# Chevrolet

# Suburban

# 2004

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# Product Information

## 2004 Chevrolet Suburban: Capable, Confident And Comfortable

The legendary Chevy Suburban continues as America's reigning premier full-size SUV.

Innovative control and handling enhancements such as StabiliTrak vehicle stability enhancement and Quadrasteer four-wheel steering ensure that Suburban - the industry's oldest active vehicle nameplate - remains capable, confident and comfortable. And that's why it's no surprise that Suburban's customer loyalty rate exceeds 50 percent.

Suburban's workhorse reputation means there's enough space to comfortably seat eight adults or to fit a 4 x 8-foot (1.2 x 2.4-meter) sheet of plywood on the load floor with the doors closed and rear seats removed. Suburban trailers as much as 12,000 pounds (5,443 kg) when properly equipped.

New features on 2004 Suburban include a tire pressure monitor and Hydroboost brakes on half-ton models and a right front passenger safety belt reminder.

### Stabilizing influences

StabiliTrak is a system that improves vehicle stability on various road surfaces at various speeds, particularly on slick surfaces or during emergency maneuvers. It is available on half-ton, two- or four-wheel-drive Suburbans with the Vortec 5300 5.3L V-8 engine (not available on Z71).

StabiliTrak helps the driver maintain control of the vehicle in sudden maneuvers, particularly in low traction conditions, in emergency lane changes, and during avoidance maneuvers. If the system determines that the vehicle is not responding appropriately to the driver's steering, StabliTrak precisely reduces engine torque and applies precise amounts of pressure to the individual front brakes to slow the vehicle and help bring it back to its intended path.

In addition, two-wheel-drive Suburbans offer available electronic traction assist to enhance surefootedness on models with a locking rear differential.

### Revolutionary Quadrasteer control

Suburban was the first full-size SUV to offer the revolutionary control and handling benefits of Quadrasteer - a four-wheel steering system that provides maneuverability and on-highway control never thought possible on a full-size SUV. Quadrasteer, available on 2500 series 2WD/4WD models, turns the rear wheels in the opposite direction of the front wheels, which helps the vehicle make tighter turns, such as when cornering, getting into a tight parking space or maneuvering a trailer. The turning diameter of 2WD models is reduced 21 percent from 44.5 feet to 35.2 feet (13.6 meters to 10.7 meters). For 4WD models, turning diameter goes from 44.3 feet to 35 feet (13.5 meters to 10.7 meters).

### New tires and wheels choices

Suburban for 2004 makes two newly designed wheels available: 16-inch cast aluminum wheels on LS and LT, and 17-inch five-spoke aluminum wheels with 16-inch steel blackwall spare, available on LT models. New tire selections include 17-inch all-season P265/70R17 blackwall tires and 17-inch all-season, P265/70R17white outlined-letter tires.

### Advanced safety

A passenger-sensing system and dual-stage front-seat frontal air bags are an integral part of Suburban's safety package. The automatic passenger-sensing air-bag system automatically deactivates the passenger-side front air bag under certain conditions to help protect smaller occupants.

Dual-stage air bags are designed to detect vehicle deceleration and, based on the deceleration data, provide an appropriate amount of air-bag inflation. The dual-level air-bag system senses the severity of a crash and determines whether to deploy the air bag with primary or "lower" amount of inflation or with primary and secondary "higher" amount of inflation. Dual-stage air bags are designed to help reduce the occurrence of inflation-induced injuries by deploying the air bag less forcefully in lower speed crashes.

The 2004 Suburban offers adjustable brake and accelerator pedals. The position of the pedals can be adjusted in unison by nearly 3 inches (76 mm) for better positioning and comfort. The feature is available with or without a memory feature.

Hydroboost brakes provide added safety with more reserve power assist for braking under specific conditions. The system will continue to provide sufficient power assist to stop the vehicle if the engine stalls or is turned off. Hydroboost uses power steering fluid pressure to decrease brake pedal effort.

Suburban for 2004 provides safety for its younger passengers as it complies with 2005 federal seat standards for child restraint anchorages. The LATCH (Lower Anchors and Tethers for CHildren) child-seat attachment system is provided in the center and right positions of the second-row split/folding bench seat. Only a top tether connection is available in the left position of the second-row bench seat. If the second-row seats are captain's chairs, the LATCH system is available in the left and right positions of the second-row seating. For the third-row seating, only the top tether attachment is available and only for the center position.

## That's quality entertainment!

Impressive entertainment systems - from an available Bose sound system to a Panasonic DVD Passenger Entertainment System - add to Suburban's creature comforts. These systems (except the base fleet radio) feature the next-generation Radio Data System and can interface with services such as the optional XM Satellite Radio (continental U.S. only). Available rear-seat audio controls allow second-row passengers to enjoy a separate audio source from front-seat occupants. An available custom-designed Bose audio system uses a high-powered six-channel amplifier and an eight-speaker sound system with sub-woofer.

XM Satellite Radio (continental U.S. only) provides 100 coast-to-coast, digital-quality channels of original music, news, sports and talk. Consumers can subscribe to the basic service for $9.99 a month - less than the cost of a single CD. In addition, GM customers with GMAC financing can choose to include the XM subscription in their car payments.

## More cabin comforts

A tri-zone manual-control heating, ventilation and air conditioning (HVAC) system is standard on Suburban. It allows the driver and front passenger to adjust the temperature to their own comfort levels - up to a 30-degree Fahrenheit (13.9-degree Celsius) difference between the two front zones.

An available tri-zone automatic HVAC system provides outstanding comfort. Customers can opt for a sunroof and rear entertainment system with rear electronic climate control - a system that automatically controls air delivery, fan speed, temperature and recirculating/outside air to provide faster warm-ups and cool-downs.

Manual rear air conditioning is standard. Rear electronic climate control is standard with the optional front system, providing second-row passengers an automatically controlled temperature setting independent from that of the front - in effect, creating tri-zone comfort.

Available exterior mirrors feature power-tilt glass and power folding to protect them in narrow spaces; heating elements that clear frost, snow or ice; left-side electrochromatic glass that automatically dims glaring headlights; puddle lights; turn signal indicators in the glass; and a memory feature. An available power-adjustable camper mirror can be extended to a vehicle width of as much as 106 inches (2,692 mm).

## Smarter systems

Suburban's advanced multiplexed electrical architecture enables the driver information center, which can be programmed for English, Spanish or French, to monitor and to report on as many as 34 system functions, including service indicators for StabiliTrak, "Ice Possible" and "Door Ajar." Available eight-button steering wheel controls allow owners to personalize several functions and safely access infotainment systems. They include duplicate controls for calculating trip and fuel data and provide easy access to the OnStar in-vehicle safety and security system.

OnStar is the leading provider of in-vehicle safety, security and information services in the U.S. and Canada. Using the Global Positioning System (GPS) satellite network and wireless technology, OnStar services include automatic notification of air bag deployment, stolen vehicle location, remote door unlock, emergency services dispatch, roadside assistance, remote diagnostics, route support, convenience services and OnStar Concierge. OnStar Personal Calling allows drivers to make and receive hands-free, voice-activated phone calls through a nationwide network in cooperation with Verizon Wireless. Virtual Advisor (U.S. only) gives subscribers access to personalized information in a hands-free, voice-activated manner with no screens or displays.

### Cleaner engines, alternate fuels

Suburban half-ton utilities with the Vortec 5300 5.3L V-8 sold in California feature a more robust catalytic converter system that meets Ultra Low Emission Vehicle (ULEV) standards. All Suburban powerplants meet Massachusetts, Maine, New York or Vermont state emissions requirements.

Suburban's impressive powertrain lineup includes the Vortec 5300 5.3L V-8 (standard on half-ton models and available in either gasoline or ethanol-compliant versions) and Vortec 6000 6.0L V-8 (standard on the three-quarter-ton models). The powerful Vortec 8100 8.1L V-8 is optional on the 2500 series three-quarter-ton models.

## New For 2004

- Tire pressure monitor on half-ton models
- Right front passenger seat belt reminder
- Hydroboost brakes on half-ton models
- Newly designed 16-inch cast aluminum wheels
- Newly designed 17-inch five-spoke aluminum wheels with 16-inch steel blackwall spare, available on LT models
- 17-inch all-season, blackwall tires P265/70R17
- 17-inch all-season, white outlined-letter tires P265/70R17
- Traction assist is available and includes locking rear differential
- New 7-to-4 pin brake wiring adapter for the trailering package
- New exterior colors: Dark Blue Metallic (replaces Indigo Blue), Silver Birch (replaces Pewter Metallic) and Sport Red Metallic (replaces Redfire)
- Emissions now include Massachusetts, Maine, New York or Vermont state requirements

## Model Lineup

| | Engines | | | Transmissions | | |
|---|---|---|---|---|---|---|
| | **Vortec 5300 SFI V8** | **Vortec 6000 SFI V8** | **Vortec 8100 SFI V8** | **4L60-E 4-spd auto** | **4L80-E 4-spd auto** | **4L85-E 4-spd auto** |
| LS / LT 1/2-ton | S | – | – | S | – | – |
| LS / LT 3/4-ton | – | S | O | – | S | O |

Standard: S
Optional: O
Not available: –

# Specifications

| **Overview** | | | |
|---|---|---|---|
| Models: | Chevrolet Suburban LS / LT 1/2-ton, LS / LT 3/4-ton | | |
| Body style / driveline: | full-size, 4-door sport utility vehicle, front engine, 2- or 4-wheel drive, 1/2- and 3/4-ton models | | |
| Construction: | body on frame | | |
| EPA vehicle class: | full-size sport utility vehicle | | |
| Manufacturing location: | Janesville, Wisconsin, and Silao, Mexico | | |
| Key competitors: | Ford Excursion | | |
| **Engines** | **Vortec 5300 5.3L V-8 (LM7/L59)** | **Vortec 6000 6.0L V-8 (LQ4)** | **Vortec 8100 8.1L V-8 (L18)** |
| Type: | 5.3L V-8 | 6.0L V-8 | 8.1L V-8 |
| Application: | std on LS/LT half-ton | std on LS/LT ¾-ton | opt on LS/LT ¾-ton |
| Displacement (cu in / cc): | 327 / 5328 | 364 / 5967 | 496 / 8128 |
| Bore & stroke (in / mm): | 3.78 x 3.62 / 96 x 92 | 4 x 3.62 / 101.6 x 92 | 4.25 x 4.37 / 1078 x 111 |
| Block material: | cast iron | cast iron | cast iron |
| Cylinder head material: | cast aluminum | cast aluminum | cast iron |
| Valvetrain: | OHV | OHV | OHV |
| Ignition system: | coil near-plug ignition, platinum-tipped spark plugs, low-resistance spark plug wires | coil near-plug ignition, platinum-tipped spark plugs, low-resistance spark plug wires | coil near-plug ignition platinum-tipped spark plugs |
| Fuel delivery: | sequential fuel injection | sequential fuel injection | sequential fuel injection |
| Compression ratio: | 9.5:1 | 9.4:1 | 9.1:1 |
| Horsepower (hp / kw @ rpm): | 295 / 220 @ 5200 | 325 / 242 @ 4000 | 320 / 239 @ 4200 |
| Torque (lb-ft / Nm @ rpm): | 330 / 447 @ 4000 | 369 / 495 @ 4000 | 445 / 604 @ 3200 |
| Recommended fuel: | ethanol-capable flex fuel | 87 octane | 87 octane |
| Maximum engine speed (rpm): | 5900 | 5600 | 5000 |
| Emissions controls: | 3-way catalytic converter, positive crankcase ventilation, evaporative collection system | 3-way catalytic converter, positive crankcase ventilation, evaporative collection system | air injection reaction (available) |
| Estimated fuel economy (mpg city / hwy / combined): | 2wd: 14 / 18 / 16<br>4wd: 13 / 17 / 15 | | |
| **Transmissions** | **Hydra-Matic 4L60-E** | **Hydra-Matic 4L80-E** | **Hydra-Matic 4L85-E** |
| Type: | 4-speed electronic automatic | 4-speed electronic automatic | 4-speed electronic automatic |
| **Gear ratios (:1):** | | | |
| First: | 3.06 | 2.48 | 2.48 |
| Second: | 1.63 | 1.48 | 1.48 |
| Third: | 1.00 | 1.00 | 1.00 |
| Fourth: | 0.70 | 0.75 | 0.75 |
| Reverse: | 2.29 | 2.08 | 2.08 |
| Final drive ratio (all models, opt): | 3.42:1 - 4.10:1 | 3.42:1 - 4.10:1 | 3.42:1 - 4.10:1 |

