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SECTION 0B

GENERAL INFORMATION

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SPECIFICATIONS

TECHNICAL DATA

Performance - Manual Transaxle

Application	2.0L SOHC	2.0L DOHC	2.2L DOHC
Maximum Speed (km/h)	188	206	TBD
Gradeability (tan \emptyset)	0.54	0.57	TBD
Minimum Turning Radius (m)	5.5	5.5	TBD

Performance - Automatic Transaxle

Application	2.0L SOHC	2.0L DOHC	2.2L DOHC
Maximum Speed (km/h)	187	192	TBD
Gradeability (tan \emptyset)	0.62	0.65	TBD
Minimum Turning Radius (m)	5.5	5.5	TBD

Engine

Application	2.0L SOHC	2.0L DOHC	2.2L DOHC
Engine Type	Overhead Cam L-4	Dual Overhead Cam L-4	Dual Overhead Cam L-4
Bore (mm)	86	86	86
Stroke (mm)	86	86	94.6
Total Displacement (cm ³)	1,998	1,998	2,198
Compression Ratio	9.2:1	9.6:1	9.6:1
Maximum Power (kw/rpm)	78 (at 5,000)	98 (at 5,400)	TBD
Maximum Torque (N•m/rpm)	178.5 (at 4,000)	184 (at 4,600)	TBD

Ignition System

Application	2.0L SOHC	2.0L DOHC	2.2L DOHC
Ignition Type	Direct Ignition System	Direct Ignition System	Direct Ignition System
Ignition Timing (° BTDC)	8	5	6
Ignition Sequence	1-3-4-2	1-3-4-2	1-3-4-2
Spark Plug Gap (mm)	0.9	0.8	0.8 / 1.0
Spark Plug Maker	Bosch	Bosch	Bosch
Spark Plug Type	WR8DC	FR8LDC4	FR8LDC4 / FLR8LDCU

Clutch - Manual Transaxle

Application	2.0L SOHC	2.0L DOHC	2.2L DOHC
Type	Single Dry Plate	Single Dry Plate	Single Dry Plate
Outside Diameter (mm)	215	225	225
Inside Diameter (mm)	145	150	150
Thickness (mm)	3.4	3.4	3.4
Fluid Capacity	Common Use; Brake Fluid	Common Use; Brake Fluid	Common Use; Brake Fluid

Manual Transaxle

Application	2.0L SOHC	2.0L DOHC	2.2L DOHC
Maker	DWMC	DWMC	DWMC
Type or Model	D-16	D-20	D-20
Gear Ratio:	-	-	-
1st	3.545:1	3.545:1	3.545:1
2nd	2.048:1	2.158:1	2.158:1
3rd	1.346:1	1.478:1	1.478:1
4th	0.971:1	1.129:1	1.129:1
5th	0.763:1	0.886:1	0.886:1
Reverse	3.333:1	3.333:1	3.333:1
Final Drive Ratio	3.944:1	3.722:1	3.722:1
Oil Capacity (L)	1.8	1.8	1.8

Automatic Transaxle

Application	2.0L SOHC	2.0L DOHC	2.2L DOHC
Maker	ZF	ZF	AISIN
Type or Model	4HP14	4HP14	50-40LE
Gear Ratio:	-	-	-
1st	2.412:1	2.412:1	3.900:1
2nd	1.369:1	1.369:1	2.228:1
3rd	1.000:1	1.000:1	1.477:1
4th	0.739:1	0.739:1	1.062:1
Reverse	2.828:1	2.828:1	4.271:1
Final Drive Ratio	4.225:1	3.979:1	2.654:1
Oil Capacity for Replacement (L)	2.5	2.5	6.5~7.0

Brake

Application	2.0L SOHC	2.0L DOHC	2.2L DOHC
Booster Size:	-	-	-
Booster 1 (in.)	7	7	7
Booster 2 (in.)	8	8	8
Master Cylinder Diameter (mm)	23.8	23.8	23.8
Booster Ratio	5.0:1	5.0:1	5.0:1
Front Brake:	-	-	-
Disc Type	Ventilated	Ventilated	Ventilated
Rear Brake:	-	-	-
Disc Type	Solid	Solid	Solid
Fluid Capacity (L)	0.5	0.5	0.5

Tire and Wheel

Application	2.0L SOHC	2.0L DOHC	2.2L DOHC
Standard Tire Size	195/70R14	205/60R15	205/60R15
Standard Wheel Size	5.5JX14	6.0JX15	6.0JX15
Inflation Pressure at Full Load:	-	-	-
195/70R14:	-	-	-
Front	29	-	-
Rear	29	-	-
205/60R15:	-	-	-
Front	-	29	29
Rear	-	29	29

Steering System

Application	2.0L SOHC	2.0L DOHC	2.2L DOHC
Gear Type	Power Rack and Pinion	Power Rack and Pinion	Power Rack and Pinion
Wheel Alignment:	-	-	-
Front:	-	-	-
Toe-In at Each wheel (°/mm)	-0.1 ± 0.08 (-0.6 ± 0.5)	-0.1 ± 0.08 (-0.6 ± 0.5)	-0.1 ± 0.08 (-0.6 ± 0.5)
Caster (°)	3 ± 1	3 ± 1	3 ± 1
Camber (°)	-0.2 ± 1	-0.2 ± 1	-0.2 ± 1
Rear:	-	-	-
Toe-In at Each wheel (°/mm)	0.16 ± 0.08 (1 ± 0.5)	0.16 ± 0.08 (1 ± 0.5)	0.16 ± 0.08 (1 ± 0.5)
Camber (°)	-0.8 ± 1	-0.8 ± 1	-0.8 ± 1
Oil Capacity (L)	1.0	1.0	1.0

Suspension

Application	2.0L SOHC	2.0L DOHC	2.2L DOHC
Front Type	MacPherson Strut	MacPherson Strut	MacPherson Strut
Rear Type	Dual Link Strut	Dual Link Strut	Dual Link Strut

Fuel System

Application	2.0L SOHC	2.0L DOHC	2.2L DOHC
Fuel Delivery	MPI	MPI	MPI
Fuel Pump Type	Electric Motor Pump	Electric Motor Pump	Electric Motor Pump
Fuel Filter Type	Cartridge	Cartridge	Cartridge
Fuel Capacity (L)	65	65	65

Lubricating System

Application	2.0L SOHC	2.0L DOHC	2.2L DOHC
Lubricating Type	Forced Feed	Forced Feed	Forced Feed
Oil Pump Type	Duocentric Rotor	Duocentric Rotor	Duocentric Rotor
Oil Filter Type	Cartridge (Full Flow)	Cartridge (Full Flow)	Cartridge (Full Flow)
Oil Pan Capacity Including Oil Filter (L)	4.0	4.0	4.0

Cooling System

Application	2.0L SOHC	2.0L DOHC	2.2L DOHC
Cooling Type	Forced Water Circulation	Forced Water Circulation	Forced Water Circulation
Radiator Type	Cross-flow	Cross-flow	Cross-flow
Water Pump Type	Centrifugal	Centrifugal	Centrifugal
Thermostat Type	Pellet Type	Pellet Type	Pellet Type
Coolant Capacity (L)	7.0	7.0	7.0

Electric System

Application	2.0L SOHC	2.0L DOHC	2.2L DOHC
Battery (Amps)	550 Cold Cranking 610 Cold Cranking	550 Cold Cranking 610 Cold Cranking	550 Cold Cranking 610 Cold Cranking
Alternator (Amps)	95	95	95
Starter (No-Load Test Current Draw):	-	-	-
1.4 kW (Amps/Volts)	Minimum 80 Maximum 120 (at 10)	Minimum 80 Maximum 120 (at 10)	Minimum 80 Maximum 120 (at 10)

VEHICLE DIMENSIONS AND WEIGHTS**Vehicle Dimensions - Manual and Automatic**

Application	2.0L SOHC	2.0L DOHC	2.2L DOHC
Overall Length (mm)	4,671	4,671	4,671
Overall Width (mm)	1,779	1,779	1,779
Overall Height (mm)	1,437	1,437	1,437
Minimum Ground Clearance (mm)	167	167	167
Wheel Base (mm)	2,670	2,670	2,670
Tread:	-	-	-
Front (mm)	1,515	1,515	1,515
Rear (mm)	1,507	1,507	1,507

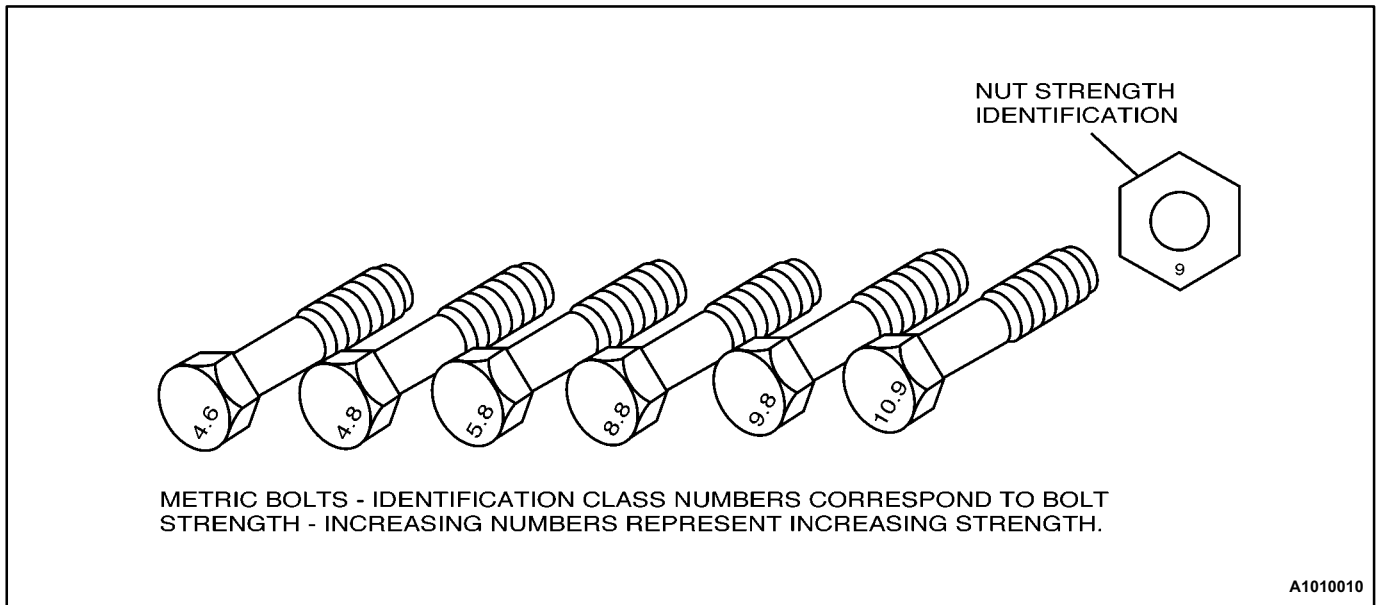
Vehicle Weights - 4 Door Notchback

Application	2.0L SOHC	2.0L DOHC	2.2L DOHC
Manual:	-	-	-
Curb Weight (kg)	1,295 - 1,320	1,325 - 1,365	TBD
Gross Vehicle Weight (kg)	1,830	1,830	TBD
Automatic:	-	-	-
Curb Weight: (kg)	1,305 - 1,330	1,336 - 1,376	TBD
Gross Vehicle Weight (kg)	1,830	1,830	TBD
Passenger Capacity	5	5	TBD

