Chevrolet

Aveo

2004

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Product Information

Aveo Brings Style, Roominess And Performance To Entry-Level Segment

Chevrolet is taking the no-compromise approach to the entry-level car market with the stylish and well-equipped 2004 Aveo, a small car with contemporary European design, a roomy interior, peppy performance and the backing of more than 4,600 Chevy dealers across North America.

Arriving in showrooms in early 2004, the Aveo will be available as a sedan or sporty five-door in base or LS trim.

Value, fuel economy, European flair and safety features go hand-in-hand with Aveo's fun-to-drive factor. Add in Chevrolet dependability and the support of Chevy dealers nationwide, and you have a winner in the making.

Chic and cabin friendly

Created in Giorgetto Giugiaro's renowned Italdesign studios in Turin, Italy, Aveo's clean lines and short front and rear overhangs give the cars a sense of panache that is rare in cars of this class.

Highly distinctive standard aerodynamic halogen headlamps with facetted lenses, amber side turn signal lamps, jewel-like taillamps and the gold Chevy bowties front and rear give the Aveo a distinctive look.

The Aveo carries five passengers comfortably, and its high roof and raised seating offer good visibility and the roomiest interior among its closest competitors.

Drivers have plenty of flexibility to select the most comfortable driving position with standard tilt steering, a seat with standard easy manual fore/aft, recline, seat height and headrest height adjustment. A 60/40 split folding rear bench seat has integral headrests on the sedan and separated headrests on the five-door.

Every Aveo has flexible storage, with seat back pockets for items such as maps and magazines. The rear seat of the four-door folds flat to provide more cargo room, while the rear seat of the five-door folds flat and flips forward, yielding 42 cubic feet (1,190L) of cargo area. The top of each headrest integrates a composite hook for holding/suspending a shopping bag over the backside of the seat, and the driver-side door also provides a huge storage pocket to carry miscellaneous items.

Seat cushions and backs are constructed of high-density foam to ensure solid comfort and support, even on extended trips. Base model seats feature standard fabric, while the LS models come with deluxe cloth covering.

A monochrome instrument panel with large, easy-to-read gauges is standard on base models, while a two-tone IP is standard on LS models. The IP includes a tachometer, speedometer, odometer, trip odometer, fuel gauge and coolant temperature gauge, with a lighting dimmer control. The IP also provides a center storage tray, cigar lighter, ashtray, extra 12-volt outlet for cell phones, digital quartz clock, lighted glove box, and knee bolsters, as a safety feature for both the driver and passengers.

More-than-expected standard amenities

Aveo offers a lengthy list of comfort and convenience features, including AM/FM stereo, tinted glass, a highly functional floor console with storage compartment, front roof radio antenna, two-speed variable intermittent wipers, rear window defogger, carpeting, floor mats, remote fuel filler door and trunk releases, overhead courtesy lamps, day/night rearview mirror, driver and passenger visor vanity mirror, dual front cupholders and a luggage floor mat.

The LS models go a step farther, with standard AM /FM stereo with CD player and MP3 playback, air conditioning, power door locks, power windows, remote keyless entry, power outside passenger-side rearview mirror, dual outside heated rearview mirrors and fabric door trim.

An appearance package available on LS models includes fog lamps, bright aluminum 14-inch alloy wheels and mudguards. The appearance package on the five-door also includes a rear spoiler.

A sliding electric sunroof and a six-speaker premium sound system are available on LS models.

Powerful and nimble

Aveo combines these strong new designs with a powertrain and chassis that provide refined, responsive performance and excellent economy.

Aveo features a peppy 1.6L dual overhead cam 16-valve inline four-cylinder that delivers 103 hp (77 kw) and 107 lb.-ft. (145 Nm) of torque. A deep-skirted block, large intake resonator, dual-muffler exhaust systems and other sound-damping technologies help reduce engine noise, while roller-type hydraulic lifters, a single-belt accessory drive and durable rubber timing belt help reduce the need for routine maintenance.

A lightweight, smooth shifting, high efficiency five-speed manual transmission is standard. A four-speed automatic is optional. The automatic features a gated shifter, allowing the driver to easily shift the transmission manually, and a "hold" button for second-gear starts on slippery surfaces.

Aveo's 97.6-inch (2,480-mm) wheelbase contributes to a smooth ride and stability. Its suspension was extensively tested in both Europe and the U.S. and tuned to provide a controlled ride and responsive handling. The front suspension features MacPherson struts with a stabilizer bar. The torsion beam rear axle provides good camber control under a wide variety of loads. Aveo is equipped with a standard rack-and-pinion steering system providing nimble handling and enhancing road feel.

Safety features

Aveo's impact-absorbing frame, standard dual front air bags and available anti-lock braking system (ABS) help provide confident control and peace of mind under a wide variety of driving conditions.

Aveo's passenger compartment forms a protective safety cage that runs from the front door hinge pillars to the A-pillars to the roof rail, back to the reinforced B-pillars and C-pillars and includes the bottom rocker panels. The front structure is designed to distribute crash energy along multiple load paths, helping direct energy away from the passenger compartment. Each of the doors features a roll-formed steel intrusion beam to help protect the occupants in certain side-impact collisions.

The Aveo's dual diagonal brake system includes large ventilated front discs and self-adjusting rear drum brakes. Rear brakes have a wide lining for increased service life. A large 9.5-inch (241-mm) power brake booster helps improve braking capability and provides solid pedal feel.

A Delphi four-channel, four-sensor ABS system with electronic brake force distribution (EBD) is available as an option.

Dual frontal air bags are standard, as are seat-belt pretensioners and height-adjustable shoulder belt anchors for the front seats. Rear-seat positions feature shoulder belts in all three seating positions. The standardized child-safety seat system, Lower Anchors and Tethers for CHildren (LATCH) secures the seat base and helps keep the child seat from pivoting forward during an aggressive stop or a forward collision. Rear child-safety door locks are also standard.

Vehicle Highlights

- All-new entry-level vehicle
- European design by Italdesign
- Roomy interior
- Responsive performance
- Stepgate shifting on available automatic transmission
- Seat belt pretensioners, optional anti-lock brakes
- Eight exterior colors: Summit White, Pastel Blue, Bright Blue Metallic, Modern Green, Victory Red, Black, Galaxy Silver Metallic, Amber Yellow

Model Lineup

	Engine	Transmissions	
	1.6L DOHC I-4	5-spd man	4-spd auto
Base Sedan/5-Door	s	s	o
LS Sedan/5-Door	s	s	o

Standard s
Optional o
Not available –

Specifications

Overview		
Models:	4-door, 5-door, LS 4-door, LS 5-door	
Body style / driveline:	4-door and 5-door, unitized frame, front engine, front-wheel drive, 5 passengers	
Construction:	steel body material, galvanized	
EPA vehicle class:	subcompact	
Manufacturing location:	Bupyong, South Korea	
Key competitors:	Hyundai Accent, Kia Rio, Toyota Echo	
Engine		
Type:	1.6L DOHC I-4	
Displacement (cu in / cc):	97.5 / 1598	
Bore & stroke (in / mm):	3.11 x 3.21 / 79 x 81.5	
Block material:	cast iron	
Cylinder head material:	aluminum	
Valvetrain:	DOHC, 4 valves per cylinder	
Fuel delivery:	multi-point fuel injection	
Compression ratio:	9.5:1	
Horsepower (hp / kw @ rpm):	103 / 77 @ 5800	
Torque (lb-ft / Nm @ rpm):	107 / 145 @ 3600	
Recommended fuel:	87 octane	
Maximum engine speed (rpm):	6500	
Emission controls:	catalytic converter / Delphi EMS (MR-140ECM)	
Estimated fuel economy (mpg city / hwy / combined):	auto: 26 / 35 / 30 (est.)man: 28 / 34 / 30 (est.)	
Transmissions	**Manual (M78)**	**Automatic (MV6)**
Type:	5-speed manual with overdrive, front-wheel drive	4-speed automatic with overdrive, front-wheel drive
Gear ratios (:1):		
First:	3.55	2.88
Second:	1.95	1.57
Third:	1.28	1.00
Fourth:	0.97	0.70
Fifth:	0.76	--
Reverse:	3.33	2.30
Final drive ratio:	3.94:1	3.84:1

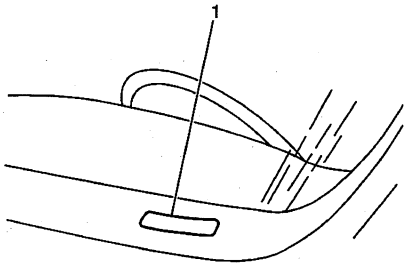
Chassis/Suspension	
Front:	MacPherson struts with offset coil springs and stabilizer bar
Rear:	trailing arm, torsion beam axle with coil
Steering type:	power rack-and-pinion
Steering ratio:	16:1
Steering wheel turns, lock-to-lock:	3.0
Turning circle, curb-to-curb (ft / m):	16.0 / 4.9
Brakes	
Type:	power-assisted front disc and rear drum, Delphi 4-channel ABS optional
Rotor diameter x thickness (in/mm):	front: 10.1 x .95 / 256 x 24
Drum diameter x width (in / mm):	rear: 7.8 x 1.38 / 200 x 35 (lining width)
Total swept area(sq in / sq cm):	front: 6.98 / 45 rear: 9.3 / 60
Wheels/Tires	
Wheel size and type:	14-inch x 5.5-inch steel with full wheel covers 14-inch x 5.5-inch aluminum alloy (optional on LS models)
Tires:	P185/60R14 all-season touring (spare: T105/70D14)

Dimensions

Exterior	Sedan	5-door
Wheelbase (in / mm):	97.6 / 2480	97.6 / 2479
Overall length (in / mm):	166.7 / 4235	152.8 / 3881
Overall width (in / mm):	65.7 / 1670	65.8 / 1671
Overall height (in / mm):	58.9 / 1495	58.9 / 1496
Track (in / mm):	front: 57.1 / 1450; rear: 55.5 / 1410	front: 57.1 / 1450; rear: 55.5 / 1410
Curb weight (lb / kg):		
Automatic	2381 / 1080	2359 / 1070
Manual	2370 / 1075	2348 / 1065
Interior	**Sedan**	**5-door**
Seating capacity (front / rear):	2 / 3	2 / 3
Head room (in / mm):	front: 39.3 / 998; rear: 37.6 / 955	front: 39.3 / 998; rear: 37.6 / 955
Leg room (in / mm):	front: 41.3 / 1048; rear: 35.4 / 898	front: 41.3 / 1048; rear: 35.4 / 898
Shoulder room (in / mm):	front: 53.6 / 1362; rear: 52.8 / 1340	front: 53.6 / 1362; rear: 52.8 / 1340
Hip room (in / mm):	front: 51.6 / 1310; rear: 52.8 / 1340	front: 51.6 / 1310; rear: 52.8 / 1340
Capacities	**Sedan**	**5-door**
EPA interior volume (cu ft / L):	102.7 / 2907	107.4 / 3040
Cargo volume (cu ft / L):	11.7 / 330	7.1 / 200 42 / 1190 seat folded & flipped
Fuel tank (gal / L):	11.9 / 45	11.9 / 45
Engine oil (qt / L):	4 / 3.75	4 / 3.75
Cooling system (qt / L):	7.4 / 7	7.4 / 7

Vehicle Identification

Vehicle Identification Number (VIN)

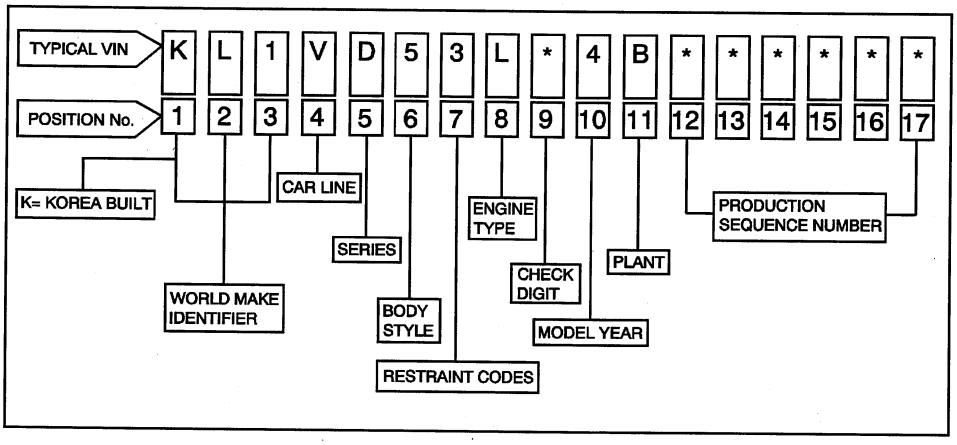


The vehicle identification number (VIN) plate is the legal identifier of the vehicle. The VIN plate is located on the upper LH corner of the Instrument Panel and can be seen through the windshield from the outside of the vehicle:

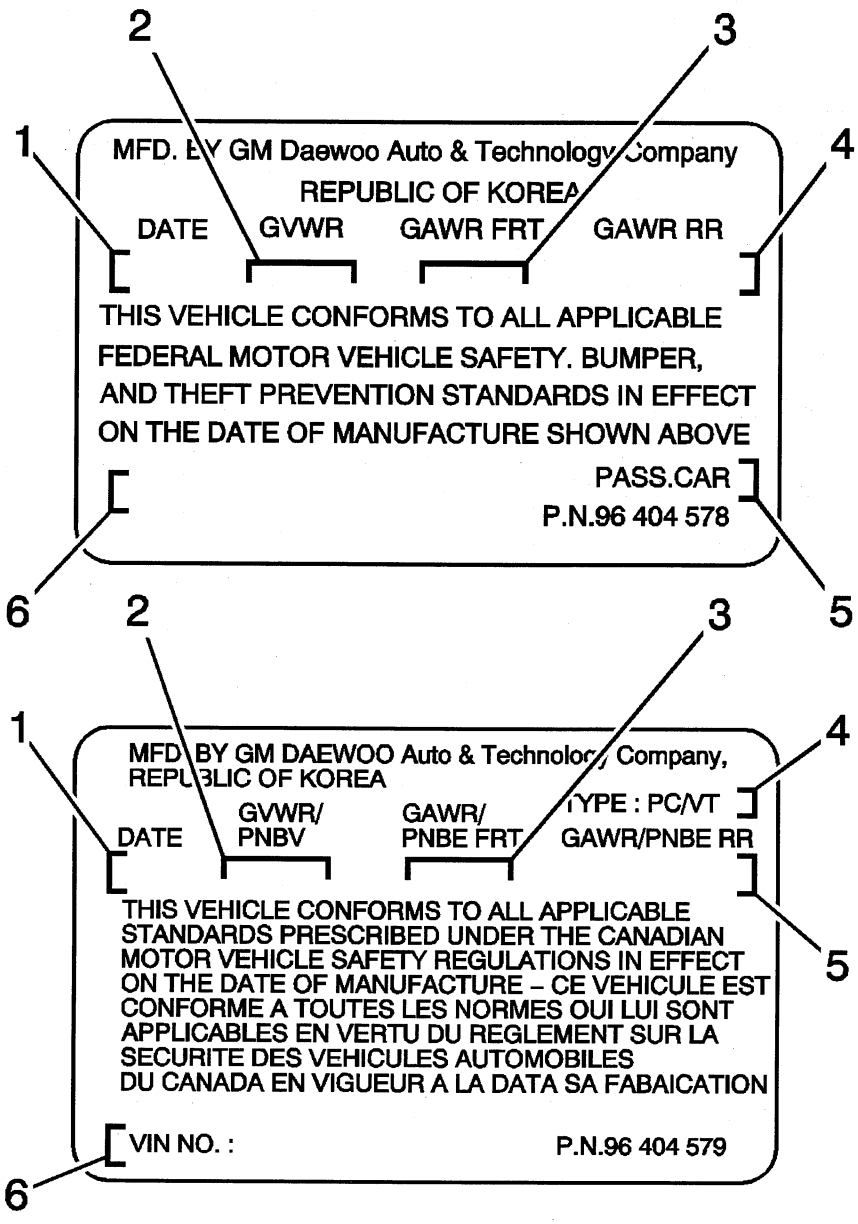
Position	Definition	Character	Description
1	Country of Origin	K	Korea
2	Manufacturer	L	General Motors Daewoo Auto and Technology Company
3	Make	A 1 2 4 5	Daewoo Chevrolet Pontiac Buick Suzuki
4	Car Line	T	T-Car, S-Car T200
5	Series	D J M	S, Base SE, LS, M SX, X
6	Body Type	5 6	4-Door Notchback 5-Door Hatchback
7	Restraint Code	1	Active Restraints - Manual Belts in All Positions
		2	Active Restraints - Manual Belts in All Positions Frontal Inflatable Restraint System - LF and RF
		3	Active Restraints - Manual Belts in All Positions Frontal Inflatable Restraint System - LF
		4	Active Restraints - Manual Belts in All Positions Frontal Inflatable Restraint System - LF and RF Side Inflatable Restraints - LF and RF
		5	Active Restraints - Manual Belts in All Positions Frontal Inflatable Restraint System - LF and RF Side Inflatable Restraint System - LF
		6	Active Restraints - Manual Belts in All Positions Frontal Inflatable Restraint System - LF and RF Side Inflatable Restraint System - LF and RF Automatic Occupant Sensor - RF
		7	Active Restraints - Manual Belts in All Positions Frontal Inflatable Restraint System - LF and RF Side Inflatable Restraint System - LF, RF, LR, RR
		8	Active Restraints - Manual Belts in All Positions Side Inflatable Restraint System - LF

8	Engine Type	Y V 6 8 3	1.5 L, SOHC, MPFI, FAM I 1.5 L, DOHC, MPFI, FAM I 1.6 L, DOHC, MPFI, FAM I 1.8 L, SOHC, MPFI, FAM II 1.8 L, DOHC, MPFI, FAM II
9	Check Digit	--	Check Digit
10	Model Year	4 5	2004 2005
11	Plant Location	B C K	Bupyung, South Korea Changwon, South Korea Kunsan, South Korea
12-17	Production Sequence Number	--	Production Sequence Number

