Chevrolet

Tracker

2004

Table of Contents

Product Information

Adventurous 2004 Chevrolet Tracker Combines A Small SUV With V-6 Power

For 2004 the Chevrolet Tracker offers three great small SUV choices that are big on capability and powered by a dependable V-6 engine. The base Tracker, along with the rugged ZR2 and LT, give Tracker a lineup of four-door models that offer Chevy Truck toughness and durability. It is a durable truck that can handle an active lifestyle.

"Tracker continues to give its owners the ability to handle just about any task, from a morning commute to an off-road adventure," said Margaret Brooks, Tracker marketing director. "And make no mistake, this is an authentic sport utility that can handle the roughest terrain."

Rugged, both on and off-road

Like all Chevy trucks, Tracker starts with a solid foundation. The steel ladder-type frame on which Tracker is built gives this Chevy Truck excellent on-road performance and the ability to go just about anywhere. Its frame and high ground clearance give Tracker many off-road advantages over many competitors that feature a unibody construction more common in passenger cars. Tracker also has achieved impressive crash test ratings.

"Combining the full-ladder frame with Tracker's 4x4 shift-on-the-fly, four-wheel-drive system gives Tracker the ability to handle the unexpected, on or off the road," Brooks said. "Tracker is a tough, durable, dependable Chevy Truck."

Precise power rack-and-pinion steering provide Tracker's confident road manners. Its highly responsive rear suspension features a five-link design to provide exceptional road feel and a greater tread width for sure-footed control and cornering. And an antiflex bar that arches across the Tracker engine compartment helps strengthen its body structure.

Value and style

Tracker gives consumers utility, performance, capability, value and style, all at a reasonable price. Available in two- or four-wheel-drive configurations, the Chevrolet Tracker is a whole lot of truck.

Tracker provides the essential power desired by small sport-utility buyers. All models come standard with a powerful 2.5L DOHC 24-valve V-6 engine that generates 165 peak horsepower (123 kw) and 162 lb.-ft. (220 Nm) of torque, while offering good fuel efficiency.

The base Tracker also includes standard AM/FM/CD radio, plus air conditioning, power rack-and-pinion steering, a folding rear seat and a shift-on-the-fly transfer case on 4WD models.

Tracker LT models add power locks and doors and more.

The Tracker ZR2 also comes standard with a V-6 engine, 8 inches (203 mm) of ground clearance, skid plates and a 4x4 transfer case that offers shift-on-the-fly four-wheel drive at speeds up to 60 mph.

Impressive, inside and out

Inside, Tracker is spacious, with plenty of room for friends - and their gear. The rear seats comfortably accommodate full-size adults. And the rear seats can be folded and stowed for even more room - up to 44.7 cubic feet (1,266L) of storage space on four-door models. Getting to that gear is easy with a hydraulic-assist, swing-out tailgate that opens to the side. There is added storage in seat back compartments, door pockets and center console.

On the outside, Tracker has bold and distinctive sculpted flanks and contoured edges. The ZR2 appearance package gives Tracker a tough-looking attitude, while the LT appearance package offers an upscale look. Other available features include tubular side steps, brush guard and fog lamps, ski and bike racks.

New For 2003

- Available in 4-door models only

Model Lineup

	Engine	Transmission
	2.5L V-6	4-spd auto
Base	s	s
ZR2	s	s
LT	s	s

Standard S
Optional O
Not available –

Specifications

Overview	
Models:	Chevrolet Tracker, Tracker LT, Tracker ZR2
Body style / driveline:	small sport utility vehicle, welded ladder-type frame, front-engine, 2- or 4-wheel drive
Construction:	welded ladder-type frame
EPA vehicle class:	sport utility vehicle
Manufacturing location:	Ingersoll, Ontario, Canada
Key competitors:	Ford Escape, Honda CR-V, Kia Sportage, Toyota RAV4
Engine	**2.5L V-6 (LE8)**
Type:	2.5L V-6
Displacement (cu in / cc):	152 / 2491
Bore & stroke (in / mm):	3.31 x 2.95 / 84 x 75
Block material:	aluminum alloy
Cylinder head material:	aluminum alloy
Valvetrain:	dual overhead camshafts
Ignition system:	coil on plug
Fuel delivery:	multi-port fuel injection
Compression ratio:	9.5:1
Horsepower (hp / kw @ rpm):	165 / 123 @ 6500
Torque (lb-ft / Nm @ rpm):	162 / 220 @ 4000
Recommended fuel:	87 octane
Emissions controls:	three-way catalytic converter, exhaust gas recirculation, positive crankcase ventilation, evaporative collection system
Estimated fuel economy (mpg city / hwy / combined):	2WD: 19 / 21 / 20 4WD 18 / 20 / 19
Transmissions	
Type:	4-speed automatic
Gear ratios: (:1):	
First:	2.83
Second:	1.49
Third:	1.00
Fourth:	0.69
Fifth:	-
Reverse:	2.70
Final drive ratio:	4.87:1

Chassis/Suspension	
Front:	independent MacPherson struts
Rear:	solid axle with five-link design
Steering type:	power rack and pinion
Steering ratio:	20.5:1
Steering wheel turns, lock-to-lock:	3
Turning circle, curb-to-curb (ft / m):	2-door: 31.5 / 9.6; 4-door: 34.8 / 10.6
Brakes	
Type:	power front disc/rear drum, optional anti-lock brakes
Rotor diameter x thickness (in/mm):	front: 11.3 x 0.67 / 287 x 17
Drum diameter x width (in / mm):	rear: 8.7 x 2.1 / 220 x 54
Total swept area (sq in / sq cm):	front: 185 / 1193 rear: 85.7 / 553
Wheels/Tires	
Wheel size and type:	• standard: Base: 15-inch x 5.5-inch styled steel;ZR2, LT: 15-inch x 6-inch alloy
Tires:	• Base 2WD: P195/75R15 all-season steel-belted radial blackwall tires • Base 4x4: P205/75R15 all-season steel-belted radial blackwall tires • LT: P215/70R15 all-season steel-belted radial blackwall tires • ZR2: P215/75R15 all-season steel-belted white outline-lettered

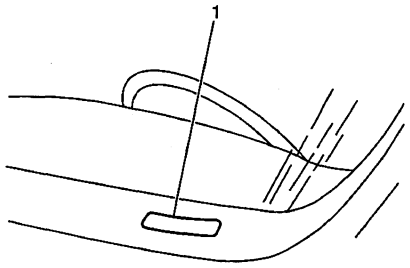
Dimensions

Exterior	
Wheelbase (in / mm):	97.6 / 2480
Overall length (in / mm):	2WD: 162.6 / 4130 4WD: 162.8 / 4135
Overall width (in / mm):	67.3 / 1710
Overall height (in / mm):	2WD: 65.6 / 1665 4WD: 66.3 / 1685
Track (in / mm):	
front:	2WD 57.5 / 1460 4WD 58.3 / 1480
rear:	2WD 57.5 / 1460 4WD 58.3 / 1480
Minimum ground clearance (in / mm):	2WD: 7.2 / 182 4WD: 8 / 202
Ground to rear load floor (in / mm):	2WD: 27.7 / 704 4WD: 26.9 / 684
Curb weight (lb / kg):	2WD: 2866 / 1300 4WD: 2987 / 1354
Interior	
Seating capacity:	5
Head room (in / mm):	front: 39.9 / 1013 rear: 39.6 / 1006
Leg room (in / mm):	front: 41.4 / 1051 rear: 35.9 / 912
Shoulder room (in / mm):	front: 52.8 / 1341 rear: 52.6 / 1336

Hip room (in / mm):	front: 50.7 / 1287 rear: 46.8 / 1188
Capacities	
EPA interior volume (cu ft / L):	117.2 / 3319
Cargo volume (cu ft / L):	
Seat up:	23.4 / 663
Seat stowed:	50.2 / 1422
GVWR, standard (lb / kg):	2WD: 3814 / 1730 4WD: 3924 / 1779
Payload, base (lb / kg):	2WD: 948 / 430 4WD: 937 / 425
Trailer towing maximum (lb / kg):	2WD: 1500 / 680 4WD: 1500 / 680
Fuel tank (gal / L):	17.4 / 66
Engine oil (qt / L):	5.2 / 5
Cooling system (qt / L):	8.5 / 8

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	Canadian Built
2	Manufacturer	C	CAMI
3	Make	N	Chevrolet MPV
4	GVWR/Brake System	B	3001-4000
5	Truck Line/Chassis Type	E J	Compact Cab 4X2 Compact Cab 4X4
6	Series	1	½ Ton
7	Body Type	3	Four Door Cab/Utility
8	Engine Type	1	2.5L, V6, MFI
9	Check Digit	--	Check Digit
10	Model Year	4	2004
11	Plant Location	6	Ingersoll, Ontario
12-17	Plant Sequence Number	--	Production Plant Sequence Number

Engine Identification

Position	Definition	Character	Description
All engines are stamped or laser etched with a identification number. The identification number contains the following 10 positions:			
1	Engine Type	H	--
2-3	Engine Displacement	25	2.5L, V6, MFI
4	Model Year	4	2004
5-10	Plant Sequence Number	--	Production Plant Sequence Number

Label - Vehicle Certification

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

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

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

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

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

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

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

Tire Placard

TIRE PLACARD

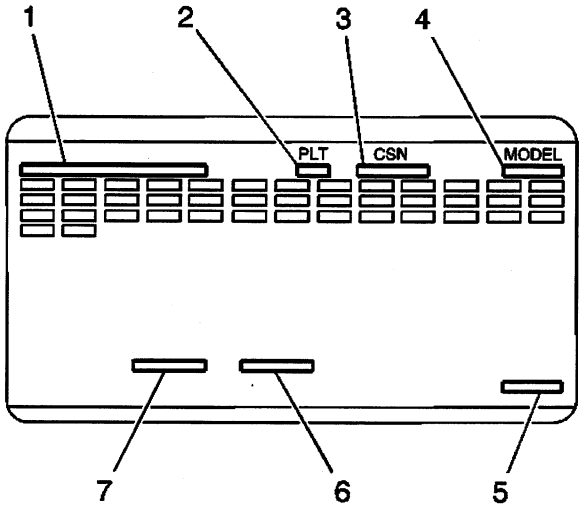
	FRONT	REAR
TIRES	P195/75R15	P195/75R15
RIMS	15X5 1/2JJ	15X5 1/2JJ
INFLATION PRESSURE COLD kPa/PSI	180/26	180/26

67D10

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

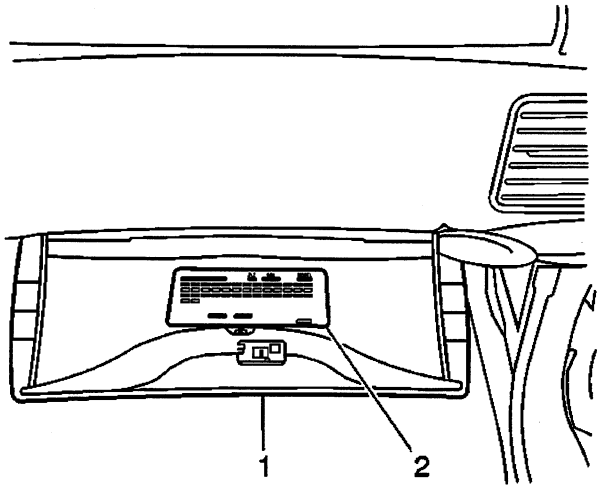
- The maximum vehicle capacity weight
- The cold tire inflation pressures
- The tire sizes (original equipment tires)
- The tire speed ratings (original equipment tires)

Service Parts Identification Label (SPID)