STANDARD BOLT SPECIFICATIONS

Bolt*	4T - Low Carbon Steel	7T - High Carbon Steel	7T - Alloy Steel
M6 X 1.0	4.1-8.1 N•m (36-72 lb•in)	4.1-9.5 N•m (48-84 lb•in)	-
M8 X 1.25	8.1-17.6 N•m (72-156 lb•in)	12.2-23.0 N•m (108-204 lb•in)	16-30 N•m (12-22 lb•ft)
M10 X 1.25	20-34 N•m (15-25 lb•ft)	27-46 N•m (20-34 lb•ft)	37-62 N•m (27-46 lb•ft)
M10 X 1.5	19-34 N•m (14-25 lb•ft)	27-45 N•m (20-33 lb•ft)	37-60 N•m (27-44 lb•ft)
M12 X 1.25	49-73 N•m (36-54 lb•ft)	61-91 N•m (45-67 lb•ft)	76-114 N•m (56-84 lb•ft)
M12 X 1.75	45-69 N•m (33-51 lb•ft)	57-84 N•m (42-62 lb•ft)	72-107 N•m (53-79 lb•ft)
M14 X 1.5	76-115 N•m (56-85 lb•ft)	94-140 N•m (69-103 lb•ft)	114-171 N•m (84-126 lb•ft)
M14 X 2.0	72-107 N•m (53-79 lb•ft)	88-132 N•m (65-97 lb•ft)	107-160 N•m (79-118 lb•ft)
M16 X 1.5	104-157 N•m (77-116 lb•ft)	136-203 N•m (100-150 lb•ft)	160-240 N•m (118-177 lb•ft)
M16 X 2.0	100-149 N•m (74-110 lb•ft)	129-194 N•m (95-143 lb•ft)	153-229 N•m (113-169 lb•ft)
M18 X 1.5	151-225 N•m (111-166 lb•ft)	195-293 N•m (144-216 lb•ft)	229-346 N•m (169-255 lb•ft)
M20 X 1.5	206-311 N•m (152-229 lb•ft)	270-405 N•m (199-299 lb•ft)	317-476 N•m (234-351 lb•ft)
M22 X 1.5	251-414 N•m (185-305 lb•ft)	363-544 N•m (268-401 lb•ft)	424-636 N•m (313-469 lb•ft)
M24 X 2.0	359-540 N•m (265-398 lb•ft)	431-710 N•m (318-524 lb•ft)	555-831 N•m (409-613 lb•ft)

* Diameter X pitch in millimeters



MAINTENANCE AND REPAIR

MAINTENANCE AND LUBRICATION

NORMAL VEHICLE USE

The maintenance instructions contained in the maintenance schedule are based on the assumption that the vehicle will be used for the following reasons:

- To carry passengers and cargo within the limitation indicated on the Tire Placard located on the edge of the driver's door.
- To be driven on reasonable road surfaces and within legal operating limits.

EXPLANATION OF SCHEDULED MAINTENANCE SERVICES

The services listed in the maintenance schedule are further explained below. When the following maintenance services are performed, make sure all the parts are replaced and all the necessary repairs are done before driving the vehicle. Always use the proper fluid and lubricants.

Drive Belt Inspection

When a separate belt drives the power steering pump, the air conditioning compressor and the generator, inspect it for cracks, fraying, wear, and proper tension. Adjust or replace the belt as needed.

Engine Oil and Oil Filter Change

Always use above the SJ grade engine oil. The SJ designation may be shown alone or in combination with other designations such as SJ/CC, etc.

Engine Oil Viscosity

Engine oil viscosity (thickness) has an effect on fuel economy and cold weather operation. Lower viscosity engine oils can provide better fuel economy and cold weather performance; however, higher temperature weather conditions require higher viscosity engine oils for satisfactory lubrication. Using oils of any viscosity other than those viscosities recommended could result in engine damage.

Cooling System Service

Drain, flush and refill the system with new coolant. Refer to „Recommended Fluids and Lubricants” in this section.

Fuel Micro-Filter Replacement

Replace the engine fuel filter every 45 000 km (27,000 miles).

The engine fuel filter is located on the center dash panel near the brake booster.

Air Cleaner Element Replacement

Replace the air cleaner element every 45 000 km (27,000 miles).

Replace the air cleaner more often under dusty conditions.

Throttle Body Mounting Bolt Torque

Check the torque of the throttle body mounting bolts.

Tighten the throttle body mounting nuts to 9 N•m (80 lbf•in) (DOHC), 15 N•m (11 lbf•ft) (SOHC), if necessary.

Spark Plug Replacement

Replace spark plugs with the same type.

	SOHC	DOHC	
Maker	Bosch	Bosch	
Type	WR8DC	FR8LDC4	FLR8LDCU
Gap	0.9mm	0.8mm	1.0mm

Spark Plug Wire Replacement

Clean the wires and inspect them for burns, cracks, or other damage. Check the wire boot fit at the direct ignition system (DIS) module and at the spark plugs. Replace the wires as needed.

Brake System Service

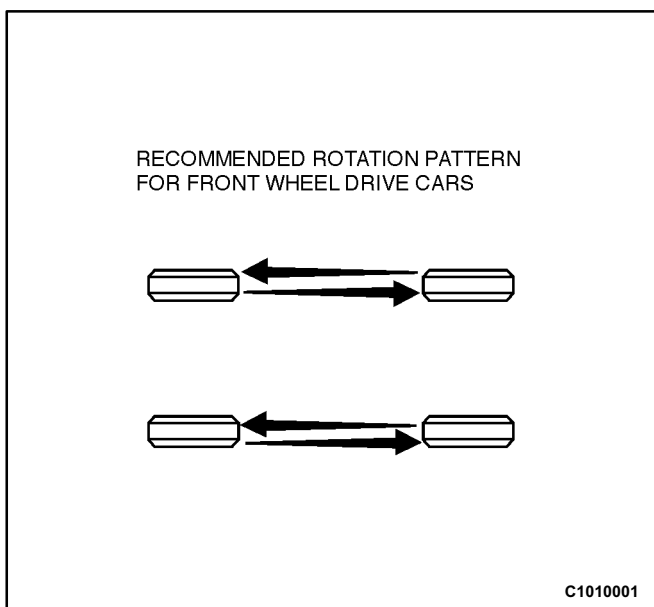
Check the disc brake pads every 15,000 km or 12 months. Check the pad and the lining thickness carefully. If the pads or the linings are not expected to last another 15,000 km, replace the pads or the linings. Check the breather hole in the brake fluid reservoir cap to be sure it is free from dirt and the passage is open.

Transaxle Service

The manual transaxle oil does not require changing. The automatic transaxle fluid should be changed every 30,000 km for ZF 14HP and every 90,000 km for AISIN 50-40LE.

Tire and Wheel Inspection and Rotation

Check the tires for abnormal wear or damage. To equalize wear and obtain maximum tire life, rotate the tires. If irregular or premature wear exists, check the wheel alignment and check for damaged wheels. While the tires and wheels are removed, inspect the brakes. Refer to „Each Time The Oil Is Changed” in this section.



SCHEDULED MAINTENANCE CHARTS

Engine

Maintenance Item	Maintenance Interval								
	Kilometers (miles) or time in months, whichever comes first								
Kilometers x 1 000	1	15	30	45	60	75	90	105	120
Miles x 1 000	.6	9	18	27	36	45	54	63	72
Months	-	12	24	36	48	60	72	84	96
Drive belts (alternator, power steering)			I		I		I		I
DOHC			I		I		I		I
Engine oil and oil filter ^{1, 3}	I	R	R	R	R	R	R	R	R
Cooling system and hose connection		I	I	I	I	I	I	I	I
Engine coolant ³	I	I	I	R	I	I	R	I	I
Fuel filter				R			R		
Fuel line and connections		I	I	I	I	I	I	I	I
Air cleaner element ²		I	I	R	I	I	R	I	I
Ignition timing		I	I	I	I	I	I	I	I
Spark plugs			I		R		I		R
DIS Module			I		I		I		I
Charcoal canister and vapor lines				I			I		
PCV System			I		I		I		I
Timing belt (camshaft belt)					I		R		I
Air condition filter*	I	R	R	R	R	R	R	R	R

Chart Symbols:

I - Inspect, and if necessary correct, clean, replenish or adjust.

R - Replace or change:

¹ If the vehicle is operated under severe conditions: short distance driving, extensive idling or driving in dusty conditions, change the engine oil and the filter every 7 500 km (4,500 miles) or six months, whichever comes first.

² More frequently if driving in dusty conditions.

³ Refer to „Recommended Fluids and Lubricants.”

Chassis and Body

Maintenance Item	Maintenance Interval								
	Kilometers (miles) or time in months, whichever comes first								
Kilometers x 1 000	1	15	30	45	60	75	90	105	120
Miles x 1 000	6	9	18	27	36	48	54	63	72
Months	-	12	24	36	48	60	72	84	96
Brake and clutch fluid ^{1, 4}	I	I	R	I	R	I	R	I	R
Brake pads and discs ³		I	I	I	I	I	I	I	I
Parking brake		I	I	I	I	I	I	I	I
Brake line and connections (including booster)		I	I	I	I	I	I	I	I
Rear hub bearing and clearance		I	I	I	I	I	I	I	I
Manual transaxle oil ¹		I	I	I	I	I	I	I	I
Clutch and brake pedal free play		I	I	I	I	I	I	I	I
Automatic transaxle fluid ¹ (ZF 14HP)	I	I	R	I	R	I	R	I	R
Automatic transaxle fluid ¹ (AISIN 50-40LE)	I	I	I	I	I	I	R	I	I
Tighten chassis and underbody bolts and nuts		I	I	I	I	I	I	I	I
Tire condition and inflation pressure	I	I	I	I	I	I	I	I	I
Wheel alignment ²	Inspect when abnormal condition is noted								
Steering wheel and linkage		I	I	I	I	I	I	I	I
Power steering fluid and lines ¹	I	I	I	I	I	I	I	I	I
Drive shaft boots		I	I	I	I	I	I	I	I
Seat belts, buckles and anchors		I	I	I	I	I	I	I	I
Lubricate locks, hinges and hood latch		I	I	I	I	I	I	I	I

Chart Symbols:

I - Inspect, and if necessary correct, clean, replenish or adjust.

R - Replace or change:

¹ Refer to „Recommended Fluids And Lubricants.”

² And if necessary, rotate and balance wheels.

³ More frequently if operated under severe conditions: short distance driving, extensive idling, frequent low-speed operation in stop and go traffic, or driving in dusty conditions.

⁴ Change the brake/clutch fluid every 15 000 km (9,000 miles) if the vehicle is mainly driven under severe conditions:
 - driving in hilly or mountainous terrain, or
 - towing a trailer/caravan frequently.

