Chevrolet

Metro

2001

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Product Information

2001 Chevrolet Metro: Becomes Fleet-Only Vehicle

DETROIT — For 2001, Chevrolet has pared its subcompact Metro lineup by eliminating all models but the LSi Sedan, and it will be offered only to fleet and rental company buyers.

"Metro is for car buyers who want high gas mileage and low cost transportation," says Margaret Brooks, Metro brand manager. "Our quality has been superb."

The 2001 Metro LSi Sedan is maneuverable, easy-to-park and well-equipped with standard features rising well beyond the more utilitarian offerings of some other manufacturers. It offers characteristics ideal for fleet and rental companies that need well-equipped, economical small cars. Companies involved in light urban delivery services or in-city account calls will also appreciate what Metro has to offer.

Comfort and convenience items such as air conditioning, 3-speed automatic transmission, AM/FM stereo radio w/digital clock, center console with dual cup holders, trip odometer, full carpeting and split-folding rear seats are all standard.

A full complement of safety features is also provided, including: dual air bags, front & rear seat shoulder belts, front disc/rear drum brakes w/dual fluid reservoirs, daytime running lamps, child- security rear door latches, composite halogen headlamps and brake/transmission interlock.

Metro's fuel-efficient but capable performance is delivered by a 1.3L SOHC aluminum engine with solid lifters and four valves per cylinder. Maneuverability and handling are enhanced with rack-and-pinion steering (power steering is optional), a 4-wheel independent MacPherson strut suspension and both front and rear stabilizer bars. Standard P155/80R-13 all-season, steel-belted radial tires ensure a smooth ride and responsive performance.

The Metro LSi Sedan will continue to be produced by CAMI (a joint-venture operation between General Motors and Suzuki) at their modern facilities in Ingersoll, Ontario, Canada.

What's New

Brand Identity

The Chevrolet Metro is one of the lowest-priced Chevys of all. Contributing to its value is a variety of standard features, including air conditioning, stainless-steel muffler, Daytime Running Lamps (DRLs) and the efficient 1.3 Liter SOHC 4-cylinder engine.

New for 2001

The Metro becomes a fleet-only vehicle in 2001

Metro History

Introduced in January 1989.
1990 – Upscale LSi Coupe and LSi Sedan models introduced
1991 – Metro Convertible introduced
1992 – New front and rear fascias; new interiors
1995 – All-new Metro Coupe exterior design; new Metro Sedan model; standard dual air bags; available 1.3 Liter, 4-cylinder engine (LSi Sedan)
1996 – Standard OBD II; optional 1.3 Liter engine available on Metro
1998 – Geo Metro name changes to Chevy Metro; redesigned front and rear fascias

Vehicle Overview

Models

- Metro LSi Sedan

Customer Profile

- Fleet only

Competition

- Kia Sephia
- Hyundai Accent
- Daewoo Lanos

Color and Trim

Exterior Colors

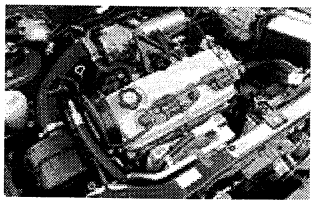
- Silver Metallic
- Dark Green Metallic
- White
- Sunset Red Metallic
- Dark Blue Metallic

Interior Fabric and Colors

- Gray Custom Cloth

Engine

1.3 Liter SOHC Engine



Technical Features of 1.3 Liter SOHC Engine:

- Multi-Port Fuel Injection
- Cast-aluminum cylinder head
- Distributorless ignition
- 4 valves per cylinder

Transmission

3-Speed Automatic Transmission

Technical Features of the 3-Speed Automatic Transmission:

- Brake/transmission shift interlock

Suspension

Front Suspension

- Independent MacPherson strut with coil springs
- 24mm stabilizer bar

Rear Suspension

- Independent MacPherson strut with coil springs
- 18mm stabilizer bar

Steering

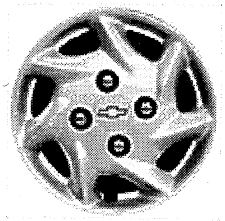
- Rack-and-pinion standard
- Power steering is optional

Brakes

- Front disc/rear drum
- Split braking system with individual master cylinder reservoirs

Wheels and Tires

Wheels



7-spoke full wheel cover with Chevy bowtie – standard

Tires

- P155/80R-13 all-season, steel-belted radial tires are standard
- Compact spare tire

Feature Availability

Interior Features	
Air bags — driver and front-passenger(1)	S
Air conditioning — with CFC-free refrigerant	S
Carpeting — full	S
Console — center, with dual cup holders and convenience tray	S
Defogger — rear-window, electric	O
Door locks — power	O(3)
— child security, rear	S
Door pockets	S
Floor mats — carpeted, front and rear	O(3)
Integrated instrument panel — features easy-to-read gauges and easy-to-operate controls	S
Mirror — inside, day/night rearview	S
Seats— rear full-folding	S
— rear split-folding with pass-through feature	O(3)
Trip odometer	S
Trunk release — remote	O(2,3)
Sound Systems	
AM/FM stereo with seek and digital clock	S
Exterior Features	
Bumpers — body-color	S
Daytime Running Lamps	S
Headlamps — composite halogen	S
Mirrors — outside, black, LH/RH manual	S
— outside, black, LH/RH remote	O(2,3)
Paint — basecoat/clearcoat	S
Tires — P155/80R-13	S
Wheel covers — 7-spoke, full	S
Spare size — compact	S
Wipers — intermittent	S
Functional Features	
Brakes — front disc/rear drum	S
Engine — 1.3 Liter SOHC L4 MFI	S
Exhaust system — muffler, stainless-steel (inner) and aluminum-coated steel (outer)	S
Steering — power	O(3)
Transmission — 3-speed automatic	S
Safety and Security Features	
Air bags – driver and front-passenger(1)	S
Child security rear-door locks	S
Daytime Running Lamps	S
Brake/transmission shift interlock (auto trans.)	S

S – Standard.
O – Optional. (Some options may be available only as part of a Preferred Equipment Group.)
NA – Not available.
(1) Always use safety belts and proper child restraints, even with air bags. Children are safer when properly secured in a rear seat. See the Owner's Manual for more safety information.
(2) Included with Optional LSi Convenience Package only.
(3) Included with Preferred Equipment Group 1SB.

Specifications

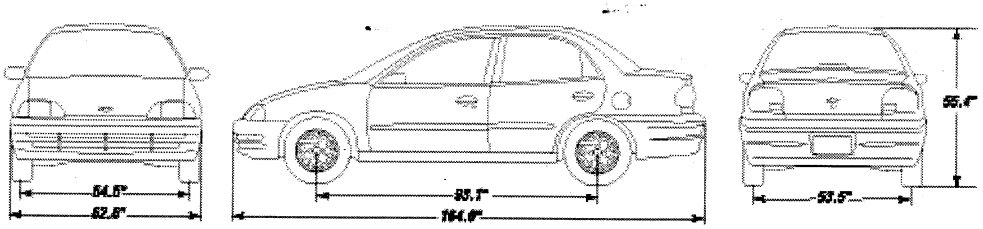
Engine Specifications	
	1.3 Liter SOHC
RPO	LY8
Displacement (liters/cu. in.)	1.3/79.0
Bore x stroke (in.)	2.91 x 2.97
(mm)	74 x 76
Compression ratio	9.5:1
Cylinder block material	aluminum
Cylinder head material	aluminum
Valvetrain configuration	SOHC
Valves per cylinder	4
Induction	MFI
Ignition system	distributorless ignition
Lifters	solid
Cam drive	belt
Coolant capacity (quarts/liters)	4.7/4.4
Oil capacity (quarts/liters)	3.3/3.1
Alternator rating (amps)	55
Battery (SAE rating, cca)	390
Recommended unleaded fuel	87 octane
Maximum engine speed (RPM)	6500
Horsepower/kW @ engine RPM	79/59 @ 6000
Torque (lb.-ft./N-m @ engine RPM)	75/101 @ 3000

Transmission Specifications	
Type	3-speed automatic
RPO	M60
First gear	2.81
Second gear	1.55
Third gear	1.00
Reverse	2.30
Final drive ratios	3.61
Fluid capacity (quarts/liters)	5.2/4.9
Case material	aluminum die-cast

Steering Specifications		
Type	Manual (standard)	Optional power
	rack-and-pinion	rack-and-pinion
Ratio (overall)	19.0:1	17.9:1
Turns stop-to-stop	3.70	3.70
Turning diameter curb-to-curb (ft./m)	31.5/9.6	31.5/9.6

Brake Specifications		
Front Brakes	U.S. Standard	Metric
— rotor size (diam. x thick.)	9.02 x .67 in.	229 x 17 mm
— swept area	139.8 sq. in.	902.0 sq. cm
Rear Brakes	U.S. Standard	Metric
— drum size (diam. x width)	7.87 x 1.18 in.	200 x 30 mm
— swept area	58.3 sq. in.	376.1 sq. cm

Dimensions

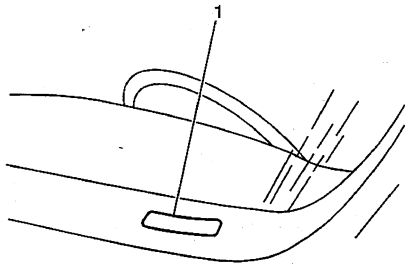


NOTE: All dimensions shown are inches/millimeters unless otherwise noted.

Exterior	
Wheelbase	93.1/2364
Length	164.0/4165
Width	62.6/1590
Height	55.4/1407
Tread width	
— front	54.5/1384
— rear	53.5/1358
Interior	
Headroom	
— front	39.3/998
— rear	37.3/947
Legroom	
— front	42.5/1079
— rear	32.2/817
Shoulder room	
— front	49.0/1244
— rear	48.3/1226
Hip room	
— front	46.9/1191
— rear	42.9/1089
Passenger volume (cu. ft./liters)	80.1/2269
Cargo volume (cu. ft./liters)	10.3/292.0
Interior volume, EPA index (cu. ft./liters)	90.4/2561
Capacities and Weights	
Seating	4
Fuel tank cap. (gal./lit. approx.)	10.3/39.0
Curb weight, estimated (lbs./kg)	1984/900

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	2	Canada
2	Manufacturer	C	CAMI
3	Make	1	Chevrolet
4-5	Carline/Series	MR	Metro
6	Body Style	2 5	2 Door 4 Door Sedan
7	Restraint System	2	Active (Manual) Belt with Driver and Passenger Inflatable Restraint System (Frontal)
8	Engine Type	6 2	1.0L L3 TBI 1.3L L4 MFI
9	Check Digit	--	--
10	Model Year	1	2001
11	Plant Location	6	Ingersoll, Ontario
12-17	Production Plant Sequence Number	--	--

VIN Derivative

Engine 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:

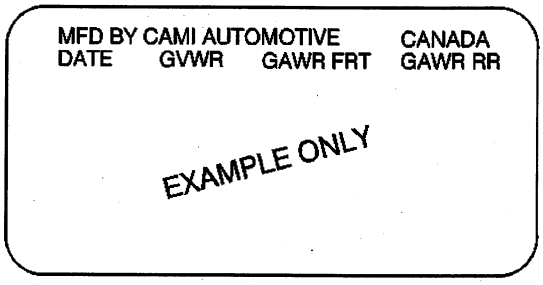
Position	Definition	Character	Description
1	Engine Type	G	--
2-3	Engine Displacement	10 or 13	10=1.0 Liter, 13=1.3 Liter
4	Model Year	1	2001
5-10	Plant Sequential Number	--	--

Transmission VIN Derivative

The transmissions are stamped or laser etched with a partial vehicle identification number (VIN), which was derived from the complete VIN. A transmission VIN derivative contains the following seven positions.