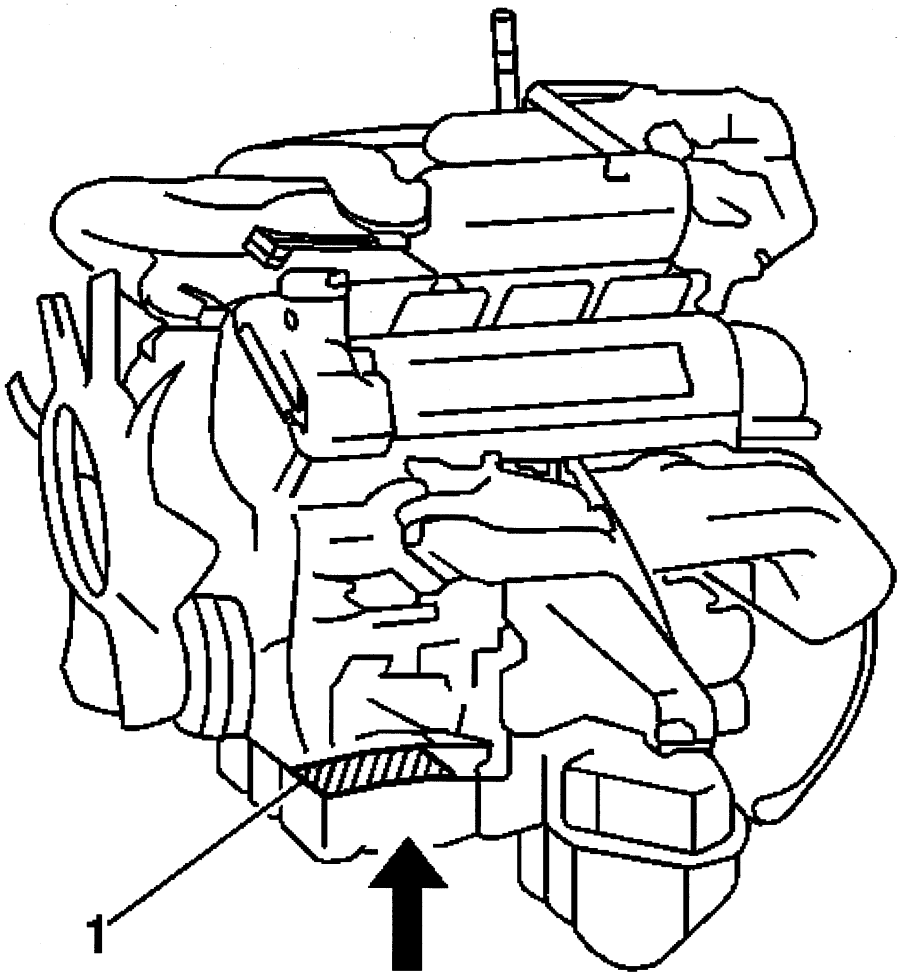
(1) Vehicle Identification Number
(2) Assembly Plant
(3) Build Sequence
(4) Model Designation
(5) Paint Technology
(6) Paint Type
(7) Exterior Paint Number

SPID Label Location



The service parts identification label (2) 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 (2) is located on the inside of the IP compartment (1).

Engine ID and VIN Derivative Location 2.5L



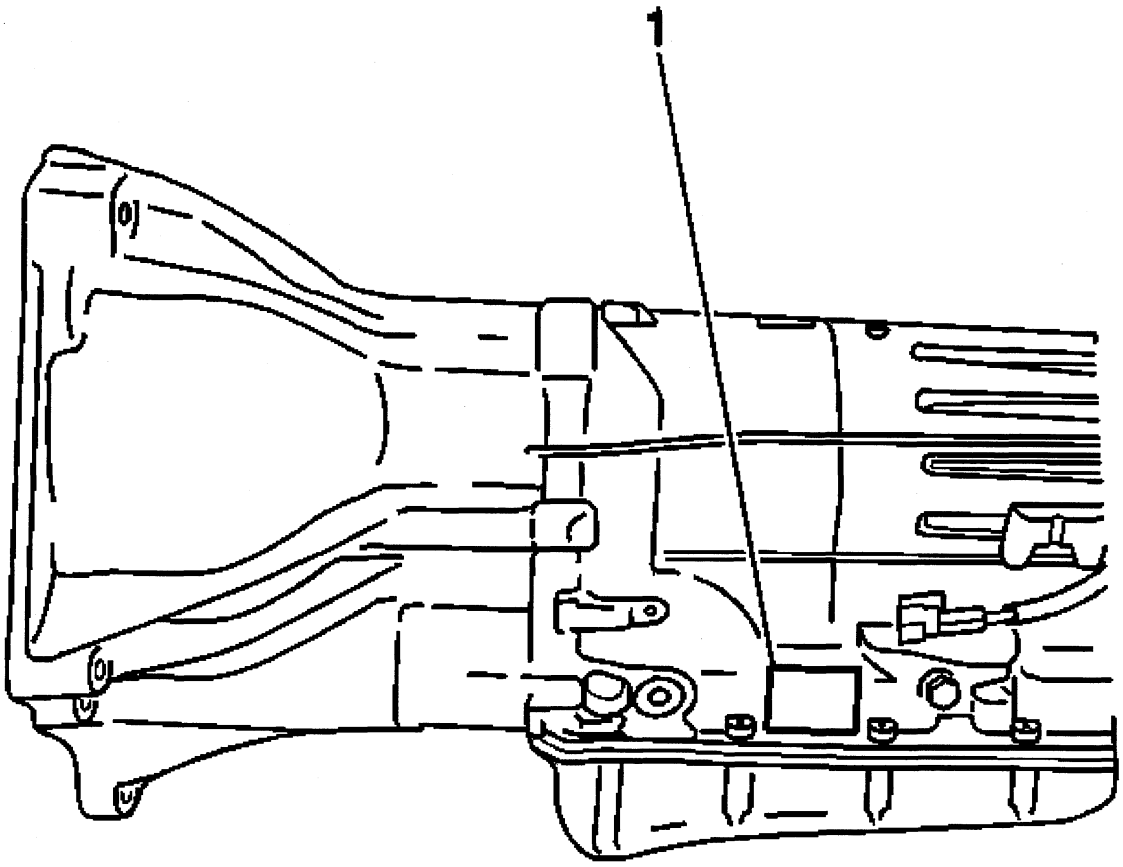
The engine code letter is the eight digit of the VIN, which identifies the engine.

Stick-on labels attached to the engine, laser etching, or stampings in the engine block indicate the engine type, the engine displacement, the model year and the production sequence number.

The engine ID number is located on the lower left front of the engine block.

Transmission ID and VIN Derivative Location

Automatic Transmission

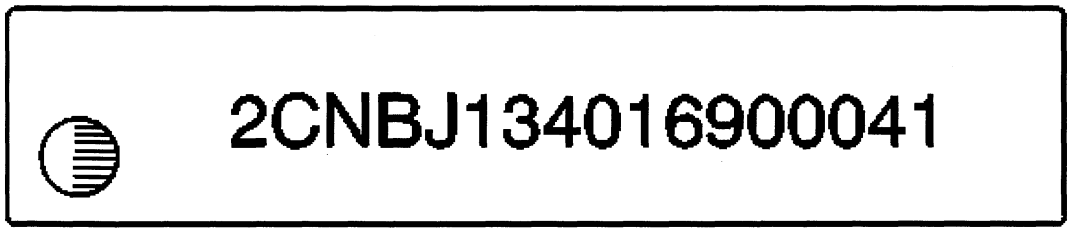


The automatic transmission model identification is located on a label or tag or stamped or etched on the transmission case (1). If this label is missing or unreadable, use the service parts identification label in order to identify the vehicle's transmission.

Engine and Transmission Usage

Body Type	Car Line (Division)	Engine Size	Fuel System	Engine RPO	Transmission Used	Transmission RPO
E/J	Tracker	2.5L	MFI	LE8	4 Speed Auto Only	M41

Labeling - Anti-Theft



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
AK5	Restraint System Front Seat, Inflatable, Driver and Passenger
AK6	Restraint System Seat, Inflatable, Driver and Passenger, Delete
AM7	Rear Folding Seat
AM9	Rear Split Back Folding Seat
AN4	Child Restraint Provisions
ARZ	Removable Stowage Net Bag
AR9	Deluxe Front Bucket Seat
AUO	Remote Entry Lock Control
AU3	Electric Door Lock Control
A31	Power Windows, All Doors
BNN	Cargo Area Stowage Compartment
BVE	Side Running Board Steps
B57	Deluxe Exterior Ornamentation
B58	Covering Floor Mat, Front & Rear, Carpeted Insert
B84	Body Side Exterior Molding
B96	Wheel Opening Molding
C25	Intermittent Rear Window Wiper System
C42	HVAC System Heater Deluxe Outside Air
C49	Electric Rear Window Defogger
C60	HVAC System Air Conditioner Front Manual Controls
DG7	Electric Remote Control Outside Mirror, Left Hand and Right Hand, Color
DL5	Decal Roadside Service Information
DR1	Manual Control Outside Mirror, Left Hand and Right Hand, Color
D42	Rear Compartment Shade
D48	Electric Remote Control Outside Mirror, Left Hand and Right Hand, Color
FE9	Federal Emission Certification
HC1	Axle Rear 4.62 Ratio
HC3	Axle Rear 5.12 Ratio
HC8	Axle Rear 4.87 Ratio
JM4	Power Brake System, Front Disc, Rear Drum, Cast Iron, Antilock, Front and Rear Wheel
J41	Power Brake System, Front Disc, Rear Drum, Cast Iron
K05	Engine Block Heater
K34	Automatic Cruise Control, Electronic
LE8	Engine Gas, 6 Cylinder, 2.5L, MFI, DOHC, Suzuki
L34	Engine Gas, 4 Cylinder, 2.0L, MFI, DOHC
MM5	Merchandised Transmission Manual 5 Speed Provisions
MX0	Merchandised Transmission Automatic Provisions, O/D
M41	4-Speed Auto Transmission, 2.828 1st, 0.730 4th
M59	5-Speed Manual Transmission, Suzuki, 3.65 1st, 0.795 5th
NC1	California Emission System, LEV
NF2	Federal Emission System, Tier 1
NF7	Federal Emission System, NLEV
NG1	Emission Certification, Geographically Restricted Registration
NV5	Differential Carrier Shield
NX2	Aluminum Spare Wheel 15 X 6.0
NY7	Transfer Case Shield
N29	Special Aluminum Wheel 15 X 6

RPO	Description
N33	Tilt Type Steering Column
N40	Non-Variable Ratio Power Steering
N79	Full Size Steel Spare Wheel
PG2	Steel Wheel 15 X 5.5
PW8	Aluminum Styled Wheel 15 X 6
P17	Spare Wheel Cover
QAR	Tire All P195/75R15-94S BW R/PE ST TL ALS
QCE	Tire All P205/75R15/N BL R/PE ST TL ALS
QCM	Tire All P215/75R15-100S WOL R/PE ST TL ALS
QPK	Tire All P215/70R15- 97S BW R/PE ST TL ALS
TL4	Painted Grille
T61	Daytime Running Lamp System
T62	Daytime Running Lamp System - Delete
T82	Automatic Headlamp Control, On-Off
UH8	Instrument Cluster, Cool Temperature, Trip Odometer, Tach
UL5	Radio Delete
UM6	Radio AM/FM Stereo, Seek/Scan, Auto Reverse Cassette, Clock, ETR
UQO	4 Speaker System, Dual Front Door Mounted, Dual Standard Range Quarter/Shelf
U1C	Radio AM/FM Stereo, Seek/Scan, Compact Disc, Clock, ETR
U19	Instrument Speedometer, Kilometers & Miles, Kilo Odometer
U73	Fixed Radio Antenna
VB1	Japan Shipping Label
VC5	Shipping Label, Except US, US Possessions, or Japan
VD9	Front & Rear Fascia, Body Color
VG8	Notice to Buyer Vehicle Label
V22	Chrome Radiator Grille
V54	Painted Roof Luggage Carrier
V73	Vehicle Statement USA/Canada
V78	Vehicle Statement - Delete
WR0	Appearance Package Special Edition Tracker
XR5	Pollen Filter
X88	Chevrolet Name Plate Conversion
YF5	Emission Certification, California
ZR2	4 x 4 Sport High Wider Performance Chassis Package
ZY1	Color Combination Solid
Z05	Convenience Package
Z49	Export Canadian Modif Mandatory Base Equip
5AO	Gloss Black Grille

Technical Information

Maintenance and Lubrication

Capacities - Approximate Fluid

Application	Specification	
	Metric	English
4-Speed Automatic Transmission (RPO M41)		
• Bottom Pan Removal-2WD	2.8 L	3.0 qts
• Bottom Pan Removal-4WD	2.5 L	2.6 qts
• Complete Overhaul-2WD - 2.5L	7.4 L	7.8 qts
• Complete Overhaul-4WD - 2.5L	7.1 L	7.5 qts
Axle Housing		
• Front	1.0 L	1.1 qts
• Rear	2.2 L	2.3 qts
Cooling System Capacity		
• 2.5L Engine	8.0 L	8.5 qts
Engine Crankcase		
• Without Filter Change 2.5L Engine	5.0 L	5.3 qts
• With Filter Change 2.5L Engine	5.5 L	5.8 qts
Fuel Tank		
• 4-Door Hardtop Models	66.0 L	17.4 gallons
Transfer Case 4WD Only	1.7 L	1.8 qts