OWNER INSPECTIONS AND SERVICES

WHILE OPERATING THE VEHICLE

Horn Operation

Blow the horn occasionally to make sure it works. Check all the button locations.

Brake System Operation

Be alert for abnormal sounds, increased brake pedal travel, or repeated pulling to one side when braking. Also, if the brake warning light goes on or flashes, something may be wrong with part of the brake system.

Exhaust System Operation

Be alert to any changes in the sound of the system or the smell of the fumes. These are signs that the system may be leaking or overheating. Have the system inspected and repaired immediately.

Tires, Wheels and Alignment Operation

Be alert to any vibration of the steering wheel or the seats at normal highway speeds. This may mean a wheel needs to be balanced. Also, a pull right or left on a straight, level road may show the need for a tire pressure adjustment or a wheel alignment.

Steering System Operation

Be alert to changes in the steering action. An inspection is needed when the steering wheel is hard to turn or has too much free play, or if unusual sounds are noticed when turning or parking.

Headlamp Aim

Take note of the light pattern occasionally. Adjust the headlamps if the beams seem improperly aimed.

AT EACH FUEL FILL

A fluid loss in any (except windshield washer) system may indicate a problem. Have the system inspected and repaired immediately.

Engine Oil Level

Check the oil level and add oil if necessary. The best time to check the engine oil level is when the oil is warm.

1. After stopping the engine, wait a few minutes for the oil to drain back to the oil pan.
2. Pull out the oil level indicator (dipstick).
3. Wipe it clean, and push the oil level indicator back down all the way.
4. Pull out the oil level indicator and look at the oil level on it.
5. Add oil, if needed, to keep the oil level above the MIN line and within the area labeled „Operating Range.” Avoid overfilling the engine, since this may cause engine damage.

6. Push the indicator all the way back down into the engine after taking the reading.

If you check the oil level when the oil is cold, do not run the engine first. The cold oil will not drain back to the pan fast enough to give a true oil level reading.

Engine Coolant Level and Condition

Check the coolant level in the coolant reservoir tank and add coolant if necessary. Inspect the coolant. Replace dirty or rusty coolant.

Windshield Washer Fluid Level

Check the washer fluid level in the reservoir. Add fluid if necessary.

AT LEAST MONTHLY

Tire and Wheel Inspection and Pressure Check

Check the tires for abnormal wear or damage. Also check for damaged wheels. Check the tire pressure when the tires are cold (check the spare also, unless it is a stowaway). Maintain the recommended pressures that are on the tire placard that is on the driver's door.

Lamp Operation

Check the operation of the license plate lamp, the headlamps (including the high beams), the parking lamps, the fog lamps, the taillamp, the brake lamps, the turn signals, the backup lamps, and the hazard warning flasher.

Fluid Leak Check

Periodically inspect the surface beneath the vehicle for water, oil, fuel or other fluids, after the vehicle has been parked for a while. Water dripping from the air conditioning system after use is normal. If you notice fuel leaks or fumes, find the cause and correct it at once.

AT LEAST TWICE A YEAR

Power Steering System Reservoir Level

Check the power steering fluid level. Keep the power steering fluid at the proper level. Refer to *Section 6A, Power Steering System*.

Brake Master Cylinder Reservoir Level

Check the fluid and keep it at the proper level. Refer to *Section 4B, Master Cylinder*. A low fluid level can indicate worn disc brake pads may need to be serviced. Check the breather hole in the reservoir cover to be free from dirt and check for an open passage.

Clutch Pedal Free Travel

Check clutch pedal free travel and adjust as necessary every 10 000 km. Measure the distance from the center of the clutch pedal to the outer edge of the steering wheel with the clutch pedal not depressed. Then measure the distance from the center of the clutch pedal to the outer edge of the steering wheel with the clutch pedal fully depressed. The difference between the two values must be greater than 140 mm.

Weatherstrip Lubrication

Apply a thin film of silicone grease using a clean cloth.

EACH TIME THE OIL IS CHANGED**Automatic Transaxle Fluid**

Refer to *Section 5A, ZF 4HP14 Automatic Transaxle*.

Manual Transaxle

Check the oil level and add oil as required. Refer to *Section 5B, Five-Speed Manual Transaxle*.

Brake System Inspection

This inspection should be done when the wheels are removed for rotation. Inspect the lines and the hoses for proper hookup, binding, leaks, cracks, chafing, etc. Inspect the disc brake pads for wear. Inspect the rotors for surface condition. Inspect other brake parts, including the parking brake, etc., at the same time. Check the parking brake adjustment. Inspect the brakes more often if habit or conditions result in frequent braking.

Steering, Suspension and Front Drive Axle Boot and Seal Inspection

Inspect the front and rear suspension and the steering system for damaged, loose, or missing parts; signs of wear; or lack of lubrication. Inspect the power steering lines and the hoses for proper hookup, binding, leaks, cracks and chafing, etc. Clean and inspect the drive axle boot and seals for damage, tears, or leakage. Replace the seals if necessary.

Exhaust System Inspection

Inspect the complete system (including the catalytic converter, if equipped). Inspect the body near the exhaust system. Look for broken, damaged, missing, or outofposition parts, as well as open seams, holes, loose connections, or other conditions which could cause heat buildup in the floor pan or could let exhaust fumes seep into the trunk or passenger compartment.

Throttle Linkage Inspection

Inspect the throttle linkage for interference or binding, damaged, or missing parts. Lubricate all linkage joints and throttle cable joints, the intermediate throttle shaft bearing, the return spring at throttle valve assembly, and the accelerator pedal sliding face with suitable grease. Check the throttle cable for free movement.

Engine Drive Belts

Inspect all belts for cracks, fraying, wear, and proper tension. Adjust or replace the belts as needed.

Hood Latch Operation

When opening the hood, note the operation of the secondary latch. It should keep the hood from opening all the way when the primary latch is released. The hood must close firmly.

AT LEAST ANNUALLY

Lap and Shoulder Belt Condition and Operation

Inspect the belt system, including the webbing, the buckles, the latch plates, the retractor, the guide loops and the anchors.

Movable Head Restraint Operation

On vehicles with movable head restraints, the restraints must stay in the desired position.

Spare Tire and Jack Storage

Be alert to rattles in the rear of the vehicle. The spare tire, all the jacking equipment, and the tools must be securely stowed at all times. Oil the jack ratchet or the screw mechanism after each use.

Key Lock Service

Lubricate the key lock cylinder.

Body Lubrication Service

Lubricate all the body door hinges including the hood, the fuel door, the rear compartment hinges and the latches, the glove box and the console doors, and any folding seat hardware.

Transaxle Neutral Switch Operation on Automatic Transaxle

Caution: Take the following precautions because the vehicle could move without warning and possibly cause personal injury or property damage:

- ***Firmly apply the parking brake and the regular brakes.***
- ***Do not use the accelerator pedal.***
- ***Be ready to promptly turn off the ignition if the vehicle starts.***

On automatic transaxle vehicles, try to start the engine in each gear. The starter should crank only in P (PARK) and in N (NEUTRAL).

Parking Brake and Transaxle P (PARK) Mechanism Operation

Caution: In order to reduce the risk of personal injury or property damage, be prepared to apply the regular brakes promptly if the vehicle begins to move.

Park on a fairly steep hill with enough room for movement in the downhill direction. To check the parking brake, with the engine running and the transaxle in N (NEUTRAL), slowly remove foot pressure from the regular brake pedal (until only the parking brake is holding the vehicle).

To check the automatic transaxle P (PARK) mechanism's holding ability, release all brakes after shifting the transaxle to P (PARK).

Underbody Flushing

Flushing the underbody will remove any corrosive materials used for ice and snow removal and dust control. At least every spring, clean the underbody. First, loosen the sediment packed in closed areas of the vehicle. Then flush the underbody with plain water.

Engine Cooling System

Inspect the coolant and freeze protection fluid. If the fluid is dirty or rusty, drain, flush and refill the engine cooling system with new coolant. Keep the coolant at the proper mixture in order to ensure proper freeze protection, corrosion protection and engine operating temperature. Inspect the hoses. Replace the cracked, swollen, or deteriorated hoses. Tighten the clamps. Clean the outside of the radiator and the air conditioning condenser. Wash the filler cap and the neck. Pressure test the cooling system and the cap in order to help ensure proper operation.

RECOMMENDED FLUIDS AND LUBRICANTS

USAGE	CAPACITY	FLUID/LUBRICANT
Engine Oil	4.0L	SOHC - SAE 10W/30, API SJ DOHC - SAE 5W/30, API SJ
Engine Coolant	7.0L	Mixture of water and good quality silicatebase antifreeze (year-round coolant)
Brake and Clutch Fluid	0.5L	SSK221 (DOT-3 Fluid)
Power Steering System Fluid	1.0L	DEXRON® II or III
Automatic Transaxle Fluid (ZF 14HP)	2.5L (when overhaul 6.2L)	DEXRON® II, III or Mercon®M, see Recommended Auto Transaxle Fluids
Automatic Transaxle Fluid (AISIN 50-40LE)	2.5L - 3.0L (when overhaul 6.5 - 7.0L)	TOTAL FLUID HX
Manual Transaxle Fluid	1.8L	CASTROL 80W
Manual Transaxle Shift Linkage	As needed	Grease (M-8122)
Key Lock Cylinders	As needed	Grease (M-8104)
Automatic Transaxle Shift Linkage	As needed	Grease
Clutch Linkage Pivot Points	As needed	Grease
Floor Shift Linkage Points	As needed	Grease
Hood Latch Assembly 1. Pivots and Spring Anchor	As needed	Grease (M-8105)
Hood and door hinges Fuel door hinge Rear compartment lid hinges	As needed	Spray Grease (M-8149) Oil (M-8030)
Weatherstrips	As needed	Wetting Agent (M-8128)

RECOMMENDED AUTOMATIC TRANSAXLE FLUIDS (ZF 14HP)