| Chassis/Suspension | |
|---|---|
| Front: | independent with torsion bars |
| Rear: | ½-ton: 5-link coil spring;<br>¾-ton: 2-stage, semi-elliptic, multileaf springs and semifloating rear axle |
| Traction control: | full-function standard; Precision Control System |
| Steering type: | ½-ton: 2WD: power integral gear; 4WD: power integral gear w/EVO Variable Assist<br>¾-ton: 2WD: power integral gear; 4WD: power integral gear |
| Gear ratio: | ½-ton: 14.2:1 gear, 15.8:1 overall;<br>¾-ton: 15 / 13:1 variable ratio gear, 16.4:1 overall |
| Steering wheel turns, lock-to-lock: | ½-ton: 3.2; ¾-ton: 3.2 |
| Turning circle, curb-to-curb (ft / m): | ½-ton: 42.3 / 12.9; ¾-ton: 44.3 / 13.5 |
| **Brakes** | |
| Type: | 4-wheel disc, 4-wheel ABS, dual-piston calipers w/ Dynamic Rear Proportioning |
| Rotor diameter x thickness (in / mm): | front: 1/2-ton: 12.01 x 1.14 / 305 x 29<br>3/4-ton: 12.80 x 1.50 / 325 x 38 |
| Front: | rear: 1/2-ton: 13 x 1.18 / 330 x 30<br>3/4-ton: 13 x 1.18 / 330 x 30 |
| **Wheels/Tires** | |
| Wheel size and type: | ½-ton: 16-inch x 7-inch cast aluminum<br>½-ton: 17-inch 6-lug machined cast aluminum<br>¾-ton: 16-inch x 6.5-inch forged cast aluminum |
| Tires: | ½-ton: P265/70R16 all-season, steel-belted radials<br>½-ton: P265/70R17 off-road steel-belted radials<br>¾-ton: LT245/75R16 all-season, steel-belted radials |

## Dimensions

| Exterior | |
|---|---|
| Wheelbase (in / mm): | 130 / 3302 |
| Overall length (in / mm): | 219.3 / 5570 |
| Overall width (in / mm): | ½-ton: 78.8 / 2001; ¾-ton: 79.8 / 2027 |
| Overall height w/roof rack (in / mm): | ½-ton: 2WD: 75.6 / 1920; 4WD: 75.4 / 1915<br>¾-ton: 2WD: 76.5 / 1943; 4WD: 76.9 / 1953 |
| Minimum ground clearance (in / mm): | ½-ton: 8.4 / 213.4; ¾-ton: 7.1 / 1803 |
| Ground to top of load floor (in / mm): | ½ ton: 2WD: 31.2 / 792; 4WD: 31 / 787<br>¾ ton: 2WD: 32.5 / 825; 4WD: 33.2 / 843 |
| Approach angle: | 23-25° |
| Departure angle: | 20-22° |
| Base curb weight (lb / kg): | ½-ton: 2WD: 4947 / 2244; 4WD: 5219 / 2367<br>¾-ton: 2WD: 5520 / 2504; 4WD: 5796 / 2629 |
| Weight distribution (% front / rear): | ½ ton: 2WD: 52 / 48; 4WD: 54 / 46<br>¾ ton: 2WD: 51 / 49; 4WD: 53 / 47 |

| Interior | First Row | Second Row | Third Row |
|---|---|---|---|
| Seating capacity, 9 maximum total: | 3 (a) | 3 (a) | 3 (b) |
| Head room (in / mm): | 40.7 / 1033 | 39 / 991 | 38.6 / 980 |
| Leg room (in / mm): | 41.3 / 1049 | 39.1 / 994 | 36.1 / 917 |
| Shoulder room (in / mm): | 65.2 / 1656 | 65.1 / 1654 | 64.8 / 1646 |
| Hip room (in / mm): | 61.4 / 1560 | 61.6 / 1564 | 49.2 / 1250 |
| Cargo volume (cu ft / L): | 134 / 3794 | 90 / 2549 | 45.7 / 1294 |

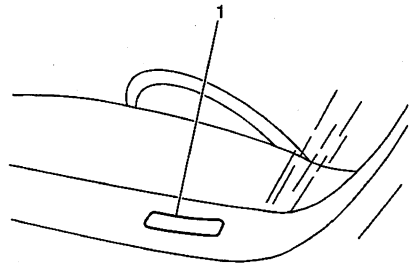
(a) 3 with bench seats, 2 with optional bucket seats
(b) 3 with optional third-row bench seat

| Capacities | Half-Ton | 3/4-Ton |
|---|---|---|
| GVWR, standard (lb / kg): | 2WD: 7000 / 3175;<br>4WD: 7200 / 3265 | 2WD: 8600 / 3901;<br>4WD: 8600 / 3901 |
| Payload, maximum (lb / kg)*: | 2WD: 2086 / 946;<br>4WD: 2077 / 942 | 2WD: 3153 / 1430;<br>4WD: 2840 / 1288 |
| Trailer towing maximum (lb / kg): | 2WD: 8400 / 3810<br>4WD: 8100 / 3674 | 2WD / 4WD: 12000 / 5443 |
| Fuel tank (gal / L): | 31 / 117 | 37.5 / 142 |
| Engine oil (qt / L): | 6 / 5.7 | 6 / 5.7 |
| Cooling system (qt / L): | | |
| Vortec 5300: | 16.8 / 15.9 | -- |
| Vortec 6000: | -- | 16.8 / 15.9 |
| Vortec 8100: | -- | 29 / 27.4 |

* Includes weight of driver, passengers, optional equipment and cargo.

# 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 | United States |
| 2 | Manufacturer | G | General Motors |
| 3 | Make | C | Chevrolet Truck |
| 4 | GVWR/Brake System | E<br>F<br>G | 6001-7000/Hydraulic<br>7001-8000/Hydraulic<br>8001-9000/Hydraulic |
| 5 | Truck Line/Chassis Type | C<br>K | 4x2<br>4x4 |
| 6 | Series | 6<br>7 | ½ Ton Luxury<br>¾ Ton Luxury |
| 7 | Body Type | 3 | Four-Door Utility |
| 8 | Engine Type | V<br>Z<br>T<br>U<br>N<br>G | 4.8L V8 MFI (LR4)<br>5.3L V8 MFI (L59)<br>5.3L V8 MFI (LM7)<br>6.0L V8 MFI (LQ4)<br>6.0L V8 MFI (LQ9)<br>8.1L V8 MFI (L18) |
| 9 | Check Digit | -- | Check Digit |
| 10 | Model Year | 4 | 2004 |
| 11 | Plant Location | G<br>J<br>R | Silao<br>Janesville<br>Arlington |
| 12-17 | Plant Sequence Number | 100,001 | 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:

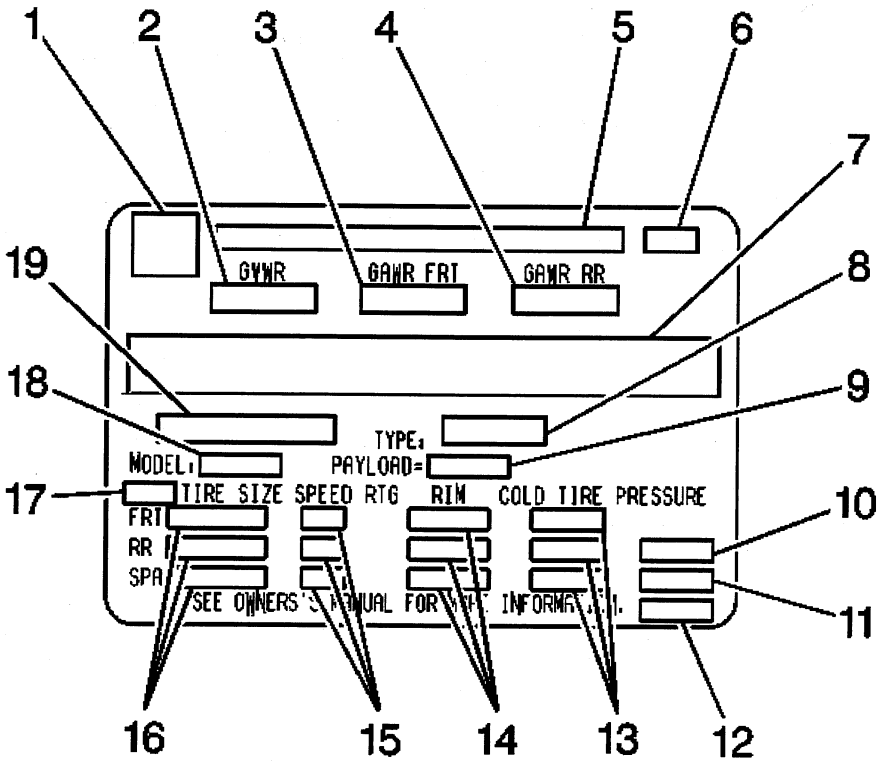
| Position | Definition | Character | Description |
|---|---|---|---|
| 1 | Division | B<br>C | Chevrolet Incomplete<br>Chevrolet Truck |
| 2 | Model Year | 4 | 2004 |
| 3 | Plant Location | G<br>J<br>R | Silao<br>Janesville<br>Arlington |
| 4-9 | Plant Sequence Number | -- | 100,001 |

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 | 2 |
| 2 | 10 |
| 3 | 11 |
| 4-5 | 12-17 |

## Vehicle Certification Label (w/o RPO Z49)

### Vehicle Certification Label -- Complete




(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.

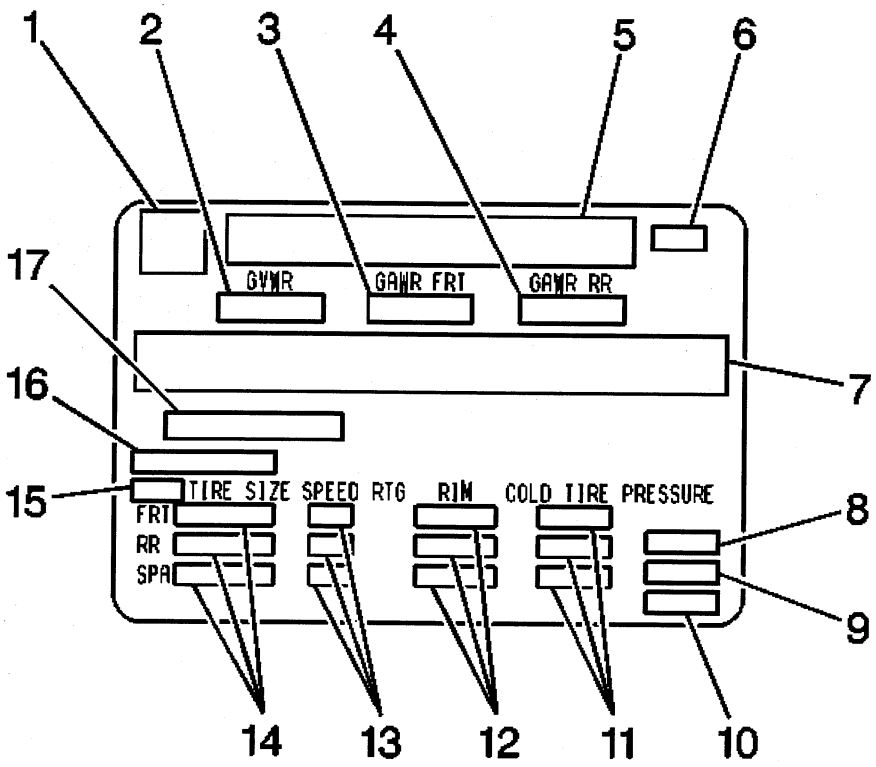
The front gross axle weight rating (GAWR FRT) is the weight exerted on the front axle. The rear gross axle weight rating (GAW RR) is the weight exerted on the rear axle. The front and rear gross axle weights must not exceed the front and rear gross axle weight ratings.