Maintenance Items

Application	Specification
A/C Evaporator Air Filter-4-door only	GM P/N 91175057
Air Cleaner Element	
• 2.5 Liter Engine	GM P/N 30025009
Fuel Filter	GM P/N 30020673
Oil Filter	
• 2.5 Liter Engine	GM P/N 91176162
Positive Crankcase Ventilation (PCV) Valve	
• 2.5 Liter Engine	GM P/N 91176183
Spark Plugs	
• 2.5 Liter Engine, NGK IFR5J11	GM P/N 91176020
• 2.5 Liter Engine, NGK BKR6E11	GM P/N 91173854
• 2.5 Liter Engine, Denso K20PR-U11	GM P/N 91173855
Spark Plug Gap	1.0-1.1 mm (0.039-0.043 in)

Tire Inflation Pressure Specifications

Tire Size	Specification	
	Metric	English
P195/75R15-Front	180 kPa	26 psi
P195/75R15-Rear	180 kPa	26 psi
P205/75R15-Front	180 kPa	26 psi
P205/75R15-Rear	180 kPa	26 psi
P215/70R15-Front	180 kPa	26 psi
P215/70R15-Rear	180 kPa	26 psi
P215/75R15-Front	180 kPa	26 psi
P215/75R15-Rear	180 kPa	26 psi
Spare	180 kPa	26 psi

Fluid and Lubricant Recommendations

Application	Fluid/Lubricant
Automatic Transmission	DEXRON®-III Automatic Transmission Fluid GM P/N 12346143 (Canadian P/N 10952622) or the equivalent
Chassis Lubrication	Chassis Lubricant GM P/N 12377985, a lubricant meeting the requirements of NLGI # 2, Category LB or GC-LB, or the equivalent
Clutch Linkage Pivot Points	Chassis Lubricant GM P/N 12377985, a lubricant meeting the requirements of NLGI # 2, Category LB or GC-LB, or the equivalent
Engine Coolant	A 50/50 mixture of clean water (preferably distilled) and a good quality Ethylene Glycol Base Coolant GM P/N 1052753 (Canadian P/N 993089) or an equivalent conforming to GM Specification 1825M or an approved recycled coolant conforming to GM Specification 1825M.
Engine Oil	The engine oil with the American Petroleum Institute Certified For Gasoline Engines "Starburst" symbol of the proper viscosity.
Floor Shift Linkage	Lubriplate® Lubricant Aerosol GM P/N 12346293, a lubricant meeting the requirements of NLGI # 2, Category LB or GC-LB, or the equivalent
Front Wheel Bearings	Wheel Bearing Lubricant meeting the requirements of NLGI # 2, Category GC or GC-LB GM P/N 1051344 (Canadian P/N 993037) or the equivalent
Hood and Door Hinges	Multi-Purpose Lubricant, Superlube® GM P/N 12346241 (Canadian P/N 10953474) or the equivalent
Hood Latch Assembly, Secondary Latch Assembly, Pivots, Spring Anchor and Release Pawl	Lubriplate® Lubricant Aerosol GM P/N 12346293, a lubricant meeting the requirements of NLGI # 2, Category LB or GC-LB, or the equivalent
Hydraulic Brake System	Delco Supreme 11® Brake Fluid GM P/N 12377967 (Canadian P/N 992667) or an equivalent DOT-3 brake fluid
Hydraulic Clutch System	Hydraulic Clutch Fluid GM P/N 12345347 (Canadian P/N 10953517) or the equivalent
Key Lock Cylinders	Multi-Purpose Lubricant, Superlube® GM P/N 12346241 (Canadian P/N 10953474) or the equivalent
Manual Transmission Shift Linkage	Chassis Lubricant GM P/N 12377985, a lubricant meeting the requirements of NLGI # 2, Category LB or GC-LB, or the equivalent
Manual Transmission-All and Transfer Case-Four-Wheel-Drive	GM Goodwrench Synthetic Manual Transmission Fluid GM P/N 12346190 (Canadian P/N 10953477) or an equivalent SAE 75W-90 GL-4 Gear Oil
Parking Brake Cable Guides	Chassis Lubricant GM P/N 12377985, or lubricant meeting the requirements of NLGI # 2, Category LB or GC-LB
Power Steering System	DEXRON®-III Automatic Transmission Fluid GM P/N 12346143 (Canadian P/N 10952622) or the equivalent

Application	Fluid/Lubricant
Rear Axle-All and Front Axle-Four-Wheel Drive	Axle Lubricant GM P/N 12345977 (Canadian P/N 10953482) or SAE 80W-90 GL-5 Gear Lubricant
Weatherstrip Conditioning	Dielectric Silicone Grease GM P/N 12345579 (Canadian P/N 1974984) Weatherstrip Lubricant-Krytox GM P/N 3634770, or the equivalent
Windshield Washer Solvent	GM Optikleen® Washer Solvent GM P/N 1051515 (Canadian P/N 993033) or the equivalent

Descriptions and Operations

Power Steering System

Power Steering Gear Description

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

- The power steering fluid reservoir
- The power steering pump
- The power steering gear
- The power steering pipes and hoses

The power steering fluid flows from the fluid reservoir through a hose to the power steering pump. The engine drive belt rotates the pump pulley. The pulley turns the pump drive shaft. The shaft turns the pump rotor. The vanes in the rotor pressurize the power steering fluid. The engine speed sensing type flow control valve controls the fluid pressure. This valve reduces the fluid pressure as the engine speed increases. The fluid flows, under pressure, from the pump, through the pipe and the hose, to the steering gear.

Important

DO NOT disassemble the power steering gear.

The steering gear is a rack and pinion type steering system. The steering gear has a control valve which directs the fluid to either side of the rack piston. The piston uses hydraulic pressure to move the rack to the left and to the right. The rack moves the tie rods. The tie rods move the steering knuckles. The steering knuckles rotate on ball joints and strut bearings and turn the front wheels and tires.

The power steering fluid flows from the steering gear, through the pipe and the hose, to the reservoir.

If the hydraulic assist fails, the driver maintains manual steering control. Under this condition, however, the driver must use more steering effort.

Steering Wheel and Column

The steering wheel and column has 4 primary functions:

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

Vehicle Steering

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

Vehicle Security

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

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

Driver Convenience

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

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

Driver Safety

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

Suspension Description and Operation

Front Suspension

The front suspension has two primary purposes:

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

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

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

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

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

Rear Suspension

The rear suspension has two primary purposes:

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

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

The rear suspension of this vehicle is a coil sprung rigid axle with 5 links. The 2 upper control arms control the longitudinal movement and the rotational movement of the axle. The 2 lower control arms also control the longitudinal movement and the rotational movement of the axle. The rear axle tie rod controls the lateral axle movement. The control arms and the tie rod retain the axle to the frame with semi-rigid bushings. The 5 links allow the axle to move up and down as the vehicle travels over bumps. This control of axle movement defines the vehicle's handling characteristics in turns.

The up and down motion of the axle is absorbed predominantly by the coil spring. This spring is retained under tension between the axle and the frame. The 2 shock absorbers dampen the oscillations of the coil spring. A shock absorber is a basic hydraulic cylinder. A shock absorber is filled with oil and has a moveable shaft that connects to a piston inside the strut. Valves inside the shock absorber offer resistance to oil flow and consequently inhibit rapid movement of the piston and shaft. This control of vertical axle movement defines the vehicle's ride characteristics as the vehicle travels over bumps.

Wheels and Tires

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Wheel Nut Caps	3 N·m	27 lb in
Wheel Nuts	100 N·m	73.8 lb ft

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.

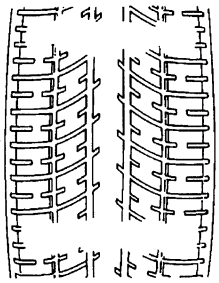
The following factors have an important influence on tire life:

- 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

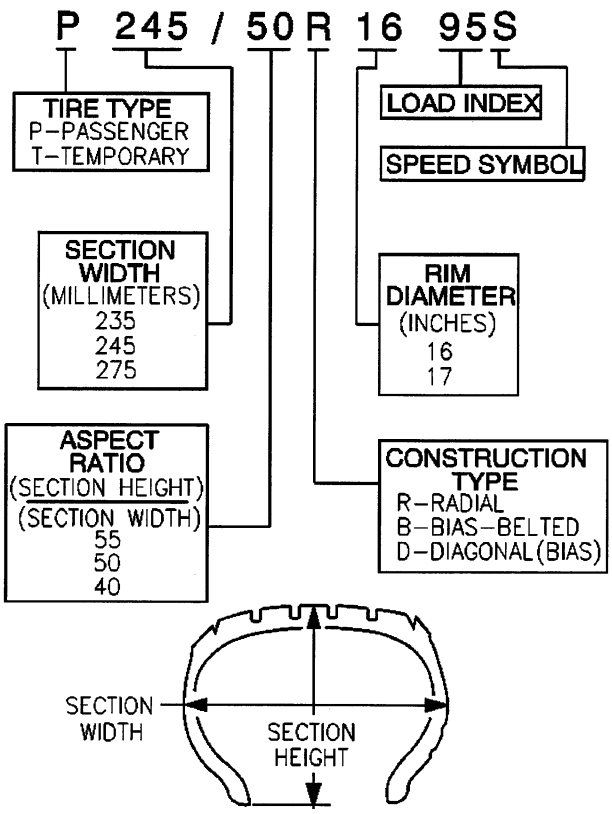
Tires with a lower than recommended pressure can cause the following conditions:

- 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

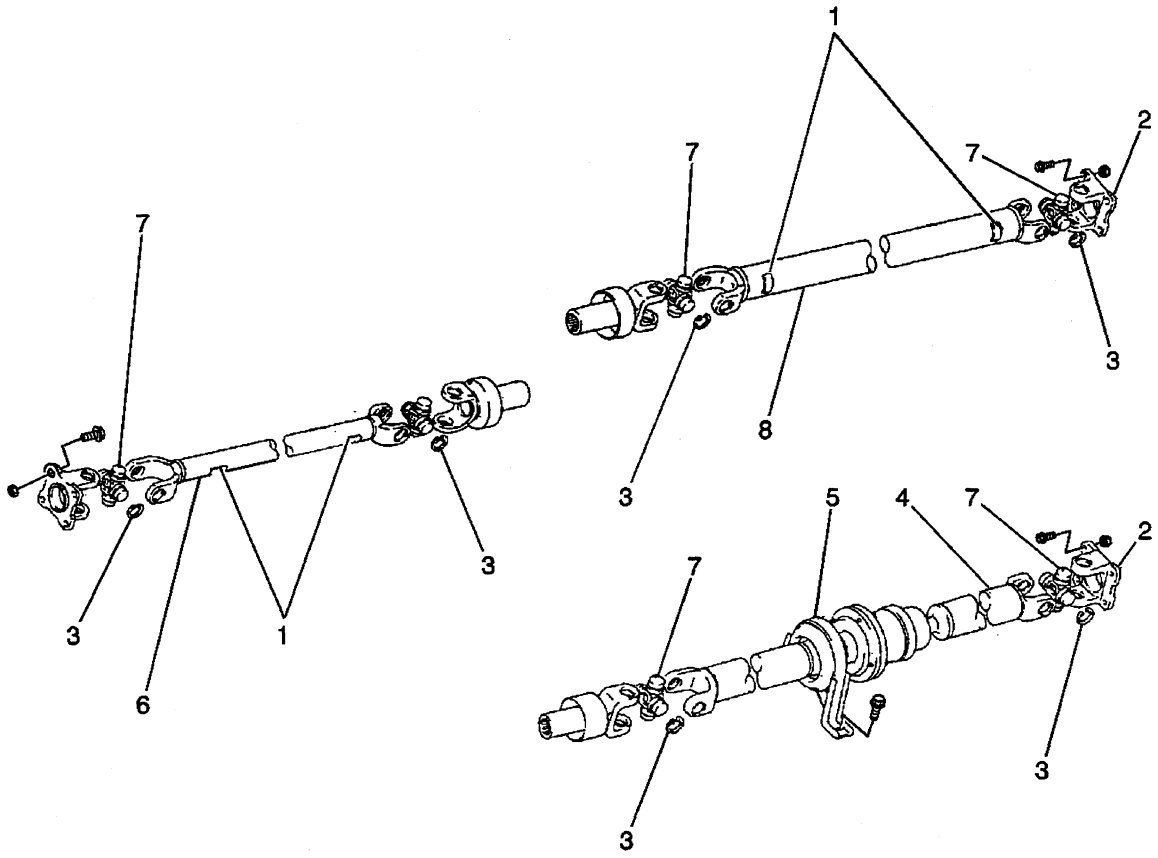


Most P-metric tire sizes do not have exact corresponding alphanumeric tire sizes. Replacement tires should be of the same tire performance criteria (TPC) specification number including the same size, the same load range, and the same construction as those originally installed on the vehicle. Consult 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