Manufacturer	Trade name	Manufacturer	Trade name
ADDINOL MINERALÖL GMBH, KRUMPA/D	ADDINOL ATF D III	KUWAIT PETROLEUM, HOOGLIJET/NL	Q8 AUTO 14 (II D-21883)
AGIP PETROLI SPA, ROM/I	AGIP ATF II D	KUWAIT PETROLEUM, HOOGLIJET/NL	Q8 AUTO 14 (II D-21677)
AGIP PETROLI SPA, ROM/I	AGIP DEXRON III	LEPRINCE+SIVEKE GMBH, HERFORD/D	LEPRINXOL FLUID CN
AGIP PETROLI SPA, ROM/I	AGIP ATF D 309	LIQUIMOLY / MEGUIN, ULM/D	MEGOL ATF II D
AGIP SCHMIERTECHNIK, WÜRZBURG/D	AUTOL GETRIEBEÖL ATF III D	MAURAN SA, ODARS/F	INTER OIL INTER MATIC ATF D2
AGIP SCHMIERTECHNIK, WÜRZBURG/D	AUTOL GETRIEBEÖL ATF-D	MIN.ÖL-RAFFIN, DOLLBERGEN, UETZE/D	PENNASOL FLUID-GETR. ÖL TYP PCN
ARAL AG, BOCHUM/D	ARAL GETR ÖL ATF 55 F-30589	MOBIL OIL, WEDEL/D	MOBIL ATF 220 D21412 / D22187
ARAL AG, BOCHUM/D	ARAL GETRIEBEÖL ATF 22	MOBIL OIL, WEDEL/D	MOBIL ATF 220 D20104 / D21685
AVIA MINERALÖL-AG, MÜNCHEN/D	AVIA FLUID ATF 86	MOL HUNGARIAN OIL, KOMARON/H	CARRIER ATF
BLASER SWISSLUBE, HASLE-RÜEGSAU/CH	BLASOL 229	MORRIS LUBRICANTS, SHREWSBURY/GB	LIQUIMATIC D II
BP OIL DEUTSCHLAND, HAMBURG/D	FRONTOL UNIVERSAL-ATF 100	NAFTEC, ALGIER/DZ	TASSILIA
BP OIL INTERNATIONAL, LONDON/GB	AUTRAN MBX	NANHAI SUPERIOR LUB-OIL, CHINA	NANHAI ATF (D2)
BUCHER+CIE AG, LANGENTHAL/CH	MOTOREX ATF SUPER D-22656	NIS-RAFINERIJA NAFTE BEOGRAD/YU	GALAX MATIC DAC
BUCHER+CIE AG, LANGENTHAL/CH	MOTOREX ATF DEXRON III MC	OEST G. MIN. ÖLWERK, FREUDENSTADT/D	ATF T 4011
C.J.DIEDERICHS SÖHNE, WUPPERTAL/D	CIDISOL-HYDR.-FLUID DEXRON II D	OMV AG, SCHWECHAT/A	OMV ATF D II (D22427)
CALPAM GMBH, ASCHAFFENBURG/D	PAMATIC FLUID 289	OMV AG, SCHWECHAT/A	OMV ATF III (F-30580)
CALPAM GMBH, ASCHAFFENBURG/D	CALPAMATIC FLUID III F	OPTIMOL ÖLWERKE, HAMBURG/D	OPTIMOL ATF T 4011
CALTEX PETROLEUM CORP., LONDON/GB	CALTEX ATF-HDA	OSWALD KLUTH, BARGFELD-STEGEN/D	UNIVERSAL ATF-D
CASTROL LTD. SWINDON/GB	CASTROL TQ-D (22765)	PAKELO MOTOR OIL, SAN BONIFACIO/I	MULTIPURPOSE TRANSM. FLUID II D
CASTROL LTD. SWINDON/GB	CASTROL TRANSMAX Z	PANOLIN AG, MADETSWIL/CH	PANOLIN ATF MULTI 21996
CASTROL LTD. SWINDON/GB	CASTROL TQ-D (21289)	PRINZ-SCHULTE, FRECHEN/D	AERO-LINE ATF-D
CASTROL LTD. SWINDON/GB	CASTROL ATF 21293	PRINZ-SCHULTE, FRECHEN/D	AERO-LINE ATF-2
CASTROL LTD. SWINDON/GB	CASTROL TQ DEXRON III F-30520	REPSOL DISTRUBCION SA, MADRID/E	REPSOL MATIC ATF
CEPSA, MADRID/E	CEPSA ATF-70	S.A.E.L, ALCOBENDAS/E	GULF ATF D II D-22233
DE OLIEBRON B.V., ZWIJNDRECHT/NL	ATF DMM	SCHMIERSTOFFRAFFINERIE SALZBERGEN/D	WINTERSHALL ATF D
DE OLIEBRON B.V., ZWIJNDRECHT/NL	ATF 289	SHELL ASEOL AG, BERN/CH	ASEOL ATF DB UNIVERSAL
DEA MINERALÖL AG, HAMBURG/D	DEAFLUID 3003	SHELL INTERNATIONAL, LONDON/GB	SHELL DONAX TA (D-21666)
DEA MINERALÖL AG, HAMBURG/D	DEAFLUID 4011	SLOVNAFT JS CO, BRATISLAVA/SLO	MADIT AUTOMATIC
DEA MINERALÖL AG, HAMBURG/D	DEAMATIC	SONOL ISRAEL LTD, HAIFA/IL	DEXRON 2 D
DEUTSCHE SHELL AG, HAMBURG/D	MAC ATF D-21666	SOPROGRASA SA, MADRID/E	SOPRAL 164
DUCKHAMS OIL, BROMLEY/GB	UNIMATIC	STL TECNOL ESCALQUENS/F	TECNOL TECMATIC D2
ELF LUBRIFIANTS, PARIS/F	TRANSANTAR DF2	SUN OIL COMPANY, AARTSELAAR/B	SUNAMATIC 149
ELF LUBRIFIANTS, PARIS/F	ELFMATIC G3	SUN OIL COMPANY, AARTSELAAR/B	SUNAMATIC 153
ELF LUBRIFIANTS, PARIS/F	TRANSANTAR DF3	SVENSKA STATOIL AB, NYNÄSHAMM/S	TRANSWAY DX III (F-30373)
ELF LUBRIFIANTS, PARIS/F	ELFMATIC G2 22329	TAMOIL LUBES, GENEVA/CH	TAMOIL ATF II D
ELF LUBRIFIANTS, PARIS/F	HUILE RENAULT DIESEL STARMATIC	TEXACO LUBRICANTS COMP., BEACON/USA	ATF MERCON / DEXRON III
ELF LUBRIFIANTS, PARIS/F	ANTAR 22329	TEXACO SERVICES LTD, BRÜSSEL/B	TEXAMATIC 9226
ELLER-MONTAN-COMP., DUISBURG/D	ELLMO-AUTOMATIK-FLUID 22233	TEXACO SERVICES LTD, BRÜSSEL/B	TEXAMATIC 4291
ERTOIL SA, MADRID/E	TRANSMISIONES AUTOMATICAS D2	TEXACO SERVICES LTD, BRÜSSEL/B	TEXAMATIC 4011
ESSO AG, JAMBURG/D	ESSO ATF D (21065)	TEXACO SERVICES LTD, BRÜSSEL/B	TEXAMATIC 4261
ESSO AG, JAMBURG/D	ESSO ATF D (21611)	TEXACO SERVICES LTD, BRÜSSEL/B	TEXAMATIC 7080
ESSO AG, JAMBURG/D	ESSO ATF F-30320	TOTAL RAFFINAGE DISTR., PARIS/F	TOTAL FLUIDE AT 42
FINA EUROPE SA, BRÜSSEL/B	FINAMATIC II-D	TOTAL RAFFINAGE DISTR., PARIS/F	TOTAL FLUIDE II D
FUCHS LUBRICANTS (UK), DERBY/GB	SILKTRAN MP-ATF	TOTAL RAFFINAGE DISTR., PARIS/F	TOTAL FLUIDE ATX
FUCHS MINERALÖL WERKE, MANNHEIM/D	TITAN ATF 4000	TOTAL SOUTH AFRICA, JOHANNESBURG/ZA	TOTAL FLUIDE ATD
GINOUVES GEORGES SA, LA FARLEDE/F	YORK LT 785	TURBOTANK BÖSCHE+BÖDEKER, BREMEN/D	TURBO UNIV. ATF MERCON 4011
GULF OIL (GB) LTD, CHELTENHAM/GB	ATF 2	UFANEFTECHIM REFINERY, UFA/RUS	UFALUB ATF
HANDEL-MIJNOVIOL B.V., NIJMEGEN/NL	KENDALL ATF DEXRON II D	UNIL DEUTSCHLAND GMBH, BREMEN/D	UNIL MATIC CN T 4011
HOMBERG GMBH+CO KG, WUPPERTAL/D	HOMBERG-GETRIEBE-FLUID D	VOLVOLUME INC., LEXINGTON/USA	VALVOLUME MULTI-PURPOSE ATF
IGOL FRANCE, PARIS/F	IGOL ATF 420	VALVOLUME INTERNAT., DORDRECHT/NL	VALVOLUME ATF TYPE D
INA D.D. RAFINERIJA ZAGREB/YU	INA-ATF SUPER	VEBA OEL AG, GELSENKIRCHEN/D	MOVARA ATF-GETRIEBEÖL DIID
ITALIANA PETROLI, GENOVA/I	TRANSMISSION FLUID DX	VEEDOL INTERNATIONAL, SWINDON/GB	VEEDOL ATF-M (22764)
KÄPPLER K., STUTTGART/D	SELECTOL FLUID GETR. ÖL II D 23	VEEDOL INTERNATIONAL, SWINDON/GB	VEEDOL UNITRANS Z
KLÖCKNER ENERGIEHANDEL GMBH, KÖLN/D	DEUTZ OEL ATF-D	VEEDOL INTERNATIONAL, SWINDON/GB	VEEDOL ATF DEXRON III F-30521
KROON OIL BV, ALMELO/NL	ATF DEXRON II D	YACCO SA, PIERRE-LES-ELBEUF/F	YACCO ATF D
KROON OIL BV, ALMELO/NL	ALMIROL ATF	ZELLER+GMELIN GMBH & CO, EISLINGEN/D	DIVINOL FLUID 666
KUWAIT PETROLEUM, HOOGLIJET/NL	Q8 AUTO 15	ZF FRIEDRICHSHAFEN AG/D	ZF ECOFLUID □A□

GENERAL DESCRIPTION AND SYSTEM OPERATION

GENERAL REPAIR INSTRUCTIONS

If a floor jack is used, the following precautions are recommended:

- Park the vehicle on level ground, „block” the front or rear wheels, set the jack against the frame, raise the vehicle and support it with chassis stands, and then perform the service operation.
- Before performing the service operation, disconnect the negative battery cable in order to reduce the chance of cable damage and burning due to shortcircuiting.
- Use a cover on the body, the seats and the floor to protect them against damage and contamination.
- Handle brake fluid and antifreeze solution with care as they can cause paint damage.
- The use of proper tools, and the required special tools where specified, are important for efficient and reliable performance of the service repairs.
- Use genuine DAEWOO parts.
- Discard used cotter pins, gaskets, Orings, oil seals, lock washers and selflocking nuts. Prepare new ones for installation. Normal functioning of the vehicle's components cannot be maintained if these fasteners and seals are reused.

- Keep the disassembled parts in order to assist in reassembly.
- Keep attaching bolts and nuts separated, as they vary in hardness and design depending on the position of the installation.
- Clean the parts before inspection or reassembly.
- Also clean the oil parts, etc. Use compressed air to make certain they are free of restrictions.
- Lubricate rotating and sliding faces of parts with oil or grease before installation.
- When necessary, use a sealer on gaskets to prevent leakage.
- Carefully observe all specifications for bolt and nut torques.