LF = Left Front
RF = Right Front
LR = Left Rear
RR = Right Rear

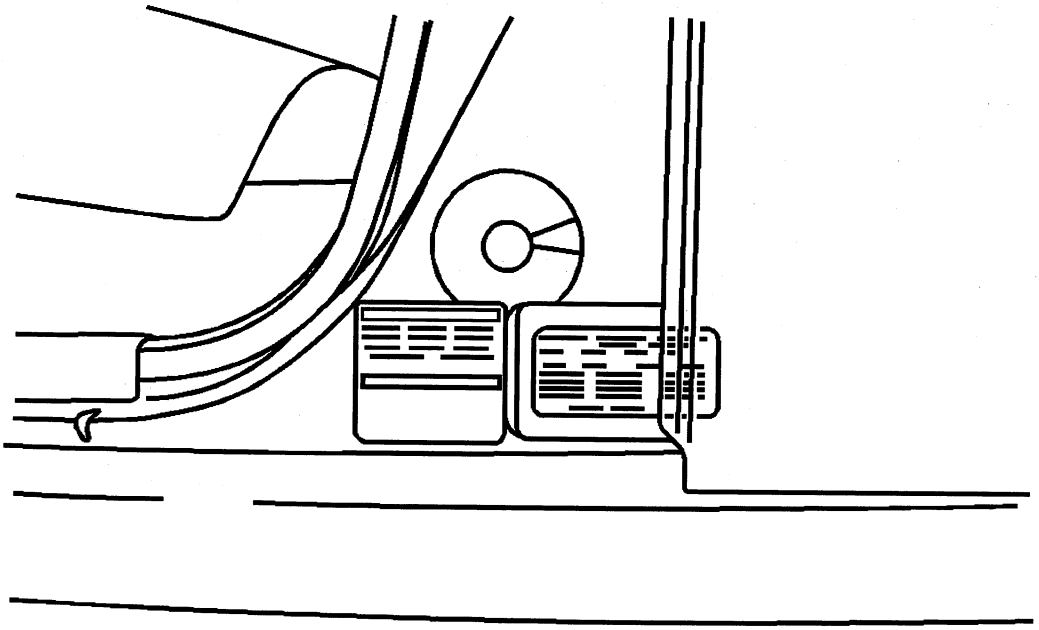


Label Certification



1. Production Date
2. Vehicle Type
3. Gross Vehicle Weight Rating
4. Gross Axle Weight Rating Front
5. Gross Axle Weight Rating Rear
6. Vehicle Identification Number

Certification Label Location



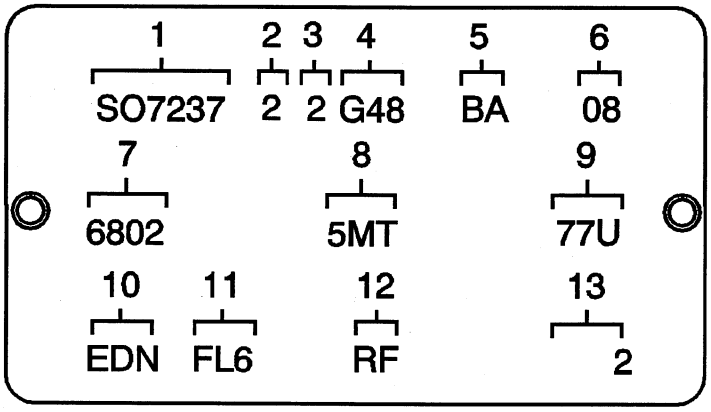
The certification label is attached to the inside of the driver side door jamb.

Tire Placard

The tire label is permanently located on the rear face of the driver's door and should be referred to for tire information. It lists the maximum vehicle load, the tire size, including the spare tire, and the cold inflation pressure, including the spare tire.

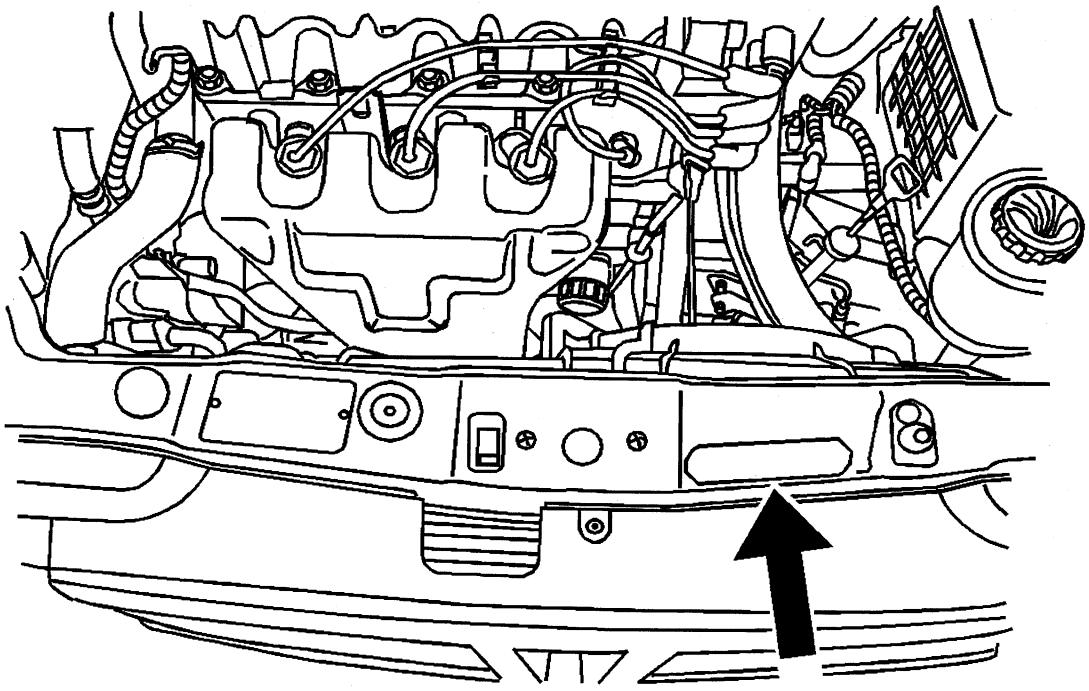
Service Parts Identification Label (SPID)

Body Identification Plate



1. P/O Number
2. Check Digit
3. Car Type
4. Body Type
5. Battery Tray
6. Production Date
7. Sequential Number
8. Hood
9. Exterior Color
10. Export Country
11. Side Indicator Lamp
12. Trunk Lid
13. P/O Plate Serial Number

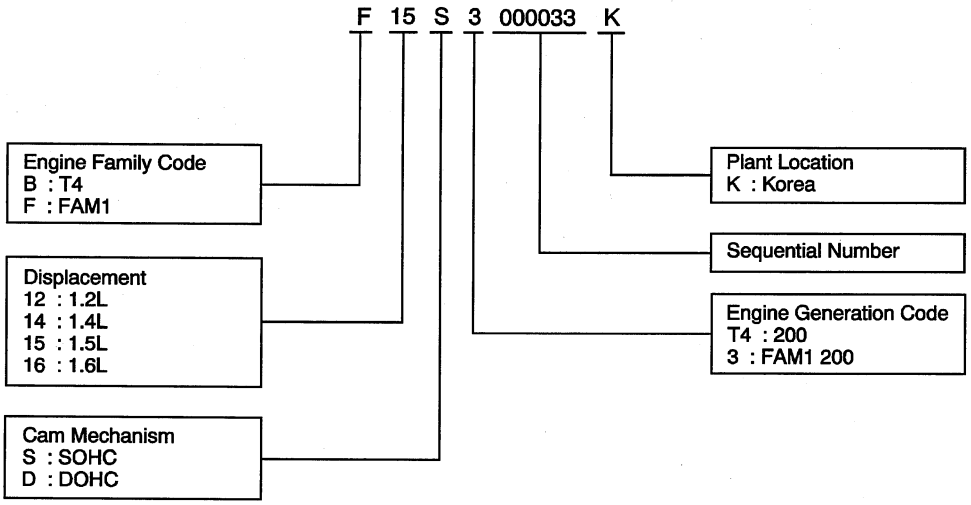
Body Identification Number Plate Location



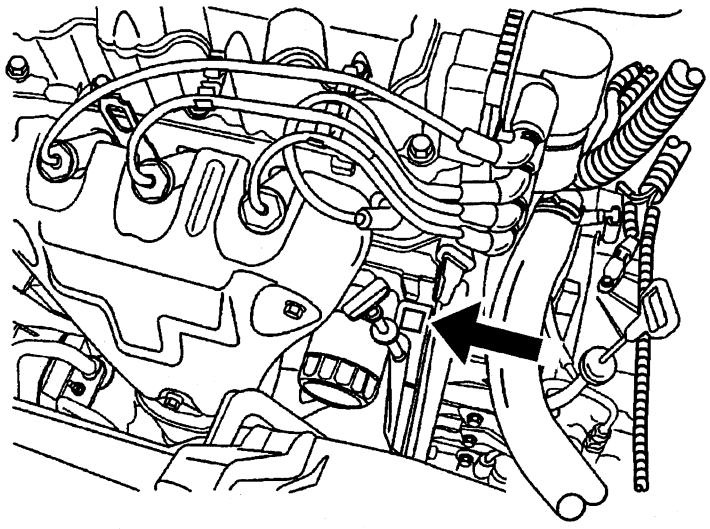
The body identification number plate is attached to the top of the front panel support.

Engine ID and VIN Derivative Location

Engine Number



Engine Number Location



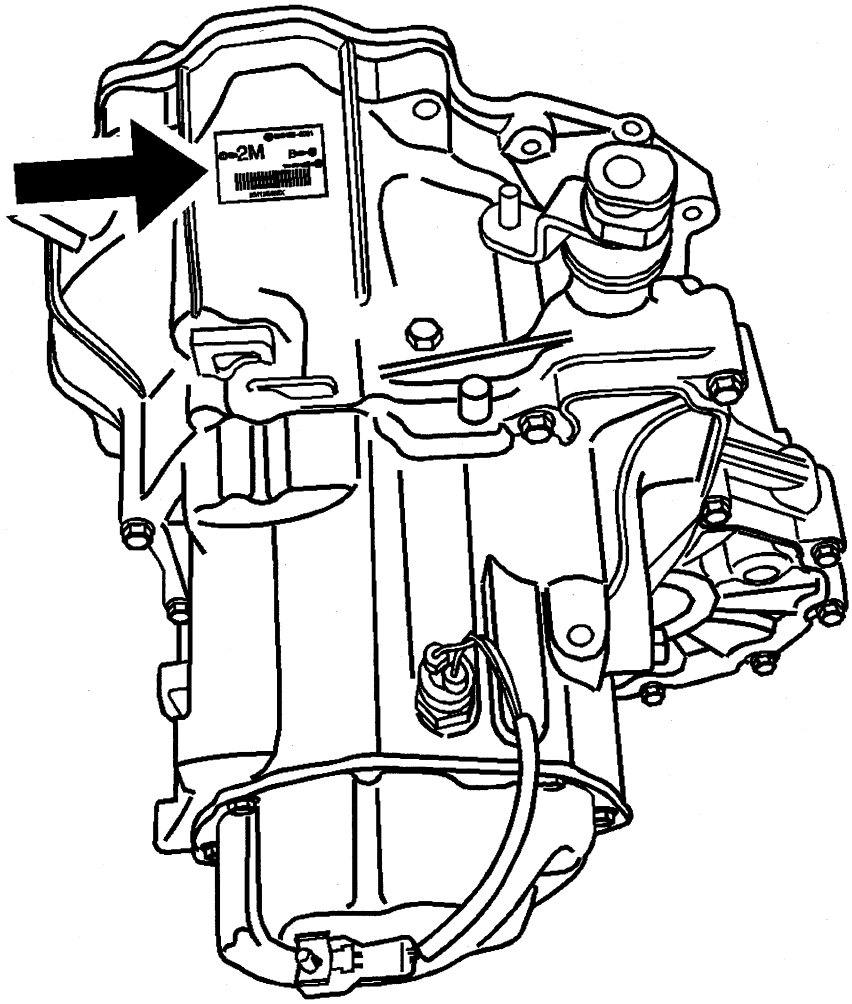
The engine number is stamped on the cylinder block under the No. 4 exhaust manifold of the engine.

Transmission ID and VIN Derivative Location

Manual Transmission Identification Number Plate (Y4M)

1. Identification Number
2. T/M Initial Manufacturing Date and Sequence Number
3. Plant to be Supplied
4. T/M Serial Number and Check Digit

Manual Transmission Identification Number Plate Location (Y4M)



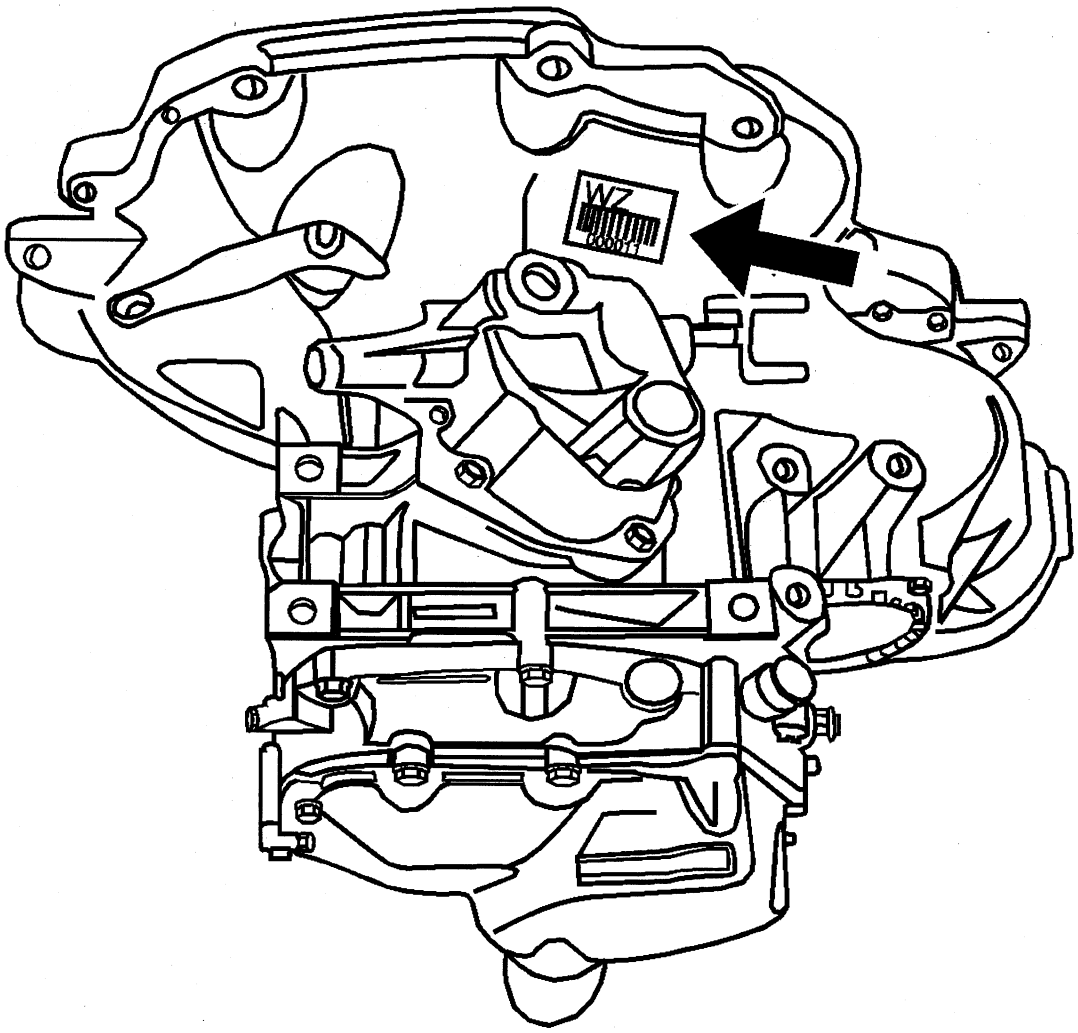
The manual transaxle identification number is attached to the top of the transmission case near the engine.

