure pump.
31. Disconnect the earth terminal from the cylinder block.
32. Remove the transmission oil level gauge pipe.
33. Remove the rear propeller shaft(A).



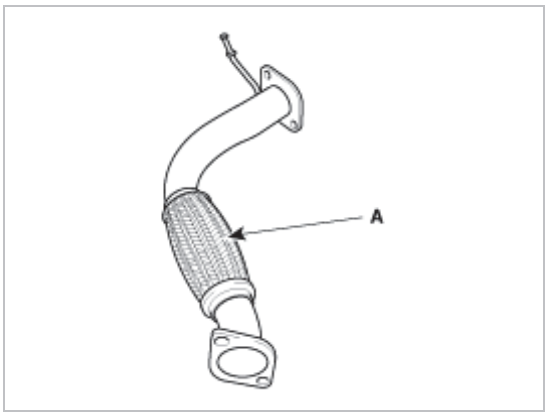


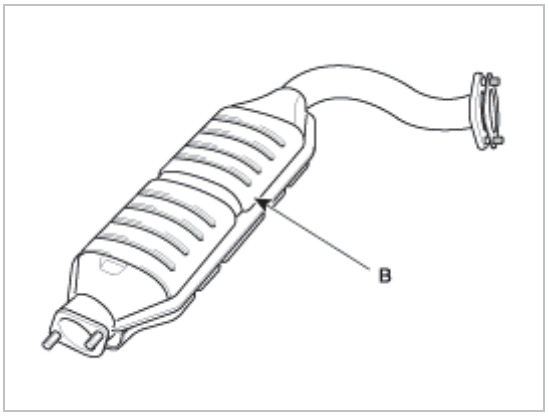
34. Remove the front propeller shaft(A).



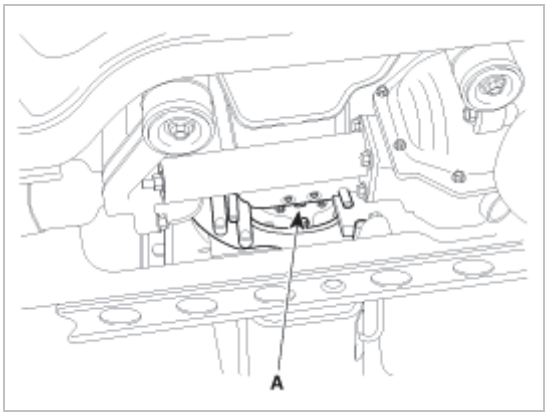


35. Remove the front exhaust pipe(A) and muffler(B).

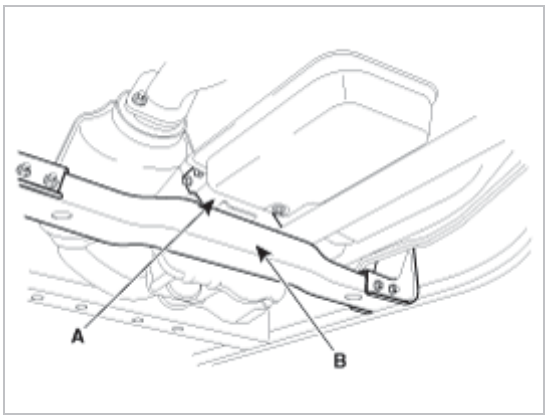




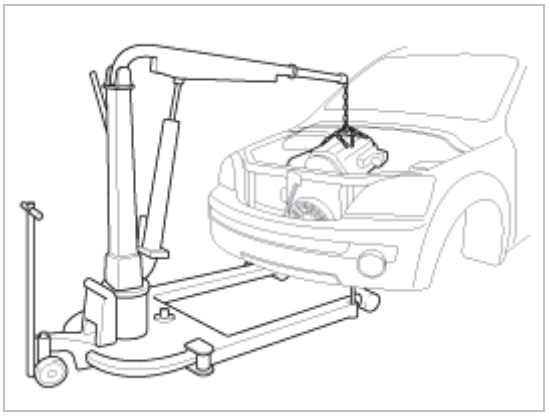
36. Remove the shift cable from the transmission.
37. Disconnect the connectors from the transmission.(See TR group)
38. Remove the transmission oil pipes.
39. Remove the drive plate-to-torque converter fixing bolts (6EA), after remove the bell housing cover. Rotate crank shaft pulley to gain access to all bolts.



40. Remove the starter.
41. Remove the transmission housing fixing bolts.
42. Remove the transmission mounting(A) and the cross member(B) after support the transmission by using a jack.



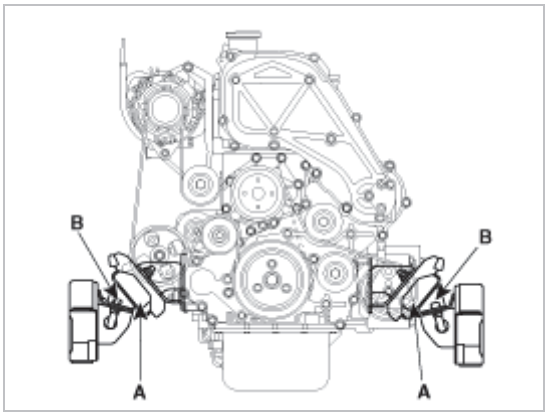
43. Remove the transmission from the vehicle.
44. Remove the engine mounting.
45. Remove the engine assembly from engine room, by using a engine crane.



INSTALLATION (A/T EQUIPPED VEHICLE)

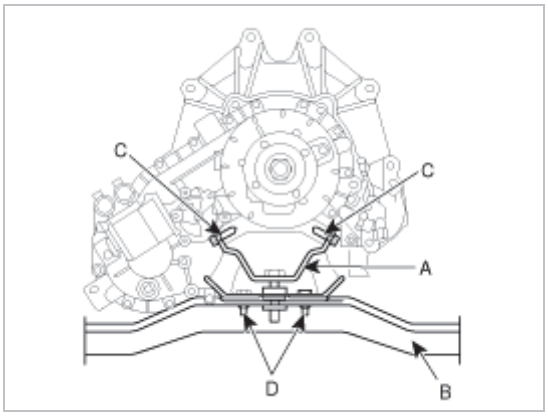
1. Install the engine assembly to engine room, by using a engine crane.
2. Install the engine mounting(A).

Tightening torque
68.6-88.3 N.m (7.0- 9.0 kgf.m, 50.6-65.1 lb-ft)



3. Install the transmission to the vehicle by using a jack.
4. Install the transmission mounting(A) and the cross member(B).

Tightening torque
Transmission to Mounting:
39.2-56.9 N.m(4.0- 5.8 kgf.m, 28.9-42.0 lb-ft)
Mounting to Cross member :
19.6-28.4 N.m(2.0-2.9 kgf.m, 14.5-21.0 lb-ft)
Cross member to Frame :



5. Install the transmission housing fixing bolts.
6. Install the starter.

Tightening torque
26.5-33.3 N.m (2.7-3.4 kgf.m, 19.5-24.6 lb-ft)

7. Install the drive plate-to-torque converter fixing bolts (6EA). Rotate crank shaft pulley to gain access to all bolts.
8. Install the bell housing cover.

Tightening torque
9.8-11.8 N.m(1.0-1.2 kgf.m, 7.2-8.7 lb-ft)

9. Install the transmission oil pipe.
10. Reconnect the connectors (8EA) to the transmission.
11. Install the shift cable to the transmission.
12. Install the front exhaust pipe and muffler.

Tightening torque
42.2-60.8 N.m(4.3-6.2 kgf.m, 31.1-44.8 lb-ft)

13. Install the front propeller shaft.

Tightening torque
Part time 4WD :
26.5·29.4 N.m (2.6-3.0 kgf.m, 18.8-21.7 lb-ft)
Full time 4WD :
49.0-58.8 N.m (5.0-6.0 kgf.m, 36.2-43.4 lb-ft)

14. Install the rear propeller shaft.

Tightening torque
49.0-58.8 N.m (5.0-6.0 kgf.m, 36.2-43.4 lb-ft)

15. Install the transmission oil level gauge pipe.
16. Install the earth terminal to the cylinder block.
17. Reconnect the vacuum hoses to the EGR valve and intake manifold.
18. Reconnect the fuel hose to the high pressure pump.
19. Reconnect the injector, TDC sensor, water temperature sensor and starter connector.
20. Install the air conditioner compressor to the cylinder block.

Tightening torque
19.6-24.5 N.m (2.0-2.5 kgf.m, 14.5-18.1 lb-ft)

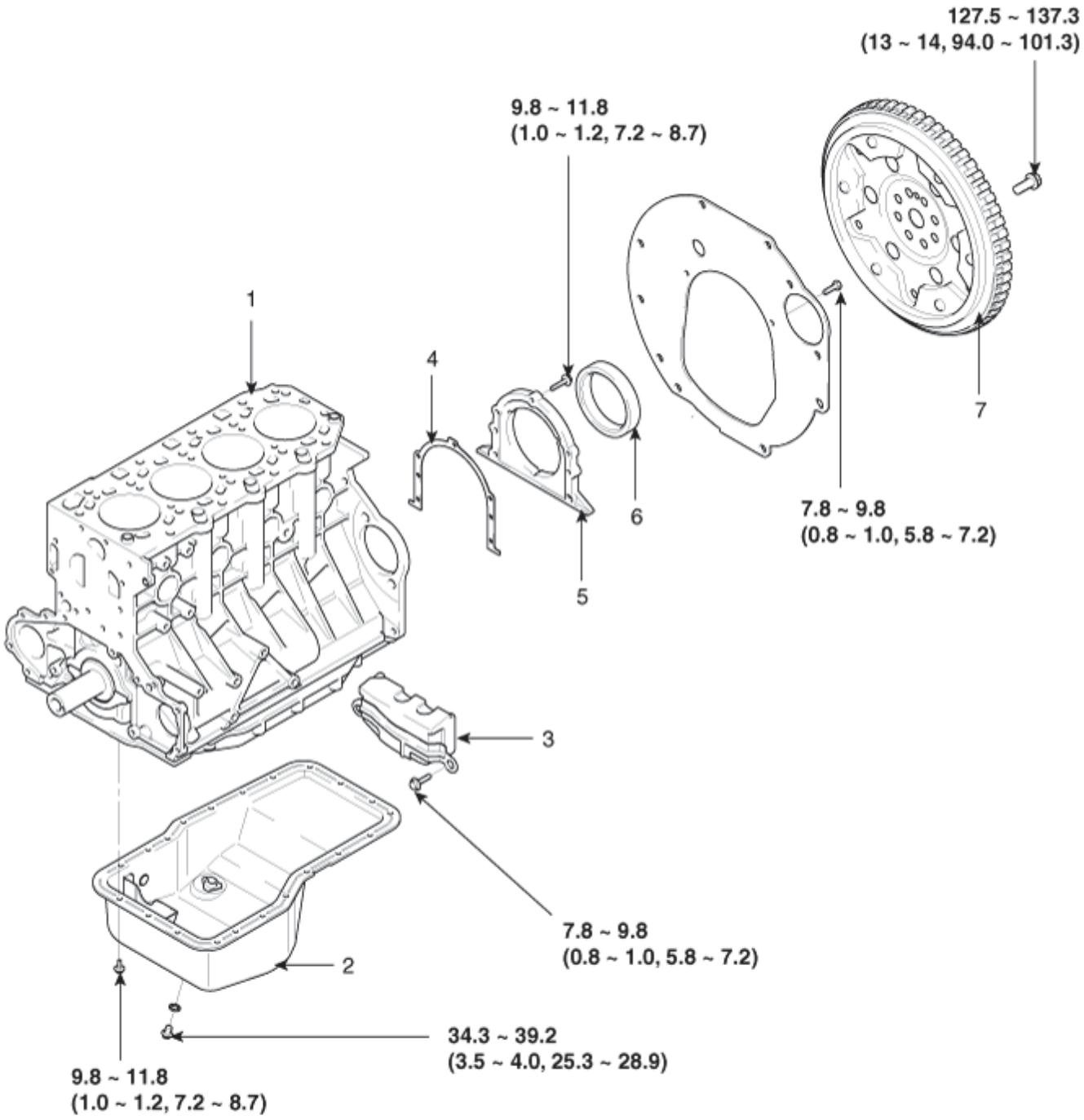
21. To install all of parts, follow the removal procedures in the reverse order.
22. Refill the transmission oil and the power steering oil and then check for leaks.
23. Refill the engine coolant and then check for leaks.

KIA MOTORS

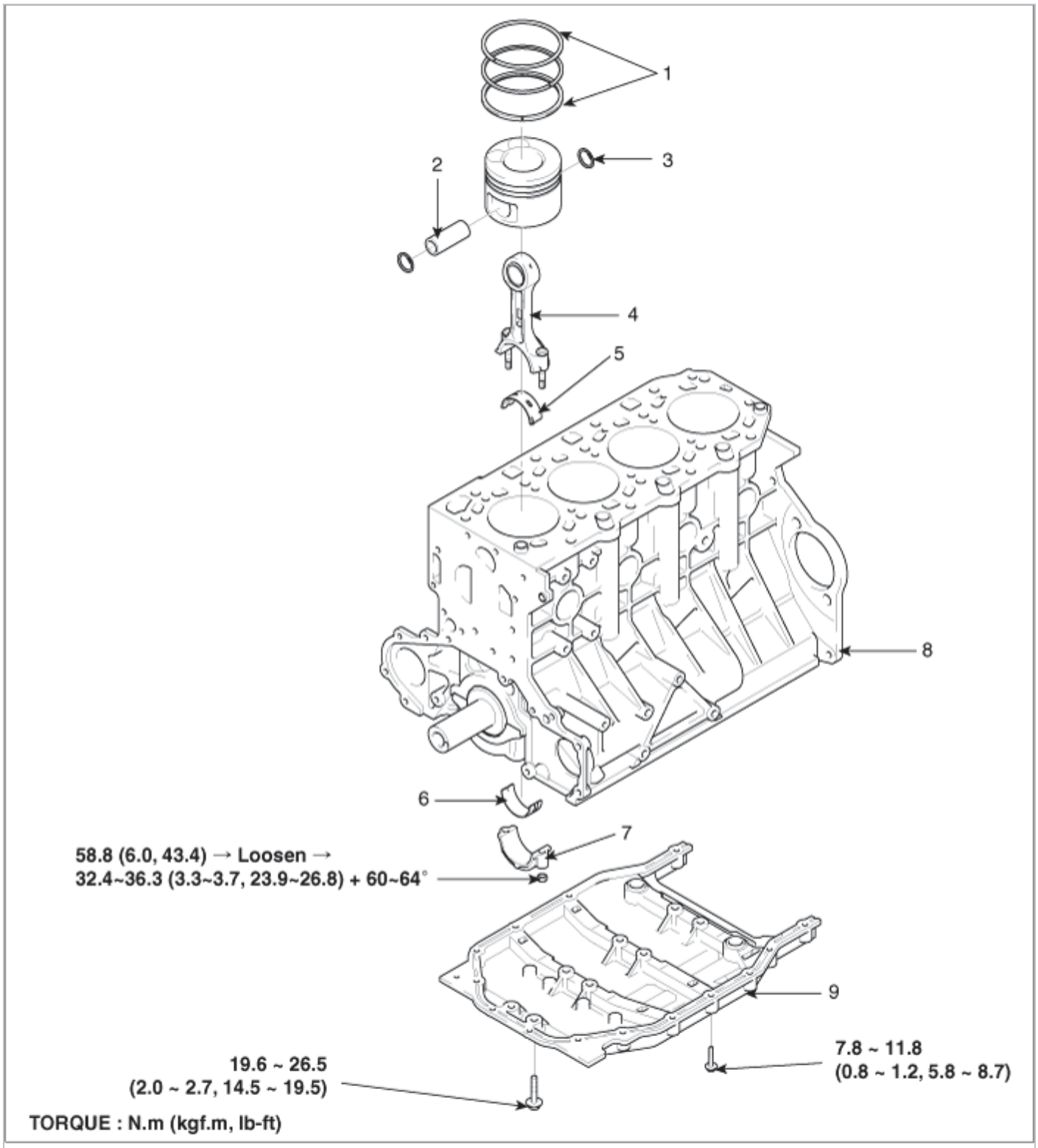
Engine Mechanical System

Cylinder Block - Cylinder Block

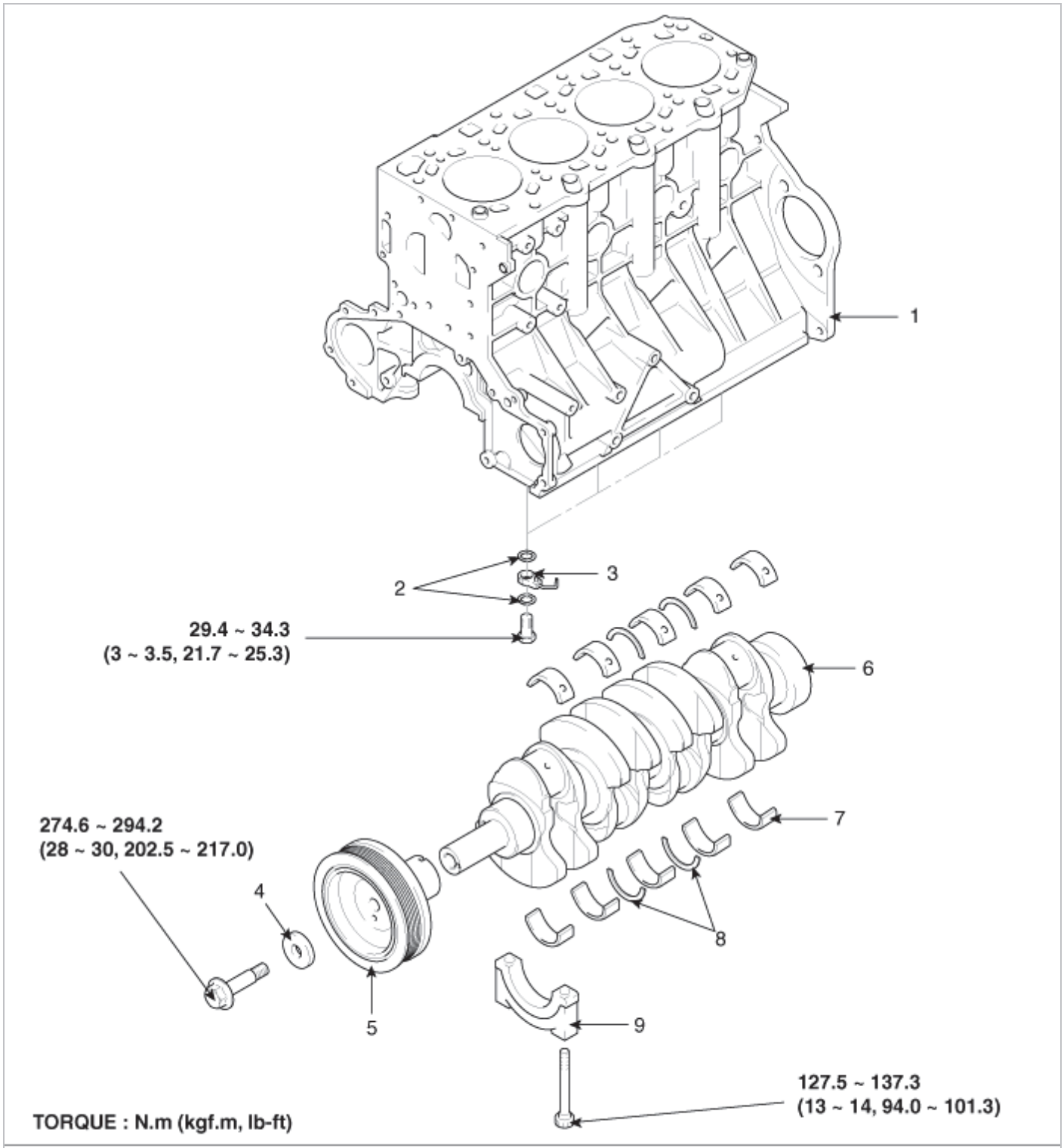
COMPONENTS



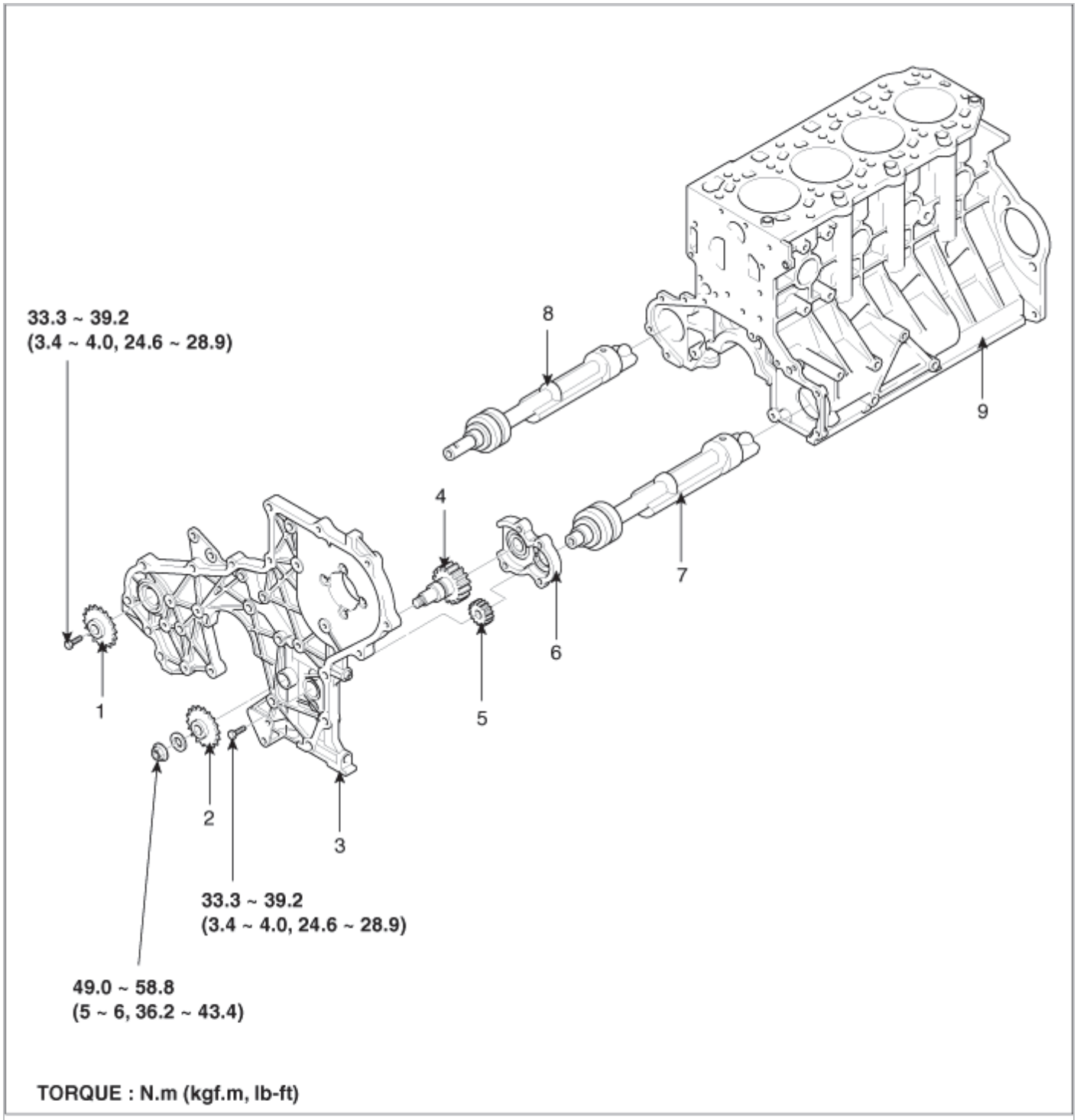
1. Cylinder block
2. Oil pan
3. Bell housing cover
4. Gasket
5. Oil seal case
6. Oil seal
7. Fly wheel



1. Piston ring
2. Piston pin
3. Snap ring
4. Connecting rod
5. Connecting rod bearing
6. Connecting rod bearing
7. Connecting rod bearing cap
8. Cylinder block
9. Bet plate



1. Cylinder block
2. Gasket
3. Oil jet
4. Washer
5. Crankshaft pulley
6. Crankshaft
7. Main bearing
8. Thrust bearing
9. Main bearing cap

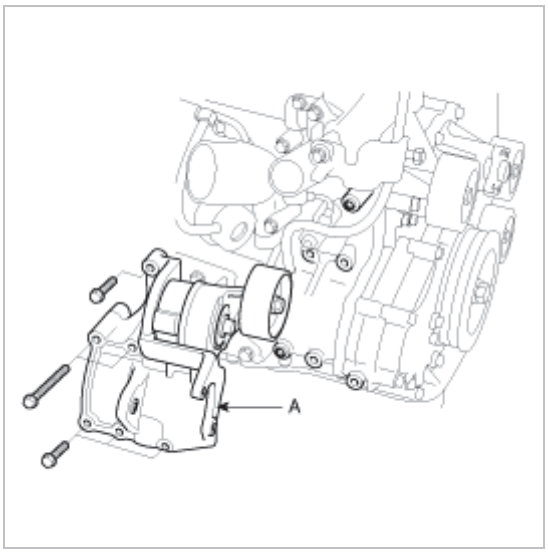


TORQUE : N.m (kgf.m, lb-ft)

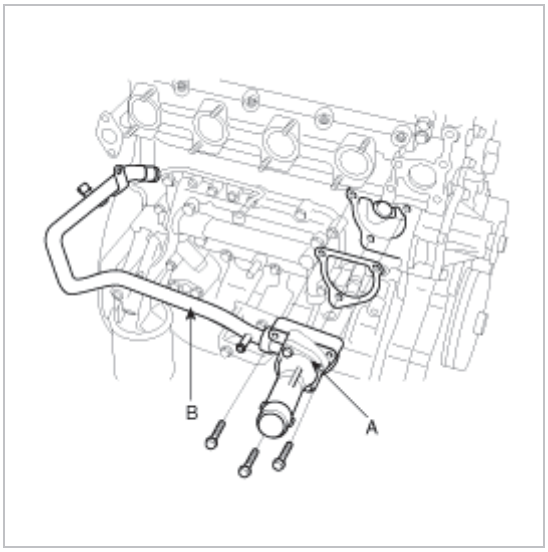
1. RH Balance shaft sprocket
2. LH Balance shaft sprocket
3. Timing chain lower under cover
4. Drive gear
5. Driven gear
6. Cover
7. LH Balance shaft
8. RH Balance shaft
9. Cylinder block

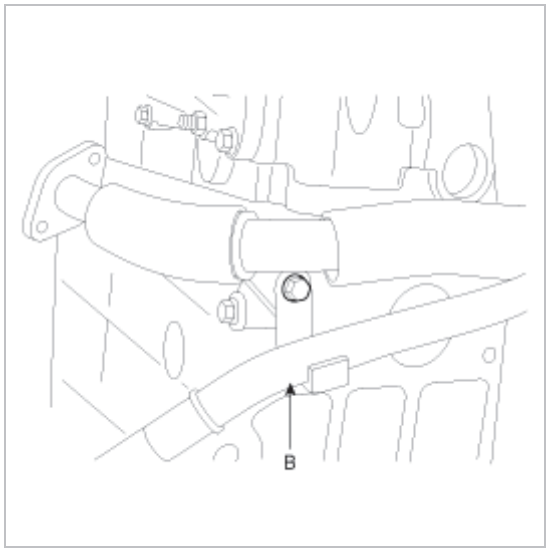
REMOVAL

1. Remove the engine and transaxle assembly from the vehicle.
2. Remove the fly wheel or drive plate.
3. Remove the timing chain
4. Remove the intake manifold and exhaust manifold.
5. Remove the cylinder head assembly.
6. Remove the oil lever gage assembly.
7. Remove the power steering pump.
8. Remove the power steering pump bracket (A).

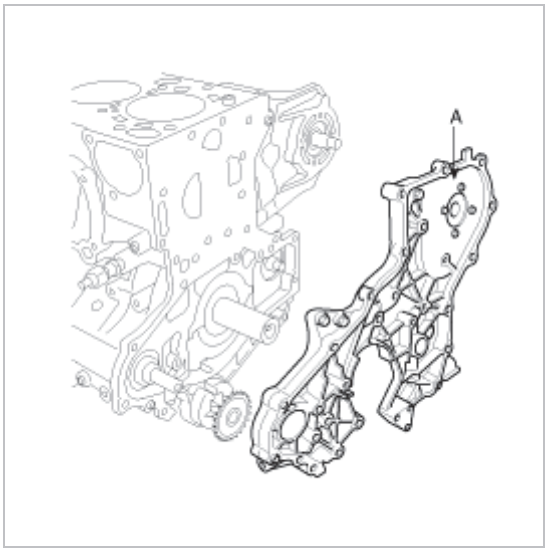


9. Remove the thermostat housing (A) and heater pipe (B).

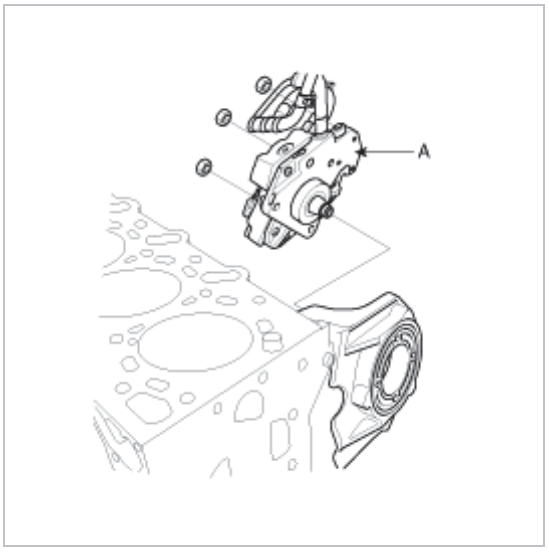




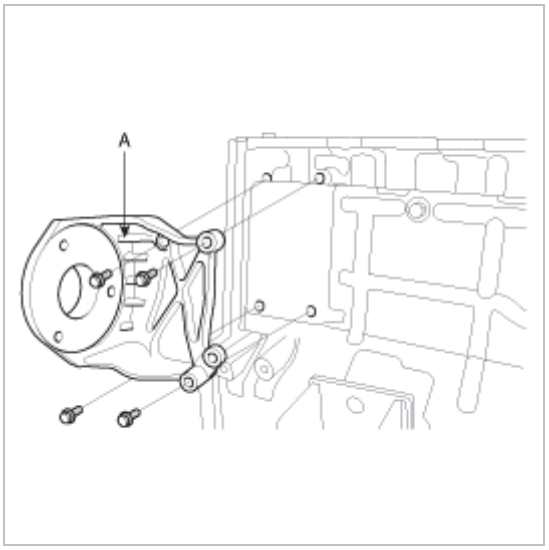
10. Remove the oil cooler.
11. Remove the water pump.
12. Remover the timing lower under cover (A).



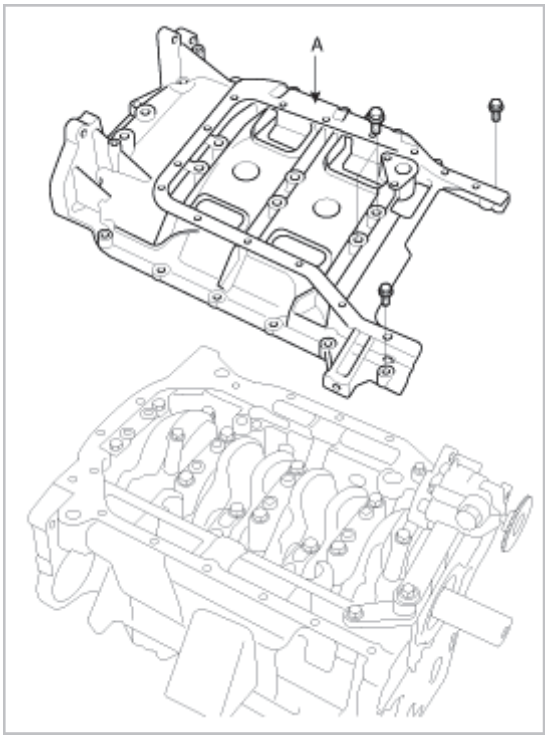
13. Remove the fuel pump (A).



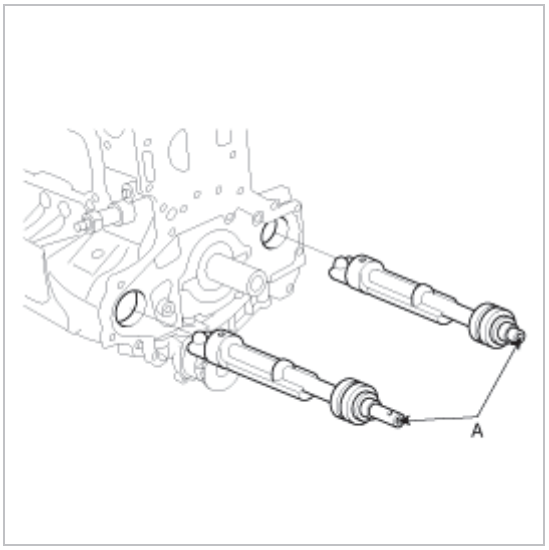
14. Remove the fuel pump bracket (A).



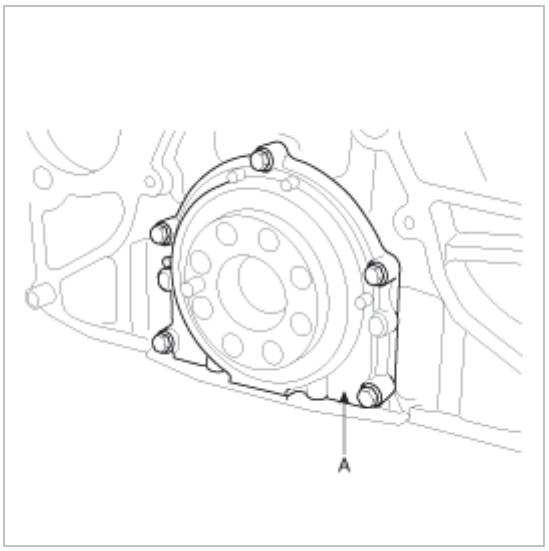
15. Remove the air compressor. (See HA group - compressor)
16. Remove the oil screen and oil supply pipe.
17. Remove the bet plate (A).



18. Remove the oil pump.
19. Remove the balance shaft (A) from cylinder block.



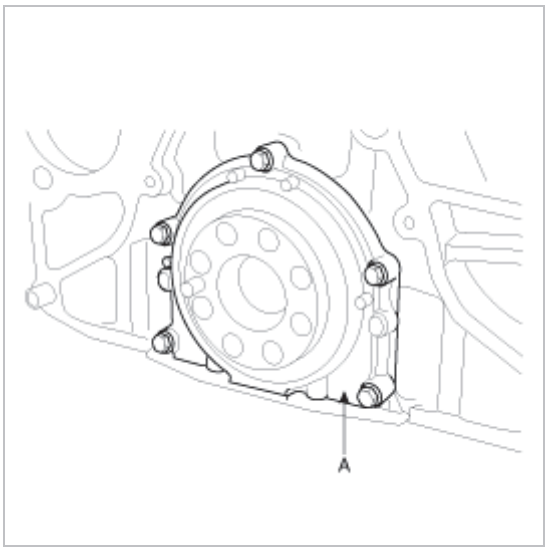
20. Remove the rear oil seal case (A).



INSTALLATION

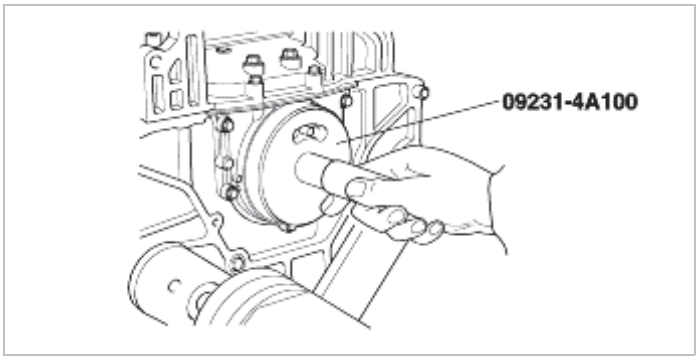
1. Install the rear oil seal (A).

Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

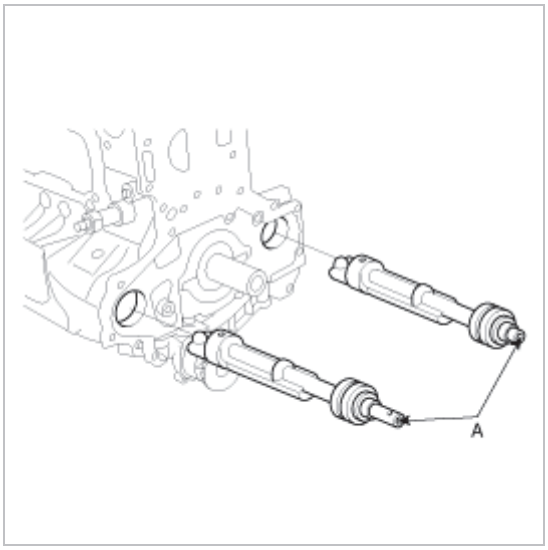


2. Temporarily install a new rear oil seal to the oil seal case and install the special tool (09231-4A100) through the rear oil seal case.

> **NOTICE**
>
> Apply engine fluid to the circumference of oil seal lip.



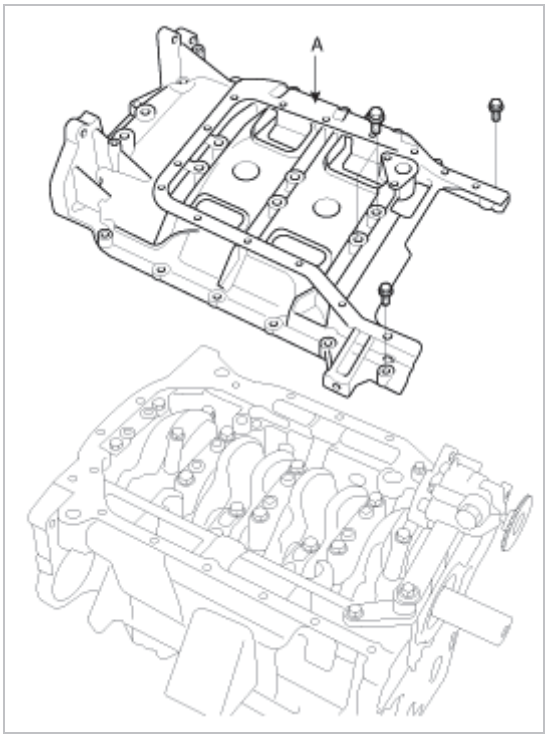
3. Apply engine fluid to the balance shaft journal and balance shaft bearing (bush).
4. Install the balance shaft(A) into cylinder block.

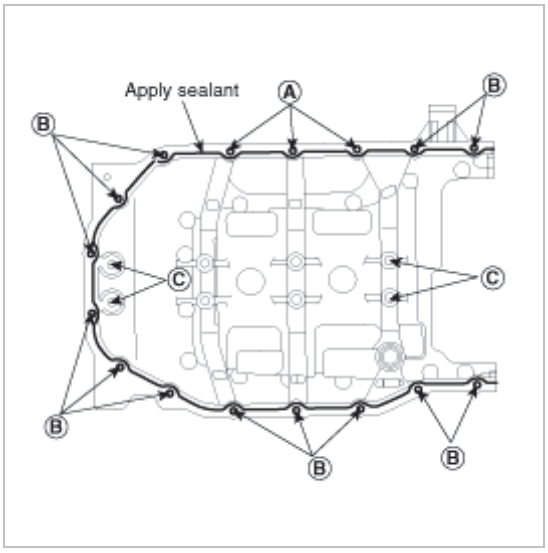


5. Install the oil pump.
6. Apply sealant on the timing chain lower under cover after clean foreign material. And Install the bet plate (A).

Bolt	Size	Quantity	Tightening torque N.m (kgf.m, lb-ft)
A	6 x 14	4 EA	9.8-11.8 (1.0-1.2, 7.2-8.7)
B	8 x 22	1 EA	19.6-26.5 (2.0-2.7, 14.5-19.5)
C	8 x 30	1 EA	19.6-26.5 (2.0-2.7, 14.5-19.5)
D	8 x 40	1 EA	19.6-26.5 (2.0-2.7, 14.5-19.5)

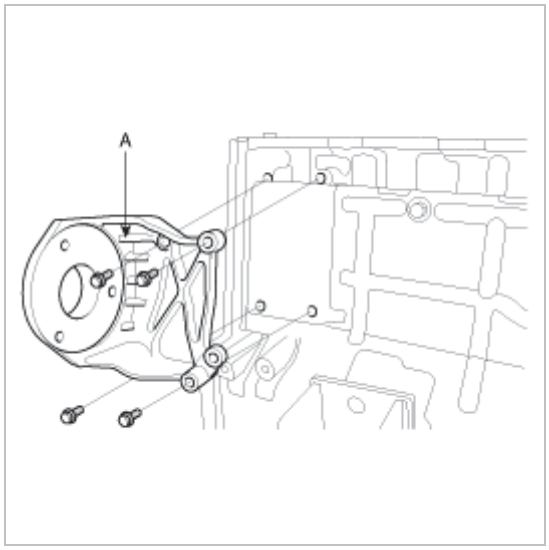
* Bolts size = Diameter x Length





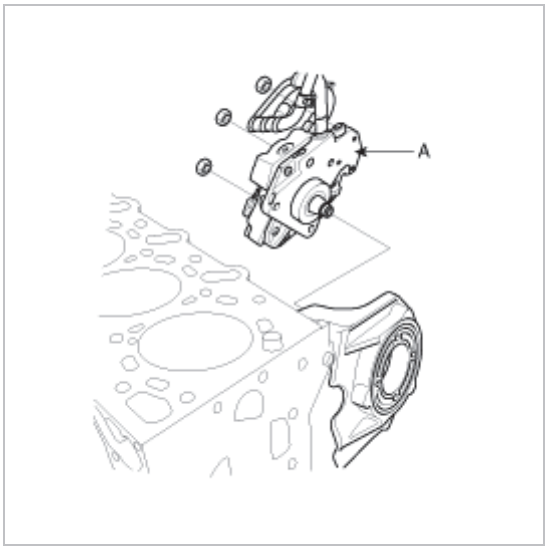
7. Install the oil screen and oil supply pipe.
8. Install the air compressor. (See HA group)
9. Install the fuel pump bracket (A).

Tightening torque :
19.6 ~ 26.5N.m (2.0~ 2.7kgf.m, 14.5~19.5lb-ft)



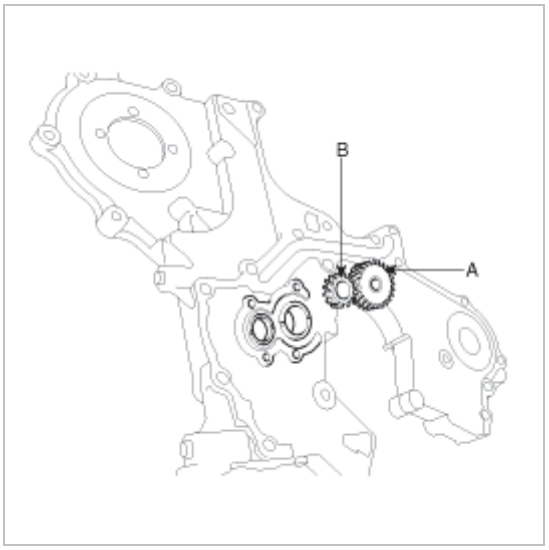
10. Install the fuel pump (A).

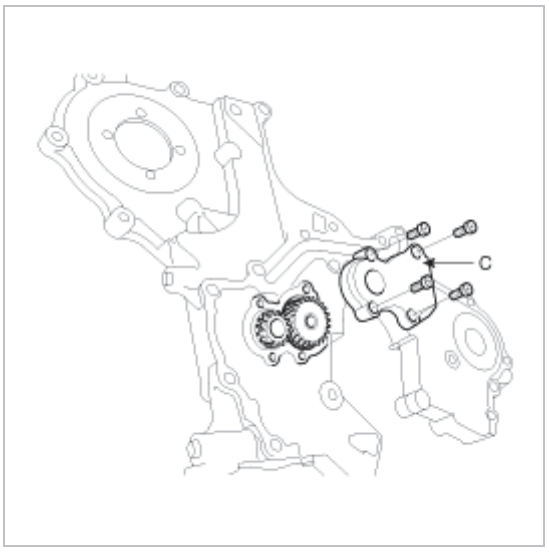
Tightening torque :
14.7 ~ 19.6N.m (1.5~ 2.0kgf.m, 10.8~14.5lb-ft)



11. Install the balance shaft drive gear (A) and driven gear (B) on the timing chain lower under cover.

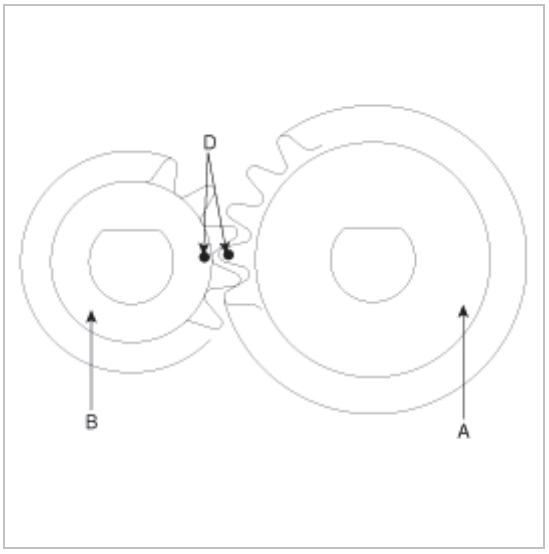
Drive gear and driven gear cover (C) :
Tightening torque :
7.8-11.8 N.m (0.8-1.2 kgf.m, 5.8-8.7 lb-ft)





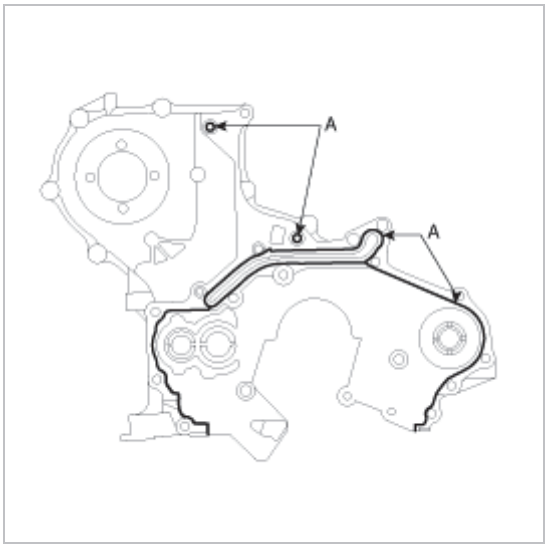
NOTICE

Align timing mark (D) on the drive gear (A) and driven gear (B).



12. Apply sealant (A) on the timing chain lower under cover after clean foreign material.

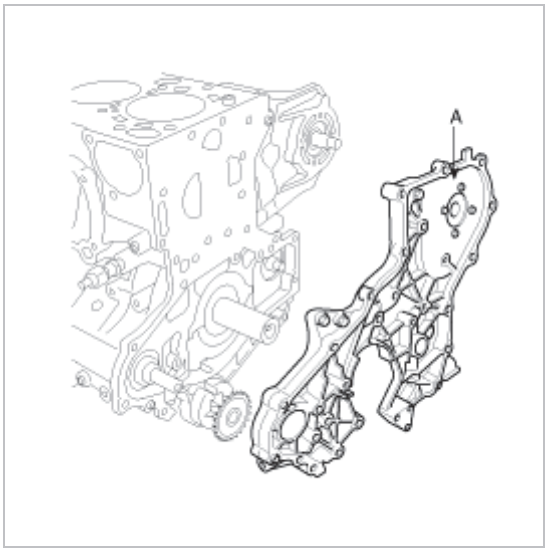
Sealant type: Lotite #5902
Bead width: 2 - 4mm (0.08 - 0.16 in)

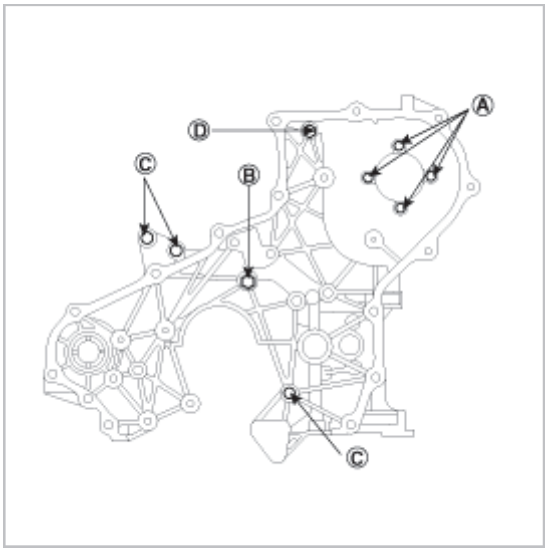


13. Install the timing chain lower under cover (A).

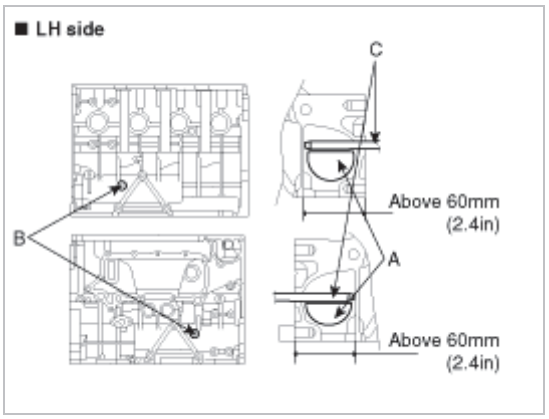
Bolt	Size	Quantity	Tightening torque N.m (kgf.m, lb-ft)
A	6 x 14	4 EA	9.8-11.8 (1.0-1.2, 7.2-8.7)
B	8 x 22	1 EA	19.6-26.5 (2.0-2.7, 14.5-19.5)
C	8 x 30	3 EA	19.6-26.5 (2.0-2.7, 14.5-19.5)
D	8 x 40	1 EA	19.6-26.5 (2.0-2.7, 14.5-19.5)

*Bolts size = Diameter x Length



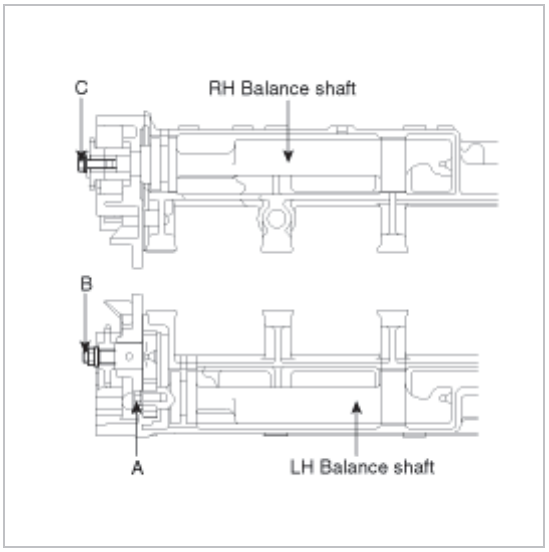


14. Insert a screw driver(C) in the cylinder block plug hole (B). Because, prevent rotation of balance shaft (A).



15. Install the LH balance shaft driven gear bolt (A) (8 x 16).

Tightening torque :
33.3 ~ 44.1N.m (3.4~ 4.0kgf.m, 24.6~32.5lb-ft)



16. Install the balance shaft sprocket.

Tightening torque :
LH balance shaft sprocket nut :
49.0-58.8 N.m (5.0-6.0 kgf.m, 36.2-43.4 lb-ft)
RH balance shaft sprocket bolt (8 x 16) :

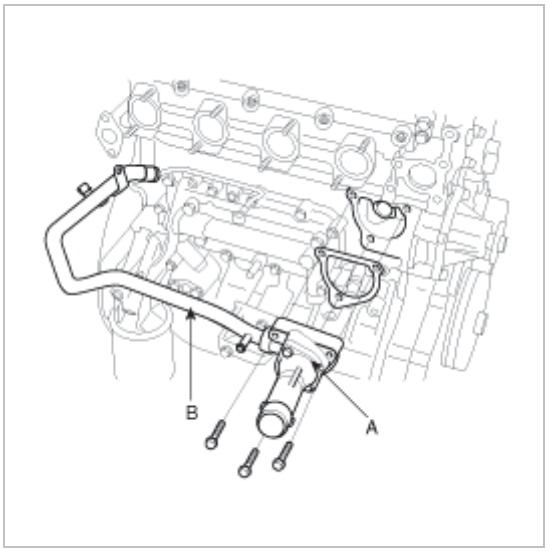
33.3-39.2 N.m (3.4-4.0 kgf.m, 24.6-28.9 lb-ft)

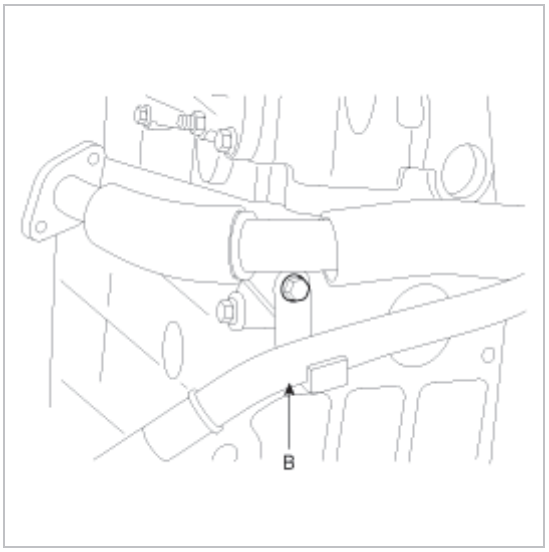
17. Install plug on the cylinder block after remove driver.

Tightening torque (plug) :
14.7-21.6 N.m (1.5-2.2 kgf.m, 10.8-15.9 lb-ft)

18. Install the water pump.
19. Install the oil cooler.
20. Install the thermostat housing (A) and heater pipe (B).

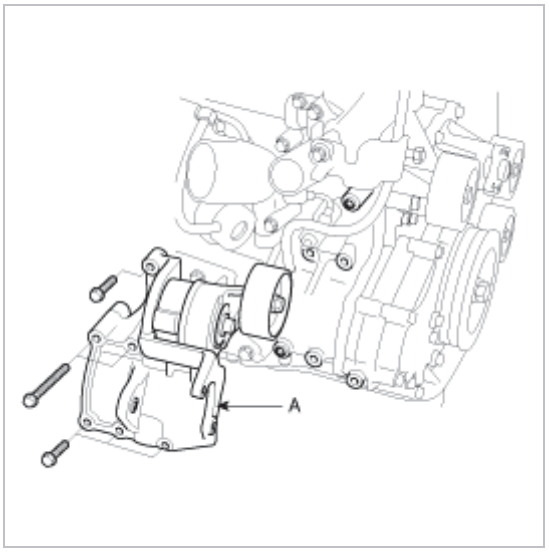
Tightening torque :
Thermostat housing: 19.6~26.5 N.m (2.0-2.7 kgf.m, 14.5 – 19.5 lb-ft)
Heater pipe: 7.8-11.8 N.m (0.8~1.2 kgf.m, 5.8-8.7 lb-ft)





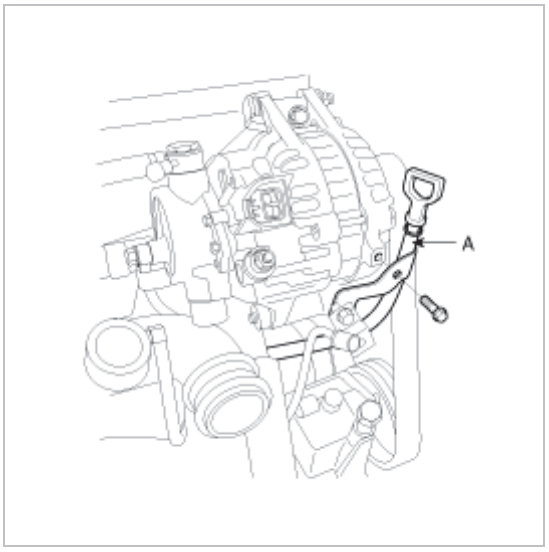
21. Install the power steering pump bracket (A).

Tightening torque :
19.6~26.5 N.m (2.0-2.7 kgf.m, 14.5-19.5 lb-ft)



22. Install the power steering pump.(See ST group)
23. Install the oil gage assembly (A).

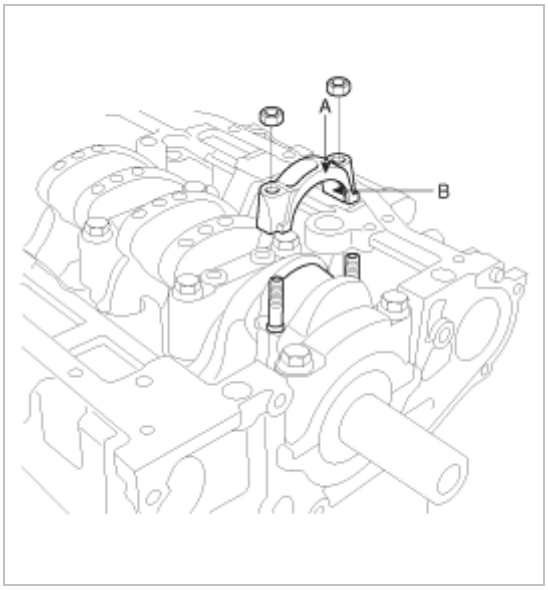
Tightening torque :
19.6~26.5 N.m (2.0~2.7 kgf.m, 14.5~19.5 lb-ft)



24. Install the cylinder head.
25. Install the intake manifold and exhaust manifold.
26. Install the timing chain.
27. Install the fly wheel or drive plate.
28. Install the engine and trans axle.

DISASSEMBLY

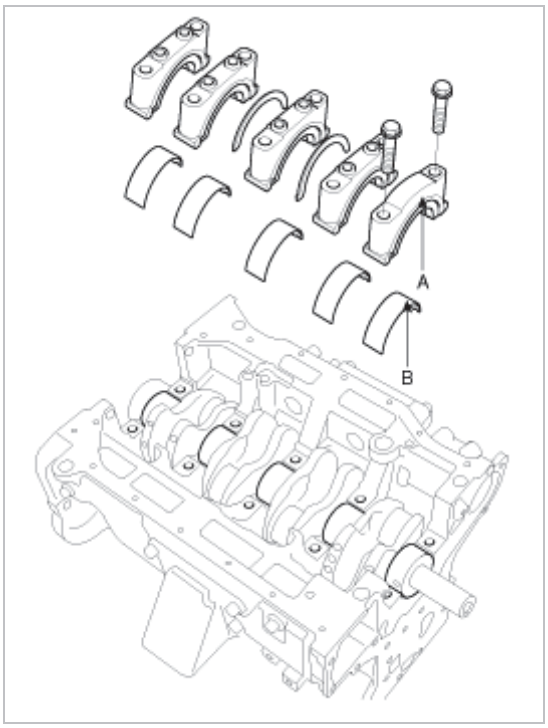
1. Remove the connecting rod bearing cap (A) and bearing (B).



NOTICE

Mark the connecting rod bearing caps to be able to reassemble in the original position and direction.

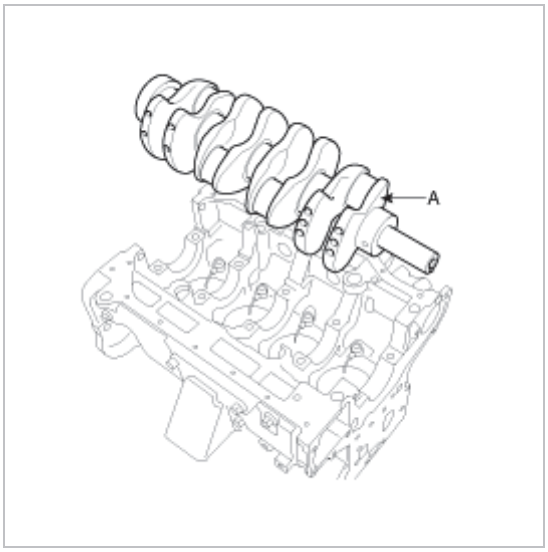
2. Remove the piston and connecting rod assembly from the cylinder block.
3. Remove the main bearing cap (A) and bearing (B).



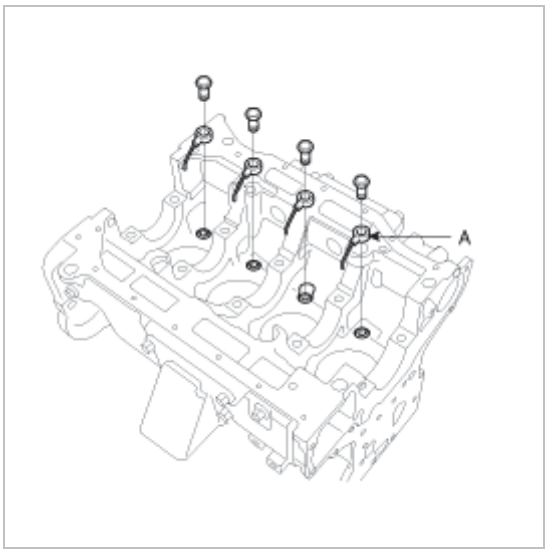
4. Remove the clank shaft (A) from cylinder block.

CAUTION

Clank shaft being careful not to damage the journals.



5. Remove the oil jet (A).

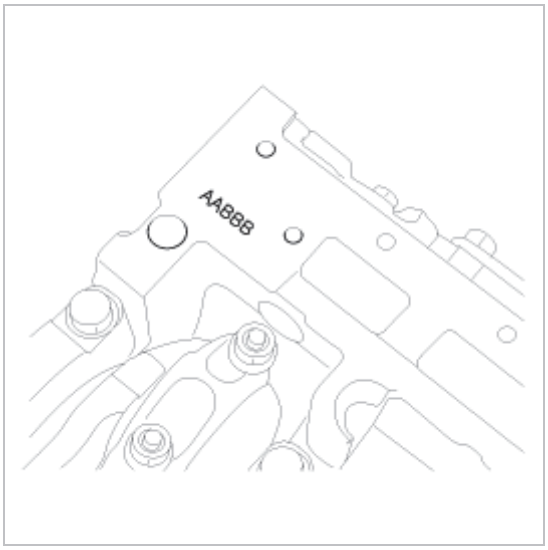


MAIN JOURNAL BEARING

1. Check the cylinder block main bearing bore size code.

NOTICE

Record the cylinder block main bearing bore size code letters on cylinder block as shown.
Reading order is from left to right with front main bearing bore size code shown first.



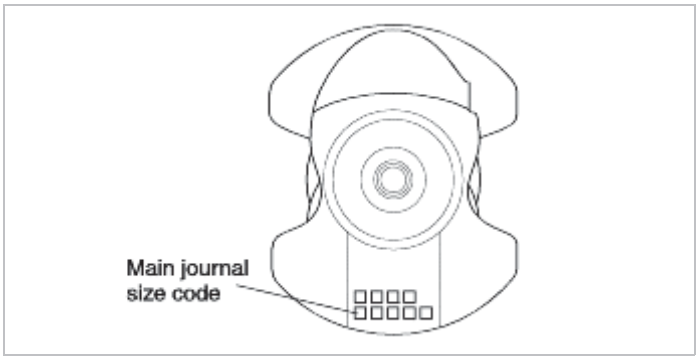
CYLINDER BLOCK MAIN BEARING BORE DIAMETER

Code	Cylinder block main bearing bore diameter (mm (in))
A	71.000 - 71.008 (2.7953 - 2.7956)
B	71.006 - 71.016 (2.7956 - 2.7959)
C	71.016 - 71.024 (2.7957 - 2.7962)

2. Check the crankshaft main journal size code.

NOTICE

Record the main journal size code letters on the crankshaft balance weight.
Reading order is from left to right as shown, with No. 1 main journal size code shown first.



CRANKSHAFT MAIN JOURNAL DIAMETER

Code	Crankshaft main journal diameter (mm (in))
A	66.994 - 67.000 (2.6376 - 2.6378)
B	66.988 - 66.994 (2.6373 - 2.6376)
C	66.982 - 66.988 (2.6371 - 2.6373)

3. Choose proper main journal bearing in below table.

MAIN JOURNAL BEARING SELECTION TABLE

Main journal bearing		Cylinder block main bearing bore size code		
		A	B	C
Crankshaft pin journal size code	A	Green	Yellow	None
	B	Yellow	None	Blue

	C	None	Blue	Red

Main journal bearing oil clearance :
0.030 - 0.054 mm (0.0012 - 0.0021 in)

MAIN JOURNAL BEARING THICKNESS

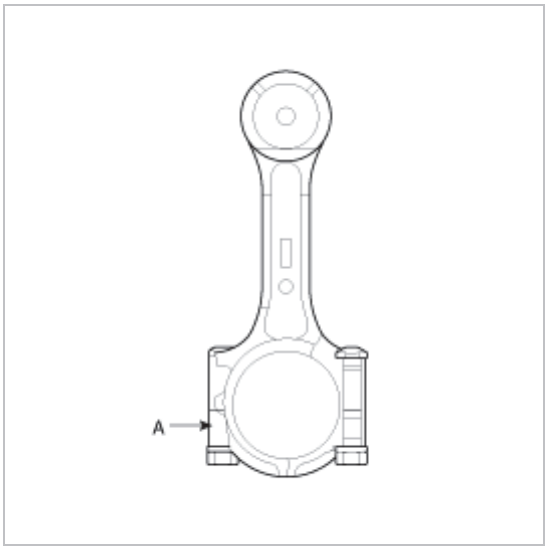
Color	Main journal bearing thickness (mm (in))
Red	1.994 - 1.997 (0.0785 - 0.0786)
Blue	1.991 - 1.994 (0.0784 - 0.0785)
None	1.988 - 1.991 (0.0783 - 0.0784)
Yellow	1.985 - 1.988 (0.0781 - 0.0783)
Green	1.982 - 1.985 (0.0780 - 0.0781)

CONNECTING ROD BEARING

1. Check the connecting rod big-end bore size code(A).

NOTICE

Record the connecting rod big-end bore size code letters on connecting rod cap as shown.



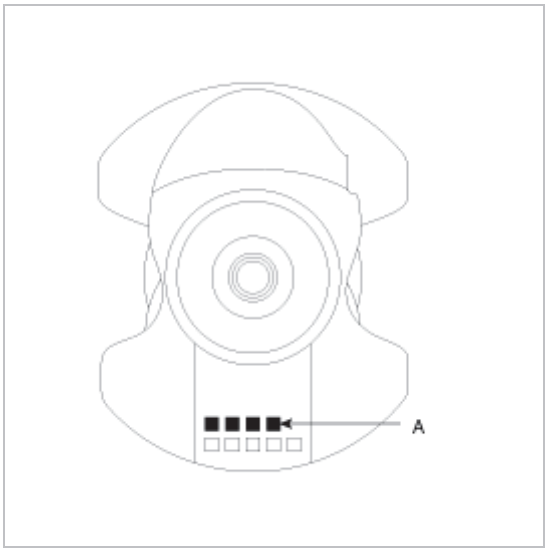
CONNECTING ROD BIG-END DIAMETER

Code	Connecting rod big-end diameter mm (in)
A	60.000 - 60.006 (2.3622 - 2.3624)
B	60.006 - 60.012 (2.3624 - 2.3627)
C	60.012 - 60.018 (2.3627 - 2.3629)

2. Check the crankshaft pin journal size code(A).

NOTICE

Record the pin journal size code letters on the No. 1 crankshaft balance weight.
Reading order is from left to right as shown, with No. 1 pin journal size code shown first.



CRANKSHAFT PIN JOURNAL DIAMETER

Code	Crankshaft pin journal diameter mm (in)
A	56.994 - 57.000 (2.2439 - 2.2441)
B	56.988 - 56.994 (2.2436 - 2.2439)
C	56.982 - 56.988 (2.2434 - 2.2436)

3. Choose proper connecting rod bearing in below table.

CONNECTING ROD BEARING SELECTION TABLE

Connecting rod bearing		Connecting rod big-end bore size code		
		A	B	C
Crankshaft pin journal size code	1	Green	Yellow	None
	2	Yellow	None	Blue
	3	None	Blue	Red

Connecting rod bearing oil clearance :
0.024 - 0.042 mm (0.0009 - 0.0017 in)

CONNECTING ROD BEARING THICKNESS

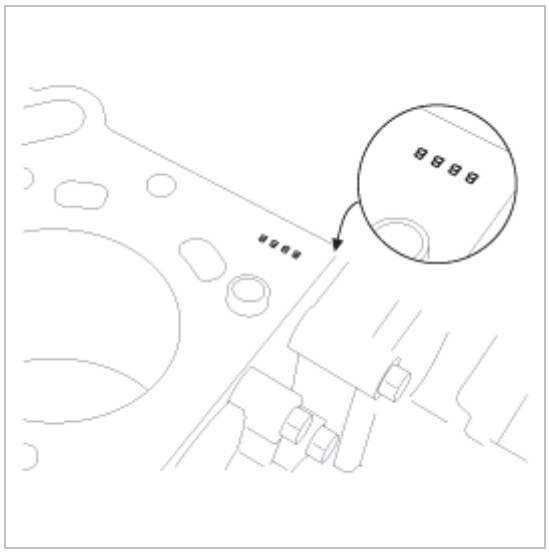
Color	Connecting rod bearing thicknessmm (in)
Red	1.497 - 1.500 (0.0589 - 0.0591)
Blue	1.494 - 1.497 (0.0588 - 0.0589)
None	1.491 - 1.494 (0.0587 - 0.0588)
Yellow	1.488 - 1.491 (0.0586- 0.0587)
Green	1.485 - 1.488 (0.0585 - 0.0586)

PISTON

1. Check the cylinder bore size code on the cylinder block bottom face.

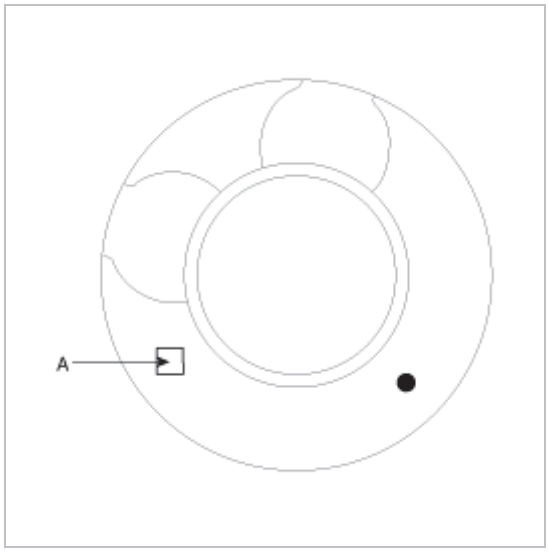
Code	Cylinder bore inner diameter (mm (in))
A	91.000-91.010 (3.5827-3.5831)
B	91.010-91.020 (3.5831-3.5835)

C	91.020-91.030 (3.5835-3.5839)



2. Check the piston size code(A) on the piston top face.

Code	Piston outer diameter (mm (in))
A	90.910-90.920 (3.5791-3.5795)
B	90.920-90.930 (3.5795-3.5799)
C	90.930-90.940 (3.5799-3.5803)

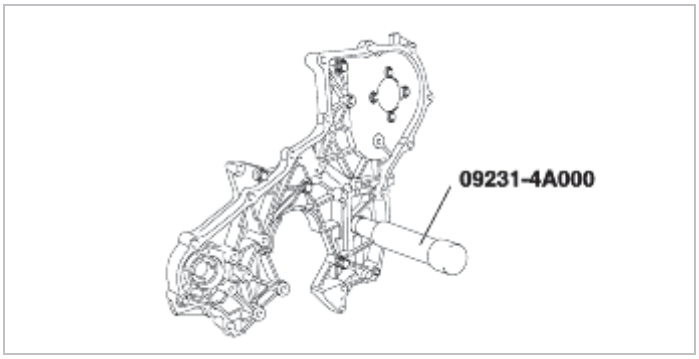


3. Select the piston related to cylinder bore size code.

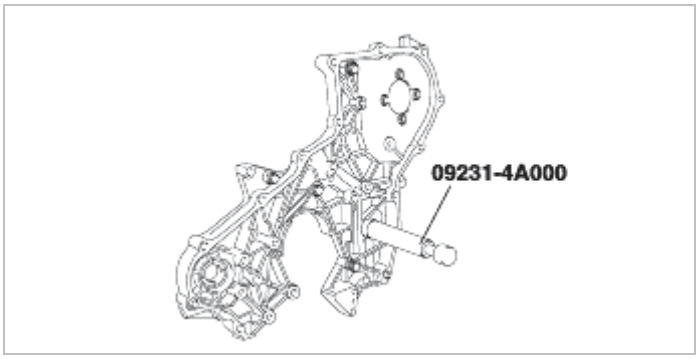
Oil clearance : 0.080-0.100 mm (0.0031-0.0039 in)

LH BALANCE SHAFT DRIVE GEAR BEARING (BUSH)

1. Use the special tool (09231-4A000) to install or remove the LH balance shaft drive gear bearing.
2. To remove the bearing, install the special tool (09231-4A000).



3. When installing the bearing, apply enough fluid to the bearing surface and cover.
4. Press-fit the bearing after aligning the bearing oil hole with the timing chain lower under cover oil hole.

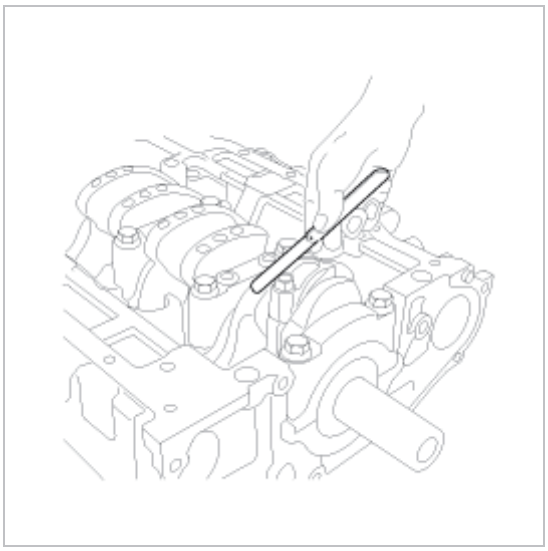


INSPECTION

CONNECTING ROD BAERING

1. Before removing the connecting rod cap, measure connecting rod side clearance. If side clearance exceeds specification, replace the connecting rod.

Side clearance : 0.05 - 0.25 mm (0.0020 - 0.0098 in)



2. Remove the connecting rod cap.
3. Measure connecting rod bearing oil clearance.
   A. Remove all foreign material and oil from the pin journals and connecting rod bearing surface.
   B. Position a plastic gauge atop the pin journals in axial direction.
   C. Install the connecting rod cap and tighten bolts.

Tightening torque :
58.8 N.m (6.0 kgf.m, 43.4 lb-ft) → Loosen → 32.4~36.3 N.m (3.3~3.7 kgf.m, 23.9~26.8 lb-ft) +

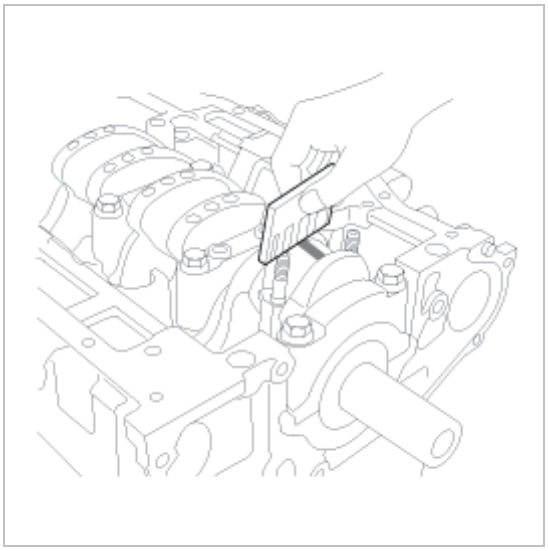
60~64°

CAUTION

Always use new connecting rod cap bolts.

D. Remove the connecting rod cap, and measure oil clearance at each journal.

Oil clearance :
0.024 - 0.042 mm (0.0009 - 0.0017 in)

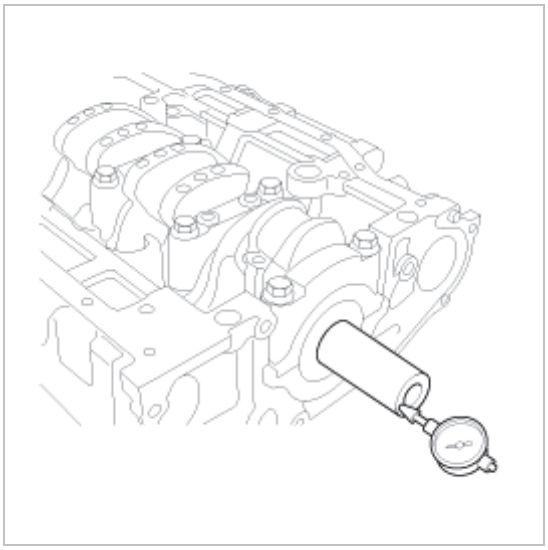


4. If oil clearance exceeds specification, replace the connecting rod bearing.

CRANK SHAFT MAIN BEARING

1. Before removing the main bearing cap, measure crankshaft end play. If end play exceeds specification, replace the thrust bearing.

End play: 0.05 - 0.25 mm (0.0020 - 0.0098 in)

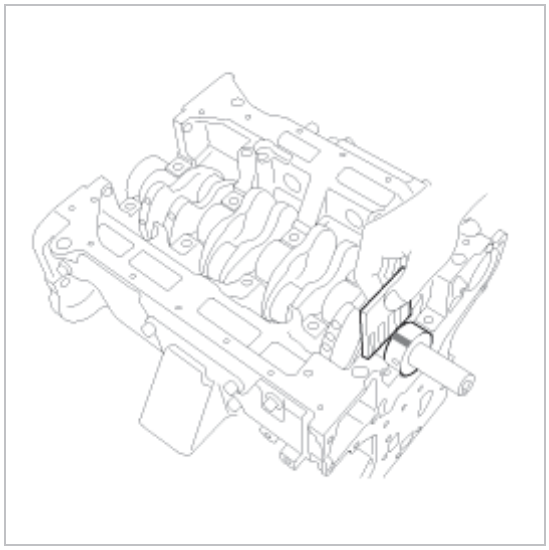


2. Remove the main bearing cap.
3. Measure main bearing oil clearance.
   A. Remove all foreign material and oil from the main journals and main bearing surface.
   B. Position a plastic gauge atop the main journals in axial direction.
   C. Install the main bearing cap and tighten bolts.

Tightening torque :
127.5-137.3 N.m (13-14 kgf.m, 94.0-101.3 lb-ft)

D. Remove the main bearing cap, and measure oil clearance at each journal.

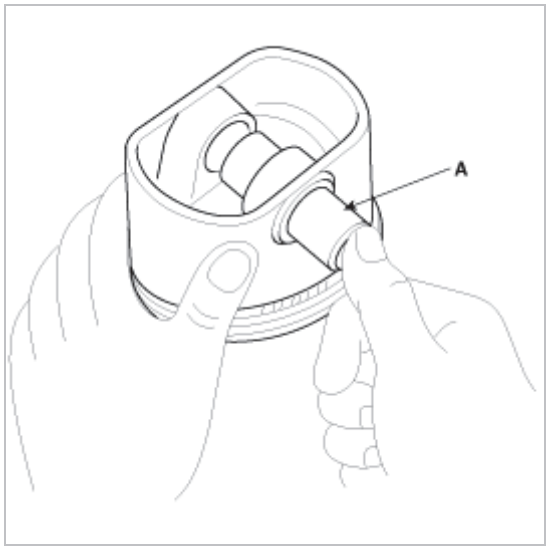
Oil clearance :
0.024 - 0.042 mm (0.0009 - 0.0017 in)

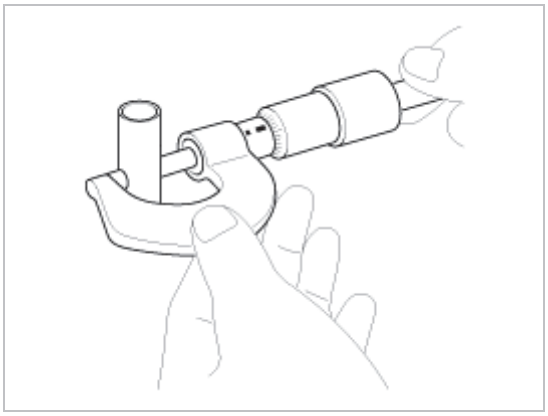


4. If oil clearance exceeds specification, replace the main bearing.

PISTON

1. Check each piston for scuffing, scoring, wear and other defects. Replace any piston that is defective.
2. Check that the piston pin fits in the piston pin hole. Replace any piston and pin assembly that is defective. The piston pin must be smoothly pressed by hand into the pin hole (at room temperature).



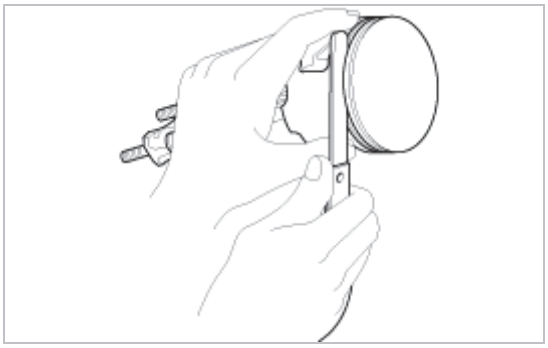


Piston pin outer diameter :
32.993-32.998 mm (1.2989-1.2991 in)
Piston pin hole inner diameter :
33.014-33.019mm (1.2998-1.3000 in)
Connecting rod small-end inner diameter :
33.020-33.033 mm (1.3000-1.3005 in)

PISTON RING

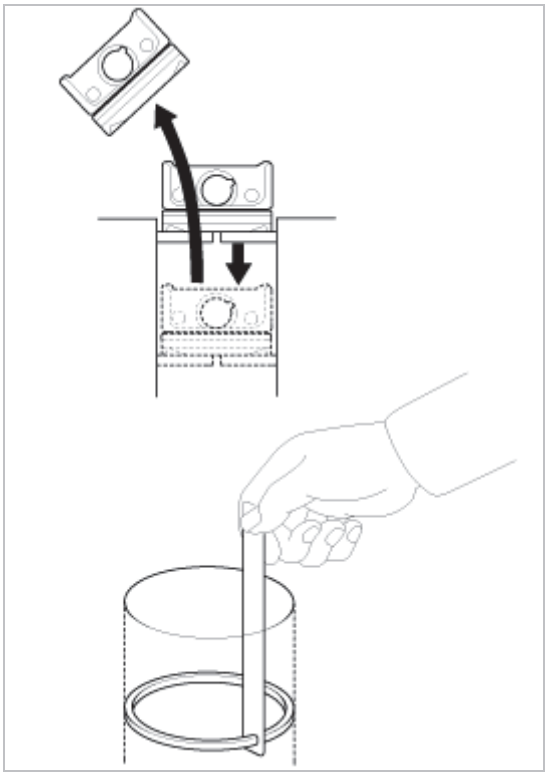
1. Check each piston ring for breakage, damage and abnormal wear. Replace the defective rings.
2. When the piston requires replacement, its ring should also be replaced.
3. Measure the clearance between piston ring and ring groove.

Piston ring side clearance :
No.2 ring : 0.05-0.09 mm (0.0020-0.0035 in)
Oil ring : 0.04-0.08 mm (0.0016-0.0031 in)



4. Place a piston ring in the cylinder bore and set it square by pushing it down with piston.

Eng gap :
No.1 ring : 0.25-0.40 mm (0.0098-0.0157 in)
No.2 ring : 0.50-0.70 mm (0.0197-0.0276 in)
Oil ring : 0.20-0.40 mm (0.0079-0.0157 in)



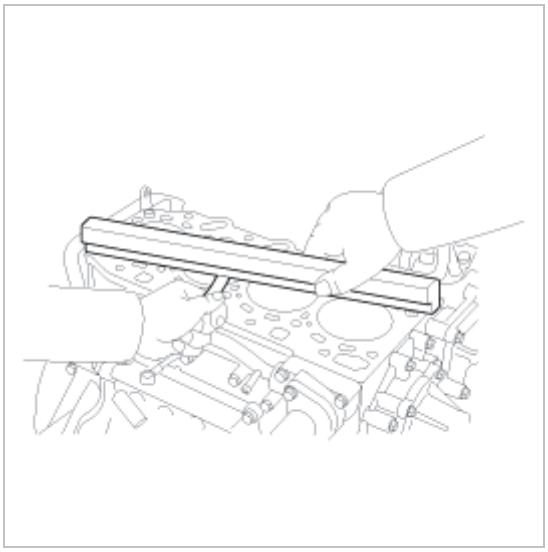
CYLINDER BLOCK

NOTICE

- Before inspection and repair, clean parts to remove dirt, oil, carbon, deposits, and scale.
- Before cleaning the cylinder block, be sure to check for evidences of water leaks and damage.
- Remover contaminants from oil holes with compressed air and, at the same time, make sure that they are not blocked.

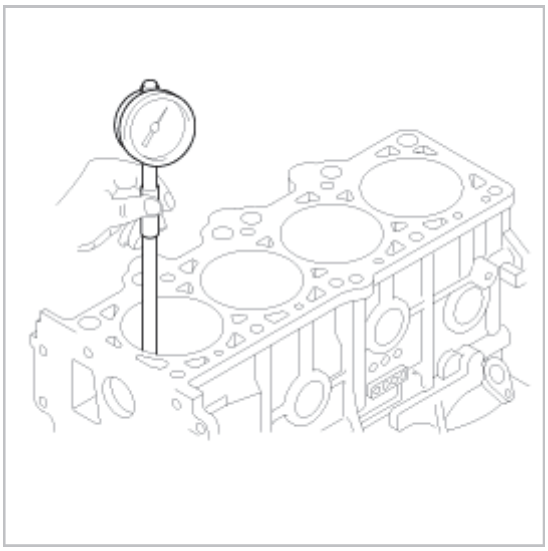
1. Check for scratches, rust, and corrosion. Use also a flaw-detecting agent for the check. If defects are evident, correct or replace.
2. Using a straightedge and thickness gauge, check the cylinder block top surface for flatness. Lay the straightedge long ways and crossways as indicated by A, B,... in illustration. If flatness is flatness is not within the limit, replace the cylinder block top surface is free from any traces of gasket material.

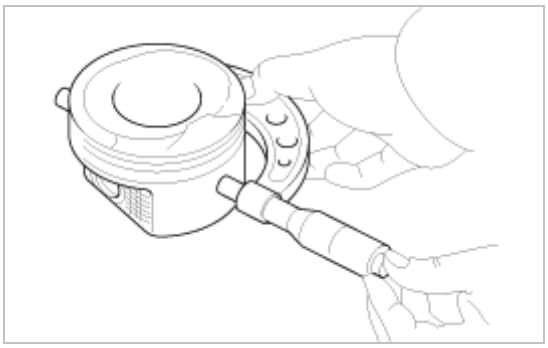
Standard value :
0.05 mm (0.002 in.)
Limit: 0.1 mm (0.004 in.)



3. Check cylinder wall for scratches and seizure.
   If defects are evident, correct (to oversize) or replace.
4. Using cylinder gauge, measure the cylinder bore.
   If it wears out excessively, bore the cylinder to oversize and replace the piston and piston rings.
   Measurement points are as shown.

Standard value :
91.000 - 91.030 mm (3.5827-3.5839 in)



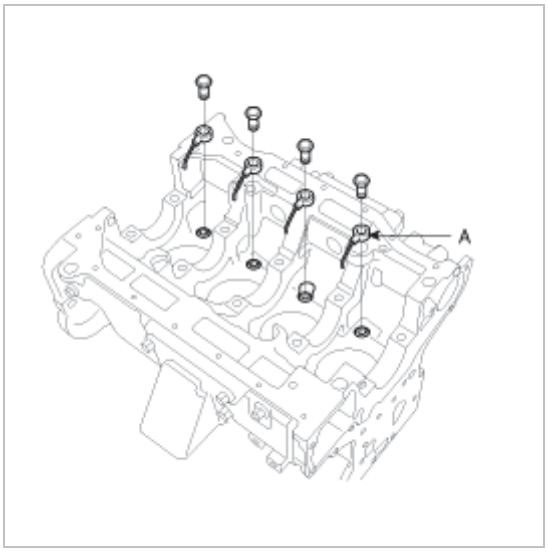


REASSEMBLY

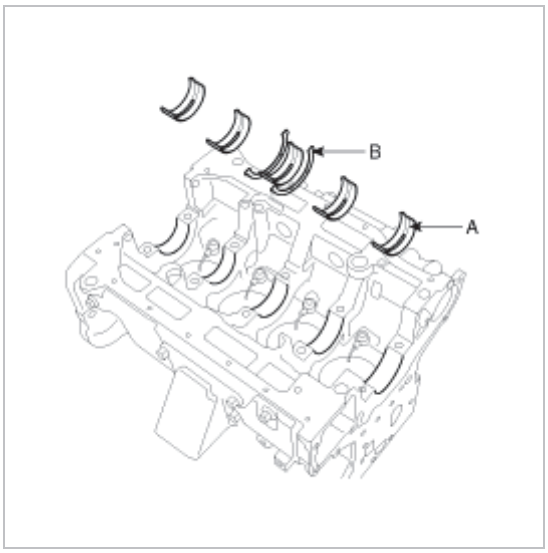
1. Install the oil jet (A).

Tightening torque :

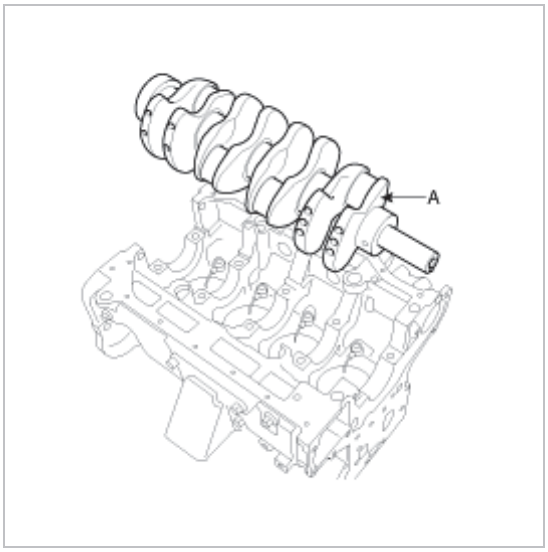
29.4 ~ 34.3N.m (3 ~ 3.5kgf.m, 21.7 ~ 25.3lb-ft)



2. Install the main bearing (A).

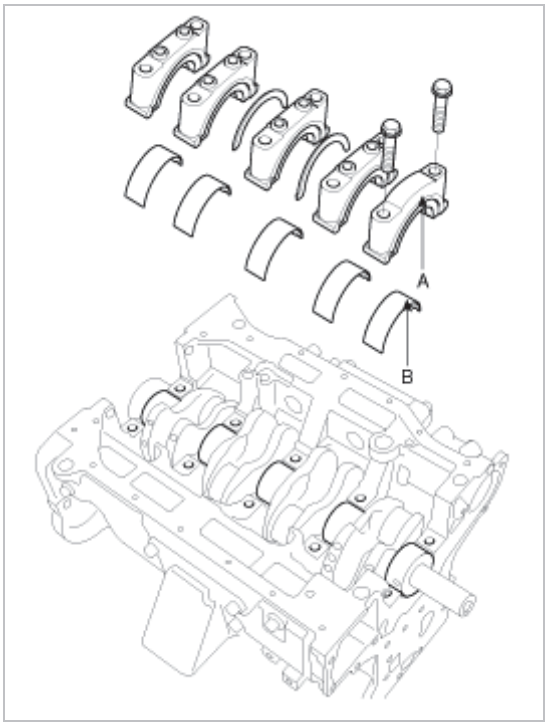


3. Install the thrust bearing (B).
4. Install the clank shaft (A).

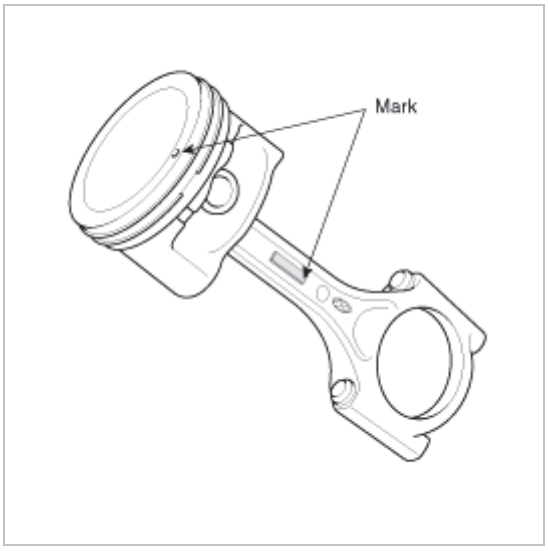


5. Check the main bearing, cap number. And then Install the main bearing (A) and bearing (B).

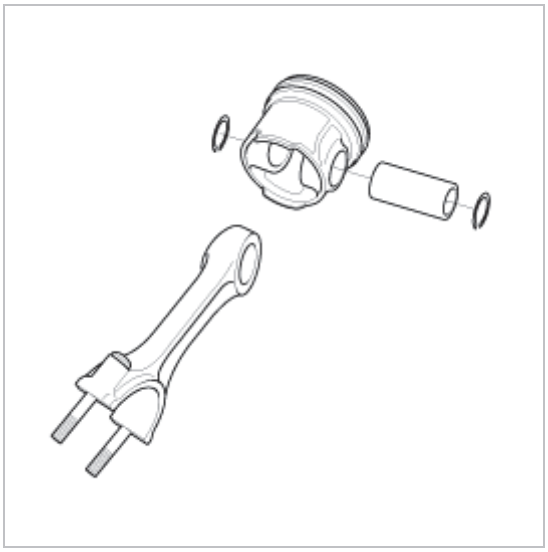
Tightening torque :
127.5 ~ 137.3N.m (13 ~ 14kgf.m, 94.0 ~101.3lb-ft)



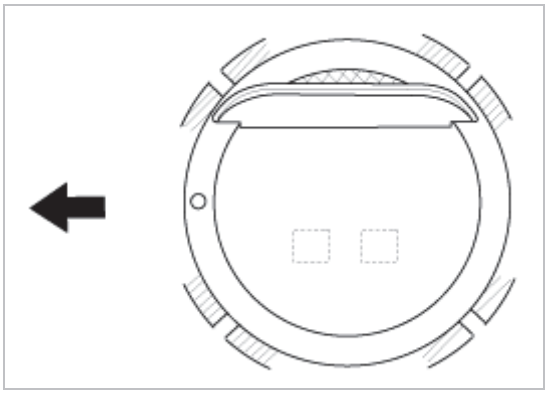
6. Check the front mark of the piston and connecting rod.



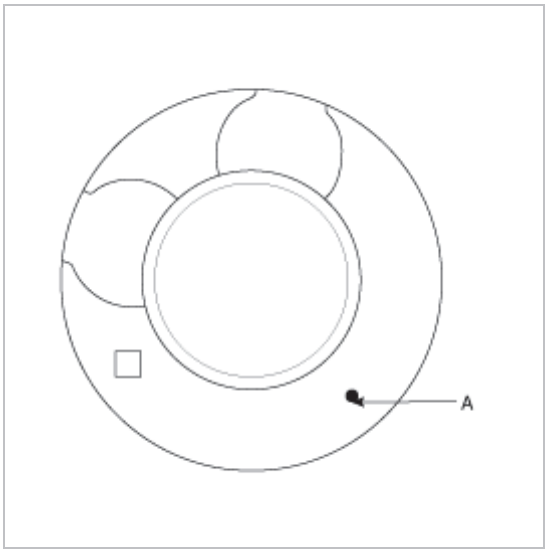
7. Line up the front marks and insert the piston pin. The piston pin must be smoothly pressed by hand into position.



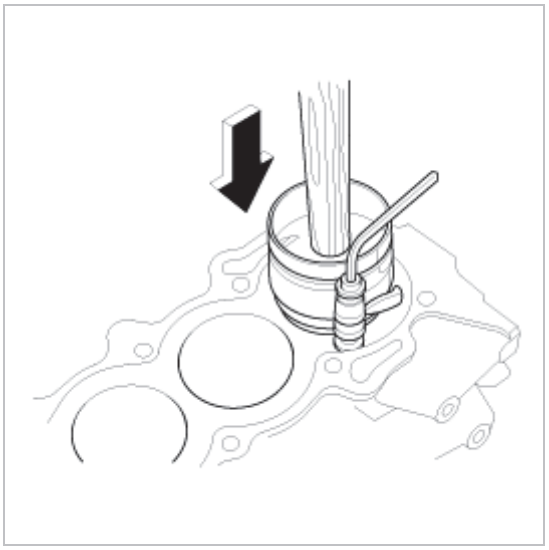
8. Install the snap ring.
9. Install the piston rings.
   A. Install the oil ring expander and 2 side rails by hand.
   B. Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
   C. Position the piston rings so that the ring ends are as shown.



10. Insert the piston and connecting rod assembly from above the top of cylinder. Ensure that the front mark (A) on the piston crown and that (front mark) on the connecting rod face toward the front of engine (to the crankshaft pulley side).



11. Clamp firm the piston rings with the ring band and install the piston assembly into cylinder. Do not strike it hard into the piston, as broken piston ring or damaged crankshaft pin journal could result.

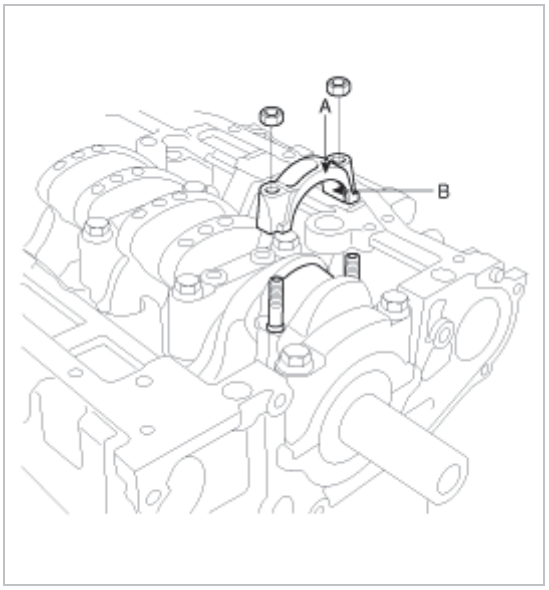


12. Install the connecting rod bearing (B).
13. Install the connecting rod and cap (A) to crankshaft pin journal.

Tightening torque :
58.8 N.m (6.0 kgf.m, 43.4 lb-ft) → Loosen → 32.4~36.3 N.m (3.3~3.7 kgf.m, 23.9~26.8 lb-ft) + 60~64°

CAUTION

Always use new connecting rod cap bolts.

