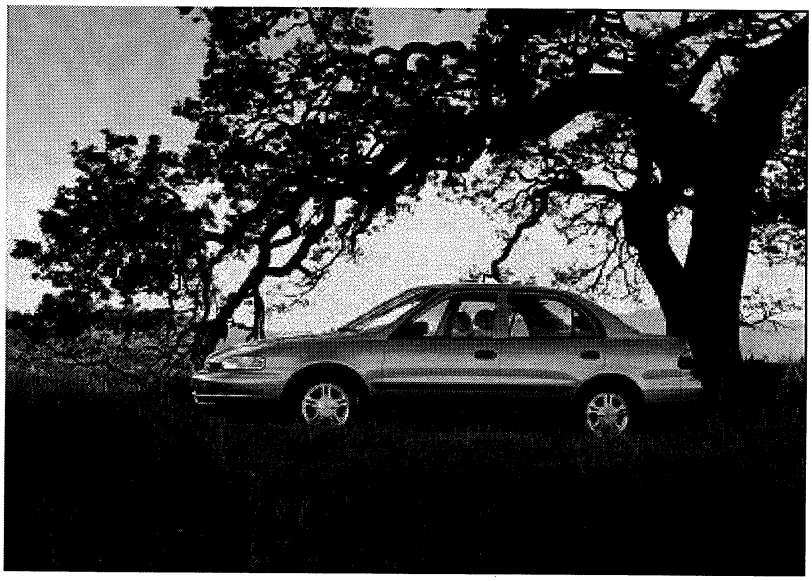
Chevrolet

Prizm



2002

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Product Information

2002 Chevrolet Prizm: Well Equipped Import Fighter

Chevrolet Prizm, long known as a well-equipped compact sedan for customers who typically consider import vehicles, enters its final model year in 2002.

"Prizm is often the choice of discriminating, college-educated buyers, particularly because it offers high quality, reliability and safety," said Margaret Brooks, Prizm brand manager. "Add comfort and convenience to the mix, and you have the perfect compact package for many buyers."

Lineup And Equipment

The Prizm Sedan and uplevel Prizm LSi Sedan comprise the lineup. Standard features include a 1.8-liter SFI 125-horsepower engine, air conditioning, rear-floor heater ducts, trip-odometer, AM/FM stereo radio and intermittent windshield wipers. The vehicle features a choice of three transmissions: a five-speed manual, three-speed automatic and four-speed automatic with overdrive. Combined with the Prizm's agile four-wheel independent suspension, these powertrain choices provide a pleasing ride in town and on the highway — or even on twisty mountain roads.

The well-equipped LSi includes remote keyless entry, an electric rear-window defogger, power door locks, a 60/40 split rear seat with pass-through feature, tilt steering wheel, tachometer, power windows, AM/FM stereo with cassette, power-operated outside rear view mirrors and special full wheel covers.

Prizm Optionalions include 14-inch alloy wheels, electric-sliding sunroof and a CD-equipped AM/FM stereo.

The powerful 1.8-liter, 125-hp sequentially-fuel injected aluminum engine, featured on both Prizm models, has dual-overhead camshafts, a near-maintenance-free direct ignition system, a single serpentine accessory drive system for added smoothness, and a torque-axis engine mounting system that helps soak up vibration and noise.

Safety And Security Features

Family-oriented buyers will appreciate Prizm's attention to safety. Standard safety equipment includes driver and front passenger air bags, lower anchors for child restraint seats and an inside trunk release handle. Optional safety equipment includes side-impact air bags for driver and front passenger as well as four-wheel antilock brakes.

Discriminating buyers who want a well-equipped, reliable compact sedan will find it in the 2002 Chevrolet Prizm.

New For 2002

- 2002 is final model year for Chevrolet Prizm

Model Lineup

	Engine		Transmissions	
	1.8-liter DOHC L4	5-speed man	3-speed auto	4-speed auto
Prizm Sedan	S	S	O	O
Prizm LSi Sedan	S	S	O	O

Standard S
Optional O

Specifications

Overview

Models:	Prizm and Prizm LSi
Body style / driveline:	five-passenger front-wheel drive, front-engine sedan
Construction:	steel unit body
EPA vehicle class:	compact
Manufacturing location:	Fremont, California
Key competitors:	Toyota Corolla, Honda Civic, Mazda Protégé, Nissan Sentra

Engine

Type and description:	1.8-liter DOHC 16-valve L4 SFI
Displacement (cu in / cc):	109.5 / 1794
Bore & stroke (in / mm):	3.11 x 3.60 / 79 x 91
Cylinder head material:	aluminum
Valvetrain:	DOHC, four valves per cylinder
Fuel injection / delivery:	sequential fuel injection
Compression ratio:	10.0:1
Horsepower (hp / kw @ rpm):	125 / 93 @ 5800
Torque (lb-ft / Nm @ rpm):	125 / 165 @ 4000
Recommended fuel:	87 octane
Maximum engine speed (rpm):	5800
Exhaust system:	single stainless steel
Estimated fuel economy (mpg city / hwy / combined):	30 / 40 / 35 (four-speed automatic transmission) 29 / 33 / 31 (three-speed automatic transmission) 32 / 41 / 36 (five-speed manual transmission)

Transmission

	5-speed manual	3-speed auto	4-speed auto w/OD
Type:	five-speed manual, front-wheel drive	three-speed auto, front-wheel drive	four-speed electronic auto w/overdrive, front-wheel drive
Gear ratios (:1):			
First:	3.17	2.81	3.64
Second:	1.90	1.55	2.01
Third:	1.31	1.00	1.30
Fourth:	0.89	—	0.89
Reverse:	3.25	2.30	2.98
Final drive ratio:	3.72:1	3.42:1	2.66:1

Chassis/Suspension

Front:	independent MacPherson struts with coil springs and 22-mm stabilizer bar
Rear:	independent MacPherson struts with coil springs and 14-mm stabilizer bar
Steering:	power rack-and-pinion
Ratio:	18.1:1
Steering wheel turns, lock-to-lock:	3.27
Turning circle, curb-to-curb (ft / m):	34 / 10.4

Brakes

Type:	front disc, rear drum, four-wheel ABS Optional
Front (diameter x thickness, in / mm):	10.04 x 0.87 / 255 x 22
Rear (diameter x thickness, in / mm):	7.87 / 200

Wheels/Tires

Standard wheel:	14-inch x 5.5-inch full wheel cover with Chevy bowtie
Available wheel:	14-inch x 5.5-inch alloy wheel with Chevy bowtie
Standard tires:	sedan: P175/65R-14 all-season tires; LSi: P185/65R-14

Dimensions

Exterior

Wheelbase (in / mm):	97.1 / 2466
Overall length (in / mm):	174.2 / 4427
Overall width (in / mm):	66.7 / 1694
Overall height (in / mm):	53.7 / 1364
Track:	
Front (in / mm):	57.5 / 1461
Rear (in / mm):	57.1 / 1450
Min. ground clearance (in / mm):	front bumper: 7.7 / 195; rear bumper: 12 / 305
Base curb weight (lbs / kg):	five-speed manual: 2398 / 1087 three-speed automatic: 2442 / 1107 four-speed automatic: 2486 / 1127
Weight distribution, front / rear:	60 / 40

Interior

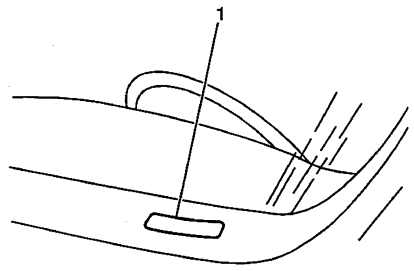
	Front	Rear
Head room (in / mm):	39.3 / 998	36.9 / 937
Head room with Optional sunroof (in / mm):	36.9 / 937	35.8 / 909
Leg room (in / mm):	42.5 / 1080	33.2 / 843
Shoulder room (in / mm):	52.8 / 1341	52.2 / 1326
Hip room (in / mm):	50.5 / 1283	51.2 / 1301

Capacities

EPA passenger volume (cu ft / liters):	88 / 2491
EPA interior volume (cu ft / liters):	100.1 / 2835
Cargo volume (cu ft / liters):	12.1 / 360
Trailer towing (max lbs / kg):	1500 / 681
Fuel tank capacity (gals / liters):	13.2 / 50
Engine oil (qts / liters):	3.5 / 3.3
Engine coolant (qts / liters):	5.8 / 5.5 (5.7 for automatic transmission)

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	1	US Built
2	Manufacturer	Y	Nummi
3	Make	1	Chevrolet
4-5	Carline/Series	SK	Prizm
6	Body Style	5	4-DR Sedan
7	Restraint System	2	Active (Manual) Belts W/Driver and Passenger Inflatable Restraint System (Frontal)
8	Engine Type	8	1.8L L4 SFI
9	Check Digit	--	Check Digit
10	Model Year	2	2002
11	Plant Location	Z	Fremont, CA
12-17	Plant Sequence Number	--	Production Plant Sequence Number

VIN Derivative

All engines and transmissions are stamped or laser etched with a partial vehicle identification number (VIN), which was derived from the complete VIN. A VIN derivative contains the following nine positions:

Position	Definition	Character	Description
1	GM Division Identifier	1	Chevrolet
2	Model Year	2	2002
3	Assembly Plant	Z	Freemont, CA
4-9	Plant Sequence Number	--	--

A VIN derivative can be used to determine if a vehicle contains the original engine or transmission, by matching the VIN derivative positions to their accompanying positions in the complete VIN:

VIN Derivative Position	Equivalent VIN Position
1	3
2	10
3	11
4-9	12-17

Vehicle Certification Label

The vehicle certification label is permanently located on the drivers door lock pillar. Refer to this label in order to obtain the following information:

- The Gross Vehicle Weight Rating (GVWR)
- The Gross Axle Weight Rating (GAWR), front and rear

The Gross Vehicle Weight (GVW) must not exceed the Gross Vehicle Weight Rating (GVWR).

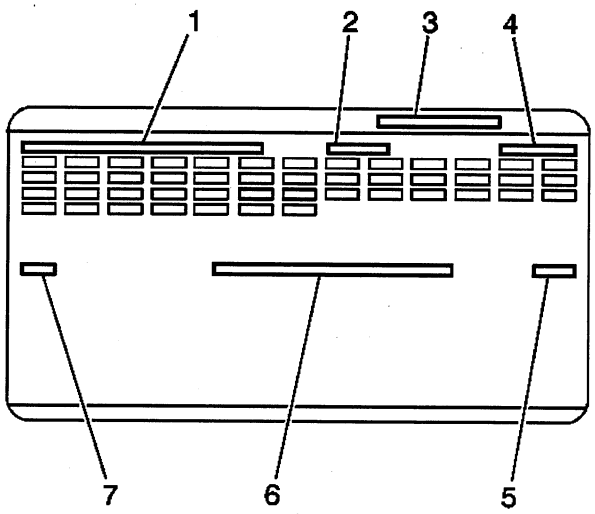
The GVW is the weight of the vehicle and everything the vehicle carries. Include the following items when figuring the GVW:

- The base vehicle weight (factory weight)
- The weight of any added vehicle accessories
- The weight of the driver and the passenger
- The weight of any cargo being carried

The front and rear Gross Axle Weights (GAW) must not exceed the Gross Axle Weight Ratings (GAWR), front and rear.

The GAW is the weight exerted on one of the axles (front or rear).

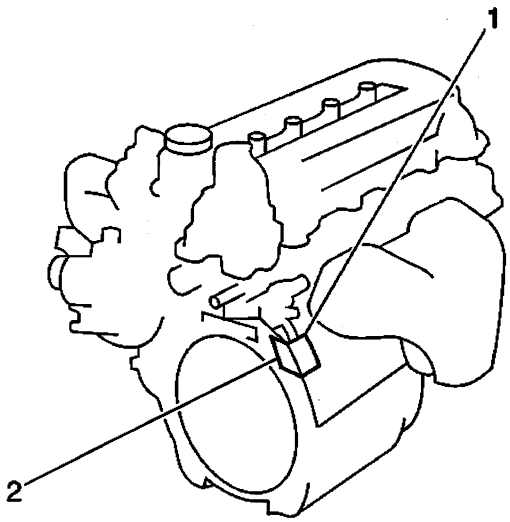
Service Parts Identification Label (SPID)



1. Vehicle Identification Number
2. Wheel Base
3. Part Number Location
4. Model Designation
5. Order Number
6. Exterior Color
7. Paint Technology

The service parts identification label is placed on the vehicle in order to help service and parts personnel identify the vehicle's original parts and the vehicle's original options.