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.

**Vehicle Certification Label – Incomplete**

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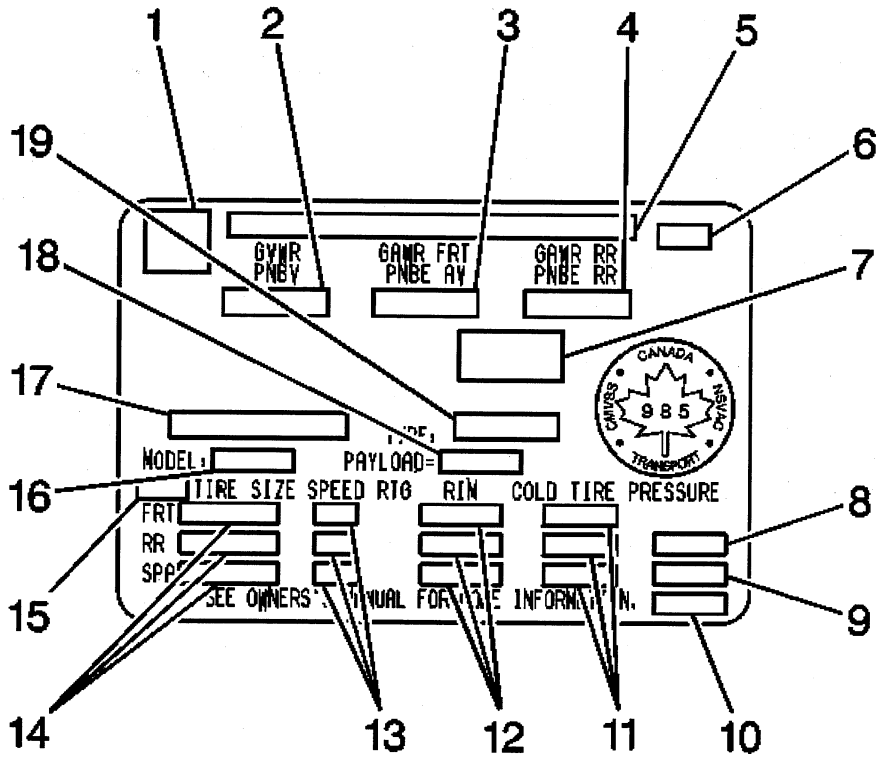


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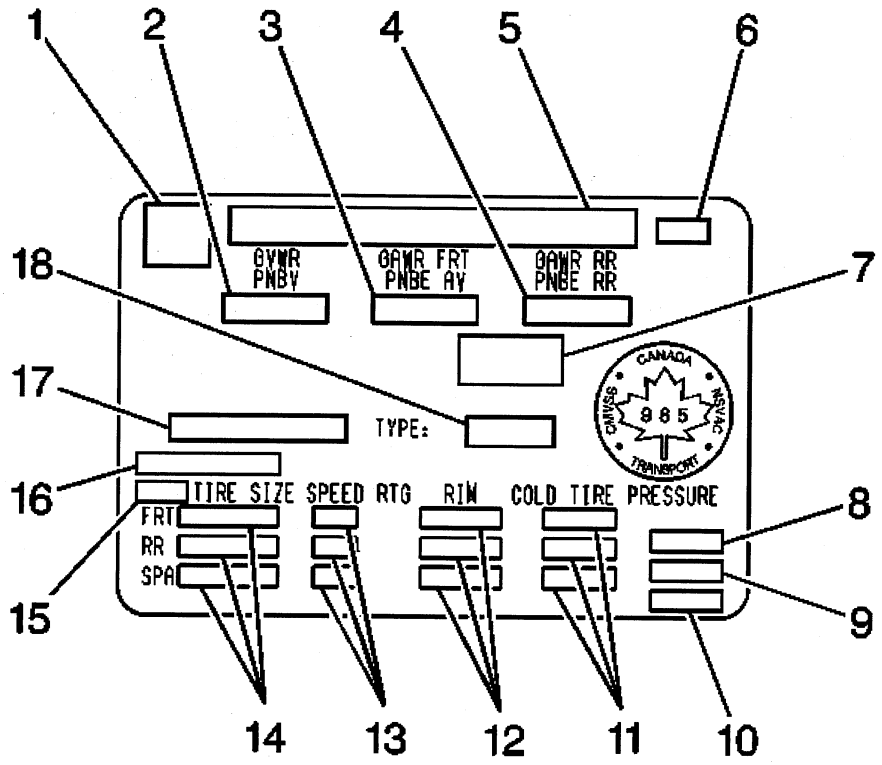


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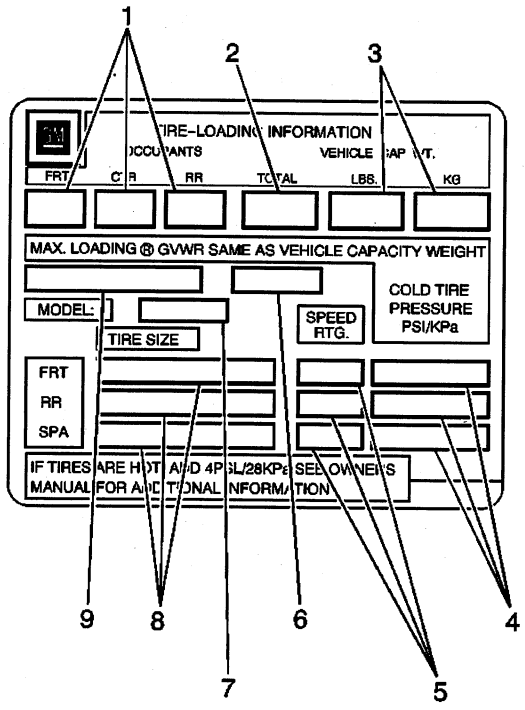
The front gross axle weight rating (GAWR FRT) is the weight exerted on the front axle. The rear gross axle weight rating (GAW RR) is the weight exerted on the rear axle. The front and rear gross axle weights must not exceed the front and rear gross axle weight ratings.

## Tire Placard

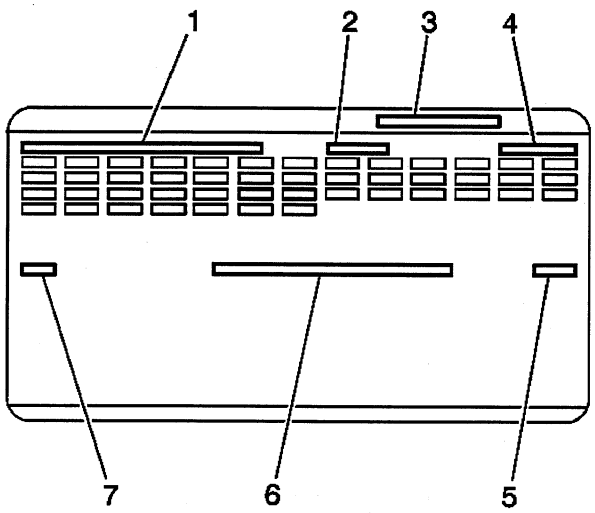



(1) Specified Occupant Seating Positions
(2) Total Occupant Seating
(3) Maximum Vehicle Capacity Weight
(4) Tire Pressures, Front, Rear, and Spare
(5) Tire Speed Rating, Front, Rear, and Spare
(6) Tire Label Code
(7) Engineering Model Minus First Character
(8) Tire Sizes, Front, Rear, and Spare
(9) Vehicle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

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

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

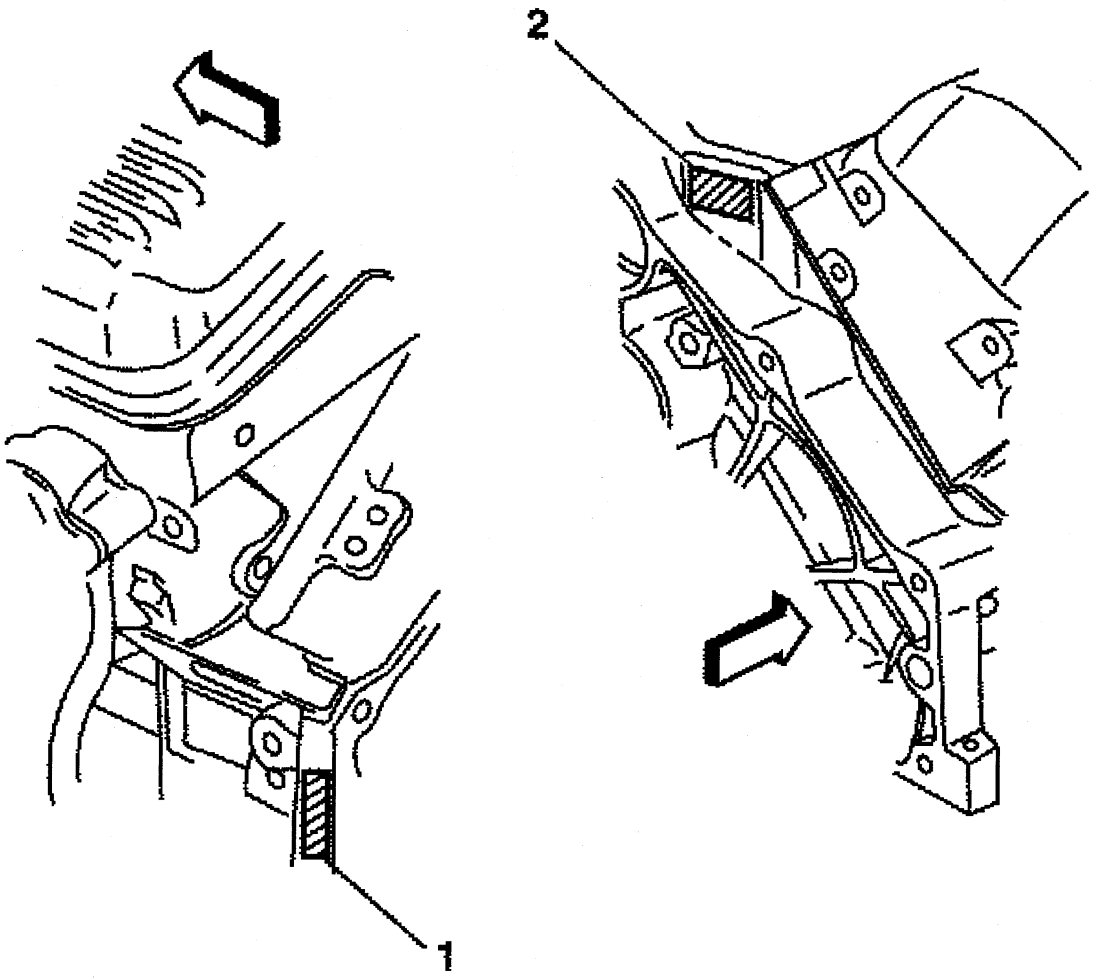
## Service Parts Identification Label (SPID)