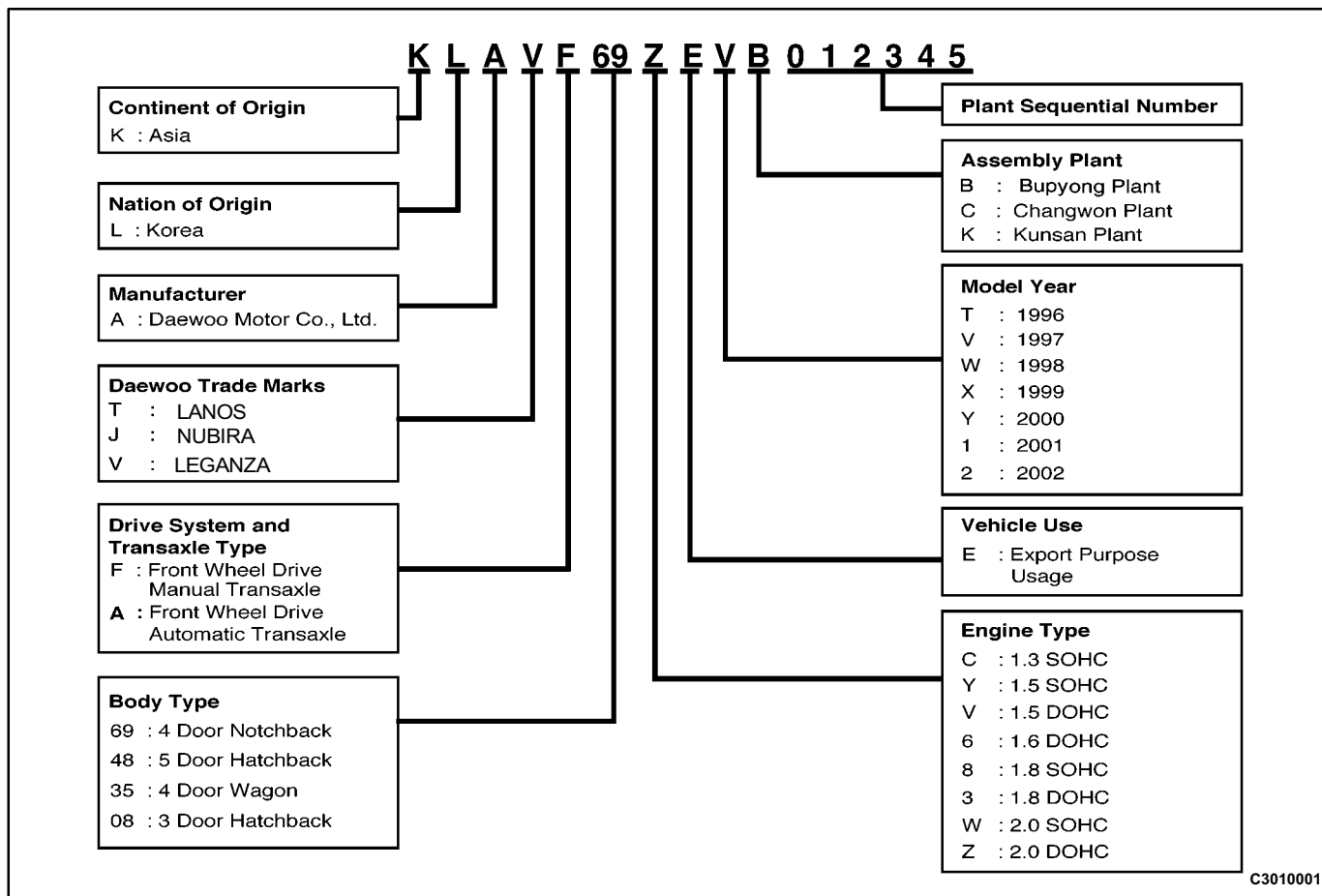
When service operation is complete, make a final check to be sure service was done properly and the problem was corrected.

GENERAL DESCRIPTION

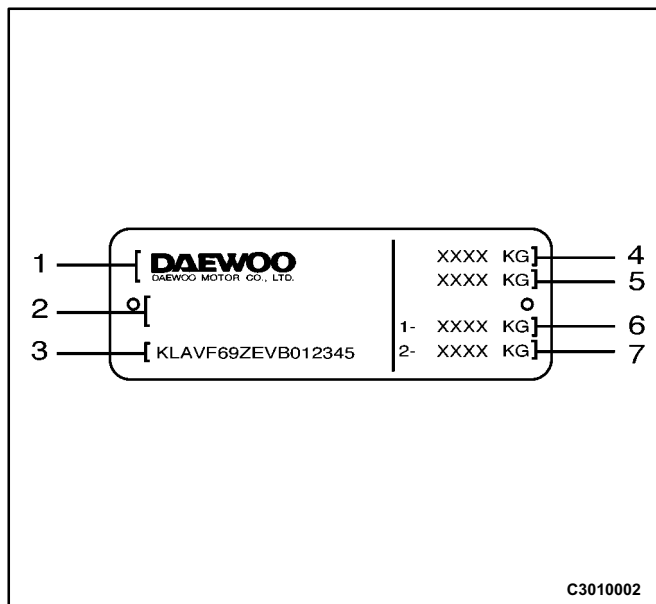
VEHICLE IDENTIFICATIONS

The vehicle identification number (VIN) plate is attached to the top right side of the front panel support. The VIN is also engraved in the top right side of the bulkhead.

Passenger Car VIN



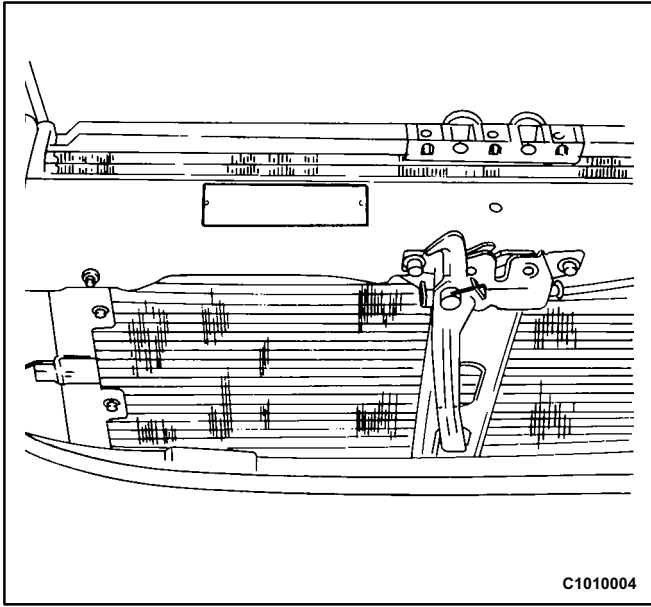
VIN Plate



- 1 Manufacturer's Name
- 2 NTA Number or WVTA Number
- 3 Vehicle Identification Number
- 4 Gross Vehicle Weight
- 5 Combination Weight
- 6 Front Axle Weight
- 7 Rear Axle Weight

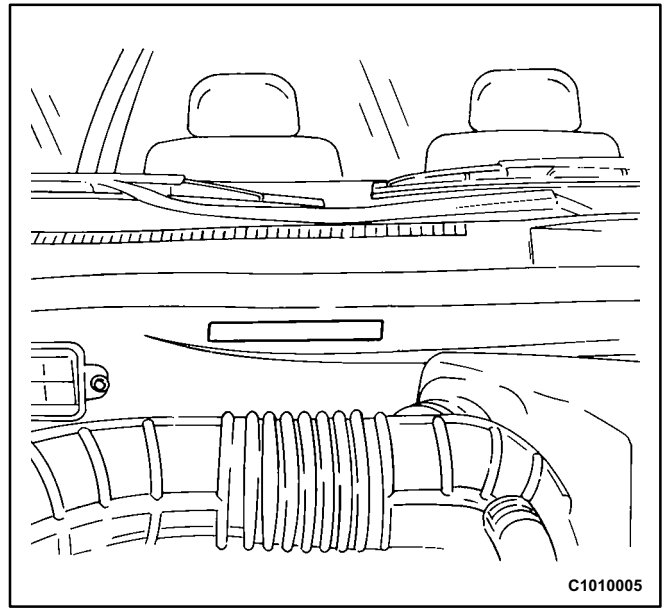
VIN Plate Location

The VIN plate is attached to the top right side of the front panel support.

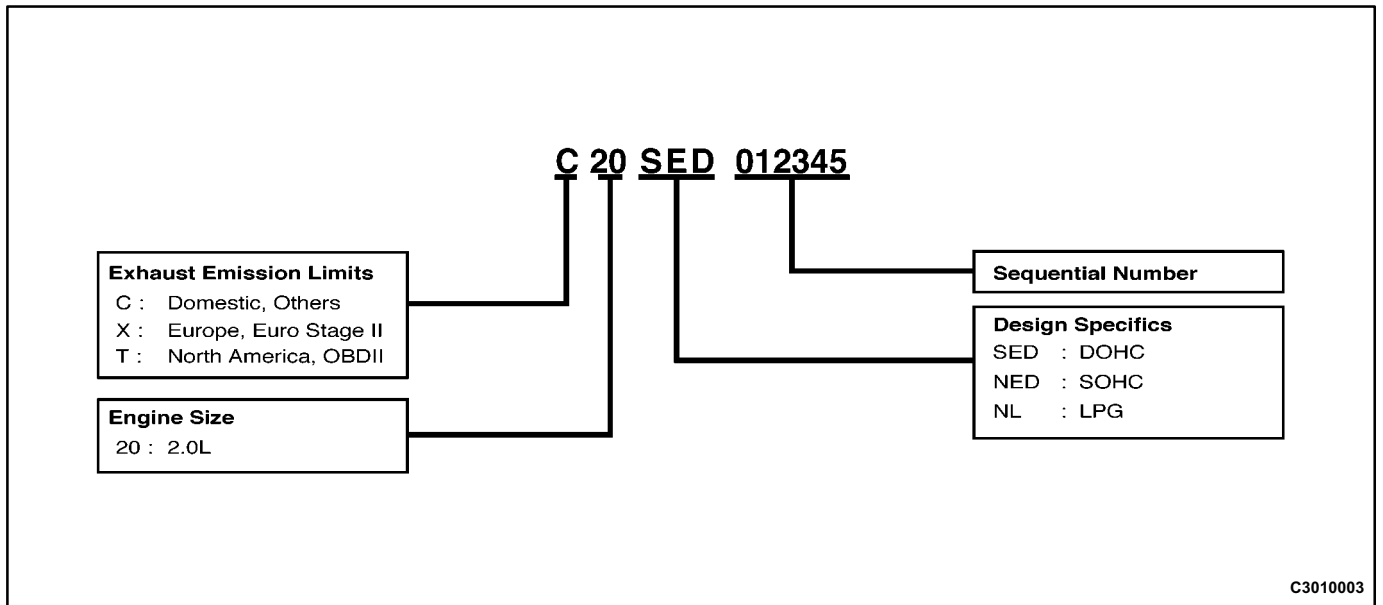


Engraved VIN Location

The engraved VIN is located on the top right side of the bulkhead.

