Chevrolet

S-10

2002

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Product Information

Chevy S-10 Pickup Continues To Offer Truck Customers A Reliable, Versatile And Affordable Pickup

With the addition of new interior and exterior enhancements, Chevrolet's S-10 Pickup adds even more comfort and flexibility to its increasingly popular compact truck lineup.

For 2002, all retail models add a tachometer and air conditioning to a comprehensive list of standard equipment that includes driver and passenger air bags, anti-lock brakes, PASSlock theft-deterrent system, and Daytime Running Lamps. Extended Cab models will offer a standard third door for easier loading and access to the cargo area on the driver's side. The Crew Cab is now available with Graphite leather trim interior, and Sandalwood paint is new for 2002.

"The S-10 Pickup offers tremendous versatility with an array of body styles and bed lengths," said Jim Campbell, S-10 Pickup brand manager. "With a Regular, Extended and Crew Cab, we have a truck that will satisfy virtually any truck buyer."

In addition to the three body configurations, S-10 Pickup offers the four-wheel- drive ZR2 Wide Stance Sport Performance Package and the Xtreme ZQ8 Sport Suspension Package for those who want extra variety.

The ZR2 package for off roaders now includes special ZR2 decals on all equipped 4 x 4 Extended Cab models. It continues to be equipped with extra-wide argent wheel flares, 46mm Bilstein high-pressure gas shocks and 31-inch x 10.5R15-inch on/off road tires.

The Xtreme – for those who want to change their image – features 270-degree ground effects, a front air dam with foglamps and Optional exterior stripes available with all exterior colors, including Dark Cherry Red Metallic, which is new to Xtreme in 2002.

The Vortec 4300 V6 engine, standard on all 4 x 4 models and available on 2WD models, delivers 190 horsepower and 250 lb-ft (on 4WD only). The efficient 2200 L4 engine with Sequential Fuel Injection is standard on all 2WD models. The Insta-trac four-wheel-drive system, allowing push-button on-the-fly four-wheel drive, is standard on all 4 x 4 models.

"S-10 Pickup has always been an affordable, reliable and versatile truck that delivers the dependability that consumers demand," said Campbell. "It can be tailored to fit the variety of needs and on-the-go lifestyles that so many people lead."

Several interior amenities come standard in the S-10 Pickup. Delayed interior lighting keeps the dome lamp lit for 15 seconds or until the ignition is turned on after closing the front doors. The stereo, power windows, and other power Options remain active for up to 20 minutes after the ignition is turned off or a door is open, thanks to the retained accessory power feature.

With a maximum wheelbase of 122.9-inches and a minimum payload of 1111 lbs. (Crew Cab model), the S-10 Pickup also is extremely nimble and maneuverable for city driving or hauling, making the S-10 Pickup a smart choice for every compact pickup buyer.

Chevrolet S-10 Pickup And GM Accessories Team Up For Adventure

Chevy S-10 Pickup has long been known as one of the segment's toughest, most versatile light trucks. And GM Accessories offers customers the ability to enhance the S-10 Pickup's appearance to better fit their individual lifestyles.

The S-10 Pickup can be altered to fit all types of owner preferences. For example, windshield and bodyside graphics complement the vehicle's body color. A Special F/X package backs up the truck's sporty punch with the power of a special sports suspension package. The pickup's low aerodynamic stance is perfectly complemented with custom fog lamps and 160-inch x 8-inch aluminum wheels.

Exterior

For customers who prefer a more traditional look, a brush/grille guard is a perfect addition. The guard wraps around the front grille and headlamps for a custom-fit appearance that offers protection on city streets or off-road terrain. Lights top off the traditional look and can be customized for work or play.

Towing And Carriers

The trailer hitch, built for convenience and long-lasting durability, allows customers numerous hauling applications. Once the hitch is in place, outdoor adventure is unlimited.

The hitch carrier system features a sturdy connection to the truck's two-inch receiver. All of GM Accessories' hitch carrier units tilt down with a hand-operated lever so the cargo area is easy to access. The ski package allows customers to carry up to six pairs of skis or four snowboards. Quick release attachments make loading and unloading a snap.

Expanded Hauling

Owners looking for more room can purchase the pickup box extender. The extender expands hauling capabilities and provides additional length or swings in for additional stability in the cargo area.

Bed rails are another handy addition for tying down cargo and protecting the vehicle from damage. Bed mats, bed liners and splash guards also help shield the pickup from mud, dirt, snow, salt and gravel.

A snapless soft tonneau cover will protect the pickup bed and cargo from the elements. A folding hard tonneau cover is available that stands up to rugged use while sheltering the load. The cover has a locking feature for extra security.

Recreation

For outdoor-oriented owners, the bed sport tent is a handy addition. The bed tent sleeps two and the lightweight unit fits into a small carrying pouch for convenient storage behind the cab seat. The food and beverage warmer/cooler is a perfect accent for road trips or tailgate parties. The warmer/cooler unit plugs into the cigarette lighter. Vinyl or carpet floor mats are also available.

Available At Chevy Dealers

Owners can purchase all GM accessory packages and individual accessories at Chevrolet dealerships.

"GM Accessories permanently installed on a new GM vehicle at the time of delivery are covered under the GM New Vehicle Limited Bumper-to-Bumper Warranty," said Jim Kornas, director sales and marketing, accessories at GM Service Parts Operations (SPO). "GM Parts and Accessories permanently installed by a GM dealer after vehicle purchase are covered for the balance of the New Vehicle Warranty, but in any event no less than 12 months or 12,000 miles."

SPO, headquartered in Grand Blanc, Mich., markets automotive replacement parts and accessories worldwide under the GM and ACDelco brand names. For more information, visit the GM Goodwrench Service Plus website at http://www.GMGoodwrench.com.

Chevrolet Adds New Package To Its Diverse S-10 Pickup Lineup

DETROIT-The 2002 Chevrolet S-10 Pickup lineup adds the all-new ZR5 option package to the Crew Cab model in the first quarter of 2002, combining a sporty, youthful exterior appearance with fully functional accessories.

"We want to give our customers the option of adding the athletic appearance and practicality that ZR5 provides to our popular S-10 Pickup Crew Cab model," said Jim Campbell, Chevrolet S-10 Pickup brand manager.

The ZR5 package will carry an MSRP of $1,500 and includes a roof rack, wheel flares, black anodized bed rails and side steps, 15" X 7" cast aluminum, five-spoke wheels with spectra gray accents, 235/75R-15 Goodyear Wrangler tires and ZR5 decals. In addition to the ZR5 package, the Crew Cab offers, as standard equipment, driver and right front passenger air bags, antilock brakes, fog lights, power door locks, power windows, air conditioning and electronic compass.

"ZR5 offers the features and comforts of an SUV with the versatility of an aggressive looking pickup, that can easily transport cargo in the bed and on the roof," Campbell said.

"The sporty stance and athletic looks of the ZR5 were influenced by similar after-market items that are popular in today's marketplace," said Ron Owen, Chevrolet S-10 Pickup assistant brand manager. "We want to offer our customers a complete package that caters to their active lifestyles, and the ZR5 does just that."

"With the addition of ZR5, we have a package for each of the S-10 Pickup body styles which bolsters our product line, making it even stronger and more diverse," said Campbell.

New For 2002

- Third door standard on all extended cab models
- Air conditioning and tachometer standard on all retail (non-fleet) models
- Graphite leather trim available on Crew Cab
- "ZR2" decal included with all ZR2 wide stance packages
- Sandalwood exterior color (Dark Cherry Red Metallic now available on Xtreme Models)
- Cold climate package standard for Northern states
- Simplified lineup with discontinuance of 2WD regular cab, long box model
- Revamped interior trim selection

Model Lineup

	Engines		Transmissions	
	2.2-liter Vortec 2200 L4	4.3-liter Vortec 4600 V6	5-speed manual	4-speed auto
2WD Regular Cab	S	O	S	O
2WD Extended Cab	S	O	S	O
4WD Extended Cab	–	S	S	O
4WD Crew Cab	–	S	–	S

Standard: S
Optional: O
Not available: –

Specifications

Overview

Model:	• 2002 Chevrolet S-10 Pickup • 2WD Regular cab short box • 2WD Extended cab short box • 4x4 Extended Cab short box • 4x4 Crew Cab
Body style / driveline:	Regular Cab (2-3 passengers), Extended Cab (3-4 passengers), Crew Cab (5 passengers), rear-wheel-drive and four-wheel-drive pickup
EPA vehicle class:	compact pickup
Manufacturing locations:	Linden, New Jersey and Shreveport, Louisiana
Key competitors:	S-10 Pickup: Ford Ranger, Dodge Dakota, Toyota Tacoma, Nissan Frontier, Mazda B-Series
	S-10 Crew Cab 4x4 Pickup: Dodge Dakota Quad Cab, Nissan Frontier Crew Cab, Toyota Tacoma Double Cab, Ford Explorer Sport Trac

Engine	**Vortec 2200 L4 (L43)**	**Vortec 4300 V6 (L35)**
Type:	2.2-liter, OHV L4 w/cast iron block	4.3-liter, OHV V6 w/cast iron block
Displacement (cu in / liters):	134 / 2200	262 / 4300
Bore & stroke (in / mm):	3.50 x 3.46 / 89.0 x 88.0	4.00 x 3.48 / 101.6 x 88.39
Cylinder head material:	cast aluminum	cast iron
Valvetrain:	OHV, two valves per cylinder	OHV, two valves per cylinder
Ignition system:	distributorless, platinum-tipped spark plugs	composite distributor, platinum-tipped spark plugs, low-resistance spark plug wires
Fuel delivery:	sequential fuel injection	sequential fuel injection
Compression ratio:	9.0:1	9.2:1
Horsepower (hp / kw @ rpm):	120 / 89 @ 5000	180 / 134 @ 4400 (2WD)
		190 / 142 @ 4400 (4x4)
Torque (lb-ft / Nm @ rpm):	140 / 190 @ 3600	245 / 332 @ 2800 (2WD)
		250 / 339 @ 2800 (4x4)
Recommended fuel:	87 octane (85 percent ethanol capable)	87 octane
Maximum engine speed (rpm):	6000	5600
Emission system:	three-way catalytic converter, exhaust gas recirculation, positive crankcase ventilation, evaporative collection system	three-way catalytic converter, exhaust gas recirculation, positive crankcase ventilation, evaporative collection system

Transmission	**MW2**	**M50**	**4L60-E**
Type:	5-speed manual w/Vortec 2200	5-speed manual w/Vortec 4300	4-speed auto
Gear ratios (:1):			
First:	3.96	3.49	3.06
Second:	2.37	2.16	1.63
Third:	1.49	1.40	1.00
Fourth:	1.00	1.00	0.70
Fifth:	0.83	0.73	—
Reverse:	3.54	3.55	2.29
Final drive ratio:	3.08 – 4.10 (3.73 standard with ZR2 wide stance package)		

Chassis/Suspension

Front:	Independent with upper and lower control arms, coil spring
Rear:	two-stage, variable-rate, multileaf rear springs
Steering type:	variable-ratio, integral power, recirculating ball-type
Ratio:	13:1 (2WD or 4WD at stop)
Steering wheel turns, lock-to-lock:	2WD: 2.8; 4WD: 3.2
Turning circle, curb-to-curb (ft / m):	2WD: 37.0 / 10.6; 4WD: 41.6 / 12.7

Brakes

Type:	2WD: vacuum power, front disc / rear drum, antilock brakes
	4WD: vacuum power, 4-wheel disc, antilock brakes
Front:	
Rotor diameter x thickness (in / mm):	2WD: 10.05 x 1.03 / 267 x 26; 4WD: 10.82 x 1.14 / 275 x 29
Swept area (sq in / sq cm):	190.1 / 3115.1
Rear:	
Drum diameter x width, 2WD (in / mm):	9.5 x 2.0 / 255 x 26
Rotor diameter x thickness, 4x4 (in / mm):	11.6 x .787 / 295 x 20
Drum swept area (sq in / sq cm):	118.5 / 1941.9

Wheels/Tires

Wheel size & type:	2WD / 4WD: 15-inch x 7-inch steel; 4WD Crew Cab: 15-inch x 7-inch aluminum
Tire size & type:	• P205/75R-15 standard all-season steel-belted radial tires (2WD) • P235/70R-15 all-season steel-belted radial blackwall tires (standard on 4x4 models) • P235/75R-15 on-/off-road steel-belted radial white outline-lettered tires (Optional on 4x4 models with Z85 suspension) • 31-inch x 10.5-inch R-15 LTC on-/off-road steel-belted radial blackwall tires (ZR2 models only) • P235/55R-16 all-season steel-belted radial blackwall tires (included with Xtreme Sport Appearance Package and ZQ8 suspension) • Full-size spare standard on ZR2-equipped models and available on all others except Xtreme or ZQ8-equipped models

Dimensions

Exterior	Regular Cab 2WD	Extended Cab 2WD	Extended Cab 4WD	Crew Cab 4WD
Wheelbase (in / mm):	108.3 / 2751	117.9 / 2995	122.9 / 3122	122.9 / 3122
Overall length (in / mm):	190.1 / 4829	206.1 / 5235	204.8 / 5201	204.8 / 5201
Overall width (in / mm):	67.9 / 1725	67.9 / 1725	67.9 / 1725	67.8 / 1723
Overall height (in / mm):	62.0 / 1575	62.7 / 1593	63.4 / 1610	63.4 / 1610
Track tread width (in / mm):				
Front:	54.8 / 1381	54.5 / 1384	57.2 / 1453	57.2 / 1453
Rear:	54.6 / 1388	54.6 / 1387	55.1 / 1400	55.1 / 1400
Min. ground clearance (in / mm):				
Front:	9.1 / 234	9.1 / 234	8.5 / 216	8.5 / 216
Rear:	7.2 / 183	7.2 / 183	7.5 / 191	7.5 / 191
Ground to top of load floor (in / mm)	25.9 / 656	27.7 / 704	22.7 / 704	22.7 / 704
Step-in height (in / mm):	17.3 / 439	17.9 / 455	18.7 / 475	
Base curb weight (lbs / kg):	3016 / 1368	3198 / 1451	3761 / 1706	4039 / 1832
Weight distribution (front / rear):	57 / 43	57 / 43	62 / 38	59 / 41

Cargo Box	Short Box	Crew Cab Box
Cargo volume (cu ft / liters):	39.4 / 1101	30.2 / 855
Length at floor (in / mm):	72.8 / 1849	55.2 / 1402
Width at floor (in / mm):	54.9 / 1394	56.6 / 1438
Width at top (in / mm):	54.9 / 1394	56.6 / 1438
Width between wheelhousing (in / mm):	40.3 / 1024	40.4 / 1026
Tailgate width (in / mm):	54.9 / 1394	56.6 / 1438
Inside height (in / mm):	17.1 / 434	17.1 / 434

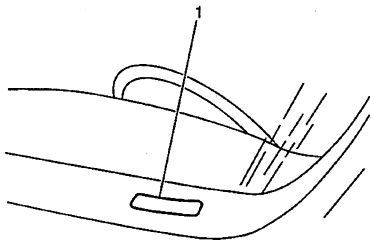
Interior	Regular Cab	Extended Cab	Crew Cab
Head room (in / mm):	39.5 / 1003	39.6 / 1006	front: 39.4 / 1002 rear: 38.2 / 970
Leg room (in / mm):	42.7 / 1007	42.7 / 1007	front: 42.7 / 1007 rear: 34.6 / 878
Shoulder room (in / mm):	56.9 / 1443	56.9 / 1443	front: 57.1 / 1450 rear: 57.2 / 1452
Hip room (in / mm):	53.6 / 1361	53.6 / 1361	front: 53.6 / 1361 rear: 53.7 / 1363

Capacities	Regular Cab	Extended Cab	Crew Cab
Seating:	2 / 3	4 / 5	5 / 6
GVWR, standard (lbs/kg):	2WD: 4200 / 1905	2WD: 4400 / 1996 4WD: 5150 / 2336	4WD: 5150 / 2336
Payload, base (lbs/kg):	2WD: 1184 / 537	2WD: 1202 / 545 4WD: 1389 / 630	4WD: 1111 / 504
Fuel tank (gal/liters):	18.0 / 68.1	18.3 / 69.3	17.5 / 66.3

	Vortec 2200	Vortec 4300
Engine oil (qts / liters):	4.5 / 4.3	4.5 / 4.3
Engine coolant (qts / liters):	manual: 11.5 / 10.8	manual: 11.9 / 11.3
	auto: 11.5 / 10.8	auto: 11.7 / 11.1
Maximum trailer weight (lbs / kg):		
Regular Cab 2WD:	3200 / 1451	6000 / 2721
Extended Cab 2WD:	3000 / 1360	5800 / 2630
Extended Cab 4WD:	—	5500 / 2494
Crew Cab 4WD:	—	5200 / 2358
Maximum tongue weight:	Tongue load should be 10-15 percent of total trailer weight up to 750 lbs. (340 kg)	

Vehicle Identification

Vehicle Identification Number (VIN)



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

Position	Definition	Character	Description
1	Country of Origin	1,4	U.S. Built
2	Manufacturer	G	General Motors
3	Make	C H K N T	Chevrolet Truck Oldsmobile MPV GMC MPV Chevrolet MPV GMC Truck
4	GVWR/Brake System	B C D E F G H J K	3,001-4,000 HYD Brakes 4,001-5,000 HYD Brakes 5,001-6,000 HYD Brakes 6,001-7,000 HYD Brakes 7,001-8,000 HYD Brakes 8,001-9,000 HYD Brakes 9,001-10,000 HYD Brakes 10,001-14,000 HYD Brakes 14,001-16,000 HYD Brakes
5	Truck Line/Chassis Type	S T	Sm Conventional Cab--4x2 Sm Conventional Cab--4x4
6	Series	1 6	½ Ton Nominal ½ Ton Luxury
7	Body Type	3 4 8 9	4-Door Cab/Utility Two-Door Cab Two-Door Utility Two-Door Extended Cab
8	Engine Type	W 4 5	4.3L V6CPI (L35) 2.2L L4 MFI (LN2) 2.2L L4 Flex Fuel MFI (L43)
9	Check Digit	--	Check Digit
10	Model Year	2	2002
11	Plant Location	K 8 2 X	Linden, NJ Shreveport, LA Moraine, OH E.E.M.S
12-17	Plant Sequence Number	--	Plant Sequence Number

VIN Derivative

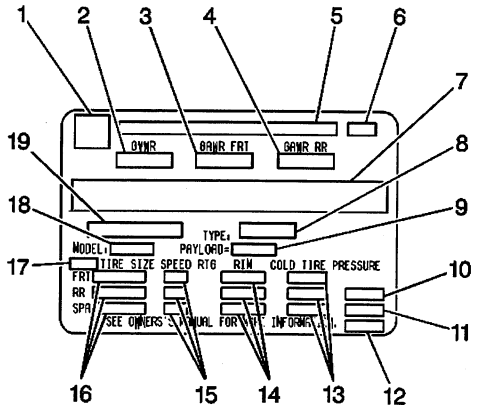
All engines and transmissions are stamped or laser etched with a partial vehicle identification number (VIN), which was derived from the complete VIN. A VIN derivative contains the following nine positions:

Position	Definition	Character	Description
1	GM Division Identifier	C H K N T	Chevrolet Truck Oldsmobile MPV GMC MPV Chevrolet MPV GMC Truck
2	Model Year	2	2002
3	Assembly Plant	K 8 2 X	Linden, NJ Shreveport, LA Moraine, OH E.E.M.S
4-9	Plant Sequence Number	--	Plant Sequence Number

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

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

Label Certification w/o RPO Z49



(1) GM Logo
(2) Gross Vehicle Weight Rating
(3) Gross Axle Weight Rating - Front
(4) Gross Axle Weight Rating - Rear
(5) Name Of Manufacturer
(6) Final Manufacturer's Date
(7) Manufacturer's Statement
(8) Model Designation
(9) Payload
(10) DUAL - When Equipped
(11) Front Axle Reserve - When Equipped
(12) Total Capacity - When Required
(13) Tire Pressure
(14) Rim Size
(15) Speed Rating - When Required
(16) Tire Size
(17) GVW Rating Code
(18) Engineering Model
(19) Vehicle Identification Number

The vehicle certification label displays the following assessments:

- The Gross Vehicle Weight Rating (GVWR)
- The Gross Axle Weight Rating (GAWR) -- Front and Rear
- The vehicle's payload rating
- The original equipment tire sizes and the recommended tire pressures

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

- The base vehicle weight (factory weight)
- The weight of all vehicle accessories, like the winches or the plows
- The weight of the driver and the passengers
- The weight of the cargo

The gross vehicle weight must not exceed the Gross Vehicle Weight Rating.

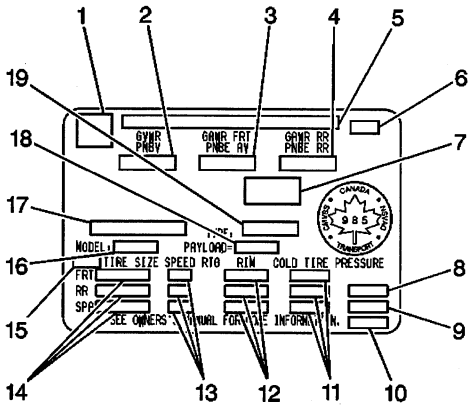
The front gross axle weight rating (GAWR FRT) is the weight exerted on the front axle. The rear gross axle weight rating (GAW RR) is the weight exerted on the rear axle. The front and rear gross axle weights must not exceed the front and rear gross axle weight ratings.