Engine ID and VIN Derivative Location



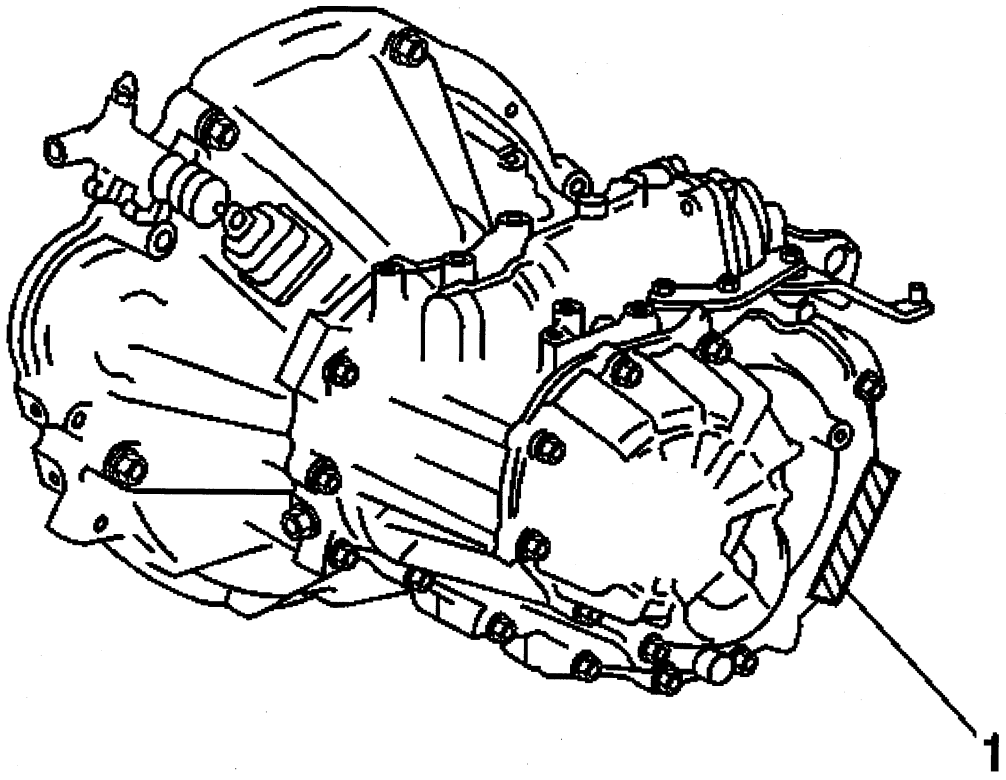
The engine code letter is the eight digit of the VIN, which identifies the engine.

Stick-on labels attached to the engine, laser etching, or stampings in the engine block indicate the engine unit number/build code date.

The engine ID number will be located on the lower left engine block (1).

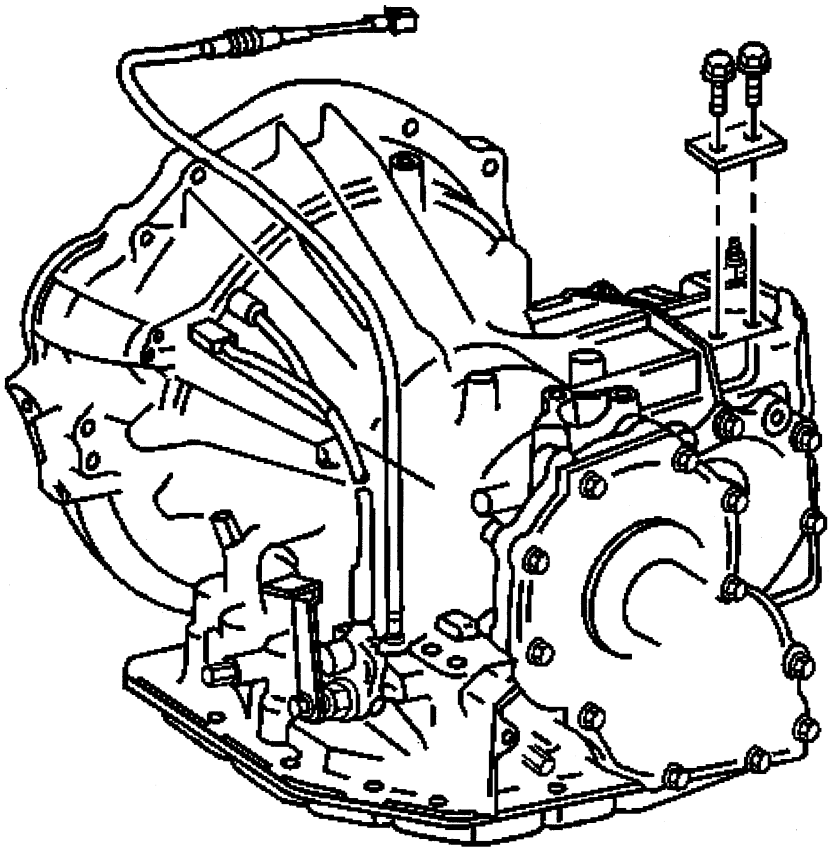
Transmission ID and VIN Derivative Location

Manual Transaxle(c)



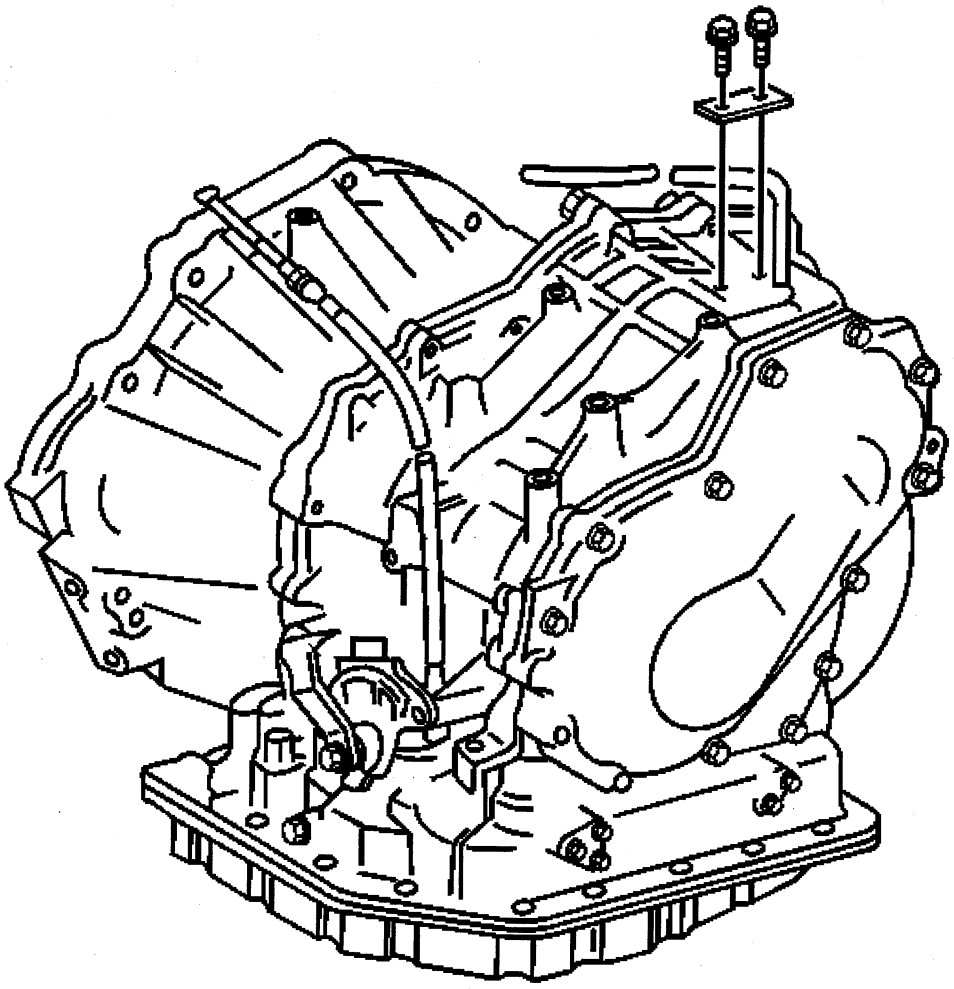
The transaxle model identification is located on a label or tag on the transmission case (1). If this label is missing or unreadable, use the service parts identification label in order to identify the vehicle's transmission.

3 Speed-Automatic Transaxle(c)



The transaxle model identification is located on a label or tag on the transmission case. If this label is missing or unreadable, use the service parts identification label in order to identify the vehicle's transmission.

4 Speed-Automatic Transaxle(c)

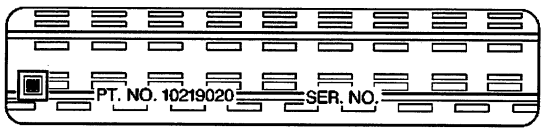


The transaxle model identification is located on a label or tag on the transmission case. If this label is missing or unreadable, use the service parts identification label in order to identify the vehicle's transmission.

Engine and Transmission Usage

Body Type	Car Line (Division)	Engine Size	Fuel System	Engine RPO	Transmission Used	Transmission RPO
S	Prizm (Chevrolet)	1.8L L4	SFI	LV6	A131 / A245E / M5	MB3 / MS7 / MB4 & MB5

Labeling - Anti-Theft



Notice

The anti-theft label found on some major body panels MUST be covered before performing any painting, rustproofing or undercoating procedures. The mask must also be removed following those procedures. Failure to follow these precautionary steps may result in liability for violation of the Federal Vehicle Theft Prevention Standard, and subject the vehicle owner to possible suspicion that the part was stolen.

Federal law requires General Motors (GM) to affix a label to certain parts on selected vehicles with the Vehicle Identification Number (VIN). The purpose of this law is to reduce the number of motor vehicle thefts by helping in the tracing and recovery of parts from stolen vehicles. The certification label on the driver's door qualifies as a theft deterrent label.

The theft deterrent label will be permanently affixed to an interior surface of the part and will contain the complete VIN. The label on replacement parts will contain the letter R, the manufacturer's logo, and the acronym for the Department of Transportation (DOT). DO NOT deface, or remove these labels.

Tire Placard

The Tire Placard is permanently located on the inside of the instrument panel compartment door. Refer to the placard in order to obtain the following information:

- The maximum vehicle capacity weight
- The total occupant seating
- The cold tire inflation pressures
- The tire sizes (original equipment tires)
- The tire speed ratings (original equipment tires)

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
AJ7	Restraint System Front Seat, Inflatable, Driver and Passenger, Front and Side
AK5	Restraint System Front Seat, Inflatable, Driver and Passenger
AM9	Rear Split Back Folding Seats
AN2	Child Integral Seat
AU0	Remote Entry Lock Control
AU3	Electric Door Locks
A01	Full Tint Windshield
A31	Power Windows
A59	Rear Compartment Lid Remote Lock Control, Manual Release
B37	Front and Rear Floor Mats
B4M	Vehicle Custom Feature Package
CF5	Electric Sliding Glass Sunroof
C49	Electric Rear Window Defogger
C60	Manual Air Conditioning
DC4	Inside Rearview Tilt Mirror, Dual Reading Lamps
DD2	Covered Inside Sunshade Mirror
DG7	Outside Mirror LH and RH, Remote Control, Electric, Color
DL5	Decal Roadside Service Information
D31	Inside Rearview Tilt Mirror
D68	Outside Mirror LH and RH, Remote Control, Color
E87	Cover, Wheel Center Cap & Retainers
FE9	Federal Emission Certification
FV1	Ratio Transaxle Final Drive 3.72
FW6	Ratio Transaxle Final Drive 3.42
F18	Ratio Transaxle Final Drive 2.65
F82	Ratio Transaxle Final Drive 3.23
JM4	Power Brake System, Front Disc, RR Drum, Cast Iron, Antilock, FRT and RR WHL
J41	Power Brake System, Front Disc, RR Drum, Cast Iron
K34	Automatic Cruise Control, Electronic
LV6	1.8L, 4-Cylinder Gas Engine w/MFI
MB3	3-Speed Automatic Transaxle
MB4	5-Speed Manual Transaxle
MM5	Merchandised Transaxle 5-Speed Manual Provisions
MS7	4-Speed Electronic Clutch Automatic Transaxle
MXO	Merchandised Transaxle Automatic Provisions, O/D
MX1	Merchandised Automatic Transaxle Provisions
NB8	California State Emission Override
NC1	California Emission System LEV
NC7	Federal Emissions Override System
NF2	Federal Emission System NLEV
NG1	Geographically Restricted Certification Emission
N41	Variable Ratio Power Steering
PB2	Wheel Covers ABS Trim
PG4	Aluminum Wheels 14 x 5.5
PO8	Super Deluxe Wheel Cover
QNU	Tire All P175/65HR14/N BL R/ST TL Hwy
QPC	Tire All P185/65HR14/N BL R/ST TL Hwy

T61	Daytime Running Lights
T82	Automatic Headlamp Control
UM6	AM/FM Stereo w/Auto Reverse Cassette with Clock, ETR
UM7	AM/FM Stereo with Clock, ETR
UQ8	4 Speaker System, Dual Front Extended Range
U1C	AM/FM Stereo w/CD Player with Clock, ETR
U16	Engine Tachometer
U25	Rear Compartment Courtesy Lamp
U79	4 Speaker System, Dual Front Coaxial Cable, Extended Range
VB1	Japan Shipping Label
VC1	Price/Fuel Economy Label
VC4	Price/Fuel Economy Label, Puerto Rico & Virgin Islands
VC5	US Possessions or Japan Shipping Label
VC6	US Territories Shipping Label, Hawaii & Puerto Rico
VG8	Notice to Buyer Vehicle Label
V60	Vehicle Statement Gulf States Organization, Incomplete Vehicle
V73	Vehicle Statement US/Canada
V78	Vehicle Statement Delete
V83	Vehicle Statement ECE Organization
V87	Vehicle Statement Gulf States Organization
YF5	California Emission Certification
8X1	Vehicle Label, Fasten Seat Belts
9J6	Steering Column Tilt Type