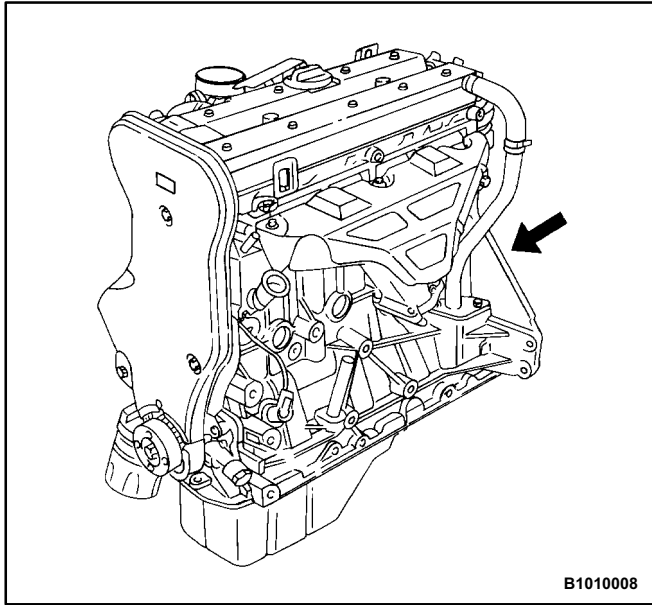


Engine Number



Engraved Engine Number Location

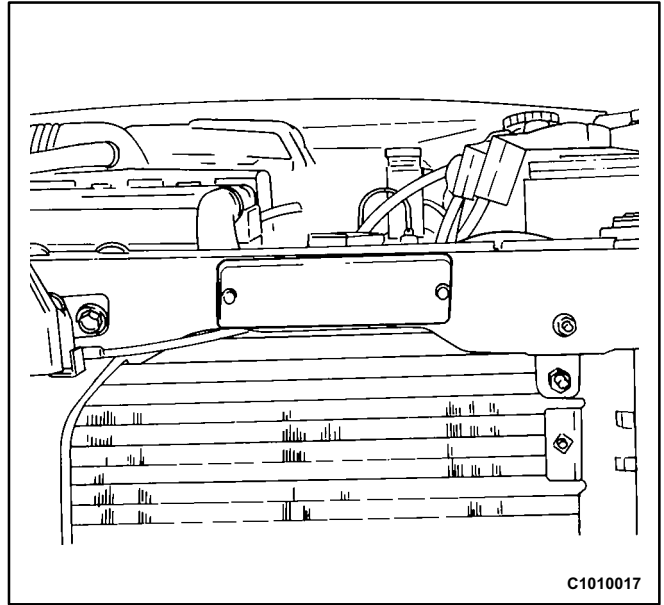
The engraved engine number is located on the engine block beneath the No. 4 exhaust manifold.



B1010008

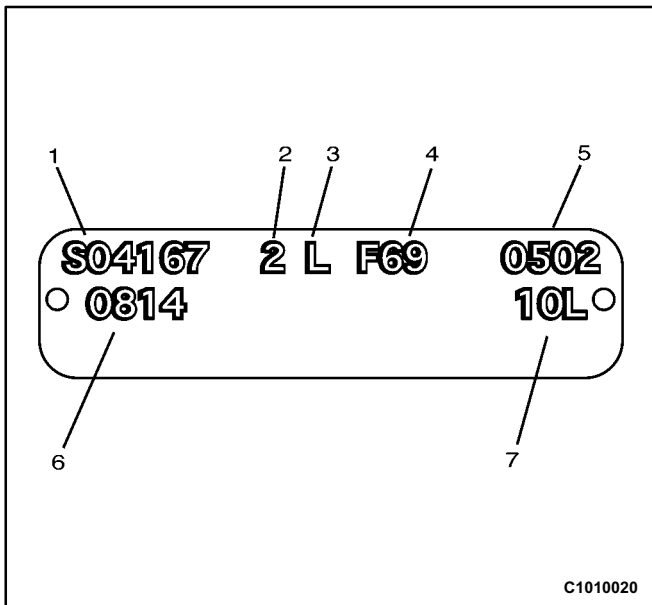
Body Identification Number Plate Location

The body identification number plate is attached to the top left side of the front panel support.



C1010017

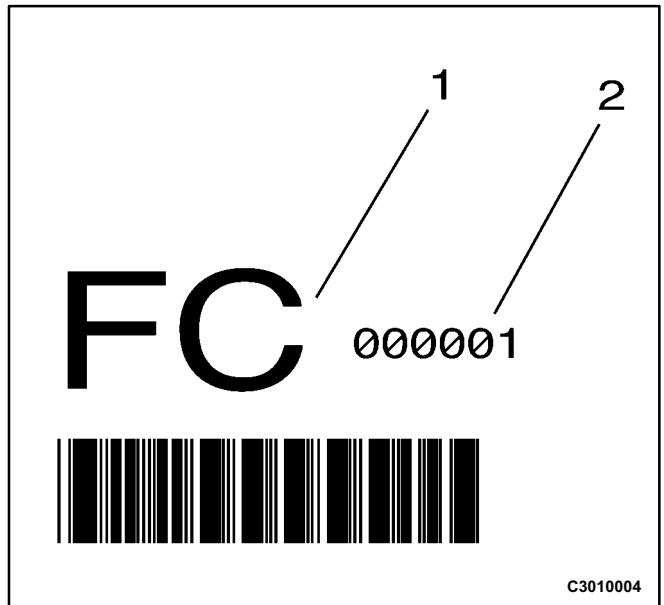
Body Identification Number Plate



C1010020

- 1 P/O Number
- 2 Check Digit
- 3 Drive
- 4 Body Type
- 5 P/O Date
- 6 Sequential Number
- 7 Exterior Color

Manual Transaxle Identification Number Plate



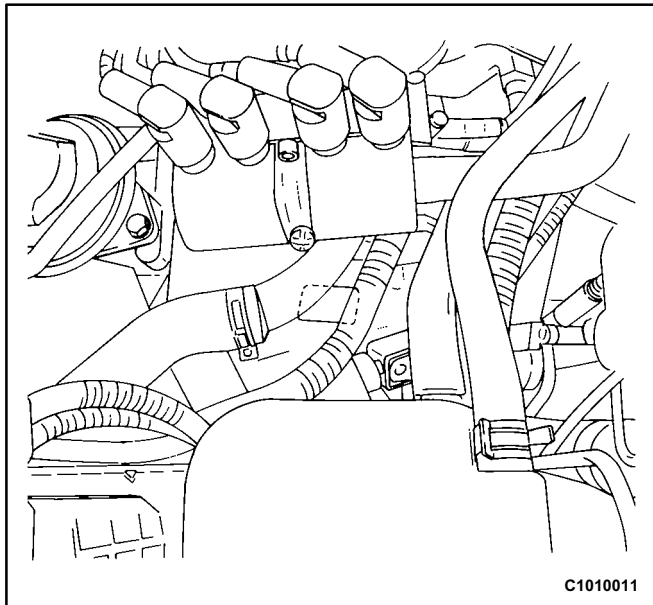
C3010004

- 1 Identification Code
- 2 Sequential Number

Identification Code	Engine	Gear Ratio
MF	2.0L SOHC	3.944 M/R
FC	2.0L DOHC	3.722 CR

Manual Transaxle Identification Number Plate Location

The manual transaxle identification number plate is attached to the top of the transaxle case near the engine.

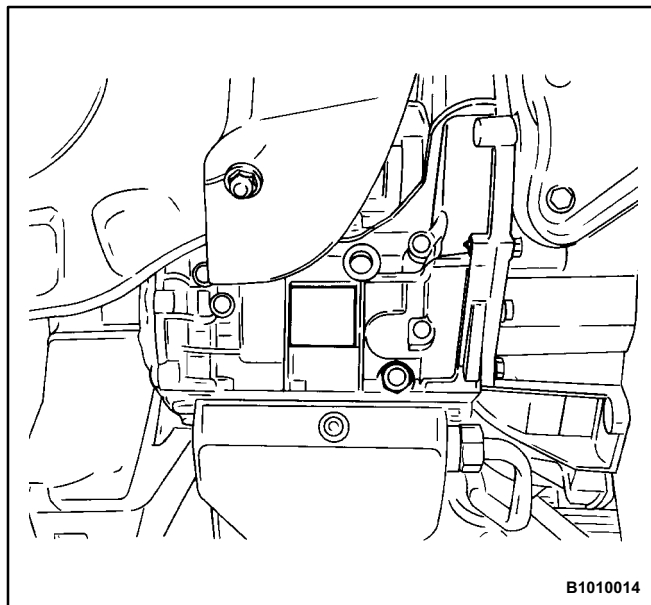


- 1 Manufacturer's Logo
- 2 Identification Code
- 3 Model Name (4HP14)
- 4 Manufacturer
- 5 Part Number
- 6 Sequential Number

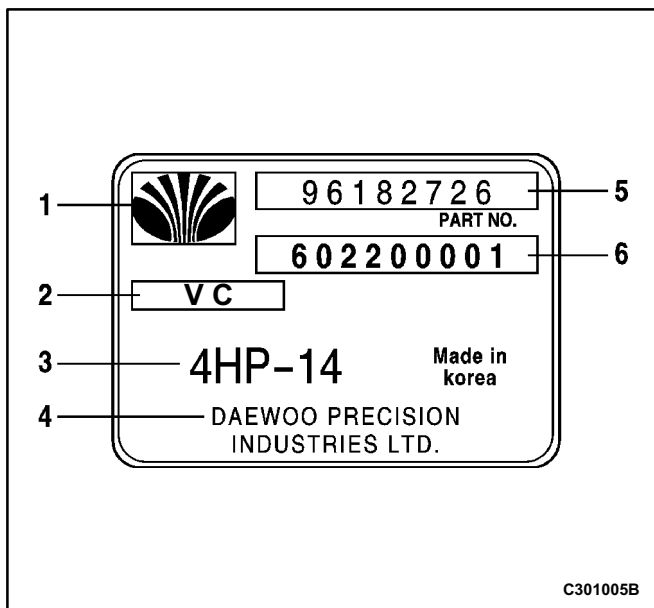
Identification Code	Engine
VB	2.0L SOHC
VC	2.0L DOHC

Automatic Transaxle Identification Number Plate Location (ZF 14 HP)

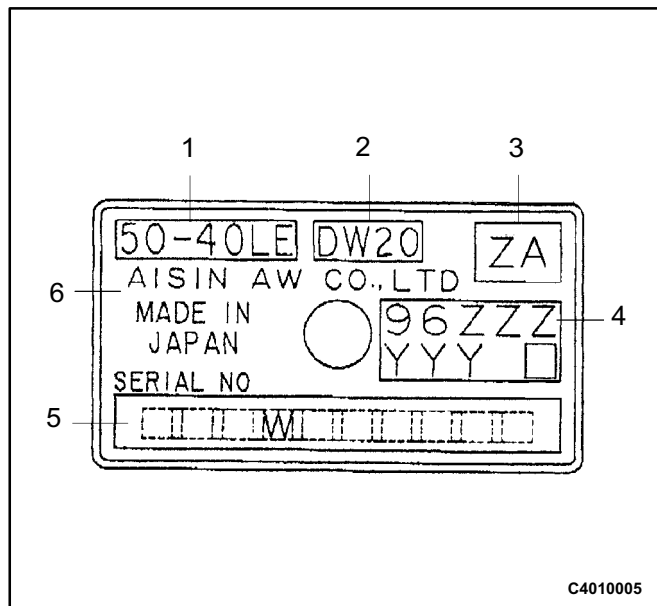
The automatic transaxle identification number plate is attached on the rear bottom side of the transaxle case near the bulkhead.