Driveline/Axle – Propeller Shaft

Front and Rear Propeller Shaft



(1) Balance Weight
(2) Pinion Flange Yoke
(3) Snap Ring
(4) 2 Piece Propeller Shaft (4 Door 2WD Equipped)
(5) Center Support and Center Support Bearing (4 Door 2WD Equipped)
(6) Front Propeller Shaft (4WD Equipped)
(7) Universal Joint
(8) Rear Propeller Shaft

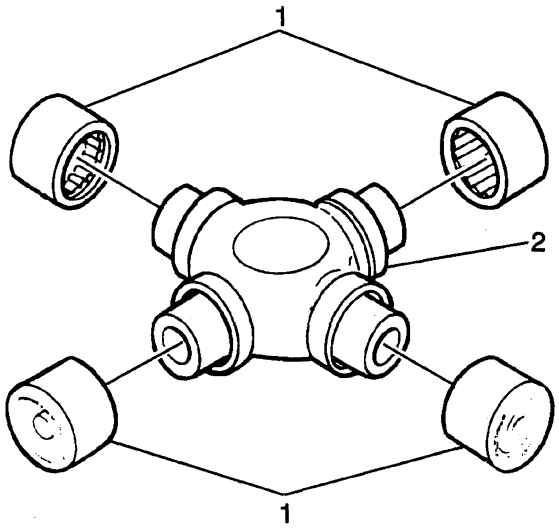
The propeller shaft is a balanced cylindrical shaft which transfers engine torque from the transmission or transfer case to the front or rear differential carrier through universal joints (7). The number of propeller shafts and universal joint assemblies can be either one propeller shaft and 2 universal joint assemblies (two-wheel drive), or 2 propeller shafts and 4 universal joint assemblies (four-wheel drive). The sliding yoke is splined to the transmission or transfer case output shaft. The sliding yoke permits fore and aft

movement of the propeller shaft as the differential moves up or down with suspension movement. The splines are lubricated internally by transmission or transfer case lubricant.

The pinion flange yoke (2) is bolted to the differential pinion flange and needs no lubrication. The propeller shaft is designed and built with the yoke lugs in line with each other. This design produces the smoothest running shaft possible and is known as phasing. The propeller shaft will absorb vibrations from speeding up and slowing on each revolution of the universal joints. A total cancellation of vibration produces a smooth flow of power through the driveline.

When servicing the propeller shaft and its components, exercise care during removal and installation procedures to make sure the propeller shaft is installed in the same position from which it was removed. It is necessary to make index marks (reference marks) on the propeller shaft pinion flange yoke and the differential pinion flange before removing them to ensure correct installation and alignment. If this precaution is not observed, a driveline imbalance may result, causing vibration, premature component wear or other problems.

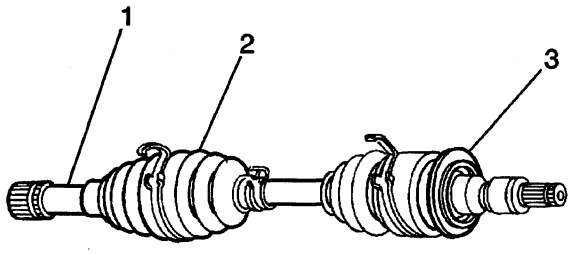
Universal Joint Description



A universal joint consists of bearing assemblies connected by a crossmember called a spider (2). The spider is shaped like a cross and has arms of equal length. The bearings used in universal joints are the needle roller type and revolve around the ends of the spider inside bearing caps which act as races. The bearing caps (1) are fitted into the propeller shaft yokes and are held in place with snap rings. The universal joint is designed to handle the effects of various loadings and axle windup during acceleration.

The universal joints will operate safely and efficiently within design angle variations. When the design angle is changed or exceeded, the operational life of the joint may decrease. Universal joints are lubricated and sealed during manufacturing and do not require maintenance. If a universal joint becomes noisy or worn, it must be replaced as an assembly.

Wheel Drive Shafts



The front drive axle shaft is a flexible assembly consisting of an inner and outer Constant Velocity (CV) joint joined by an axle shaft (1). The inner or differential-side CV joint is a double offset design which is completely flexible and has the capability of an in and out movement. The outer or wheel-side CV joint (2) is a ball joint design that is completely flexible, but cannot move in and out.

Front Drive Axle Description and Operation

The front axle assembly consists of the following:

- Front axle housing
- Differential carrier
- Left inner axle shaft
- Left drive axle shaft
- Right drive axle shaft

The front axle housing is mounted to the vehicle frame. The differential carrier is mounted in the right side of the front axle housing. The front propeller shaft turns the differential assembly which transfers engine power when in 4WD mode to the right and left drive axle shafts. The front axle housing is sealed and contains a synthetic gear lubricant which lubritcates the differential assembly, left inner axle shaft and its support bearing. The front axle housing is also vented to prevent excessive heat buildup.

The differential assembly utilizes a hypoid beveled ring and pinion gear set. It consists of a ring gear which is mounted to the differential case, a pinion gear which is mounted in the differential carrier, and a set of four gears mounted inside the differential case. Two of these gears are known as side gears and the other two are known as differential pinion gears. The right side gear is splined to the right drive axle shaft, and the left side gear is splined to the left inner axle shaft.

At the end of the left inner axle shaft is a flange which bolts to a similar flange at the differential-side joint of the left drive axle shaft. Because these shafts are splined to the differential side gears, the right drive axle and the left inner axle shaft rotate as their respective side gear rotates. The differential pinion gears are mounted on a pinion shaft and are free to rotate on it. The pinion shaft is fitted into bores in the differential case and is held in place by a roll pin. The differential case is mounted in the differential carrier where the pinion gear drives the ring gear, differential case, and its side and differential pinion gears.

Differential

The differential assembly utilizes a hypoid beveled ring and pinion gear set. It consists of a ring gear which is mounted to the differential case, a pinion gear which is mounted in the differential carrier, and a

set of four gears mounted inside the differential case. Two of these gears are known as side gears and the other two are known as differential pinion gears. The right side gear is splined to the right drive axle shaft, and the left side gear is splined to the left inner axle shaft.

At the end of the left inner axle shaft is a flange which bolts to a similar flange at the differential-side joint of the left drive axle shaft. Because these shafts are splined to the differential side gears, the right drive axle and the left inner axle shaft rotate as their respective side gear rotates. The differential pinion gears are mounted on a pinion shaft and are free to rotate on it. The pinion shaft is fitted into bores in the differential case and is held in place by a roll pin. The differential case is mounted in the differential carrier where the pinion gear drives the ring gear, differential case, and its side and differential pinion gears.

Front Axle Operation

When the transfer case is placed in 4WH or 4WL, the electric motor actuator turns on and builds pressure. When the pressure reaches the specific amount (within seconds) the actuator engages and locks the differential into the drive mode. Engine torque is provided by the front propeller shaft. The propeller shaft is bolted to the pinion flange by a universal joint. The pinion gear turns the ring gear and differential case, which causes the side gears to rotate with the case. This action in turn causes the left inner axle shaft and the right drive axle shaft to rotate and drive the front wheels. When both wheels have equal traction, the differential pinion gears do not rotate on the pinion shaft. This is due to an input force which is equally divided between the side gears. In other words, the differential pinion gears revolve with the pinion shaft, but do not rotate around it. When the vehicle turns a corner, the outer drive axle must turn faster than the inner drive axle. When the inner drive axle turns slower than the outer, it slows its side gear. The differential pinion gears will roll around the slower drive axle side gear providing torque to the outer drive axle. When the transfer case is placed in 2WH or N, the front axle is disengaged and the front propeller shaft as well as all front axle components remain stationary while the front wheels are free to rotate.

4WD Actuator Pump Operation

The 4WD Actuator pump consists of the following components:

- The pump motor
- The release valve
- The pressure switch
- The release valve solenoid
- The check valve
- The pump diaphragm

When the transfer control lever is shifted to the 4WD position, the pump motor and release valve solenoid is energized by the PCM after receiving the 4WD switch ON signal. The Pump motor rotates and moves the pump diaphragm to supply compressed air to the 4WD actuator. When the air pressure being supplied to the actuator exceeds the specified level, the pressure switch opens the ground circuit which stops the pump motor. The air pressure is retained within the system to maintain 4WD operation.

When the transfer control lever is shifted to the 2WD or Neutral position, the current flow to the release valve solenoid is shut off by the PCM. When the release solenoid is off, the release valve opens and the air pressure within the system is released to the atmosphere. Therefore, the front differential is changed to 2WD mode by the 4WD actuator located on the front differential housing.

Rear Drive Axle Description and Operation

The rear axle assembly contains two rigid axle shafts which transfer engine torque to the rear wheels. These axle shafts are supported in the rear axle housing by bearings at both outer ends, and driven by the differential assembly which is mounted in the center of the rear axle housing. A propeller shaft turns the differential assembly and transfers power to the rear axle shafts. The rear axle housing is sealed and contains a synthetic gear lubricant which lubricates the differential assembly and axle shafts bearings. The rear axle housing is also vented to prevent excessive heat buildup. The rear trailing rods connect the rear axle housing to the frame and act as pivot points for the housing as it moves up and down with the rear suspension. Coil springs support the rear of the vehicle and are seated into the frame and rear axle

housing axle. Shock absorbers are fitted between the rear axle housing and the frame to help to reduce road vibration and rough pavement. An upper control arm is fitted to the body by bushings, and to the rear differential carrier by a rear control arm ball joint to prevent the rear axle housing from moving in a lateral direction.

The differential assembly uses a hypoid, beveled ring and pinion gear set. It consists of a ring gear which is mounted to the differential case and a pinion gear which is mounted in the differential carrier. The ring and pinion gears are in constant mesh with each other. A set of six gears are mounted inside the differential case. Two of these gears are known as side gears and the other four are known as differential pinion gears. Each side gear is splined to an axle shaft which causes each axle shaft to turn when its side gear rotates. The differential pinion gears are mounted on a pinion cross shaft and are free to rotate on it. The pinion shaft is fitted into a bore in the differential case and is held in place by a pinion shaft roll pin. The differential case is mounted in the differential carrier where the pinion gear drives the ring gear, differential case, and the side and differential pinion gears. The differential carrier is mounted near the center of the rear axle housing.

Engine torque is provided by a rear propeller shaft that is bolted to the pinion gear by a universal joint and pinion flange. The pinion gear is in constant mesh with the ring gear and causes it to turn. The ring gear then rotates the differential case causing the differential pinion gears to turn with the case. This causes the side gears and both rear axle shafts to rotate. When both wheels have equal traction, the pinion gears do not rotate on the cross shaft. This is due to an input force that is equally divided between the side gears. In other words, the pinion gears revolve with the cross shaft but do not rotate around it. When the vehicle turns a corner, the outer axle must turn faster than the inner axle. When the inner axle turns slower than the outer, it slows its side gear. The differential pinion gears will roll around the slower side gear providing torque to the outer axle shaft.

Rear Wheel Speed Sensor (ABS)

A four-wheel antilock braking system is optional equipment on this vehicle. The rear wheel speed sensor is mounted on the rear differential carrier. The rear wheel speed sensor consists of a magnetic core, with a magnet and a coil. The speed sensor exciter ring is mounted on the differential case behind the ring gear and rotates with the case. An electrical impulse is produced each time a gear tooth of the speed sensor exciter ring passes the rear wheel speed sensor, allowing the sensor to receive a signal in direct proportion to the rear axle speed. This signal is then sent to the Electronic Brake Control Module (EBCM). For more information and diagnostic procedures, refer to Antilock Brake System.

Transfer Case Description

In 4WD equipped vehicles, the transfer case, located at the rear of the transmission, is responsible for transferring engine torque to the front and rear wheels.

The transfer case contains an input gear, countershaft and counter gear, rear output shaft, low output gear and a front output shaft, for front drive, connected and driven by a drive chain.

The transfer case gearshift control lever can be placed in four positions:

- 4H: by a direct connection with the transmission output shaft
- 4L: gear reduction by a connection with the input gear, counter gear and low output gear
- N: by way of the reduction clutch sleeve located between the input gear and the low output gear
- 2H: high speed to the rear wheels only by way of the front drive clutch sleeve located at the center of the rear output shaft

The case has an oil gallery and a plate at the synchronizer to provide proper lubrication under normal and harsh driving conditions. The front drive shift fork mechanism has an auxiliary spring to ensure a smooth shift from 4H to 2H.