Manual Transmission Identification Number Plate (D-16)

1. Identification Code
2. Sequential Number

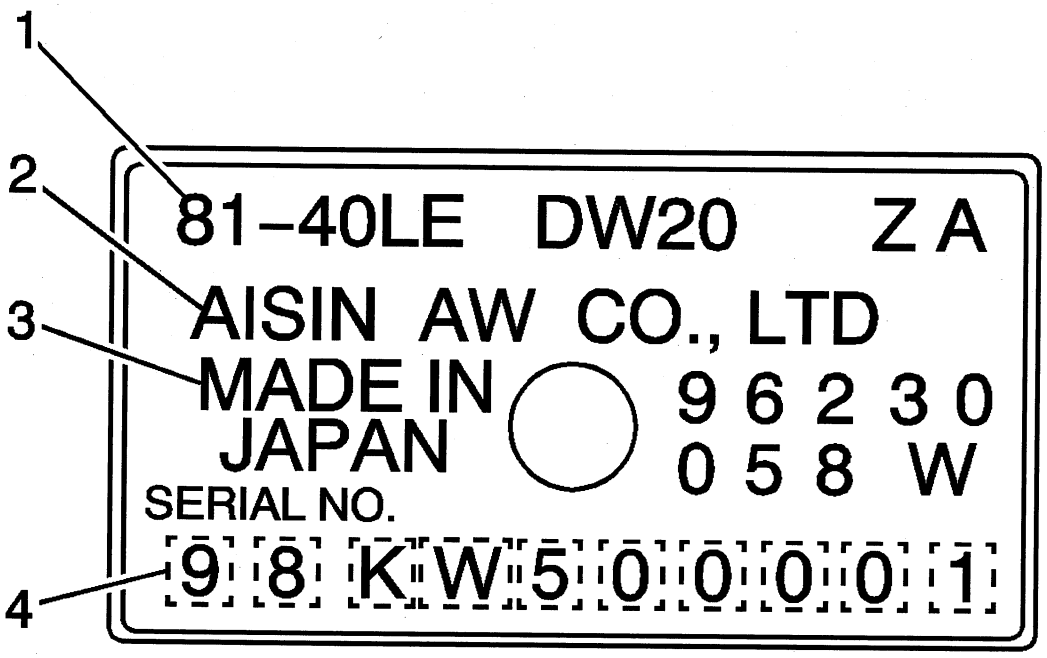
Identification Code	Engine	Gear Ratio
SX	1.5L SOHC	3.722 Semi Wide
SY	1.4L DOHC	3.722 Semi Wide
W2	1.4L DOHC	4.176 Semi Wide

Manual Transaxle Identification Number Plate Location (D-16)



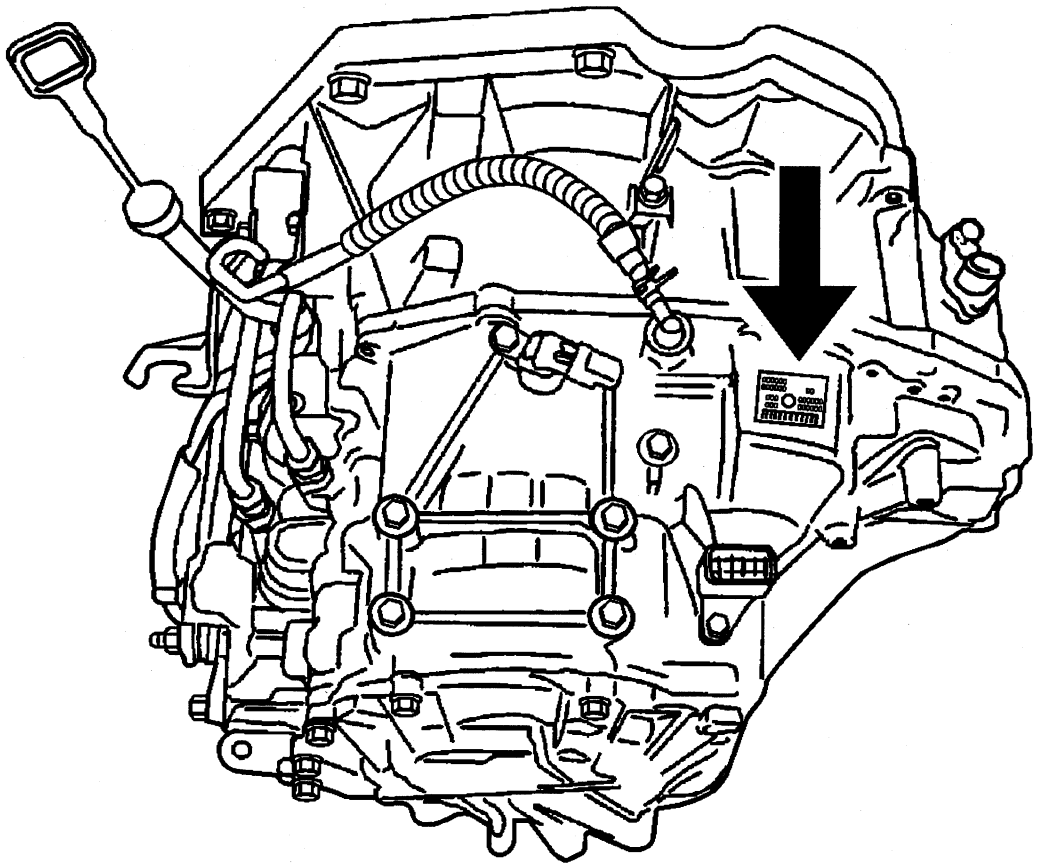
The manual transaxle identification number is attached to the top of the transmission case near the engine.

Automatic Transmission Identification Number Plate



1. AW's Lot Number
2. Part ID Code
3. GM DATC Part Number
4. AW's Serial Number

Automatic Transaxle Identification Number Plate Location



The automatic transaxle identification number plate is attached on the upper side of the transaxle case.

RPO Code List

The production/process codes provide the description of the Regular Production Options (RPOs) used on the vehicle. The RPO list is printed on the Service Parts Identification Label. The following is a list of the RPO abbreviations and the description of each:

RPO	Description
A31	Windows, power
AK5	Air bags, frontal
AR7	Seats, front Cloth bucket
AR7	Seats, front Deluxe Cloth bucket
B37	Floormats, carpeted, front and rear
BAH	Theft-deterrent system, engine immobilizer
C3Z	Defogger, rear-window
C60	Air conditioning, front manual
CF5	Sunroof, power
D31	Mirror, inside rearview
D80	Spoiler, rear
FE9	Emissions, Federal requirements
FX1	Axle, 3.94 ratio
GY5	Axle, 3.75 ratio
J41	Brakes, front disc/rear drum
JM4	Brakes, 4-wheel antilock, front disc/rear drum
K05	Engine block heater
K99	Generator, 85 amp
L91	Engine, E-TEC II 1.6L DOHC
MM5	Transmission, 5-speed manual
MX0	Transmission, 4-speed automatic
N40	Steering, power
NB8	Emissions override
NC7	Emissions override, Federal
NE1	Emissions, Maine, Massachusetts, New York or Vermont state requirements
PG4	Wheels, 14" (35.6 cm) aluminum
PY8	Wheels, 14" (35.6 cm) steel
Q98	Tires, P185/60R14
U3L	Sound system, ETR AM/FM stereo with CD player and MP3 playback
UA5	Keyless entry, remote
UAE	Sound system feature, 6-speakers, premium
UBZ	Instrumentation, analog
UM7	Sound system, ETR AM/FM stereo
YF5	Emissions, California state requirements

Technical Information

Maintenance and Lubrication

Capacities - Approximate Fluid

Application	Specification	
	Metric	English
Automatic Transaxle - 1.2 L and 1.4/1.5 L SOHC	5.6 liters	5.9 quarts
Automatic Transaxle - 1.4 L DOHC	5.8 liters	6.2 quarts
Brake Fluid and Clutch Fluid	0.5 liters	0.5 quarts
Clutch Linkage Pivot Points	As Required	
Engine Oil - 1.4/1.5 l SOHC and 1.4 L DOHC	3.75 liters	4 quarts
Engine Oil - 1.2 L SOHC	3.2 liters	3.4 quarts
Engine Coolant - 1.4/1.5 L SOHC and 1.4 DOHC	7.0 liters	7.4 quarts
Engine Cooling - 1.2 L SOHC	5.2 liters	5.5 quarts
Floor Shift Linkage Points	As Required	
Hood Latch Assembly, Pivots and Spring Anchor, Release Pawl	As Required	
Hood and Door Hinges, Fuel Door Hinge, Rear Compartment Lid Hinges	As Required	
Key Lock Cylinders	As Required	
Manual Transaxle - 1.4/1.5 L SOHC and 1.4 L DOHC	1.8 liters	2 quarts
Manual Transaxle - 1.2 L SOHC	2.1 liters	2.2 quarts
Manual Transaxle Shift Linkage	As Required	
Power Steering System	1.1 liters	1.2 quarts
Weatherstrips	As Required	

Maintenance Items

Application	Part/Number
Spark Plugs - 1.4/1.5 L SOHC	Champion Type RN9YC, 0.7-0.8 mm (0.028-0.031 in) SOHC
Spark Plugs - 1.4 L DOHC	NGK Type BKR6E-11, 1-1.1 mm (0.039-0.043 in)
Spark Plugs - 1.2 L SOHC	NGK Type BPR5EY-11, 1-1.1 mm (0.039-0.043 in)

Fluid and Lubricant Recommendations

Application	Fluid/Lubricant
Automatic Transaxle	ESSO JWS 3309 or T-IV Automatic Transmission Fluid (GM Part No. U.S. 88900925, in Canada 22689186)
Brake Fluid and Clutch Fluid	DOT-3 or DOT-4
Clutch Linkage Pivot Points	Engine Oil
Engine Coolant	Mixture of water and good quality ethylene glycol base antifreeze (year-round coolant)
Engine Oil	API SJ (ILSAC GF-II) Grade or Better SAE 5W-30, SAE 10W-30, SAE 15W-40 (Cold area: SAE 5W-30, Hot area: SAE 15W-40)
Floor Shift Linkage Points	Engine Oil
Hood Latch Assembly Pivots and Spring Anchor Release Pawl	 Engine Oil Multipurpose type grease meeting requirements NLGI No. 1 or 2
Hood and Door Hinges, Fuel Door Hinge, Rear Compartment Lid Hinges	Engine oil
Key Lock Cylinders	Silicone Lubricant
Manual Transaxle	Manual Transaxle Fluid B0400075, SAE 75 W-58 (1.2 SOHC) SAE 80W (1.4L/1.5 L SOHC and 1.4 L DOHC)
Manual Transaxle Shift Linkage	Multipurpose type grease meeting requirements NLGI No. 1 or 2
Power Steering System	DEXRON®-III or DEXRON®-IID
Weatherstrips	Silicone Grease

Descriptions and Operations

Power Steering System

The power steering system consists of 3 components: the power steering pump, the power steering fluid reservoir, and the power steering rack and pinion gear. The power steering pump is a vane-type pump providing hydraulic pressure for the system and is powered by the engine. It draws on the power steering fluid reservoir, which in turn is connected to the power steering gear. A pressure-relief valve inside the flow control valve limits the pump pressure. The power steering rack and pinion gear has a rotary control valve which directs hydraulic fluid coming from the power steering pump to one side or the other side of the rack piston. The integral rack piston is attached to the rack. The rack piston converts hydraulic pressure to a linear force which moves the rack to the left or the right. The force is then transmitted through the inner and the outer tie rods to the steering knuckles, which turn the wheels.

The power rack and pinion steering system has a rotary control valve which directs the hydraulic fluid coming from the hydraulic pump to one side or the other side of the rack piston. The integral rack piston is attached to the rack. The rack piston converts hydraulic pressure to a linear force which moves the rack left or right. The force is then transmitted through the inner and the outer tie rods to the steering knuckles, which turn the wheels.

If hydraulic assist is not available, manual control is maintained. However, under these conditions, more steering effort is required. The movement of the steering wheel is transferred to the pinion. The movement of the pinion is then transferred through the pinion teeth, which mesh with the teeth on the rack, causing the rack to move.

A vane-type pump provides hydraulic pressure for the system.

The boot and rack guide, the rack bearings, and the valve and pinion assembly are no longer serviceable on this vehicle. They must be replaced as whole units.

Manual Steering Gear Description and Operation

The manual rack and pinion steering system consists of two main components: the rack and the pinion. The motion of the pinion is transferred through the pinion teeth that mesh with the teeth on the rack, which moves the rack. The force is then transmitted through the arms on the struts, which turn the wheels.

Steering Wheel and Column

The steering wheel and column has 4 primary functions:

- Vehicle steering
- Vehicle security
- Driver convenience
- Driver safety

Vehicle Steering

The steering wheel is the first link between the driver and the vehicle. The steering wheel is fastened to a steering shaft within the column. At the lower end of the column, the intermediate shaft connects the column to the steering gear.

Vehicle Security

Theft deterrent components are mounted and designed into the steering column. The following components allow the column to be locked in order to minimize theft:

- The ignition switch
- The steering column lock
- The ignition cylinder

Driver Convenience

The steering wheel and column may also have driver controls attached for convenience and comfort. The following controls may be mounted on or near the steering wheel or column.

- The turn signal switch
- The hazard switch
- The headlamp dimmer switch
- The wiper/washer switch
- The horn pad/cruise control switch
- The redundant radio/entertainment system controls
- The tilt or tilt/telescoping functions
- The HVAC controls

Driver Safety

The energy-absorbing steering column compresses in the event of a front-end collision, which reduces the chance of injury to the driver. The mounting capsules break away from the mounting bracket in the event of an accident.

Suspension Description and Operation

Front Suspension

General Description (SOHC Engine)

The front suspension for this vehicle is a combination knuckle/strut and spring design.

The control arms pivot from the body. The lower control arm pivots use rubber bushings. The upper end of the strut is isolated by a rubber mount and contains a bearing to allow the wheel to turn.

The lower end of the steering knuckle pivots on a ball joint bolted to the control arm. The ball joint is fastened to the steering knuckle with a nut, and to the lower control arm with rivets.

When servicing the control arm-to-body attachment and the stabilizer shaft-to-body insulators, make sure the attaching bolts are loose until the control arms are moved to the trim height, which is curb height. Trim height is the normal position to which the control arms move when the vehicle is sitting on the ground.

General Description (DOHC Engine)

The front suspension for this vehicle is a combination knuckle/strut and spring design.

The control arms pivot from the body. The lower control arm pivots use rubber bushings. The upper end of the strut is isolated by a rubber mount and contains a bearing to allow the wheel to turn.

The lower end of the steering knuckle pivots on a ball joint bolted to the control arm. The ball joint is fastened to the steering knuckle with a nut, and to the lower control arm with rivets.

When servicing the control arm-to-body attachment and the stabilizer shaft-to-body insulators, make sure that the attaching bolts are loose until the control arms are moved to the trim height, which is curb height. Trim height is the normal position to which the control arms move when the vehicle is sitting on the ground.

The springs in the front suspension DOHC engine are stronger and the shocks are heavier than are the springs and shocks in the front suspension SOHC engine.

Rear Suspension

The rear suspension consists of an axle with trailing arms and a twisting cross beam, 2 coil springs, 2 shock absorbers, 2 upper spring insulators, and 2 spring compression bumpers. The axle support assembly attaches to the underbody through a rubber bushing located at the front of each of the control arms. The brackets are integral with the underbody side rails. The axle structure maintains the

relationships of the wheels to the body. A serviceable stabilizer shaft, incorporated with the axle beam, attaches to each of the control arms.

Each coil spring is retained between a seat in the underbody and a seat welded to the top of the rear axle control arm. The coil spring lower end rests on a compression bumper in the welded bracket on top of the rear axle, while a rubber insulator is used to isolate the coil spring upper end from the vehicle underbody seat.

Wheels and Tires

General Description

The factory installed tires are designed to operate satisfactorily with loads up to and including the full rated load capacity when these tires are inflated to the recommended pressures.

The following factors have an important influence on tire life:

- Correct tire pressures
- Correct wheel alignment
- Proper driving techniques
- Tire rotation

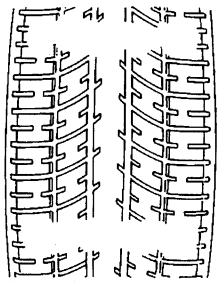
The following factors increase tire wear:

- Heavy cornering
- Excessively rapid acceleration
- Heavy braking

Tread Wear Indicators Description

The original equipment tires have tread wear indicators that show when you should replace the tires.

The location of these indicators are at 72 degree intervals around the outer diameter of the tire. The indicators appear as a 6 mm (0.25 in) wide band when the tire tread depth becomes 1.6 mm (2/32 in).



Metric Wheel Nuts and Bolts Description

Metric wheel/nuts and bolts are identified in the following way:

- The wheel/nut has the word Metric stamped on the face.
- The letter M is stamped on the end of the wheel bolt.

The thread sizes of metric wheel/nuts and the bolts are indicated by the following example: M12 x 1.5.

- M = Metric
- 12 = Diameter in millimeters
- 1.5 = Millimeters gap per thread

Tire Inflation Description

When you inflate the tires to the recommended inflation pressures, the factory-installed wheels and tires are designed in order to handle loads to the tire's rated load capacity. Incorrect tire pressures, or under-inflated tires, can cause the following conditions:

- Vehicle handling concerns
- Poor fuel economy
- Shortened tire life
- Tire overloading

Inspect the tire pressure when the following conditions apply:

- The vehicle has been sitting at least 3 hours.
- The vehicle has not been driven for more than 1.6 km (1 mi).
- The tires are cool.

Inspect the tires monthly or before any extended trip. Adjust the tire pressure to the specifications on the tire label. Install the valve caps or the extensions on the valves. The caps or the extensions keep out dust and water.

The kilopascal (kPa) is the metric term for pressure. The tire pressure may be printed in both kilopascal (kPa) and psi. One psi equals 6.9 kPa.

Inflation Pressure Conversion (Kilopascals to PSI)

kPa	psi	kPa	psi
140	20	215	31
145	21	220	32
155	22	230	33
160	23	235	34
165	24	240	35
170	25	250	36
180	26	275	40
185	27	310	45
190	28	345	50
200	29	380	55
205	30	415	60
Conversion: 6.9 kPa = 1 psi			

Tires with a higher than recommended pressure can cause the following conditions:

- A hard ride
- Tire bruising
- Rapid tread wear at the center of the tire

Tires with a lower than recommended pressure can cause the following conditions:

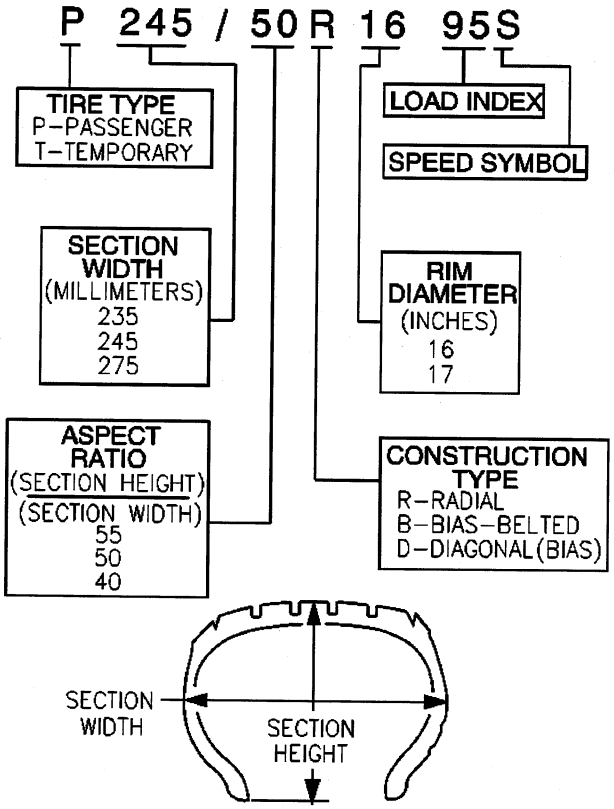
- A tire squeal on turns
- Hard steering
- Rapid wear and uneven wear on the edge of the tread
- Tire rim bruises and tire rim rupture
- Tire cord breakage
- High tire temperatures
- Reduced vehicle handling
- High fuel consumption
- Soft riding

Unequal pressure on the same axle can cause the following conditions:

- Uneven braking
- Steering lead
- Reduced vehicle handling

Refer to the Tire Placard for specific tire and wheel applications and tire pressures.