Technical Information

Maintenance and Lubrication

Capacities - Approximate Fluid

Application	Specification	
	Metric	English
3-Speed Automatic Transaxle		
• Drain and Refill	2.5 liters	2.6 quarts
• Overhaul w/o Torque Converter	5.5 liters	5.8 quarts
• Overhaul with New Torque Converter	6.9 liters	7.3 quarts
Differential (3-Speed Automatic Only)		
• Drain and Refill	1.4 liters	1.5 quarts
4-Speed Automatic Transaxle		
• Drain and Refill	3.1 liters	3.3 quarts
• Overhaul w/o Torque Converter	7.6 liters	8.0 quarts
• Overhaul with New Torque Converter	9.0 liters	9.5 quarts
Manual Transaxle		
• Drain and Refill	1.9 liters	2.0 quarts
Engine Coolant System		
• Manual Transaxle	6.2 liters	6.6 quarts
• Automatic Transaxle	6.1 liters	6.4 quarts
Engine Oil		
• With Filter Change	3.7 liters	3.9 quarts
Fuel System		
• Fuel Tank	50 liters	13.2 gallons

Maintenance Items

Application	Specification
Air Cleaner Element	GM P/N 94856888
Engine Oil Filter	GM P/N 94858995
Fuel Filter	GM P/N 94856919
Positive Crankcase Ventilation (PCV) Valve	
• Engine w/Serial Number Beginning with Five	GM P/N 94859406
• Engine w/Serial Number Beginning with Zero	GM P/N 94859404
Spark Plugs - Denso (SR16R-11)	GM P/N 94859448
Spark Plug Gap	1.0-1.2 mm (0.040-0.043 in)
Windshield Wiper Blades	
• Left Side (500 mm long)	GM P/N 94857770
• Right Side (450 mm long)	GM P/N 94857769

Tire Inflation Pressure Specifications

Application	Specification	
	Metric	English
P175/65R14	210 kPa	30 psi
P185/65R14	210 kPa	30 psi
Spare	420 kPa	60 psi

Fluid and Lubricant Recommendations

Application	Fluid/Lubricant
Automatic Transaxle	DEXRON®-III Automatic Transmission Fluid GM P/N 12346143 (Canadian P/N 10952622) or the equivalent
Chassis Lubrication	Chassis Lubricant GM P/N 12377985, a lubricant meeting the requirements of NLGI # 2, Category LB or GC-LB or the equivalent
Clutch Linkage Pivot Points	Chassis Lubricant GM P/N 12377985, a lubricant meeting the requirements of NLGI # 2, Category LB or GC-LB or the equivalent
Engine Coolant	A 50/50 mixture of clean water (preferably distilled) and a good quality Ethylene Glycol Base CoolantGM P/N 1052753 (Canadian P/N 993089) or equivalent which conforms to GM Specification 1825M, or an approved recycled coolant which conforms to GM Specification 1825M.
Engine Oil	The engine oil with the American Petroleum Institute Certified For Gasoline Engines "Starburst" symbol of the correct viscosity.
Floor Shift Linkage	Lubriplate® Lubricant Aerosol GM P/N 12346293, a lubricant meeting the requirements of NLGI # 2, Category LB or GC-LB or the equivalent
Hood and Door Hinges	Multi-Purpose Lubricant, Superlube®, GM P/N 12346241 (Canadian P/N 10953474) or the equivalent.
Hood Latch Assembly, Secondary Latch Assembly, Pivots, Spring Anchor and Release Pawl	Lubriplate® Lubricant Aerosol GM P/N 12346293, a lubricant meeting the requirements of NLGI # 2, Category LB or GC-LB or the equivalent
Hydraulic Brake System	Delco Supreme 11® Brake Fluid GM P/N 12377967 (Canadian 992667) or an equivalent DOT-3 brake fluid
Hydraulic Clutch System	Hydraulic Clutch Fluid GM P/N 12345347 (Canadian P/N 10953517) or the equivalent
Key Lock Cylinders	Multi-Purpose Lubricant, Superlube®, GM P/N 12346241 (Canadian P/N 10953474) or the equivalent.
Manual Transaxle	GM Goodwrench Synthetic Manual Transmission Fluid GM P/N 12346190 (Canadian P/N 10953477) or an equivalent SAE 75W-90 GL-4 Gear Oil.
Manual Transaxle Shift Linkage	Chassis Lubricant GM P/N 12377985, a lubricant meeting the requirements of NLGI # 2, Category LB or GC-LB or the equivalent
Weatherstrip Conditioning	Dielectric Silicone Grease GM P/N 12345579 (Canadian P/N 1974984), or Weatherstrip Lubricant-Krytox (GM P/N 3634770) or the equivalent.
Windshield Washer Solvent	GM Optikleen® Washer Solvent GM P/N 1051515 (Canadian P/N 993033) or the equivalent.

Descriptions and Operations

Power Steering System

The power steering system is a closed loop system. The power steering system consists of the following three major components:

- The power steering fluid reservoir
- The power steering pump
- The power steering gear

The power steering fluid is drawn from the power steering fluid reservoir by the power steering pump via the power steering reservoir hose. The power steering pump pressurizes and moves the power steering fluid through the system. The power steering pump discharges through the power steering gear inlet hose, which transports the pressurized power steering fluid to the power steering gear. After exiting the power steering gear via the power steering gear outlet hose the power steering fluid returns to the power steering reservoir.

Power Steering Pump

The power steering pump uses a ten vane hydraulic pump to provide steering assistance. The pump is driven by the engine using a multi-ribbed belt and uses an engine speed sensing type flow control valve. This valve reduces the output pressure to the gear as engine speed increases, providing higher pump pressure when the engine is at or near idle speed and a lower (but safe) pressure at high engine speed.

This vehicle uses a power steering pump which is mounted at the front of the transverse mounted engine toward the rear of the engine compartment. This pump has a separate power steering fluid reservoir.

Power Steering Gear

The power rack and pinion steering system has a control valve which directs hydraulic fluid under pressure to either side of the rack piston. The piston, attached to the rack, uses hydraulic pressure to move the steering rack left or right. This moves the tie rods and steering knuckles, which turn the front wheels.

If the hydraulic assist should fail, manual control is maintained, however, under this condition more steering effort is required.

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

The front suspension has 2 primary purposes:

- Isolate the driver from irregularities in the road surface.
- Define the ride and handling characteristics of the vehicle.

The front suspension absorbs the impact of the tires travelling over irregular road surfaces and dissipates this energy throughout the suspension system. This process isolates the vehicle occupants from the road surface. The rate at which the suspension dissipates the energy and the amount of energy that is absorbed is how the suspension defines the vehicle's ride characteristics. Ride characteristics are designed into the suspension system and are not adjustable. The ride characteristics are mentioned in this description in order to aid in the understanding of the functions of the suspension system. The suspension system must allow for the vertical movement of the tire and wheel assembly as the vehicle travels over irregular road surfaces while maintaining the tire's relationship with the road.

The steering knuckle is suspended between a lower control arm and a strut assembly. The lower control arm attaches to the steering knuckle at the outermost point of the control arm. The attachment is through a ball and socket type joint. The innermost end of the control arm is attached at two points to the crossmember with semi-rigid bushings. The upper portion of the steering knuckle is attached to a strut assembly. The strut assembly is attached to the vehicle body with an upper bearing. The steering knuckle moves up and down independent of the vehicle body structure.

This up and down motion of the steering knuckle as the vehicle travels over bumps is absorbed predominantly by the coil spring. This spring is retained under tension over the strut assembly. The strut has an absorber in order to dampen out the oscillations of the coil spring. A strut is a basic hydraulic cylinder. The strut is filled with oil and has a moveable shaft that connects to a piston inside the strut. Valves inside the shock absorber offer resistance to oil flow and consequently inhibit rapid movement of the piston and shaft. Each end of the strut is designed as the connection point of the suspension system to the vehicle and acts as the coil spring seat. This allows the strut to utilize the dampening action to reduce the recoil of a spring alone. The lower control arm is allowed to pivot at the vehicle frame in a vertical fashion. The ball joint allows the steering knuckle to maintain the perpendicular relationship to the road surface.

Front suspensions systems utilize a stabilizer shaft. The stabilizer shaft connects between the left lower control arm and the right lower control arm through the stabilizer shaft links and the stabilizer shaft insulators. This bar controls the amount of independent movement of the suspension when the vehicle turns. Limiting the independent movement defines the vehicles handling characteristics on turns.

Rear Suspension

The rear suspension has two primary purposes:

- Isolate the driver from irregularities in the road surface.
- Define the ride and handling characteristics of the vehicle.

The rear suspension absorbs the impact of the tires travelling over irregular road surfaces and dissipates this energy throughout the suspension system. This process isolates the vehicle occupants from the road surface. The rate at which the suspension dissipates the energy and the amount of energy that is absorbed is how the suspension defines the vehicle's ride characteristics. Ride characteristics are designed into the suspension system and are not adjustable. The ride characteristics are mentioned in this description in order to aid in the understanding of the functions of the suspension system. The suspension system must allow for the vertical movement of the tire and wheel assembly as the vehicle travels over irregular road surfaces while maintaining the tire's relationship to the road.

The knuckle is suspended between 2 lower control arms, a trailing arm, and a strut assembly. The outer ends of the lower control arms attach to the knuckle with semi-rigid bushings. The inner ends of the lower control arms attach to the crossmember with semi-rigid bushings. The upper portion of the knuckle is attached to a strut assembly. The strut assembly then connects to the vehicle body by way of an upper bearing. The steering knuckle moves up and down independent of the vehicle body structure.

The up and down motion of the knuckle as the vehicle travels over bumps is absorbed predominantly by the coil spring. This spring is retained under tension over the strut assembly. The strut has an absorber in order to dampen out the oscillations of the coil spring. A strut is a basic hydraulic cylinder. The strut is filled with oil and has a moveable shaft that connects to a piston inside the strut. Valves inside the absorber offer resistance to oil flow and consequently inhibit rapid movement of the piston and shaft. Each end of the strut is designed as the connection point of the suspension system to the vehicle and acts as the coil spring seat. This allows the strut to utilize the dampening action to reduce the recoil of a spring alone. The lower control arm is allowed to pivot at the crossmember in a vertical fashion.

The rear suspension utilizes a stabilizer shaft. The stabilizer shaft connects between the left strut and the right strut with the stabilizer shaft links and the stabilizer shaft insulators. This controls the amount of independent movement of the suspension when the vehicle turns. Limiting the independent movement defines the vehicles handling characteristics on turns.

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.

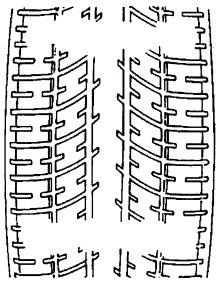
The following factors have an important influence on tire life:

- 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

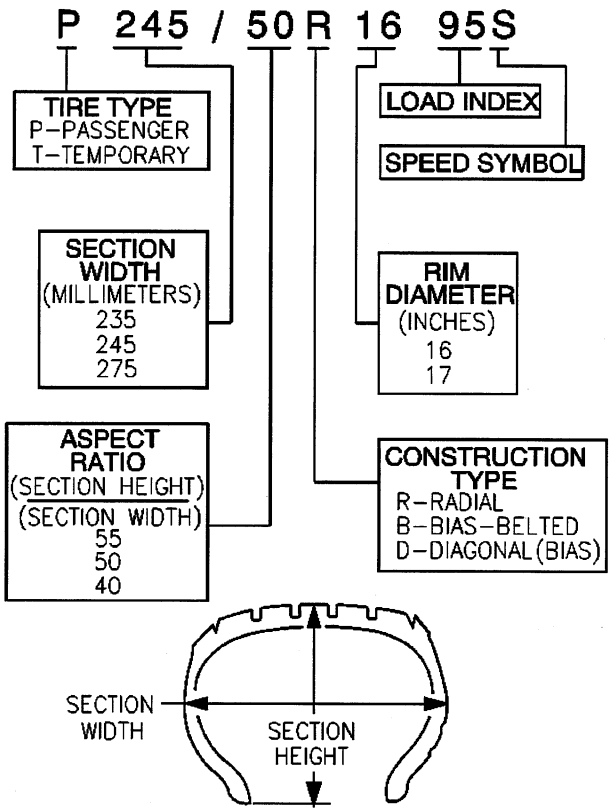
Tires with a lower than recommended pressure can cause the following conditions:

- 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

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 System Description and Operation

Wheel Drive Shafts

The wheel drive shaft is a flexible assembly consisting of an inner constant-velocity joint and an outer constant-velocity joint. The joints are joined together by the axle shaft. Two different types of joints are used on the wheel drive shafts.

The inner joint or differential-side joint is a tripot design. This design allows the differential side joint to be completely flexible as well as being capable of an in-and-out motion. This design allows the wheel drive shaft to move in or out as well as up and down to meet front suspension requirements.

The outer constant velocity joint, or wheel-side joint, is a ball and socket design. This design allows complete flexibility but does not have the capability of in-and-out motion.

The right wheel drive shaft is equipped with a dynamic dampener which reduces vibration and noise.

Each of the joints is covered with a boot to protect the lubricant and the joint from environmental contamination and foreign objects. Each of the boots is clamped to the joint to provide a leak proof connection.