The payload rating defines the vehicle's maximum allowable cargo load. The cargo load includes the driver and the passengers. The payload rating is based on the vehicle's factory installed equipment. Deduct from the payload rating the weight of accessories added to the vehicle after the final date of manufacture .

The vehicle may have a Gross Combination Weight Rating (GCWR). The Gross Combination Weight Rating refers to the total maximum weight of the loaded tow vehicle (including driver and passengers) and a loaded trailer.

The vehicle's tires must be the proper size and properly inflated for the load the vehicle is carrying.

Label Certification with RPO Z49



(1) Logo
(2) Gross Vehicle Weight Rating
(3) Gross Axle Weight Rating - Front
(4) Gross Axle Weight Rating - Rear
(5) Name of Manufacturer
(6) Final Manufacturer's Date
(7) RFI Statement - Canada Only
(8) DUAL - When Equipped
(9) Front Axle Reserve - When Equipped
(10) Total Capacity - When Required
(11) Tire Pressure
(12) Rim Size
(13) Speed Rating - When Required
(14) Tire Size
(15) GVW Rating Code
(16) Engineering Model
(17) Vehicle Identification Number
(18) Payload
(19) Model Designation

The vehicle certification label displays the following assessments:

- The Gross Vehicle Weight Rating (GVWR)
- The Gross Axle Weight Rating (GAWR) -- Front and Rear
- The vehicle's payload rating
- The original equipment tire sizes and the recommended tire pressures

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

- The base vehicle weight factory weight
- The weight of all vehicle accessories, like the winches or the plows
- The weight of the driver and the passengers
- The weight of the cargo

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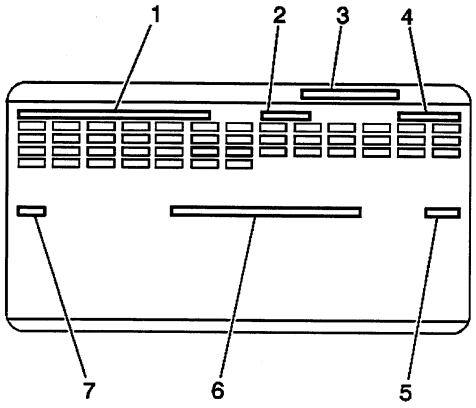
The payload rating defines the vehicle's maximum allowable cargo load. The cargo load includes the driver and the passengers. The payload rating is based on the vehicle's factory installed equipment. Deduct from the payload rating the weight of accessories added to the vehicle after the final date of manufacture .

The vehicle may have a Gross Combination Weight Rating (GCWR). The Gross Combination Weight Rating refers to the total maximum weight of the loaded tow vehicle including driver and passengers and a loaded trailer.

The vehicle tires must be the proper size and properly inflated for the load the vehicle is carrying.

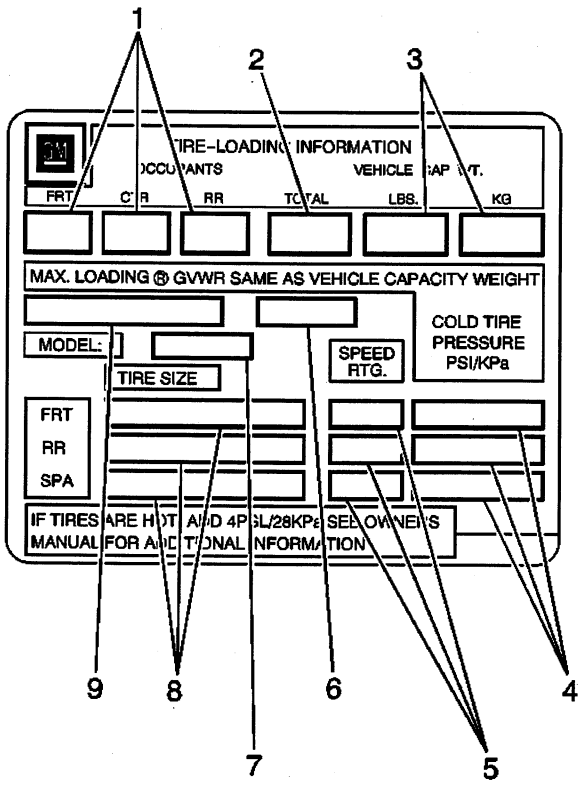
Service Parts Identification Label (SPID)



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

The service parts identification label is located on the instrument panel storage compartment door in order to help service and parts personnel identify the vehicle's original parts and the vehicle's original options.

Tire Placard

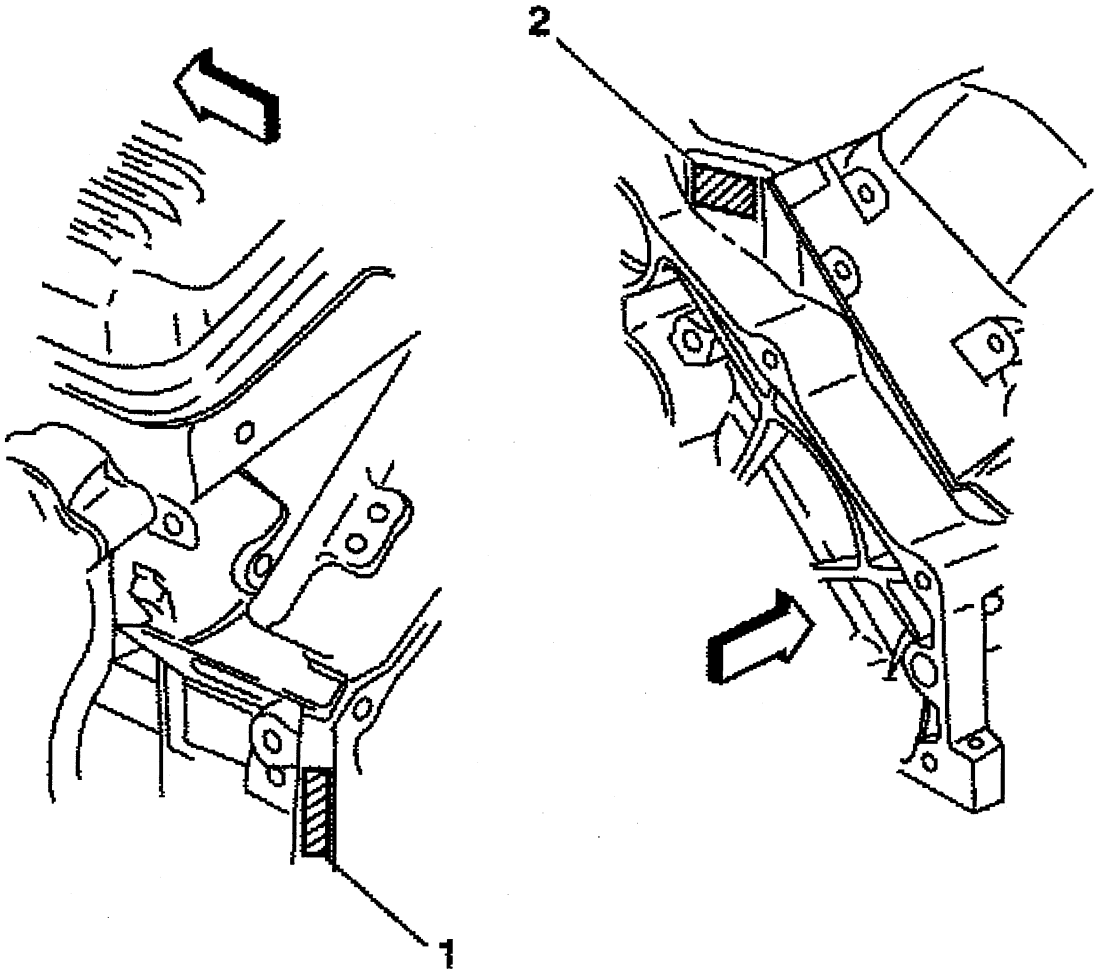


(1) Specified Occupant Seating Positions
(2) Total Occupant Seating
(3) Maximum Vehicle Capacity Weight
(4) Tire Pressures, Front, Rear, and Spare
(5) Tire Speed Rating, Front, Rear, and Spare
(6) Tire Label Code
(7) Engineering Model Minus First Character
(8) Tire Sizes, Front, Rear, and Spare
(9) Vehicle Identification Number

The Tire Placard is permanently located on the edge of the driver's door. Refer to the placard in order to obtain the following information:

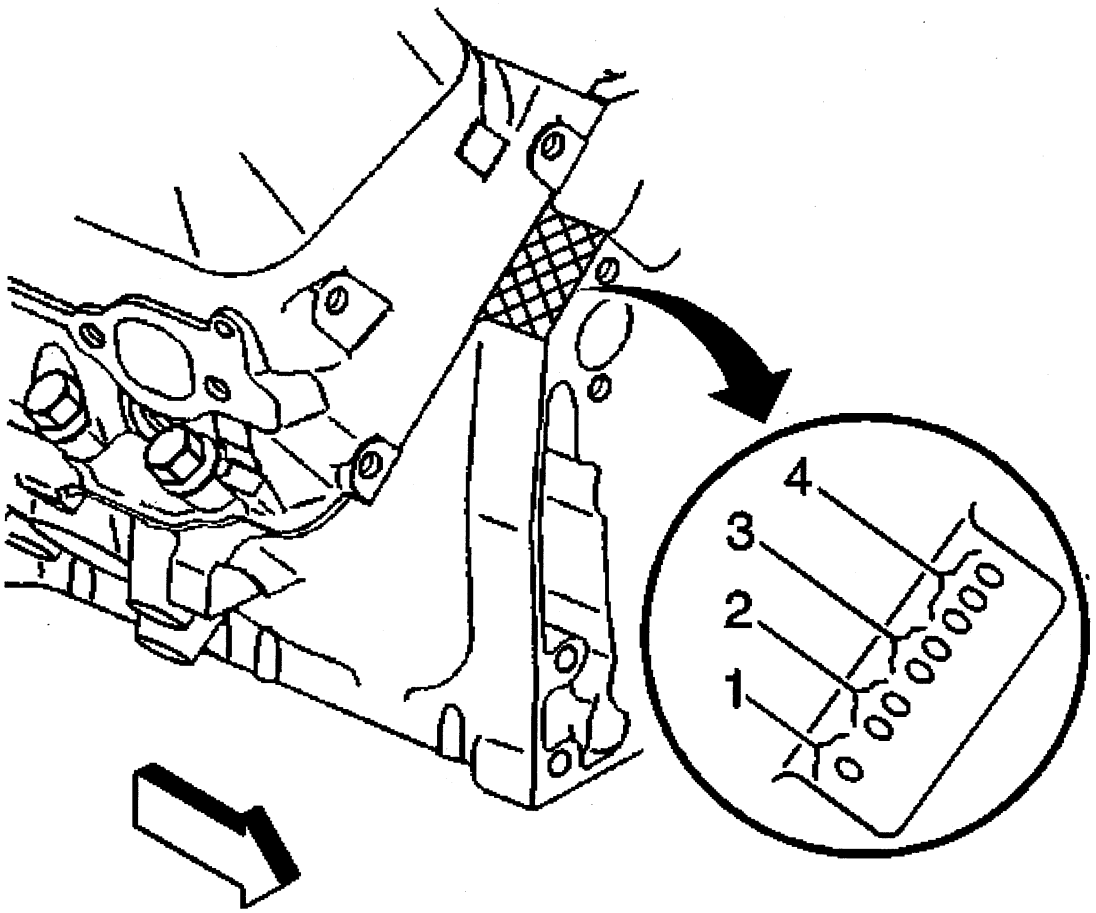
- The maximum vehicle capacity weight
- The cold tire inflation pressures
- The tire sizes (original equipment tires)
- The tire speed ratings (original equipment tires)

Engine ID and VIN Derivative Location 4.3L



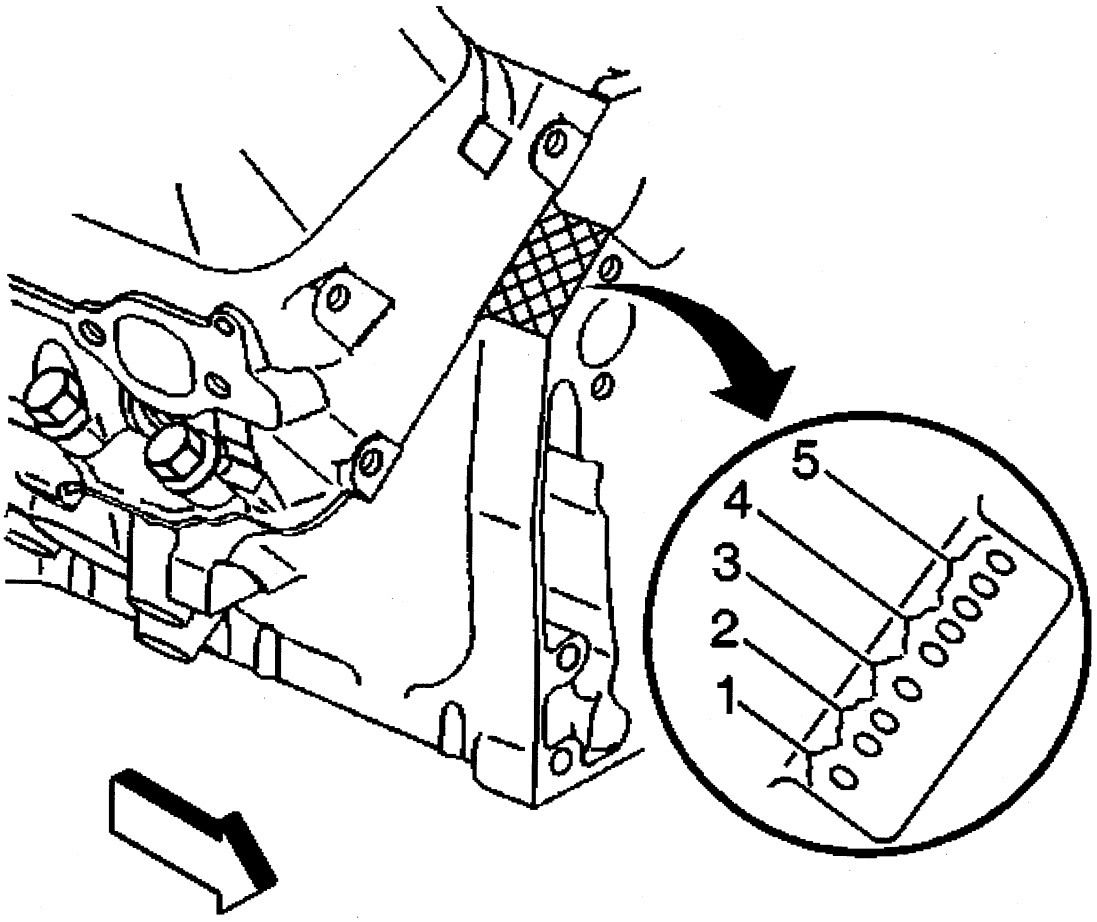
The Vehicle Identification Number (VIN) Derivative is located on the left side rear of the engine block (1) or on the right side rear (2) and typically is a nine digit number stamped or laser etched onto the engine at the vehicle assembly plant.

- The first digit identifies the division.
- The second digit identifies the model year.
- The third digit identifies the assembly plant.
- The fourth through ninth digits are the last six digits of the Vehicle Identification Number (VIN).



Engines built at the Tonawanda engine plant have the engine identification number located at the right front top of the engine block.

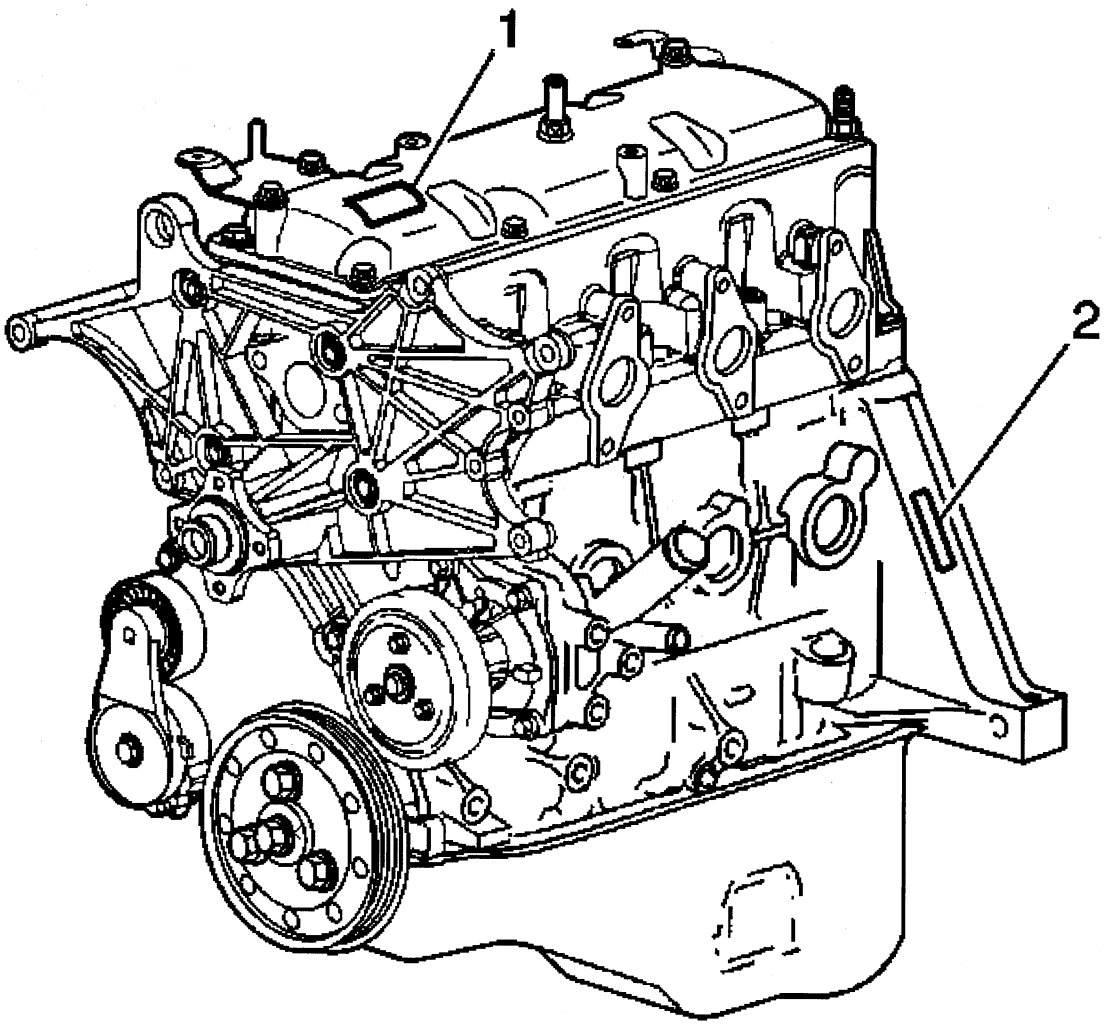
- The first digit (1) is the source code.
- The second and third digits (2) are the month of build.
- The fourth and fifth digits (3) are the date of build.
- The sixth, seventh, and eighth digits (4) are the broadcast code.



Engines built at the Romulus engine plant have the engine identification number located at the right front top of the engine block.

- The first digit (1) is the source code.
- The second and third digits (2) are the month of build.
- The fourth digit (3) is the hour of the build.
- The fifth and sixth digits (4) are the date of build.
- The seventh, eighth, and ninth digits (5) are the broadcast code.

Engine ID and VIN Derivative Location 2.2L

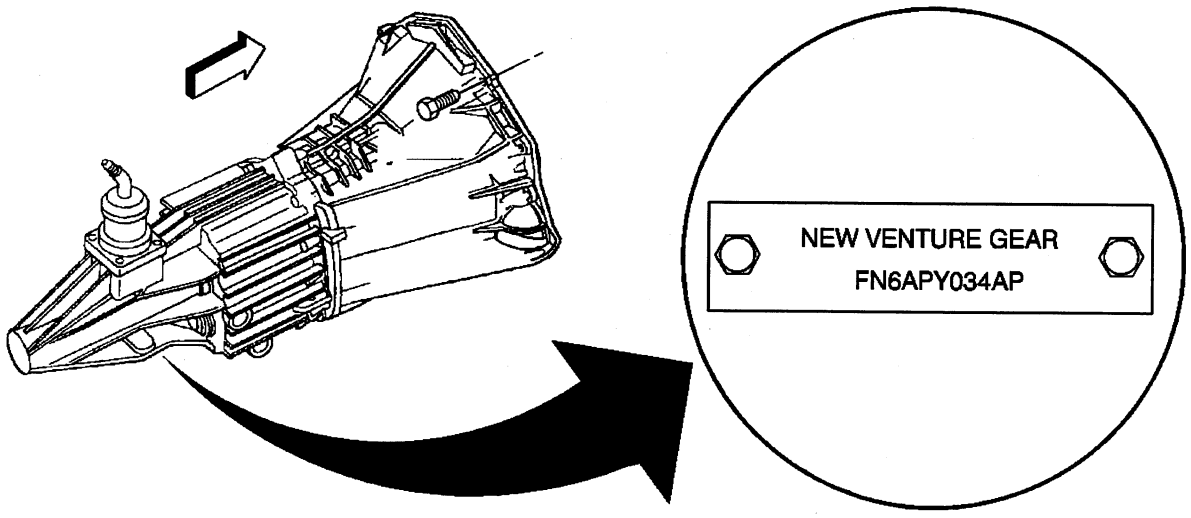


Identification can be made through the use of the Broadcast Code label on the valve rocker arm cover (1) and the use of the partial VIN etched on the left side of the engine block above the starter (2).