Position	Definition	Character	Description
1	Model Year	1	2001
2-7	Serial Number	--	--

Vehicle Certification Label



The vehicle certification label permanently located on the left door lock pillar. Refer to this label to obtain:

- 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).

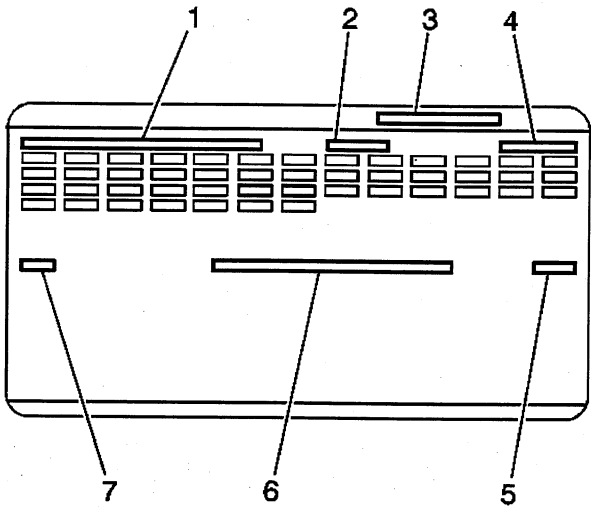
The GVW is the weight of the vehicle and everything it carries. Include the following items when figuring the GVW:

- 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. The label is located on the lower left-hand corner of the spare tire cover.

Tire Placard

RECOMMENDED

	FRONT	REAR	SPARE TIRE
TIRE SIZE	P165/65R13		T115/70D14
COLD TIRE PRESSURE AT MAX. LOAD	26PSI 180 kPa		60 PSI 420 kPa

VEHICLE CAPACITY

MAX LOAD (LBS)	688 (OCCUPANTS PLUS LUGGAGE)	
OCCUPANTS	FRONT 2	REAR 0

SEE OWNER'S MANUAL FOR ADDITIONAL INFORMATION

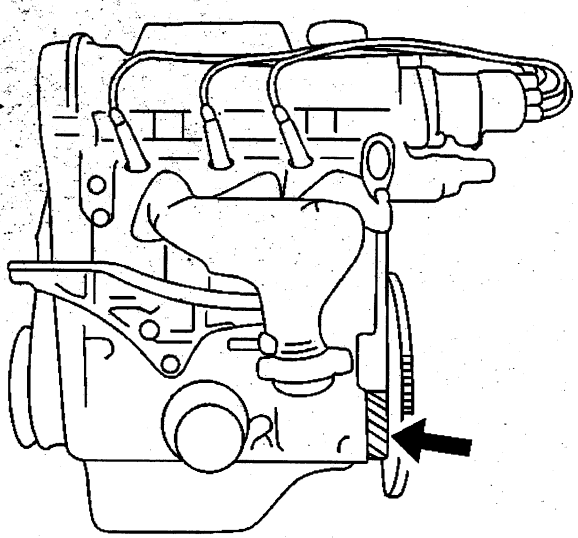
The tire placard is located on the left door lock pillar. Refer to the placard to obtain:

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

Engine ID and VIN Derivative Location

The eighth character in the Vehicle Identification Number (VIN) identifies the engine. Adhesive-backed labels attached to the engine, laser etching or stampings on the engine block indicate the engine unit number/date code. All engines are stamped with a VIN derivative. For more information on the VIN derivative, refer to VIN Derivative above.

1.0L Engine ID Location

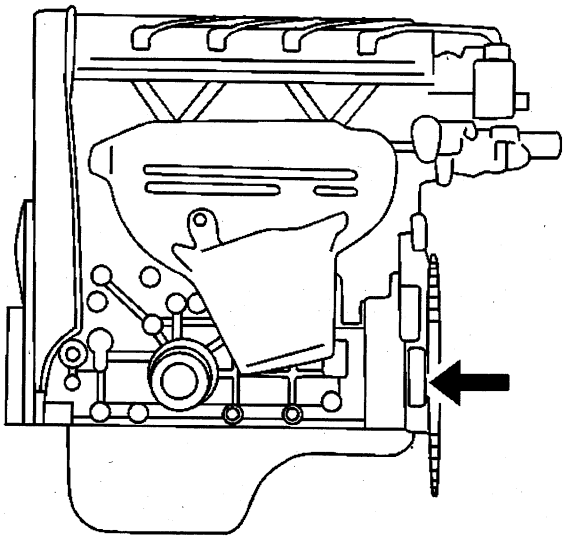


The engine code letter is the eight digit of the VIN, which identifies the engine.

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.

1.3L Engine ID Location



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

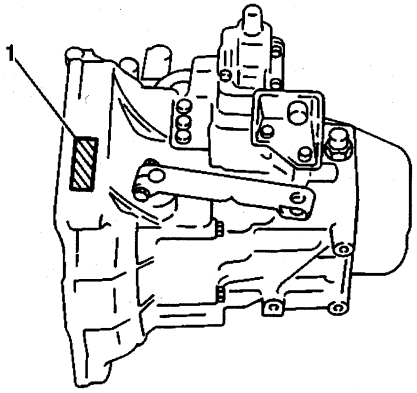
Stick-on labels attached to the engine, laser etching, or stampings in the engine block indicate the engine unit number/build code date.

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

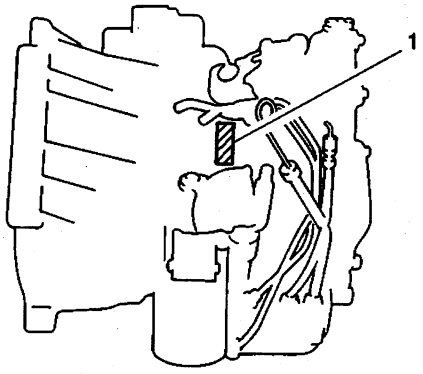
Transmission ID and VIN Derivative Location

The manual transaxle and automatic transaxle model identification are 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.

Manual Transmission



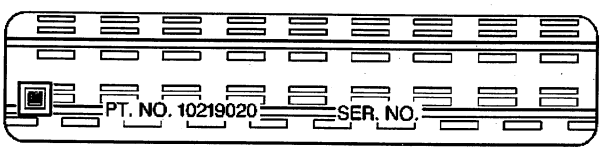
Automatic Transmission



Engine and Transmission Usage

Body Type	Car Line (Division)	Engine Size	Fuel System	Engine RPO	Trans Used	Trans RPO
MR	Metro (Chevrolet) / Firefly (GM Of Canada)	1.0L L3	TBI	LP2	M5	M42 / M58
MR	Metro (Chevrolet) / Firefly (GM Of Canada)	1.3L L4	MFI	LY8	M5	M42 / M58
MR	Metro (Chevrolet) / Firefly (GM Of Canada)	1.3L L4	MFI	LY8	A3	M60

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.

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
AF5	Adjuster Seat Easy Entry Pass
AK5	Inflatable Front Seat Restraint System
AM9	Split Back Folding Rear Seats
AN4	Child Restraint Provisions
AU3	Power Door Locks
A59	Compartment Lid Remote Release
B37	Front and Rear Carpeted Floor Mats
B4M	Vehicle Custom Feature Package
B84	Body Side Moldings
CD4	Intermittent Controlled Wipers
C25	Rear Window Wiper/Washer
C41	HVAC System Heater Outside Air, with Fan
C49	Rear Window Defogger
C60	Air Conditioning with Front Manual Controls
DL5	Roadside Service Information Decal
DR1	LH and RH Manual Rearview Mirrors
D42	Rear Compartmtent Security Cover
D68	LH and RH Remote Rearview Mirrors
FE9	Federal Emission Requirements
FX8	3.61 Final Drive Ratio
FX9	4.39 Final Drive Ratio
FY3	3.79 Final Drive Ratio
J41	Front Disc, Rear Drum Braking System
JM4	4-Wheel Anitlock Braking System (ABS)
LP2	1.0 Liter, 3-Cylinder Engine
LY8	1.3 Liter, 4-Cylinder Engine
MM5	Merchandised Transmission Manual 5 Speed Provisions
MX1	Merchandised Transmission Automatic Provisions
M42	5-Speed Manual Transmission
M58	5-Speed Manual Transmission (3-Cyl only)
M60	3-Speed Electronic Automatic Transmission
NB7	California Emission System TLEV
NC1	California Emisssion System LEV
NC9	California Emission System ZEV
NF2	Federal Emission System, Tier 1
NG1	MA/NY State Emission Requirements
NB8	MA/NY State Emission Override
NC7	Federal Emissions Override
N41	Power Steering
PB2	Plastic Wheel Trim Cover, ABS
P08	LSI Wheel Covers
T61	Daytime Running Lamps
UM6	AM/FM Stereo w/ Cassette
UM7	AM/FM Stereo
UX7	Dual Front Door Mounted 4 Speaker System, Deluxe Extended Range Package
U1C	AM/FM Stereo w/ Cassette and CD

U16	Engine Tachometer
U25	Rear Compartmtent Lamp
VC4	Price/Fuel Economy Label
VC5	Shipping Label
VG4	Undervehicle Protector Compound, Black
VG8	Notice to Buyer Vehicle Label
VK3	License Plate Front Mounting Package
V60	Vehicle Statement Gulf States Organization, Incomplete Vehicle
V73	Vehicle Statement US/Canada
V78	Vehicle Statement Delete
V83	Vehicle Statement ECE Organization
W8X	Radio Provisions Installation
YF5	California Emission Requirements
ZO5	Convenience Package
Z41	Pontiac Canadian Conversion
Z49	Modified Canadian Export, Mandatory Base Equipment
16U	Bright White
17U	Silvermist Metallic
19U	Black
29U	Blue Green Metallic
35U	Green Metallic
47U	Dark Blue Metallic
52D	Light Neutral Cloth Bucket Seats
52H	Medium Neutral II Cloth Bucket Seats
52I	Light Neutral Interior Trim
53U	Light Toreador Red Metallic
74U	Victory Red (297C)

Maintenance and Lubrication

Capacities - Approximate Fluid

Application	Specification	
	Metric	English
Automatic Transaxle		
• Drain and Refill	1.5 liters	1.6 quarts
• Overhaul w/o Torque Converter	3.5 liters	3.7 quarts
• Overhaul w/ Torque Converter	4.9 liters	5.2 quarts
Manual Transaxle		
• Drain and Refill	2.4 liters	2.5 quarts
Cooling System Capacity 1.0L (3-Cyl Engine)		
• Engine, Radiator and Heater Core	3.3 liters	3.49 quarts
• Coolant Recovery Reservoir	0.6 liters	0.63 quarts
• Total	3.9 liters	4.13 quarts
Cooling System Capacity 1.3L (4-Cyl w/ Automatic Transaxle)		
• Engine, Radiator and Heater Core	4.13 liters	4.37 quarts
• Coolant Recovery Reservoir	0.6 liters	0.63 quarts
• Total	4.73 liters	5.0 quarts
Cooling System Capacity 1.3L (4-Cyl w/ Manual Transaxle)		
• Engine, Radiator and Heater Core	4.0 liters	4.23 quarts
• Coolant Recovery Reservoir	0.6 liters	0.63 quarts
• Total	4.6 liters	4.9 quarts
Engine Oil (1.0L & 1.3L)		
• With Filter Change	3.3 liters	3.5 quarts
• Without Filter Change	3.1 liters	3.3 quarts
Fuel System		
• Fuel Tank	40.0 liters	10.6 gallons

Maintenance Items

Application	Specification
Air Cleaner (ACL) Filter	AC Type A1203C
Engine Oil Filter	AC Type PF53
Fuel Filter	GM P/N 96068664
Positive Crankcase Ventilation (PCV) Valve	GM P/N 96051849
Spark Plugs	
• AC Type (1.0 L engine)	R42XLS
• NGK Type (1.0 L engine)	BKR6ES-11
• NGK Type (1.3 L engine)	BKR6E-11
• Denso Type (1.0 L engine)	W20EPR-U11
• Denso Type (1.3 L engine)	K20PR-U11
Spark Plug and Gap	1.0-1.1 mm (0.039-0.045 in)