You can shift from 2H to 4H or from 4H to 2H at any speed less than 100 kph (60 mph) and with the front wheels straight ahead. This is accomplished by a synchronizer installed to the front drive clutch. The front axle will engage faster if you take your foot off the accelerator pedal for a few seconds as you shift.

In 2WD equipped vehicles, the transfer case, located at the rear of the transmission, is responsible for transferring engine torque to the rear wheels. This transfer case is different from that of the 4WD vehicles.

It is not equipped with a gearshift control lever for 4H, 4L, 2H, and N positions. This transfer case contains an input gear, countershaft and countergear, rear output shaft and low output gear.

The powertrain control module (PCM) and the front drive axle actuator pump are the main components of the four wheel drive engagement system. The pump is controlled by the PCM. The pump compresses air to engage the front axle. When the transfer case is in four wheel drive (4H or 4L), the four wheel drive switch closes providing a ground signal to the PCM. The PCM actuates the pump which pressurizes the actuator in the front axle. This pressure engages the axle hub which connects the front drive shaft to the axle shafts, allowing the transmission/transfer case to turn the front wheels. The PCM will not operate the pump for more than 10 seconds in order to protect it. The PCM also provides a ground for the 4WD indicator in the instrument cluster. The indicator is provided ignition voltage through the IG fuse. With power and ground supplied, the indicator illuminates.

When the transfer case is in 4L (with auto trans), the four wheel drive low switch provides a ground signal to the PCM. The PCM will not engage the torque converter clutch while this signal is present.

When the transfer case is returned to the two wheel drive mode, the release valve in the pump opens and releases the pressure in the actuator. Without pressure, the hub disengages. The PCM also removes the ground to the 4WD indicator which causes the indicator to turn off.

Braking System Description and Operation

Hydraulic Brake System Description and Operation

System Component Description

The hydraulic brake system consists of the following:

Hydraulic Brake Master Cylinder Fluid Reservoir

Contains supply of brake fluid for the hydraulic brake system.

Hydraulic Brake Master Cylinder

Converts mechanical input force into hydraulic output pressure.

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

Hydraulic Brake Pressure Balance Control System

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

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

Hydraulic Brake Pipes and Flexible Brake Hoses

Carries brake fluid to and from hydraulic brake system components.

Hydraulic Brake Wheel Apply Components

Converts hydraulic input pressure into mechanical output force.

System Operation

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

Brake Assist System Description and Operation

System Component Description

The brake assist system consists of the following:

Brake Pedal

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

Brake Pedal Pushrod

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

Vacuum Brake Booster

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

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

Vacuum Source

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

Vacuum Source Delivery System

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

System Operation

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

Disc Brake System Description and Operation

System Component Description

The disc brake system consists of the following components:

Disc Brake Pads

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

Disc Brake Rotors

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

Disc Brake Pad Hardware

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

Disc Brake Caliper Hardware

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

System Operation

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

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

Drum Brake System Description and Operation

System Component Description

The drum brake system consists of the following:

Drum Brake Shoes

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

Brake Drums

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

Drum Brake Hardware

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

Drum Brake Adjusting Hardware

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

System Operation

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

Park Brake System Description and Operation

System Component Description

The park brake system consists of the following:

Park Brake Lever Assembly

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

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

Park Brake Cables

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

Park Brake Cable Equalizer

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

Park Brake Apply Lever

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

Park Brake Actuator/Adjuster

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

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

Drum Brake Shoes

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

System Operation

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

ABS Description and Operation

Antilock Brake System

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

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

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

Engine Description and Operation

Engine Mechanical Specifications - 2.5L

Application	Specification	
	Metric	English
General		
• Engine Type	V6	
• RPO Code	LE8	
• Displacement	2500 cc	153 CID
• Bore	84 mm	3.31 in
• Stroke	75.0 mm	2.95 in
• Compression Ratio	9.5:1	
• Firing Order	1-6-5-4-3-2	
• Spark Plug Type-Denso	SK16PR11 or SK20PR11 or K20PR-U11	
• Spark Plug Type-NGK	BKR6E11 or IFR5J11 or IFR6J11	
• Spark Plug Gap	1.0-1.1 mm	0.039-0.043 in
Compression		
• Compression Pressure at 400 RPM-Standard	1400-1600 kPa	199-227 psi
• Compression Pressure-Minimum	1300 kPa	185 psi
• Compression Pressure Difference Between Any Two Cylinders-Maximum	100 kPa	14.2 psi
Engine Vacuum		
• Vacuum at Sea Level at 800 RPM	59.9-80.2 kPa	17.7-23.7 in Hg
Lubrication System		
• Oil Pressure at 4000 RPM	390-470 kPa	55.5-66.8 psi
• Oil Capacity with Filter Change	5.5 L	5.8 qt
• Oil Capacity without Filter Change	5.0 L	5.2 qt
Cooling System		
• Cooling System Capacity	8.0 L	8.5 qt
• Temperature at which Thermostat begins to Open	82°C	179°F
• Temperature at which Thermostat Fully Open	95°C	203°F
• Thermostat Valve Lift	8 mm at 95°C	0.32 in at 203°F
• Cooling Fan Belt Deflection at 10 kg (22 lbs) of Force-New Belt	7-9 mm	0.27-0.35 in
• Cooling Fan Belt Deflection at 10 kg (22 lbs) of Force-Used Belt	9-11 mm	0.35-0.43 in
• Radiator Cap Relief Valve Pressure	108 kPa	15.7 psi
• Temperature at which Fan Clutch begins to Engage	50-70°C	122-158°F
Camshaft		
• Journal Outside Diameter	25.959-25.980 mm	1.0220-1.0228 in
• Journal Bore Diameter	26.000-26.033 mm	1.0236-1.0249 in
• Journal Oil Clearance-Standard	0.020-0.074 mm	0.0008-0.0029 in
• Journal Oil Clearance-Maximum	0.12 mm	0.0047 in
• Lobe Height Exhaust-Standard	39.428-39.588 mm	1.5523-1.5586 in
• Lobe Height Exhaust-Minimum	39.400 mm	1.5512 in
• Lobe Height Intake-Standard	39.445-39.605 mm	1.5530-1.5593 in
• Lobe Height Intake-Minimum	39.400 mm	1.5512 in
• Runout	0.10 mm	0.0039 in

Application	Specification	
	Metric	English
Connecting Rods and Bearings		
• Connecting Rod Bearing Clearance-Standard	0.039-0.057 mm	0.001-0.0022 in
• Connecting Rod Bearing Clearance-Maximum	0.080 mm	0.0031 in
• Connecting Rod Bushing Inside Diameter	21.003-21.011 mm	0.8269-0.8272 in
• Connecting Rod Bow-Maximum	0.050 mm	0.0020 in
• Connecting Rod Side Clearance-Maximum	0.45 mm	0.0177 in
• Connecting Rod Side Clearance-Standard	0.25-0.40 mm	0.0099-0.0157 in
• Connecting Rod Twist-Maximum	0.10 mm	0.0039 in
• Crankshaft Diameter Out-of-Round and Taper-Maximum	0.01 mm	0.0004 in
• Crankshaft Diameter-Standard	49.982-50.000 mm	1.9678-1.9685 in
• Crankshaft Diameter - 0.25 mm (0.0098 in) Undersize	49.732-49.750 mm	1.9580-1.9586 in
Crankshaft		
• Journal Taper	0.01 mm	0.0004 in
• Journal Out-of-Round	0.01 mm	0.0004 in
• Runout at Center Journal	0.06 mm	0.0023 in
• Thrust Bearing Thickness-Standard	2.500 mm	0.0984 in
• Thrust Bearing Thickness - 0.125 mm (0.0049 in) Oversize	2.563 mm	0.1009 in
• Thrust Play-Standard	0.11-0.31 mm	0.0044-0.0122 in
• Thrust Play-Maximum	0.38 mm	0.0149 in
• Reground Journal Finished Diameter	64.732-64.750 mm	2.5485-2.5492 in
Cylinder Head		
• Gasket Surface Distortion	0.05 mm	0.0020 in
• Seating Distortion Intake and Exhaust Manifolds	0.10 mm	0.004 in
Cylinder Block		
• Cylinder Bore-Standard-Stamped 1	84.01-84.02 mm	3.3075-3.3078 in
• Cylinder Bore-Standard-Stamped 2	84.00-84.01 mm	3.3071-3.3074 in
• Cylinder Bore-Maximum	84.050 mm	3.3090 in
• Cylinder Bore-Allowance for Honing	0.02 mm	0.008 in
• Gasket Surface Distortion-Maximum	0.06 mm	0.0024 in
• Taper and Out-of-Round-Maximum	0.10 mm	0.0039 in
Flywheel		
• Flywheel Face Runout	0.2 mm	0.0078 in
Main Bearings		
• Crankshaft Journal Diameter - "1" Stamping	64.994-65.000 mm	2.5588-2.5590 in
• Crankshaft Journal Diameter - "2" Stamping	64.988-64.994 mm	2.5586-2.5588 in
• Crankshaft Journal Diameter - "3" Stamping	64.982-64.988 mm	2.5583-2.5586 in
• Main Bearing Cap Bore Diameter - "A" Stamping	70.000-70.006 mm	2.7559-2.7561 in
• Main Bearing Cap Bore Diameter - "B" Stamping	70.006-70.012 mm	2.7561-2.7563 in
• Main Bearing Cap Bore Diameter - "C" Stamping	70.012-70.018 mm	2.7563-2.7566 in
• Main Bearing Clearance-Standard	0.024-0.044 mm	0.0009-0.0017 in
• Main Bearing Clearance-Maximum	0.060 mm	0.0023 in
• Main Bearing Thickness--Standard-Black	2.449-2.503 mm	0.0984-0.0985 in
• Main Bearing Thickness--Standard-Colorless	2.502-2.506 mm	0.0985-0.0986 in
• Main Bearing Thickness--Standard-Yellow	2.505-2.509 mm	0.0986-0.0987 in

Application	Specification	
	Metric	English
• Main Bearing Thickness--Standard-Blue	2.508-2.512 mm	0.0987-0.0988 in
• Main Bearing Thickness--Standard-Pink	2.508-2.500 mm	0.0983-0.0984 in
• Main Bearing Thickness--0.25 mm (0.0098 in) Undersize-Black and Red	2.624-2.628 mm	0.1033-0.1034 in
• Main Bearing Thickness--0.25 mm (0.0098 in) Undersize-Red Only	2.627-2.631 mm	0.1034-0.1035 in
• Main Bearing Thickness--0.25 mm (0.0098 in) Undersize-Yellow and Red	2.630-2.634 mm	0.1035-0.1036 in
• Main Bearing Thickness--0.25 mm (0.0098 in) Undersize-Blue and Red	2.633-2.637 mm	0.1036-0.1037 in
• Main Bearing Thickness--0.25 mm (0.0098 in) Undersize-Pink and Red	2.633-2.637 mm	0.1037-0.1038 in
Oil Pump		
• Housing-to-Oil Pump Gear Set Side Clearance-Maximum	0.11 mm	0.0043 in
• Outer Rotor-to-Oil Pump Body Radial Clearance-Maximum	0.15 mm	0.0059 in
• Outer Pressure Relief Valve-Relief Pressure	430 kPa	61.6 psi
• Outer Pressure Relief Spring Free Length	63.5 mm	2.5 in
• Outer Pressure Relief Spring Tension	86 Newtons at 52.0 mm	62.2 lb at 2.05 in
Pistons		
• Diameter-Standard Marked 1	83.980-83.990 mm	3.3063-3.3067 in
• Diameter-Standard Marked 2	83.970-83.980 mm	3.3059-3.3062 in
• Diameter - 0.25 mm (0.0098 in) Oversize	84.220-84.240 mm	3.3157-3.165 in
• Diameter - 0.50 mm (0.0196 in) Oversize	84.470-84.490 mm	3.3256-3.3264 in
• Cylinder Bore Diameter-Maximum	84.050 mm	3.3090 in
• Cylinder Bore Taper-Maximum	0.10 mm	0.004 in
• Cylinder Bore Out-of-Round-Maximum	0.10 mm	0.004 in
• Piston Pin Clearance	0.003-0.014	0.0001-0.0005
• Piston Pin Diameter	20.997-21.000 mm	0.8266-0.8268 in
• Piston-to-Cylinder Bore Clearance	0.02-0.04 mm	0.0008-0.0015 in
• Ring End Gap - Top Ring-Standard	0.20-0.35 mm	0.0079-0.0137 in
• Ring End Gap - Top Ring-Maximum	0.07 mm	0.0276 in
• Ring End Gap - Lower Ring-Standard	0.35-0.50 mm	0.0138-0.0196 in
• Ring End Gap - Lower Ring-Maximum	0.07 mm	0.0276 in
• Ring End Gap - Oil Ring-Standard	0.20-0.70 mm	0.0079-0.0275 in
• Ring End Gap - Oil Ring-Maximum	1.8 mm	0.0709 in
• Ring Groove Clearance - Lower Compression Ring	0.020-0.060 mm	0.0008-0.0023 in
• Ring Groove Clearance - Upper Compression Ring	0.030-0.070 mm	0.0012-0.0027 in
Valves		
• Guide Inside Diameter	6.000-6.012 mm	0.2362-0.2367 in
• Valve Margin - Intake-Standard	1.0 mm	0.039 in
• Valve Margin - Intake-Minimum	0.6 mm	0.023 in
• Valve Margin - Exhaust-Standard	1.2 mm	0.047 in
• Valve Margin - Exhaust-Minimum	0.7 mm	0.027 in
• Valve Head Radial Runout-Maximum	0.8 mm	0.003 in