P-Metric Sized Tires Description



Most P-metric tire sizes do not have exact corresponding alphanumeric tire sizes. Replacement tires should be of the same tire performance criteria (TPC) specification number including the same size, the same load range, and the same construction as those originally installed on the vehicle. Consult a tire dealer if you must replace the P-metric tire with other sizes. Tire companies can best recommend the closest match of alphanumeric to P-metric sizes within their own tire lines.

Driveline/Axle Description and Operation

Front Drive Axle Description and Operation (Automatic)

Drive axles are flexible shaft assemblies that transmit rotational force from the transaxle to the front-wheel assemblies. Each axle assembly consists of an inner and an outer constant-velocity joint connected to an axle shaft. The inner joint is completely flexible and has the ability to move in and out. The outer joint is also flexible, but it cannot move in and out.

The drive axles use one type of outboard joint and one type of inboard joint. The inboard ends of both drive axles incorporate a female spline that installs over a stub shaft protruding from the transaxle.

Front Drive Axle Description and Operation (Manual)

Drive axles are flexible shaft assemblies that transmit a rotational force from the transaxle to the front-wheel assemblies. Each axle assembly consists of an inner constant-velocity joint and an outer constant-velocity joint connected to an axle shaft. The inner joint is completely flexible and has the ability to move in and out. The outer joint is also flexible, but it cannot move in and out.

The drive axles use one type of outboard joint and one type of inboard joint. The inboard ends of both drive axles incorporate a male spline that interlocks with the transaxle gears using snap rings.

Braking System Description and Operation

Hydraulic Brake System Description and Operation

System Component Description

The hydraulic brake system consists of the following:

Hydraulic Brake Master Cylinder Fluid Reservoir

Contains supply of brake fluid for the hydraulic brake system.

Hydraulic Brake Master Cylinder

Converts mechanical input force into hydraulic output pressure.

Hydraulic output pressure is distributed from the master cylinder through two hydraulic circuits, supplying diagonally-opposed wheel apply circuits.

Hydraulic Brake Pressure Balance Control System

Regulates brake fluid pressure delivered to hydraulic brake wheel circuits, in order to control the distribution of braking force.

Pressure balance control is achieved through dynamic rear proportioning (DRP), which is a function of the ABS modulator.

Hydraulic Brake Pipes and Flexible Brake Hoses

Carries brake fluid to and from hydraulic brake system components.

Hydraulic Brake Wheel Apply Components

Converts hydraulic input pressure into mechanical output force.

System Operation

Mechanical force is converted into hydraulic pressure by the master cylinder, regulated to meet braking system demands by the pressure balance control system, and delivered to the hydraulic brake wheel circuits by the pipes and flexible hoses. The wheel apply components then convert the hydraulic pressure back into mechanical force which presses linings against rotating brake system components.

Brake Assist System Description and Operation

System Component Description

The brake assist system consists of the following:

Brake Pedal

Receives, multiplies and transfers brake system input force from driver.

Brake Pedal Pushrod

Transfers multiplied input force received from brake pedal to brake booster.

Vacuum Brake Booster

Uses source vacuum to decrease effort required by driver when applying brake system input force.

When brake system input force is applied, air at atmospheric pressure is admitted to the rear of both vacuum diaphragms, providing a decrease in brake pedal effort required. When input force is removed, vacuum replaces atmospheric pressure within the booster.

Vacuum Source

Supplies force used by vacuum brake booster to decrease brake pedal effort.

Vacuum Source Delivery System

Enables delivery and retention of source vacuum for vacuum brake booster.

System Operation

Brake system input force is multiplied by the brake pedal and transferred by the pedal pushrod to the hydraulic brake master cylinder. Effort required to apply the brake system is reduced by the vacuum brake booster.

Disc Brake System Description and Operation

System Component Description

The disc brake system consists of the following components:

Disc Brake Pads

Applies mechanical output force from the hydraulic brake calipers to friction surfaces of brake rotors.

Disc Brake Rotors

Uses mechanical output force applied to friction surfaces from the disc brake pads to slow speed of tire and wheel assembly rotation.

Disc Brake Pad Hardware

Secures disc brake pads firmly in proper relationship to the hydraulic brake calipers. Enables a sliding motion of brake pads when mechanical output force is applied.

Disc Brake Caliper Hardware

Provides mounting for hydraulic brake caliper and secures the caliper firmly in proper relationship to caliper bracket. Enables a sliding motion of the brake caliper to the brake pads when mechanical output force is applied.

System Operation

Mechanical output force is applied from the hydraulic brake caliper pistons to the inner brake pads. As the pistons press the inner brake pads outward, the caliper housings draw the outer brake pads inward. This allows the output force to be equally distributed. The brake pads apply the output force to the friction surfaces on both sides of the brake rotors, which slows the rotation of the tire and wheel assemblies. The

correct function of both the brake pad and brake caliper hardware is essential for even distribution of braking force.

Drum Brake System Description and Operation

System Component Description

The drum brake system consists of the following:

Drum Brake Shoes

Applies mechanical output force (from hydraulic brake wheel cylinders) to friction surface of brake drums.

Brake Drums

Uses mechanical output force applied to friction surface from drum brake shoes to slow speed of tire and wheel assembly rotation.

Drum Brake Hardware

Secures drum brake shoes firmly in proper relationship to hydraulic brake wheel cylinders. Enables sliding motion of brake shoes needed to expand toward friction surface of drums when mechanical output force is applied; provides return of brake shoes when mechanical output force is relieved.

Drum Brake Adjusting Hardware

Provides automatic adjustment of brake shoes to brake drum friction surface whenever brake apply occurs during rearward motion of the vehicle.

System Operation

Mechanical output force is applied from the hydraulic brake wheel cylinder pistons to the top of the drum brake shoes. The output force is then distributed between the primary and secondary brake shoes as the shoes expand toward the friction surface of the brake drums. The brake shoes apply the output force to the friction surface of the brake drums, which slows the rotation of the tire and wheel assemblies. The proper function of both the drum brake hardware and adjusting hardware is essential to the proper distribution of braking force.

Park Brake System Description and Operation

System Component Description

The park brake system consists of the following:

Park Brake Lever Assembly

Receives, multiplies, and transfers park brake system apply input force from operator to park brake cable system.

Releases applied park brake system when lever is returned to at-rest, lowered, position.

Park Brake Cables

Transfers input force received from park brake lever, through park brake cable equalizer, to park brake apply levers.

Park Brake Cable Equalizer

Evenly distributes input force to both the left and right park brake units.

Park Brake Apply Lever

Multiplies and transfers input force to park brake actuator/adjuster.

Park Brake Actuator/Adjuster

Uses multiplied input force from apply lever to expand drum brake shoes toward the friction surface of the brake drum.

Threaded park brake actuators/adjusters are also used to control clearance between the drum brake shoes and the friction surface of the brake drum.

Drum Brake Shoes

Applies mechanical output force from park brake actuator/adjuster to friction surface of the brake drum.

System Operation

Park brake apply input force is received by the park brake lever assembly being applied. The input force is multiplied by the lever assembly, transferred, and evenly distributed, through the park brake cables and the park brake cable equalizer, to the left and right park brake apply levers. The park brake apply levers multiply and transfer the apply input force to the park brake actuators/adjusters which expand the drum brake shoes toward the friction surface of the brake drum in order to prevent the rotation of the rear tire and wheel assemblies. The park brake lever assembly releases an applied park brake system when it is returned to the at-rest, lowered, position.

ABS Description and Operation

Antilock Brake System

When wheel slip is detected during a brake application, the ABS enters antilock mode. During antilock braking, hydraulic pressure in the individual wheel circuits is controlled to prevent any wheel from slipping. A separate hydraulic line and specific solenoid valves are provided for each wheel. The ABS can decrease, hold, or increase hydraulic pressure to each wheel brake. The ABS cannot, however, increase hydraulic pressure above the amount which is transmitted by the master cylinder during braking.

During antilock braking, a series of rapid pulsations is felt in the brake pedal. These pulsations are caused by the rapid changes in position of the individual solenoid valves as the EBCM responds to wheel speed sensor inputs and attempts to prevent wheel slip. These pedal pulsations are present only during antilock braking and stop when normal braking is resumed or when the vehicle comes to a stop. A ticking or popping noise may also be heard as the solenoid valves cycle rapidly. During antilock braking on dry pavement, intermittent chirping noises may be heard as the tires approach slipping. These noises and pedal pulsations are considered normal during antilock operation.

Vehicles equipped with ABS may be stopped by applying normal force to the brake pedal. Brake pedal operation during normal braking is no different than that of previous non-ABS systems. Maintaining a constant force on the brake pedal provides the shortest stopping distance while maintaining vehicle stability.

Engine Description and Operation

Engine Mechanical – 1.6L – L91

General Specifications

Application	Specification	
	Metric	English
General Data		
• Engine Type	4 Cylinder - In-Line	
• Displacement	1598 cm^3	97.51 in^3
• Bore Stroke	79.0x81.5 mm	3.1x3.21 in
• Compression Ratio	9.5:1	
• Firing Order	1-3-4-2	
• Maximum Power - At 6200 RPM	77 kw/103.3 hp	
• Maximum Torque - At 3400 RPM	145 N·m	106.9 lb ft
Cylinder Bore		
• Diameter	79 mm	3.1 in
• Out of Round - Maximum	0.0065 mm	0.00025 in
• Taper - Maximum	0.0065 mm	0.00025 in
Piston		
• Diameter	78.970 mm	3.07 in
• Clearance to Bore	0.03 mm	0.0012 in
Piston Rings		
• Ring, End Gap - Top Compression	0.15-0.3 mm	0.006-0.012 in
• Ring, End Gap - Second Compression	0.3-0.5 mm	0.012-0.019 in
• Groove Clearance - Top Impression	0.05-0.09 mm	0.0019-0.0035 in
• Groove Clearance - Second Compression	0.06-0.10 mm	0.0024-0.0039 in
Piston Pin		
• Diameter	18 mm	0.708 in
• Pin Off-Set	0.5-0.7 mm	0.019-0.027 in
Camshaft		
• Lift Intake	7.2 mm	0.283 in
• Lift Exhaust	7.2 mm	0.283 in
• End Play	0.1-0.25 mm	0.0039-0.0079 in
• Journal OD - No. 1	29.94 mm	1.179 in
• Journal OD - No. 2	26.94 mm	1.061 in
• Journal OD - No. 3	26.94 mm	1.061 in
• Journal OD - No. 4	26.94 mm	1.061 in
• Journal OD - No. 5	26.94 mm	1.061 in
• Bearing OD - No. 1	30.01 mm	1.181 in
• Bearing OD - No. 2	27.01 mm	1.063 in
• Bearing OD - No. 3	27.01 mm	1.063 in
• Bearing OD - No. 4	27.01 mm	1.063 in
• Bearing OD - No. 5	27.01 mm	1.063 in
Crankshaft		
• Main Journal - Diameter - All	55 mm	2.17 in
• Taper - Maximum	0.005 mm	0.0001 in
• Out of Round - Maximum	0.004 mm	0.0001 in

• Main Bearing Clearance - All	0.026-0.042 mm	0.001-0.00165 in
• Crankshaft End Play	0.1 mm	0.003 in
• Connecting Rod Journal - Diameter - All	43 mm	1.69 in
• Taper - Maximum	0.005 mm	0.00019 in
• Out of Round - Maximum	0.004 mm	0.00015 in
• Rod Bearing Clearance - All	0.019-0.07 mm	0.0007-0.0027 in
• Rod Side Clearance	0.07-0.242 mm	0.0027-0.009 in
Valve Stem		
• Valve Lash Compensators	Hydraulic	
• Face Angle - All	45-45, 25 degrees	
• Seat Angle - All	44.5-45 degrees	
• Seat Runout - Maximum, All	0.05 mm	0.0197 in
• Face Runout - Maximum, All	0.03 mm	0.0012 in
• Seat Width - Intake	1.17-1.57 mm	0.0461-0.0618 in
• Seat Width - Exhaust	1.4-1.8 mm	0.055-0.071 in
• Valve Guide Inside Diameter - All	6-6.02 mm	0.236-0.237 in
• Valve Stem Diameter - Intake	5.955-5.97 mm	0.234-0.235 in
• Valve Stem Diameter - Exhaust	5.935-5.95 mm	0.2336-0.2342 in
• Valve Diameter - All - Intake	28.57 mm	1.125 in
• Valve Diameter - Exhaust	27.24 mm	1.074 in
• Valve Spring Loads - Valve Open	551-609 N	405-447 lbs
• Valve Spring Loads - Valve Closed	247-273 N	181-200 lbs
Lubricating Type	Forced Feed	
Oil Filter Type	Cartridge (Full Flow)	
Oil Pan Capacity Including Oil Filter	3.75 liter	4 quarts
Oil Pump		
• Gap Between Oil Pump Body and Out Rotor	0.4-0.484 mm	0.0157-0.0191 in
• Out Rotor Side Clearance	0.045-0.1 mm	0.0018-0.0039 in
• Inner Rotor Side Clearance	0.035-0.085 mm	0.0014-0.0033 in
• Relief Valve Spring Free Length	81 mm	3.2 in
Oil Pump Type	Rotary (Trochoid)	

Fastener Tightening Specifications

Application	Specification	
	Metric	English
A/C Compressor Mounting Bolts	27 N·m	20 lb ft
A/C Compressor Mounting Bracket Bolts	50 N·m	37 lb ft
Air Filter Housing Bolts	12 N·m	106 lb in
Alternator Adjusting Bolt	20 N·m	15 lb ft
Alternator Adjusting Bracket Retaining Bolt	20 N·m	15 lb ft
Auxiliary Catalytic Converter-to-Exhaust Manifold Nuts and Bracket Bolts	40 N·m	30 lb ft
Camshaft Cap Bolts	16 N·m	12 lb ft
Camshaft Gear Bolt	67.5 N·m	49 lb ft
Camshaft Pressure Plate Bolts	10 N·m	89 lb in
Connecting Rod Bearing Cap Bolts	25 N·m+30°+15°	18 lb ft+30°+15°
Coolant Pump Retaining Bolts	10 N·m	89 lb in
Coolant Temperature Sensor	20 N·m	15 lb ft
Crankshaft Bearing Cap Bolts	50 N·m+45°+15°	37 lb ft+45°+15°
Crankshaft Position Sensor Retaining Bolt	10 N·m	89 lb in

Crankshaft Pulley Bolt	95 N·m+30°+15°	70 lb ft+30°+15°
Cylinder Head Bolts - Camshaft Support Housing and Cylinder Head Mounting Bolts	25 N·m +60°+60°+60°+15°	18 lb ft +60°+60°+60°+10°
Electronic Ignition System Ignition Coil Mounting Bolts	10 N·m	89 lb in
Electronic Ignition System Ignition Coil Mounting Plate Bolts	10 N·m	89 lb in
Engine Mount Bracket Retaining Bolt	65 N·m	48 lb ft
Engine Mount Bracket-to-Engine Mount Retaining Bolts	60 N·m	44 lb ft
Engine Mount Retaining Nuts	40 N·m	30 lb ft
Exhaust Flexible Pipe Bracket Bolts	40 N·m	30 lb ft
Exhaust Gas Recirculation Valve Adapter Bolts	25 N·m	18 lb ft
Exhaust Manifold Heat Shield Bolts	15 N·m	11 lb ft
Exhaust Manifold Nuts	25 N·m	18 lb ft
Flexible Plate Bolts	60 N·m	44 lb ft
Flexible Plate Inspection Cover Bolts	10 N·m	89 lb in
Flywheel Bolts	35 N·m+30°+15°	26 lb ft+30°+15°
Flywheel Inspection Cover Bolts	12 N·m	106 lb in
Front Muffler-to-Main Catalytic Converter Nuts	30 N·m	22 lb ft
Fuel Rail Retaining Bolts	25 N·m	18 lb ft
Intake Manifold Retaining Nuts	25 N·m	18 lb ft
Intake Manifold Support Bracket Lower Bolt-to-Engine Block	40 N·m	30 lb ft
Intake Manifold Support Bracket Upper Bolts	25 N·m	18 lb ft
Lower Timing Belt Cover Bolts	10 N·m	89 lb in
Oil Pan Retaining Bolts	10 N·m	89 lb in
Oil Pressure Switch	40 N·m	30 lb ft
Oil Pump Retaining Bolts	10 N·m	89 lb in
Oil Pump/Pickup Tube and Support Bracket Bolts	10 N·m	89 lb in
Oil Pump Safety Relief Valve Bolt	36 N·m	22 lb ft
Oil Pump Rear Cover Bolts	6 N·m	53 lb in
Power Steering Pump Mounting Bolts	25 N·m	18 lb ft
Power Steering Pump Pulley Bolts	25 N·m	18 lb ft
Rear Timing Belt Cover Bolts	10 N·m	89 lb in
Spark Plug Cover Bolts	3 N·m	27 lb in
Spark Plugs	25 N·m	18 lb ft
Thermostat Housing Mounting Bolts	20 N·m	15 lb ft
Throttle Cable Bracket Bolts	8 N·m	71 lb in
Timing Belt Automatic Tensioner Bolt	25 N·m	18 lb ft
Timing Belt Idler Pulley Bolt	40 N·m	30 lb in
Transaxle Bell Housing Bolts	75 N·m	55 lb ft
Transaxle Brace Bolts	40 N·m	30 lb ft
Transaxle Torque Converter Bolts	65 N·m	48 lb ft
Upper Timing Belt Cover Bolts	10 N·m	89 lb in
Valve Cover Bolts	10 N·m	89 lb in

Engine Component Description

Cylinder Head and Gasket

The cylinder head is made up of an aluminum alloy. The cylinder head uses crossflow intake and exhaust ports. A spark plug is located on the exhaust side of each combustion chamber.