Drive Belt Tension Specifications

Application	Specification	
	Metric	English
Coolant Pump/Generator		
• New Belt (under 5 minutes of use)	5-7 mm at 10 kg	0.20-0.27 in at 22 lbs
• Used Belt	6-8 mm at 10 kg	0.24-0.32 in at 22 lbs
A/C Compressor	7-9 mm at 10 kg	0.28-0.35 in at 22 lbs
Power Steering Pump	7-9 mm at 10 kg	0.28-0.35 in at 22 lbs

Tire Inflation Pressure Specifications

Application	Specification	
	Metric	English
Front and rear tires (P155/80R13)	220 kPa	32 psi
Compact spare tire only	420 kPa	60 psi

Fluid and Lubricant Recommendations

Application	Fluid/Lubricant
Automatic Transaxle	DEXRON®-III Automatic Transmission Fluid (GM P/N 12346143) 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 Coolant (GM P/N 1052753), an 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.
Hood and Door Hinges	Multi-Purpose Lubricant, Superlube®, (GM P/N 12346241) or the equivalent.
Hood Latch Assembly and Secondary Latch	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), or an equivalent DOT-3 Brake Fluid.
Key Lock Cylinders	Multi-Purpose Lubricant, Superlube®, (GM P/N 12346241) or the equivalent
Manual Transaxle	GM Goodwrench Synthetic Manual Transmission Fluid (GM P/N 12346190) 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
Parking Brake Cable Guides	Chassis Lubricant (GM P/N 12377985) or a lubricant meeting the requirements of NLGI # 2, Category LB or GC-LB
Power Steering System	DEXRON®-III Automatic Transmission Fluid (GM P/N 12346143) or the equivalent
Weatherstrip Conditioning	Dielectric Silicone Grease (GM P/N 12345579), Weatherstrip Lubricant-Krytox (GM P/N 3634770) or the equivalent.
Windshield Washer Solvent	GM Optikleen ® Washer Solvent (GM P/N 1051515) or the equivalent.

Descriptions and Operations

Power Steering System Description

Power Steering Pump Description

The power steering pump uses a 10 vane hydraulic pump in order to provide steering assistance. The pump is driven by the engine using a multi-ribbed belt. The pump uses an engine speed sensing-type flow control valve. The valve reduces the output pressure to the gear as the engine speed increases. The valve provides higher pump pressure when the engine is at or near idle speed. The valve provides a lower, but safe, pressure at a high engine speed.

This vehicle uses a power steering pump which is mounted at the front of the transverse-mounted engine, toward the front of the engine compartment. The pump has an external mounted power steering fluid reservoir.

Power Steering Gear Description

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

If the hydraulic assist fails, the vehicle maintains manual control. This condition requires more steering effort.

Manual Steering System Description

Rack and pinion steering provides the following features:

- Simplicity
- Excellent control
- Excellent road feel

As you turn the steering wheel, the steering shaft and the pinion rotate. The pinion gear teeth mesh with the teeth on the rack, converting the rotary motion of the steering wheel into a linear motion of the rack.

The tie rods fasten to each end of the rack. The tie rods extend to the following components:

- The tie rod ends
- The right and the left steering knuckles

This design allows the driver to turn the wheels in the desired direction.

Steering Wheel and Column - Standard Description and Operation

The steering column includes the following 3 functions in addition to the steering function:

1. In a front-end collision, the steering column absorbs the energy from the crash. The steering column collapses in order to minimize injury to the driver.
2. The ignition switch locks the ignition switch cylinder and the steering column. This minimizes the chance of vehicle theft.
3. The steering column levers control the following components:
    - The turn signal switch
    - The headlamp switch
    - The headlamp dimmer switch
    - The windshield wiper switch
    - The windshield washer switch

The turn signal switch and the SIR coil are serviced as a unit. The switch consists of the following components:

- The turn signal switch
- The headlamp switch
- The headlamp dimmer switch
- The windshield wiper switch
- The windshield washer switch
- The hazard switch
- The inflatable restraint steering wheel module coil
- The turn signal switch base

Use the correct fasteners in order to ensure the energy-absorbing action of the steering column. Tighten the fasteners to the correct torque. During assembly, apply a thin layer of grease to all friction points.

Plastic injections keep the column rigid. The following actions may shear or loosen the plastic injections:

- Using an incorrect steering wheel puller
- Dropping the steering column
- Striking the steering column
- Leaning on the steering column

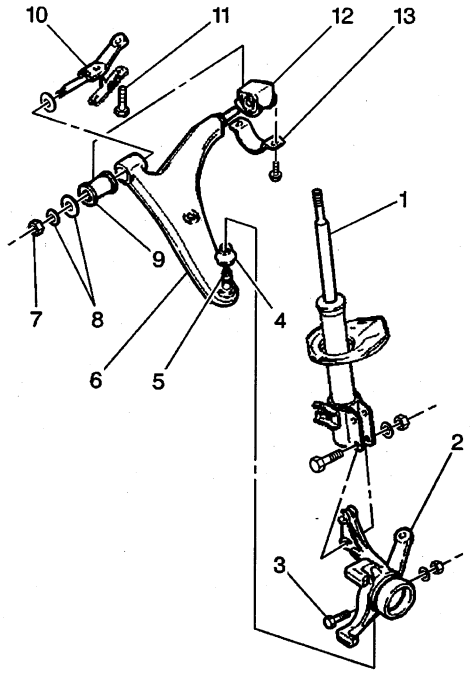
Ignition Lock System Description

All automatic transaxle equipped models of this vehicle are equipped with steering columns that contain a mechanical neutral start system. This system relies on a mechanical block in order to prevent starting the engine with the transaxle in any position other than P (park) or N (neutral).

An interlink (back drive) cable connects the ignition switch to the gearshift selector. This cable prevents the gearshift selector from moving unless the ignition is in the ON position.

Suspension Description and Operation

Front Suspension



The front suspension is independent and uses struts, as opposed to separate shock absorbers and coil springs.

The upper end of the front struts are anchored to the vehicle body by strut supports. Rubber mounts isolate the strut and strut supports. The lower end of each strut (1) connects to the upper end of the steering knuckle (2). The lower end of each knuckle attaches to the ball joint (5). The ball joint attaches to the suspension control arm (6).

Rear Suspension

The independent rear suspension on this vehicle utilizes struts and coil springs which are separate from each other. The springs can be removed without removing the struts. The struts (shock absorbers) attach to the body at their top and to the suspension knuckle at their bottom. The coil springs attach at the body at their top and to the rear suspension arm at their bottom.

The rear suspension arms fasten to the body by the front and the rear rubber bushings. A control rod runs from the body to the rear of each suspension knuckle.

The rear wheel bearings are housed in the brake drum/hub assembly on non ABS-equipped vehicles and in the hub assembly on ABS-equipped vehicles. Each wheel has dual inner and outer ball bearing assembly that cannot be serviced. If the bearings fail because of one of the following reasons, they must be replaced.

- Loss of grease
- Pitted or scored races
- Out-of-round bearings

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.

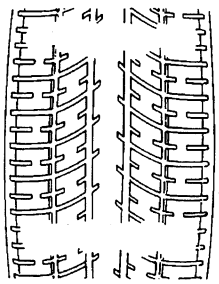
The following factors have an important influence on tire life:

- 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

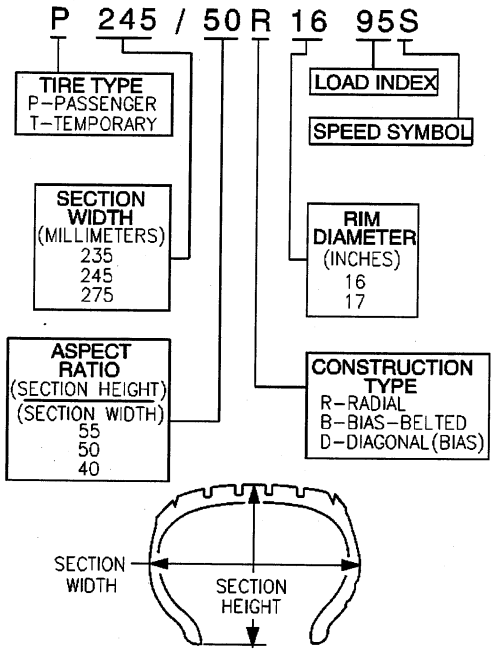
Tires with a lower than recommended pressure can cause the following conditions:

- 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

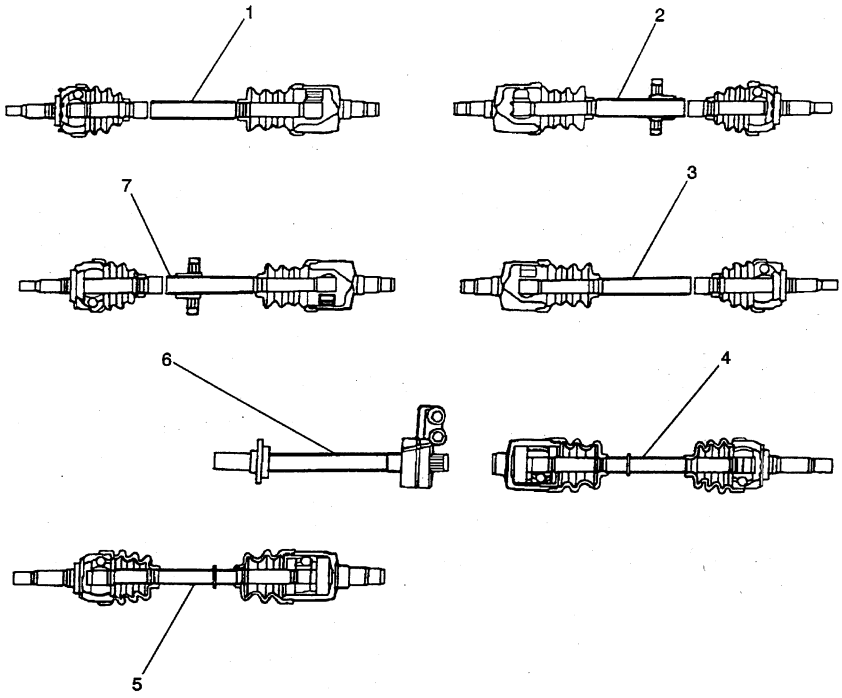
P-Metric Sized Tires Description



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



(1) Left Wheel Drive Shaft (Automatic Transaxle)
(2) Right Wheel Drive Shaft (Automatic Transaxle)
(3) Right Wheel Drive Shaft (Manual Transaxle 1.0L Vehicles Only)
(4) Right Wheel Drive Shaft (Manual Transaxle 1.3L Vehicles Only)
(5) Left Wheel Drive Shaft (Manual Transaxle 1.3L Vehicles Only)
(6) Right Wheel Intermediate Shaft (Manual Transaxle)
(7) Left Wheel Intermediate Shaft (Manual Transaxle 1.0L Vehicles Only)

The drive axle is a flexible assembly consisting of an inner constant-velocity joint and an outer constant-velocity joint. The joints are joined together by the wheel drive shaft. Three different types of joints are used on the drive axles, depending on the engine/transaxle combination. The inner joint or differential-side joint can be either a double offset or Tri-Pot design. These designs allow the differential side joint to be completely flexible as well as being capable of an in-and-out motion. This in-and-out motion allows the drive axle 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 manual transaxle model is equipped with a right intermediate shaft that is used as an extension to provide equal engine torque to the right wheel drive shaft.

Braking System Description and Operation

Hydraulic Brake System Description and Operation

System Component Description

The hydraulic brake system consists of the following:

Hydraulic Brake Master Cylinder Fluid Reservoir

Contains supply of brake fluid for the hydraulic brake system.