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

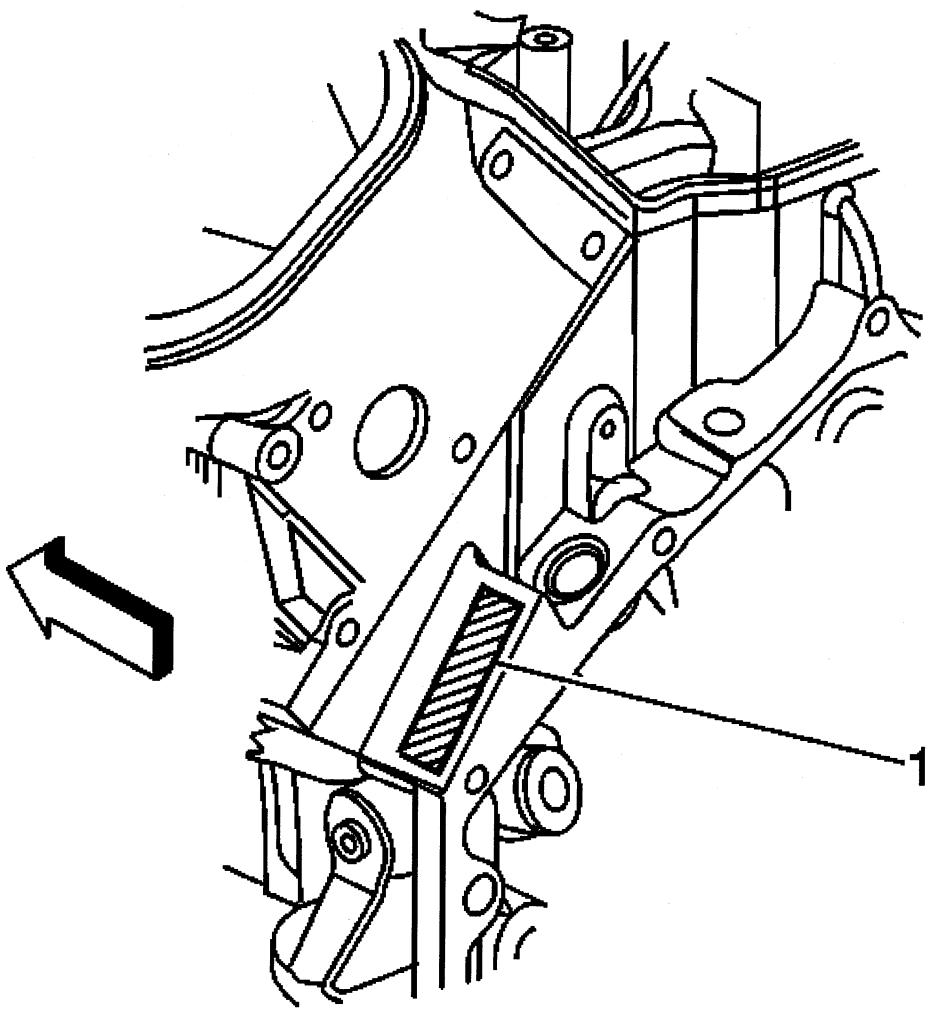
The service parts identification label is placed on the vehicle in order to help service and parts personnel identify the vehicle's original parts and the vehicle's original options.

## Engine ID and VIN Derivative Location 5.3L & 6.0L



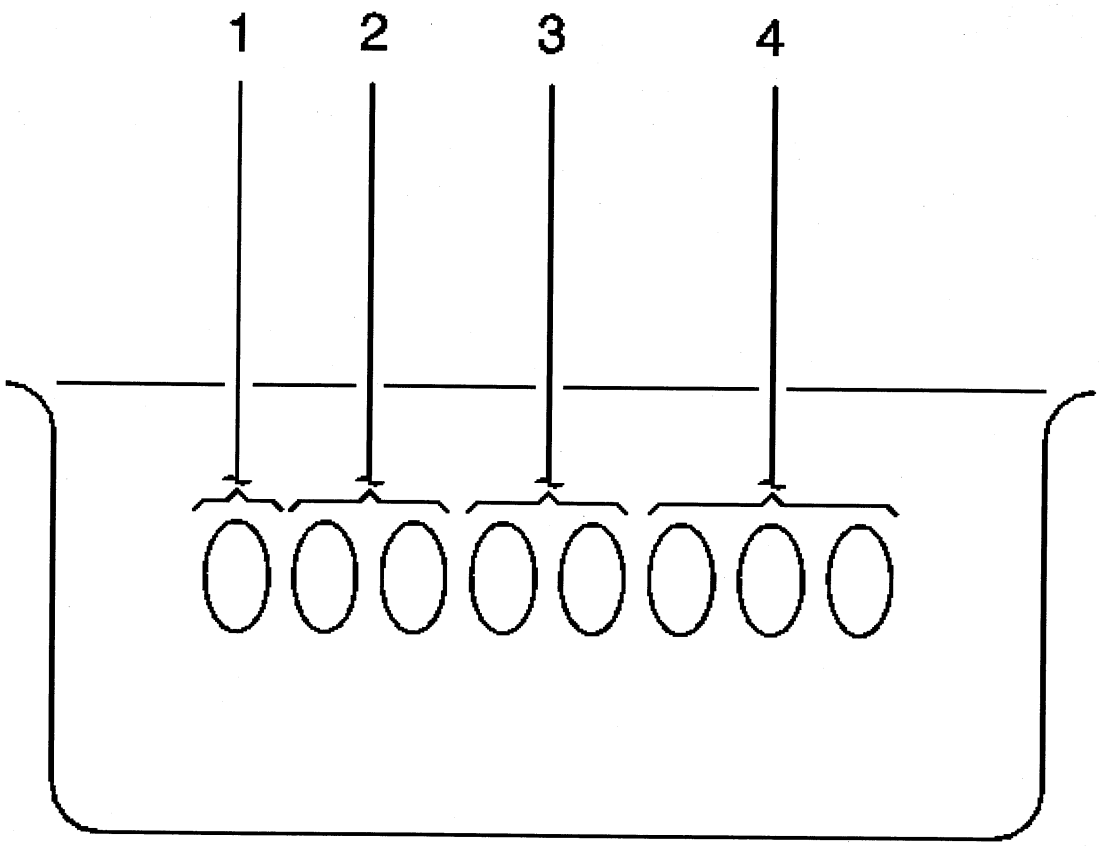

(1) Primary Engine Identification Number Location
(2) Secondary Engine Identification Number Location

## Engine ID and VIN Derivative Location 8.1L




(1) Engine Identification Number Location

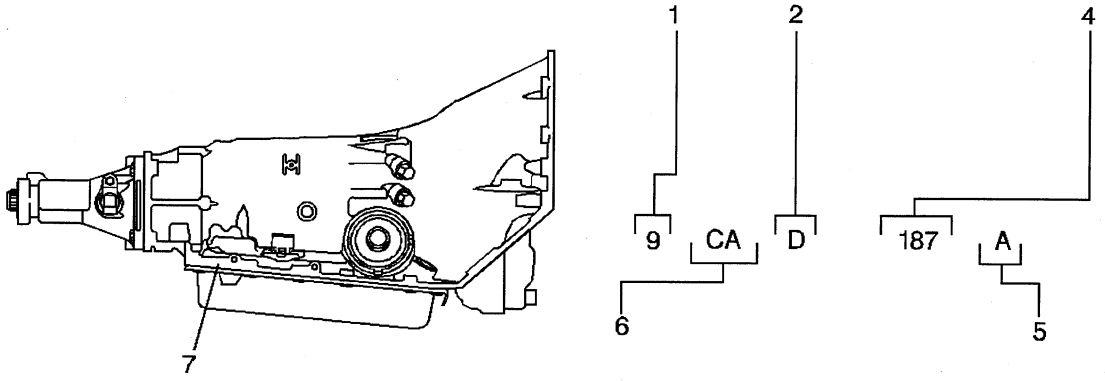
## Engine ID Legend

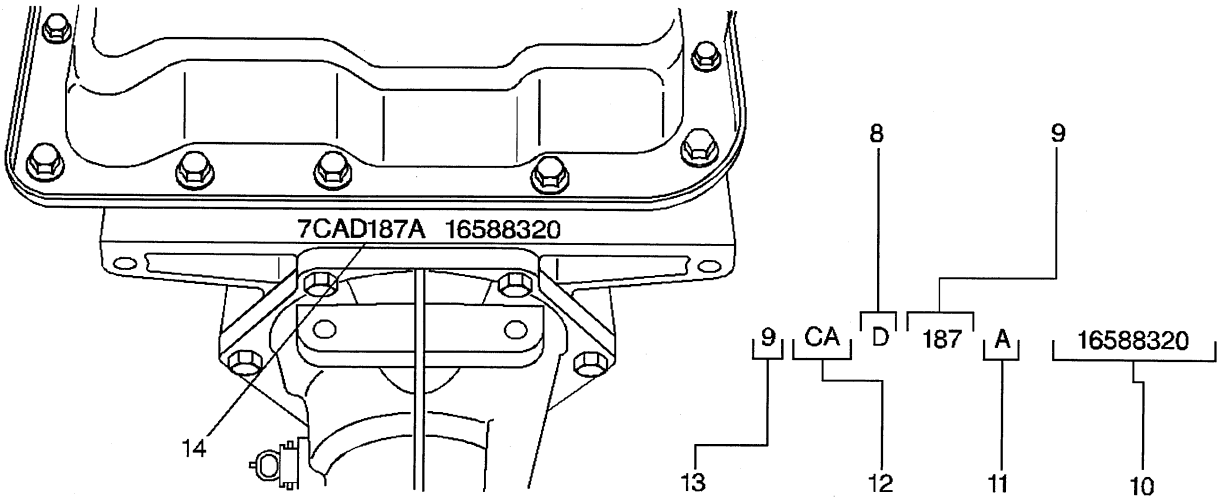



1. Source Code
2. Month of Build
3. Date of Build
4. Broadcast Code

## Transmission ID and VIN Derivative Location

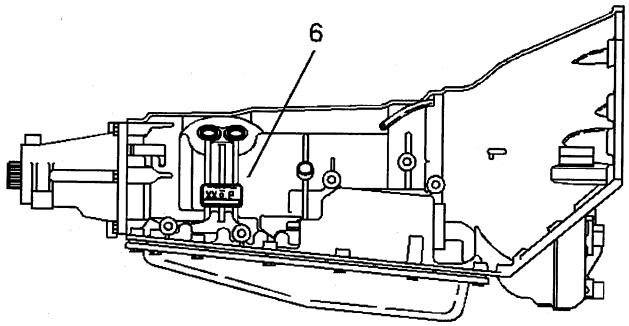
### 4L60-E Transmission ID Location

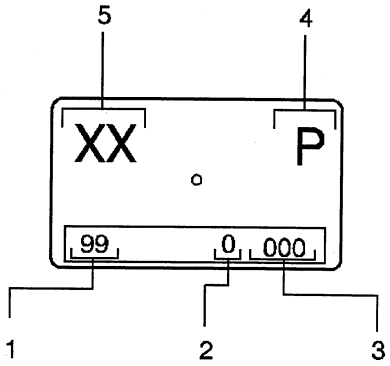



(1) Model Year
(2) Hydra-Matic 4L60-E
(4) Julian Date (or Day of the Year)
(5) Shift Built (A, B, J = First Shift; C, H, W = Second Shift)
(6) Model
(7) Transmission ID Location
(8) Hydra-Matic 4L60-E
(9) Julian Date (or Day of the Year)
(10) Serial No.
(11) Shift Built (A, B, J = First Shift; C, H,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