Crankshaft

The crankshaft has 8 integral weights which are cast with it for balancing. Oil holes run through the center of the crankshaft to supply oil to the connecting rods, the bearings, the pistons, and the other components. The end thrust load is taken by the thrust washers installed at the center journal.

Timing Belt

The timing belt coordinates the crankshaft and the camshaft and keeps them synchronized. The timing belt also turns the coolant pump. The timing belt and the pulleys are toothed so that there is no slippage between them. There is a tension pulley that maintains the correct timing belt tension. The timing belt is made of a tough reinforced rubber similar to that used on the serpentine accessory drive belt. The timing belt requires no lubrication.

Oil Pump

The oil pump draws engine oil from the oil pan and feeds it under pressure to the various parts of the engine. An oil strainer is mounted before the inlet of the oil pump to remove impurities which could clog or damage the oil pump or the other engine components. When the drive gear rotates, the driven gear rotates. This causes the space between the gears to open and narrow constantly, pulling oil in from the oil pan when the space opens and pumping the oil out to the engine as it narrows.

At high engine speeds, the oil pump supplies a much higher amount of oil than required for lubrication of the engine. The oil pressure regulator prevents too much oil from entering the engine lubrication passages. During normal oil supply, a coil spring and a valve keep the bypass closed, directing all of the oil pumped to the engine. When the amount of oil being pumped increases, the pressure becomes high enough to overcome the force of the spring. This opens the valve of the oil pressure regulator, allowing the excess oil to flow through the valve and drain back to the oil pan.

Oil Pan

The oil pan is mounted to the bottom of the cylinder block. The oil pan houses the crankcase and is made of aluminum.

Engine oil is pumped from the oil pan by the oil pump. After the oil passes through the oil filter, the oil is fed through 2 paths to lubricate the cylinder block and the cylinder head. In one path, the oil is pumped through the oil passages in the crankshaft to the connecting rods, then to the pistons and the cylinders in the cylinder block. The oil then drains back into the oil pan. In the 2nd path, the oil is pumped through the oil passages to the camshaft. The oil passes through the internal passageways in the camshafts to lubricate the valve assemblies in the cylinder head before draining back into the oil pan.

Exhaust Manifold

A single 4-port, rear-takedown exhaust manifold is used with this engine. The exhaust manifold is designed to direct the escaping exhaust gases out of the combustion chambers with a minimum of back pressure. The oxygen sensor (O2S) is mounted to the exhaust manifold.

Intake Manifold

The intake manifold has 4 independent long ports and uses inertial supercharging to improve engine torque at low and moderate speeds. The plenum is attached to the intake manifold.

Camshafts

This engine is a dual over head camshaft (DOHC) type, which means there are 2 camshafts. One camshaft operates the intake valves, and the other camshaft operates the exhaust valves. The camshafts sit in journals in the cylinder head on the top of the engine. They are held in place by camshaft caps. The

camshaft journals of the cylinder head are drilled for oil passages. Engine oil travels to the camshafts under pressure where it lubricates each camshaft journal. The oil returns to the oil pan through drain holes in the cylinder head. The camshaft lobes are machined into the solid camshaft to open and close the intake and exhaust valves precisely the correct amount at the correct time. The camshaft lobes are oiled by splash action from pressurized oil escaping from the camshaft journals.

Exhaust Gas Recirculation (EGR) Valve

The exhaust gas recirculation (EGR) system is used to lower oxides of nitrogen (NOx) emission levels caused by high combustion temperatures. The main element of the system is the EGR valve which is operated electrically by the engine control module (ECM).

The EGR valve feeds small amounts of exhaust gas into the intake manifold to decrease the combustion temperature. The amount of exhaust gas recirculated is controlled by variations in electrical signal and exhaust back pressure. If too much exhaust gas enters, combustion will not take place. For this reason, very little exhaust gas is allowed to pass through the valve, especially at idle.

The EGR valve is controlled precisely by the ECM according to various operating conditions of the engine.

Drive Belt System Description

The drive belt system consists of the following components:

- The drive belt
- The drive belt tensioner
- The drive belt idler pulley
- The crankshaft balancer pulley
- The accessory drive component mounting brackets
- The accessory drive components
  - The power steering pump, if belt driven
  - The generator
  - The A/C compressor, if equipped
  - The engine cooling fan, if belt driven
  - The water pump, if belt driven
  - The vacuum pump, if equipped
  - The air compressor, if equipped

The drive belt system may use one belt or two belts. The drive belt is thin so that it can bend backwards and has several ribs to match the grooves in the pulleys. There also may be a V-belt style belt used to drive certain accessory drive components. The drive belts are made of different types of rubbers (chloroprene or EPDM) and have different layers or plys containing either fiber cloth or cords for reinforcement.

Both sides of the drive belt may be used to drive the different accessory drive components. When the back side of the drive belt is used to drive a pulley, the pulley is smooth.

The drive belt is pulled by the crankshaft balancer pulley across the accessory drive component pulleys. The spring loaded drive belt tensioner keeps constant tension on the drive belt to prevent the drive belt from slipping. The drive belt tensioner arm will move when loads are applied to the drive belt by the accessory drive components and the crankshaft.

The drive belt system may have an idler pulley, which is used to add wrap to the adjacent pulleys. Some systems use an idler pulley in place of an accessory drive component when the vehicle is not equipped with the accessory.

Engine Cooling

Engine Cooling System Specifications

Application	Specification	
	Metric	English
Coolant in the Cooling System		
• 1.6L DOHC	7.0L	7.4 qt
Coolant Type	Forced Water Circulation	
Radiator Type	Cross-flow	
Thermostat Type	Pellet Type	
Water Pump Type	Centrifugal	

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Coolant Pump Mounting Bolts	10 N·m	89 lb in
Electric Cooling Fan Assembly Mounting Bolts	4 N·m	35 lb in
Electric Cooling Fan Motor Nut	3.2 N·m	28 lb in
Electric Cooling Fan Motor Retaining Screws	4 N·m	35 lb in
Negative Battery Terminal Retainer Bolt	15 N·m	11 lb ft
Surge Tank Attaching Bolt	10 N·m	89 lb in
Thermostat Housing Mounting Bolts	20 N·m	15 lb ft
Upper Left Radiator Retaining Bolt	7 N·m	62 lb in
Upper Right Radiator Retaining Bolt	7 N·m	62 lb in

Cooling System Description and Operation

The cooling system maintains the engine temperature at an efficient level during all engine operating conditions. When the engine is cold, the cooling system cools the engine slowly or not at all. This slow cooling of the engine allows the engine to warm up quickly.

The cooling system includes a radiator and recovery subsystem, cooling fans, a thermostat and housing, a coolant pump, and a coolant pump drive belt. The timing belt drives the coolant pump.

All components must function properly in order for the cooling system to operate. The coolant pump draws the coolant from the radiator. The coolant then circulates through water jackets in the engine block, the intake manifold, and the cylinder head. When the coolant reaches the operating temperature of the thermostat, the thermostat opens. The coolant then goes back to the radiator where it cools.

This system directs some coolant through the hoses to the heater core. This provides for heating and defrosting. The surge tank is connected to the radiator to recover the coolant displaced by expansion from the high temperatures. The surge tank maintains the correct coolant level.

The cooling system for this vehicle has no radiator cap or filler neck. The coolant is added to the cooling system through the surge tank.

Radiator

This vehicle has a lightweight tube-and-fin aluminum radiator. Two models of radiators are available: small, standard, and heavy duty. The 2 models vary only by capacity. Plastic tanks are mounted on the right and the left sides of the radiator core.

On vehicles equipped with automatic transaxles, the transaxle fluid cooler lines run through the left radiator tank. A radiator drain cock is on this radiator.

To drain the cooling system, open the drain cock.

Surge Tank

Caution: As long as there is pressure in the cooling system, the temperature can be considerably higher than the boiling temperature of the solution in the radiator without causing the solution to boil. Removal of the pressure cap while the engine is hot and pressure is high will cause the solution to boil instantaneously -- possibly with explosive force -- spewing the solution over the engine, fenders and the person removing the cap.

The surge tank is a transparent plastic reservoir, similar to the windshield washer reservoir.

The surge tank is connected to the radiator by a hose and to the engine cooling system by another hose. As the vehicle is driven, the engine coolant heats and expands. The portion of the engine coolant displaced by this expansion flows from the radiator and the engine into the surge tank. The air trapped in the radiator and the engine is degassed into the surge tank.

When the engine stops, the engine coolant cools and contracts. The displaced engine coolant is then drawn back into the radiator and the engine. This keeps the radiator filled with coolant to the desired level at all times and increases the cooling efficiency.

Maintain the coolant level between the MIN and the MAX marks on the surge tank when the system is cold.

Coolant Pump

The belt-driven centrifugal coolant pump consists of an impeller, a drive shaft, and a belt pulley. The coolant pump is mounted on the front of the transverse-mounted engine, and is driven by the timing belt.

The impeller is supported by a completely sealed bearing.

The coolant pump is serviced as an assembly and, therefore, cannot be disassembled.

Thermostat

A wax pellet-type thermostat controls the flow of the engine coolant through the engine cooling system. The thermostat is mounted in the thermostat housing to the front of the cylinder head.

The thermostat stops the flow of the engine coolant from the engine to the radiator to provide faster warm-up, and to regulate the coolant temperature. The thermostat remains closed while the engine coolant is cold, preventing circulation of the engine coolant through the radiator. At this point, the engine coolant is allowed to circulate only throughout the heater core to warm it quickly and evenly.

As the engine warms, the thermostat opens. This allows the engine coolant to flow through the radiator where the heat is dissipated through the radiator. This opening and closing of the thermostat permits enough engine coolant to enter the radiator to keep the engine within proper engine temperature operating limits.

The wax pellet in the thermostat is hermetically sealed in a metal case. The wax element of the thermostat expands when it is heated and contracts when it is cooled.

As the vehicle is driven and the engine warms, the engine coolant temperature increases. When the engine coolant reaches a specified temperature, the wax pellet element in the thermostat expands and exerts pressure against the metal case, forcing the valve open. This allows the engine coolant to flow through the engine cooling system and cool the engine.

As the wax pellet cools, the contraction allows a spring to close the valve.

The thermostat begins to open at 87°C (189°F) and is fully open at 102°C (216°F). The thermostat closes at 86°C (187°F).

Electric Cooling Fan

The cooling fans are mounted behind the radiator in the engine compartment. The electric cooling fans increase the flow of air across the radiator fins and across the condenser on A/C-equipped vehicles. This helps to speed cooling when the vehicle is at idle or moving at low speeds.

The fan size is 366 mm (14.4 in) in diameter with 5 blades to aid the airflow through the radiator and the condenser. A non-A/C model is 300 mm (11.8 in). An electric motor attached to the radiator support drives the fan.

A/C OFF or Non-A/C Model

- The cooling fans are actuated by the engine control module (ECM) using a low-speed cooling fan relay and a high-speed cooling fan relay. On A/C-equipped vehicles, a series/parallel cooling fan relay is also used.
- The ECM will turn the cooling fans ON at low speed when the coolant temperature reaches 93°C (199°F) and high speed at 97°C (207°F).
- The ECM will change the cooling fans from high speed to low speed at 94°C (201°F) and turn the cooling fans OFF at 90°C (194°F).

A/C ON

- The ECM will turn the cooling fans ON at low speed when the A/C system is ON. The ECM will change to high speed when the coolant temperature reaches 97°C (207°F) or high-side A/C pressure reaches 1 882 kPa (273 psi).
- The cooling fans will return to low speed when the coolant temperature reaches 94°C (201°F) or high-side A/C pressure reaches 1 448 kPa (210 psi).

Engine Coolant Temperature (ECT) Sensor

The engine coolant temperature (ECT) sensor uses a thermistor to control the signal voltage to the engine control module (ECM) and controls the instrument panel temperature indicator. The ECT sensor is located on the cylinder head. Refer to the appropriate engine controls section for diagnosis and replacement of the engine coolant temperature (ECT) sensor.

Engine Block Heater

The vehicle is designed to accept an engine block heater. The engine block heater helps to warm the engine for improved cold weather starting. It can also help reduce fuel consumption when a cold engine is warming up.

The engine block heater utilizes an existing expansion plug for installation and is located in the engine block in an existing freeze plug port.

Contact your General Motors dealer for further information or installation.

Engine Electrical

General Specifications

Application	Specification
Battery	
• Manual	550 Cold Cranking Amps
• Automatic	550 Cold Cranking Amps
Alternator	85 A
Starter-Manual (No-Load Test Current Draw)	0.8 kW Maximum 50 A (Drive Pinion Speed at Minimum 5,000 RPM, 11.5 V
Starter-Automatic (No-Load Test Current Draw)	1.2 kW Maximum 90 A (Drive Pinion Speed at Minimum 2,000 RPM, 12 V

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Battery Cable Nuts	4.5 N·m	40 lb in
Battery Carrier Tray Lower Bolts	20 N·m	15 lb ft
Battery Carrier Tray Upper Bolts	20 N·m	15 lb in
Battery Retainer Clamp-to-Battery Rod Nuts	4 N·m	35 lb in
Engine Mount Lower Bracket Bolts (1.2L)	41 N·m	30 lb ft
Front Bearing Plate Screws	8 N·m	71 lb in
Fuel Rail Retaining Bolts	20 N·m	15 lb in
Generator Adjusting Bolt (1.2L)	7 N·m	62 lb ft
Generator Battery Lead Nut	15 N·m	11 lb ft
Generator Brush Holder Screws	12 N·m	106 lb in
Generator Drive and End Bearing Nut	81 N·m	60 lb ft
Generator Drive End Bearing Nut	81 N·m	60 lb ft
Generator Lower Bracket Mounting Bolt (1.2L)	28 N·m	21 lb ft
Generator Lower Bracket-to-Generator Nuts	25 N·m	18 lb ft
Generator Pulley Nut (1.2L)	110 N·m	81 lb ft
Generator Shackle Bracket Bolt	25 N·m	18 lb ft
Generator Through-Bolts	10 N·m	89 lb in
Harness Ground Bolt	41 N·m	30 lb ft
Reaction Rod Bolt and Nut (1.2L)	83 N·m	61 lb ft
Starter Field Coil Connector Nut	8 N·m	71 lb in
Starter Mounting Bolts (1.2L)	23 N·m	17 lb ft
Starter Mounting Bolts (1.4L/1.5L SOHC and 1.4L/1.6L DOHC)	43 N·m	32 lb ft
Starter Solenoid Assembly Screws	8 N·m	71 lb in
Starter Solenoid Nuts	15 N·m	11 lb ft
Starter Through-Bolts	6 N·m	53 lb in

Battery Usage

Application	Description
L4 Engine	
Cold Cranking Amps	550 amps
Load Test	270 amps
RC - Minimum	90 minutes
Replacement	85B-60

Starter Motor Usage

Application	Description
Starter	
• No Load Test @ 12 volts (1.4L/1.5L SOHC and 1.4L/1.6L DOHC)	Maximum 90 amps
• Drive Pinion Speed (1.4L/1.5L SOHC and 1.4L/1.6L DOHC)	Minimum 2,600 RPM
• No Load Test 9 volts (1.2L)	Maximum 150 amps
• Drive Pinion Speed (1.2L)	Minimum 2,000 RPM
Solenoid	
• Hold-in Windings @ 12 volts	12-20 amps
• Pull-in Windings @ 12 volts	60-90 amps

Generator Usage

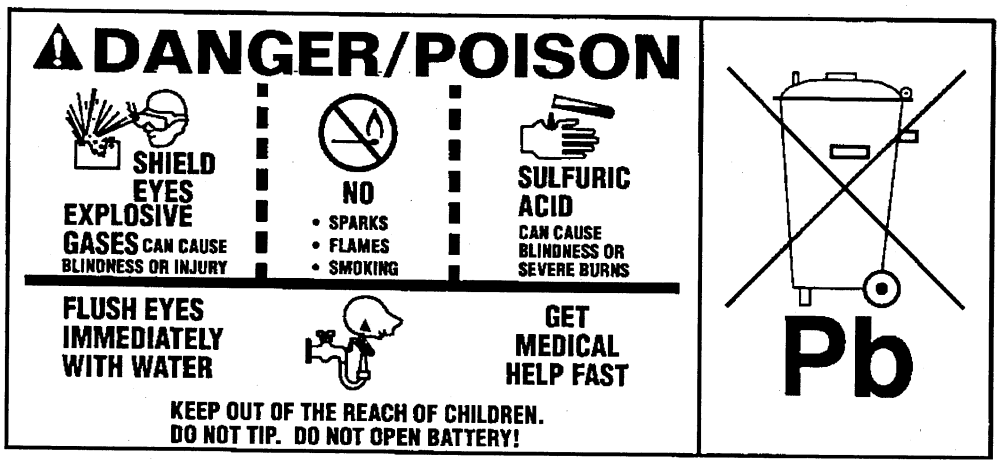
Application	Specification
Generator Model	CS121D

Battery Description and Operation

Caution

Batteries produce explosive gases, contain corrosive acid, and supply levels of electrical current high enough to cause burns. Therefore, to reduce the risk of personal injury when working near a battery:

- **Always shield your eyes and avoid leaning over the battery whenever possible.**
- **Do not expose the battery to open flames or sparks.**
- **Do not allow the battery electrolyte to contact the eyes or the skin. Flush immediately and thoroughly any contacted areas with water and get medical help.**
- **Follow each step of the jump starting procedure in order.**
- **Treat both the booster and the discharged batteries carefully when using the jumper cables.**



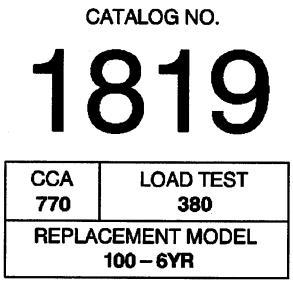
The maintenance free battery is standard. There are no vent plugs in the cover. The battery is completely sealed except for two small vent holes in the side. These vent holes allow the small amount of gas that is produced in the battery to escape.