Hydraulic Brake Master Cylinder

Converts mechanical input force into hydraulic output pressure.

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

Hydraulic Brake Pressure Balance Control System

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

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

Hydraulic Brake Pipes and Flexible Brake Hoses

Carries brake fluid to and from hydraulic brake system components.

Hydraulic Brake Wheel Apply Components

Converts hydraulic input pressure into mechanical output force.

System Operation

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

Brake Assist System Description and Operation

System Component Description

The brake assist system consists of the following:

Brake Pedal

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

Brake Pedal Pushrod

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

Vacuum Brake Booster

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

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

Vacuum Source

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

Vacuum Source Delivery System

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

System Operation

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

Disc Brake System Description and Operation

System Component Description

The disc brake system consists of the following components:

Disc Brake Pads

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

Disc Brake Rotors

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

Disc Brake Pad Hardware

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

Disc Brake Caliper Hardware

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

System Operation

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

Drum Brake System Description and Operation

System Component Description

The drum brake system consists of the following:

Drum Brake Shoes

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

Brake Drums

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

Drum Brake Hardware

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

Drum Brake Adjusting Hardware

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

System Operation

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

Park Brake System Description and Operation

System Component Description

The park brake system consists of the following:

Park Brake Lever Assembly

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

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

Park Brake Cables

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

Park Brake Cable Equalizer

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

Park Brake Apply Lever

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

Park Brake Actuator/Adjuster

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

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

Drum Brake Shoes

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

System Operation

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

ABS Description and Operation

Antilock Brake System

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

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

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

Engine Description and Operation

Engine Mechanical – 1.0L

Mechanical Specifications

Application	Specification	
	Millimeters	Inches
General		
• Engine Type	L3	
• RPO Code	LP2	
• Displacement	1000 cc	61 CID
• Bore	74.15 mm	2.919 in
• Stroke	90 mm	3.54 in
• Firing Order	1-3-2	
• Spark Plug Type-AC	R42XLS	
• Spark Plug Gap	1.0-1.1 mm	0.039-0.043 in
Compression		
• Compression Pressure at 250 RPM (Standard)	1400 kPa	199 psi
• Compression Pressure (Minimum)	1100 kPa	156 psi
• Compression Pressure Difference Between Any Two Cylinders (Maximum)	100 kPa	15 psi
Engine Vacuum		
• Vacuum at 800 RPM at Sea Level	52.6-65.8 kPa	15.7-19.7 in Hg
Lubrication System		
• Oil Pressure (at 4000 RPM)	323-421 kPa	46.9-61.1 psi
• Oil Capacity with Filter Change	3.3L	3.5L
Cooling System		
• Cooling System Capacity	3.9L	4.1 qt
• Temperature at which Thermostat begins to Open	83°C	179°F
• Temperature at which Thermostat Fully Open	95°C	203°F
• Thermostat Valve Lift	More than 8 mm at 95°C (203°F	
• Radiator Cap Relief Valve Pressure	108 kPa	15.7 psi

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Air Cleaner-to-Cylinder Head Bolt	10 N·m	89 lb in
A/C Compressor Drive Belt Tensioner	45 N·m	33 lb ft
Battery Cable Nut	15 N·m	11 lb ft
Connecting Rod Bearing Cap Nuts	35 N·m	26 lb ft
Camshaft Housing Bolts	11 N·m	97 lb in
Camshaft Timing Gear Bolt	60 N·m	44 lb ft
Coolant Pump Pulley Bolts	24 N·m	18 lb ft
Crankshaft Pulley Bolts	16 N·m	12 lb ft
Crankshaft Timing Gear Bolt	130 N·m	96 lb ft
Cylinder Head-to-Engine Block Bolts	73 N·m	54 lb ft
Valve Rocker Arm Cover Nuts	5 N·m	44 lb in
Engine Oil Drain Plug	35 N·m	26 lb ft

Engine Oil Pan Bolts and Nuts	11 N·m	97 lb in
Exhaust Manifold Bolts and Nuts	23 N·m	17 lb ft
Exhaust Manifold-to-Front Pipe/Three Way Catalytic Converter (TWC) Assembly Bolts	45 N·m	33 lb ft
Exhaust Manifold Stiffener Bracket Bolts	50 N·m	37 lb ft
Flywheel Retaining Bolts	75 N·m	55 lb ft
Generator Mounting Bolts and Nuts	23 N·m	17 lb ft
Guide Tube Bolt	11 N·m	97 lb in
Heated Oxygen Sensor	40-50 N·m	29-36 lb ft
Heat Shield Bolts	6 N·m	49 lb in
Intake Manifold Mounting Bolts	23 N·m	17 lb ft
Lower Generator Cover Bolts	5.5 N·m	49 lb in
Main Bearing Bolts	54 N·m	40 lb ft
Oil Pressure Switch	14 N·m	10 lb ft
Oil Pump Mounting Bolts	11 N·m	97 lb in
Oil Pump Strainer Bolt	11 N·m	97 lb in
Oil Pump Strainer Bracket Bolt	11 N·m	97 lb in
Rear Engine Mount Through Bolt and Nut	55 N·m	41 lb ft
Rear Engine Mount-to-Bulkhead Bolts	55 N·m	41 lb ft
Rear Main Seal Housing Bolts	12 N·m	106 lb in
Resonator/Muffler/Tail Pipe Assembly-to-Front Pipe/Three Way Catalytic Convert (TWC) Assembly Nuts	40 N·m	29 lb ft
Timing Belt Cover Nut and Bolts	11 N·m	97 lb in
Timing Belt Tensioner Bolt	27 N·m	20 lb ft
Timing Belt Tensioner Stud	11 N·m	97 lb in
Torque Rod Bracket Bolts	55 N·m	41 lb ft
Torque Rod-to-Frame Through Bolt	55 N·m	41 lb ft
Torque Rod-to-Torque Rod Bracket Through Bolt and Nut	55 N·m	41 lb ft
Upper Generator Adjustment Bolt	23 N·m	17 lb ft
Upper Rear Mounting Bracket Retaining Nuts	55 N·m	41 lb ft

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 Mechanical – 1.3L

Mechanical Specifications

Application	Specification	
	Metric	English
General		
• Engine Type	L4	
• RPO Code	LY8	
• Displacement	1300 cc	79 CID
• Bore	74.15 mm	2.919 in
• Stroke	90 mm	3.54 in
• Firing Order	1-3-4-2	
• Spark Plug Type-Denso	K20PR-U11	
• Spark Plug Type-NGK	BKR6E11	
• Spark Plug Gap	1.0-1.1 mm	0.039-0.043 in
Compression		
• Compression Pressure at 250 RPM (Standard)	1350 kPa	192 psi
• Compression Pressure (Minimum)	1100 kPa	156 psi
• Compression Pressure Difference Between Any Two Cylinders (Maximum)	100 kPa	15 psi
Engine Vacuum		
• Vacuum at 800 RPM at Sea Level	59.2-76.3 kPa	17.7-22.8 in Hg
Lubrication System		
• Oil Pressure (at 4000 RPM)	330-430 kPa	46.9-61.1 psi
• Oil Capacity with Filter Change	3.3L	3.5L
Cooling System		
• Cooling System Capacity	5.0L	4.7 qt
• Temperature at which Thermostat begins to Open	83°C	179°F
• Temperature at which Thermostat Fully Open	95°C	203°F
• Thermostat Valve Lift	More than 8 mm at 95°C (203°F	
• Radiator Cap Relief Valve Pressure	108 kPa	15.7 psi

Fastener Tightening Specifications

Application	Specification	
	Metric	English
A/C Compressor Belt Tensioner Lock Nut	45 N·m	33 lb ft
A/C Low Side Bracket Bolt	15 N·m	11 lb ft
Battery Cable Nut	15 N·m	11 lb ft
Camshaft Housing Bolts	11 N·m	97 lb in
Camshaft Sensor Housing Bolts	11 N·m	97 lb in

Camshaft Timing Sprocket Bolt	60 N·m	43 lb ft
Connecting Rod Bearing Cap Nuts	35 N·m	26 lb ft
Coolant Pump Mounting Nuts and Bolts	13 N·m	115 lb in
Coolant Pump Pulley Bolts	11 N·m	97 lb in
Coolant Return Pipe Bolts	20 N·m	15 lb ft
Crankshaft Pulley Bolts	16 N·m	12 lb ft
Crankshaft Timing Sprocket Bolt	130 N·m	94 lb ft
Cylinder Head Bolts	68 N·m	49 lb ft
Valve Rocker Arm Cover Bolts	11 N·m	97 lb in
Engine Oil Drain Plug	35 N·m	26 lb ft
Engine Oil Pan Bolts and Nuts	11 N·m	97 lb in
Exhaust Manifold With PUP	32 N·m	24 lb ft
Exhaust Manifold Without PUP	23 N·m	17 lb ft
Exhaust Manifold Stiffener Bracket Bolts	50 N·m	37 lb ft
Flywheel Retaining Bolts: Automatic Transaxle Equipped Vehicles	95 N·m	69 lb ft
Flywheel Retaining Bolts: Manual Transaxle Equipped Vehicles	78 N·m	57 lb ft
Front Pipe/Catalytic Converter Assembly-to-Exhaust Manifold Bolts	50 N·m	37 lb ft
Front Pipe/Catalytic Converter Assembly-to-Resonator/Center Pipe Nuts	35 N·m	26 lb ft
Generator Cover Plate Bolts	10 N·m	89 lb in
Generator Mounting Bolts and Nuts	23 N·m	17 lb ft
Guide Tube Bolts	11 N·m	97 lb in
Heat Shield Bolts	15 N·m	11 lb ft
Intake Manifold Mounting Bolts and Nuts	23 N·m	17 lb ft
Main Bearing Cap Bolts	54 N·m	40 lb ft
Oil Pressure Switch	14 N·m	10 lb ft
Oil Pump Mounting Bolts	11 N·m	97 lb in
Oil Pump Strainer Bolt	11 N·m	97 lb in
Oil Pump Strainer Bracket Bolt	11 N·m	97 lb in
Rear Engine Mount Frame Bracket-to-Frame Bolts	55 N·m	41 lb ft
Rear Engine Mount Connecting Bracket-to-Rear engine Mount Frame Bracket Nuts	55 N·m	41 lb ft
Rear Engine Mount-to-Engine Bracket Nut	55 N·m	41 lb ft
Rear Engine Mount-to-Bulkhead Bolts	55 N·m	41 lb ft
Rear Engine Mount-to-Engine Bracket-to-Engine Bolts and Nut	55 N·m	41 lb ft
Rear Engine Mount Through Bolts and Nut	55 N·m	41 lb ft
Rear Main Seal Housing Bolts	11 N·m	97 lb in
Resonator/Center Pipe-to-Front Pipe/Catalytic Converter Assembly Nuts	35 N·m	26 lb ft
Right Engine Mount Through Bolt	55 N·m	41 lb ft
Right Engine Mount-to-Mounting Bracket Bolts	55 N·m	41 lb ft
Rocker Arm Shaft Bolts	11 N·m	97 lb in
Timing Belt Cover Nut and Bolts	11 N·m	97 lb in
Timing Belt Tensioner Bolt	25 N·m	18 lb ft
Timing Belt Tensioner Stud	11 N·m	97 lb in
Torque Rod Bracket Bolts	55 N·m	41 lb ft
Torque Rod-to-Frame Through Bolt	55 N·m	41 lb ft
Torque Rod-to-Torque Rod Brace Bolt	55 N·m	41 lb ft
Torque Rod-to-Torque Rod Bracket Through Bolt and Nut	55 N·m	41 lb ft
Upper Generator Adjustment Bolt	23 N·m	17 lb ft
Upper Rear Mounting Bracket Retaining Nuts	55 N·m	41 lb ft