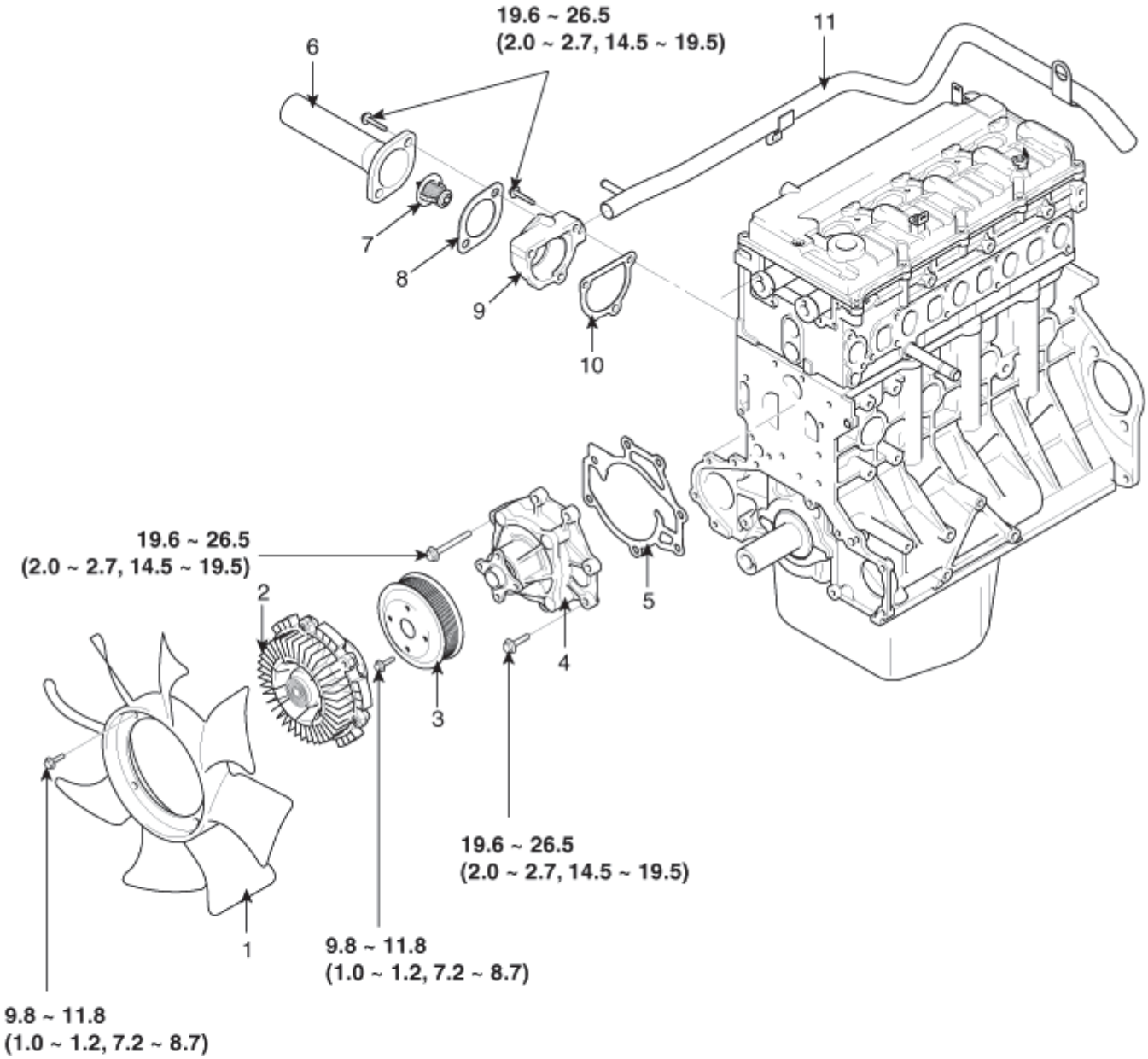


KIA MOTORS

Engine Mechanical System

Cooling System

COMPONENTS



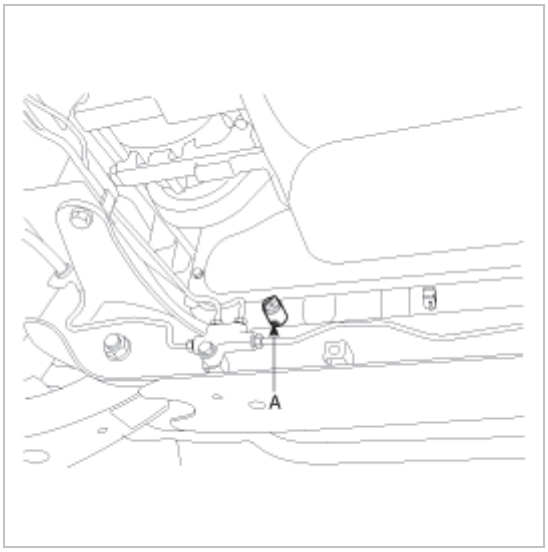
TORQUE : N.m (kgf.m, lb-ft)

1. Fan
2. Fan cluch
3. Water pump pully
4. Water pump
5. Gasket
6. Water inlet
7. Thermostat fitting
8. Gasket
9. Thermostat housing
10. Gasket
11. Heater pipe

REMOVAL

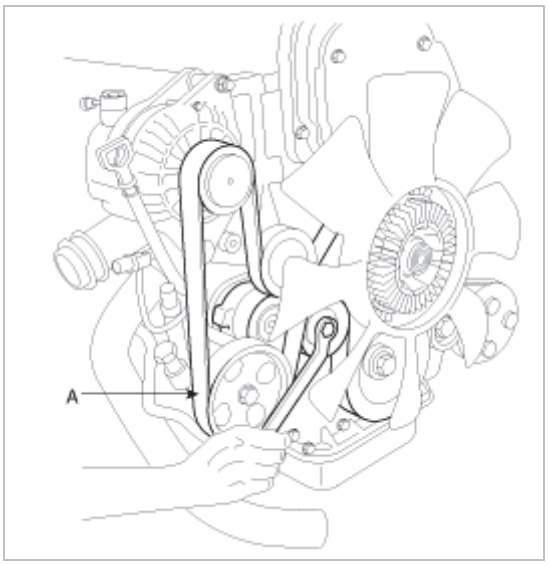
WATER PUMP

1. Remove the drain plug(A).

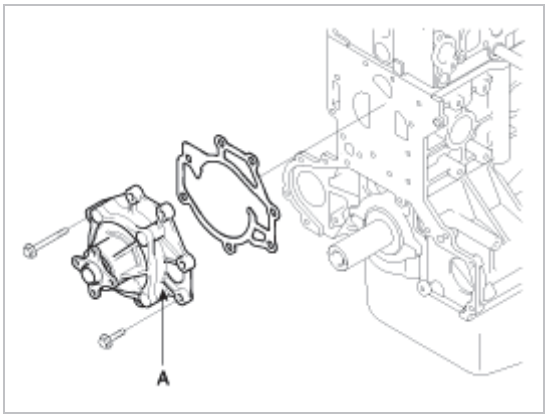


2. Remove the radiator cowl cover.
3. Remove the drive belt(A).

> NOTICE
>
> Loosen the water pulley bolt first, and remove the drive belt.

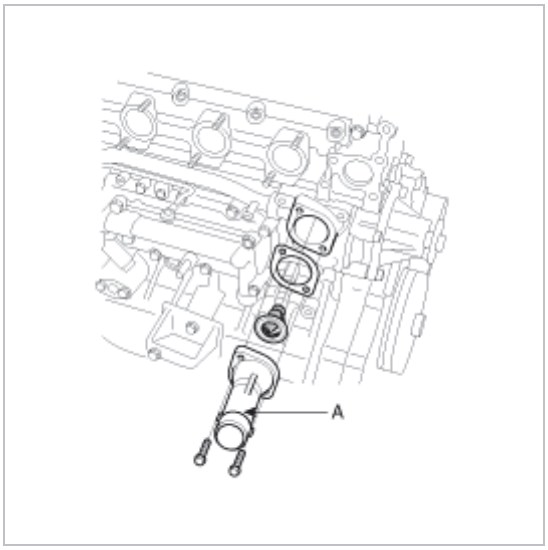


4. Remove the water pump pulley.
5. Remove the water pump(A) from cylinder block.



Thermostat

1. Drain the coolant so its lever is below the thermostat.
2. Remove the water inlet fitting(A).



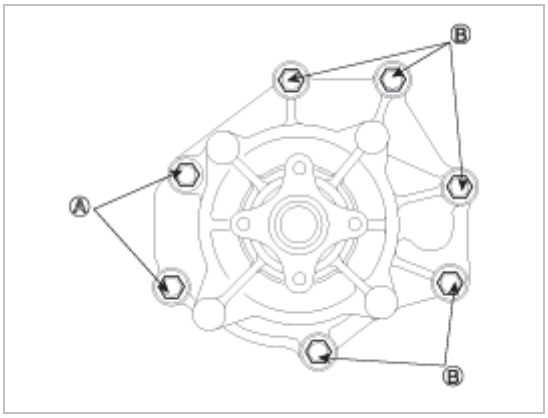
3. Remove the thermostat.

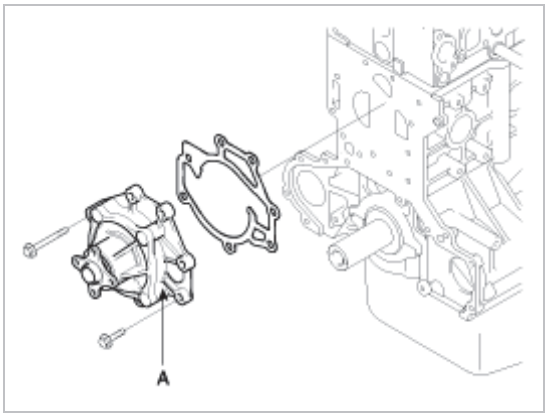
INSTALLATION

WATER PUMP

1. Install the water pump (A) with new gasket to the cylinder block.

Tightening torque :
A bolts (8 x 45) 2EA :
19.6-26.5 N.m (2.0-2.7 kgf.m, 14.5-19.5 lb-ft)
B bolts (8x45) 2EA:
19.6-26.5 N.m (2.0-2.7 kgf.m, 14.5-19.5 lb-ft)



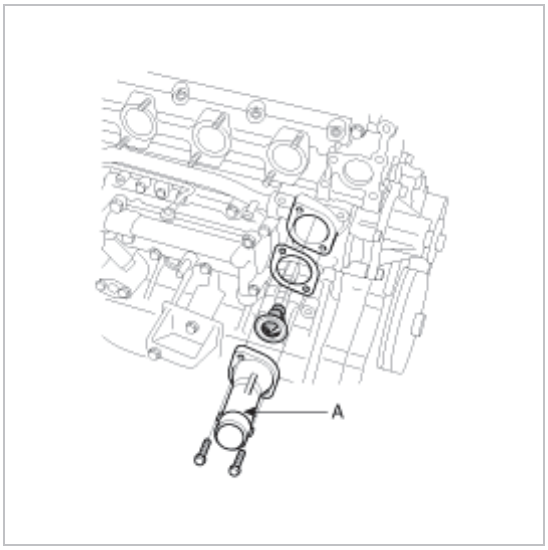


2. Install the cooling fan.
3. Install the drive belt.
4. Install the radiator cowl upper cover.
5. Refill the engine coolant.

THERMOSTAT

1. Check that the flange of the thermostat is correctly seated in the socket of the thermostat housing.
2. Install the inlet fitting (A).

Tightening torque :
Engine coolant inlet fitting bolt :
19.6 - 26.5 N.m(2.0-2.7kgf.m, 14.5-19.5 lb-ft)



3. Refill the coolant.

INSPECTION

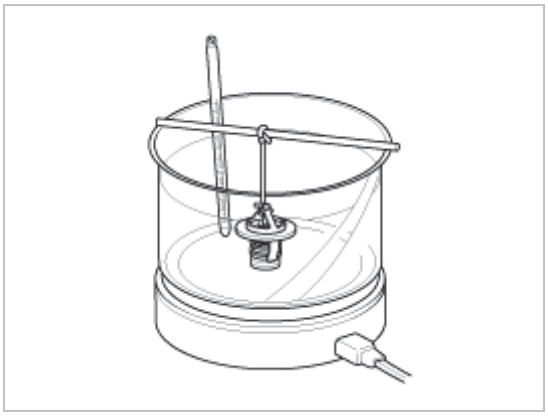
WATER PUMP

1. Check the pump for cracks, damage of wear. Replace the water pump assembly if necessary.
2. Check the bearing for damage, abnormal noise, and sluggish rotation. Replace the water pump assembly if necessary.
3. Check the bearing for damage, abnormal noise, and sluggish rotation. Replace the water pump assembly if necessary.

THERMOSTAT

1. Check that the valve operates properly.
2. Verify the temperature at which the valve begins to open.

ITEM	SPECIFICATION
Valve opening temperature	82°C(180°F)
Valve closing temperature	77°C(171°F)
Full opening temperature	95°C(203°F)

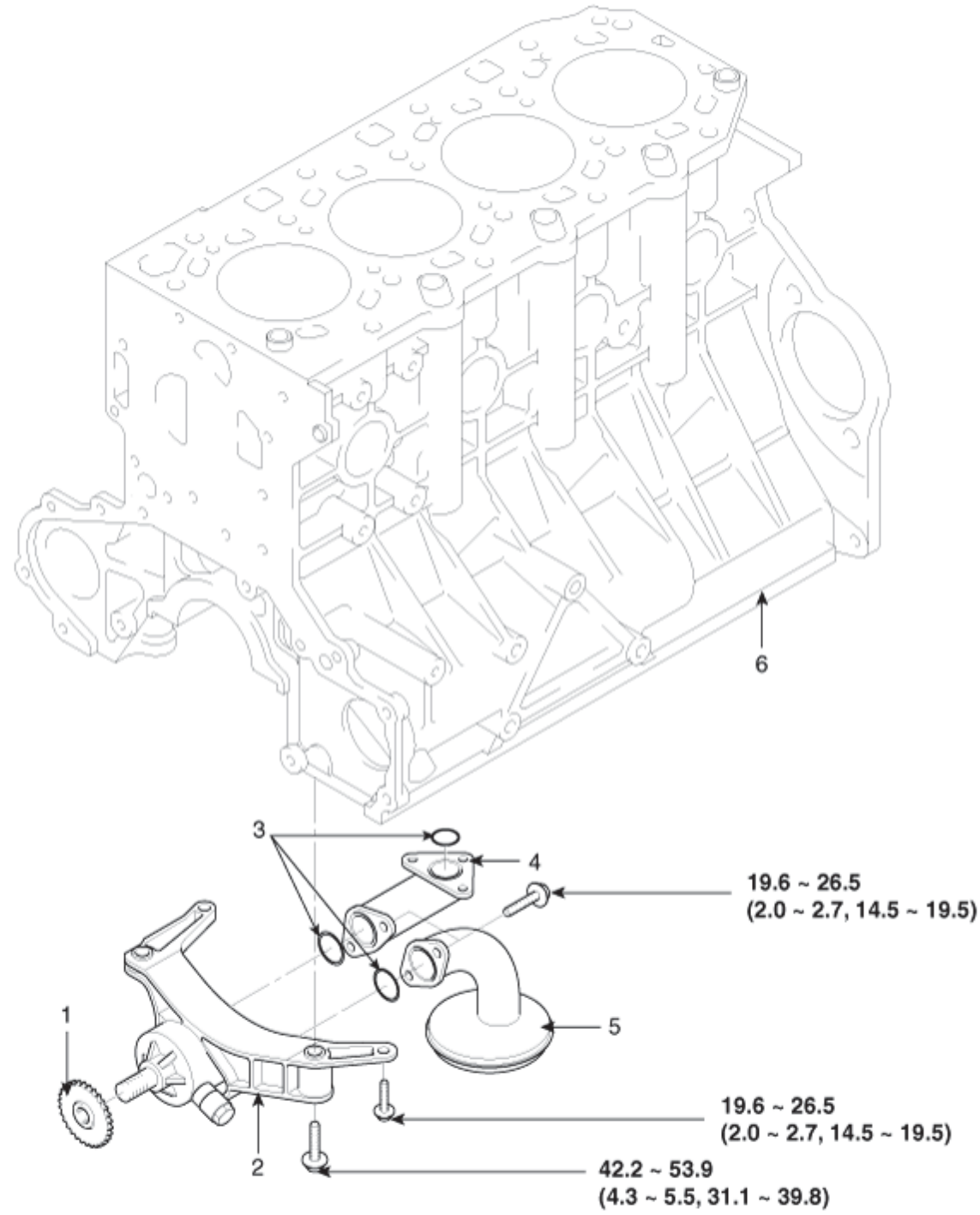


KIA MOTORS

Engine Mechanical System

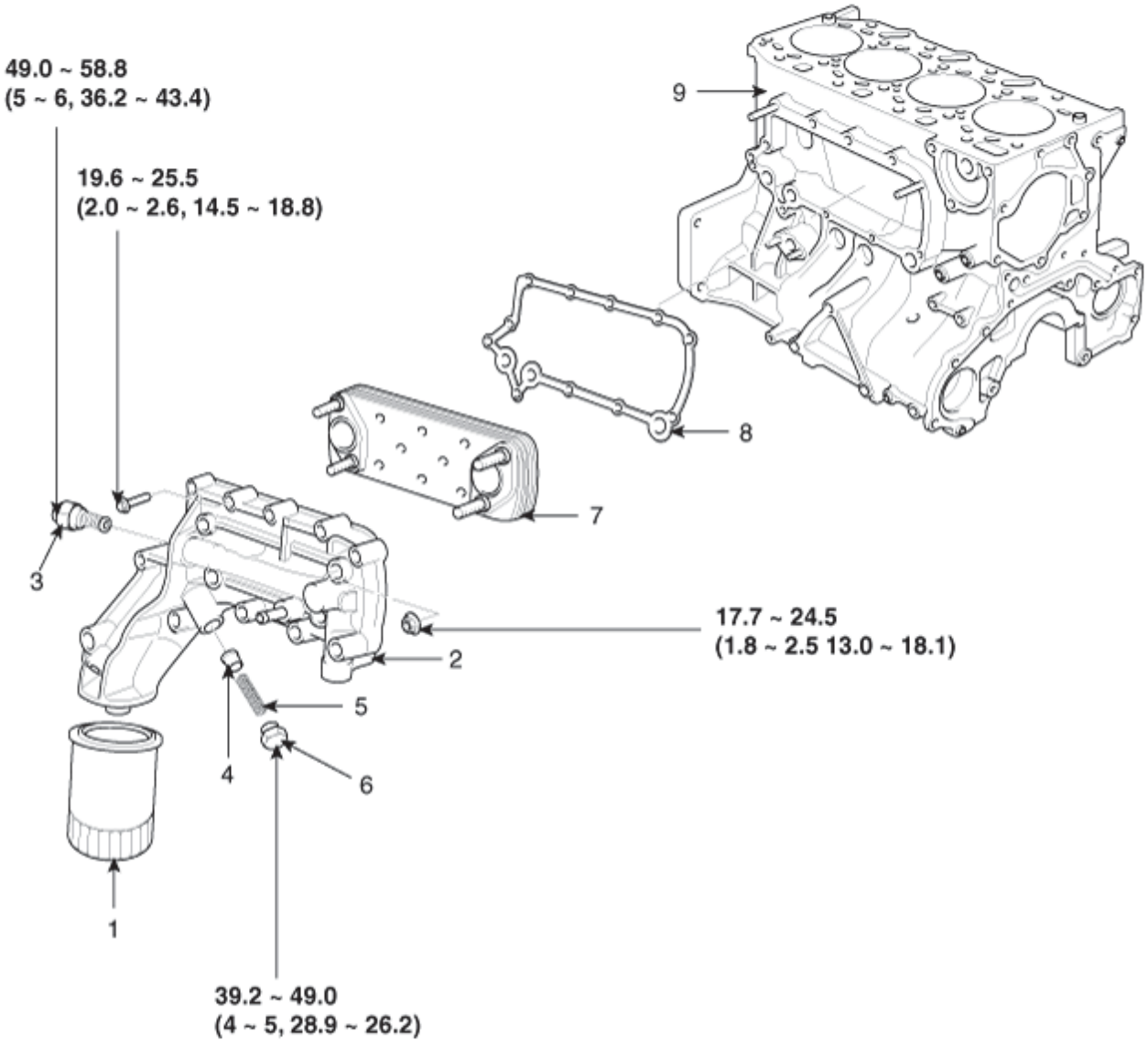
Lubrication System

COMPONENTS



TORQUE : N.m (kgf.m, lb-ft)

1. Oil pump sprocket
2. Oil pump
3. O-ring
4. Oil supply pipe
5. Oil screen
6. Cylinder block



TORQUE : N.m (kgf.m, lb-ft)

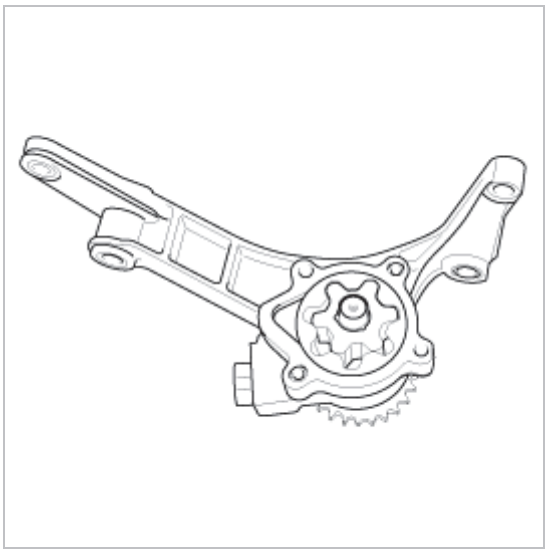
1. Oil filter
2. Oil cooler cover
3. Oil cooler by-fass valve
4. Relief plunger
5. Relief spring
6. Relief valve plug
7. Oil cooler
8. Gasket
9. Cylinder block

INSPECTION

OIL PUMP

1. Make sure the outer rotor and inner rotor turn smoothly with no excessive play between them.
2. Check the side clearance and body clearance.

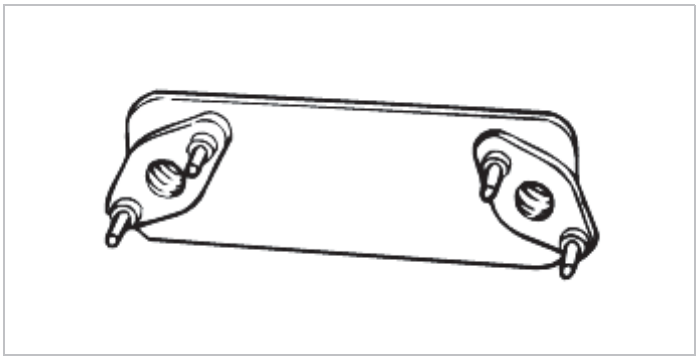
Side clearance :
Inner rotor: 0.040-0.085 mm (0.0016-0.0033 in)
Outer rotor: 0.050-0.100 mm (0.0020-0.0039 in)
Body clearance (Between outer rotor and body) :
0.100-0.176 mm (0.0039-0.0069 in)



3. If clearance is excessive, replace the oil pump.

OIL COOLER

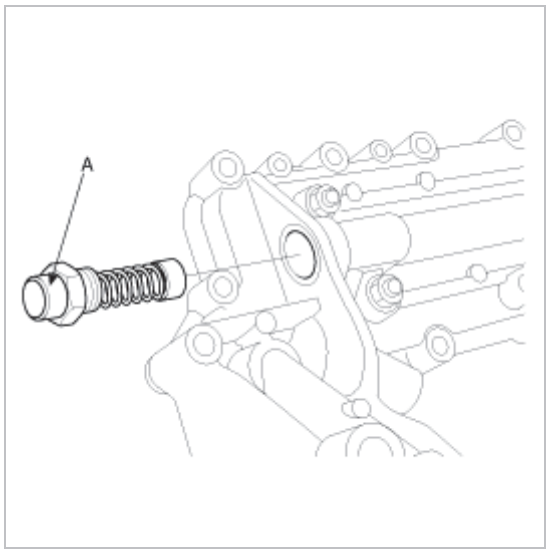
1. Inspect visually the core for clogging or damage, and replace it if a problem is found.



OIL COOLER BY-PASS VALVE

1. Check that the valve operates properly.
2. Verify the temperature at which the valve (A) begins to open.

Item	Temperature °C (°F)	Lift mm (in)
Valve opening temperature	91.5-94.5 (196.7-202.1)	0.05 (0.002)
Full opening Full opening	97-103 (206.6-217.4)	5 (0.197)
Full lift	150 (302)	Below 11 (0.433)



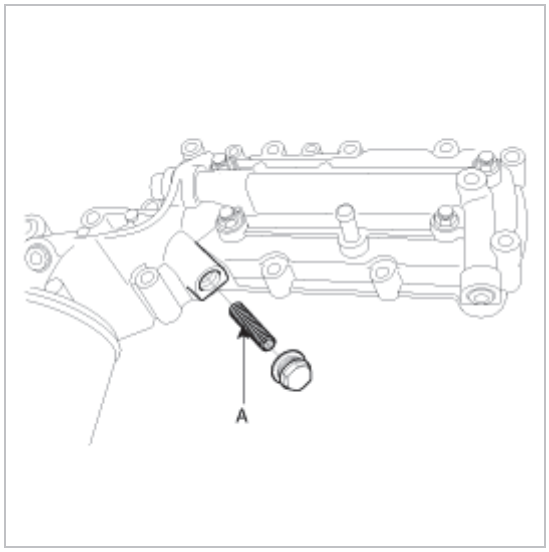
OIL RELIEF VALVE

1. Check the relief plunger for wear or damage.
2. Check the relief spring for weak.

Free length: 52.5mm (2.0669in)

3. Check the relief spring (A) of pressure.

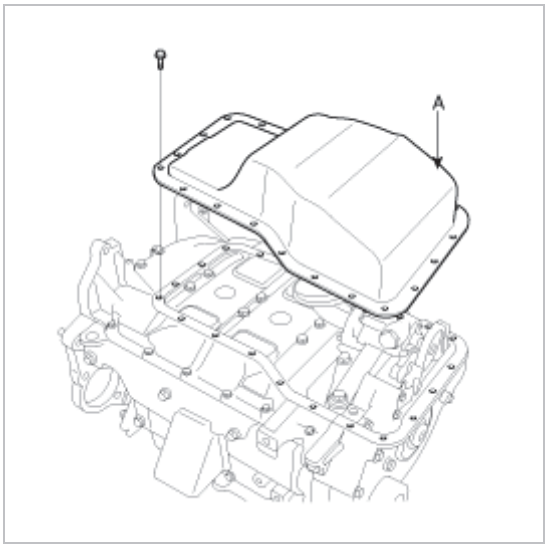
Spring pressure :
6.7kg/40.1mm (14.8 lb/1.5787in)
8.7/36.3mm (19.2 lb/1.4291in)



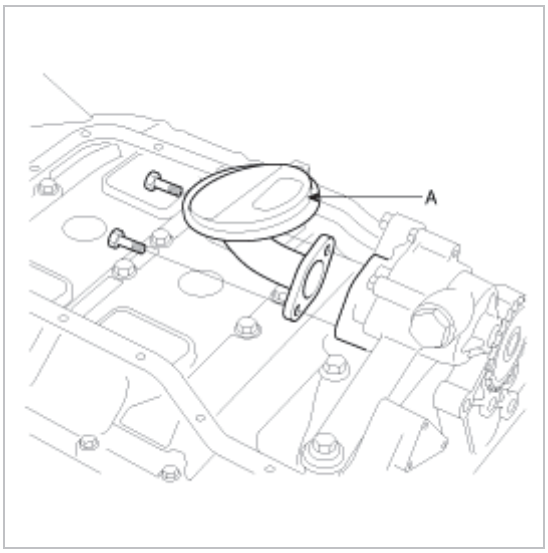
REMOVAL

OIL PUMP

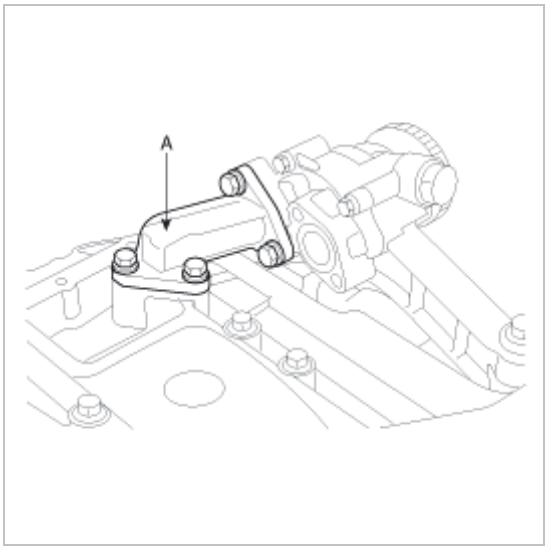
1. Drain engine oil.
2. Remove the timing chain "C" and "B".
3. Remove the oil pan. Refer to "Oil pan (A)".



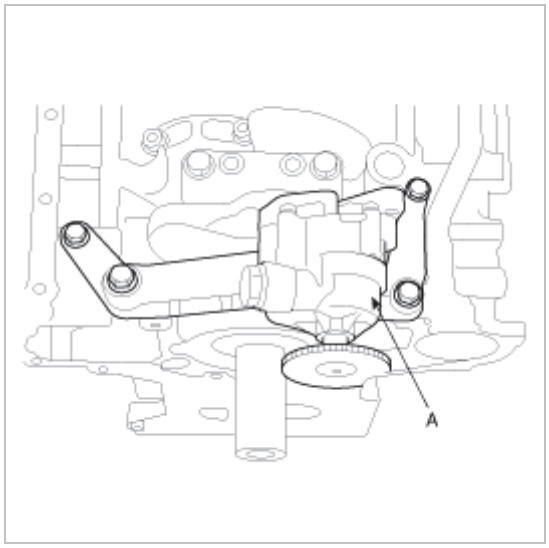
4. Remove the oil screen (A) from the oil pump.



5. Remove the oil feed pipe (A) from the oil pump and bed plate.

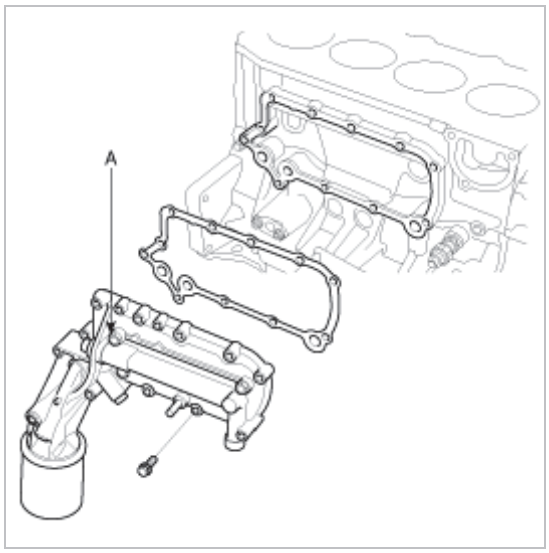


6. Remove the bet plate.
7. Remove the oil pump assembly (A) from the cylinder block.

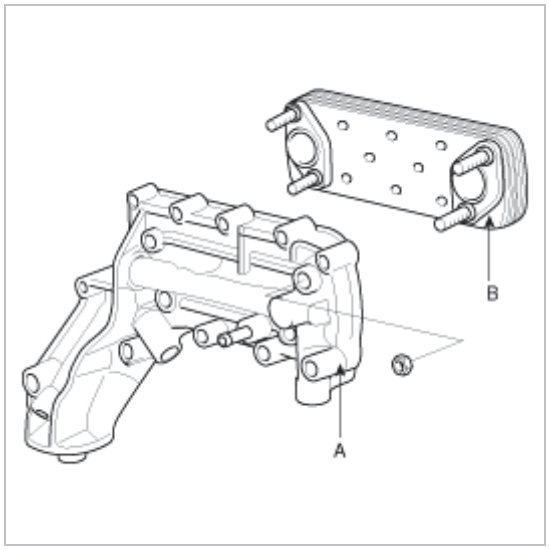


OIL COOLER

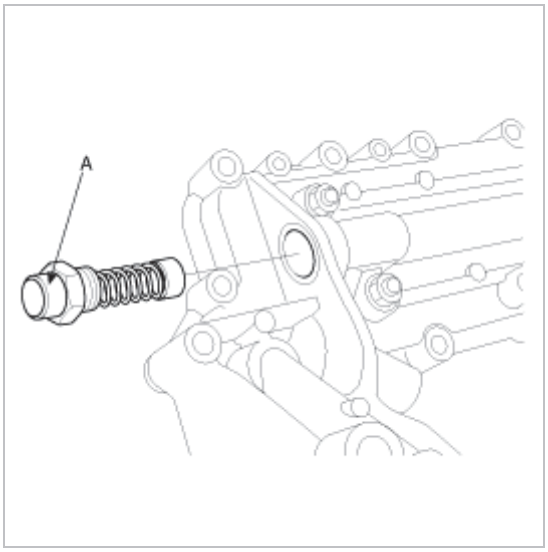
1. Drain engine coolant and engine oil.
2. Remove the engine oil filter.
3. Remove the oil cooler assembly (A) from the cylinder block.

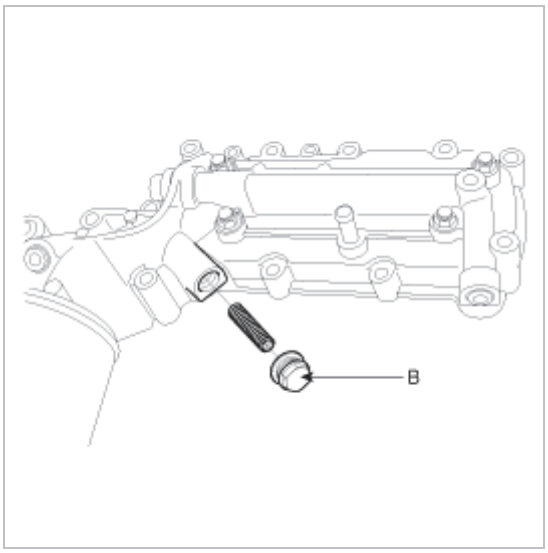


4. Remove the oil cooler (B) from the oil cooler cover (A).



5. Remove the oil cooler by-pass valve (A) and the relief valve (B) from the oil cooler cover.

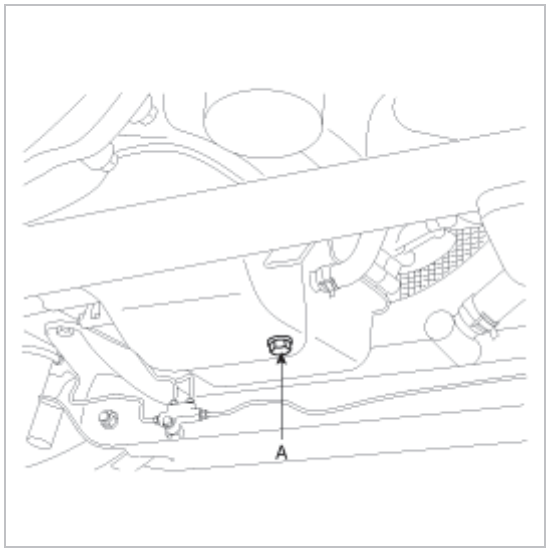




OIL AND FILTER REPLACEMENT

1. Run the engine until it reaches normal operating temperature.
2. Turn off the engine.
3. Remove the oil filler cap and the drain plug. Drain the engine oil.
4. Tighten the drain plug (A) to the specified torque.

Tightening torque
Oil pan drain plug :
35 ~ 45 N.m (3.5 ~ 4.5 kgf.m, 25 ~ 33 Ib-ft)



NOTICE

Whenever tightening the oil drain plug, use a new drain plug gasket.

5. Fill new engine oil through the oil filler cap opening.

Capacity :
Total : 9.0L (9.51 US qt, 7.91 lmp qt)
Oil pan : 7.4L (7.82 US qt, 6.50 lmp qt)
Drain and refill including oil filter : 8.2L(8.66 US qt, 7.21 lmp qt)
Oil quality : ABOVE API CF-4 (VGT:CH-4) or ACEA B4

NOTICE

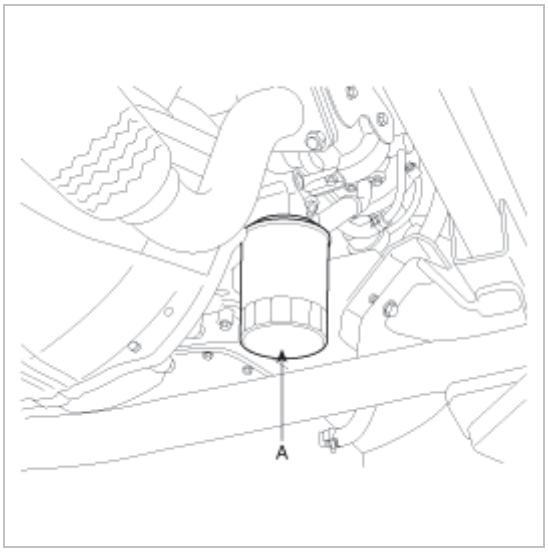
Do not overfill. This will cause oil aeration and loss of oil pressure.

6. Install the oil filler cap.
7. Start and run the engine.
8. Turn off the engine and then check the oil level. Add oil if necessary.

OIL FITER

1. Use a filter wrench to remove the oil filter.
2. Before installing the new oil filter on the engine, apply clean engine oil of the surface of the rubber gasket.
3. Tighten the oil filter (A) of the specified torque.

Oil filter :
22 ~ 25 N.m (2.2 ~ 2.5 kgf.m, 16 ~ 18 lb-ft)



4. Start and run the engine and check for engine oil leaks.
5. After stopping the engine, check the oil level and add oil as necessary.

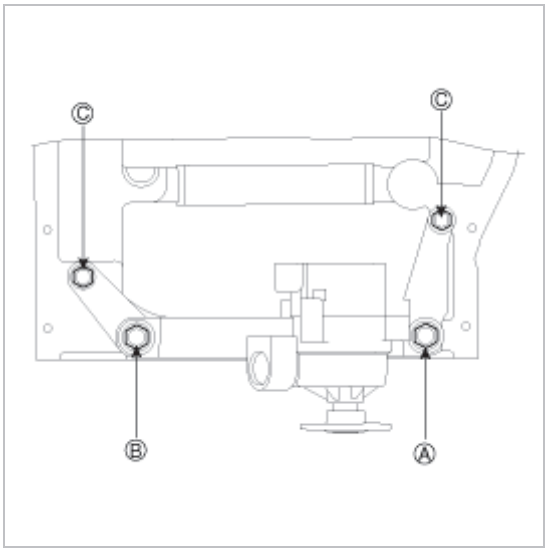
INSTALLATION

OIL PUMP

1. Install the oil pump assembly to the cylinder block.

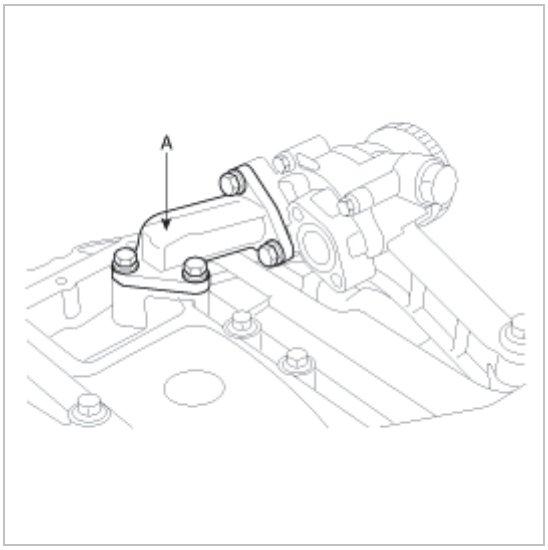
Bolt	Size	Quantity	Quantity Tightening torque N.m (kgf.m, lb-ft)
A	10 x 35	1 EA	42.2-53.9 (4.3-5.5, 31.1-39.8)
B	10 x 60	1 EA	42.2-53.9 (4.3-5.5, 31.1-39.8)
C	8 x 22	2 EA	19.6-26.5 (2.0-2.7, 14.5-19.5)

* Bolts size = Diameter x Length

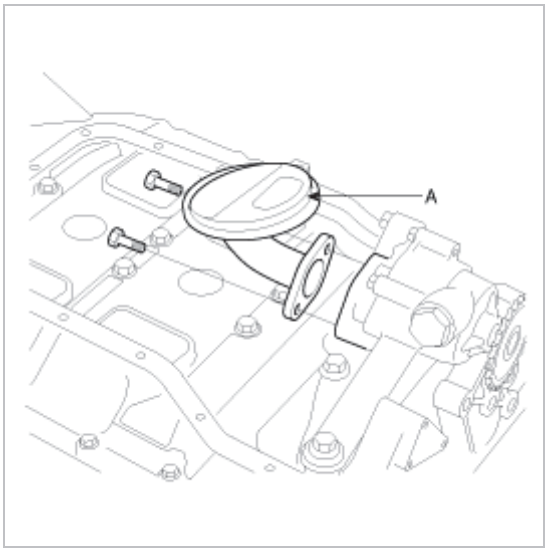


2. Install the bet plate.
3. Install the oil feed pipe (A) to the oil pump and bed plate.

Tightening torque :
19.6 ~ 26.5 N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)

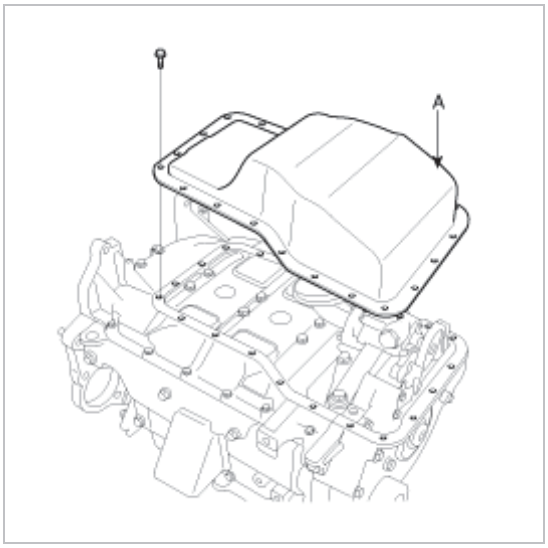


4. Install the oil screen (A) to the oil pump.



5. Install the oil pan (A).

Tightening torque :
9.8 ~ 11.8 N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

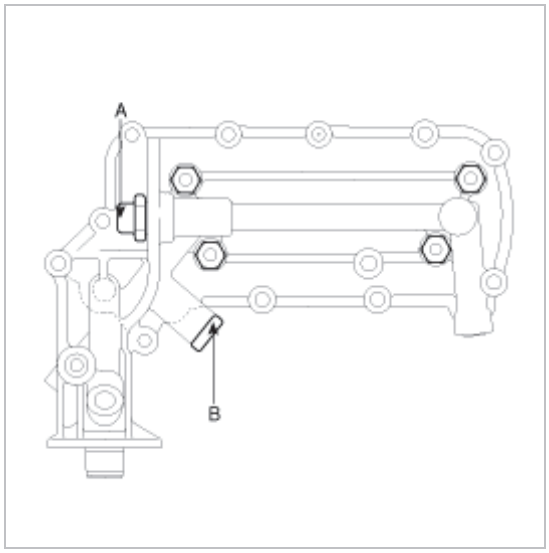


6. Install the timing chain "B" and "C". Refer to "Timing chain".
7. Refill engine oil and check for oil leak.

OIL COOLER

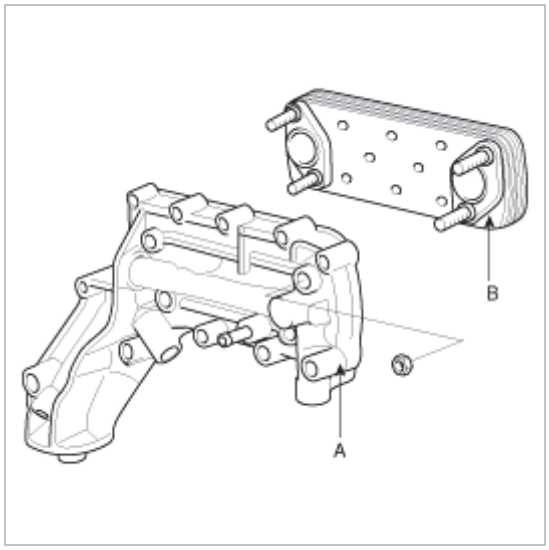
1. Install the oil cooler by-pass valve (A) and the relief valve (B) to the oil cooler cover.

Tightening torque :
Oil cooler by-pass valve :
49.0 ~ 58.8 N.m (5 ~ 6kgf.m, 36.2 ~ 43.4lb-ft)
Relief valve plug :
39.2 ~ 49.0 N.m (4 ~ 5 kgf.m, 28.9 ~ 36.2 lb-ft)



2. Install the oil cooler (B) to oil cooler cover (A).

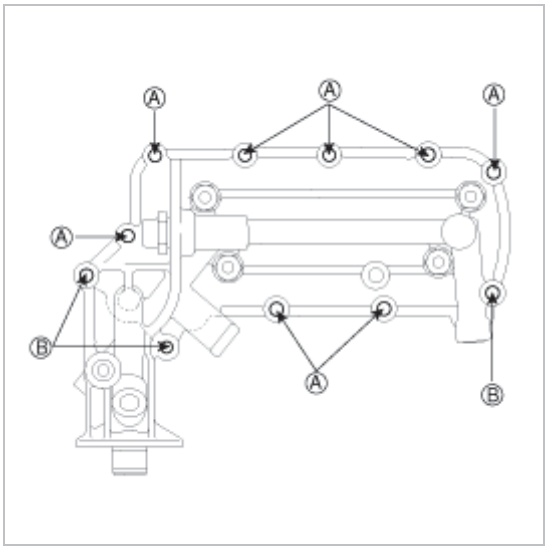
Tightening torque :
17.7 ~ 24.5 N.m (1.8 ~ 2.5 kgf.m, 13.0 ~ 18.1lb-ft)

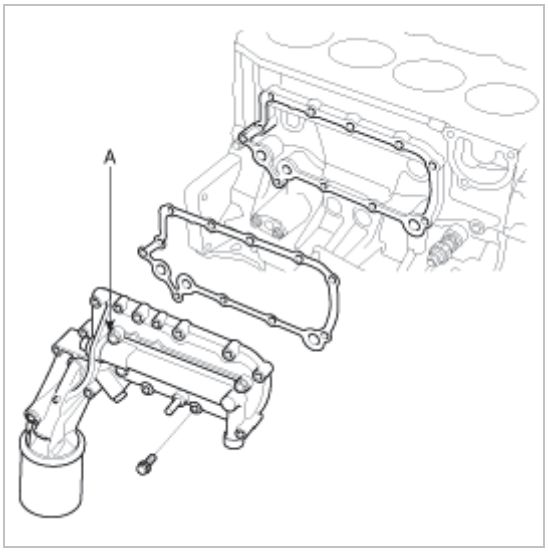


3. Install the oil cooler assembly (A) to the cylinder block with new gasket.

Bolt	Size	Quantity	Tightening torque N.m (kgf.m, lb-ft)
A	8 x 35	8 EA	19.6-25.5 (2.0-2.6, 14.5-18.8)
B	8 x 60	3 EA	(2.0-2.6, 14.5-18.8)

* Bolts size = Diameter x Length





4. Install the engine oil filter.

Tightening torque :
19.6 ~ 24.5 N.m (2.0 ~ 2.5kgf.m, 14.5 ~ 18.1lb-ft)

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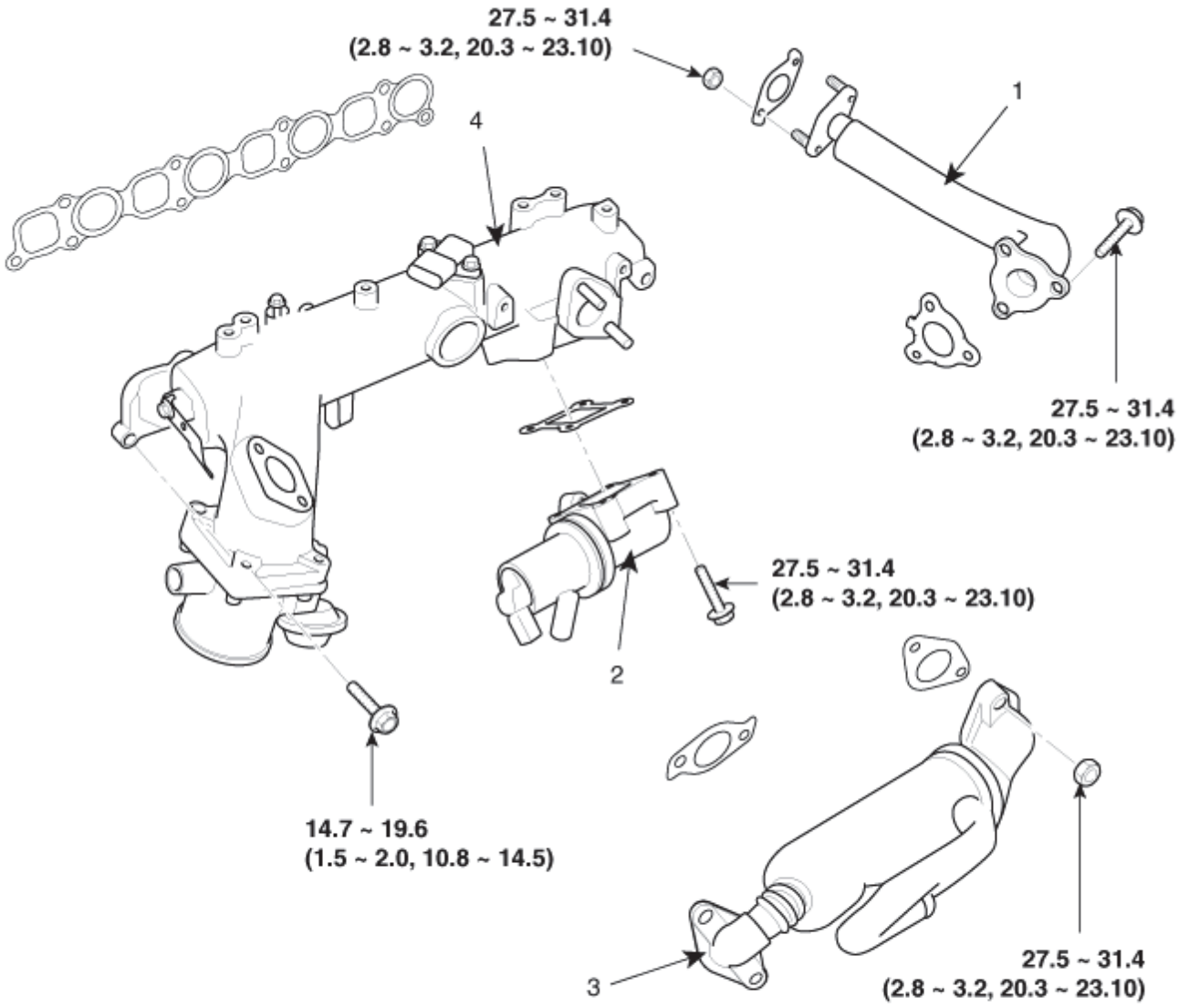
5. Refill the engine oil and engine coolant.
6. Check for oil and coolant leak.

KIA MOTORS

Engine Mechanical System

Intake and Exhaust System - Intake Manifold

COMPONENTS

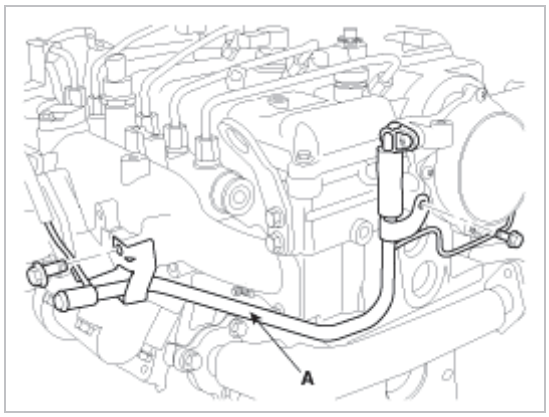


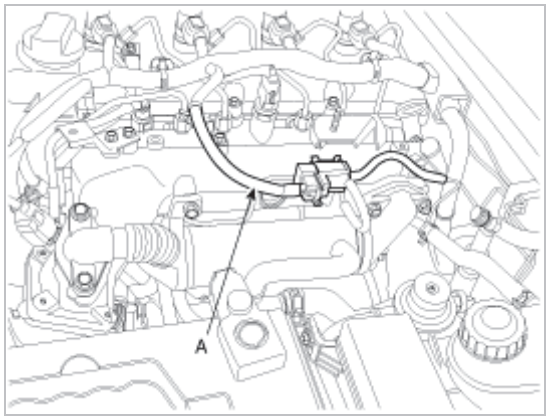
TORQUE : N.m (kgf.m, lb-ft)

1. EGR pipe
2. EGR solenoid valve
3. EGR cooler
4. Intake manifold

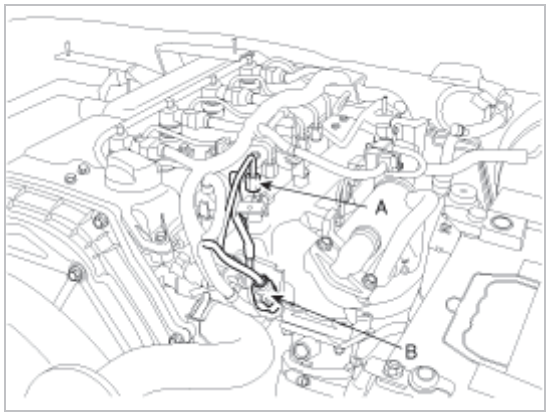
REMOVAL

1. Remove the vacuum line(A, B).

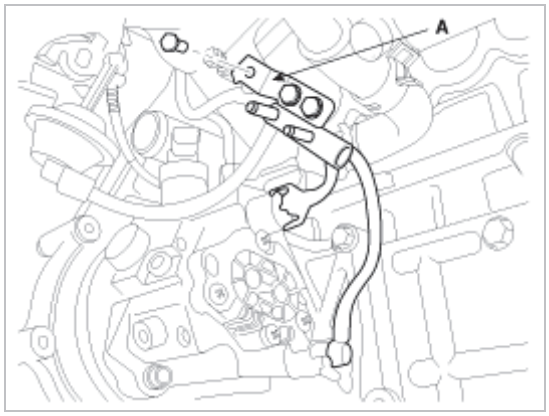




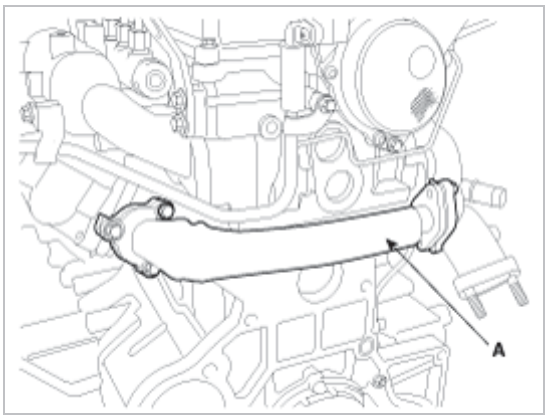
2. Remove the high pipe bracket(A) and the coolant temperature sensor connector(B).



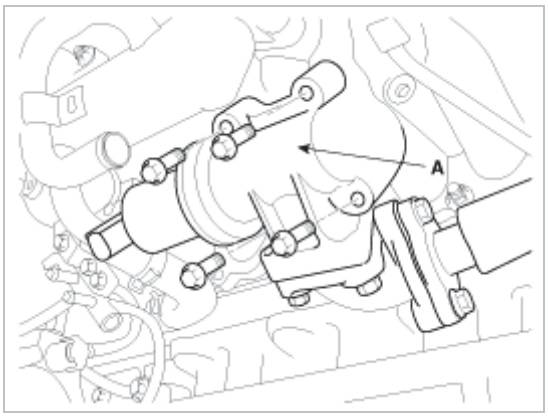
3. Remove the high pump fuel hose bracket(A).



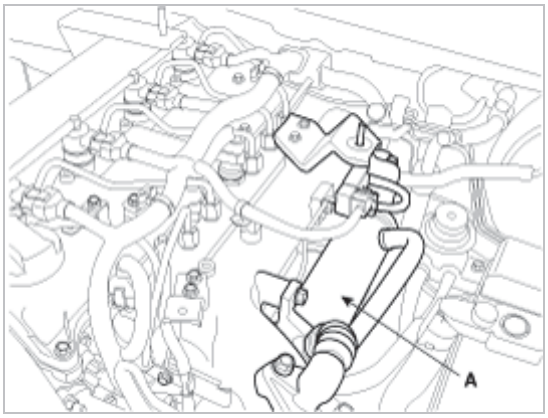
4. Remove the EGR pipe(A).



5. Remove the EGR valve(A).



6. Remove the EGR cooler(A).



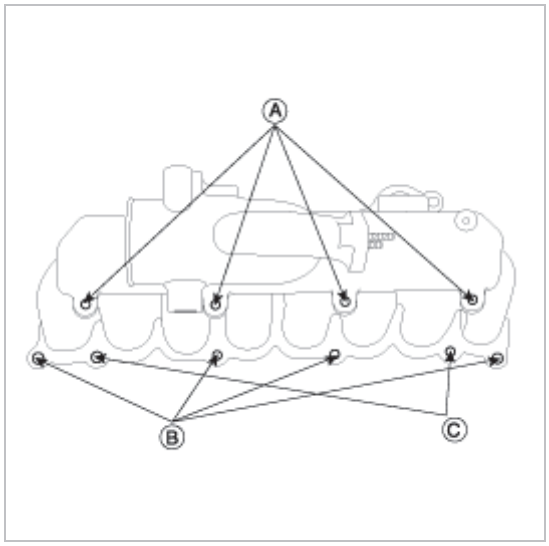
7. Remove the intake manifold.

INSTALLATION

1. Install the intake manifold with new gasket.

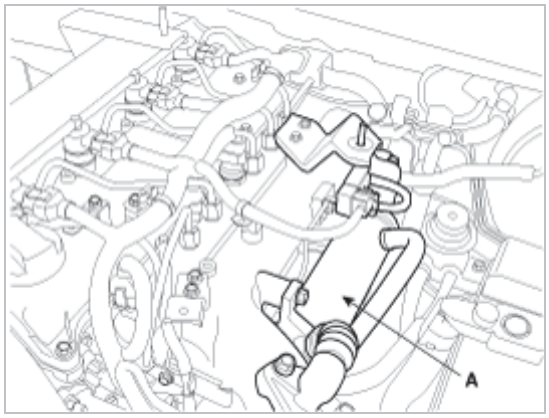
Bolt	Size	Quantity	Tightening torque N.m (kgf.m, lb-ft)
A	8 x 112	4 EA	14.7 ~ 19.6 (1.5 ~ 2.0, 10.8 ~ 14.5)
B	8 x 32	4 EA	14.7 ~ 19.6 (1.5 ~ 2.0, 10.8 ~ 14.5)
C	nuts	2 EA	14.7 ~ 19.6 (1.5 ~ 2.0, 10.8 ~ 14.5)

* Bolts size = Diameter x Length



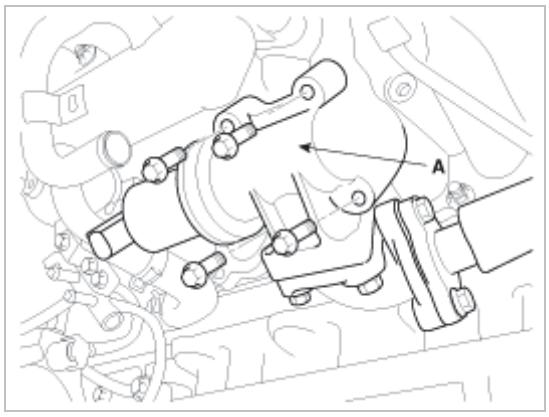
2. Install the EGR cooler(A).

Tightening torque :
27.5 ~ 31.4N.m (2.8 ~ 3.2kgf.m, 20.3 ~ 23.1lb-ft)



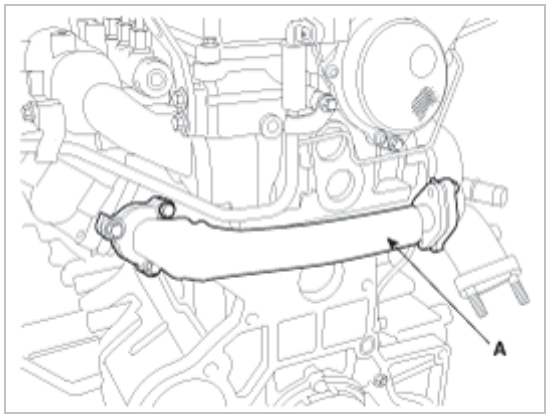
3. Install the EGR valve(A).

Tightening torque :
27.5 ~ 31.4N.m (2.8 ~ 3.2kgf.m, 20.3 ~ 23.1lb-ft)

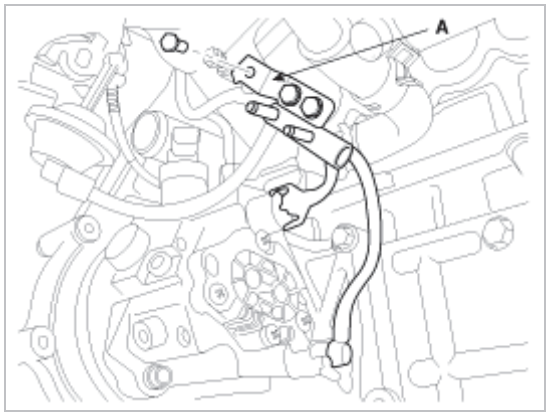


4. Install the EGR pipe(A).

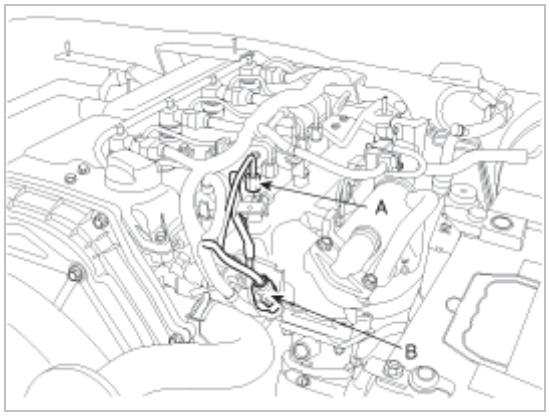
Tightening torque :
27.5 ~ 31.4N.m (2.8 ~ 3.2kgf.m, 20.3 ~ 23.1lb-ft)



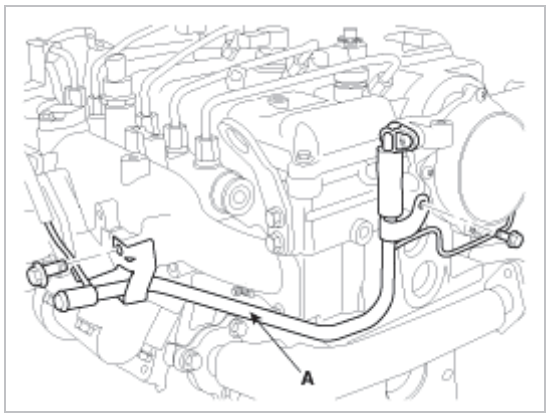
5. Install the high pump fuel hose bracket(A).

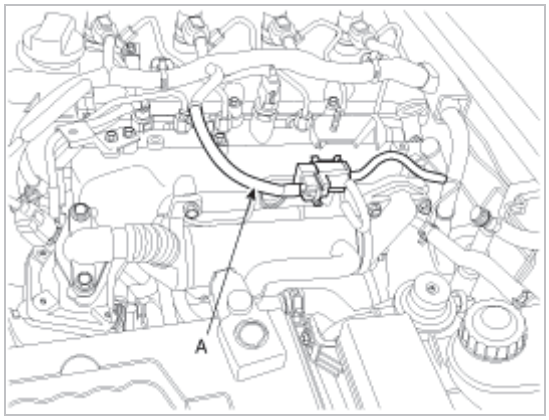


6. Install teh high pipe bracket(A) and coolant temperature sensor connector(B).



7. Install the vacuum line(A, B).



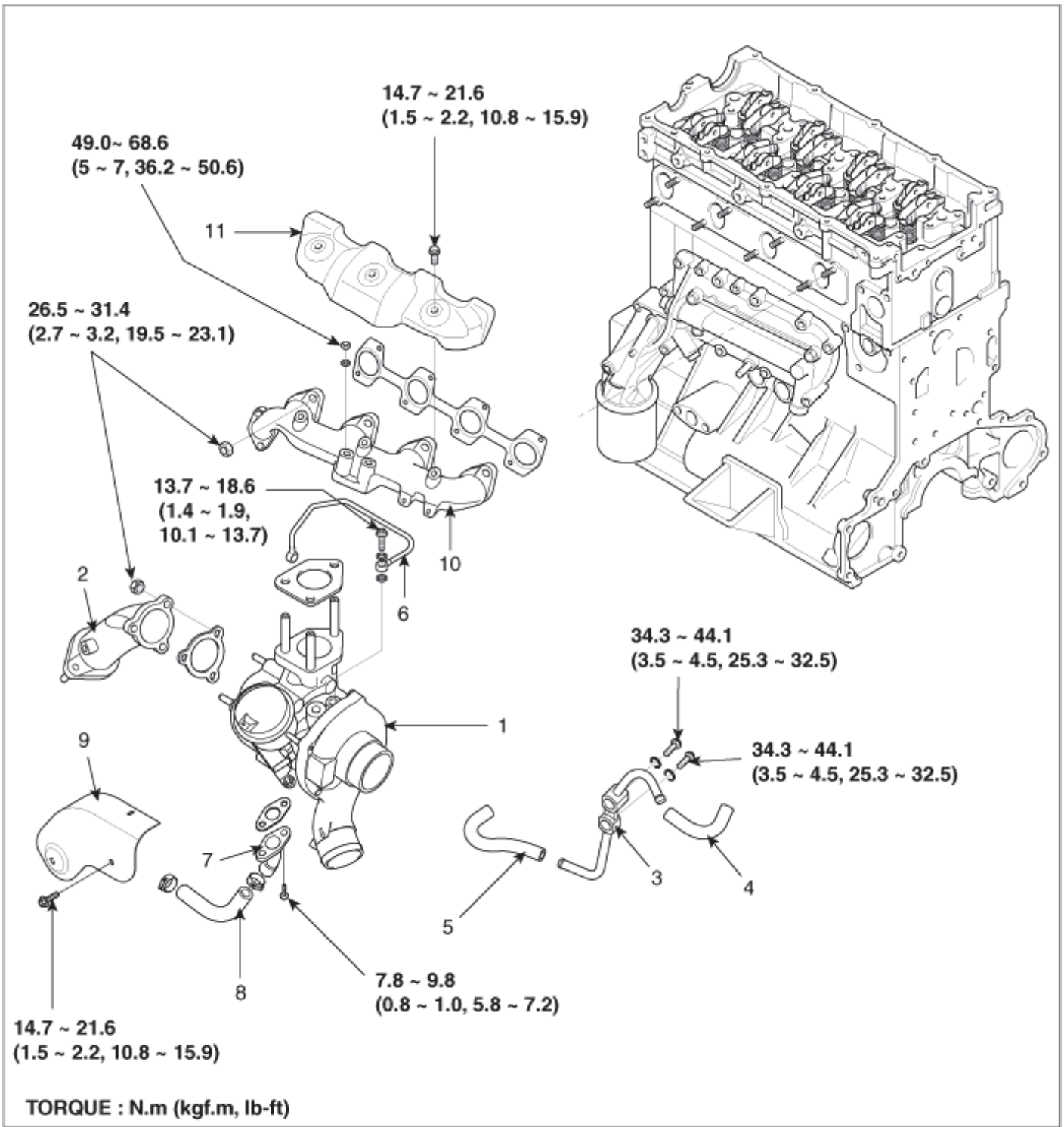

A

KIA MOTORS

Engine Mechanical System

Intake and Exhaust System - Exhaust Manifold

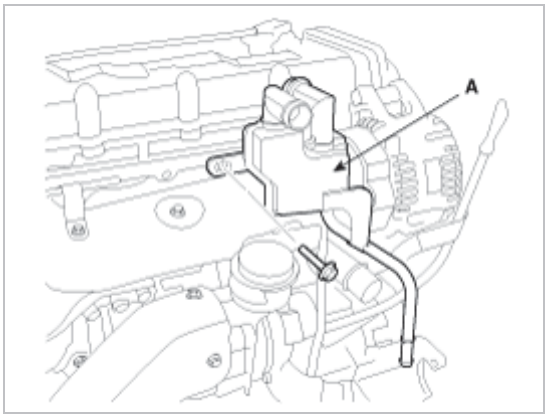
COMPONENTS



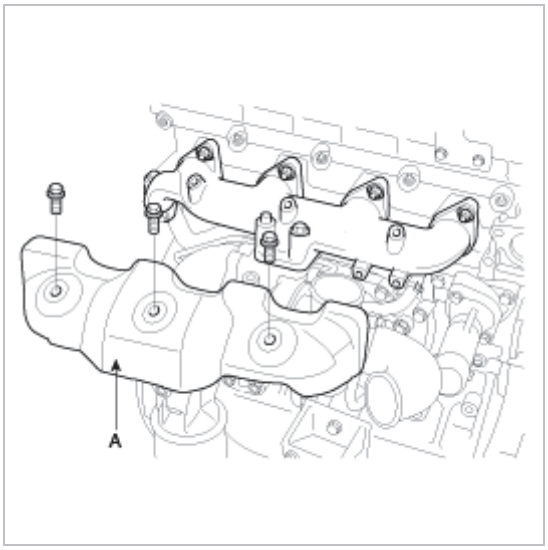
1. Turbo charger assembly
2. Turbo charger outlet fitting
3. Turbo charger coolant pipe
4. Turbo charger coolant inlet hose
5. Turbo charger coolant outlet hose
6. Turbo charger oil inlet pipe
7. Turbo charger oil outlet pipe
8. Turbo charger oil outlet hose
9. Heater protector
10. Exhaust manifold
11. Heater protector

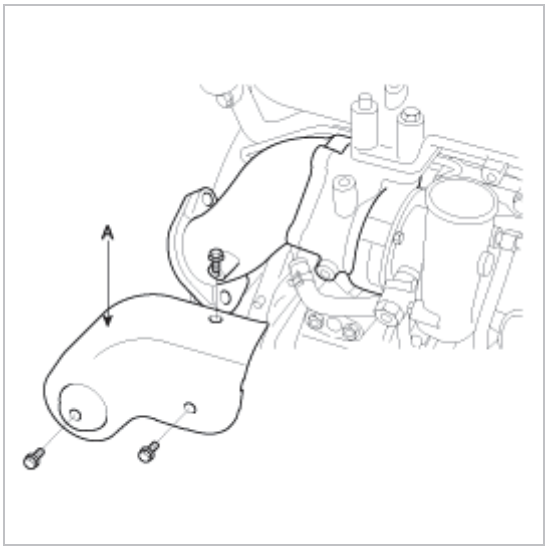
REMOVAL

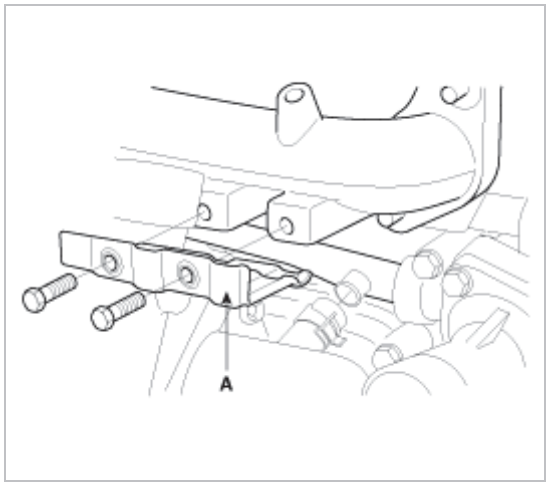
1. Remove the oil separator(A).



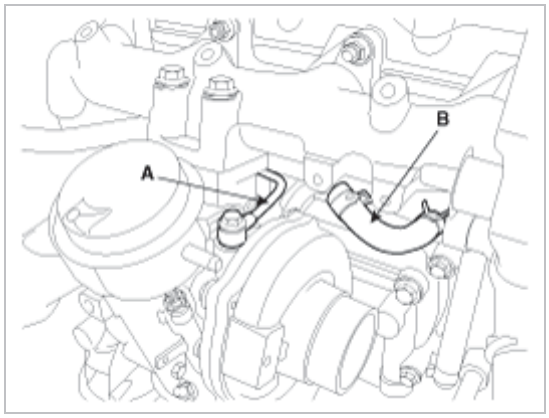
2. Remove the heater protectors(A).

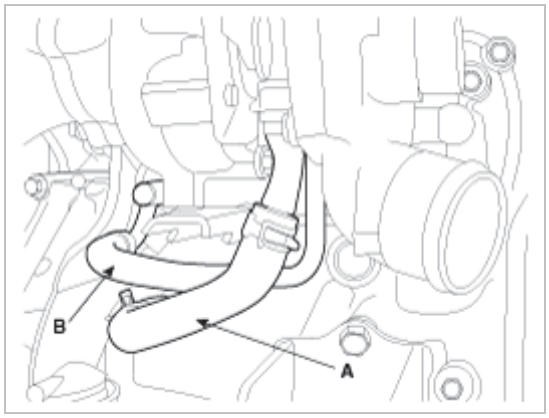






3. Remove the oil hose(A) and coolant hose(B) from the turbo charger.



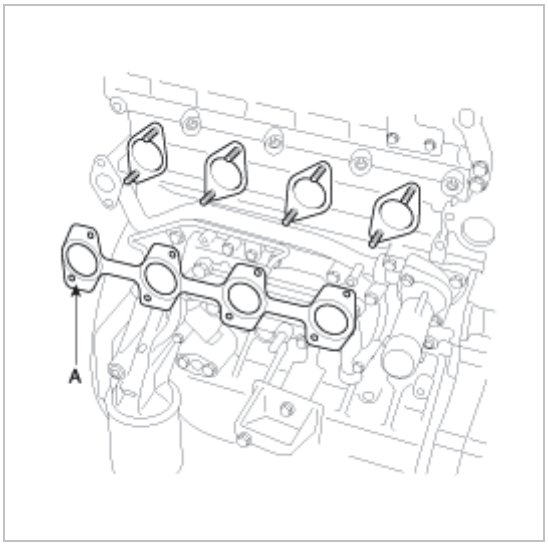


4. Remove the EGR pipe(A).
5. Remove the turbo charge bracket(A) and bolt(B).

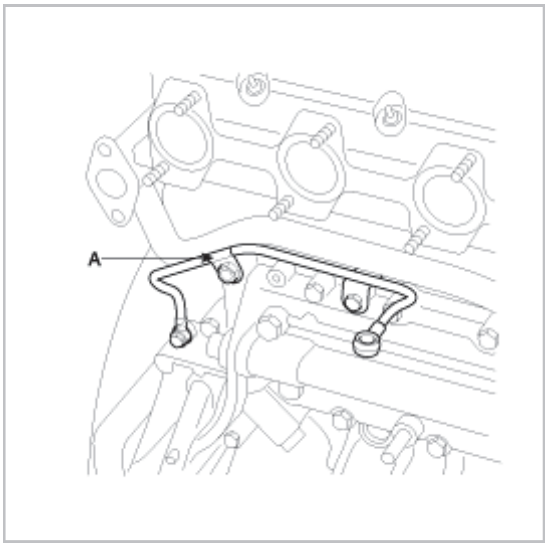
6. Remove the exhaust manifold(A).

INSTALLATION

1. Install the exhaust manifold gasket(A).



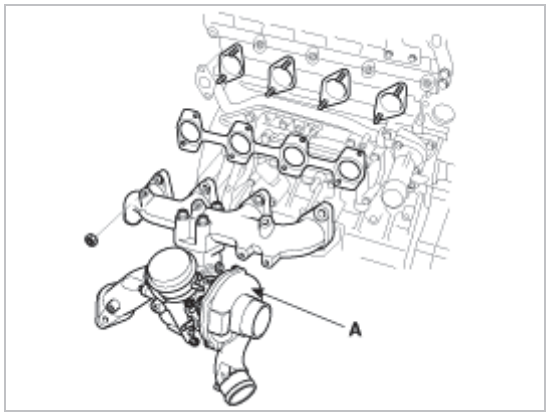
2. Install the turbo charge oil feed line(A).



3. Install the exhaust manifold(A) from cylinder head.

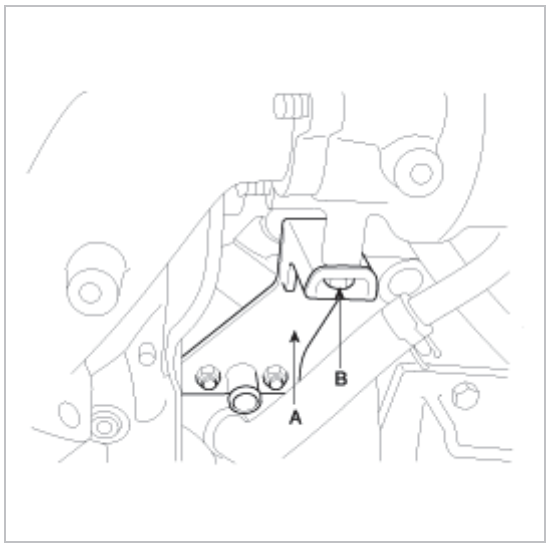
Tightening torque :

16.7 ~ 25.5N.m(1.7 ~ 2.6kgf.m, 12.3 ~ 18.8lb-ft)



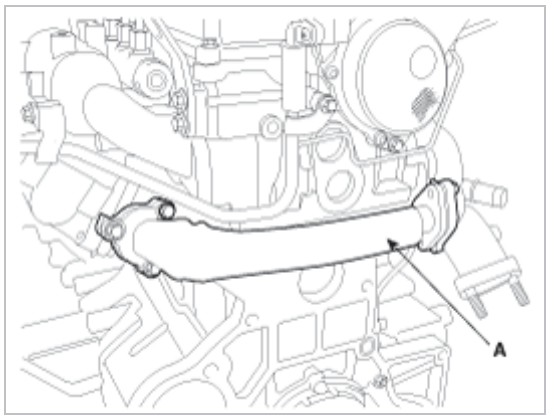
4. Install the bolt(B) from turbo charge bracket(A).

Tightening torque :
14.7 ~ 19.6N.m(1.5 ~ 2.0kgf.m, 10.8 ~ 14.5lb-ft)

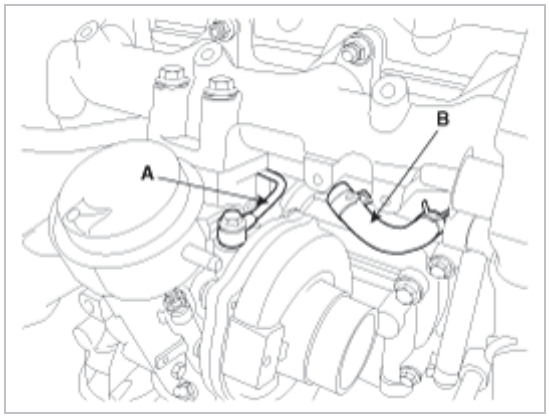


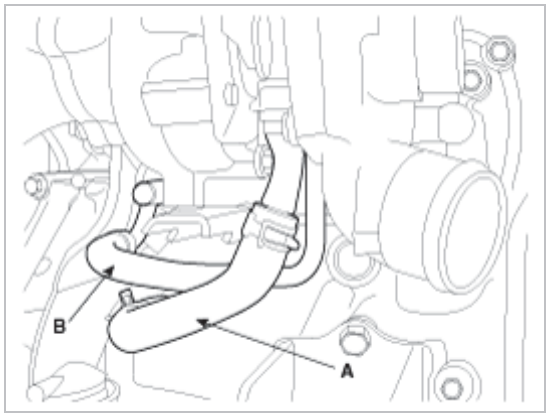
5. Install the EGR pipe(A).

Tightening torque :
27.5 ~ 31.4N.m(2.8 ~ 3.2kgf.m, 20.3 ~ 23.1lb-ft)



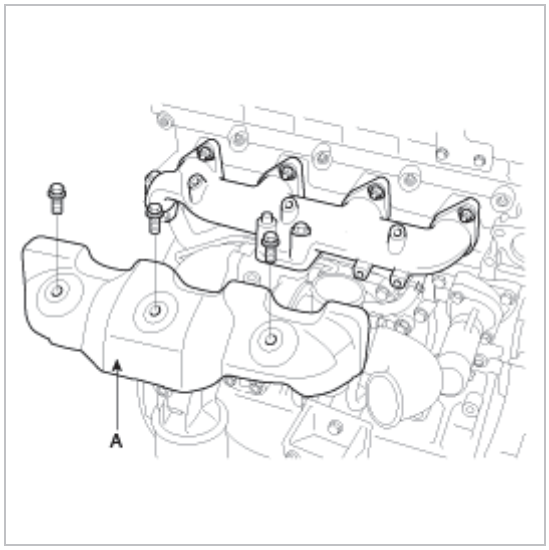
6. Install the oil hose(A) and coolant hose(B) from turbo charge.

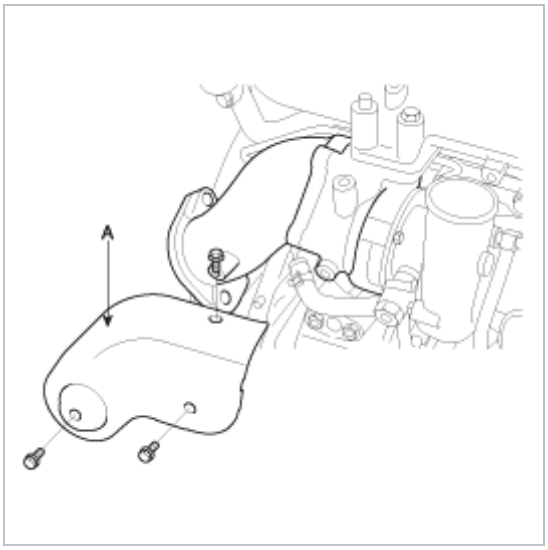


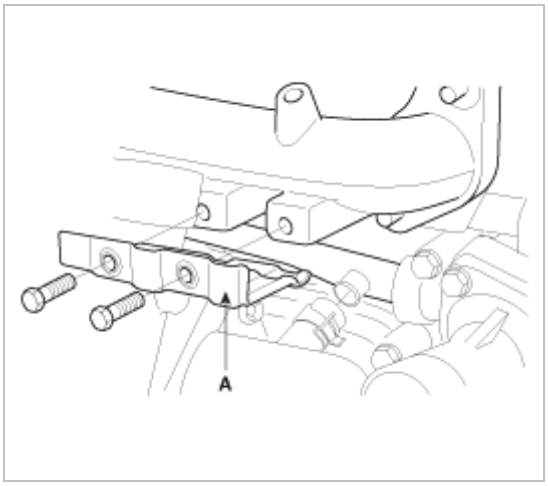


7. Install the heater protector(A).

Tightening torque :
14.7 ~ 21.6N.m(1.5 ~ 2.2kgf.m, 10.8 ~ 15.9lb-ft)

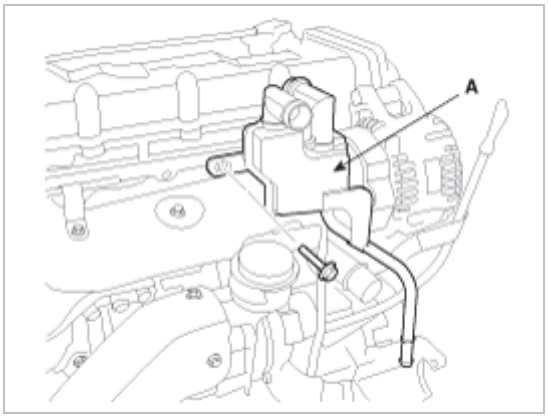






8. Install the oil sperator(A).

Tightening torque :
7.8 ~ 9.8N.m(0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)



KIA MOTORS

Engine Electrical System

General Information

TROUBLESHOOTING

CHARGING SYSTEM

Symptom	Suspect Area	Remedy
Charging warning indicator does not light with ignition switch "ON" and engine off	Fuse blown Light burned out Wiring connection loose Electronic voltage regulator	Check fuses Replace light Tighten loose connections Replace voltage regulator
Charging warning indicator does not go out with engine running (Battery requires frequent recharging)	Drive belt loose or worn Battery cables loose, corroded or worn Fuse blown Fusible link blown Electronic voltage regulator or generator Wiring	Adjust tension or replace drive belt Repair or replace cavles Check fuses Replace fusible link Test generator Repair wiring
Engine hesitates/poor acceleration Overcharge	Drive belt loose or worn Wiring connection loose or open circuit Fusible link blown Poor grounding Electronic voltage regulator or generator Worn battery Electronic voltage regulator Voltage sensing wire	Adjust tension or replace drive belt Tighten loose connection or repair wiring Replace fusible link Repair Test generator, if faulty, repair or replace Replace battery Replace voltage regulator Repair wire

STARTING SYSTEM

Symptom	Suspect Area	Remedy
Engine will not crank	Battery charge low Battery cables loose, corroded or worn out Transaxle range switch (Vehicle with automatic transaxle only) Fusible link blown Starter motor faulty Ignition switch faulty	Charge or replace battery Repair or replace cables Adjust or replace switch Replace fusible link Repair starter motor Inspect
Engine cranks slowly	Battery charge low Battery cables loose, corroded or worn out Starter motor	Charge or replace battery Repair or replace cables Repair starter motor
Starter keeps running	Starter motor Ignition switch	Repair starter motor Inspect
Starter spins but engine will not crank	Short in wiring Pinion gear teeth broken or starter motor Ring gear teeth broken	Repair wiring Repair starter motor Replace flywheel ring gear or torque converter

CRUISE CONTROL SYSTEM

NOTICE

Before troubleshooting :

- Check the ECM(10A), Horn(10A), ECU #3(10A) and ECU B+(15A) fuse in the under - hood fuse/relay box.
- Check that the horn sounds.

- Check the tachometer to see if it works properly.

Symptom	Suspect Area	See Page
Cruise control cannot be set	Remocon switch Brake switch A/T gear position switch Cruise control unit	See page EE-34 See page EE-35 See page TR group-automatic transaxle See page EE-6
Cruise control cannot be set but indicator light does not go on	Dimming circuit in gauge Cruise control unit	See page EE-6 See page EE-6
Cruise speed is noticeably higher or lower than what was set	Vehicle speed sensor Cruise control unit and actuator cable deflection Cruise control unit	See page TR group-automatic transaxle See page EE-35 See page EE-6
Excessive overshooting or undershooting when trying to set speed	Cruise control unit and actuator cable deflection Vehicle speed sensor Cruise control unit	See page EE-35 See page TR group-automatic transaxle See page EE-6
Speed fluctuation on a flat road with cruise control set	Vehicle speed sensor Cruise control unit and actuator cable deflection Cruise control unit	See page TR group-automatic tranxaxle See page EE-35 See page EE-8
Vehicle does not decelerate or accelerate accordingly when SET/RESUME/CANCEL button is pushed	Remocon switch Cruise control unit	See page EE-57 See page EE-6
Cruise control does not cancel when shift lever is moved to N position (A/T)	A/T gear position switch Cruise control unit	See page TR group-automatic tranxaxle See page EE-6
Set speed is not cancelled when brake pedal is pushed	Brake switch Cruise control unit	See page EE-35 See page EE-6
Cruise control will not cancel when main switch is pushed OFF	Remocon switch Cruise control unit	See page EE-34 See page EE-6
Cruise control will not cancel when CANCEL button is pushed	Remocon switch Cruise control unit	See page EE-34 See page EE-6
Set speed will not resume when RESUME button (with main switch on, when set speed is temporarily cancelled)	Remocon switch Cruise control unit	See page EE-34 See page EE-6
The transmission shifts down slower than normal when going up a hill with the cruise control on (A/T)	Troubleshooting the cruise control communication circuit	See page EE-6

SPECIFICATION

STARTING SYSTEM

Item			Specifications
Starter	Type		Reduction drive (with planetary gear)
	Rated voltage		12V, 2.2KW
	No. of pinion teeth		10
	No-load charasteristics	Voltage	11V
		Amperage	130A, MAX
		Speed	4,500rpm, MIN

CHARGING SYSTEM

Item		Specifications
Alternator	Type	Battery voltage sensing
	Rated voltage	13.5V, 110A
	Voltage regulator	I.C regulator built-in type
	Regulator setting voltage	14.4 ± 0.3V
	Temperrature compensation	-10 ± 3mV/°C
Battery	Type	MF 100 AH
	Cold cranking amperage at-18°C (0°F)	850A
	Reserve capacity	182min
	Specific gravity at 20°C (77°F)	1.280 ± 0.01

NOTICE

- COLD CRANKING AMPERAGE is the amperage a battery can deliver for 30 seconds and maintain a terminal voltage of 7.2V or greater at a specified temperature.
- REVERSE CAPACITY RATING is amount of time a battery can deliver 25A and maintain a minimum terminal voltage of 10.5V at 26.7°C(80°F)

PREHEATING SYSTEM

Item		Specifications
Glow plug	Rated voltage	DC 12V
	Current	250MΩ
Glow plug relay	Rated voltage	DC 12V
	Operating voltage range	DC 9V ~ DC 16V
	Operating temperature range	-40°C ~ 120°C
	Rated load current	DC 12V, 70A

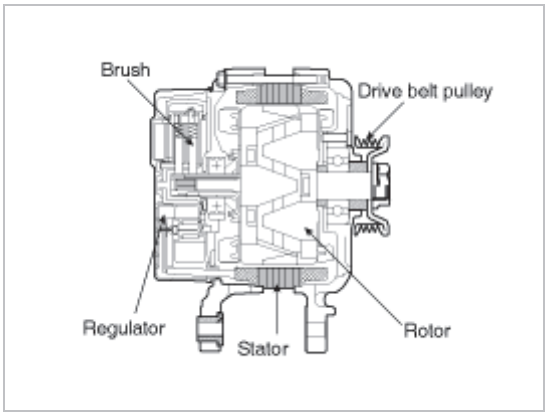
KIA MOTORS

Engine Electrical System

Charging System

DESCRIPTION

The conventional internal voltage detection type alternator controls the charging voltage regardless of the battery condition and according to the external load change so that it sometimes causes battery under or over charging or causes flickering of meters and lamps due to ripples of generated voltage resulting from load fluctuation. The figure below show the internal circuits of the alternator and voltage regulator.



ON-VEHICLE INSPECTION

CAUTION

- Check that the battery cables are connected to the correct terminals.
- Disconnect the battery cables when the battery is given a quick charge.
- Do not perform tests with a high voltage insulation resistance tester.
- Never disconnect the battery while the engine is running.

CHECK BATTERY TERMINALS, FUSIBLE LINK AND FUSES

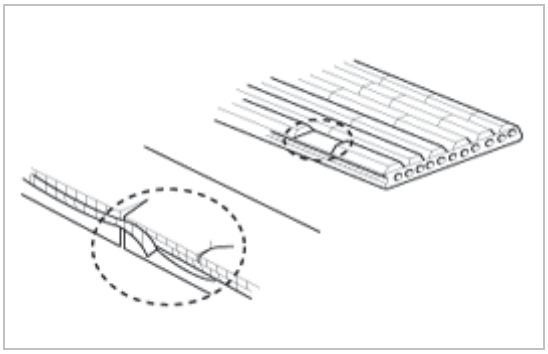
1. Check that the battery terminals are not loose or corroded.
2. Check the fusible link and fuses for continuity.

INSPECT DRIVE BELT

1. Visually check the belt for excessive wear, frayed cords etc.
   If any defect has been found, replace the drive belt.

NOTICE

Cracks on the rib side of a belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.



2. Using a belt tension gauge, measure the drive belt tension.

VISUALLY CHECK ALTERNATOR WIRING AND LISTEN FOR ABNORMAL NOISES

1. Check that the wiring is in good condition.
2. Check that there is no abnormal noise from the alternator while the engine is running.

CHECK DISCHARGE WARNING LIGHT CIRCUIT

1. Warm up the engine and then turn it off.
2. Turn off all accessories.
3. Turn the ignition switch "ON". Check that the discharge warning light is it.
4. Start the engine. Check that the light goes off.

INSPECT CHARGING SYSTEM

VOLTAGE DROP TEST OF ALTERNATOR OUTPUT WIRE

This test determines whether or not the wiring between the alternator "B" terminal and the battery (+) terminal is good by the voltage drop method.

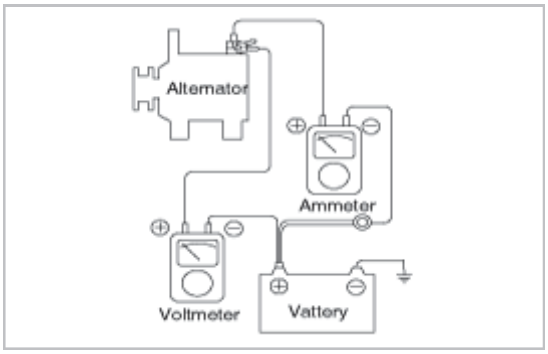
PREPARATION

1. Turn the ignition switch to "OFF".

NOTICE

To find abnormal conditions of the connection, actions should not be taken on the two terminals and each connection during the test.

2. Connect a digital voltmeter between the alternator "B" terminal and battery (+) lead wire to the battery (+) terminal. Connect the (+) lead wire of the voltmeter to the "B" terminal and the (-) lead wire to the battery (+) terminal.



CONDITIONS FOR THE TEST

1. Start the engine.
2. Switch on the headlamps, blower motor and so on. And then, read the voltmeter under this condition.

RESULT

1. The voltmeter may indicate the standard value.

0.2V max.

2. If the value of the voltmeter is higher than expected (above 0.2V max.), poor wiring is suspected. In this case check the wiring from the alternator "B" terminal to the fusible link to the battery (+) terminal. Check for loose connections, color change due to an overheated harness, etc. Correct them before testing again.
3. Upon completion of the test, set the engine speed at idle. Turn off the head lamps, blower motor and the ignition switch.

OUTPUT CURRENT TEST

This test determines whether or not the alternator gives an output current that is equivalent to the nominal output.

PREPARATION

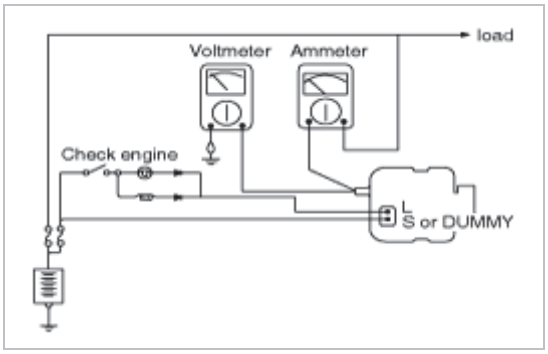
1. Prior to the test, check the following items and correct as necessary.
   Check the battery installed in the vehicle to ensure that it is in good condition. The battery checking method is described in "BATTERY".
   The battery that is used to test the output current should be one that has been partially discharged. With a fully charged battery, the test may not be conducted correctly due to an insufficient load.
   Check the tension of the alternator drive belt.
2. Turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Disconnect the alternator output wire from the alternator "B" terminal.
5. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire. Be sure to connect the (-) lead wire of the ammeter to the disconnected output wire.

NOTICE

Tighten each connection securely, as a heavy current will flow. Do not rely on clips.

6. Connect a voltmeter (0 to 20V) between the "B" terminal and ground. Connect the (+) lead wire to the alternator "B" terminal and (-) lead wire to a good ground.

7. Attach an engine tachometer and connect the battery ground cable.
8. Leave the engine hood open.



TEST

1. Check to see that the voltmeter reads as the same value as the battery voltage. If the voltmeter reads 0V, and the open circuit in the wire between the alternator "B" terminal and battery (-) terminal, a blown fusible link or poor grounding is suspected.
2. Start the engine and turn on the headlights.
3. Set the headlights to high beam and the heater blower switch to HIGH, quickly increase the engine speed to 2,500 rpm and read the maximum output current value indicated by the ammeter.

> **NOTICE**
>
> After the engine starts up, the charging current quickly drops. Therefore, the above operation must be done quickly to read the maximum current value correctly.

RESULT

1. The ammeter reading must be higher than the limit value. If it is lower but the alternator output wire is in good condition, remove the alternator from the vehicle and test it.

Limit value : 50% of the reated currend.

> **NOTICE**
>
> - The nominal output current value is shown on the nameplate affixed to the alternator body.
> - The output current value changes with the electrical load and the temperature of the alternator itself. Therefore, the nominal output current may not be obtained. If such is the case, keep the headlights on the cause discharge of the battery, or use the lights of another vehicle to increase the electrical load.
>   The nominal output current may not be obtained if the temperature of the alternator itself or ambient temperature is too high.
>   In such a case, reduce the temperature before testing again.

2. Upon completion of the output current test, lower the engine speed to idle and turn "OFF" the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the ammeter and voltmeter and the engine tachometer.
5. Connect the alternator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

REGULATED VOLTAGE TEST

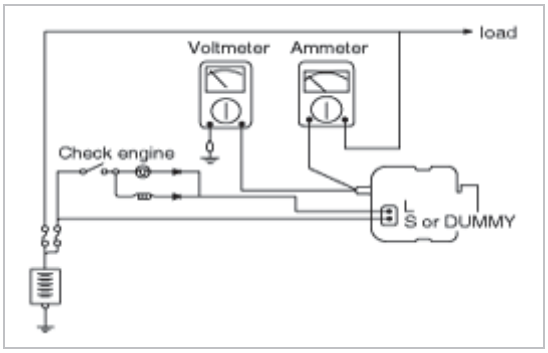
The purpose of this test is to check that the electronic voltage regulator controls voltage correctly.

PREPARATION

1. Prior to the test, check the following items and correct if necessary.
   Check that the battery installed on the vehicle is fully charged. For battery checking method, see "BATTERY".

Check the alternator drive belt tension.

2. Turn ignition switch to "OFF".
3. Disconnect the battery ground cable.
4. Connect a digital voltmeter between the "B" terminal of the alternator and ground. Connect the (+) lead of the voltmeter to the "B" terminal of the alternator. Connect the (-) lead to good ground or the battery (-) terminal.
5. Disconnect the alternator output wire from the alternator "B" terminal.
6. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire. Connect the (-) lead wire of the ammeter to the disconnected output wire.
7. Attach the engine tachometer and connect the battery ground cable.



TEST

1. Turn on the ignition switch and check to see that the voltmeter indicates the following value.

Battery voltage

2. If it reads 0V, there is an open circuit in the wire between the alternator "B" terminal and the battery and the battery (-), or the fusible link is blown.
3. Start the engine. Keep all lights and accessories off.
4. Run the engine at a speed of about 2,500 rpm and read the voltmeter when the alternator output current drops to 10A or less.

RESULT

1. If the voltmeter reading agrees with the value listed in the Regulating Voltage Table below, the voltage regulator is functioning correctly. If the reading is other than the standard value, the voltage regulator or the alternator is faulty.
REGULATING VOLTAGE TABLE

Voltage regulator ambient temperature °C (°F)	Regulating voltage (V)
-30 (-22)	14.2 ~ 15.3
25 (77)	14.2 ~ 14.8
135 (275)	13.3 ~ 14.8

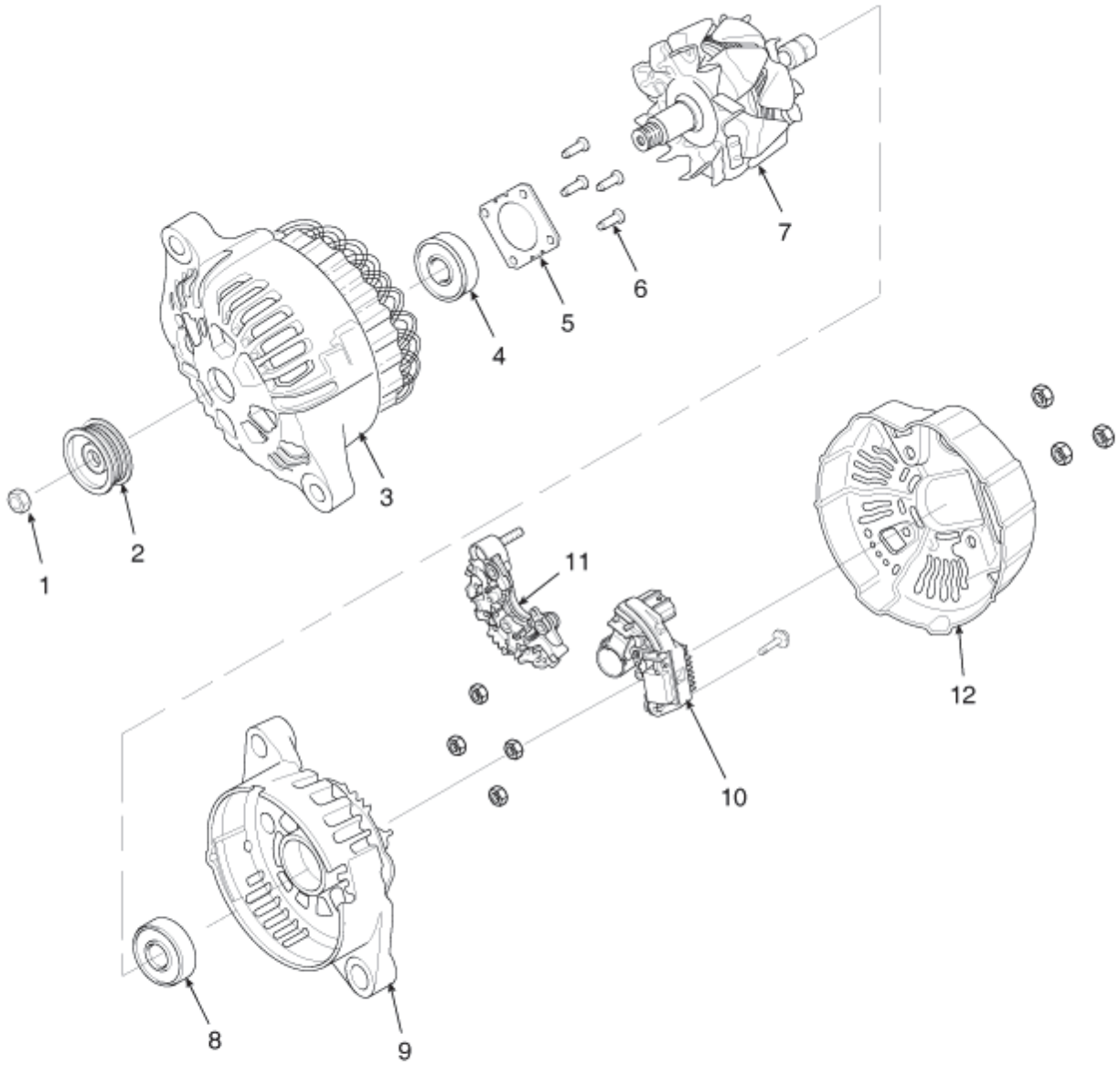
2. Upon completion of the test, reduce the engine speed to idle, and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the voltmeter and ammeter and the engine tachometer.
5. Connect the alternator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

KIA MOTORS

Engine Electrical System

Charging System - Alternator

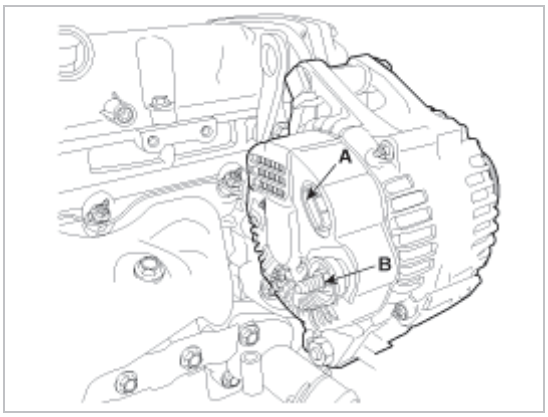
COMPONENTS



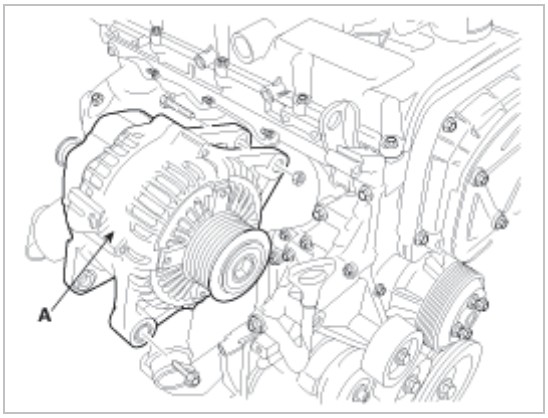
1. Nut
2. Pulley
3. Pront bracket
4. Pront bearing
5. Bearing cover
6. Bearing cover bolts
7. Rotor
8. Rear bearing
9. Rear bracket
10. Brush holder assembly
11. Regulator
12. Rear cover

REPLACEMENT

1. Disconnect the battery negative terminal frist, then the positive terminal.
2. Disconnect the alternator connector(A) and "B" terminal cable(B) from the alternator.
3. Remove the drive belt.