The broadcast code identifies the engine, transmission, and vehicle relationship. The partial VIN identifies the specific vehicle by sequence number.

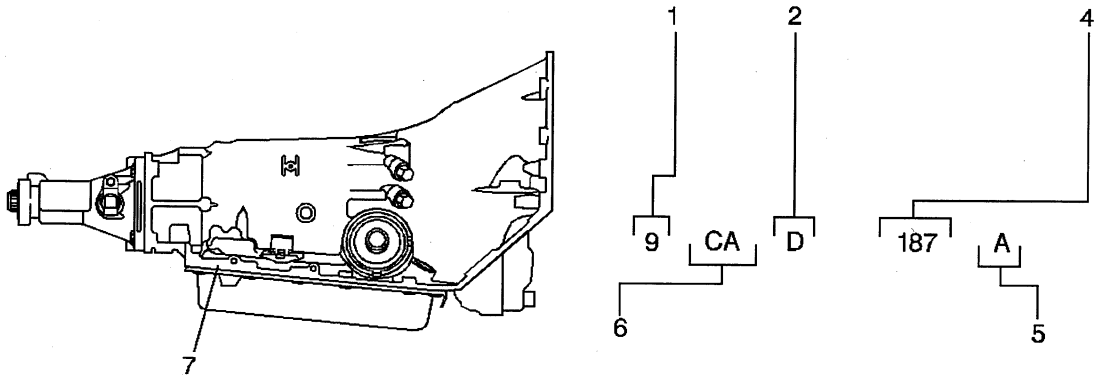
Transmission ID and VIN Derivative Location

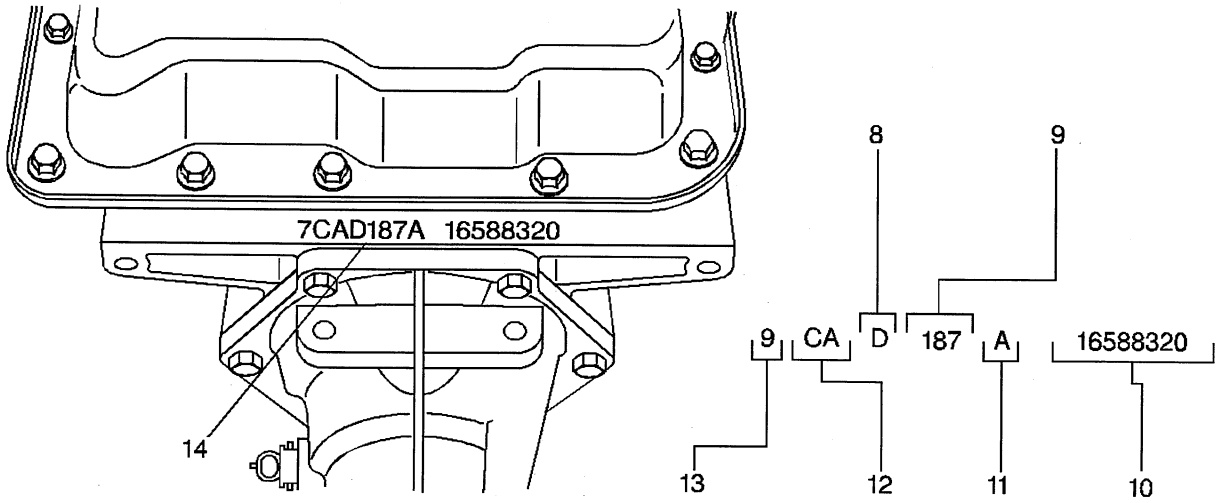
Manual Transmission



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

4L60-E Transmission ID Location





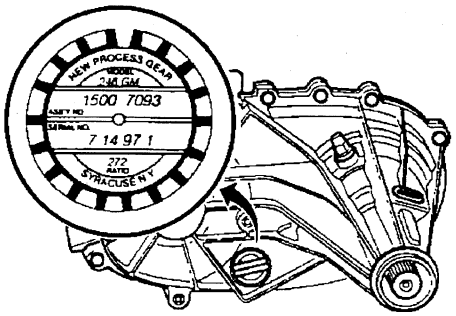
(1) Model Year
(2) Hydra-Matic 4L60-E
(4) Julian Date (or Day of the Year)
(5) Shift Built (A, B, J = First Shift; C, H, W = Second Shift)
(6) Model
(7) Transmission ID Location
(8) Hydra-Matic 4L60-E
(9) Julian Date (or Day of the Year)
(10) Serial No.
(11) Shift Built (A, B, J = First Shift; C, H, W = Second Shift)
(12) Model
(13) Model Year
(14) Transmission ID Location

Engine and Transmission Usage

Model	Engine		Transmission	
	Base	Option	Base	Option
S105 (06)	4.3L V6 (L35)	--	4 Spd. Auto. (M30)	--
S105 (16)	4.3L V6 (L35)	--	5 Spd. Manual (M50)	4 Spd. Auto. (M30)
S106 (03)	2.2L L4 (L43)	2.2L L4 (L43) 4.3L V6 (L35)	5 Spd. Manual (M50) 5 Spd. Manual (MW2)	4 Spd. Auto. (M30)
S106 (53)	2.2L L4 (L43)	2.2L L4 (L43) 4.3L V6 (L35)	5 Spd. Manual (MW2) 5 Spd. Manual (M50)	4 Spd. Auto. (M30)
S108 (03)	2.2L L4 (L43)	2.2L L4 (L43) 4.3L V6 (L35)	5 Spd. Manual (MW2) 5 Spd. Manual (M50)	4 Spd. Auto. (M30)
T105 (06)	4.3L V6 (L35)	--	5 Spd. Manual (M50) 4 Spd. Auto. (M30)	5 Spd. Manual (M50)
T105 (16)	4.3L V6 (L35)	--	5 Spd. Manual (M50)	4 Spd. Auto. (M30)
T106 (03)	4.3L V6 (L35)	4.3L V6 (L35)	5 Spd. Manual (M50)	4 Spd. Auto. (M30)
T106 (43)	4.3L V6 (L35)	--	4 Spd. Auto. (M30)	--
T106 (53)	4.3L V6 (L35)	4.3L V6 (L35)	5 Spd. Manual (M50)	4 Spd. Auto. (M30)

Model Codes: S-Two-Wheel Drive and T-Four-Wheel Drive
03--Two-Door Cab
06--Four-Door Utility
16--Two-Door Utility
43--Four-Door Pickup
53--Two-Door Extended Cab
08--Long Box Pickup

Transfer Case Identification



NV MODEL IDENTIFICATION KEY

246

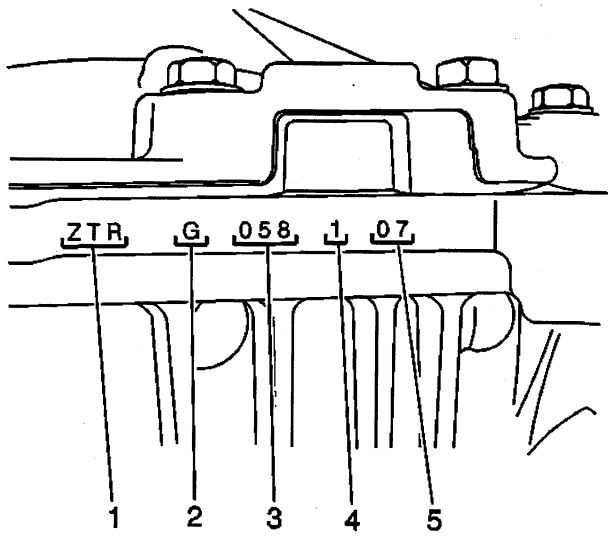
1	Single Speed	3	T – Truck/L – Van	1	Manual
2	2 Speed	4	K – Truck	3	Selectable
				6	Automatic

An identification tag is attached to the rear half of the transfer case. The tag provides the following information:

- The transfer case model number
- An assembly number
- A serial number
- The low range reduction ratio

The information on this tag is necessary for servicing the transfer case. If the tag is removed or becomes dislodged during service operations, keep the identification tag with the unit.

Axle Identification – Front



(1) Broadcast Code
(2) Supplier Code (G = American Axle)
(3) Julian Date (Day of Year)
(4) Shift Built (1 = First Shift; 2 = Second Shift) (Optional for 8.25" and 9.25" axles)
(5) Hour Built

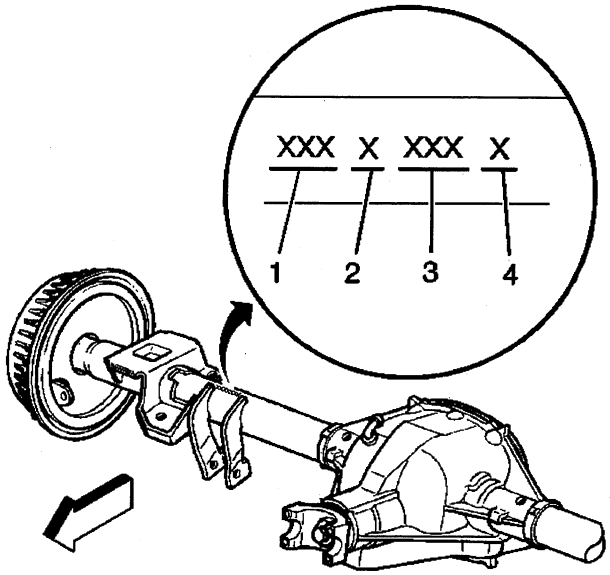
Front axle identification information is stamped on the top of the differential carrier assembly.

The following broadcast codes identifies the axle ratio:

Broadcast Code	Ratio
ZTM	3.08
ZTN, ZTU, ZTW, ZSY, ZA2, ZC2	3.42
ZTP, ZTR, ZTS, ZTX, ZSZ, ZB2,ZD2	3.73
ZTT,ZF2	4.10
ZH2	4.56

The information on the differential carrier assembly is necessary for servicing.

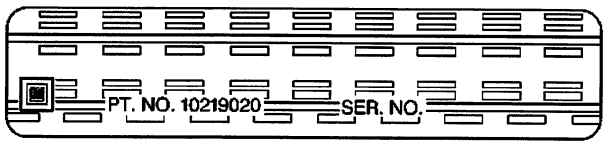
Axle Identification – Rear



(1) Rear Axle Ratio
(2) Build Source (C = Buffalo; K = Canada)
(3) Julian Date
(4) Shift Built (1 = First; 2 = Second)

All rear axles are identified by a broadcast code on the right axle tube near the carrier. The rear axle identification and manufacturer's codes must be known before attempting to adjust or to repair axle shafts or the rear axle case assembly. Rear axle ratio, differential type, manufacturer, and build date information is stamped on the right axle tube on the forward side.

Labeling - Anti-Theft



Notice

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

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

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

RPO Code List

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

RPO	Description
AA3	Window Tinted, Deep Tint
AG0	Adjuster, Front Seat, Power
AG1	Adjuster, Driver Seat, Power 6-Way
AG2	Adjuster, Passenger Seat, Power 6-Way
AH8	Adjuster, Passenger Seat, Power 8-Way
AJ1	Window Tinted, Deep Tint
AM6	Seat, Front Split, 3 Passenger, Center Arm Rest
AM7	Seat, Rear Folding
ANL	Sale Package Air Deflector and Fog Lamp
AN3	Seat, Front Bucket
AP9	Restraint, Cargo Net
AU0	Remote Keyless Entry
AU3	Power Door Locks
AU5	Lock Control Remote Entry, Specific Frequency
AU8	Lock Control Remote Entry, Specific Frequency
AV5	Seat, Front Bucket, High Back
AX4	Restraint Conversion Seat, Manual, European
A26	Window, European Glazing, All
A28	Window, Rear Full Width, Sliding
A31	Window Power Operated, Side
A52	Seat, Front Bench
BAG	Parts Package Export
BG9	Covering Floor Rubber
BNB	Ornamentation Exterior, Unpainted
BZY	Liner PUBX
B30	Covering, Floor Carpet
B32	Covering Floor Mats, Front Auxiliary
B84	Molding B/S Exterior
B94	Ornamentation Extgerior, Emblem, Body
CE4	Washer, Headlamp, High Pressure
CF5	Sun Roof, Glass, Sliding, Electric
CKD	Vehicle Completely Knocked Down
CTB	Appearance Package Chevy Trailblazer Sport
CTF	Interim Control
C25	Wiper System Rear Window, Intermittent
C3A	GVW RATING 4400 LBS
C3G	GVW RATING 4450 LBS
C3T	GVW RATING 5350 LBS
C42	HVAC System Heater Deluxe, Outside Air
C49	Defogger Rear Window, Electric
C5A	GVW Rating 4900 lbs
C5C	GVW Rating 5000 lbs
C5D	GVW Rating 4600 lbs
C5T	GVW Rating 4200 lbs
C6F	GVW Rating 5150 lbs
C6I	GVW Rating 4850 lbs
C60	HVAC System Air Conditioner, Front Manual Controls

C68	HVAC System Air Conditioner, Front Manual Controls, Electronic
DC4	Mirror, Inside Rearview Tilt, Dual Reading Lamps
DD0	Mirrors, Outside, Remote Control, Electric, Heated, Light Sensitive
DD8	Mirrors, Inside, RV, Light Sensitive
DH6	Mirrors, Inside Front Van, Sunshade
DK2	Mirror, Outside Remote Control, Electric, Heated, Color
DK7	Console Roof Interior, Custom
DK8	Console Roof Interior, Deluxe
DR4	Mirror, Outside Left Hand and Right Hand, Remote Control, Electric, Heated, Light Sensitive, Power Folding, Color
D07	Console Front Compartment Floor, Custom
D34	Mirror I/S Front VAN Left Hand and Right Hand, Sunshade, No Illumination
D44	Mirror, Outside, Color
D55	Console Front Compartment, Floor
D96	Stripe, Body Side Upper
EVA	Test DVT, Evaporator Emission Requirement
E24	Door, Side Cargo, Hinged
E55	Body Equipment End Gate
E62	Body Equipment Stepside
E63	Body Equipment Fleetside PUBX
FF4	Arm Torsion Bar Spring Adjustment (C)
FF5	Arm Torsion Bar Spring Adjustment (D)
FF6	Arm Torsion Bar Spring Adjustment (E)
FF7	Arm Torsion Bar Spring Adjustment (F)
FK2	Arm Torsion Bar Spring Adjustment (A)
FK3	Arm Torsion Bar Spring Adjustment (B)
GT4	Axle Rear 3.73 Ratio (Dup with 5X1)
GT5	Axle Rear 4.10 Ratio (Dup with GT8)
GU4	Axle Rear 3.08 Ratio
GU6	Axle Rear 3.42 Ratio
G67	Level Control Auto, Air
G80	Axle Positraction Limited, Slip
JC1	Brake Vacuum Power, 4-Wheel DISC, 5500 lbs
JDE	Appearance Package Jimmy "Diamond Edition"
JM3	Booster Brake, 240 mm Tandem, High Flow
JNG	Shaft Propeller, Painted
KA1	Heater Seat
K05	Engine Block Heater
K18	Reactor System, Air Injection, Electric
K34	Cruise Control Automatic, Electronic
K42	Air Cleaner Off-Road Package
K53	Fuel Sender Assembly, Robust Fuel System
K60	Generator, 100 Amp
L35	Engine, Gas, 6 Cylinder, 4.3 L, V6
L43	Engine, Flexible Fuel, 4 Cylinder, 2.2 L, MFI
MW2	Transmission, Manual 5-Speed, 76 mm, 3.96 1st, .83 5th, O/D
M30	Transmission, Automatic 4-Speed, 4L60E, Electronic
M50	Transmission, Manual 5-Speed, 85 mm, 3.49 1st, O/D
NB8	Emission Override California System
NC1	Emission System California LEV
NC7	Emission Override Federal System
NF4	Emission System Clean Fuel, Fleet
NF7	Emission System Federal NLEV
NM8	Leaded Fuel, System Compatible

NN8	Emission Override Unleaded Fuel, Export
NP1	Transfer Case Electric Shift Control, Two-Speed
NP4	Transfer Case Active
NP5	Steering Wheel Leather Wrapped
NP6	Provisions Transfer Case, Export
NP8	Transfer Case Active, Two-Speed, Push Button Control
NT3	Emission System EEC 00
N12	Exhaust System Rear Exit
N33	Steering Column Tilt Type
N40	Steering Power, Non-Variable Ration
N60	Wheel, Aluminum, Painted
N90	Wheel 15 x 7, Aluminum Cast, 4.75 inch Bolt
N96	Wheel 16 x 8, Cast Aluminum
PA3	Wheel 15 x 7, Aluminum Styled
PF2	Wheel 15 x 7, Aluminum
PH1	Wheel 15 x 7, Steel
PNV	Carrier Outside Spare Tire Mount Not Desired
PW1	Wheel 15 x 7, Aluminum, Diamond Finish
P01	Trim Discs Wheel, Var 1
P16	Carrier Rear Mounted, Spare Tire
QBF	Tire, P235/70R15 Black Wall, All Season
QBG	Tire, P235/70R15 White Wall, All Season
QCA	Tire, P205/75R15, White Wall, All Season
QCB	Tire P235/55R16, Black Wall, AL2
QCE	Tire, P205/75R15/N Black Wall, All Season
QEB	Tire P235/75R15/N White Wall, All Season
QES	Tire P235/75R15-105S, Black Wall, All Season
QJJ	Tire 31X10.50R15LT/C Black Wall, OOR
QLN	Tire 235/70R15-103H Black Wall, All Season
QQX	Tire All P235/60R16 BW R/PE ST TL AL3
RSA	Restraint Front Seat, Auto, Passive
RYJ	Covering Cargo Area, Retractable
TB4	Body Equipment Lift Gate
TB7	Body Equipment Lift Gate (Manual) Aluminum
TR6	Headlamps Control Leveling System, Manual
TT6	Headlamps High Intensity Discharge
TU6	Headlamps Control Flash to Pass
T1J	Equipment Export Material Regulatory
T37	Fog Lamp, Deluxe
T61	Lighting, Daytime Running
T84	Headlamps, Right, Rule of Road, E Mark Rectangular
T85	Headlamps, Left, Rule of Road, E Mark Rectangular
T89	Lamp, Tail and Stop, Export
T90	Lamp, Signaling and Marker, Export
UA1	Battery, High Capacity, Wet
UC2	Speedometer, Kilometer and Miles, Kilometer Odometer
UC4	Speedometer, Kilometer and Miles, Miles Odometer
UD4	Alarm Vehicle Speed, 120 K/H
UE1	Communication System Vehicle, GPS 1
UK3	Electronic System Steering Wheel Accessory Controls
UK6	Radio Control Rear Seat and Earphone Jacks
UL0	Radio, AM/FM Stereo, Seek/Scan, Auto Reverse Music Search Cassette, Auto Tone, Clock
UL2	European Frequencies

UM6	Radio, AM/FM Stereo, Seek/Scan, Auto Reverse Cassette, Clock
UM7	Radio, AM/FM Stereo, Seek/Scan, Clock
UN0	Radio, AM/FM, Stereo, Seek/Scan, Compact Disc, Auto Tone, Clock
UP0	Radio, AM/FM, Stereo, Seek/Scan, Auto Reverse Music Search Cassette, CD, Auto Tone, Clock
UP8	Radio Provisions for Stereo Instrumentation
UQ3	Speaker System Performance Enhanced Audio
UW3	Radio, AM/FM, Stereo, Seek/Scan, Auto Reverse Music Search Cassette, Data System, Clock
UY7	Wiring Harness Truck Trailer, HD
U1F	Radio, AM/FM, Stereo, Seek/Scan, Auto Reverse Music Search Cassette, Compact Disc, HPS, Clock
U1Z	Player Multiple Compact Disc, Passenger Compartment
U16	Tachometer Engine
U19	Metric Scale Instrument Cluster
U73	Antenna, Fixed, Radio
U75	Antenna, Power, Radio
U89	Wiring Harness Car Trailer
VF6	Bumper Rear Step
VF7	Bumper Rear Step, Delete
VGC	Protector Film, Paint Etch Preventive
VK3	License Plate Front, Front Mounting Package
VL4	License Plate Front Mounting Package
VL6	License Plate Front, Front Mounting Package, Japanese
VP6	Noise Control
VR4	Trailer Hitch Weight Distributing Platform
VR6	Hook Tie Down
V21	Guard Radiator, Grille, Painted
V37	Bumper Front and Rear, Chrome
V4A	Performance Package Chevy Xtreme
V54	Luggage Carrier Roof, Painted
WX7	Wiring Provisions
XBF	Tire Front P235/70R15 Black Wall
XBG	Tire Front P235/70R15 White Wall
XCA	Tire Front P205/75R15 White Wall
XCB	Tire Front P235/55R16 Black Wall
XCE	Tire Front P205/75R15/N Black Wall
XEB	Tire Front P235/75R15/N White Wall
XES	Tire Front P235/75R15-105S Black Wall
XJJ	Tire Front 31X10.50R15LT/C Black Wall
XLN	Tire Front 235/70R15-103H Black Wall
XQX	Tire Front P235/60R16-99H BW R/PE ST TL AL3
YBF	Tire Rear P235/70R15 Black
YBG	Tire Rear P235/70R15 White
YB5	Buildout C.O.
YCA	Tire Rear P205/75R15 White
YCB	Tire Rear P235/55R16 Black
YCE	Tire Rear P205/75R15/N Black
YC3	Convenience Package Decor Level #3
YC5	Connvenience Package Decor Level #5
YC6	Convenience Package Decor Level #6
YC7	Convenience Package Decor Level #7
YD3	Axle (Base Equip) For Scheduling GVW Plate
YD5	Spring Front Base Equipment
YD6	Spring Rear, Base Equipment
YEB	Tire Rear P235/75R15/N White Wall