Engine Cooling

Engine Cooling System Approximate Capacities

Application	Specification	
	Metric	English
Cooling System Capacity 1.0 L 3-Cylinder Engine		
• Engine, Radiator and Heater Core	3.3 Liters	3.49 Quarts
• Coolant Recovery Reservoir	0.6 Liters	0.63 Quarts
• Total	3.9 Liters	4.13 Quarts
Cooling System Capacity 1.3 L 4-Cylinder Engine: Automatic Transaxle		
• Engine, Radiator and Heater Core	4.13 Liters	4.37 Quarts
• Coolant Recovery Reservoir	0.6 Liters	0.63 Quarts
• Total	4.73 Liters	5.0 Quarts
Cooling System Capacity 1.3 L 4-Cylinder Engine: Manual Transmission		
• Engine, Radiator and Heater Core	4.0 Liters	4.23 Quarts
• Coolant Recovery Reservoir	0.6 Liters	0.63 Quarts
• Total	4.6 Liters	4.9 Quarts

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Coolant Pump Mounting Nuts and Bolts	13 N·m	115 lb in
Coolant Pump Pulley Mounting Bolts	24 N·m	18 lb ft
Lower Generator Cover Plate Bolts	10 N·m	89 lb in
Lower Radiator Cooling Fan Mounting Bolt	10 N·m	89 lb in
Thermostat Housing Bolt	27 N·m	20 lb ft
Upper Generator Adjustment Bolt	23 N·m	17 lb ft
Upper Generator Mounting Bracket Bolt	23 N·m	17 lb ft
Upper Radiator/Fan Mounting Bolts	10 N·m	89 lb in
Water Outlet Retaining Bolts	20 N·m	15 lb ft

Cooling System Description and Operation

Coolant Heater

The optional engine coolant heater (RPO K05) operates using 110-volt AC external power and is designed to warm the coolant in the engine block area for improved starting in very cold weather -29°C (-20°F). The coolant heater helps reduce fuel consumption when a cold engine is warming up. The unit is equipped with a detachable AC power cord. A weather shield on the cord is provided to protect the plug when not in use.

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 Oil Cooler

The engine oil cooler is a heat exchanger. It is located inside the left side end tank of the radiator. The engine oil temperature is controlled by the temperature of the engine coolant that surrounds the oil cooler in the radiator.

The engine oil pump, pumps the oil through the engine oil cooler line to the oil cooler. The oil then flows through the cooler where the engine coolant absorbs heat from the oil. The oil is then pumped through the oil cooler return line, to the oil filter, to the engine block oil system.

Transmission Oil Cooler

The transmission oil cooler is a heat exchanger. It is located inside the right side end tank of the radiator. The transmission fluid temperature is regulated by the temperature of the engine coolant in the radiator.

The transmission oil pump, pumps the fluid through the transmission oil cooler line to the transmission oil cooler. The fluid then flows through the cooler where the engine coolant absorbs heat from the fluid. The fluid is then pumped through the transmission oil cooler return line, to the transmission.

Engine Electrical

General Specifications

Application	Specification	
	Metric	English
Battery Specifications		
• Catalog Number	974	
• Cold Cranking Amperes	390	
• Replacement Model	26R-50S	
• Reserve Capacity Minutes	71	
• Test Load Amperes	190	
Drive Belt Tension		
• Drive Belt Deflection (New Belt)	5-7 mm at 10 kg	0.20-0.27 in at 22 lbs
• Drive Belt Deflection (Used Belt)	6-8 mm at 10 kg	0.24-0.31 in at 22 lbs
Ignition System		
• Camshaft Position (CMP) Sensor Resistance 1.0L	185-275 ohms at -10 to 50°C (14-122°F) 240-325 ohms at 50-100°C (122-212°F)	
• Crankshaft Position (CKP) Sensor Resistance	360-460 ohms at 20°C (68°F)	
• Ignition Coil Resistance--Primary Winding 1.0L	1.08-1.32 ohms	
• Ignition Coil Resistance--Secondary Winding 1.0L	22.1k-29.9k ohms	
• Ignition Coil Resistance--Secondary Winding 1.3L	8.5k-11.5k ohms at 20°C (68°F)	
• Secondary Wire Resistance 1.0L	10k-22k ohms/m	3.0k-6.7k ohms/ft
• Secondary Wire Resistance 1.3L	4k-10k ohms/m	1.2k-3.0k ohms/ft)
• Noise Suppressor Filter Resistance	2.2k ohms	
• Signal Rotor Air Gap	Approx. 0.2 mm (0.008 in)	
• Spark Plug Gap	1.0-1.1 mm	0.039-0.043 in
• Spark Plug Type 1.0L--AC	R42XLS	
• Spark Plug Type 1.0L--Denso	W20EPR-U11	
• Spark Plug Type 1.0L--NGK	BPR6ES-11	
• Spark Plug Type 1.3L--Denso	K20PR-U11	
• Spark Plug Type 1.3L--NGK	BKR6E-11	
Generator Specifications		
• Brush Length--Standard	16 mm	0.63 in
• Brush Length--Minimum	2 mm	0.08 in
• Condenser Capacity	0.5 microfarads	
• Direction of Rotation	Clockwise (Pulley Side)	
• Maximum Generator Output	55 amps	
• Maximum Generator Speed	18,000 RPM	
• Normal Operating Voltage	12 volts	
• Polarity Negative (-) Ground No-Load Generator Speed	1,100 RPM	
• Regular Voltage	14.7-15.0 volts	
• Temperature Range	-30 to 80°C	-22 to 170°F

Starter Motor Specifications--Automatic Transaxle Equipped Vehicles		
• Brush Length--Standard	17.5 mm	0.69 in
• Brush Length--Minimum	12.0 mm	0.47 in
• Brush Spring Tension--Standard	2.1 kg	4.63 lbs
• Brush Spring Tension--Minimum	0.7 kg	1.54 lbs
• Commutator Insulation Depth--Standard	0.5-0.8 mm	0.020-0.031 in
• Commutator Insulation Depth--Minimum	0.2 mm	0.008 in
• Commutator Outside Diameter--Standard	29.4 mm	1.157 in
• Commutator Outside Diameter--Minimum	28.8 mm	1.134 in
• Commutator Run-Out--Standard	0.05 mm	0.002 in
• Commutator Run-Out--Maximum	0.40 mm	0.016 in
• Direction of Rotation	Clockwise (as viewed from pinion)	
• Number of Pinion Teeth	8	
• Output	1.2 kwatts	
• Rating	30 seconds	
• Solenoid Operating Voltage	8 volts maximum	
• Starter Motor Current Draw--No--Load	50-75 amps max. at 11 volts	
• Starter Motor Current Draw--Load (9.1 N·m / 80.5 lb in of torque)	300 amps at 7.7 volts	
• Starter Motor Current Draw--Locked Rotor (18.6 N·m / 13.7 lb ft of torque)	780 amps max. at 4 volts	
• Voltage	12 volts	
Starter Motor Specifications--Manual Transaxle Equipped Vehicles		
• Brush Length--Standard	17.0 mm	0.67 in
• Brush Length--Minimum	11.5 mm	0.45 in
• Brush Spring Tension--Standard	1.6 kg	3.53 lbs
• Brush Spring Tension--Minimum	1.0 kg	2.20 lbs
• Commutator Insulation Depth--Standard	0.4-0.6 mm	0.016-0.024 in
• Commutator Insulation Depth--Minimum	0.2 mm	0.008 in
• Commutator Outside Diameter--Standard	32.0 mm	1.260 in
• Commutator Outside Diameter--Minimum	31.4 mm	1.236 in
• Commutator Run-Out--Standard	0.05 mm	0.002 in
• Commutator Run-Out--Maximum	0.40 mm	0.016 in
• Direction of Rotation	Clockwise (as viewed from pinion)	
• Number of Pinion Teeth	8	
• Output 1.0L (VIN 6)	0.8 kwatts	
• Output 1.3L (VIN 9)	0.9 kwatts	
• Rating	30 seconds	
• Solenoid Operating Voltage	8 volts maximum	
• Starter Motor Current Draw--No-load	60 Amps maximum at 11 Volts	
• Starter Motor Current Draw--Load (2.7 N·m / 23.9 lb in. of torque)	150 Amps maximum at 9 Volts	
• Starter Motor Current Draw--Locked Rotor (8.6 N·m / 76.1 lb in. of torque)	380 Amps maximum at 5 Volts	
• Voltage	12 Volts	

Fastener Tightening Specifications

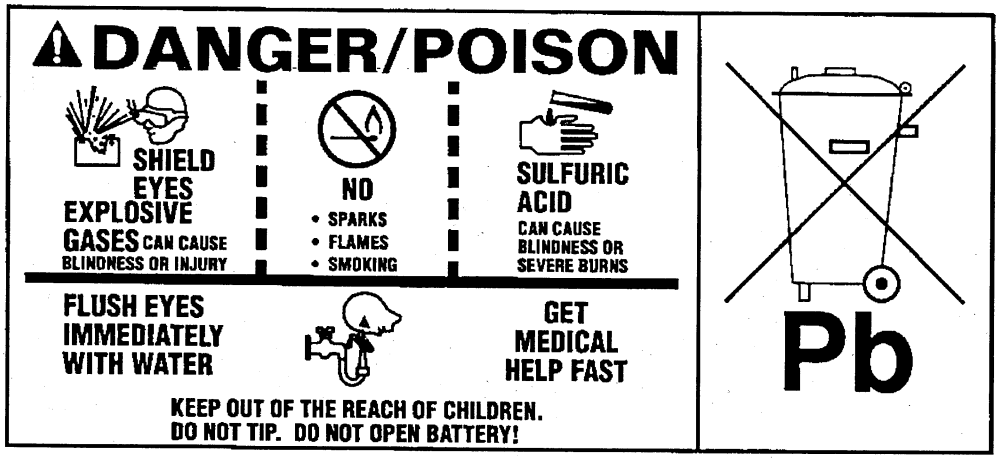
Application	Specification	
	Metric	English
Automatic Transaxle Ground Bolt	50 N·m	37 lb ft
Battery Cable-to-Battery Terminals	5.5 N·m	48.68 lb in
Battery Cable-to-Battery Terminal Retainers	15 N·m	11 lb ft
Battery Retainer Bracket Bolts	8 N·m	71 lb in
Battery Terminal Retaining Nut	10 N·m	89 lb in
Body Ground Bolt	8 N·m	71 lb in
Camshaft Position (CMP) Sensor Retaining Screws	5 N·m	44 lb in
Commutator End Cover Bolts	8 N·m	71 lb in
Distributor Flange Bolts	15 N·m	11 lb ft
Drive Pulley Retaining Nut	65 N·m	48 lb ft
Field Coil Lead Wire Retaining Nut	10 N·m	89 lb in
Frame Bolts and Nuts	30 N·m	22 lb ft
Generator B Terminal Nut	10 N·m	89 lb in
Generator Housing Bolts	30 N·m	22 lb ft
Generator Mounting Bolts	23 N·m	17 lb ft
Ignition Coil Mounting Bracket Bolts	15 N·m	11 lb ft
Manual Transaxle Ground Bolt	23 N·m	17 lb ft
Positive Battery Cable-to-Solenoid Retaining Nut	10 N·m	89 lb in
Solenoid Mounting Nuts	7 N·m	62 lb in
Spark Plugs	28 N·m	21 lb ft
Starter Motor Assembly Mounting Bolts	23 N·m	17 lb ft
Stator Stud Bolts	8 N·m	71 lb in

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

CATALOG NO.

1819

CCA	LOAD TEST
770	380
REPLACEMENT MODEL	
100 – 6YR	

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

The cranking circuit consists of the battery, starter motor, ignition switch, and related wiring.

These starter motors are not serviceable and are replaced as assemblies only.