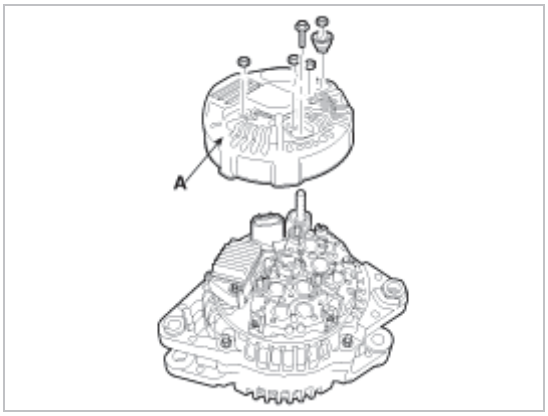
4. Remove the through bolt and the alternator(A).



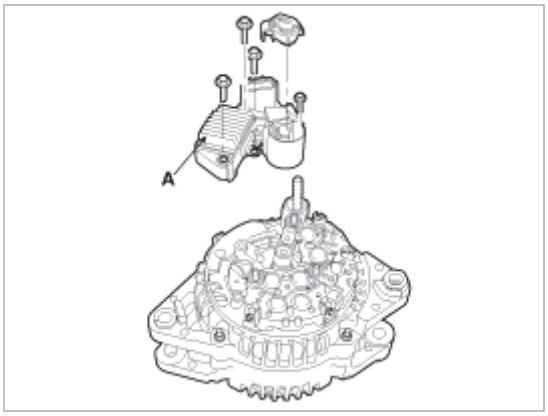
5. Installation is the reverse of removal.

DISASSEMBLY

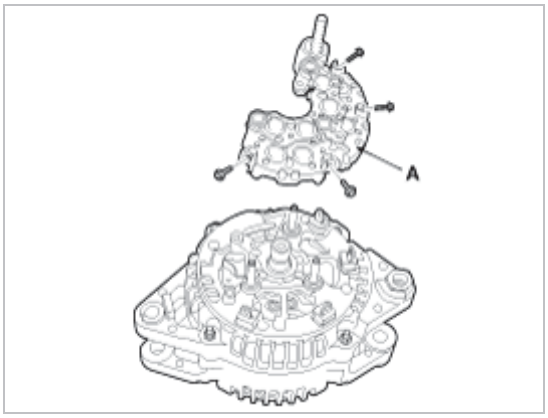
1. Remove the nuts and bolts frist, and cover(A).



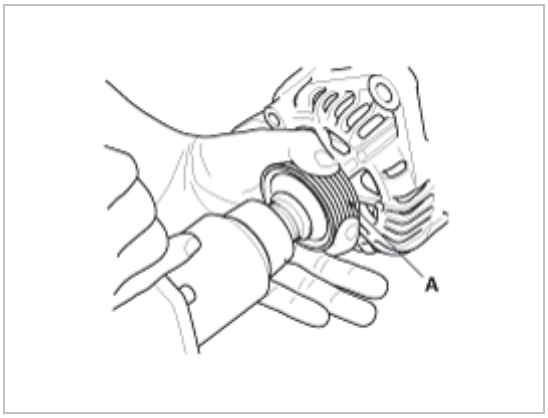
2. Remve the brush holder assembly(A).



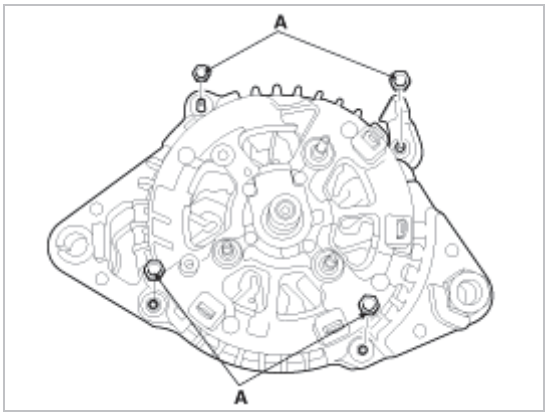
3. Remove the regulator(A).



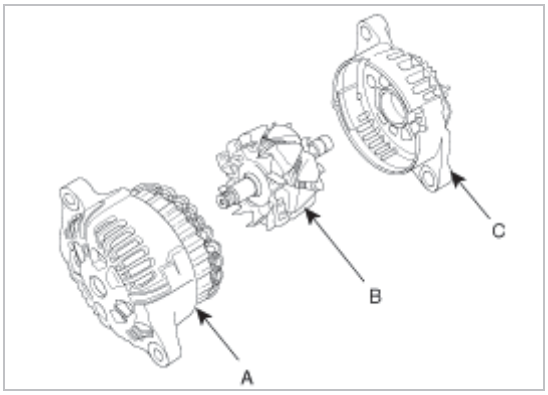
4. Remove the alternator pulley(A).



5. Remove the rear bracket nuts(A).



6. Separate the front bracket(A), rotor(B) rear bracket(C).

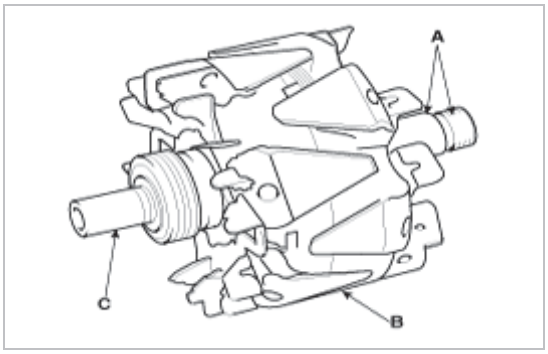


7. Installation is the reverse of removal.

INSPECTION

INSPECT ROTOR

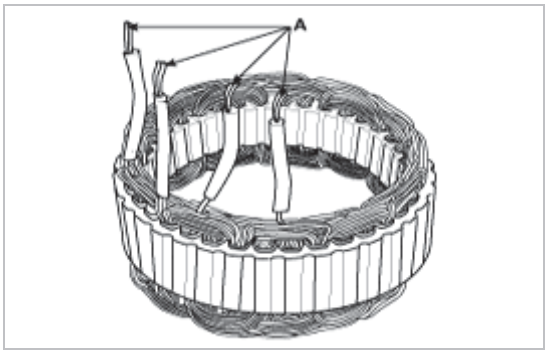
1. Check that there is continuity between the slip rings(A).



2. Check that there is no continuity between the slip rings and the rotor(B) or rotor shaft(C).
3. If the rotor fails either continuity check, replace the alternator.

INSPECT STATOR

1. Check that there is continuity between each pair of leads(A).



2. Check that there is no continuity between each lead and the coil core.
3. If the coil fails either continuity check, replace the generator.

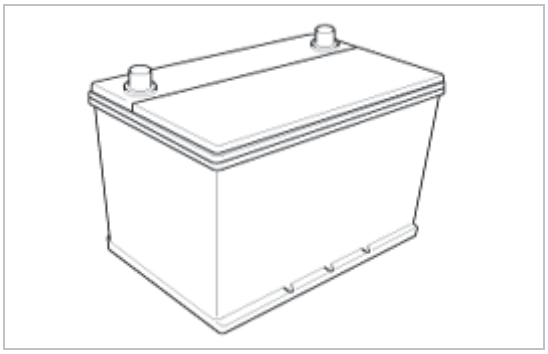
KIA MOTORS

Engine Electrical System

Charging System - Battery

DESCRIPTION

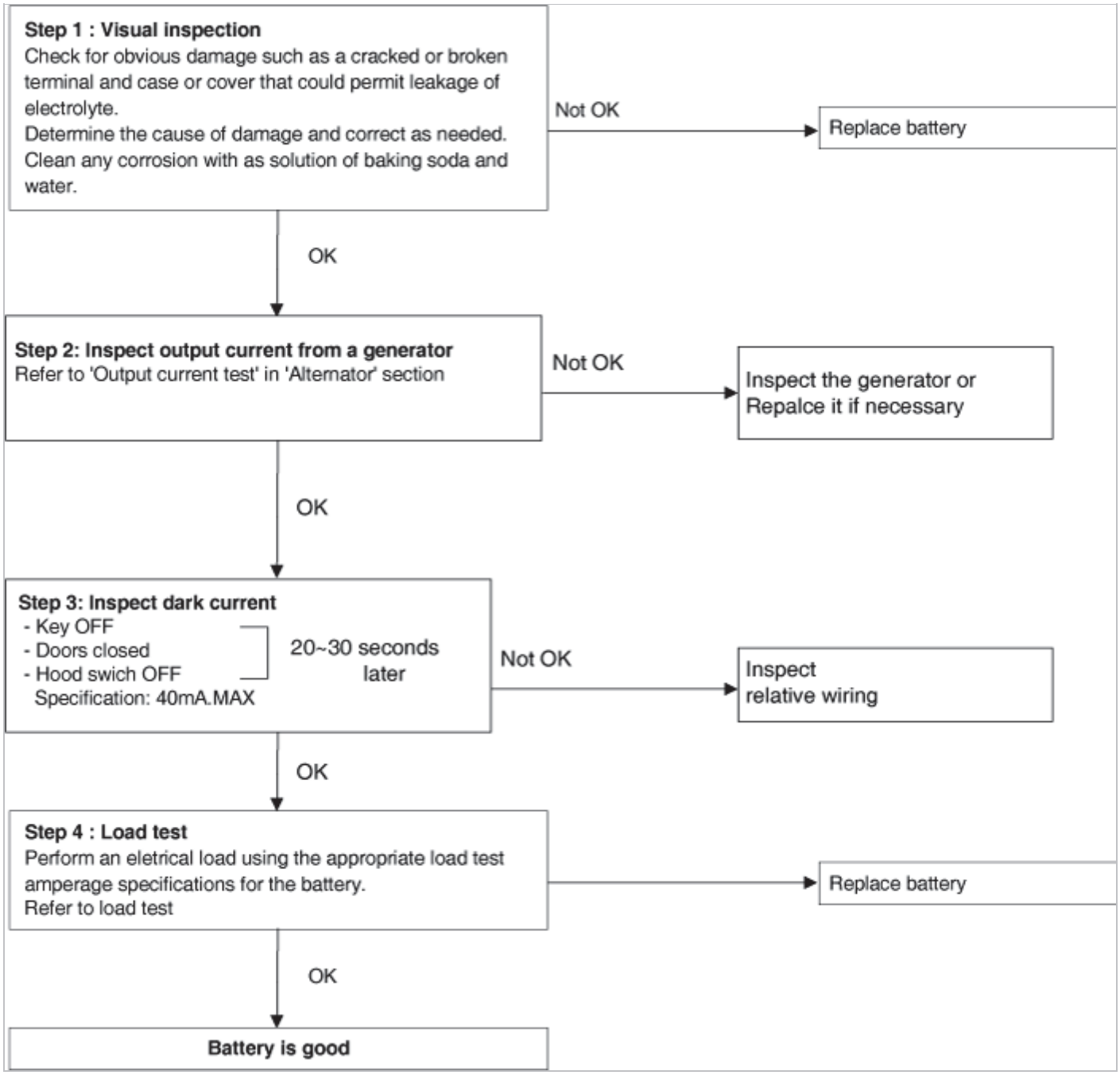
1. The maintenance-free battery is, as the name implies, totally maintenance free and has no removable battery cell caps.
2. Water never needs to be added to the maintenance-free battery.
3. The battery is completely sealed, except for small vent holes in the cover.



INSPECTION

BATTERY DIAGNOSTIC TEST(1)

CHECKING FLOW



LOAD TEST

1. Perform the following steps to complete the load test procedure for maintenance free batteries.
2. Connect the load tester clamps to the terminals and proceed with the test as follow :
   A. If the battery has been on charge, remove the surface charge by connect a 300 ampere load for 15 seconds.
   B. Connect the voltmeter and apply the specified load.
   C. Read the voltage after the load has been applied for 15 seconds.
   D. Disconnect the load.
   E. Compare the voltage reading with the minimum and replace the battery if battery test voltage is below that shown in the voltage table.

Voltage	Temperature
9.6	20°C (70°F) and above
9.5	16 °C (60 °F)
9.4	10 °C (50 °F)
9.3	4 °C (40 °F)
9.1	-1 °C (30 °F)
8.9	-7 °C (20 °F)
8.7	-12 °C (10 °F)
8.5	-18 °C (0 °F)

NOTICE

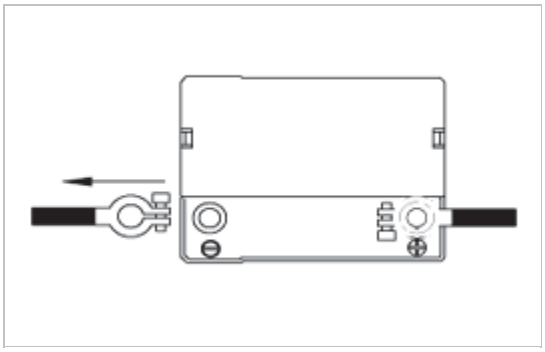
- If the voltage is less than shown in the table, the battery is good.
- If the voltage is greater than shown in the table, replace the battery.

BATTERY DIAGNOSTIC TEST

1. Make sure the ignition switch and all accessories are in the OFF position.
2. Disconnect the battery cables (negative first).
3. Remove the battery from the vehicle.

CAUTION

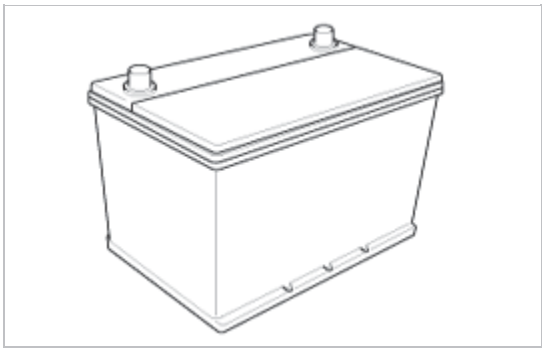
Care should be taken in the event the battery case is cracked or leaking, to protect your skin from the electrolyte. Heavy rubber gloves (not the household type) should be worn when removing the battery.



4. Inspect the battery carrier for damage caused by the loss of electrolyte. If acid damage is present, it will be necessary to clean the area with a solution of clean warm water and baking soda. Scrub the area with a stiff brush and wipe off with a cloth moistened with baking soda and water.
5. Clean the top of the battery with the same solution as described in Step(3).
6. Inspect the battery case and cover for cracks. If cracks are present, the battery must be replaced.
7. Clean the battery posts with a suitable battery post tool.
8. Clean the inside surface of the terminal clamps with a suitable battery cleaning tool. Replace damaged or frayed cables and broken terminal clamps.
9. Install the battery in the vehicle.
10. Connect the cable terminals to the battery post, making sure the tops of the terminals are flush with the tops of the posts.
11. Tighten the terminal nuts securely.
12. Coat all connections with light mineral grease after tightening.

CAUTION

When batteries are being charged, an explosive gas forms beneath the cover of each cell. Do not smoke near batteries being charged or which have recently been charged. Do not break live circuits at the terminals of batteries being charged. A spark will occur when the circuit is broken. Keep open flames away from the battery.



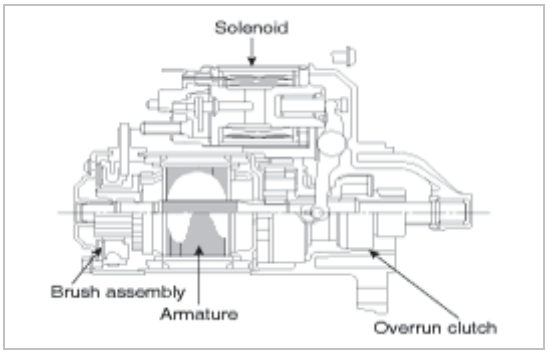
KIA MOTORS

Engine Electrical System

Starting System

DESCRIPTION

The starting system includes the battery, starter motor, solenoid switch, ignition switch, inhibitor switch(A/T), ignition lock switch, connection wires and the battery cable.
When the ignition key is turned to the start position, current flows and energizes the starter motor's solenoid coil. The solenoid plunger and clutch shift lever are activated, and the clutch pinion engages the ring gear.
The contacts close and the starter motor cranks. In order to prevent damage caused by excessive rotation of the starter armature when the engine starts, the clutch pinion gear overruns.



INSPECTION

STARTER TEST

> **NOTICE**
>
> The air temperature must be between 59 and 100°F (15 and 38°C) before testing.

Recommended procedure :

- Use a starter system tester.
- Connect and operate the equipment in accordance with the manufacturer's instructions.
- Test and troubleshoot as described.

Alternate Procedure :

- Use the following equipment :
  - Ammeter, 0~400A
  - Voltmeter, 0~20V (accurate within 0.1 volt)
  - Tachometer, 0~1,200 rpm
- Hook up a voltmeter and ammeter as shown.

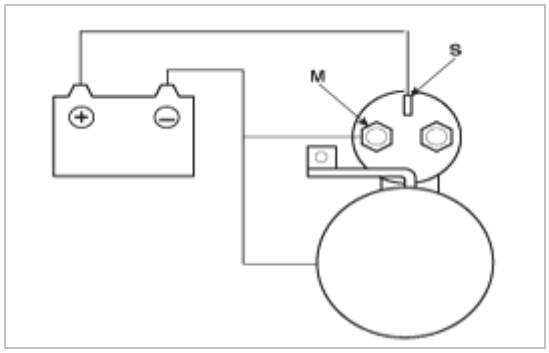
> **NOTICE**
>
> After this test, or any subsequent repair, reset the ECM/PCM to clear any codes.

Check the Starter Engagement :

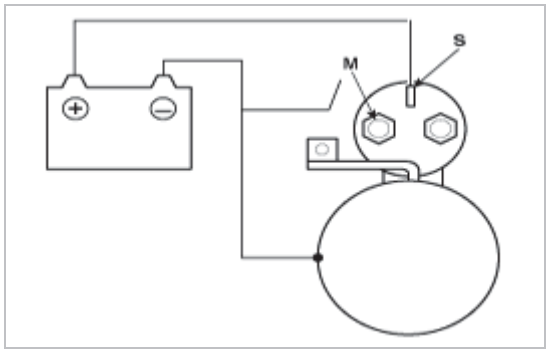
1. Remove the ECM(B+) fuse from the fuse/relay box.
2. Turn the ignition switch to START (III) with the shift lever in N or P position (A/T) or with the clutch pedal depressed (M/T). The starter should crank the engine.
   A. If the starter does not crank the engine, go to step 3.
   B. If it cranks the engine erratically or too slowly, go to "Check for Wear and Damage" on the next page.
3. Check the battery, battery positive cable, ground, starter cut relay, and the wire connections for looseness and corrosion. Test again.
   If the starter still does not crank the engine, go to step 4.
4. Unplug the connector from the starter.
5. Connect a jumper wire from the battery positive (+) terminal to the solenoid terminal.
   The starter should crank the engine.
   A. If the starter still does not crank the engine, remove it, and diagnose its internal problem.
   B. If the starter cranks the engine, go to step 6.
6. Check the ignition switch.
7. Check the starter relay.
8. Check the A/T gear position switch (A/T) or the clutch interlock switch (M/T).
9. Check for an open in the wire between the ignition switch and starter.

STARTER SOLENOID TEST

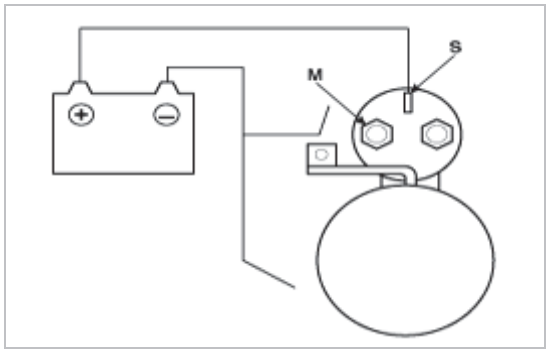
1. Disconnect the wires from the Sterminal and the M terminal.
2. Connect the battery as shown. If the starter pinion pops out, it is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



3. Disconnect the battery from the M terminal.
   If the pinion does not retract, the hold-in coil is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



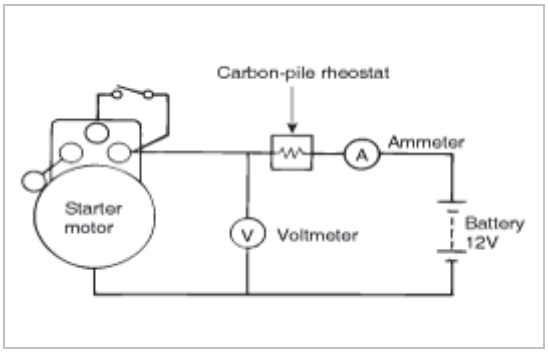
4. Disconnect the battery also from the body. If the pinion retracts immediately, it is working properly.
   To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



FREE RUNNING TEST

1. Place the starter motor in a vise equipped with soft jaws and connecta fully-charged 12-volt battery to starter motor as follows :
2. Connect a test ammeter (100-ampere scale) and carbon pile rheostatas shown is the illustration.
3. Connect a voltmeter (15-volt scale) across starter motor.
4. Rotate carbon pile to the off position.
5. Connect the battery cable from battery's negative post to the starter motor body.
6. Adjust until battery voltage shown on the voltmeter reads 11 volts.
7. Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely :

: Max. 120 Amps
: Min. 4,000 rpm



CLEANING

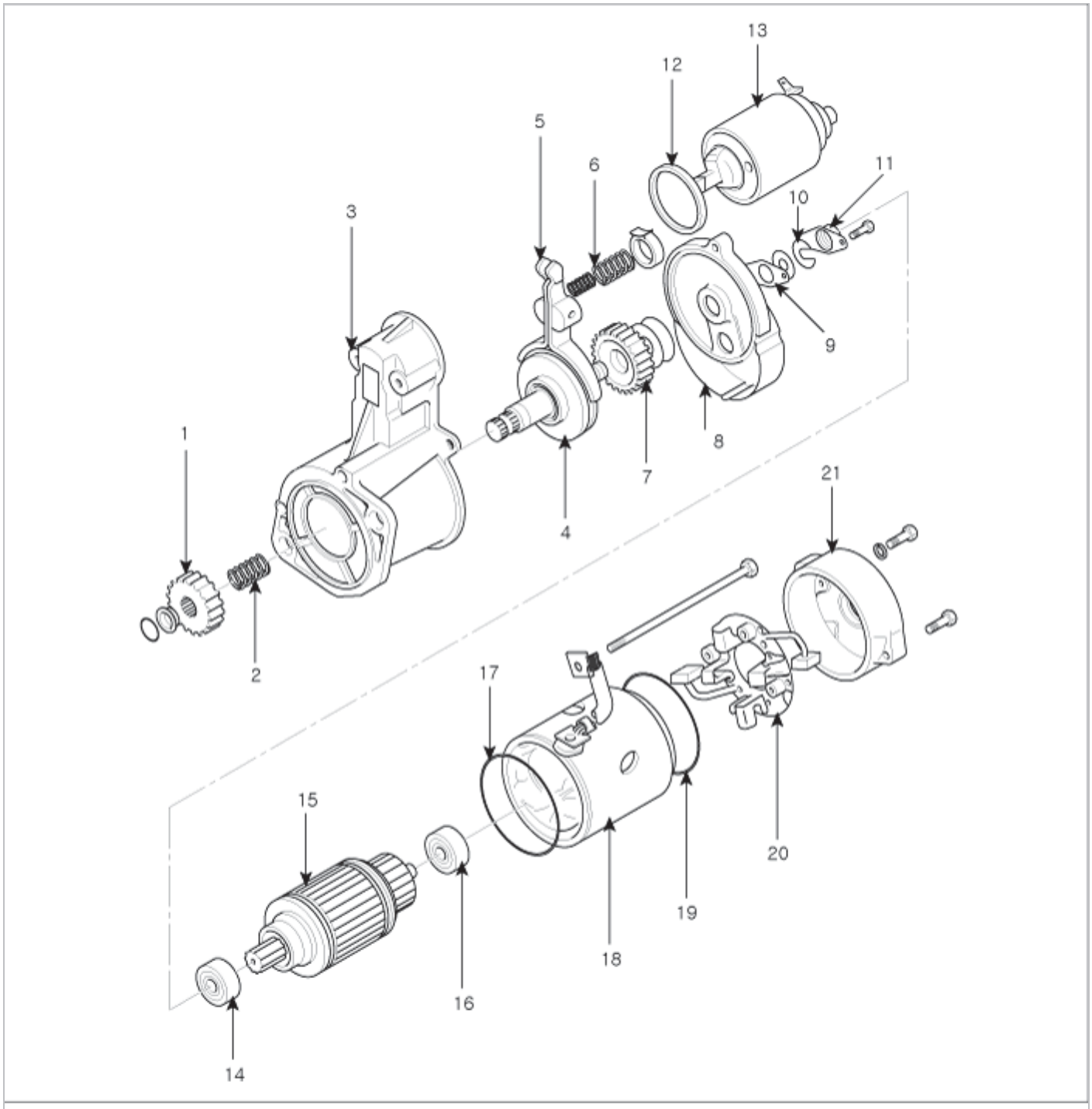
1. Do not immerse parts in cleaning solvent. Immersing the yoke assembly and/or armature will damage the insulation. Wipe these parts with a cloth only.
2. Do not immerse the drive unit in cleaning solvent. The overrun clutch is pre-lubricated at the factory and solvent will wash lubrication from the clutch.
3. The drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.

KIA MOTORS

Engine Electrical System

Starting System - Starter

COMPONENTS

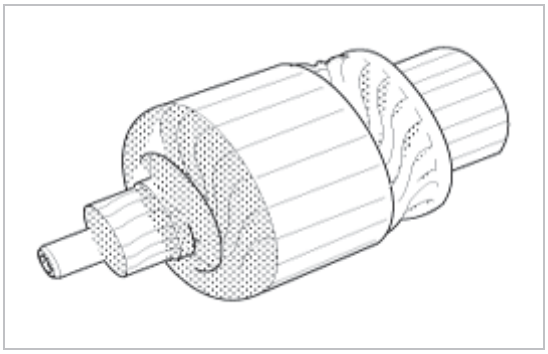


1. Pinion gear
2. Spring
3. Front bracket
4. Pinion shaft
5. Lever
6. Spring
7. Gear
8. Center bracket
9. Plate
10. Stopring
11. Cover
12. Washer
13. Magnetic swich
14. Bearing
15. Armature
16. Bearing
17. O-ring
18. Yoke assembly
19. O-ring
20. Brush holder
21. Rear bracket

INSPECTION

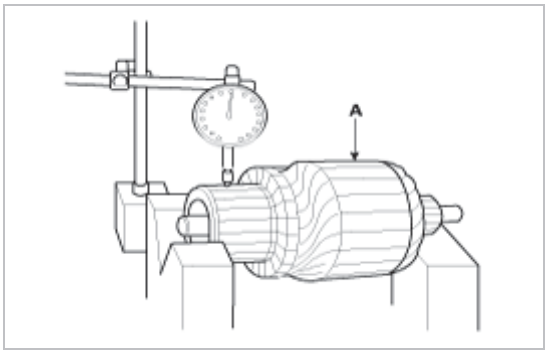
ARMATURE INSPECTION AND TEST

1. Remove the starter.
2. Disassemble the starter as shown at the beginning of this procedure.
3. Inspect the armature for wear or damage from contact with the permanent magnet. If there is wear or damage, replace the armature.

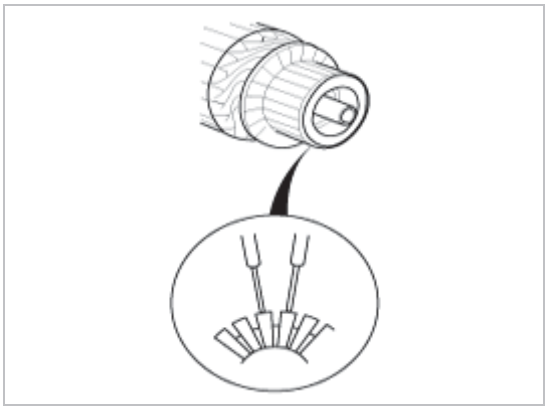


4. Measure the commutator (A) runout.
   A. If the commutator runout is within the service limit, check the commutator for carbon dust or brass chips between the segments.
   B. If the commutator runout is not within the service limit, replace the armature.

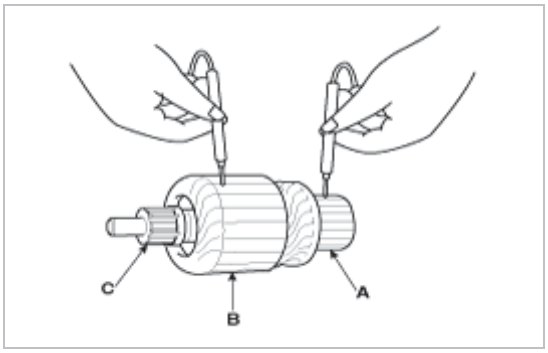
Commutator Runout
Standard (New) : 0.02mm (0.001 in.) max.
Service limit : 0.05mm (0.002 in.)



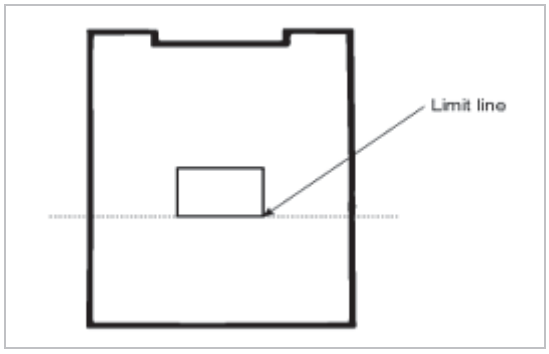
5. Check for continuity between the segments of the commutator. If an open circuit exists between any segments, replace the armature.



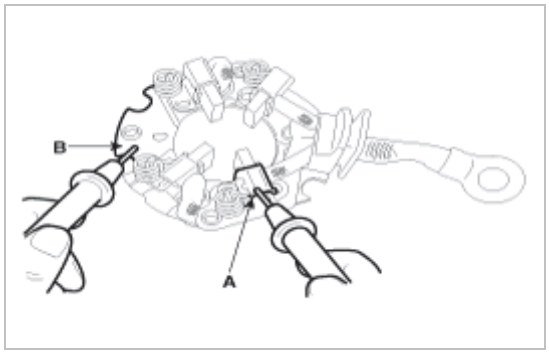
6. Check with an ohmmeter that no continuity exists between the commutator (A) and armature coil core (B), and between the commutator and armature shaft (C). If continuity exists, replace the armature.



INSPECT STARTER BRUSH

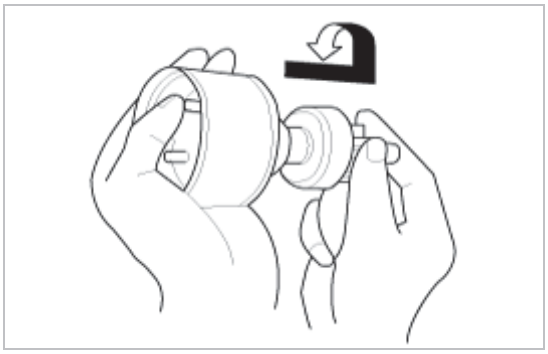


STARTER BRUSH HOLDER TEST



INSPECT OVERRUNNING CLUTCH

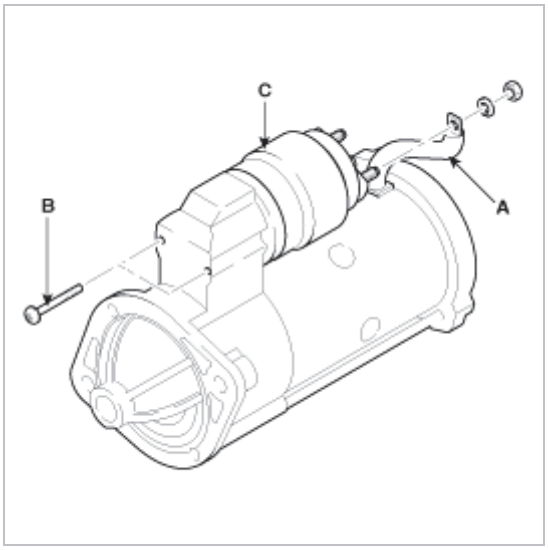
1. Slide the overrunning clutch along the shaft.
   Replace it if does not slide smoothly.
2. Rotate the overrunning clutch (A) both ways.
   Does it lock in one direction and rotate smoothly in reverse? If it does not lock in either direction or it locks in both directions, replace it.



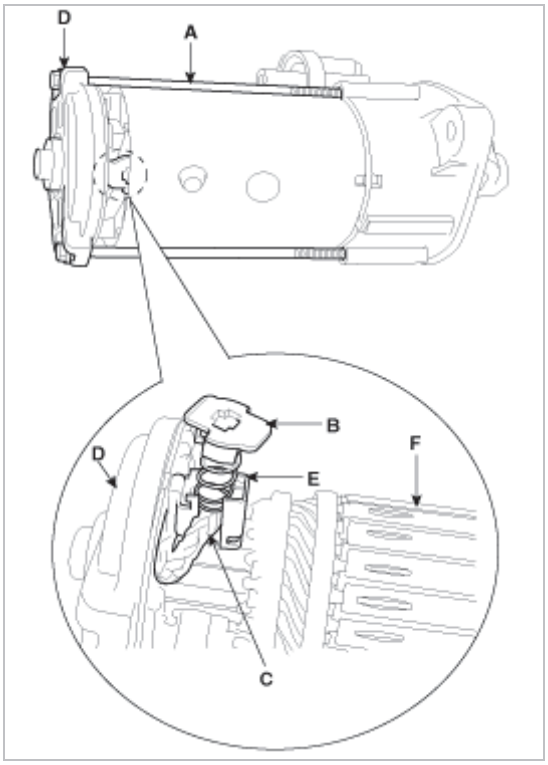
3. If the starter driver gear (B) is worn or damaged, replace the overrunning clutch assembly: the gear is not available separately.
   Check the condition of the flywheel or torque converter ring gear if the starter drive gear teeth are damaged.

DISASSEMBLY

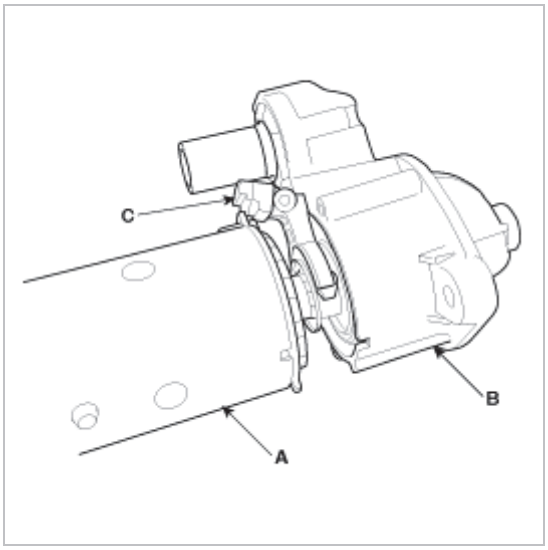
1. Remove the magnetic swich "M" terminal(A) and magnetic swich(C).



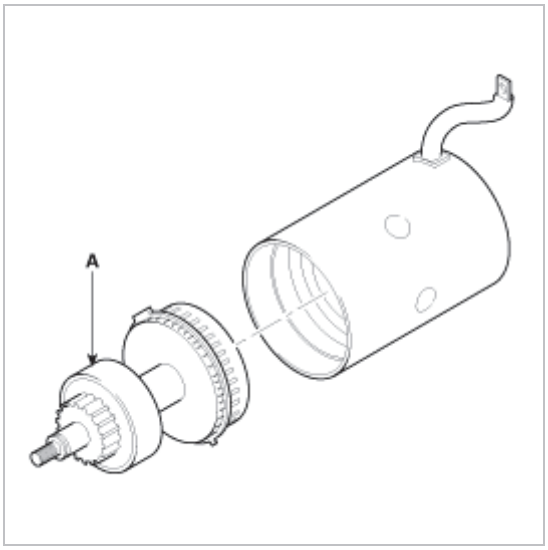
2. Remove the brusth spring by(B) using screw driver, the disconnect the brush(C) from the brush holder. Disconnect the rear bracket(D), brush holder(E) and armature(F).



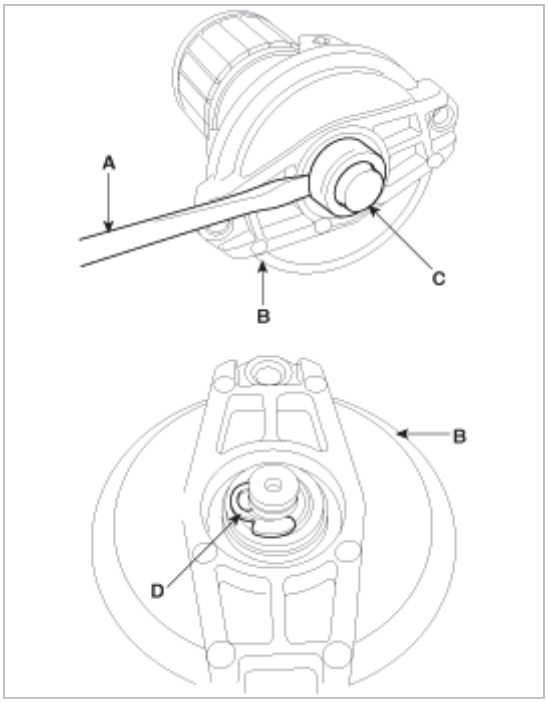
3. Remove the yoke assembly with the front bracket(B) and pinion shift lever assembly(C).



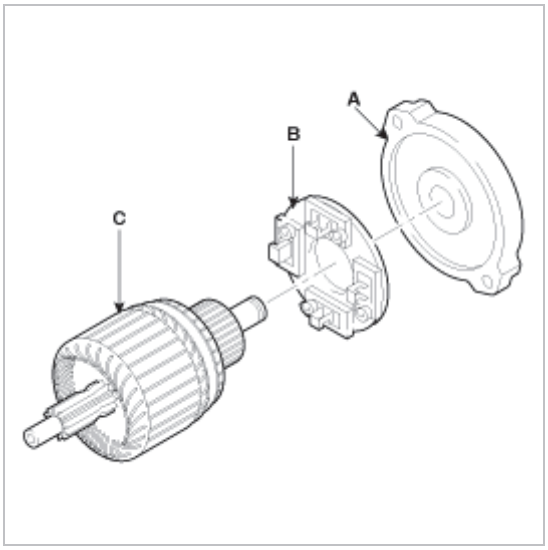
4. Remove the over running clutch assembly(A).



5. Using a screw driver(A), remove the rear bracket packing(C) and key(D).



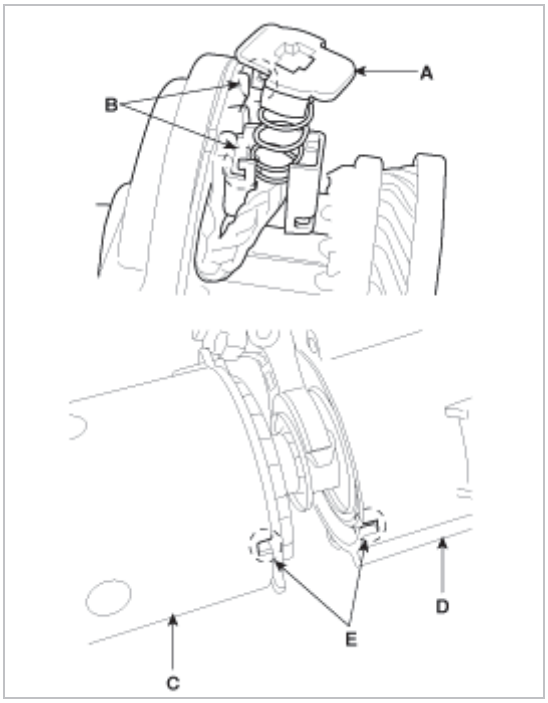
6. Separat the rear bracket(A), brush holder(B), armature(C).



7. Reassembly is the reverse of disassembly

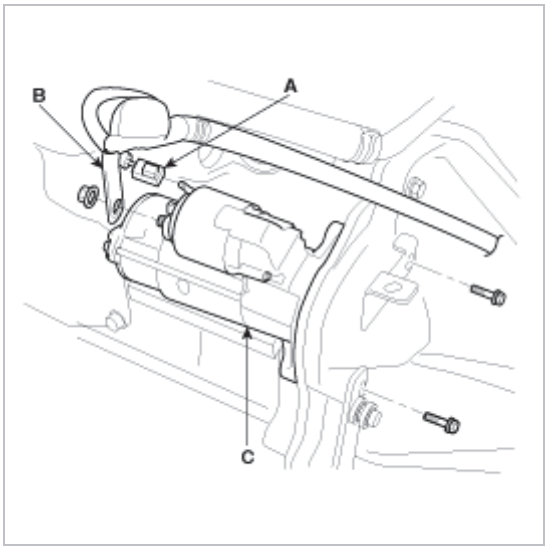
NOTICE

- When installing the brush spring(A), take care not to break the brush edge part(B).
- When installing the yoke(C) and front bracket(D), align the mark(E) on the yoke to mark the range of the front bracket.



REPLACMENT

1. Disconnect the negative cable.
2. Disconnect the stater cable from the "B" teminal(B) on the solenoid then disconnect the "S" teminal connector(A).
3. Remove the 2bolts holding the stater, then remove the stater(C).



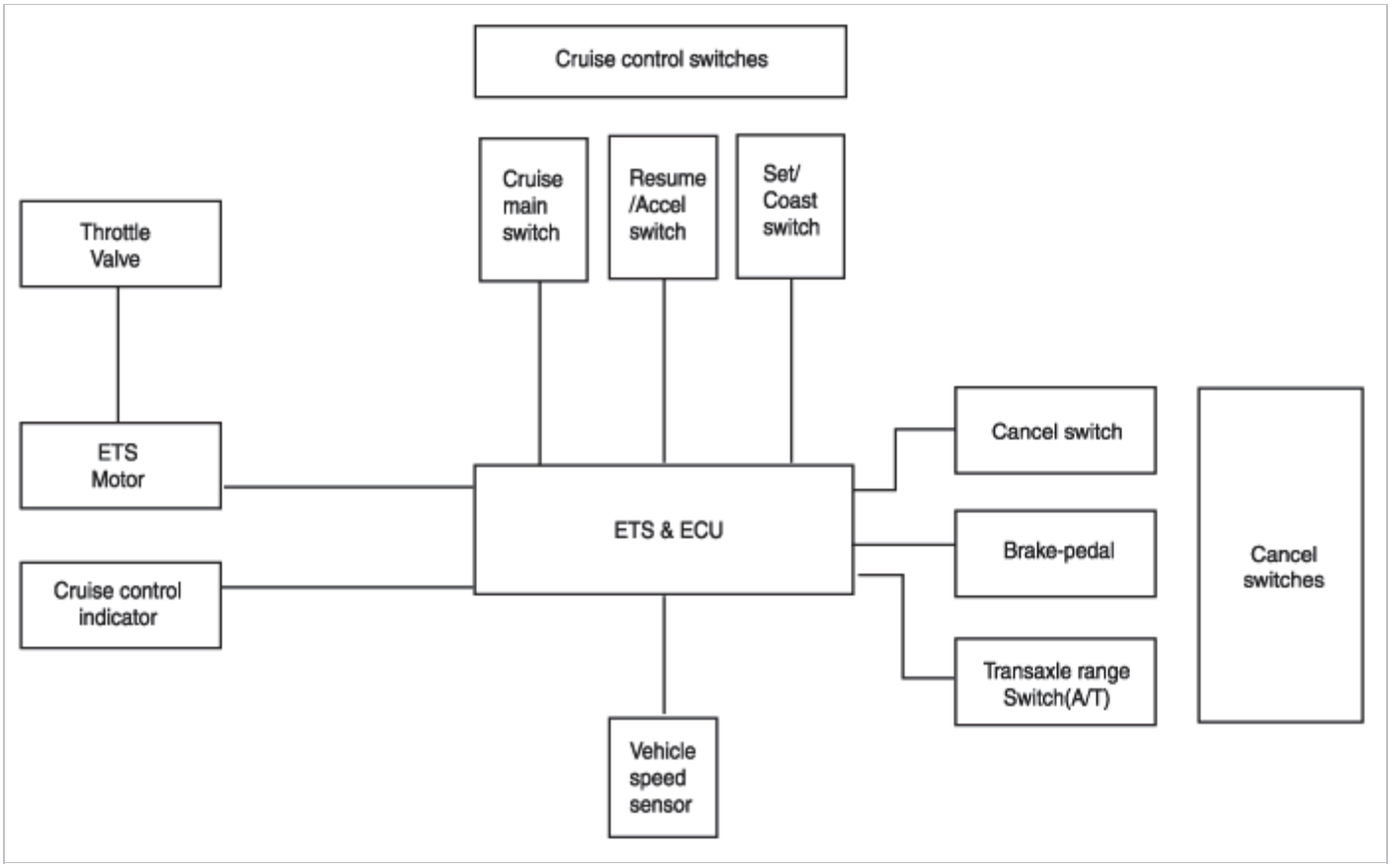
4. Installation is the reverse of removal.

KIA MOTORS

Engine Electrical System

Cruise Control System

SYSTEM BLOCK DIAGRAM



COMPONENT PARTS AND FUNCTION OUTLINE

Component part		Function
Vehicle-speed sensor		Converts vehicle speed to pulse.
Engine control module (ECM)		Receives signals from sensor and control switches;
Cruise control indicator		Illuminate when CRUISE main switch is ON (Built into cluster)
Cruise Control switches	CRUISE main switch	Switch for automatic speed control power supply.
	Resume/Accel switch	Controls automatic speed control functions by Resume/Accel switch (Set/Coast switch)
	Set/Coast switch	
Cancel switch	Cancel switch	Sends cancel signals to ECM
	Brake-pedal switch	
	Transaxle range switch (A/T) Clutch switch (M/T)	
ETS motor		Regulates the throttle valve to the set opening by ECM.

* ETS : Electronic Throttle System

CRUISE CONTROL

Cruise control system is engaged by "ON/OFF" main switch located on right of steering wheel column. System has the capability to cruise, coast, resume speed, and accelerate, and raise "tab-up" or lower "tab-down" set speed.
It also has a safety interrupt, engaged upon depressing brake or shifting select lever.
ECM is a speed control system that maintains a required vehicle speed at normal driving conditions.
The main components of cruise control system are mode control switches, transaxle range switch, brake switch,

vehicle speed sensor, ECM and ETS motor that connect throttle body.
ECM contains a low speed limit which will prevent system engagement below a minimum speed of 40km/h (25mph).
The operation of the controller is controlled by mode control switches located on steering wheel.
Transaxle range switch and brake switch are provided to disengage the cruise control system. The switches are on brake pedal bracket and transaxle. When the brake pedal is depressed or select lever shifted, the cruise control system is electrically disengaged and the throttle is returned to the idle position.

Cruise main switch

Cruise control system is engaged by pressing "ON/OFF" push button. Releasing "ON/OFF" push button release throttle, clears cruise memory speed, and puts vehicle in a non-cruise mode.

Coast/Set switch

COAST/SET switch located on right of steering wheel column has two positions - "Normal" and "Depressed". The set position - With COAST/SET switch depressed and then released the cruise speed will be set at the speed the vehicle was going when COAST/SET switch was released. The coast position - With COAST/SET switch fully depressed, driver can lower cruise speed. To decrease cruise speed, COAST/SET switch is held in, disengaging cruise control system. When vehicle has slowed to required cruise speed, releasing COAST/SET switch will re-engage speed at new selected speed.
The tab down - To lower vehicle speed, cruise must be engaged and operating. Tab down is done by quickly pressing and releasing COAST/SET switch. Do not hold COAST/SET switch in depressed position.
Tab down is a function which will cause the cruise control 's speed of vehicle to decrease by 1 mph (1.6km/h)

Resume/Accel switch

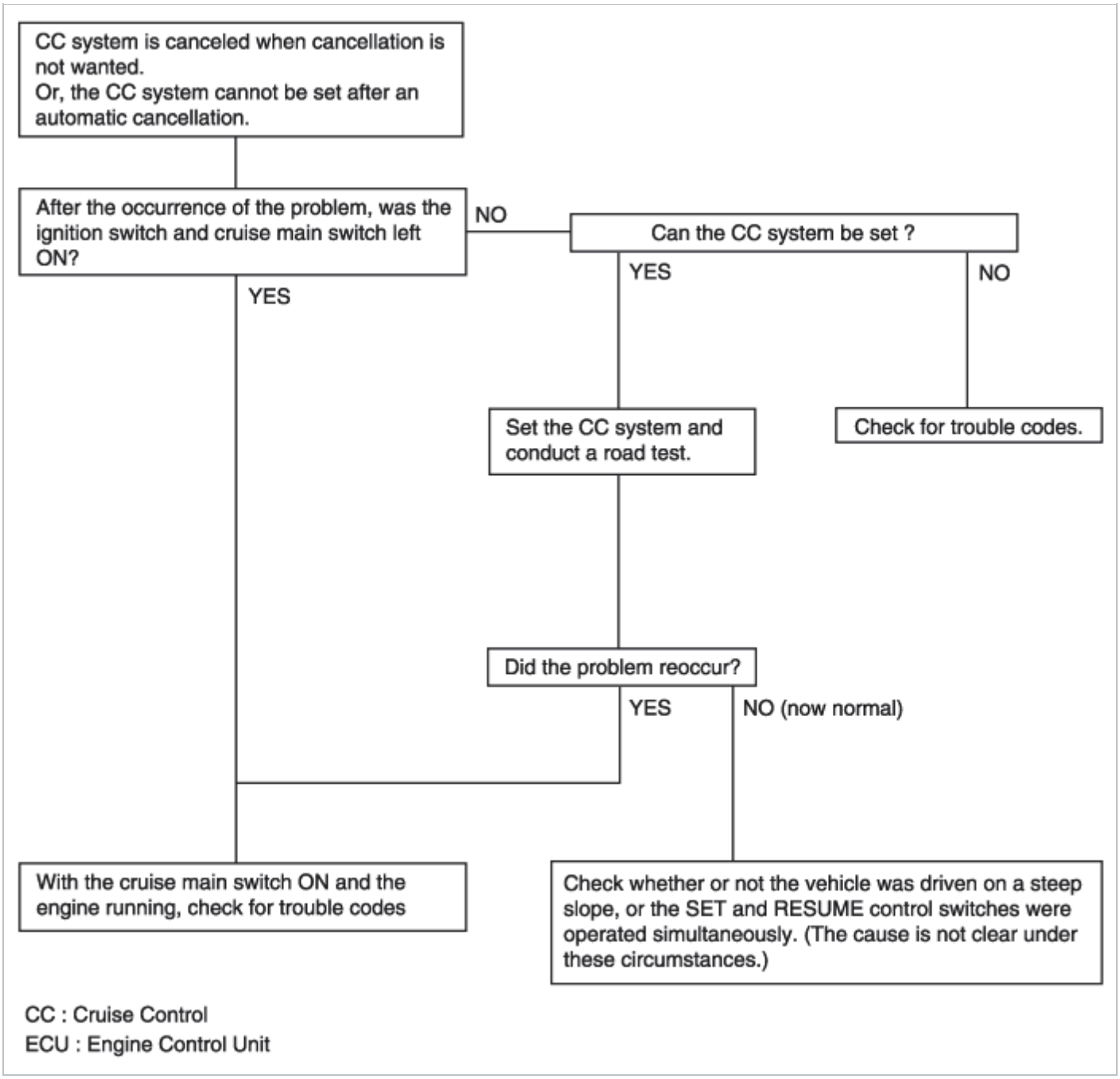
RES/ACCEL switch located on right of steering wheel column has two positions - "Normal" and "Depressed".
The resume position - With RES/ACCEL switch depressed and then release, this switch also returns cruise control operation to last speed (Which is temporarily disengaged by Cancel switch or Brake pedal), setting when momentarily operating RES/ACCEL switch by constant acceleration.
The accel position - With RES/ACCEL switch depressed and held in, disengaging cruise control system, when vehicle has accelerated to required cruise speed, releasing RES/ACCEL switch will re-engage speed at new selected speed.
The tab up - To increase vehicle speed, the cruise must be engaged and operating.
Tab up is done by quickly pressing and releasing RES/ACCEL switch less than 0.5 second. Do not hold RES/ACCEL switch in depressed position. Tab up is a function in which cruise speed can be increased by 1mph (1.6km/h).

Cancel switch

Cruise control system is temporarily disengaged by pressing "CANCEL" switch.
Cruise speed canceled by this switch will be recovered by RES/ACCEL switch

TROUBLE SYMPTOM CHARTS

TROUBLE SYMPTOM 1



CC : Cruise Control
ECU : Engine Control Unit

TROUBLE SYMPTOM 2

Trouble symptom	Probable cause	Remedy
The set vehicle speed varies greatly upward or downward "Surging" (repeated alternating acceleration and deceleration) occurs after setting	Malfunction of the vehicle speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
	Malfunction of ECM	Check input and output signals at ECM

TROUBLE SYMPTOM 3

Trouble symptom	Probable cause	Remedy

The CC system is not canceled when the brake pedal is depressed	Damaged or disconnected wiring of the brake pedal switch	Repair the harness or replace the brake pedal switch
	Malfunction of the ECM signals	Check input and output signals at ECM

TROUBLE SYMPTOM 4

Trouble symptom	Probable cause	Remedy
The CC system is not canceled when the shift lever is moved to the "N" position (It is canceled, however, when the brake pedal is depressed	Damaged or disconnected wiring of inhibitor switch input circuit	Repair the harness or repair or replace the inhibitor switch
	Improper adjustment of inhibitor switch	
	Malfunction of the ECM signals	Check input and output signals at ECM

TROUBLE SYMPTOM 5

Trouble symptom	Probable cause	Remedy
Cannot decelerate (coast) by using the SET switch	Temporary damaged or disconnected wiring of SET switch input circuit	Repair the harness or replace the SET switch
	Malfunction of the ECM signals	Check input and output signals at ECM

TROUBLE SYMPTOM 6

Trouble symptom	Probable cause	Remedy
Cannot accelerate or resume speed by using the RESUME switch	Damaged or disconnected wiring, or short circuit, or RESUME switch input circuit	Repair the harness or replace the RESUME switch
	Malfunction of the ECM signals	Check input and output signals at ECM

TROUBLE SYMPTOM 7

Trouble symptom	Probable cause	Remedy
CC system can be set while driving at a vehicle speed of less than 40km/h (25mph), or there is no automatic cancellation at that speed	Malfunction of the vehicle-speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
	Malfunction of the ECM signals	Check input and output signals at ECM

TROUBLE SYMPTOM 8

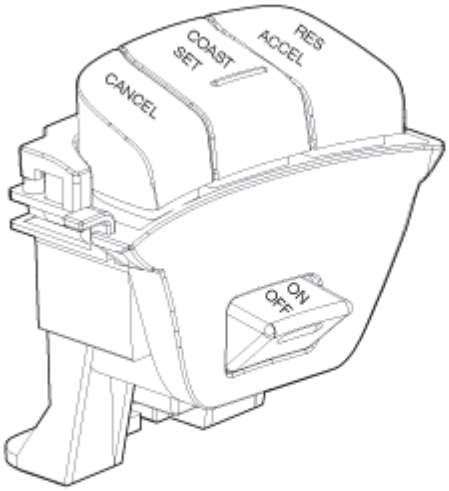
Trouble symptom	Probable cause	Remedy
The cruise main switch indicator lamp does not illuminate (But CC system is normal)	Damaged or disconnected bulb of cruise main switch indicator lamp	Repair the harness or replace the part.
	Harness damaged or disconnected	

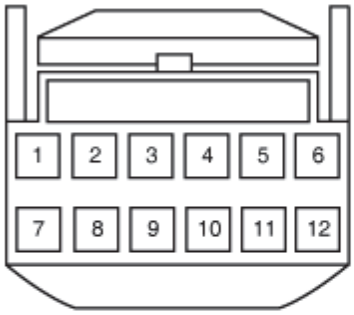
KIA MOTORS

Engine Electrical System

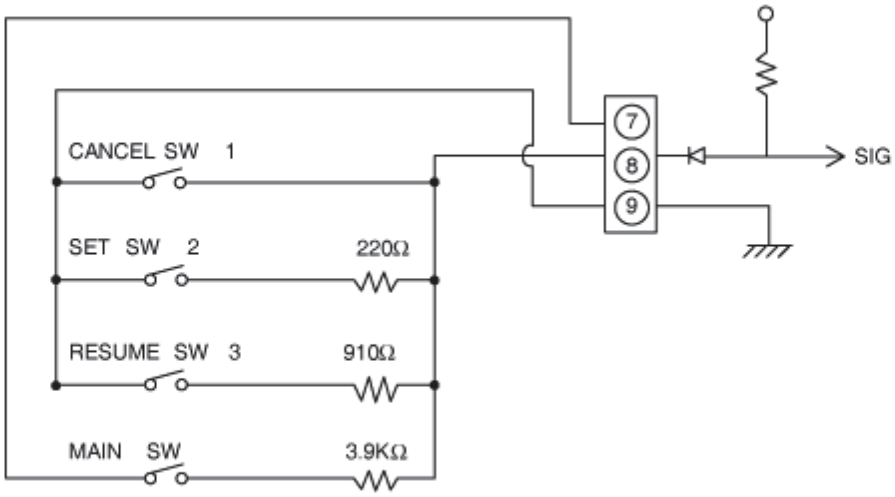
Cruise Control System - Cruise Control Switch

CIRCUIT DIAGRAM



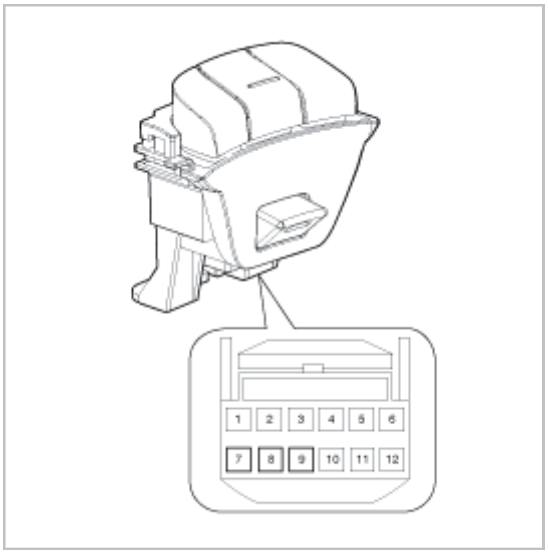


SW \ T	FUNCTION	OHM	OUT PUT VOLTAGE
1	CRUISE MAIN	3.9kΩ±%	-
2	CANCEL	0 Ω±%	0V ±0.25V
3	SET/COAST	220 Ω ±1%	1.5V ±0.25V
4	RESUME/ACCEL	910 Ω ±1%	3.0V ±0.25V



MEASURING RESISTANCE

1. Disconnect the cruise control switch connector from the control switch.



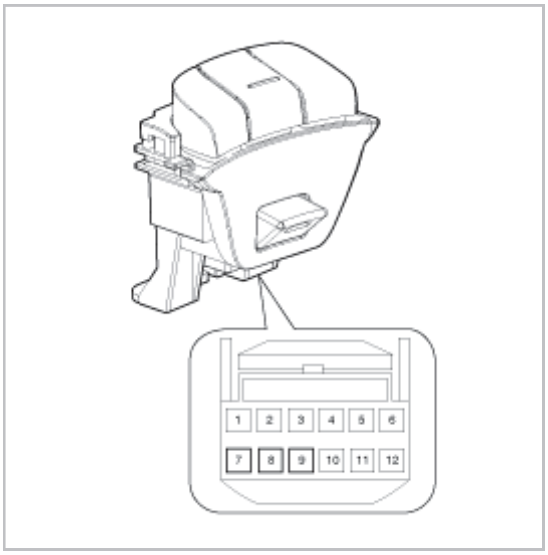
2. Measure resistance between terminals on the control switch when each function switch is ON (switch is depressed).

Function switch	Terminal	Resistance
Cruise Main	7-9	3.9kΩ ± 1%
Cancel	8-9	0Ω ± 1%
Set/Coast	8-9	220Ω ± 1%
Resume/Accel	8-9	910Ω ± 1%

3. If not within specification, replace switch.

MEASURING VOLTAGE

1. Connect the cruise control switch connector to the control switch.



2. Measure voltage between terminals on the harness side connector when each function switch is ON (switch is depressed).

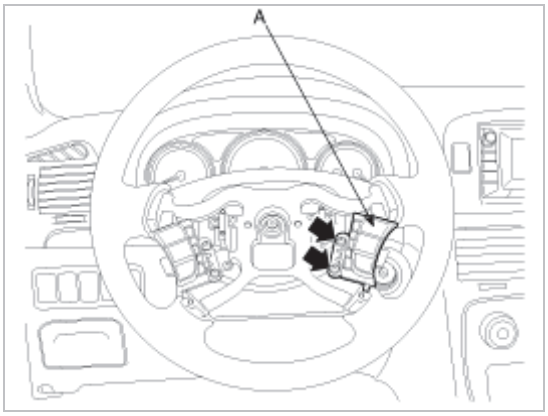
Function switch	Terminal	Voltage
Cruise Main	7-9	-

Cancel	8-9	0.0V ± 0.25V
Set/Coast	8-9	1.5V ± 0.25V
Resume/Accel	8-9	3.0V ± 0.25V

3. If not within specification, replace switch.

REMOVAL

1. Disconnect the battery (-) terminal.
2. Remove the driver side air bag module. (Refer to RT GR.)
3. Disconnect the cruise control switch connector and then remove the cruise control switch(A) with two screws.



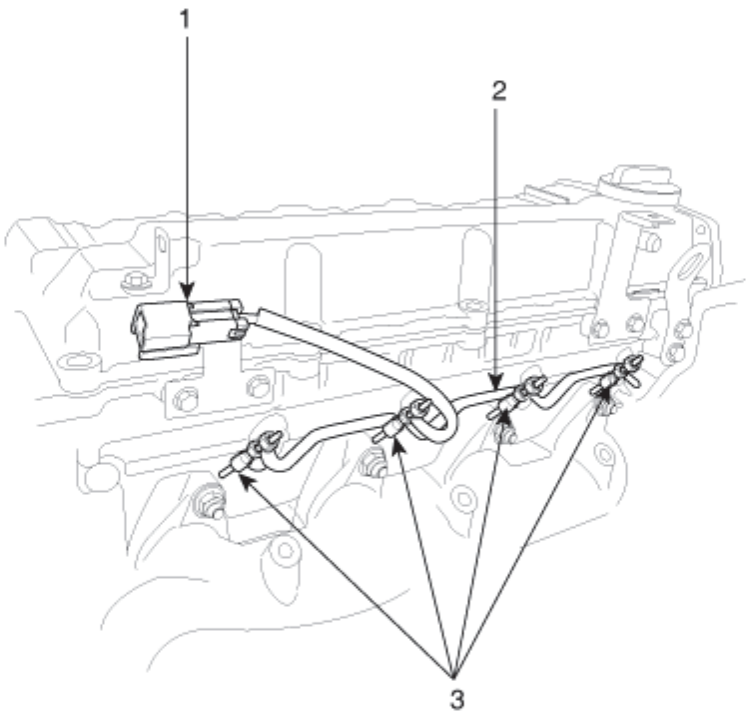
4. Installation is the reverse of removal.

KIA MOTORS

Engine Electrical System

Preheating System

COMPONENTS



1. Glow plug connector
2. Plate
3. Glow plug

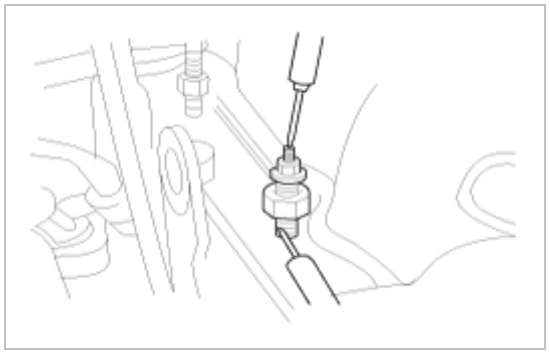
INSPECT PREHEATING SYSTEM

Conditions before inspection :
Battery voltage : 12V

1. Connect voltmeter between glow plug plate and plug body (ground).
2. Check indicated value on voltmeter with ignition switch ON.
3. Check that preheat indication lamp lights for about 6 seconds and indicates battery voltage (about 9V or over) for about 36 seconds immediately afterignitionswitch is turned on. [At cooling water temperature 20°C (68°F)]

> NOTICE
>
> Continuity time varies depending upon cooling water temperature.

4. After checking 3, set ignition switch at START position.
5. The system is normal if battery voltage (about 9V or over) is generatedforabout 6 seconds during engine cranking and after start operation. [at coolingwater temperature 20°C (68°F)]
6. When the voltage or continuity time is not normal, check the terminal voltage in glow control unit, and single parts.



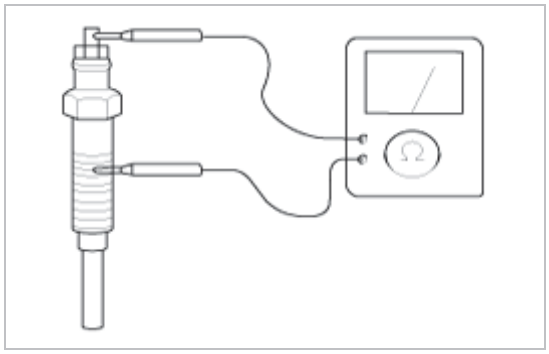
INSPECT GLOW PLUS

1. Check the continuity between the terminal and body as illustrated. Replaceif discontinuity or with large resistance.

Standard value : 0.25Ω

> CAUTION
>
> Remove oil from plug before measuring as glow plug resistance is verysmall.

2. Check for rust on glow plug plate.
3. Check glow plug for damage.

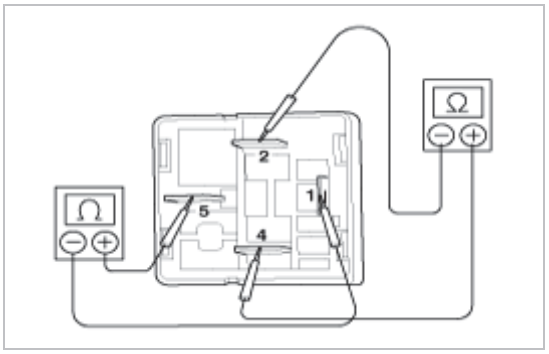


INSPECT GLOW PLUG RELAY

1. Remove the glow plug relay.
2. Inspect the relay continuity.

A. Using an ohmmeter, check that there is continuity between terminals 2 and 4.
If there is no continuity, replace the relay.

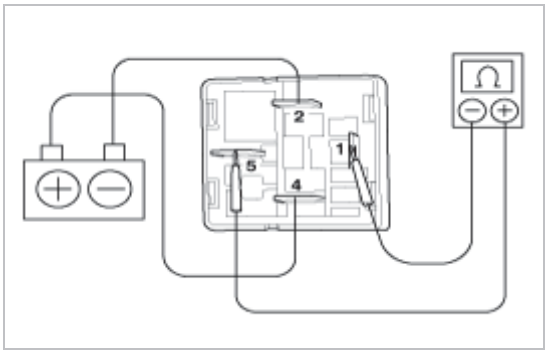
B. Check that there is no continuity between terminals 1 and 5.
If there is continuity, replace the relay.



3. Inspect the relay operation.

A. Apply battery positive voltage across terminals 2 and 4.

B. Using an ohmmeter, check that there is continuity between terminals 1 and 5.
If there is no continuity, replace the relay.



4. Install the glow plug relay.

KIA MOTORS

Manual Transaxle System

General Information

SPECIFICATION

Engine type		A2.5 VGT
Manual transaxle type		M5SR1
Gear ratio	1st	4.393
	2nd	2.306
	3rd	1.452
	4th	1.000
	5th	0.825
	Reverse	4.632
Final gear ratio		3.727
T/M oil capacity(ℓ)※		3.5 liter

※ The quantity in the chart above is for the reference. The actual filling quantity of the automatic transaxle fluid must be set according to 'INSPECTION' or 'REPLACEMENT' procedure of the automatic transaxle fluid.

Recommended transaxle oil			SAE 75W/85 or API GL - 4
Check&Replenishment			Every one year or every 15,000km
Replacement	Private use	Normal use	No service required
		Severe use(※)	Every 90,000 Km
	Business use		

※ Severe use(marked '※') is defined as:

1. Driving on rough road(bumpy road, gravel road, snowy road, unpaved road etc.).
2. Driving on mountain road, ascent/descent.
3. Repetition of short distance driving.
4. More than 50% operation in heavy city traffic during hot weather above 32°C(89.6°F).
5. Police car, Taxi, Commercial type operation or trailer towing, etc.

KIA MOTORS

Manual Transaxle System

Manual Transaxle System

SERVICE ADJUSTMENT PROCEDURE

Transmission oil inspection and replacement

1. After parking the vehicle on a plain, stop the engine.
2. After removing the oil filler plug and washer, inspect the manual transaxle fluid condition and quantity.
3. If the manual transaxle fluid is contaminated, drain it out by removing the oil drain plug.
4. Tighten the new oil drain plug and feed manual transaxle fluid to a proper level.

TORQUE:
58.83~63.74 Nm(6.0~6.5kgf.m, 43.39~47.01lb-ft)
Oil type: SAE75W/90 or API GL-4
Oil quantity:
3.2 liter

---

5. Retighten the oil filler plug with a new washer.

TORQUE:
58.83~63.74 Nm(6.0~6.5kgf.m, 43.39~47.01lb-ft)

Back up lamp switch inspection

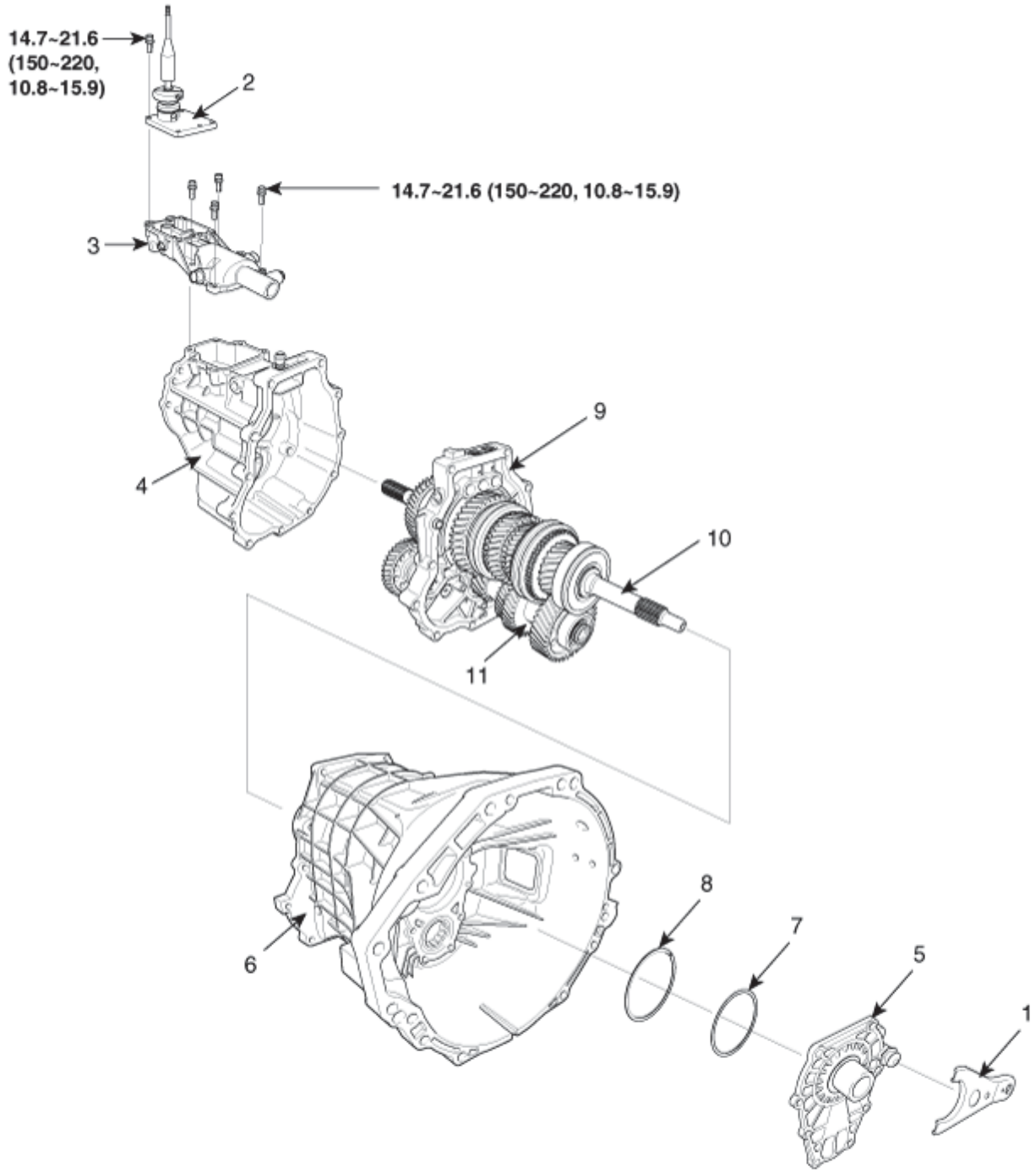
1. Disconnect the back up lamp switch connector.
2. Inspect the continuity of the switch. When the shift lever is located in reverse range, it should be applied an electric current.
3. Replace the back up lamp switch, if necessary.

KIA MOTORS

Manual Transaxle System

Manual Transaxle System - Manual Transaxle

COMPONENTS

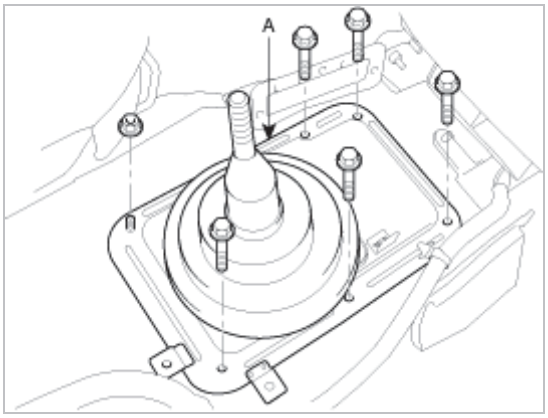


TORQUE : Nm (kgf.cm, lb-ft)

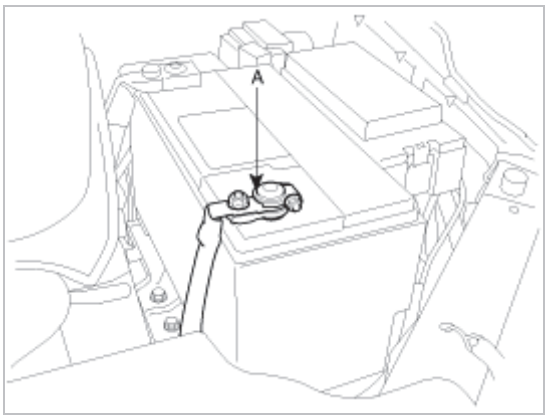
1. Clutch release folk
2. Control lever complete
3. Transmission control housing assembly
4. Transfer adapter
5. Front bearing retainer assembly
6. Transmission case
7. Front bearing retainer spacer
8. Snap ring
9. Intermediate plate
10. Main shaft assembly
11. Count shaft assembly

REMOVAL

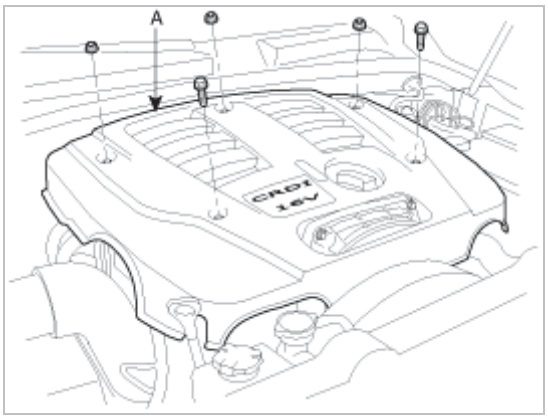
1. Remove the console. (see BD group)
2. Remove the console cover dust assembly(A).



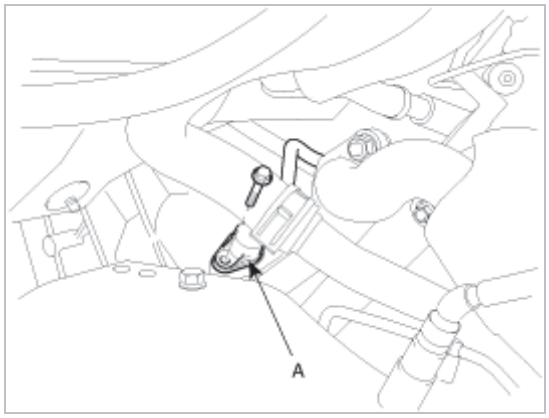
3. Remove the battery (-) terminal(A).



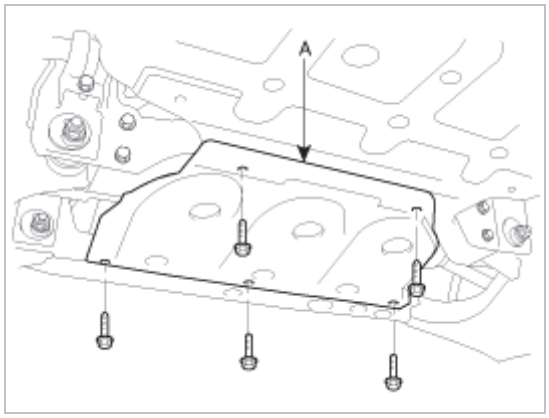
4. Remove the engine cover(A).



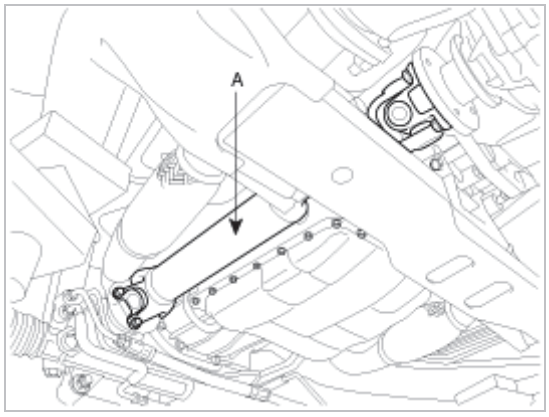
5. Remove the CKP sensor(A).



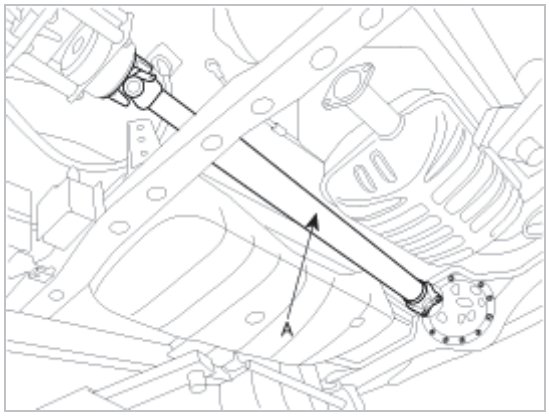
6. Remove the under cover(A).



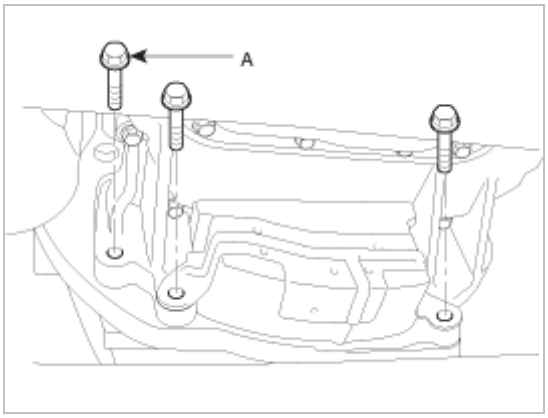
7. Remove the front propeller shaft(A). (4WD)



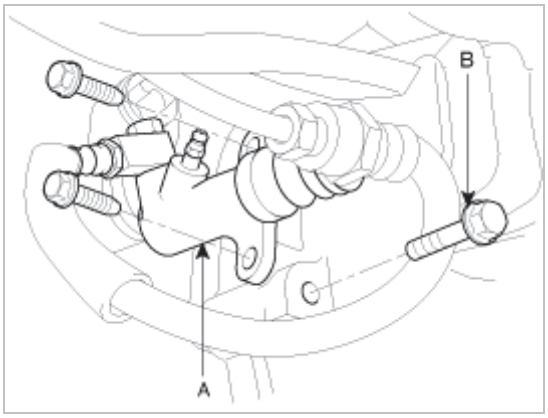
8. Remove the rear propeller shaft(A).



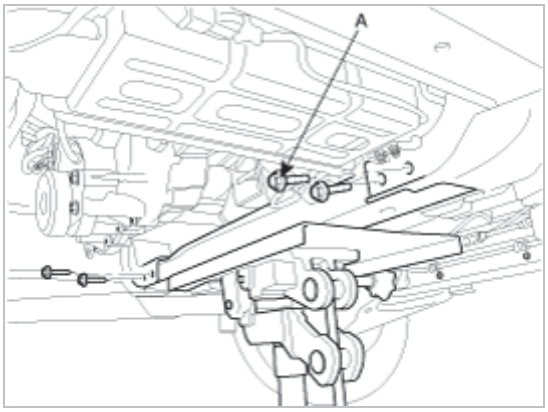
9. Remove the transmission lower mounting bolts(A).



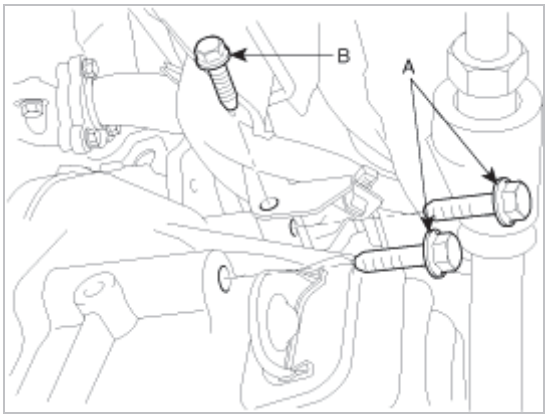
10. Remove the clutch release cylinder(A) and transmission mounting bolt(B).



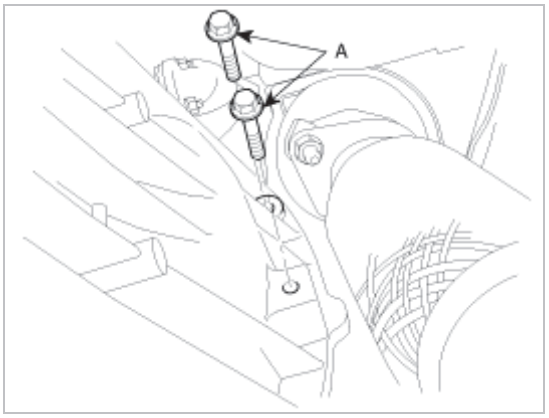
11. Remove the mounting bolts(A) supporting the transmission with a jack.



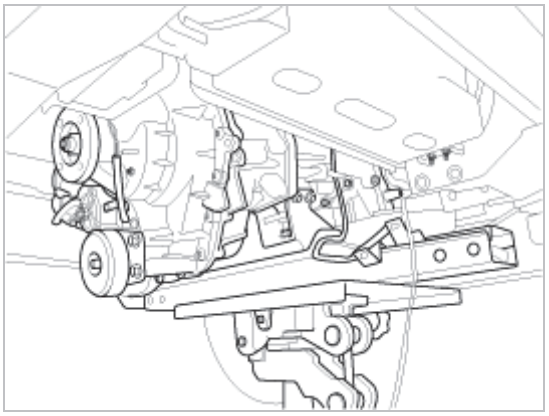
12. Remove the starter motor mounting bolts(A) and wire harness mounting bolt(B).



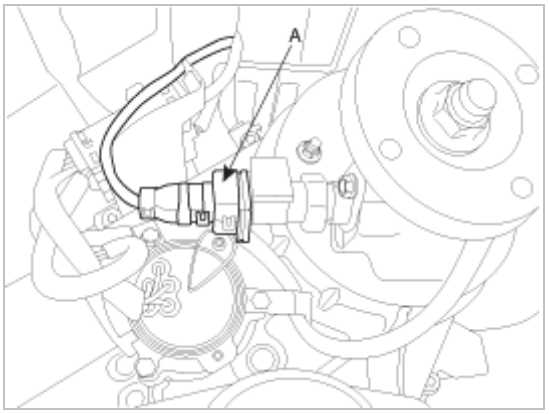
13. Remove the transmission mounting bolts(A).



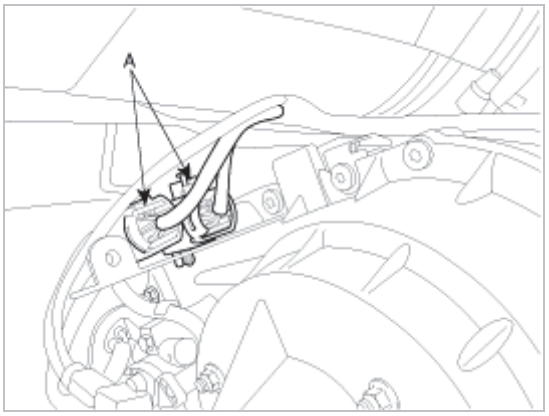
14. Lower the jack slightly to make easy to remove the related connector and bolts on the upper part of transmission.



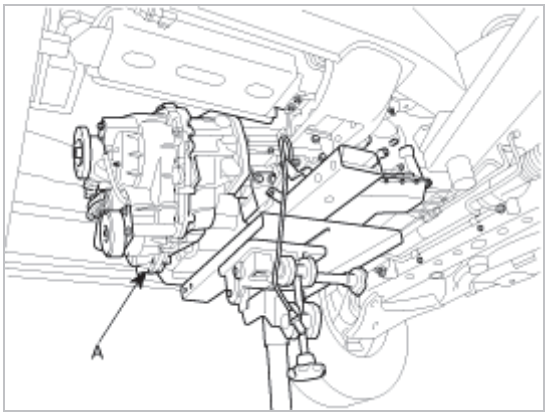
15. Remove the vehicle speed sensor connector(A).



16. Remove the transfer case connectors(A). (4WD)

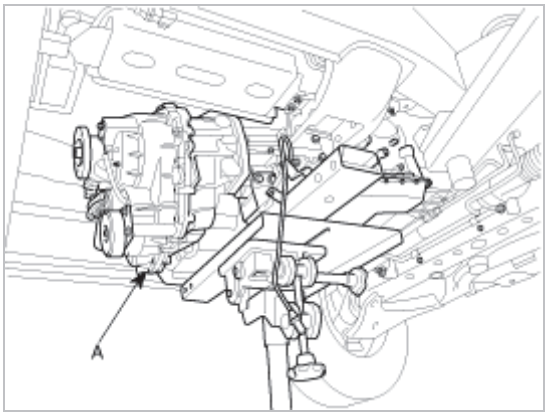


17. Remove the transmission upper mounting bolts.
18. Remove the transmission assembly(A).



INSTALLATION

1. Lowering the vehicle or lifting up a jack, install the transmission assembly(A/B).



2. Tighten the transmission mounting bolts.

TORQUE
42.16~53.93Nm (4.3~5.5 kgf.m, 31.1~39.78 lb-ft)

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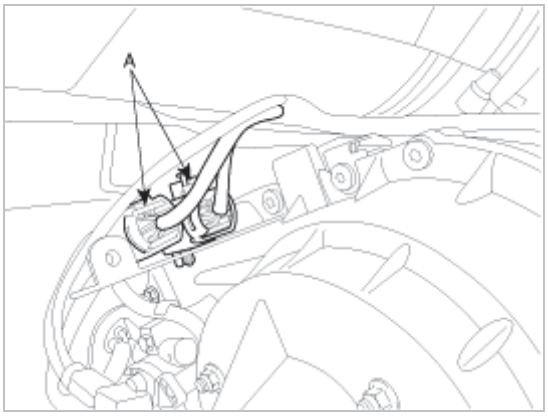
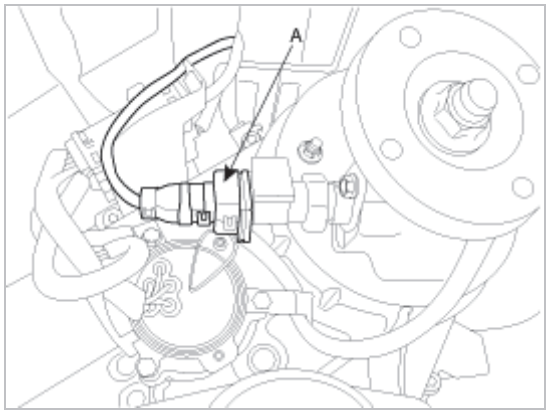
3. Install the transfer case connectors(A). (4WD)

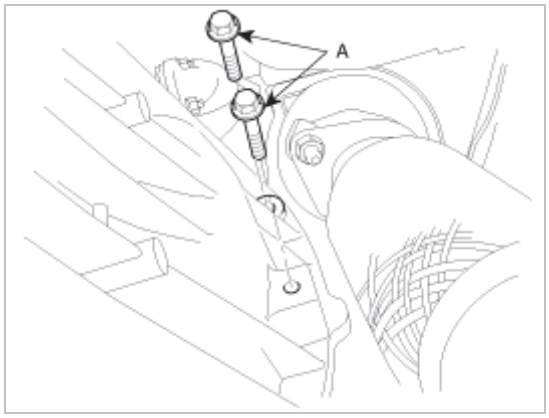


4. Install the vehicle speed sensor connector(A).



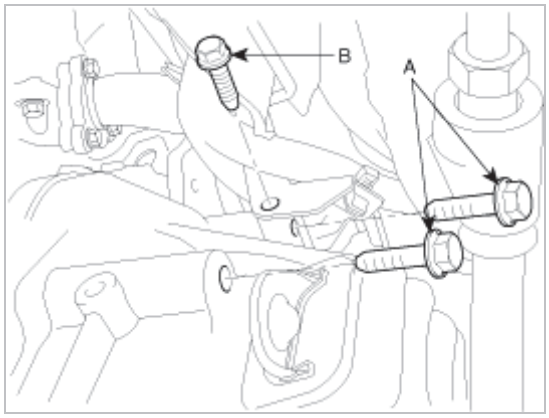
5. Install the transmission mounting bolts(A).

TORQUE
A: 42.16~53.93Nm (4.3~5.5 kgf.m, 31.1~39.78 lb-ft)

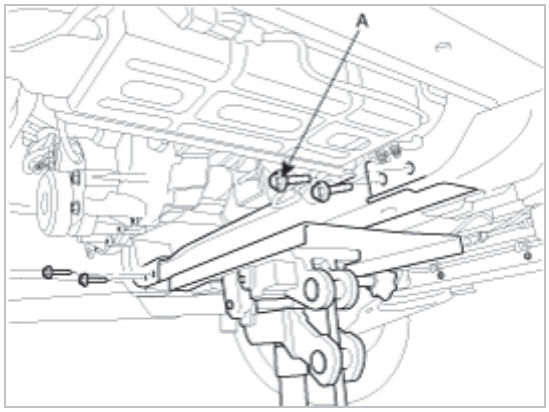


6. Install the starter motor mounting bolts(A) and wire harness mounting bolt(B).

TORQUE
A: 49~63.74Nm (5.0~6.5 kgf.m, 36.16~47 lb-ft)

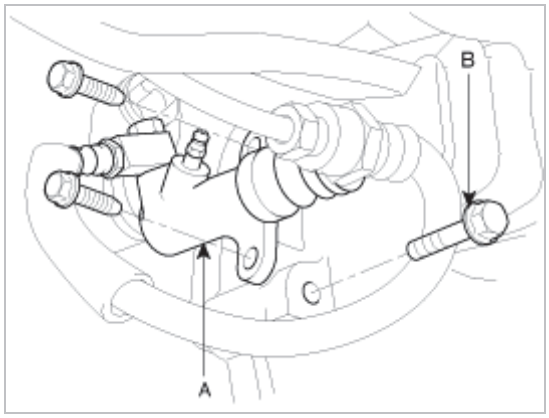


7. Install the crossmember mounting bolts(A).

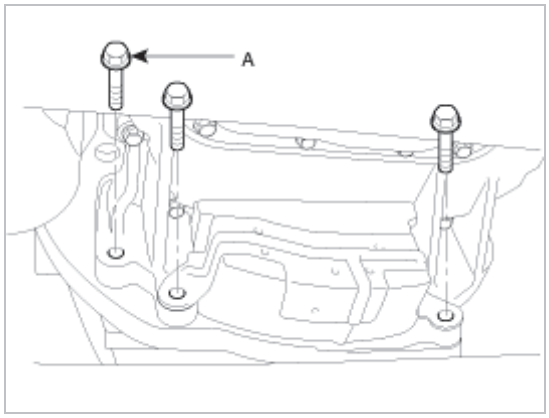


8. Install the clutch release cylindre(A) and transmission mounting bilt(B).

TORQUE :
B: 42.16~53.93Nm (4.3~5.5 kgf.m, 31.1~39.78 lb-ft)

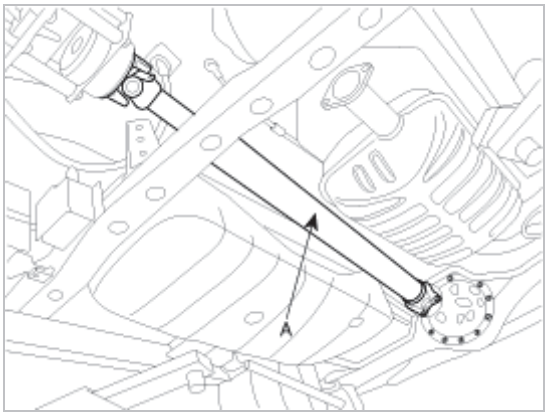


9. Install the Tighten the transaxle lower mounting bolts(A).



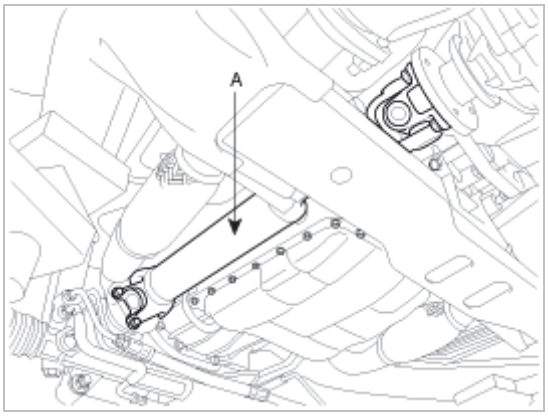
10. Install the rear propeller shaft(A).

TORQUE :
58.83~68.64Nm (6~7 kgf.m, 43.39~50.63 lb-ft)

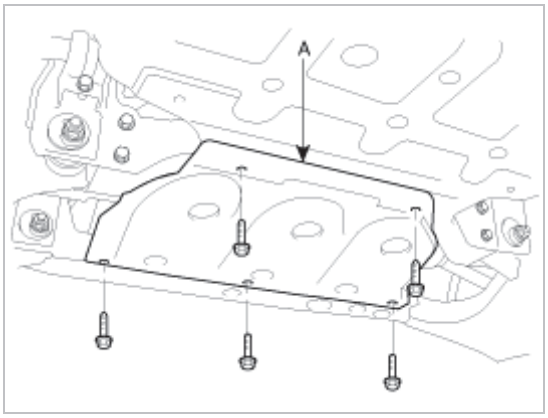


11. Install the front propeller shaft(A). (4WD)

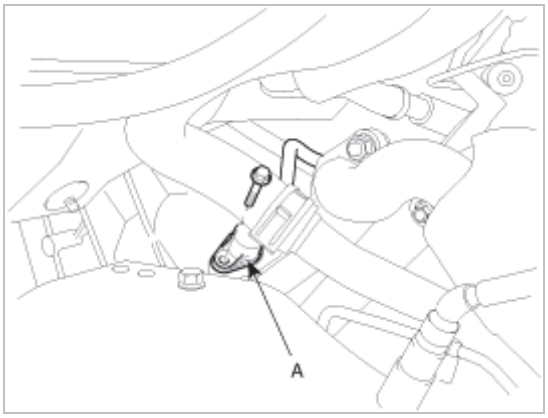
TORQUE :
58.83~68.64Nm (6~7 kgf.m, 43.39~50.63 lb-ft)



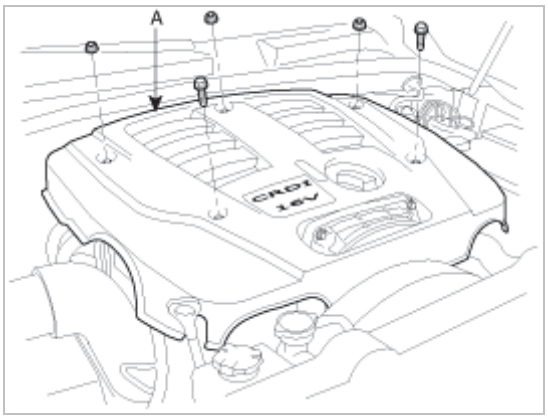
12. Install the under cover(A).



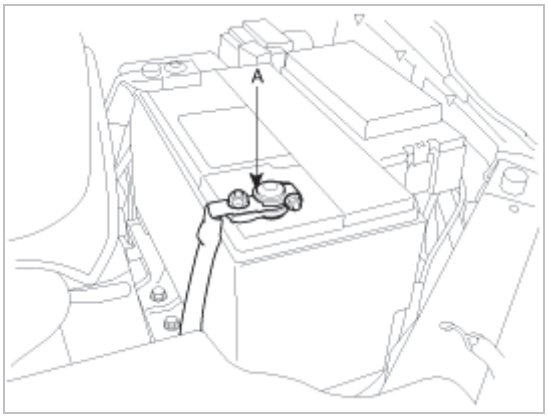
13. Install the CKP sensor(A).



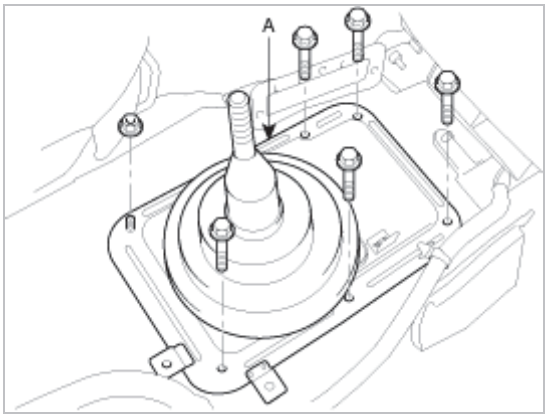
14. Install the engine cover(A).



15. Install the battery (-) terminal(A).



16. Install the console cover dust assembly.



17. Install the console. (see BD group)

KIA MOTORS

Automatic Transaxle System

General Information

SPECIFICATION

Type			A5SR2
Driving system			2WD/ 4WD
T/CON	Type		3 elements, 1 stage, 2 phase
	Identification inscription [Nominal diameter (mm)]		8 (Φ250)
	Stall torque ratio		1.76
Transmission	Manipulating system		Remote control flow transmission (Cable method)
	Shift position	P	Fix output axle (Engine start allowed)
		R	Reverse
		N	Neutral (Engine start allowed)
		D	1↔2↔3↔4↔5
	Gear ratio	1st	3.827
		2nd	2.368
		3rd	1.52
		4th	1
		5th	0.834
		Reverse	2.613
		Final gear ratio	3.333
	Control method		Electronic control
	Function	Lock-up control	Equipped
		Operating fluid pressure control	Equipped
		Real time feedback transmission control	Equipped
		Transmission pattern auto change control	Equipped
		Self-diagnosis control	Equipped
		Fail-safe function	Equipped
		Sports mode function	Equipped
	Speedometer gear teeth (drive/driven)		6/14
	Oil pump	Type	Trochoid oil pump
		Driving system	Engine drive
	ATF oil	The recommended	APOLLOIL ATF RED-1
		Quantity	10ℓ(10.57 US qt, 8.8 lmp.qt)

KIA MOTORS

Automatic Transaxle System

Automatic Transaxle System

DESCRIPTION

We have employed A5SR2, the 5th speed automatic transmission with full range electronic control and sports mode that provides smooth driving with lesser transmission shock as well as pleasant driving from manual transmission.

A/t electronic control system is the system where an optimized transmission has been realized from taking a grasp of driving status, A/T internal status at A/T control unit that has integrated with control valve assembly.
This paper describes apparatus cross-sectional view, major controls and control circuit diagram, major components and their functions, and etc.