Application	Specification	
	Metric	English
• Head Angles for Refinishing - Area Above Seat Contact Surface	15 Degrees	
• Head Angles for Refinishing - Area Below Seat Contact Surface-Exhaust Valve Only	60 Degrees	
• Head Angles for Refinishing - Seat Contact Surface	45 Degrees	
• Head Angles for Refinishing - Face Contact Surface	45 Degrees	
• Seating Contact Width-Seat	1.1-1.3 mm	0.0433-0.0512 in
• Seating Contact Width-Face	1.1-1.3 mm	0.0433-0.0512 in
• Inner Spring Free Length-Standard	36.08 mm	1.4204 in
• Inner Spring Free Length-Minimum	35.00 mm	1.3780 in
• Outer Spring Free Length-Standard	40.44 mm	1.5921 in
• Outer Spring Free Length-Minimum	39.22 mm	1.5441 in
• Inner Spring Preload-Standard	6.9-7.9 kg at 27.5 mm	15.2-17.4 lb at 1.08 in
• Inner Spring Preload-Minimum	5.9 kg at 27.5 mm	13.0 lb at 1.08 in
• Inner Spring Side Clearance-Maximum	1.6 mm	0.063 in
• Outer Spring Preload-Standard	15.4-17.8 kg at 31.7 mm	33.9-39.2 lb at 1.25 in
• Outer Spring Preload-Minimum	13.3 kg at 31.7 mm	30.0 lb at 1.25 in
• Outer Spring Side Clearance-Maximum	1.8 mm	0.070 in
• Stem Outside Diameter - Exhaust Valves	5.940-5.955 mm	0.2339-0.2344 in
• Stem Outside Diameter - Intake Valves	5.965-5.980 mm	0.2348-0.2354 in
• Stem-to-Guide Clearance - Exhaust Valves-Standard	0.045-0.072 mm	0.0018-0.0028 in
• Stem-to-Guide Clearance - Exhaust Valves-Maximum	0.09 mm	0.0035 in
• Stem-to-Guide Clearance - Intake Valves-Standard	0.020-0.047 mm	0.0008-0.0018 in
• Stem-to-Guide Clearance - Intake Valves-Maximum	0.07 mm	0.0027 in
• Valve Guide-Oversize	0.03 mm	0.0012 in
• Valve Guide Protrusion	13.5 mm	0.53 in
• Lifter - Outside Diameter	30.959-30.975 mm	1.2188-1.2194 in
• Lifter - Cylinder Head Bore Diameter	31.000-31.025 mm	1.2205-1.2214 in
• Lifter-to-Cylinder Head Oil Clearance-Standard	0.025-0.066 mm	0.0010-0.0025 in
• Lifter-to-Cylinder Head Oil Clearance-Maximum	0.015 mm	0.0059 in
Valve Lash	Hydraulic - Non-Adjustable	

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Air Conditioner (A/C) Compressor Mounting Bolts	23 N·m	17 lb ft
Air Conditioner (A/C) Compressor Bracket Mounting Bolts	55 N·m	40 lb ft
Camshaft Bearing Cap Bolts	12 N·m	106 lb in
Camshaft Position Sensor Bolt	15 N·m	11 lb ft
Camshaft Timing Sprocket Bolts	80 N·m	58 lb ft
Connecting Rod Bearing Cap Nuts	45 N·m	33 lb ft
Crankshaft Position Sensor Bolt	6 N·m	53 lb in
Crankshaft Pulley Bolt	150 N·m	109 lb ft
Cylinder Head Cover Bolts	10.5 N·m	93 lb in
Cylinder Head Bolts		
• First Pass	53 N·m	39 lb ft
• Second Pass	84 N·m	61 lb ft
• Third Pass	Loosen to 0	

Application	Specification	
	Metric	English
• Fourth Pass	53 N·m	39 lb ft
• Fifth Pass	84 N·m	61 lb ft
• Sixth Pass - Final Torque	105 N·m	76 lb ft
Cylinder Head M 6 Bolt	11 N·m	97 lb in
Drive Belt Tensioner Bolts		
• Accessory Drive Belt Tensioner Bolts	25 N·m	19 lb ft
Engine Cooling Fan Nuts	25 N·m	18 lb ft
Engine Ground Wire Bolts	15 N·m	11 lb ft
Engine Mount Nuts	50 N·m	37 lb ft
Engine Oil Drain Plug	35 N·m	26 lb ft
Engine Oil Pan Nuts and Bolts	11 N·m	97 lb in
Exhaust Manifold Heat Shield Bolts	10 N·m	89 lb in
Exhaust Manifold-to-Cylinder Head Nuts	30 N·m	22 lb ft
Exhaust Manifold-to-Bracket Bolts	50 N·m	37 lb ft
Fuel Rail Banjo Fitting	30 N·m	22 lb ft
Flywheel Retaining Bolts		
• Automatic Transmission	70 N·m	51 lb ft
Generator Mounting Bolts and Nuts	23 N·m	17 lb ft
Generator Terminal Nut	8 N·m	71 lb in
Heated Oxygen HO2S1 and HO2S2 Sensor	45 N·m	33 lb ft
Ignition Coil Bolts	10 N·m	89 lb in
Intake Manifold Bolts and Nuts	23 N·m	17 lb ft
Lower Crankcase Bolts		
• First Pass	19 N·m	14 lb ft
• Second Pass - Final Torque	27 N·m	20 lb ft
Main Bearing Cap Bolts		
• First Pass	42 N·m	31 lb ft
• Second Pass - Final Torque	58 N·m	42 lb ft
Negative Battery Cable	15 N·m	11 lb ft
Oil Pressure Switch	14 N·m	11 lb ft
Oil Pump Bolts	27 N·m	20 lb ft
Oil Pump Case Bolts	12 N·m	106 lb in
Oil Pump Strainer Bolts	11 N·m	97 lb in
Power Steering Pump Bolts	25 N·m	19 lb ft
Spark Plugs	25 N·m	18 lb ft
Starter Bolts	11 N·m	97 lb in
Strut Tower Brace	50 N·m	37 lb ft
Throttle Body Bolts and Nuts	12 N·m	106 lb in
Timing Chain Cover Nut and Bolts	11 N·m	97 lb in
Timing Chain Tensioner Bolts - Left Camshaft	12 N·m	106 lb in
Timing Chain Tensioner Bolts - Right Camshaft	11 N·m	97 lb in
Timing Chain Tensioner Nuts - Left Camshaft	45 N·m	33 lb ft
Timing Chain Tensioner Bolts - Primary	11 N·m	97 lb in
Timing Chain Tensioner Guide Bolts - Primary	11 N·m	97 lb in
Timing Chain Tensioner Shoe Nut - Primary	27 N·m	20 lb ft
Torque Converter Bolts	65 N·m	47 lb ft
Transmission to Engine Mounting Bolts	80 N·m	58 lb ft
Water Pump Bolts	27 N·m	20 lb ft

Engine Component Description

Engine Construction

The engine is a six cylinder, 60 degree V, four stroke gasoline unit with a Double Overhead Cam (DOHC) valve mechanism arranged for V-type valve configuration.

The DOHC is mounted over the cylinder head and is driven by the crankshaft through timing chains. In this configuration there are no push rods and no rocker arms provided in the valve train system.

Cylinder Block

The cylinder block is an aluminum casting with six cast iron cylinder sleeves. The cylinder block has six cylinders with a V-type arrangement. The cylinders are numbered 1 through 6 starting from the crankshaft pulley, left bank, alternating between the left and right bank. The cylinder block contains coolant jackets through which coolant flows around the cylinders, to cool the cylinder block and maintain a constant operating temperature. The lower crankcase of the cylinder block is also an aluminum casting with cast iron inserts at the main bearing locations. The lower crankcase runs the entire perimeter of the cylinder block.

Crankshaft

The crankshaft is nodular cast iron and is supported by four main bearings. The crankshaft is counterbalanced by the flywheel, the crankshaft balancer and counterweights cast into the crankshaft. Oil holes run through the center of the crankshaft to supply oil to the connecting rods, bearings, pistons and other components. The end thrust load is taken by the thrust washers installed between the number two and three cylinders. The main bearings are of the precision insert type. The front of the crankshaft incorporates a sprocket which drives the oil pump through a sprocket and chain.

Connecting Rod and Piston

Each piston is cast aluminum alloy and has two compression rings and one oil ring. The piston rings are of a low tension type to reduce friction. The top compression ring is plated with chromium for abrasion resistance. The second compression ring is gray iron. The oil ring is a 3-piece spring construction, consisting of two rails and one spacer.

The piston pin is offset 0.5 mm (0.02 in) toward the thrust side. This allows a gradual change in thrust pressure against the cylinder wall as the piston travels through the bore. The connecting rods are forged steel, heat treated and shot peened. Piston pins are chromium steel and have a full floating fit in the pistons and in the connecting rods. The connecting rod bearings are of the precision insert type.

Oil Pump

The oil pump is bolted to the bottom of the lower crankcase. A sprocket on the front of the oil pump is driven by a chain from the sprocket on the front of the crankshaft. The tension on the oil pump drive chain is accomplished by an adjustable guide.

Oil Pan

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

Cylinder Head

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

Each cylinder head has 3in-line combustion chambers. Each combustion chamber has two intake valves and two exhaust valves.

A fuel injector is positioned near each set of intake valves. During each intake stroke of the engine, a fuel injector sprays or atomizes fuel into a fine mist. This mist mixes with air drawn in through the intake manifold as the piston reaches the bottom of the cylinder during the intake stroke.

Valves

The valve train is driven by a double overhead camshaft. Each camshaft has 6 cam lobes. Each cam lobe operates an intake or exhaust valve. Valve lash is not adjustable. Valve lash is provided for by hydraulic valve lash (HVL) adjusters.

There are two intake and two exhaust valves per cylinder. There are two valve springs per valve. The valve springs are conical-shaped to fit inside the valve lifter body. Positive valve stem seals are used on all valves.

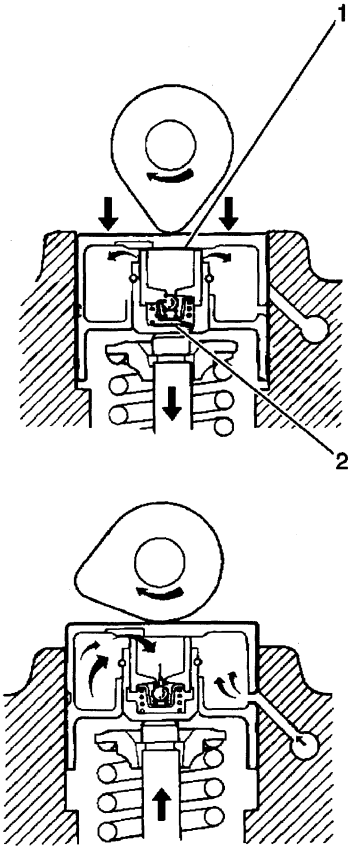
Valve Lifters

Direct acting hydraulic valve lifters are used. The valve lifter body includes a hardened iron contact foot bonded to a steel shell. These lifters are not repairable.

Valve Lifter (Hydraulic Valve Lash Adjuster) Operation

The hydraulic valve lash (HVL) adjuster located between the camshaft and the valve stem is a direct acting type.