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 Specifications

Application	Specification	
	Metric	English
Camshaft		
• Bearing Caps Oil Clearance (Standard)	0.035-0.072 mm	0.0014-0.0028 in
• Bearing Caps Oil Clearance (Maximum)	0.10 mm	0.0039 in
• Journal Outside Diameter (Standard)	22.949-22.965 mm	0.9035-0.9041 in
• Lobe Height Exhaust (Minimum)	43.61 mm	1.7169 in
• Lobe Height Exhaust (Standard)	43.761-43.861 mm	1.7229-1.7268 in
• Lobe Height Intake (Minimum)	44.18 mm	1.7394 in
• Lobe Height Intake (Standard)	44.333-44.433 mm	1.7454-1.7493 in
• Runout (Maximum)	0.03 mm	0.0012 in
• Thrust Clearance (Standard)	0.040-0.095 mm	0.0016-0.0037 in
• Thrust Clearance (Maximum)	0.11 mm	0.0043 in
Connecting Rods and Bearings		
• Connecting Rod Bearing Clearance (Maximum)	0.080 mm	0.0031 in
• Connecting Rod Bearing Clearance (Standard)	0.028-0.060 mm	0.0011-0.0024 in
• Connecting Rod Bow (Maximum)	0.050 mm	0.0020 in
• Connecting Rod Bushing Inside Diameter	20.012-20.021 mm	0.7878-0.7882 in
• Connecting Rod Side Clearance (Maximum)	0.40 mm	0.0157 in
• Connecting Rod Side Clearance (Standard)	0.160-0.342 mm	0.0063-0.0135 in
• Connecting Rod Twist (Maximum)	0.05 mm	0.0039 in
• Crankshaft Diameter	43.992-44.000 mm	1.7320-1.7328 in
• Crankshaft Diameter Out-of-Round and Taper (Maximum)	0.02 mm	0.0004 in
• Rod Bearing Thickness ("1" Stamping)	1.486-1.490 mm	0.0585-0.0587 in
• Rod Bearing Thickness ("2" Stamping)	1.490-1.494 mm	0.0587-0.0588 in
• Rod Bearing Thickness ("3" Stamping)	1.494-1.498 mm	0.0588-0.0590 in
Crankshaft		
• Journal Taper or Out-of-Round	0.02 mm	0.0008 in
• Runout at Center Journal	0.03 mm	0.0012 in
• Thrust Bearing Thickness	1.930-1.980 mm	0.0760-0.0780 in
• Thrust Play (Maximum)	0.30 mm	0.0118 in
• Thrust Play (Standard)	0.04-0.24 mm	0.0016-0.0094 in
Cylinder Head		
• Gasket Surface Distortion (Maximum)	0.05 mm	0.0020 in
• Seating Distortion Intake and Exhaust Manifolds	0.05 mm	0.0020 in
Cylinder Block		
• Cylinder Bore (Standard)	79.000-79.013 mm	3.1102-3.1107 in
• Cylinder Bore (Maximum)	79.02 mm	3.1110 in
• Gasket Surface Distortion (Maximum)	0.05 mm	0.0020 in
• Taper and Out-of-Round (Maximum)	0.10 mm	0.0039 in
Flywheel		
• Flywheel Face Runout	0.1 mm	0.004 in

Main Bearings		
• Crankshaft Journal Diameter ("0" Stamping)	47.998-48.000 mm	1.8897-1.8898 in
• Crankshaft Journal Diameter ("1" Stamping)	47.996-47.998 mm	1.8896-1.8897 in
• Crankshaft Journal Diameter ("2" Stamping)	47.994-47.996 mm	1.8895-1.8896 in
• Crankshaft Journal Diameter ("3" Stamping)	47.992-47.994 mm	1.8894-1.8895 in
• Crankshaft Journal Diameter ("4" Stamping)	47.990-47.992 mm	1.8893-1.8894 in
• Crankshaft Journal Diameter ("5" Stamping)	47.988-47.990 mm	1.8892-1.8893 in
• Main Bearing Cap Bore Diameter ("0" Stamping)	52.000-52.003 mm	2.0472-2.0473 in
• Main Bearing Cap Bore Diameter ("1" Stamping)	52.003-52.005 mm	2.0473-2.0474 in
• Main Bearing Cap Bore Diameter ("2" Stamping)	52.005-52.007 mm	2.0474-2.0475 in
• Main Bearing Cap Bore Diameter ("3" Stamping)	52.007-52.010 mm	2.0475-2.0476 in
• Main Bearing Cap Bore Diameter ("4" Stamping)	52.010-52.012 mm	2.0476-2.0477 in
• Main Bearing Cap Bore Diameter ("5" Stamping)	52.012-52.014 mm	2.0477-2.0478 in
• Main Bearing Cap Bore Diameter ("6" Stamping)	52.014-52.016 mm	2.0478-2.0479 in
• Main Bearing Clearance (Maximum)	0.050 mm	0.0020 in
• Main Bearing Clearance (Standard)	0.015-0.032 mm	0.0006-0.0013 in
• Main Bearing Thickness ("1" Stamping)	1.994-1.997 mm	0.0785-0.0786 in
• Main Bearing Thickness ("2" Stamping)	1.997-2.000 mm	0.0786-0.0787 in
• Main Bearing Thickness ("3" Stamping)	2.000-2.003 mm	0.0787-0.0789 in
• Main Bearing Thickness ("4" Stamping)	2.003-2.006 mm	0.0789-0.0790 in
Timing Chain and Sprockets		
• Chain Elongation (Maximum)	122.6 mm	4.827 in
• Camshaft Sprocket Diameter With Chain (Minimum)	97.4 mm	3.835 in
• Crankshaft Sprocket Diameter With Chain (Minimum)	51.6 mm	2.031 in
Oil Pump		
• Housing-to-Oil Pump Gear Set Side Clearance (Maximum)	0.15 mm	0.0059 in
• Outer Rotor-to-Inner Rotor Tip Clearance	0.35 mm	0.0138 in
• Outer Rotor-to-Oil Pump Body Radial Clearance (Maximum)	0.30 mm	0.0118 in
Pistons		
• Diameter	78.925-78.935 mm	3.1073-3.1077 in
• Pin Clearance	Interference Fit	Interference Fit
• Pin Diameter	20.004-20.013 mm	0.7876-0.7879 in
• Piston-to-Cylinder Bore Clearance (Standard)	0.065-0.088 mm	0.0026-0.0035 in
• Piston-to-Cylinder Bore Clearance (Maximum)	0.10 mm	0.0039 in
• Ring End Gap - Lower Ring (Maximum)	1.20 mm	0.0472 in
• Ring End Gap - Lower Ring (Standard)	0.35-0.50 mm	0.0138-0.0197 in
• Ring End Gap - Oil Ring (Maximum)	1.05 mm	0.0413 in
• Ring End Gap - Oil Ring (Standard)	0.15-0.40 mm	0.0059-0.0157 in
• Ring End Gap - Top Ring (Maximum)	1.05 mm	0.0413 in
• Ring End Gap - Top Ring (Standard)	0.25-0.35 mm	0.0098-0.0138 in
• Ring Groove Clearance - Lower Compression Ring	0.030-0.070 mm	0.0012-0.0028 in
• Ring Groove Clearance - Upper Compression Ring	0.030-0.070 mm	0.0012-0.0028 in
Valves		
• Guide Inside Diameter	5.510-5.530 mm	0.2169-0.2177 in
• Head Angles for Refinishing - Area Above Seat Contact Surface	15 Degrees	

• Head Angles for Refinishing - Seat Contact Surface	45 Degrees	
• Seating Contact Width (Standard)	1.25 mm	0.049 in
• Seating Contact Width (Maximum)	0.75 mm	0.030 in
• Spring Deviation	1.6 mm	0.063 in
• Spring Free Length	45.90 mm	1.8070 in
• Spring Preload (Standard)	16.2-17.9 kg at 33.6 mm	35.7-39.5 lb at 1.323 in
• Spring Side Clearance (Maximum)	2.0 mm	0.079 in
• Stem Outside Diameter - Exhaust Valves	5.465-5.480 mm	0.2152-0.2157 in
• Stem Outside Diameter - Intake Valves	5.470-5.485 mm	0.2154-0.2159 in
• Stem-to-Guide Clearance - Exhaust Valves (Standard)	0.030-0.065 mm	0.0012-0.0026 in
• Stem-to-Guide Clearance - Exhaust Valves (Maximum)	0.10 mm	0.0039 in
• Stem-to-Guide Clearance - Intake Valves (Standard)	0.025-0.060 mm	0.0010-0.0024 in
• Stem-to-Guide Clearance - Intake Valves (Maximum)	0.08 mm	0.0031 in
Valve Guides		
• Valve Guide Bushing Bore Diameter (Standard)	10.335-10.356 mm	0.4068-0.4077 in
• Valve Guide Bushing Bore Diameter (Maximum)	10.356 mm	0.4077 in
Valve Lash		
• Cold - Exhaust Valve	0.25-0.35 mm	0.010-0.014 in
• Cold - Intake Valve	0.15-0.25 mm	0.006-0.010 in
Valve Lifters		
• Lifter Diameter	30.966-30.976 mm	1.2191-1.2195 in
• Oil Clearance (Maximum)	0.079 mm	0.0031 in
• Oil Clearance (Standard)	0.024-0.059 mm	0.0009-0.0023 in

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Air Cleaner (ACL) Mounting Bolts	7 N·m	62 lb in
Camshaft Bearing Cap Bolts	19 N·m	14 lb ft
Camshaft Sensor Bolt	15 N·m	11 lb ft
Camshaft Timing Sprocket Bolts	55 N·m	40 lb ft
Connecting Rod Bearing Cap Bolts		
• First Pass	30 N·m	22 lb ft
• Second Pass	90°	90°
Coolant Bypass Pipe to Cylinder Head Bolt	15 N·m	11 lb ft
Crankshaft Position Sensor Bolt	9 N·m	80 lb in
Crankshaft Pulley Bolt	118 N·m	87 lb ft
Cylinder Head Cover Bolts and Nuts	10 N·m	7 lb ft
Cylinder Head Bolts		
• First Pass	35 N·m	26 lb ft
• Second Pass	180°	180°
Drive Belt Tensioner Bolt	100 N·m	74 lb ft
Drive Belt Tensioner Nut	29 N·m	21 lb ft
Engine Coolant Drain Union	25 N·m	18 lb ft
Engine Crossmember To Body Bolts	39 N·m	29 lb ft
Engine Mount (LH Side) Bolts	80 N·m	60 lb ft
Engine Mount Bolts (RH Side)	52 N·m	38 lb ft
Engine Mount Insulator Bolts (RH Side)	52 N·m	38 lb ft
Engine Oil Drain Plug	35 N·m	26 lb ft

Engine Oil Pan Nuts and Bolts	9 N·m	80 lb in
Exhaust Bracket-to-Exhaust Manifold Bolt	35 N·m	26 lb ft
Exhaust Manifold Flange Bolts	62 N·m	46 lb ft
Exhaust Manifold Heat Shield Bolts	20 N·m	15 lb ft
Exhaust Manifold-to-Bracket Bolts	50 N·m	37 lb ft
Exhaust Manifold-to-Cylinder Head Bolts	50 N·m	37 lb ft
Exhaust Pipe-to-Three Way Catalytic Converter (TWC) Clamp Bolt	43 N·m	32 lb ft
Front Engine Mount To Engine Mount Crossmember	52 N·m	38 lb ft
Fuel Injector Harness Bolts	12 N·m	106 lb in
Flywheel Retaining Bolts		
• First Pass	49 N·m	36 lb ft
• Second Pass	90°	90°
Fuel Rail to Cylinder Head Bolts	14 N·m	10 lb ft
Generator Mounting Bolts and Nuts	23 N·m	17 lb ft
Heated Oxygen (HO2S1) Sensor	44 N·m	32 lb ft
Ignition Coil Bracket Bolts	14 N·m	10 lb ft
Intake Manifold Nuts and Bolts		
• Upper Bolts	34 N·m	25 lb ft
• Lower Bolt	46 N·m	34 lb ft
Intake Manifold Support Bracket Bolts	50 N·m	37 lb ft
Knock Sensor Bolt	39 N·m	29 lb ft
Lower Crankcase Bolts	18 N·m	13 lb ft
Main Bearing Cap Bolts		
• First Pass	22 N·m	16 lb ft
• Second Pass	44 N·m	32 lb ft
• Third Pass	45°	45°
• Third Pass (Final Torque)	45°	45°
Oil Control Valve Filter	9 N·m	80 lb in
Oil Control Valve Housing To Cylinder Head Bolts	9 N·m	80 lb in
Oil Filter Adapter	30 N·m	17 lb ft
Oil Level Indicator Guide Tube Bolt	24 N·m	18 lb ft
Oil Pan Baffle	9 N·m	80 lb in
Oil Pressure Switch	13 N·m	9 lb ft
Oil Pump Bolts	11 N·m	97 lb in
Oil Pump Strainer Bolt	9 N·m	80 lb in
Oil Pump Strainer Bracket Bolt	11 N·m	97 lb in
Power Steering Pump Bolts	36 N·m	27 lb ft
Rear Engine Mount Bracket To Suspension Crossmember	87 N·m	64 lb ft
Spark Plugs	28 N·m	21 lb ft
Starter Bolts	30 N·m	22 lb ft
Suspension Crossmember To Body Bolts		
Crossmember Front Bolts	157 N·m	116 lb ft
Crossmember Rear Bolts	113 N·m	83 lb ft
Throttle Body Nuts and Bolts	23 N·m	17 lb ft
Timing Chain Cover Nut and Bolts (10 mm head)	10 N·m	89 lb in
Timing Chain Cover Nut and Bolts (12 mm head)	18 N·m	14 lb ft
Timing Chain Cover Stud Nut	9.3 N·m	80 lb in
Timing Chain Dampener Bolt	21 N·m	15 lb ft
Timing Chain Shoe Bolts	10 N·m	89 lb in
Timing Chain Tensioner Bolts	21 N·m	15 lb ft
Timing Controller Assembly	55 N·m	40 lb ft
Torque Converter Bolts	35 N·m	26 lb ft
Transmission to Engine Mounting Bolts	64 N·m	47 lb ft

Ventilation Pipe To Cylinder Head Cover	10 N·m	7 lb ft
Ventilation Pipe To Intake Manifold	25 N·m	18 lb ft
Water Bypass Pipe To Cylinder Block		
• Bolt	8.5 N·m	75 lb in
• Nut	10 N·m	7 lb ft
Water Bypass Pipe To Cylinder Head	9 N·m	80 lb in
Water Jacket Plug	25 N·m	18 lb ft
Water Pump Bolts	12 N·m	106 lb in
Windshield Washer Reservoir Bolt	10 N·m	89 lb in

Engine Component Description

Cylinder Block

The cylinder block is an aluminum casting with four cast iron cylinder sleeves. The cylinder block has four in-line cylinders which are numbered 1 through 4 starting from the crankshaft pulley. The cylinder block contains coolant jackets through which coolant flows around the cylinders, to cool the cylinder block and maintain a constant operating temperature. The lower crankcase of the cylinder block is also an aluminum casting with cast iron inserts at the main bearing locations. The lower crankcase runs the entire perimeter of the cylinder block.