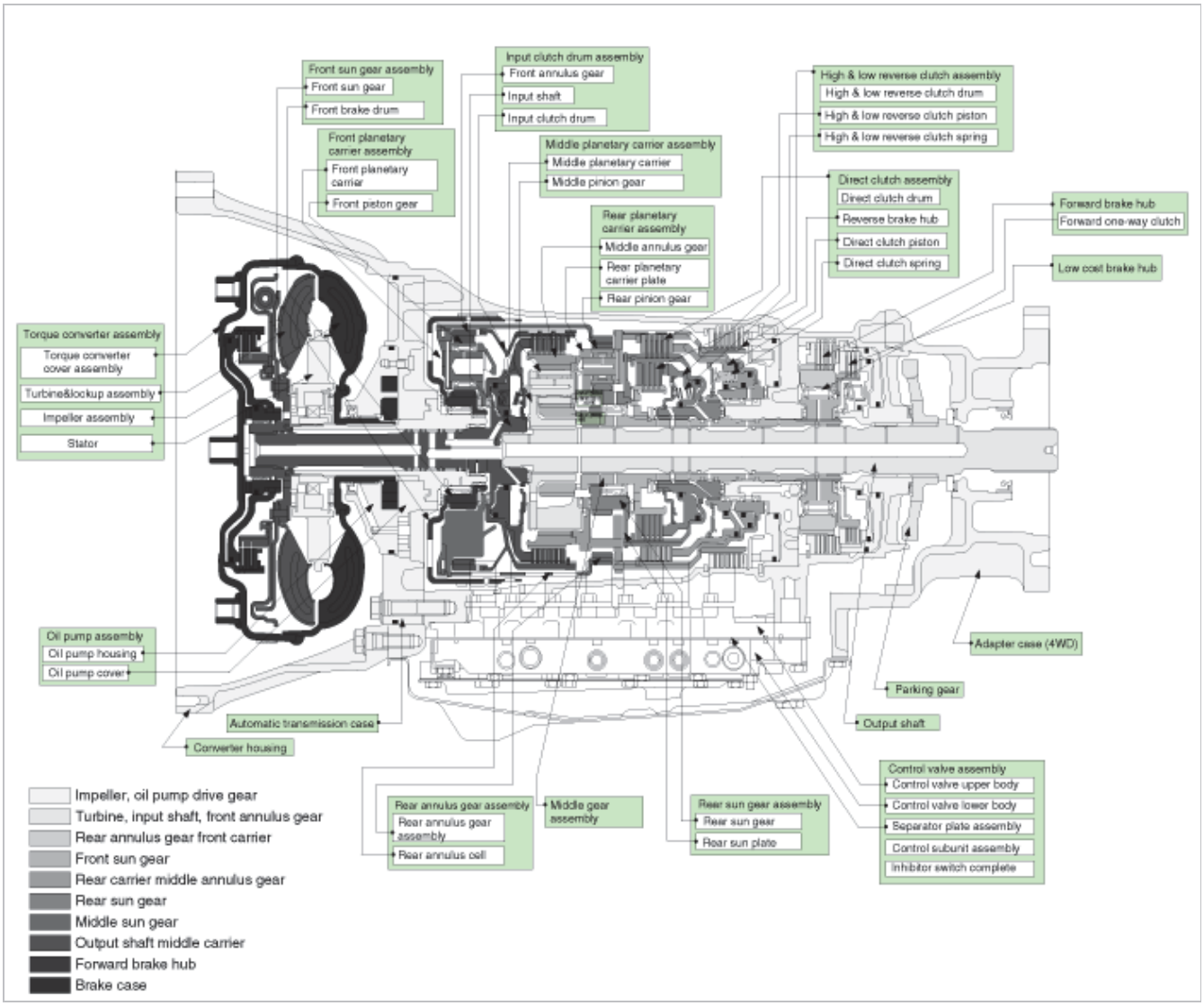
A5SR2

Item	Contents
Improved transmission feel	- Integrated control over engine and A/T (CAN communication control) system employed - Turbine sensor 1.2 employed - Real time feedback control at all phases applied
Improved driving	- Sports mode function employed - Snow mode function employed (2WD applied) - Gear ratio extension
Improved fuel consumption	- Slip lock-up employed - Full range lock-up employed (Larger lock-up zone) - E-flow torque converter employed (Improved driving efficiency) - Small transmission power train employed
Improved safety	- Transmission lock apparatus (P range maintenance apparatus affixed) employed
Improved maintenance	- Electronic system diagnosis tester (hi-scan) counterpart

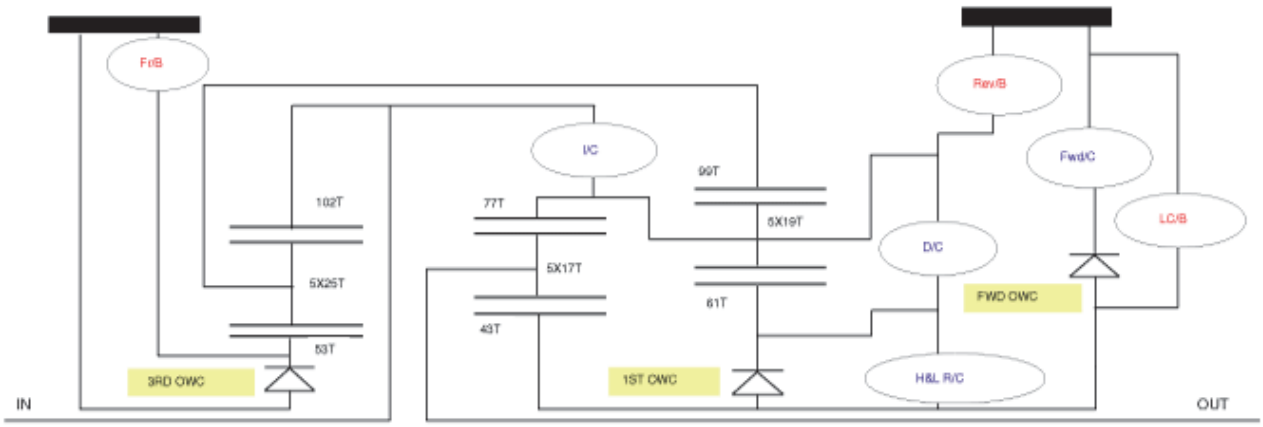
MAJOR COMPONENTS AND THEIR FUNCTIONS

Part name	Acronyms	Function
Front brake	F/B	Fastens the front sun gear
Input clutch	I/ C	Engages the input shaft, with the middle annulus gear and the front annulus gear
Direct clutch	D/C	Engages the rear planetary carrier with a rear sun gear
High & low reverse clutch	H&L R/C	Engages the middle sun gear with the rear sun gear
Reverse brake	R/B	Fastens the rear planetary carrier
Forward brake	FWD/B	Fastens the middle sun gear
Low cost brake	LC/B	Fastens the middle sun gear
1st one-way clutch	1st OWC	Allows the rear sun gear to turn freely forward relative to the mid sun gear but fastens it for reverse rotation
Forward one-way clutch	FWD OWC	Allows the mid sun gear to turn freely in the forward direction but fastens it for reverse rotation
3rd one-way clutch	3rd OWC	Allows the front sun gear to turn freely in the forward direction but fastens it for reverse rotation

COMPONENTS


Front sun gear assembly
Front sun gear
Front brake drum
Input clutch drum assembly
Front annulus gear
Input shaft
Input clutch drum
High & low reverse clutch assembly
High & low reverse clutch drum
High & low reverse clutch piston
High & low reverse clutch spring
Front planetary carrier assembly
Front planetary carrier
Front piston gear
Middle planetary carrier assembly
Middle planetary carrier
Middle pinion gear
Direct clutch assembly
Direct clutch drum
Reverse brake hub
Direct clutch piston
Direct clutch spring
Forward brake hub
Forward one-way clutch
Rear planetary carrier assembly
Middle annulus gear
Rear planetary carrier plate
Rear pinion gear
Low cost brake hub
Torque converter assembly
Torque converter cover assembly
Turbine&lockup assembly
Impeller assembly
Stator
Oil pump assembly
Oil pump housing
Oil pump cover
Adapter case (4WD)
Parking gear
Automatic transmission case
Converter housing
Output shaft
Control valve assembly
Control valve upper body
Control valve lower body
Separator plate assembly
Control subunit assembly
Inhibitor switch complete
Rear annulus gear assembly
Rear annulus gear assembly
Rear annulus cell
Middle gear assembly
Rear sun gear assembly
Rear sun gear
Rear sun plate
Impeller, oil pump drive gear
Turbine, input shaft, front annulus gear
Rear annulus gear front carrier
Front sun gear
Rear carrier middle annulus gear
Rear sun gear
Middle sun gear
Output shaft middle carrier
Forward brake hub
Brake case

OPERATION



Shift Position		I/C	H&L R/C	D/C	Rev/B	Fr/B	LC/B	Fwd/B	Ratio1 OWC	Forword OWC	Ratio 2 OWC	Remarks
P			△			△						Parking position
R			0		0	0			◎		◎	Reverse position
N			△			△	△**					Neutral position
D	1st		△*			△		0	◎	◎	◎	Automatic shift 1↔2↔3 ↔4↔5
	2nd			0		△		0		◎	◎	
	3rd		0	0		0		△	◇		◎	
	4th	0	0	0				△	◇			
	5th	0	0			0		△	◇		◇	
5M	5th	0	0			0		△	◇		◇	Fix to the 5th speed
4M	4th	0	0	0				△	◇			Fix to the 4th speed
3M	3rd		0	0		0		△	◇		◎	Fix to the 3rd speed
2M	2nd			0		0	0	0		◎	◎	Fix to the 2nd speed
1M	1st		0			0	0	0	◎	◎	◎	Fix to the 1st speed

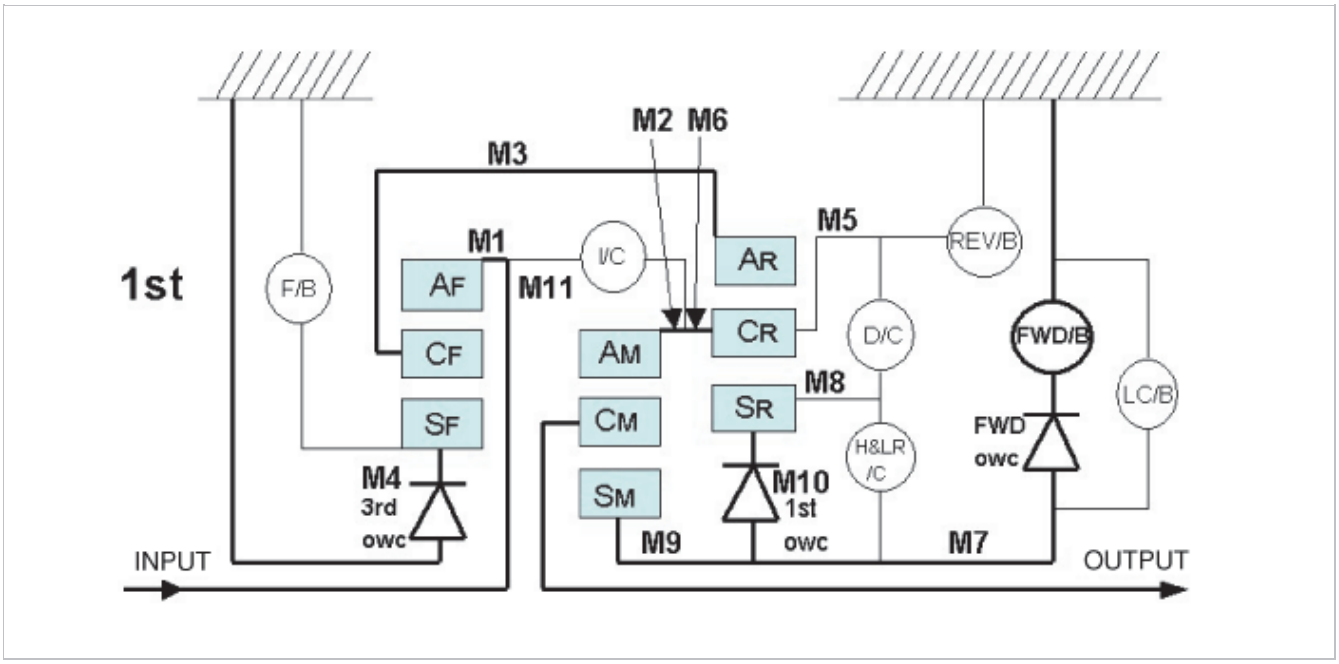
0 : Operates.
◎ : Operates during progressive acceleration.
◇ : Operates and effects power transmission while coasting.
△ : Line pressure is applied but does not affect power transmission.
△* : Operates under conditions shown in the high & low reverse clutch operating condition.
△** : Operates under conditions shown in the LC/B operating condition.
Note) Delay control is applied during D(4,3,2,1) ⇒N shift.

OPERATING PRINCIPLES OF EACH RANGE

1. N range
   Since the forward and reverse brakes are released, driving force of input shaft is not transmitted to output shaft.
2. P range
   A. Since the forward and reverse brakes are released, as those in the N range, driving force of input shaft is not transmitted to output shaft.
   B. Parking pawl that is linked with select lever parking gear meshes with and fastens output shaft mechanically.
3. D, M2, M3, M4, M5 range 1st speed
   A. Fastens the front brake.
   B. The front brake and the forward one-way clutch regulate reverse rotation of the mid sun gear.

C. The 1st one-way clutch regulates reverse rotation of the rear sun gear.

D. The 3rd one-way clutch regulates reverse rotation of the front sun gear.



*** POWER FLOW**

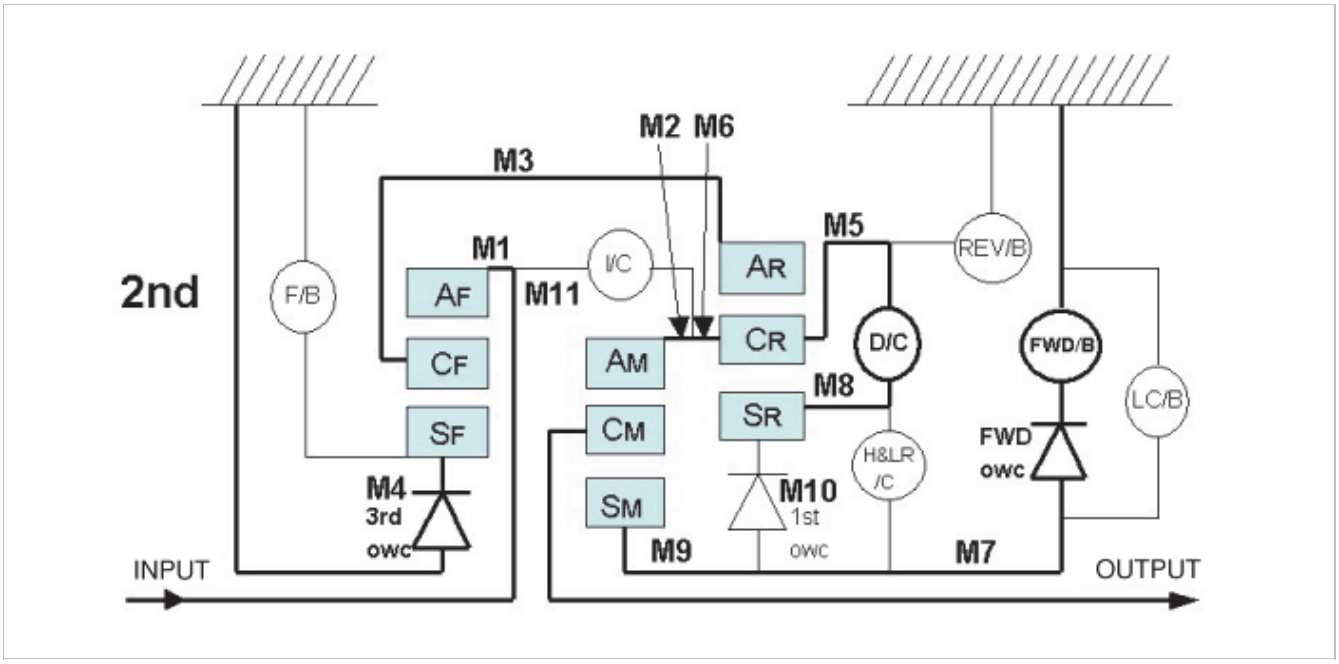
Input shaft→Front internal gear→Front carrier→Rear internal gear→Rear carrier→Middle internal gear→Middle carrier→Output shaft

4. D, M3, M4, M5 range ratio 2nd

A. Fasten the front brake.

B. The front brake and the forward one-way clutch regulate reverse rotation of the mid sun gear.

C. The 3rd one-way clutch regulates reverse rotation of the front sun gear.



The direct clutch is coupled and the rear carrier and the rear sun gear are connected.

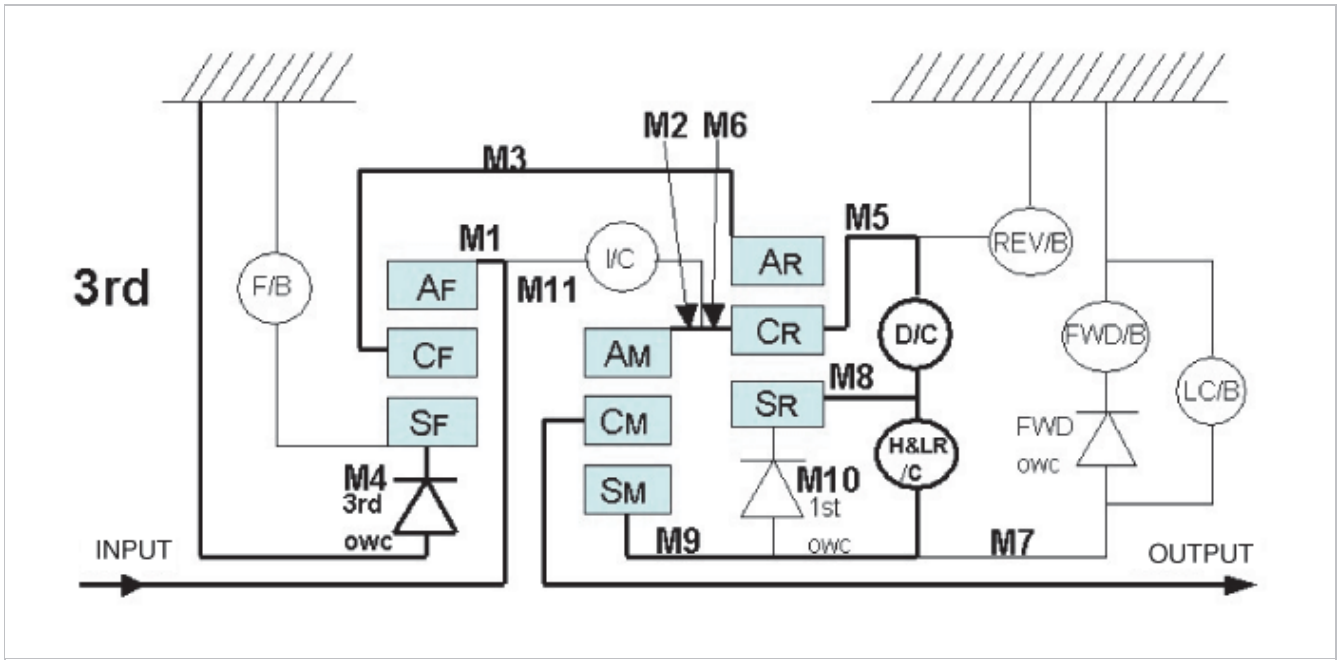
*** POWER FLOW**

Input shaft→Front internal gear→Front carrier→Rear internal gear→Rear carrier→Rear carrier→Middle internal gear→Middle carrier→Output shaft

5. D, M3, M4, M5 range 3rd speed

A. Fastens the front brake.

B. The 3rd one-way clutch regulates reverse rotation of the front sun gear.



C. The high & low reverse clutch is coupled and the middle and rear sun gears are connected.

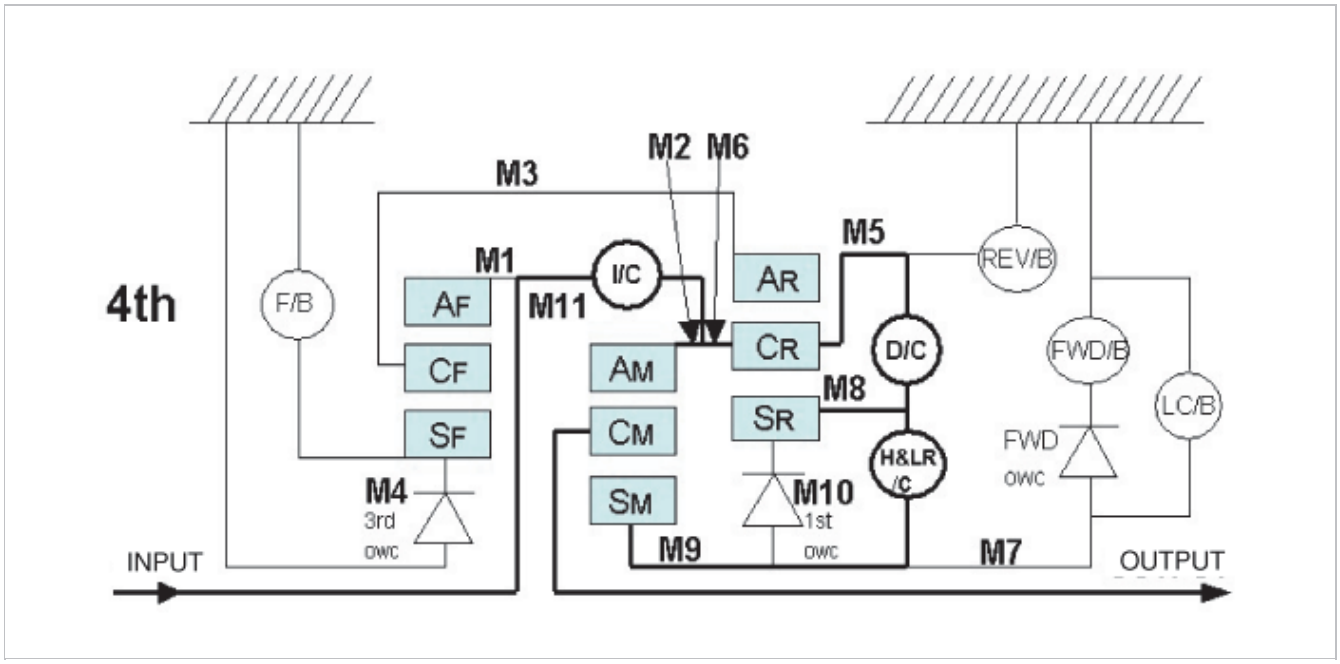
*** POWER FLOW**

Input shaft→Front internal gear→Front carrier→Rear internal gear→Rear carrier→Rear carrier→Middle internal gear→Middle carrier→Output shaft

6. D, M4, M5 range 4th speed

A. The front brake is released and sun gear turns freely forward.

B. The input clutch is coupled and the front and middle internal gears are connected.



C. Driving force is conveyed to the front internal gear, the middle internal gear, and the rear carrier and the three planetary gears rotate forward as a unit.

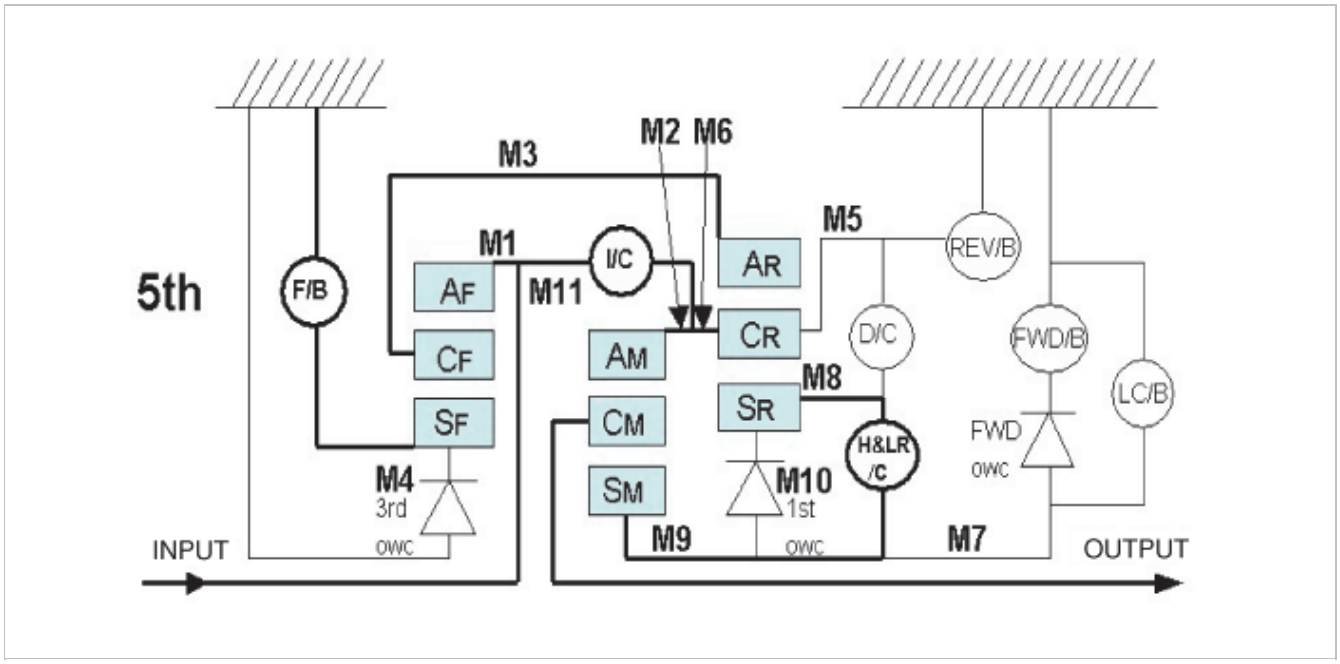
*** POWER FLOW**

Input shaft→Front internal gear→Front carrier→Rear internal gear→Rear carrier→Middle internal carrier→Middle carrier→Output shaft

7. D, M5 range 5th speed

A. The front brake fastens the front sun gear.

B. The direct clutch is released and the rear carrier and rear sun gear are disconnected.



*** POWER FLOW**

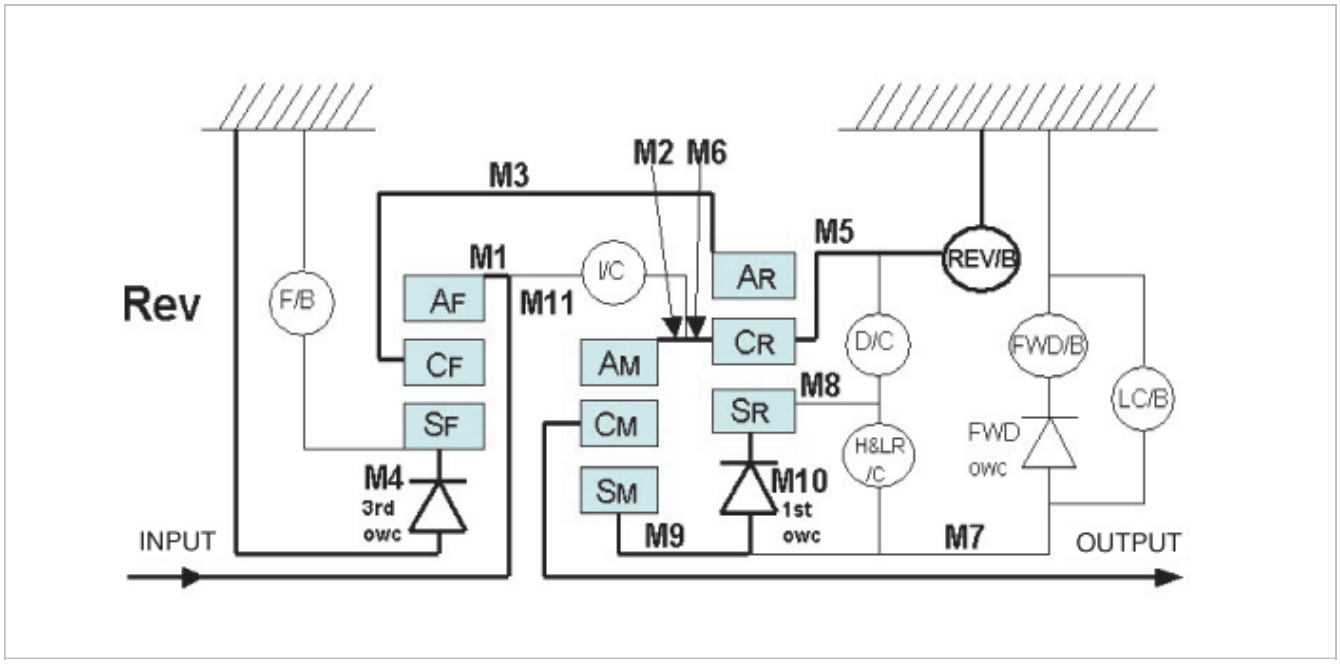
Input shaft→Front internal→Front carrier→Rear internal input shaft→Middle internal→Rear carrier→Rear sun gear→Middle sun carrier→Middle carrier→Output shaft

8. R range

A. The front brake fastens the front sun gear.

B. The high & low reverse clutch is coupled and the middle and rear sun gears are connected.

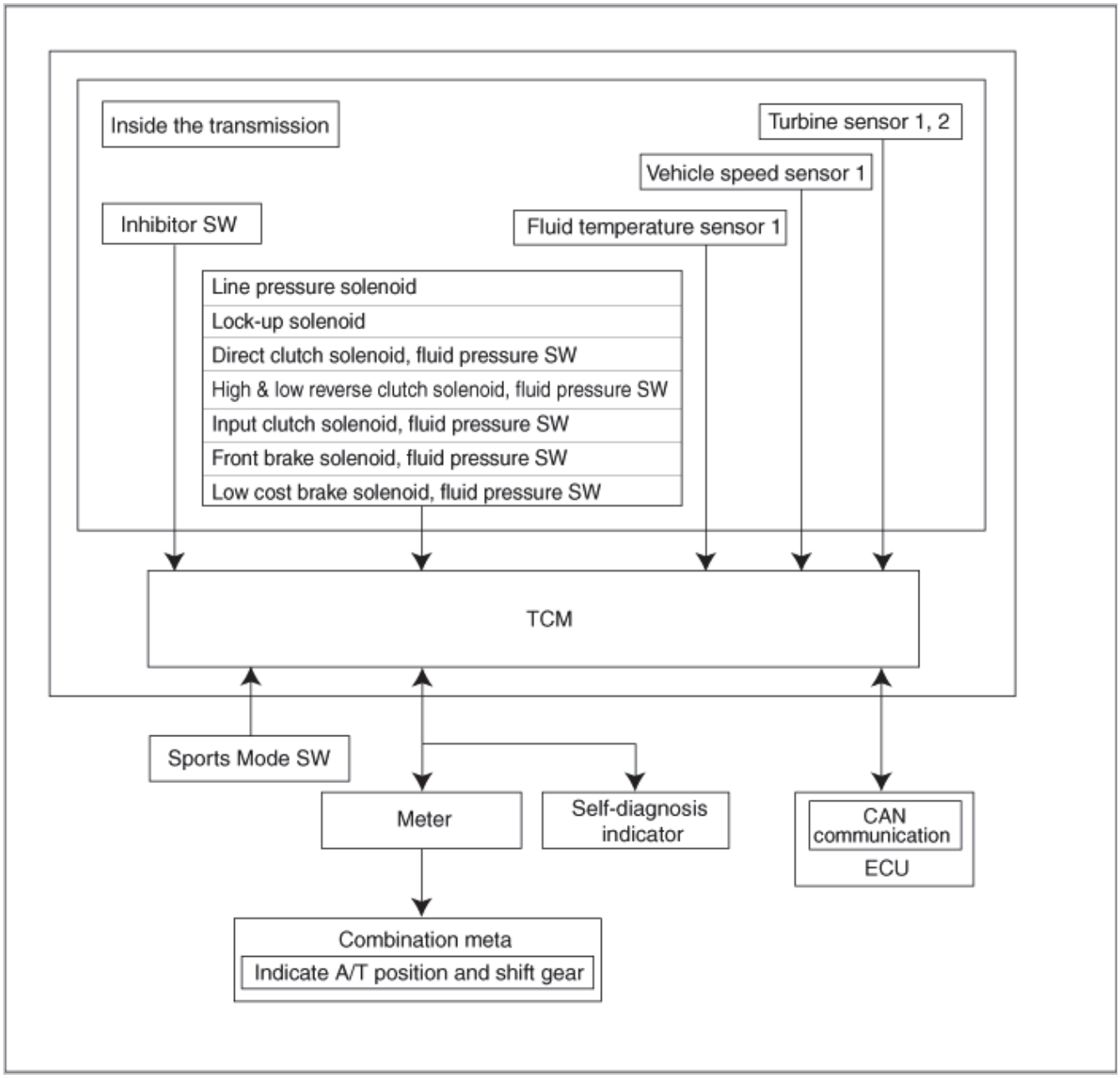
C. The reverse brake fastens the rear carrier.



*** POWER FLOW**

Input shaft→Front internal→Front carrier→Rear internal→Rear sun gear→Middle sun gear→Middle carrier→Output shaft

CONTROL SYSTEM DIAGRAM



MAIN COMMUNICATION SIGNAL

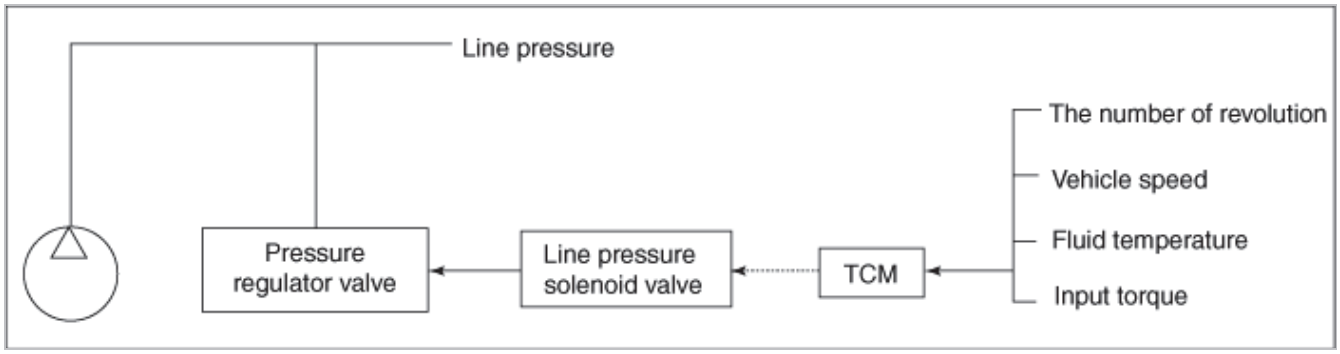
Input to ECM(CAN)	Output to ECM(CAN)	Input from external sys.	Output to external sys.
-	-	A/T driving mode SW	Self-diagnosis indicator
Engine torque signal	Output revolution signal	Sports mode SW	Range signal (P, R, N, D)
Engine revolution signal	Turbine sensor signal	Up SW	Range signal
-	Torque reduction request signal	Down SW	Reverse lamp signal
Accelerator opening signal		Stop lamp SW	N position signal
Power		4 x 4 Low signal	

LINE PRESSURE CONTROL

- If the engine control unit sends the input torque signal equivalent to the engine driving force to the A/T control unit (TCM), the A/T control unit (TCM) controls line pressure solenoid.
- This line pressure solenoid controls the pressure regulator valve as the signal pressure and adjusts the pressure

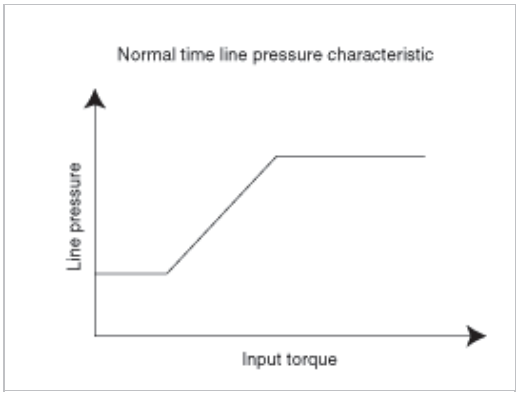
of theoperating oil discharged from the oil pump to the line pressure most appropriate to the driving plate.

LINE PRESSURE SYSTEM DIAGRAM

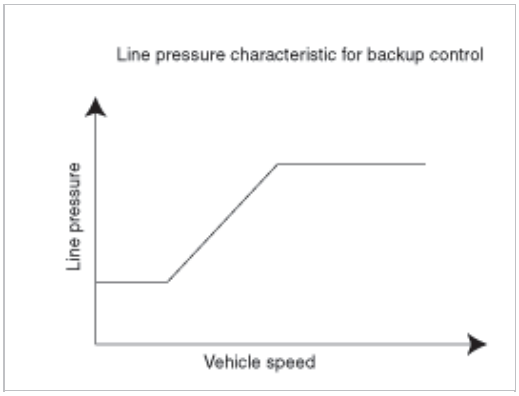


Line pressure control based on line pressure characteristic pattern of A/T control unit (TCM)

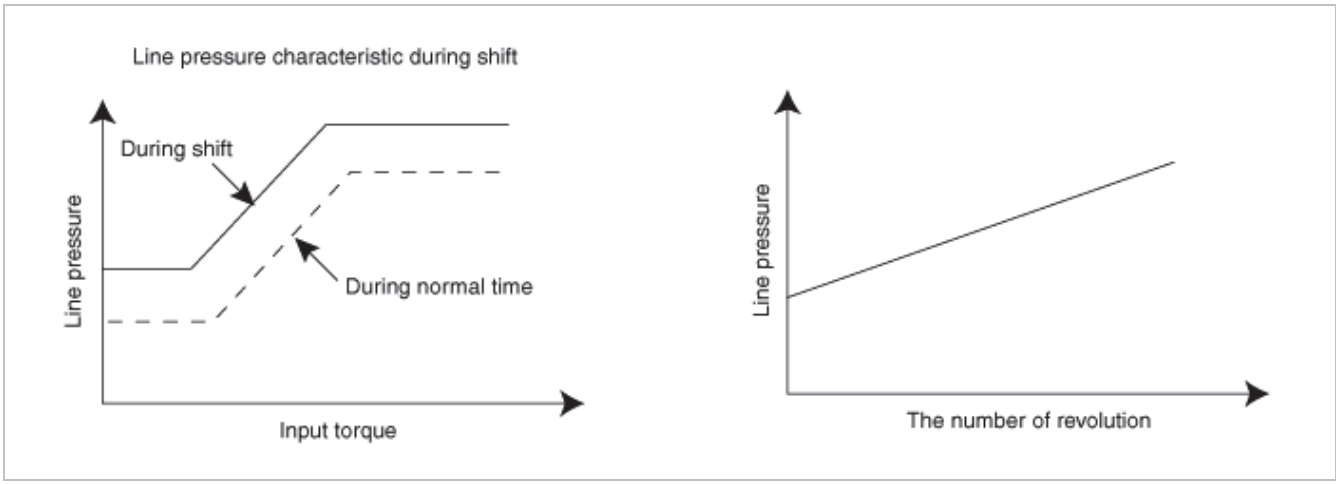
- A/T control unit (TCM) has stored in memory a number of patterns for the optimum line pressure characteristics according to driving conditions.
- In order to obtain the most appropriate line pressure characteristic to meet the current driving state, the TCM controlsthe line pressure solenoid current valve and thus controls the line pressure.
  - Normal line pressure control.
    Each clutch is adjusted to the necessary pressure to match the engine drive force.



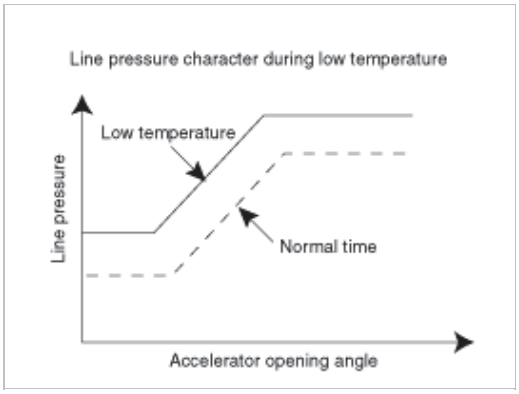
  - Back-up control (Engine brake)
    Line pressure according to speed is set during shift down by select operation while driving.



- During shift change
  Set to line pressure that is necessary for shift change. Therefore, line pressure characteristic is set according to input torque and shift types.



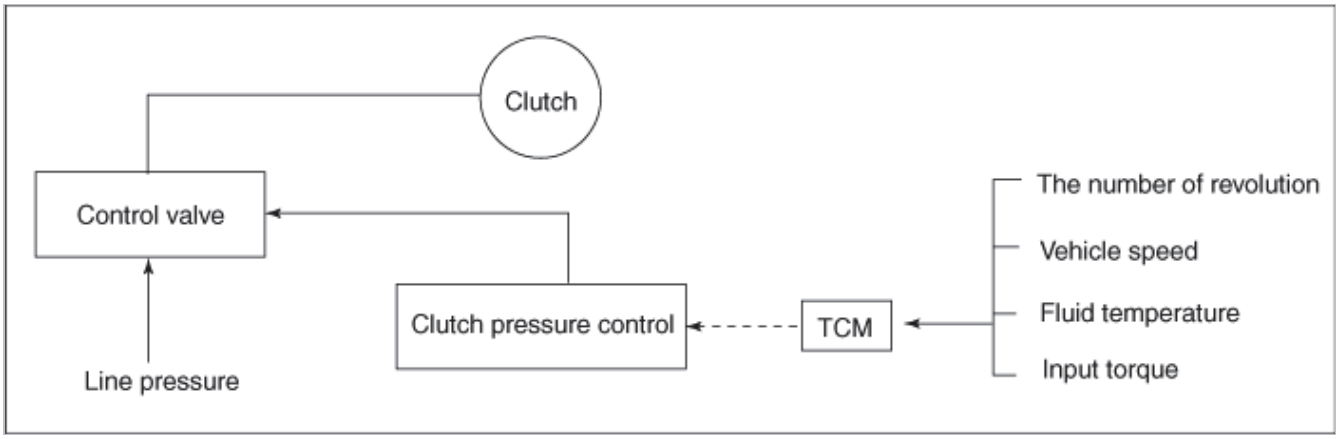
- At low fluid temperature
  When the A/T fluid temperature drops below the prescribed temperature, in order to speed up the action of each friction element, the line pressure is set higher than the normal line pressure characteristic.



Shift control

- The clutch pressure control solenoid is controlled by the signals from the switches and sensors. Thus the clutch pressure is adjusted to be appropriate to the engine load state and vehicle driving state. It becomes possible to finely control the clutch hydraulic pressure with high precision and a smoother shift change characteristic is attained.

SHIFT CONTROL SYSTEM DIAGRAM



Shift description
Controls clutches with optimum timing and fluid pressure in response to engine speed, engine torque information, and etc.

Lock-up control

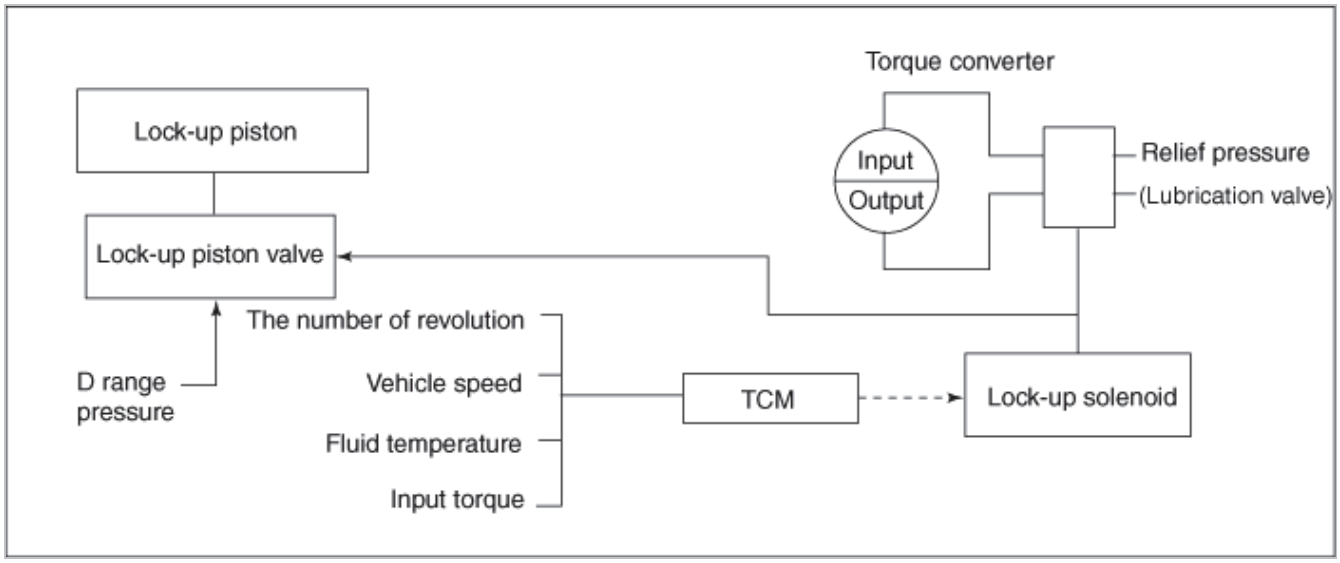
Lock-up control is to enhance delivery efficiency by preventing the torque converter from slipping, engaging the lock-up piston into the torque converter.
It operates lock-up solenoid control in response to a signal from A/T control unit (TCM) and lock-up control valve behavior control, engages or releases the lock up piston of the torque converter.

LOCK-UP OPERATING CONDITION TABLE

Select lever	D range			Sports mode	
Gear position	5	4	3	5	4
Lock-up	○	-	-	○	○
Slip lock-up	○	○	-	-	-

Lock-up control valve control
- In the lock-up control valve, there is operating fluid pressure circuit linked into the lock-up piston and lock-up solenoid operates valve shift in response to a signal from the A/T control unit.
- Operating fluid pressure circuit that is applied to the lock-up piston chamber is controlled with the release or apply sides.

LOCK-UP CONTROL SYSTEM DIAGRAM



Lock-up released
- In the lock-up control valve, there is operating fluid pressure circuit connected into the lock-up piston and lock-up solenoid operates valve shift in response to a signal from the A/T control unit.
  Therefore, the lock-up piston is not coupled.

Lock-up applied
- During the lock-up applied status, lock-up apply pressure is generated having the lock-up control valve to L/U by the lock-up solenoid.
  Therefore, press the lock-up piston to be coupled.

Smooth lock-up control
- A/T control unit (TCM) controls current value that is output to the lock-up solenoid when shifting lock-up applied state from lock-up released state.
  Therefore the lock-up clutch is temporarily set to half-clutched state when shifting the lock-up applied state to reduce the shock.

Half-clutched state
- Changes current value that is output to the lock-up solenoid from A/T control unit (TCM) to gradually increase lock-up solenoid pressure.
  In this way, the lock up apply pressure gradually rises and while the lock-up piston is put into half-clutched status, the lock-up piston operating pressure is increased and the coupling is completed smoothly.

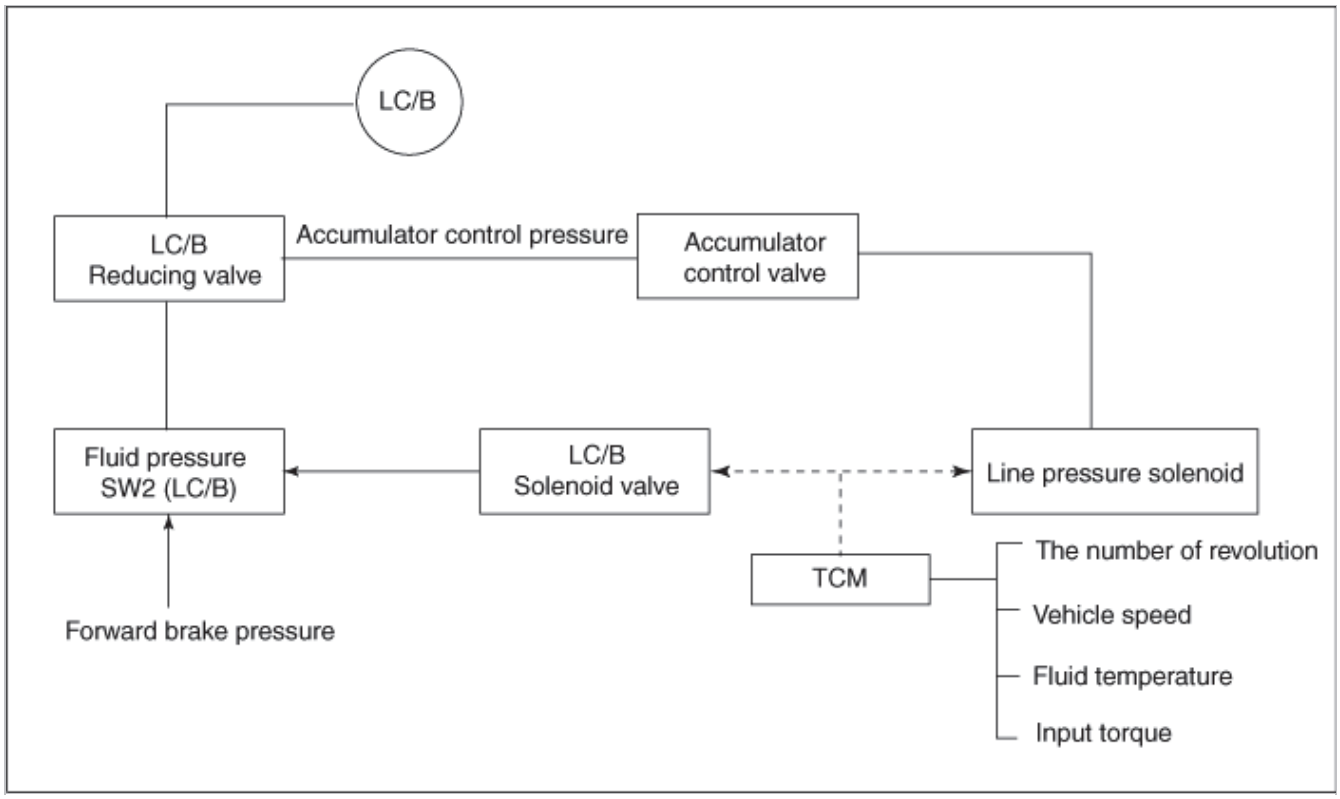
Slip lock-up control

- In the slip region, A/T control unit controls current value of the lock-up solenoid to half-clutched status. Therefore lock-up operates from low speed absorbing torque fluctuation of engine.
  Thereby fuel consumption was increased during low accelerator opening with 4th, and 5th gears at low speed.

Engine brake control

- The forward one-way clutch delivers driving force from the engine to the rear wheel but reverse driving from the wheel drive is not delivered since the one-way clutch is idling.
  Therefore low coast brake solenoid is operated to prevent the forward one-way clutch from idling so that the engine brake is operated in the same as before.

ENGINE BRAKE CONTROL SYSTEM DIAGRAM



- The operation of the low coast brake solenoid switches the low coast brake switch valve and controls the coupling and releasing of the low coast brake.
  The low coast brake reducing valve controls the low coast brake coupling force.

CONTROL VALVE

Control valve functions

Valve name	Function
Torque converter regulator valve	Regulates line pressure to the optimum pressure (torque converter operating pressure) to prevent pressure applied to the torque converter from being excessive.
Pressure regulator valve Pressure regulator plug Pressure regulator sleeve	Regulates oil pump discharge pressure to the optimum pressure (line pressure) in response to the driving conditions.
Front brake control valve	Regulates line pressure to the optimum pressure (front brake pressure) to be applied to the front brake during the front brake apply.
Accumulator control valve	Regulates pressure applied to the accumulator piston, and the low coast reducing valve (accumulator control pressure) inresponse to the driving conditions (regulates clutch pressure at 1st, 2nd, 3rd, 5th gears).

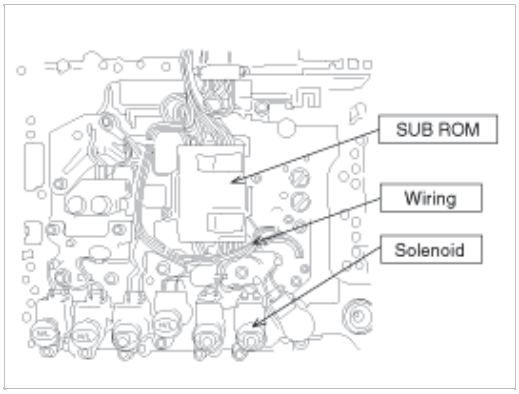
Pilot valve A	Regulates line pressure to the regular pressure required by line pressure control, shift control, and lock-up control (pilot pressure).
Pilot valve B	Regulates line pressure to the regular pressure required by shift control (pilot pressure).
Low coast brake switching valve	Provides the low coast brake reducing valve with line pressure during engine brake operation.
Low coast brake reducing valve	Regulates line pressure to the optimum pressure to be applied to the low coast brake when the low coast brake is coupled.
N-R accumulator	Produces the stabilizing pressure for when N-R is selected.
Direct clutch piston switching valve	Operates in 4th gear and switches the direct clutch coupling capacity.
High&low reverse clutch control valve	Regulates line pressure to the optimum pressure (high&low reverse clutch pressure) to be applied to the high&low reverse clutch when the high&low reverse clutch is coupled (regulates clutch pressure in 1st, 3rd, 4th, 5th gears).
Input clutch control valve	Regulates line pressure to the optimum pressure (input clutch pressure) to be applied to the input clutch when the inputclutch is coupled (regulates clutch pressure in 4th, 5th gears).
Direct clutch control valve	Regulates line pressure to the optimum pressure (direct clutch pressure) to be applied to the direct clutch when the direct clutch is coupled (regulates clutch pressure in 2nd, 3rd, 4th gears).
Lock-up control valve Lock-up control plug Lock-up control sleeve	Switches lock-up to operating or released. Also, by performing the lock-up operation transiently, lock-up smoothly.
Torque converter lubrication valve	Operates to switch torque converter, cooling, and oil path of lubrication system during lock-up.
Cool bypass valve	Allows excess oil to by pass cooler circuit without being fed into it.
Line pressure relief valve	Discharges excess oil from line pressure circuit.
N-D accumulator	Produces the stabilizing pressure for when N-D is selected.
Manual valve	Delivers line pressure to each circuit in response to each select position. Circuit to which line pressure is not sent drain.

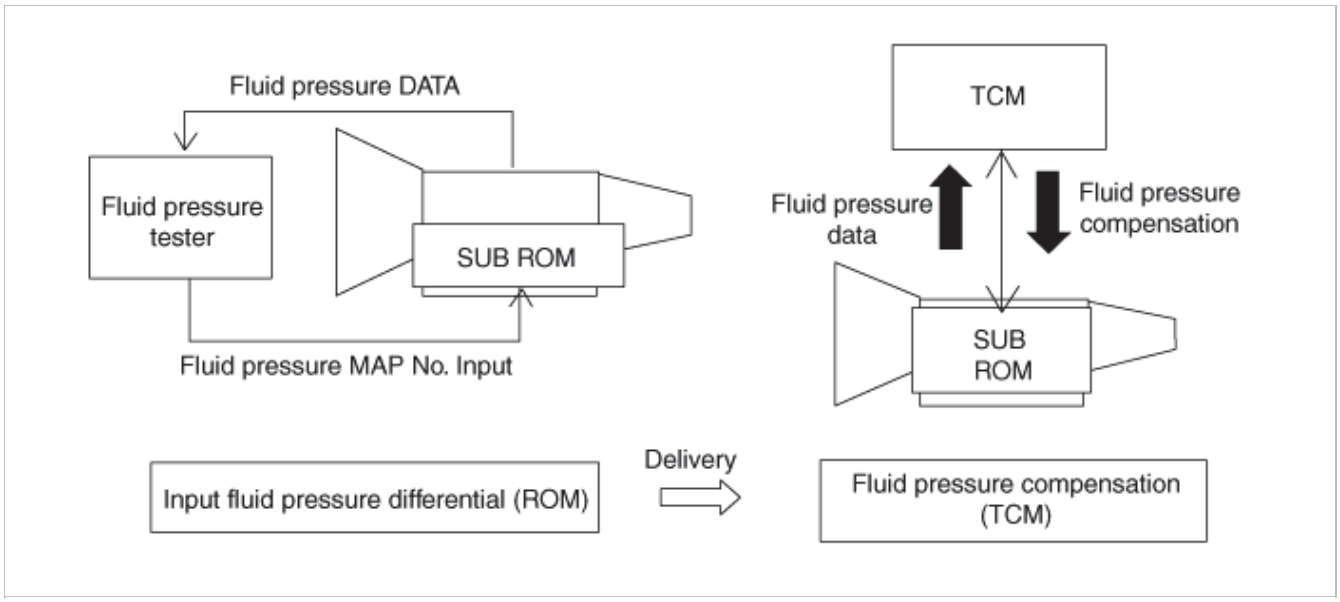
FUNCTION OF PRESSURE SWITCH

Name	Function
Fluid pressure switch 1 (FR/B)	Detects abnormal fluid pressure of the front brake. When it detects any malfunction, it puts the system into fail-safe mode.
Fluid pressure switch 2(LC/B)	Detects abnormal fluid pressure of the low coast brake. When it detects any malfunction, it puts the system into fail-safe mode.
Fluid pressure switch 3(I/C)	Detects abnormal fluid pressure of the input clutch. When it detects any malfunction, it puts the system into fail-safe mode.
Fluid pressure switch 5(D/C)	Detects abnormal fluid pressure of the direct clutch. When it detects any malfunction, it puts the system into fail-safe mode.
Fluid pressure switch 6 (H&LR/C)	Detects abnormal fluid pressure of the high&low reverse clutch. When it detects any malfunction, it puts the system into fail-safe mode.

SUB ROM unit

1. Installing location: The valve body upper part
2. Function: To obtain A/T fluid pressure stability by compensating for solenoid&valve body unit fluid pressure differential.
3. Principle: Install additional ROM onto valve body of automatic transmission and input fluid pressure differential of solenoid &valve body so that TCM reads the input data to perform fluid pressure compensation.



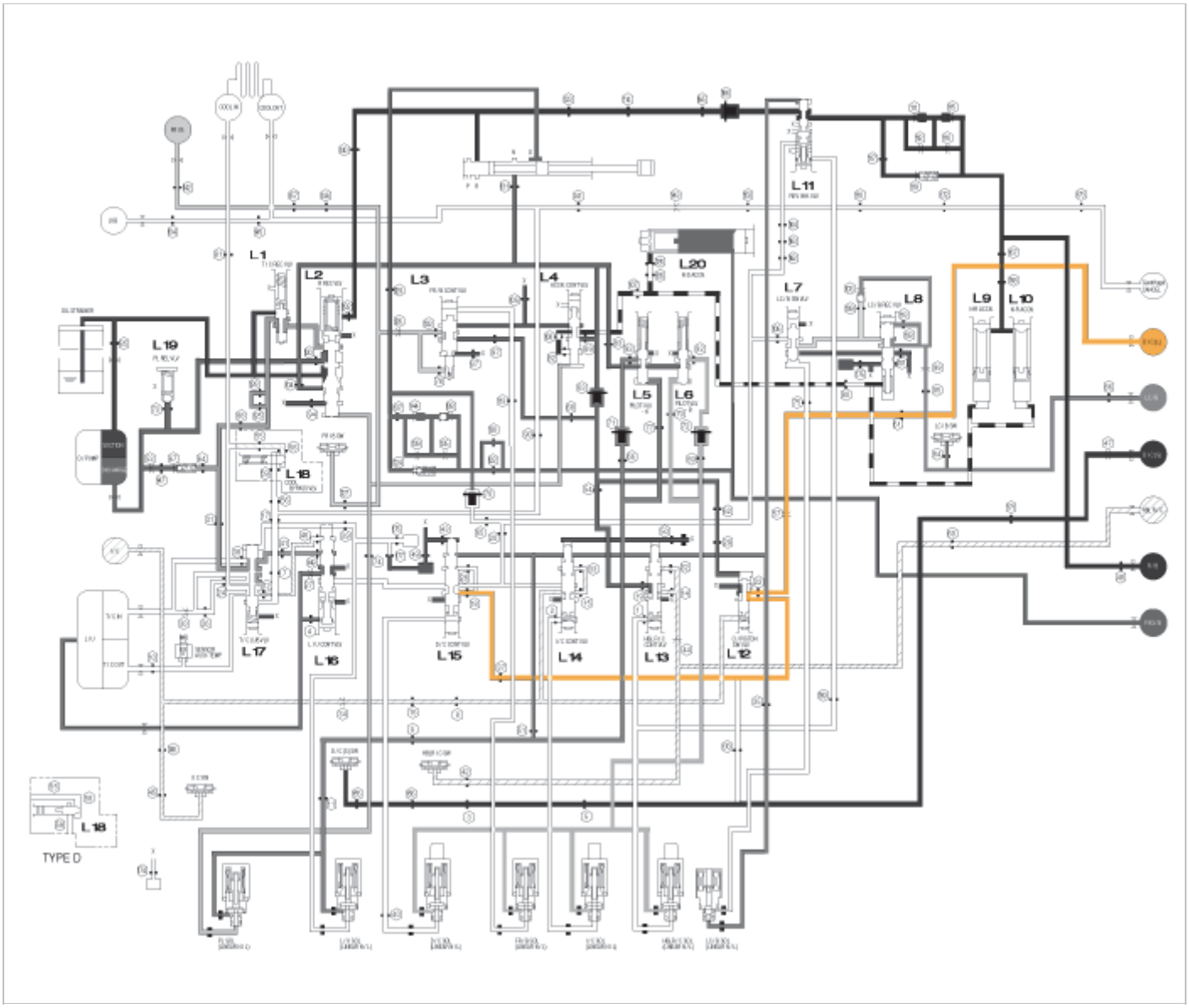


4. Maintenance
   (1) When replacing with a new TCM in the vehicle
      A. TCM automatically reads SUB ROM DATA during I.G ON. At this time, shift range valve is off for about 2.5 second.

   (2) When replacing A/T (regardless of new or old ones) in the vehicle
      A. Must erase SUB ROM DATA stored in TCM.
      B. Erase SUB ROM DATA in SCAN TOOL delete mode during shift stage in R-range + accelerator opening angle maintains 50% + I.G ON.
      C. TCM reads SUB ROM DATA from a new A/T upon I.G ON again after I.G OFF.

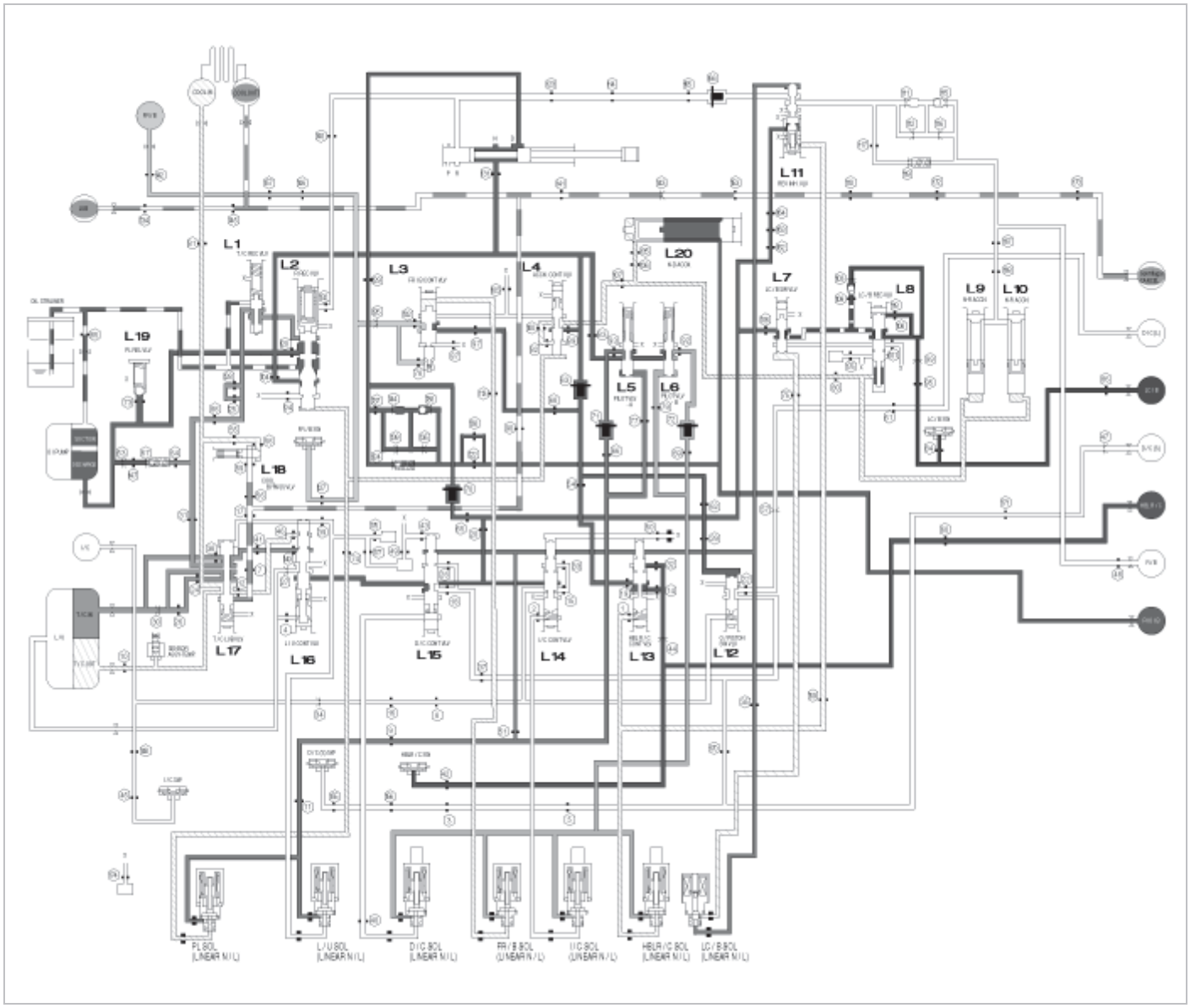
   (3) Moving TCM from vehicle A to another vehicle B
      A. Perform the same way as in 2) above.

VALVE BODY fluid pressure circuit diagram (D Range)



* Refer to body valves for L(number) valve name.

1st gear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FL SOL (LINEAR M / L)
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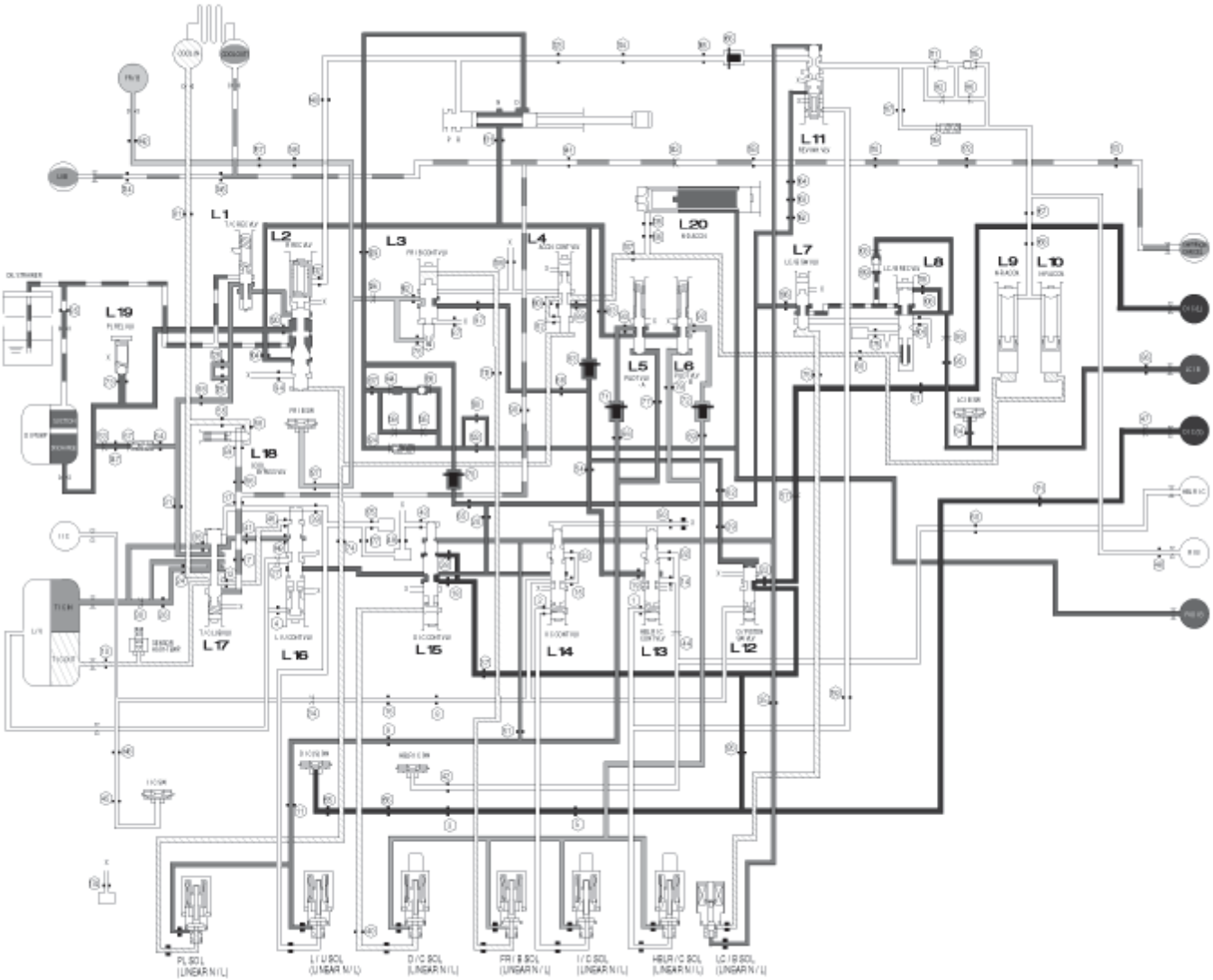
D / C SOL (LINEAR M / L)
FR / B SOL (LINEAR N / L)
1 / C SOL (LINEAR N / L)
HBLR / C SOL (LINEAR M / L)
LC / B SOL (LINEAR M / L)

2nd gear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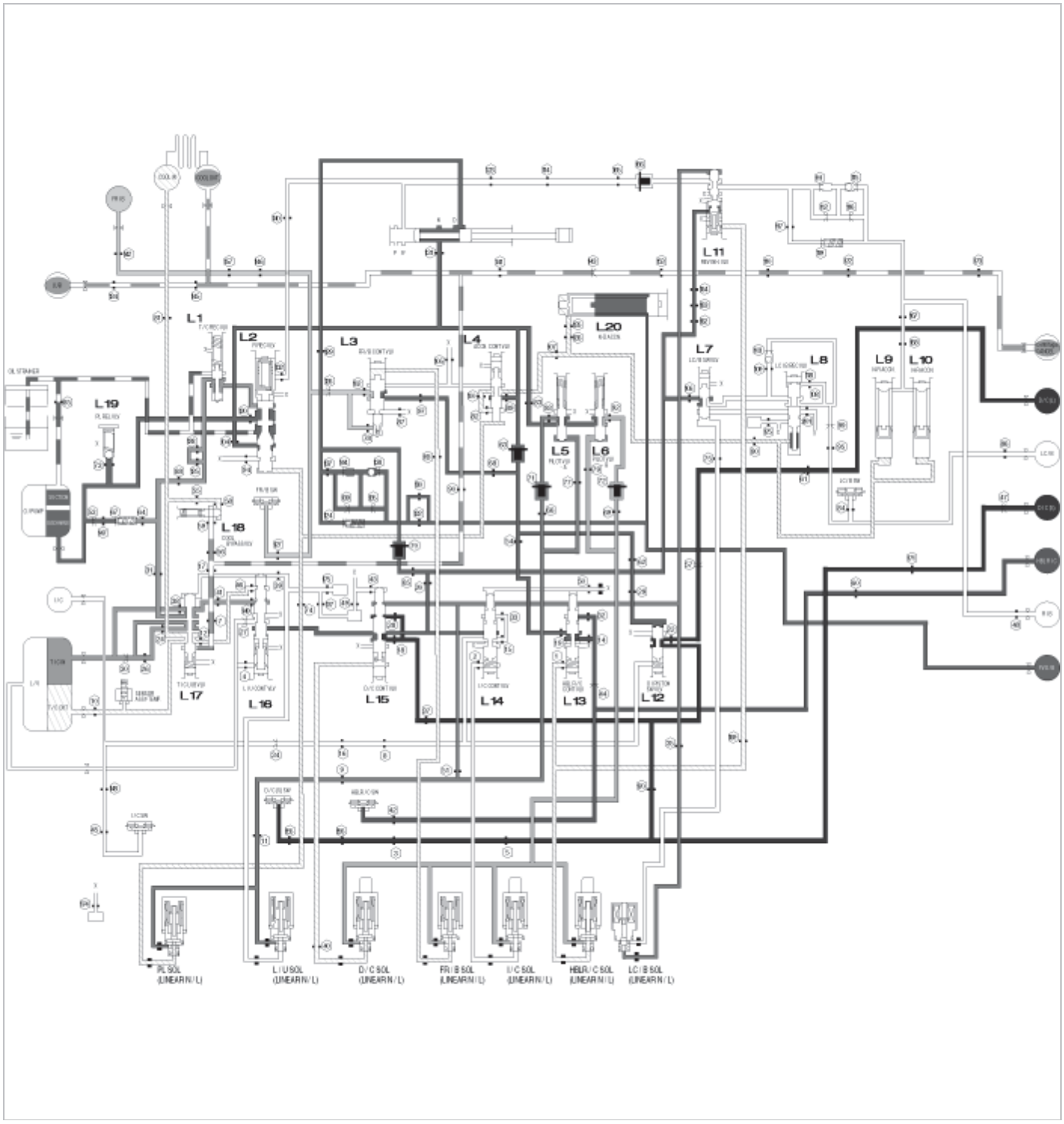
3rd gear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PL SOL (LINEAR N / L)
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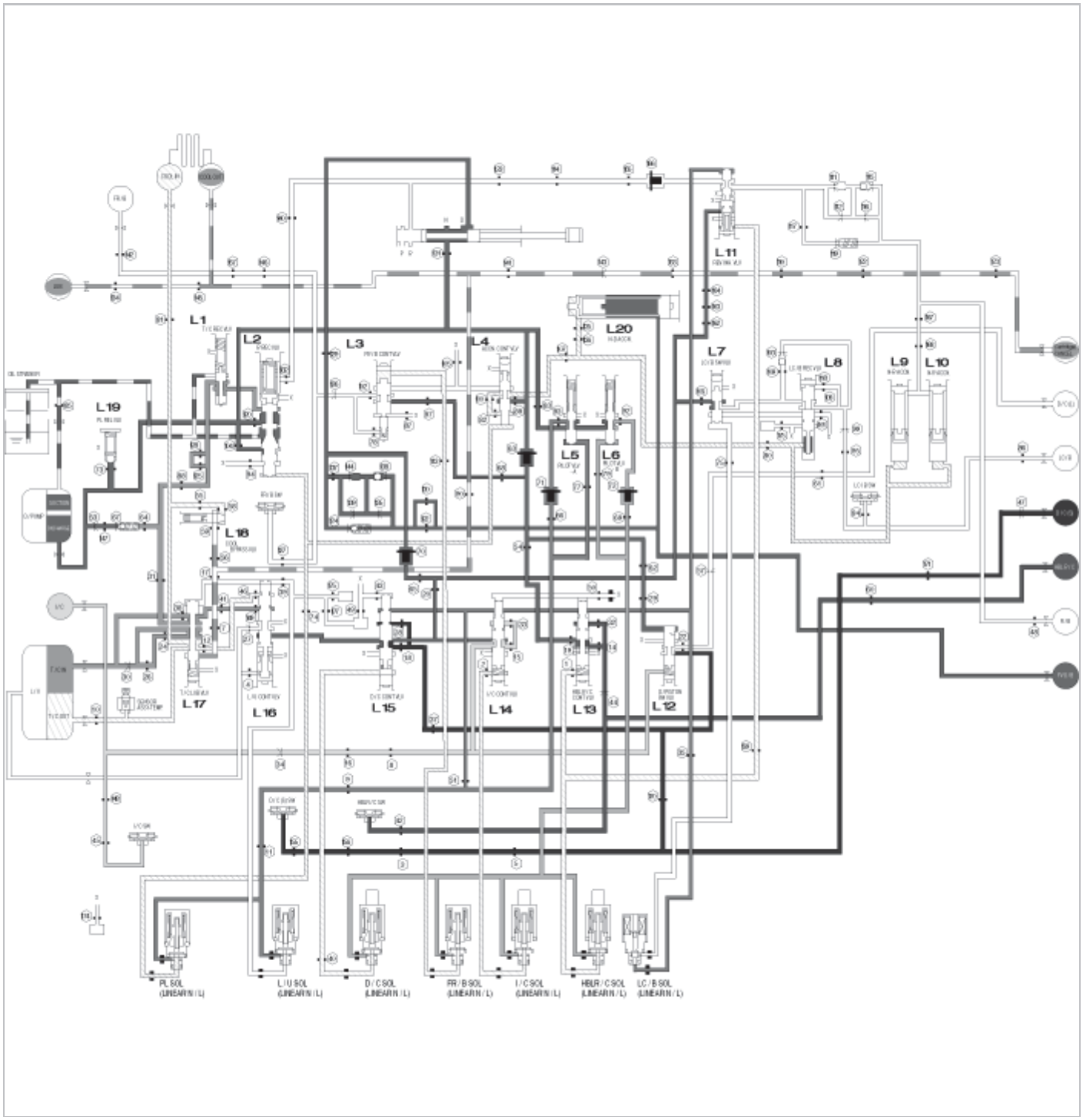
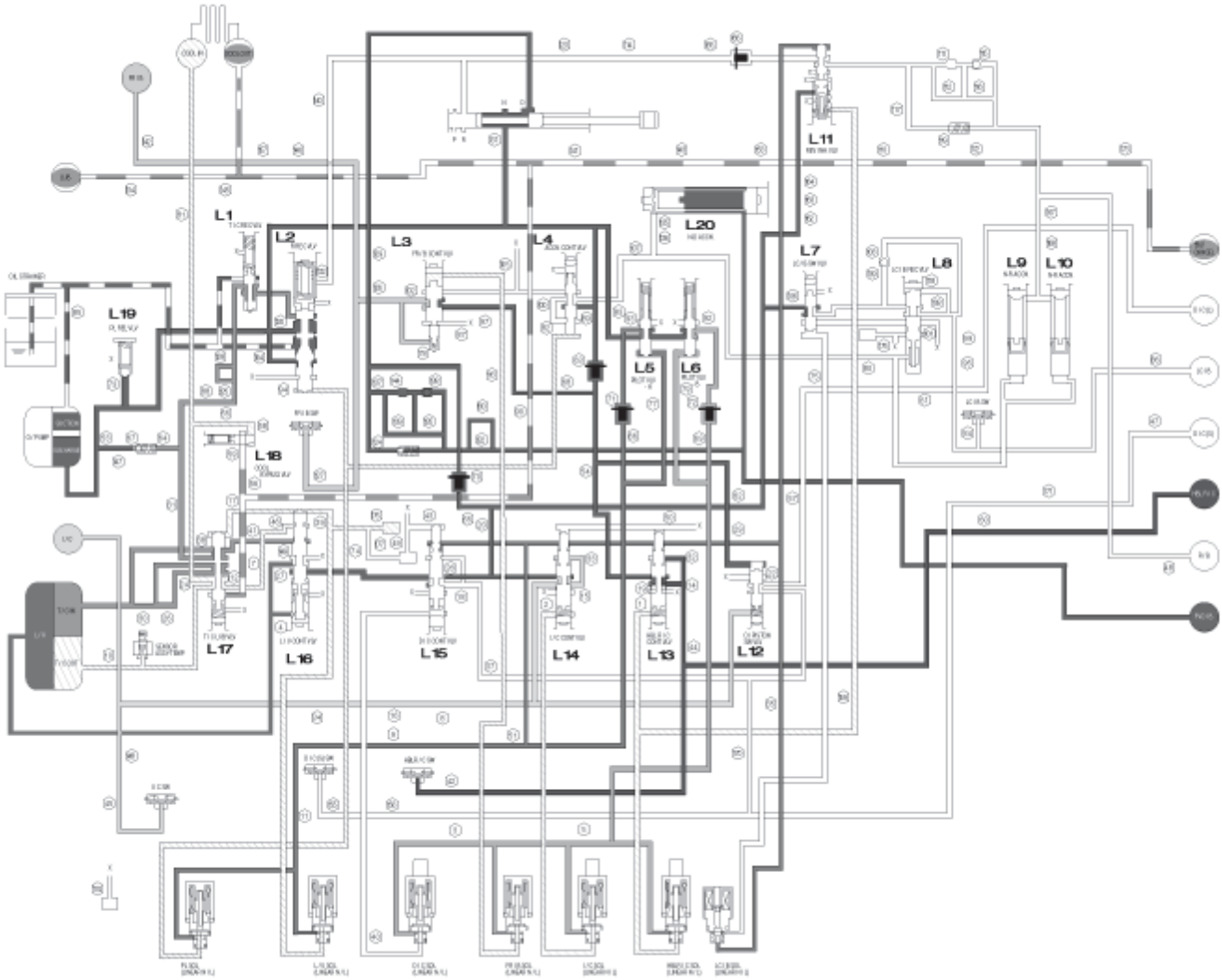
I / C SOL (LINEAR N / L)
HBLR / C SOL (LINEAR N / L)
LC / B SOL (LINEAR N / L)

4th gear



5th gear (lock-up)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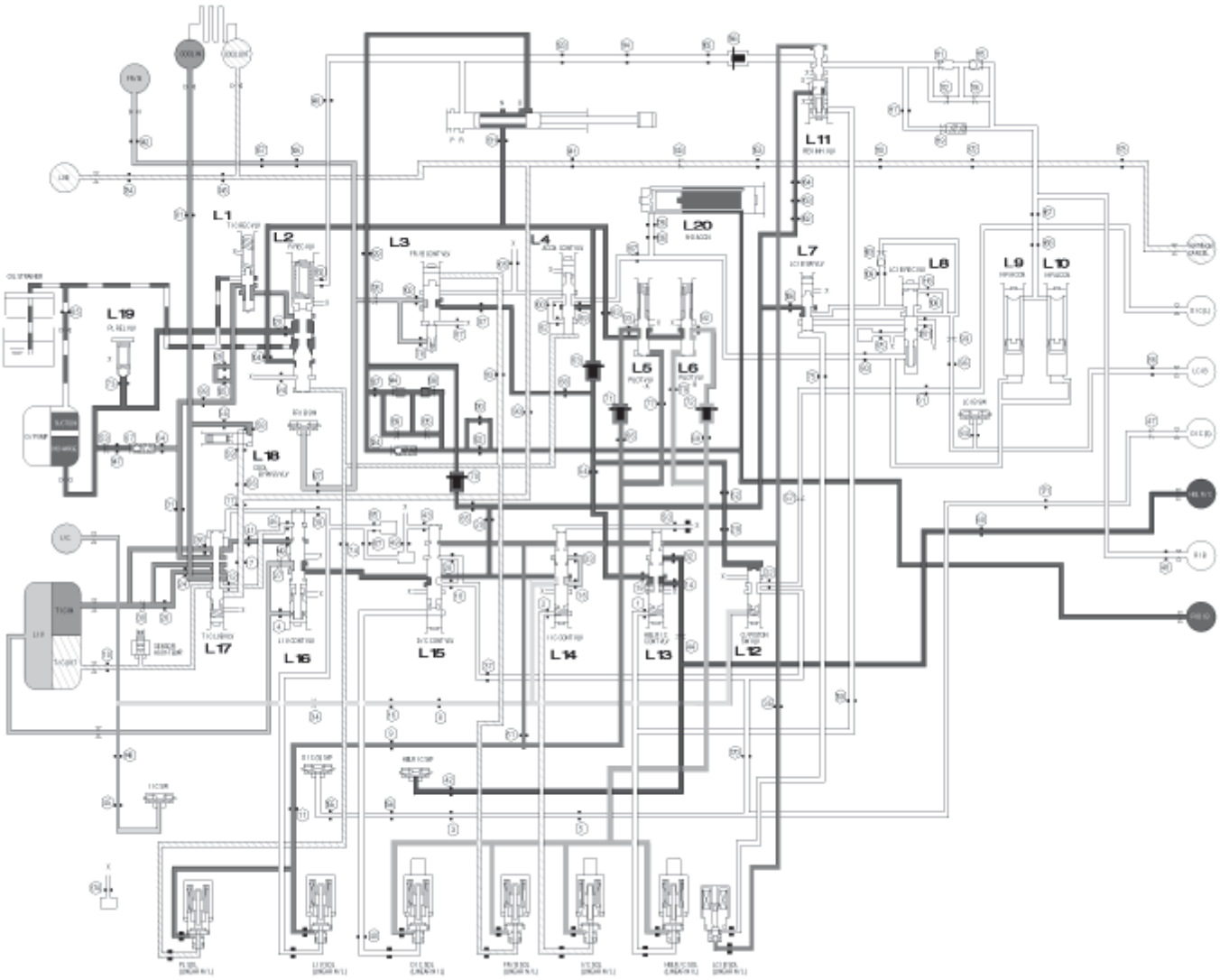
5th gear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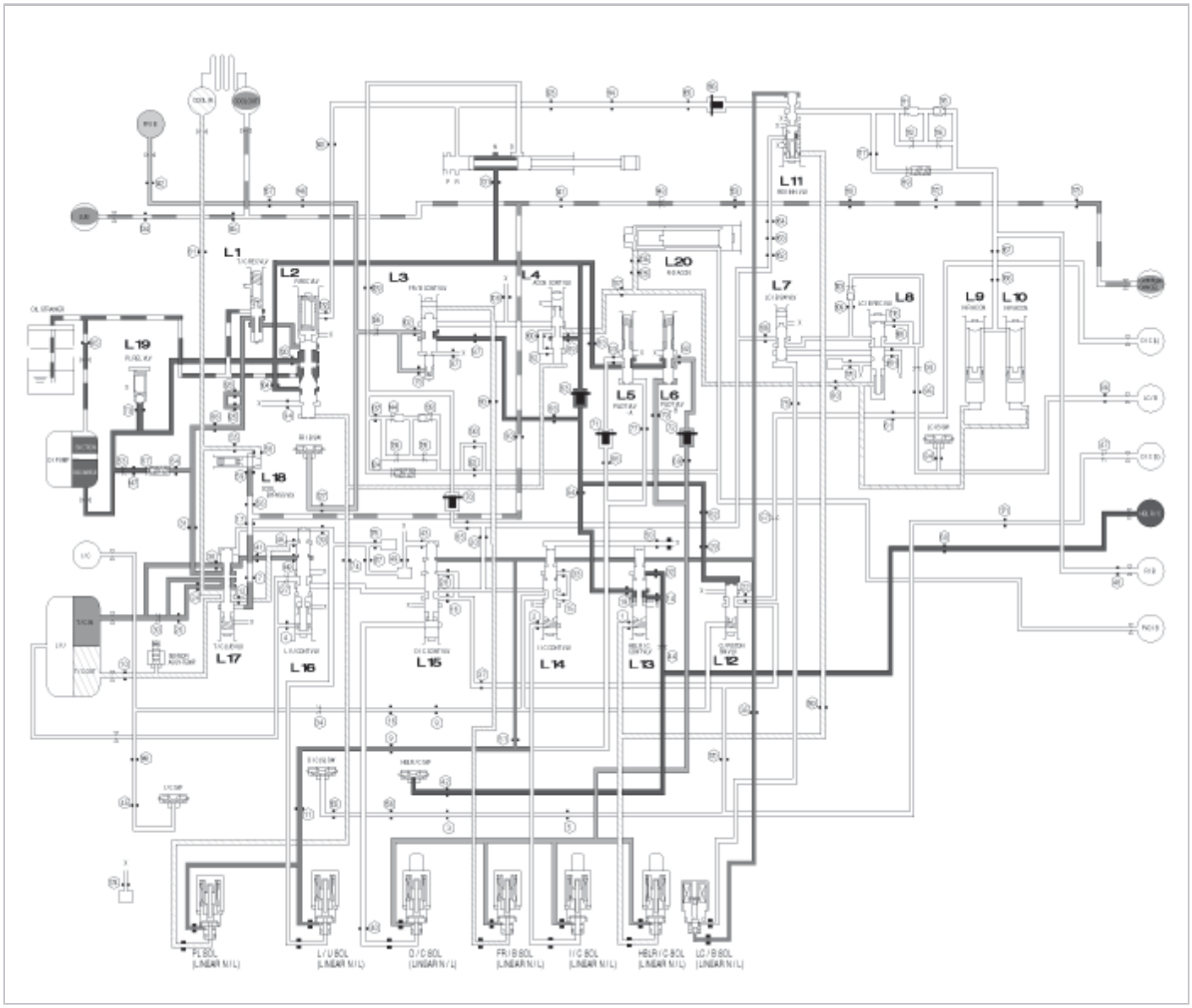
P&N range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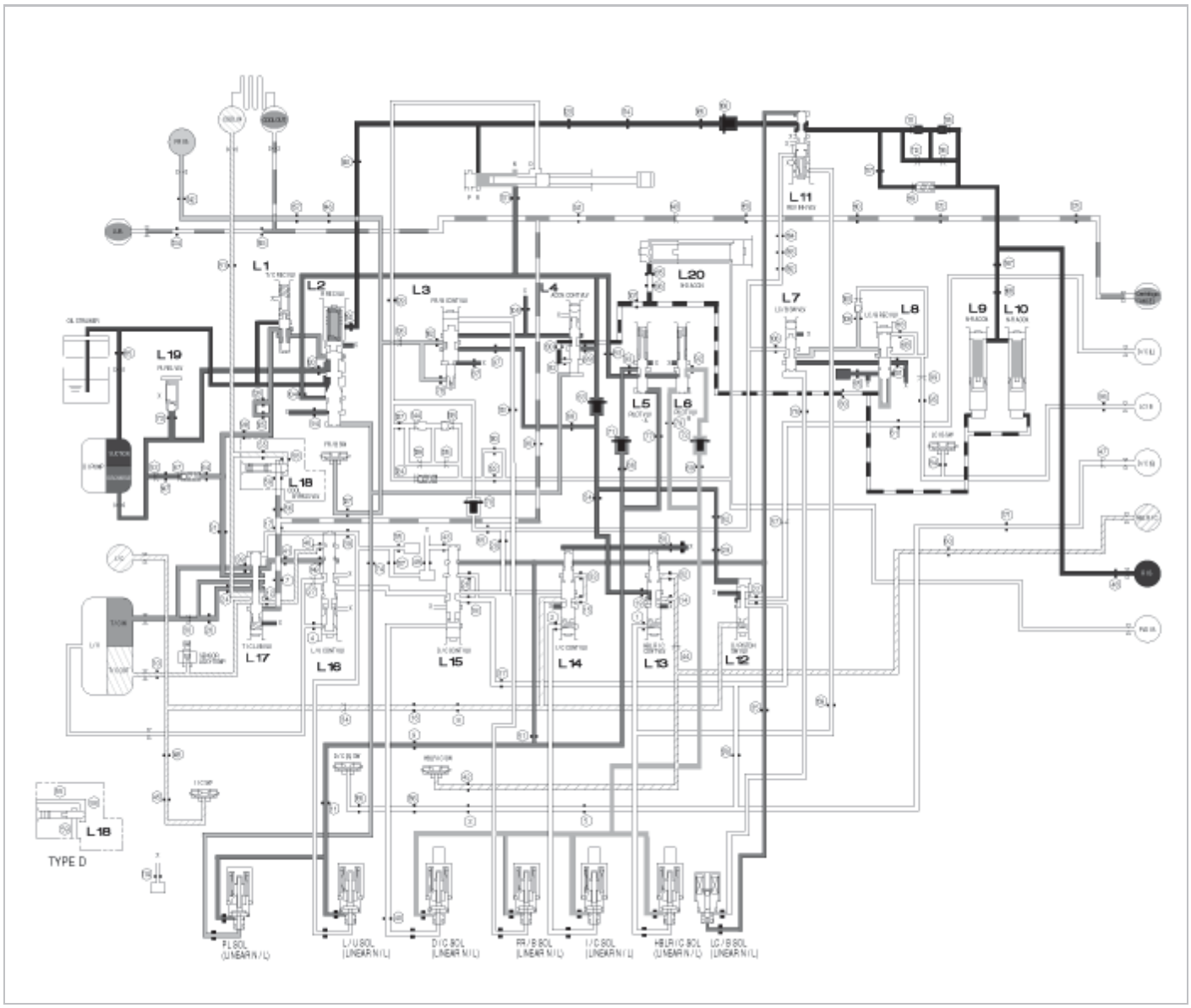
R range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TYPE D
F L SOL (LINEAR N / L)
L / U SOL (LINEAR N / L)
D / C SOL (LINEAR N / L)
RR / B SOL (LINEAR N / L)
I / C SOL (LINEAR N / L)
HBLR / C SOL (LINEAR N / L)
LC / B SOL (LINEAR N / L)

BASIC INSPECTION ADJUSTMENT

TRANSAXLE FLUID LEVEL

INSPECTION

1. Drive the vehicle until the fluid reaches normal operating temperature [70~80°C(158~176°F)].
2. Place the vehicle on a level surface.
3. Move the gear selector lever through all gear positions. This will fill the torque converter with trans fluid. Set the selector lever to the "N" (Neutral) position.
4. Before removing the oil level gauge, wipe all contaminants from around the oil level gauge. Then take out the oil level gauge and check the condition of the fluid.

> NOTICE
>
> If the fluid smells as if it is burning, it means that the fluid has been contaminated by fine particles from the bushes and friction materials, a transmission overhaul may be necessary.

5. Check that the fluid level is in the "HOT" mark on the oil level gauge. If fluid level is low, add automatic transaxle fluid until the level reaches the "HOT" mark.

Automatic transaxle fluid :
APOLLOIL ATF RED-1
ATF capacity: 10ℓ(10.57 US qt, 8.8 lmp.qt)

> NOTICE
>
> Low fluid level can cause a variety of abnormal conditions because it allows the pump to take in air along with fluid. Air trapped in the hydraulic system forms bubbles, which are compressible. Therefore, pressures will be erratic, causing delayed shifting, slipping clutches and brakes, etc. Improper filling can also raise fluid level too high. When the transaxle has too much fluid, gears churn up foam and cause the same conditions which occur with low fluid level, resulting in accelerated deterioration of automatic transaxle fluid. In either case, air bubbles can cause overheating, and fluid oxidation, which can interfere with normal valve, clutch, and brake operation. Foaming can also result in fluid escaping from the transaxle vent where it may be mistaken for a leak.

6. Insert the oil level gauge securely.

> NOTICE
>
> When new, automatic transmission fluid should be red, The red dve is added so the assembly plant can identify it as transmission fluid and distinguish it from engine oil or antifreeze. The red dve, which is not an indicator of fluid quality, is not permanent. As the vehicle is driven the transmission fluid will begin to look darker. The color may eventually appear light brown.

REPLACEMENT

If you have a fluid changer, use this changer to replace the fluid. If you do not have a fluid replace the fluid by the following procedure.

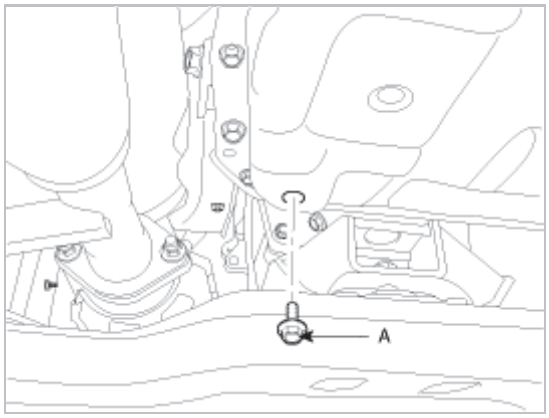
1. Disconnect the hose, which connects the transmission and the oil cooler (inside the radiator).
2. Start the engine and let the fluid drain out.

Running conditions : "N" range with engine idling

> CAUTION
>
> The engine should be stopped within one minute after it is started. If the fluid has all drained out before then,

the engine should be stopped at that point.

3. Remove the drain plug(A) from the bottom of the transmission case to drain the fluid.



4. Install the drain plug via the gasket, and tighten it the specified torque.

TORQUE:
58.83~63.74Nm (6~6.5kgf.m, 43.39~47.01lb-ft)

5. Pour the new fluid in through the oil filler tube.

CAUTION

Stop pouring if the full volume of fluid cannot be poured in.

6. Repeat the procedure in step (2).

NOTICE

Check the old fluid for contamination. If it has been contaminated, repeat the steps (5) and (6).

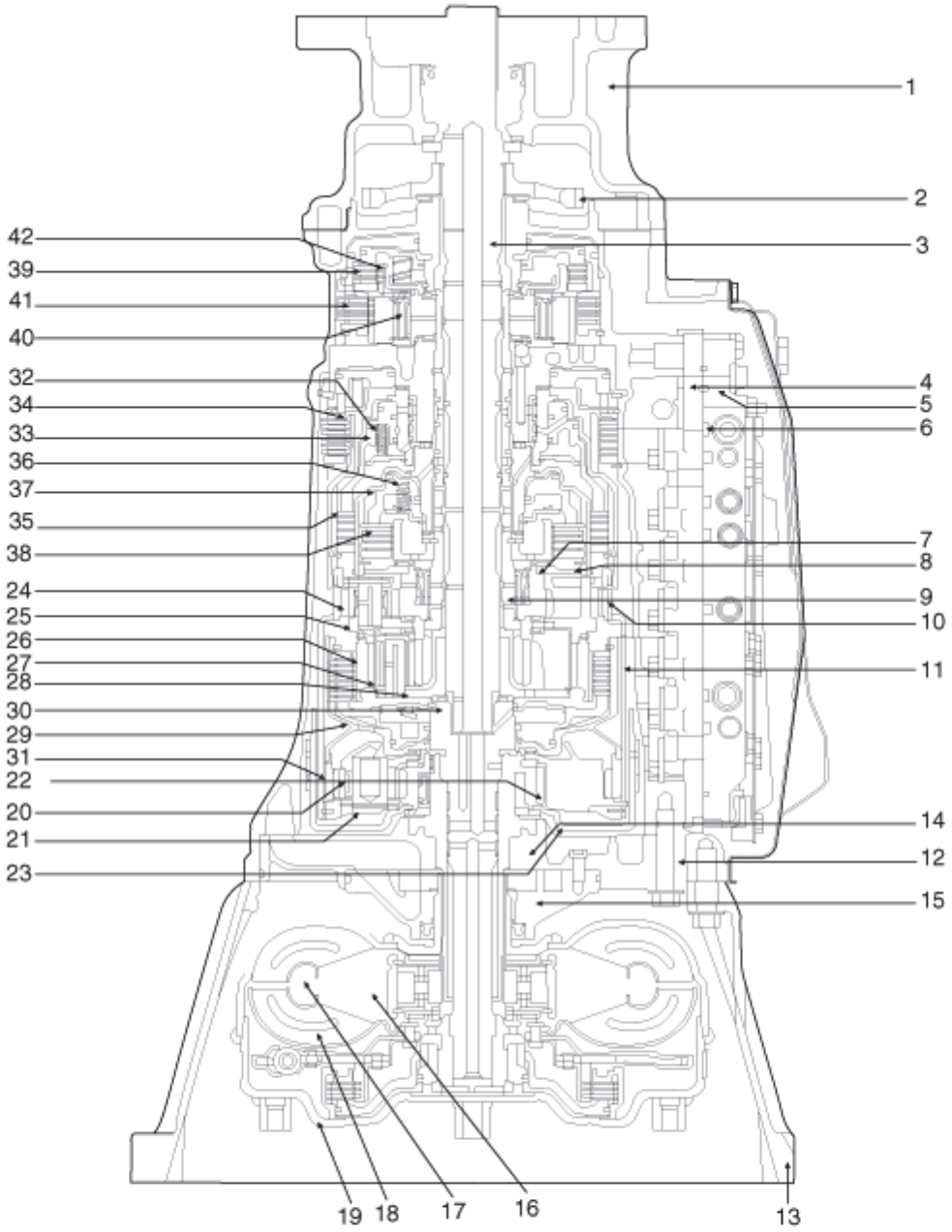
7. Pour the new fluid in through the oil filler tube.
8. Reconnect the hose, which was disconnected in step (1) above, and firmly replace the oil level gauge.
   (In case of this "replace", this means after wiping off any dirt around the oil level gauge, insert it into the filler tube.)
9. Start the engine and run it at idle for 1~2 minutes.
10. Move the select lever through all positions, and then move it to the "N" or "P" position.
11. Drive the vehicle until the fluid temperature rises to the normal temperature (70~80°C(158~176°F)), and then check the fluid level again. The fluid level must be at the HOT mark.
12. Firmly insert the oil level gauge into the oil filler tube.

KIA MOTORS

Automatic Transaxle System

Automatic Transaxle System - Automatic Transaxle

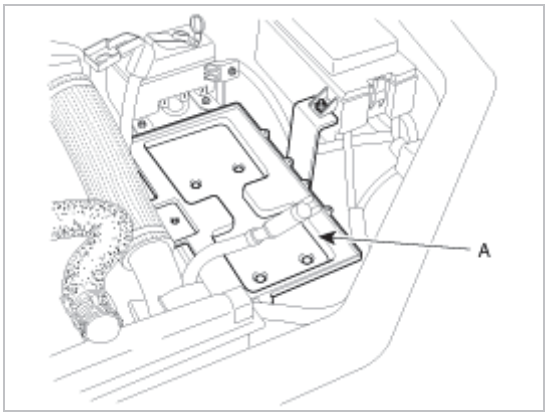
COMPONENTS



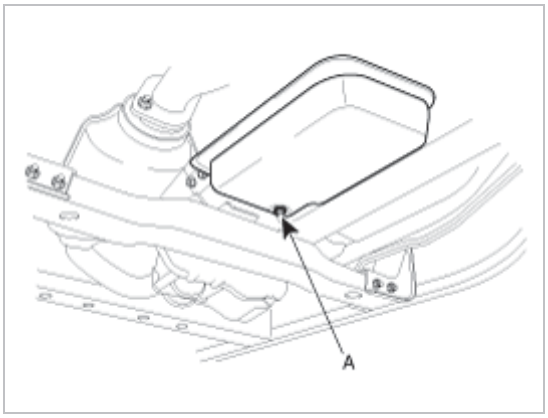
1. Adapter case (4WD)
2. Parking gear
3. Output shaft
4. Control valve upper body
5. Control valve lower body
6. Separator plate assembly
7. Rear sun gear
8. Rear sun plate
9. Middle sun gear assembly
10. Rear annulus gear assembly
11. Rear annulus cell
12. Automatic transmission case
13. Converter housing
14. Oil pump cover
15. Oil pump housing
16. Stator
17. Impeller assembly
18. Turbine & lockup assembly
19. Torque converter cover assembly
20. Front pinion gear
21. Front planetary carrier
22. Front sun gear
23. Front brake drum
24. Rear pinion gear
25. Rear planetary carrier plate
26. Middle annulus gear
27. Middle pinion gear
28. Middle planetary carrier
29. Input clutch drum
30. Input shaft
31. Front annulus gear
32. Direct clutch return spring
33. Direct clutch piston
34. Reverse brake hub
35. Direct clutch assembly
36. High & low reverse clutch return spring
37. High & low reverse clutch piston
38. High & low reveres clutch assembly
39. Low coast brake clutch assembly
40. Forward one-way clutch
41. Forward brake clutch assembly
42. Low coast brake hub

Removal

1. Remove the battery and battery tray (A).



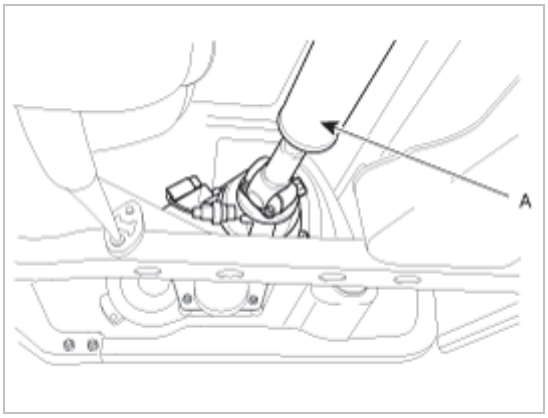
2. Drain the automatic transmission fluid after removing the drain plug (A).