The [PG] starter motors are [non-]repairable starter motors. They have pole pieces that are arranged around the armature within the starter housing. When the solenoid windings are energized, the pull-in winding circuit is completed to ground through the starter motor. The hold-in winding circuit is completed to ground through the solenoid. The windings work together magnetically to pull in and hold in the plunger. The plunger moves the shift lever. This action causes the starter drive assembly to rotate on the armature shaft spline as it engages with the flywheel ring gear on the engine. At the same time, the plunger closes the solenoid switch contacts in the starter solenoid. Full battery voltage is then applied directly to the starter motor and it cranks the engine.

As soon as the solenoid switch contacts close, current stops flowing thorough the pull-in winding as battery voltage is now applied to both ends of the windings. The hold-in winding remains energized; its magnetic field is strong enough to hold the plunger, shift lever, starter drive assembly, and solenoid switch contacts in place to continue cranking the engine. When the engine starts, the pinion gear overrun protects the armature from excessive speed until the switch is opened.

When the ignition switch is released from the START position, crank voltage is removed from the starter solenoid S terminal. Current flows from the motor contacts through both windings to ground at the end of the hold-in winding. However, the direction of the current flow through the pull-in winding is now in the opposite direction of the current flow when the winding was first energized.

The magnetic fields of the pull-in and hold-in windings now oppose one another. This action of the windings, along with the help of the return spring, cause the starter drive assembly to disengage and the solenoid switch contacts to open simultaneously. As soon as the contacts open, the starter motor is turned off.

Charging System Description and Operation

Generator

The generator is non-repairable. The generator(s) feature 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 the tightening of mounting components. Otherwise, the generator is replaced as a complete unit.

Regulator

The voltage regulator controls the field current of the rotor in order to limit system voltage. 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.

Engine Controls

Engine Controls – 1.0L

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Air Cleaner Bracket Bolt	10 N·m	89 lb in
Air Cleaner Stud Bracket Bolts	10 N·m	89 lb in
Crankshaft Position (CKP) Sensor Bolt	10 N·m	89 lb in
Distributor Flange Bolts	15 N·m	11 lb ft
ECT Sensor	12.5-17.5 N·m	9.5-12.5 lb ft
EGR Valve Bolts	20 N·m	15 lb ft
EVAP Canister Filter Bolts	10 N·m	89 lb in
EVAP Canister Purge Valve Bracket Bolts	11 N·m	8 lb ft
EVAP Tank Pressure Control Solenoid Vacuum Valve Screw	1.6 N·m	14 lb in
Fuel Injector Resistor Bracket Bolts	10 N·m	89 lb in
Fuel Pipe Guard Nuts	15 N·m	11 lb ft
Fuel Sender Assembly Bolts	10 N·m	89 lb in
Fuel Tank Mounting Bolts	25 N·m	18 lb ft
Fuel Tank Pressure Sensor Bolts	1.2-2.0 N·m	11-18 lb in
Fuel Vapor Separator Screw	1.2-2.0 N·m	11-18 lb in
HO2S 1	40-50 N·m	29-36 lb ft
HO2S 2	40-50 N·m	29-36 lb ft
ISC Motor Screws	2.8-4.0 N·m	24-36 lb in
MAP Sensor Bracket Bolts	10 N·m	89 lb in
Negative Battery Cable-to-Negative Battery Terminal Retainer	5.5 N·m	49 lb in
Parking Brake Cable Bracket Bolt	15 N·m	11 lb ft
PCM Bracket Bolts	6 N·m	53 lb in
Throttle Body Fuel Injection (TBI) Unit Bolts	23 N·m	17 lb ft
TBI Unit Upper Assembly to Lower Assembly Bolts	3.5 N·m	31 lb in
TP Sensor Bolts	1.6-2.4 N·m	11-21.5 lb in

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 it is bad enough, it can damage your engine.

If you're using fuel rated at 87 octane or higher and you hear heavy knocking, your engine needs service. But don't worry if you hear a little pinging noise when you're accelerating or driving up a hill. That's normal, and you don't have to buy a higher octane fuel to get rid of pinging. It's the 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 to meet California Emission Standards, indicated on the under hood emission control label, it 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 it is determined that the cause of the condition is the type of fuels used, repairs may not be covered by your warranty.

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

Engine Controls – 1.3L

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Air Cleaner Assembly Bolts	10 N·m	89 lb in
Crankshaft Position (CKP) Sensor Bolt	10 N·m	89 lb in
Camshaft Position (CMP) Sensor Bolt	10 N·m	89 lb in
ECT Sensor	15 N·m	11 lb ft
EVAP Canister Filter Bolts	10 N·m	89 lb in
EVAP Canister Purge Valve Bracket Bolts	11 N·m	8 lb ft
EVAP Tank Pressure Control Solenoid Valve Bolt	1.6 N·m	14 lb in
Fuel Limiter Vent Valve (FLVV) Bolts	1.6 N·m	12 lb in
Fuel Pipe Guard Nuts	15 N·m	11 lb ft
Fuel Pressure Regulator Bolts	8-12 N·m	71-106 lb in
Fuel Rail Bolts	18-28 N·m	13-20 lb ft
Fuel Sender Assembly Bolts	10 N·m	89 lb in
Fuel Tank Mounting Bolts	25 N·m	18 lb ft
Fuel Tank Pressure Control Valve Attaching Screw	1.2-2.0 N·m	11-18 lb in
Fuel Tank Pressure Sensor Bolts	1.2-2.0 N·m	11-18 lb in
Fuel Vapor Separator Bolts	1.2-2.0 N·m	11-18 lb in
HO2S 1	40-50 N·m	29-36 lb ft
HO2S 2	40-50 N·m	29-36 lb ft
IAC Valve Screws	3.3 N·m	29 lb in
Ignition Coil Bolts	10 N·m	89 lb in
Intake Manifold Brace Bolts	25-35 N·m	18.5-25 lb ft
MAP Sensor Bracket Bolts	10 N·m	89 lb in
Negative Battery Cable-to-Negative Battery Terminal Retainer	5.5 N·m	49 lb in
Parking Brake Cable Bracket Bolt	15 N·m	11 lb ft
PCM Bracket Bolts	6 N·m	54 lb in
PSP Switch	27 N·m	20 lb ft
Spark Plugs	28 N·m	20 lb ft
Throttle Body Bolts and Nuts	18-23 N·m	13.5-17 lb ft
TP Sensor Bolts	2.0 N·m	18 lb in
Vehicle Speed Sensor (A/T) Bolt	8 N·m	72 lb in

Exhaust System

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Front Pipe/Three-Way Catalytic Converter (TWC): Assembly-to-Exhaust Manifold Bolts	50 N·m	37 lb ft
Front Pipe/Three-Way Catalytic Converter (TWC): Assembly-to-Resonator/Muffler/Tail Pipe Nuts	35 N·m	26 lb ft
Hanger Bolts	15 N·m	11 lb ft

Exhaust System Description

Important

Use of non-OEM parts may cause driveability concerns.

General Description

The exhaust system is used to carry and treat the gases that are created by the engine. When the engine exhaust valve opens hot gases created by the engine combustion cycle are allowed to travel out through the cylinder head into the exhaust manifold. In the exhaust manifold the exhaust gases combine with exhaust gases from the other cylinders and pass through a flanged port into the three-way catalytic converter pipe. The exhaust gases pass through the catalytic converter to reduce pollutants from the exhaust stream gases. The three-way catalytic converter pipe carries the exhaust gases on to the exhaust system where the resonator and muffler are used to reduce the noise levels of the exhaust. The exhaust system exits at the rear of the vehicle to reduce exhaust noise and prevent fumes from entering the vehicle. Exhaust system hangers and insulators support the weight of the exhaust system, isolate engine noise, isolate engine vibration, space the system away from the underbody of the vehicle and allow for exhaust system expansion that occurs as the exhaust system warms up.

Exhaust Manifold

The exhaust manifold is a component of the exhaust system used to collect and carry hot exhaust gases away from the engine. Made from cast iron, the exhaust manifold combines the exhaust gases from several cylinders. The exhaust manifold is bolted to the cylinder head with a exhaust manifold gasket between them. The left (front) exhaust manifold connects to a crossover pipe that is part of the right (rear) exhaust manifold and carries the exhaust gases from the front of the vehicle over the transmission to the right (rear) exhaust manifold. The gases are combined in the right (rear) manifold and directed on to the three-way catalytic converter. The three-way catalytic converter pipe and gasket are bolted to the right (rear) exhaust manifold. The right (rear) exhaust manifold has two tapped holes. The heated oxygen sensor (HO2S) threads into the hole by the flange and the EGR valve pipe threads into the hole where the crossover meets the right (rear) exhaust manifold.

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.

Exhaust Pipe Description

The exhaust pipe carries exhaust gases treated by the three-way catalytic converter through a resonator and into the exhaust muffler. As exhaust gases travel through the resonator and muffler baffles, exhaust noise is lessened. The exhaust system exits at the rear of the vehicle to reduce exhaust noise and eliminate fumes from entry into the vehicle. Exhaust system hangers and insulators support the weight of the exhaust pipe, the resonator, and the muffler. The exhaust system hangers also space the exhaust system away from the underbody of the vehicle and allow the exhaust system to expand as the exhaust system warms up.

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 – M42 and M58

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Backup Lamp Switch	23 N·m	17 lb ft
Clutch Cable Bracket Bolts	28 N·m	21 lb ft
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
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 Control Shaft Front Through Bolt and Nut	20 N·m	15 lb ft
Gearshift Control Shaft Joint Through Bolt and Nut	20 N·m	15 lb ft
Gearshift Control Shaft Rear Through Bolt and Nut	20 N·m	15 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
Left Case Cover Bolts	12 N·m	106 lb in
Left Transaxle Mount Bracket 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
Rear Transaxle Mount Retaining Bolts	60 N·m	44 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 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 Lever/Filler Plug	21 N·m	15 lb ft
Transaxle Side Cover Bolts	12 N·m	106 lb in

Transaxle General Specifications

Shim Part Number	Shim Thickness	
	Metric	English
96051167	0.8 mm	0.03 in
96051165	1.0 mm	0.04 in
96051356	1.2 mm	0.05 in
96053031	1.4 mm	0.06 in

Gearshift Control Lever 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

Lubrication Specifications

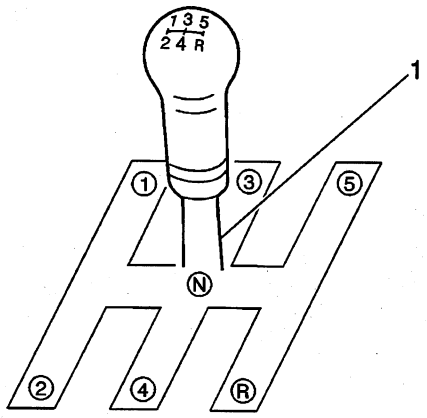
Application	Specification	
	Metric	English
Manual Transaxle Drain and Refill	2.4 liters	2.5 quarts
Recommended Transaxle Oil	GM Goodwrench Synthetic Manual Transmission Fluid, (GM P/N 12346190) or an equivalent SAE 75W-90 GL-4 Gear Oil.	

Transmission Component and System Description

Synchronizers

The low speed synchronizer mounts on the countershaft. The low speed synchronizer will engage either with the countershaft 1st gear or with the countershaft 2nd gear. The high speed synchronizer mounts on the input shaft. The high speed synchronizer will engage either with the input shaft 3rd gear or with the input shaft 4th gear. The 5th speed synchronizer mounts on the input shaft. The 5th speed synchronizer engages with the input shaft 5th gear. The countershaft meshes with and turns the ring gear of the differential assembly that supplies power to the drive axles.

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.

An arm and a yoke to the gearshift and to the select shaft assembly transmit the transaxle gearshift shaft movement. This happens 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 the select shaft assembly actuate each shift shaft and each fork for the desired transaxle gearshift. A gearshift interlock plate prevents 2 different gears from engaging during shifting.