The battery has three functions as a major source of energy:

- Engine cranking
- Voltage stabilizer
- Alternate source of energy with generator overload.

The battery specification label (example below) contains information about the following:

- The test ratings
- The original equipment catalog number
- The recommended replacement model number



A battery has 2 ratings:

- Reserve capacity
- Cold cranking amperage

When a battery is replaced use a battery with similar ratings. Refer to the battery specification label on the original battery or refer to Battery Usage .

Reserve Capacity

Reserve capacity is the amount of time in minutes it takes a fully charged battery, being discharged at a constant rate of 25 amperes and a constant temperature of 27°C (80°F) to reach a terminal voltage of 10.5 V. Refer to Battery Usage for the reserve capacity rating of the original equipment battery.

Cold Cranking Amperage

The cold cranking amperage is an indication of the ability of the battery to crank the engine at cold temperatures. The cold cranking amperage rating is the minimum amperage the battery must maintain for 30 seconds at -18°C (0°F) while maintaining at least 7.2 volts. Refer to Battery Usage for the cold cranking amperage rating for this vehicle.

Circuit Description

The battery positive terminal supplies Battery Positive voltage to the under hood fuse block and the rear fuse block. The under hood fuse block provides a cable connection for the generator and a cable connection for the starter.

The battery negative terminal is connected to chassis ground G305 and supplies ground for the AD converter in the DIM.

Starting System Description and Operation

Wound field starter motors have pole pieces, arranged around the armature, which are energized by wound field coils.

Enclosed shift lever cranking motors have the shift lever mechanism and the solenoid plunger enclosed in the drive housing, protecting them from exposure to dirt, icy conditions, and splashes.

In the basic circuit, solenoid windings are energized when the switch is closed. The resulting plunger and shift lever movement causes the pinion to engage the engine flywheel ring gear. The solenoid main contacts close. Cranking then takes place.

When the engine starts, pinion overrun protects the armature from excessive speed until the switch is opened, at which time the return spring causes the pinion to disengage. To prevent excessive overrun, the switch should be released immediately after the engine starts.

Starting System

The engine electrical system includes the battery, the ignition, the starter, the generator, and all the related wiring. Diagnostic tables will aid in troubleshooting system faults. When a fault is traced to a particular component, refer to that component section of the service manual.

The starting system circuit consists of the battery, the starter motor, the ignition switch, and all the related electrical wiring. All of these components are connected electrically.

Charging System Description and Operation

The charging system has several models available, including the 0114D (ValeoMando) or the CS-121D (Delphi). The number denotes the outer diameter, in millimeters of the stator lamination.

CS generators are equipped with internal regulators. The Y connection (ValeoMando) or Delta (Delphi) stator, a rectifier bridge, and a rotor with slip rings and brushes are electrically similar to earlier generators. A conventional pulley and fan are used. There is no test hole.

Unlike three-wire generators, the 0114D (ValeoMando) or CS-121D (Delphi) may be used with only two connections; battery positive and an L terminal to the charge indicator lamp. Use of the "P", "I", and "S" terminals is optional. The "P" terminal is connected to the stator and may be connected externally to a tachometer or other device.

As with other charging systems, the charge indicator lamp lights when the ignition switch is turned to ON, and goes out when the engine is running. If the charge indicator is on with the engine running, a charging system defect is indicated. This indicator light will glow at full brilliance for several kinds of defects, as well as when the system voltage is too low.

The regulator voltage setting varies with temperature and limits the system voltage by controlling the rotor field current. The mono regulator having 2-3 pins in the terminal can be applied for generator. The regulator maintains the system voltage by controlling field current on-off without typically fixed frequency.

The generator provides DC voltage to operate the vehicle's electrical systems and to recharge the battery. Built-in regulators control the voltage output of the generator. When the ignition switch is turned to the ON position, battery voltage is applied through the F4 fuse, and the charge indicator to the regulator in the generator. When the generator is not rotating, the regulator provides a good ground and causes the charge indicator to light. Voltage from the F7 fuse also generates a magnetic field around the field coil. As the engine starts and the generator begins to rotate, a voltage is also generated in the stator. The voltage regulator senses this voltage and takes control of the field current. AC voltage is generated in 3 stator coils. This AC voltage is converted to DC voltage in the rectifier bridge. The DC output, after being regulated by the voltage regulator, is applied to the vehicle's battery and electrical supply circuits at the BAT terminal of the generator. A separate output voltage is provided to the charge indicator. Since equal voltage is now being provided to both sides of the charge indicator, the lamp loses its ground and goes out. The voltage regulator is also connected to battery voltage through the generator BAT terminal. When the battery is fully charged, the voltage regulator decreases field excitation. This reduces the output

of the generator to prevent overcharging. When the battery has been discharged or is heavily loaded, the voltage regulator increases the field excitation and voltage output of the generator.

Engine Controls

Fuel System Specifications

Use regular unleaded gasoline rated at 87 octane or higher. It is recommended that the gasoline meet specifications which have been developed by the American Automobile Manufacturers Association (AAMA) and endorsed by the Canadian Motor Vehicle Manufacturers Association for better vehicle performance and engine protection. Gasoline meeting the AAMA specification could provide improved driveability and emission control system performance compared to other gasolines. For more information, write to: American Automobile Manufacturer's Association, 7430 Second Ave, Suite 300, Detroit MI 48202.

Be sure the posted octane is at least 87. If the octane is less than 87, you may get a heavy knocking noise when you drive. If the knocking is bad enough, the knocking can damage your engine.

If you are using fuel rated at 87 octane or higher and you hear heavy knocking, your engine needs service. But do not worry if you hear a little pinging noise when you are accelerating or driving up a hill. That is normal, and you do not have to buy a higher octane fuel to get rid of the pinging. However, if there is a heavy, constant knock, that means you have a problem.

Notice

Your vehicle was not designed for fuel that contains methanol. Do not use methanol fuel which can corrode metal parts in your fuel system and also damage plastic and rubber parts. This kind of damage would not be covered under your warranty.

If your vehicle is certified to meet California Emission Standards, indicated on the under hood emission control label, your vehicle is designed to operate on fuels that meet California specifications. If such fuels are not available in states adopting California emissions standards, your vehicle will operate satisfactorily on fuels meeting federal specifications, but emission control system performance may be affected. The malfunction indicator lamp on your instrument panel may turn ON and/or your vehicle may fail a smog-check test. If this occurs, return to your authorized dealer for diagnosis to determine the cause of failure. In the event there is a determination that the cause of the condition is the type of fuels used, repairs may not be covered by your warranty.

Some gasolines that are not reformulated for low emissions may contain an octane-enhancing additive called methylcyclopentadienyl manganese tricarbonyl (MMT). Ask your service station operator whether or not the fuel contains MMT.

Engine Controls

Ignition System Specifications

Application	Specification	
	Metric	English
Ignition Type	Direct Ignition System	
Ignition Timing (BTDC)	4°	
Ignition Sequence	1-3-4-2	
Spark Plug Gap	1.0-1.1 mm	0.039-0.043 in
Spark Plug Maker	Woojin	
Spark Plug Type	BKR6E-11	

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accessory Mounting Bracket Bolts	37 N·m	27 lb ft
Camshaft Position Sensor Bolts	12 N·m	106 lb in
Crankshaft Position Sensor Retaining Bolt	6.5 N·m	58 lb in
Electronic Ignition System Ignition Coil Retaining Bolts	10 N·m	89 lb in
Engine Control Module Bolts	4 N·m	35 lb in
Engine Coolant Temperature Sensor Bolt	20 N·m	15 lb ft
Evaporative Emission Canister Flange Bolt	20 N·m	15 lb ft
Evaporative Emission Canister Protective Cover	8 N·m	71 lb in
Evaporative Emission Canister Purge Solenoid Bracket Bolt	5 N·m	44 lb in
Evaporative Emission Vent Solenoid Bolt	8.5 N·m	75 lb in
Exhaust Gas Recirculation Valve Retaining Bolts	30 N·m	22 lb ft
Fuel Filter Mounting Bracket Assembly Bolt	4 N·m	35 lb in
Fuel Pressure Regulator Retaining Screw	12 N·m	106 lb in
Fuel Rail Retaining Bolts	25 N·m	18 lb ft
Fuel Tank Retaining Bolts	20 N·m	15 lb ft
Idle Air Control Valve Retaining Bolts	3 N·m	27 lb in
Knock Sensor Bolt	20 N·m	15 lb ft
Manifold Absolute Pressure Sensor Mounting Bracket Bolt	4 N·m	35 lb in
Manifold Absolute Pressure Sensor Retaining Bolts and Nuts	8 N·m	71 lb in
Oxygen Sensor Bolt	42 N·m	31 lb ft
Rear A/C Compressor Mounting Bracket Bolts	35 N·m	26 lb ft
Spark Plug Cover Bolts	3 N·m	27 lb in
Throttle Body Retaining Nuts	15 N·m	11 lb ft
Throttle Position Sensor Retaining Bolts	2 N·m	18 lb in
Variable Geometry Induction System Solenoid	10 N·m	89 lb in

Exhaust System

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Catalytic Converter-to-Exhaust Manifold Nuts	50 N·m	37 lb ft
Connecting Pipe-to-Catalytic Converter Nuts	40 N·m	30 lb ft
Exhaust Manifold Cover Bolts	15 N·m	11 lb ft
Front Muffler-to-Connecting Pipe Nuts	30 N·m	22 lb ft
Front Muffler-to-Rear Muffler Nuts	30 N·m	22 lb ft
Post-Converter Heated Oxygen Sensor	41 N·m	30 lb ft

Exhaust System Description

Important

Use of non-OEM parts may cause driveability concerns.

The exhaust system carries exhaust gases, treated by the catalytic converter, through a resonator, if applicable and into the exhaust muffler where exhaust noise is lessened.

In order to secure the exhaust pipe to the exhaust manifold, a flange and seal-joint coupling is utilized. The exhaust system may utilize a slip-joint coupling design with a clamp and a U-bolt or a flange connection with a gasket.

Exhaust hangers and rubber insulators help to support the weight of the exhaust pipe along with insulating any exhaust system vibration, rattle, or noise.

Exhaust hangers also space the exhaust system away from the underbody of the vehicle and allows the exhaust system to expand as the exhaust system warms up.

Exhaust heat shields are used to protect the body and other components from damage due to the heat from the exhaust system.

The exhaust system may be comprised of the following components:

- Exhaust manifold
- Exhaust pipes
- Catalytic converters
- Exhaust muffler
- Exhaust resonator, if equipped
- Exhaust tail pipe, if equipped
- Exhaust hangers
- Exhaust heat shields

Resonator

Some exhaust systems are equipped with a resonator. The resonator, located either before or after the muffler, allows the use of mufflers with less back pressure. Resonators are used when vehicle characteristics require specific exhaust tuning.

Catalytic Converter

The catalytic converter is an emission control device added to the engine exhaust system in order to reduce hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx) pollutants from the exhaust gas.

The catalytic converter is comprised of a ceramic monolith substrate, supported in insulation and housed within a sheet metal shell. The substrate may be washcoated with 3 noble metals:

- Platium (Pt)
- Palladium (Pd)

- Rhodium (Rh)

The catalyst in the converter is not serviceable.

Muffler

The exhaust muffler reduces the noise levels of the engine exhaust by the use of tuning tubes. The tuning tubes create channels inside the exhaust muffler that lower the sound levels created by the combustion of the engine.

Transmission/Transaxle Description and Operation

Manual Transmission – YM4

Fastener Tightening Specifications

Application	Specification	
	Metric	English
5th/Reverse Gear Shift Shaft Bolt	10-16 N·m	7-12 lb ft
Back Up Light Switch Nut	15-18 N·m	11-13 lb ft
Counter Shaft 5th Gear Nut	60-80 N·m	44-59 lb ft
Crankshaft Position Sensor Bolt	5-8 N·m	44-71 lb in
Differential Ring Gear Bolt	80-100 N·m	59-74 lb ft
Engine Mounting Rear Damping Bolts	50-60 N·m	37-44 lb ft
Front Exhaust Pipe Nut - Exhaust Manifold Side/Muffler Side	25-35 N·m	18-25 lb ft
Gear Shift Lever Bolts	4-7 N·m	35-62 lb in
Ground Wire Bolt	10-16 N·m	7-12 lb ft
High Speed Shift Shaft Bolt - 5th Gear Shift	10-16 N·m	7-12 lb ft
Low Speed Shift Shaft Bolt - 3rd and 4th Gear Shift	10-16 N·m	7-12 lb ft
Oil Drain Plug	25-30 N·m	18-22 lb ft
Oil Level Plug	25-30 N·m	18-22 lb ft
Radiator Lower Hose Bracket Bolts	8-15 N·m	70-132 lb in
Rear Damping Block Connection Nut and Bolt	78-85 N·m	55-63 lb ft
Reverse Idle Gear Shaft Bolt	18-28 N·m	13-21 lb ft
Reverse Shift Lever Bolt	18-28 N·m	13-21 lb ft
Select Cable Nut - Shift Lever Side	8-12 N·m	71-106 lb in
Side Cover - Clutch Plate	8-12 N·m	71-106 lb in
Side Cover Bolt	8-12 N·m	71-106 lb in
Side Cover Plate Screw	6-7 N·m	53-62 lb in
Shift Interlock Bolt	18-28 N·m	13-21 lb ft
Speedometer Driven Gear Bolt	5-8 N·m	44-71 lb in
Transaxle Lower Bolt	55-65 N·m	41-48 lb ft
Transaxle Mounting Bolt - Rear Bracket	45-55 N·m	33-41 lb ft
Transaxle Mounting Bolts - Rear Damping Block	50-60 N·m	37-44 lb ft
Transaxle Upper Bolt - Engine Side	55-65 N·m	41-48 lb ft

Transmission Specifications

General Specifications

Application	Specification	
	Metric	English
General		
• Type - Forward Gear	Synchronized Mesh Type	
• Type - Reverse Gear	Sliding Mesh Type	
• Gear Ratio - 1st	3.417	
• Gear Ratio - 2nd	1.950	
• Gear Ratio - 3rd	1.280	
• Gear Ratio - 4th	0.971	
• Gear Ratio - 5th	0.758	
• Gear Ratio - Reverse	3.273	
• Final Drive Ratio	4.105	
• Fluid Capacity	2.1 L	2.21 qt
• Fluid Classification	75W-85	GL-4
Service		
• Clearance Between Gear and Synchronizer Ring - Limit	0.5 mm	0.020 in
• Clearance Between Gear and Synchronizer Ring - Standard	1.0 mm	0.039 in
• Clearance Between Sleeve and Shift Fork - Limit	1.0 mm	0.039 in
• Clearance Between Sleeve and Shift Fork - Standard	0.2-0.6 mm	0.008-0.024 in
• Key Groove Width of Synchronizer Ring - Limit - 1st Gear	10.0 mm	0.394 in
• Key Groove Width of Synchronizer Ring - Standard - 1st Gear	9.6 mm	0.378 in
• Key Groove Width of Synchronizer Ring - Limit - 2nd, 3rd, 4th Gear	10 mm	0.394 in
• Key Groove Width of Synchronizer Ring - Standard - 2nd, 3rd, 4th Gear	9.6 mm	0.378 in
• Key Groove Width of Synchronizer Ring - Limit - 5th Gear	9.8 mm	0.386 in
• Key Groove Width of Synchronizer Ring - Standard - 5th Gear	9.4 mm	0.370 in
• Shift Fork End Thickness for Low Speed Shift Fork - Limit - 1st-2nd Gear	8.1 mm	0.319 in
• Shift Fork End Thickness for Low Speed Shift Fork - Standard - 1st-2nd Gear	8.7 mm	0.343 in
• Shift Fork End Thickness for Low Speed Shift Fork - Limit - 3rd-4th Gear	7.2 mm	0.283 in
• Shift Fork End Thickness for High Speed Shift Fork - Standard - 3rd-4th Gear	7.8 mm	0.307 in
• Shift Fork End Thickness for Low Speed Shift Fork - Limit - 5th Gear	7.2 mm	0.283 in
• Shift Fork End Thickness for Shift Fork - Standard - 5th Gear	7.8 mm	0.307 in
• Speedometer Gear Ratio - Driven/Drive	17/18	0.944
• Thrust Free Play of Differential Side Gear	0.05-0.33 mm	0.002-0.013 in

Performance - Manual Transmission

Application	Specification	
	Metric	English
Gradeability	0.4 (tan O)	
Maximum Speed	153 km/h	95.1 mph
Minimum Turning Radius	4.8 m	15.7 ft

Manual Transmission

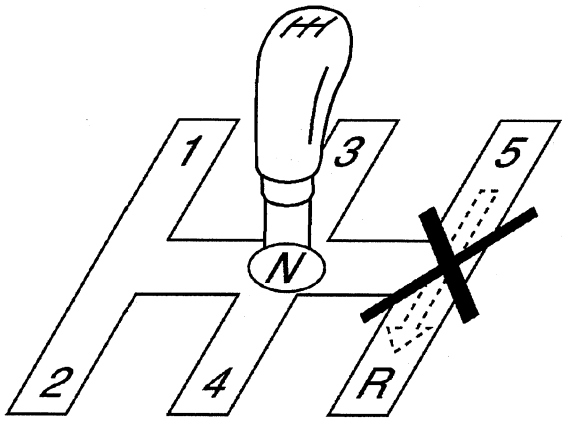
Application	Specification	
	Metric	English
Final Drive Ratio	4.105:1	
Gear Ratio		
• 1st	3.417:1	
• 2nd	1.950:1	
• 3rd	1.280:1	
• 4th	0.971:1	
• 5th	0.758:1	
• Reverse	3.273:1	
Maker	DWMC	
Oil Capacity	2.1 L	2.22 qt
Type or Model	Y4M	

Transmission General Description

This 5-speed transaxle assembly adopts the synchronized mesh type of 5 forward speed. The reverse speed gear is driven by sliding idle gear without synchronizer.