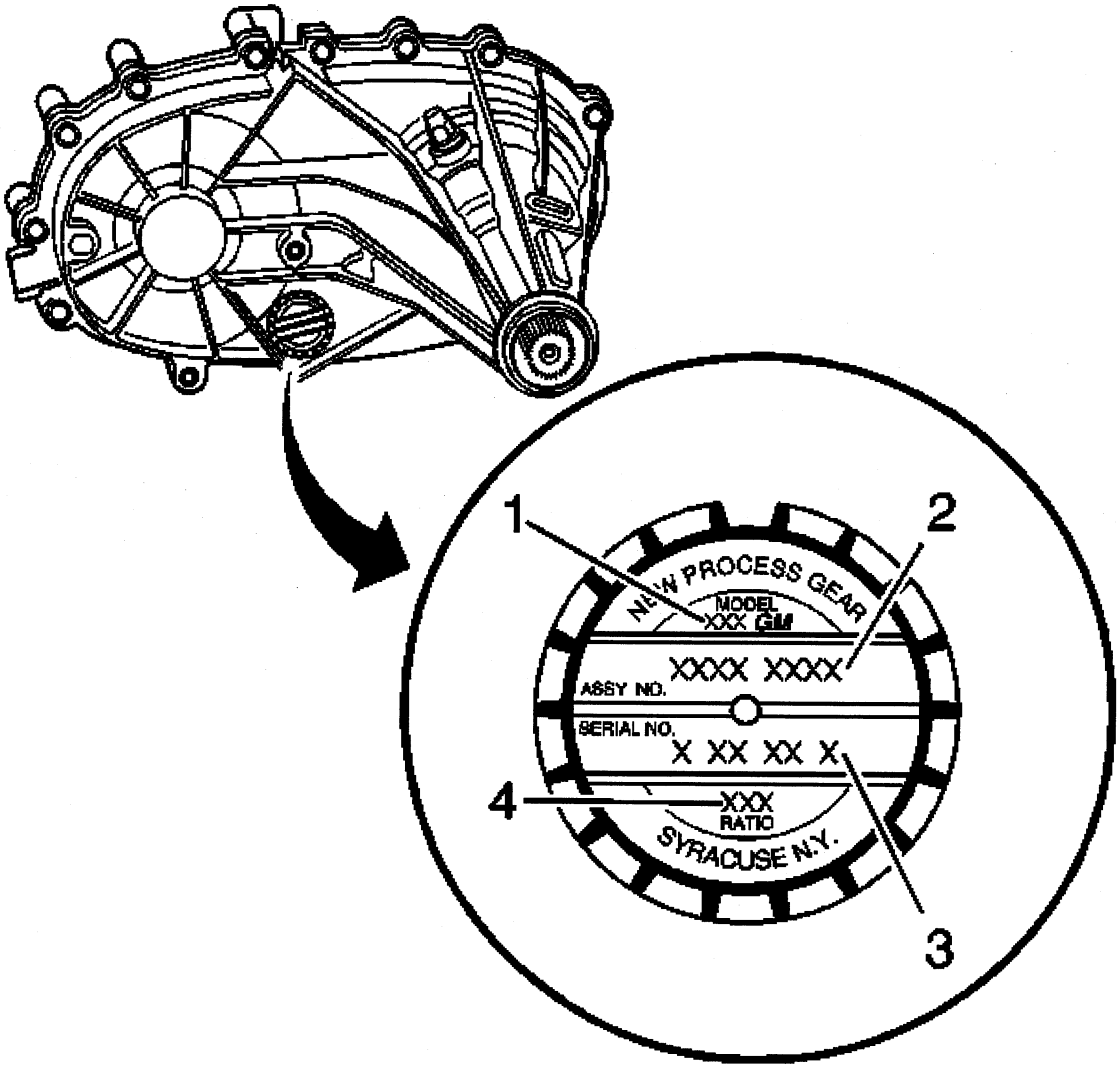
## 4L80-E Transmission ID Location




1. Calendar Year
2. Julian Date of the Year
3. Shift and Line Number
4. Plant
5. Model
6. Location on Transmission

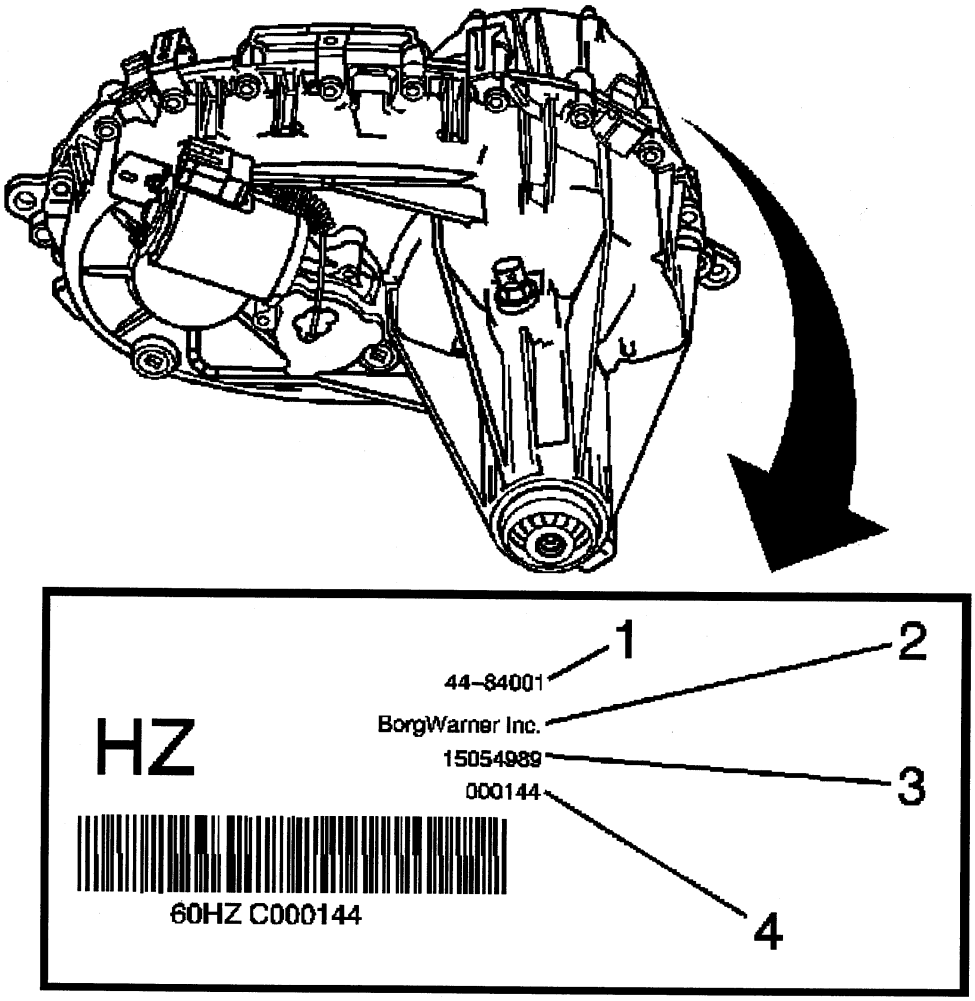
## Transfer Case Identification




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

1 Model number (1)
   A First Digit-1 =Single Speed, 2=Two-Speed
   B Second Digit-2 = T Utility, 3 =T-Truck, L-Van, 4 or 6 = K Truck and Utility
   C Third Digit-1 = Manual, 3 = Electric Shift, 6 = Automatic, 9 = All Wheel Drive
2 Assembly number (2)
3 Serial number (Date and Shift Code) (3)
4 Low range reduction ratio (4)

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.

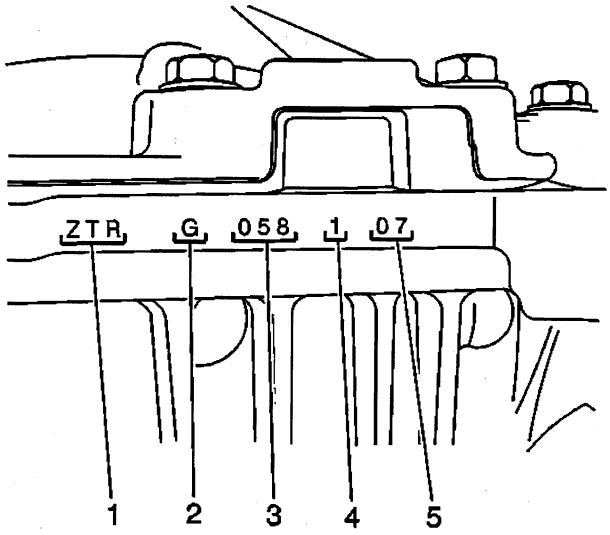



An identification tag is attached to the rear half of the transfer case. The tag provides the following information:

- 1. Model number
- 2. Manufacturer
- 3. Part Number
- 4. Serial Number

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

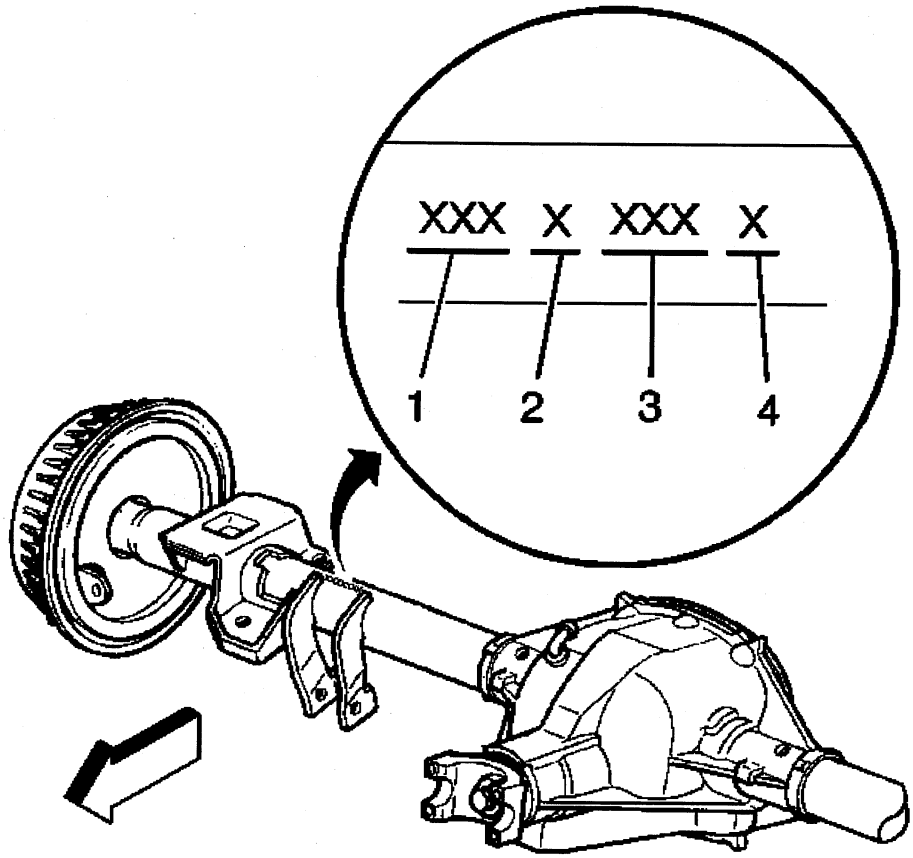
Front axle identification information is stamped on the top of the differential carrier assembly.

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.

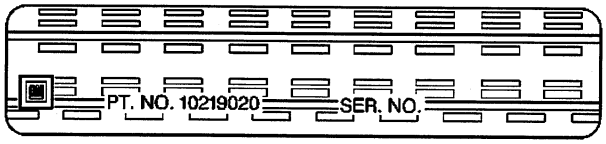
## Axle Identification – Rear




(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 |
|---|---|
| AC6 | Window Tinted Deep, Rear, S/D |
| AE7 | Seat FRT Split, Driver, PASS |
| AG1 | Adjuster FRT ST Power, Multi-Directional, Driver |
| AG2 | Adjuster PASS ST Power, Multi-Directional |
| AJ1 | Windows Deep Tint, All Except W/S And DRS |
| AJ7 | Restraint System Seat, Inflatable, Driver and Passenger, Front and Side |
| AL0 | Sensor Indicator Inflatable Restraint, Front Passenger/Child Presence Detector |
| AL4 | Seat RR BKT |
| ANJ | Window Tinted Export Compliant, Non-Deep |
| AN3 | Seat FRT, Individual (Non BKT) |
| AP9 | Net Convenience |
| ARL | Plant Code Arlington, TX USA |
| AS3 | Seat RR |
| AT5 | Seat Rear CTR, Folding |
| AU0 | Remote Function Actuation - Keyless Entry - Domestic |
| AU3 | Lock Control Side Door, Electric |
| AU8 | Remote Function Actuation, Specific Frequency |
| AX4 | Restraint Conversion Seat, Manual, European |
| A04 | Windshield Tinted, Less Upper Shadeband |
| A31 | Window Power Operated, All Doors |
| A95 | Seat FRT BKT, High Back, Driver and PASS RECL |
| BAG | Parts Package Export |
| BG9 | Rubber Floor Covering |
| BPH | Appearance Package Chevrolet Off Road |
| BS1 | Insulation Acoustical PKG |
| BVE | Side Steps Runningboard |
| BVF | Side Steps Runningboard, Color Keyed |
| BVQ | Side Steps Runningboard, Tubular Chrome |
| BVR | Side Steps Runningboard, Tubular Stainless Steel |
| BVS | Side Steps Runningboard, Color |
| BW1 | Ornamentation Exterior Rear End |
| BW2 | Molding B/S Deluxe |
| BX2 | Molding B/S Lower, Extra Wide |
| B30 | Floor Covering Carpet |
| B37 | Covering Floor Mat, Front and Rear, Auxiliary |
| B39 | Covering Floor Carpet, Load Floor |
| B41 | Covering Floor Mat, Load Floor |
| B58 | Covering Floor MAT, FRT And RR, Carpeted Insert |
| B71 | Wheel Opening Flares |
| B85 | Molding - Body Side , Exterior, Bright |
| B96 | Molding Wheel Opening |
| CF5 | Roof Sun Glass, Sliding, Electric |
| CJ2 | HVAC System Air Conditioner Front, Auto Temperature Control, Auxiliary Temperature Control |
| CJ3 | HVAC System Air Conditioner Front, Manual Temperature Control, Auxiliary Temperature Control |
| C25 | Wiper System, Rear Window, Intermittent |
| C36 | Heater Auxiliary |