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 into reverse:

- The fifth and reverse gearshift cam, and the return spring
- The interlock plate of the gearshift

In fifth gear, the fifth and reverse gearshift cam turns clockwise with the gearshift and with the select shaft. The cam guide return spring pushes the fifth and reverse gearshift cam upward. The 5th and reverse gearshift shaft meets the interlock guide bolt for 5th-to-reverse at this location. Then, the 5th and reverse gearshift cam cannot turn any further. If the 5th and reverse gearshift cam cannot turn, you cannot shift from 5th gear to reverse gear.

If a shift to reverse gear is cancelled, you can shift from 5th gear to neutral. Shift to the neutral position between 3rd gear and 4th gear in order to cancel the 5th and reverse gearshift cam. Moving the gearshift control lever to the position between the 5th and reverse causes the following conditions:

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

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

Clutch

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Clutch Cable Grommet Bolts	6 N·m	53 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		
• 1.0 Liter Engine	61 N·m	45 lb ft
• 1.3 Liter Engine	78 N·m	57 lb ft

The clutch assembly contains four major components: the clutch disc, the clutch pressure plate, the clutch release bearing, and the flywheel.

The clutch disc is a single, dry disc comprised of asbestos material which is riveted onto a steel plate (like that of a brake pad). The hub of the clutch disc is splined to the transaxle input shaft turning the transaxle input shaft when the clutch disc is engaged. The clutch disc is also fitted with either 4 torsional coil springs (1.0 liter engine) or 6 torsional coil springs (1.3 liter engine) placed between the clutch disc and the clutch hub. These springs help to reduce shock upon clutch engagement.

The clutch pressure plate is bolted to the flywheel and turns with the engine. The clutch disc is fitted between the clutch pressure plate and the flywheel. 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 cable pulls on the clutch release arm and turns the clutch release shaft. The clutch release shaft pushes the clutch release bearing 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 causing the flywheel to turn the clutch disc and the transaxle input shaft.

The Clutch Pedal Position (CPP) switch is mounted above the clutch pedal and contacts the clutch pedal lever. This switch is incorporated in the starter motor circuit in order to prevent the engine from being started with the clutch engaged or with the transaxle in gear. When the clutch pedal is not depressed, an

open in the starter motor circuit exists preventing the starter from operating. When the clutch pedal is depressed, the circuit is closed making the starter motor circuit complete and operational. For diagnosis of the CPP switch refer to Electrical Diagnosis in Engine Electrical.

Automatic Transmission - 3 Speed-M60

Fastener Tightening Specifications

Application	Specification	
	Metric	English
2nd Brake Solenoid Retaining Bolt	4 N·m	35 lb in
Ball Stud Nuts and Bolts	60 N·m	44 lb ft
Direct Clutch Solenoid Retaining Bolt	4 N·m	35 lb in
Engine Wiring Harness Bracket Bolts	16 N·m	12 lb ft
Filler Tube Bracket Bolt	6 N·m	53 lb in
Fluid Filter Screen Bolts	6 N·m	53 lb in
Flywheel Cover Bolts	10 N·m	89 lb in
Flywheel-to-Torque Converter Bolts	19 N·m	14 lb ft
Inlet and Outlet Union Bolts	22 N·m	16 lb ft
Interlock Cable Bolt	13 N·m	115 lb in
Left Transaxle Mount Bracket Bolts	55 N·m	40 lb ft
Left Transaxle Mount Retaining Nuts	55 N·m	40 lb ft
Line PressureTap Bolt	9 N·m	80 lb in
Lower Engine-to-Transaxle Retaining Bolt and Nut	55 N·m	40 lb ft
Lower Rear Engine Mount-to-Bulkhead Bolt	55 N·m	40 lb ft
Lower Valve Body Bolts	12 N·m	106 lb in
Lower Valve Body Cover Bolts	4 N·m	35 lb in
Negative (-) Battery Cable-to-Transaxle Case Bolt	15 N·m	11 lb ft
Park/Neutral Position Switch Mounting Bolt	23 N·m	17 lb ft
Rear Engine Mount Bracket Bolts and Nuts	55 N·m	40 lb ft
Rear Engine Torque Rod Assembly Bolts	55 N·m	40 lb ft
Selector Lever Assembly Housing Seat Nuts	16 N·m	11.5 lb ft
Shift Select Cable Bulkhead Grommet Bolts	20 N·m	15 lb ft
Solenoid Wiring Harness Retaining Bracket Bolt	20 N·m	15 lb ft
Solenoid Wiring Harness Retaining Plate Nut	20 N·m	15 lb ft
Speedometer Driven Gear Case Retaining Bolt	8 N·m	11 lb ft
Starter Motor Retaining Bolts	23 N·m	17 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	6 N·m	53 lb in
Upper Rear Transaxle Mount-to-Bulkhead Bolt	55 N·m	40 lb ft
Upper Transaxle-to-Engine Retaining Bolts	55 N·m	40 lb ft
Upper Valve Body Bolts	6 N·m	53 lb in
Vehicle Speed Sensor (VSS) Retaining Bolt	23 N·m	17 lb ft

Fluid Capacity Specifications

Application	Specification	
	Metric	English
Fluid Recommended	Dexron®-III Automatic Transmission Fluid	
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

Automatic Transmission Shift Lock Control Description

The automatic transmission shift lock control system prevents the driver from shifting out of Park without depressing the brake pedal. The shift lock control solenoid is provided battery voltage when the ignition is in the ON position and the vehicle is in Park. The shift lock control 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 control solenoid is energized and releases the locking tab on the floor shifter.

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Abbreviations and Meanings

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

BLK	Black
BLU	Blue
BP	Back Pressure
BPCM	Battery Pack Control Module
BPMV	Brake Pressure Modulator Valve
BPP	Brake Pedal Position
BRN	Brown
BTDC	Before Top Dead Center
BTM	Battery Thermal Module
BTSI	Brake Transmission Shift Interlock
Btu	British Thermal Units
C	
°C	Degrees Celsius
CAC	Charge Air Cooler
CAFE	Corporate Average Fuel Economy
Cal	Calibration
Cam	Camshaft
CARB	California Air Resources Board
CC	Coast Clutch
cm^3	Cubic Centimeters
CCM	Convenience Charge Module, Chassis Control Module
CCOT	Cycling Clutch Orifice Tube
CCP	Climate Control Panel
CD	Compact Disc
CE	Commutator End
CEAB	Cold Engine Air Bleed
CEMF	Counter Electromotive Force
CEX	Cabin Exchanger
cfm	Cubic Feet per Minute
cg	Center of Gravity
CID	Cubic Inch Displacement
CKP	Crankshaft Position
CKT	Circuit
C/Ltr	Cigar Lighter
CL	Closed Loop
CLS	Coolant Level Switch
CMC	Compressor Motor Controller
CMP	Camshaft Position
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO2	Carbon Dioxide
Coax	Coaxial
COMM	Communication

Conn	Connector
CPA	Connector Position Assurance
CPP	Clutch Pedal Position
CPS	Central Power Supply
CPU	Central Processing Unit
CRT	Cathode Ray Tube
CRTC	Cathode Ray Tube Controller
CS	Charging System
CSFI	Central Sequential Fuel Injection
CTP	Closed Throttle Position
cu ft	Cubic Foot/Feet
cu in	Cubic Inch/Inches
CV	Constant Velocity Joint
CVRSS	Continuously Variable Road Sensing Suspension
Cyl	Cylinder(s)
D	
DAB	Delayed Accessory Bus
dB	Decibels
dBA	Decibels on A-weighted Scale
DC	Direct Current, Duty Cycle
DCM	Door Control Module
DE	Drive End
DEC	Digital Electronic Controller
DERM	Diagnostic Energy Reserve Module
DI	Distributor Ignition
dia	Diameter
DIC	Driver Information Center
Diff	Differential
DIM	Dash Integration Module
DK	Dark
DLC	Data Link Connector
DMCM	Drive Motor Control Module
DMM	Digital Multimeter
DMSDS	Drive Motor Speed and Direction Sensor
DMU	Drive Motor Unit
DOHC	Dual Overhead Camshafts
DR, Drvr	Driver
DRL	Daytime Running Lamps
DTC	Diagnostic Trouble Code
E	
EBCM	Electronic Brake Control Module
EBTCM	Electronic Brake and Traction Control Module

EC	Electrical Center, Engine Control
ECC	Electronic Climate Control
ECI	Extended Compressor at Idle
ECL	Engine Coolant Level
ECM	Engine Control Module, Electronic Control Module
ECS	Emission Control System
ECT	Engine Coolant Temperature
EEPROM	Electrically Erasable Programmable Read Only Memory
EEVIR	Evaporator Equalized Values in Receiver
EFE	Early Fuel Evaporation
EGR	Exhaust Gas Recirculation
EGR TVV	Exhaust Gas Recirculation Thermal Vacuum Valve
EHPS	Electro-Hydraulic Power Steering
EI	Electronic Ignition
ELAP	Elapsed
ELC	Electronic Level Control
E/M	English/Metric
EMF	Electromotive Force
EMI	Electromagnetic Interference
Eng	Engine
EOP	Engine Oil Pressure
EOT	Engine Oil Temperature
EPA	Environmental Protection Agency
EPR	Exhaust Pressure Regulator
EPROM	Erasable Programmable Read Only Memory
ESB	Expansion Spring Brake
ESC	Electronic Suspension Control
ESD	Electrostatic Discharge
ESN	Electronic Serial Number
ETC	Electronic Throttle Control, Electronic Temperature Control, Electronic Timing Control
ETCC	Electronic Touch Climate Control
ETR	Electronically Tuned Receiver
ETS	Enhanced Traction System
EVAP	Evaporative Emission
EVO	Electronic Variable Orifice
Exh	Exhaust

F	
°F	Degrees Fahrenheit
FC	Fan Control
FDC	Fuel Data Center
FED	Federal All United States except California
FEDS	Fuel Enable Data Stream
FEX	Front Exchanger
FF	Flexible Fuel
FFH	Fuel-Fired Heater
FI	Fuel Injection
FMVSS	Federal U.S. Motor Vehicle Safety Standards
FP	Fuel Pump
ft	Foot/Feet
FT	Fuel Trim
F4WD	Full Time Four-Wheel Drive
4WAL	Four-Wheel Antilock
4WD	Four-Wheel Drive
FW	Flat Wire
FWD	Front Wheel Drive, Forward
G	
g	Grams, Gravitational Acceleration
GA	Gage, Gauge
gal	Gallon
gas	Gasoline
GCW	Gross Combination Weight
Gen	Generator
GL	Gear Lubricant
GM	General Motors
GM SPO	General Motors Service Parts Operations
gnd	Ground
gpm	Gallons per Minute
GRN	Green
GRY	Gray
GVWR	Gross Vehicle Weight Rating
H	
H	Hydrogen
H2O	Water
Harn	Harness
HC	Hydrocarbons
H/CMPR	High Compression
HD	Heavy Duty

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

K	
KAM	Keep Alive Memory
KDD	Keyboard Display Driver
kg	Kilogram
kHz	Kilohertz
km	Kilometer
km/h	Kilometers per Hour
km/l	Kilometers per Liter
kPa	Kilopascals
KS	Knock Sensor
kV	Kilovolts
L	
L	Liter
L4	Four Cylinder Engine, In-Line
L6	Six-Cylinder Engine, In-Line
lb	Pound
lb ft	Pound Feet Torque
lb in	Pound Inch Torque
LCD	Liquid Crystal Display
LDCL	Left Door Closed Locking
LDCM	Left Door Control Module
LDM	Lamp Driver Module
LED	Light Emitting Diode
LEV	Low Emissions Vehicle
LF	Left Front
lm	Lumens
LR	Left Rear
LT	Left
LT	Light
LT	Long Term
LTPI	Low Tire Pressure Indicator
LTPWS	Low Tire Pressure Warning System
M	
MAF	Mass Air Flow
Man	Manual
MAP	Manifold Absolute Pressure
MAT	Manifold Absolute Temperature
max	Maximum
M/C	Mixture Control
MDP	Manifold Differential Pressure