Crankshaft

The crankshaft is cast nodular iron with eight counterweights. Oil holes run through the center of the crankshaft to supply oil to the connecting rods, bearings, pistons and other components. The end thrust load is taken by the thrust washers installed at the center number three bearing journal.

Connecting Rod and Piston

The connecting rods are forged steel, heat treated and shot peened. The connecting rod incorporates the semi-floating type pin. The pistons are cast aluminum. The piston rings are of a low tension type to reduce friction. The top compression ring is stainless steel. The second compression ring is cast iron. The oil ring is a 3-piece spring construction.

Oil Pan

The oil pan is constructed of stamped steel and is mounted to the lower crankcase. The oil pan includes a baffle that helps prevent the oil from shifting away from the oil pump suction pipe during hard turns, acceleration or stopping.

Cylinder Head

The cylinder head is an aluminum casting with pressed-in valve guides and valve seat inserts. The fuel injection nozzles are located in the intake ports.

Valves

There are two intake and two exhaust valves per cylinder. The valve springs are conical-shaped. Positive valve stem seals are used on all valves.

Camshaft

Two camshafts are used, one for all intake valves, the other for all exhaust valves. The camshafts are cast iron. The intake camshaft also has the camshaft position sensor lobe cast onto it.

Camshaft Housings and Covers

The camshaft housings and covers are cast aluminum. The camshafts run directly in cylinder head housing covers without bearing inserts.

Camshaft Drive

An inverted tooth chain is used. A mechanical tensioner and two guides control chain motion.

Timing Chain Housing and Cover

The timing chain housing is die cast aluminum and retains the crankshaft front seal.

Intake and Exhaust Manifold

The intake manifold is made of aluminum. The exhaust manifold is cast iron.

Lubrication

The lubrication system consists of an oil pan, oil pump screen, oil pump, oil filter and oil pressure regulator. This pressure-fed lubrication system supplies oil to the moving parts of the engine.

The oil pump picks up 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 to the oil pump to remove impurities which could clog or damage the oil pump or other engine components. The oil pump itself is a trochoid gear type pump with internal drive and driven gears. When the drive rotates, the driven gear rotates in the same direction, but on a different center point. This causes the space between the gears to constantly open and narrow, pulling oil in from the oil pan when the space opens and pumping the oil out to the engine as it narrows.

The oil filter is a full flow type with a relief valve built into the paper filter element. Contaminants which can get into the oil during operation could cause accelerated engine wear or seizing if allowed into the engine. The oil filter, situated at the beginning of the oil passage circuit, removes these contaminants as the oil passes through it. The relief valve spring will open under the pressure of the oil and allow oil to bypass the filter and flow directly to the engine.

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 valve keeps the bypass closed, directing all 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, opening the valve and allowing excess oil to flow through the valve and drain back to the oil pan.

Oil is pumped from the oil pan by the oil pump. After it passes through the oil filter, it is fed through two paths to lubricate the cylinder block and cylinder head.

In one path, the oil is pumped through oil passages in the crankshaft to the connecting rods, then to the pistons and cylinders. It then drains back to the oil pan.

In the second path, the oil is pumped through passages to the camshaft. The oil passes through internal passageways in the camshafts to lubricate the valve assemblies before draining back to the oil pan.

Engine Cooling

Engine Cooling System Approximate Capacities

Application	Specification	
	Metric	English
Automatic Transmission	5.7 liters	6.0 quarts
Manual Transmission	5.8 liters	6.1 quarts

Fastener Tightening Specifications

Application	Specification	
	Metric	English
A/C Condenser Bracket to Radiator Bolts	10 N·m	89 lb in
Battery Cable	15 N·m	11 lb ft
Fan Control Switch-Thermostat Housing	34 N·m	25 lb ft
Radiator Fan Assembly Bolts	6 N·m	53 lb in
Radiator Fan Blade Nut	6 N·m	53 lb in
Radiator Upper Support Bracket Bolts	13 N·m	9 lb ft
Thermostat Housing Nuts	9 N·m	80 lb in
Water Pump Bolts	11 N·m	8 lb ft

Cooling System Description and Operation

Cooling System

The cooling system's function is to maintain an efficient engine operating temperature during all engine speeds and operating conditions. The cooling system is designed to remove approximately one-third of the heat produced by the burning of the air-fuel mixture. When the engine is cold, the coolant does not flow to the radiator until the thermostat opens. This allows the engine to warm quickly.

Cooling Cycle

Coolant flows from the radiator outlet and into the water pump inlet. Some coolant flows from the water pump, to the heater core, then back to the water pump. This provides the passenger compartment with heat and defrost capability as the coolant warms up.

Coolant also flows from the water pump outlet and into the engine block. In the engine block, the coolant circulates through the water jackets surrounding the cylinders where it absorbs heat.

The coolant then flows through the cylinder head gasket openings and into the cylinder heads. In the cylinder heads, the coolant flows through the water jackets surrounding the combustion chambers and valve seats, where it absorbs additional heat.

From the cylinder heads, the coolant flows to the thermostat. The flow of coolant will either be stopped at the thermostat until the engine reaches normal operating temperature, or it will flow through the thermostat and into the radiator where it is cooled. At this point, the coolant flow cycle is completed.

Efficient operation of the cooling system requires proper functioning of all cooling system components. The cooling system consists of the following components:

Coolant

The engine coolant is a solution made up of a 50-50 mixture of DEX-COOL and suitable drinking water. The coolant solution carries excess heat away from the engine to the radiator, where the heat is dissipated to the atmosphere.

Radiator

The radiator is a heat exchanger. It consists of a core and two tanks. The aluminum core is a tube and fin crossflow design that extends from the inlet tank to the outlet tank. Fins are placed around the outside of the tubes to improve heat transfer to the atmosphere.

The inlet and outlet tanks are a molded, high temperature, nylon reinforced plastic material. A high temperature rubber gasket seals the tank flange edge to the aluminum core. The tanks are clamped to the core with clinch tabs. The tabs are part of the aluminum header at each end of the core.

The radiator also has a drain cock located in the bottom of the left hand tank. The drain cock unit includes the drain cock and drain cock seal.

The radiator removes heat from the coolant passing through it. The fins on the core transfer heat from the coolant passing through the tubes. As air passes between the fins, it absorbs heat and cools the coolant.

Pressure Cap

The pressure cap seals the cooling system. It contains a blow off or pressure valve and a vacuum or atmospheric valve. The pressure valve is held against its seat by a spring, which protects the radiator from excessive cooling system pressure. The vacuum valve is held against its seat by a spring, which permits opening of the valve to relieve vacuum created in the cooling system as it cools off. The vacuum, if not relieved, might cause the radiator and/or coolant hoses to collapse.

The pressure cap allows cooling system pressure to build up as the temperature increases. As the pressure builds, the boiling point of the coolant increases. Engine coolant can be safely run at a temperature much higher than the boiling point of the coolant at atmospheric pressure. The hotter the coolant is, the faster the heat transfers from the radiator to the cooler, passing air.

The pressure in the cooling system can get too high. When the cooling system pressure exceeds the rating of the pressure cap, it raises the pressure valve, venting the excess pressure.

As the engine cools down, the temperature of the coolant drops and a vacuum is created in the cooling system. This vacuum causes the vacuum valve to open, allowing outside air into the surge tank. This equalizes the pressure in the cooling system with atmospheric pressure, preventing the radiator and coolant hoses from collapsing.

Coolant Recovery System

The coolant recovery system consists of a plastic coolant recovery reservoir and overflow tube. The recovery reservoir is also called a recovery tank or expansion tank. It is partially filled with coolant and is connected to the radiator fill neck with the overflow tube. Coolant can flow back and forth between the radiator and the reservoir.

In effect, a cooling system with a coolant recovery reservoir is a closed system. When the pressure in the cooling system gets too high, it will open the pressure valve in the pressure cap. This allows the coolant, which has expanded due to being heated, is allowed to flow through the overflow tube and into the recovery reservoir. As the engine cools down, the temperature of the coolant drops and a vacuum is created in the cooling system. This vacuum opens the vacuum valve in the pressure cap, allowing some of the coolant in the reservoir to be siphoned back into the radiator. Under normal operating conditions, no coolant is lost. Although the coolant level in the recovery reservoir goes up and down, the radiator and cooling system are kept full. An advantage to using a coolant recovery reservoir is that it eliminates almost all air bubbles from the cooling system. Coolant without bubbles absorbs heat much better than coolant with bubbles.

Air Baffles and Seals

The cooling system uses deflectors, air baffles and air seals to increase cooling system capability. Deflectors are installed under the vehicle to redirect airflow beneath the vehicle and through the radiator to increase engine cooling. Air baffles are also used to direct airflow through the radiator and increase cooling capability. Air seals prevent air from bypassing the radiator and A/C condenser, and prevent recirculation of hot air for better hot weather cooling and A/C condenser performance.

Water Pump

The water pump is a centrifugal vane impeller type pump. The pump consists of a housing with coolant inlet and outlet passages and an impeller. The impeller is mounted on the pump shaft and consists of a

series of flat or curved blades or vanes on a flat plate. When the impeller rotates, the coolant between the vanes is thrown outward by centrifugal force.

The impeller shaft is supported by one or more sealed bearings. The sealed bearings never need to be lubricated. Grease cannot leak out, dirt and water cannot get in as long as the seal is not damaged or worn.

The purpose of the water pump is to circulate coolant throughout the cooling system. The water pump is driven by the crankshaft via the drive belt.

Thermostat

The thermostat is a coolant flow control component. It's purpose is to help regulate the operating temperature of the engine. It utilizes a temperature sensitive wax-pellet element. The element connects to a valve through a small piston. When the element is heated, it expands and exerts pressure against the small piston. This pressure forces the valve to open. As the element is cooled, it contracts. This contraction allows a spring to push the valve closed.

When the coolant temperature is below the rated thermostat opening temperature, the thermostat valve remains closed. This prevents circulation of the coolant to the radiator and allows the engine to warm up. After the coolant temperature reaches the rated thermostat opening temperature, the thermostat valve will open. The coolant is then allowed to circulate through the thermostat to the radiator where the engine heat is dissipated to the atmosphere. The thermostat also provides a restriction in the cooling system, after it has opened. This restriction creates a pressure difference which prevents cavitation at the water pump and forces coolant to circulate through the engine block.

Engine Electrical

General Specifications

Application	Specification	
	Metric	English
Charging System		
• Brush Length - Standard	10.5 mm	0.413 in
• Brush Length - Minimum	1.5 mm	0.059 in
• Direction of Rotation	Clockwise (as viewed from pulley side)	
• Maximum Generator Output	80 Amps	
• Maximum Generator Speed	18,00 RPM	
• No-Load Generator Speed	1100 RPM	
• Normal Operating Voltage	12 Volts	
• Polarity	Negative Ground	
• Regulator Voltage	13.5-15.1 volts	
• Rotor Slip Ring Diameter - Standard	14.2-14.4 mm	0.559-0.567 in
• Rotor Slip Ring Diameter - Minimum	12.8 mm	0.504 in
• Standard Rotor Resistance at 20°C (68°F)	2.7-3.1ohms	
• Temperature Range	30-90°C	-22-194°F
Drive Belt Tension		
• Drive Belt Deflection - New	5-7 mm at 10 kg	0.20-0.27 in at 22 lbs
• Drive Belt Deflection - Used	6-8 mm at 10 kg	0.24-0.31 in at 22 lbs
Starting System		
• Brush Length - Standard	15.5 mm	0.610 in
• Brush Length - Minimum	10.0 mm	0.394 in
• Brush Spring Tension - Standard	1.8-2.4 kg	4.0-5.3 lbs
• Brush Spring Tension - Minimum	1.2 kg	2.6 lbs
• Commutator Insulation Depth - Standard	0.60 mm	0.024 in
• Commutator Insulation Depth - Minimum	0.20 mm	0.008 in
• Commutator Outside Diameter - Standard	30 mm	1.18 in
• Commutator Outside Diameter - Minimum	29 mm	1.14 in
• Commutator Runout - Standard	0.05 mm	0.002 in
• Direction of Rotation	Clockwise (as viewed from pinion)	
• Number of Pinion Teeth	9	
• Output	1.4 kwatts	
• Rating	30 seconds	
• Starter Current Draw, no load	90 Amps at 11.5 Volts	
• Starter Current Draw, load, manual transaxle (9.1 N·m/80.5 lb in of torque)	300 Amps at 7.7 Volts	
• Starter Current Draw, load, automatic transaxle (10.4 N·m/92 lb in of torque)	300 Amps at 7.7 Volts	
• Locked Rotor - Manual Transaxle (18.6 N·m/13.8 lb ft)	780 Amps at 4 Volts	
• Locked Rotor - Automatic Transaxle (25.5 N·m/18.8 lb ft)	980 Amps at 4 Volts	
• Starter Solenoid Operating Voltage	8 Volts minimum	
• Solenoid Contact Plate Wear - Maximum	0.9 mm	0.035 in
• Voltage	12 Volts	