With the engine oil delivered into it from the oil pump, the HVL adjuster operates as follows to adjust the valve lash, clearance to 0 automatically at all times.



1. When the camshaft is not depressing the HVL adjuster, the adjuster is held against the camshaft and the valve stem by the plunger spring. In this state, the valve lash is kept at 0. At 0 valve lash, the oil pressure becomes equal in the A (1) and B (2) chambers, and the check ball closes the passage between these 2 chambers.
2. When the lobe of the camshaft starts pressing the HVL adjuster, the adjuster and plunger are pushed downward at the same time the body is pushed upward by the counterforce from the valve stem. As a result, the B (2) chamber is compressed and the pressure rises inside the HVL adjuster. The engine oil in the B (2) chamber will leak through the slight clearance between the body and the plunger. However, since the compression time is very short, the volume of engine oil in the B (2) chamber will only change slightly and the HVL adjuster, plunger and body as one unit, push down the valve stem to open the valve.
3. When the pushing of the camshaft against the HVL adjuster is over, the operation starts again as described in step 1. As the oil pressure in the B (2) chamber is lower than that in A (1) (the oil in the B (2) chamber under high pressure has leaked gradually -- refer to step 2), the oil pressure in the A (1) chamber pushes the check ball open to allow the engine oil to flow from the A (1) chamber to the B (2) chamber until the oil pressure becomes equal between the two chambers.

Camshaft

4 camshafts are used, 2 for all intake valves, the other 2 for all exhaust valves. The camshafts are cast iron. The left hand bank exhaust camshaft rear end is slotted to mate with, and drive the camshaft position sensor.

Camshaft Housings and Caps

The camshaft housings and caps are cast aluminum. The camshafts run directly on the housings and caps without bearing inserts.

Camshaft Drive

3 roller timing chains are used. One chain is driven from the crankshaft and drives an idler gear and the right bank intake camshaft. A second chain is driven from the idler gear and drives the camshafts left bank camshafts. A third chain is driven from the right bank intake camshaft and drives the right bank exhaust camshaft.

A mechanical, ratcheting tensioner applies tension to an adjustable guide on the slack side of the crankshaft timing chain. A fixed guide controls crankshaft chain motion on the tension side of the chain.

An hydraulic tensioner and an upper guide control camshaft chain motion. The hydraulic tensioner incorporates a guide which applies tension to the slack side of the camshaft timing chain.

Timing Chain Housing and Cover

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

Cylinder Head Covers

The cylinder head covers are die cast aluminum and house the ignition coils.

Intake and Exhaust Manifolds

The intake manifolds are made of aluminum. The exhaust manifolds are cast iron.

Lubrication Description

The oil pump is of a trochoid type, and is mounted under the crankshaft. Oil is drawn up through the oil pump strainer and passed through the pump to the oil filter. The filtered oil flows into 3 paths in the cylinder block. In one path, the oil reaches the crankshaft journal bearings. Oil from the crankshaft journal bearings is supplied to the connecting rod bearings by means of intersecting passages drilled in the crankshaft, and then injected from the big end of the connecting rod to lubricate the piston, rings, and cylinder wall.

In other paths oil goes up to the cylinder heads and lubricates valves and camshafts after passing through he internal oilway of camshafts.

An oil relief valve is provided on the oil pump. This valve starts relieving oil pressure when the pressure exceeds about 430 kPa (61.1 psi).

Engine Cooling

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Air Conditioning (A/C) Flexible Hose Bolts	15 N·m	11 lb ft
Air Conditioning (A/C) Mounting Bracket Bolts	23 N·m	17 lb ft
Battery Cable-to-Battery Terminal Retainers	15 N·m	11 lb ft
Cooling Fan Nuts	11 N·m	97 lb in
Coolant Intake Pipe Bolt	11 N·m	97 lb in
Crankshaft Pulley Bolts	16 N·m	12 lb ft
Engine Oil Level Indicator Tube Mounting Bolt	11 N·m	97 lb in
Fan Clutch Nuts		
• 2.0L Engine	11 N·m	97 lb in
• 2.5L Engine	25 N·m	18 lb ft
Generator Mounting Bracket Bolt	23 N·m	17 lb ft
Generator Upper Mounting Bolt	27 N·m	20 lb ft
Heater Outlet Line Bolt	15 N·m	11 lb ft
Outlet Support Pipe Bolt	11 N·m	97 lb in
Power Steering Fluid Reservoir Bolts	15 N·m	11 lb ft
Radiator Bolts	10 N·m	89 lb in
Shroud Bolts	11 N·m	97 lb in
Thermostat Cap Bolts	16 N·m	12 lb ft
Water Pump Pulley Bolts	23 N·m	17 lb ft
Water Pump Nuts and Bolts	13 N·m	115 lb in

Cooling System Description and Operation

Coolant Heater – 2.0L Only

The engine coolant heater is used to preheat the engine coolant for cold weather starting. The engine coolant heater operates from a 110-volt AC power source and uses a heating element installed in the engine block coolant jacket. The heating element warms the coolant when the heater cord is plugged into an AC power source.

The unit has a detachable electrical cord. If the heater fails to operate, inspect the cord connections and power supply before replacing the heating element.

Cooling System

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

Cooling Cycle

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

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

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

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

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

Coolant

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

Radiator

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

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

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

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

Pressure Cap

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

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

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

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

Coolant Recovery System

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

In effect, a cooling system with a coolant recovery reservoir is a closed system. When the pressure in the cooling system gets too high, it will open the pressure valve in the pressure cap. This allows the coolant, which has expanded due to being heated, is allowed to flow through the overflow tube and into the recovery reservoir. As the engine cools down, the temperature of the coolant drops and a vacuum is created in the cooling system. This vacuum opens the vacuum valve in the pressure cap, allowing some of the coolant in the reservoir to be siphoned back into the radiator. Under normal operating conditions,

no coolant is lost. Although the coolant level in the recovery reservoir goes up and down, the radiator and cooling system are kept full. An advantage to using a coolant recovery reservoir is that it eliminates almost all air bubbles from the cooling system. Coolant without bubbles absorbs heat much better than coolant with bubbles.

Air Baffles and Seals

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

Water Pump

The water pump is a centrifugal vane impeller type pump. The pump consists of a housing with coolant inlet and outlet passages and an impeller. The impeller is mounted on the pump shaft and consists of a series of flat or curved blades or vanes on a flat plate. When the impeller rotates, the coolant between the vanes is thrown outward by centrifugal force.

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

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

Thermostat

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

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

Engine Electrical

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Battery Cable-to-Battery Terminal Retainers	15 N·m	11 lb ft
Battery Hold Down Bracket Nuts	8 N·m	71 lb in
Body Ground Bolt	8 N·m	71 lb in
Camshaft Position (CMP) Sensor Retaining Screws	15 N·m	11 lb ft
Commutator End Cover Bolts	8 N·m	71 lb in
Field Coil Lead Wire Retaining Nut	10 N·m	89 lb in
Generator B Terminal Nut	10 N·m	89 lb in
Generator Housing Bolts	17 N·m	10 lb ft
Generator Mounting Bolts	23 N·m	17 lb ft
Generator Pulley Nut	118 N·m	86 lb ft
Ignition Coil Bolts	10 N·m	89 lb in
Solenoid Mounting Screws	7 N·m	62 lb in
Spark Plugs	25 N·m	19 lb ft
Starter Motor Mounting Bolts	30 N·m	22 lb ft
Starter Solenoid Nut	8 N·m	71 lb in

Battery Usage

Application	Specification		
	60 Amp	70 Amp	85 Amp
• Amphere Hour Capacity	36	48	54
• Catalog Number	974	2841	3274
• Cold Cranking Amperes	390	600	700
• Replacement Model	26R-50S	85-7YR	24R-7YR
• Reserve Capacity Minutes	71	--	--
• Test Load Amperes	190	295	350

Generator Usage

Application	Specification	
	Metric	English
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 (Viewed From Pulley Side)	
Maximum Generator Output	60, 70 and 85 amps	
Maximum Generator Speed	18,000 RPM	
Normal Operating Voltage	12 volts	
Polarity Negative (-) Ground No-Load Generator Speed	1,300 RPM	
Regular Voltage	14.4-15.0 volts	
Rotor Slip Ring Resistance	2.5-2.9 ohms	
Temperature Range	-30 to 90°C	-22 to 194°F

Starter Motor Usage

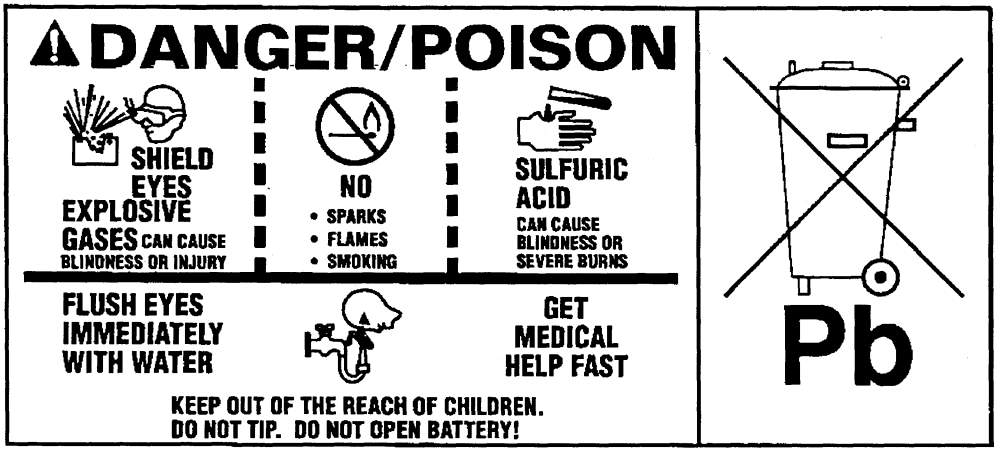
Application	Specification	
	Metric	English
Brush Length--Standard 1.2kW	12.3 mm	0.44 in
Brush Length--Minimum 1.2kW	7 mm	0.28 in
Brush Length--Standard 1.4kW	16.5 mm	0.65 in
Brush Length--Minimum 1.4kW	12.0 mm	0.47 in
Commutator Run-Out--Standard	0.05 mm	0.002 in
Commutator Run-Out--Maximum	0.40 mm	0.015 in
Commutator Outside Diameter--Standard	29.4 mm	1.16 in
Commutator Outside Diameter--Minimum	28.8 mm	1.13 in
Commutator Insulation Depth--Standard	0.4-0.6 mm	0.015-0.023 in
Commutator Insulation Depth--Minimum	0.2 mm	0.008 in
Direction of Rotation	Clockwise as viewed from pinion	
Number of Pinion Teeth	8	
Output	1.2 and 1.4 kwatts	
Rating	30 seconds	
Solenoid Operating Voltage	8 volts maximum	
Starter Motor Current Draw--No--Load-1.2 kW	90 Amps maximum at 11 Volts at 2500 RPM	
Starter Motor Current Draw--No--Load--1.4 kW	90 amps max. at 11 volts at 3000 RPM	
Starter Motor Current Draw--Load -1.2 kW (11 N·m / 97 lb in of torque 880 RPM)	300 amps at 7.5 volts	
Starter Motor Current Draw--Load -1.4 kW (10 N·m / 89 lb in of torque 1000 RPM)	300 amps at 7.7 volts	
Starter Motor Current Draw--Locked Rotor -1.2 kW (20 N·m / 14 lb ft of torque)	760 amps max. at 4 volts	
Starter Motor Current Draw--Locked Rotor -1.4 kW (23 N·m / 17 lb ft of torque)	980 amps max. at 4 volts	
Voltage	12 volts	

Battery Description and Operation

Caution

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

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



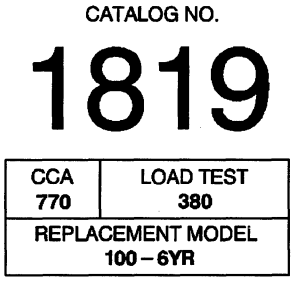
The maintenance free battery is standard. There are no vent plugs in the cover. The battery is completely sealed except for two small vent holes in the side. These vent holes allow the small amount of gas that is produced in the battery to escape.

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

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

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

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



A battery has 2 ratings:

- Reserve capacity
- Cold cranking amperage

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

Reserve Capacity

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

Cold Cranking Amperage

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

Circuit Description

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

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

Starting System Description and Operation

The cranking circuit consists of the battery, the starter motor, the ignition switch and related parts. All of these components are connected electrically.