YES	Tire Rear P235/75R15-105S Black Wall
YE2	Convenience Package Decor Level #2, Low Trim
YE3	Convenience Package Decor Level #3, High Trim
YF5	Certification Emission, California
YJJ	Tire Rear 31X10.50R15LT/C Black Wall
YLN	Tire Rear 235/70R15-103H Black Wall
YQX	Tire Rear P235/60R16-99H BW R/PE ST TL AL3
ZAA	Tire, Spare Compact
ZBF	Tire, Spare P235/70R15 Black Wall
ZBG	Tire, Spare P235/70R15 White Wall
ZCA	Tire, Spare P205/75R15 White Wall
ZCE	Tire, Spare P205/75R15/N Black Wall
ZEB	Tire, Spare P235/75R15/N White Wall
ZES	Tire, Spare P235/75R15-105S Black Wall
ZJJ	Tire, Spare 31X10.50R15LT/C Black Wall
ZLN	Tire, Spare 235/70R15-103H Black Wall
ZL1	Noise Control with less than 8000 LB GVW
ZM5	Sales Package Underbody Shield
ZM6	Chassis Package Off-Road Suspension
ZM8	Sales Package Combination Electric Tailgate Release/Rear Window Defogger
ZQ2	Sales Package Driver Convenience
ZQ3	Sales Package Driver Convenience II
ZQ6	Sales Package Drive Convenience III
ZQ8	Chassis Package Sport
ZR2	Chassis Package High Wider Performance, 4x4 Sport
ZW7	Chassis Package Premium Smooth Ride
ZX8	GVW Override
Z70	Conversion Name Plate Oldsmobile
Z82	Trailer Provisions Special Equipment, H.D.
Z83	Chassis Package Solid Smooth Ride
Z85	Chassis Package Increased Capacity
Z87	Chassi Package Low Rider Performance
Z88	Conversion Name Plate "GMC"
5P2	Wheel, Aluminum, Special
8A0	Lock Spare Tire, Keyed Two-Piece Hoist Shaft
8P2	Window Tinted Deep, All Except W/S and Doors (SEO)
8U4	Heater Engine Block (SEO)
9J6	Steering Column Tilt Type (SEO)

Technical Information

Maintenance and Lubrication

Capacities - Approximate Fluid

Application	Specification	
	Metric	English
Axles		
Front Axle	1.2 liters	1.27 quarts
Rear Axle-7.625	1.7 liters	1.8 quarts
Rear Axle-8.6	1.9 liters	2.0 quarts
Engine Cooling System		
• 2.2L (VIN 4) Automatic	9.2 liters	9.7 quarts
• 2.2 L (VIN 4) Manual	9.4 liters	9.9 quarts
• 4.3 L (VIN W) Automatic (Pickup)	13.1 liters	13.8 quarts
• 4.3 L (VIN W) Manual (Pickup)	13.3 liters	14.0 quarts
• 4.3 L (VIN W) Automatic (Utility)	11.1 liters	11.7 quarts
• 4.3 L (VIN W) Manual (Utility)	11.3 liters	11.9 quarts
Engine Crankcase		
• 2.2L (VIN 4)	4.3 liters	4.5 quarts
• 4.3 L (VIN W)	4.3 liters	4.5 quarts
Fuel Tank		
• (2-Door Models)	72.0 liters	19.0 gallons
• (Crew Cab Models)	72.0 liters	19.0 gallons
• (4-Door Models)	68.0 liters	18.0 gallons
• (Regular Extended Cab Models)	70.0 liters	18.5 gallons
Transmission		
• 4L60-E After Filter/Pan Removal	4.7 liters	5.0 quarts
• After Complete Overhaul-4L60-E	10.6 liters	11 quarts
• New Venture Gear 1500 Manual Transmission	2.7 liters	2.9 quarts
• New Venture Gear 3500 Manual Transmission	2.0 liters	2.2 quarts
Power Steering Capacity	0.64 ltrs-0.99 ltrs	0.68 qts-1.05 qts

Maintenance Items

Application	Part Number
Automatic Transmission Filter Kit	GM P/N 24200796
Air Cleaner	
• 2.2 L (VIN 4)	AC Type A1163C
• 4.3 L (VIN X)	AC Type A1163C
• 4.3 L (VIN W)	AC Type A1163C
Engine Oil Filter	
• 2-Wheel Drive	AC Type PF-47 (PF-52 Optional)
• 4-Wheel Drive	AC Type PF-52
PCV Valve	
• 4.3 L (VIN X)	AC Type CV789C
• 4.3 L (VIN W)	AC Type CV769C
Spark Plugs	
• 2.2 L (VIN 4)	AC Type 41-948 (GAP 1.27 mm, 0.040 in)
• 4.3 L (VIN X)	AC Type 41-932 (GAP 1.14 mm, 0.060 in)
• 4.3 L (VIN W)	AC Type 41-932 (GAP 1.52 mm, 0.060 in)
Thermostat (Blazer, Jimmy)	GM P/N 12559051
Fuel Filter	
• 2.2 L (VIN 4)	AC Type GF-481
• 4.3 L (VIN X)	AC Type GF-481
• 4.3 L (VIN W)	AC Type GF-481
Windshield Wiper Blades	Trico 51 cm (20 in)
Backglass Wiper Blade	Trico 36 cm (14 in)

Fluid and Lubricant Recommendations

Usage	Fluid/Lubricant
Engine Oil	Engine Oil with the American Petroleum Institute Certified For Gasoline Engines Starburst symbol of the proper viscosity.
Engine Coolant	A 50/50 mixture of clean, drinkable water and use only GM Goodwrench DEX-COOL® or Havoline® DEX-COOL® (orange-colored, silicate-free) coolant conforming to GM specification 6277M.
Engine Coolant Supplemental Sealer	**DO NOT** use cooling system seal tabs, or similar compounds, unless otherwise instructed. The use of cooling system seal tabs, or similar compounds, may restrict coolant flow through the passages of the cooling system or the engine components. Restricted coolant flow may cause engine overheating and/or damage to the cooling system or the engine components/assembly.
Hydraulic Brake System	Delco Supreme 11® Brake Fluid (GM P/N 12377967 or equivalent DOT-3 Brake Fluid).
Windshield Washer Solvent	GM Optikleen® Washer Solvent (GM P/N 1051515 or equivalent).
Hydraulic Clutch System	Hydraulic Clutch Fluid (GM P/N 12345347 or equivalent DOT-3 Brake Fluid).
Park Brake Cable Guides	Chassis Lubricant (GM P/N 12377985 or equivalent) or lubricant meeting requirements of NLGI Grade 2, Category LB or GC-LB.
Power Steering System	GM Power Steering Fluid (GM P/N 1052884-1 pint, 1050017-1 quart, or equivalent).
Manual Transmission	• L4 engine: Manual Transmission Fluid with 5% Friction modifier (GM P/N 12377916). • V6 engine: Synchromesh Transmission Fluid (GM P/N 12345349).
Automatic Transmission	DEXRON®-III Automatic Transmission Fluid with a G-License Number (G-xxxx). The G-License Number will be found on the back label.
Key Lock Cylinders	Multi-Purpose Lubricant, Superlube® (GM P/N 12346241 or equivalent).
Chassis Lubrication	Chassis Lubricant (GM P/N 12377985 or equivalent) or lubricant meeting requirements of NLGI Grade 2, Category LB or GC-LB.
Front Wheel Bearings-RWD	Wheel Bearing Lubricant meeting requirements of NLGI Grade 2, Category GC or GC-LB (GM P/N 1051344 or equivalent).
Rear Axle (Standard)	Axle Lubricant (GM P/N 1052271) or SAE 80W-90 GL-5 Gear Lubricant.
Rear Axle (Locking Differential)	Axle Lubricant, use only GM Part No. 1052271 (in Canada use Part No. 10950849). Do not add friction modifier.
Transfer Case	DEXRON®-III Automatic Transmission Fluid.
Automatic Transfer Case	Automatic Transfer Case Fluid (GM P/N 12378396 or equivalent).
Column Shift Linkage	Chassis Lubricant (GM P/N 12377985 or equivalent) meeting requirements of NLGI Grade 2, Category LB or GC-LB.
Floor Shift Linkage	Chassis Lubricant (GM P/N 12377985 or equivalent) meeting requirements of NLGI Grade 2, Category LB or GC-LB.
Propeller Shaft Slip Splines and Universal Joints	Chassis Lubricant (GM P/N 12377985 or equivalent) or lubricant meeting requirements of NLGI Grade 2, Category LB or GC-LB.
Clutch Pushrod to Fork Joint	Chassis Lubricant (GM P/N 12377985 or equivalent) or lubricant meeting requirements of NLGI Grade 2, Category LB or GC-LB.
Constant Velocity Universal Joint	Chassis Lubricant (GM P/N 12377895 or equivalent) or lubricant meeting requirements of NLGI Grade 2, Category LB or GC-LB.
Hood Latch Assembly, Pivots and Spring Anchor, Release Pawl	Lubriplate® Lubricant Aerosol (GM P/N 12346293 or equivalent) or lubricant meeting requirements of NLGI Grade 2, Category LB or GC-LB.
Hood and Door Hinges	Multi-Purpose Lubricant, Superlube® (GM P/N 12346241 or equivalent).

Endgate Mounted Spare Tire Carrier (if equipped), Outer Endgate Handle Pivot Points and Hinges	Multi-Purpose Lubricant, Superlube® (GM P/N 12346241 or equivalent).
Weatherstrip conditioning	Dielectric Silicone Grease (GM P/N 12345579 or equivalent).
Weatherstrip squeaks	Synthetic Grease with Teflon, Loctite Superlube® (GM P/N 12371287 or equivalent).

Descriptions and Operations

Power Steering System

The hydraulic power steering system consists of the following components:

- The pump
- The fluid reservoir
- The steering gear
- The pressure hose
- The return hose
- The cooler (optional)

The power steering pump is a vane-type pump. The pump houses the internal components inside the reservoir. The pump operates submerged in oil.

Two bore openings are located at the rear of the pump housing. The larger opening contains the following components:

- The cam ring
- The pressure plate
- The thrust plate
- The rotor and vane assembly
- The end plate

The smaller opening contains the following components:

- The pressure hose union
- The flow control valve
- The spring

The flow control orifice is part of the pressure control union. The pressure relief valve inside the flow control valve limits the pump pressure.

The power steering gear has a recirculating ball system. The system acts as a rolling thread between the worm shaft and the rack position. The lower end of the worm shaft is supported by a preloaded thrust bearing and two conical thrust races. The upper end of the worm shaft is supported by an adjusted plug. When you turn the worm shaft right, the rack piston moves up in the gear. When you turn the worm shaft left, the rack piston moves down in gear. The rack piston teeth mesh with the sector. The sector is part of the pitman shaft. The pitman shaft turns the wheels through the steering linkage.

The control valve in the steering gear directs the power steering fluid to either side of the rack piston. The rack piston converts the hydraulic pressure into a mechanical force. You can control the vehicle manually if the steering system becomes damaged and loses hydraulic pressure.

Steering Linkage Description and Operation

The steering linkage consists of the following components:

- A pitman arm
- An idler arm
- A relay rod
- 2 adjustable tie rods

When you turn the steering wheel, the steering gear rotates the pitman arm which forces the relay rod to one side. The tie rods connect to the relay rod with the ball studs. The tie rods transfer the steering force to the wheels. Use the tie rods in toe adjustments. The tie rods are adjustable. The pitman arm support the relay rod. The idler arm pivots on a support attached to the frame rail and the ball stud attaches to the relay rod.

The 2 tie rod are threaded into the tube and secured with jam nuts. Right and left hand threads are used in order to permit the adjustment of toe.

Tie Rod Description

- There are two tie rod assemblies. Each tie rod assembly consists of the following components:
  - Sleeve
  - Two clamps
  - Two tie rod ends
- The two tie rod ends are threaded into the sleeve and secured with the clamps.
- The right and left hand threads are used for the following components:
  - Toe-in adjustments
  - Steering gear centering
- Before any service is performed, note the following items:
  - Position of the tie rod adjuster tube
  - Direction from which the bolts are installed
- The tie rod adjuster components may be rusted. If the torque required to remove the nut from the bolt exceeds 9 N·m (62 lb in), perform the following steps:
  - Replace the nuts.
  - Rotate the clamps until they move freely.
- Install all parts, with the correct part number, in the proper position.
- All of the procedures for the following items apply to the left and the right sides:
  - Alignment
  - Adjustment
  - Assembly

Steering Wheel and Column - Standard Description and Operation

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 – Coil Spring (2WD)

The front suspension has 2 primary purposes:

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

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

This requires that the steering knuckle be suspended between an upper and a lower control arm. The lower control arm attaches from 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 attached at 2 points to the vehicle frame, through semi-rigid bushings. The upper control arm attaches to the frame in the same fashion. Between the lower control arm and a spring seat on the vehicle's frame, under tension, is a coil spring.

This up and down motion of the steering knuckle as the vehicle travels over bumps is absorbed predominantly by the coil spring. The vertical movement of the steering knuckle as the vehicle travels over irregular road surfaces will tend to compress the spring and spring tension will lead the spring to return to the original, at-rest state. This action isolates the vehicle from the road surface. The upper and lower control arms are 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.

A shock absorber is used in conjunction with this system in order to dampen out the oscillations of the coil spring. A shock absorber is a basic hydraulic cylinder. The shock is filled with oil and has a moveable shaft that connects to a piston inside the shock absorber. Valves inside the shock absorber offer resistance to oil flow and consequently inhibit rapid movement of the piston and shaft. Each end of the shock absorber is connected in such a fashion to utilize this recoil action of a spring alone.

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

Front Suspension – Torsion Bar (4WD)

The front suspension has 2 primary purposes:

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

The front suspension absorbs the impact of the tires travelling over irregular road surfaces and dissipates this energy throughout the suspension system. This process isolates the vehicle occupants from the road surface. The rate at which the suspension dissipates the energy and the amount of energy that is absorbed is how the suspension defines the vehicle's ride characteristics. Ride characteristics are designed into the suspension system and are not adjustable. The ride characteristics are mentioned in this description in order to aid in the understanding of the functions of the suspension system. The

suspension system must allow for the vertical movement of the tire and wheel assembly as the vehicle travels over irregular road surfaces while maintaining the tire's horizontal relationship to the road.

This requires that the steering knuckle be suspended between an upper and a lower control arm. The lower control arm attaches from 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 2 points to the vehicle frame through semi-rigid bushings. The upper control arm attaches to the frame in the same fashion. Attached to the lower control arm is a torsion bar. Torsion bars are steel or steel composite shaft that connects from the lower control arm an adjustable mount at the torsion bar crossmember. The torsion bar functions as a spring in this suspension system. The torsion bar absorbs energy from irregular road surfaces by twisting force along the center axis. The torsion bar has a resistance to this twisting motion and will return to the original, at-rest position similar to that of a spring.

A shock absorber is used in conjunction with this system in order to dampen out the oscillations of the torsion bar. A shock absorber is a basic hydraulic cylinder. The shock is filled with oil and has a moveable shaft that connects to a piston inside the shock absorber. Valves inside the shock absorber offer resistance to oil flow and consequently offer resistance to rapid movement of the piston and shaft. Each end of the shock absorber is connected in such a fashion in order to utilize this recoil action of a torsion bar alone.

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

Rear Suspension

These vehicles use a leaf spring and a solid rear axle suspension system.

The rear axle assembly is attached to multi-leaf springs with U-bolts. The front ends of the springs are attached to the frame at the front hangers with rubber bushings. The rear ends of the springs are attached to the frame with shackles that use rubber bushings. Shackles allow the springs to change position while the vehicle is in motion.

Two direct double-acting shock absorbers provide ride control. The shock absorbers are angle-mounted between the frame. The shock absorbers are attached with brackets. The brackets are attached to the anchor plate.

The rear spring steel stabilizing shaft helps minimize body roll and sway during cornering. The rear stabilizer shaft is connected to the rear axle and the frame with the following components:

- The rubber insulators
- The clamps
- The link assemblies

Wheels and Tires

General Description

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

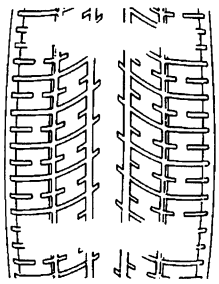
The following factors have an important influence on tire life:

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

The following factors increase tire wear:

- Heavy cornering
- Excessively rapid acceleration
- Heavy braking

Tread Wear Indicators Description



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

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

Metric Wheel Nuts and Bolts Description

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

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

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

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

Tire Inflation Description

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

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

Inspect the tire pressure when the following conditions apply:

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

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

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

Inflation Pressure Conversion (Kilopascals to PSI)

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

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

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

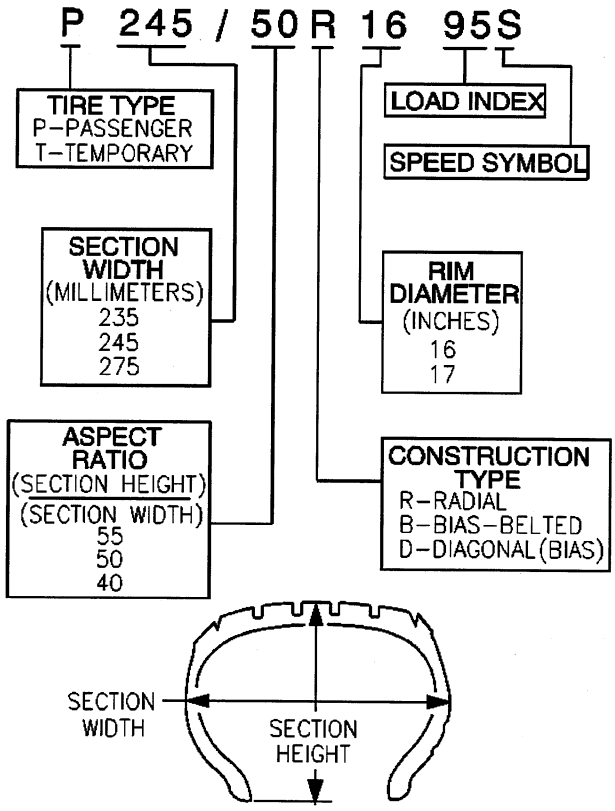
Tires with a lower than recommended pressure can cause the following conditions:

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

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

- Uneven braking
- Steering lead
- Reduced vehicle handling

P-Metric Sized Tires Description



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

Driveline System Description and Operation

Driveline/Axle – Propeller Shaft

The propeller shaft is a tube with universal joints at both ends which do not require periodic maintenance, that transmit power from the transfer case or transmission output shaft to the differential.

Front Propeller Shaft Description

The front propeller shaft transmits rotating force from the transfer case to the front differential when the transfer case is engaged. The front propeller shaft connects to the transfer case using a splined slip joint.

One Piece Propeller Shaft Description

A 1 piece propeller shaft uses a splined slip joint to connect the driveline to the transmission or transfer case.

Two Piece Propeller Shaft Description

There are 3 universal joints used on the two piece propeller shaft, A center bearing assembly is used to support the propeller shaft connection point, and help isolate the vehicle from vibration.

Propeller Shaft Phasing Description

The propeller shaft is designed and built with the yoke lugs (ears) in line with each other. This produces the smoothest running shaft possible. A propeller shaft designed with built in yoke lugs in line is known as in - phase. An out of phase propeller shaft often causes vibration. The propeller shaft generates vibration from speeding up and slowing down each time the universal joint goes around. The vibration is the same as a person snapping a rope and watching the wave reaction flow to the end. An in phase propeller shaft is similar to 2 persons snapping a rope at the same time and watching the waves meet and cancel each other out. A total cancellation of vibration produces a smooth flow of power in the drive line. All splined shaft slip yokes are keyed in order to ensure proper phasing.

Universal Joint Description

The universal joint is connected to the propeller shaft. The universal consist of 4 caps with needle bearings and grease seals mounted on the trunnions of a cross or spider. These bearings and caps are greased at the factory and no periodic maintenance is required. There are 2 universal joints used in a one piece propeller shaft and 3 used in two piece propeller shaft. The bearings and caps are pressed into the yokes and held in place with snap rings, except for 2 bearings on some models witch are strapped onto the pinion flange of the differential. Universal joints are designed to handle the effects of various loads and rear axle windup conditions during acceleration and braking. The universal joint operates efficiently and safely within the designed angle variations. when the design angles are exceeded, the operational life of the joint decreases.

Center Bearing Description

Center bearings support the driveline when using 2 or more propeller shafts. The center bearing is a ball bearing mounted in a rubber cushion that attaches to a frame crossmember. The manufacturer prelubricates and seals the bearing. The cushion allows vertical motion at the driveline and helps isolate the vehicle from vibration.