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Battery		
• Battery Cable-to-Battery Terminal Retainer	15 N·m	11 lb ft
• Battery Cable-to-Generator Retaining Nut	8 N·m	71 lb in
• Battery Hold Down Bracket Nuts	8 N·m	71 lb in
• Body Ground Bolt	14 N·m	10 lb ft
• Fuse and Relay Block-to-Inner Fender Bolts	15 N·m	11 lb ft
• Ground Bolt	23 N·m	17 lb ft
• Positive (+) Battery Cable-to-Starter Solenoid Retaining Nut	9 N·m	78 lb in
Charging System		
• Brush Holder Screws	2 N·m	18 lb in
• Drive Pulley Retaining Nut	111 N·m	81 lb ft
• End Cover Bolt	4 N·m	35 lb in
• End Cover Nuts	4.5 N·m	39 lb in
• Generator B+ Terminal Retaining Nut	4 N·m	36 lb in
• Generator End Frame Bolts	4.5 N·m	39 lb in
• Generator Front Bearing Retainer Screws	3 N·m	27 lb in
• Generator Lower Mounting Bolt	54 N·m	40 lb ft
• Generator Upper Mounting Bolt	25 N·m	18 lb ft
• Generator Rectifier Screws	3 N·m	26 lb in
• Voltage Regulator Screws	2 N·m	18 lb in
Cranking System		
• Field Frame End Cover Bolts	1.5 N·m	13 lb in
• Positive (+) Battery Cable-to-Starter Solenoid Retaining Nut	9 N·m	78 lb in
• Solenoid End Cover Bolts	6 N·m	53 lb in
• Solenoid Lead Wire Nut	6 N·m	53 lb in
• Solenoid Terminal Nuts	17 N·m	12 lb ft
• Starter Drive Housing Bolts	6 N·m	52 lb in
• Starter Motor Mounting Bolts	37 N·m	27 lb ft
• Starter Through Bolts	6 N·m	52 lb in
Ignition System		
• Ignition Coil Bolts	9 N·m	78 lb in
• Spark Plugs	18 N·m	13 lb ft

Battery Usage

Application	Specification
Catalog Number	35
Cold Cranking Amperes	310
Replacement Model	35-60
Reserve Capacity Minutes	90
Test Load Amperes	150

Battery Temperature vs Minimum Voltage

Estimated Temperature °F	Estimated Temperature °C	Minimum Voltage
70 or above	21 or above	9.6
50	10	9.4
32	0	9.1
15	-10	8.8
0	-18	8.5
Below 0	Below -18	8.0

Spark Plug Usage

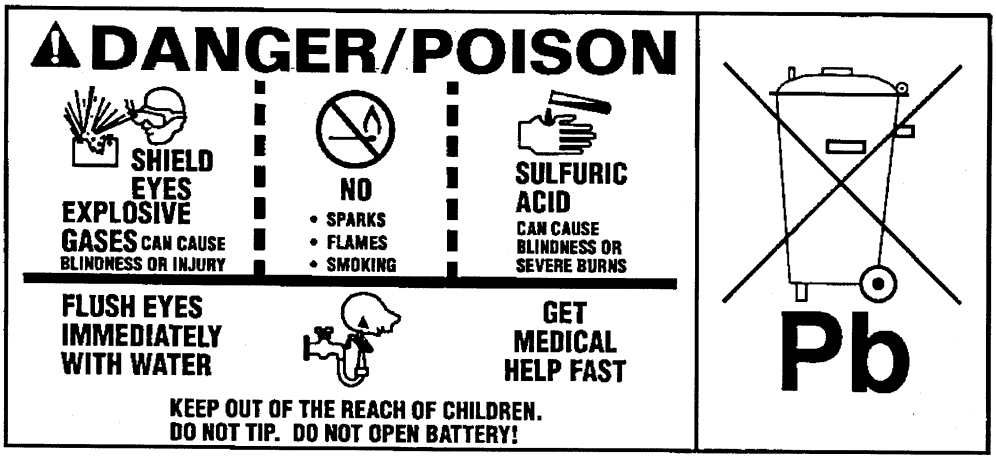
Engine	Spark Plug Type	Spark Plug Gap
1.8L	Denso Type SK16R11	1.0-1.1 mm (0.039-0.043 in) Maximum used spark plug gap: 1.2 mm (0.047 in)
	NGK Type IFR5A11	

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.**



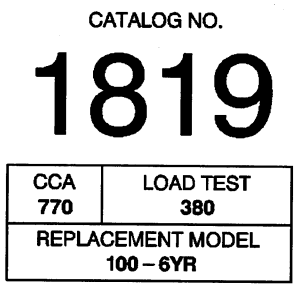
The maintenance free battery is standard. There are no vent plugs in the cover. The battery is completely sealed except for two small vent holes in the side. These vent holes allow the small amount of gas that is produced in the battery to escape.

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

Cranking Circuit

The cranking circuit consists of the battery, the starter motor, the ignition switch, and related electrical wiring. There is a fusible link in the wire running from the starter solenoid to the generator. For more information on the cranking circuit, refer to Cranking System Operation.

Starter Motor

The PG-260 starter motor achieves gear reduction at the rate of 5:1 through planetary gears. It's relatively small size and light weight offer improved cranking performance and reduced current requirements.

Solenoid windings are energized when the ignition switch is turned to the START position and the transmission is in the NEUTRAL or PARK. The plunger and shift lever movement causes the pinion to mesh with the engine flywheel ring gear, the solenoid main contacts to close, and the engine cranks. When the engine starts, the pinion overrunning clutch protects the armature from excessive speed until the key is released, at which time the plunger return spring causes the pinion to disengage. To prevent excessive overrunning, the key should be released immediately when the engine starts.

Charging System Description and Operation

Generator

The generator features the following major components:

- The delta stator
- The rectifier bridge
- The rotor with slip rings and brushes
- A conventional pulley
- Dual internal fans
- The regulator

The pulley and the fan cool the slip ring and the frame.

The generator features permanently lubricated bearings. Service should only include tightening of mount components. Otherwise, replace the generator as a complete unit.

Regulator

The voltage regulator controls the rotor field current in order to limit the system voltage. When the field current is on, the regulator switches the current on and off at a rate of 400 cycles per second in order to perform the following functions:

- Radio noise control
- Obtain the correct average current needed for proper system voltage control

At high speeds, the on-time may be 10 percent with the off-time at 90 percent. At low speeds, the on-time may be 90 percent and the off-time 10 percent.

Circuit Description

The generator provides voltage to operate the vehicle's electrical system and to charge its battery. A magnetic field is created when current flows through the rotor. This field rotates as the rotor is driven by the engine, creating an AC voltage in the stator windings. The AC voltage is converted to DC by the rectifier bridge and is supplied to the electrical system at the battery terminal.

When the engine is running, the generator turn-on signal is sent to the generator from the PCM, turning on the regulator. The generator's voltage regulator controls current to the rotor, thereby controlling the output voltage. The rotor current is proportional to the electrical pulse width supplied by the regulator. When the engine is started, the regulator senses generator rotation by detecting AC voltage at the stator through an internal wire. Once the engine is running, the regulator varies the field current by controlling the pulse width. This regulates the generator output voltage for proper battery charging and electrical

system operation. The generator F terminal is connected internally to the voltage regulator and externally to the PCM. When the voltage regulator detects a charging system problem, it grounds this circuit to signal the PCM that a problem exists. The PCM monitors the generator field duty cycle signal circuit. The system voltage sense circuit receives battery positive voltage that is Hot At All Times through a fuse link that is connected to the starter motor. This voltage is used by the regulator as the reference for system voltage control.

Engine Controls

Ignition System Specifications

Application	Specification	
	Metric	English
Firing Order	1-3-4-2	
Spark Plug Torque	18 N·m	13 lb ft
Spark Plug Gap	1.0-1.2 mm	0.040-0.043 in
Spark Plug Type	SR16R11 DENSO	

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accelerator Cable Adjusting Locknut	8 N·m	71 lb in
Accelerator Cable Attaching Fastener	2 N·m	18 lb in
Accelerator Cable-to-bulkhead Fastener	15 N·m	11 lb ft
Accelerator Pedal Bracket Fastener	10 N·m	89 lb in
Accelerator Pedal Cable-to-bulkhead Fastener	15 N·m	11 lb ft
Air Cleaner Lower Assembly Fastener	18 N·m	13 lb ft
Camshaft Position (CMP) Actuator Solenoid Valve Fastener	7.5 N·m	66 lb in
Camshaft Position (CMP) Actuator Solenoid Valve Oil Filter Fastener	30 N·m	22 lb ft
Camshaft Position (CMP) Sensor Fastener	8.8 N·m	77 lb in
Crankshaft Position (CKP) Sensor Fastener	8.8 N·m	77 lb in
Engine Coolant Temperature (ECT) Sensor	20 N·m	15 lb ft
Engine Cover Plate Fastener	9 N·m	80 lb in
Evaporative Emission (EVAP) Canister Purge Valve Fastener	8.8 N·m	77 lb in
EVAP Canister Support Bracket Fastener	18.5 N·m	13 lb ft
EVAP Canister Vent Solenoid Valve Fastener	15 N·m	11 lb ft
EVAP/Fuel Pipe Protector Fasteners	1.2-2 N·m	11-18 lb in
Fuel Filler Pipe Bracket Fastener	30 N·m	22 lb ft
Fuel Filler Pipe-to-Fuel Filler Pipe Bracket Fasteners	6 N·m	53 lb in
Fuel Injector Wire Harness Cover Plate Fastener	16 N·m	12 lb ft
Fuel Pipe Front Bulkhead Support Fastener	6 N·m	53 lb in
Fuel Rail Fastener	18.5 N·m	13 lb ft
Fuel Rail Inlet Pipe Hold Fastener	9 N·m	80 lb in
Fuel Sender Assembly Hold Down Plate Fastener	4 N·m	35 lb in
Fuel Tank Retaining Strap Fastener	39 N·m	29 lb ft
Heated Oxygen Sensor (HO2S) 1	44 N·m	32 lb ft
Heated Oxygen Sensor (HO2S) 2	44 N·m	32 lb ft
Idle Air Control (IAC) Fasteners	18.5 N·m	13 lb ft
Ignition Coil Fastener	9 N·m	80 in ft
Intake Manifold Fastener	18.5 N·m	13 lb ft
Knock Sensor (KS)	39 N·m	29 lb ft
Mass Air Flow (MAF) Sensor Fasteners	2 N·m	18 lb in
Muffler Flange Fasteners	50 N·m	37 lb ft
Muffler Retaining Band Fasteners	13 N·m	115 lb in
Negative Battery Cable Terminal Retainer Fastener	15 N·m	11 lb ft
Oil Filter Plug	21 N·m	15 lb ft
Parking Brake Cable Fasteners	6 N·m	53 lb in
Powertrain Control Module (PCM) Mounting Fastener	15 N·m	11 lb ft
Power Steering Pressure (PSP) Switch	21 N·m	15 lb ft
Spark Plug	18 N·m	13 lb ft
Throttle Body/Accelerator Cable Bracket Fastener	20 N·m	15 lb ft

Throttle Body Fastener	20 N·m	15 lb ft
Throttle Position (TP) Sensor Fasteners	3.5 N·m	30 lb in
TV Cable and Bracket Fastener	8.8 N·m	77 lb in
Vehicle Speed Sensor (VSS) Fastener	16 N·m	12 lb ft

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.

Exhaust System

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Front Pipe-to-Exhaust Manifold Bolts	50 N·m	37 lb ft
Front Pipe-to-Three Way Catalytic Converter (TWC) Clamp	50 N·m	37 lb ft
Hanger Bolts	13 N·m	115 lb in
Heated Oxygen Sensor #1 Nuts	41 N·m	30 lb ft
Heated Oxygen Sensor #2	45 N·m	33 lb ft
Three Way Catalytic Converter (TWC)-to-Muffler/Tail Pipe Assembly	50 N·m	37 lb ft

Exhaust System Description

Important

Use of non-OEM parts may cause driveability concerns.

The exhaust system design varies according to the model designation and the intended use of the vehicle.

In order to secure the exhaust pipe to the exhaust manifold, the exhaust system utilizes a flange and seal joint coupling. A flange and gasket coupling secures the catalytic converter assembly to the muffler assembly.

Hangers suspend the exhaust system from the underbody, allowing some movement of the exhaust system and disallowing the transfer of noise and vibration into the vehicle.

Heat shields protect the vehicle from the high temperatures generated by the exhaust system.