Reverse Gear Mis-Shift Preventing Mechanism

It prevents the gear from directly being shifted from 5th to reverse when shifting to reverse from 5th. Shift to the reverse in neutral position to prevent the shift cam from being interfered to the shift guide bolt.



In case of shifting to 5th gear, shift and select shaft rotates to right that shift cam aparts from guide bolt and moves upwards by returning spring. Therefore, shifting to reverse in this condition is impossible because of interference of guide bolt.

When shifting to reverse from neutral position between 5th and reverse, shift cam rotates to left and shifting is possible.

Differential is integrated with transmission case and installed on chassis together with engine. It changes the direction of power and increase torque by reducing speed.

Reduction gear is installed parallel to counter shaft and is helical gear type. Differential gear is bevel gear type and is integrated with reduction gear.

Clutch

General Specifications

Application	Specification	
	Metric	English
Fluid (Hydraulic Clutch)	Common Use, Brake Fluid	
Inside Diameter (1.4L/1.5L SOHC/1.4L/1.6L DOHC Hydraulic Clutch)	145 mm	5.7 in
Inside Diameter (1.2L Cable Clutch)	127 mm	5.0 in
Outside Diameter	215 mm	8.5 in
Outside Diameter (1.2L Cable Clutch)	184 mm	7.2 in
Thickness	8.4 mm	0.331 in
Type	Single Dry Plate	

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Clutch Control Cable Mounting Nuts	13 N·m	115 lb in
Clutch Master Cylinder Nuts	22 N·m	16 lb ft
Clutch Pedal Shaft Nut	20 N·m	15 lb ft
Pressure Plate-to-Flywheel Bolts (Cable)	18 N·m	13 lb ft
Pressure Plate-to-Flywheel Bolts (Hydraulic)	15 N·m	11 lb ft
Release Arm Bolt and Nut	16 N·m	12 lb ft
Release Cylinder Bolts	20 N·m	15 lb ft

Hydraulic Clutch Description

Clutch Driving Members

The driving members consist of 2 flat surfaces machined to a smooth finish. One of these is the rear face of the engine flywheel and the other is the pressure plate. The pressure plate is fitted into a steel cover which is bolted to the flywheel.

Clutch Driven Members

The driven member is the clutch disc with a splined hub. The splined hub is free to slide lengthwise along the splines of the input shaft and drives the input shaft through these same splines.

The driving and driven members are held in contact by spring pressure. This pressure is exerted by a diaphragm spring in the pressure plate assembly.

Hydraulic Clutch Operating Members

The clutch release system consists of the clutch pedal, the clutch shaft, the fork, and the release bearing. When pressure is applied to the clutch pedal, the fork pivots on its shaft and the inner end pushes against the release bearing. The bearing then pushes against the release levers in the pressure plate assembly, thereby releasing the clutch.

Automatic Transaxle – Aisen (81-40LE)

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Check Valve Spring Bolts	6.5 N·m	57 lb in
Control Cable Adjusting Nut	8 N·m	71 lb in
Damping Block Connection Nut and Bolt	80 N·m	59 lb ft
Differential Case-to-Differential Ring Gear Bolt	102 N·m	75 lb ft
Drain Plug	17 N·m	13 lb ft
Fluid Cooler Inlet Pipe Bolt	9 N·m	80 lb in
Fluid Cooler Inlet Pipe Fitting Nut	35 N·m	26 lb ft
Fluid Cooler Rear Outlet Pipe Clip Bolt	9 N·m	80 lb in
Fluid Cooler Rear Outlet Pipe Fitting Nut	35 N·m	26 lb ft
Front Outlet Pipe Clip Bolt	9 N·m	80 lb in
Front Outlet Pipe Union Bolt	35 N·m	26 lb ft
Input Speed Sensor Retaining Bolt	5.4 N·m	48 lb in
Manual Detent Spring Bolt	9.8 N·m	87 lb in
Manual Valve Lever Shaft Nut	12 N·m	106 lb in
Lower Transaxle-to-Engine Retaining Bolts	73 N·m	54 lb ft
Lower Transaxle-to-Engine Retaining Bolts	31 N·m	23 lb ft
Lower Transaxle-to-Engine Retaining Bolts	21 N·m	15 lb ft
Oil Pan Bolts	7 N·m	62 lb in
Oil Pump Bolts	25 N·m	18 lb ft
Oil Reservoir Lock Plate Bolts	5.4 N·m	48 lb in
Oil Strainer Bolts	9.8 N·m	87 lb in
Output Speed Sensor Retaining Bolt	7.4 N·m	65 lb in
Park/Neutral Position Switch Bolts	5.4 N·m	48 lb in
Parking Lock Pawl Bracket Bolts	7.4 N·m	65 lb in
Planetary Ring Gear Nut--Maximum	29 N·m	22 lb ft
Planetary Ring Gear Nut--Standard	9.8 N·m	87 lb in
Rear Mounting Bracket Bolts	60 N·m	44 lb ft
Screw Plugs	7.4 N·m	65 lb in
Shift Control Lever Assembly Mounting Bolts	8 N·m	71 lb in
Shift Solenoid Valve Bolts	11 N·m	97 lb in
Stator Shaft Bolts	25 N·m	18 lb ft
TCM Retaining Bolts	5 N·m	44 lb in
Torque Converter Bolts	45 N·m	43 lb ft
Transaxle Apply Clamp Bolt	5.4 N·m	48 lb in
Transaxle Case Plate Bolt	9.8 N·m	87 lb in
Transaxle Housing Bolts	29 N·m	22 lb ft
Transaxle Rear Cover Bolts	25 N·m	18 lb ft
Unions	25 N·m	18 lb ft
Upper Transaxle Mounting Bracket Bolts	60 N·m	44 lb ft
Upper Transaxle-to-Engine Mounting Bolts	73 N·m	54 lb ft
Valve Body Bolts	11 N·m	97 lb in

Transmission General Specifications

Application	Specification	
	Metric	English
Maker	AISIN	
Type or Model	81-40LE	
Gear Ratio - 1st	2.875:1	
Gear Ratio - 2nd	1.568:1	
Gear Ratio - 3rd	1.000:1	
Gear Ratio - 4th	0.697:1	
Reverse	2.300:1	
Final Drive Ratio	3.750:1	
Oil Capacity	5.6L	5.9 qt
Transmission Fluid Type	T-IV Automatic Transmission Fluid (GM Part No. U.S. 88900925, in Canada 22689186)	

Transmission General Description

The new automatic transmission AISIN (81-40LE) is an electronically controlled 4-speed automatic transmission with lock-up mechanism.

The transmission is mainly composed of the torque converter with lock up clutch, newly developed 4-speed planetary gear unit, the hydraulic control system and the electric control system.

Hydraulic Control System

Based on the hydraulic pressure created by the oil pump, the TCM sends signals to the solenoid and the hydraulic control system governs the hydraulic pressure acting on the torque converter, planetary gear, clutches, and brakes in accordance with the vehicle driving conditions.

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Abbreviations and Meanings

Abbreviation	Meaning
A	
A	Ampere(s)
ABS	Antilock Brake System
A/C	Air Conditioning
AC	Alternating Current
ACC	Accessory, Automatic Climate Control
ACL	Air Cleaner
ACR4	Air Conditioning Refrigerant, Recovery, Recycling, Recharging
AD	Automatic Disconnect
A/D	Analog to Digital
ADL	Automatic Door Lock
A/F	Air/Fuel Ratio
AH	Active Handling
AIR	Secondary Air Injection
ALC	Automatic Level Control, Automatic Lamp Control
AM/FM	Amplitude Modulation/Frequency Modulation
Ant	Antenna
AP	Accelerator Pedal
APCM	Accessory Power Control Module
API	American Petroleum Institute
APP	Accelerator Pedal Position
APT	Adjustable Part Throttle
ASM	Assembly, Accelerator and Servo Control Module
ASR	Acceleration Slip Regulation
A/T	Automatic Transmission/Transaxle
ATC	Automatic Transfer Case, Automatic Temperature Control
ATDC	After Top Dead Center
ATSLC	Automatic Transmission Shift Lock Control
Auto	Automatic
avg	Average
A4WD	Automatic Four-Wheel Drive
AWG	American Wire Gage
B	
B+	Battery Positive Voltage
BARO	Barometric Pressure
BATT	Battery
BBV	Brake Booster Vacuum
BCA	Bias Control Assembly
BCM	Body Control Module
BHP	Brake Horsepower
BLK	Black
BLU	Blue
BP	Back Pressure
BPCM	Battery Pack Control Module
BPMV	Brake Pressure Modulator Valve
BPP	Brake Pedal Position
BRN	Brown

BTDC	Before Top Dead Center
BTM	Battery Thermal Module
BTSI	Brake Transmission Shift Interlock
Btu	British Thermal Units
	C
°C	Degrees Celsius
CAC	Charge Air Cooler
CAFE	Corporate Average Fuel Economy
Cal	Calibration
Cam	Camshaft
CARB	California Air Resources Board
CC	Coast Clutch
cm^3	Cubic Centimeters
CCM	Convenience Charge Module, Chassis Control Module
CCOT	Cycling Clutch Orifice Tube
CCP	Climate Control Panel
CD	Compact Disc
CE	Commutator End
CEAB	Cold Engine Air Bleed
CEMF	Counter Electromotive Force
CEX	Cabin Exchanger
cfm	Cubic Feet per Minute
cg	Center of Gravity
CID	Cubic Inch Displacement
CKP	Crankshaft Position
CKT	Circuit
C/Ltr	Cigar Lighter
CL	Closed Loop
CLS	Coolant Level Switch
CMC	Compressor Motor Controller
CMP	Camshaft Position
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO2	Carbon Dioxide
Coax	Coaxial
COMM	Communication
Conn	Connector
CPA	Connector Position Assurance
CPP	Clutch Pedal Position
CPS	Central Power Supply
CPU	Central Processing Unit
CRT	Cathode Ray Tube
CRTC	Cathode Ray Tube Controller
CS	Charging System
CSFI	Central Sequential Fuel Injection
CTP	Closed Throttle Position
cu ft	Cubic Foot/Feet
cu in	Cubic Inch/Inches
CV	Constant Velocity Joint
CVRSS	Continuously Variable Road Sensing Suspension

Cyl	Cylinder(s)
D	
DAB	Delayed Accessory Bus
dB	Decibels
dBA	Decibels on A-weighted Scale
DC	Direct Current, Duty Cycle
DCM	Door Control Module
DE	Drive End
DEC	Digital Electronic Controller
DERM	Diagnostic Energy Reserve Module
DI	Distributor Ignition
dia	Diameter
DIC	Driver Information Center
Diff	Differential
DIM	Dash Integration Module
DK	Dark
DLC	Data Link Connector
DMCM	Drive Motor Control Module
DMM	Digital Multimeter
DMSDS	Drive Motor Speed and Direction Sensor
DMU	Drive Motor Unit
DOHC	Dual Overhead Camshafts
DR, Drvr	Driver
DRL	Daytime Running Lamps
DTC	Diagnostic Trouble Code
E	
EBCM	Electronic Brake Control Module
EBTCM	Electronic Brake and Traction Control Module
EC	Electrical Center, Engine Control
ECC	Electronic Climate Control
ECI	Extended Compressor at Idle
ECL	Engine Coolant Level
ECM	Engine Control Module, Electronic Control Module
ECS	Emission Control System
ECT	Engine Coolant Temperature
EEPROM	Electrically Erasable Programmable Read Only Memory
EEVIR	Evaporator Equalized Values in Receiver
EFE	Early Fuel Evaporation
EGR	Exhaust Gas Recirculation
EGR TVV	Exhaust Gas Recirculation Thermal Vacuum Valve
EHPS	Electro-Hydraulic Power Steering
EI	Electronic Ignition
ELAP	Elapsed
ELC	Electronic Level Control
E/M	English/Metric
EMF	Electromotive Force
EMI	Electromagnetic Interference
Eng	Engine
EOP	Engine Oil Pressure
EOT	Engine Oil Temperature

EPA	Environmental Protection Agency
EPR	Exhaust Pressure Regulator
EPROM	Erasable Programmable Read Only Memory
ESB	Expansion Spring Brake
ESC	Electronic Suspension Control
ESD	Electrostatic Discharge
ESN	Electronic Serial Number
ETC	Electronic Throttle Control, Electronic Temperature Control, Electronic Timing Control
ETCC	Electronic Touch Climate Control
ETR	Electronically Tuned Receiver
ETS	Enhanced Traction System
EVAP	Evaporative Emission
EVO	Electronic Variable Orifice
Exh	Exhaust
F	
°F	Degrees Fahrenheit
FC	Fan Control
FDC	Fuel Data Center
FED	Federal All United States except California
FEDS	Fuel Enable Data Stream
FEX	Front Exchanger
FF	Flexible Fuel
FFH	Fuel-Fired Heater
FI	Fuel Injection
FMVSS	Federal U.S. Motor Vehicle Safety Standards
FP	Fuel Pump
ft	Foot/Feet
FT	Fuel Trim
F4WD	Full Time Four-Wheel Drive
4WAL	Four-Wheel Antilock
4WD	Four-Wheel Drive
FW	Flat Wire
FWD	Front Wheel Drive, Forward
G	
g	Grams, Gravitational Acceleration
GA	Gage, Gauge
gal	Gallon
gas	Gasoline
GCW	Gross Combination Weight
Gen	Generator
GL	Gear Lubricant
GM	General Motors
GM SPO	General Motors Service Parts Operations
gnd	Ground
gpm	Gallons per Minute
GRN	Green
GRY	Gray
GVWR	Gross Vehicle Weight Rating

H	
H	Hydrogen
H2O	Water
Harn	Harness
HC	Hydrocarbons
H/CMPR	High Compression
HD	Heavy Duty
HDC	Heavy Duty Cooling
hex	Hexagon, Hexadecimal
Hg	Mercury
Hi Alt	High Altitude
HO2S	Heated Oxygen Sensor
hp	Horsepower
HPL	High Pressure Liquid
HPS	High Performance System
HPV	High Pressure Vapor
HPVS	Heat Pump Ventilation System
Htd	Heated
HTR	Heater
HUD	Head-up Display
HVAC	Heater-Ventilation-Air Conditioning
HVACM	Heater-Vent-Air Conditioning Module
HVIL	High Voltage Interlock Loop
HVM	Heater Vent Module
Hz	Hertz
I	
IAC	Idle Air Control
IAT	Intake Air Temperature
IC	Integrated Circuit, Ignition Control
ICCS	Integrated Chassis Control System
ICM	Ignition Control Module
ID	Identification, Inside Diameter
IDI	Integrated Direct Ignition
IGBT	Insulated Gate Bi-Polar Transistor
ign	Ignition
ILC	Idle Load Compensator
in	Inch/Inches
INJ	Injection
inst	Instantaneous, Instant
IP	Instrument Panel
IPC	Instrument Panel Cluster
IPM	Instrument Panel Module
I/PEC	Instrument Panel Electrical Center
ISC	Idle Speed Control
ISO	International Standards Organization
ISS	Input Speed Shaft, Input Shaft Speed
K	
KAM	Keep Alive Memory
KDD	Keyboard Display Driver
kg	Kilogram

kHz	Kilohertz
km	Kilometer
km/h	Kilometers per Hour
km/l	Kilometers per Liter
kPa	Kilopascals
KS	Knock Sensor
kV	Kilovolts
L	
L	Liter
L4	Four Cylinder Engine, In-Line
L6	Six-Cylinder Engine, In-Line
lb	Pound
lb ft	Pound Feet Torque
lb in	Pound Inch Torque
LCD	Liquid Crystal Display
LDCL	Left Door Closed Locking
LDCM	Left Door Control Module
LDM	Lamp Driver Module
LED	Light Emitting Diode
LEV	Low Emissions Vehicle
LF	Left Front
lm	Lumens
LR	Left Rear
LT	Left
LT	Light
LT	Long Term
LTPI	Low Tire Pressure Indicator
LTPWS	Low Tire Pressure Warning System
M	
MAF	Mass Air Flow
Man	Manual
MAP	Manifold Absolute Pressure
MAT	Manifold Absolute Temperature
max	Maximum
M/C	Mixture Control
MDP	Manifold Differential Pressure
MFI	Multiport Fuel Injection
mi	Miles
MIL	Malfunction Indicator Lamp
min	Minimum
MIN	Mobile Identification Number
mL	Milliliter
mm	Millimeter
mpg	Miles per Gallon
mph	Miles per Hour
ms	Millisecond
MST	Manifold Surface Temperature
MSVA	Magnetic Steering Variable Assist, Magnasteer®
M/T	Manual Transmission/Transaxle
MV	Megavolt

mV	Millivolt
N	
NAES	North American Export Sales
NC	Normally Closed
NEG	Negative
Neu	Neutral
NI	Neutral Idle
NiMH	Nickel Metal Hydride
NLGI	National Lubricating Grease Institute
N·m	Newton-meter Torque
NO	Normally Open
NOx	Oxides of Nitrogen
NPTC	National Pipe Thread Coarse
NPTF	National Pipe Thread Fine
NOVRAM	Non-Volatile Random Access Memory
O	
O2	Oxygen
O2S	Oxygen Sensor
OBD	On-Board Diagnostics
OBD II	On-Board Diagnostics Second Generation
OC	Oxidation Converter Catalytic
OCS	Opportunity Charge Station
OD	Outside Diameter
ODM	Output Drive Module
ODO	Odometer
OE	Original Equipment
OEM	Original Equipment Manufacturer
OHC	Overhead Camshaft
ohms	Ohm
OL	Open Loop, Out of Limits
ORC	Oxidation Reduction Converter Catalytic
ORN	Orange
ORVR	On-Board Refueling Vapor Recovery
OSS	Output Shaft Speed
oz	Ounce(s)
P	
PAG	Polyalkylene Glycol
PAIR	Pulsed Secondary Air Injection
PASS, PSGR	Passenger
PASS-Key®	Personalized Automotive Security System
P/B	Power Brakes
PC	Pressure Control
PCB	Printed Circuit Board
PCM	Powertrain Control Module
PCS	Pressure Control Solenoid
PCV	Positive Crankcase Ventilation
PEB	Power Electronics Bay
PID	Parameter Identification
PIM	Power Inverter Module
PM	Permanent Magnet Generator