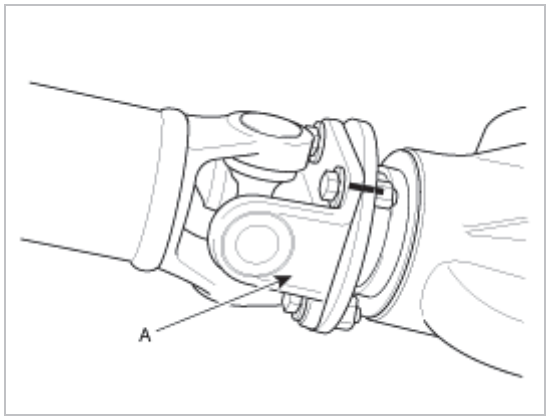
3. Disconnect the control cable.
4. Remove the under cover.
5. Disconnect the ATF oil cooler hose.
6. Remove the transmission oil level gage pipe.
7. Remove the rear propeller shaft (A).

Tightening torque :
49.1 ~ 58.9 N.m (5.0 ~ 6.0 kgf.m, 36.2 ~ 43.4lb-ft)

[Front side]



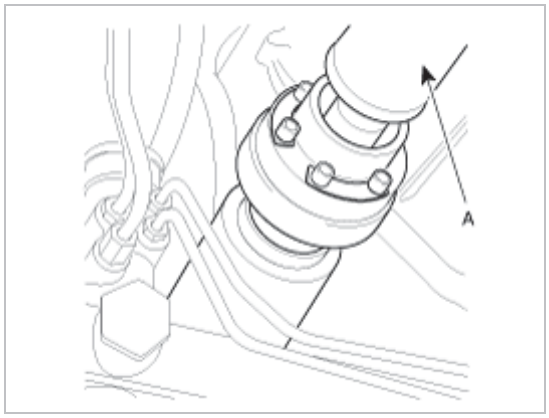
[Rear side]



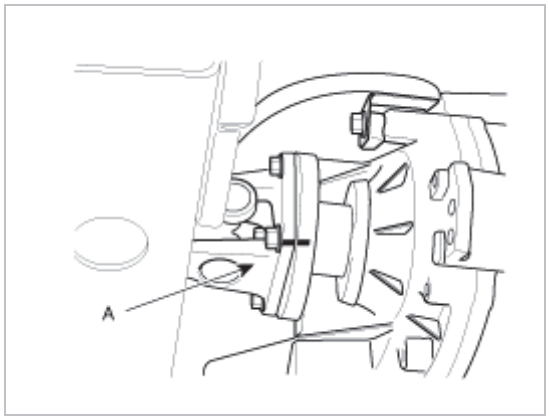
8. Remove the front propeller shaft (A).

Tightening torque :
Part time 4WD: 25.5 ~ 29.4 N.m (2.6 ~ 3.0 kgf.m, 18.8 ~ 21.7 lb-ft)
Full time 4WD: 49.1 ~ 58.9 N.m (5.0 ~ 6.0 kgf.m, 36.2 ~ 43.4lb-ft)

[Front side]

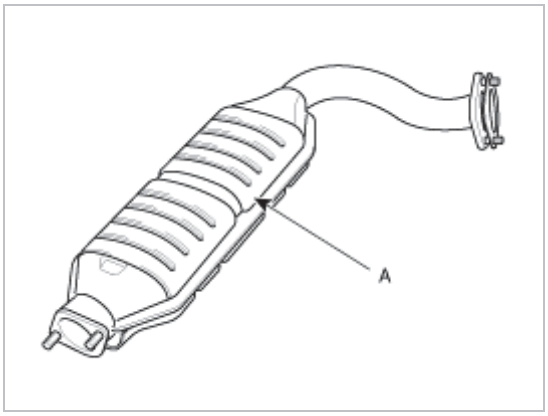


[Rear side]

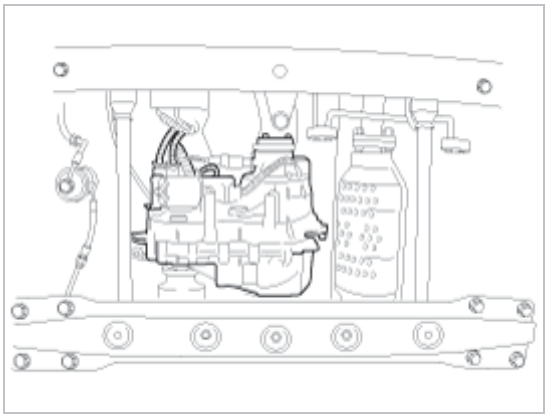


9. Remove the front muffler (A).

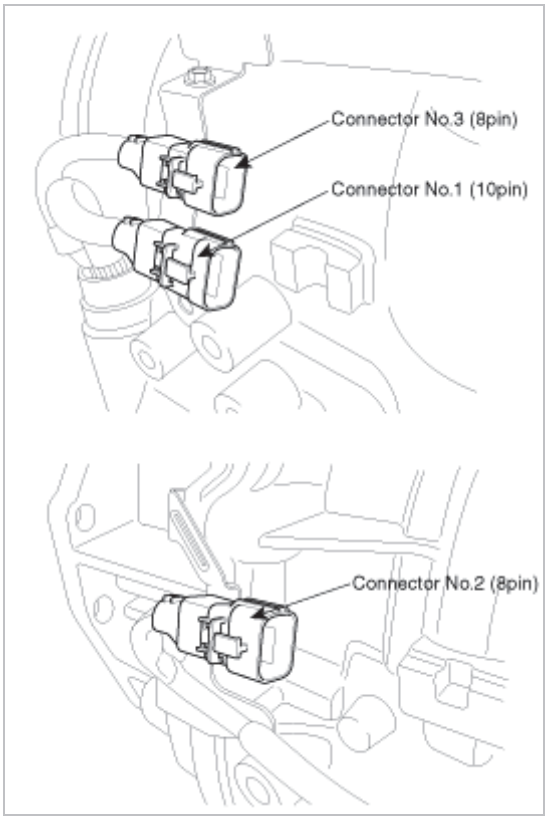
Tightening torque :
42.2 ~ 60.8 N.m (4.3 ~ 6.2 kgf.m, 31.1 ~ 44.9 lb-ft)



10. Disconnect the transfer case connector (4WD).

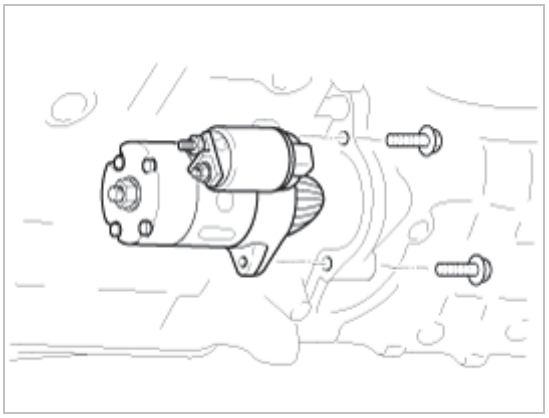


11. Disconnect the transmission connector (3ea).



12. Remove the starter motor.

Tightening torque :
26.5 ~ 33.4 N.m (2.7 ~ 3.4 kgf.m, 19.5 ~ 24.6 lb-ft)

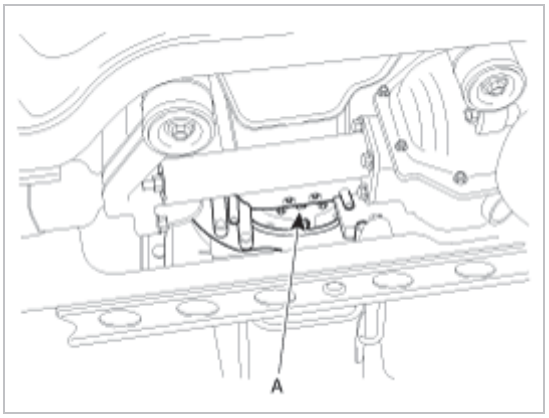


13. Remove the bellhousing cover.

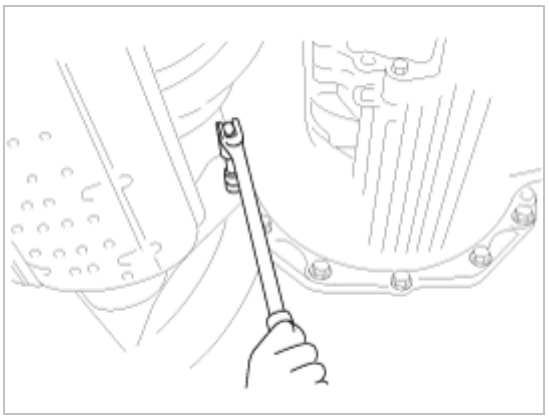
Tightening torque :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

---

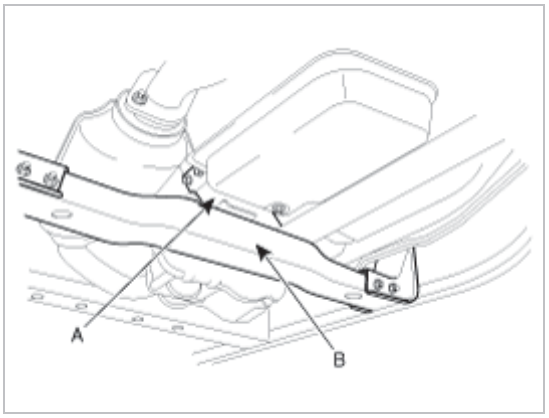
14. Remove the drive plate (A) and the torque converter mounting bolt (6ea).
15. Remove the mounting bolt after rotating the crankshaft pully.



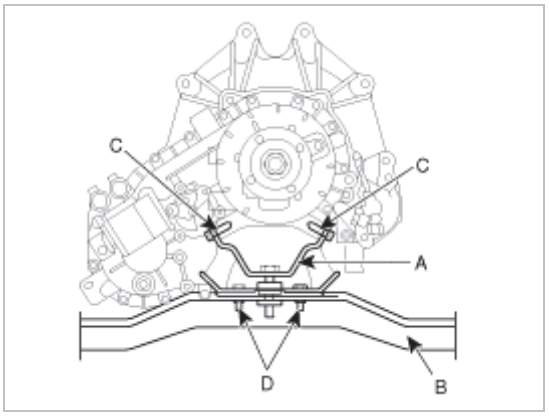
16. Remove the transmission housing mounting bolt.



17. Remove the transmission mounting (A) and the cross member (B) with a jack.



Tightening torque :
Bolt (C): 39.2 ~ 49.1 N.m (4.0 ~ 5.0 kgf.m, 28.9 ~ 36.2 lb-ft)
Bolt (D): 19.6 ~ 28.4 N.m (2.0 ~ 2.9 kgf.m, 14.5 ~21.0 lb-ft)



18. Remove the transmission.

Installation

1. Installation is the reverse of removal.

CAUTION

After replacement or reinstallation procedure of the automatic transaxle assembly, must perform procedures below.

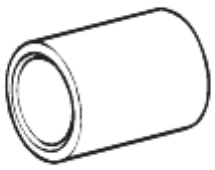
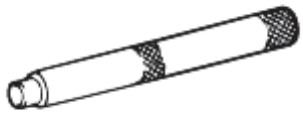
- Power steering fluid replacement and air bleeding (Refer to "General information" in ST group.)
- Adding automatic transaxle fluid. (Refer to "automatic transaxle assembly" in this group.)

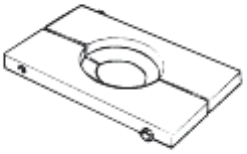
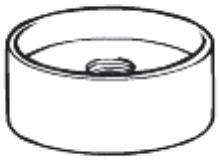
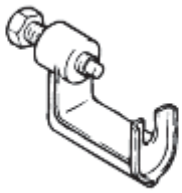
KIA MOTORS

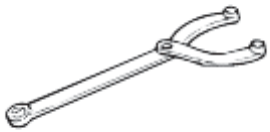
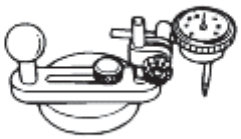
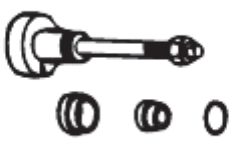
Driveshaft and Axle

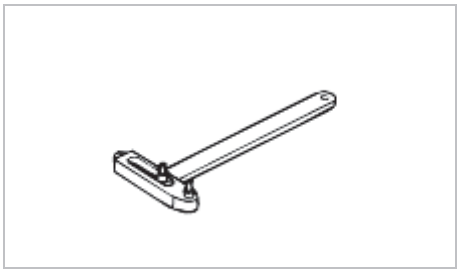
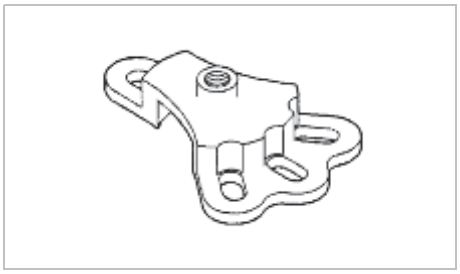
General Information

SPECIAL TOOL

Tool (Number and Name)	Illustration	Use
Bushing remover and installer 09216-21100		Press-fitting of the inner shaft housing dust seal
Bearing outer race installer 09432-33700		Installation of the front hub bearing (Use with 09500-21000)
Bar 09500-21000		Installation of the front hub bearing (Use with 09432-33700)
Draft 09517-21400		Removal of the outer race from the carrier
Universal joint remover 09493-43000		Removal and installation of the journal bearing
Oil seal installer 09517-21000		Press-fitting of the differential drive pinion oil seal (Use with 09500-21000)
Remove plate		Removal of the differential drive

09527-4A000		pinion inner bearing
Bearing puller 09517-43001		• Removal of the front lower arm ball joint • Removal of the differential side bearing
Preload socket 09532-11600		Measurement of the drive pinion starting torque (Use with torque wrench)
Oil seal installer 09532-32000		Installation of the differential drive pinion front bearing outer race
Oil seal installer 09542-4A000		Press-fitting of the oil seal into knuckle (Use with 09500-11000)
Ball joint remover 0K670 321 019		Disconnection of the tie rod ball joint

Oil seal installer 09532-32100B		Installation of the differential drive pinion rear bearing outer race (Use with 09500-11000)
Working base 09517-43401		Supporting for the differential carrier
End yoke holder 09517-21700		Removal and installation of the differential self-locking nut
Drive pinion 0K993 270 A09		For adjusting height of drive pinion
Gauge block 0K993 270 A08		
Drive pinion model 0K993 270 A10		

Adjusting nut wrench 0K993 270 014		For adjusting screw disassembly
LSD test adapter 09530-FM000		For testing of LSD performance.

TROUBLESHOOTING

Symptom		Probable cause	Remedy
Propeller shaft	Noise at start	Worn journal bearing	Replace
		Worn sleeve yoke spline or flange yoke	Replace
		Loose propeller shaft installation	Retighten
	Noise and vibration at high speed	Unbalanced propeller shaft	Replace
		Improper snap ring selection	Adjust the clearance
		Worn journal bearing	Replace
Drive shaft, Inner shaft	Noise during wheel rotation	Housing tube bent	Replace
		Inner shaft bent	
		Inner shaft bearing worn, pounding	Replace
		Drive shaft assembly worn damaged, bent	Check or replace
	Noise due to excessive play of wheel in turning direction	Inner shaft and side gear serration play	Replace
		Drive shaft and side gear serration play	
Axle shaft, axle housing	Noise while wheels are rotating	Bent axle shaft	Replace
		Worn or scarred axle shaft bearing	Replace
	Grease leakage	Worn or damaged oil seal	Replace
		Malfunction of bearing seal	Replace
Differential	Constant noise	Improper drive gear and drive pinion gear tooth contact	Correct or replace
		Loose, worn or damaged side bearing	
		Loose, worn or damaged drive pinion bearing	
		Worn drive gear, drive pinion	
		Worn side gear thrust washer or pinion shaft	
		Deformed drive gear of differential case	
		Damaged gear	
		Foreign material	Eliminate the foreign (Replace the parts if necessary)
		Insufficient oil	Replenish
Differential	Gear noise while driving	Poor gear engagement	Correct or replace
		Improper gear adjustment	
		Improper drive pinion preload adjustment	
		Damaged gear	Replace
		Foreign material	Eliminate the foreign material and check (Replace the parts if necessary)
		Insufficient oil	Replenish
	Gear noise while	Improper drive pinion preload adjustment	Correct or replace

	coasting		
		Damaged gear	Replace
	Bearing noise while driving or coasting	Cracked or damaged drive pinion rear bearing	Replace
	Noise while turning	Loose side bearing	Replace
		Damaged side gear, pinion gear or pinion shaft	
	Heat	Improper gear backlash	Adjust
		Excessive preload	
		Insufficient oil	Replenish
	Oil leakage	Differential carrier not tightened	Retighten, apply sealant, or replace the gasket
		Seal malfunction	
		Worn or damaged oil seal	Replace
		Excessive oil	Adjust the oil level

SPECIFICATION

PROPELLER SHAFT

Items			Specification
Joint type	Front		UJ + UJ
	Rear		UJ + UJ
Length X O.D. (mm(in))	Front(4WD)	Diesel 2.5 VGT A/T	675 X 63.5 (26.57 X 2.50) (Blue)
		Diesel 2.5 VGT M/T	640.8 X 63.5 (25.23 X 2.50) (Green)
		Diesel 2.5 WGT A/T, M/T	660.4 X 63.5 (26.00 X 2.50) (Yellow)
		Gasoline 3.3/3.8 A/T	625.5 X 63.5 (24.63 X 2.50) (Silver)
	Rear(4WD)	Diesel 2.5 VGT A/T	1123 X 76.2 (44.21 X 3.00) (Blue)
		Diesel 2.5 VGT M/T	1156 X 76.2 (45.51 X 3.00) (Green)
		Diesel 2.5 WGT A/T, M/T	1137 X 76.2 (44.76 X 3.00) (Yellow)
		Gasoline 3.3/3.8 A/T	1172 X 76.2 (46.14 X 3.00) (Silver)
	Rear(2WD)	Diesel 2.5 VGT A/T	1462.8 X 76.2 (57.59 X 3.00) (Green)
		Diesel 2.5 WGT A/T	1476 X 76.2 (58.11 X 3.00) (Blue)
		Diesel 2.5 WGT M/T	1496 X 76.2 (58.90 X 3.00) (Yellow)
		Gasoline 3.3/3.8 A/T	1531.6 X 76.2 (60.30 X 3.00) (Silver)
Run-out (mm(in))			0.3 (0.01)

UJ : Universal Joint
O.D. : Outer Diameter

FRONT AXLE AND DRIVESHAFT

Items			Specification
Front axle hub bearing type			Double taper roller bearing
Driveshaft joint type (4WD)		Outer	BJ
		Inner	TSJ
Differential (4WD)	Reduction gear type		Hypoid gear
	Reduction ratio	Diesel 2.5 WGT M/T	4.181 (White)
		Diesel 2.5 VGT M/T	3.727 (Red)
		Diesel 2.5 WGT A/T Diesel 2.5 VGT A/T	3.333 (Green)
		Gasoline 3.3/3.8 A/T	3.333 (Green)

BJ : Birfield Joint, TSJ : Three Spherical Joint

REAR AXLE AND AXLE SHAFT

Items			Specification
Axle housing type			Banjo type
Axle shaft supporting type			Semi-floating type
Differential	Reduction gear type		Hypoid gear
	Reduction ratio	Diesel 2.5 WGT M/T	4.181 (White)
		Diesel 2.5 VGT M/T	3.727 (Red)
		Diesel 2.5 WGT A/T Diesel 2.5 VGT A/T	3.333 (Green)
		Gasoline 3.3/3.8 A/T	3.333 (Green)

LUBRICANTS

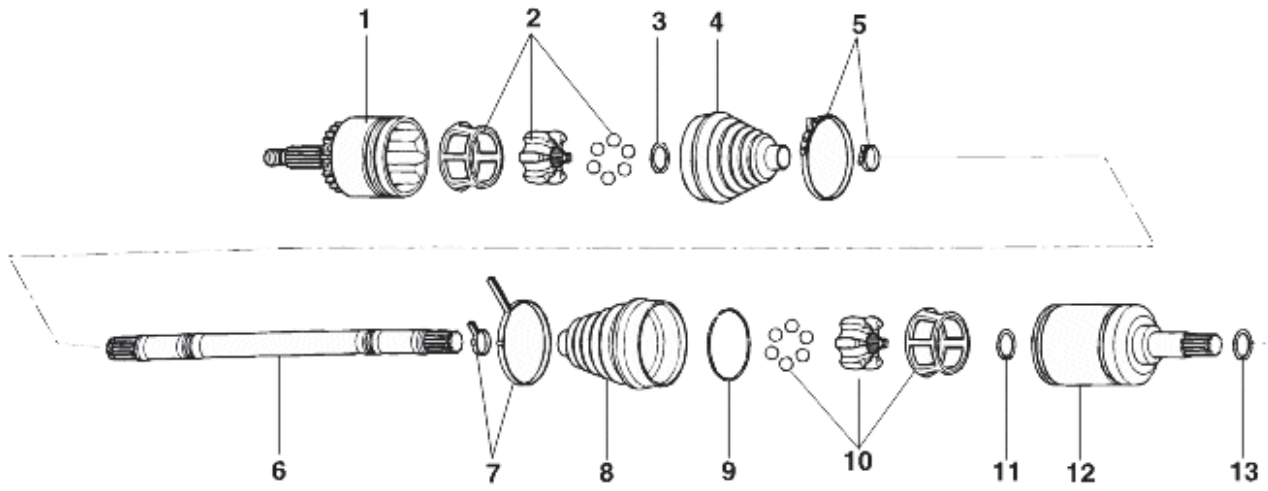
Items		Specification	Quantity
Driveshaft	BJ Boot grease	Repair kit grease	210g
	TSJ Boot grease	Repair kit grease	150g
Differential	Hypoid gear oil	SAE90, API GL-5 (MOBIL : MOBIL LUBE HD, SHELL : SHELL SPIRAX HD)	(Fill the reservoir to the plug hole) Front : 1.3L Rear : 1.6L
	LSD oil	SAE 85W-90, API GL-5 (MOBIL : INFILREX 33, SK : G-LS)	

KIA MOTORS

Driveshaft and Axle

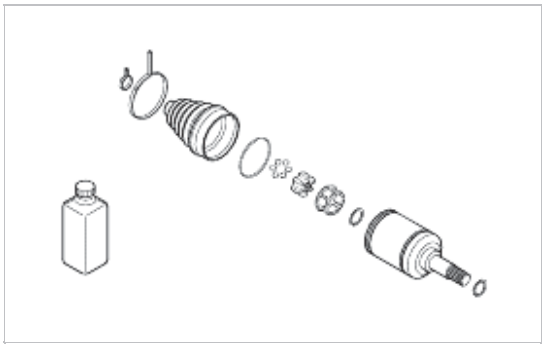
Driveshaft Assembly - Front Driveshaft

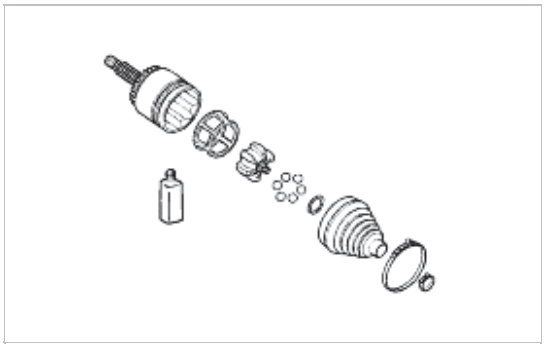
COMPONENTS (T.S.J.-B.J.)



1. B.J assembly
2. B.J inner race and ball
3. Snap ring
4. B.J boot
5. B.J boot band
6. Drive shaft
7. T.S.J boot band
8. T.S.J boot
9. Clip
10. T.S.J inner race and ball
11. Snap ring
12. T.S.J assembly
13. Clip

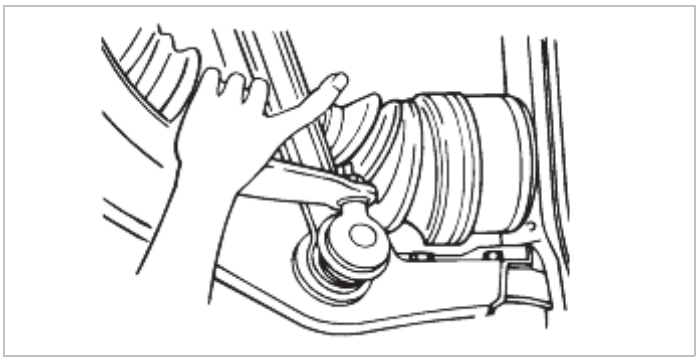
REPAIR KIT

Kit name	Illustration	Components
T.S.J boot kit		• T.S.J boot band • T.S.J boot • Snap ring • Spider assembly • Snap ring • T.S.J assembly • Clip • Grease

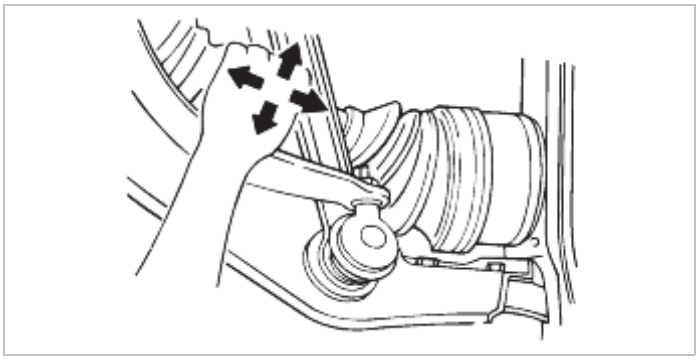
B.J boot kit		• B.J assembly • B.J inner race and ball • Snap ring • B.J boot • B.J boot band • Grease

INSPECTION

1. Inspect for torn or loose CV joint boots.

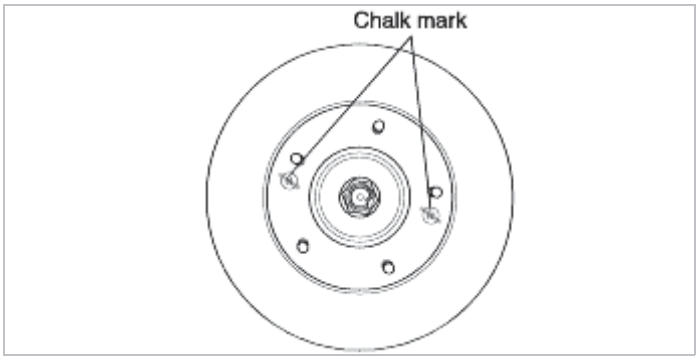


2. Test for loose drive shaft splines. By grasping the drive shaft and tugging up and down and fore and aft.
3. Also inspect for bent or broken drive shaft.

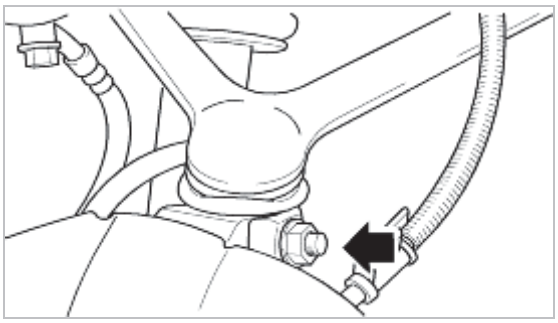


REMOVAL (HALFSHAFTS)

1. Remove the lock nut from front hub.



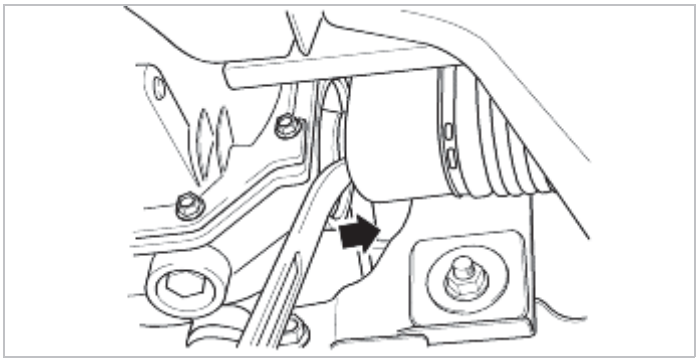
2. Remove the upper control arm link lock bolt, spring washer and nut.



3. Remove tie rod end cotter pin and using a ball joint puller, remove tie rod end from steering knuckle.

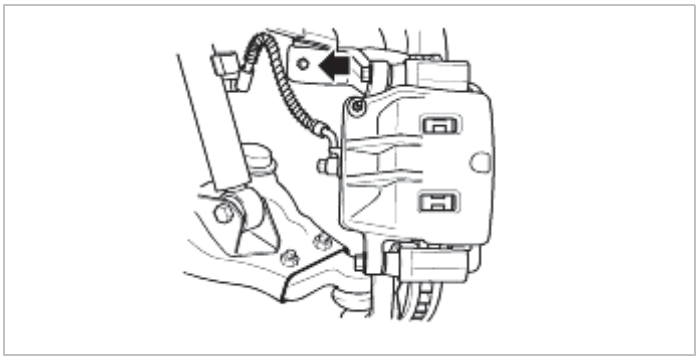
4. Mark drive shaft for identical installation position.
5. Using tool, pry the drive shaft from the differential housing.

> **NOTICE**
>
> • Do not pull on the drive shaft ; doing so will damage the boots. Be sure to use the pry bar.



6. Remove the drive shaft from the knuckle

> **NOTICE**
>
> • Temporarily install the knuckle to the upper arm.



INSTALLATION

1. Coincide the joining mark between the drive shaft and the differential and insert the shaft.

> **CAUTION**
>
> • Insert the drive shaft (RH side) carefully into the oil seal to avoid any damage.

2. Install the knuckle assembly and tighten.
   (1) Tie-rod ball joint

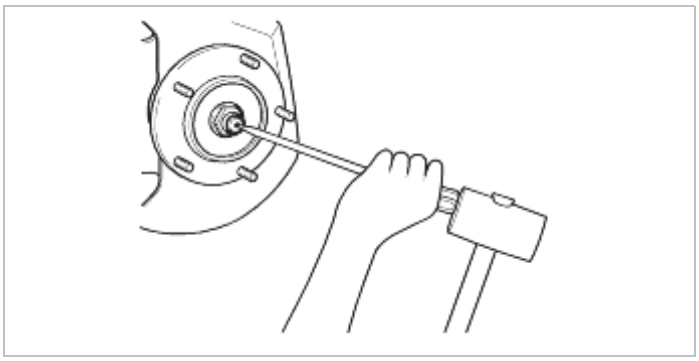
Tightening torque :
70-80 N·m (7.0-8.0 kg·m, 51-57 lb·ft)

(2) Upper arm link lock bolt

Tightening torque :
44-55 N·m (4.4-5.5 kg·m, 32-39 lb·ft)

3. Tighten the lock nut and then caulk the flange of lock nut on the end of drive shaft.

Tightening torque :
245-275 N·m (24.5-27.5 kg·m, 177-198 lb·ft)



4. Install wheel and tire.

DISASSEMBLY

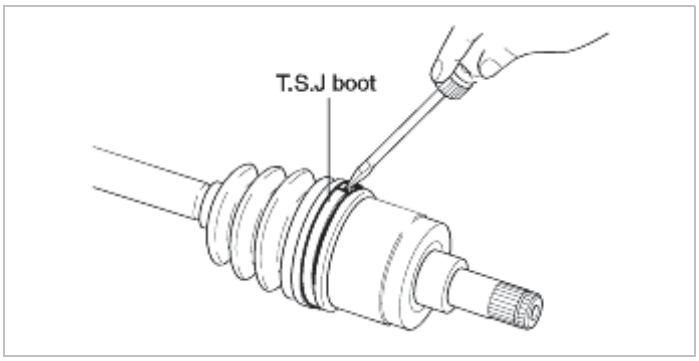
NOTICE

1. Do not disassemble the B.J assembly.
2. The Drive shaft joint uses special grease. Do not substitute with another type of grease.
3. The Boot band should be replaced with a new one.

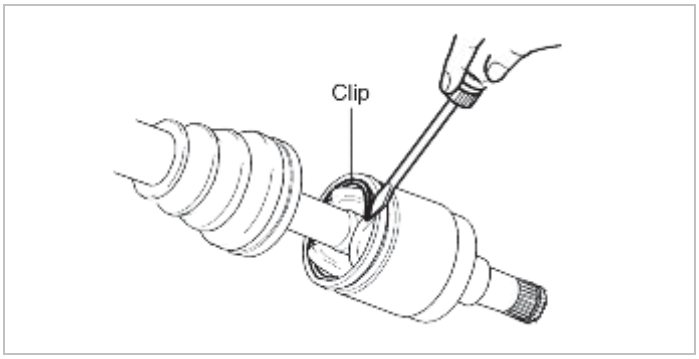
1. Remove the T.S.J boot band and pull the boot from T.S.J outer race.

NOTICE

Be careful not to damage it.

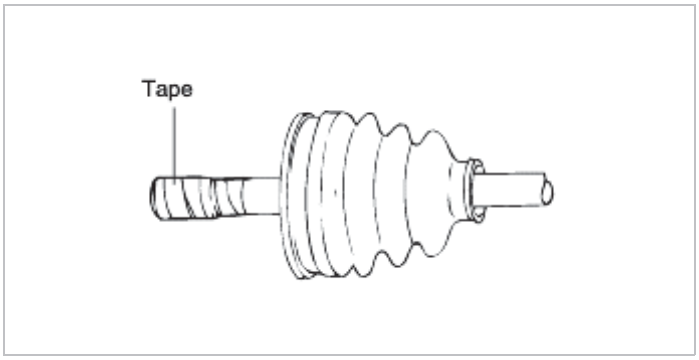


2. Remove the clip using a screwdriver.



3. Remove the drive shaft from the T.S.J outer race.
4. Remove the snap ring and disassemble the inner race and ball from the shaft.
5. Remove the B.J boot band and pull out the T.S.J boot and the B.J boot.

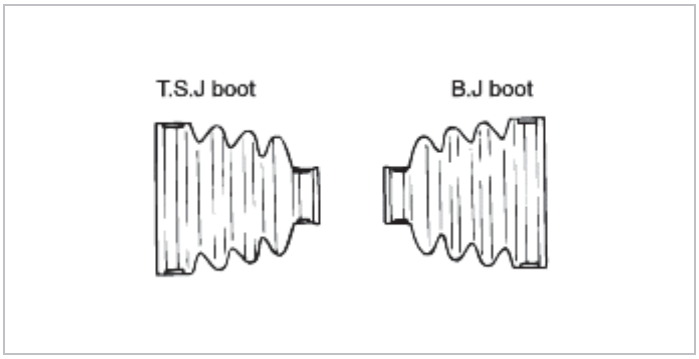
> **CAUTION**
>
> If the boot is reused, wrap a tape around the drive shaft splines to protect the boot.



REASSEMBLY

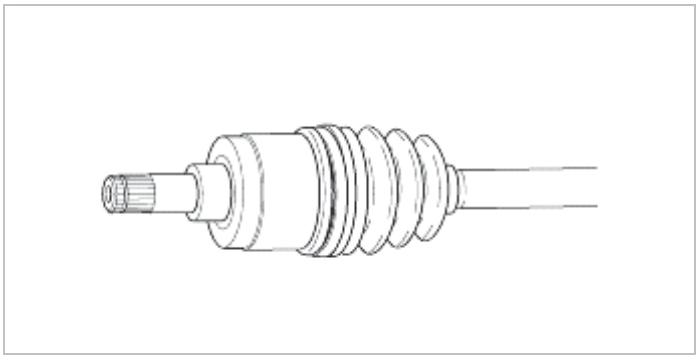
1. Wrap a tape around the drive shaft spline (T.S.J side) to avoid boot damage.
2. Apply specified grease to the drive shaft and install the boots.

Items	Quantity (gr.)
B.J	170
T.S.J	140



3. Add specified grease as much as was wiped away at the time of inspection.
4. Tighten the boot bands.

> **CAUTION**
>
> Keep the specified distance between the boot bands to control the air when they are tightened.



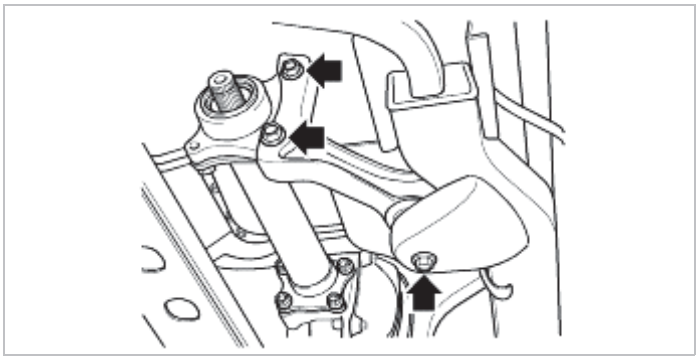
KIA MOTORS

Driveshaft and Axle

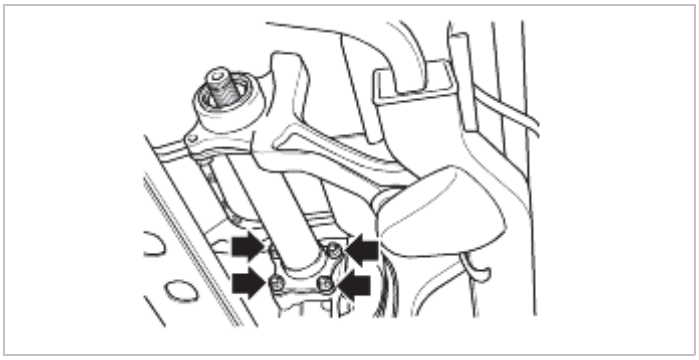
Driveshaft Assembly - Center Bearing and Inner Shaft

REMOVAL (OUTPUT SHAFT)

1. Remove diff mounting bracket.



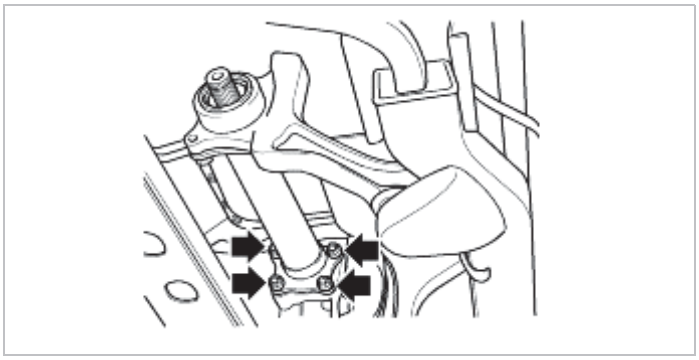
2. Remove output shaft from differential housing.



INSTALLATION

1. Install output shaft to differential case.

Tightening torque :
80-120 N·m (8-12 kg·m, 58-86 lb·ft)

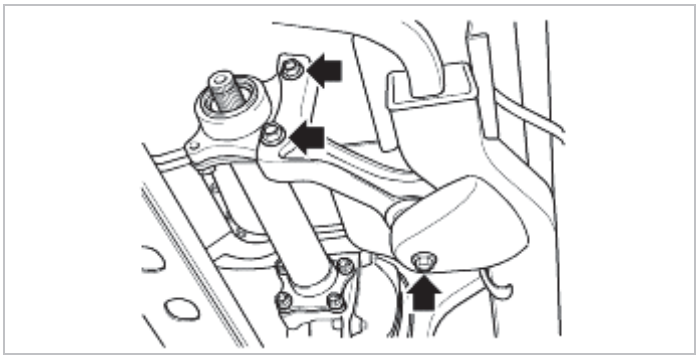


CAUTION

- Be carefully that oil seal does not damage by clip during install.

2. Install diff mounting bracket to the bearing housing.

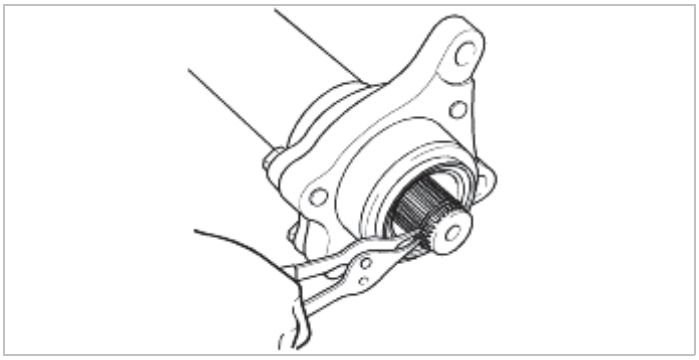
Tightening torque :
110-150 N·m (11-15 kg·m, 80-108 lb·ft)



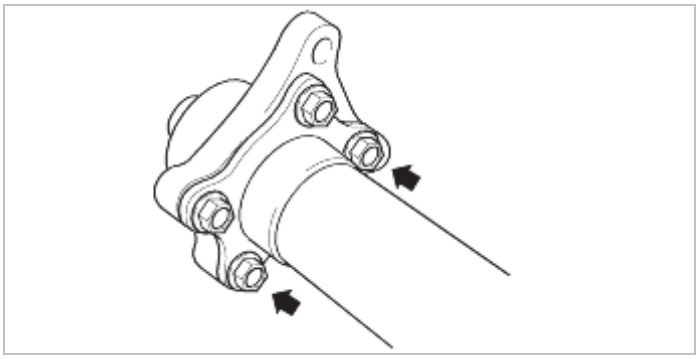
3. Tighten diff mounting bracket bolt.

DISASSEMBLY

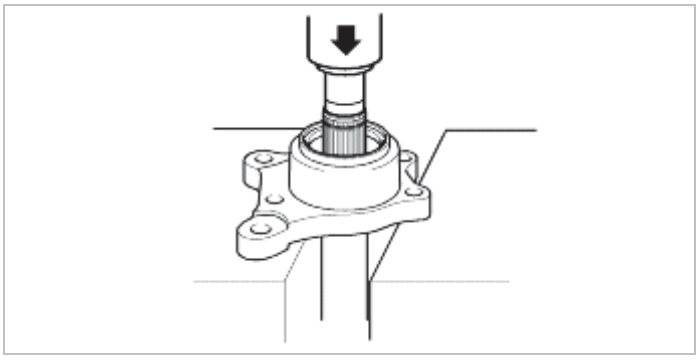
1. Remove axle clip using plier.



2. Remove output shaft housing.



3. Using a hydraulic press, remove bearing housing from the output shaft.



4. Remove dust seal and then using a hydraulic press, remove bearing.

INSPECTION

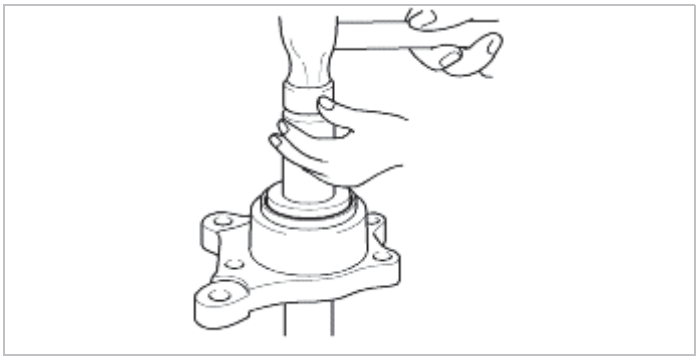
- Output shaft for damage.
- Bearing for roughness or noise.
- Dust seal for damage.
- Bearing housing for cracks.

REASSEMBLY (OUTPUT SHAFT)

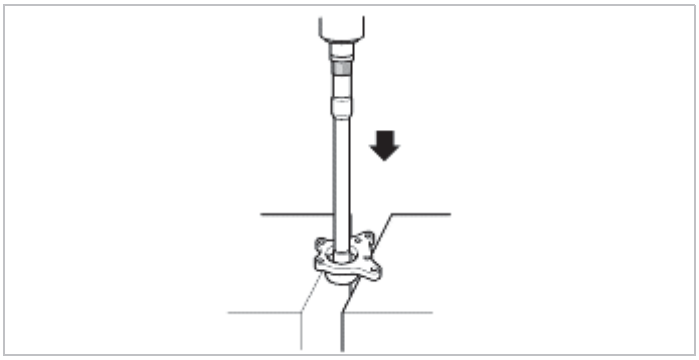
1. Install dust seal into bearing housing.

NOTICE

- Apply the grease on the lip of dust seal.

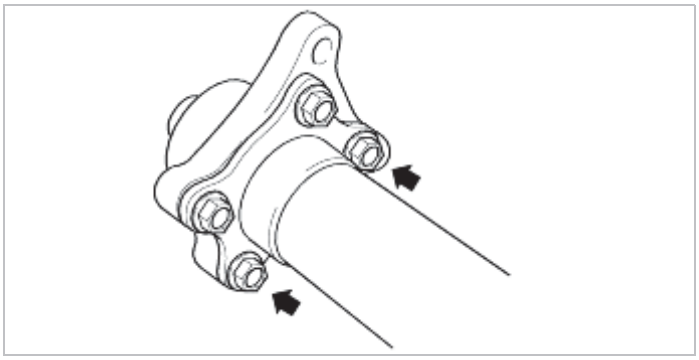


2. Using a hydraulic press, install bearing onto output shaft.
3. Using a hydraulic press, install shaft with bearing into bearing housing.

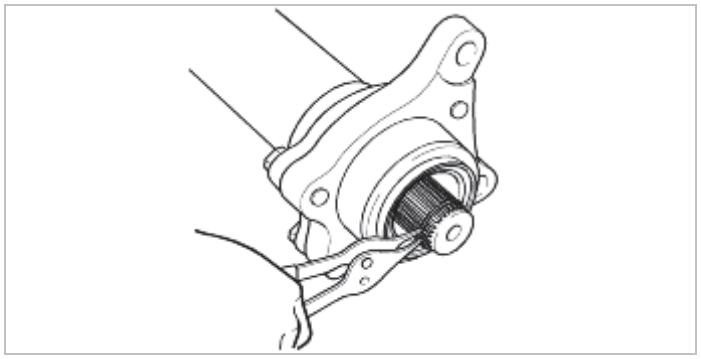


4. Install the output shaft housing to the bearing housing.

Tightening torque :
71-95 N·m (7.1-9.5 kg·m, 51-68 lb·ft)



5. Using a plier, install new clip onto output shaft.



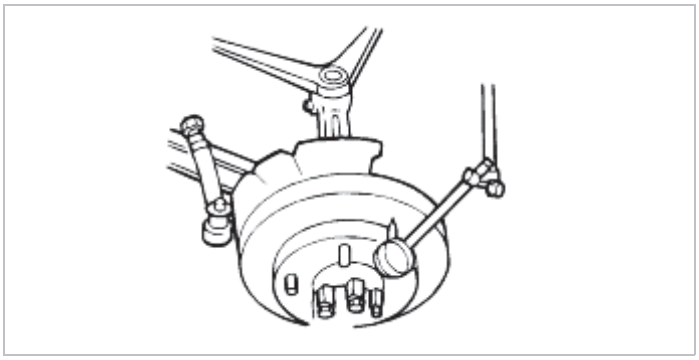
KIA MOTORS

Driveshaft and Axle

Front Axle Assembly

INSPECTION

1. Remove two bolts and remove brake caliper from brake rotor. Temporarily tie caliper to vehicle frame with wire.
2. Mount dial indicator with plunger zeroed against brake rotor at 4.7 inch (12 cm) from rotor center.



3. Turn rotor and read dial indicator for run out dimension.

Run out not to exceed 0.0012 in (0.03 mm)

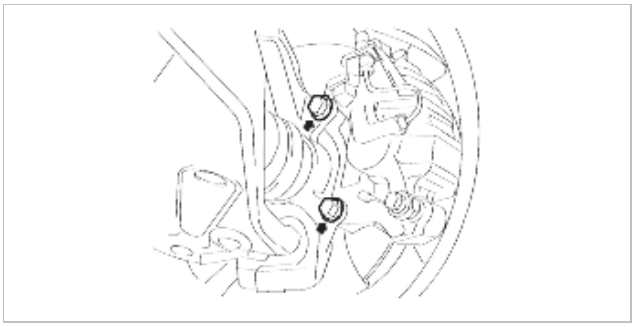
KIA MOTORS

Driveshaft and Axle

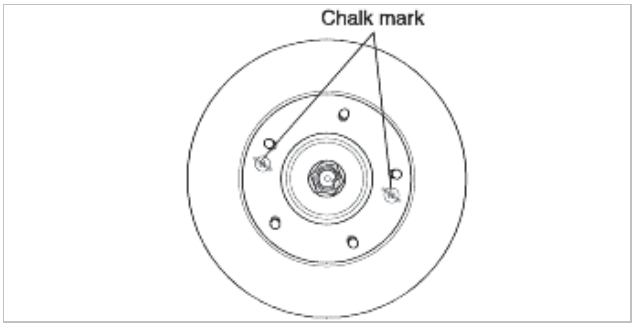
Front Axle Assembly - Front Hub/Axle

REMOVAL

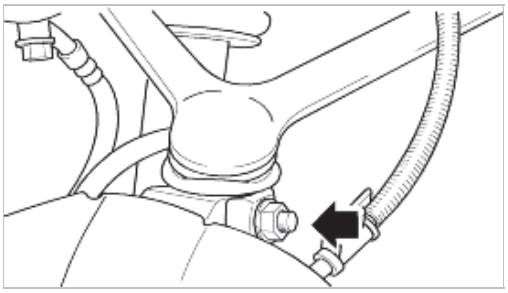
1. Remove the vehicle speed sensor.
2. Remove two bolts and remove brake caliper from brake rotor. Temporarily tie caliper to vehicle frame with wire.



3. Remove two screws and remove brake rotor.
4. Using a lock nut wrench (or equivalent), remove lock nut and plain washer (2WD).

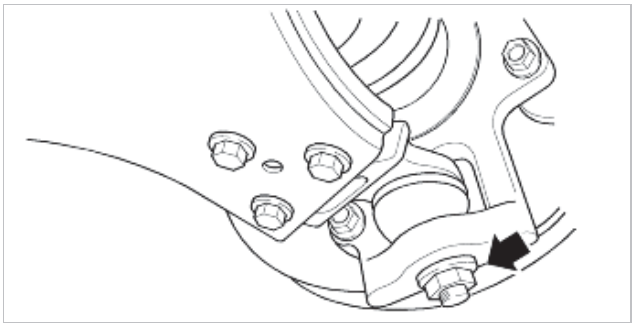


5. Remove the upper arm link lock bolt, spring washer and nut.



6. Remove tie rod end cotter pin and using a ball joint remover, remove tie rod end from steering knuckle.

7. Remove lower arm cotter pin using a ball joint remover, and remove lower arm from steering knuckle.

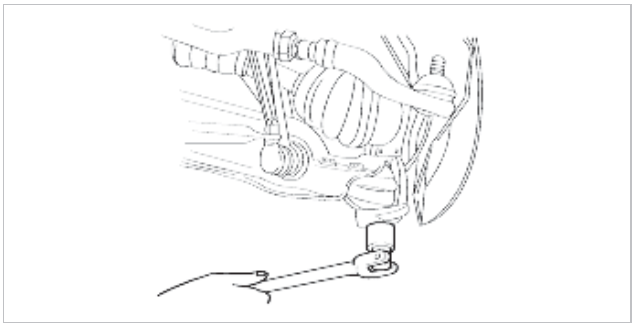


8. Remove steering knuckle from vehicle.

INSTALLATION

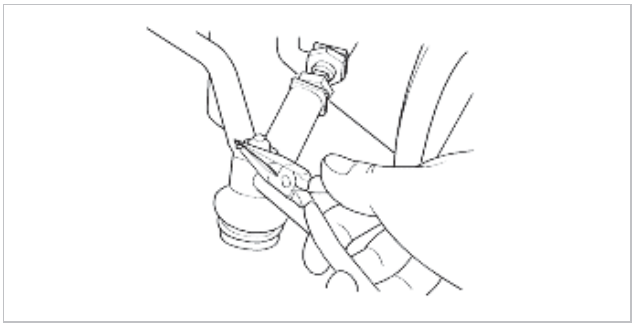
1. Put steering knuckle on the drive shaft end with upper and lower ball joints in mounting holes.
2. Attach lower arm, tighten lock nut, and install cotter pin.

Tightening torque :
160-180 N·m (16.0-18.0 kg·m, 116-130 lb·ft)



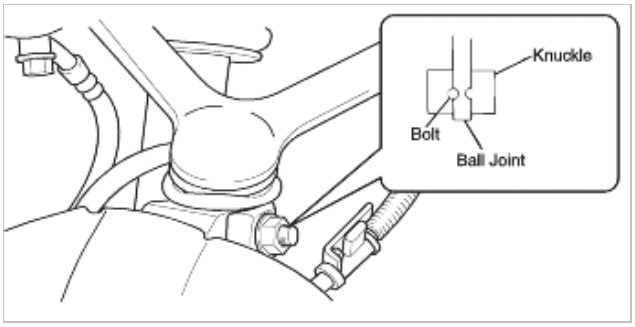
3. Attach tie rod end to knuckle, tighten nut, and install cotter pin.

Tightening torque :
70-80 N·m (7.0-8.0 kg·m, 51-57 lb·ft)

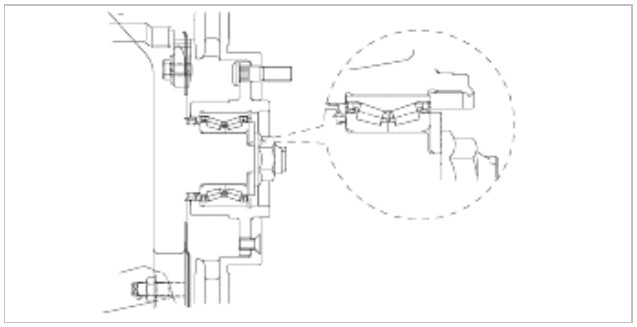


4. Insert upper arm link lock bolt with spring washer and tighten nut.

Tightening torque :
44-55 N·m (4.4-5.5 kg·m, 32-39 lb·ft)

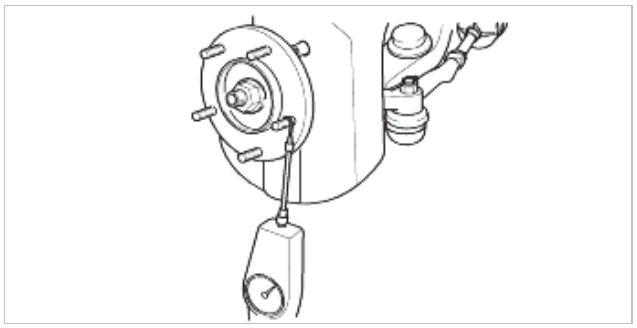


5. Install the chamfer of plain washer toward the bearing (2WD)

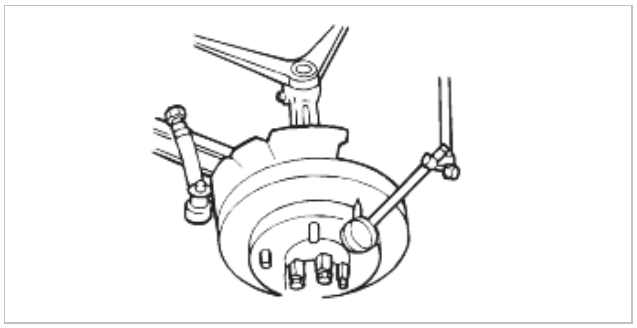


6. Screw lock nut up against wheel hub assembly and using a lock nut wrench, tighten nut to tightening torque to set bearing preload. Use spring scale to measure.

Bearing preload :
10 ib·in (Max 60 kg·cm)
Tightening torque :
245-275 N·m (24.5-27.5 kg·m, 178-198 lb·ft)



7. Caulk the flange of lock nut on the end of drive shaft.
8. Put brake rotor on wheel bearing hub bolts and install the two retaining screws.
9. Mount dial indicator with plunger zeroed against brake rotor at 4.7 in (12 cm) from rotor center.

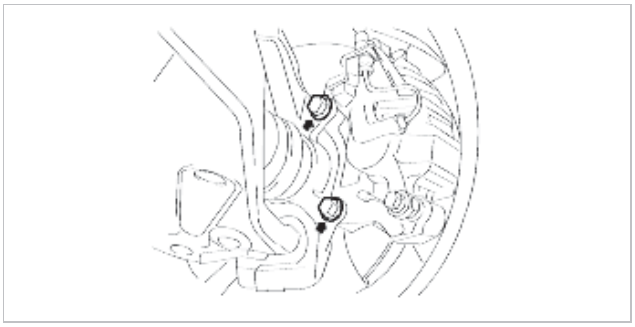


10. Turn rotor and read dial indicator for run out dimension.

Run out not to exceed 0.0012 inch (0.03 mm)

11. Install brake caliper and tighten two bolts.

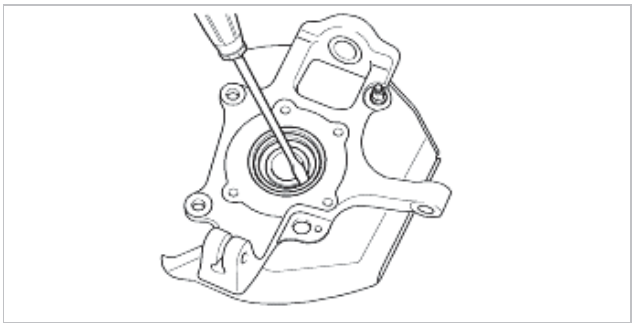
Tightening torque :
80-104 N·m (8.0-10.4 kg·m, 57-75 lb·ft)



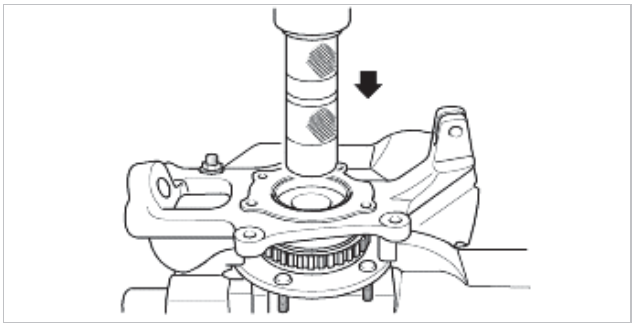
12. Install wheel and tire.

DISASSEMBLY

1. Using a screwdriver, pry out oil seal from knuckle (4WD).



2. Press the wheel hub from the knuckle (4WD).
   Press the knuckle and then remove wheel hub (2WD).



INSPECTION

1. Inspect bearing for wear or damage.
2. Inspect steering knuckle for wear or damage.

REASSEMBLY

1. Install the dust cover to the knuckle.

Tightening torque :
16-23 N·m (1.6-2.3 kg·m, 12-16 lb·ft)

2. Install new oil seal and then install the wheel hub to the knuckle by pressing.
3. Apply grease to the wheel bearing and seal lip.

KIA MOTORS

Driveshaft and Axle

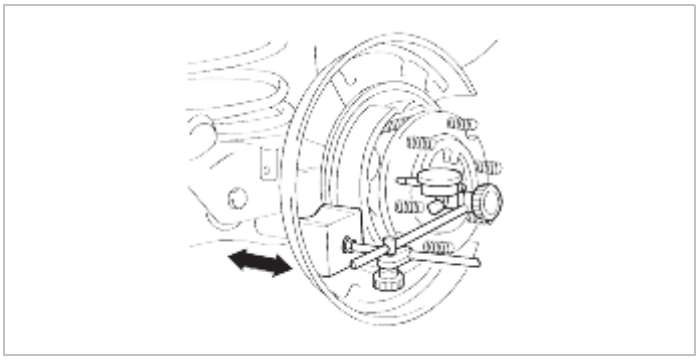
Rear Axle Assembly

SERVICE INSPECTION PROCEDURE

AXLE SHAFT END PLAY CHECK

1. Measure the axle shaft end play using a dial indicator.

Standard value : 0-0.05mm (0-0.002 in.)

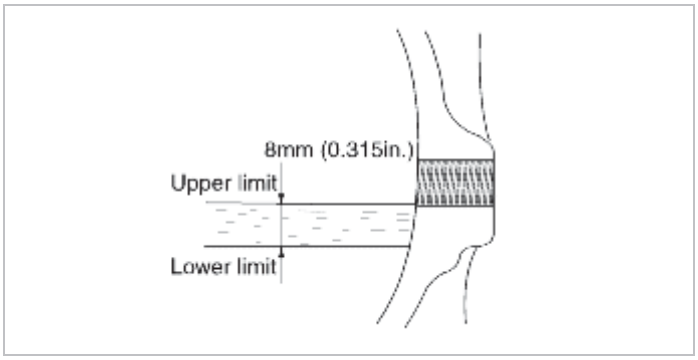


2. If the axle shaft end play exceeds the standard value, replace the bearing with a new one.

GEAR OIL LEVEL CHECK

1. Remove the filler plug and check the quantity of oil in the differential carrier.
2. It is enough if oil is applied until the filler plug.

Specified gear oil :
Hipoid gear oil
Conventional differential
SAE90, API GL-5
With Limited Slip Differential
SAE85W90, API GL-5
SPECIFIED GEAR OIL QUANTITY : 1.6 Liter



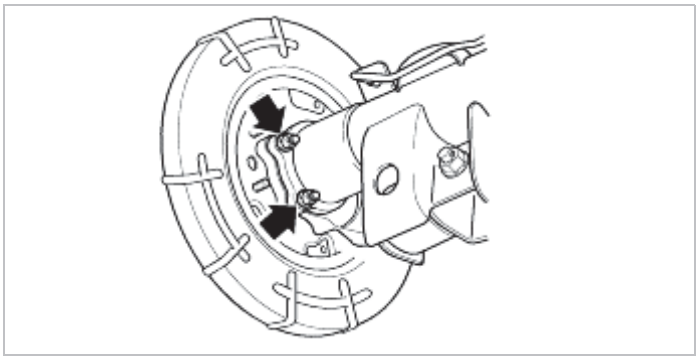
KIA MOTORS

Driveshaft and Axle

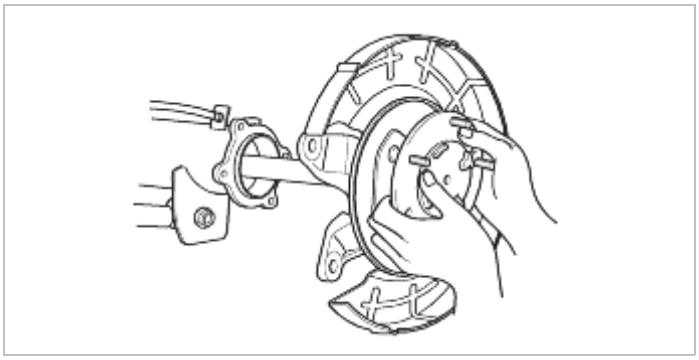
Rear Axle Assembly - Rear Axle Shaft Assembly

REMOVAL

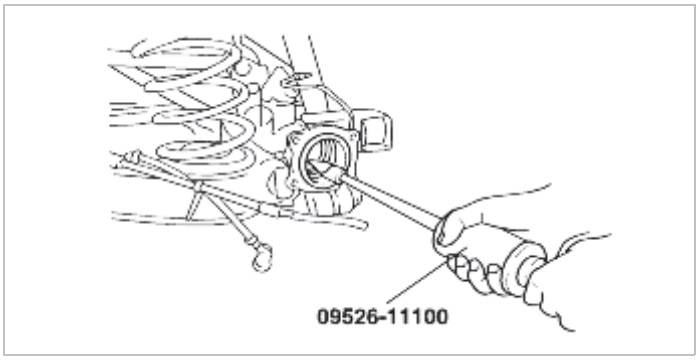
1. Remove the disk brake and parking brake assembly (Refer to "BR Group").
2. Remove the parking brake cable and speed sensor cable.
3. Remove the rear axle shaft mounting bolt.



4. Remove the rear axle shaft.

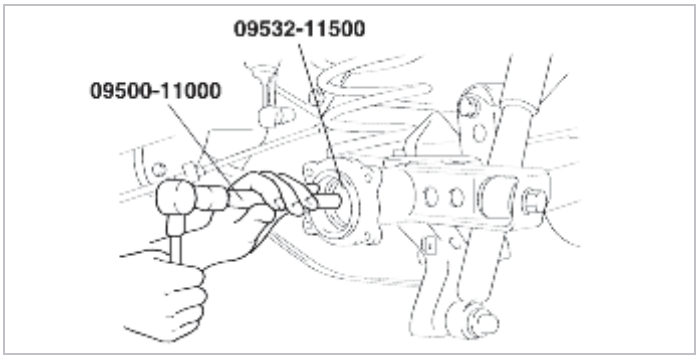


5. Using the special tool (09526-11100), remove the oil seal.



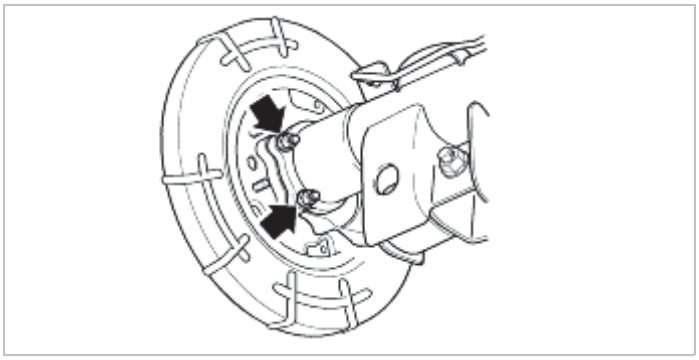
INSTALLATION

1. Installation is the reverse of removal.
2. Apply grease to the oil seal lip.
3. Using the special tools (09500-11000, 09532-11500), install the oil seal.



4. After installing the axle shaft, tighten the nut.

Tightening torque :
43-60 N·m (4.4-6.2 kg·m, 32-44 lb·ft)



5. Adjust the parking brake lever stroke.

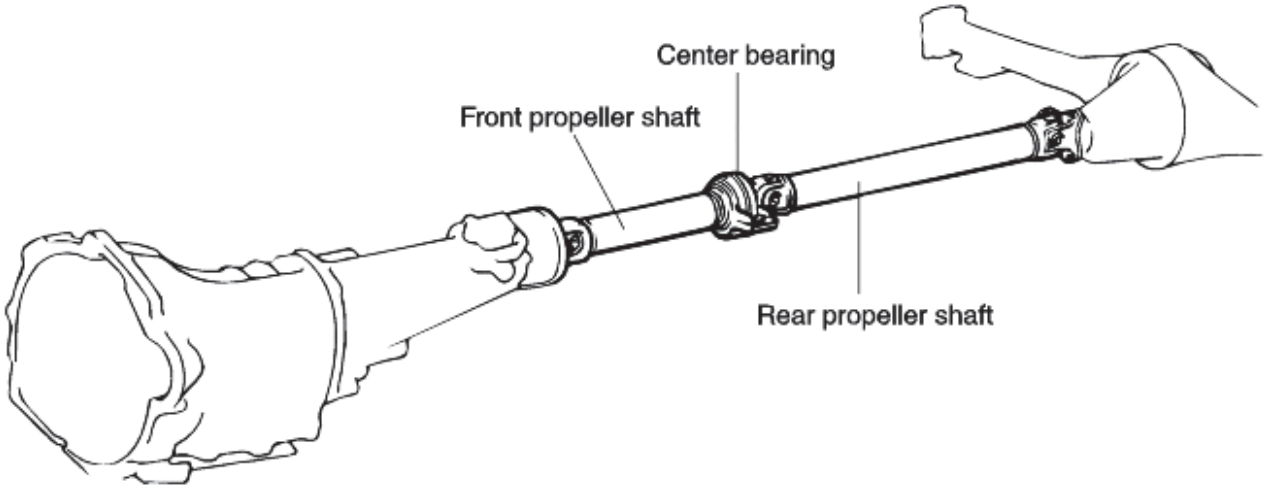
KIA MOTORS

Driveshaft and Axle

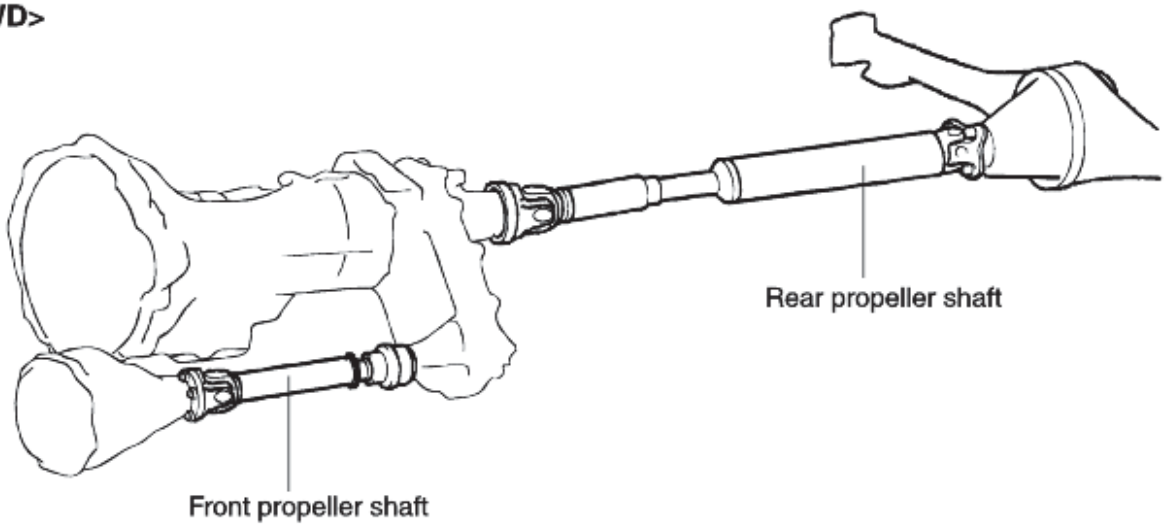
Propeller Shaft Assembly

COMPONENTS

<2WD>

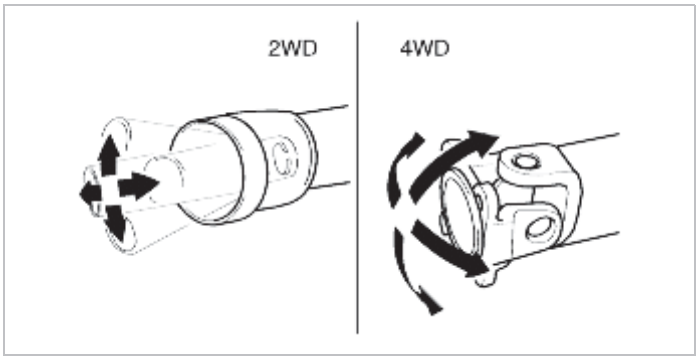


<4WD>



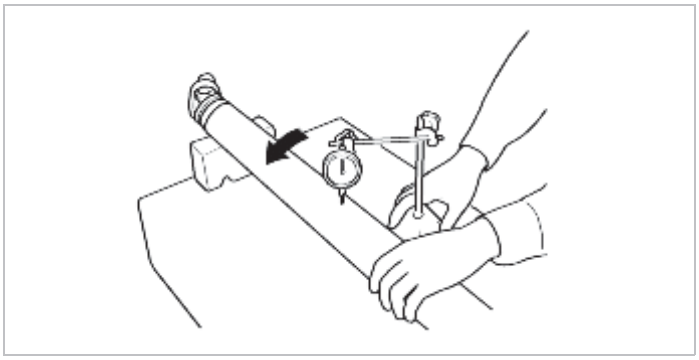
INSPECTION

1. Check the sleeve yoke, center yoke and flange yoke for wear, damage or cracks.
2. Check the propeller shaft yokes for wear, damage or cracks.
3. Check the propeller shaft for bends, twisting or damage.
4. Check the universal joints for smooth operation in all directions.



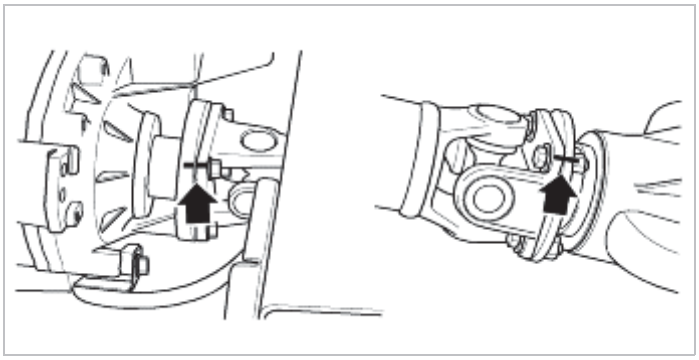
5. Check the center bearing for smooth movement (2WD).
6. Check the center bearing mounting rubber for damage or deterioration (4WD).
7. Measure the propeller shaft run out with a dial indicator.

Limit	Front	0.3 mm (0.012 in.) or less
	Rear	0.3 mm (0.012 in.) or less



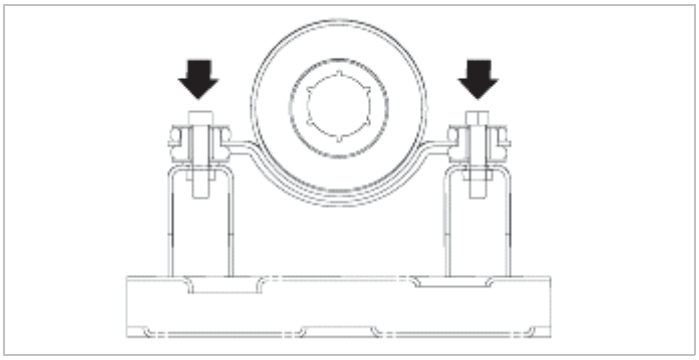
REMOVAL

1. Raise and support vehicle.
2. Place index marks (reference marks) on the propeller shaft and their matching transfer case and differential input shafts.



3. Remove four bolts holding universal flange to transfer case (4WD).

Remove bolts holding center bearing bracket (2WD).



4. Remove four bolts holding universal flange to differential.
5. Remove propeller shaft.

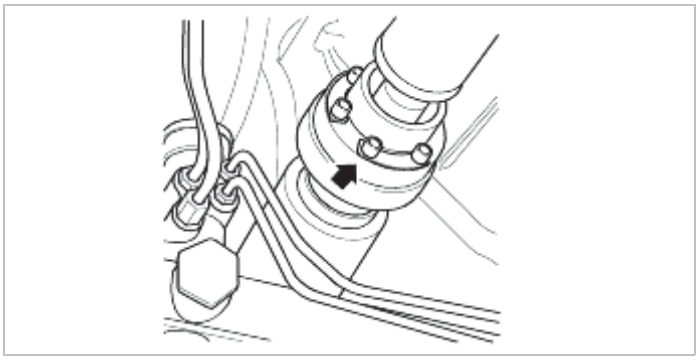
NOTICE

- When removing the propeller shaft, be careful not to damage the dust cover or spline.

INSTALLATION

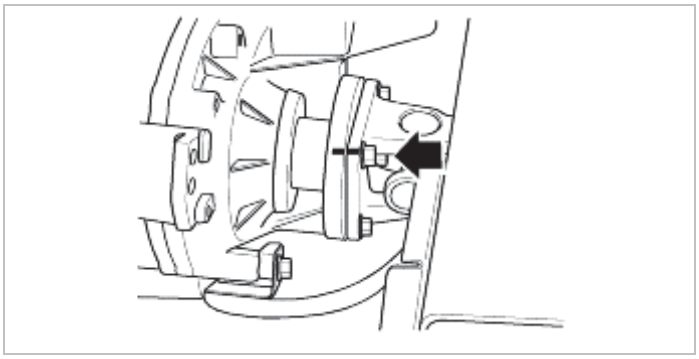
1. Connect propeller shaft flange to companion flange on front differential (4WD).
   A. Align index marks on the flange and connect the flanges with four bolts and nuts.
   B. Tighten the bolts and nuts.

Tightening torque :
26-30 N·m (2.6-3.0 kg·m, 19-21 lb·ft)
- Full time 4WD
50-60 N·m (5.0-6.0 kg·m, 36-43 lb·ft)
- Part time 4WD



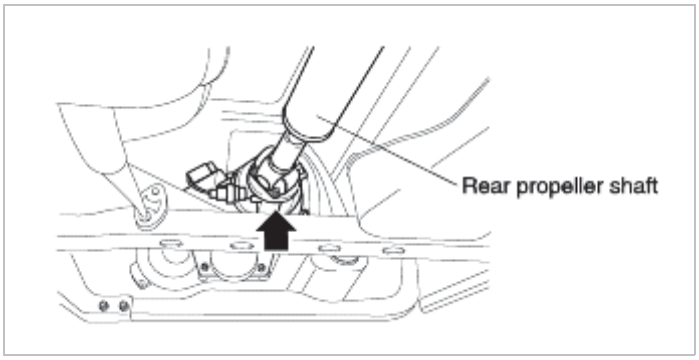
2. Connect front propeller shaft flange to companion flange on transfer (4WD).
   A. Align index marks on the flange and connect the flanges with four bolts and nuts.
   B. Tighten the bolts.

Tightening torque :
50-60 N·m (5.0-6.0 kg·m, 36-43 lb·ft)



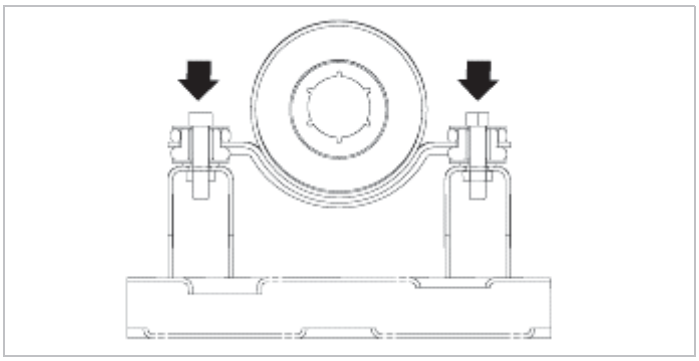
3. Connect rear propeller shaft flange to companion flange on transfer. (4WD)
   A. Align index marks on the flange and connect the flanges with four bolts and nuts.
   B. Tighten the bolts.

Tightening torque :
50-60 N·m (5.0-6.0 kg·m, 36-43 lb·ft)



4. Connect the propeller shaft spline to transmission (2WD)
   A. Align index mark on the spline and then install the propeller shaft.
   B. Tighten the bolts holding the center bearing bracket.

Tightening torque :
37-54 N·m (3.7-5.4 kg·m, 27-39 lb·ft)

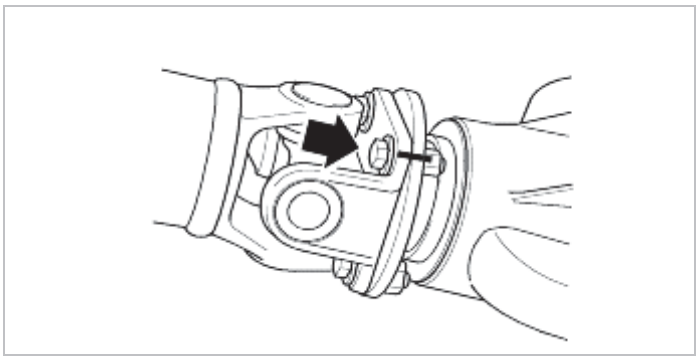


CAUTION

- Be careful not to damage the dust cover of propeller shaft when installing the propeller shaft (2WD)

5. Connect propeller shaft flange to companion flange on rear differential.
   A. Align index marks on the flange and connect the flange with four bolts and nuts.
   B. Tighten the bolts and nuts.

Tightening torque :
50-60 N·m (5.0-6.0 kg·m, 36-43 lb·ft)



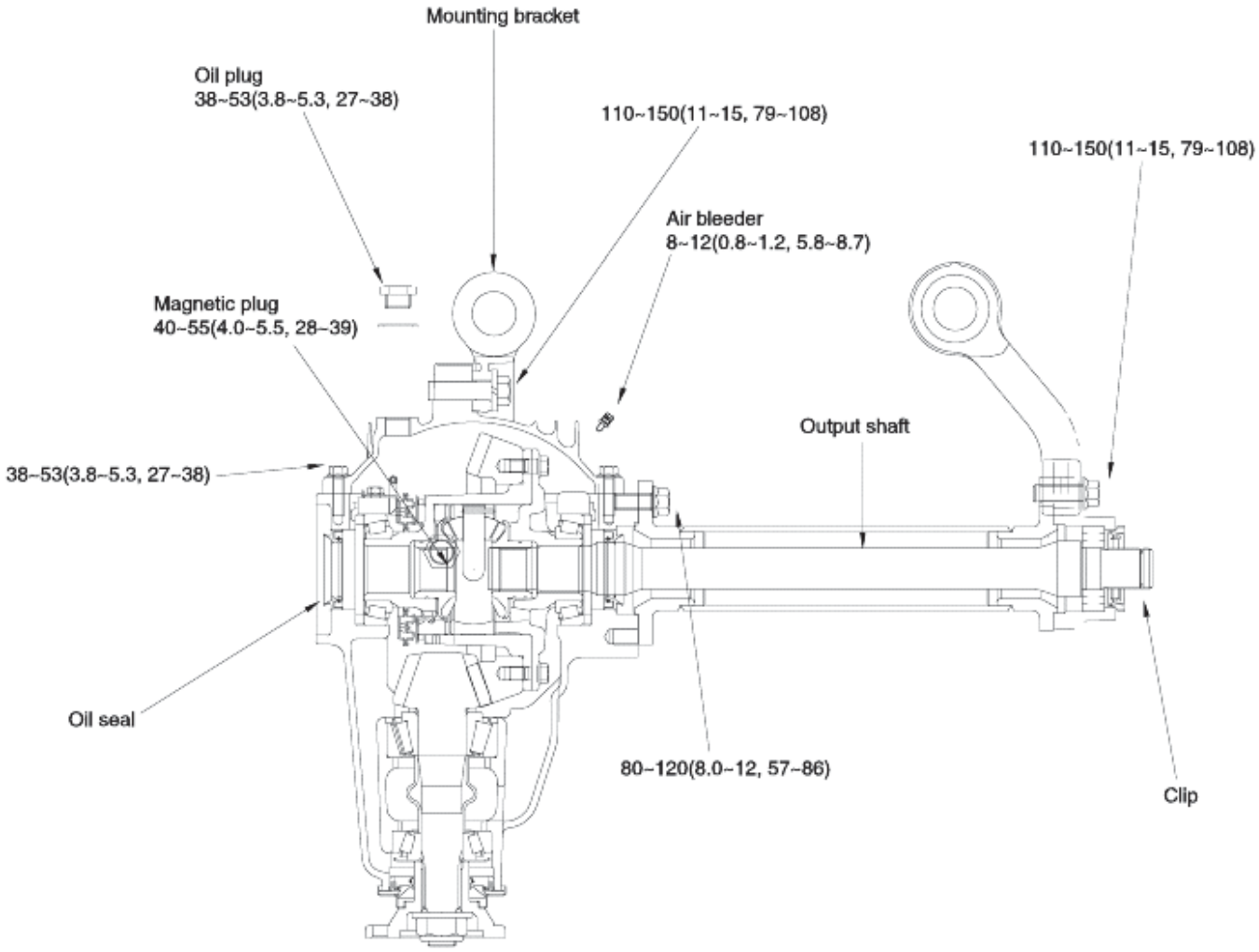
6. After installing the propeller shaft fill the grease into the nipple until it comes out from the sleeve yoke plug hole.

KIA MOTORS

Driveshaft and Axle

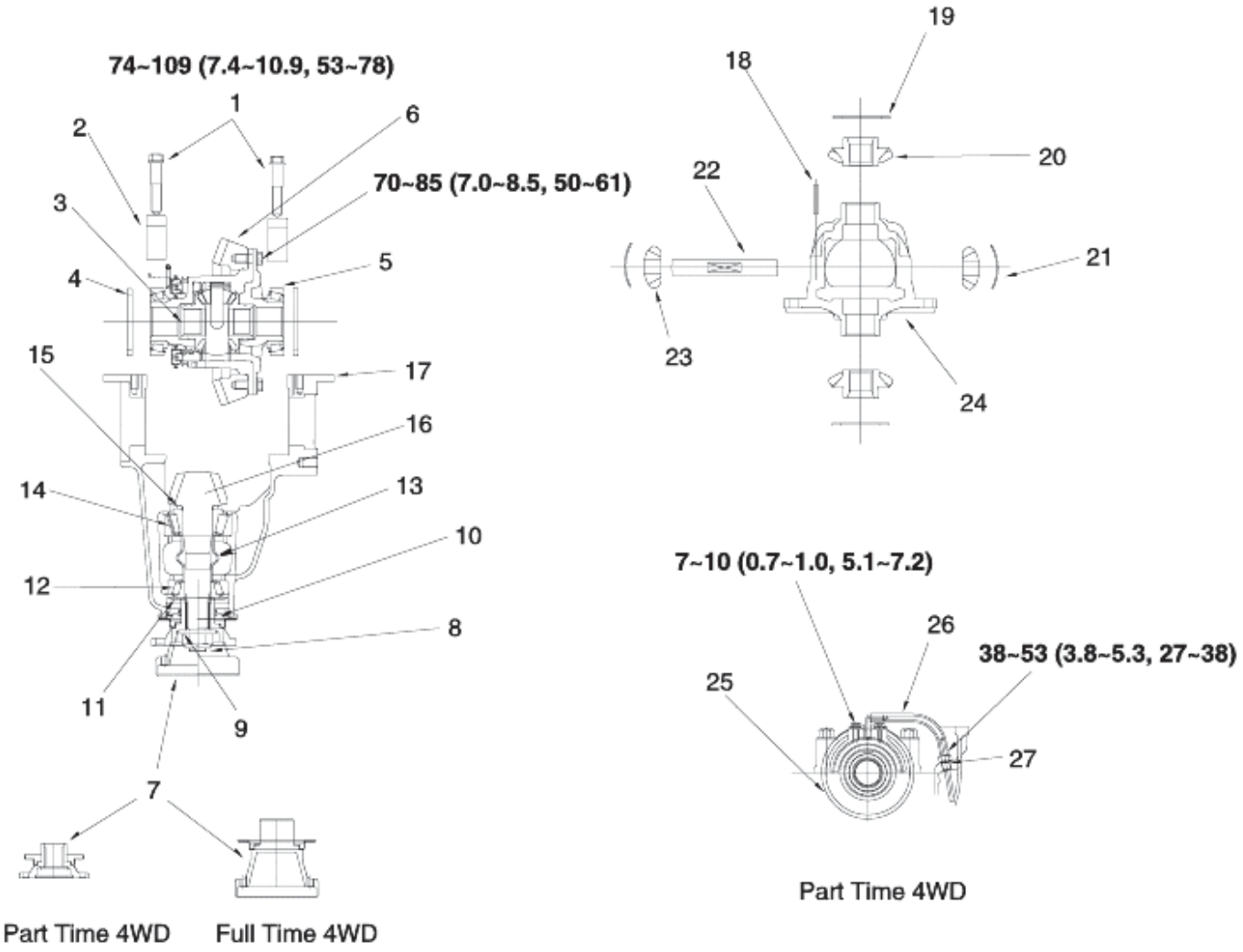
Differential Carrier Assembly - Front (4WD)

Components



TORQUE : N·m (kg·m, lb·ft)

Front differential components

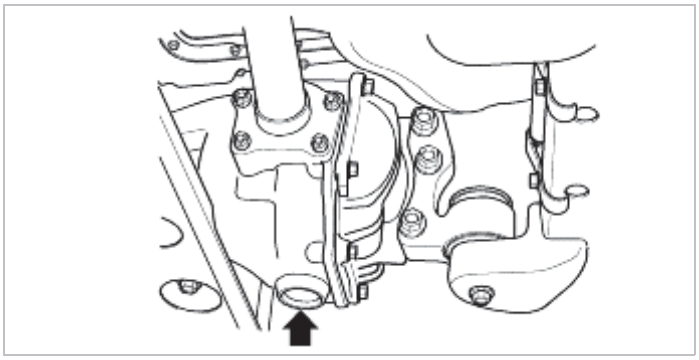


TORQUE : N·m (kg·m, lb·ft)

1. Bearing cap bolt.
2. Bearing cap
3. Differential assembly
4. Spacer
5. Side bearing
6. Ring gear
7. Companion flange
8. Lock nut
9. Lock washer
10. Oil seal
11. Oil slinger
12. Outer bearing
13. Distance piece
14. Inner bearing
15. Spacer
16. Drive pinion
17. Carrier asembly
18. Pin
19. Thrust washer
20. Side gear
21. Washer
22. Pinion shaft
23. Pinion gear
24. Case
25. Actuator
26. Hose
27. Packing

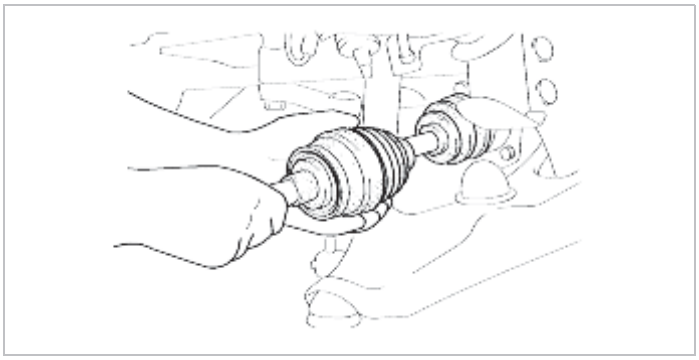
Removal

1. Drain oil.



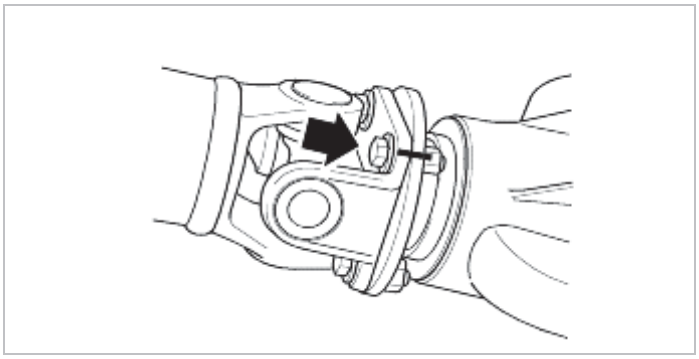
2. Remove the drive shaft and the output shaft.

> **CAUTION**
>
> When removing the drive shaft, be careful not to damage the differential carrier oil seal by interference of spline part.



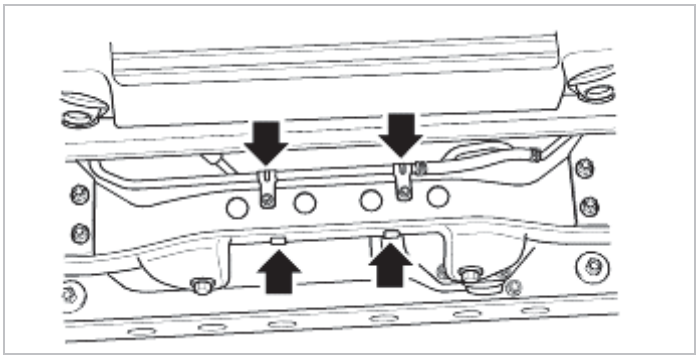
3. Remove the front propeller shaft.

> **NOTICE**
>
> Make match mark on the flange yoke and differential companion flange to avoid any mistake when installing them again.

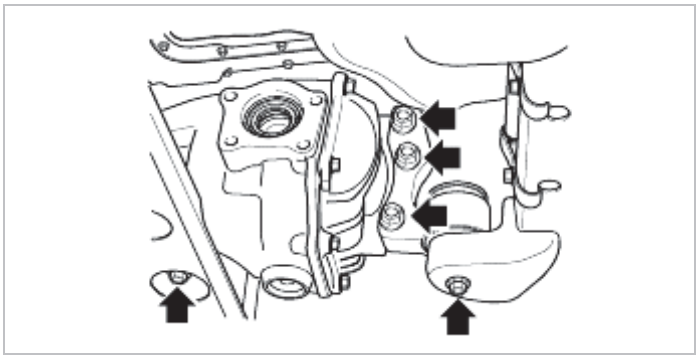


4. Remove the power steering tube mounting bracket.

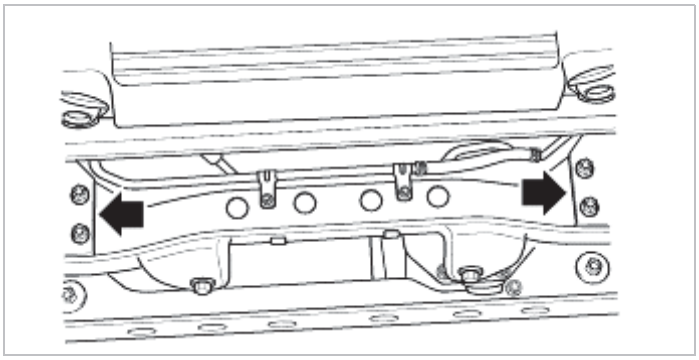
Tightening torque :
18-23 N·m (1.8-2.3 kg·m, 13-16 lb·ft)



5. Remove the differential mounting bracket.



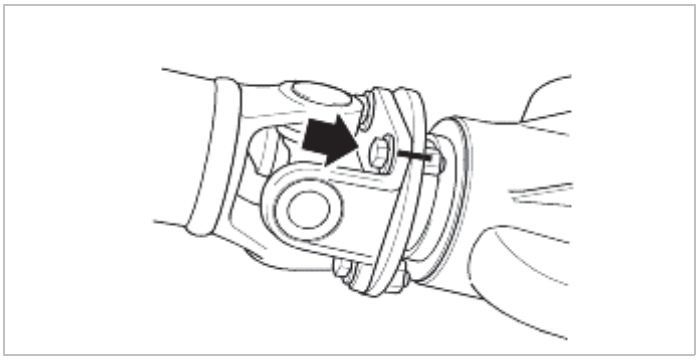
6. Remove the front member.



7. Remove the differential mounting bolt.
8. Remove the differential carrier.

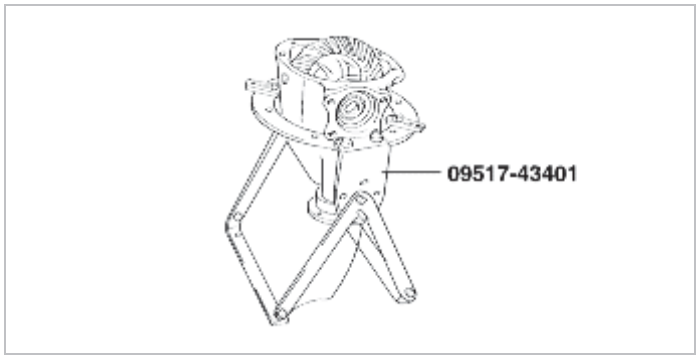
Installation

1. Installation is the reverse of removal.
2. Align the matchmark on the flange yoke and the companion flange.
   Tighten the propeller shaft and the front differential carrier.



INSPECTION BEFORE DISASSEMBLY

Mount the differential carrier on the special tool(09517-43401).

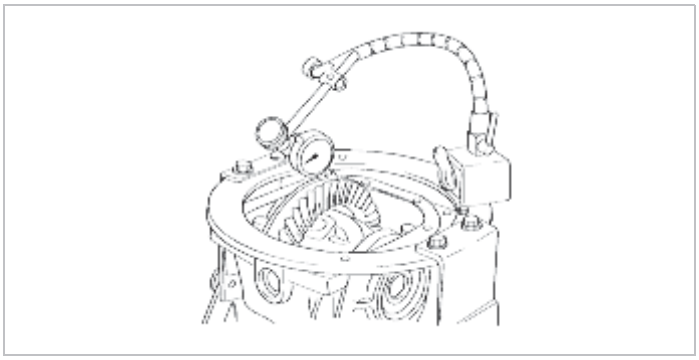


FINAL DRIVE GEAR BACKLASH

1. Fix the drive gear so it cannot move and measure the final drive gearbacklash with a dial indicator.

> NOTICE
>
> Measure at four points or more on the circumference of the drive gear.

Standard value : 0.09-0.11mm (0.0035-0.0043 in.)



DRIVE GEAR RUNOUT

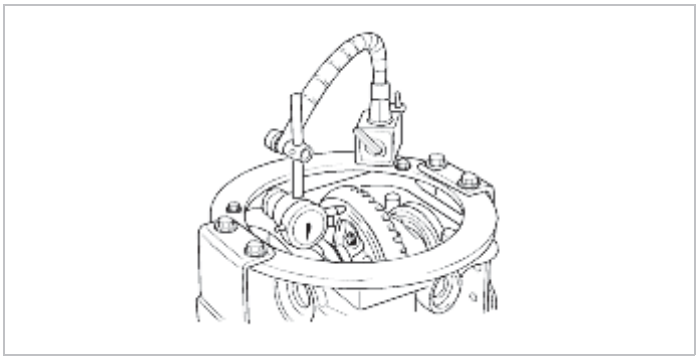
Check the back-face lash as follows:

1. Place a dial gauge on the back-face of the drive gear and measure the runout.

Limit : 0.05 mm (0.0020 in.)

2. If the runout is beyond the limit, check that there are no foreign substances between the drive gear and differential case and, that the bolts fixing the drive gear are not loose.
3. If nothing is wrong in check (2), adjust the drive gear depth and remeasure.

> NOTICE
>
> If these adjustments are impossible, replace the case or install a new drive gear/drive pinion as a set.

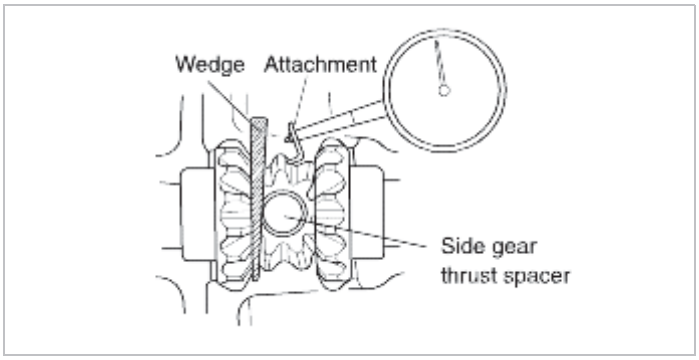


DIFFERENTIAL GEAR BACKLASH

1. Fix the side gear with a wedge so it cannot move and measure the differential gear backlash with a dial indicator on the pinion gear.

> **NOTICE**
>
> Take the measurements at two places (4 places for LSD) on the pinion gear.

Standard value : 0-0.1 mm (0-0.0039 in.)



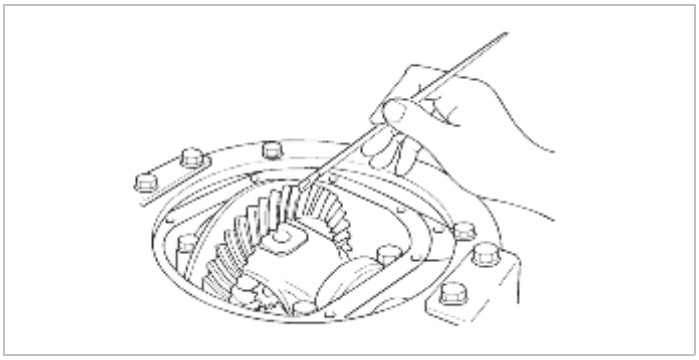
2. If the backlash exceeds the limit, adjust using side bearing spacers.

> **NOTICE**
>
> If adjustment is impossible, replace the side gear and pinion gears as a set.

FINAL DRIVE GEAR TOOTH CONTACT

Check the final drive gear tooth contact by following the steps below :

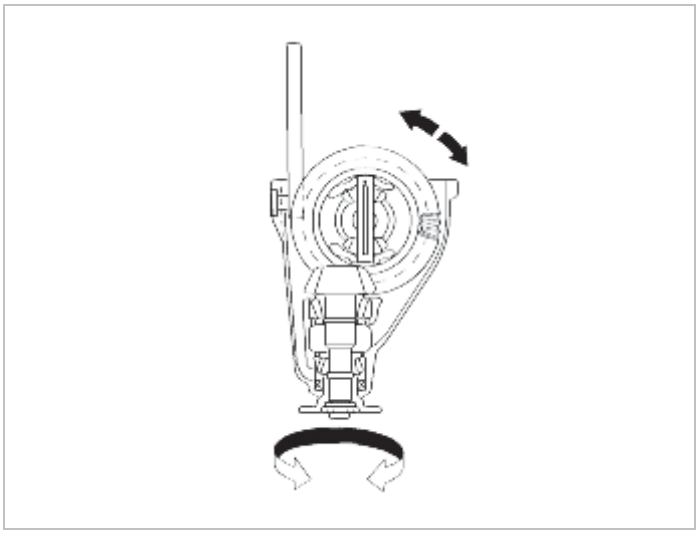
1. Apply the same amount of machine blue slightly to both surfaces of the drive gear teeth.

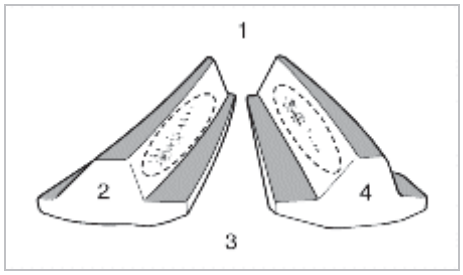
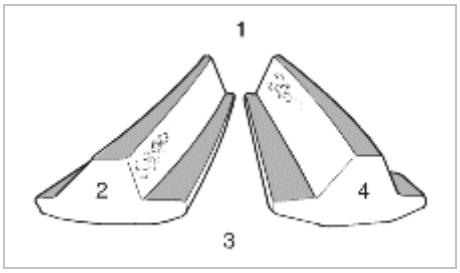
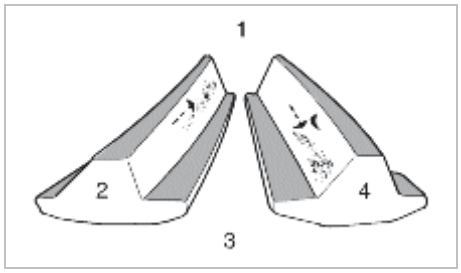
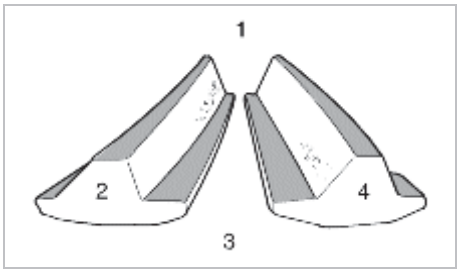
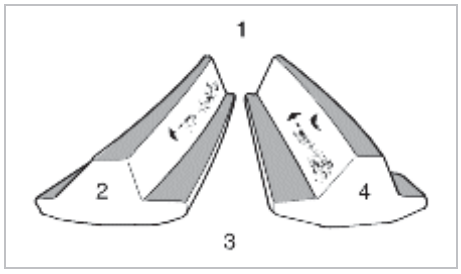


2. Insert a brass rod between the differential carrier and the differential case, and then rotate the companion flange by hand (once in the normal direction, and then once in the reverse direction) while applying a load to the drive gear so that some torque (approximately 25-30 kg-cm) is applied to the drive pinion.