| RPO | Description |
|---|---|
| C49 | Defogger RR Window, Electric |
| C5H | GVW Rating 6,900 LBS |
| C5U | GVW Rating 6,800 LBS |
| C5W | GVW Rating 7,000 LBS |
| C5Z | GVW Rating 7,200 LBS |
| C6P | GVW Rating 8,600 LBS/3,900 KG |
| C69 | HVAC System Rear Air Conditioner |
| C7K | GVW Rating 6,500 lbs |
| DF5 | Mirror, I/S R/V LT Sensitive, Compass, O/S Temp Display |
| DH6 | Mirror, I/S Front Van, LH And RH, Illumination with Sunshade |
| DK7 | Console Roof Interior, Custom |
| DK8 | Console Roof Interior, Deluxe |
| DL3 | Mirror, O/S LH and RH, Remote Control, Electric, Heated, Power Folding, Turn Signal Indicator, Light Sensitive, Color |
| DL8 | Mirror, O/S LH And RH, Remote Control, Electric, Heated |
| DNR | Equipment, Dealer Installed |
| DPF | Mirror, O/S LH and RH, Wide Load, Remote Control, Electric, Heated |
| DR4 | Mirror, O/S LH and RH, Remote Control, Electric, Heated, Light Sensitive, Power Folding, Color |
| DT3 | Rear Box Compartment, Stowage |
| DT4 | Ashtray, Cigarette Lighter |
| DUF | Equipment, Duffle Bag and Daypack |
| D07 | Console Front Compartment, Floor, Custom |
| D31 | Mirror I/S R/V Tilt (Duplicate with D36) |
| D55 | Console Front Compartment, Floor |
| D99 | Body Provisions for Special Two Tone Paint |
| EN4 | Cover, Rear Compartment Hard, Rear Compartment, Cargo |
| EVA | Test DVT, EVAP Emission Requirement |
| E37 | Pickup Box, Inner DK Composite |
| E52 | Body Equipment One Piece Lift Gate With Lift Glass |
| E95 | Cover, Rear Compartment Tonneau, Rear Compartment |
| FF4 | Arm, Left Torsion Bar Spring Adjustment (C) |
| FF5 | Arm, Right Torsion Bar Spring Adjustment (D) |
| FF6 | Arm, Left Torsion Bar Spring Adjustment (E) |
| FF7 | Arm, Right Torsion Bar Spring Adjustment (F) |
| FK2 | Arm, Left Torsion Bar Spring Adjustment (A) |
| FK3 | Arm, Right Torsion Bar Spring Adjustment (B) |
| FT2 | Arm, Left Torsion Bar Spring Adjustment (FT2) |
| FT3 | Arm, Right Torsion Bar Spring Adjustment (FT3) |
| F0F | Fleet Incentive Tourism Industry Inc. DBA Budget Sales and Leasing |
| F60 | Spring Front Heavy Duty |
| GND | Sales Package Avalanche Ground Affects |
| GT4 | Axle Rear 3.73 Ratio (DUP With 5 x 1) |
| GT5 | Axle Rear 4.10 Ratio (DUP With GT8) |
| GU6 | Axle Rear 3.42 Ratio |
| G63 | Provisions, Luggage Carrier, Roof |
| G65 | Level Control Manual, Self-Adjusting |
| G69 | Level Control Auto, Air, HD |
| G80 | Axle Positraction Limited Slip |
| G86 | Axle, Limited Slip |
| JAN | Plant Code Janesville, WI, USA |
| JE1 | Brake System, Europe |

| RPO | Description |
|---|---|
| JF4 | Power Adjustable Pedals |
| JH2 | Brake Hyd Power, Disc/ Disc, 7,200 lb |
| JH6 | Brake Hyd Power, 4-Wheel Disc, 9,900 lb |
| JL4 | Control Active Brake |
| J81 | Indicator Switch, Export |
| KA6 | Rear Seat Heater |
| KC4 | Heavy Duty Engine Oil Cooling |
| KG3 | Generator 145 Amp |
| KNP | Cooling System Trans, HD |
| KUP | Throttle Control Electronic |
| K05 | Heater Engine Block |
| K34 | Cruise Control, Automatic, Electronic |
| K47 | Air Cleaner High Capacity |
| K68 | Generator 105 Amp |
| LM7 | Engine Gas, 8 CYL, 5.3L, MFI, Iron, GM |
| LQ4 | Engine Gas, 8 CYC, 6.0L, MFI, Iron, GM |
| LQ9 | Engine Gas, 8 CYC, 6.0L, MFI, Iron, GM, HO |
| LR4 | Engine Gas, 8 Cechy, 4.8L MFI, Iron, GM |
| L18 | Engine Gas, 8 CYL, 8.1L, MFI |
| L59 | Engine Flexible Fuel (Gas/Alc), 8 cyl, 5.3L, MFI, V8, GM |
| MN8 | Transmission Auto 4-Speed, HMD, 4L80-E, Heavy Duty |
| MSL | Plant Code, Silao, Mexico |
| MTF | Provisions, Fire Extinguisher Mounting |
| MT1 | Transmission 4-Speed Auto W/Elect Controls H.D. - Hydra-Matic 4L80-E |
| M30 | Transmission Auto 4-Speed, HMD, 4L60-E, Electronic |
| M32 | Transmission Auto 4-Speed Hydra-Matic Drive, 4L60-E Electronic, HD |
| NA1 | Emission System GVW less than 8, 500 lb |
| NA4 | Emission System GVW greater than 8, 500 lb |
| NC1 | Emission System California, LEV |
| NF4 | Emission System Clean Fuel Fleet |
| NF9 | Emission System General Unleaded |
| NK5 | Steering Wheel, Standard |
| NP5 | Steering Wheel, Leather Wrapped |
| NP7 | Steering Column, EEC Approved |
| NP8 | New Venture Gear 246 |
| NR3 | Transfer Case - All Wheel Drive (AWD), Open Differential, Single Speed |
| NR4 | Transfer Case - 4 Wheel Drive (4WD), Open Differential, 2 Speed |
| NT3 | Emission System EEC 00 |
| NT8 | Emission System, Federal, Tier 2 A |
| NT9 | Emission System Federal, Tier 2 Phase-out |
| NU4 | Emission System, California LEV2 Plus |
| NW7 | Traction Control - Electronic |
| NYS | Steering Four Wheel |
| NZZ | Skid Plate Off-Road |
| N12 | Exhaust System Rear Exit |
| N30 | Steering Wheel Deluxe |
| N88 | Wheel - New - Aluminum - 17 x 7.5, Premium |
| N89 | Wheel - New - Aluminum - 17 x 7.5, Sport |
| N93 | Wheel - New - Aluminum - 17 x 7.5 |
| N94 | Wheel - New - Aluminum - 17 x 7.5, Chrome |
| PF4 | Wheel - Cast - Aluminum- 16 X 7.0 |
| PF9 | Wheel - Cast - Aluminum- 16 X 7.0 |

| RPO | Description |
|---|---|
| PY0 | Wheel - New - Aluminum - 16 X 6.5 |
| PY2 | Wheel 16 X 6.5 Chrome Appearance |
| P03 | Wheel Cover, Var 3 |
| P25 | Wheel 17 X 7.5 Aluminum 5-Spoke Premium |
| P27 | Wheel 17 X 7.5 Aluminum 6-Spoke Premium |
| P96 | Equipment Mexican Modified, Mandatory Base Equipment |
| QAN | Tire All P265/70R 17 - 113S BW R/PE ST TL AL2 |
| QAQ | Tire All P265/70R 17 - 113H BW R/PE ST TL AL2 |
| QAS | Tire All P265/70R 17 - 113S WOL R/PE ST TL AL2 |
| QB5 | Wheel 16 x 6.5, Steel |
| QCP | Tire All P255/70R 16 - 109H BW R/PE ST TL ALS |
| QIW | Tire All LT245/75R16E R/PE ST TL OOR BL |
| QIX | Tire All LT265/75R16/C BW R/PE ST TL OOR 12OQ |
| QIZ | Tire All LT245/75R16/E BW R/PE ST TL OOR 12OQ |
| QJM | Tire All P265/70R17 - 113SWOL R/PE ST TL OOR |
| QJP | Tire All P265/70R17 - 113S BW R/PE ST TL OOR |
| QLP | Tire All LT2465/75R16/E BW R/PE ST TL ALS 120/116S |
| QMJ | Tire All P265/70R16 - 111S BW R/PE ST TL AL2 |
| QMK | Tire All P265/70R16 - 111S WOL R/PE ST TL AL2 |
| QNK | Tire All P245/75R16 - 109S BW R/PE ST TL ALS |
| QNL | Tire All P465/75R16 - 109S WOL R/PE ST TL ALS |
| RYJ | Shade Cargo Area, Retractable |
| R4W | Tire Brand All, Michelin |
| R4Y | Tire Brand All, Goodyear |
| R5C | Tire Brand All, Bridgestone |
| SAF | Lock, Spare Tire, Hoist Shaft |
| SLT | Equipment Chevrolet LT Sales Package |
| TL1 | Grille Special |
| TRB | Grille Radiator, Body Color |
| TRW | Provisions Lamp, Roof Mounted |
| TR2 | Lamp Turn Signal, Enlarged |
| TR3 | Grille Radiator, Body Color w/Chrome Emblem |
| TR6 | Headlamps Control Leveling System, Manual |
| T2H | Ornamentation Exterior, Export Unique Requirements |
| T2J | Ornamentation Interior, Export Unique Requirements |
| T62 | Daytime Running Lamp System - Delete |
| T74 | Headlamps Control Automatic, Delay |
| T78 | Headlamps Control - Delete |
| T79 | Rear Fog Lamp |
| T84 | Headlamps, Right Hand Rule of the Road, E Mark |
| T89 | Lamp, Tail and Stop, Export |
| T9H | Provisions Lamp, Front Fog |
| T96 | Fog Lamps - Front |
| UB0 | Radio AM/FM Stereo, Seek/Scan, CD, Auto Tone, Data System, Clock, ETR |
| UB1 | Radio AM/FM Stereo, Seek/Scan, Auto Reverse Music, Search Cassette, CD, Auto Tone, Data System, Clock, ETR |
| UC2 | Speedometer Instrument, Kilometers and Miles, Kilometer Odometer, Positive Bias |
| UC6 | Radio AM/FM Stereo, Seek/Scan, RDS, Multiple Compact Disc, Auto Tone Control, Clock, ETR |
| UD4 | Alarm, Vehicle Speed, 120 K/H |
| UD7 | Sensor Indicator Rear Parking Assist |
| UE1 | Communication System Vehicle, G.P.S. 1 |