Wheel Drive Shafts Description and Operation

Front Wheel Drive Shafts are flexible assemblies which consist of the following components:

- Front wheel drive shaft constant velocity joint outer joint.
- Front wheel drive shaft tri-pot joint inner joint.
- The front wheel drive shaft connects the front wheel drive shaft tri-pot joint and the front wheel drive shaft constant velocity joint.
- Wheel Drive Shaft Seal Cover 15 Series

- The front wheel drive shaft tri-pot joint is completely flexible, and moves with an in and out motion.
- The front wheel drive shaft constant velocity joint is flexible but can not move in and out.

The Wheel Drive Shaft is a balanced shaft that transmits rotational force from the front differential to the front wheels when the transfer case is engaged. The wheel drive shaft is mounted to the front differential by bolting the flange of the wheel drive shaft to the flange on the inner output shaft of the front differential. The other end of the wheel drive shaft is splined to fit into and drive the hub assembly when the transfer case is engaged. The tri-pot joint and constant velocity joint on the wheel drive shaft allows the shaft to be flexible to move with the suspension travel of the vehicle.

Front Drive Axle Description and Operation

The Front Drive Axle consist of the following components:

- Differential Carrier Housing
- Differential Assembly
- Left and Right Output Shafts
- Inner Axle Shaft Housing
- Inner Axle Shaft

The front axle on the four-wheel-drive model vehicle does not have a central disconnect feature. The axle uses a conventional ring and pinion gear set in order to transmit the driving force of the engine to the wheels. The open differential allows the wheels to turn at different rates of speed while the axle continues to transmit the driving force. This prevents tire scuffing when going around corners and premature wear on internal axle parts. The ring and pinion set and the differential are contained within the carrier. The axle identification number on top of the differential carrier assembly or on a label on the right half of differential carrier assembly. The drive axles are completely flexible assemblies consisting of inner and outer constant velocity CV joints protected by thermoplastic boots and connected by a wheel drive shaft.

Rear Drive Axle Description and Operation

Rear Axles for this vehicle consist of the following components:

- Differential axle housing
- Differential carrier
- Right and left axle tubes
- Right and left axle shafts

A open differential has a set of 4 gears. Two are side gears and 2 are pinion gears. Some differentials have more than 2 pinion gears. Each side gear is splined to an axle shaft so each axle shaft ; so that each axle shaft turns when its side gear rotates. The pinion gears are mounted on a differential pinion shaft, and the gears are free to rotate on this shaft. The pinion shaft is fitted into a bore in the differential case and is at right angles to the axle shafts. Power is transmitted through the differential as follows: the drive pinion rotates the ring gear. The ring gear being bolted to the differential case, rotates the case, The differential pinion, as it rotates the case, forces the pinion gears against the side gears. When both wheels have equal traction, the pinion gears do not rotate on the pinion shaft because of input force on the pinion gear is equally divided between the 2 side gears. Therefore, the pinion gears revolve with the pinion shaft, but do not rotate around the shaft itself. The side gears, being splined to the axle shafts and in mesh with the pinion gears rotate the axle shafts. If a vehicle were always driven in a straight line, the ring and pinion gears would be sufficient. The axle shaft could be solidly attached to the ring gear and both driving wheels would turn at equal speed. However, if it became necessary to turn a corner, the tires would scuff and slide because the differential allows the axle shafts to rotate at different speeds. When the vehicle turns a corner, the inner wheel turns slower than the out wheel and slows its rear axle side gear (as the shaft is splined to the side gear). The rear axle pinion gears will roll around the slowed rear axle side gear, driving the rear axle side gear wheel faster.

Locking Differential Description and Operation

The locking differential consists of the following components:

- Differential case - 1 or 2 piece
- Locking differential spider - 2 piece case only
- Pinion gear shaft - 1 piece case only
- Differential pinion gear shaft lock bolt - 1 piece case only
- 2 clutch discs sets
- Locking differential side gear
- Thrust block
- Locking differential clutch disc guides
- Differential side gear shim
- Locking differential clutch disc thrust washer
- Locking differential governor
- Latching bracket
- Cam plate assembly
- Differential pinion gears
- Differential pinion gear thrust washers

The optional locking differential (RPO G80) enhances the traction capability of the rear axle by combining the characteristics of a limited-slip differential and the ability of the axle shafts to "lock" together when uneven traction surfaces exist. The differential accomplishes this in 2 ways. First by having a series of clutch plates at each side of the differential case to limit the amount of slippage between each wheel. Second, by using a mechanical locking mechanism to stop the rotation of the right differential side gear, or the left differential side gear on the 10.5 inch axle, in order to transfer the rotating torque of the wheel without traction to the wheel with traction. Each of these functions occur under different conditions.

Limited-Slip Function

Under normal conditions, when the differential is not locked, a small amount of limited-slip action occurs. The gear separating force developed in the right-hand (left-hand side on 10.5 inch axle) clutch pack is primarily responsible for this.

The operation of how the limited-slip function of the unit works can be explained when the vehicle makes a right-hand turn. Since the left wheel travels farther than the right wheel, it must rotate faster than the ring gear and differential case assembly. This results in the left axle and left side gear rotating faster than the differential case. The faster rotation of the left-side gear causes the pinion gears to rotate on the pinion shaft. This causes the right-side gear to rotate slower than the differential case.

Although the side gear spreading force produced by the pinion gears compresses the clutch packs, primarily the right side, the friction between the tires and the road surface is sufficient to overcome the friction of the clutch packs. This prevents the side gears from being held to the differential case.

Locking Function

Locking action occurs through the use of some special parts:

- A governor mechanism with 2 flyweights
- A latching bracket
- The left side cam plate and cam side gear

When the wheel-to-wheel speed difference is 100 RPM or more, the flyweights of the governor will fling out and one of them will contact an edge of the latching bracket. This happens because the left cam side gear and cam plate are rotating at a speed different, either slower or faster, than that of the ring gear and differential case assembly. The cam plate has teeth on its outer diameter surface in mesh with teeth on the shaft of the governor.

As the side gear rotates at a speed different than that of the differential case, the shaft of the governor rotates with enough speed to force the flyweights outward against spring tension. One of the flyweights

catches its edge on the closest edge of the latching bracket, which is stationary in the differential case. This latching process triggers a chain of events.

When the governor latches, it stops rotating. A small friction clutch inside the governor allows rotation, with resistance, of the governor shaft while one flyweight is held to the differential case through the latching bracket. The purpose of the governor's latching action is to slow the rotation of the cam plate as compared to the cam side gear. This will cause the cam plate to move out of its detent position.

The cam plate normally is held in its detent position by a small wave spring and detent humps resting in matching notches of the cam side gear. At this point, the ramps of the cam plate ride up on the ramps of the cam side gear, and the cam plate compresses the left clutch pack with a self-energizing action.

As the left clutch pack is compressed, it pushes the cam plate and cam side gear slightly toward the right side of the differential case. This movement of the cam side gear pushes the thrust block which compresses the right-hand side gear clutch pack.

At this point, the force of the self-energizing clutches and the side gear separating force combine to hold the side gears to the differential case in the locking stage.

The entire locking process occurs in less than 1 second. The process works with either the left or right wheel spinning, due to the design of the governor and cam mechanism. A torque reversal of any kind will unlatch the governor, causing the cam plate to ride back down to its detent position. Cornering or deceleration during a transmission shift will cause a torque reversal of this type. The differential unit returns to its limited-slip function.

The self-energizing process would not occur if it were not for the action of one of the left clutch discs. This energizing disc provides the holding force of the ramping action to occur. It is the only disc which is splined to the cam plate itself. The other splined discs fit on the cam side gear.

If the rotating speed of the ring gear and differential case assembly is high enough, the latching bracket will pivot due to centrifugal force. This will move the flyweights so that no locking is permitted. During vehicle driving, this happens at approximately 32 km/h (20 mph) and continues at faster speeds.

When comparing the effectiveness of the locking differential, in terms of percent-of-grade capability to open and limited-slip units, the locking differential has nearly 3 times the potential of the limited-slip unit under the same conditions.

Locking Differential Torque-Limiting Disc

The locking differential design was modified in mid-1986 to include a load-limiting feature to reduce the chance of breaking an axle shaft under abusive driving conditions. The number of tangs on the energizing disc in the left-hand clutch pack was reduced allowing these tangs to shear in the event of a high-torque engagement of the differential locking mechanism.

At the time of failure of the load-limiting disc, there will be a loud bang in the rear axle and the differential will operate as a standard differential with some limited-slip action of the clutch packs at low torques.

The service procedure, when the disc tangs shear, involves replacing the left-hand clutch plates and the wave spring. It is also necessary to examine the axle shafts for twisting because at high torques it is possible to not only shear the load-limiting disc, but to also twist the axle shafts.

Transfer Case Description – NV233

The NVG 233 transfer case features a 3 button shift control switch, located on the instrument panel. When the ignition is in the RUN position, the transfer case shift control module starts monitoring the transfer case shift control switch, to determine if a new mode/gear position has been selected. At a single press of the transfer case shift control switch, the lamp of the new position begins flashing to inform the driver that the transfer case shift control module has received the request for a new mode/gear position. The lamp continues to flash until all shifting criteria has been met and the new mode/gear position has been reached, or has engaged. Once the new mode/gear position is fully active, the switch indicator lamp for the new position remains ON constantly.

The NVG 233 transfer case provides the driver with 3 manual mode/gear positions:

- 2HI - 2 Wheel Drive high range
- 4HI - 4 Wheel Drive high range
- 4LO - 4 Wheel Drive low range

Any of these mode/gear positions may be selected while driving the vehicle. However, the transfer case will not allow a shift into, or out of, 4LO unless the following criteria has been met:

- The engine is running.
- The automatic transmission is in Neutral, or the clutch pedal is applied on manual transmissions.
- The vehicle speed is below 5 km/h (3 mph).

Transfer Case Description – NV236/246

The NVG 236/246 transfer case features a 4 button shift control switch located on the instrument panel. When the vehicle has the ignition key in the RUN position, the transfer case shift control module starts monitoring the transfer case shift control switch to determine if the driver desires a new mode/gear position. At a single press of the transfer case shift control switch, the lamp of the new desired position will begin flashing to inform the driver that the transfer case shift control module has received the request for a new mode/gear position. The lamp will continue to flash until all shifting criteria has been met and the new mode/gear position has been reached, or has been engaged. Once the new mode/gear position is fully active, the switch indicator lamp for the new position will remain ON constantly.

During normal driving situations the transfer case can operate in the Auto 4WD mode. In the Auto 4WD mode the transfer case shift control module monitors rear wheel slip speed, based on the inputs from both the front and rear propshaft speed sensors. When the vehicle experiences a rear wheel slip condition, the transfer case shift control module sends a pulse width modulated (PWM) signal to an electronic motor, which is the transfer case encoder motor. This motor rotates the transfer case sector shaft, applying a clutch pack. This clutch pack is designed to deliver a variable amount of torque, normally delivered to the rear wheels, and transfers it to the front wheels. Torque is then ramped up to the front wheels until the front propshaft speed sensor matches that of the rear propshaft speed sensor. Torque is then ramped down until torque is completely removed from the front wheels or until rear wheel slip is once again detected. The process would then repeat.

The NVG 236/246 transfer case has the added feature of also providing the driver with 3 manual mode/gear positions:

- 4HI - 4 Wheel Drive high range
- 2HI - 2 Wheel Drive high range
- 4LO - 4 Wheel Drive low range

The driver may choose to select any of these mode/gear positions while driving the vehicle. However, the transfer case will not allow a shift into or out of 4LO unless the following criteria has been met:

- The engine is running.
- The automatic transmission is in Neutral, clutch depressed on manual transmissions.
- The vehicle speed is below 5 km/h (3 mph).

This transfer case also has a Neutral position. A shift to the Neutral position allows the vehicle to be towed without the rear axle rotating the transfer case main shaft and the transmission output shaft. Neutral position may be obtained only if the following criteria has been met:

- The key is ON.
- The automatic transmission is in Neutral, clutch depressed on manual transmissions.
- The vehicle speed is below 5 km/h (3 mph).
- The transfer case is in 2HI mode.

Once these conditions have been met, press and hold both the 2HI and 4LO buttons for 10 seconds. When the system completes the shift to neutral, the red neutral lamp will illuminate.

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

The park brake system is applied by depressing the park brake pedal. Applying the park brake pedal places tension on the park brake cables, which actuates the rear park brake mechanism. The system mechanically forces the rear brake shoes against the brake drums, locking the rear brakes.

All vehicles, except the RWD pickups, are equipped with a four-wheel disc braking system. The park brake shoes on these vehicles are inside a brake drum which is part of a one-piece drum/rotor casting. The park brake shoes are mechanically applied to lock the rear wheels.

This section covers park brake component replacement and adjustment. The park brake must be adjusted any time the park brake cables have been replaced or disconnected, or if the park brake holding ability is inadequate. The lever on the disc brakes must also be properly seated when this procedure is performed.

The park brake is not designed for use in the place of service brakes and should be applied only after the vehicle is brought to a complete stop, except in an emergency. Before working on the park brake system, make sure the service brakes are in good working order and adjusted properly.

Park Brake Lever

The park brake lever is located on the left side of the driver's compartment and is activated by foot pressure. The lever assembly has a clutch mechanism in it to allow varying degrees of park brake application. The park brake release handle under the instrument panel allows the driver to release the park brake and control the foot lever release velocity.

Cable System

The park brake uses a cable system that includes one front cable and two rear cables. The front cable connects to the park brake lever on one end and the equalizer on the other end. The rear cables attach to the equalizer on one end and to either the park brake struts in the drum brakes, or the lever on the disc brakes on the other end.

Notice

Handling of the parking brake cables during service requires extra care. Damage to the nylon coating reduces the corrosion protection. If the damaged area passes through the seal, increased parking brake effort could result. Avoid contacting the coating with sharp-edged tools, or the sharp surfaces of the vehicle underbody.

This vehicle is equipped with coated park brake cable assemblies. The wire strand is coated with a nylon material that slides over plastic seals inside the conduit end fittings. This is for corrosion protection and reduced park brake effort.

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 2.2L

Mechanical Specifications

Application	Specifications	
	Metric	English
General Data		
• Engine Type	L-4	
• Displacement	2.2 L	134 CID
• RPO (Engine VIN Code)	L43/LN2	
• Bore	89 mm	3.5 in
• Stroke	88 mm	3.46 in
• Compression Ratio	8.85:1	
• Firing Order	1-3-4-2	
• Oil Pressure @ 65°C (150°F)	348 kpa	56 psi @ 3000 RPM
Cylinder Bore		
• Diameter	88.991-89.009 mm	3.5036-3.5043 in
• Out Of Round Maximum	0.013 mm	0.0005 in
• Taper -- Thrust Side Maximum	0.013 mm	0.0005 in
• Lubrication System		
• Oil Capacity Without Filter Change	3.473 L	3.5 qts
• When Changing the Oil Filter, Up to an Additional 0.473 Liter or One Half Quart of Oil May Be Needed. Filter Type or Equivalent	PF-47	
• Oil Pressure (3000 RPM @ 65°C (150°F)	348 kPa	56 psi min.
Piston		
• Clearance (42.7 mm from top of piston)		
• Factory Specification	0.015-0.047 mm	0.00059-0.00185 in
• Service Specification	0.055-0.087 mm	0.0022-0.0034 in
Piston Ring Compression		
• Top Groove Side Clearance	0.05-0.09 mm	0.0020-0.0035 in
• Second Groove Side Clearance	0.04-0.08 mm	0.0016-0.0031 in
• Top Ring Gap	0.25-0.50 mm	0.010-0.020 in
• Second Ring Gap	0.30-0.45 mm	0.0012-0.0177 in
Piston Ring Oil		
• Groove Clearance	0.013-0.220 mm	0.0005-0.0087 in
• Gap	0.25-0.76 mm	0.010-0.030 in
Piston Pin		
• Diameter	20.3200-20.3251 mm	0.8000-0.8002 in
• Clearance In Piston	0.0079-0.018 mm	0.00031-0.00071 in
• Interference Fit In Rod	0.021-0.0511 mm	0.0008-0.0020 in
Oil Pump		
• Outer Gerotor Thickness	17.087-17.099 mm	0.6727-0.6731 in
• Oil Pump Drive to Driven Gear Backlash	0.23-0.51 mm	0.0091-0.0201 in
• Valve to Bore Clearance	0.038-0.089 mm	0.0015-0.0035 in
• Gear Lash	0.094-0.195 mm	0.004-0.008 in
• Gear Pocket Depth	30.36-30.44 mm	1.195-1.198 in

• Gear Pocket Diameter	38.18-38.25 mm	1.503-1.506 in
• Gear Length (Drive Gear)	30.45-30.48 mm	1.199-1.20 in
• Gear Length (Idler)	30.45-30.48 mm	1.199-1.20 in
• Gear Diameter (Drive Gear)	38.05-38.10 mm	1.498-1.50 in
• Gear Diameter (Idler)	38.05-38.10 mm	1.498-1.5 in
• Gear Side Clearance (Drive Gear)	0.038-0.102 mm	0.001-0.004 in
• Gear Side Clearance (Idler)	0.038-0.102 mm	0.001-0.004 in
• End Clearance	0.05-0.18 mm	0.002-0.007 in
Crankshaft		
• Main Journal Diameter	63.360-63.384 mm	2.4945-2.4954 in
• Main Journal Taper	0.005 mm	0.00019 in
• Main Journal Out Of Round	0.005 mm	0.00019 in
• Main Bearing Clearance	0.015-0.047 mm	0.0006-0.0019 in
• Crankshaft End Play	0.0511-0.1780 mm	0.002-0.007 in
• Rod Bearing Journal Diameter	50.758-50.784 mm	1.9983-1.9994 in
• Rod Bearing Journal Taper	0.005 mm	0.00019 in
• Rod Bearing Journal Out Of Round	0.005 mm	0.00019 in
• Rod Bearing Journal Clearance	0.025-0.079 mm	0.00098-0.0031 in
• Rod Side Clearance	0.10-0.38 mm	0.0039-0.0149 in
Camshaft		
• Lobe Lift (Inlet and Exhaust)	6.687 mm	0.2633 in
• Journal Diameter	47.453-47.478 mm	1.868-1.869 in
• Journal Clearance	0.038-0.088 mm	0.0015-0.0035 in
Valve System		
• Rocker Arm Ratio	40.64 mm	1.6
• Valve Face Angle	--	45°
• Valve Face Runout	0.038 mm	0.0014 in
• Valve Margin (Exhaust)	2.21-1.79 mm	0.087-0.080 in
• Valve Margin (Inlet)	1.96-1.16 mm	0.061-0.04 in
• Valve Head Diameter (Inlet)	44 mm	1.73 in
• Valve Head Diameter (Exhaust)	37 mm	1.45 in
• Valve Overall Length (Inlet)	134.23 mm	5.28 in
• Valve Overall Length (Exhaust)	127 mm	5.00 in
• Valve Stem to Guide Clearance (Inlet)	0.019-0.053 mm	0.0007-0.0020 in
• Valve Stem to Guide Clearance (Exhaust)	0.035-0.075 mm	0.0014-0.0029 in
• Valve Guide Inside Diameter	7.000-7.020 mm	0.275-0.276 in
• Valve Tip to Retainer Groove Centerline (Exhaust)	5.38-5.90 mm	0.212-0.232 in
• Valve Tip to Retainer Groove Centerline (Intake)	4.94-5.46 mm	0.194-0.215 in
• Valve Springs Free Length	48.7 mm	1.91 in
• Valve Seat Width (Inlet)	2.80 mm	0.110 in
• Valve Seat Width (Exhaust)	3.51 mm	0.138 in
• Valve Springs Load (Closed)	361-325 N @ 40.64 mm	81.2-73.1 lb @ 1.600 in
• Valve Springs Load (Open)	957-893 N @ 29.85 mm	215-201 lb @ 1.175 in