The starter solenoid windings are energized when the ignition switch is turned to the start position and the clutch pedal position (CPP) switch (manual transmission) or the transmission range switch (automatic transmission) is closed. (In manual transmission equipped vehicles, the clutch pedal must be fully depressed to activate the clutch pedal position switch.) The resulting plunger and shift lever movement causes the drive pinion to engage the engine flywheel ring gear and the starter solenoid contacts to close.

With the contacts closed, the starter solenoid provides a closed circuit between the positive (+) battery terminal and the starter motor. The circuit is complete and cranking occurs as soon as the starter solenoid contacts are closed (the starter motor is permanently grounded to the engine block). When the engine starts, the clutch and drive assembly is designed to overrun and protect the armature from excessive speed until the ignition switch is released from the start position. After the ignition switch is released from the start position, a return spring in the solenoid assembly forces the starter solenoid contacts open, breaking the circuit between the battery and the starter motor, and disengaging the clutch and drive assembly. The ignition switch should be released immediately upon engine start-up to prevent prolonged overrun.

Charging System Description and Operation

All models utilize an internal regulator charging system. The integrated circuit (IC) regulator is a solid state unit that is mounted inside the generator to the rear end frame. All regulator components are enclosed in a solid mold to protect them from heat and corrosive elements.

The generator rotor bearings contain enough grease to eliminate the need for periodic lubrication. Two brushes carry current through two slip rings to the field coil mounted on the rotor. Stator windings are assembled inside a laminated core that form part of the generator drive end frame. A rectifier bridge that contains 6 diodes is connected to the stator windings. These diodes electrically change stator AC voltage into DC voltage. This DC voltage is then transmitted to the generator output terminal. Two neutral diodes are utilized to smooth out voltage fluctuations caused by varying generator speeds. A capacitor (condenser), mounted in the regulator, protects the rectifier bridge and neutral diodes. This capacitor also suppresses radio interference noise.

Engine Controls

Engine Controls – 2.5L

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accelerator Control Cable Adjusting Locknut	23 N·m	17 lb ft
Air Cleaner Assembly Bolts	10 N·m	89 lb in
Camshaft Position (CMP) Sensor Housing Bolts	15 N·m	11 lb ft
Camshaft Position (CMP) Sensor Bolt	15 N·m	11 lb ft
Crankshaft Position (CKP) Sensor Bolt	10 N·m	89 lb in
Engine Coolant Temperature (ECT) Sensor	15 N·m	11 lb ft
Exhaust Gas Recirculation (EGR) Valve Pipe Bolts	15 N·m	11 lb ft
EGR Valve Pipe Midway Bolt	10 N·m	89 lb in
EGR Valve Bolts	25 N·m	18 lb ft
Evaporative Emission (EVAP_ Canister Air Filter Fastener	10 N·m	89 lb in
EVAP Canister Purge Valve Bracket Bolt	10 N·m	89 lb in
EVAP Canister Vent Solenoid Bracket Bolt	11 N·m	8 lb ft
EVAP Canister Vent Valve Fastener	10 N·m	89 lb in
EVAP Tank Pressure Control Solenoid Valve Bracket Bolt	25 N·m	18 lb ft
Fuel Cut-Off Valve Fasteners	1.6 N·m	14 lb in
Fuel Filter Bracket Bolt	11 N·m	8 lb ft
Fuel Filter Bracket-to-Fuel Filter Bolt	11 N·m	8 lb ft
Fuel Level Vent Valve (FLVV)	1.6 N·m	14 lb in
Fuel Pipe Guard Nuts	15 N·m	11 lb ft
Fuel Pressure Regulator Bolts	10 N·m	89 lb in
Fuel Rail Bolts	23 N·m	17 lb ft
Fuel Rail Crossover Pipe Bolts	30 N·m	22 lb ft
Fuel Sender (fuel pump) Assembly Bolts	5 N·m	45 lb in
Fuel Supply Pipe and Fuel Return Pipe to Engine Bolt	10 N·m	89 lb in
Fuel Supply Pipe Union Bolt	30 N·m	22 lb ft
Fuel Tank Filler Pipe Bolts	3.5 N·m	30 lb in
Fuel Tank Pressure(FTP) Sensor Bolts	1.6 N·m	14 lb in
Fuel Tank Shield (Protector) Bolts	50 N·m	36 lb ft
Fuel Tank Straps Bolts	50 N·m	36 lb ft
Fuel Tank Vent Valve Fasteners	3.5 N·m	30 lb in
Heated Oxygen Sensor (HO2S) 1	45 N·m	32 lb ft
HO2S 2	45 N·m	32 lb ft
Idle Aie Control (IAC) Valve Fasteners	3.5 N·m	30 lb in
Ignition Coil Bolt	10 N·m	89 lb in
Ignition Coil Cover Fastener	3 N·m	26 lb in
Intake Collector-to-Intake Manifold Bolts and Nuts	23 N·m	16 lb ft
Intake Surge Tank Nuts	23 N·m	16 lb ft
Manifold Absolute Pressure (MAP) Sensor Fasteners	3 N·m	26 lb in
Negative Battery Cable-to-Negative Battery Terminal Retainer	8 N·m	72 lb in
PCM Bracket Bolts	10 N·m	89 lb in
Pressure Control Valve-to-Fuel Tank Fasteners	3.5 N·m	30 lb in
Spark Plugs	25 N·m	18 lb ft
Throttle Body Bolts and Nuts	12 N·m	8.5 lb ft
Throttle Position (TP) Sensor Bolts	2.5 N·m	22 lb in
Vehicle Speed Sensor (A/T) Bolt	6 N·m	54 lb in

Ignition System Specifications

Application	Specification	
	Metric	English
Firing Order	1-6-5-4-3-2	
Ignition Timing	5°±1° BTDC	
Spark Plug Torque	25 N·m	18 lb ft
Spark Plug Gap	1.0-1.1 mm	0.039-0.043 in
Spark Plug Type	SK16PR11 DENSO	

Fuel System Specifications – All

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

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

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

Notice

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

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

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

Exhaust System

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Catalytic Converter Assembly-to-Resonator/Muffler/Tail Pipe Nuts	35 N·m	26 lb ft
Front Pipe-to-Catalytic Converter Assembly Bolts	50 N·m	37 lb ft
Front Pipe-to-Exhaust Manifold Bolts	50 N·m	37 lb ft
Hanger Bolts	15 N·m	11 lb ft
PUP Catalytic Converter-to-Exhaust Manifold Nuts	50 N·m	37 lb ft
PUP Catalytic Converter-to-Standard Catalytic Converter Assembly Bolts	50 N·m	37 lb ft

Exhaust System Description

Periodic maintenance of the exhaust system is not required; however, if the vehicle is raised for other service, check the general condition of the following components:

- The Three-Way Catalytic Converter (TWC)
- The pipes
- The muffler

Check the complete exhaust system and nearby body areas for the following, which could permit exhaust fumes to seep into the passenger compartment:

- Broken parts
- Damaged parts
- Missing parts
- Mispositioned parts
- Open seams
- Holes
- Loose connections
- Other deterioration Dust or water in the rear compartment may indicate a problem in one of these areas. Any faulty areas should be corrected immediately.

The exhaust system consists (from front to rear) of the following components:

- The exhaust manifold
- The Warm-Up Three-Way Catalytic Converter (WU-TWC), if equipped
- The exhaust manifold heat shield
- The front pipe/TWC assembly
- The resonator/muffler/tail pipe assembly

Various flexible rubber hangers suspend the system along the underside of the vehicle.

Transmission/Transaxle Description and Operation

Automatic Transmission - 4 Speed-M41

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Brake Applying Cover Bolts	10 N·m	89 lb in
Cooler Pipe Clamp Bolt	23 N·m	17 lb ft
Cooler Pipe Flare Nuts	25 N·m	18 lb ft
Fluid Filler Tube Bracket Bolt	23 N·m	17 lb ft
Fluid Filter Screen Bolts	5 N·m	44 lb in
Flywheel Inspection Cover Bolts	10 N·m	89 lb in
Flywheel-to-Torque Converter Bolts	65 N·m	48 lb ft
Front Propeller Shaft Bolts and Nuts (Four-Wheel Drive Models)	50 N·m	37 lb ft
Front Skid Plate Bolts	54 N·m	40 lb ft
Left and Right Case Stiffener Bolts	60 N·m	44 lb ft
Lower Transmission Retaining Nuts	85 N·m	62 lb ft
Manual Selector Bolts	18 N·m	13 lb ft
Manual Shaft Lever Nut	13 N·m	115 lb in
Rear Propeller Shaft Bolts and Nuts	50 N·m	37 lb ft
Shift Select Cable Locknut	7 N·m	62 lb in
Shift Solenoid Assembly Bolts	10 N·m	89 lb ft
TCC Control Valve Plate Bolts	5 N·m	44 lb in
Torque Stopper Bushing Bolts (Four-Wheel Drive Models)	50 N·m	37 lb ft
Transfer Adapter Case Bolts	31 N·m	23 lb ft
Transmission Fluid Drain Plug	17 N·m	13 lb ft
Transmission Fluid Pan Bolts	5 N·m	44 lb in
Transmission Range Switch Bolt	5 N·m	44 lb in
Transmission Range Switch Set Nut	5 N·m	44 lb in
Upper Transmission Retaining Bolts	85 N·m	62 lb ft

Transmission General Information

This automatic is a full automatic type with three speeds plus overdrive. The torque converter is a three element, one step and two phase type and is equipped with an electronically controlled lock up mechanism. The internal drive components consist of 3 sets of planetary gear units. 3 disc type clutches, 4 disc type brakes and 3 one-way clutches.

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.

Abbreviations and Meanings

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

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

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

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

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

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

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

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

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

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

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

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Conversion - English/Metric

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

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

Equivalents - Decimal and Metric

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

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

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Fasteners

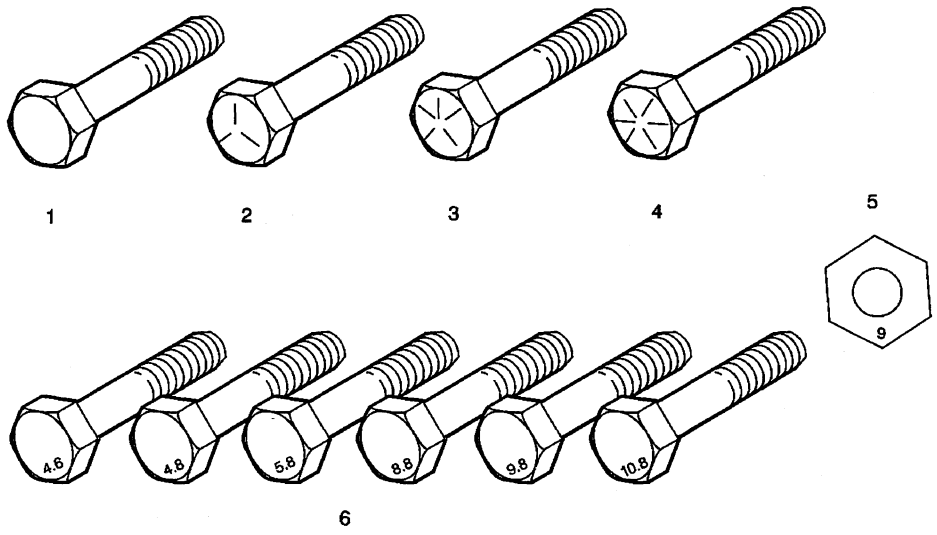
Metric Fasteners

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

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

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

Fastener Strength Identification



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

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

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

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

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

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

Prevailing Torque Fasteners

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

All Metal Prevailing Torque Fasteners

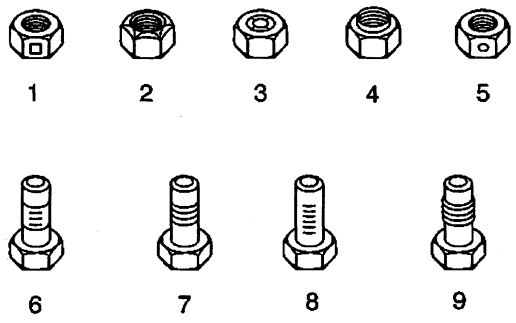
These fasteners accomplish the thread interface by a designed distortion or deformation in the fastener.

Nylon Interface Prevailing Torque Fasteners

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

Adhesive Coated Fasteners

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



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

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

A prevailing torque fastener may be reused ONLY if:

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

Metric Prevailing Torque Fastener Minimum Torque Development

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

English Prevailing Torque Fastener Minimum Torque Development

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