> **CAUTION**
>
> If the drive gear is rotated too much, the tooth contact pattern will become unclear and difficult to check.

3. Check the tooth contact pattern.



Standard tooth contact pattern 1. Narrow tooth side 2. >Drive-side tooth surface (the side receiving power during acceleration) 3. Wide tooth side 4. Coast-side tooth surface (the side receiving power during coast-down)	
Problem	Solution
Tooth contact pattern resulting from excessive pinion height  The drive pinion is positioned too far from the center of the drive gear.	 Increase the thickness of the pinion height adjusting shim, and position the drive pinion closer to the center of the drive gear. Also, for backlash adjustment, reposition the drive gear further from the drive pinion.
Tooth contact pattern resulting from insufficient pinion height  The drive pinion is positioned too close to the center of the drive gear.	 Decrease the thickness of the pinion height adjusting shim, and position the drive pinion further from the center of the drive gear. Also, for backlash adjustment, reposition the drive gear closer to the drive pinion.

A. Tooth contact pattern is a method for judging the result of the adjustment of drive pinion height and final drive gear backlash. The adjustment of drive pinion height and final drive gear backlash should be repeated until the tooth contact patterns are similar to the standard tooth contact pattern.

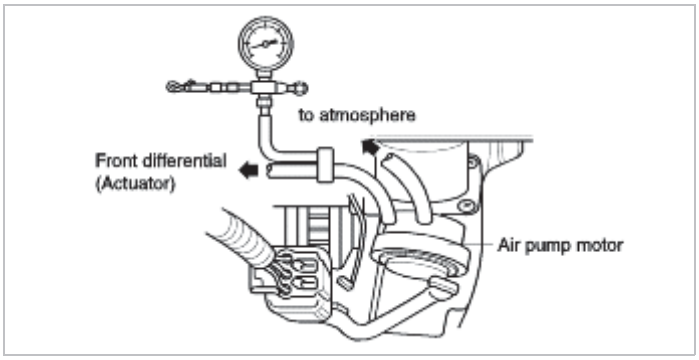
B. When you cannot obtain a correct pattern, the drive gear and drive pinion have exceeded their limits. Both gears should be replaced as a set.

4WD CONTROL SYSTEM (PART TIME 4WD)

FUNCTION CHECK

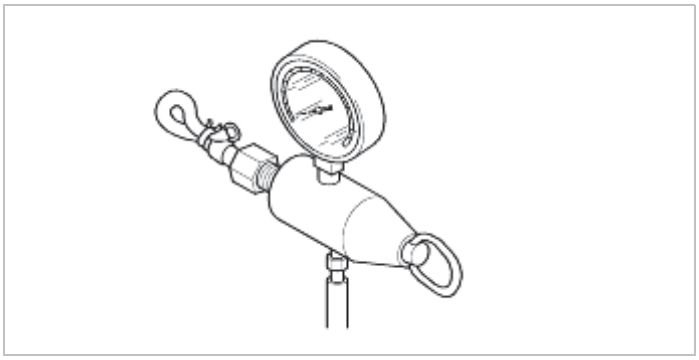
1. Air pressure gauge is attached in between air hoses that connect differential (actuator) with air pump motor assy. Air pressure gauge adjustment screw shall be fastened until it stops ultimately. And make a blind stopper at air check sidebyusing fuel hose etc.

> **CAUTION**
>
> • Air pressure gauge shall be installed by using 3-way union etc.
> • Take heed not to snap or bend the piping hose.



2. Turn the ignition switch on and shift the transfer lever 2H→4H.
3. Check that the motor starts to revolve in 1 second and stops when Air pressure gauge value displayed with in the specified value.

Specified pressure :
37-57 kPa (5.4-8.2 lb/in², 0.38-0.58 kgf/cm²)



4. Check that if transfer lever is shifted to 2H then promptly Air pressure gauge value drops down.
5. Confirm that motor returns when Air pressure adjustment screw has been loosened to lower the gauge pressure value after motor had started to revolve by shifting transfer lever to 4H. And also check that the motor stops after several secondssince it started to run.

ACTUATOR CHECK

1. Detach air hose from air pump motor assy. and then attach Air pressure gauge at air hose.
2. Attach compressor air hose to Air pressure gauge and then set to specified pressure by fastening adjustment screw. Whence check that actuator is operated to affect the axle lock.

Specified pressure :

37 kPa (5.4 lb/in², 0.38 kgf/cm²).

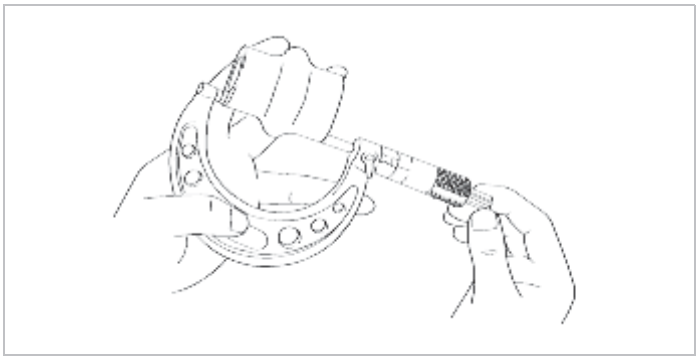
WARNING

Take heed that there is potential for diaphragm breakage if pressure beyond 200 kPa (28 lb/in², 2.0 kgf/cm²) is applied.
Do not use the air gun.

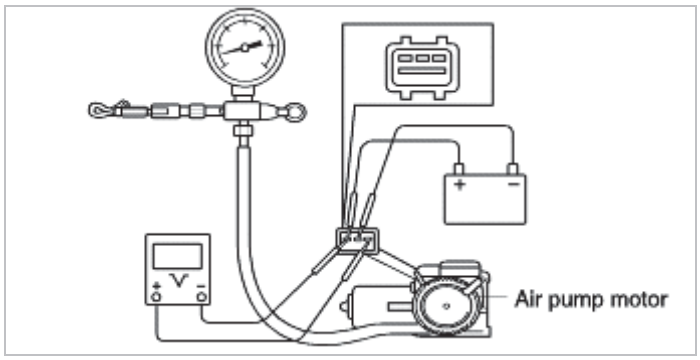
INSPECTION

1. Check the companion flange for wear or damage.
2. Check the bearings for wear or discoloration.
3. Check the gear carrier for cracks.
4. Check the drive pinion and drive gear for wear or cracks.
5. Check the side gears, pinion gears and pinion shaft for wear or damage.
6. Check the side gear spline for wear or damage.
7. Check the length of the distance piece.

Standard length :
54.80-58.09 mm(2.16-2.21 in.)



8. Check the air pump motor
   (1) Attach air pressure gauge, voltmeter and battery to air pump motor as in figure. Air pressure gauge adjustment screw shall be fastened until it stops ultimately. And make a blind stopper at air check side by using fuel hose etc.



   (2) Confirm that motor runs when battery has been connected. And check that motor stops when returned to specified pressure.

Specified pressure :
37-57 kPa (5.4-8.2 lb/in², 0.38-0.58kgf/cm²)

CAUTION

Check also air leak.

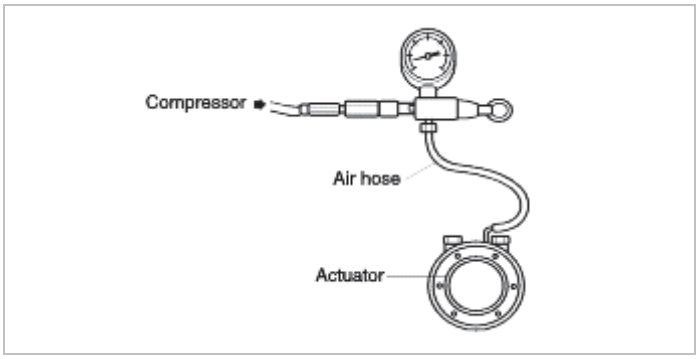
(3) Read voltmeter indication value so as to check if it is within specified range.

Voltage :
about 0 V (when motor runs)
10-14 V (when motor stopped)

9. Check the actuator.
(1) Attach air pressure gauge to actuator as in figure.

CAUTION

Loosen adjustment screw before attaching air hose to air pressure gauge.

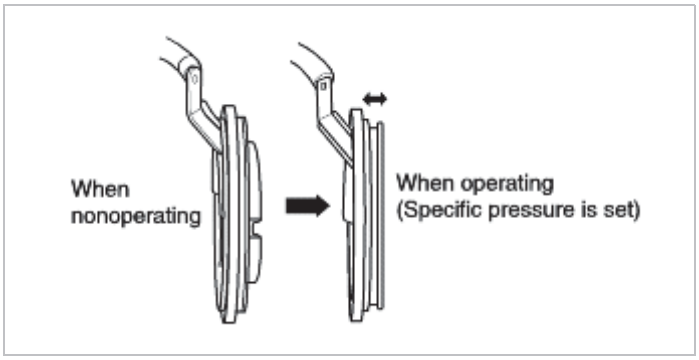


(2) Check that actuator is operated when air pressure gauge adjustment screw has been tightened to set at specified pressure. Also check air leak from actuator.

Adjusted pressure :
37 kPa (5.4 lb/in², 0.38 kgf/cm²)

CAUTION

Take heed that there is potential for diaphragm breakage if pressure beyond 200 kPa (28 lb/in², 2.0 kgf/cm²) is applied.
Do not use the air gun.



DISASSEMBLY

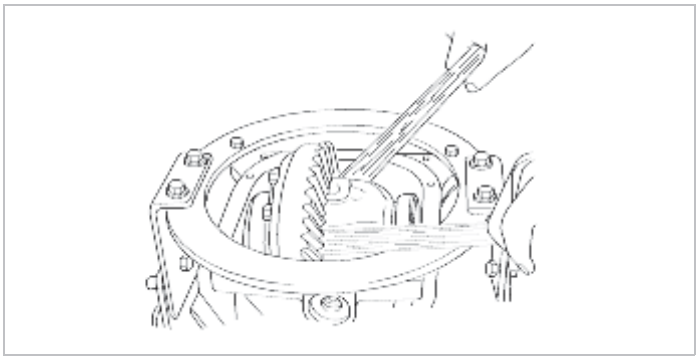
1. REMOVAL OF THE DIFFERENTIAL CASE ASSEMBLY

CAUTION

Remove the differential case assembly slowly and carefully. Be careful so that the side bearing outer race is not dropped.

NOTICE

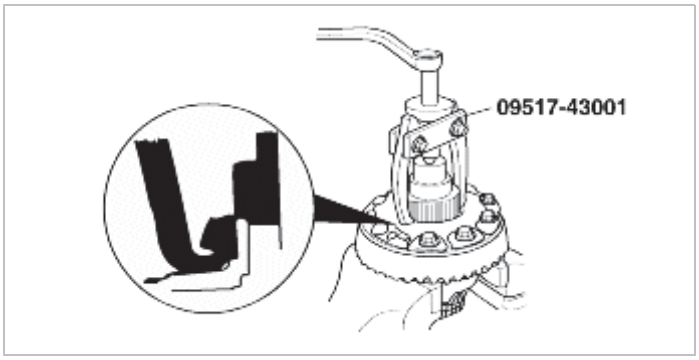
Keep the right and left side bearings separate so that they are not mixed during reassembly.



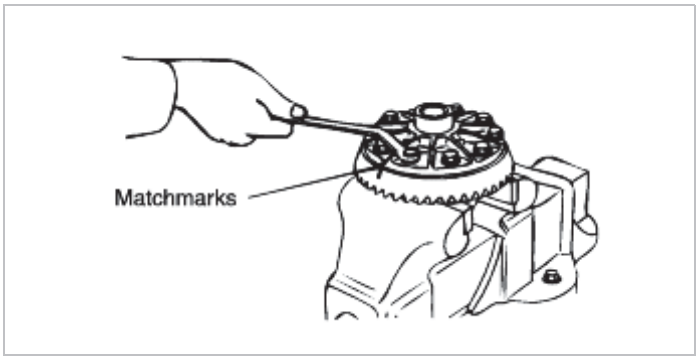
2. REMOVAL OF THE SIDE BEARING INNER RACES
   Fit the nut on top of the differential case, and then use the special tool(09517-43001) to remove the side bearing inner race.

NOTICE

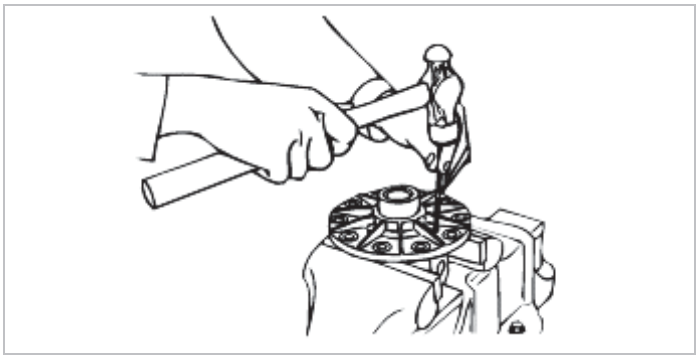
Attach the prongs of the special tool to the inner race of the side bearing through the notched section in the differential case.



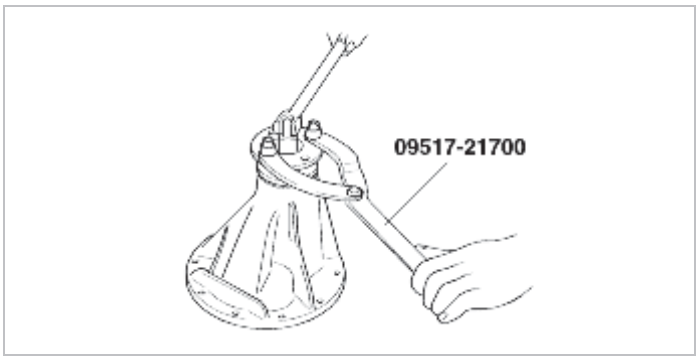
3. REMOVAL OF DRIVE GEAR
   A. Make the matchmarks to the differential case and the drive gear.
   B. Loosen the drive gear attaching bolts in diagonal sequence to remove the drive gear.



4. REMOVAL OF LOCK PIN (FOR CONVENTIONAL DIFFERENTIAL)



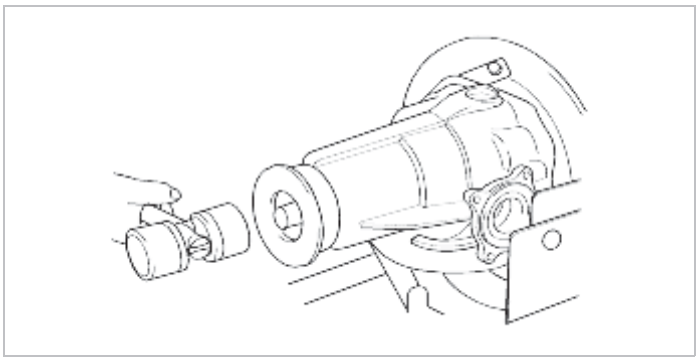
5. REMOVAL OF SELF-LOCKING NUT



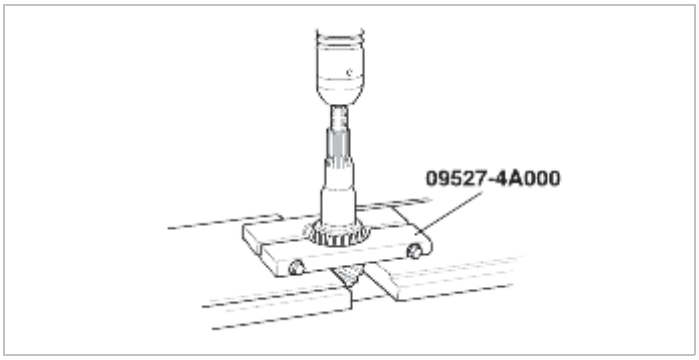
6. REMOVAL OF DRIVE PINION
   A. Make the matchmarks to the drive pinion and companion flange.

> **CAUTION**
>
> Matchmarks should not be made to the contact surfaces of the companion flange and the propeller shaft.

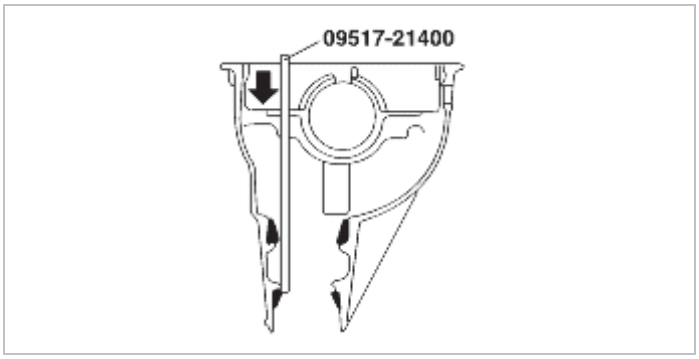
   B. Drive out the drive pinion together with the drive pinion spacer and drive pinion front shims.



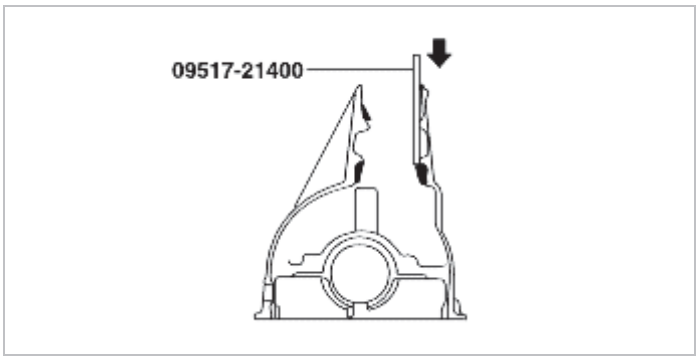
7. REMOVAL OF DRIVE PINION INNER BEARING INNER RACE



8. REMOVAL OF OIL SEAL / DRIVE PINION OUTER BEARING INNER RACE / DRIVE PINION OUTER BEARING OUTER RACE

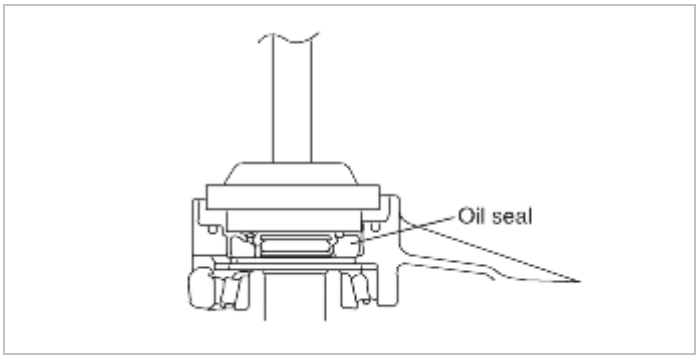


9. REMOVAL OF DRIVE PINION INNER BEARING OUTER RACE



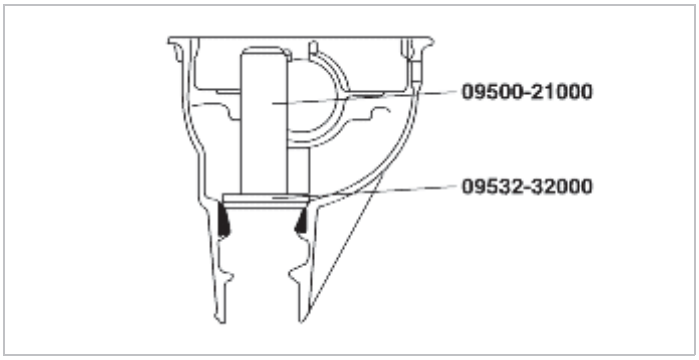
REASSEMBLY

1. PRESS-FITTING OIL SEAL



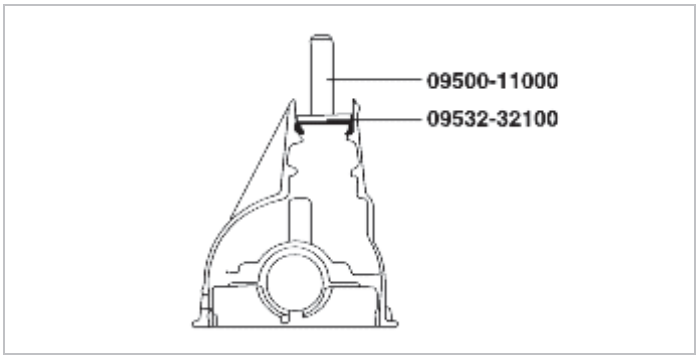
2. DRIVE PINION OUTER BEARING OUTER RACE INSTALLATION

> **CAUTION**
>
> When press-fitting the outer race, do not incline it.



3. DRIVE PINION INNER BEARING OUTER RACE INSTALLATION

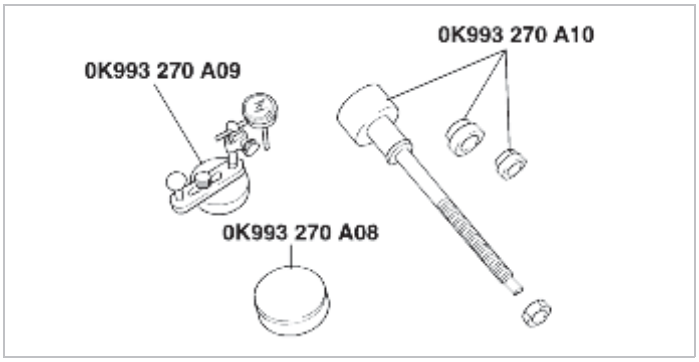
> **CAUTION**
>
> When press-fitting the outer race, do not incline it.



4. ADJUSTMENT OF PINION HEIGHT

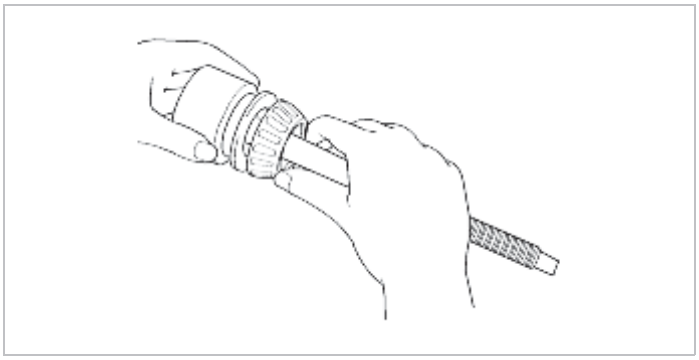
Adjustment the drive pinion height by the following procedure.

(1) For assembly of pinion, use drive pinion model(0K993 270 A01), pinion height adjustment gauge body(0K993 270 A09) and gauge block(ht. 28 mm(1.102 in)).



(2) Assemble spacer and inner bearing inner race to pinion model and fix it with O-ring.

> **NOTICE**
>
> Use spacer disassembled.



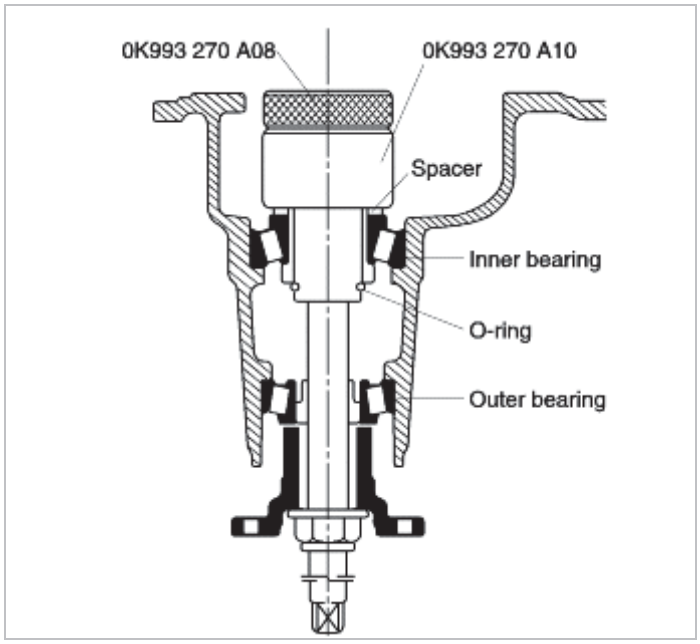
(3) Install pinion model assembly to carrier.

(4) Assemble outer bearing, companion flange washer, and lock nut.

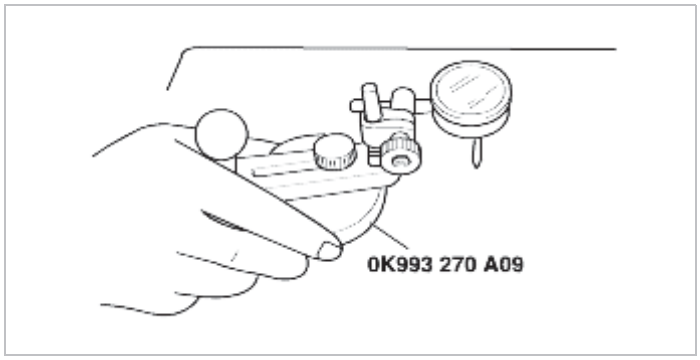
> **NOTICE**
>
> Use washer and lock nut disassembled.

(5) Tighten lock nut.

> **NOTICE**
>
> • Tighten to the extent the companion flange can be screwed by hand.



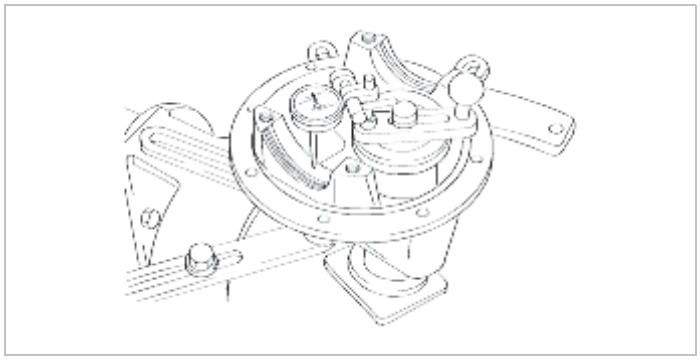
(6) Put pinion height adjusting gauge body at right angle and adjust it to 0.



(7) Put pinion height adjusting gauge body and gauge block to the upper side of pinion model.

(8) Dial gauge needle should be placed at the lowest part of side bearing.

(9) Measure minimum positions of both sides (LH, RH).



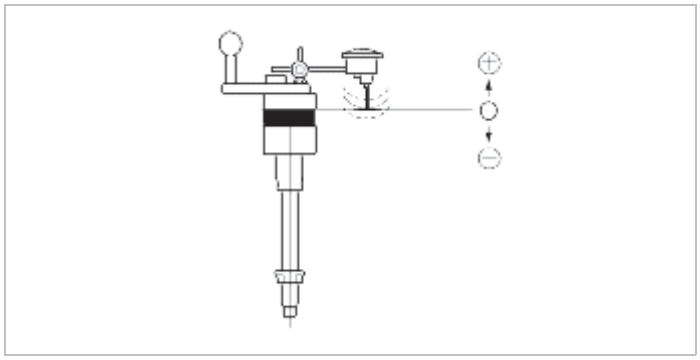
(10) Add both values and divide it by 2.

(11) If the value of the above step 10 is not within specification, use new spacer adding the values to current spacer.

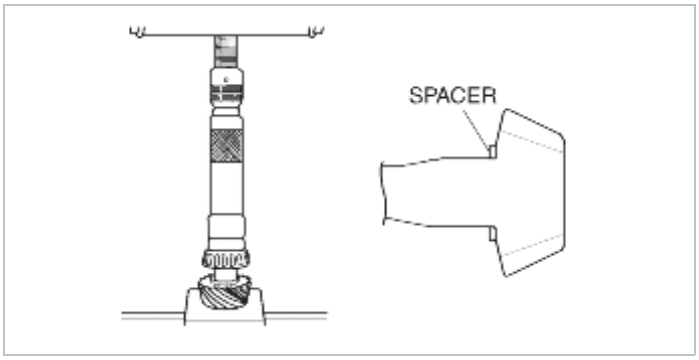
Standard clearance :
-0.025~0.025 mm (-0.001~0.001 in)

MARK	THICKNESS	MARK	THICKNESS
08	3.08(0.1212)	29	3.29(0.1259)
11	3.11(0.1224)	32	3.32(0.1307)
14	3.14(0.1236)	35	3.35(0.1318)

17	3.17(0.1248)	38	3.38(0.1330)
20	3.20(0.1259)	41	3.41(0.1342)
23	3.23(0.1271)	44	3.44(0.1354)
26	3.26(0.1283)	47	3.47(0.1366)



5. Adjustment of drive pinion preload.



(1) Install spacer.

(2) Push inner bearing in using SST.

NOTICE

- Keep pressuring until the sudden increase of necessary power.
- Place the spacer for adjusting pinion height, ensuring exact direction of installation.

(3) Install distance piece.

(4) Push outer bearing in using SST.

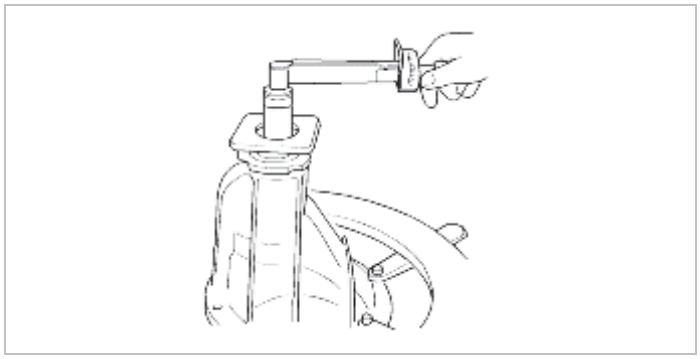
(5) Install drive pinion assembly.

(6) Install companion flange and tighten lock nut.

Tightening torque :
127-284 N·m (13-29 kg·m, 94-210 lb·ft)

NOTICE

Do not install oil seal.



(7) Turn companion flange by hand so that bearing be put at the right place.

(8) Measure preload of drive pinion. If the result is not within specification, use new distance piece and measure again.

Preload :
127-176 N·m (13-18 kg·m, 94-130 lb·ft)

(9) Remove the lock nut and then install the oil seal.

(10) >Install the companion flange and tighten lock nut.

Tightening torque :
127-284 N·m (13-29 kg·m, 94-210 lb·ft)

6. ADJUSTMENT OF DIFFERENTIAL GEAR BACKLASH

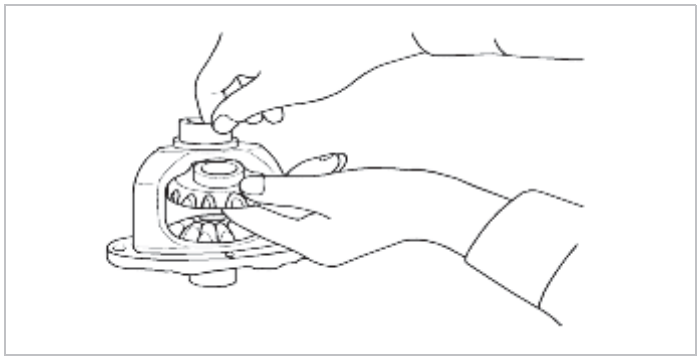
Adjust the differential gear backlash according to the following procedures :

(1) Assemble the side gears, side gear spacers, pinion gears, and pinion washers into the differential case.

(2) Temporarily install the pinion shaft.

NOTICE

Do not install the lock pin yet.

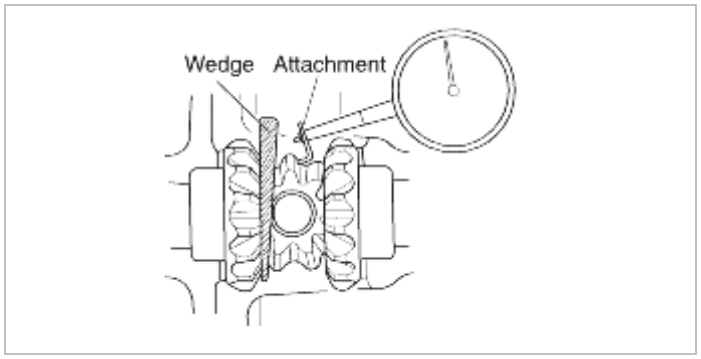


(3) Insert a wedge in the side gear and measure the differential gear backlash with a dial indicator on the pinion gear.

NOTICE

Measure both pinion gears separately.

Standard value : 0-0.1 mm (0-0.0039 in.)
Limit : 0.2 mm (0.008 in.)



(4) If the differential gear backlash exceeds the limit, adjust the backlash by selecting thicker side gear thrust spacers.

(5) Measure the differential gear backlash once again, and confirm that it is within the limit.

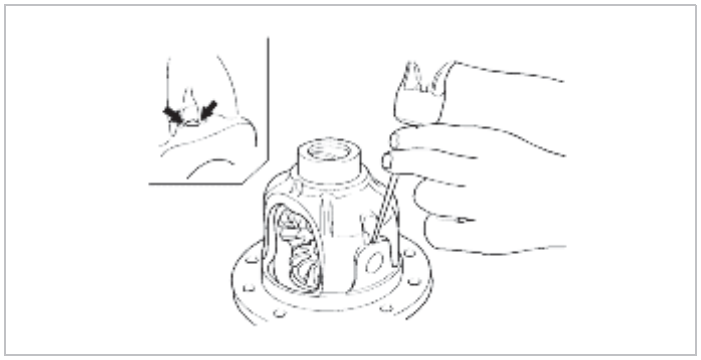
NOTICE

- After adjustment, check that the backlash is within the limit and the differential gear rotates smoothly.
- When adjustment is impossible, replace the side gear and the pinion gear as a set.

7. INSTALLATION OF THE LOCK PIN

(1) Align the pinion shaft lock pin hole with the differential case lock pin hole, and drive in the lock pin.

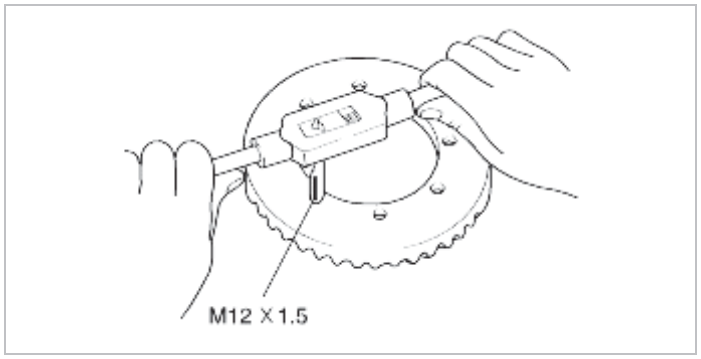
(2) Fix the lock pin in place by staking two points around the lock pin hole with a punch.



8. INSTALLATION OF THE DRIVE GEAR

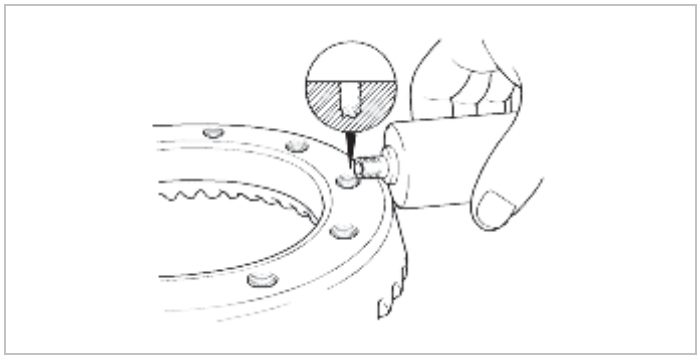
(1) Clean the drive gear attaching bolts.

(2) Remove the adhesive on the threaded holes of the drive gear use a tap (M10 x 1.25), and then clean the threaded holes with compressed air.



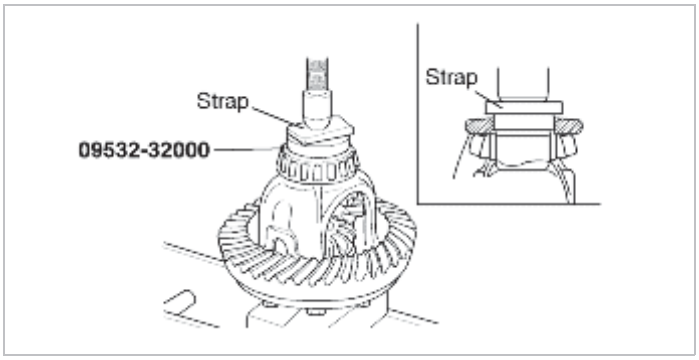
(3) Apply the specified adhesive to the threaded holes of the drive gear.

Specified adhesive : LOCTITE #262 or equivalent



(4) Install the drive gear in the differential case with the matchmarks properly aligned. Tighten the bolts to the specified torque in a diagonal sequence.

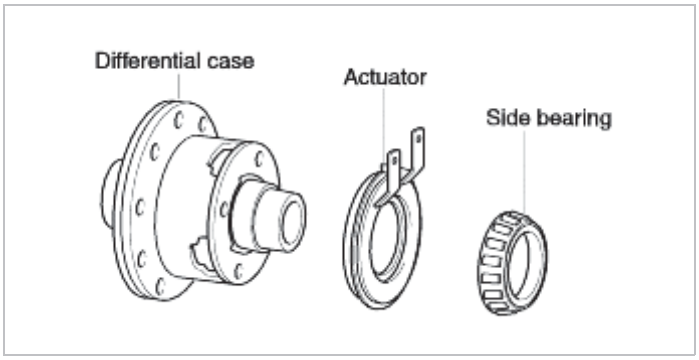
9. PRESS THE SIDE BEARING INNER RACE



10. Attach actuator at differential case RH side as figure

CAUTION

Take heed of actuator direction.



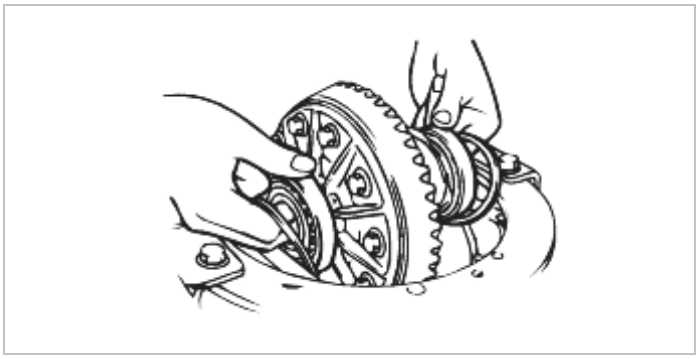
11. ADJUSTMENT OF FINAL DRIVE GEAR BACKLASH

Adjust the final drive gear backlash according to the following procedures :

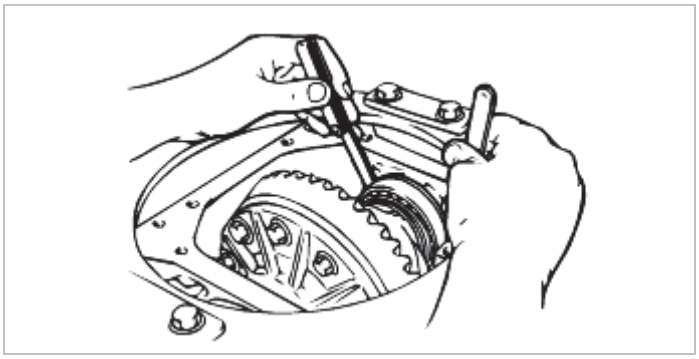
(1) Install side bearing spacers which are thinner than those removed, to the side bearing outer races, and then mount the differential case assembly into the gear carrier.

NOTICE

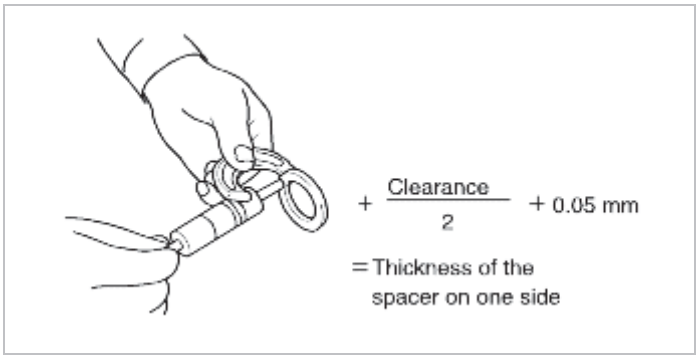
Select side bearing spacers with the same thickness for both the drive pinion side and the drive gear side.



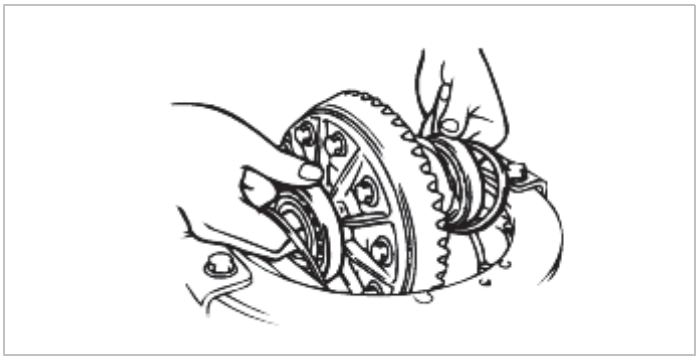
(2) Push the differential case to one side, and measure the clearance between the gear carrier and the side bearing with a feeler gauge.



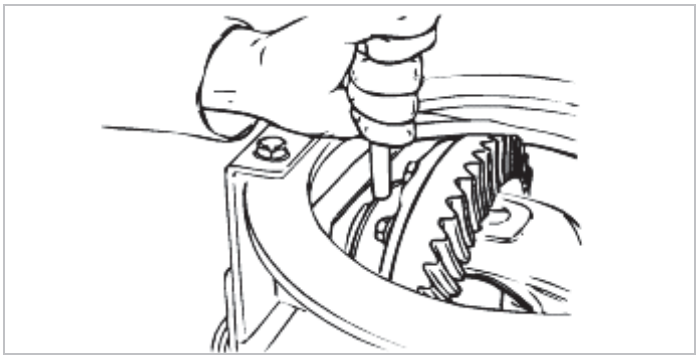
(3) Select two pairs of spacers, which correspond to the value calculated according to the expression in the illustration. Install one pair each to the drive pinion side and the drive gear side.



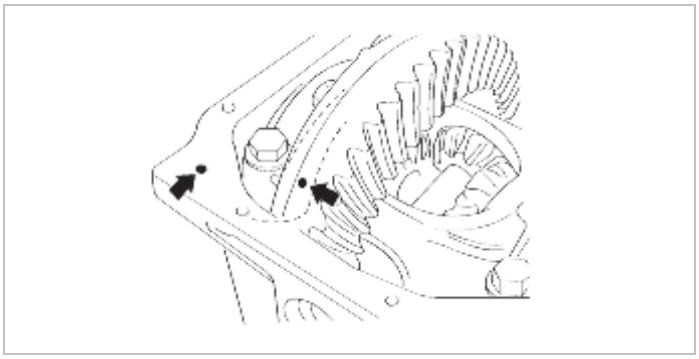
(4) Install the side bearing spacers and differential case assembly, as shown in the illustration, to the gear carrier.



(5) Tap the side bearing spacers with a brass bar to fit them to the side bearing outer race.



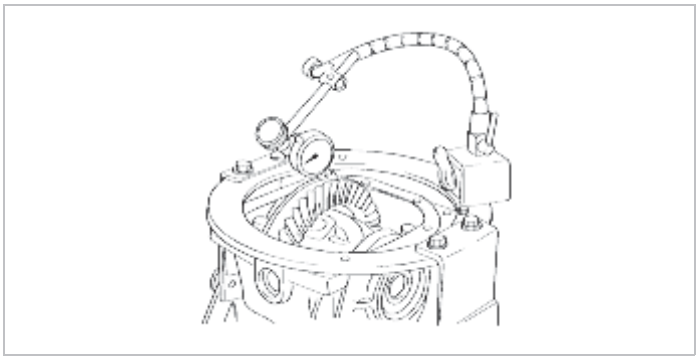
(6) Align the matchmarks on the gear carrier and the bearing cap and tighten the bearing cap.



(7) With the drive pinion locked in place, measure the final drive gear backlash with a dial indicator on the drive gear.

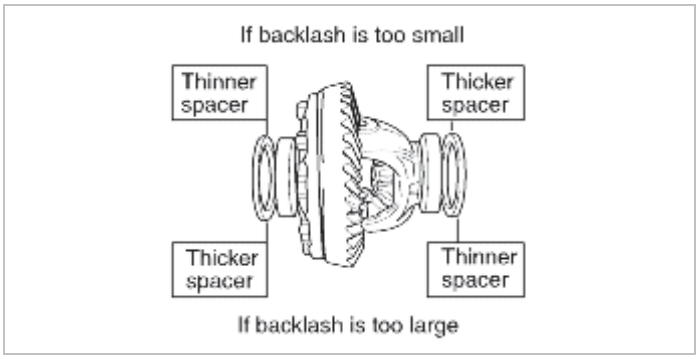
> **NOTICE**
>
> Measure at four points or more on the circumference of the drive gear.

Standard value : 0.09-0.11 mm (0.0035-0.0043 in.)



(8) Change the side bearing spacers as illustrated and then adjust the final drive gear backlash between the drive gear and the drive pinion.

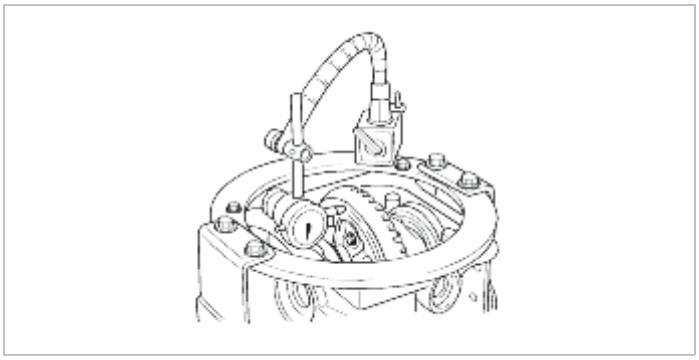
> **NOTICE**
>
> When increasing the number of side bearing spacers, use the same number for each and as few as possible.



(9) Check the drive gear and drive pinion for tooth contact. If poor contact is evident, adjust again.

(10) Measure the drive gear runout at the shoulder on the reverse side of the drive gear.

Limit : 0.05 mm (0.002 in.)



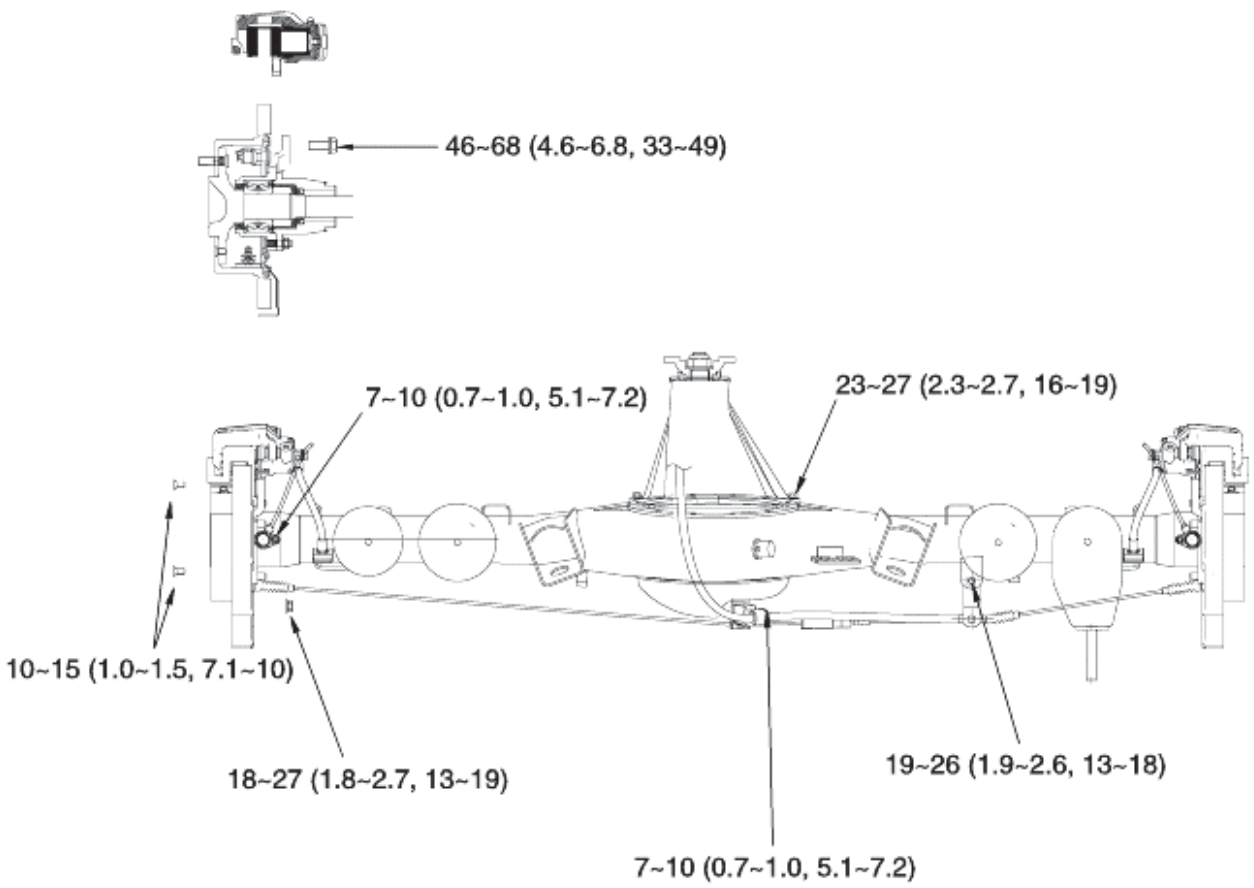
(11) If the drive gear runout exceeds the limit, reinstall by changing the position of the drive gear and differential case, and remeasure.

KIA MOTORS

Driveshaft and Axle

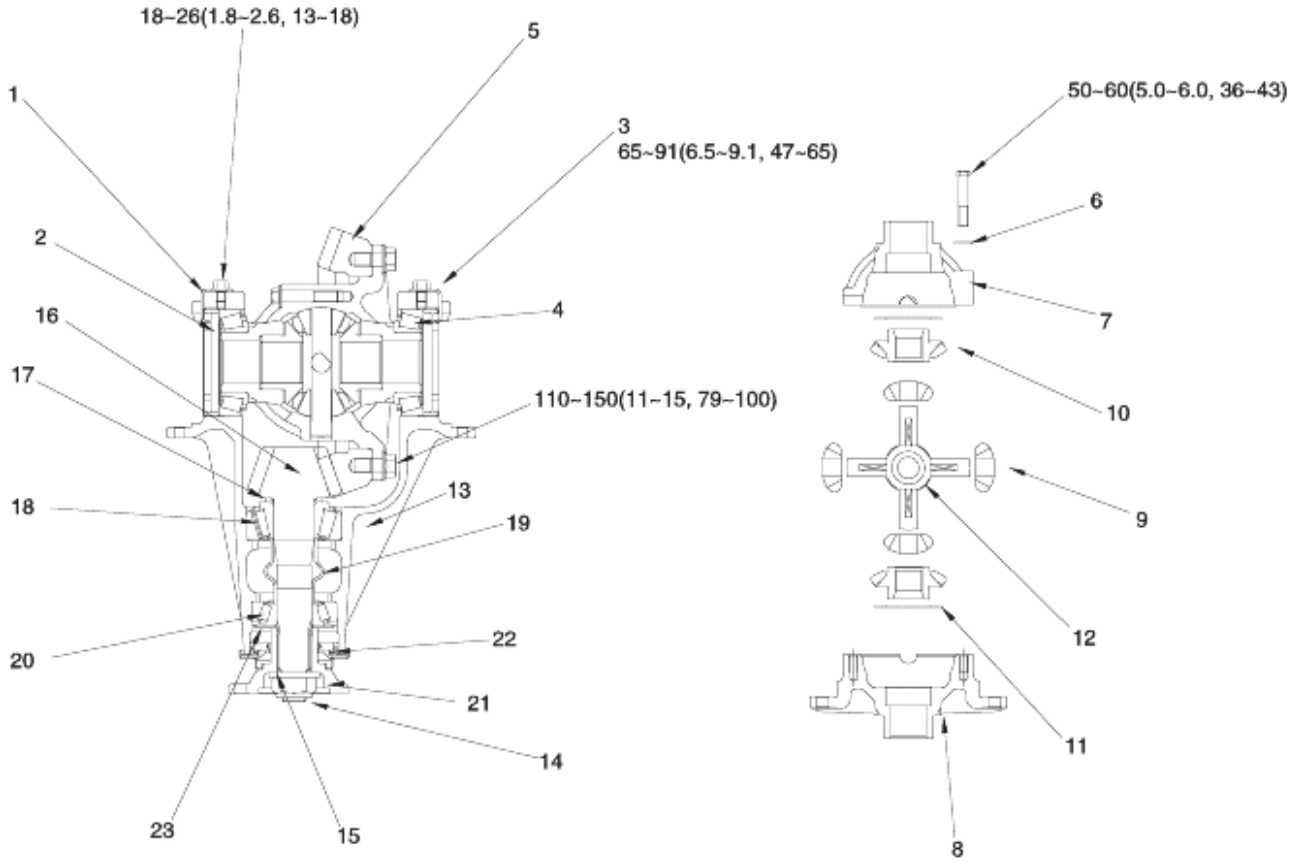
Differential Carrier Assembly - Rear

COMPONENTS



Torque : N·m(kg-m, lb-ft)

REAR DIFFERENTIAL COMPONENTS



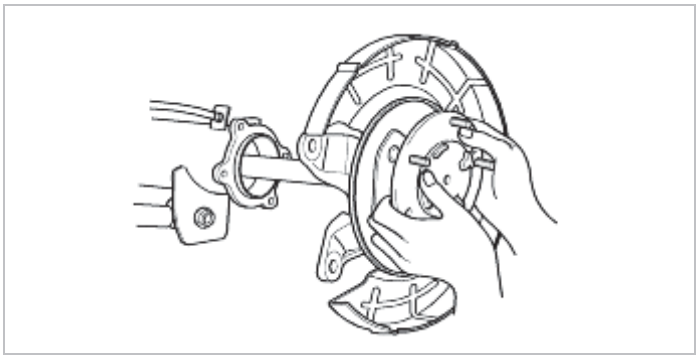
TORQUE : N·m (kg·m, lb·ft)

1. Lock plate
2. Side bearing nut
3. Bearing cap
4. Side bearing
5. Ring gear
6. Washer
7. Differential upper case
8. Differential lower case
9. Pinion gear
10. Side gear
11. Side gear thrust washer
12. Spider
13. Differential carrier case
14. Lock nut
15. Lock washer
16. Dirve pinion
17. Spacer
18. Inner bearing
19. Distance piece
20. Outer bearing
21. Companion flange
22. Oil seal
23. Oil slinger

REMOVAL

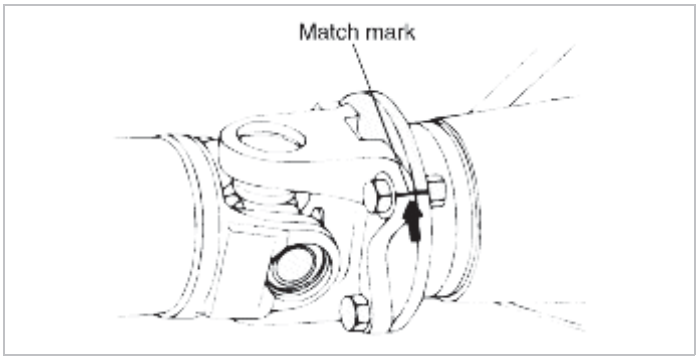
1. Drain the differential gear oil.
2. Remove the rear disk brake.
3. Remove the parking brake and cable.
4. Remove the stabilizer bar.
5. Pull out the rear axle shaft.

> **CAUTION**
>
> Be careful not to damage the oil seal when pulling axle shaft.



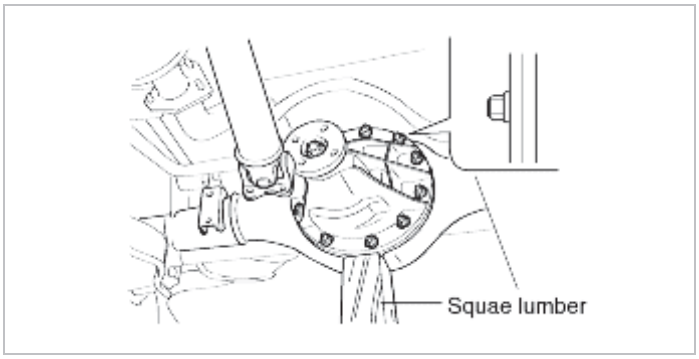
6. After marking the match mark on the flange yoke of the rear propeller shaft and the companion flange of the differential case, remove the rear propeller shaft assembly.

> **CAUTION**
>
> Suspend the propeller shaft from the body with wire, etc.



7. Remove the attaching nuts and strike the lower part of differential carrier assembly with a piece of times several times to loosen, then remove the differential carrier assembly.

> **NOTICE**
>
> Use care not to strike the companion flange.



INSTALLATION

1. DIFFERENTIAL CARRIER ASSEMBLY
   Apply specified sealant to axle housing flange surface, and install the differential carrier assembly.

   Specified sealant : Three bond 1215 or equivalent

   Tightening torque :
   23-27 Nm (2.3-2.7 kg·m,16-19 lb·ft)
   Specified sealant : Three bond 1215 or equivalent

2. PROPELLER SHART
   Align the match marks on the flange yoke and companion flange, and install the propeller shaft.

   Tightening torque :
   50-60 Nm (500-600 kg·cm, 37-44 lb·ft)

3. AXLE SHAFT ASSEMBLY
   (1) Apply specified sealant to the axle housing and bearing case end faces.

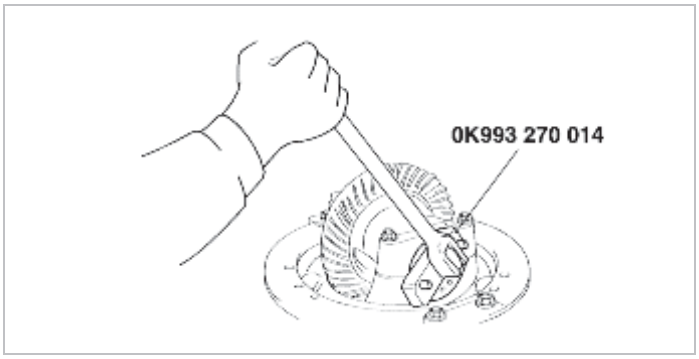
   Specified sealant : Three bond 1104

DISASSEMBLY

1. SIDE BEARING NUT

NOTICE

Keep the right and left side bearing nuts separate so that they are not mixed during reassembly.

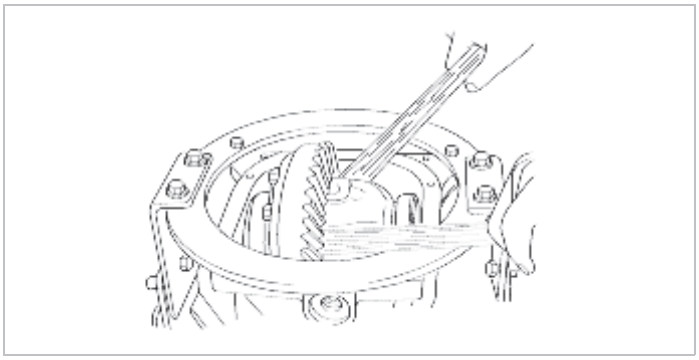


2. REMOVAL OF THE DIFFERENTIAL CASE ASSEMBLY

CAUTION

- Remove the differential case assembly slowly and carefully.
- Be careful so that the side bearing outer race is not dropped.

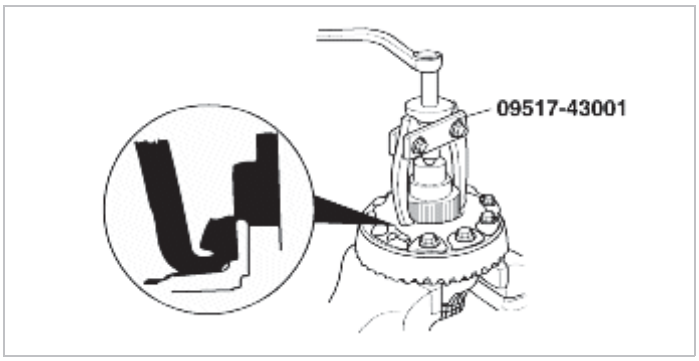
• Keep the right and left side bearing outer races separate so that they are not mixed during reassembly.



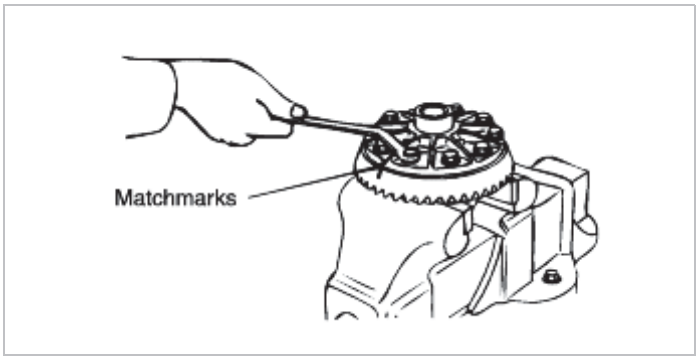
3. REMOVAL OF THE SIDE BEARING INNER RACES
   Fit the nut on top of the differential case, and then uses the special tool to remove the side bearing inner race.

NOTICE

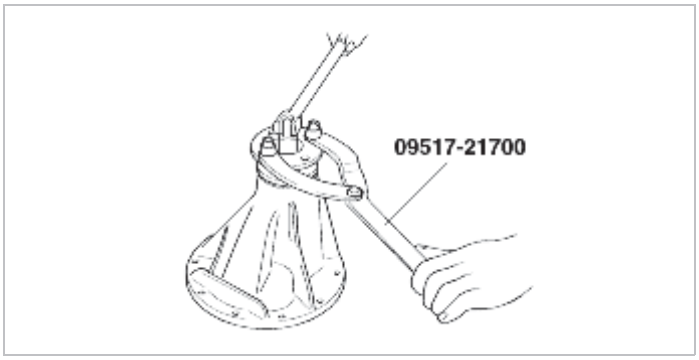
Attach the prongs of the special tool (09517-43001) to the inner race of the side bearing through the notched section in the differential case.



4. REMOVAL OF DRIVE GEAR
   A. Make the match marks to the differential case and the drive gear.
   B. Loosen the drive gear attaching bolts in diagonal sequence to remove the drive gear.



5. REMOVAL THE LOCK NUT

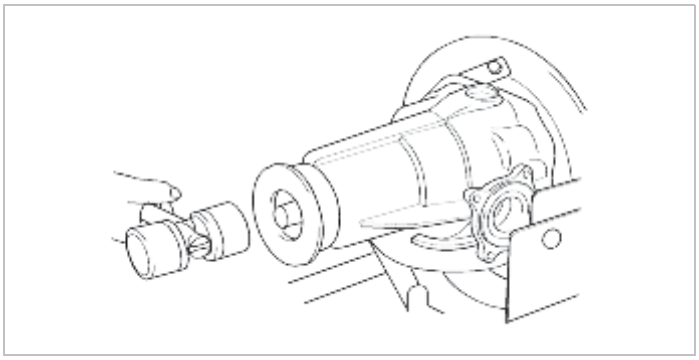


6. REMOVAL OF DIRVE PINION

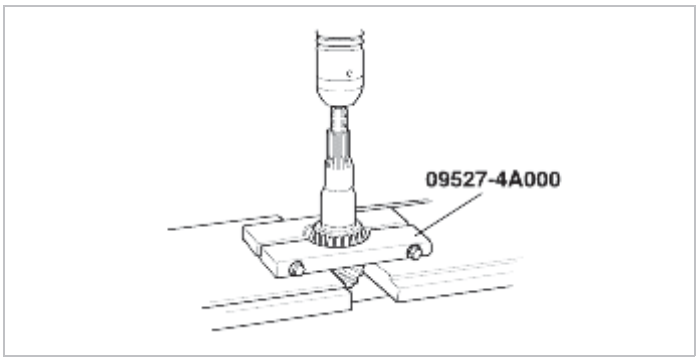
A. Make the match marks on the drive pinion and companion flange.

> **CAUTION**
>
> Match marks should not be made on the contact surfaces of the companion flange and the propeller shaft.

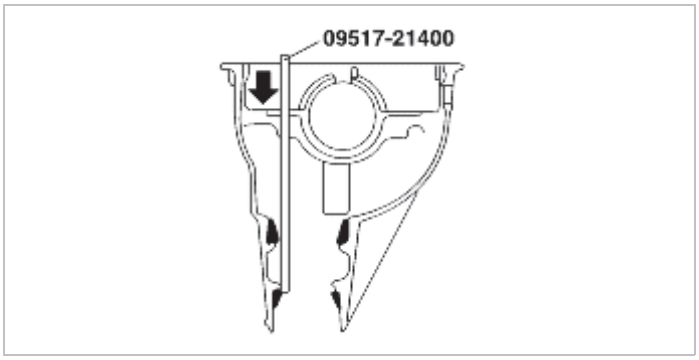
B. Drive out the drive pinion together with the drive pinion spacer and drive pinion front shims.



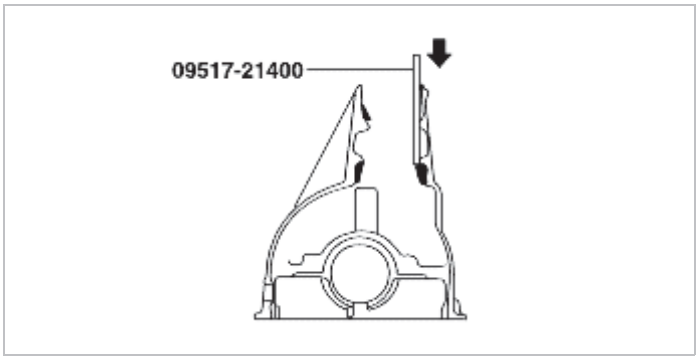
7. REMOVAL OF DRIVE PINION REAR BEARING INNER RACE



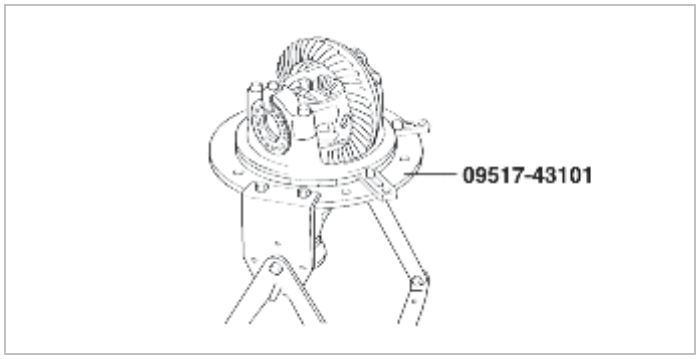
8. REMOVAL OF OIL SEAR / DRIVE PINION FRONT BEARING INNER RACE / DRIVE PINION FRONT BEARING OUTER RACE



9. REMOVAL OF DRIVE PINION REAR BEARING OUTER RACE



INSPECTION BEFORE DISASSEMBLY



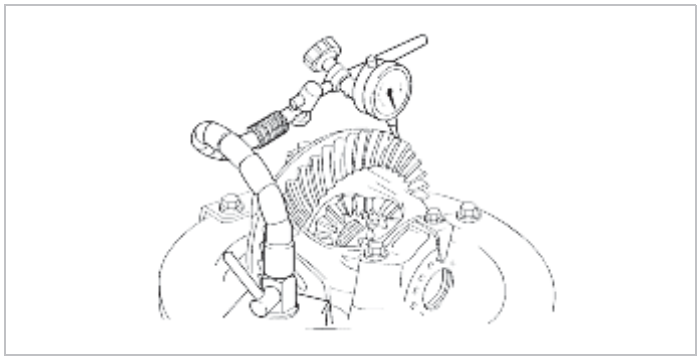
1. FINAL DRIVE GEAR BACKLASH

Check the final drive gear backlash by the following procedure.

(1) Place the drive pinion and move the drive gear to check backlash is within the standard range.

> **NOTICE**
>
> Measure at 4 points on the gear periphery.

Standard value
0.13-0.18 mm (0.0051-0.0071 in.)



(2) Adjust with the side bearing nuts if backlash values are not within standard range.

> **NOTICE**
>
> After adjusting, check the state of the final drive gear's tooth contact.

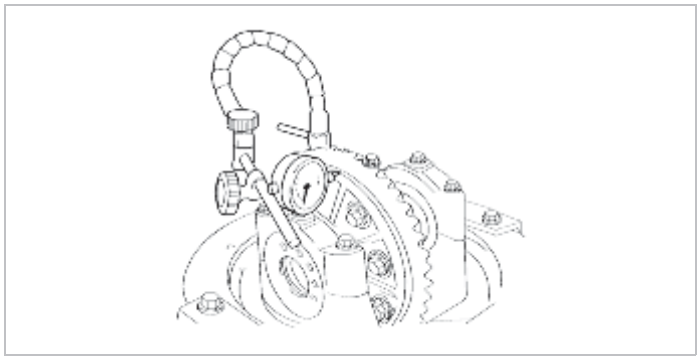
2. DRIVE GEAR RUNOUT

Check the back-face lash as follows:

(1) Place a dial gauge on the back-face of the drive gear and measure the runout.

Limit : 0.05mm (0.0020in.)

(1)



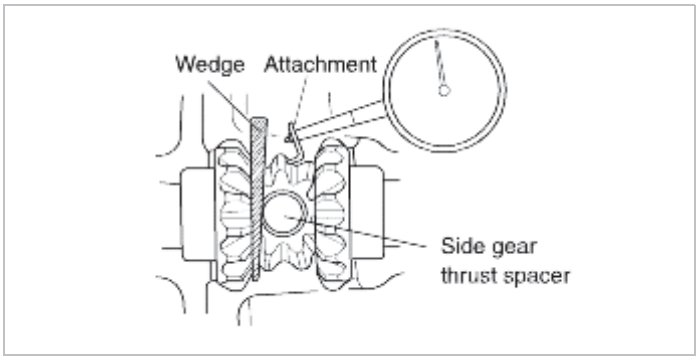
(2) If the run out is beyond the limit, check that there are no foreign substances between the drive gear and differential case and, that the bolts fixing the drive gear are not loose.

3. DIFFERENTIAL GEAR BACKLASH

(1) Fix the side gear with a wedge so it cannot move and measure the differential gear backlash with a dial indicator on the pinion gear.

> **NOTICE**
>
> Take the measurements at two places on the pinion gear.

Standard value : 0-0.1 mm (0-0.0039 in.)



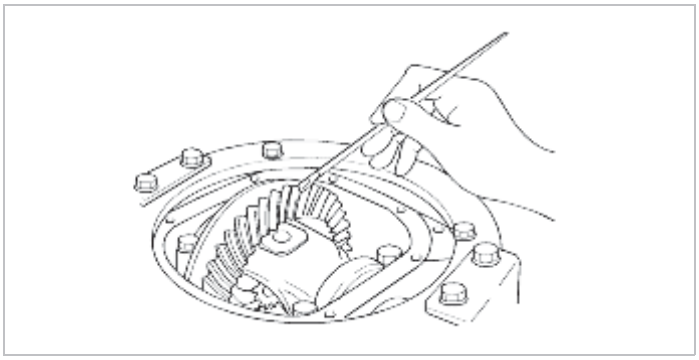
(2) If the backlash exceeds the limit, adjust using side bearing spacers.

> **NOTICE**
>
> If adjustment is impossible, replace the side gear and pinion gears as a set.

4. FINAL DRIVE GEAR TOOTH CONTACT

Check the final drive gear tooth contact by following the steps below :

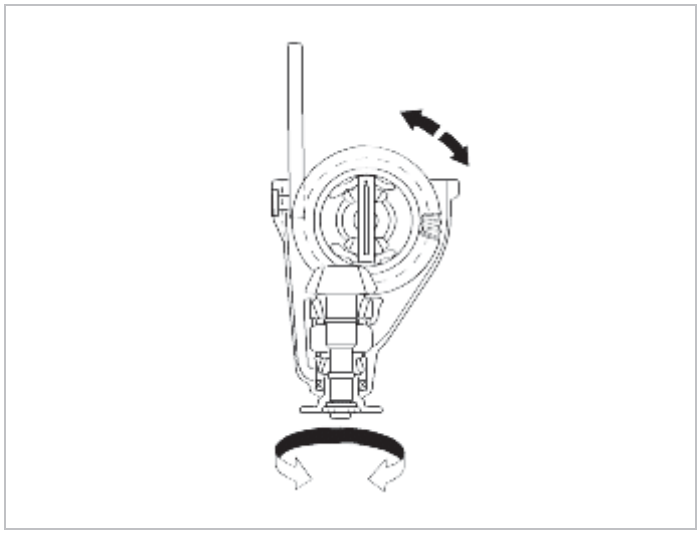
(1) Apply the same amount of machine blue slightly to both surfaces of the drive gear teeth.

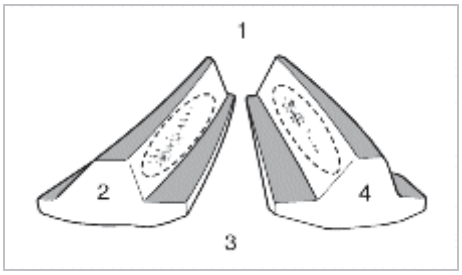
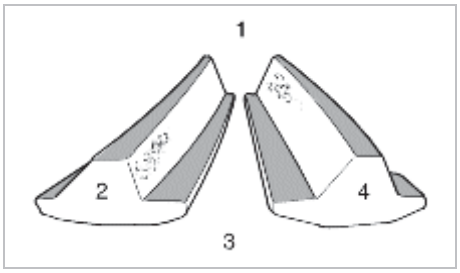
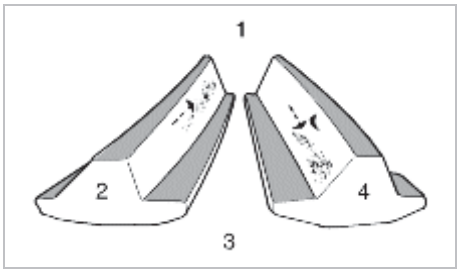
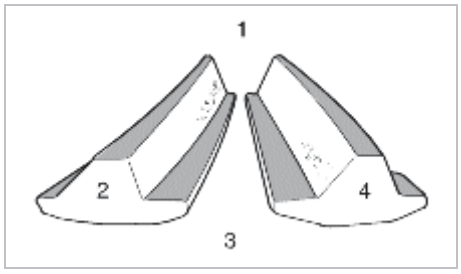
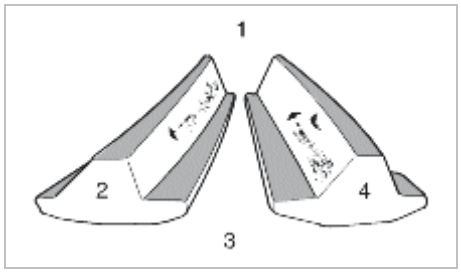


(2) Insert a brass rod between the differential carrier and the differential case, and then rotate the companion flange by hand (once in the normal direction, and then once in the reverse direction) while applying a load to the drive gear so that some torque (approximately 25-30kg·cm) is applied to the drive pinion.

> **CAUTION**
>
> If the drive gear is rotated too much, the tooth contact pattern will become unclear and difficult to check.

(3) Check the tooth contact pattern.



1. Narrow tooth side 2. Drive-side tooth surface (the side receiving power during acceleration) 3. Wide tooth side 4. Coast-side tooth surface (the side receiving power during coast-down)	
Problem	Solution
Tooth contact pattern resulting from excessive pinion height	
	
The drive pinion is positioned too far from the center of the drive gear.	Also, for backlash adjustment, reposition the drive gear further from the drive pinion.
Tooth contact pattern resulting from insufficient pinion height	
	
The drive pinion is positioned too close to the center of the drive gear.	Decrease the thickness of the pinion height adjusting shim, and position the drive pinion further from the center of the drive gear. Also, for backlash adjustment, reposition the drive gear closer to the drive pinion.

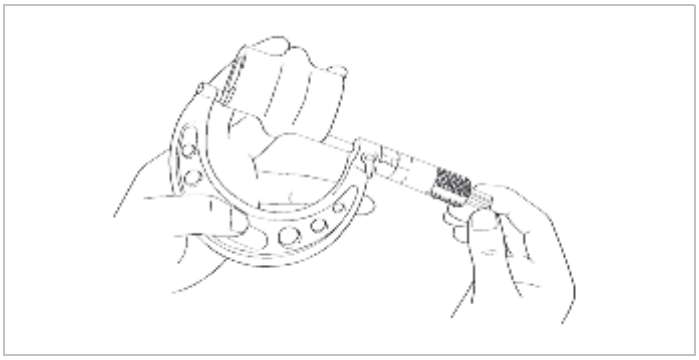
NOTICE

- Tooth contact pattern is a method for judging the result of the adjustment of drive pinion height and final drive gear backlash. The adjustment of drive pinion height and final drive gear backlash should be repeated until the tooth contact patterns are similar to the standard tooth contact pattern.
- When you cannot obtain a correct pattern, the drive gear and drive pinion have exceeded their limits. Both gears should be replaced as a set.

INSPECTION

1. Check the companion flange for wear or damage.
2. Check the bearings for wear or discoloration.
3. Check the gear carrier for cracks.
4. Check the drive pinion and drive gear for wear or cracks.
5. Check the side gears, pinion gears and pinion shaft for wear or damage.
6. Check the side gear spline for wear or damage.
7. Check the length of the distance piece.

Standard length :
54.80-58.09 mm (2.16-2.21 in.)

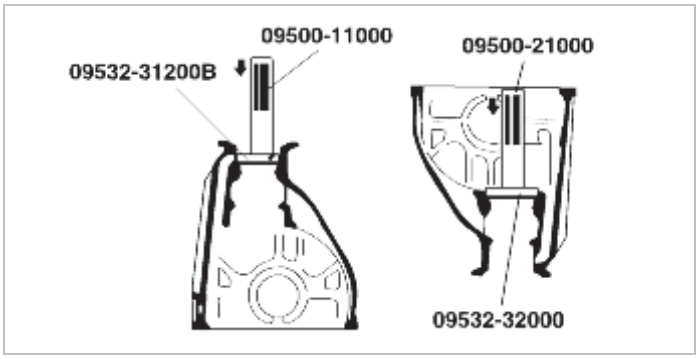


REASSEMBLY

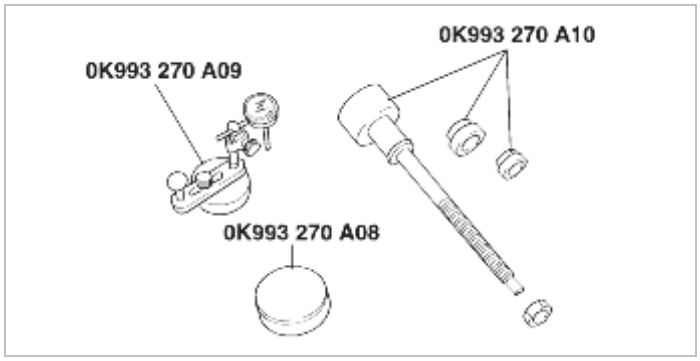
1. Install the drive pinion rear bearing outer race and drive pinion front bearing outer race using the special tools (09500-11000, 09500-21000, 09532-31200B and 09532-32000).

CAUTION

Be careful not to press in the outer race when it is inclined.



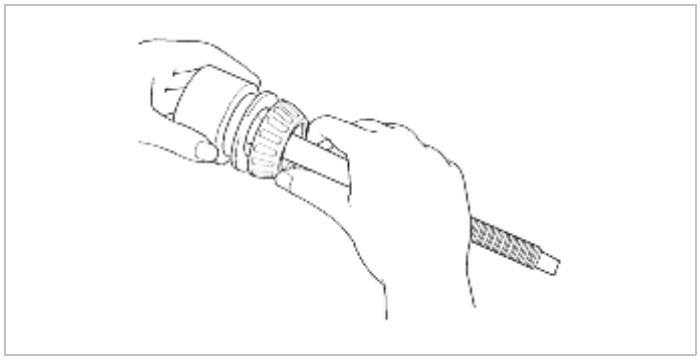
2. ADJUSTMENT OF PINION HEIGHT
   Adjustment the drive pinion height by the following procedure.
   (1) For assembly of pinion, use drive pinion model (0K993 270 A01), pinion height adjustment gauge body (0K993 270 A09) and gauge block (ht. 28 mm (1.102 in)).



(2) Assemble spacer and inner bearing inner race to pinion model and fix it with O-ring.

NOTICE

- Use spacer disassembled.



(3) Install pinion model assembly to carrier.

(4) Assemble outer bearing, companion flange washer, and lock nut.

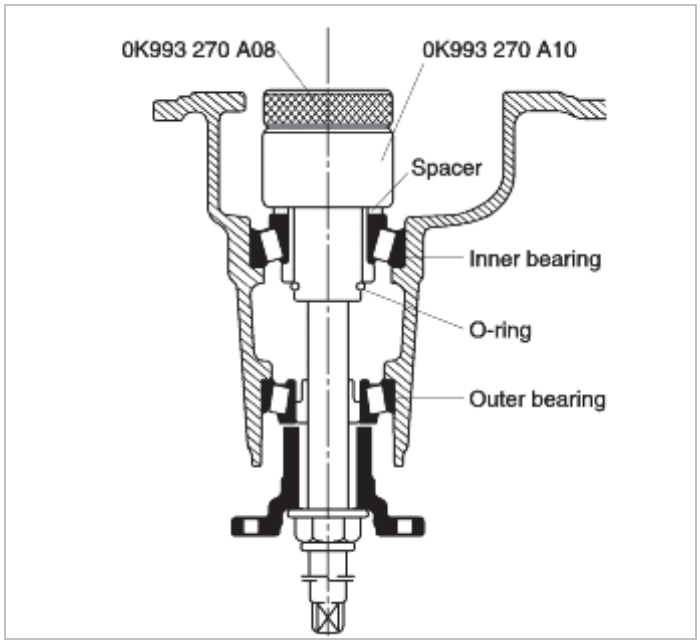
NOTICE

- Use washer and lock nut disassembled.

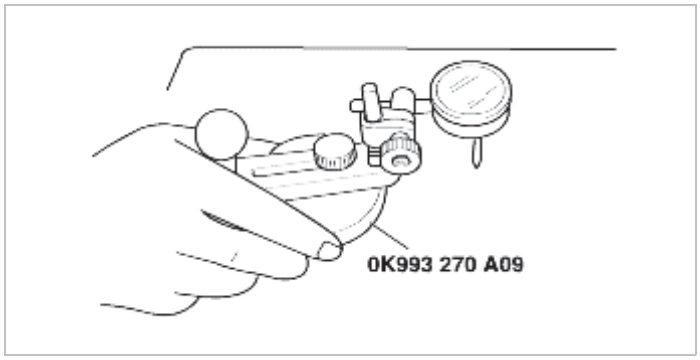
(5) Tighten lock nut.

NOTICE

- Tighten to the extent the companion flange can be screwed by hand.



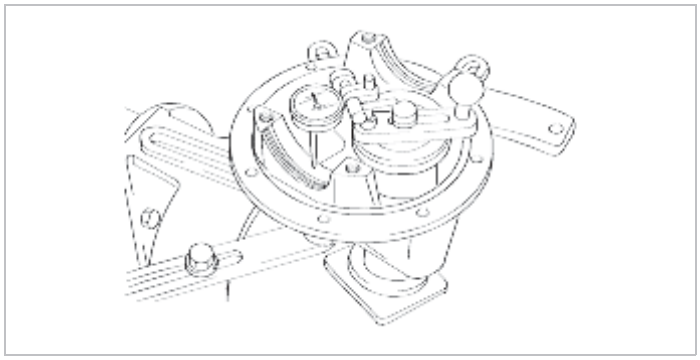
(6) Put pinion height adjusting gauge body at right angle and adjust it to 0.



(7) Put pinion height adjusting gauge body and gauge block to the upper side of pinion model.

(8) Dial gauge needle should be placed at the lowest part of side bearing.

(9) Measure minimum positions of both sides (LH, RH).

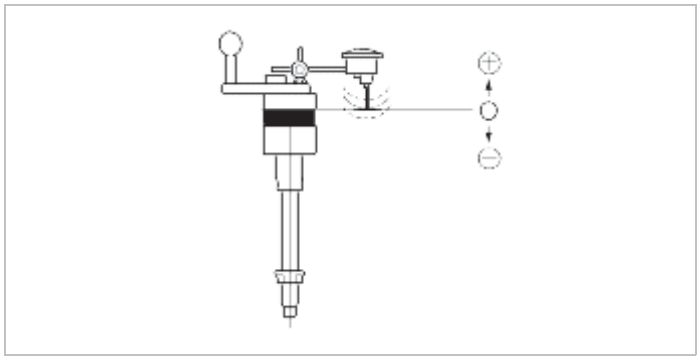


(10) Add both values and divide it by 2.

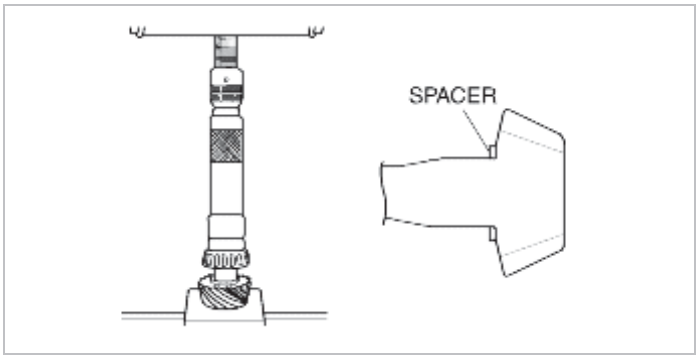
(11) If the value of the above step 10 is not within specification, use new spacer adding the values to current spacer.

Standard clearance :
-0.025~0.025 mm (-0.001~0.001 in)

MARK	THICKNESS	MARK	THICKNESS
08	3.08(0.1212)	29	3.29(0.1259)
11	3.11(0.1224)	32	3.32(0.1307)
14	3.14(0.1236)	35	3.35(0.1318)
17	3.17(0.1248)	38	3.38(0.1330)
20	3.20(0.1259)	41	3.41(0.1342)
23	3.23(0.1271)	44	3.44(0.1354)
26	3.26(0.1283)	47	3.47(0.1366)



3. Adjustment of drive pinion preload.



(1) Install spacer.

(2) Push inner bearing in using SST.

NOTICE

- Keep pressuring until the sudden increase of necessary power.
- Place the spacer for adjusting pinion height, ensuring exact direction of installation.

(3) Install distance piece.

(4) Push outer bearing in using SST.

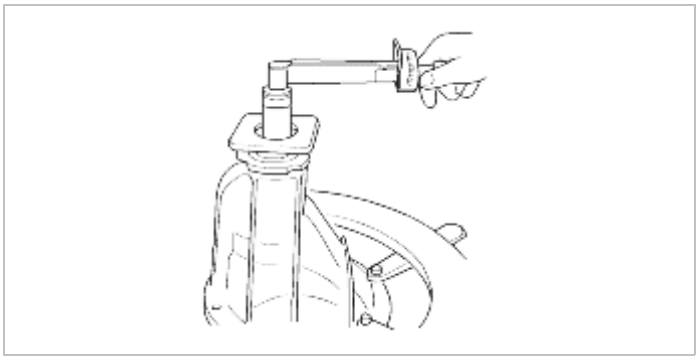
(5) Install drive pinion assembly.

(6) Install companion flange and tighten lock nut.

Tightening torque :
127-284 N·m (13-29 kg·m, 94-210 lb·ft)

NOTICE

- Do not install oil seal.



(7) Turn companion flange by hand so that bearing be put at the right place.

(8) Measure preload of drive pinion. If the result is not within specification, use new distance piece and measure again.

Preload :
127-176 N·m (13-18 kg·cm, 94-130 lb·ft)

(9) Remove the lock nut and then install the oil seal.

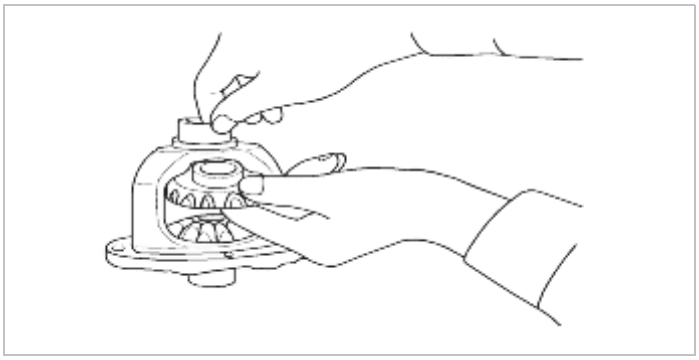
(10) Install the companion flange and tighten lock nut.

Tightening torque :
127-284 N·m (13-29 kg·m, 94-210 lb·ft)

ADJUSTMENT OF DIFFERENTIAL GEAR BACKLASH

1. Assemble the side gears, side gear spacers, pinion gears, and pinion washers into the differential case.
2. Temporarily, install the pinion shaft.

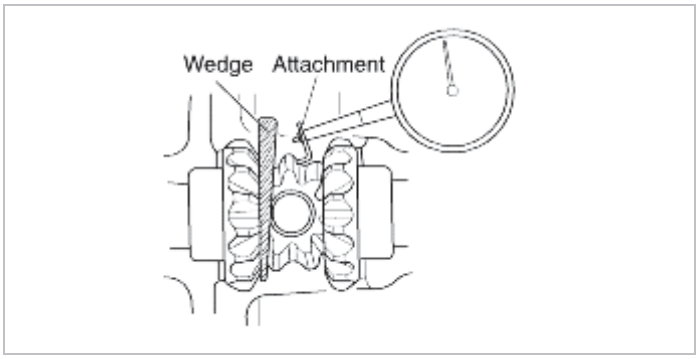
> **NOTICE**
>
> Do not install the lock pin yet.



3. Insert a wedge in the side gear and measure the differential gear backlash with a dial indicator on the pinion gear.

> **NOTICE**
>
> Measure both pinion gears separately.

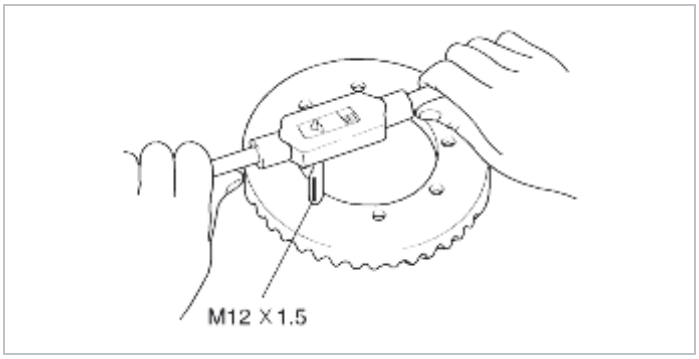
Standard value : 0-0.1 mm (0-0.0039 in.)
Limit : 0.2 mm (0.008 in.)



4. If the differential gear backlash exceeds the limit, adjust the backlash by installing thicker side gear thrust spacers.
5. Measure the differential gear backlash once again, and confirm that it is within the limit.

> **NOTICE**
>
> - After adjustment, check that the backlash is within the limit and the differential gear rotates smoothly.
> - When adjustment is impossible, replace the side gear and the pinion gear as a set.

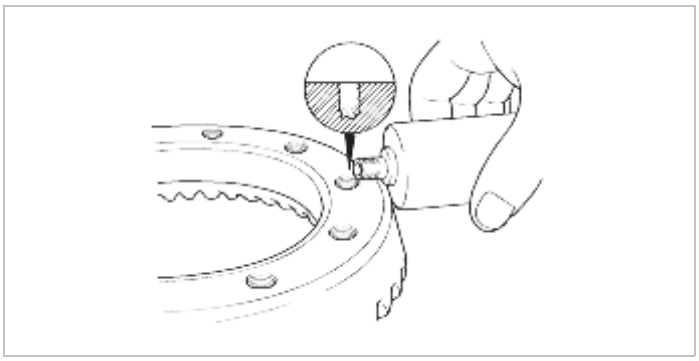
6. Installation of the drive gear
   A. Clean the drive gear attaching bolts.
   B. Remove the adhesive on the threaded holes of the drive gear with a tap (M12 x 1.5), and then clean the threaded holes with compressed air.



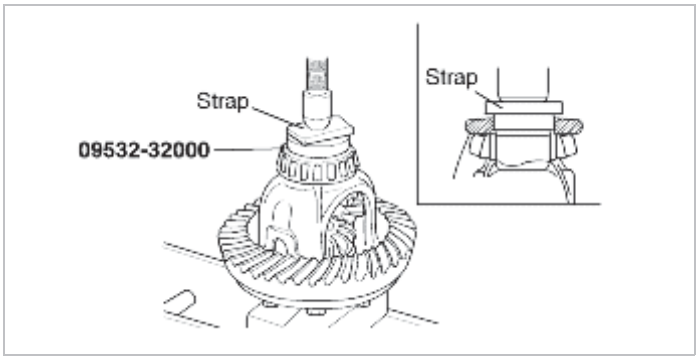
C. Apply the specified adhesive to the threaded holes of the drive gear.

Specified adhesive :
LOCTITE #262 or equivalent

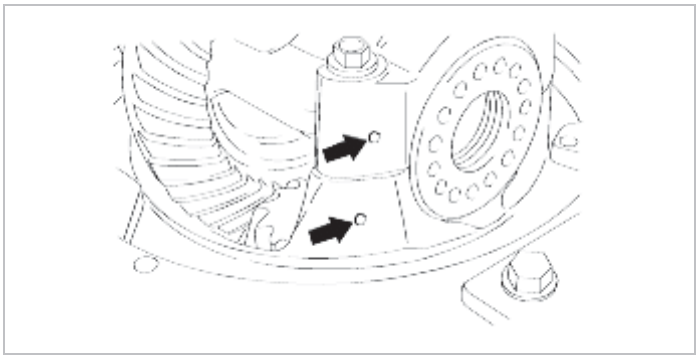
D. Install the drive gear in the differential case with the matchmarks properly aligned. Tighten the bolts to the specified torque (11-15 kg·m) in a diagonal sequence.



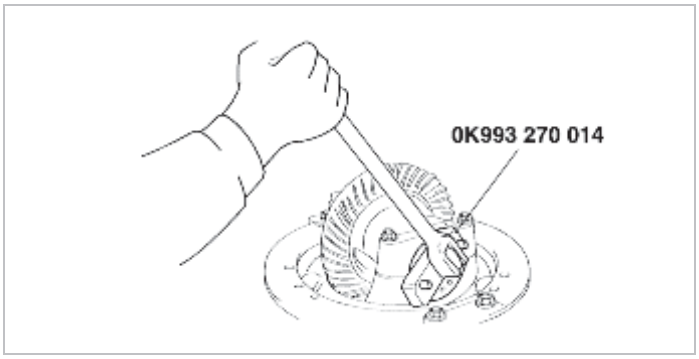
7. Press-fit the side bearing inner race



8. Align the match mark on the gear carrier and the bearing cap, and then tighten the bearing cap.



9. ADJUSTMENT OF FINAL DRIVE GEAR BACKLASH
Adjust final drive gear backlash as follows :
(1) Using the special tool (09521-43001), temporarily tighten the side bearing nut until it is in the state just before preloading of the side bearing.

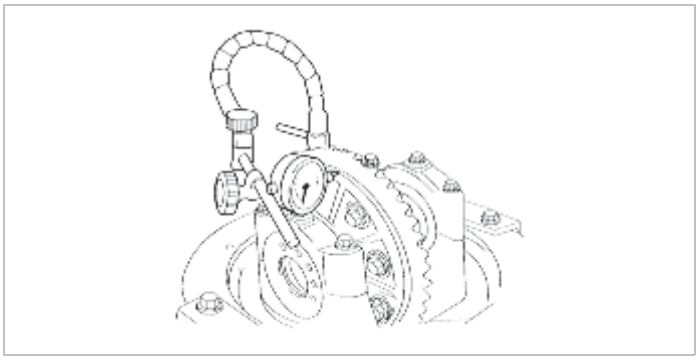


(2) Measure the final drive gear backlash.

Standard value :
0.13-0.18mm (0.0051-0.0071 in.)

NOTICE

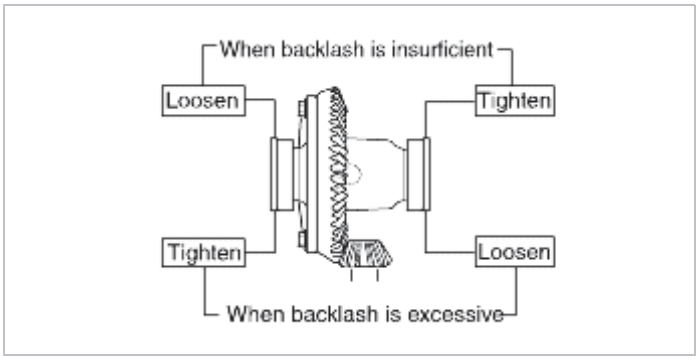
Measure at lease 4 points on the drive gear periphery.



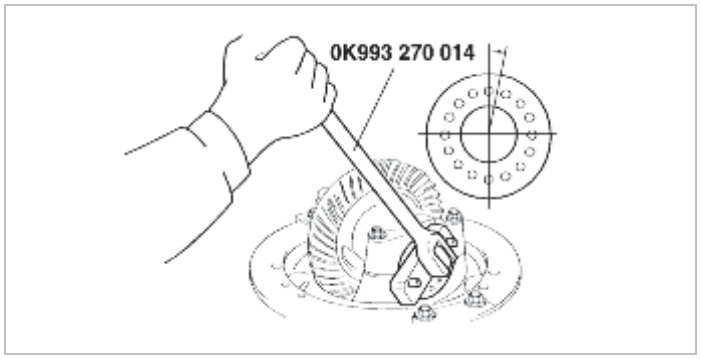
(3) Using the special tool (09521-43000), adjust the backlash to standard value by moving the side bearing nut as shown.

NOTICE

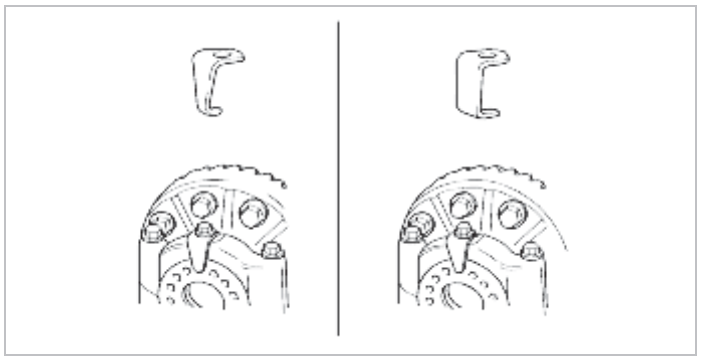
First turn the side bearing nut for loosening, and then turn (by the same amount) the side bearing nut for tightening.



(4) Using the special tool (09521-43001) to apply the preload, turn down both right and left side bearing nut on half the distance between centers of two neighboring holes.



(5) Choose and install the lock plates two kinds.

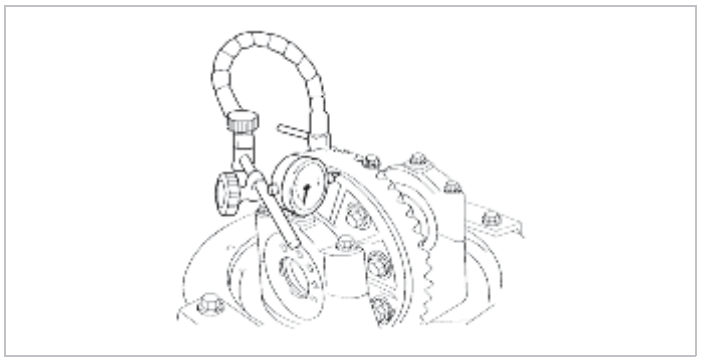


(6) Check the final drive gear tooth contact. If poor contact is evident, make adjustment.

(7) Measure the drive gear run out.

Limit : 0.05mm (0.0020in.)

(8) When drive gear run out exceeds the limit, remove the differential case and then the drive gears, moving them to different positions and reinstalling them.