Fastener Tightening Specifications

Application	Specifications	
	Metric	English
Accelerator Cable Mounting Bracket	10 N·m	89 lb in
Accessory Bracket Bolts	50 N·m	37 lb ft
Battery Negative Cable Bolt To Engine	35 N·m	26 lb ft
Battery Positive Cable Retainer Bolt To Engine	35 N·m	26 lb ft
Camshaft Position Sensor to Block Bolt	10 N·m	89 lb in
Camshaft Rear Cover Bolts	12 N·m	106 lb in
Camshaft Sprocket Bolt	130 N·m	96 lb in
Camshaft Thrust Plate Bolts	12 N·m	106 lb in
Clutch Cover and Pressure Plate Assembly Bolts		
• First Pass	20 N·m	15 lb ft
• Final Pass	45°	
Connecting Rod Cap Nuts	52 N·m	38 lb ft
Crankshaft Bearing Cap Bolts - First Pass	50 N·m	31 lb ft
Crankshaft Bearing Cap Bolts - Second Pass	95 N·m	70 lb ft
Crankshaft Pulley Hub to Crankshaft Bolts	105 N·m	77 lb ft
Crankshaft Pulley to Hub Bolt	50 N·m	37 lb ft
Crankshaft Sensor Bolt	8 N·m	72 lb in
Cylinder Head Bolts -- Long		
• First Pass	63 N·m	46 lb ft
• Final Pass	90°	
Cylinder Head Bolts -- Short		
• First Pass	58 N·m	43 lb ft
• Final Pass	90°	
Direct Ignition System Coil Assembly	25 N·m	18 lb ft
Drive Belt Tensioner Bolt	50 N·m	37 lb ft
EGR Port Cover Bolts	11 N·m	97 lb in
Engine Front Cover Bolts	11 N·m	97 lb in
Engine Front Cover Nuts	10 N·m	89 lb in
Engine Front Cover Studs	7 N·m	62 lb in
Engine Lift Bracket Nut	50 N·m	37 lb ft
Engine Mount Rear Bolt to Transmission	45 N·m	33 lb ft
Engine Mount Rear Nut to Crossmember	45 N·m	33 lb ft
Engine Mount Shield Bolt	11 N·m	97 lb in
Engine Mount Through Bolt And Studs	45 N·m	33 lb ft
Engine Mount to Engine Bolt	55 N·m	41 lb ft
Engine Wire Harness Bracket at Bolt to Rear of Cylinder Head	25 N·m	18 lb ft
Engine Wire Harness Bracket at Rear of Cylinder Head Bolts to Valve Cover	10 N·m	89 lb in
Engine Wiring Harness Retaining Bolt To Intake Manifold	12 N·m	106 lb in
Exhaust Manifold Nuts	13 N·m	118 lb in
Fan Pully Bolts	30 N·m	22 lb ft
Flywheel Bolts	75 N·m	55 lb ft
Generator Output Wire Nut	17 N·m	13 lb ft
Generator Rear Brace Bolts	25 N·m	18 lb ft
Generator Rear Brace Nuts	25 N·m	18 lb ft
Ground Wires Bolt	35 N·m	26 lb ft
Heater Hose Bracket to Oil Fill Tube	14 N·m	10 lb ft
Intake Manifold Bolts	24 N·m	17 lb ft
Intake Manifold Nuts	24 N·m	17 lb ft
Intake Manifold Studs	12 N·m	105 lb in

Knock Sensor	19 N·m	26 lb ft
Lifter Guide Bolts	11 N·m	97 lb in
Oil Filter	17 N·m	13 lb ft
Oil Filter Adapter	35 N·m	26 lb ft
Oil Gallery Plug - Large - Rear of Engine Block	33 N·m	24 lb ft
Oil Gallery Plug - Small - Rear of Engine Block	15 N·m	11 lb ft
Oil Gallery Plugs - Side of Block Above Oil Filter	21 N·m	15 lb ft
Oil Level Indicator Tube Nut	12 N·m	106 lb in
Oil Pan Drain Plug	45 N·m	33 lb ft
Oil Pan Nuts and Bolts	10 N·m	89 lb in
Oil Pressure Sensor/Switch	12 N·m	106 lb in
Oil Pump Cover Bolts	10 N·m	89 lb in
Oil Pump Drive Assembly Bolt	25 N·m	18 lb ft
Oil Pump Mounting Bolt	44 N·m	32 lb ft
Oxygen Sensor	42 N·m	31 lb ft
Power Steering Pump Front Bolts	30 N·m	22 lb ft
Power Steering Pump Lower Bolts	50 N·m	37 lb ft
Power Steering Pump Nuts	50 N·m	37 lb ft
Rocker Arm Bolts	25 N·m	19 lb ft
Spark Plugs	17 N·m	13 lb ft
Starter Positive Cable Retainer Bolt to Block	35 N·m	26 lb ft
Throttle Body to Intake Manifold Bolts	10 N·m	89 lb in
Timing Chain Tensioner Bolts	24 N·m	17 lb ft
Transmission Support Brace Bolts	50 N·m	37 lb ft
Valve Rocker Arm Cover Bolts	10 N·m	89 lb in
Water Jacket Drain Plug	15 N·m	11 lb ft
Water Outlet Pipe	26 N·m	19 lb ft
Water Pump Bolts	25 N·m	18 lb ft
Water Pump Inlet	25 N·m	18 lb ft
Water Pump Pulley Bolts	30 N·m	22 lb ft

Engine Component Description

Engine Block

The engine block is cast iron. The engine block has four cylinders arranged in-line. The engine block is a one piece casting. The cylinders are encircled by coolant jackets.

Cylinder Head

The cylinder head is cast aluminum made in a lost-foam casting process. This results in a casting requiring very little final machining. The cylinder head has sintered powdered metal valve guides and valve seats.

Crankshaft

The crankshaft is cast nodular iron. Five crankshaft bearings support the crankshaft. The bearings are retained by bearing caps. Number four crankshaft bearing also serves as the crankshaft thrust bearing. The bearing caps are machined with the block for proper alignment and clearances. The bearing caps are retained by two bolts each. Four connecting rod journals are spaced 90 degrees apart. There is one connecting rod on each journal.

Piston and Connecting Rod Assemblies

The pistons are cast aluminum. The pistons use two compression rings and one oil control ring assembly. The piston is a low friction, lightweight design with a flat top and barrel shaped skirt. The piston pins are chromium steel. They have a floating fit in the piston and are retained by a press fit in the connecting rod. The connecting rods are forged steel. The connecting rods are machined with the rod cap installed for proper clearances and alignments.

Camshaft

The camshaft is steel. The camshaft is supported by five bearings pressed into the engine block. The camshaft is of an assembled design with each lobe, journal, and the oil pump drive gear assembled onto a hollow tube which is then expanded to hold the components in place. The camshaft timing chain sprocket mounted to the front of the camshaft is driven by the crankshaft sprocket thorough a camshaft timing chain.

Valve Train

The LN2 valve train utilizes cast steel rocker arms with a roller bearing fulcrum. Motion is transmitted from the camshaft through the hydraulic roller valve lifters and the tubular pushrods to the valve rocker arms. The valve rocker arm pivots on a roller bearing in order to open the valve. The valve train is of the net-lash type without provision for manual adjustment. All valve train lash is taken up by hydraulic roller valve lifters.

The valve springs are of a conical type which reduce valve train harmonics and noise.

The valve seals are integral with the valve spring seats.

Intake Manifold and Fuel Rail

The intake manifold is constructed of a composite material incorporating metallic compression limiters at the mounting points for the throttle body, fuel rail, and the manifold to cylinder head flange. The fuel rail is of an assembled tubular design.

Exhaust Manifold

The exhaust manifold is cast iron.

Drive Belt System Description

The drive belt system consists of the following components:

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

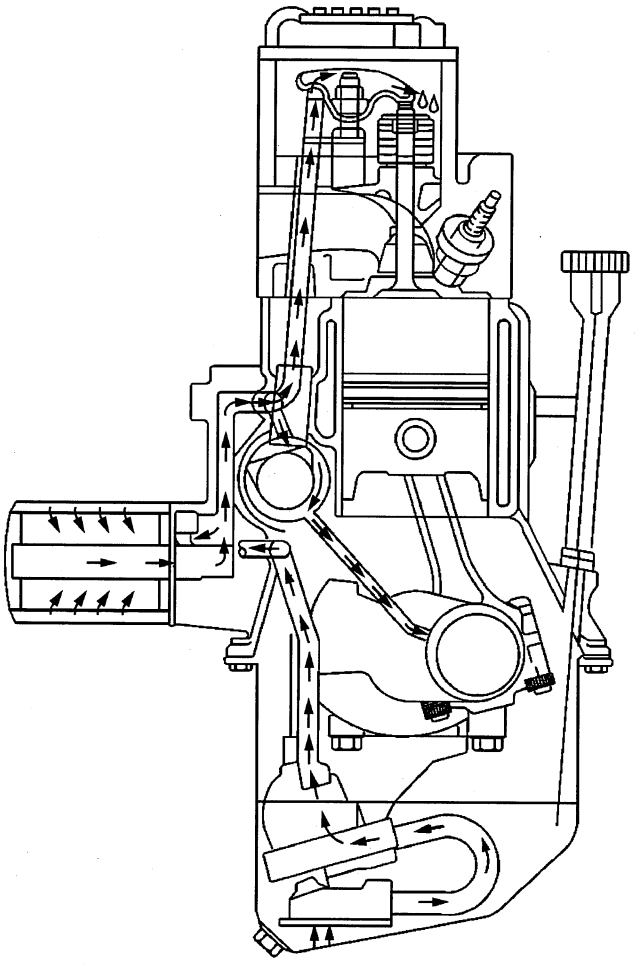
The drive belt system may use 1 belt or 2 belts. The drive belt is thin so that it can bend backwards and has several ribs to match the grooves in the pulleys. There also may be a V-belt style belt used to drive certain accessory drive components. The drive belts are made of different types of rubbers -- chloroprene or EPDM -- and have different layers or plys containing either fiber cloth or cords for reinforcement.

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

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

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

Lubrication



Full pressure lubrication, through a full-flow oil filter is supplied by a gear-type oil pump. Oil is drawn up through the oil pump screen and passes through the pump to the oil filter. The oil filter is a full-flow paper element unit with an anti-drain back valve. An oil filter bypass valve is used to ensure adequate oil supply, in the event the filter becomes plugged or develops excessive pressure drop. Filtered oil flows into the main gallery and then to the camshaft, the balance shaft, the rear bearing, and the crankshaft bearings. The valve lifter oil gallery supplies oil to the valve lifters. Oil flows from the valve lifters through the hollow valve pushrods to the valve rocker arms. Oil drains back to the crankcase through the oil drain holes in the cylinder head. The camshaft timing chain is drip fed from the front camshaft bearing. The pistons and piston pins are lubricated by oil splash.

Engine Mechanical – 4.3L

Mechanical Specifications

Application	Specification	
	Metric	English
General Data		
• Engine Type	V6	
• RPO Code	L35/LU3	
• VIN Code	W/X	
• Displacement	4.3 L	262 CID
• Bore	101.60 mm	4.012 in
• Stroke	88.39 mm	3.480 in
• Compression Ratio	9.2:1	
• Firing Order	1-6-5-4-3-2	
• Spark Plug Gap	1.52 mm	0.060 in
• Oil Pressure - Minimum - at Normal Operating Temperature	42 kPa at 1,000 RPM 125 kPa at 2,000 RPM 166 kPa at 4,000 RPM	6 psig at 1,000 RPM 18 psig at 2,000 RPM 24 psig at 4,000 RPM
Balance Shaft		
• Rear Bearing Journal Clearance	0.050-0.088 mm	0.0020-0.0035 in
• Rear Bearing Journal Diameter	38.085-38.100 mm	1.4994-1.500 in
Camshaft		
• End Play	0.0254-0.2286 mm	0.0010-0.0090 in
• Journal Diameter	47.440-47.490 mm	1.8677-1.8696 in
• Journal Diameter Out-of-Round	0.025 mm - Maximum	0.0010 in - Maximum
• Lobe Lift - Exhaust	7.20-7.30 mm	0.283-0.287 in
• Lobe Lift - Intake	6.97-7.07 mm	0.274-0.278 in
• Runout	0.065 mm	0.0026 in
Connecting Rod		
• Connecting Rod Bearing Clearance - Production	0.038-0.078 mm	0.0015-0.0031 in
• Connecting Rod Bearing Clearance - Service	0.025-0.063 mm	0.0010-0.0025 in
• Connecting Rod Journal Diameter	57.116-57.148 mm	2.2487-2.2497 in
• Connecting Rod Journal Out-of-Round - Production	0.007 mm - Maximum	0.0002 in - Maximum
• Connecting Rod Journal Out-of-Round - Service	0.025 mm - Maximum	0.0010 in - Maximum
• Connecting Rod Journal Taper - Production	0.00508 mm - Maximum	0.00030 in - Maximum
• Connecting Rod Journal Taper - Service	0.025 mm - Maximum	0.0010 in - Maximum
• Connecting Rod Side Clearance	0.15-0.44 mm	0.006-0.017 in
Crankshaft		
• Crankshaft Bearing Clearance - Journal #1-Production	0.02-0.508 mm	0.0008-0.0020 in
• Crankshaft Bearing Clearance - Journal #2, #3, and #4-Production	0.028-0.058 mm	0.0011-0.0023 in
• Crankshaft Bearing Clearance - Journal #1-Service	0.0254-0.05 mm	0.0010-0.0020 in
• Crankshaft Bearing Clearance - Journal #2, #3, and #4-Service	0.025-0.063 mm	0.0010-0.0250 in
• Crankshaft End Play	0.050-0.20 mm	0.002-0.008 in

• Crankshaft Journal Diameter - Journal #1	62.199-62.217 mm	2.4488-2.4495 in
• Crankshaft Journal Diameter - Journal #2 and #3	62.191-62.215 mm	2.4485-2.4494 in
• Crankshaft Journal Diameter - Journal #4	62.179-62.203 mm	2.4480-2.4489 in
• Crankshaft Journal Out-of-Round - Production	0.005 mm - Maximum	0.0002 in - Maximum
• Crankshaft Journal Out-of-Round - Service	0.025 mm - Maximum	0.0010 in - Maximum
• Crankshaft Journal Taper - Production	0.007 mm - Maximum	0.0003 in - Maximum
• Crankshaft Runout	0.025 mm - Maximum	0.0010 in - Maximum
Cylinder Bore		
• Diameter	101.618-101.643 mm	4.0007-4.0017 in
• Out-of-Round - Production	0.0127 mm - Maximum	0.00050 in - Maximum
• Out-of-Round - Service	0.05 mm - Maximum	0.002 in - Maximum
• Taper - Production Relief Side	0.025 mm - Maximum	0.0010 in - Maximum
• Taper - Production Thrust Side	0.012 mm - Maximum	0.0005 in - Maximum
• Taper - Service	0.025 mm - Maximum	0.0010 in - Maximum
Cylinder Head		
• Surface Flatness	0.10 mm - Maximum	0.004 in - Maximum
Exhaust Manifold		
• Surface Flatness - Flange to Flange	0.25 mm - Maximum	0.010 in - Maximum
• Surface Flatness - Individual Flange	0.05 mm - Maximum	0.002 in - Maximum
Intake Manifold		
• Surface Flatness	0.10 mm - Maximum	0.004 in - Maximum
Oil Pan		
• Oil Pan Alignment at Rear of Engine Block	0.3 mm - Maximum	0.011 in - Maximum
Piston		
• Piston Bore Clearance - Production	0.018-0.061 mm	0.0007-0.0024 in
• Piston Bore Clearance - Service	0.075 mm - Maximum	0.0029 in - Maximum
Piston Pin		
• Clearance in Piston - Production	0.013-0.023 mm	0.0005-0.0009 in
• Clearance in Piston - Service	0.025 mm - Maximum	0.0010 in - Maximum
• Diameter	23.545-23.548 mm	0.9270-0.9271 in
• Fit in Connecting Rod	0.012-0.048 mm - Interference	0.0005-0.0019 in - Interference
Piston Rings - End Gap Measured in Cylinder Bore		
• Piston Compression Ring Gap - Production-Top Groove	0.25-0.40 mm	0.010-0.016 in
• Piston Compression Ring Gap - Production-2nd Groove	0.38-0.58 mm	0.015-0.023 in
• Piston Compression Ring Gap - Service-Top Groove	0.25-0.50 mm	0.010-0.020 in
• Piston Compression Ring Gap - Service-2nd Groove	0.38-0.80 mm	0.015-0.031 in
• Piston Compression Ring Groove Clearance - Production-Top Groove	0.030-0.070 mm	0.0012-0.0027 in
• Piston Compression Ring Groove Clearance - Production-2nd Groove	0.040-0.080 mm	0.0015-0.0031 in
• Piston Compression Ring Groove Clearance -	0.030-0.085 mm	0.0012-0.0033 in

Service		
• Piston Oil Ring Gap - Production	0.25-0.76 mm	0.010-0.029 in
• Piston Oil Ring Gap - Service	0.005-0.090 mm	0.0002-0.0035 in
• Piston Oil Ring Groove Clearance - Production	0.046-0.196 mm	0.0018-0.0077 in
• Piston Oil Ring Groove Clearance - Service	0.046-0.200 mm	0.0018-0.0079 in
Valve System		
• Valve Face Angle	45 degrees	
• Valve Head Edge Margin	0.79 mm - Minimum	0.031 in - Minimum
• Valve Lash	Net Lash--No Adjustment	
• Valve Lift - Exhaust	10.879 mm	0.4280 in
• Valve Lift - Intake	10.527 mm	0.4140 in
• Valve Lifter	Hydraulic Roller Type	
• Valve Rocker Arm	Roller Pivot Type	
• Valve Rocker Arm Ratio	1.5:1	
• Valve Seat Angle	46 degrees	
• Valve Seat Runout	0.05 mm - Maximum	0.002 in - Maximum
• Valve Seat Width - Exhaust	1.651-2.489 mm	0.065-0.098 in
• Valve Seat Width - Intake	1.016-1.651 mm	0.040-0.065 in
• Valve Spring Free Length	51.3 mm	2.02 in
• Valve Spring Installed Height - Exhaust	42.92-43.43 mm	1.670-1.700 in
• Valve Spring Installed Height - Intake	42.92-43.43 mm	1.670-1.700 in
• Valve Spring Pressure - Closed	338-374 N at 43.2 mm	76-84 lb at 1.70 in
• Valve Spring Pressure - Open	832-903 N at 32.3 mm	187-203 lb at 1.27 in
• Valve Stem Clearance - Exhaust-Production	0.025-0.069 mm	0.0010-0.0027 in
• Valve Stem Clearance - Exhaust-Service	0.025-0.094 mm	0.0010-0.0037 in
• Valve Stem Clearance - Intake-Production	0.025-0.069 mm	0.0010-0.0027 in
• Valve Stem Clearance - Intake-Service	0.025-0.094 mm	0.0010-0.0037 in
• Valve Stem Oil Seal Installed Height - Measured from the Top of the Large Diameter Valve Guide Bevel to the Bottom of the Valve Stem Oil Seal	1-2 mm	0.03937-0.07874 in

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accelerator Control Cable and Cruise Control Cable Bracket Nut	9 N·m	80 lb in
Accelerator Control Cable Bracket Nut	12 N·m	106 lb in
Accelerator Control Cable Bracket Stud to Throttle Body	12 N·m	106 lb in
Air Cleaner Outlet Duct Hose Clamp	4 N·m	32 lb in
Air Cleaner Outlet Duct Wingnut	2 N·m	18 lb in
Balance Shaft Driven Gear Bolt	20 N·m + 35 degrees	15 lb ft + 35 degrees
Balance Shaft Retainer Bolt	12 N·m	106 lb in
Battery Negative Cable Bolt to Engine	17 N·m	13 lb ft
Camshaft Retainer Bolt	12 N·m	106 lb in
Camshaft Sprocket Bolt	25 N·m	18 lb ft
Crankshaft Balancer Bolt	95 N·m	70 lb ft
Crankshaft Balancer Remover/Installer Bolt	25 N·m	18 lb ft
Crankshaft Pulley Bolt	58 N·m	43 lb ft
Crankshaft Rear Oil Seal Housing Bolt and Nut	12 N·m	106 lb in
Cylinder Head Bolt	30 N·m	22 lb ft
• Long Bolt Final Pass	75 degrees	

• Medium Bolt Final Pass	65 degrees	
• Short Bolt Final Pass	55 degrees	
Drive Belt Idler Pulley Bolt	50 N·m	37 lb ft
Drive Belt Tensioner Bolt	50 N·m	37 lb ft
EGR Valve Inlet Pipe Clamp Bolt	25 N·m	18 lb ft
EGR Valve Inlet Pipe Nut at Exhaust Manifold	30 N·m	22 lb ft
EGR Valve Inlet Pipe Nut at Intake Manifold	25 N·m	18 lb ft
Engine Coolant Temperature (ECT) Sensor	20 N·m	15 lb ft
Engine Coolant Temperature Gage Sensor	20 N·m	15 lb ft
Engine Flywheel Bolt	100 N·m	74 lb ft
Engine Front Cover Bolt	12 N·m	106 lb in
Engine Lift Bracket Bolt	15 N·m	11 lb ft
Engine Mount Bolt (Through-bolt)	74 N·m	55 lb ft
Engine Mount Bolt to Engine	55 N·m	41 lb ft
Engine Mount Bracket Bolt to Frame	45 N·m	33 lb ft
Engine Mount Nut (Through-bolt)	63 N·m	46 lb ft
Engine Oil Cooler Pipe Clip Bolt to Oil Pan	9 N·m	80 lb in
Engine Oil Level Sensor	13 N·m	115 lb in
Engine Wiring Harness Bracket Bolt to Generator and Drive Belt Tensioner Bracket	25 N·m	18 lb ft
Engine Wiring Harness Bracket Bolt to Rear of Cylinder Head	35 N·m	26 lb ft
Engine Wiring Harness Bracket Nut to Intake Manifold	12 N·m	106 lb in
Fuel Pipe Bracket Bolt to Rear of Cylinder Head	30 N·m	22 lb ft
Generator and Drive Belt Tensioner Bracket Stud to Engine	20 N·m	15 lb ft
Ground Wire or Strap Bolt to Rear of Cylinder Head	35 N·m	26 lb ft
Lower Intake Manifold Bolt		
• First Pass in Sequence	3 N·m	27 lb in
• Second Pass in Sequence	12 N·m	106 lb in
• Final Pass in Sequence	15 N·m	11 lb ft
Oil Level Indicator Tube Bolt	12 N·m	106 lb in
Oil Pan Bolt and Nut	25 N·m	18 lb ft
Oil Pan Drain Plug	25 N·m	18 lb ft
Oil Pump Bolt to Rear Crankshaft Bearing Cap	90 N·m	66 lb ft
Power Steering Pump Bracket Bolt to Engine	41 N·m	30 lb ft
Power Steering Pump Bracket Stud Nut	41 N·m	30 lb ft
Power Steering Pump Bracket Stud to Engine	20 N·m	15 lb ft
Power Steering Pump Nut to Engine	41 N·m	30 lb ft
Power Steering Pump Rear Bracket Nut to Engine Stud	41 N·m	30 lb ft
Remote Oil Filter Adapter Mounting Bracket Bolt	30 N·m	22 lb ft
Remote Oil Filter Adapter Nut	25 N·m	18 lb ft
Remote Oil Filter Inlet and Outlet Hose Clip Bolt	10 N·m	89 lb in
Remote Oil Filter Inlet and Outlet Hose to Remote Oil Filter Adapter Bolt	35 N·m	26 lb ft
Remote Oil Filter Inlet and Outlet Hose to Remote Oil Filter Pipe Adapter Bolt	35 N·m	26 lb ft
Secondary Air Injection (AIR) Reactor Pipe Bracket Nut	41 N·m	37 lb ft
Spark Plug Wire Support Bolt	12 N·m	106 lb in
Starter Motor Wiring Harness/Transmission Cooler Pipe Bracket Bolt to Oil Pan	9 N·m	80 lb in
Transmission Bolt to Oil Pan	47 N·m	35 lb ft
Transmission Cover Bolt	12 N·m	106 lb in

Upper Intake Manifold Stud		
• First Pass	5 N·m	44 lb in
• Final Pass	9 N·m	80 lb in
Valve Lifter Pushrod Guide Bolt	16 N·m	12 lb ft
Valve Rocker Arm Bolt	30 N·m	22 lb ft
Valve Rocker Arm Cover Bolt	12 N·m	106 lb in

Engine Component Description

Balance Shaft

The cast iron balance shaft is mounted in the crankcase above and in-line with the camshaft. A camshaft gear drives the gear attached to the balance shaft. The front end of the balance shaft is supported by a ball-type bearing. The rear end of the balance shaft uses a sleeve-type bearing.