| RPO | Description |
|---|---|
| UG1 | Garage Door Opened, Universal |
| UG2 | Garage Door Opened, Universal - Delete |
| UJ6 | Indicator, Low Tire Pressure |
| UK3 | Control Steering Wheel, Accessory |
| UK6 | Radio Control RR Seat And Earphone Jacks |
| UL2 | Frequencies, European |
| UL4 | Frequencies, South America |
| UL8 | Frequencies, Saudi Arabian |
| UM7 | Radio - AM/FM Stereo, Seek/Scan Clock, ETR |
| UM8 | Radio - AM/FM Stereo, Seek/Scan CD, ETR, Navigation Clock |
| UQ3 | Speaker System, Performance Enhanced Audio |
| UQ7 | Speaker System Premium Performance, Enhanced Audio, Bose® |
| U01 | Roof Marker Lamps |
| U1S | Player Multiple Compac Disc |
| U19 | Speedometer INST, Kilo And Miles, Kilo Odometer |
| U2K | Digital Audio System S-Band |
| U34 | Display Celsius Temperature |
| U42 | Entertainment Package Rear Seat |
| U84 | Antenna, Body Side Window, Radio |
| VBX | Language Label Arabic |
| VB3 | Bumper Rear Step, Chrome, Impact Strip |
| VB5 | Bumper Front, Color |
| VC4 | Label Price/Fuel Economy, Puerto Rico and Virgin Islands |
| VC5 | Label Shipping, Except US, US Possessions, or Japan |
| VC7 | Label Price/Fuel Economy, Guam |
| VD1 | Provision Options, Europe |
| VFF | Video Format Region 1, NTSC |
| VFJ | Video Format Region 2, PAL |
| VFK | Video Format Region 3, NTSC |
| VFM | Video Format Region 4, NTSC |
| VFP | Video Format Region 5, PAL |
| VGC | Protector Film, Paint Etch Preventive |
| VG3 | Bumper Front Impact Strip |
| VG8 | Vehicle Label, Notice to Buyer |
| VJ3 | Label, Plate ECE Approval and Vehicle Identification |
| VK3 | License Plate, Front Mounting Package |
| VPH | Vehicle Preparation - Overseas Delivery |
| VP6 | Noise Control |
| VR4 | Trailer Hitch Weight Distributing Platform |
| VR6 | Hook, Tie-Down, Shipping |
| VR7 | Hook, Tow, Second Rear |
| VT4 | Bumper Front Color Keyed |
| VT5 | Bumper Rear Color Keyed |
| VXS | Vehicle Complete |
| VZ2 | Calibration Speedometer A |
| VZ3 | Label, Mercury Disposal Notification |
| V1K | Luggage Carrier Bar, Center Cross |
| V20 | Guard Radiator, Grille, Black |
| V22 | Grille Radiator, Chrome |
| V3A | Guard Radiator, Grille, Gray and Chrome |
| V43 | Rear Bumper Step, Color |
| V54 | Roof Luggage Carrier, Painted |

| RPO | Description |
|---|---|
| V73 | Vehicle Statement, USA/Canada |
| V76 | Front Towing Hook |
| V78 | Vehicle Statement - Delete |
| V87 | Vehicle Statement, Gulf States Organization |
| V92 | Trailer Provisions |
| V98 | Factory Delivery Processing |
| WBH | Merchandised Package, Base Decor |
| WV9 | Merchandised Package, Value Leader |
| XAN | Tire Front P265/70R17-113S BW R/PE ST TL AL2 |
| XAQ | Tire Front P265/70R17-113H BW R/PE ST TL AL2 |
| XAS | Tire Front P265/70R17-113S WOL R/PE ST TL AL2 |
| XCP | Tire Front P255/70R17-109H BW R/PE ST TL ALS |
| XGK | Tire Front LT245/75R16/E BW R/PE ST TL OOR 120Q |
| XHH | Tire Front LT245/75R16/E BW R/PE ST TL ALS 120Q |
| XHS | Tire Front P265/75R16-114H BW R/PE ST TL AT A Temp |
| XJM | Tire Front P265/70R17-113S WOL R/PE ST TL OOR |
| XJP | Tire Front P265/70R17-113S BW R/PE ST TL OOR |
| XLP | Tire Front LT245/75R16/E BW R/PE ST TL ALS 120/116S |
| XMJ | Tire Front P265/70R16-111S BW R/PE ST TL AL2 |
| XMK | Tire Front P265/70R16-111S WOL R/PE ST TL AL2 |
| XNK | Tire Front P245/75R16-109S BW R/PE ST TL ALS |
| XNL | Tire Front P245/75R16-109S WOL R/PE ST TL ALS |
| X88 | Conversion Name Plate Chevrolet |
| YAN | Tire Rear P265/70R17-113S BW R/PE ST TL AL2 |
| YAQ | Tire Rear P265/70R17-113H BW R/PE ST TL AL2 |
| YAS | Tire Rear P265/70R17-113S WOL R/PE ST TL AL2 |
| YCP | Tire Rear P255/70R16-109H BW R/PE ST TL ALS |
| YE9 | Convenience Package Comfort and Decor Level #3 |
| YGK | Tire Rear LT245/75R16/E BW R/PE ST TL OOR 120Q |
| YHH | Tire Rear LT245/75R16/E BW R/PE ST TL ALS 120Q |
| YHS | Tire Rear P265/75R16-114H BW R/PE ST TL AT A Temp Rating |
| YJM | Tire Rear P265/70R17-113S WOL R/PE ST TL OOR |
| YJP | Tire Rear P265/70R17-113S BW R/PE ST TL OOR |
| YLP | Tire Rear LT245/75R16/E BW R/PE ST TL ALS 120/116S |
| YMJ | Tire Rear P265/70R16-111S BW R/PE ST TL AL2 |
| YMK | Tire Rear P265/70R16-111S WOL R/PE ST TL AL2 |
| YNK | Tire Rear P245/75R16-109S BW R/PE ST TL ALS |
| YNL | Tire Rear P245/75R16-109S WOL R/PE ST TL ALS |
| Y91 | Merchandised PKG Luxury Edition |
| Y92 | Merchandised PKG Special Edition |
| ZCP | Tire Spare P255/70R16-109H BW R/PE ST TL ALS |
| ZGC | Tire Spare P265/75R16-114S BW R/PE ST TL AT |
| ZGK | Tire Spare LT245/75R16/E BW R/PE ST TL 00R 120Q |
| ZHH | Tire Spare LT245/75R16/E BW R/PE ST TL ALS 120Q |
| ZHS | Tire Spare P265/75R16-114H BW R/PE ST TL AT A Temp Rating |
| ZLP | Tire Spare LT245/75R16/E BW R/PE ST TL ALS 120/116S |
| ZMJ | Tire Spare P265/70R16-111S BW R/PE ST TL AL2 |
| ZMK | Tire Spare P265/70R16-111S WOL R/PE ST TL AL2 |
| ZM9 | Sales Package Comfort & Convenience |
| ZNK | Tire Spare P245/75R16-109S BW R/PE ST TL ALS |
| ZNL | Tire Spare P245/75R16-109S WOL R/PE ST TL ALS |
| ZQ1 | Chassis Package Smooth Ride |

| RPO | Description |
|---|---|
| ZW7 | Chassis Package Premium Smooth Ride |
| ZW9 | Base Body or Chassis |
| ZY1 | Color Combination, Solid |
| Z49 | Export Canadian Modified, Mandatory Base Equipment |
| Z5X | Mirror Provisions, Arabic Language |
| Z55 | Chassis Package Bi-State, Real Time Damping |
| Z66 | Appearance Package Premium Ride Suspension |
| Z71 | Chassis Package Off Road |
| Z75 | Conversion Name Plate Cadillac |
| Z82 | Trailer Provisions Special Equipment, H. D. |
| Z85 | Chassis Package Increased Capacity |
| Z88 | Conversion Name PLT GMC |

# Technical Information

## Maintenance and Lubrication

### Capacities - Approximate Fluid

| Application | Specification | |
|---|---|---|
| | Metric | English |
| **Axle Capacities** | | |
| Front Drive Axle (8.25") | 1.43 liters | 1.51 quarts |
| Front Drive Axle (9.25") | 1.73 liters | 1.83 quarts |
| Rear Drive Axle (8.6") | 2.03 liters | 2.15 quarts |
| Rear Drive Axle (9.5") | 2.6 liters | 2.75 quarts |
| Rear Drive Axle (9.75") | 2.84 liters | 3.00 quarts |
| Rear Drive Axle (10.5") | 2.6 liters | 2.75 quarts |
| **Engine Cooling System** | | |
| 5.3L (VIN T) with Front A/C | 13.0 liters | 14.0 quarts |
| 5.3L (VIN T) with Front and Rear A/C | 15.0 liters | 15.8 quarts |
| 6.0L (VIN V) | 15.0 liters | 15.8 quarts |
| 6.0L (VIN V) with Optional Engine Oil Cooler | 14.6 liters | 15.4 quarts |
| 8.1L (VIN G) Automatic Transmission | 25.0 liters | 27.0 quarts |
| **Engine Crankcase** | | |
| 5.3L (VIN T) with Filter | 5.7 liters | 6.0 quarts |
| 6.0L (VIN U) with Filter | 5.7 liters | 6.0 quarts |
| 8.1L (VIN G) with Filter | 6.1 liters | 6.5 quarts |
| **Transmission** | | |
| 4L60-E 4 Spd. HMD Auto Oil Pan Removal | 4.7 liters | 5.0 quarts |
| 4L60-E 4 Spd. HMD Auto After Complete Overhaul | 10.6 liters | 11.2 quarts |
| 4L80-E Auto Oil Pan Removal (MT1) | 7.3 liters | 7.7 quarts |
| 4L80-E Auto (MT1) After Complete Overhaul | 12.8 liters | 13.5 quarts |
| **Fuel Tank** | | |
| Tahoe/Yukon | 98.4 liters | 26.0 gallons |
| Suburban/Yukon XL (1500 Series) | 117.3 liters | 31.0 gallons |
| Suburban/Yukon XL (2500 Series) | 145.7 liters | 37.0 gallons |
| **Transfer Case** | | |
| Borg Warner 4481 (NR3) | 1.4 Liters | 1.5 Quarts |
| Borg Warner 4482 (NR4) | 1.4 Liters | 1.5 Quarts |
| New Venture Gear 246 (NP8) | 1.9 Liters | 2.0 Quarts |

## Maintenance Items

| Usage | Type |
|---|---|
| **Engine Air Cleaner/Filter** | |
| 5.3L (VIN T) | A1519C*†<br>25313348** |
| 5.3L (VIN Z) | A1519C*†<br>25313348** |
| 6.0L (VIN U) | A1518C*<br>25313349** |
| 8.1L (VIN G) | A1518C*<br>25313349** |
| **Engine Oil Filter** | |
| 5.3L (VIN T) | PF44<br>25010633** |
| 5.3L (VIN Z) | PF44<br>25010633** |
| 6.0L (VIN U) | PF44<br>25010633** |
| 6.6L (VIN 1) | P/N 97214983 |
| 8.1L (VIN G) | PF454<br>89028862** |
| **Spark Plugs** | |
| 5.3L (VIN T) | 12571164**<br>41-985* |
| 5.3L (VIN Z) | 12571164**<br>41-985* |
| 6.0L (VIN U) | 12571164**<br>41-985* |
| 8.1L (VIN G) | 12578277**<br>41-983* |
| **Fuel Filter** | |
| 5.3L (VIN T) | GF626 |
| 5.3L (VIN Z) | GF626 |
| 6.0L (VIN U) | GF626 |
| 8.1L (VIN G) | GF626 |
| **Wiper Blades (Front)** | |
| 5.3L (VIN T) | 15153642** |
| 5.3L (VIN Z) | 15153642** |
| 6.0L (VIN U) | 15153642** |
| 8.1L (VIN G) | 15153642** |
| **Wiper Blade Type (Front)** | |
| 5.3L (VIN T) | ITTA |
| 5.3L (VIN Z) | ITTA |
| 6.0L (VIN U) | ITTA |
| 8.1L (VIN G) | ITTA |
| **Wiper Blade Length (Front)** | |
| 5.3L (VIN T) | 22 inches (56.0 cm) |
| 5.3L (VIN Z) | 22 inches (56.0 cm) |
| 6.0L (VIN U) | 22 inches (56.0 cm) |
| 8.1L (VIN G) | 22 inches (56.0 cm) |

| | |
|---|---|
| **Wiper Blades (Rear)** | |
| 5.3L (VIN T) | 22121329** |
| 5.3L (VIN Z) | 22121329** |
| 6.0L (VIN U) | 22121329** |
| 8.1L (VIN G) | 22121329** |
| **Wiper Blade Type (Rear)** | |
| 5.3L (VIN T) | ITTA |
| 5.3L (VIN Z) | ITTA |
| 6.0L (VIN U) | ITTA |
| 8.1L (VIN G) | ITTA |
| **Wiper Blade Length (Rear)** | |
| 5.3L (VIN T) | 14 inches (35.0 cm) |
| 5.3L (VIN Z) | 14 inches (35.0 cm) |
| 6.0L (VIN U) | 14 inches (35.0 cm) |
| 8.1L (VIN G) | 14 inches (35.0 cm) |

* ACDelco part number
** GM part number
† A1518C high-capacity air cleaner filter may be substituted.
†† Spark Plug Gag is 0.040 inches (1.01 mm).