MFI	Multiport Fuel Injection
mi	Miles
MIL	Malfunction Indicator Lamp
min	Minimum
MIN	Mobile Identification Number
mL	Milliliter
mm	Millimeter
mpg	Miles per Gallon
mph	Miles per Hour
ms	Millisecond
MST	Manifold Surface Temperature
MSVA	Magnetic Steering Variable Assist, Magnasteer®
M/T	Manual Transmission/Transaxle
MV	Megavolt
mV	Millivolt
N	
NAES	North American Export Sales
NC	Normally Closed
NEG	Negative
Neu	Neutral
NI	Neutral Idle
NiMH	Nickel Metal Hydride
NLGI	National Lubricating Grease Institute
N·m	Newton-meter Torque
NO	Normally Open
NOx	Oxides of Nitrogen
NPTC	National Pipe Thread Coarse
NPTF	National Pipe Thread Fine
NOVRAM	Non-Volatile Random Access Memory
O	
O2	Oxygen
O2S	Oxygen Sensor
OBD	On-Board Diagnostics
OBD II	On-Board Diagnostics Second Generation
OC	Oxidation Converter Catalytic
OCS	Opportunity Charge Station
OD	Outside Diameter
ODM	Output Drive Module
ODO	Odometer
OE	Original Equipment
OEM	Original Equipment Manufacturer
OHC	Overhead Camshaft

ohms	Ohm
OL	Open Loop, Out of Limits
ORC	Oxidation Reduction Converter Catalytic
ORN	Orange
ORVR	On-Board Refueling Vapor Recovery
OSS	Output Shaft Speed
oz	Ounce(s)
P	
PAG	Polyalkylene Glycol
PAIR	Pulsed Secondary Air Injection
PASS, PSGR	Passenger
PASS-Key®	Personalized Automotive Security System
P/B	Power Brakes
PC	Pressure Control
PCB	Printed Circuit Board
PCM	Powertrain Control Module
PCS	Pressure Control Solenoid
PCV	Positive Crankcase Ventilation
PEB	Power Electronics Bay
PID	Parameter Identification
PIM	Power Inverter Module
PM	Permanent Magnet Generator
P/N	Part Number
PNK	Pink
PNP	Park/Neutral Position
PRNDL	Park, Reverse, Neutral, Drive, Low
POA	Pilot Operated Absolute Valve
POS	Positive, Position
POT	Potentiometer Variable Resistor
PPL	Purple
ppm	Parts per Million
PROM	Programmable Read Only Memory
P/S, PS	Power Steering
PSCM	Power Steering Control Module, Passenger Seat Control Module
PSD	Power Sliding Door
PSP	Power Steering Pressure
psi	Pounds per Square Inch
psia	Pounds per Square Inch Absolute
psig	Pounds per Square Inch Gauge
pt	Pint
PTC	Positive Temperature Coefficient
PWM	Pulse Width Modulated

Q	
QDM	Quad Driver Module
qt	Quart(s)
R	
R-12	Refrigerant-12
R-134a	Refrigerant-134a
RAM	Random Access Memory, Non-permanent memory device, memory contents are lost when power is removed.
RAP	Retained Accessory Power
RAV	Remote Activation Verification
RCDLR	Remote Control Door Lock Receiver
RDCM	Right Door Control Module
Ref	Reference
Rev	Reverse
REX	Rear Exchanger
RIM	Rear Integration Module
RF	Right Front, Radio Frequency
RFA	Remote Function Actuation
RFI	Radio Frequency Interference
RH	Right Hand
RKE	Remote Keyless Entry
Rly	Relay
ROM	Read Only Memory, Permanent memory device, memory contents are retained when power is removed.
RPM	Revolutions per Minute Engine Speed
RPO	Regular Production Option
RR	Right Rear
RSS	Road Sensing Suspension
RTD	Real Time Damping
RT	Right
RTV	Room Temperature Vulcanizing Sealer
RWAL	Rear Wheel Antilock
RWD	Rear Wheel Drive
S	
s	Second(s)
SAE	Society of Automotive Engineers
SC	Supercharger
SCB	Supercharger Bypass
SCM	Seat Control Module
SDM	Sensing and Diagnostic Module
SEO	Special Equipment Option
SFI	Sequential Multiport Fuel Injection

SI	System International Modern Version of Metric System
SIAB	Side Impact Air Bag
SIR	Supplemental Inflatable Restraint
SLA	Short/Long Arm Suspension
sol	Solenoid
SO2	Sulfur Dioxide
SP	Splice Pack
S/P	Series/Parallel
SPO	Service Parts Operations
SPS	Service Programming System, Speed Signal
sq ft, ft^2	Square Foot/Feet
sq in, in^2	Square Inch/Inches
SRC	Service Ride Control
SRI	Service Reminder Indicator
SRS	Supplemental Restraint System
SS	Shift Solenoid
ST	Scan Tool
STID	Station Identification Station ID
S4WD	Selectable Four-Wheel Drive
Sw	Switch
SWPS	Steering Wheel Position Sensor
syn	Synchronizer
	T
TAC	Throttle Actuator Control
Tach	Tachometer
TAP	Transmission Adaptive Pressure, Throttle Adaptive Pressure
TBI	Throttle Body Fuel Injection
TC	Turbocharger, Transmission Control
TCC	Torque Converter Clutch
TCS	Traction Control System
TDC	Top Dead Center
TEMP	Temperature
Term	Terminal
TFP	Transmission Fluid Pressure
TFT	Transmission Fluid Temperature
THM	Turbo Hydro-Matic
TIM	Tire Inflation Monitoring, Tire Inflation Module
TOC	Transmission Oil Cooler
TP	Throttle Position
TPA	Terminal Positive Assurance
TPM	Tire Pressure Monitoring, Tire Pressure Monitor
TR	Transmission Range

TRANS	Transmission/Transaxle
TT	Tell Tail Warning Lamp
TV	Throttle Valve
TVRS	Television and Radio Suppression
TVV	Thermal Vacuum Valve
TWC	Three Way Converter Catalytic
TWC+OC	Three Way + Oxidation Converter Catalytic
TXV	Thermal Expansion Valve
U	
UART	Universal Asynchronous Receiver Transmitter
U/H	Underhood
U/HEC	Underhood Electrical Center
U-joint	Universal Joint
UTD	Universal Theft Deterrent
UV	Ultraviolet
V	
V	Volt(s), Voltage
V6	Six-Cylinder Engine, V-Type
V8	Eight-Cylinder Engine, V-Type
Vac	Vacuum
VAC	Vehicle Access Code
VATS	Vehicle Anti-Theft System
VCIM	Vehicle Communication Interface Mode
VCM	Vehicle Control Module
V dif	Voltage Difference
VDOT	Variable Displacement Orifice Tube
VDV	Vacuum Delay Valve
vel	Velocity
VES	Variable Effort Steering
VF	Vacuum Fluorescent
VIO	Violet
VIN	Vehicle Identification Number
VLR	Voltage Loop Reserve
VMV	Vacuum Modulator Valve
VR	Voltage Regulator
V ref	Voltage Reference
VSES	Vehicle Stability Enhancement System
VSS	Vehicle Speed Sensor

W	
w/	With
W/B	Wheel Base
WHL	Wheel
WHT	White
w/o	Without
WOT	Wide Open Throttle
W/P	Water Pump
W/S	Windshield
WSS	Wheel Speed Sensor
WU-OC	Warm Up Oxidation Converter Catalytic
WU-TWC	Warm Up Three-Way Converter Catalytic
X	
X-valve	Expansion Valve
Y	
yd	Yard(s)
YEL	Yellow

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Conversion - English/Metric

English	Multiply/ Divide by	Metric
In order to calculate English measurement, divide by the number in the center column. In order to calculate metric measurement, multiply by the number in the center column.		
Length		
in	25.4	mm
ft	0.3048	m
yd	0.9144	
mi	1.609	km
Area		
sq in	645.2	sq mm
	6.45	sq cm
sq ft	0.0929	sq m
sq yd	0.8361	
Volume		
cu in	16,387.00	cu mm
	16.387	cu cm
	0.0164	L
qt	0.9464	
gal	3.7854	
cu yd	0.764	cu m
Mass		
lb	0.4536	kg
ton	907.18	
	0.907	tonne (t)
Force		
Kg F	9.807	newtons (N)
oz F	0.278	
lb F	4.448	
Acceleration		
ft/s²	0.3048	m/s²
In/s²	0.0254	
Torque		
Lb in	0.11298	N·m
lb ft	1.3558	
Power		
hp	0.745	kW

Pressure (Stress)		
inches of H2O	0.2488	kPa
lb/sq in	6.895	
Energy (Work)		
Btu	1055	J (J= one Ws)
lb ft	1.3558	
kW hour	3,600,000.00	
Light		
Foot Candle	10.764	lm/m²
Velocity		
mph	1.6093	km/h
Temperature		
(°F - 32) 5/9	=	°C
°F	=	(9/5 °C + 32)
Fuel Performance		
235.215/mpg	=	100 km/L

Equivalents - Decimal and Metric

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

Fraction (in)	Decimal (in)	Metric (mm)
5/8	0.625	15.875
41/64	0.640625	16.27187
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

Fasteners

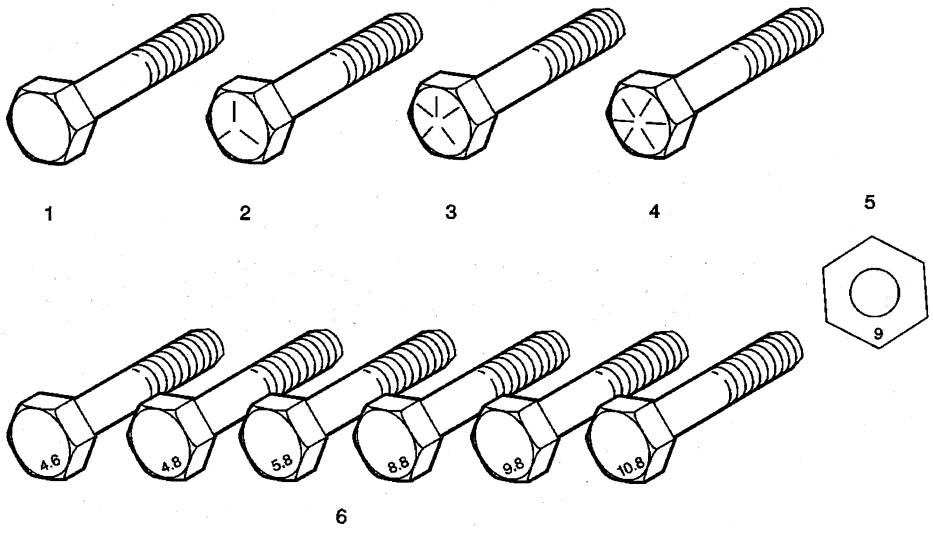
Metric Fasteners

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

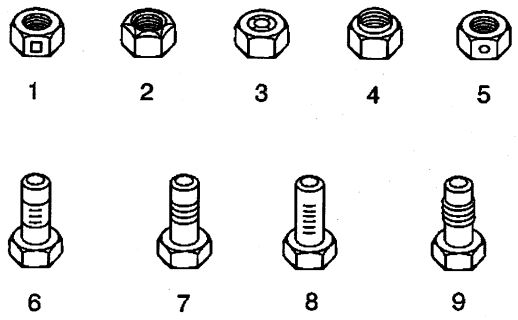
These fasteners accomplish the thread interface by a designed distortion or deformation in the fastener.

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