Camshaft

The steel camshaft is supported by four bearings pressed into the engine block. The camshaft timing chain sprocket mounted to the front of the camshaft is driven by the crankshaft sprocket through a camshaft timing chain.

Crankshaft

The cast nodular iron crankshaft is supported by four crankshaft bearings. The number four crankshaft bearing at the rear of the engine is the end thrust bearing. The crankshaft bearings are retained by bearing caps that are machined with the engine block for proper alignment and clearances. The crankshaft position sensor reluctor ring has three lugs used for crankshaft timing and is constructed of powdered metal. The crankshaft position sensor reluctor ring has a slight interference fit onto the crankshaft and an internal keyway for correct positioning.

Cylinder Heads

The cast iron cylinder heads have one intake and one exhaust valve for each cylinder. A spark plug is located between the valves in the side of the cylinder head. The valve guides and seats are integral to the cylinder head. The 4.3L heavy duty applications have pressed in exhaust valve seats. The valve rocker arms are positioned on the valve rocker arm supports and retained by a bolt.

Engine Block

The cast iron engine block has six cylinders arranged in a V shape with three cylinders in each bank. Starting at the front side of the engine block, the cylinders in the left bank are numbered 1-3-5 and cylinders in the right bank are numbered 2-4-6 (when viewed from the rear). The firing order of the cylinders is 1-6-5-4-3-2. The cylinders are encircled by coolant jackets.

Exhaust Manifolds

The cast iron exhaust manifolds direct exhaust gases from the combustion chambers to the exhaust system. The left side exhaust manifold has a port for the EGR valve inlet pipe.

Intake Manifold

The intake manifold is a two-piece design. The upper portion is made from a composite material and the lower portion is cast aluminum. The throttle body attaches to the upper manifold. The lower manifold has an exhaust gas recirculation (EGR) port cast into the manifold for mixture. The (EGR) valve bolts into the lower intake manifold. The Central Sequential Multiport Fuel Injection system uses multiple fuel injectors to meter and distribute fuel to each engine cylinder. The Central (SFI) is retained by a bracket bolted to the lower intake manifold. The fuel meter body also houses the pressure regulator. Metal inlet and outlet fuel lines and nylon delivery tubes connect to the Central (SFI) unit. The delivery tubes independently distribute fuel to each cylinder through nozzles located at the port entrance of each manifold runner where the fuel is atomized.

Piston and Connecting Rod Assemblies

The cast aluminum pistons use two compression rings and one oil control assembly. The piston is a low friction, lightweight design with a flat top and barrel shaped skirt. The piston pins are offset 0.9 mm (0.0354 in) toward the major thrust side (right side) to reduce piston slap as the connecting rod travels from one side of the piston to the other side after a stroke. The piston pins have a floating fit in the piston and are retained by a press fit in the connecting rod. The connecting rods are forged steel. The connecting rods are machined with the rod cap installed for proper clearances and alignments.

Valve Train

Motion is transmitted from the camshaft through the hydraulic roller valve lifters and the tubular valve pushrods to the roller type valve rocker arms. The roller type valve rocker arm pivots on a needle type bearing in order to open the valve. The valve rocker arms for each bank of cylinders are mounted to a one piece valve rocker arm support. Each valve rocker arm is retained on the valve rocker arm support and the cylinder head by a bolt. The hydraulic valve lifters keep all the parts of the valve train in constant contact. Each hydraulic valve lifter acts as an automatic adjuster and maintains zero lash in the valve train. This eliminates the need for periodic valve adjustment.

Drive Belt System Description

The drive belt system consists of the following components:

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

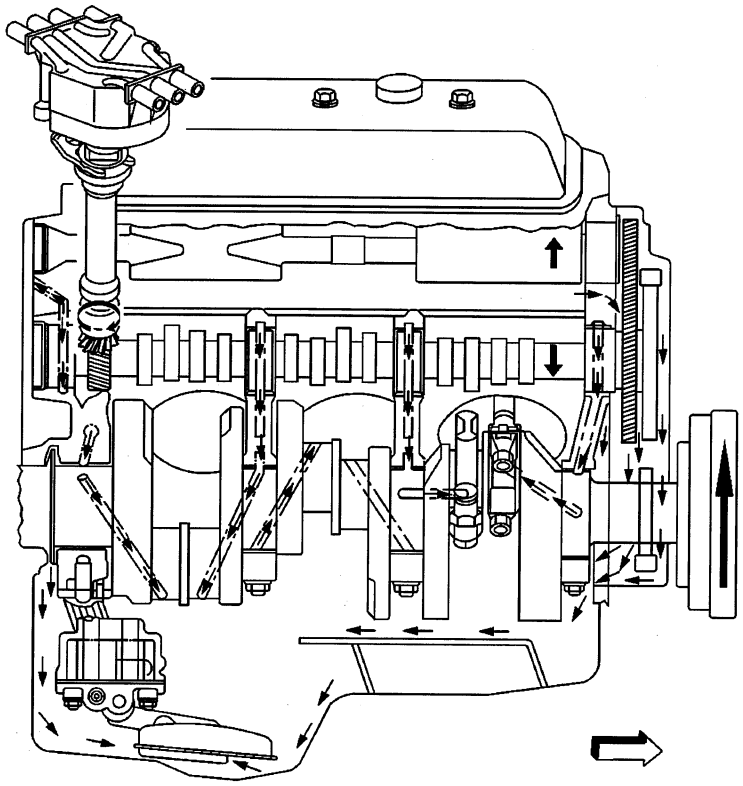
The drive belt system may use one belt or two belts. The drive belt is thin so that it can bend backwards and has several ribs to match the grooves in the pulleys. There also may be a V-belt style belt used to drive certain accessory drive components. The drive belts are made of different types of rubbers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

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

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

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

Lubrication



Full pressure lubrication, through a full-flow oil filter is supplied by a gear-type oil pump. Oil is drawn up through the oil pump screen and passes through the pump to the oil filter. The oil filter is a full-flow paper element unit with an anti-drain back valve. An oil filter bypass valve is used to ensure adequate oil supply, in the event the filter becomes plugged or develops excessive pressure drop. Filtered oil flows into the main gallery and then to the camshaft, the balance shaft, the rear bearing, and the crankshaft bearings. The valve lifter oil gallery supplies oil to the valve lifters. Oil flows from the valve lifters through the hollow valve pushrods to the valve rocker arms. Oil drains back to the crankcase through the oil drain holes in the cylinder head. The camshaft timing chain is drip fed from the front camshaft bearing. The pistons and piston pins are lubricated by oil splash.

Engine Cooling

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Coolant Recovery Reservoir Nuts	8-11 N·m	6-8 lb ft
Engine Coolant Heater Cord Bolt	8 N·m	71 lb in
Engine Coolant Heater Mounting Screw	1.9 N·m	17 lb in
Engine Oil Cooler Line Clamp Bolt	10 N·m	89 lb in
Engine Oil Cooler Line to Adapter Bolt	35 N·m	26 lb ft
Engine Oil Cooler Line to Radiator Connectors	31 N·m	23 lb ft
Engine Oil Cooler Lines to Oil Filter Adapter Retaining Bolt	35 N·m	26 lb ft
Fan Clutch Assembly Nut to Water Pump Pulley Stud	56 N·m	40 lb ft
Fan Clutch Mounting Bolts	33 N·m	24 lb ft
Fan Shroud Bolts	10 N·m	89 lb in
Intake Air Duct Clamp	5 N·m	44 lb in
Remote Filter Housing Bracket to Radiator Core Support	30 N·m	22 lb ft
Remote Filter Housing to Bracket Nuts	25 N·m	18 lb ft
Steering Linkage Shield Bolts	32 N·m	24 lb ft
Throttle Body Bracket Nuts	10 N·m	89 lb in
Water Outlet Housing Bolt 2.2 L	10 N·m	89 in lb
Water Outlet Housing Bolts 4.3 L	19 N·m	14 lb ft
Water Pump Bolt 2.2L	25 N·m	18 lb ft
Water Pump Bolt and Stud 4.3L	41 N·m	30 lb ft
Water Pump Pulley Bolts	25 N·m	18 lb ft

Cooling System Description and Operation

Coolant Heater

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

Cooling System

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

Cooling Cycle

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

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

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

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

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

Coolant

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

Radiator

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

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

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

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

Pressure Cap

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

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

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

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

Coolant Recovery System

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

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

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

Air Baffles and Seals

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

Water Pump

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

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

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

Thermostat

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

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

Engine Oil Cooler

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

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

Transmission Oil Cooler

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

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

Engine Electrical

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Battery Hold Down Retainer Nut	17 N·m	13 lb ft
Battery Negative Cable to Engine (2.2L)	12 N·m	106 lb in
Battery Negative Cable to Engine Block Bolt (4.3L)	17 N·m	13 lb ft
Battery Negative Cable to Engine Block Bolt (2.2L)	17 N·m	13 lb ft
Battery Negative Cable to Frame (2.2L)	6 N·m	53 lb in
Battery Negative Cable to Frame (4.3L)	9 N·m	80 lb in
Battery Negative Cable to Radiator Support (2.2L)	6 N·m	53 lb in
Battery Negative Cable to Radiator Support (4.3L)	9 N·m	80 lb in
Battery Positive Cable Harness to Engine (4.3L)	9 N·m	80 lb in
Battery Positive Cable Nut	6 N·m	80 lb in
Battery Positive Cable to Generator Nut	17 N·m	13 lb ft
Battery Positive Cable to Starter Nut	9 N·m	80 lb in
Battery Positive Cable to Underhood Fuse Block Bolt	10 N·m	89 lb in
Battery Terminal Bolt	15 N·m	11 lb ft
Battery Tray Bolt	25 N·m	18 lb ft
Differential Carrier Shield Bolt	25 N·m	18 lb ft
Engine to Transmission Brace Bolt and Nut	50 N·m	37 lb ft
Engine Wiring Harness to Starter	1.9 N·m	17 lb in
Engine Wiring Harness Bracket to Generator Mounting Bracket Bolt	25 N·m	18 lb ft
Fan Pulley Bolt (2.2L)	30 N·m	22 lb ft
Generator Mounting Bolt (4.3L)	50 N·m	37 lb ft
Generator Mounting Bolt - Front (2.2L)	25 N·m	18 lb ft
Generator Mounting Bolt - Rear (2.2L)	50 N·m	37 lb ft
Generator Mounting Brace to Air Intake Plenum Stud Nut (2.2L)	25 N·m	18 lb ft
Generator Mounting Brace to Engine Stud Nut (2.2L)	50 N·m	37 lb ft
Generator Mounting Brace to Generator Bolt (2.2L)	25 N·m	18 lb ft
Generator Mounting Bracket Bolt (2.2L)	50 N·m	37 lb ft
Generator Mounting Bracket Bolt and Nut (4.3L)	41 N·m	30 lb ft
Generator Output (Bat) Terminal Nut	17 N·m	12 lb ft
Ground Strap to Cowl Bolt	17 N·m	12 lb ft
Ground Strap to Cowl Bolt/Nut	50 N·m	37 lb ft
Heater Hose Bracket to Generator Bolt (4.3L)	25 N·m	18 lb ft
Starter Motor Mounting Bolt (2.2L)	43 N·m	32 lb ft
Starter Motor Mounting Bolt (4.3L)	50 N·m	37 lb ft

Battery Usage

Standard	
Cold Cranking Amperage (CCA)	525 A
Reserve Capacity Rating	90 Minutes
Replacement Battery Number	75-60
Optional	
Cold Cranking Amperage (CCA)	690 A
Reserve Capacity Rating	90 Minutes
Replacement Battery Number	75-84

Battery Temperature vs Minimum Voltage

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

Starter Motor Usage

Applications	Starter Type
2.2L (L43)	PG-260F
4.3L (L35)	PG-260G

Generator Usage

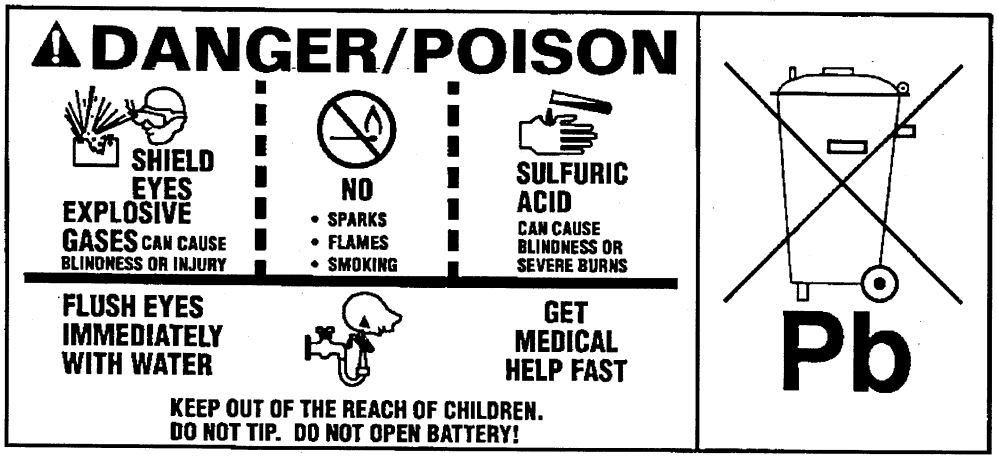
Engine	Generator Model	Option Code	Rated Output AMPS	Load Test Output AMPS
Gasoline Engine	CS130D	K60	100 A	70 A

Battery Description and Operation

Caution

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

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



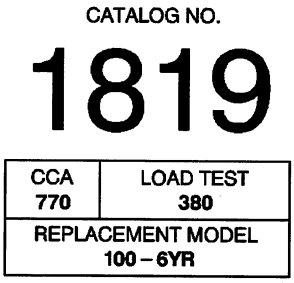
The maintenance free battery is standard. There are no vent plugs in the cover. The battery is completely sealed except for two small vent holes in the side. These vent holes allow the small amount of gas that is produced in the battery to escape.

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

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

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

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



A battery has 2 ratings:

- Reserve capacity
- Cold cranking amperage

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

Reserve Capacity

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

Cold Cranking Amperage

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

Circuit Description

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

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

Starting System Description and Operation

Cranking Circuit

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

Starter Motor

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

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

Charging System Description and Operation

Generator

The generator features the following major components:

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

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

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

Regulator

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

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

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

Circuit Description

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

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

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

Engine Controls

Engine Controls – 2.2L

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accel. Cable Bracket Bolts	12 N·m	107 lb in
Accel. Cable Bracket Nut	26 N·m	19 lb ft
Air Cleaner Outlet Resonator Clamp	5 N·m	44 lb in
Air Cleaner Outlet Resonator Mounting Screws	6 N·m	53 lb in
Accel. Pedal Nuts	30 N·m	22 lb ft
CKP Sensor Bolts	8 N·m	71 lb in
CMP Sensor Bolts	10 N·m	88 lb in
Engine Coolant Sensor	20 N·m	15 lb ft
Engine Oil Pressure Sensor	12 N·m	107 lb in
EVAP Canister Retainer Attaching Bolt	10 N·m	88 lb in
Flex Duct Clamps	5 N·m	44 lb in
Fuel Filter Fitting	27 N·m	20 lb ft
Fuel Pipe Clamp Bolt	12 N·m	107 lb in
Fuel Pipe Fittings	27 N·m	20 lb ft
Fuel Return Pipe Nut	30 N·m	22 lb ft
Fuel Line Clamp Screws	10 N·m	88 lb in
Fuel Line Fitting to Fuel Rail	27 N·m	20 lb ft
Fuel Pressure Regulator Retainer Screw	12 N·m	107 lb in
Fuel Rail Attaching Bolts	24 N·m	18 lb ft
HO2S 2	41 N·m	31 lb ft
ICM Cover Bolts	22 N·m	16 lb ft
ICM Screws	4 N·m	35 lb in
Idle Air Control Valve	3 N·m	27 lb in
Ignition Coil Housing Screws	4 N·m	35 lb in
Idle Air Control Valve	3 N·m	27 lb in
Knock Sensor	19 N·m	14 lb ft
Lower Air Cleaner Mounting Bolt	6 N·m	53 lb in
MAP Sensor Attaching Screw	6.5 N·m	58 lb in
Muffler Hanger Bolt	15 N·m	11 lb ft
O2S 1	41 N·m	31 lb ft
Outlet Pipe Bracket	6 N·m	53 lb in
PCM Retainer Attaching Bolts	10 N·m	88 lb in
PCM Electrical Connector Screws	8 N·m	71 lb in
Purge Valve Mounting Bracket Attaching Bolt	8 N·m	71 lb in
Regulator Retainer	11.5 N·m	103 lb in
Resonator Attaching Bolt	6 N·m	53 lb in
Separator and Solenoid Attaching Bolts	8 N·m	71 lb in
Spark Plugs	18 N·m	13 lb ft
Tank Retaining Straps Bolt	45 N·m	33 lb ft
Throttle Body Attaching Bolts	6.5 N·m	58 lb in
Throttle Position Sensor	2 N·m	18 lb in
TP Sensor Mounting Screws	3 N·m	27 lb in
Upper Air Cleaner Cover Screws	3 N·m	27 lb in

Engine Controls – 4.3L

Ignition System Specifications

Application	Specification	
	Metric	English
Firing Order	1-6-5-4-3-2	
Spark Plug Gap	1.52 mm	0.06 in
Spark Plug Torque	15 N·m	11 lb ft
Spark Plug Type	R41-932 [AC plug type]	
Spark Plug Wire Resistance	1,000 ohms per ft	

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accelerator Cable Routing Bracket Mounting Nuts	9 N·m	80 lb in
Accelerator Control Cable Bracket Mounting Studs and Nuts	12 N·m	106 lb in
Accelerator Pedal Mounting Nuts	9 N·m	80 lb in
Air Cleaner Adapter Stud	9 N·m	80 lb in
Air Cleaner Housing Mounting Nut	10 N·m	89 lb in
Air Cleaner Outlet Duct Hose Clamp	4 N·m	35 lb in
Air Cleaner Outlet Duct Retaining Wingnut	2 N·m	18 lb in
Camshaft Position (CMP) Sensor Screws	2.2 N·m	19 lb in
Coolant Hose Nipple	17 N·m	13 lb ft
Crankshaft Position (CKP) Sensor Mounting Bolt	9 N·m	80 lb in
Distributor Cap Screws	2.4 N·m	21 lb in
Distributor Mounting Clamp Bolt	25 N·m	18 lb ft
Distributor Rotor Hold Down Screws	1.9 N·m	17 lb in
Engine Coolant Temperature (ECT) Sensor	20 N·m	15 lb ft
Evaporative emissions (EVAP) Canister Mount Bolt	12 N·m	106 lb in
Fuel Fill Hose Clamp	2.5 N·m	22 lb in
Fuel Fill Pipe to Fill Pipe Housing Attaching Screws	1.9 N·m	17 lb in
Fuel Pipe Bracket Bolt-Rear	6 N·m	53 lb in
Fuel Pipe Bracket to Frame Bolt	15 N·m	11 lb ft
Fuel Pipe Fittings	27 N·m	20 lb ft
Fuel Pipe Ground Strap Bolt	15 N·m	11 lb ft
Fuel Pipe Retainer Clip Bolt	30 N·m	22 lb ft
Fuel Pipe Retainer Nuts	3 N·m	27 lb in
Fuel Pipe to Fuel Rail Retaining Screw	3 N·m	27 lb in
Fuel Pressure Regulator Bracket	3.5 N·m	31 lb in
Fuel Rail Attaching Bolts	10 N·m	89 lb in
Fuel Tank Front Shield Nut-Pickup	25 N·m	18 lb ft
Fuel Tank Shield Bolts-2-Door	11 N·m	97 lb in
Fuel Tank Shield Bolts-4-Door	33 N·m	24 lb ft
Fuel Tank Shield to Crossmember Bolts and Nuts-Pickup	23 N·m	17 lb ft
Fuel Tank Shield to Frame Bolts-Pickup	11 N·m	97 lb in
Fuel Tank Shield to Frame Nut-Pickup	25 N·m	18 lb ft
Fuel Tank Strap Bolt and Nut-Pickup and 4-Door Utility	18 N·m	13 lb ft
Fuel Tank Strap Nuts-2-Door Utility	91 N·m	67 lb ft
Fuel Vent Hose Clamp	1.7 N·m	15 lb in
Heated Oxygen (HO2S) Sensor	42 N·m	31 lb ft
Idle Air Control (IAC) Valve Attaching Screws	3 N·m	27 lb in
Ignition Coil Mounting Screws	11 N·m	97 lb in
Ignition Control Module (ICM) Mounting Screws	3.5 N·m	31 lb in
Knock Sensor (KS)	25 N·m	18 lb ft