Automatic Transaxle Identification Number Plate (ZF 14 HP)



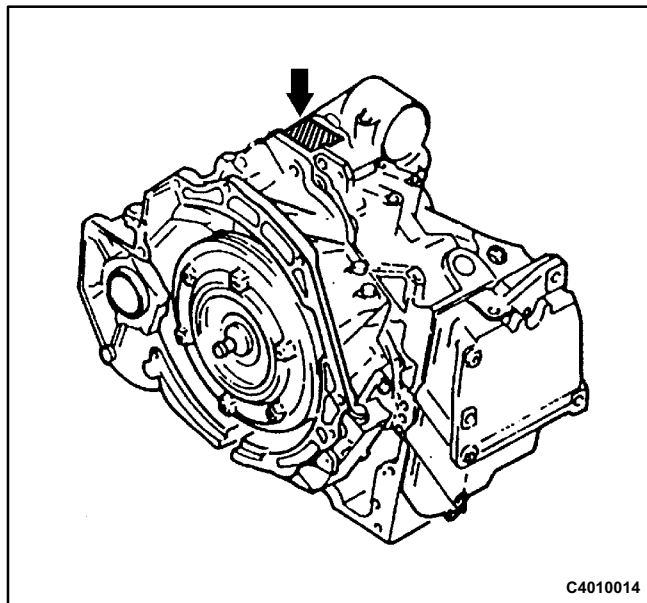
Automatic Transaxle Identification Number Plate (AISIN 50-40LE)



- | | |
|---------------------|---------------------|
| 1 Model Number | 4 DWMC Part Number |
| 2 DWMC Model Number | 5 T/M Serial Number |
| 3 ID Code | 6 Manufacturer |

Automatic Transaxle Identification Number Plate Location

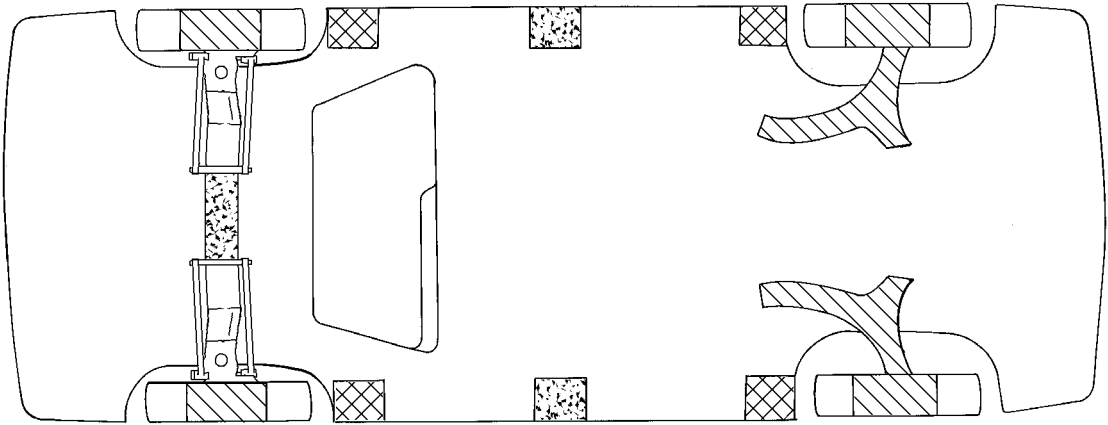
The automatic transaxle identification number plate is attached on the rear bottom side of the transaxle case near the bulkhead.



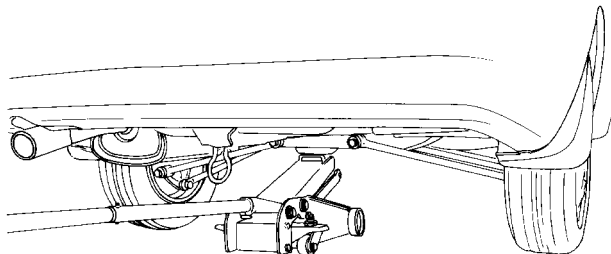
Identification Code	Engine
ZA	2.2 DOHC

VEHICLE LIFTING PROCEDURES

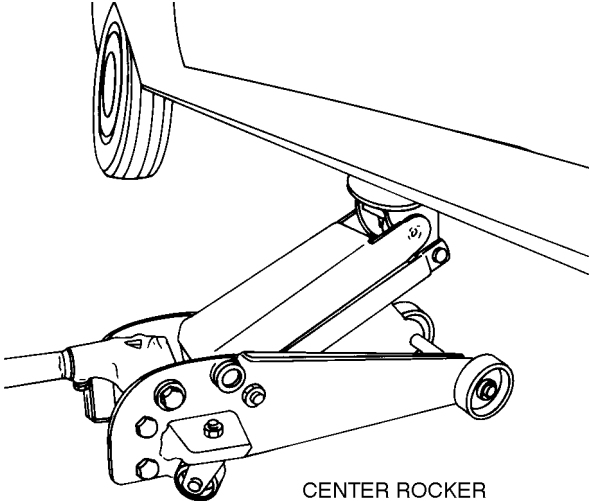
Notice: To raise the vehicle, place the lifting equipment only at the points indicated. Failure to use these precise positions may result in permanent body deformation. Many dealer service facilities and service stations are equipped with automotive hoists that bear upon some parts of the frame in order to lift the vehicle. If any other hoist method is used, use special care to avoid damaging the fuel tank, the filler neck, the exhaust system, or the underbody.



☒ FRAME CONTACT HOIST ☒ SUSPENSION CONTACT HOIST ☒ FLOOR JACK



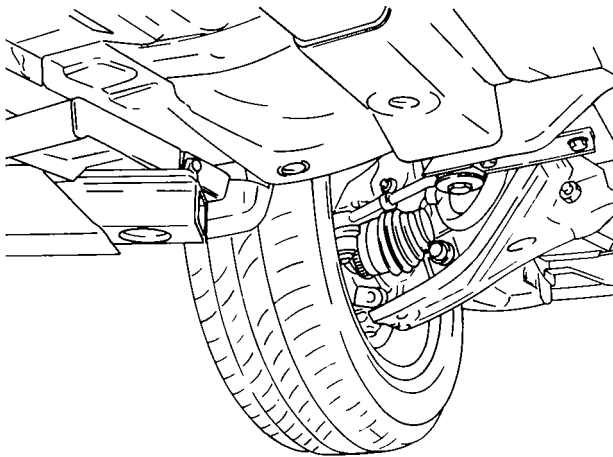
REAR SUSPENSION
AXLE LIFT POINT



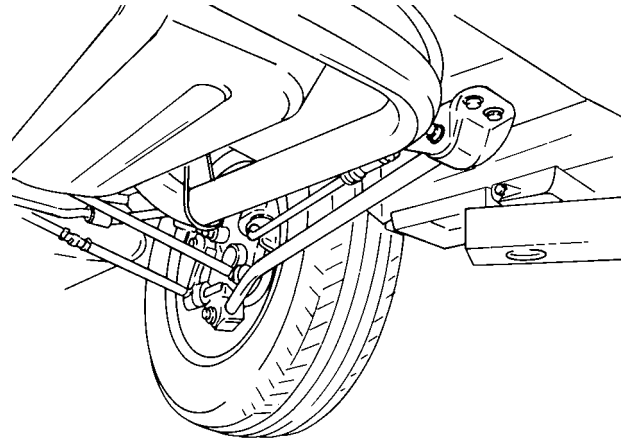
CENTER ROCKER
LIFT POINT (LH/RH)

B1010017

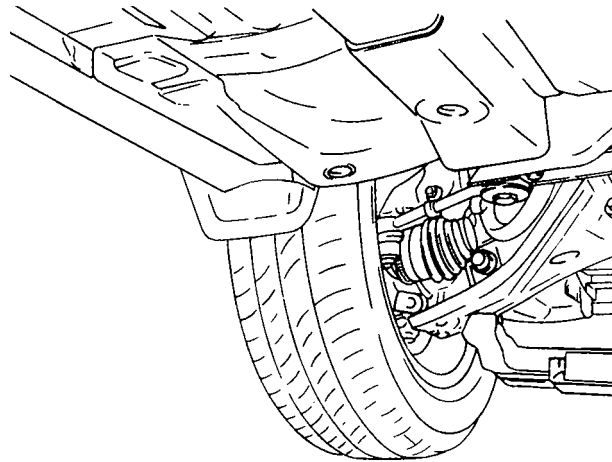
Vehicle Lifting Points



FRAME CONTACT HOIST
REARWARD OF FRONT TIRE



FRAME CONTACT HOIST
FORWARD OF REAR WHEEL



SUSPENSION CONTACT HOIST
UNDER FRONT LOWER CONTROL ARM

C1010014

ENGINE

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SECTION 1C	DOHC ENGINE MECHANICAL
SECTION 1D	ENGINE COOLING
SECTION 1E	ENGINE ELECTRICAL
SECTION 1F	ENGINE CONTROLS
SECTION 1G	ENGINE EXHAUST

SECTION 1

ENGINE

SECTION 1A

GENERAL ENGINE INFORMATION

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DIAGNOSIS

COMPRESSION TEST

Important: Disconnect the Crankshaft Position Sensor (CPS) connector to disable the fuel and the ignition systems.

Test the compression pressure for each cylinder. Low compression pressure may be the fault of the valves or the pistons. The following conditions should be considered when you check the cylinder compression:

- The engine should be at normal operating temperature.
 - The throttle must be wide open.
 - All the spark plugs should be removed.
 - The battery must be at or near full charge.
1. Place approximately three squirts of oil from a plunger type oiler into each spark plug port.
 2. Insert the engine compression gauge into each spark plug port.
 3. Crank test each cylinder with four to five compression strokes using the starter motor.

4. The lowest reading should not be less than 70% of the highest reading. The compression gauge reading should not be less than 689 kPa (100 psi) for any of the cylinders.

5. Examine the gauge readings obtained after the four "puffs" per cylinder are obtained from cranking the starter motor. The readings are explained in the following descriptions:

- Normal Condition - Compression builds up quickly and evenly to specified compression on each cylinder.
- Piston Rings Faulty - Compression is low on the first stroke and tends to build up on following strokes, but the compression pressure does not reach normal. The compression pressure improves considerably with the addition of oil into the cylinder.
- Valves Faulty - Low compression pressure on the first stroke. The compression pressure does not tend to build up on the following strokes. The compression pressure does not improve much with the addition of oil into the cylinder.