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 - MB4 and MB5

Transaxle Specifications

Application	Specification	
	Metric	English
Distance from the Gearshift Control Lever Knob to the Instrument Panel	122 mm	4.8 in
Gearshift Control Lever Vertical Play (Maximum)	0.2 mm	0.0007 in

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Backup Lamp Switch	23 N·m	17 lb ft
Clutch Line Bracket Bolts	12 N·m	106 lb in
Clutch Release Cylinder Bolts	12 N·m	106 lb in
Clutch Release Lever Bolt and Nut	23 N·m	17 lb ft
Extension Rod Retaining Nut	40 N·m	29 lb ft
Flywheel Cover Bolts	20 N·m	15 lb ft
Front Transaxle Bolt	60 N·m	44 lb ft
Gearshift Control Lever Guide Plate Bolts	10 N·m	89 lb in
Gearshift Control Lever Housing Nuts	6 N·m	53 lb in
Gearshift Control Lever Housing-to-Guide Plate Nuts	40 N·m	29 lb ft
Gearshift Guide Case Bolts	12 N·m	106 lb in
Gearshift Interlock Bolt	28 N·m	21 lb ft
Gearshift Yoke Bolt	28 N·m	21 lb ft
Heat Insulator Bolts and Nut	20 N·m	15 lb ft
Hold Down Bracket Bolt and Nut	12 N·m	106 lb in
Left Case Cover Bolts	12 N·m	106 lb in
Left Transaxle Mount Bracket Bolts	60 N·m	44 lb ft
Left Transaxle Mount Bolts	60 N·m	44 lb ft
Left Transaxle Mount Retaining Nuts	60 N·m	44 lb ft
Left Transaxle Mount Through Bolt	60 N·m	44 lb ft
Lower Transmission to Engine Bolts		
• #1 Bolts	23 N·m	11 lb ft
• #2 Bolts	46 N·m	34 lb ft
Rear Transaxle Mount Retaining Bolts	60 N·m	44 lb ft
Rear 3 Mount Nuts	57 N·m	42 lb ft
Rear Transaxle Mount Through Bolt and Nut	60 N·m	44 lb ft
Right Case-to-Engine Block Mounting Bolts	60 N·m	44 lb ft
Speedometer Driven Gear Case Retaining Bolt	7 N·m	62 lb in
Starter Bolts	39 N·m	29 lb ft
Starter Motor Retaining Bolts	28 N·m	21 lb ft
Transaxle Drain Plug	21 N·m	15 lb ft
Transaxle Hanger Bolt	12 N·m	106 lb in
Transaxle Oil Level/Filler Plug	21 N·m	15 lb ft
Transaxle Side Cover Bolts	12 N·m	106 lb in
Transaxle Upper Side Mounting Bolts	64 N·m	47 lb ft
Vehicle Speed Sensor Bolt	6 N·m	53 lb in

Lubrication Specifications

Application	Specification	
	Metric	English
Manual Transaxle Drain and Refill	2.4 liters	2.5 quarts

Transmission General Description

Synchronizers

The transaxle is designed for the use with transverse-mounted engines, and therefore incorporates the differential. It is similiar to other transaxles in its general construction features. The case is made of aluminum for a high strength-to-weight ratio. The design incorporates the familiar parallel dual shaft arrangement which minimizes weight and conserves space. All forward gears are synchronized, while reverse uses the sliding idler gear arrangement. The synchronizers for 1st and 2nd gears are located on the output shaft. The input shaft carries the synchronizers for 3rd, 4th, and 5th gears. This proven design offers good shift feel with low idling noise.

Fifth and Reverse Gearshift Cam

The following components operate together in order to prevent the gearshift control lever from being shifted from 5th gear directly to reverse:

- The 5th and reverse gearshift cam and return spring
- The gearshift interlock plate

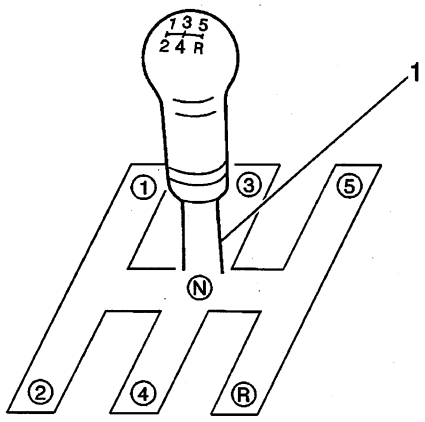
When the gearshift control lever shifts to 5th gear, the 5th and reverse gearshift cam turns clockwise with the gearshift and select shaft. The cam guide return spring pushes the 5th and reverse gearshift cam upward. The 5th and reverse gearshift shaft meets the 5th to reverse interlock guide bolt at this location. Then the 5th and reverse gearshift cam cannot turn any further. A 5th to reverse gear shift is no longer possible when the 5th and reverse gearshift cam cannot turn.

Shifting from 5th gear to neutral is possible when a reverse gear shift remains canceled. When the gearshift and select shaft moves to the neutral position between 3rd and 4th gears, the 5th and reverse gearshift cam cancels. Moving the gearshift control lever to the position between the 5th and reverse causes the following conditions:

- The gearshift and select shaft moves upward.
- The 5th and reverse interlock guide bolt holds the 5th and reverse gearshift cam stationary.

The gearshift and select lever can now move to the reverse position without interference from the 5th and reverse gearshift cam.

Control Cables Gearshift Controls



Gear selection begins in the gearshift control lever (1).

The gearshift control shaft transmits gear selection from the gearshift control lever to the transaxle. The gearshift control shaft joint connects the gearshift control shaft to the transaxle gearshift shaft.

The shift lever movement is transmitted to the transaxle by a rigid cable.

This allows vibration from the engine and the transaxle to be absorbed by the cable assembly and not to be transmitted to the body or shift lever.

An arm and a yoke to the gearshift and select shaft assembly transmits the transaxle gearshift shaft movement when the transaxle gearshift shaft performs the following movements:

- The transaxle gearshift shaft moves in.
- The transaxle gearshift shaft moves out.
- The transaxle gearshift shaft turns.

The gearshift and select shaft assembly actuates each shift shaft and fork for the desired transaxle gearshift. A gear shift interlock plate prevents 2 different gears from engaging during shifting.

Clutch

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Bracket to Instrument Panel Bolt	15 N·m	11 lb ft
Clutch Actuator Cylinder Bolts	12 N·m	9 lb ft
Clutch Master Cylinder Mounting Nuts	12 N·m	106 lb in
Clutch Pedal Position (CPP) Switch Lock Nut	13 N·m	115 lb in
Clutch Pedal Shaft Bolt and Nut	20 N·m	15 lb ft
Clutch Pressure Plate Cover Bolts	23 N·m	17 lb ft
Flywheel Bolts	88 N·m	65 lb ft
Master Cylinder Retaining Nuts	21 N·m	15 lb ft

Hydraulic Clutch Description

Hydraulic Clutch

The hydraulic clutch mechanism engages and disengages the clutch system.

The clutch release system consists of the following components:

- The Clutch master cylinder
- The 2 fluid pipes
- The 1 fluid hose
- The Clutch actuator cylinder assembly

A pushrod controls the clutch master cylinder. The cylinder is mounted to the front of the dash. The clutch actuator cylinder assembly is mounted to the side the clutch housing.

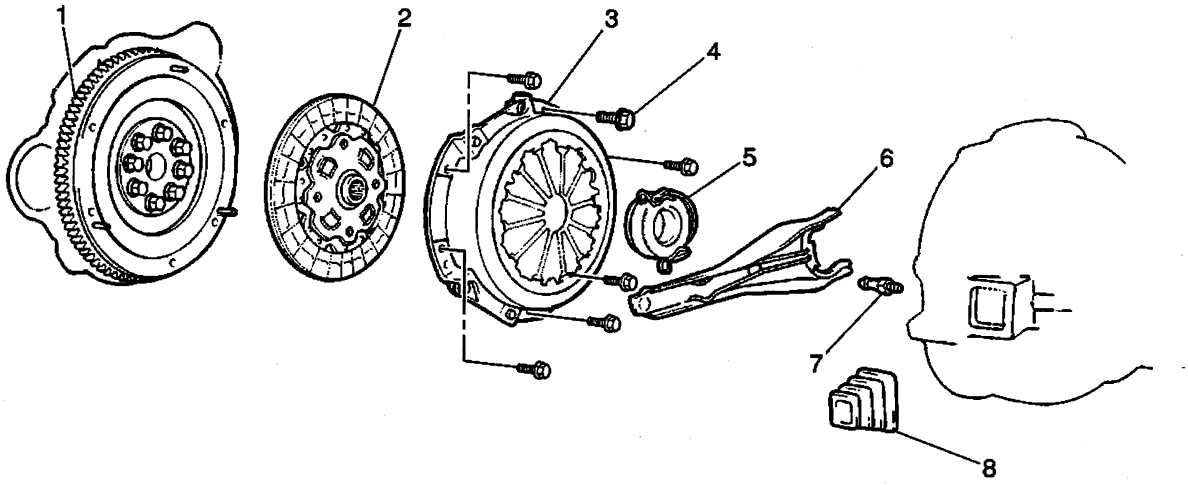
The clutch hydraulic system is serviced as 2 components, the clutch master cylinder assembly and the clutch actuator cylinder assembly, 2 fluid pipes and 1 fluid hose.

Depressing the clutch pedal moves a piston inside the clutch master cylinder and displaces hydraulic clutch fluid to the clutch actuator cylinder. A hydraulic force is developed from the release bearing pressing on the diaphragm spring. The force of the diaphragm spring on the clutch disc decreases as the force of the release bearing increases. This process continues until the clutch is disengaged. The hydraulic clutch system does not require adjustment.

Hydraulic Clutch Fluid

When adding fluid or refilling the system after service operations, use Hydraulic Clutch Fluid GM P/N 12345347 or an equivalent fluid that meets DOT 3 specifications only.

Clutch Operating Members

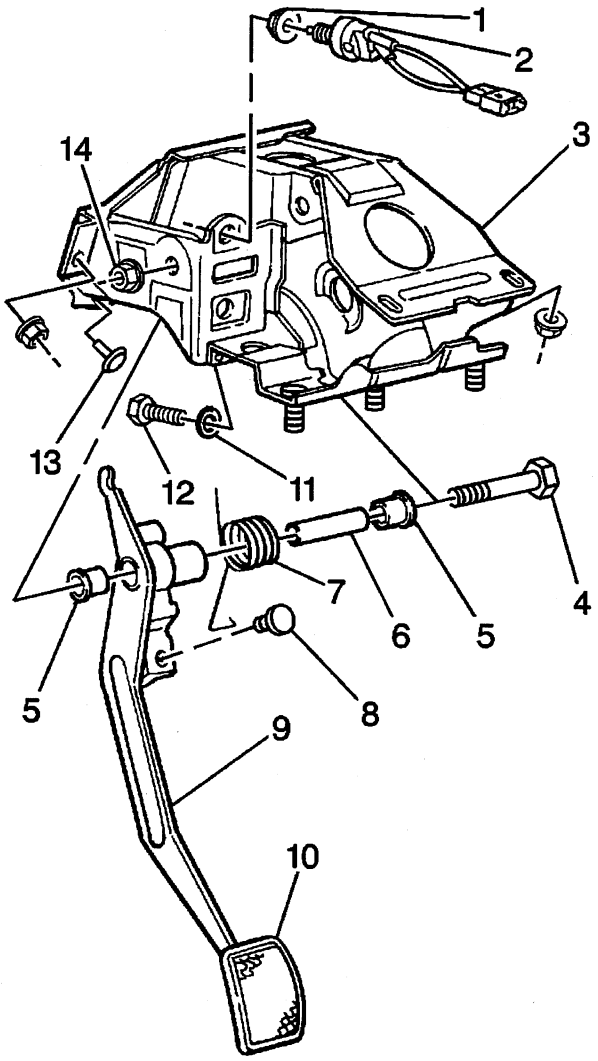


The clutch assembly contains the following 5 major components:

- The flywheel (1)
- The clutch disc (2)
- The clutch pressure plate (3)
- The clutch release bearing (5)
- The clutch release fork (6)

The clutch disc (2) is a single, dry disc composed of asbestos material which is riveted onto a steel plate (similar to a brake pad). The hub of the clutch disc is splined to the transaxle input shaft. The hub turns the transaxle input shaft when the clutch disc is engaged. The torsional coil springs are placed between the clutch disc and the clutch hub. The torsional coil springs reduce shock upon clutch engagement.

The clutch pressure plate (3) is bolted to the flywheel and turns with the engine. The clutch disc (2) is fitted between the clutch pressure plate (3) and the flywheel (1). The clutch pressure plate is loaded with a diaphragm type spring which maintains constant pressure against the clutch disc and the flywheel when the clutch is engaged. When the clutch pedal is depressed, the clutch release fork (6) pushes the clutch release bearing (5) into the clutch pressure plate spring levers. This releases pressure against the clutch disc and the flywheel, interrupting engine torque to the transaxle. When the clutch pedal is released, clutch pressure plate spring pressure releases and applies pressure against the clutch disc and the flywheel. This condition causes the flywheel to turn the clutch disc and the transaxle input shaft.



The clutch pedal position (CPP) switch (2) is mounted above the clutch pedal (10) and contacts the clutch pedal lever (9). This switch is incorporated in the starter motor circuit in order to prevent the engine from being started with the clutch engaged or the transaxle in gear. When the clutch pedal is not depressed, an open in the starter motor circuit prevents the starter from operating. When the clutch pedal is depressed, the circuit closes, completing the starter motor circuit.