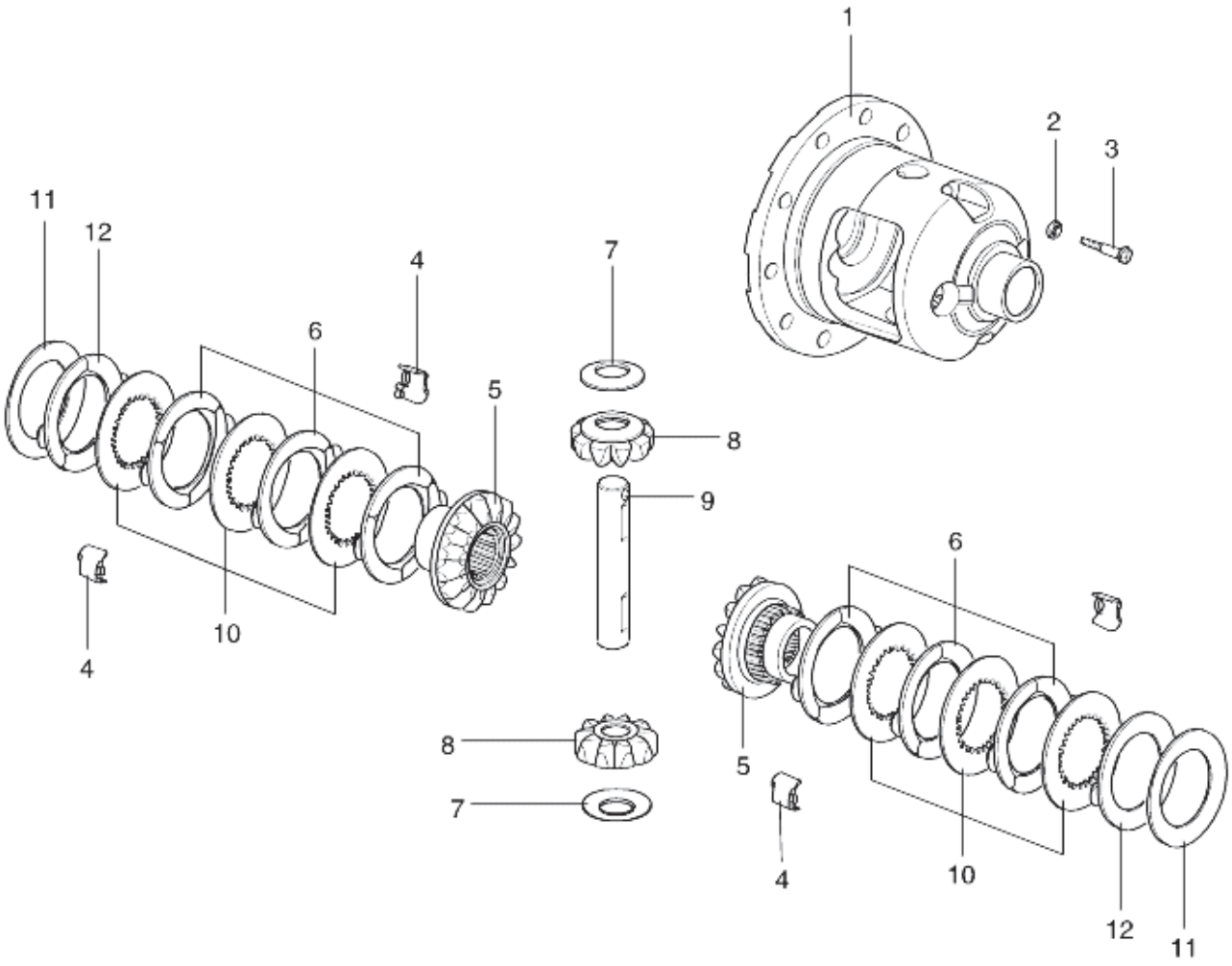


KIA MOTORS

Driveshaft and Axle

Differential Carrier Assembly - Limited Slip Differential (LSD)

COMPONENTS



1. Case
2. Washer-lock
3. Screw-lock
4. Guide-ear
5. Gear-side
6. Eared disc S/A (carbon on both sides)
7. Thrust washer-pinion
8. Pinion gear
9. Cross shaft-pinion
10. Disc-splined friction
11. Shim-side gear
12. Eared disc S/A (carbon on one side)

DISASSEMBLY

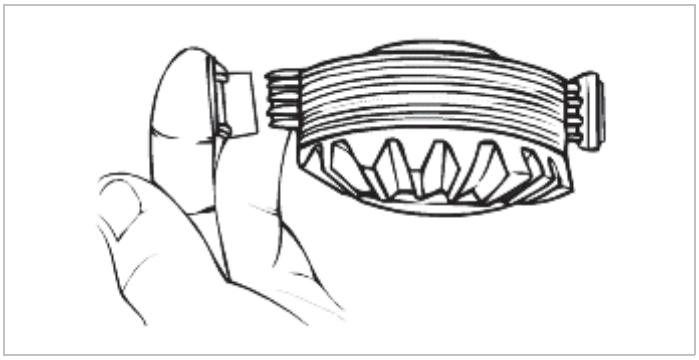
1. Remove the threaded lock screw and the cross shaft.
2. Without preload on the side gears they can be turned by hand. Rotate the side gears until the pinions are in the window area. Remove the pinions and pinion thrust washers.
3. Remove the gear sub-assemblies (side gear, disc pack, ear guides and disc pack shims). Do not mix parts. Identify the parts so they can be reassembled to the original location.

INSPECTION

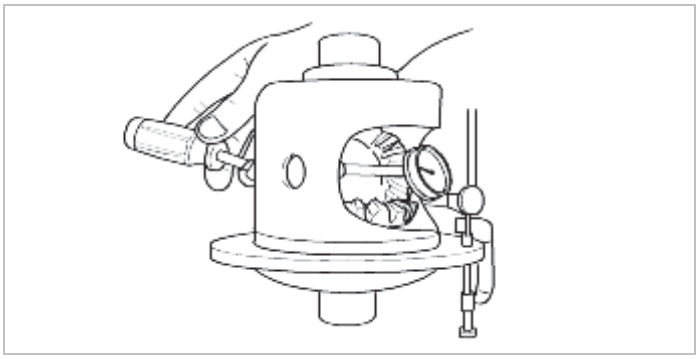
1. Check the side gears, pinions, pinion thrust washers, and cross shaft for wear or damage. If there is excessive wear, cracks, nicks, grooves or galling replace the parts.
2. Inspect the carbon surfaces. After cleaning with a solvent, the carbon surface should appear like a course weave fabric with flat spots on the peaks of the weave. If the surface is smooth, either from wear or from the weave filled with debris replaces the entire disc pack.
3. Measure the thickness of the carbon friction discs. If any of the double sided discs are less than 2.56 mm (0.101in.) orthe single sided disc is less than 2.15mm (0.085 in.), replace the entire disc pack.
4. Inspect the splined friction discs If they have grooves or a mirror likes finishing, replacing the entire disc pack. Small scratches on a buff like finish are okay.

REASSEMBLY AND SHIM SELECTION

1. Apply axle lubricant to all sliding surfaces. Be especially careful to coat the mating surfaces of the friction discs.
2. Starting with a double sided eared disc next to the side gear, stack four eared discs and three splined discs on to the spline of side gear. A splined disc goes in between each eared disc with the last eared disc being single sided and the carbon surface facing the side gear. Use a heavy bearing grease in the ear guides to hold them in place during assembly.



3. Select a shim 0.76mm (0.030in.) thick and place on the hub side of the disc pack subassembly.
4. Lubricate and assemble the other side gears as above.
5. Install the flange end side gear subassembly and shim in the flange end of the differential case.
6. Position pinion gears and thrust washers on the side gears and install the cross shaft through the case and pinions.
7. Install a dial indicator on the case so that the indicator tip rests against a pinion tooth face.
8. Compress the clutch pack with a large screwdriver or pry bar asshown. Rotate the pinion gear back and forth to obtain backlash. Tooth backlash should be 0 to 0.10mm (0 to 0.004in.). If required, change the 0.76mm (0.30in.) Shim to obtain theproper backlash.



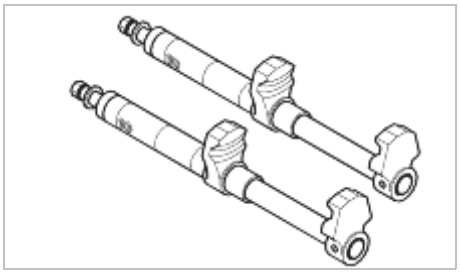
9. Remove the side gear subassembly and repeat the tooth backlash procedure for the other gear pack on the opposite side of the case.
10. Remove the cross shaft, pinions and thrust washers and reinstall the first side gear subassembly and shim in the flange end of the case.
11. Install a pinion and thrust washer througheach window so that the gear teeth mesh and so that the pinions are in line with each other. Rotate one side gear so the pinions and thrust washers rotate at a position where they line up with the cross shaft holes in the case.
12. Install the pinion shaft, lock screw and lock washer. Tighten the lock screw to 30-40Nm (3.1~4.1 kg·m, 22-29lb·ft) torque.

KIA MOTORS

Suspension System

General Information

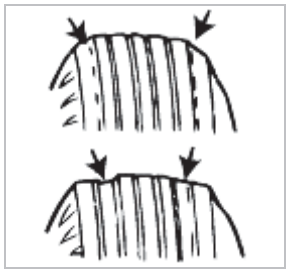
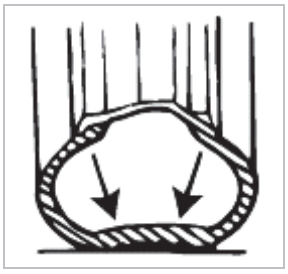
SPECIAL SERVICE TOOL

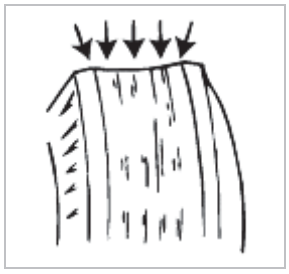
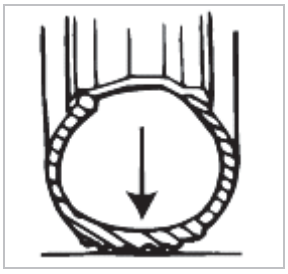
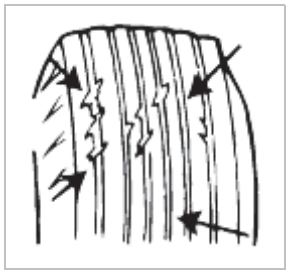
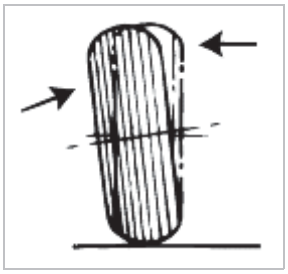
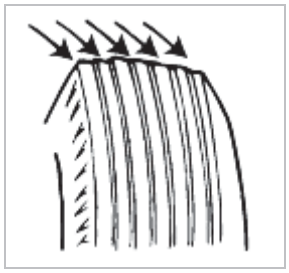
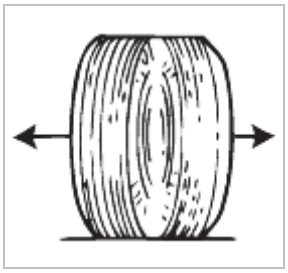
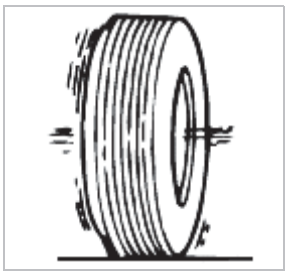
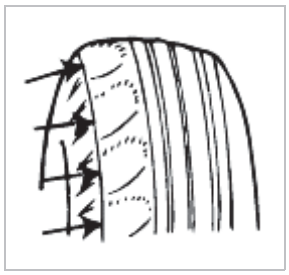
Tool (Number and name)	Illustration	Use
0K2A1 341 001A Coil spring compressure		For removal of front shock absorber spring

TROUBLESHOOTING

Symptoms	Possible causes	Remedy
Excessive vehicle rolling	Broken or deteriorated stabilizer	Replace
	Damaged shock absorber	Replace
Abnormal noise	Loose mounting parts	Retighten
	Broken or worn wheel bearing	Replace
	Shock absorber malfunction	Replace
	Damaged tire	Replace
Poor riding	Excessive tire inflation pressure	Adjust the tire inflation the pressure
	Shock absorber malfunction	Replace
	Loose wheel nut	Tighten to the specified torque
	Distorted or broken coil spring	Replace
	Damaged tire	Replace
	Worn bushing	Replace
Vehicle leans to one side	Deformed arm assembly	Replace
	Worn bushing	Replace
	Distorted or broken coil spring	Replace
Hard steering	Improper front wheel alignment	Repair
	Excessive turning resistance of lower arm ball joint	Replace
	Lack of tire inflation pressure	Adjust
	Power steering malfunction	Repair or Replace
Wandering	Improper front wheel alignment	Repair
	Worn or loose lower arm bushing	Retighten or Replace
Bottoming	Broken or worn coil spring	Replace

DIAGNOSIS (TIRES/WHEELS)

Problem	Possible Cause	Action
Rapid wear at shoulders 	Under-inflation or lack of rotation 	Adjust the tire pressure
Rapid wear at center	Over-inflation or lack of rotation	

		
Cracked treads 	Under-inflation	
Wear on one side 	Excessive camber 	Inspect the camber
Feathered edge 	Incorrect toe 	Adjust the toe-in
Bald spots 	Unbalanced wheel 	Adjust the imbalanced wheels
Scalloped wear 	Lack of rotation of tires or worn or out-of-alignment suspension	Rotate the tires inspect the front suspension alignment

SPECIFICATIONS

FRONT SUSPENSION

Item			Specification
Suspension type			Double wishbone coil spring
Shock absorber	Type		Gas pressurized
	Stroke		112mm (4.41in.)
	Damping force(Piston speed: 0.3m/s)	Compression	82±15kg (804±147N)
		Extension	124±18kg (1217±177N)
	I.D. color		Red
Coil spring	Free height		341.8mm
	I.D. color		Red

REAR SUSPENSION

Item			Specification
Suspension type			5 link coil spring
Shock absorber	Type		Gas pressurized
	Stroke		186mm (7.32in.)
	Damping force (Piston speed: 0.3m/s)	Compression	78±14kg (765±137N)
		Extension	158±23kg (1550±226N)
	I.D. color		Yellow
Shock absorber (Self levelizer)	Type		Gas pressurized
	Stroke		180mm (7.09in.)
	Damping force (Piston speed: 0.3m/s)	Compression	36±9kg (350±85N)
		Extension	175±23 (1710±220N)
	I.D. color		Yellow
Coil spring	Free height		353.9mm (13.93in.)
	I.D. color		Blue
Coil spring (Self levelizer)	Free height		360.4mm (14.19in.)
	I.D. color		Purple

WHELL AND TIRE

Item		Specification
Tire		225/75 R16
		245/70 R16
		245/65 R17
Wheel		7.0J × 16
		7.0J × 17
Tire pressure	Front	2.1kg/cm² (30psi)
	Rear	2.1kg/cm² (30psi)

WHEEL ALIGNMENT

TYPE		SPECIFICATION
Front	Toe	0°±0.2° (0±0.079in.)
	Camber angle	0°±0.5°
	Caster angle	3.89°±0.5°
	King pin angle	12.13°
Rear	Camber	0.5°±0.5°
	Toe-in	0° ± 0.2° (0±0.079)

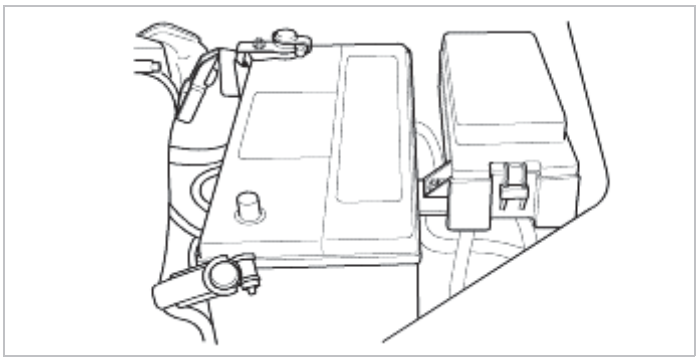
KIA MOTORS

Suspension System

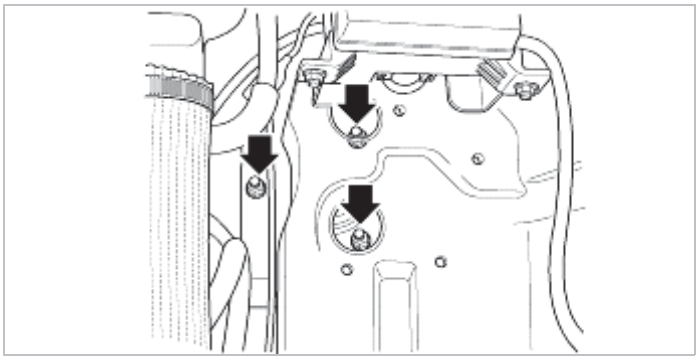
Front Suspension System - Front Strut Assembly

REMOVAL

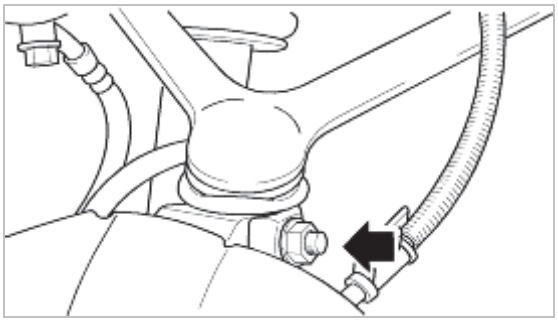
1. Loosen battery cable and mounting bolt and then remove battery.



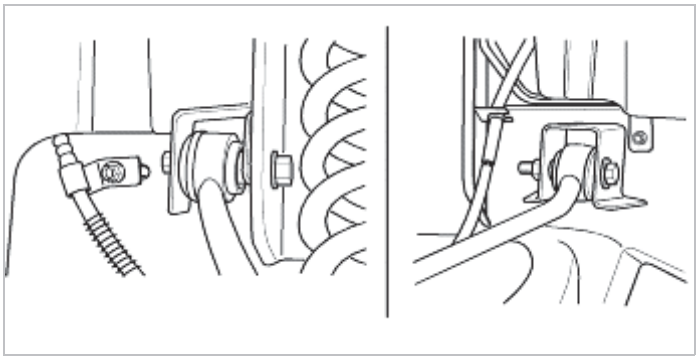
2. Remove three shock absorber mounting block nuts from the mounting block.



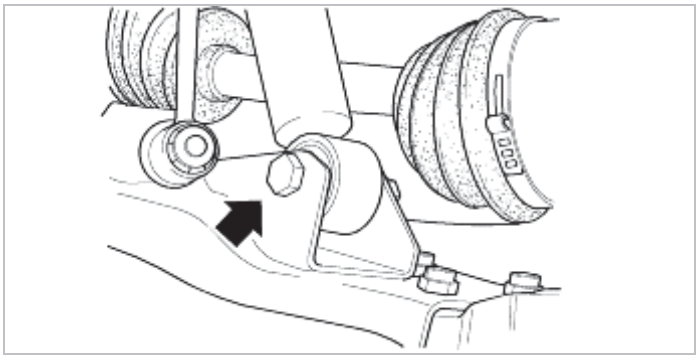
3. Raise the front of the vehicle and support it with safety stands.
4. Remove the front wheels.
5. Remove the bolt on the steering knuckle side that secures the upper arm ball joint.



6. Remove the brake hose bracket and then the remove the upper arm bolts and nuts.



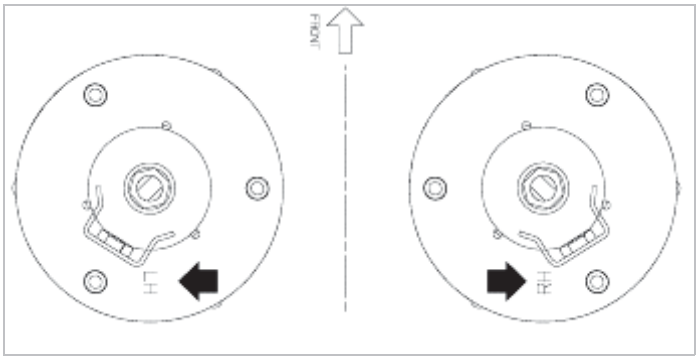
7. Remove the shock absorber lower nut.



8. Remove the spring and shock absorber assembly from the vehicle as an assembly.

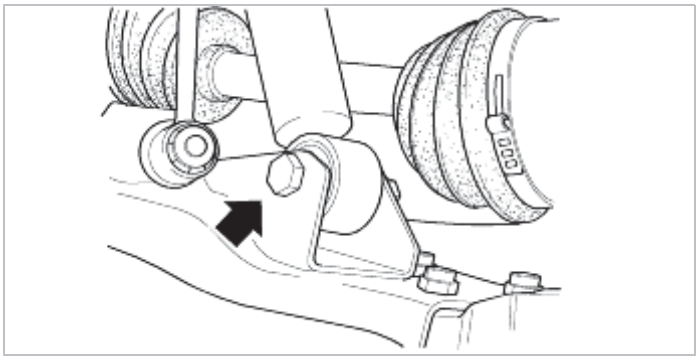
INSTALLATION

1. After making sure identification mark on the spring seat. Position the spring and shock absorber assembly into the upper mounting block.

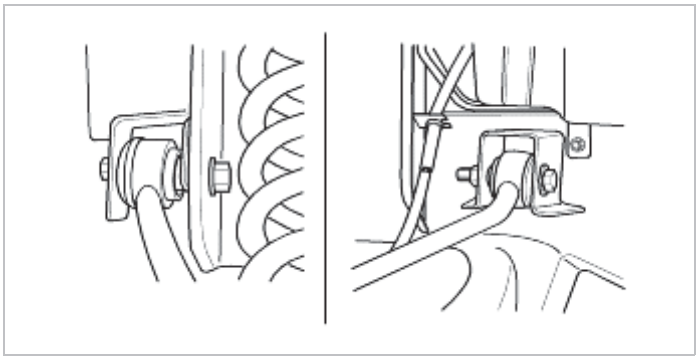


2. Install the mounting block nuts by 3-4 threads only.
3. Insure the front of the vehicle is raised and supported with safety stands.
4. Tighten the lower nut of the shock absorber.

Tightening torque :
122-140 N·m (12.2-14 kg·m, 88-101 lb·ft)

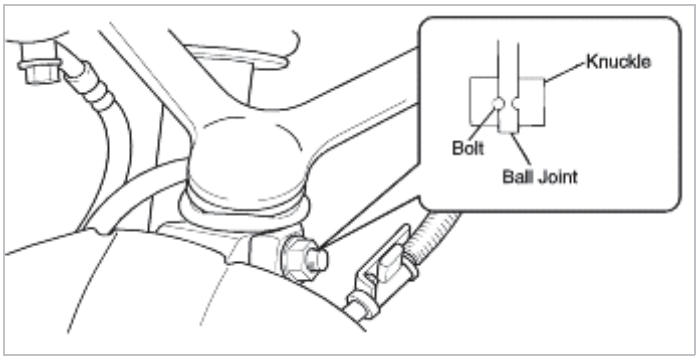


5. Position the upper arm to the frame brackets, insert the bolts and hand tighten the nuts.



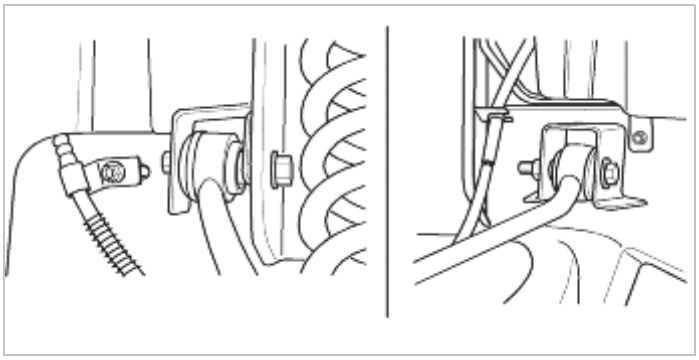
6. Install the upper arm ball joint into the top of the steering knuckle and tighten the side bolt and nut.

Tightening torque :
45-55 N·m (4.4-5.5 kg·m, 31-39 lb·ft)



7. Tighten the upper arm bolts and nuts and then install brake hose brackets.

Tightening torque :
76-95 N·m (7.6-9.5 kg·m, 54-68 lb·ft)

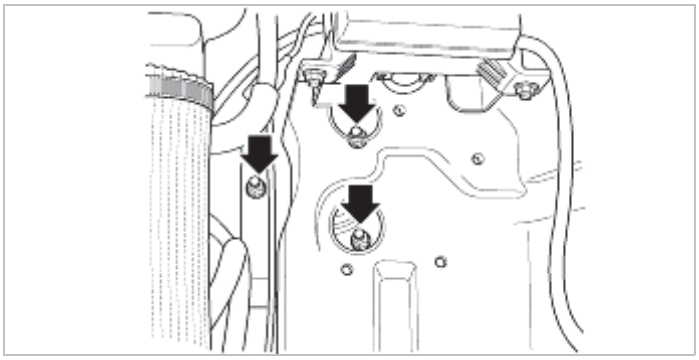


8. Install the wheels and secure with lock nuts.

Tightening torque :
90-120 N·m (9-12 kg·m, 65-86 lb·ft)

9. Lower the vehicle.
10. Tighten the mounting block nut.

Tightening torque :
44-55 N·m (4.4-5.5 kg·m, 31-39 lb·ft)



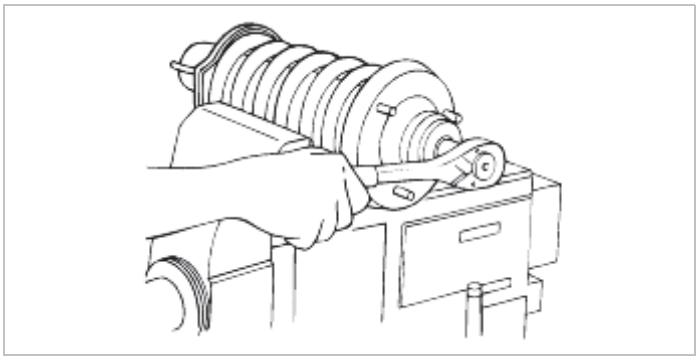
11. Install the battery mounting bracket and the battery.
12. After installing the front shock absorber and coil spring assembly, measure the wheel alignment and adjust if necessary.

DISASSEMBLY

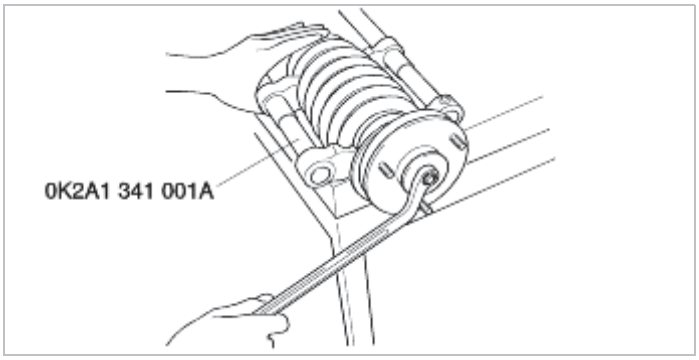
1. Secure the shock absorber in a suitable vise.
2. Loosen the piston rod nut several turns.

NOTICE

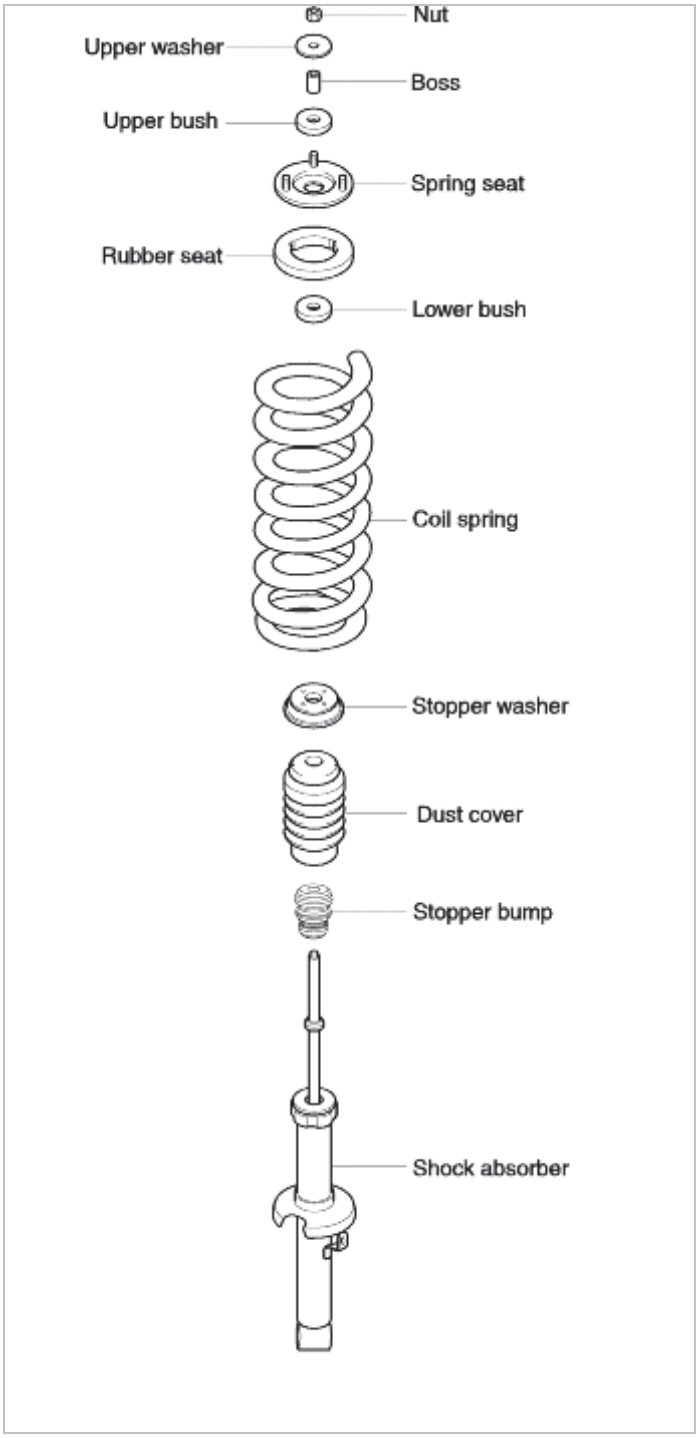
- Use copperplate in the jaws of the vise to protect the shock absorber bottom bracket.
- Remove the piston rod nut until coil spring is compressed and secured.



3. While still secured in a vise, compress the coil spring with SST.

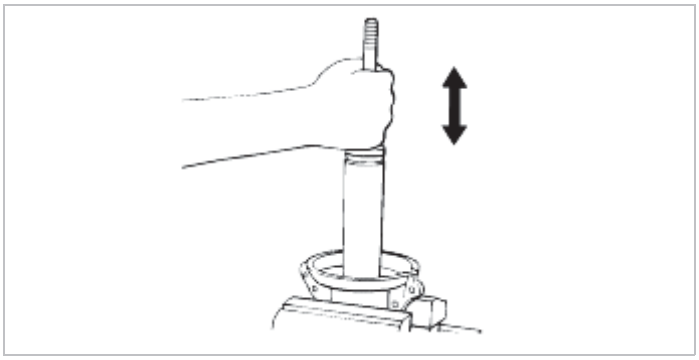


4. Remove the piston rod nut and each part as below.

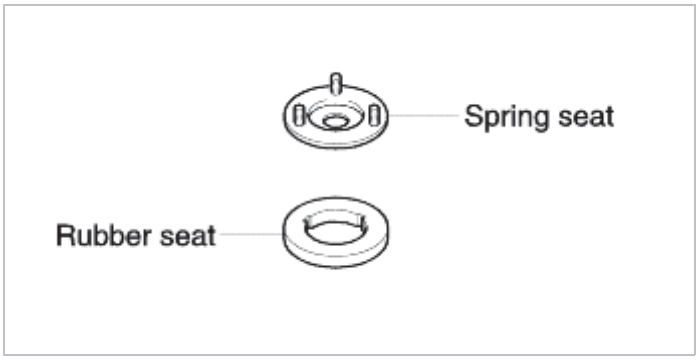


INSPECTION/REBUILD

1. Secure a handle to the shock absorber piston rod and compress and lift the rod three times with a constant speed. Inspect for uniform working force and abnormal noise.

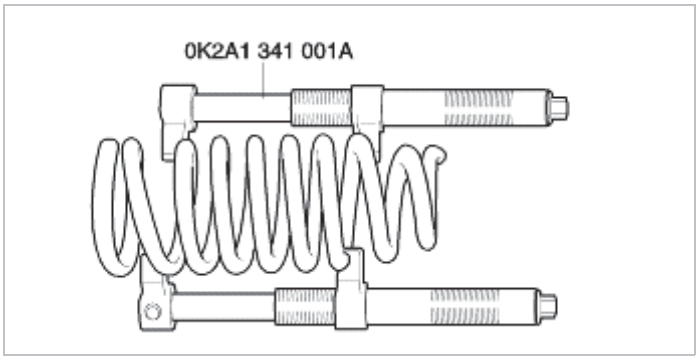


2. Inspect the entire shock absorber for signs of oil leakage; replace if required.
3. Inspect the coil spring for stress cracks and/or other damage.
4. Inspect for damage or deterioration of the upper and lower bushes.
5. Inspect for damage or tearing of the spring seat and rubber seat.



ASSEMBLY

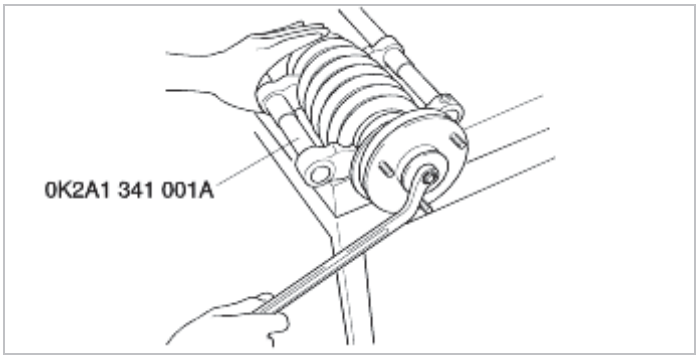
1. Secure the bottom portion of the shock absorber in a vise and compress the coil spring with SST.



NOTICE

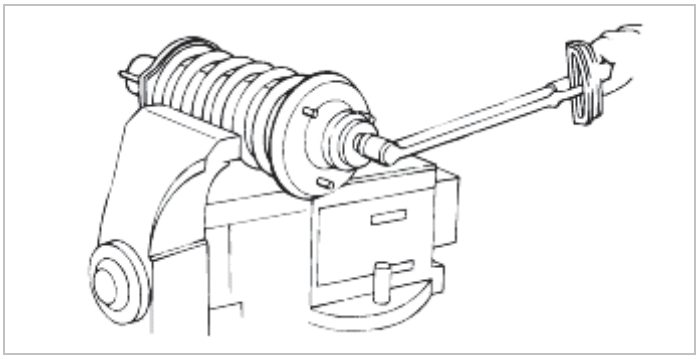
Use copperplate in the jaws of the vise to protect the shock absorber bottom bracket.

2. Set the end of the coil spring to the rubber seat and install the coil spring.
3. Assemble stopper bump, dust cover, stopper washer, lower bush, rubber seat, spring seat, boss, upper bush and upper washer in sequence.
4. Hand tighten the piston rod nut.



5. Carefully loosen the coil spring compressor and remove it.
6. With the bottom bracket of the shock absorber still in the vice, tighten the piston rod nut.

Tightening torque :
76-95 N·m (7.6-9.5 kg·m, 54-68 lb·ft)



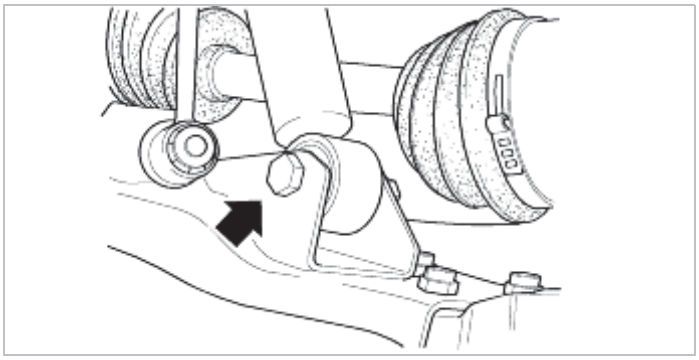
KIA MOTORS

Suspension System

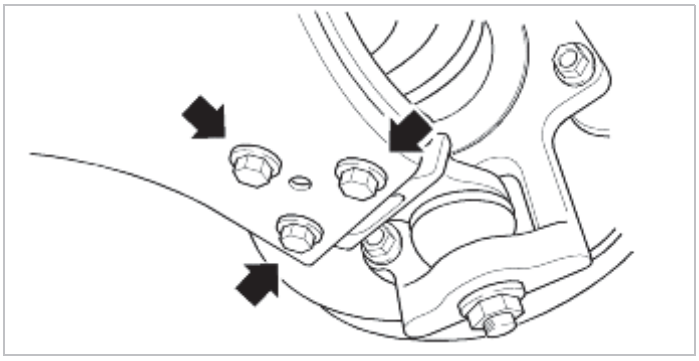
Front Suspension System - Front Lower Arm

REMOVAL

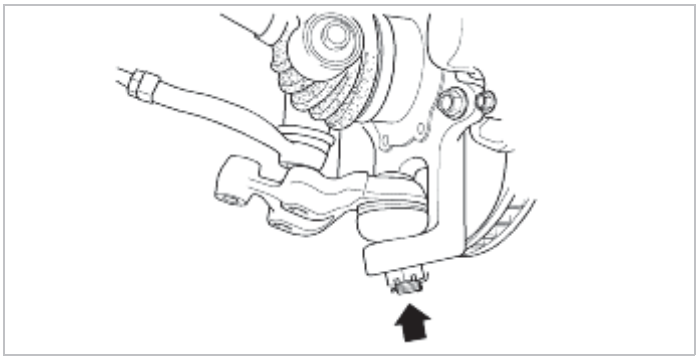
1. Raise the front of the vehicle and support it with safety stands.
2. Remove the front wheels.
3. Remove the lower nut of control link of stabilizer bar.
4. Remove the lower nut of shock absorber.



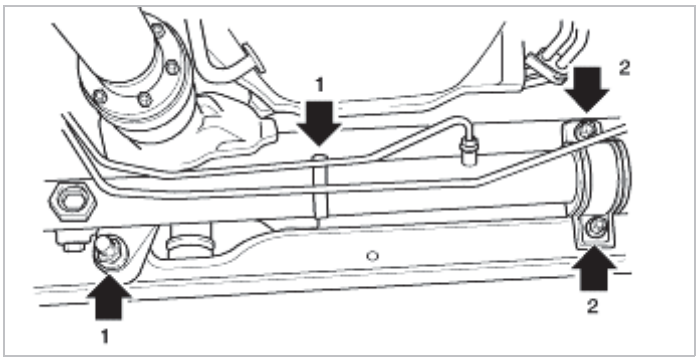
5. Remove the bolts and nuts that joins lower arm and lower arm ball joint.



6. Remove the cotter pin and castle nut from the lower arm ball joint.

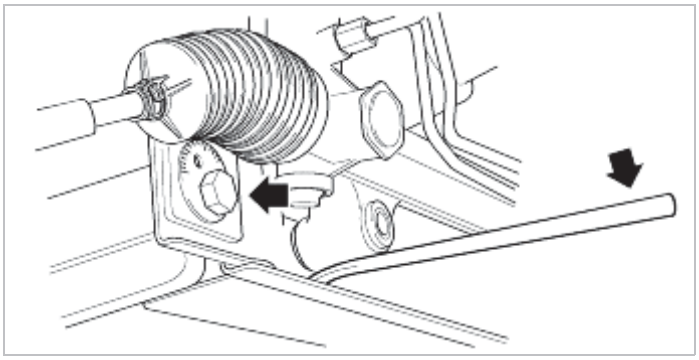


7. Remove the lower arm ball joint from the steering knuckle with SST.
8. Remove the steering gear mounting bolts and nuts.



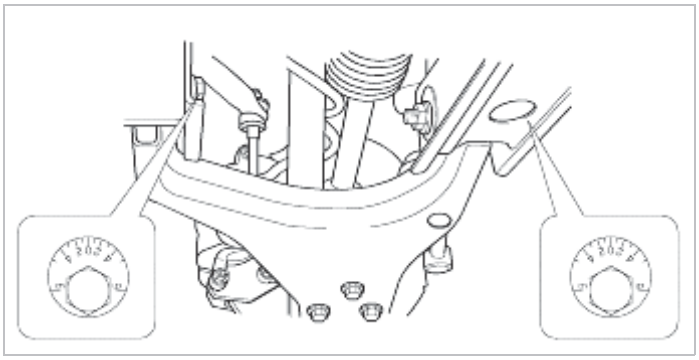
9. Remove the spindle from the front frame crossmember brackets during raising the steering gear box by using

suitable bar.



NOTICE

Before loosening the nuts of the spindles, make note of the numerical setting and mark the location on the frame bracket and plate so it can be re-installed to the same setting and location.



10. Remove the lower arm.

BUSHING REPLACEMENT

1. For bushing removal, utilize a standard bearing press.
2. Install the new bushing using a standard bearing press.

NOTICE

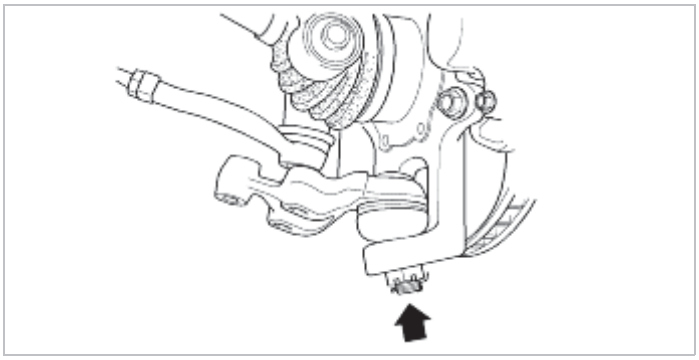
Apply lubricant to the new bushings prior to installation.

INSTALLATION

1. Install the lower arm ball joint to the steering knuckle.

Tightening torque :
160-180 N·m (16-18 kg·m, 115-130 lb·ft)

2. Install a new cotter pin through the castle nut.

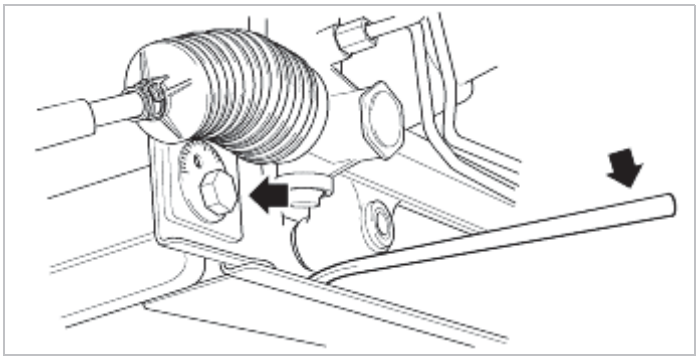


3. Position the lower arm to the front frame crossmember brackets and then position the spindle during lift up the

steering gear box by using suitable bar.

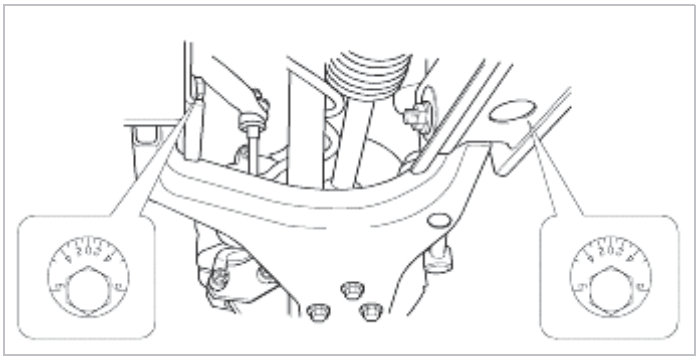
4. Install the lower arm spindles.

Tightening torque :
265-305 N·m (26.5-30.5 kg·m, 191-220 lb·ft)



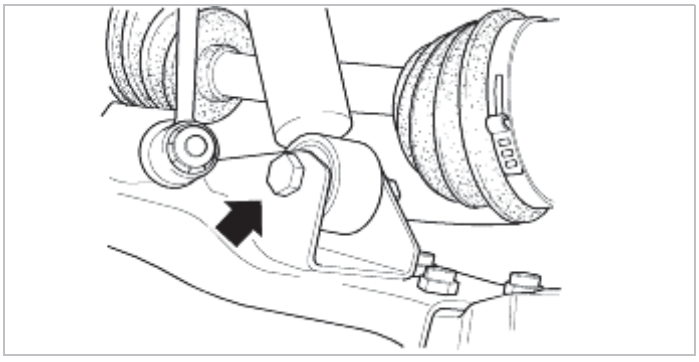
NOTICE

Align the spindle to the numerical setting and marked location on the frame bracket and plate so the same setting and location is maintained.



5. Install the lower nut of the shock absorber.

Tightening torque :
122-140 N·m (12.2-14 kg·m, 88-101 lb·ft)



6. Install the lower nut of control link of stabilizer bar.

Tightening torque :
95-117 N·m (9.5-11.7 kg·m, 68-84 lb·ft)

7. Install the wheels and secure the lock nuts.

Tightening torque :
90-120 N·m (9-12 kg·m, 65-86 lb·ft)

8. Remove the safety stands and lower the vehicle.

NOTICE

After installation, measure the wheel alignment and adjust if necessary. Refer to "Wheel Alignment" in this section.

INSPECTION

1. Inspect for worn or deteriorated lower arm bushings.
2. Inspect for bent, cracked or damaged lower arm.
3. Inspect for worn or damaged ball joint.
4. Replace if damaged, deformed or cracked; replace bushing if worn or deteriorated. Refer to "Bushing Replacement" in the following procedure.

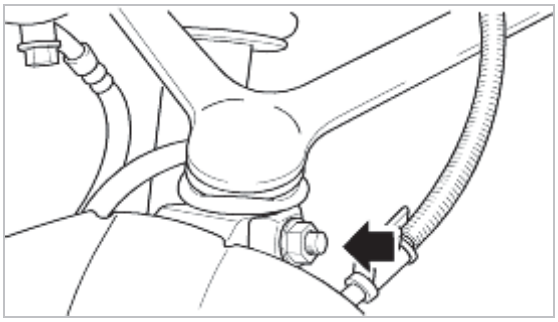
KIA MOTORS

Suspension System

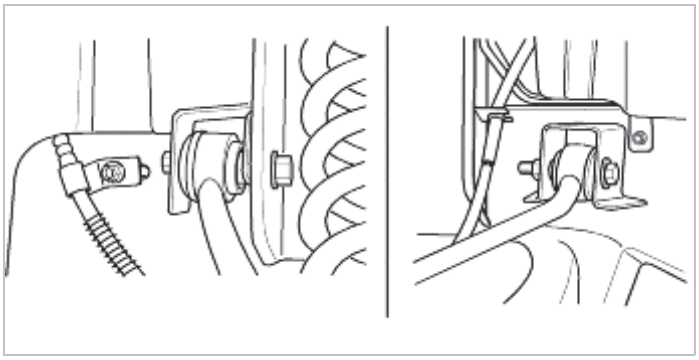
Front Suspension System - Front Upper Arm

REMOVAL

1. Raise the front of the vehicle and support it with safety stands.
2. Remove the front wheels.
3. Remove the bolt on the steering knuckle side that secures the upper arm ball link.



4. Remove the brake hose bracket and then remove the upper arm bolts and nuts.



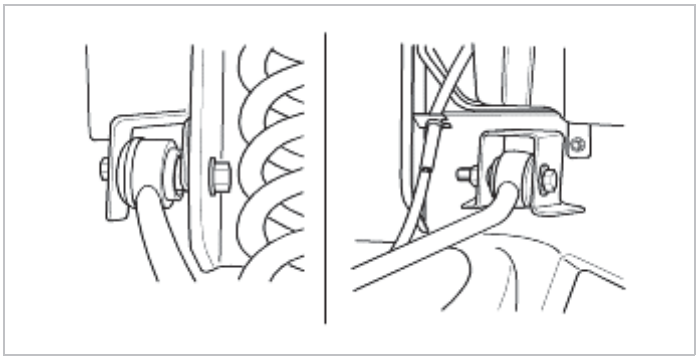
REPLACING THE BUSHING

1. Secure the upper arm in a suitable vise.
2. Using a standard bearing press, remove the old bushing.
3. Install the new bushing and then press it into the upper arm with a standard bearing press.

> NOTICE
>
> Apply lubricant to the new bushings to facilitate insertion into the upper arm.
> The upper arm ball joint link and dust boot are non-replaceable items. Replace the upper arm if these items are damaged and/or deteriorated.

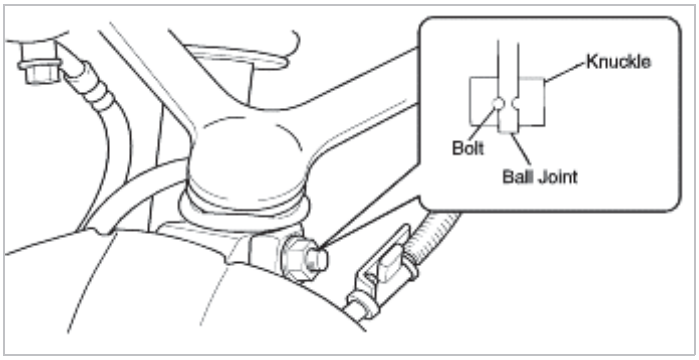
INSTALLATION

1. Raise the front of the vehicle and support it with safety stands.
2. Position the upper arm to the frame brackets, insert the bolts and hand tighten the nuts.



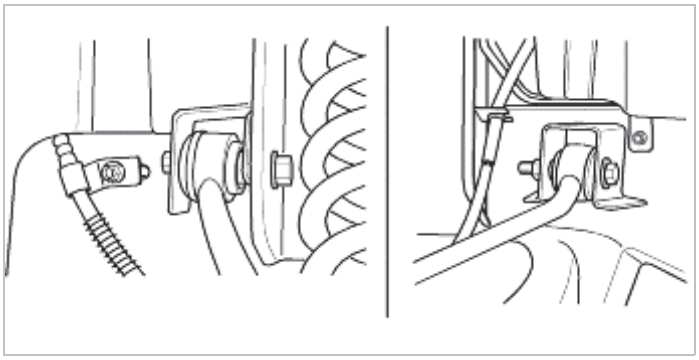
3. Install the upper arm ball joint into the top of the steering knuckle and tighten the side bolt and nut.

Tightening torque :
44-55 N·m (4.4-5.5 kg·m, 31-39 lb·ft)



4. Tighten the upper arm bolts and nuts and then install brake hose brackets.

Tightening torque :
76-95 N·m (7.6-9.5 kg·m, 54-68 lb·ft)



5. Install the wheels and secure with lock nuts.

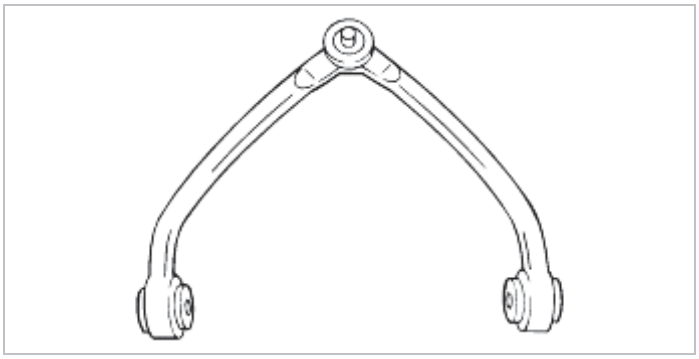
Tightening torque :
90-120 N·m (9-12 kg·m, 65-86 lb·ft)

NOTICE

After installation, measure the wheel alignment and adjust if necessary. Refer to "Wheel Alignment" in this section.

INSPECTION

1. Inspect for bent, cracked or otherwise damaged upper arm.
2. Inspect for worn or deteriorated upper arm bushing.
3. Inspect for worn or damaged ball link and replace if damaged, deformed or cracked.
4. Replace bushings if worn or deteriorated. Refer to "Replacing the Bushing" in the following procedure.



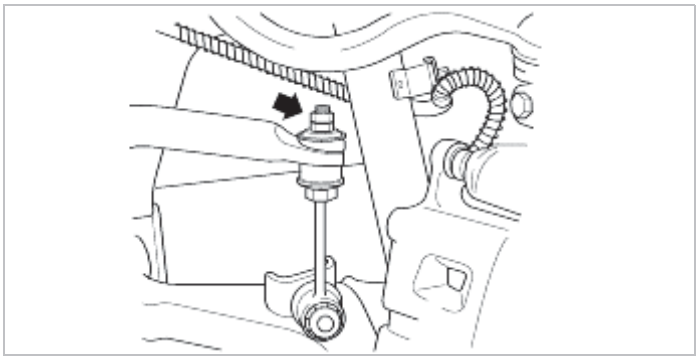
KIA MOTORS

Suspension System

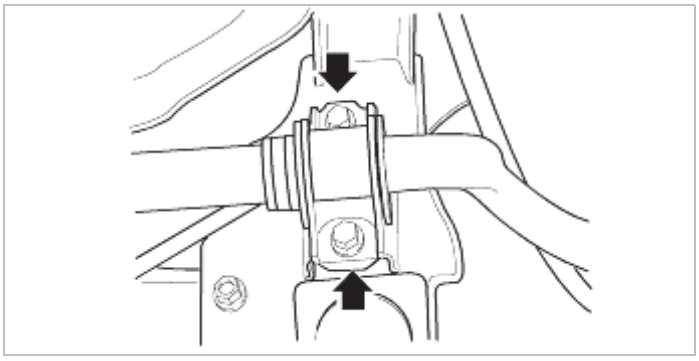
Front Suspension System - Front Stabilizer Bar

REMOVAL

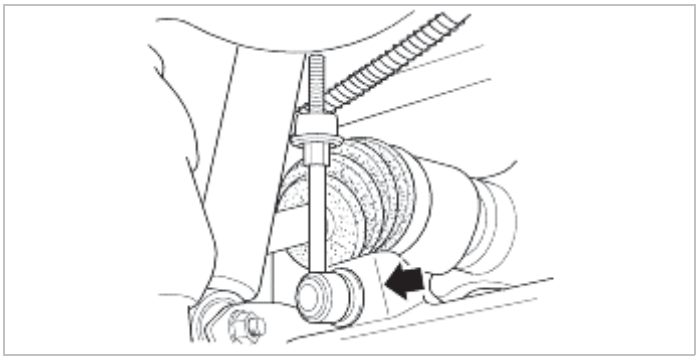
1. Raise up the front of the vehicle and support it with safety stands.
2. Remove the wheels.
3. Remove the undercover.
4. Remove the nuts and oil damper rubbers of control link.



5. Remove the stabilizer bar bushing brackets and then remove the stabilizer bar.



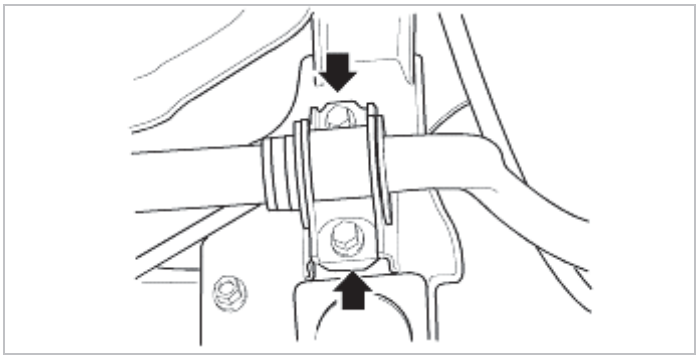
6. Remove the control link from the lower arm.



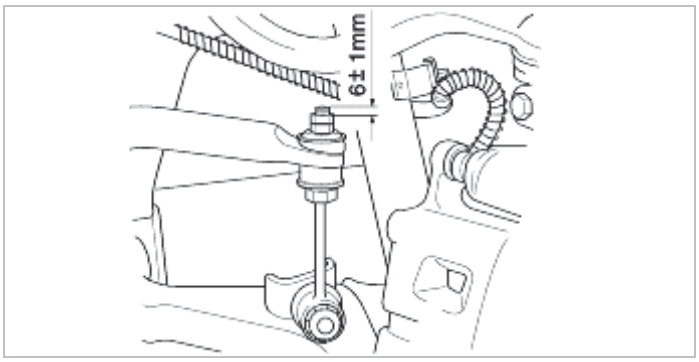
INSTALLATION

1. Position the control links to the lower arm.
2. Loosely tighten the control link nuts.
3. Install the stabilizer bar on the control link.
4. Align the clamp bushing inside of stabilizer bushing and install bracket.

Tightening torque :
44-55 N·m (4.4-5.5 kg·m, 31-39 lb·ft)



5. Install the oil damper rubber and nut, and then tighten to the specified length.

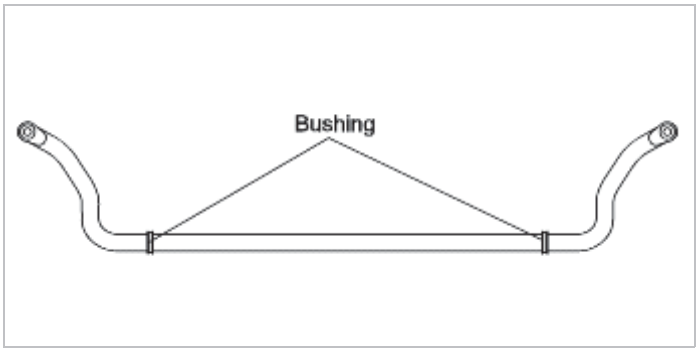


6. Tighten the lower nut of control link.

Tightening torque :
95-117 N·m (9.5-11.7 kg·m, 68-84 lb·ft)

INSPECTION

1. Inspect for bent, cracked or damaged stabilizer bar.
2. Inspect for worn or deteriorated stabilizer bar bushing.



3. Inspect for worn or damaged ball joint of control link.

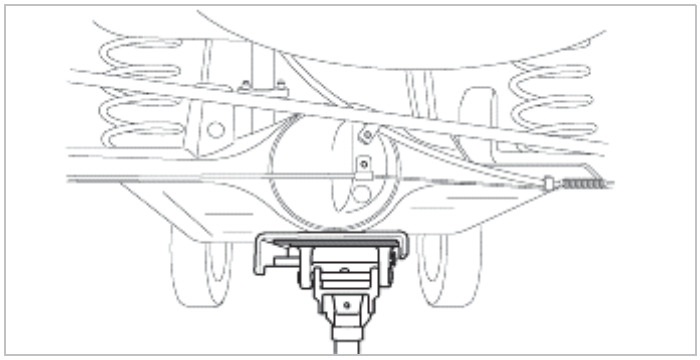
KIA MOTORS

Suspension System

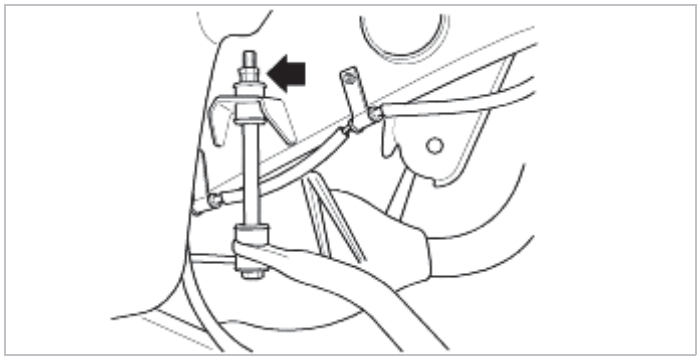
Rear Suspension System - Rear Shock Absorber

REMOVAL

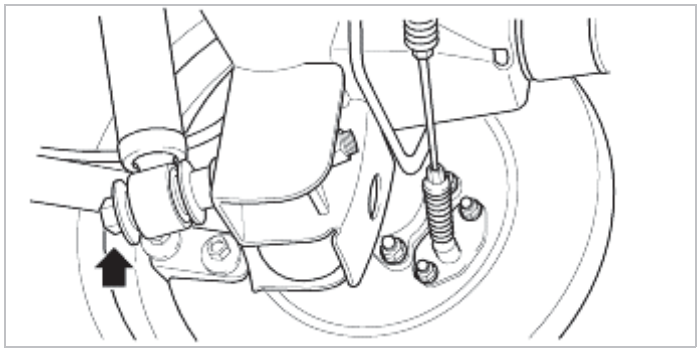
1. Raise the rear of the vehicle and support it with safety stands.
2. Remove the rear wheels.
3. Raise the rear axle housing to facilitate removal of the shock absorbers.



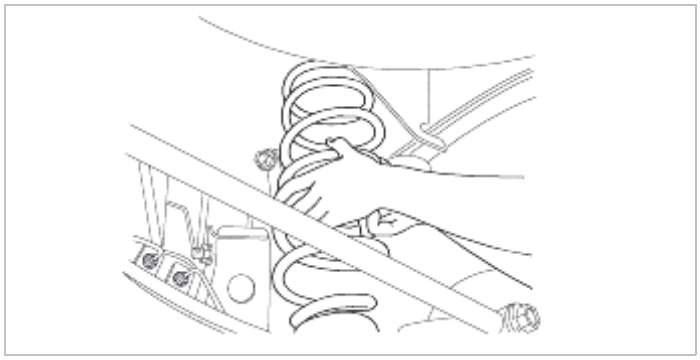
4. Remove stabilizer link upper mounting nut.



5. Remove the rear shock absorber lower nut and washer.



6. Remove the shock absorber upper bolt, and then remove the shock absorber.
7. Lower the rear axle housing slowly to facilitate removal of the coil spring.

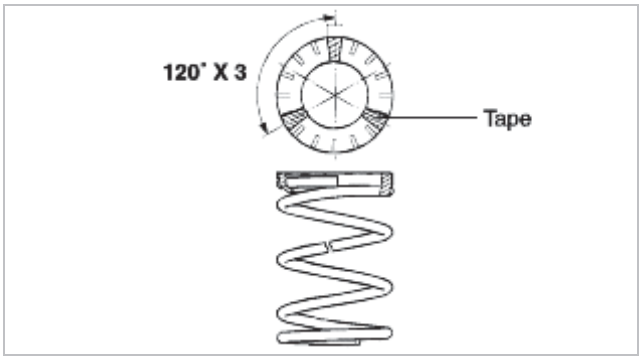


8. Remove the upper rubber seat.

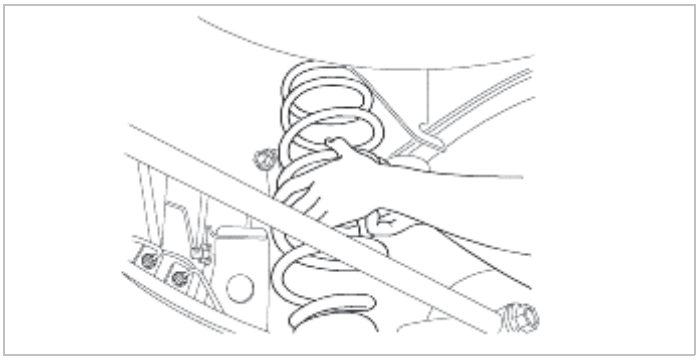
INSTALLATION

1. Position the upper rubber seat to the coil spring.

> **CAUTION**
>
> Align the spring end with the groove of the spring pad and fix the spring and the spring pad by adhering the 3 parts with tape.



2. Slowly raise the rear axle housing while installing the coil spring.

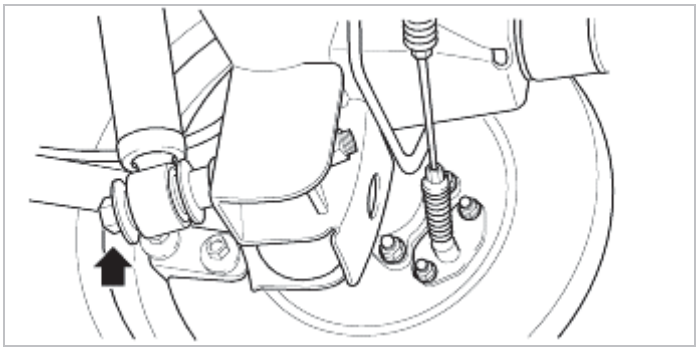


3. Install the shock absorber upper nut.

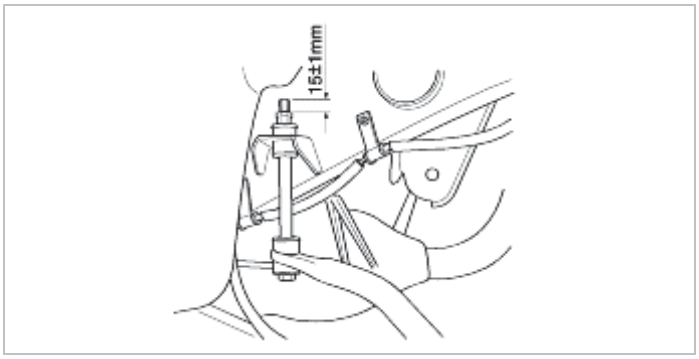
Tightening torque :
122-140 N·m (12.2-14 kg·m, 88-101 lb·ft)

4. Install the shock absorber lower bolt.

Tightening torque :
122-140 N·m (12.2-14 kg·m, 88-101 lb·ft)



5. Install the stabilizer link upper mounting nut to the specified length.



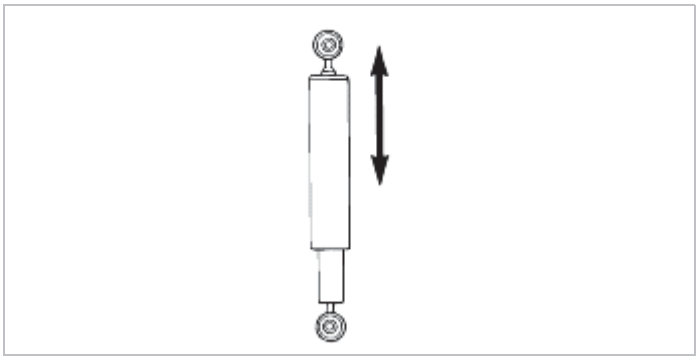
6. Install the wheels and secure with lug nuts.

Tightening torque :
90-120 N·m (9-12 kg·m, 65-86 lb·ft)

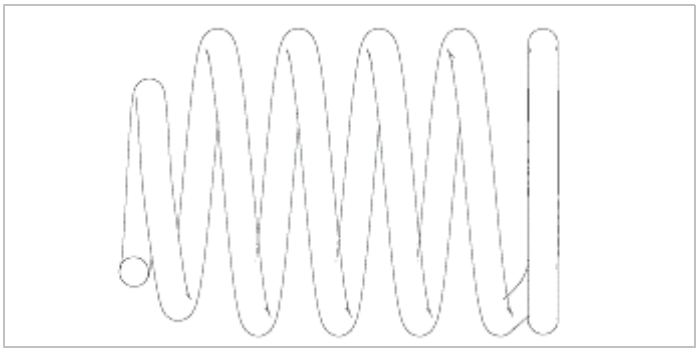
7. Remove the safety stands and lower the vehicle.

INSPECTION

1. Compress and expand the shock absorber three to four times and analyze for uniform working force and abnormal noise.
2. Inspect for gas leakage.



3. Inspect the shock absorber for a worn or deteriorated rubber bushing.
4. Replace the rear shock absorber assembly if a problem is found.
5. Inspect the rear coil spring for bends, cracks or other damage.



6. Inspect the upper rubber seats for tears and/or deterioration.
7. Inspect the rear jounce stop for damage and/or deterioration.
8. Replace if damaged, deformed or cracked; replace bushings if worn or deteriorated.

KIA MOTORS

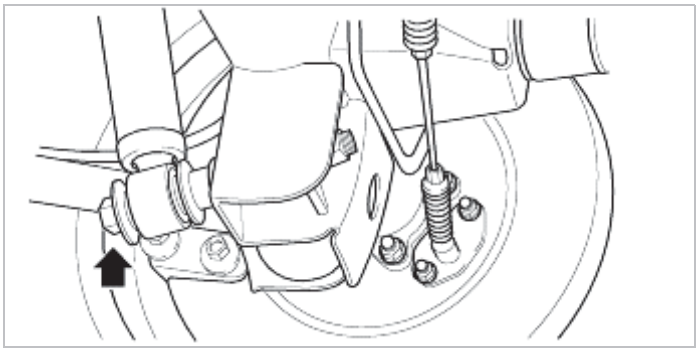
Suspension System

Rear Suspension System - Upper Arm, Lower Arm And Assist Link

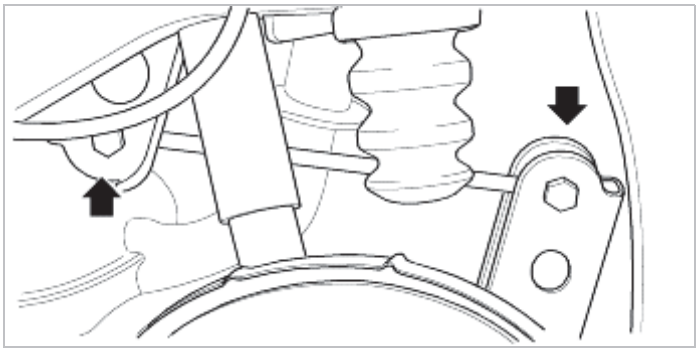
REAR UPPER ARM

Removal

1. Raise the rear of the vehicle and support it with safety stands.
2. Remove the rear wheels.
3. Raise the rear axle housing to facilitate removal of the upper arm.
4. Remove shock absorber lower bolt.

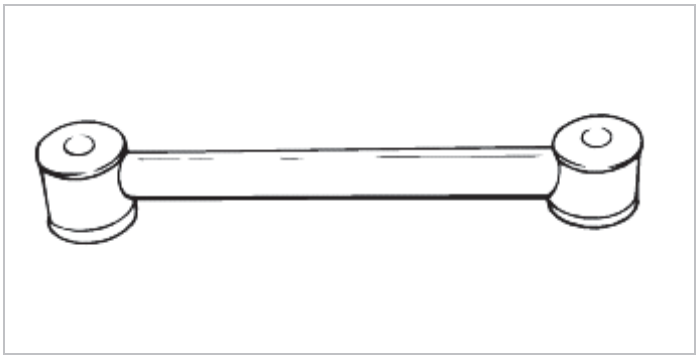


5. Loosen the upper arm bolts and remove the upper arm.



Inspection

1. Inspect the upper arm for bends, cracks and/or other damage.
2. Inspect the upper arm bushings for wear and/or deterioration.
3. Replace if damaged, deformed or cracked; replace bushings if worn or deteriorated. Refer to Bushing Replacement in the following procedure.



Bushing Replacement

1. Press out the bushing using a standard bearing press.
2. Apply soapy water to the bushing and press into place using a standard bearing press.

Installation

1. Install the upper arm and the bolts.

Tightening torque :
122-140 N·m (12.2-14 kg·m, 88-101 lb·ft)

2. Install shock absorber lower bolt.

Tightening torque :
122-140 N·m (12.2-14 kg·m, 88-101 lb·ft)

3. Lower the rear axle housing.
4. Install the wheels and secure with lug nuts.

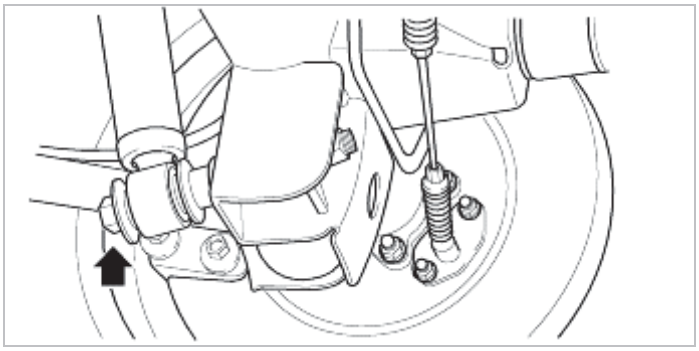
Tightening torque :
90-120 N·m (9-12 kg·m, 65-86 lb·ft)

5. Remove the safety stands and lower the vehicle.

REAR LOWER ARM

Removal

1. Raise the rear of the vehicle and support it with safety stands.
2. Remove the rear wheels.
3. Raise the rear axle housing to facilitate removal of the lower arm.
4. Remove shock absorber lower bolt.



5. Remove wheel speed sensor cable from rear lower arm.
6. Loosen the lower arm bolts and remove the lower arm.

Inspection

1. Inspect the lower arm for bends, cracks and/or other damage.
2. Inspect the lower arm bushings for wear and/or deterioration.
3. Replace if damaged, deformed or cracked; replace bushings if worn or deteriorated. Refer to Bushing Replacement in the following procedure.

Bushing Replacement

1. Press out the bushing using a standard bearing press.
2. Apply lubricant to the bushing and press into place using a standard bearing press.

Installation

1. Install the lower arm and the bolts.

Tightening torque :
122-140 N·m (12.2-14 kg·m, 88-101 lb·ft)

2. Install wheel speed sensor cable to the rear lower arm.

3. Install shock absorber lower bolt.

Tightening torque :
122-140 N·m (12.2-14 kg·m, 88-101 lb·ft)

4. Lower the rear axle housing.
5. Install the wheels and secure with lug nuts.

Tightening torque :
90-120 N·m (9-12 kg·m, 65-86 lb·ft)

6. Remove the safety stands and lower the vehicle.

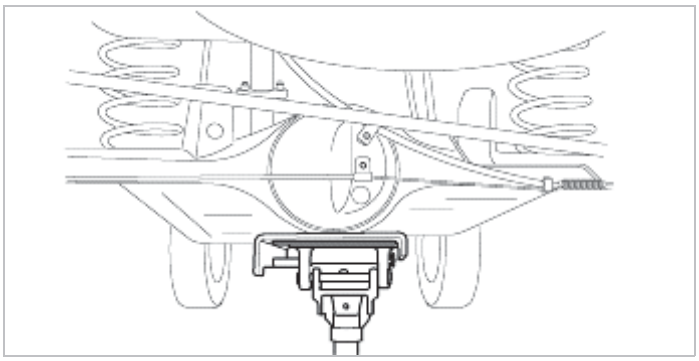
KIA MOTORS

Suspension System

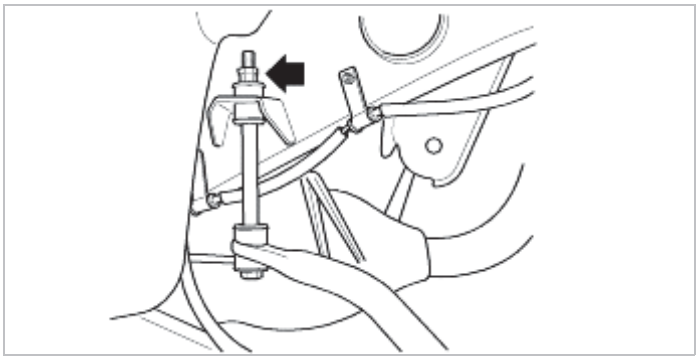
Rear Suspension System - Rear Stabilizer Bar

REMOVAL

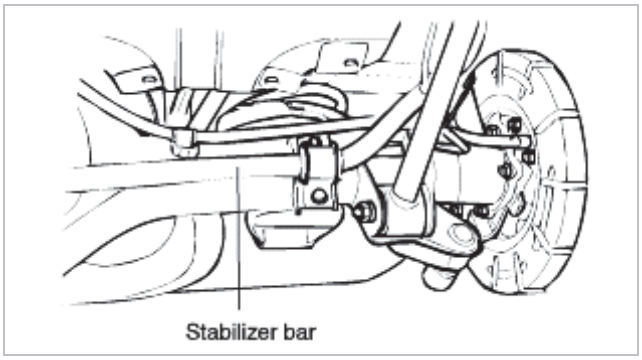
1. Support the bottom of the rear differential carrier with a jack.



2. Remove the stabilizer link mounting nut.



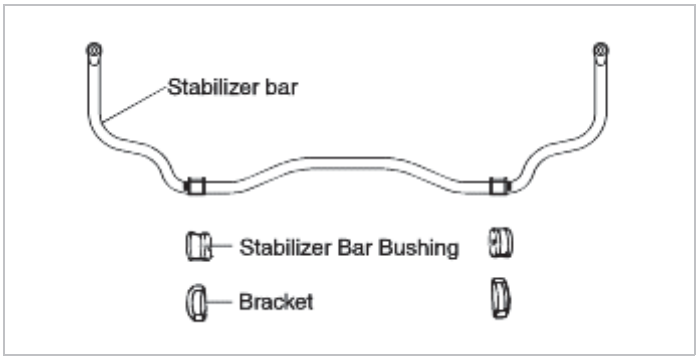
3. Remove the stabilizer bar bushing bracket.



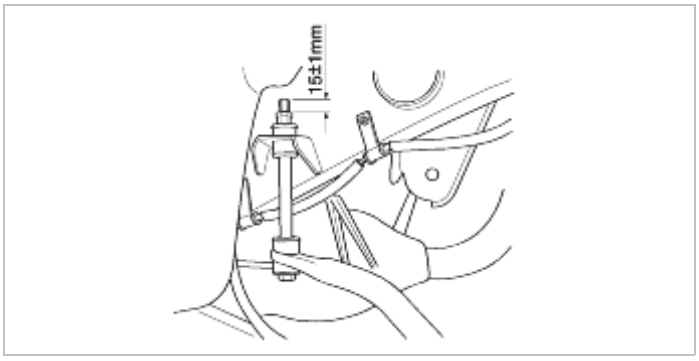
INSTALLATION

1. Align the identification mark white paint on stabilizer bar with bushing and install the stabilizer bar bushing bracket.

Tightening torque :
19-23N·m (1.9-2.3 kg·m, 13-16lb·ft)



2. Install the joint cup and nut and then tighten to the specified length.



KIA MOTORS

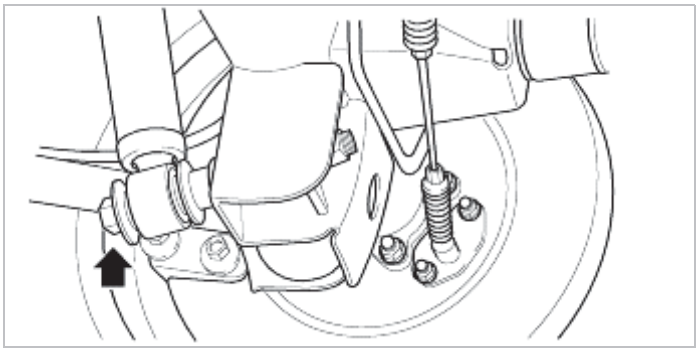
Suspension System

Rear Suspension System - Lateral Rod

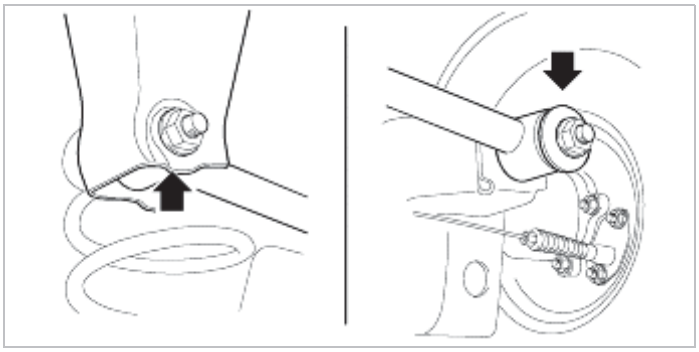
LATERAL ROD

Removal

1. Raise the rear of the vehicle and support it with safety stands.
2. Remove the rear wheels.
3. Raise the rear axle housing to facilitate removal of the lateral rod.
4. Remove shock absorber lower bolt.

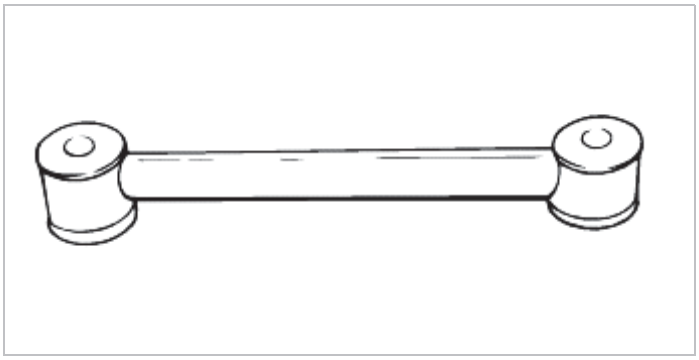


5. Loosen the lateral rod bolts and remove the lateral rod.



Inspection

1. Inspect the lateral rod for bends, cracks and/or other damage.



2. Inspect the lateral rod bushings for wear and/or deterioration.
3. Replace if damaged, deformed or cracked; replace bushings if worn or deteriorated. Refer to "Bushing Replacement" in the following procedure.

Bushing Replacement

1. Press out the bushing using a standard bearing press.
2. Apply lubricant to the bushing and press into place using a standard bearing press.

Installation

1. Install the lateral rod and the bolts.

Tightening torque :
187-215 N·m (18.7-21.5 kg·m, 135-155 lb·ft)

2. Install shock absorber lower bolt.

Tightening torque :
122-140 N·m (12.2-14.0 kg·m, 88-101 lb·ft)

3. Lower the rear axle housing.
4. Install the wheels and secure with lug nuts.

Tightening torque :
90-120 N·m (9-12 kg·m, 65-86 lb·ft)

5. Remove the safety stands and lower the vehicle.

KIA MOTORS

Suspension System

Tires/Wheels

FRONT WHEEL ALIGNMENT

WARNING

PROVIDE SUFFICIENT SUPPORT FOR THE VEHICLE TO REDUCE THE POSSIBILITY OF THE VEHICLE FALLING, CAUSING PERSONAL INJURY OR DEATH.

Wheel alignment refers to the angular relationship between the wheels, control arms, suspension and the ground. It deals with tire camber, caster, toe-in and wheel balancing. Proper wheel alignment and wheel balance insures a safe, quiet ride with minimal tire wear. This section assumes that all components are in good working condition. Performing this exercise may also detect any problem areas in the front suspension. It is advisable to replace defective components before attempting a wheel alignment.

Inspection

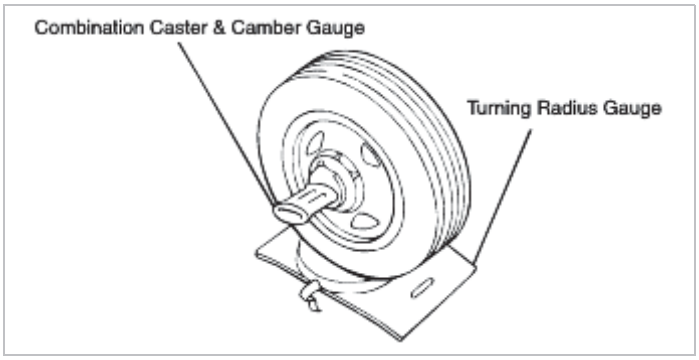
1. Inspect tires for proper balance and inflation. Balance tires and set to the recommended pressure if necessary.
2. Inspect front wheel bearing play and reduce the bearing play; replace any defective bearings.
3. Inspect for any excessive looseness of the ball joints and steering center link.
4. Place the vehicle on level ground and confirm that there are no passengers or luggage on board.
5. Push down on the front of the vehicle to determine the correct operation of the shock absorbers.

CAMBER

Inspection (Camber)

1. Position the vehicle so that the front wheel is on the turning-radius gauge.
2. Remove wheel cover.
3. Attach the standard camber gauge to the hub and measure the camber.

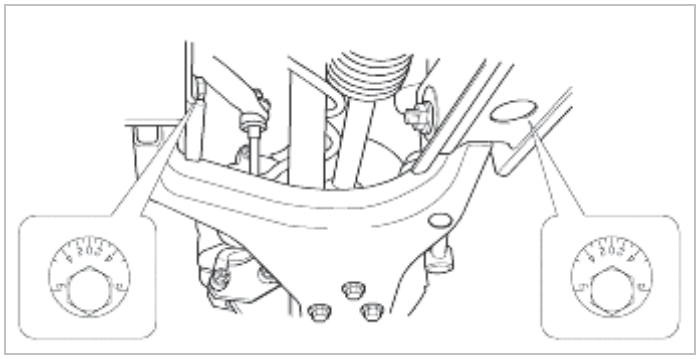
Camber :
0.39 ± 0.5° (No Passenger Load)
0° (2 Passenger Load)



Adjustment (Camber)

1. Turn the front spindle clockwise so that the number "1" mark is aligned with the vertical line on the spindle bracket.
2. Turn the rear spindle clockwise so that the number "1" mark is aligned with the vertical line on the spindle bracket.

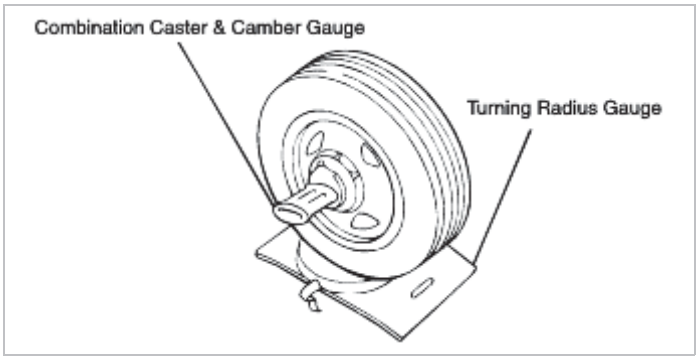
Each numerical point indicated on the spindle increases the camber by 0.18 degrees when turned to the vertical line on the spindle bracket.



CASTER

Inspection (Caster)

1. Position the vehicle so that the front wheel is on the turning-radius gauge.
2. Remove the wheel cover.



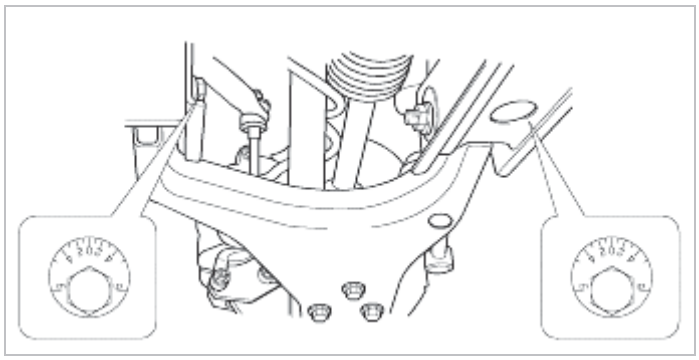
3. Attach a standard caster gauge to the hub and measure the caster.

Caster :
3.30° ± 0.5° (No Passenger Load)
3.55° (2 Passenger Load)

Adjustment (Caster)

1. Turn the front spindle clockwise until the number "1" mark is aligned with the vertical line on the spindle bracket.
2. Turn the rear spindle counter-clockwise until the number "1" mark is aligned with the vertical line on the spindle bracket.

Each numerical point indicated on the spindle increases the caster by 0.23 degrees when turned to the vertical line.



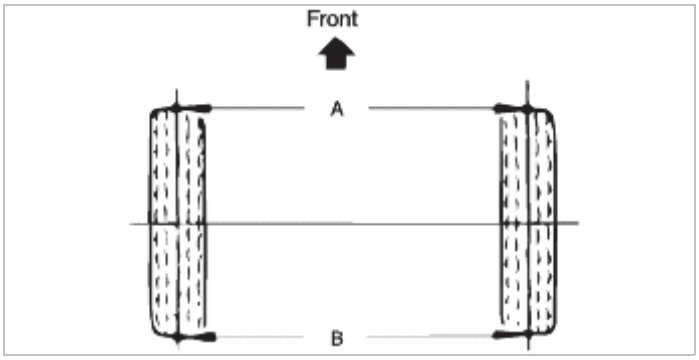
TOE-IN

INSPECTION (TOE-IN)

1. Position the vehicle on level ground and place the front wheels in a straight-ahead position within ± 5 degrees.
2. Measure the toe-in with a standard toe-in gauge.

Toe-in (B-A) :

0°±0.2°(0±0.079in.)
(No Passenger Load)
0 in. (0°)
(2 Passenger Load)

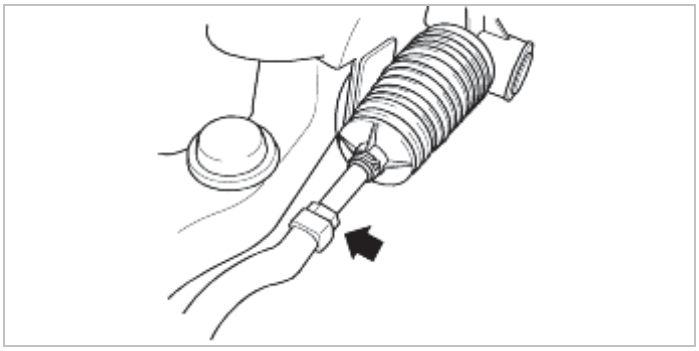


ADJUSTMENT (TOE-IN)

1. Loosen the left and right tie-rod lock nuts.
2. Toe to specifications by turning the tie-rod by the center adjuster.
3. Tighten the left and right tie-rod lock nuts.

Tightening torque :
50-55 N·m (5.0-5.5 kg·m, 36-39 lb·ft)

4. Repeat adjustment instructions for opposite side.



KIA MOTORS

Suspension System

Tires/Wheels - Tire

TIRE WEAR

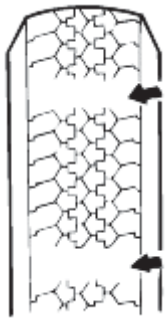
1. Measure the tread depth of the tire.

Tread depth of tire (Limit) :
1.6 mm (0.0630 in.)

2. If the tread depth is less than the limit, replace the tire.

NOTICE

When the tread depth of the tire is reduced to 1.6 mm(0.0630 in.) or less, the wear indicators will appear.



KIA MOTORS

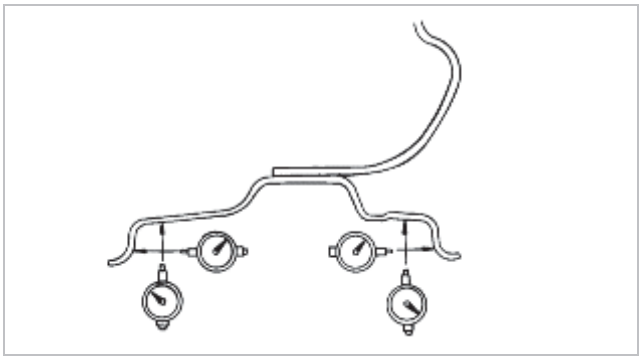
Suspension System

Tires/Wheels - Wheel

WHEEL RUNOUT

1. Jack up the vehicle and support it with jack stands.
2. Measure wheel runout with a dial indicator.
3. Replace the wheel if wheel runout exceeds the limit.
   Wheel runout [Limit]

Direction	Aluminum wheel	Steel wheel
Radial	0.3 mm (0.012 in.)	1.0 mm (0.039 in.)
Axial	0.3 mm (0.012 in.)	1.2 mm (0.222 in.)



WHEEL NUT TIGHTENING

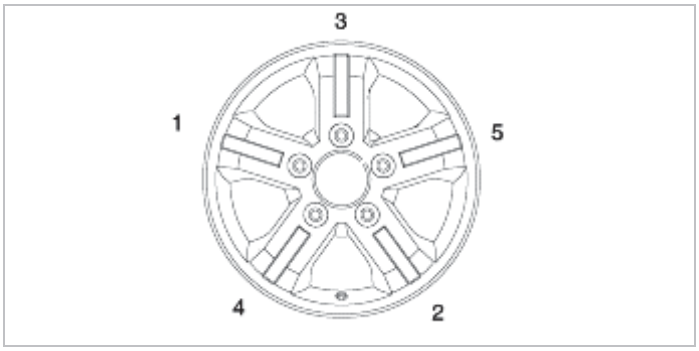
1. Tightening torque.

Tightening torque :
90-120 N·m (9-12 kg·m, 65-86 lb·ft)

CAUTION

When using an impact-wrench, adjust the tightening torque completely.

2. Tighten all the wheel nut according to the order shown in the illustration until they are all tight.



KIA MOTORS

Restraint

General Information

PRECAUTIONS

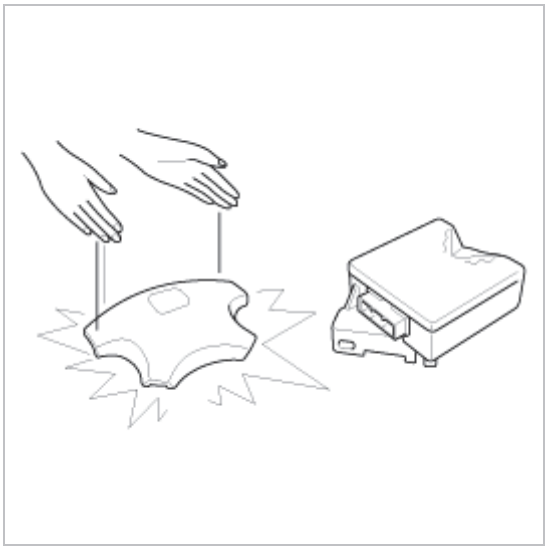
GENERAL PRECAUTIONS

Please read the following precautions carefully before performing the airbag system service. Observe the instructions described in this manual, or the airbags could accidentally deploy and cause damage or injuries.

- Except when performing electrical inspections, always turn the ignition switch OFF and disconnect the negative cable from the battery, and wait at least three minutes before beginning work.

> **NOTICE**
>
> The contents in the memory are not erased even if the ignition switch is turned OFF or the battery cables are disconnected from the battery.

- Use the replacement parts which are manufactured to the same standards as the original parts and quality.
  Do not install used SRS parts from another vehicle.
  Use only new parts when making SRS repairs.
- Carefully inspect any SRS part before you install it.
  Do not install any part that shows signs of being dropped or improperly handled, such as dents, cracks or deformation.



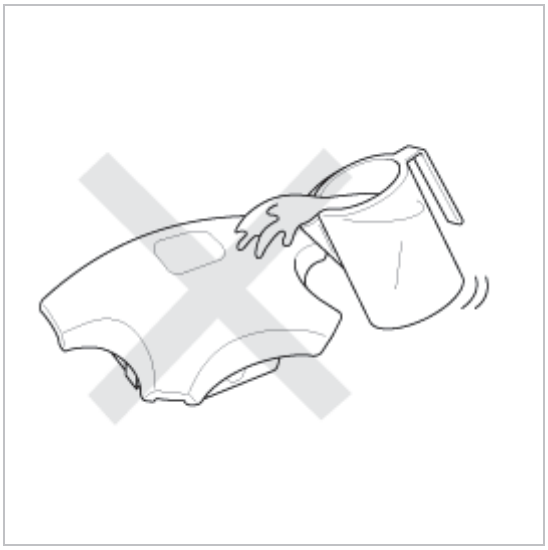
- Before removing any of the SRS parts (including the disconnection of the connectors), always disconnect the SRS connector.

AIRBAG HANDLING AND STORAGE

Do not disassemble the airbags; it has no serviceable parts. Once an airbag has been deployed, it cannot be repaired or reused.

For temporary storage of the air bag during service, please observe the following precautions.

- Store the removed airbag with the pad surface up.
- Keep free from any oil, grease, detergent, or water to prevent damage to the airbag assembly.

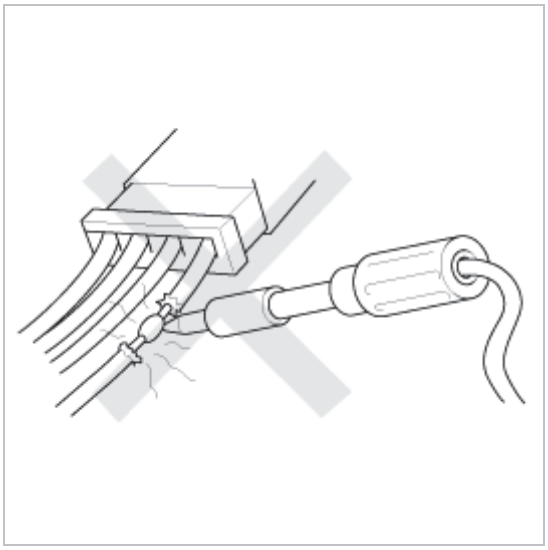


- Store the removed airbag on secure, flat surface away from any high heat source (exceeding 85°C/185°F).
- Never perform electrical inspections to the airbags, such as measuring resistance.
- Do not position yourself in front of the airbag assembly during removal, inspection, or replacement.
- Refer to the scrapping procedures for disposal of the damaged airbag.
- Be careful not to bump or impact the SRS unit or the side impact sensors whenever the ignition switch is ON, wait at least three minutes after the ignition switch is turned OFF before begin work.
- During installation or replacement, be careful not to bump (by impact wrench, hammer, etc.) the area around the SRS unit and the side impact sensor. The airbags could accidentally deploy and cause damage or injury.
- After a collision in which the airbags were deployed, replace the front airbags and the SRS unit. After a collision in which the side airbag was deployed, replace the side airbag, the front impact sensor and side impact sensor on the side where the side airbag deployed and the SRS unit. After a collision in which the airbags or the side air bags did not deploy, inspect for any damage or any deformation on the SRS unit and the side impact sensors. If there is any damage, replace the SRS unit, the front impact sensor and/or the side impact sensors.
- Do not disassemble the SRS unit, the front impact sensor or the side impact sensors
- Turn the ignition switch OFF, disconnect the battery negative cable and wait at least three minutes before beginning installation or replacement of the SRS unit.
- Be sure the SRS unit, the front impact sensor and side impact sensors are installed securely with the mounting bolts.
- Do not spill water or oil on the SRS unit,or the front impact sensor or the side impact sensors and keep them away from dust.
- Store the SRS unit, the front impact sensor and the side impact sensors in a cool (less than 40°C/104°F) and dry (30% ~ 80%, no moisture) area.

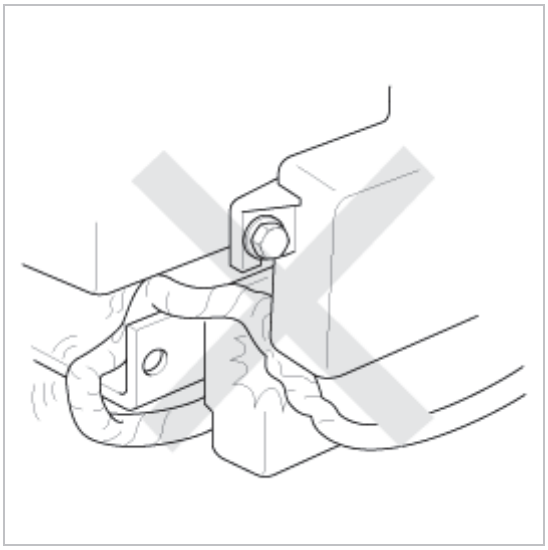
WIRING PRECAUTIONS

SRS wiring can be identified by special yellow outer covering (except the SRS circuits under the front seats). Observe the instructions described in this section.

- Never attempt to modify, splice, or repair SRS wiring.
  If there is an open or damage in SRS wiring, replace the harness.



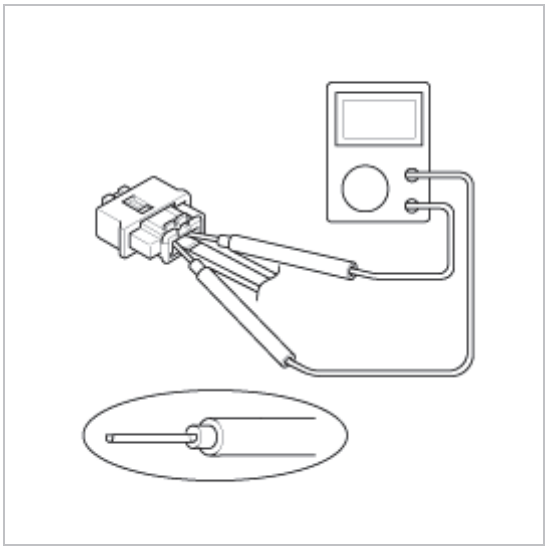
- Be sure to install the harness wires so that they are not pinched, or interfere with other parts.



- Make sure all SRS ground locations are clean, and grounds are securely fastened for optimum metal-to-metal contact. Poor grounding can cause intermittent problems that are difficult to diagnose.

PRECAUTIONS FOR ELECTRICAL INSPECTIONS

- When using electrical test equipment, insert the probe of the tester into the wire side of the connector.
  Do not insert the probe of the tester into the terminal side of the connector, and do not tamper with the connector.



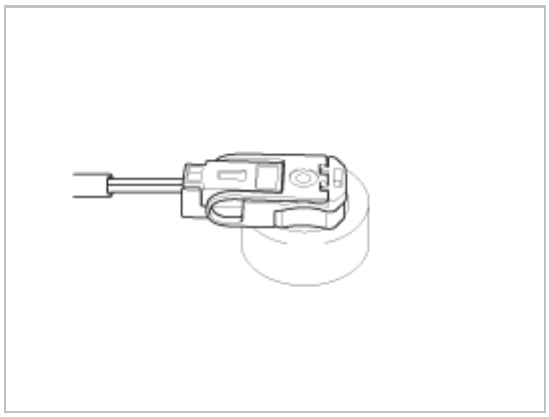
- Use a u-shaped probe. Do not insert the probe forcibly.
- Use specificed service connectors for troubleshooting.

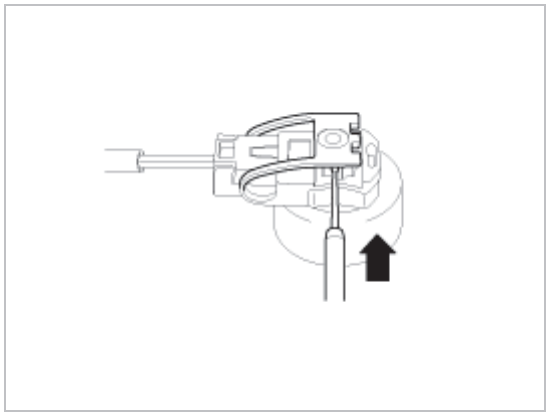
Using improper tools could cause an error in inspection due to poor metal contact.