OIL PRESSURE TEST

Step	Action	Value(s)	Yes	No
1	Is low or no oil pressure indicated?	-	Go to Step 2	System OK
2	Check the oil level in the crankcase. Is the level low?	-	Go to Step 3	Go to Step 4
3	Add oil so that the oil level is up to the full mark on the indicator. Is the repair complete?	-	Go to Step 1	-
4	Check the idle speed. Is the idle speed below the value specified?	850 rpm	Go to Step 5	Go to Step 6
5	Increase the idle speed. Is the speed increased?	-	Go to Step 1	-
6	Inspect the oil pressure switch. Is the oil pressure switch incorrect or malfunctioning?	-	Go to Step 7	Go to Step 8
7	Install a new oil pressure switch. Is the repair complete?	-	Go to Step 1	-
8	Inspect the oil pressure gauge on the cluster. Is the oil pressure gauge incorrect or malfunctioning?	-	Go to Step 9	Go to Step 10
9	Install a new oil pressure gauge. Is the repair complete?	-	Go to Step 1	-
10	Inspect the engine oil. Is the engine oil in the crankcase diluted or of the improper viscosity?	-	Go to Step 11	Go to Step 12
11	Install new engine oil of the proper viscosity for the expected temperatures. Is the repair complete?	-	Go to Step 1	-
12	Inspect the oil pump. Is the pump worn or dirty?	-	Go to Step 13	Go to Step 14
13	Replace the oil pump. Is the repair complete?	-	Go to Step 1	-
14	Inspect the oil filter. Is the oil filter plugged?	-	Go to Step 15	Go to Step 16
15	Install a new oil filter. Is the repair complete?	-	Go to Step 1	-
16	Inspect the oil pickup screen. Is the oil pickup screen loose or plugged?	-	Go to Step 17	Go to Step 18
17	Tighten or replace the oil pickup screen as necessary. Is the repair complete?	-	Go to Step 1	-
18	Inspect the oil pickup tube. Are there any holes in the oil pickup tube?	-	Go to Step 19	Go to Step 20
19	Replace the oil pickup tube. Is the repair complete?	-	Go to Step 1	-

OIL PRESSURE TEST (Cont'd)

Step	Action	Value(s)	Yes	No
20	Inspect the bearing clearances. Are the bearing clearances more than the values specified?	Crankshaft 0.040 mm (0.0016 in.) Connecting Rod 0.063 mm (0.0025 in.)	Go to Step 21	Go to Step 22
21	Replace the bearing if necessary. Is the repair complete?	-	Go to Step 1	-
22	Inspect the oil galleries. Are the oil galleries cracked, porous or plugged?	-	Go to Step 23	Go to Step 24
23	Repair or replace the engine block. Is the repair complete?	-	Go to Step 1	-
24	Inspect the gallery plugs. Are any of the gallery plugs missing or not installed properly?	-	Go to Step 25	Go to Step 26
25	Install plugs or repair as necessary. Is the repair complete?	-	Go to Step 1	-
26	Inspect the camshaft. Is the camshaft worn or is there evidence of poor machining?	-	Go to Step 27	System OK
27	Replace the camshaft. Is the repair complete?	-	Go to Step 1	-

OIL LEAK DIAGNOSIS

Most fluid oil leaks are easily located and repaired by visually finding the leak and replacing or repairing the necessary parts. On some occasions a fluid leak may be difficult to locate or repair. The following procedures may help you in locating and repairing most leaks.

Finding the Leak

1. Identify the fluid. Determine whether it is engine oil, automatic transmission fluid, power steering fluid, etc.
2. Identify where the fluid is leaking from.
 - 2.1. After running the vehicle at normal operating temperature, park the vehicle over a large sheet of paper.
 - 2.2. Wait a few minutes.
 - 2.3. You should be able to find the approximate location of the leak by the drippings on the paper.
3. Visually check around the suspected component. Check around all the gasket mating surfaces for leaks. A mirror is useful for finding leaks in areas that are hard to reach.
4. If the leak still cannot be found, it may be necessary to clean the suspected area with a degreaser, steam or spray solvent.
 - 4.1. Clean the area well.
 - 4.2. Dry the area.
 - 4.3. Operate the vehicle for several miles at normal operating temperature and varying speeds.

4.4. After operating the vehicle, visually check the suspected component.

4.5. If you still cannot locate the leak, try using the powder or black light and dye method.

Powder Method

1. Clean the suspected area.
2. Apply an aerosol type powder (such as foot powder) to the suspected area.
3. Operate the vehicle under normal operating conditions.
4. Visually inspect the suspected component. You should be able to trace the leak path over the white powder surface to the source.

Black Light and Dye Method

A dye and light kit is available for finding leaks. Refer to the manufacturer's directions when using the kit.

1. Pour the specified amount of dye into the engine oil fill tube.
2. Operate the vehicle under normal operating conditions as directed in the kit.
3. Direct the light toward the suspected area. The dyed fluid will appear as a yellow path leading to the source.

Repairing the Leak

Once the origin of the leak has been pinpointed and traced back to its source, the cause of the leak must be determined in order for it to be repaired properly. If a gasket is replaced, but the sealing flange is bent, the

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new gasket will not repair the leak. The bent flange must be repaired also. Before attempting to repair a leak, check for the following conditions and correct them as they may cause a leak.

Gaskets

- The fluid level/pressure is too high.
- The crankcase ventilation system is malfunctioning.
- The fasteners are tightened improperly or the threads are dirty or damaged.
- The flanges or the sealing surface is warped.
- There are scratches, burrs or other damage to the sealing surface.
- The gasket is damaged or worn.

- There is cracking or porosity of the component.
- An improper seal was used (where applicable).

Seals

- The fluid level/pressure is too high.
- The crankcase ventilation system is malfunctioning.
- The seal bore is damaged (scratched, burred or nicked).
- The seal is damaged or worn.
- Improper installation is evident.
- There are cracks in the component.
- The shaft surface is scratched, nicked or damaged.
- A loose or worn bearing is causing excess seal wear.

KNOCK DIAGNOSIS

Definition for Knock

Engine knock refers to various types of engine noise. Heavy knock is usually very loud and the result of broken or excessively worn internal engine components. Light

knock is a noticeable noise, but not as loud. Light knock can be caused by worn internal engine components. Loose or broken external engine components can also cause heavy or light knock.

Engine Knocks Cold and Continues for Two-Three Minutes and/or Knock Increases with Engine Torque

Step	Action	Value(s)	Yes	No
1	Does the engine knock when it is cold and continue for two to three minutes or does the knock increase with torque?	-	Go to Step 2	System OK
2	Inspect the flywheel. Is the flywheel contacting the splash shield?	-	Go to Step 3	Go to Step 4
3	Reposition the splash shield. Is the repair complete?	-	Go to Step 1	-
4	Inspect the balancer and the drive pulleys. Is either the balancer or the drive pulleys loose or broken?	-	Go to Step 5	Go to Step 6
5	Tighten or replace the balancer or the drive pulleys. Is the repair complete?	-	Go to Step 1	-
6	Inspect the pistontobore clearance. Is the clearance more than the value specified?	0.030 mm	Go to Step 7	Go to Step 8
7	1. Rebore the cylinder and hone to size. 2. Replace the piston. Is the repair complete?*	-	Go to Step 1	-
8	Inspect the connecting rod. Is the connecting rod bent?	-	Go to Step 9	System OK
9	Replace the connecting rod. Is the repair complete?	-	Go to Step 1	-

* Cold engine piston knock usually disappears when the cylinder is grounded out. Cold engine piston knock, which disappears in about 1.5 minutes, is considered acceptable.

Heavy Knock Hot with Torque Applied

Step	Action	Value(s)	Yes	No
1	Is there a heavy knock when the engine is hot and torque is applied?	-	Go to <i>Step 2</i>	System OK
2	Inspect the balancer and pulley hub. Is the balancer or pulley hub broken?	-	Go to <i>Step 3</i>	Go to <i>Step 4</i>
3	Replace the broken balancer or pulley hub. Is the repair complete?	-	Go to <i>Step 1</i>	-
4	Inspect the torque converter bolts. Are the bolts tightened to value specified?	60 N•m	Go to <i>Step 5</i>	Go to <i>Step 6</i>
5	Tighten the torque converter bolts. Is the repair complete?	-	Go to <i>Step 1</i>	-
6	Inspect the accessory belts. Are the belts too tight or nicked?	-	Go to <i>Step 7</i>	Go to <i>Step 8</i>
7	Replace and/or tension the belts to specifications as necessary. Is the repair complete?	-	Go to <i>Step 1</i>	-
8	Inspect the exhaust system. Is the system grounded?	-	Go to <i>Step 9</i>	Go to <i>Step 10</i>
9	Reposition the system as necessary. Is the repair complete?	-	Go to <i>Step 1</i>	-
10	Inspect the flywheel. Is the flywheel cracked?	-	Go to <i>Step 11</i>	Go to <i>Step 12</i>
11	Replace the flywheel. Is the repair complete?	-	Go to <i>Step 1</i>	-
12	Inspect the main bearing clearance. Is the clearance more than the value specified?	0.040 mm	Go to <i>Step 13</i>	Go to <i>Step 14</i>
13	Replace the main bearings as necessary. Is the repair complete?	-	Go to <i>Step 1</i>	-
14	Inspect the rod bearing clearance. Is the clearance more than the value specified?	0.063 mm	Go to <i>Step 15</i>	System OK
15	Replace the rod bearings as necessary. Is the repair complete?	-	Go to <i>Step 1</i>	-

Light Knock Hot

Step	Action	Value(s)	Yes	No
1	Is there a light knock when the engine is hot?	-	Go to Step 2	System OK
2	Is detonation or spark knock evident?	-	Go to Step 3	Go to Step 4
3	Check the engine timing and the fuel quality. Was the problem found?	-	Go to Step 1	-
4	Inspect the torque converter bolts. Are the bolts loose?	-	Go to Step 5	Go to Step 6
5	Tighten the torque converter bolts. Is the repair complete?	-	Go to Step 1	-
6	Inspect the manifold. Is there an exhaust leak at the manifold?	-	Go to Step 7	Go to Step 8
7	Tighten the bolts or replace the gasket. Is the repair complete?	-	Go to Step 1	-
8	Check the rod bearing clearance. Is the clearance within the value specified?	0.019- 0.063 mm	Go to Step 9	System OK
9	Replace the rod bearings as necessary. Is the repair complete?	-	Go to Step 1	-

Knocks During Initial StartUp But Lasts Only a Few Seconds

Step	Action	Value(s)	Yes	No
1	Does the engine knock during initial startup but last only a few seconds?	-	Go to Step 2	System OK
2	Check the engine oil. Is the proper viscosity oil used in the crankcase?	-	Go to Step 4	Go to Step 3
3	Install oil of the proper viscosity for the expected seasonal temperatures. Is the repair complete?	-	Go to Step 1	-
4	Inspect the hydraulic lifters. Is there evidence of hydraulic lifter bleeddown?	-	Go to Step 5	Go to Step 6
5	Clean, test and replace the lifters as necessary. Is the repair complete?*	-	Go to Step 1	-
6	Inspect the crankshaft end clearance. Is the clearance more than value specified?	0.302 mm	Go to Step 7	Go to Step 8
7	Replace the crankshaft thrust bearing. Is the repair complete?	-	Go to Step 1	-
8	Inspect the front main bearing clearance. Is the clearance more than the value specified?	0.040 mm	Go to Step 9	System OK
9	Replace the worn parts of the front main bearing. Is the repair complete?	-	Go to Step 1	-

* When the engine is stopped, some valves will be open. Spring pressure against the lifters will tend to bleed lifter down. Attempts to repair this should be made only if the problem is consistent.
An engine that is operated for only short periods between startups may have lifter noise that lasts for a few minutes. This is a normal condition.