Automatic Transmission - 3 Speed-MB3

Fluid Capacity Specifications

Application	Specification	
	Metric	English
Differential	1.4 liters	1.5 qts
Fluid Recommended	Dexron®-III Automatic Transmission Fluid GM P/N 12346143 or equivalent	
Overhaul Less Torque Converter	5.5 liters	5.8 qts
Transaxle Fluid Pan Removal	2.5 liters	2.6 qts

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accumulator Cover Bolts	10 N·m	89 lb in
Air Cleaner (ACL) Bolts	12 N·m	106 lb in
Apply Pipe Bracket Bolts	10 N·m	89 lb in
Center Crossmember Rear Bolt and Nuts	61 N·m	45 lb ft
Detent Spring Bolts	10 N·m	89 lb in
Differential Drain Plug	39 N·m	29 lb ft
Differential Filler Plug	39 N·m	29 lb ft
Fluid Cooler Inlet Pipe Bracket Bolt	5 N·m	44 lb in
Fluid Cooler Outlet Pipe Bracket Bolt	5 N·m	44 lb in
Fluid Filler Tube Bracket Bolt	5 N·m	44 lb in
Fluid Filter Screen Bolts	10 N·m	89 lb in
Flywheel-to-Torque Converter Bolts	19 N·m	14 lb ft
Front Exhaust Pipe Support Bolts	19 N·m	14 lb ft
Front Exhaust Pipe Support Nuts and Bolts	19 N·m	14 lb ft
Front Exhaust Pipe-to-Ehaust Manifold Nuts	62 N·m	46 lb ft
Front Exhaust Pipe-to-TWC Mating Flange Bolts	43 N·m	32 lb ft
Front Suspension Crossmember Bolts	206 N·m	152 lb ft
Front Transaxle Mount Bolts	64 N·m	47 lb ft
Front Transaxle Mount Through Bolt and Nut	87 N·m	64 lb ft
Governor Cover Retaining Bolts	13 N·m	115 lb in
Ground Strap Bolt	13 N·m	115 lb in
Inlet and Outlet Fluid Cooler Pipe Flare Nuts	27 N·m	20 lb ft
Inner Shift Select Cable Grommet Retainer Bolts	5 N·m	44 lb in
Left Drive Axle Stone Shield Bolts	5 N·m	44 lb in
Left Transaxle Mount Through Bolt	87 N·m	64 lb ft
Left Transaxle Mounting Bracket Bolts	56 N·m	41 lb ft
Left Transaxle Mounting Bracket Reinforcement Bolts	21 N·m	15 lb ft
Lower Engine Reinforcement Brace Bolts	64 N·m	47 lb ft
Lower Valve Body Bolts	5.4 N·m	48 lb in
Manual Lever Nut	12 N·m	106 lb in
Manual Selector Bolts	13 N·m	115 lb in
Manual Shaft Nut	6.9 N·m	61 lb in
Manual Valve Body Bolts	10 N·m	89 lb in
Outer Shift Select Cable Grommet Retainer Bolts	5 N·m	44 lb in
Outlet Fluid Cooler Pipe Flare Nuts	27 N·m	20 lb ft
Park/Neutral Position (PNP) Switch Bolts	5.4 N·m	48 lb in
Rear Transaxle Mount Nuts	57 N·m	42 lb ft
Rear Transaxle Mount Through Bolt	87 N·m	64 lb ft
Right Kick Panel Plastic Nut	5.4 N·m	48 lb in
Shift Select Cable Nut	12 N·m	106 lb in

Solenoid Wire Harness Retaining Bolt	6 N·m	53 lb in
Splash Shield Bolts	5 N·m	44 lb in
Throttle Valve Cam Bolt	10 N·m	89 lb in
Transaxle Cooler Pipe Retaining Bracket Bolt	10 N·m	7.5 lb in
Transaxle Drain Plug	23 N·m	17 lb ft
Transaxle Fluid Pan Bolts	4.9 N·m	43 lb in
Transaxle-to-Engine Bolts	64 N·m	47 lb ft
TV Cable Adjust Nut	8 N·m	71 lb in
TV Cable Guide Bracket Bolt	8 N·m	71 lb in
TV Cable Locknut	8 N·m	71 lb in
TV Cable Retaining Bolt	8 N·m	71 lb in
Upper Valve Body Bolts	5.4 N·m	48 lb in
Valve Body Assembly Bolts	10 N·m	89 lb in
Vehicle Speed Sensor (VSS) Bolt	6 N·m	53 lb in

Automatic Transmission Shift Lock Control Description

The automatic transmission shift lock control system prevents the driver from shifting out of Park without pressing the brake pedal. The shift lock solenoid is energized when the ignition is in the ON position and the vehicle is in Park. The shift lock solenoid is mounted near the floor shifter in the front floor console, and mechanically locks the shifter from moving. When pressure is applied to the brake pedal, the shift lock solenoid is de-energized and releases the locking tab on the floor shifter.

Automatic Transmission Shift Lock Control Circuit Description

The automatic transmission shift interlock is designed to prevent shifting the transaxle out of PARK without pressing the brake pedal. The shift lock control module controls the shift lock solenoid and the ignition key lock solenoid based on inputs from the CIG and ECU-IG fuses, the stoplamp switch and the shift lock control switch. The shift lock solenoid is energized when the ignition switch is in ACC, ON or START and the shift lock control switch is in the P position. The stoplamp switch is provided battery voltage from the STOP fuse. When the brake pedal is depressed, a brake signal is sent to the module and the solenoid is de-energized allowing the transaxle to be shifted out of the PARK position. The solenoid remains de-energized until the transaxle is shifted to PARK. When the transaxle is shifted to the PARK position, a signal is sent to the module through the control switch and the solenoid becomes re-energized.

Automatic Transmission - 4 Speed-MS7

Fluid Capacity Specifications

Application	Specification	
	Metric	English
Fluid Recommended	Dexron®-III Automatic Transmission Fluid GM P/N 12346143 or equivalent	
Overhaul Less Torque Converter	3.5 liters	3.7 qts
Overhaul with New Torque Converter	4.9 liters	5.2 qts
Pan Removal	1.5 liters	1.6 qts

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Air Cleaner (ACL) Bolts	12 N·m	106 lb in
Center Crossmember Rear Bolt and Nuts	61 N·m	45 lb ft
Detent Spring Bolts	10 N·m	89 lb in
Fluid Cooler Inlet Pipe Bracket Bolt	5 N·m	44 lb in
Fluid Cooler Outlet Pipe Bracket Bolt	5 N·m	44 lb in
Fluid Filler Tube Bracket Bolt	5 N·m	44 lb in
Fluid Filter Screen Bolts	10 N·m	89 lb in
Flywheel-to-Torque Converter Bolts	19 N·m	14 lb ft
Front Exhaust Pipe Support Bolts	19 N·m	14 lb ft
Front Exhaust Pipe Support Nuts and Bolts	19 N·m	14 lb ft
Front Exhaust Pipe-to-Exhaust Manifold Nuts	62 N·m	46 lb ft
Front Exhaust Pipe-to-TWC Mating Flange Bolts	43 N·m	32 lb ft
Front Suspension Crossmember Bolts	206 N·m	152 lb ft
Front Transaxle Mount Bolts	64 N·m	47 lb ft
Front Transaxle Mount Through Bolt and Nut	87 N·m	64 lb ft
Ground Strap Bolt	34 N·m	25 lb ft
Inlet and Outlet Fluid Cooler Pipe Flare Nuts	27 N·m	20 lb ft
Inner Shift Select Cable Grommet Retainer Bolts	5 N·m	44 lb in
Left Drive Axle Stone Shield Bolts	5 N·m	44 lb in
Left Transaxle Mount Through Bolt	87 N·m	64 lb ft
Left Transaxle Mounting Bracket Bolts	56 N·m	41 lb ft
Left Transaxle Mounting Bracket Reinforcement Bolts	21 N·m	15 lb ft
Lower Engine Reinforcement Brace Bolts	64 N·m	47 lb ft
Lower Valve Body-to-Upper Valve Body Bolts 38 mm (1.50 in)	6.4 N·m	57 lb in
Lower Valve Body-to-Upper Valve Body Bolts 25 mm (0.98 in)	10 N·m	89 lb in
Manual Lever Nut	12 N·m	106 lb in
Manual Selector Bolts	13 N·m	115 lb in
Manual Shaft Nut	6.9 N·m	61 lb in
Outer Shift Select Cable Grommet Retainer Bolts	5 N·m	44 lb in
Pressure Relief Valve Retaining Bolt	6.4 N·m	57 lb in
Park/Neutral Position (PNP) Switch Bolts	5.4 N·m	48 lb in
Rear Transaxle Mount Nuts	57 N·m	42 lb ft
Rear Transaxle Mount Through Bolt	87 N·m	64 lb ft
Right Kick Panel Plastic Nut	5.4 N·m	48 lb in
Shift Select Cable Nut	12 N·m	106 lb in
Shift Solenoid Retaining Bolt	6.4 N·m	57 lb in
Solenoid Wire Harness Clip Bolt	6 N·m	53 lb in
Solenoid Wire Harness Retaining Bolt	6 N·m	53 lb in
Solenoid Wiring Harness Retaining Bracket Bolt	20 N·m	15 lb ft

Splash Shield Bolts	5 N·m	44 lb in
Throttle Valve Cam Bolt	10 N·m	89 lb in
Torque Converter Clutch (TCC) Solenoid Retaining Bolt	6.4 N·m	57 lb in
Transaxle Drain Plug	17 N·m	13 lb ft
Transaxle Cooler Pipe Retaining Bracket Bolt	10 N·m	7.5 lb in
Transaxle Drain Plug	23 N·m	17 lb ft
Transaxle Fluid Pan Bolts	4.9 N·m	43 lb in
Transaxle Solenoid Wire Harness Retaining Bolt	5.5 N·m	49 lb in
Transaxle-to-Engine Bolts	64 N·m	47 lb ft
TV Cable Adjust Nut	8 N·m	71 lb in
TV Cable Guide Bracket Bolt	8 N·m	71 lb in
TV Cable Locknut	8 N·m	71 lb in
TV Cable Retaining Bolt	8 N·m	71 lb in
Valve Body Assembly Bolts	10 N·m	89 lb in
Vehicle Speed Sensor (VSS) Bolt	6 N·m	53 lb in

Automatic Transmission Shift Lock Control Description

The automatic transmission shift lock control system prevents the driver from shifting out of Park without pressing the brake pedal. The shift lock solenoid is energized when the ignition is in the ON position and the vehicle is in Park. The shift lock solenoid is mounted near the floor shifter in the front floor console, and mechanically locks the shifter from moving. When pressure is applied to the brake pedal, the shift lock solenoid is de-energized and releases the locking tab on the floor shifter.

Automatic Transmission Shift Lock Control Circuit Description

The automatic transmission shift interlock is designed to prevent shifting the transaxle out of PARK without pressing the brake pedal. The shift lock control module controls the shift lock solenoid and the ignition key lock solenoid based on inputs from the CIG and ECU-IG fuses, the stoplamp switch and the shift lock control switch. The shift lock solenoid is energized when the ignition switch is in ACC, ON or START and the shift lock control switch is in the P position. The stoplamp switch is provided battery voltage from the STOP fuse. When the brake pedal is depressed, a brake signal is sent to the module and the solenoid is de-energized allowing the transaxle to be shifted out of the PARK position. The solenoid remains de-energized until the transaxle is shifted to PARK. When the transaxle is shifted to the PARK position, a signal is sent to the module through the control switch and the solenoid becomes re-energized.

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

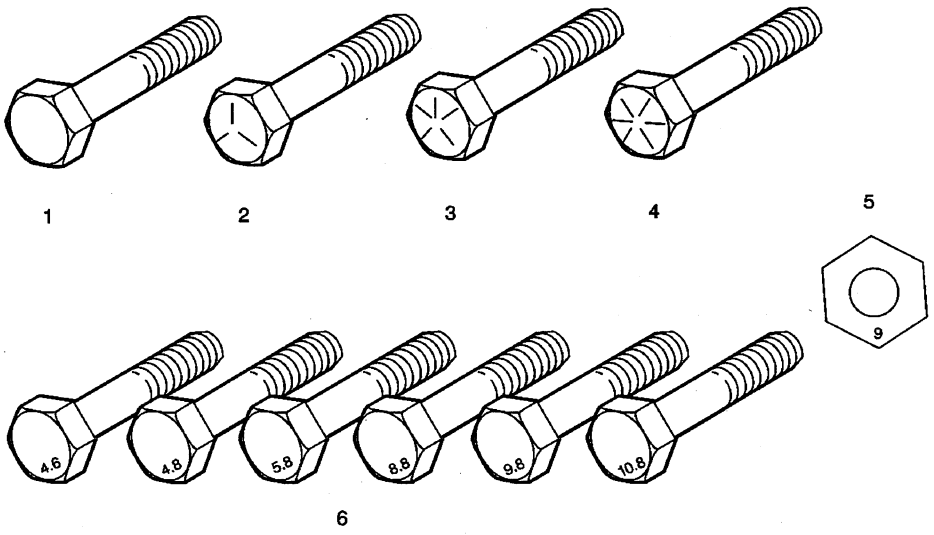
Metric Fasteners

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

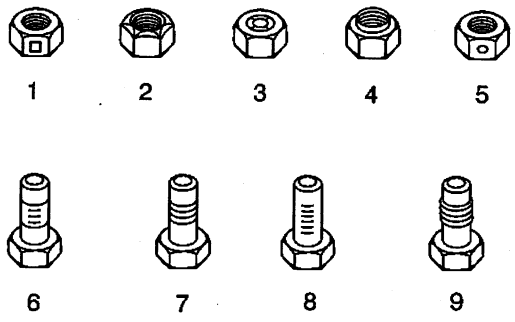
These fasteners accomplish the thread interface by a designed distortion or deformation in the fastener.

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