AIRBAG CONNECTOR(I)

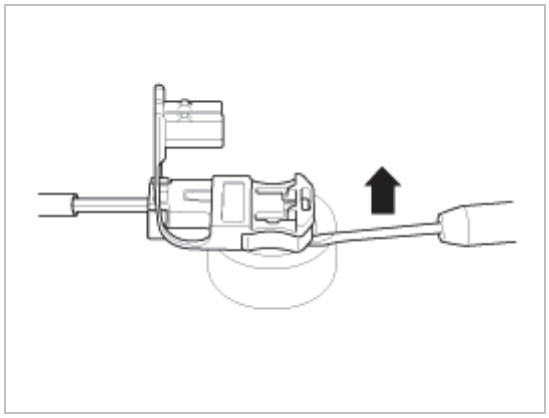
DISCONNECTING

1. Remove the locking button using driver of connector to disconnect the connector.



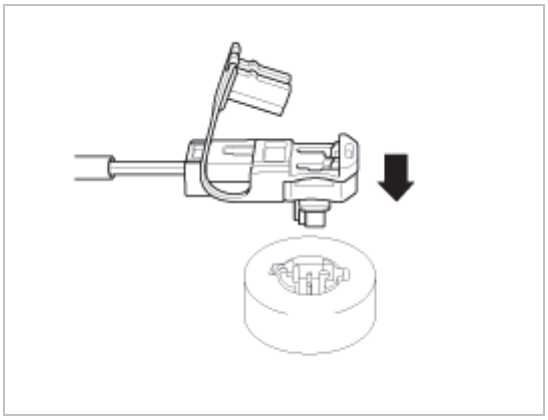


2. Lift up the connector inserting the driver underlay the connector body.

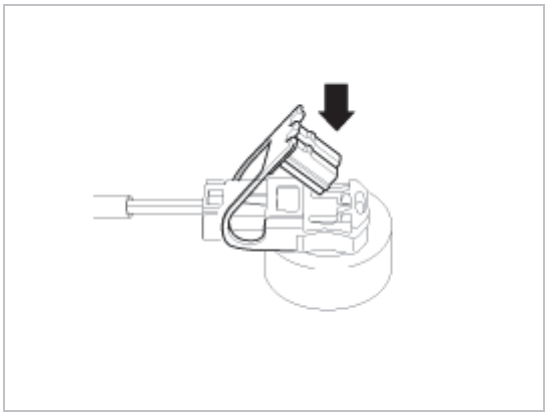


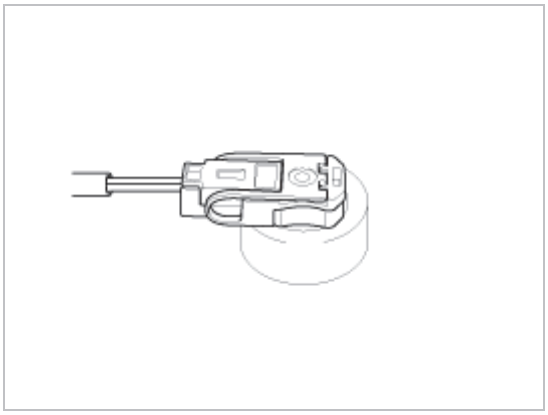
CONNECTING

1. Connect the connetor body before inserting the locking button of connector.



2. Press firmly the locking button of connector untill the connector click to lock.

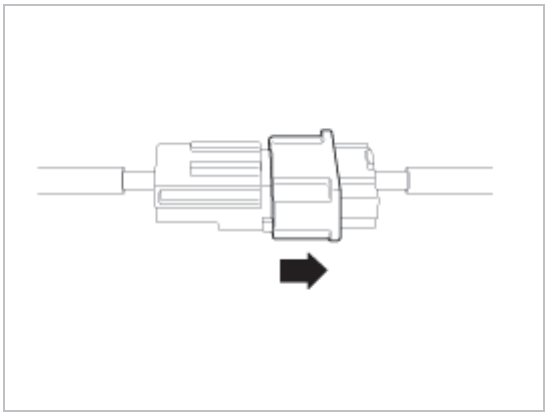




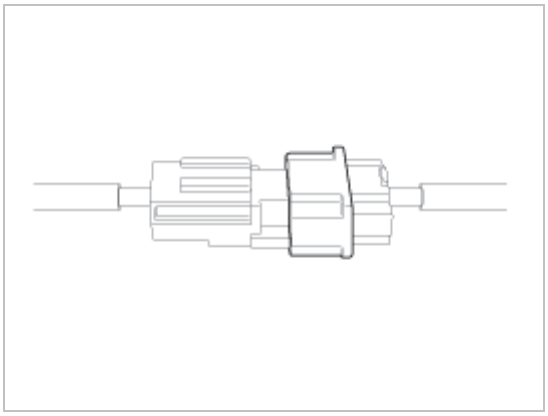
AIRBAG CONNECTOR(II)

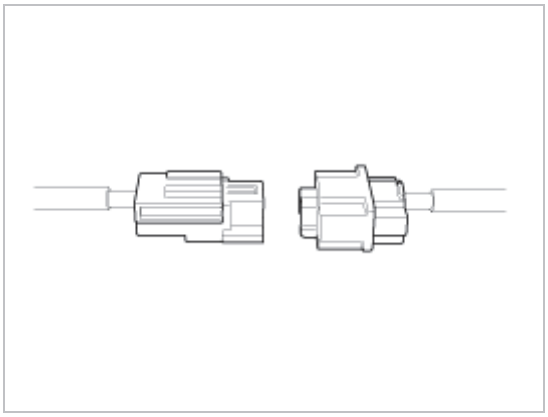
DISCONNECTING

1. Pull the outside part of the connector in the direction of an arrow below.



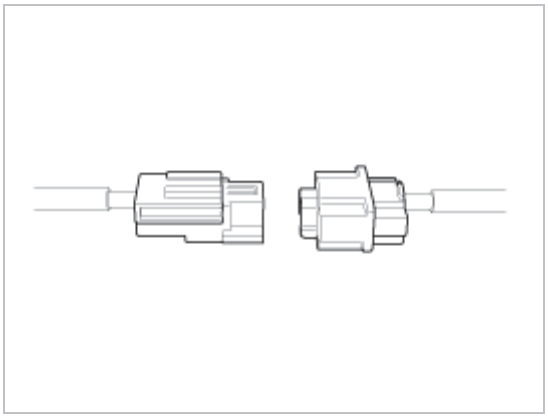
2. Disconnect the connector completely.



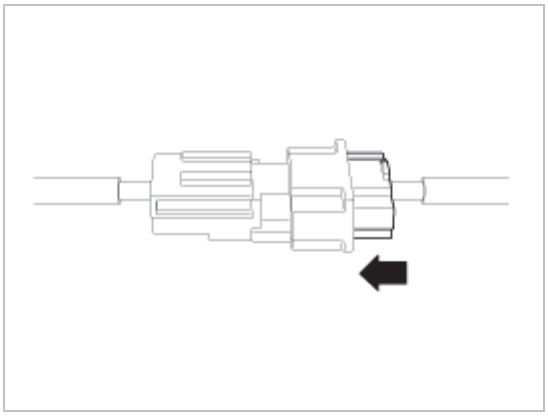


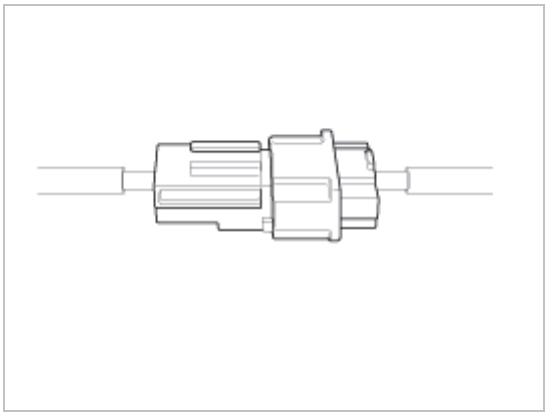
CONNECTING

1. Arrange the connectors for connection.



2. Connect the connectors till occurring the sounds of locking completely in the direction of an arrow below.





GENERAL

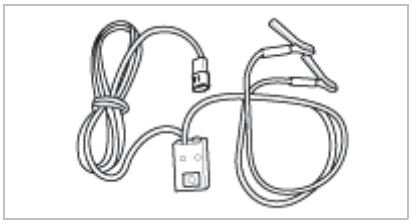
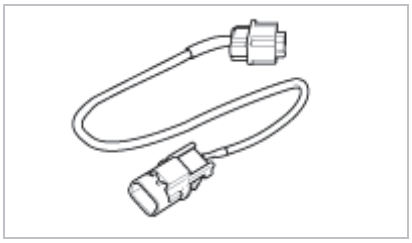
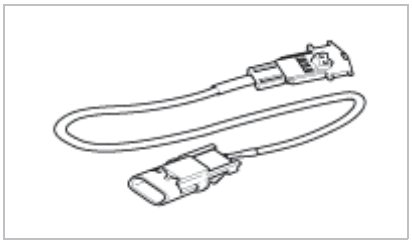
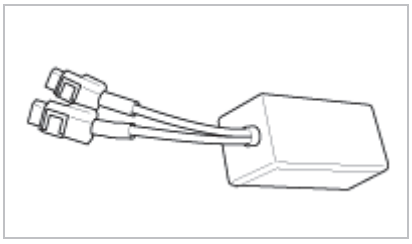
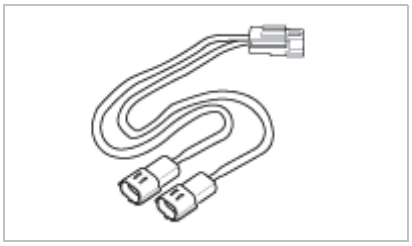
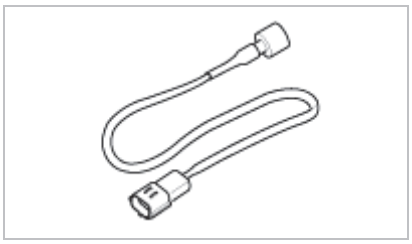
The supplemental restraint system (SRS) is designed to supplement the seat belt to help reduce the risk or severity of injury to the driver and passenger by activating and deploying the driver, passenger, side airbag and belt pretensioner in certain frontal or side collisions.
The SRS (Airbag) consists of : a driver side airbag module located in the center of the steering wheel, which contains the folded cushion and an inflator unit ; a passenger side airbag module located in the passenger side crash pad contains the folded cushion assembled with inflator unit ; side airbag modules located in the front seat contain the folded cushion and an inflator unit ; curtain airbag modules located inside of the headliner which contains folded cushions and inflator units. The impact sensing function of the SRSCM is carried out by electronic accelerometer that continuously measure the vehicle's acceleration and delivers a corresponding signal through amplifying and filtering circuitry to the microprocessor.

SRSCM (SRS Control Module)

SRSCM will detect front impact with front impact sensor, and side impact with side impact sensor, and determine airbag module deployment.

1. DC/DC converter: DC/DC converter in power supply unit includes up/down transformer converter, and provide ignition voltage for 2 front airbag ignition circuits and the internal operation voltage of the SRSCM. If the internal operation voltage is below critical value setting, it will perform resetting.
2. Safety sensor: Safety sensor is located in airbag ignition circuit. Safety sensor will operate airbag circuit at any deployment condition and release airbag circuit safely at normal driving condition. Safety sensor is a double contact electro-mechanical switch that will close detecting deceleration above certain criteria.
3. Back up power supply: SRSCM has separate back up power supply, that will supply deployment energy instantly in low voltage condition or upon power failure by front crash.
4. Self diagnosis: SRSCM will constantly monitor current SRS operation status and detect system failure while vehicle power supply is on, system failure may be checked with trouble codes using scan tool. (Hi-Scan)
5. Airbag warning lamp on: Upon detecting error, the module will transmit signal to SRSCM indicator lamp located at cluster. MIL lamp will indicate driver SRS error. Upon ignition key on, SRS lamp will turn on for about six seconds.
6. Trouble code registration: Upon error occurrence in system, SRSCM will store DTC corresponding to the error. DTC can be cleared only by Hi-Scan. However, if an internal fault code is logged or if a crash is recorded the fault clearing should not happen.
7. Self diagnostic connector: Data stored in SRSCM memory will be output to Hi-Scan or other external output devices through connector located below driver side crash pad.
8. Once airbag is deployed, SRSCM should not be used again but replaced.
9. SRSCM will determine whether passenger put on seat belt by the signal from built-in switch in seat belt buckle, and deploy front seat airbag at each set crash speed.
10. Side airbag deployment will be determined by SRSCM that will detect satellite sensor impact signal upon side crash, irrespective to seat belt condition.

SPECIAL SERVICE TOOLS

Tool(Number and Name)	Illustration	Use
Deployment tool 0957A-34100A		Airbag deployment tool
Deployment adapter 0957A-3E110		Use with deployment tool. (PAB)
Deployment adapter 0957A-38500		Use with deployment tool. (DAB, CAB, BPT)
Dummy 0957A-38200		Simulator to check the resistance of each wiring harness
Dummy adapter 0957A-3E100		Use with dummy (PAB)
Dummy adapter 0957A-2G000		Use with dummy (DAB, CAB, BPT)

DAB : Driver Airbag
PAB : Passenger Airbag
SAB : Side Airbag
CAB : Curtain Airbag
BPT : Seat Belt Retractor Pretensioner

WARNING LAMP ACTIVATION

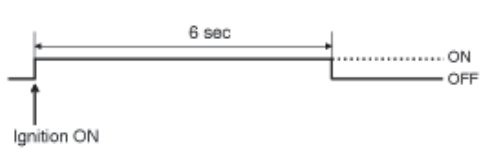
WARNING LAMP BEHAVIOR AFTER IGNITION ON

As soon as the operating voltage is applied to the SRSCM ignition input, the SRSCM activates the warning lamp for a bulb check.

The lamp shall turn on for 6 seconds during the initialization phase and be turned off afterward. However, in order to indicate the driver, the warning lamp shall turn on for 6 seconds and off for one second then on continuously after the operating voltage is applied if any active fault exists.

1. Active fault or historical fault counter is greater or equal to 10

2. Normal or historical fault counter is less than 10



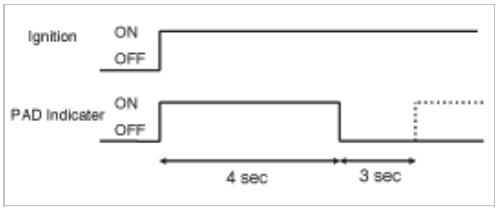
SRSCM INDEPENDENT WARNING LAMP ACTIVATION

There are certain fault conditions in which the SRSCM cannot function and thus cannot control the operation of the standard warning lamp. In these cases, the standard warning lamp is directly activated by appropriate circuitry that operates independently of the SRSCM. These cases are:

1. Loss of battery supply to the SRSCM : warning lamp turned on continuously.
2. Loss of internal operating voltage : warning lamp turned on continuously.
3. Loss of Microprocessor operation : warning lamp turned on continuously.
4. SRSCM not connected : warning lamp turned on continuously through the shorting bar.

PASSENGER AIRBAG DEACTIVATION (PAD) LAMP OPERATION

The SRSCM is designed with circuitry and software to drive a PAD lamp, which is used for depowered airbag system. For the PAD indicator circuitry to function properly, both the SRSCM and PAD indicator are sourced from the same ignition line. After ignition on, the PAD indicator will be turned on for 4 seconds and off for 3 seconds during the initialization phase. Thereafter the lamp will be turned on as long as the PAD switch is in the disabled position.



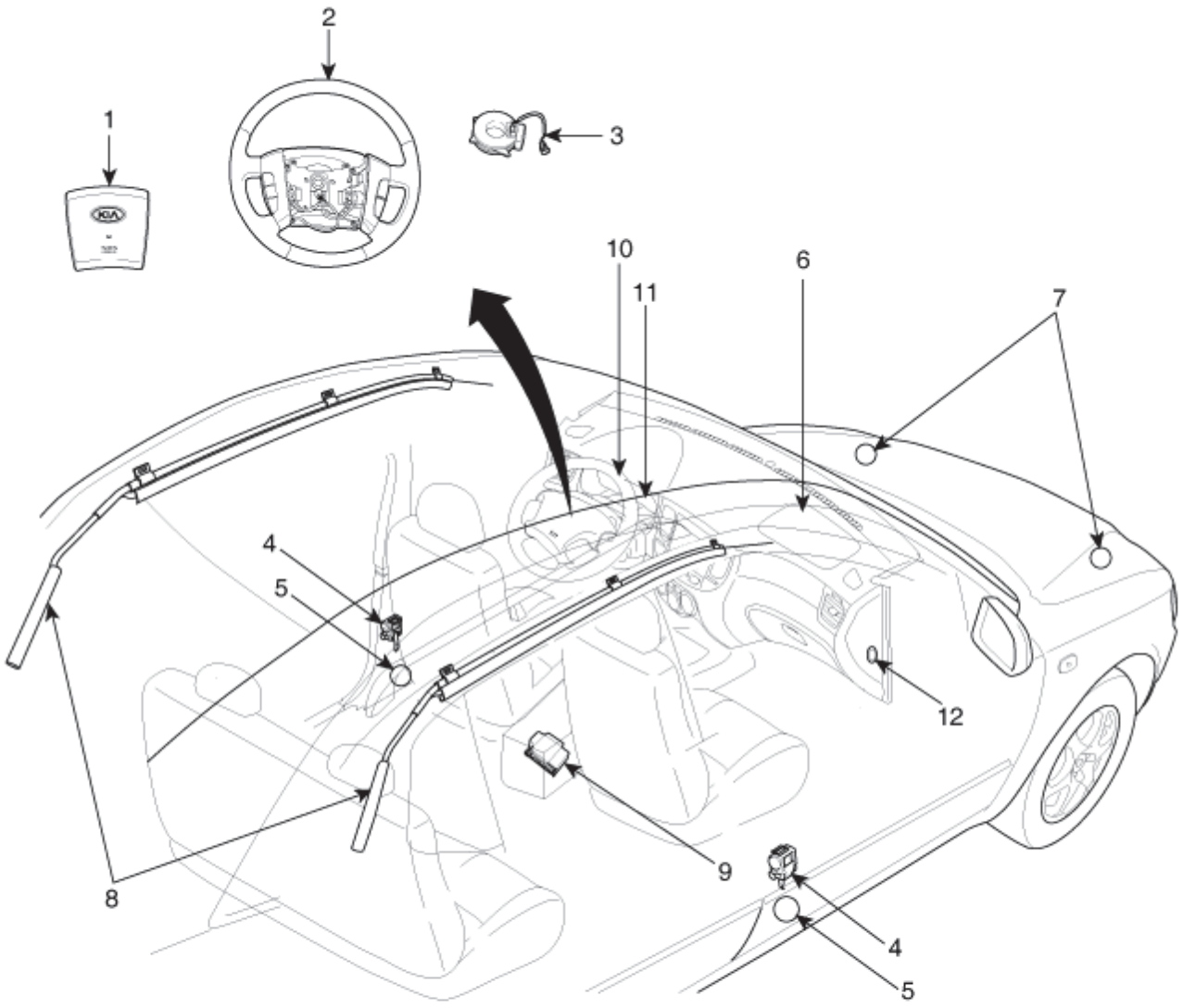
PASSENGER RESTRAINTS ACTIVATION WITH PAD SWITCH

The PAD switch affects the activation of the front passenger airbag only and the switch is controlled manually. The PAD switch will be functioned as follows:

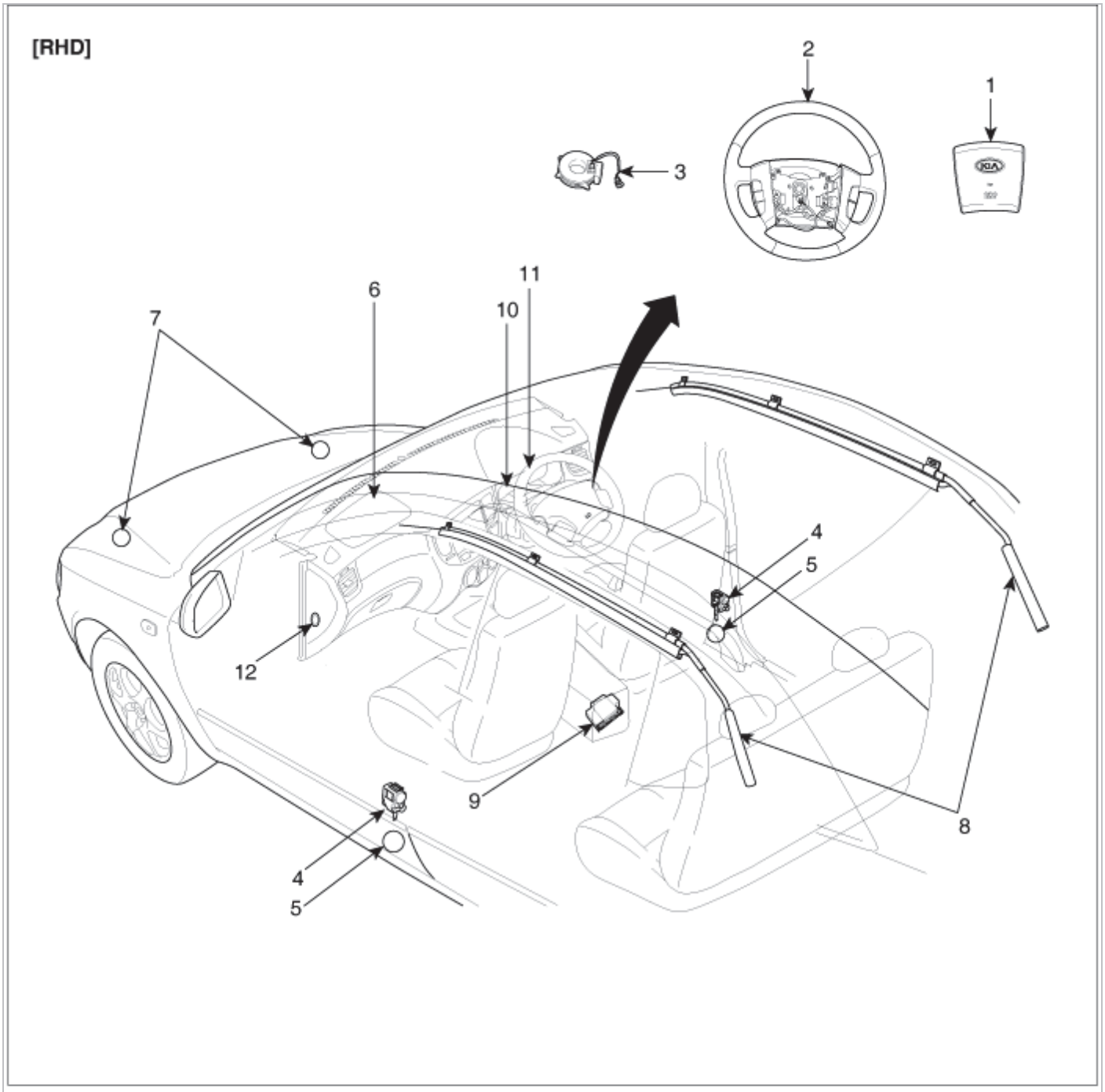
PAD Switch status	PAD Lamp	PAB
Phase-up	ON → OFF	Enabled
OFF	ON	Disabled
ON	OFF	Enabled
Fault	OFF	Enabled

COMPONENTS

[LHD]



1. Driver Airbag (DAB)
2. Steering Wheel
3. Clock Spring
4. Seat Belt Pretensioner (BPT)
5. Side Impact Sensor (SIS)
6. Passenger Airbag (PAB)
7. Front Impact Sensor (FIS)
8. Curtain Airbag (CAB)
9. Supplemental Restraint System Control Module(SRSCM)
10. Airbag Warning Lamp
11. Passenger Airbag Deactivation (PAD) Lamp
12. PAD Switch



1. Driver Airbag (DAB)
2. Steering Wheel
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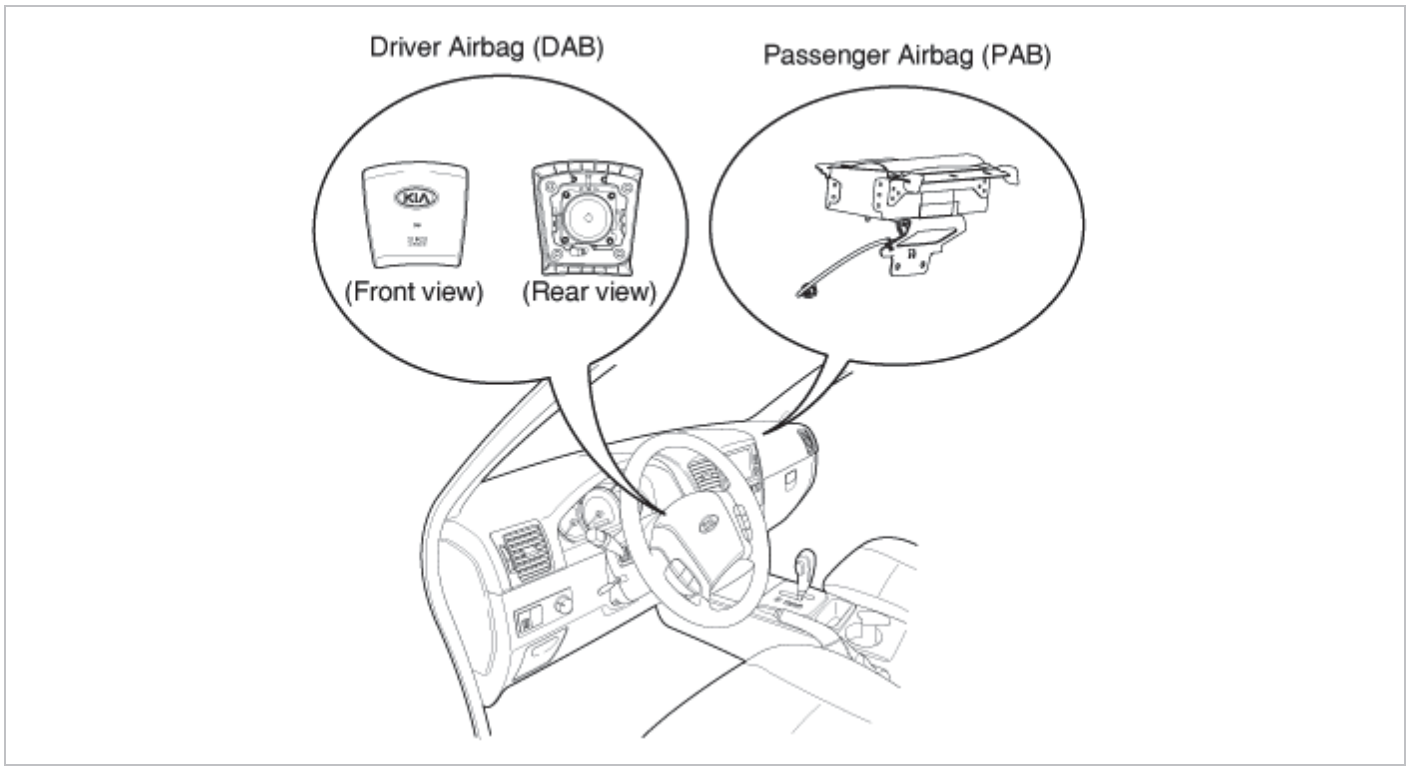
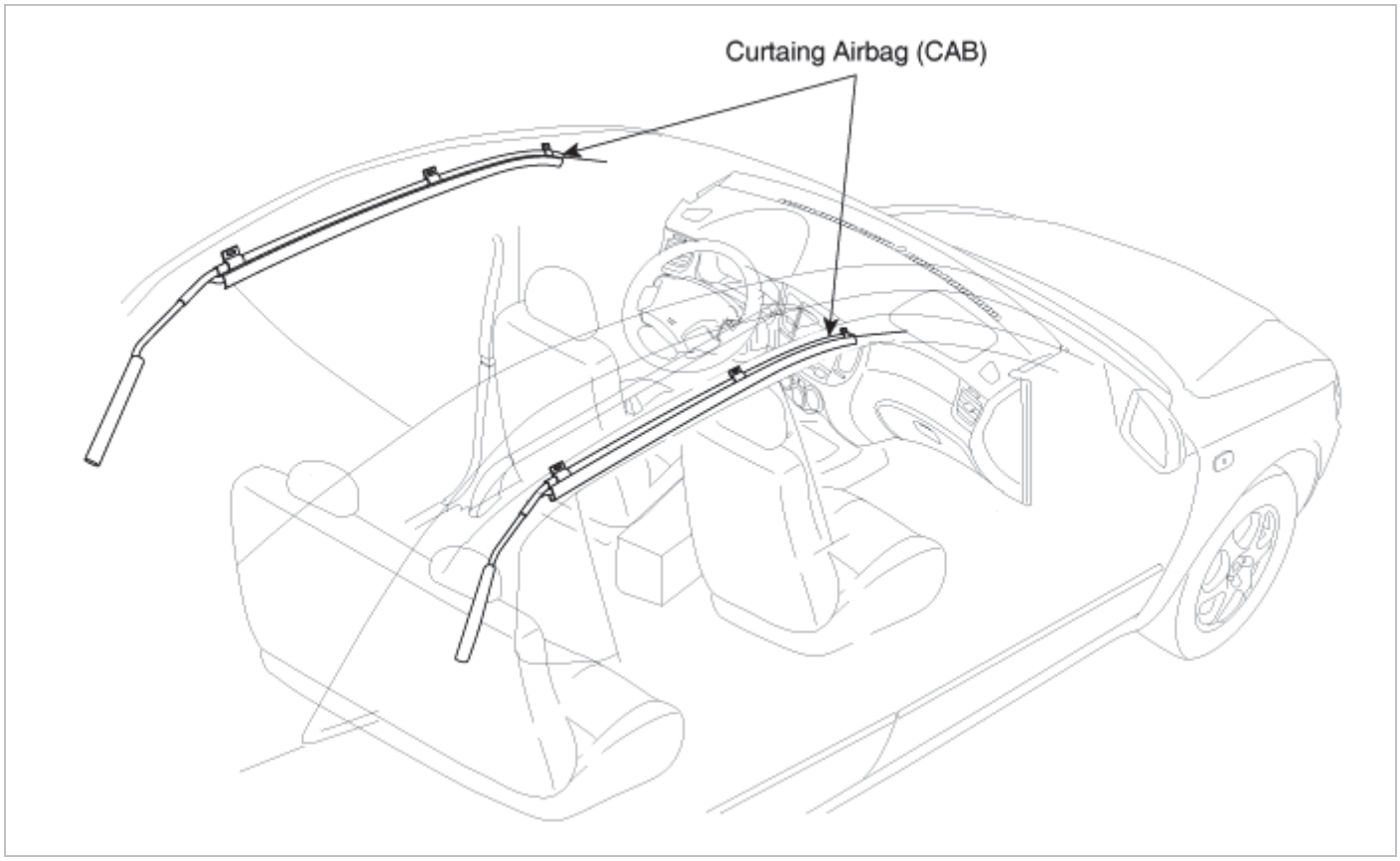
5. Side Impact Sensor (SIS)
6. Passenger Airbag (PAB)
7. Front Impact Sensor (FIS)
8. Curtain Airbag (CAB)
9. Supplemental Restraint System Control Module(SRSCM)
10. Airbag Warning Lamp
11. Passenger Airbag Deactivation (PAD) Lamp
12. PAD Switch

COMPONENTS LOCATION

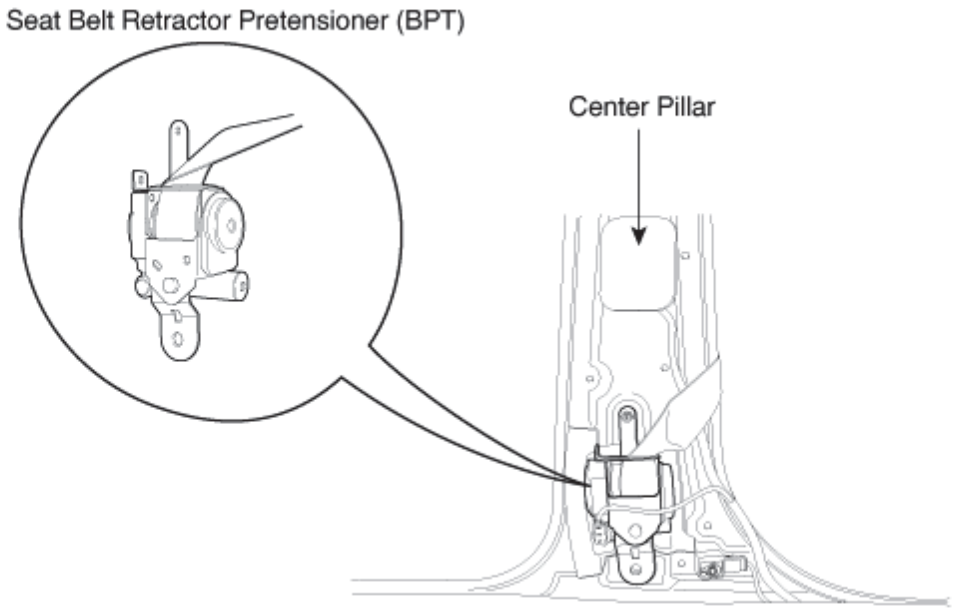
DRIVER AIRBAG (DAB) / PASSENGER AIRBAG (PAB)



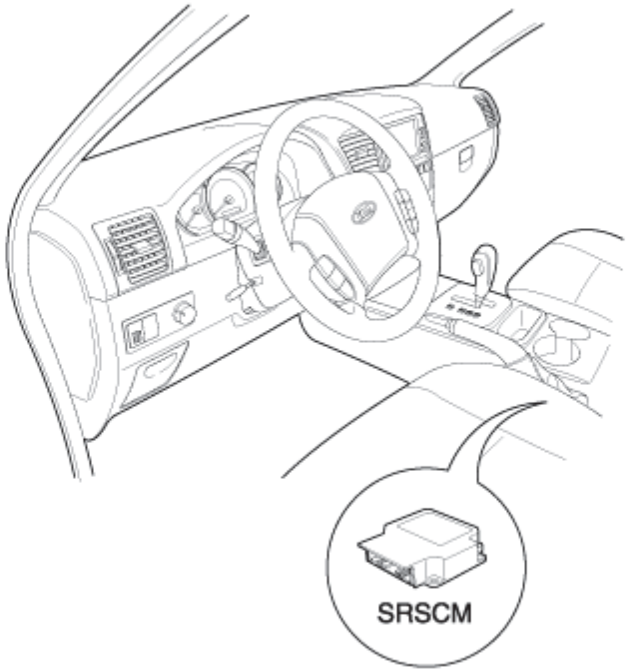
CURTAIN AIRBAG (CAB)



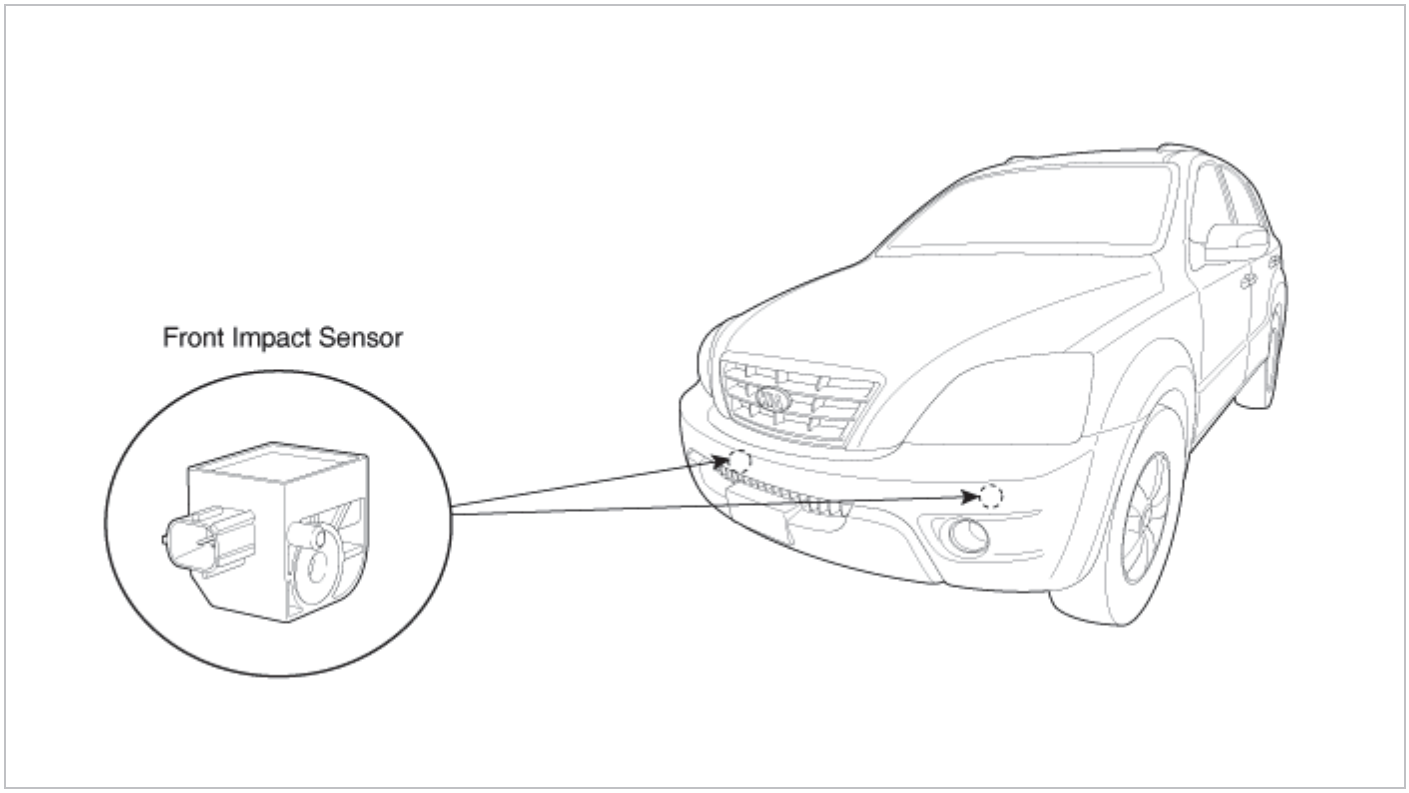
SEAT BELT RETRACTOR PRETENSIONER (BPT)



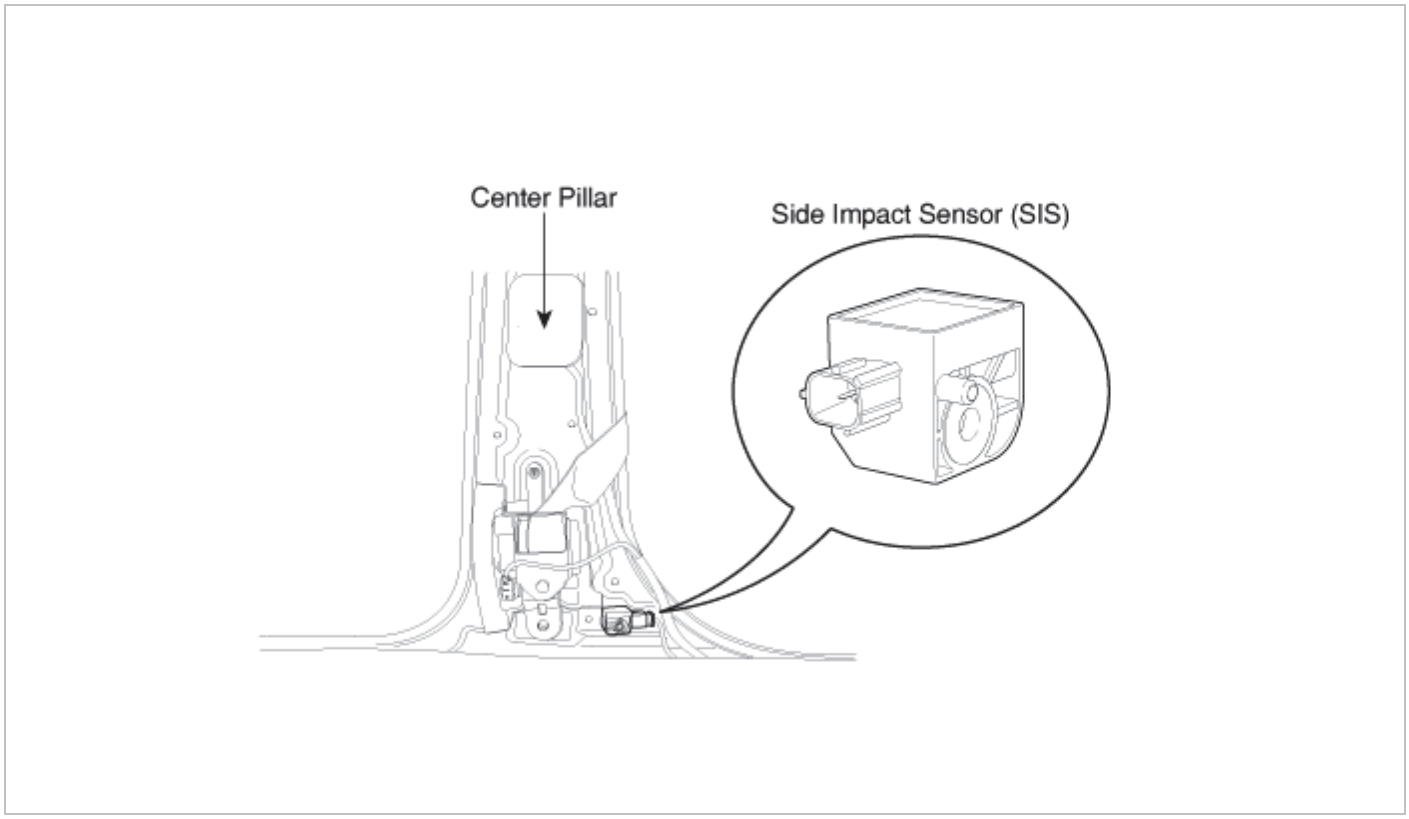
SUPPLEMENTAL RESTRAINT SYSTEM CONTROL MODULE (SRSCM)



FRONT IMPACT SENSOR (FIS)



SIDE IMPACT SENSOR (SIS)



COMPONENT REPLACEMENT AFTER DEPLOYMENT

NOTICE

Before doing any SRS repairs, use the Hi-Scan Pro to check for DTCs. Refer to the Diagnostic Trouble Code list for repairing of the related DTCs.

When the front airbag(s) deployed after a collision, replace the following items.

- SRSCM
- Deployed airbag(s)
- Seat belt pretensioner(s)
- Front impact sensors
- SRS wiring harnesses
- Inspect the clock spring for heat damage.
  If any damage found, replace the clock spring.

When the seat belt pretensioner(s) deployed after a collision, replace the following items.

- Seat belt pretensioner(s)
- SRSCM (if B1658 detected)
- Front impact sensors
- SRS wiring harnesses

When the side/curtain airbag(s) deployed after a collision, replace the following items.

- SRSCM
- Deployed airbag(s)
- Side impact sensor(s) for the deployed side(s)
- SRS wiring harnesses

After the vehicle is completely repaired, confirm the SRS airbag system is OK.

- Turn the ignition switch ON, the SRS indicator should come on for about 6 seconds and then go off.

SPECIFICATION

Item	Resistance (Ω)
Driver Airbag (DAB)	1.6 ~ 6.4
Passenger Airbag (PAB)	1.8 ~ 6.4
Curtain Airbag (CAB)	1.8 ~ 4.8
Seat Belt Retractor Pretensioner (BPT)	1.8 ~ 6.4

TIGHTENING TORQUES

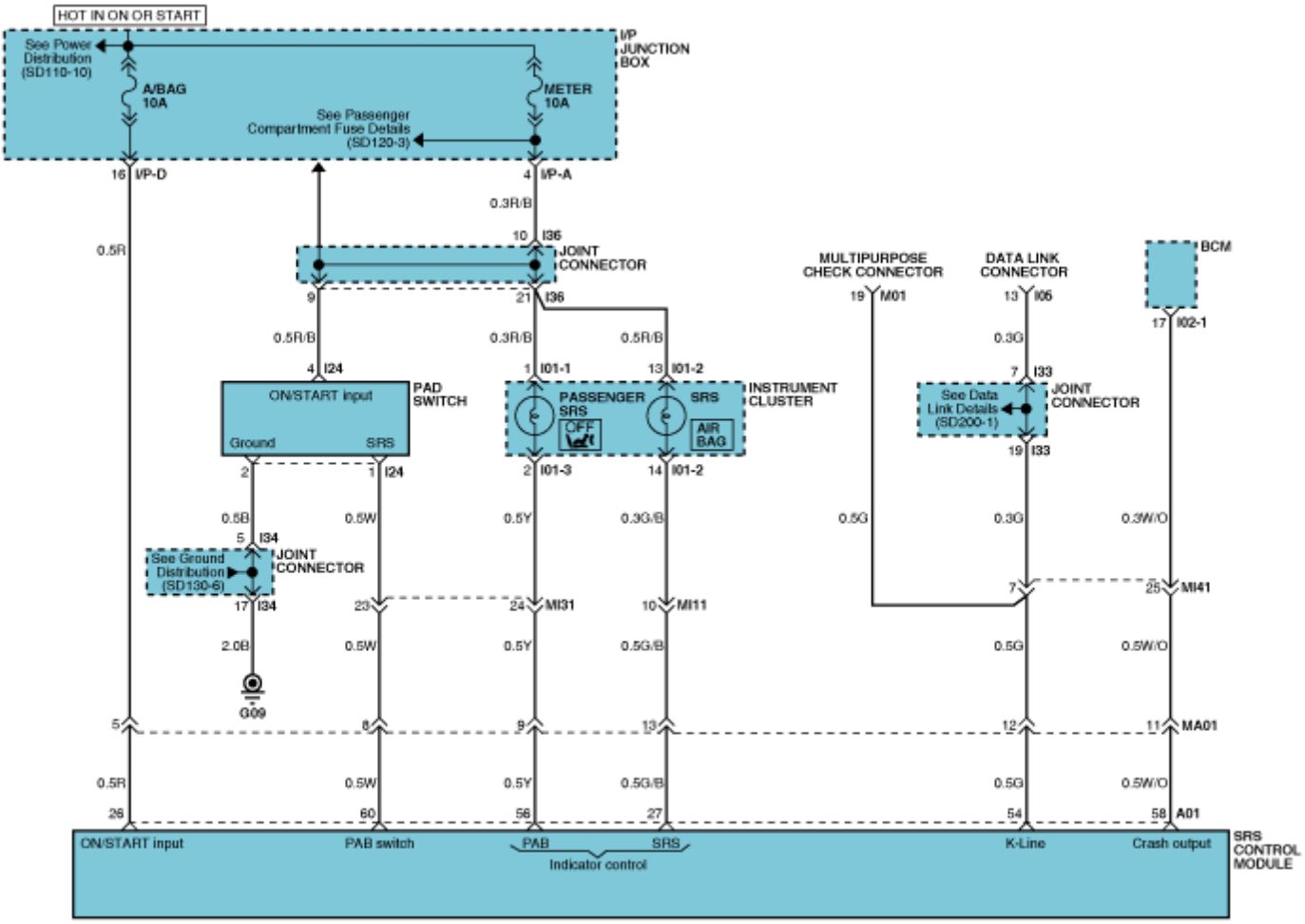
Item	kgf·m	Nm	lb-ft
Driver Airbag (DAB)	0.8 ~ 1.1	7.9 ~ 10.8	5.8 ~ 8.0
Passenger Airbag (PAB)	Bolt : 1.9 ~ 2.7 Nut : 0.9 ~ 1.4	18.6 ~ 26.5 8.8 ~ 13.7	13.7 ~ 19.5 6.5 ~ 10.1
Curtain Airbag (CAB)	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
Seat Belt Anchor Bolt (BPT)	4.0 ~ 5.5	39.2 ~ 53.9	28.9 ~ 39.8
SRSCM Mounting Bolt	1.0 ~ 1.4	10.2 ~ 13.8	7.5 ~ 10.2
Front Impact Sensor (FIS) Mounting Bolt	1.0 ~ 1.4	10.2 ~ 13.8	7.5 ~ 10.2
Side Impact Sensor (SIS) Mounting Bolt	1.0 ~ 1.4	10.2 ~ 13.8	7.5 ~ 10.2

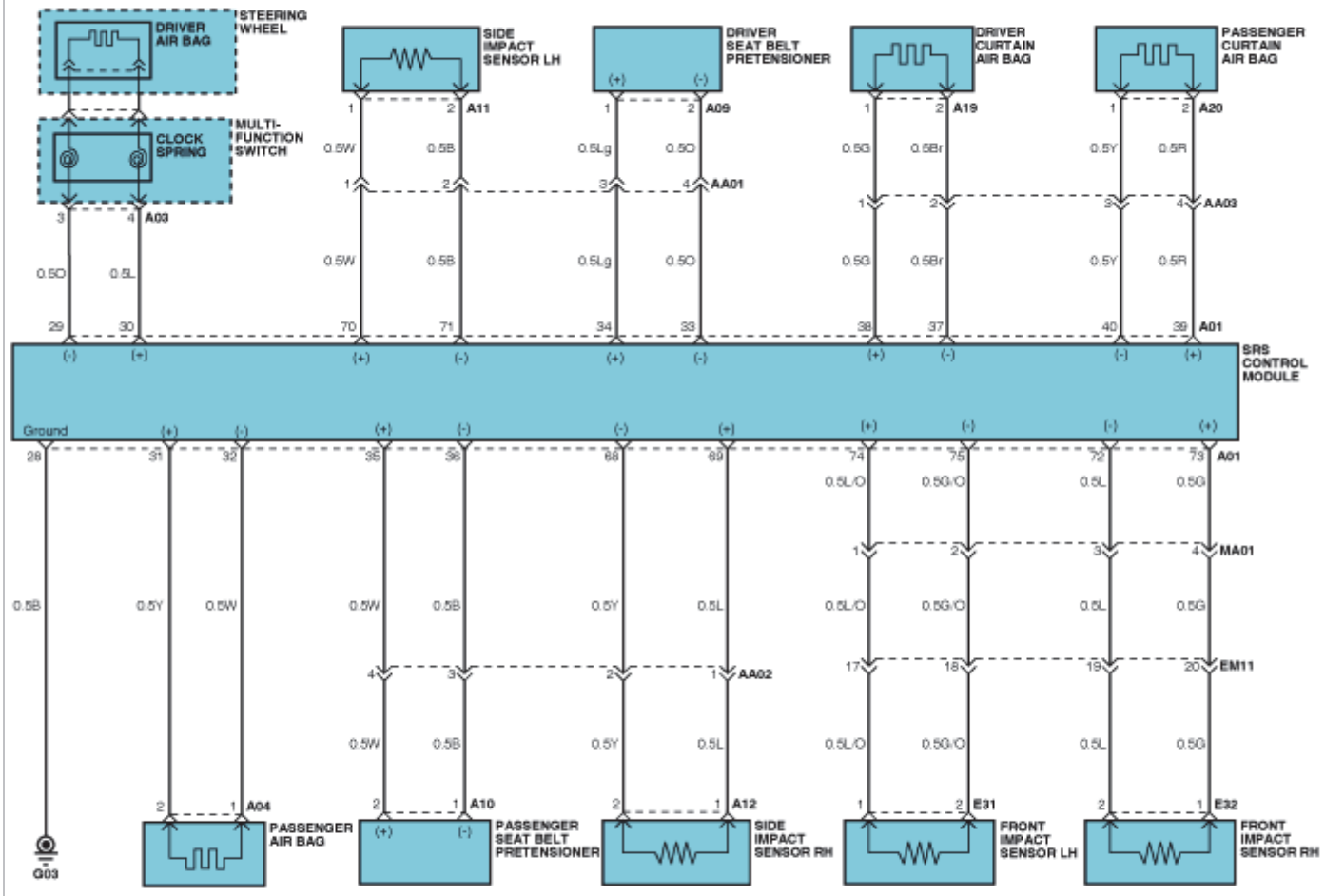
KIA MOTORS

Restraint

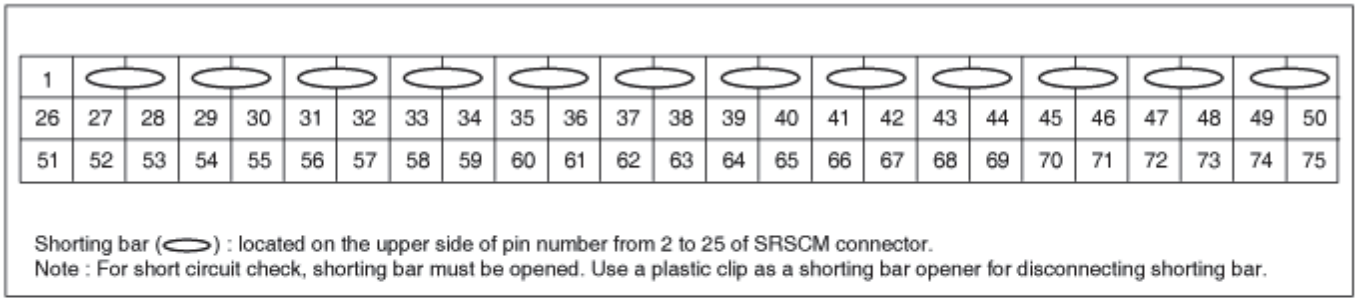
Supplement Restrain System Control Module - SRS Control Module (SRnodeM)

CIRCUIT DIAGRAM





SRSCM CONNECTOR TERMINAL



Shorting bar ( ) : located on the upper side of pin number from 2 to 25 of SRSCM connector.
Note : For short circuit check, shorting bar must be opened. Use a plastic clip as a shorting bar opener for disconnecting shorting bar.

Pin	Function	Pin	Function
1	-	50	-
2~25	Shorting Bar	51	-
26	Ignition	52	-
27	Airbag Warning Lamp	53	-
28	Power Ground	54	K-Line Diagnostic
29	Driver Airbag Low	55	-
30	Driver Airbag High	56	PAB off Lamp
31	Passenger Airbag High	57	-
32	Passenger Airbag Low	58	Crash Output
33	Seat Belt Pretensioner [Driver] Low	59	-
34	Seat Belt Pretensioner [Driver] High	60	PAD Switch
35	Seat Belt Pretensioner [Passenger] High	61	-
36	Seat Belt Pretensioner [Passenger] Low	62	-
37	Curtain Airbag [Driver] Low	63	-
38	Curtain Airbag [Driver] High	64	-
39	Curtain Airbag [Passenger] High	65	-
40	Curtain Airbag [Passenger] Low	66	-
41	-	67	-
42	-	68	Side Impact Sensor [Passenger] Low
43	-	69	Side Impact Sensor [Passenger] High
44	-	70	Side Impact Sensor [Driver] High
45	-	71	Side Impact Sensor [Driver] Low
46	-	72	Front Impact Sensor [Passenger] Low
47	-	73	Front Impact Sensor [Passenger] High
48	-	74	Front Impact Sensor [Driver] High
49	-	75	Front Impact Sensor [Driver] Low

DIAGNOSTIC TROUBLE CODES (DTC)

DTC	FAULT DESCRIPTION	REMARK
B1101	Battery Voltage High	
B1102	Battery Voltage Low	
B1103	Communication Voltage too Low	
B1326	Front Impact Sensor [Driver] Short to Ground	

B1327	Front Impact Sensor [Driver] Short to Battery	
B1328	Front Impact Sensor [Driver] Defect	
B1329	Front Impact Sensor [Driver] Communication Error	
B1330	Front Impact Sensor [Driver] Wrong ID	
B1331	Front Impact Sensor [Passenger] Short to Ground	
B1332	Front Impact Sensor [Passenger] Short to Battery	
B1333	Front Impact Sensor [Passenger] Defect	
B1334	Front Impact Sensor [Passenger] Communication Error	
B1335	Front Impact Sensor [Passenger] Wrong ID	
B1346	Driver Airbag Resistance too High	
B1347	Driver Airbag Resistance too Low	
B1348	Driver Airbag Circuit Short to Ground	
B1349	Driver Airbag Circuit Short to Battery	
B1352	Passenger Airbag Resistance too High	
B1353	Passenger Airbag Resistance too Low	
B1354	Passenger Airbag Circuit Short to Ground	
B1355	Passenger Airbag Circuit Short to Battery	
B1361	Seat Belt Pretensioner [Front-Driver] Resistance too High	
B1362	Seat Belt Pretensioner [Front-Driver] Resistance too Low	
B1363	Seat Belt Pretensioner [Front-Driver] Circuit Short to Ground	
B1364	Seat Belt Pretensioner [Front-Driver] Circuit Short to Battery	
B1367	Seat Belt Pretensioner [Front-Passenger] Resistance too High	
B1368	Seat Belt Pretensioner [Front-Passenger] Resistance too Low	
B1369	Seat Belt Pretensioner [Front-Passenger] Circuit Short to Ground	
B1370	Seat Belt Pretensioner [Front-Passenger] Circuit Short to Battery	
B1395	Squib Interconnection Fault	
B1400	Side Impact Sensor [Front-Driver] Defect	
B1401	Side Impact Sensor [Front-Driver] Short to Ground	
B1402	Side Impact Sensor [Front-Driver] Short to Battery	
B1403	Side Impact Sensor [Front-Passenger] Defect	
B1404	Side Impact Sensor [Front-Passenger] Short to Ground	
B1405	Side Impact Sensor [Front-Passenger] Short to Battery	
B1409	Side Impact Sensor [Front-Driver] Communication Error	
B1410	Side Impact Sensor [Front-Passenger] Communication Error	
B1414	Side Impact Sensor [Front-Driver] Wrong ID	
B1415	Side Impact Sensor [Front-Passenger] Wrong ID	
B1473	Curtain Airbag [Driver] Resistance too High	
B1474	Curtain Airbag [Driver] Resistance too Low	
B1475	Curtain Airbag [Driver] Circuit Short to Ground	
B1476	Curtain Airbag [Driver] Circuit Short to Battery	
B1477	Curtain Airbag [Passenger] Resistance too High	

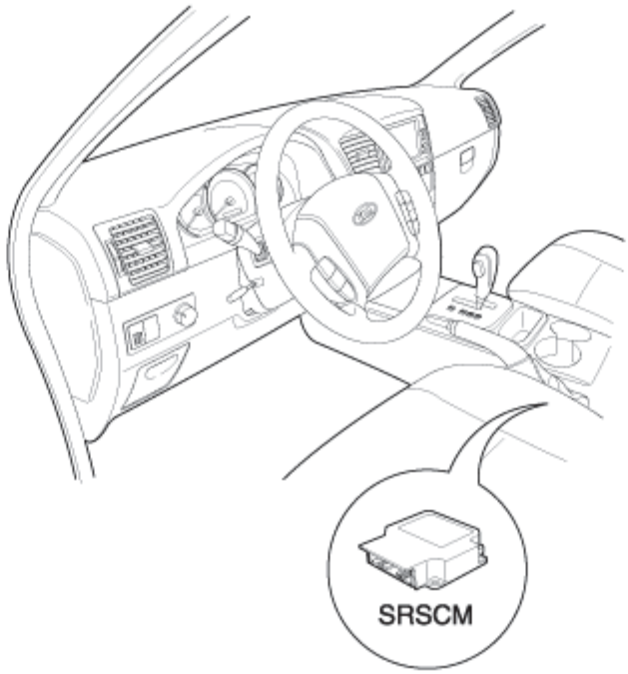
B1478	Curtain Airbag [Passenger] Resistance too Low	
B1479	Curtain Airbag [Passenger] Circuit Short to Ground	
B1480	Curtain Airbag [Passenger] Circuit Short to Battery	
B1527	Passenger Airbag Deactivation Switch Open or Short to Battery	
B1528	Passenger Airbag Deactivation Switch Short or Short to Ground	
B1530	Passenger Airbag Deactivation Switch Instablility	
B1620	Supplemental Restraint System Control Module Internal Fault (Replace SRSCM)	
B1650	Crash Recorded - Frontal (Replace SRSCM)	
B1651	Crash Recorded - Driver Side (Replace SRSCM)	
B1652	Crash Recorded - Passenger Side (Replace SRSCM)	
B1657	Crash Recorded - Belt Pretensioner Only	
B1658	Belt Pretensioner 6 times Deployment (Replace SRSCM)	
B2500	Warning Lamp Fault	
B2505	Passenger Airbag Deactivation Lamp Fault	

DESCRIPTION

The primary purpose of the SRSCM (Supplemental Restraints System Control Module) is to discriminate between an event that warrants restraint system deployment and an event that does not. The SRSCM must decide whether to deploy the restraint system or not. After determining that pretensioners and/or airbag deployment is required, the SRSCM must supply sufficient power to the pretensioners and airbag igniters to initiate deployment. The SRSCM determines that an impact may require deployment of the pretensioners and airbags from data obtained from impact sensors and other components in conjunction with a safing function.

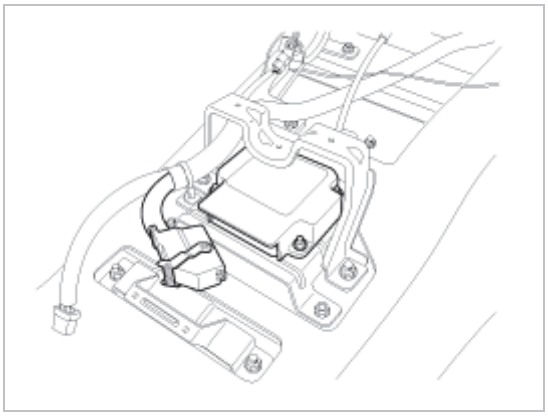
The SRSCM will not be ready to detect a crash or to activate the restraint system devices until the signals in the SRSCM circuitry stabilize. It is possible that the SRSCM could activate the safety restraint devices in approximately 2 seconds but is guaranteed to fully function after prove-out is completed. The SRSCM must perform a diagnostic routine and light a system readiness indicator at key-on. The system must perform a continuous diagnostic routine and provide fault annunciation through a warning lamp indicator in the event of fault detection. A serial diagnostic communication interface will be used to facilitate servicing of the restraint control system.

COMPONENTS



REMOVAL

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
3. Disconnect the DAB, PAB, CAB and BPT connectors.
4. Remove the floor console and heater ducts. (Refer to BD group)
5. Disconnect the SRSCM harness connector after pulling the connector locking lever.



6. Remove the SRSCM mounting bolt (1EA) and nuts (2EA) from the SRSCM, then remove the SRSCM.

INSTALLATION

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
3. Install the SRSCM with the SRSCM mounting bolt and nuts.

Tightening torque (SRSCM Mounting bolt)
: 1.0 ~ 1.4 kgf.m (10.2 ~ 13.8 Nm, 7.5 ~ 10.2 lb.ft)

NOTICE

Use new mounting bolts when replacing the SRSCM after a collision.

4. Connect the SRSCM harness connector completely with pushing the connector locking lever.
5. Install the heater ducts and floor console. (Refer to BD group)
6. Connect the DAB, PAB, CAB and BPT connectors.
7. Reconnect the battery negative cable.
8. After installing the SRSCM, confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

KIA MOTORS

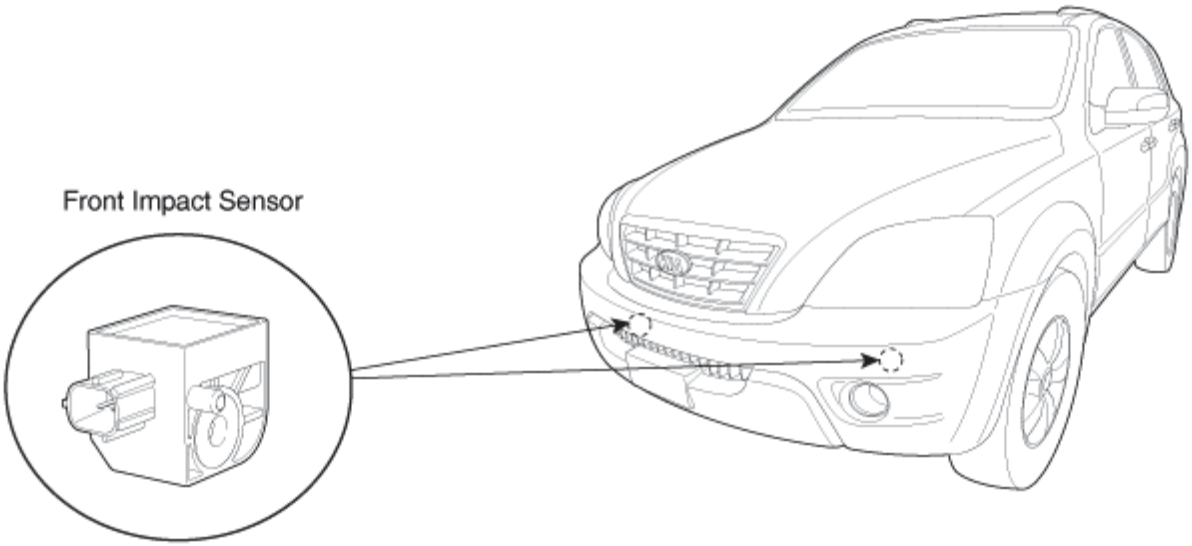
Restraint

Supplement Restrain System Control Module - Front Impact Sensor (FIS)

DESCRIPTION

The front impact sensor (FIS) is installed in the side member. They are remote sensors that detect acceleration due to a collision at its mounting location. The primary purpose of the Front Impact Sensor (FIS) is to provide an indication of a collision. The Front Impact Sensor(FIS) sends acceleration data to the SRSCM.

COMPONENTS

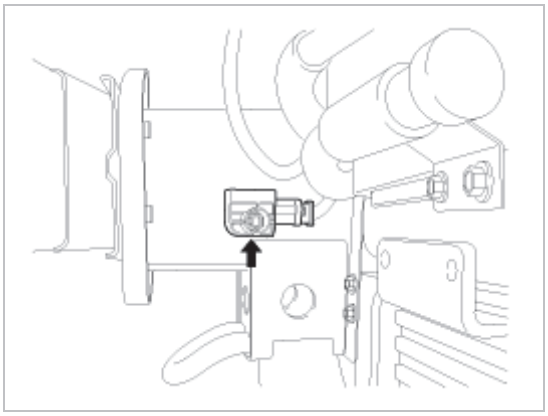


REMOVAL

CAUTION

- Removal of the airbag must be performed according to the precautions/ procedures described previously.
- Before disconnecting the front impact sensor connector, disconnect the front airbag connector(s).
- Do not turn the ignition switch ON and do not connect the battery cable while replacing the front impact sensor.

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the Front bumper. (Refer to BD group)
3. Remove the Front Impact Sensor mounting bolt.



4. Disconnect the Front Impact Sensor connector.

INSTALLATION

CAUTION

- Do not turn the ignition switch ON and do not contact the battery cable while replacing the front impact sensor.

1. Install the new Front Impact Sensor.
2. Tighten the Front Impact Sensor mounting bolt.

Tightening torque
: 1.0 ~ 1.4 kgf.m (10.2 ~ 13.8 Nm, 7.5 ~ 10.2 lb.ft)

3. Connect the Front Impact Sensor connector.
4. Install the front bumper. (Refer to BD group)
5. Reconnect the battery negative cable.
6. After installing the Front Impact Sensor, confirm proper system operation: Turn the ignition switch ON the SRS indicator light should be turned on for about six seconds and then go off.

KIA MOTORS

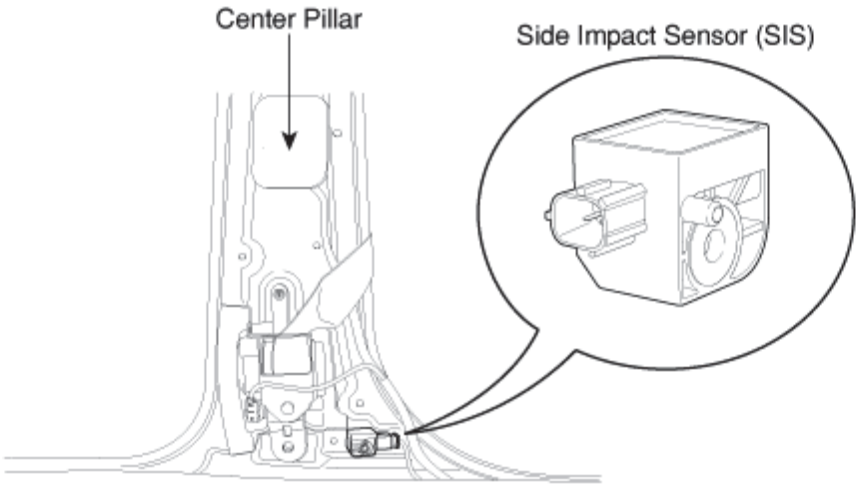
Restraint

SRSCM - Side Impact Sensor (SIS)

DESCRIPTION

The Side Impact Sensor (SIS) system consists of two front SIS which are installed in the center pillar (LH and RH) They are remote sensors that detect acceleration due to collision at their mounting locations. The primary purpose of the Side Impact Sensor (SIS) is to provide an indication of a collision. The Side Impact Sensor (SIS) sends acceleration data to the SRSCM.

COMPONENTS

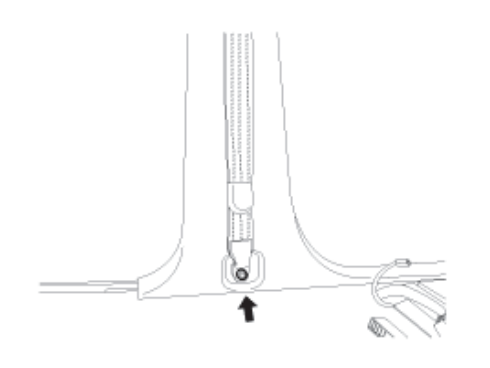


REMOVAL

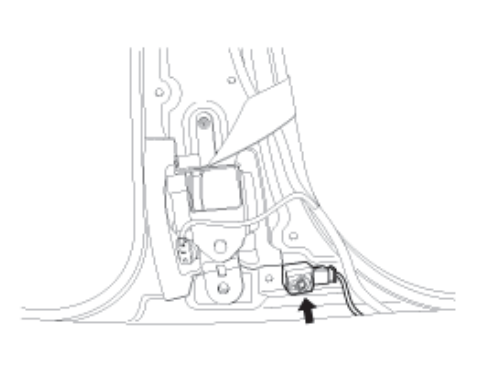
CAUTION

- Removal of the airbag must be performed according to the precautions/procedures described previously.
- Before disconnecting the side impact sensor connector(s), disconnect the side airbag connector(s).
- Do not turn the ignition switch ON and do not connect the battery cable while replacing the side impact sensor.

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the lower anchor bolt.



3. Remove the following parts. (Refer to BD group)
   A. Door scuff trim, Center pillar trim
4. Disconnect the Side Impact Sensor connector and remove the Side Impact Sensor mounting bolt.



INSTALLATION

CAUTION

- Do not turn the ignition switch ON and do not connect the battery cable while replacing the side impact sensor.

1. Install the new Side Impact Sensor with the bolt then connect the SRS harness connector to the Side Impact Sensor.

   Tightening torque
   : 1.0 ~ 1.4 kgf.m (10.2 ~ 13.8 Nm, 7.5 ~ 10.2 lb.ft)

2. Install the center pillar trim. (Refer to BD group)
3. Install the door scuff trim. (Refer to BD group)
4. Inatall the lower anchor bolt.
5. Reconnect the battery negative cable.
6. After installing the Side Impact Sensor, confirm proper system operation: Turn the ignition switch ON, the SRS indicator light should be turned on for about six seconds and then go off.

KIA MOTORS

Restraint

Airbag Module

AIRBAG DISPOSAL

SPECIAL TOOL REQUIRED

Before scrapping any airbags or side airbags (including those in a whole vehicle to be scrapped), the airbags or side airbags must be deployed. If the vehicle is still within the warranty period, before deploying the airbags or side airbags, the Technical Manager must give approval and/or special instruction. Only after the airbags or side airbags have been deployed (as the result of vehicle collision, for example), can they be scrapped.
If the airbags or side airbags appear intact (not deployed), treat them with extreme caution. Follow this procedure.

DEPLOYING AIRBAGS IN THE VEHICLE

If an SRS equipped vehicle is to be entirely scrapped, its airbags or side airbags should be deployed while still in the vehicle. The airbags or side airbags should not be considered as salvageable parts and should never be installed in another vehicle.

1. Turn the ignition switch OFF, and disconnect the battery negative cable and wait at least three minutes.
2. Confirm that each airbag or side airbag is securely mounted.
3. Confirm that the special tool is functioning properly by following the check procedure.

DRIVER'S AIRBAG :

1. Remove the driver's airbag and install the SST(0957A-38500).
2. Install the driver's airbag on the steering wheel.

FRONT PASSENGER'S AIRBAG :

1. Remove the glove box, then disconnect the 2P connector between the front passenger's airbag and SRS main harness.
2. Install the SST(0957A-3E110).

CURTAIN AIRBAG :

1. Disconnect the 2P connector between the curtain airbag and wire harness.
2. Install the SST(0957A-38500).

SEAT BELT PRETENSIONER :

1. Disconnect the 2P connector from the seat belt pretensioner.
2. Install the SST(0957A-38500).
3. Place the deployment tool at least thirty feet (10 meters) away from the airbag.
4. Connect a 12 volt battery to the tool.
5. Push the tool's deployment switch. The airbag should deploy (deployment is both highly audible and visible: a loud noise and rapid inflation of the bag, followed by slow deflection)
6. Dispose of the complete airbag. No part of it can be reused. Place it in a sturdy plastic bag and seal it securely.

DEPLOYING THE AIRBAG OUT OF THE VEHICLE

If an intact airbag has been removed from a scrapped vehicle, or has been found defective or damage during transit, storage or service, it should be deployed as follows :

1. Confirm that the special tool is functioning properly by following the check procedure.
2. Position the airbag face up, outdoors on flat ground at least thirty feet (10meters) from any obstacles or people.

DISPOSAL OF DAMAGED AIRBAG

1. If installed in a vehicle, follow the removal procedure of driver's airbag front passenger's and side airbag.
2. In all cases, make a short circuit by twisting together the two airbag inflator wires.
3. Package the airbag in exactly the same packing that the new replacement part come in.

KIA MOTORS

Restraint

Airbag Module - Driver Airbag (DAB) Module And Clock Spring

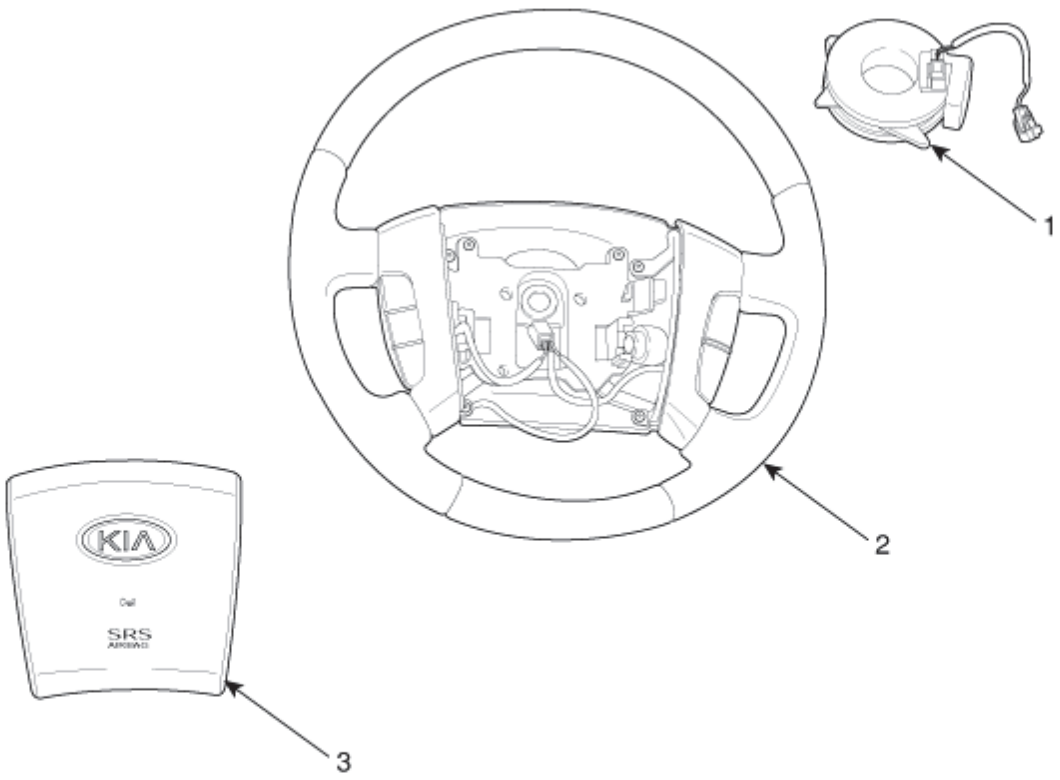
DESCRIPTION

Driver Airbag (DAB) is installed in steering wheel and electrically connected to SRSCM via clockspring. It protects the driver from danger by deploying a bag when frontal crash occurs. The SRSCM determines deployment of Driver Airbag (DAB).

CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

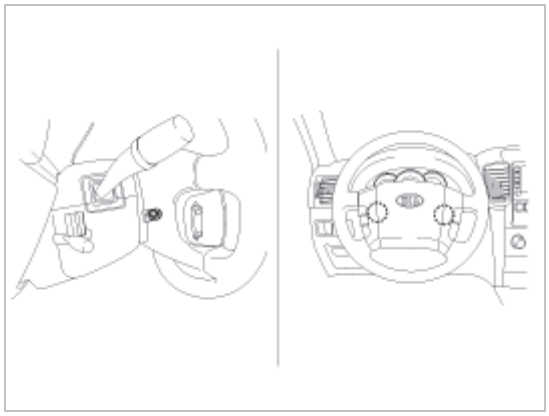
COMPONENTS



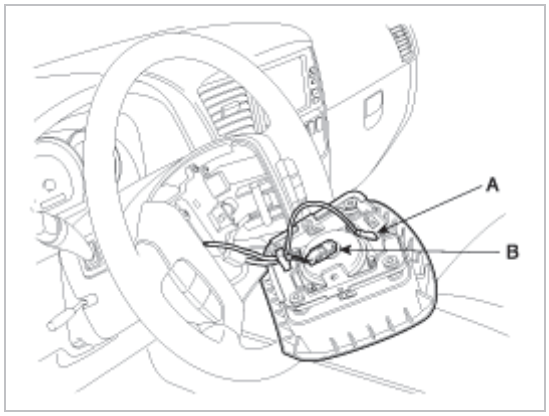
1. Clock Spring
2. Steering Wheel
3. Driver Airbag (DAB)

REMOVAL

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. Remove the airbag module mounting bolts(2EA).



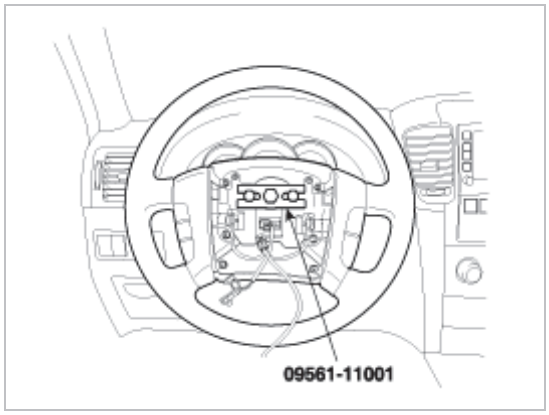
3. Disconnect the horn connector(A).



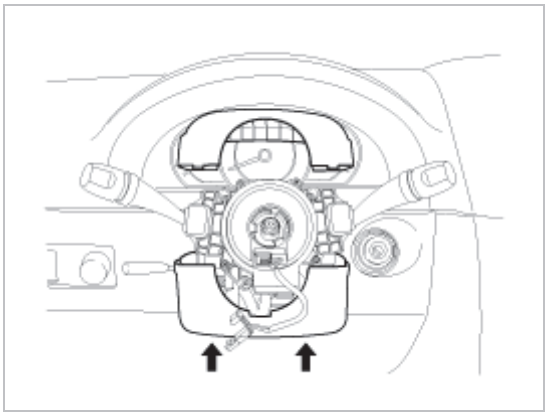
4. Release the connector locking pin, then disconnect the driver airbag module connector(B).

> **CAUTION**
>
> The removed airbag module should be stored in a clean, dry place with the pad cover face up.

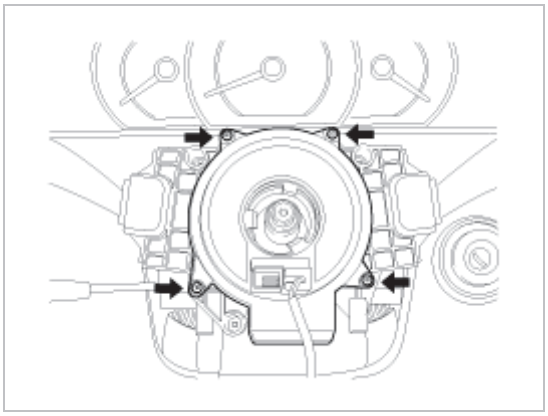
5. Remove the steering wheel with SST (SST No. 09561-11001) after unfastening the mounting nut.



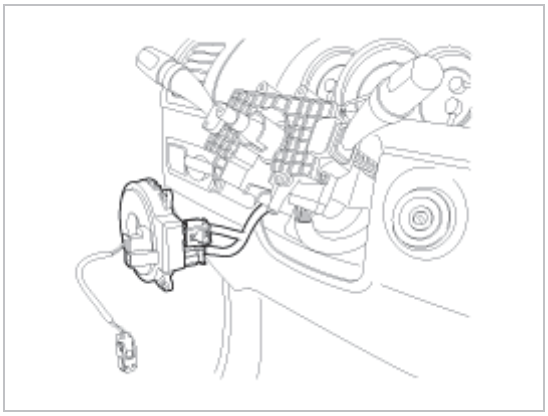
6. Remove the steering wheel column cover after unscrewing 3 screws.



7. Unscrew the clock spring tightening screws. (4EA)

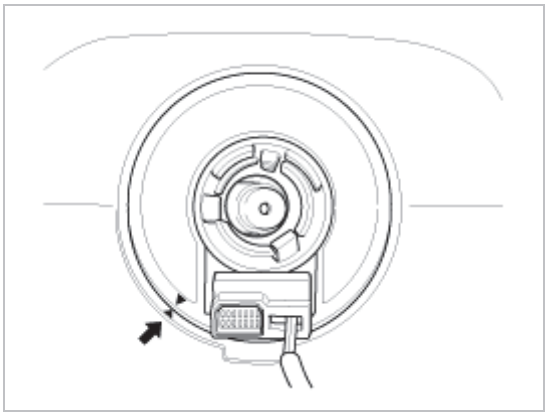


8. Disconnect the clock spring wiring harness and the horn wiring harness connector from the clock spring.



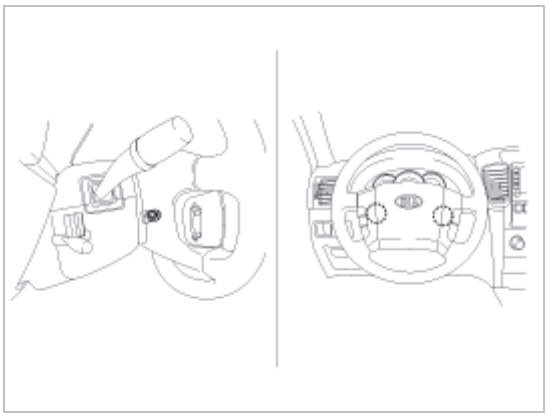
INSTALLATION

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable from battery and wait for at least three minutes before beginning work.
3. Connect the clock spring harness connector and horn harness connector to the clock spring.
4. Install the clock spring with 4 screws.
5. Set the center position by getting marks between the clock spring and the cover into line. Make an array the mark (▶◀) by turning the clock spring clockwise to the stop and then 2.4 revolutions counterclockwise.



6. Install the steering wheel column cover and the steering wheel. (Refer to ST group)
7. Connect the Driver Airbag (DAB) module connector and horn connector, then install the Driver Airbag (DAB) module on the steering wheel.
8. Secure the Driver Airbag (DAB) with the new mounting bolts.

Tightening torque (DAB Mounting Bolt)
: 0.8 ~ 1.1 kgf.m (7.9 ~ 10.8 Nm, 5.8 ~ 8.0 lb.ft)



9. Connect the battery negative cable.
10. After installing the airbag, confirm proper system operation:
    A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.
    B. Make sure horn button works.

INSPECTION

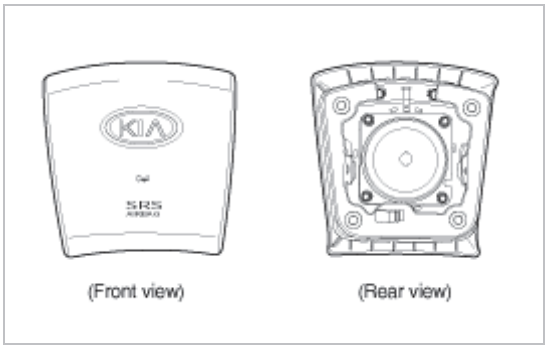
DRIVER AIRBAG (DAB)

If any improper parts are found during the following inspection, replace the airbag module with a new one.

CAUTION

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

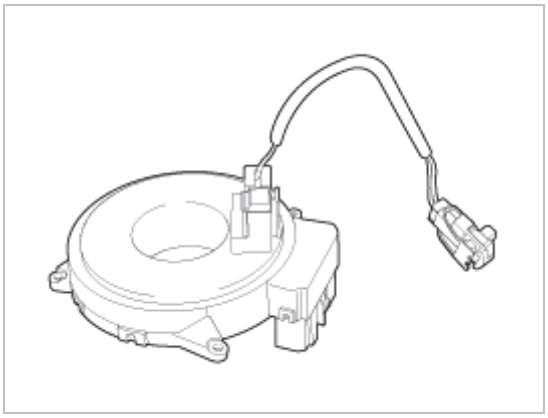
1. Check pad cover for dents, cracks or deformities.
2. Check the airbag module for denting, cracking or deformation.
3. Check hooks and connectors for damage, terminals for deformities, and harness for binds.
4. Check airbag inflator case for dents, cracks or deformities.



5. Install the airbag module to the steering wheel to check for fit or alignment with the wheel.

CLOCKSPRING

1. If, as a result of the following checks, even one abnormal point is discovered, replace the clock spring with a new one.
2. Check connectors and protective tube for damage, and terminals for deformities.



KIA MOTORS

Restraint

Airbag Module - Passenger Airbag (PAB) Module

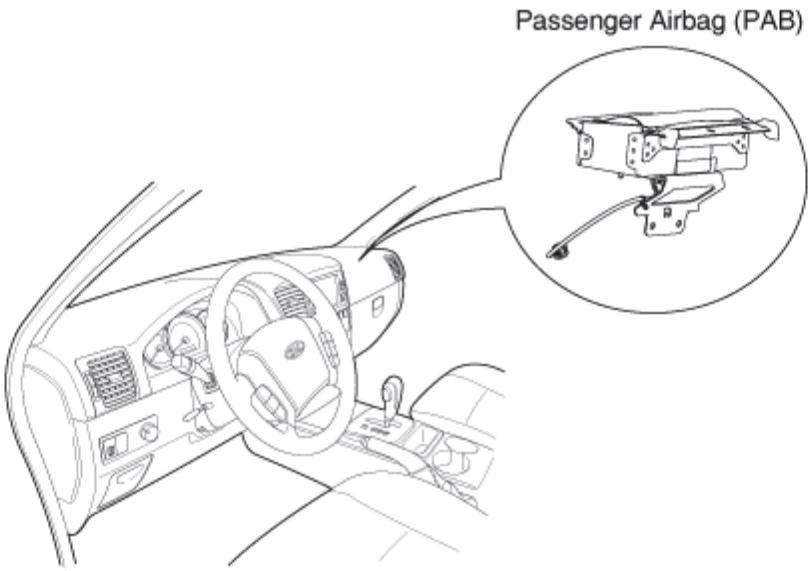
DESCRIPTION

The passenger Airbag (PAB) is installed inside the crash pad and protects the front passenger in the event of a frontal crash. The SRSCM determines if and when to deploy the PAB.

CAUTION

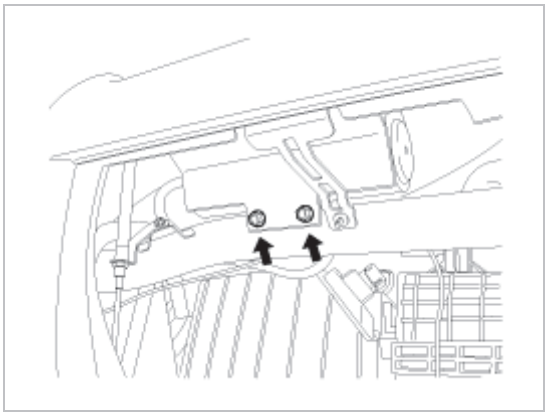
Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

COMPONENTS

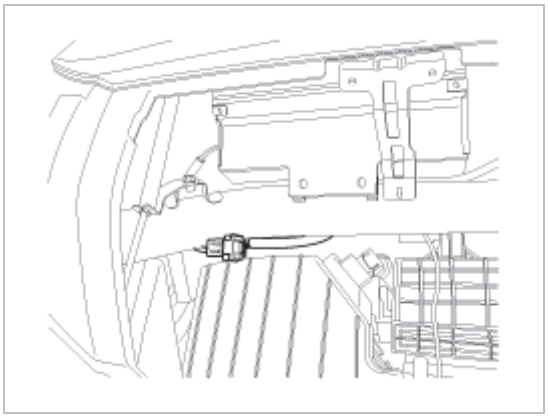


REMOVAL

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. Remove the glove box. (Refer to BD group)
3. Remove the PAB mounting bolts (2EA).



4. Disconnect the PAB module connector.



5. Remove the crash pad. (Refer to BD group)

> **NOTICE**
>
> If the crash pad is damaged when the PAB is deployed, replace the damaged crash pad and PAB together.

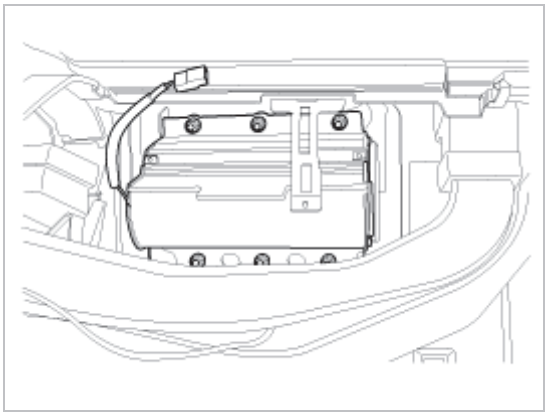
6. Remove the heater duct from the crash pad.
7. Remove the mounting nuts(6EA) from the crash pad. Then remove the passenger airbag.

> **CAUTION**
>
> The removed airbag module should be stored in a clean and dry place with the pad cover face up.

INSTALLATION

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable from battery and wait for at least three minutes before beginning work.
3. Place a Passenger Airbag (PAB) on the crash pad and tighten the Passenger Airbag (PAB) mounting nuts.

Tightening torque
: 0.9 ~ 1.4 kgf.m (8.8 ~ 13.7 N.m, 6.5 ~ 10.1 lb.ft)



4. Install the heater duct to the crash pad.
5. Install the crash pad. (Refer to BD group)
6. Tighten the PAB mounting bolt.

Tightening torque
: 1.9 ~ 2.7 kgf.m (18.6 ~ 26.5 N.m, 13.7 ~ 19.5 lb.ft)

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7. Connect the Passenger Airbag (PAB) harness connector to the SRS main harness connector.
8. Reinstall the glove box. (Refer to BD group)
9. Reconnect the battery negative cable.
10. After installing the Passenger Airbag (PAB), confirm proper system operation:
    A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

KIA MOTORS

Restraint

Airbag Module - Curtain Airbag (CAB) Module

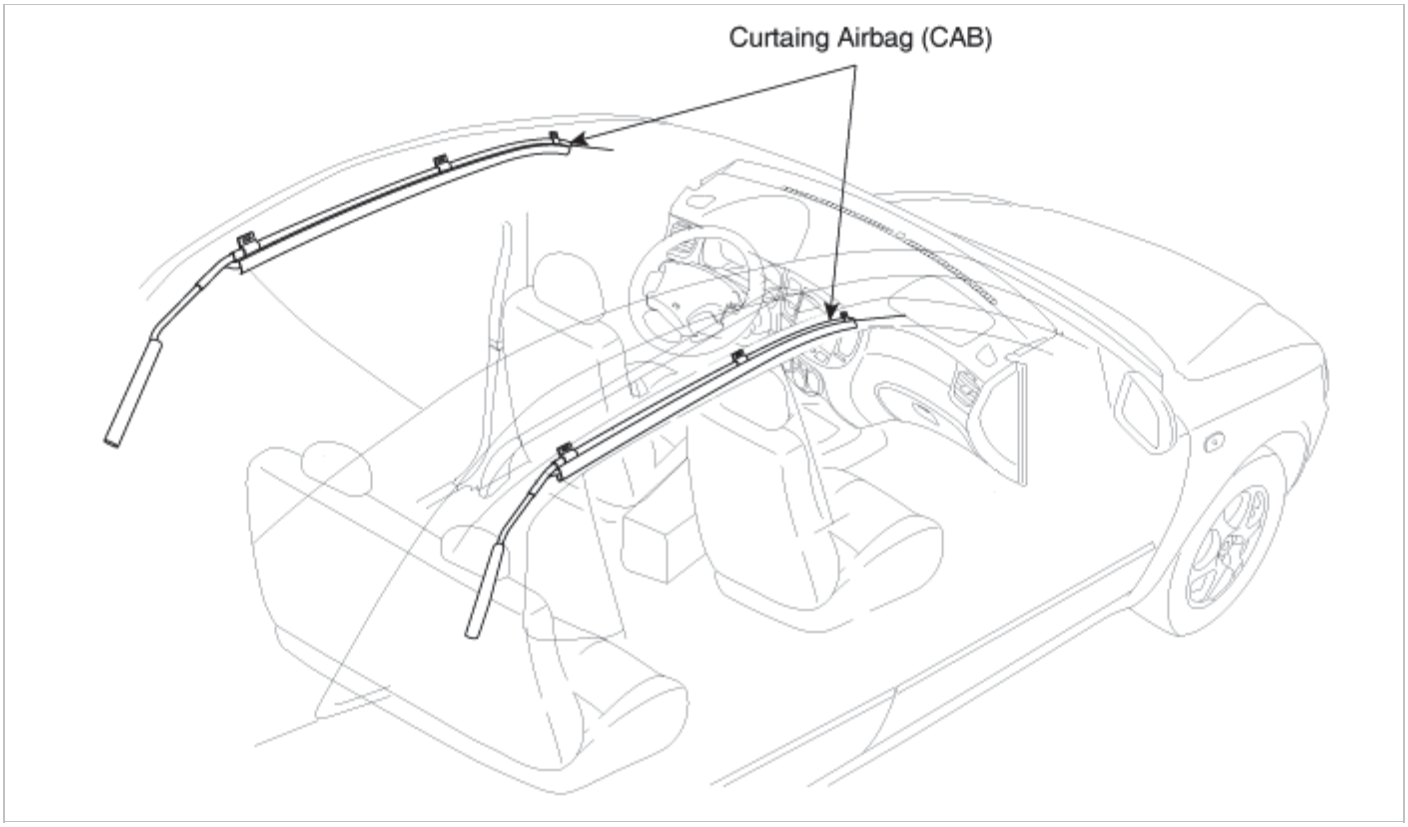
DESCRIPTION

Curtain airbags are installed inside the headliner (LH and RH) and protect the driver and passenger from danger when side crash occurs. The SRSCM determines deployment of curtain airbag by using side impact sensor (SIS) signal.

CAUTION

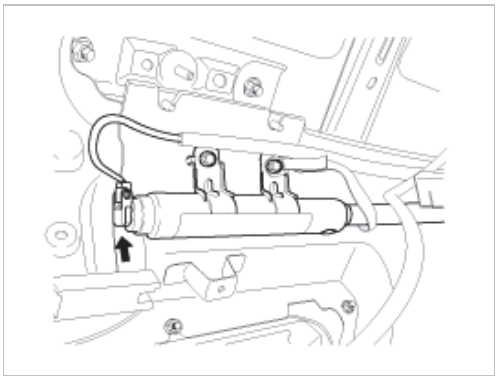
Never attempt to measure the circuit resistance of the airbag module even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

COMPONENTS

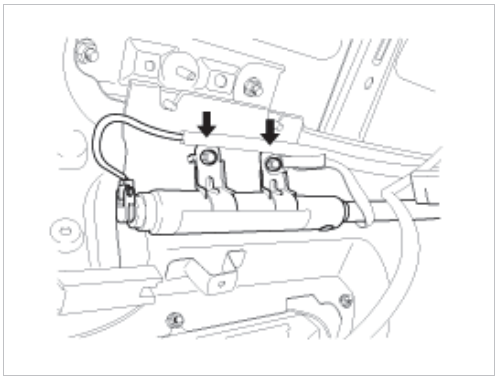


REMOVAL

1. Disconnect the battery negative cable and wait for at least 3 minutes before beginning work.
2. Remove the following parts. (Refer to BD group)
   A. Side trim, Roof trim
3. Disconnect the Curtain Airbag harness connector.



4. After loosening the mounting bolts(6EA) and nut (1EA) remove the curtain airbag.



INSTALLATION

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes.
3. Install a Curtain Airbag (CAB) on the mounting bracket.
4. Tighten the CAB mounting bolts (6EA) and nut (1EA).

Tightening torque
: 0.8 ~ 1.2 kgf.m(7.8 ~ 11.8 Nm, 5.8 ~ 8.7 lb.ft)

CAUTION

- Never twist the airbag module when installing it. If the module is twisted, airbag module may operate abnormally.

5. Connect the CAB connector.
6. Install the following parts. (Refer to BD group)
   A. Side trim, Roof trim
7. Reconnect the battery negative cable.
8. After installing the Curtain Airbag (CAB), confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

KIA MOTORS

Restraint

Seat Belt Pretentionner

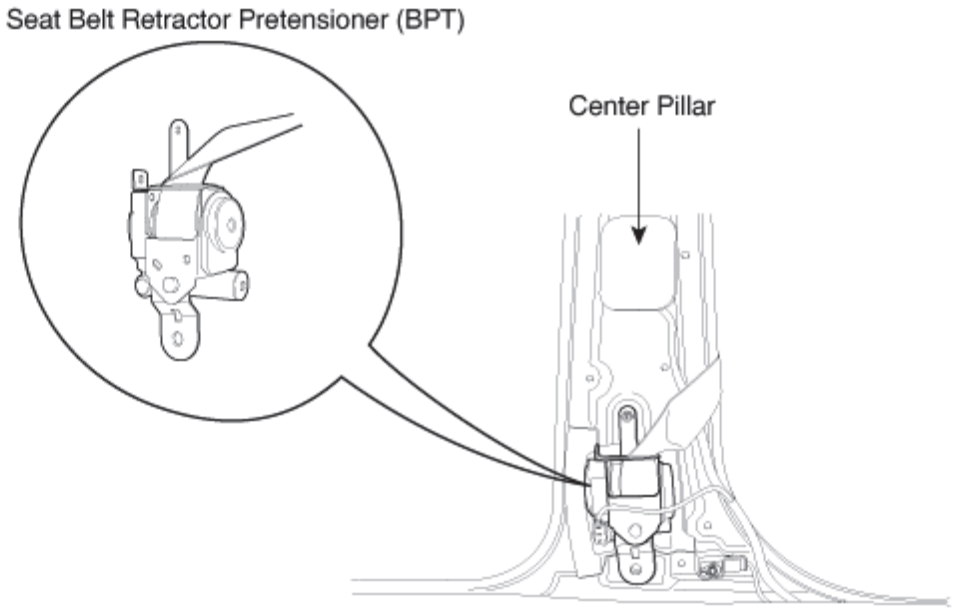
DESCRIPTION

The Seat Belt Pretensioners (BPT) are installed inside Center Pillar (LH & RH). When a vehicle crashes with a certain degree of frontal impact, the pretensioner seat belt helps to reduce the severity of injury to the front seat occupants by retracting the seat belt webbing. This prevents the front occupants from thrusting forward and hitting the steering wheel or the instrument panel when the vehicle crashes.

CAUTION

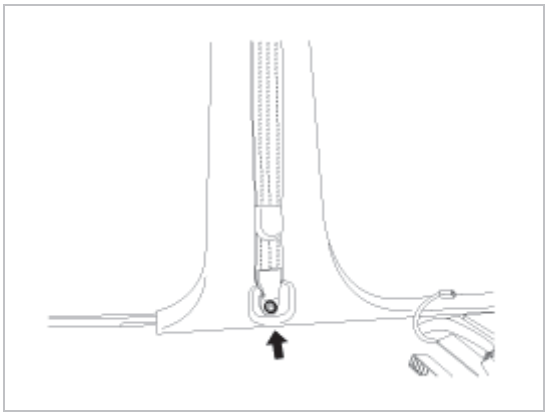
Never attempt to measure the circuit resistance of the Seat Belt Pretensioner (BPT) even if you are using the specified tester. If the circuit resistance is measured with a tester, the pretensioner will be ignited accidentally. This will result in serious personal injury.

COMPONENTS

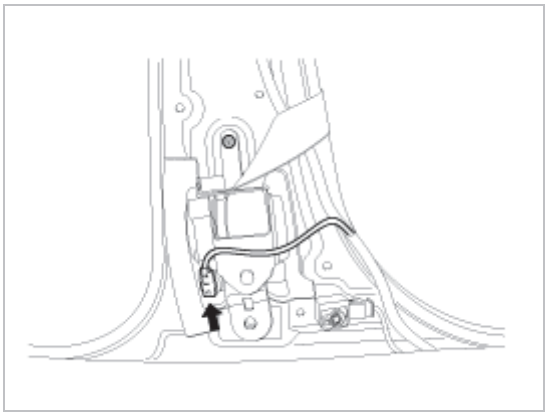


REMOVAL

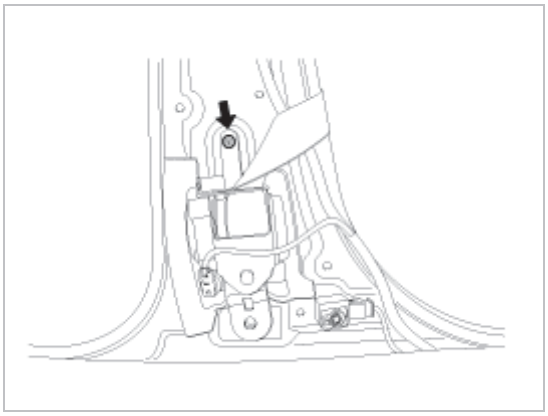
1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the lower anchor bolt.



3. Remove the following parts. (Refer to BD group)
   A. Door scuff trim, Center pillar trim
4. Remove the upper anchor bolt.
5. Disconnect the Seat Belt Pretensioner connector.



6. Loosen the Seat Belt Pretensioner mounting bolt and remove the Seat Belt Pretensioner.



INSTALLATION

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes.
3. Install the Seat Belt Pretensioner (BPT) with a bolt.

Tightening torque

: 4.0 ~ 5.5 kgf.m (39.2 ~ 53.9 Nm, 28.9 ~ 39.8 lb.ft)

4. Connect the Seat Belt Pretentioner (BPT) connector.
5. Install the upper anchor bolts.

Tightening torque (Seat Belt Anchor Bolt)
: 4.0 ~ 5.5 kgf.m (39.2 ~ 53.9 Nm, 28.9 ~ 39.8 lb.ft)

6. Install the center pillar trim.
7. Install the door scuff trim.
8. Install the lower anchor bolt.
9. Reconnect the battery negative cable.
10. After installing the Seat Belt Pretensioner (BPT), confirm proper system operation:
    A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.