Mass Air Flow (MAF) Sensor Clamps	4 N·m	35 lb in
Powertrain Control Module (PCM) Electrical Connector Screws	8 N·m	71 lb in
Power Brake Fitting	13 N·m	115 lb in
Pressure Regulator Screw	9.5 N·m	84 lb in
Purge Valve Mounting Bracket Attaching Bolt	8 N·m	71 lb in
Steering Linkage Shield Mounting Bolts	33 N·m	24 lb ft
Throttle Body Assembly Retaining Studs	9 N·m	80 lb in
Throttle Cable Bracket Bolts	25 N·m	18 lb ft
Throttle Position (TP) Sensor Screws	2 N·m	18 lb in
Upper Manifold Bolts	8 N·m	71 lb in
Upper Manifold Nuts	8 N·m	71 lb in
Vacuum Module Attaching Bolts	8 N·m	71 lb in

Fuel System Specifications

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

Be sure the posted octane is at least 87. If the octane is less than 87, you may get a heavy knocking noise when you drive. If 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
Accessory Mounting Bracket Bolts (2.2L)	30 N·m	22 lb ft
Accessory Mounting Bracket Lower Bolt (2.2L)	50 N·m	37 lb ft
Accessory Mounting Bracket to Cylinder Head Stud Nuts (2.2L)	50 N·m	37 lb ft
Air Injection Pipe Nut to Exhaust Manifold Stud (2.2L)	10 N·m	89 lb in
Catalytic Converter to Exhaust Manifold Stud Nuts (4.3L)	53 N·m	39 lb ft
Catalytic Converter to Muffler Flange nuts (2.2L)	35 N·m	26 lb ft
Catalytic Converter to Muffler Flange nuts (4.3L)	40 N·m	30 lb ft
Exhaust Manifold Bolts and Stud (4.3L)		
• First Pass	15 N·m	11 lb ft
• Final Pass	30 N·m	22 lb ft
Exhaust Manifold Heat Shield Bolts	12 N·m	106 lb in
Exhaust Manifold Nuts (2.2L)	13 N·m	115 lb in
Exhaust Manifold Pipe to Catalytic Converter Flange Nuts (2.2L)	35 N·m	26 lb ft
Exhaust Manifold Pipe to Exhaust Manifold Bolts (2.2L)	30 N·m	22 lb ft
Hanger to Frame Bolts	17 N·m	13 lb ft
Oil Level Indicator Tube Bolt (4.3L)	12 N·m	106 lb in
Radiator Inlet Hose Support Bracket Nut (4.3L)	36 N·m	27 lb ft

Exhaust System Description

Important

Use of non-OEM parts may cause driveability concerns.

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

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

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

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

Resonator

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

Catalytic Converter

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

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

- Platium (Pt)
- Palladium (Pd)
- Rhodium (Rh)

The catalyst in the converter is not serviceable.

Manual Transmission – NV 3500

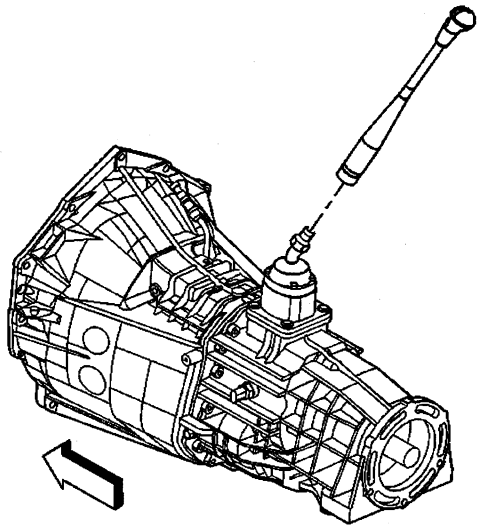
Fastener Tightening Specifications

Application	Specification	
	Metric	English
Backup Lamp Switch	37 N·m	27 lb ft
Clutch Actuator Bolt	8 N·m	71 lb in
Clutch Housing Cover Bolts	14 N·m	10 lb ft
Front Bearing Retainer Bolts	14 N·m	10 lb ft
Oil Drain and Fill Plugs	30 N·m	22 lb ft
Shift Boot Screws	2 N·m	18 lb in
Shift Housing to Transmission Bolts	20 N·m	15 lb ft
Shift Lever Adjusting Nut	48 N·m	35 lb ft
Transmission-to-Engine Studs and Bolts	47 N·m	35 lb ft
Transmission Mount Bolt	50 N·m	37 lb ft
Transmission Mount Nut	50 N·m	33 lb ft
Transmission Mount to Crossmember Nut	45 N·m	33 lb ft
Transmission Mount to Transmission Bolt	50 N·m	37 lb ft
Vehicle Speed Sensor Bolt	16 N·m	12 lb ft

Lubrication Specifications

Application	Specification	
	Metric	English
New Venture Gear NV3500 Manual Transmission Synchromesh Transmission Fluid GM P/N 12345349	2.0 liters	2.2 quarts

Transmission System Description and Operation



The New Venture Gear NV3500 (85 mm) is a five speed manual transmission used on light duty truck with 4.3L, 5.0L, and 5.7L engines. This manual transmission is identified by the RPO's M50 and MG5. The reason for 2 different RPO codes is because of the different first speed gear ratios that the transmission can contain. The shift assembly design inside the transmission for NV3500 installed on C/K (GMT400 and GMT 800) trucks are different from that of NV3500 transmissions that are installed in smaller S/T trucks. The 85 mm is the distance between the input shaft and the counter shaft. The transmission is available in rear wheel and 4WD versions. The NV3500 transmission is built in Muncie, Indiana by New Venture Gear, (a division of New Process Gear) for General Motors Powertrain.

The transmission has the following features:

- Constant mesh helical gearing for reduced noise
- A 2 piece aluminum housing
- Synchronized shifting in all forward gears
- A shift tower mounted shift lever
- Single rail shift system

Muffler

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

Transmission/Transaxle Description and Operation

Manual Transmission – NV 1500

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Backup Lamp Switch	37 N·m	28 lb ft
Bearing Retainer Bolts	29 N·m	21 lb ft
Clutch Actuator Bolt	8 N·m	71 lb in
Clutch Housing Cover Bolts	14 N·m	10 lb ft
Oil Drain and Fill Plugs	30 N·m	22 lb ft
Shift Boot Screws	2 N·m	18 lb in
Shift Housing to Transmission Bolts	20 N·m	15 lb ft
Shift Lever Nut	48 N·m	35 lb ft
Vehicle Speed Sensor	16 N·m	12 lb ft
Transmission-to-Engine Studs and Bolts	47 N·m	35 lb ft
Transmission Mount to Cross Member Nut	57 N·m	42 lb ft
Transmission Mount to Transmission Bolts (2.2L)	45 N·m	33 lb ft
Transmission Mount to Transmission Bolts (4.3L)	50 N·m	37 lb ft

Lubrication Specifications

Application	Specification	
	Metric	English
NV1500		
Synchro-Mesh Transmission Fluid With Friction Modifier GM P/N 12377916	2.7 l	2.9 qt

Transmission System Description and Operation

- The RPO code for the NV1500 is MW2.
- The NV1500 transmission is synchronized in all five gears.
- The NV1500 transmission has a 2 piece aluminum housing that contains the following components:
  - The front input shaft
  - The rear output shaft
  - The mainshaft gears
  - The countershaft
  - The reverse and idler gear
  - The shift forks
  - The shift shaft components

Clutch

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Clutch Housing Cover Bolts	14 N·m	10 lb ft
Clutch Pedal Bolt and nut	25 N·m	19 lb ft
Clutch Plate to Flywheel Bolts NV 1500	44 N·m	33 lb ft
Clutch Plate to Flywheel Bolts NV 3500	40 N·m	29 lb ft
Concentric Slave Cylinder Bolts	8 N·m	71 lb in

Clutch Description and Operation

Clutch Driving Members

The clutch driving members are two flat surfaces machined to a smooth finish. They are:

- The rear face of the engine flywheel
- The front face of the clutch pressure plate

Clutch Driven Members

The driven member is the clutch driven plate. The clutch driven plate has a splined hub. The splined hub slides lengthwise along the splines of the input shaft. The splined hub drives the input shaft through these same splines. The driving and driven members are held together with spring pressure. This pressure is exerted by a diaphragm spring in the clutch pressure plate.

Clutch Operating Members

Hydraulic Clutch Fluid

Notice

Do not use mineral or paraffin-base oil in the clutch hydraulic system. These fluids may damage the rubber parts in the cylinders.

Hydraulic Clutch

The clutch release system consists of the following components:

- A master cylinder with a reservoir
- A switch
- An actuator cylinder connected to hydraulic tubing

With depression of the clutch pedal, the clutch master cylinder becomes pressurized from the force of the push rod into the master cylinder. This forces hydraulic fluid into the tubing from the master cylinder to the concentric slave cylinder. The slave cylinder then engages by pushing the release bearing into the diaphragm spring and releasing the clutch.

A hole in the cowl panel accommodates the master cylinder. A quick connect coupling helps route the hydraulic tubing. The concentric slave cylinder is inside the transmission and on the input bearing retainer. The hydraulic control system can be replaced without having to gain access to the clutch system internal components, simply engage the quick connect coupling mounted through the transmission housing.

No adjustments to the clutch system are necessary. As the clutch wears, the fluid level in the master cylinder reservoir changes to compensates for clutch wear. A new system will have fluid in the reservoir.

An electrical switch on the push rod has two functions: One function is a clutch interlock, ensuring the engine does not start unless the clutch pedal is engaged (positioned to the floor). The second function is to cut off the cruise-control system (if so equipped) when the clutch pedal is engaged.

Automatic Transmission - 4L60-E

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accumulator Cover to Case Bolt	8.0-14.0 N·m	6-10 lb ft
Case Extension to Case Bolt	42.0-48.0 N·m	31-35 lb ft
Case Extension to Case Bolt (4WD Shipping)	11.2-22.6 N·m	8.3-16.7 lb ft
Converter Cover Bolt	10 N·m	89 lb in
Converter Housing to Case Screw	65.0-75.0 N·m	48-55 lb ft
Cooler Pipe Connector	35.0-41.0 N·m	26-30 lb ft
Detent Spring to Valve Body Bolt	20.0-27.0 N·m	15-20 lb ft
Floorshift Control Bolt	10 N·m	89 lb in
Flywheel to Torque Converter Bolt	63 N·m	46 lb ft
Forward Accumulator Cover to Valve Body Bolt	8.0-14.0 N·m	6-10 lb ft
Heat Shield to Transmission Bolt	17 N·m	13 lb ft
Line Pressure Plug	8.0-14.0 N·m	6-10 lb ft
Manual Shaft to Inside Detent Lever Nut	27.0-34.0 N·m	20-25 lb ft
Negative Battery Cable Bolt	15 N·m	11 lb ft
Oil Level Indicator Bolt	47 N·m	35 lb ft
Oil Pan to Transmission Case Bolt	11 N·m	97 lb in
Oil Passage Cover to Case Bolt	8-14.0 N·m	6-10 lb ft
Park Brake Bracket to Case Bolt	27.0-34.0 N·m	20-25 lb ft
Park/Neutral Position Switch Screw	3 N·m	27 lb in
Plate to Case Bolt (Shipping)	27.0-34.0 N·m	20-25 lb ft
Plate to Converter Bolt (Shipping)	27.0-34.0 N·m	20-25 lb ft
Plug Assembly, Automatic Transmission Oil Pan (C/K)	30-40 N·m	22.1-29.5 lb ft
Plug Assembly, Automatic Transmission Oil Pan (Y)	28-32 N·m	20.7-23.6 lb ft
Pressure Control Solenoid Bracket to Valve Body Bolt	8.0-14.0 N·m	6-10 lb ft
Pump Assembly to Case Bolt	26.0-32.0 N·m	19-24 lb ft
Pump Cover to Pump Body Bolt	20.0-27.0 N·m	15-20 lb ft
Shift Cable Grommet Screw	1.7 N·m	15 lb in
Shift Control Cable Attachment	20 N·m	15 lb ft
Speed Sensor Retainer Bolt	10.5-13.5 N·m	7.7-10 lb ft
Stud, Automatic Transmission Case Extension (Y-car)	18.0-22.0 N·m	13-16 lb ft
TCC Solenoid Assembly to Case Bolt	8.0-14.0 N·m	6-10 lb ft
Trans Mount to Transmission Bolt	25 N·m	18 lb ft
Transmission Fluid Pressure Manual Valve Position Switch to Valve Body Bolt	8.0-14.0 N·m	6-10 lb ft
Transmission Oil Cooler Pipe Fitting	35.0-41.0 N·m	26-30 lb ft
Transmission Oil Pan to Case Bolt	9.5-13.8 N·m	7-10 lb ft
Transmission to Engine Bolt	47 N·m	35 lb ft
Valve Body to Case Bolt	8.0-14.0 N·m	6-10 lb ft

Transmission General Specifications

Name	Hydra-matic 4L60-E
RPO Codes	M30
Production Location	Toledo, Ohio Romulus, MI Ramos Arizpe, Mexico
Vehicle Platform (Engine/Transmission) Usage	S/T
Transmission Drive	Longitudinally-Mounted Rear Wheel Drive
1st Gear Ratio	3.059:1
2nd Gear Ratio	1.625:1
3rd Gear Ratio	1.000:1
4th Gear Ratio	0.696:1
Reverse	2.294:1
Torque Converter Size (Diameter of Torque Converter Turbine)	245 mm 258 mm 298 mm 300 mm
Pressure Taps	Line Pressure
Transmission Fluid Type	DEXRON® III
Transmission Fluid Capacity (Approximate)	245 mm Converter Dry: 8.3 l (8.8 qt) 258 mm Converter Dry: 8.8 l (9.3 qt) 298 mm Converter Dry: 11.25 l (11.9 qt) 300 mm Converter Dry: 11.50 l (12.1 qt)
Transmission Type: 4	Four Forward Gears
Transmission Type: L	Longitudinal Mount
Transmission Type: 60	Product Series
Transmission Type: E	Electronic Controls
Position Quadrant	P, R, N, Overdrive, D, 2, 1 P, R, N, Overdrive, 3, 2, 1
Case Material	Die Cast Aluminum
Transmission Weight Dry (Approximate)	245 mm Converter 65.4 kg (144.30 lb) 258 mm Converter 79.9 kg (176.6 lb) 298 mm Converter 70.5 kg (155.70 lb) 300 mm Converter 86.17 kg (190.5 lb)
Transmission Weight Wet (Approximate)	245 mm Converter 72.4 kg (159.55 lb) 258 mm Converter 89.2 kg (197.7 lb) 298 mm Converter 80.5 kg (176.16 lb) 300 mm Converter 98.4 kg (218.0 lb)
Maximum Trailer Towing Capacity	6 130 kg (13,500 lb)
Maximum Gross Vehicle Weight (GVW)	3 900 kg (8,600 lb)

Fluid Capacity Specifications

Application	Specification	
	Metric	English
Bottom Pan Removal	4.7 liters	5 quarts
Complete Overhaul	10.6 liters	11 quarts
(measurements are approximate)		

Transmission Component and System Description

The 4L60E transmission consists primarily of the following components:

- Torque converter assembly
- Servo assembly and 2-4 band assembly
- Reverse input clutch and housing
- Overrun clutch
- Forward clutch
- 3-4 clutch
- Forward sprag clutch assembly
- Lo and reverse roller clutch assembly
- Lo and reverse clutch assembly
- Two planetary gear sets: Input and Reaction
- Oil pump assembly
- Control valve body assembly

The electrical components of the 4L60-E are as follows:

- 1-2 and 2-3 shift solenoid valves
- 3-2 shift solenoid valve assembly
- Transmission pressure control (PC) solenoid
- Torque converter clutch (TCC) solenoid valve
- TCC pulse width modulation (PWM) solenoid valve
- Automatic transmission fluid pressure (TFP) manual valve position switch
- Automatic transmission fluid temperature (TFT) sensor
- Vehicle speed sensor assembly

Adapt Function

Transmission Adapt Function

The 4L60-E transmission uses a line pressure control system, which has the ability to continuously adapt the system's line pressure. This compensates for normal wear of the following parts:

- The clutch fiber plates
- The seals
- The springs

The PCM maintains the Upshift Adapt parameters for the transmission The PCM monitors the AT ISS sensor and the AT OSS during commanded shifts in order to determine if a shift is occurring too fast or too slow. The PCM adjusts the signal from the transmission pressure control solenoid in order to maintain a set shift feel.

Transmission adapts must be reset whenever the transmission is overhauled or replaced.

Automatic Transmission Shift Lock Control Description

The automatic transmission shift lock control is a safety device that prevents an inadvertent shift out of PARK when the ignition is ON. The driver must press the brake pedal before moving the shift lever out of the PARK position. The system consist of the following components:

- The automatic transmission shift lock control solenoid.
- The automatic transmission shift lock control switch.
- The park/neutral position switch.

With the ignition in the ON position battery positive voltage is supplied to the park/neutral position switch. With the transmission in the PARK position the contacts in the park/neutral position switch are closed. This allows current to flow through the switch to the automatic transmission shift lock control switch. The circuit continues through the normally-closed switch to the automatic transmission shift lock control solenoid. The automatic transmssion shift lock control soleniod is permanently grounded. This energizes the automatic transmission shift lock control solenoid, locking the shift linkage in the PARK position. When the driver presses the brake pedal the contacts in the automatic transmission shift lock control switch open, causing the automatic transmission shift lock control solenoid to release. This allows the shift lever to move from the PARK position.

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Abbreviations and Meanings

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

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

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

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

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

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

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

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

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

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

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

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Conversion - English/Metric

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

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

Equivalents - Decimal and Metric

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

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

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Fasteners

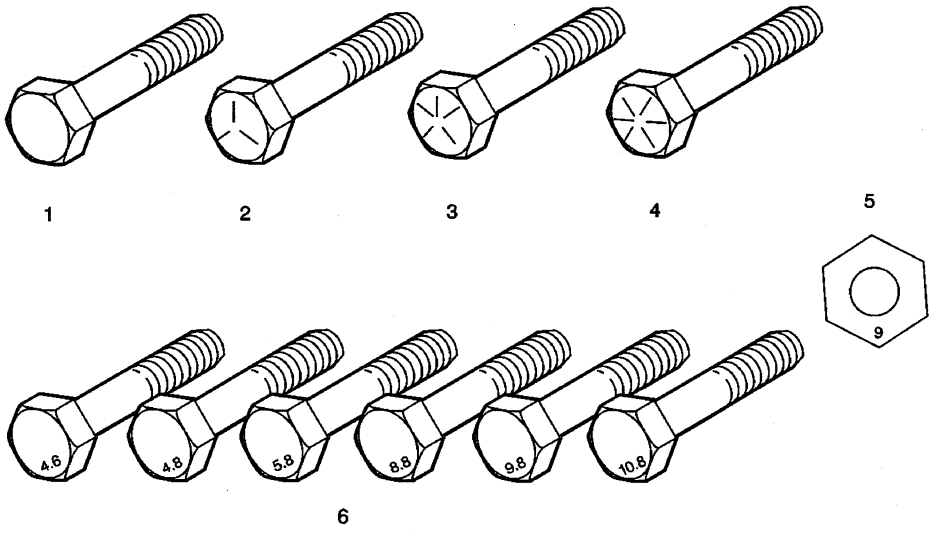
Metric Fasteners

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

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

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

Fastener Strength Identification



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

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

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

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

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

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

Prevailing Torque Fasteners

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

All Metal Prevailing Torque Fasteners

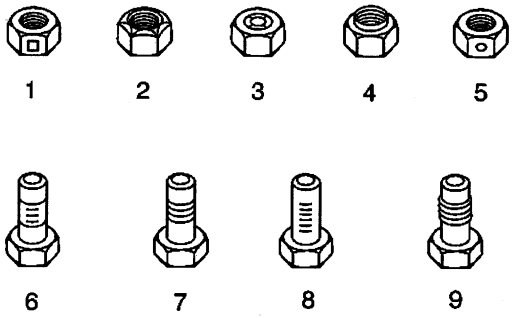
These fasteners accomplish the thread interface by a designed distortion or deformation in the fastener.

Nylon Interface Prevailing Torque Fasteners

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

Adhesive Coated Fasteners

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



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

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

A prevailing torque fastener may be reused ONLY if:

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

Metric Prevailing Torque Fastener Minimum Torque Development

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

English Prevailing Torque Fastener Minimum Torque Development

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