P/N	Part Number
PNK	Pink
PNP	Park/Neutral Position
PRNDL	Park, Reverse, Neutral, Drive, Low
POA	Pilot Operated Absolute Valve
POS	Positive, Position
POT	Potentiometer Variable Resistor
PPL	Purple
ppm	Parts per Million
PROM	Programmable Read Only Memory
P/S, PS	Power Steering
PSCM	Power Steering Control Module, Passenger Seat Control Module
PSD	Power Sliding Door
PSP	Power Steering Pressure
psi	Pounds per Square Inch
psia	Pounds per Square Inch Absolute
psig	Pounds per Square Inch Gauge
pt	Pint
PTC	Positive Temperature Coefficient
PWM	Pulse Width Modulated
Q	
QDM	Quad Driver Module
qt	Quart(s)
R	
R-12	Refrigerant-12
R-134a	Refrigerant-134a
RAM	Random Access Memory, Non-permanent memory device, memory contents are lost when power is removed.
RAP	Retained Accessory Power
RAV	Remote Activation Verification
RCDLR	Remote Control Door Lock Receiver
RDCM	Right Door Control Module
Ref	Reference
Rev	Reverse
REX	Rear Exchanger
RIM	Rear Integration Module
RF	Right Front, Radio Frequency
RFA	Remote Function Actuation
RFI	Radio Frequency Interference
RH	Right Hand
RKE	Remote Keyless Entry
Rly	Relay
ROM	Read Only Memory, Permanent memory device, memory contents are retained when power is removed.
RPM	Revolutions per Minute Engine Speed
RPO	Regular Production Option
RR	Right Rear
RSS	Road Sensing Suspension
RTD	Real Time Damping
RT	Right

RTV	Room Temperature Vulcanizing Sealer
RWAL	Rear Wheel Antilock
RWD	Rear Wheel Drive
	S
s	Second(s)
SAE	Society of Automotive Engineers
SC	Supercharger
SCB	Supercharger Bypass
SCM	Seat Control Module
SDM	Sensing and Diagnostic Module
SEO	Special Equipment Option
SFI	Sequential Multiport Fuel Injection
SI	System International Modern Version of Metric System
SIAB	Side Impact Air Bag
SIR	Supplemental Inflatable Restraint
SLA	Short/Long Arm Suspension
sol	Solenoid
SO2	Sulfur Dioxide
SP	Splice Pack
S/P	Series/Parallel
SPO	Service Parts Operations
SPS	Service Programming System, Speed Signal
sq ft, ft^2	Square Foot/Feet
sq in, in^2	Square Inch/Inches
SRC	Service Ride Control
SRI	Service Reminder Indicator
SRS	Supplemental Restraint System
SS	Shift Solenoid
ST	Scan Tool
STID	Station Identification Station ID
S4WD	Selectable Four-Wheel Drive
Sw	Switch
SWPS	Steering Wheel Position Sensor
syn	Synchronizer
	T
TAC	Throttle Actuator Control
Tach	Tachometer
TAP	Transmission Adaptive Pressure, Throttle Adaptive Pressure
TBI	Throttle Body Fuel Injection
TC	Turbocharger, Transmission Control
TCC	Torque Converter Clutch
TCS	Traction Control System
TDC	Top Dead Center
TEMP	Temperature
Term	Terminal
TFP	Transmission Fluid Pressure
TFT	Transmission Fluid Temperature
THM	Turbo Hydro-Matic
TIM	Tire Inflation Monitoring, Tire Inflation Module
TOC	Transmission Oil Cooler

TP	Throttle Position
TPA	Terminal Positive Assurance
TPM	Tire Pressure Monitoring, Tire Pressure Monitor
TR	Transmission Range
TRANS	Transmission/Transaxle
TT	Tell Tail Warning Lamp
TV	Throttle Valve
TVRS	Television and Radio Suppression
TVV	Thermal Vacuum Valve
TWC	Three Way Converter Catalytic
TWC+OC	Three Way + Oxidation Converter Catalytic
TXV	Thermal Expansion Valve
U	
UART	Universal Asynchronous Receiver Transmitter
U/H	Underhood
U/HEC	Underhood Electrical Center
U-joint	Universal Joint
UTD	Universal Theft Deterrent
UV	Ultraviolet
V	
V	Volt(s), Voltage
V6	Six-Cylinder Engine, V-Type
V8	Eight-Cylinder Engine, V-Type
Vac	Vacuum
VAC	Vehicle Access Code
VATS	Vehicle Anti-Theft System
VCIM	Vehicle Communication Interface Mode
VCM	Vehicle Control Module
V dif	Voltage Difference
VDOT	Variable Displacement Orifice Tube
VDV	Vacuum Delay Valve
vel	Velocity
VES	Variable Effort Steering
VF	Vacuum Fluorescent
VIO	Violet
VIN	Vehicle Identification Number
VLR	Voltage Loop Reserve
VMV	Vacuum Modulator Valve
VR	Voltage Regulator
V ref	Voltage Reference
VSES	Vehicle Stability Enhancement System
VSS	Vehicle Speed Sensor
W	
w/	With
W/B	Wheel Base
WHL	Wheel
WHT	White
w/o	Without
WOT	Wide Open Throttle
W/P	Water Pump

W/S	Windshield
WSS	Wheel Speed Sensor
WU-OC	Warm Up Oxidation Converter Catalytic
WU-TWC	Warm Up Three-Way Converter Catalytic
X	
X-valve	Expansion Valve
Y	
yd	Yard(s)
YEL	Yellow

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Conversion - English/Metric

English	Multiply/ Divide by	Metric
In order to calculate English measurement, divide by the number in the center column. In order to calculate metric measurement, multiply by the number in the center column.		
Length		
in	25.4	mm
ft	0.3048	m
yd	0.9144	
mi	1.609	km
Area		
sq in	645.2	sq mm
	6.45	sq cm
sq ft	0.0929	sq m
sq yd	0.8361	
Volume		
cu in	16,387.00	cu mm
	16.387	cu cm
	0.0164	L
qt	0.9464	
gal	3.7854	
cu yd	0.764	cu m
Mass		
lb	0.4536	kg
ton	907.18	
	0.907	tonne (t)
Force		
Kg F	9.807	newtons (N)
oz F	0.278	
lb F	4.448	
Acceleration		
ft/s²	0.3048	m/s²
In/s²	0.0254	
Torque		
Lb in	0.11298	N·m
lb ft	1.3558	
Power		
hp	0.745	kW
Pressure (Stress)		
inches of H2O	0.2488	kPa
lb/sq in	6.895	
Energy (Work)		
Btu	1055	J (J= one Ws)
lb ft	1.3558	
kW hour	3,600,000.00	
Light		
Foot Candle	10.764	lm/m²

Velocity		
mph	1.6093	km/h
Temperature		
(°F - 32) 5/9	=	°C
°F	=	(9/5 °C + 32)
Fuel Performance		
235.215/mpg	=	100 km/L

Equivalents - Decimal and Metric

Fraction (in)	Decimal (in)	Metric (mm)
1/64	0.015625	0.39688
1/32	0.03125	0.79375
3/64	0.046875	1.19062
1/16	0.0625	1.5875
5/64	0.078125	1.98437
3/32	0.09375	2.38125
7/64	0.109375	2.77812
1/8	0.125	3.175
9/64	0.140625	3.57187
5/32	0.15625	3.96875
11/64	0.171875	4.36562
3/16	0.1875	4.7625
13/64	0.203125	5.15937
7/32	0.21875	5.55625
15/64	0.234375	5.95312
1/4	0.25	6.35
17/64	0.265625	6.74687
9/32	0.28125	7.14375
19/64	0.296875	7.54062
5/16	0.3125	7.9375
21/64	0.328125	8.33437
11/32	0.34375	8.73125
23/64	0.359375	9.12812
3/8	0.375	9.525
25/64	0.390625	9.92187
13/32	0.40625	10.31875
27/64	0.421875	10.71562
7/16	0.4375	11.1125
29/64	0.453125	11.50937
15/32	0.46875	11.90625
31/64	0.484375	12.30312
1/2	0.5	12.7
33/64	0.515625	13.09687
17/32	0.53125	13.49375
35/64	0.546875	13.89062
9/16	0.5625	14.2875
37/64	0.578125	14.68437
19/32	0.59375	15.08125
39/64	0.609375	15.47812
5/8	0.625	15.875
41/64	0.640625	16.27187

Fraction (in)	Decimal (in)	Metric (mm)
21/32	0.65625	16.66875
43/64	0.671875	17.06562
11/16	0.6875	17.4625
45/64	0.703125	17.85937
23/32	0.71875	18.25625
47/64	0.734375	18.65312
3/4	0.75	19.05
49/64	0.765625	19.44687
25/32	0.78125	19.84375
51/64	0.796875	20.24062
13/16	0.8125	20.6375
53/64	0.828125	21.03437
27/32	0.84375	21.43125
55/64	0.859375	21.82812
7/8	0.875	22.225
57/64	0.890625	22.62187
29/32	0.90625	23.01875
59/64	0.921875	23.41562
15/16	0.9375	23.8125
61/64	0.953125	24.20937
31/32	0.96875	24.60625
63/64	0.984375	25.00312
1	1.0	25.4

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Fasteners

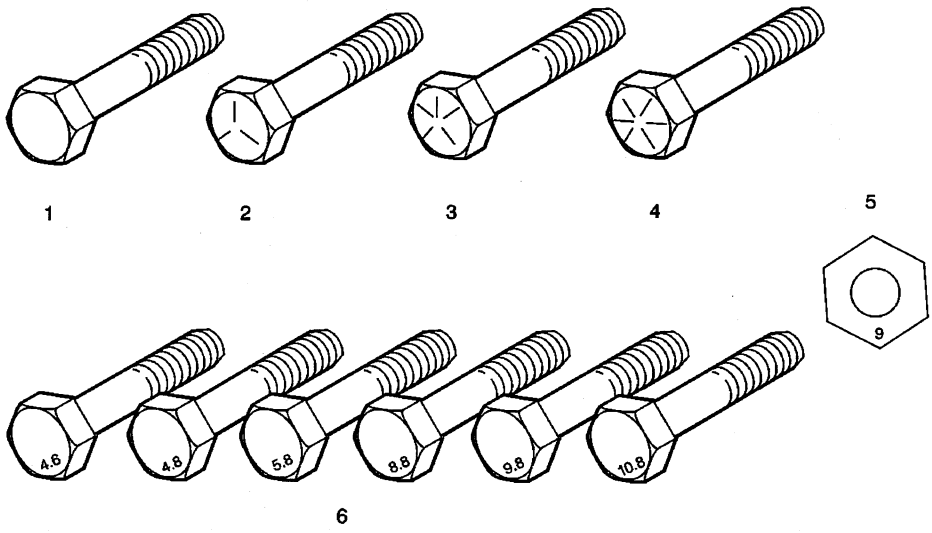
Metric Fasteners

This vehicle provides fastener dimensions using the metric system. Most metric fasteners are approximate in diameter to equivalent English fasteners. Make replacements using fasteners of the same nominal diameter, thread pitch, and strength.

A number marking identifies the OE metric fasteners except cross-recess head screws. The number also indicates the strength of the fastener material. A Posidrive® or Type 1A cross-recess identifies a metric cross-recess screw. For best results, use a Type 1A cross-recess screwdriver, or equivalent, in Posidrive® recess head screws.

GM Engineering Standards and North American Industries have adopted a portion of the ISO-defined standard metric fastener sizes. The purpose was to reduce the number of fastener sizes used while retaining the best thread qualities in each thread size. For example, the metric M6.0 X 1 screw, with nearly the same diameter and 25.4 threads per inch replaced the English 1/4-20 and 1/4-28 screws. The thread pitch is midway between the English coarse and fine thread pitches.

Fastener Strength Identification



1. English Bolt, Grade 2 (Strength Class)
2. English Bolt, Grade 5 (Strength Class)
3. English Bolt, Grade 7 (Strength Class)
4. English Bolt, Grade 8 (Strength Class)
5. Metric Nut, Strength Class 9
6. Metric Bolts, Strength Class Increases as Numbers Increase

The most commonly used metric fastener strength property classes are 9.8 and 10.9. The class identification is embossed on the head of each bolt. The English, inch strength classes range from grade 2 to grade 8. Radial lines are embossed on the head of each bolt in order to identify the strength class. The number of lines on the head of the bolt is 2 lines less than the actual grade. For example, a grade 8 bolt will have 6 radial lines on the bolt head. Some metric nuts are marked with a single digit strength identification number on the nut face.

The correct fasteners are available through GM SPO. Many metric fasteners available in the aftermarket parts channels are designed to metric standards of countries other than the United States, and may exhibit the following:

- Lower strength
- No numbered head marking system
- Wrong thread pitch

The metric fasteners on GM products are designed to new, international standards. The following are the common sizes and pitches, except for special applications:

- M6.0 X 1
- M8 X 1.25
- M10 X 1.5
- M12 X 1.75
- M14 X 2.00
- M16 X 2.00

Prevailing Torque Fasteners

Prevailing torque fasteners create a thread interface between the fastener and the fastener counterpart in order to prevent the fastener from loosening.

All Metal Prevailing Torque Fasteners

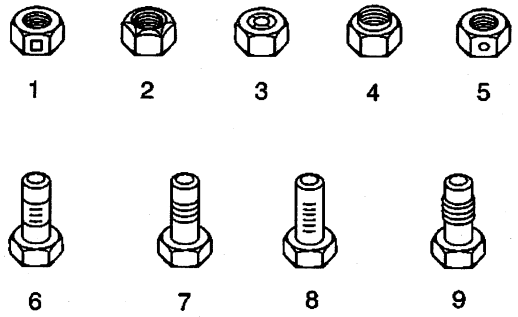
These fasteners accomplish the thread interface by a designed distortion or deformation in the fastener.

Nylon Interface Prevailing Torque Fasteners

These fasteners accomplish the thread interface by the presence of a nylon material on the fastener threads.

Adhesive Coated Fasteners

These fasteners accomplish the thread interface by the presence of a thread-locking compound on the fastener threads. Refer to the appropriate repair procedure in order to determine if the fastener may be reused and the applicable thread-locking compound to apply to the fastener.



1. Prevailing Torque Nut, Center Lock Type
2. Prevailing Torque Nut, Top Lock Type
3. Prevailing Torque Nut, Nylon Patch Type
4. Prevailing Torque Nut, Nylon Washer Insert Type
5. Prevailing Torque Nut, Nylon Insert Type

6. Prevailing Torque Bolt, Dry Adhesive Coating Type
7. Prevailing Torque Bolt, Thread Profile Deformed Type
8. Prevailing Torque Bolt, Nylon Strip Type
9. Prevailing Torque Bolt, Out-of-Round Thread Area Type

A prevailing torque fastener may be reused ONLY if:

- The fastener and the fastener counterpart are clean and not damaged
- There is no rust on the fastener
- The fastener develops the specified minimum torque against its counterpart prior to the fastener seating

Metric Prevailing Torque Fastener Minimum Torque Development

Application	Specification	
	Metric	English
All Metal Prevailing Torque Fasteners		
6 mm	0.4 N·m	4 lb in
8 mm	0.8 N·m	7 lb in
10 mm	1.4 N·m	12 lb in
12 mm	2.1 N·m	19 lb in
14 mm	3 N·m	27 lb in
16 mm	4.2 N·m	37 lb in
20 mm	7 N·m	62 lb in
24 mm	10.5 N·m	93 lb in
Nylon Interface Prevailing Torque Fasteners		
6 mm	0.3 N·m	3 lb in
8 mm	0.6 N·m	5 lb in
10 mm	1.1 N·m	10 lb in
12 mm	1.5 N·m	13 lb in
14 mm	2.3 N·m	20 lb in
16 mm	3.4 N·m	30 lb in
20 mm	5.5 N·m	49 lb in
24 mm	8.5 N·m	75 lb in

English Prevailing Torque Fastener Minimum Torque Development

Application	Specification	
	Metric	English
All Metal Prevailing Torque Fasteners		
1/4 in	0.5 N·m	4.5 lb in
5/16 in	0.8 N·m	7.5 lb in
3/8 in	1.3 N·m	11.5 lb in
7/16 in	1.8 N·m	16 lb in
1/2 in	2.3 N·m	20 lb in
9/16 in	3.2 N·m	28 lb in
5/8 in	4 N·m	36 lb in
3/4 in	7 N·m	54 lb in
Nylon Interface Prevailing Torque Fasteners		
1/4 in	0.3 N·m	3 lb in
5/16 in	0.6 N·m	5 lb in
3/8 in	1 N·m	9 lb in
7/16 in	1.3 N·m	12 lb in
1/2 in	1.8 N·m	16 lb in
9/16 in	2.5 N·m	22 lb in
5/8 in	3.4 N·m	30 lb in
3/4 in	5 N·m	45 lb in