## 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 | 50/50 mixture of clean drinkable water and use only GM Goodwrench® DEX-COOL® or Havoline® DEX-COOL® coolant |
| Hydraulic Brake System | Delco Supreme 11® Brake Fluid GM P/N 12377967 (Canadian P/N 992667) or equivalent DOT-3 brake fluid |
| Windshield Washer Solvent | GM Optikleen® Washer Solvent GM P/N 1051515 (Canadian P/N 993033) or equivalent |
| Hydraulic Clutch System | Hydraulic Clutch Fluid GM P/N 12345347 (Canadian P/N 1095351) or equivalent DOT-3 brake fluid |
| Power Steering System | GM Power Steering Fluid GM P/N 1052884 - 1 pint, 1050017 - 1 quart (Canadian P/N 993294 - 1 pint, 992646 - 1 quart) or equivalent |
| Automatic Transmission | DEXRON®-III, Automatic Transmission Fluid |
| Key Lock Cylinders | Multi-Purpose Lubricant, Superlube® GM P/N 12346241 (Canadian P/N 10953474) or equivalent |
| Floor Shift Linkage | Lubriplate® Lubricant Aerosol GM P/N 1052349 (Canadian P/N 992723) or equivalent or lubricant meeting requirements of NLGI # 2 Category LB or GC-LB |
| Chassis Lubrication | Chassis Lubricant GM P/N 12377985 or equivalent or lubricant meeting requirements of NLGI # 2 Category LB or GC-LB |
| Front Axle | SAE 80W-90 Axle Lubricant GM P/N 1052271 (Canadian P/N 10953455) or equivalent |
| Rear Axle | SAE 75W-90 Synthetic Axle Lubricant GM P/N 12378261 (Canadian P/N 10953455) or equivalent meeting GM Specification 9986115 |
| Rear Axle (with NYS Quadrasteer Axle Only) | SAE 75W-90 Synthetic Axle Lubricant GM P/N 12378557 (Canadian P/N 88901362) or equivalent.<br>Do not add friction modifier. |
| Automatic Transfer Case (NP8 Only) | AUTO-TRAK II Fluid GM P/N 12378508 (Canadian P/N 10953626) |
| Automatic transfer Case (NP3, NR3, NR4) | Dexron® III Automatic Transmission Fluid |

| Usage | Fluid/Lubricant |
|---|---|
| Front Axle Propshaft Spline or One-Piece Propshaft Spline (Two-Wheel Drive with Auto. Trans.) | Spline Lubricant, Special Lubricant GM P/N 12345879 (Canadian P/N 10953511) or lubricant meeting requirements of GM 9985830 |
| Hood Latch Assembly, Secondary Latch, Pivots, Spring Anchor and Release Pawl | Lubriplate® Lubricant Aerosol GM P/N 1052349 (Canadian P/N 992723) or equivalent or lubricant meeting requirements of NLGI # 2, Category LB or GC-LB |
| Hood Hinges | Multi-Purpose lubricant, Superlube® GM P/N 12346241 (Canadian P/N 10953474) or equivalent |
| Body Door Hinge Pins, Liftgate Hinge and Linkage, Folding Seats and Fuel Door Hinge | Multi-Purpose lubricant, Superlube® GM P/N 12346241 (Canadian P/N 10953474) or equivalent |
| Outer Tailgate Handle Pivot Points | Multi-Purpose lubricant, Superlube® GM P/N 12346241 (Canadian P/N 10953474) or equivalent |
| Weatherstrip Conditioning | Dielectric Silicone Grease GM P/N 12345579 (Canadian P/N 1974984) or equivalent |
| Weatherstrip Squeaks | Synthetic Grease with Teflon, Superlube® GM P/N 12371287 (Canadian P/N 10953437) or equivalent |

# Descriptions and Operations

## Power Steering System

The hydraulic power steering pump is a constant displacement vane-type pump that provides hydraulic pressure and flow for the power steering gear. The hydraulic power steering pumps are either belt-driven or direct-drive, cam-driven.

The power steering fluid reservoir holds the power steering fluid and may be integral with the power steering pump or remotely located. The following locations are typical locations for the remote reservoir:

- Mounted to the front of the dash panel
- Mounted to the inner fender
- Mounted to a bracket on the engine

The 2 basic types of power steering gears are listed below:

- A recirculating ball system
- A rack and pinion system

In the recirculating ball system, a worm gear converts steering wheel movement to movement of a sector shaft. A pitman arm attached to the bottom of the sector shaft actually moves one tie rod and an intermediate rod move the other tie rod.

In the rack and pinion system, the rack and the pinion are the 2 components that convert steering wheel rotation to lateral movement. The steering shaft is attached to the pinion in the steering gear. The pinion rotates with the steering wheel. Gear teeth on the pinion mesh with the gear teeth on the rack. The rotating pinion moves the rack from side to side. The lateral action of the rack pushes and pulls the tie rods in order to change the direction of the vehicle's front wheels.

The power steering pressure hose connects the power steering pump union fitting to the power steering gear and allows pressurized power steering fluid to flow from the pump to the gear.

The power steering return hose returns fluid from the power steering gear back to the power steering fluid reservoir. The power steering return line may contain an integral fin-type or line-type power steering fluid cooler.

In a typical power steering system, a pump generates hydraulic pressure, causing fluid to flow, via the pressure hose, to the steering gear valve assembly. The steering gear valve assembly regulates the incoming fluid to the right and left chambers in order to assist in right and left turns.

Turning the steering wheel activates the valve assembly, which applies greater fluid pressure and flow to 1 side of the steering gear piston, and lower pressure and flow to the other side of the piston. The pressure assists the movement of the gear piston. Tie rods transfer this force to the front wheels, which turn the vehicle right or left.

## Steering Linkage

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.

The condition of the steering linkage affects the steering performance. If parts are bent, damaged, worn, or poorly lubricated, potentially dangerous steering action will result.

## Steering Wheel and Column

The steering wheel and column has 4 primary functions:

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

### Vehicle Steering

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

### Vehicle Security

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

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

### Driver Convenience

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

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

## Rear Wheel Steering Description

Quadrasteer™ is a 4-wheel steering system that dramatically enhances low speed maneuverability, high speed stability, and towing capability. The system is an electrically powered rear wheel steering system comprised of the following components:

- A steerable, solid rear axle
- A heavy duty wiring harness and fuse
- A programmable control module
- A power relay in the control module
- A rack and pinion style steering actuator mounted on the rear differential cover
- An electric motor assembly on top of the rear steering actuator
- Three hall effect switches in the motor assembly

- A shorting relay in the motor assembly
- A rear wheel position sensor located under a cover on the bottom of the actuator, below the motor assembly
- A steering wheel position sensor located at the base of the steering column
- A mode select switch on the dash

The system operates in 3 principal modes, as follows:

## 2-Wheel Steer Mode:

Normal steering operation--The rear wheels held in a centered position and rear wheel steering is disabled while in this mode.

## 4-Wheel Steer Mode:

The 4-wheel steering mode provides 3 principal phases of steering: negative phase, neutral phase, and positive phase. Negative phase occurs at low speeds and the rear wheels turn opposite of the front wheels. In the neutral phase, the rear wheels are centered and do not turn. Positive phase occurs at higher speeds and the rear wheels turn in the same direction as the front wheels .

NOTE : There is a cross-over speed. This is the speed at which the control module transitions from negative phase steering to positive phase steering. In 4-wheel steer mode, this transition occurs when the vehicle obtains a speed of 65 km/h (40 mph).

## 4-Wheel Steer Tow Mode

The 4-wheel steer tow mode provides more positive phase steering than the normal 4-wheel steering at high speed. During low speed driving, the 4-wheel steer tow mode provides similar negative phase steering as it does in the normal 4-wheel steering mode.

The cross over speed in the 4-wheel steer tow mode occurs at 40 km/h (25 mph).

## Rear-Wheel-Steering-Control-Module

The rear wheel steering control module controls all functions of the rear wheel steering system. The module has a dedicated power feed line from an under hood fuse holder, via a 125-amp mega fuse . The module is located in the rear of the vehicle on the underbody. The module uses the inputs listed above to determine when and how far to turn the rear wheels. The module uses the hall switches in the motor assembly, a shorting relay , and a motor control relay to monitor and control the direction and speed of the motor. The module also controls the duty cycle of the phase leads to the motor . The motor control relay is part of the rear wheel steering control module and is not serviceable . The module uses both a class 2 and a discrete vehicle speed signal. The 2 vehicle speed signals are used for comparison purposes . The system will not function without a discrete vehicle speed sensor signal. The module uses digital inputs from the steering wheel position sensor to determine steering wheel position and rate of change. The body control module (BCM) sends a class 2 message for the analog portion of the signal from the steering wheel position sensor. The rear wheel position sensor signals provide the module with rear wheel position data. The module will send out a class 2 message to the instrument panel cluster (IPC) to turn ON and OFF the Service 4 Wheel Steering message. The rear wheel steering control module also controls the ground circuits for the mode indicator lamps in the mode select switch.

The control module allows the vehicle rear wheels to turn a maximum of 12 degrees left or right. When the vehicle is operated in reverse, the maximum rear wheel steering angle is 5 degrees left or right. When the vehicle is sitting still in the test mode the system will move a maximum of 5 degrees left or right.

**Important**

The rear wheel steering control module may shut down if the system is operated under very extreme conditions and becomes overheated. The Service 4 Wheel Steering message will not be displayed. Once the temperature decreases back to operating range, the rear wheel steering system will resume normal operation upon the next ignition cycle.

## Rear Wheel Steering Mode Switch

The mode switch located in the instrument panel allows the driver the option of selecting 2-wheel steering, 4-wheel steering, or 4-wheel steering tow modes of operation. The mode switch has indicators that show which mode the rear wheel steering system is in . When all indicators are lit the rear wheel steering control module has lost its memory settings and the scan tool must be used to re-calibrate the rear wheel steering control module . During a mode change, the indicator for the selected mode will flash until the mode change is complete. The rear wheel steering control module will wait for the steering wheel to pass the center position before entering the selected mode. The indicators on the mode switch are LEDs , the switch is also back lit .

## Rear Wheel Steering Motor Assembly

The rear wheel steering motor assembly is a 3 phase, 6 pole, brushless DC motor. The motor assembly is located on the top of the rear steering actuator, and transmits its power through a planetary gear set inside the actuator. There are 3 hall switches inside the assembly: hall A , hall B , and hall C . The rear wheel steering control modules uses the hall switch inputs to monitor the position, speed and direction of the motor. There is a motor phase shorting relay located inside the motor assembly. The hall switches and shorting relay are part of the motor assembly and cannot be serviced separately. The motor leads are not to be repaired or spliced in any fashion. If there is damage to the motor wiring, the motor assembly must be replaced, as any damage to the wiring could permit water intrusion into the actuator. The motor assembly can be serviced separately from the actuator.

## Steering Wheel Position Sensor

The steering wheel position sensor (SWPS) provides one analog signal and 3 digital signals. The digital signals, Phase A, Phase B and marker pulse, are direct inputs to the rear wheel steering control module. The analog signal is input to the body control module (BCM) and is sent via a class 2 message to the rear wheel steering control module. Battery voltage is supplied to the sensor from the cruise fuse to operate the digital portion of the sensor. A 12-volt reference is provided by the rear wheel steering control module to the Phase A, Phase B, and marker pulse circuits of the SWPS. The module monitors each circuit as it is either remains high or is pulled low by the SWPS. The scan tool displays the Phase A and Phase B data parameters as either HIGH or LOW when the steering wheel is being rotated. Each change from HIGH to LOW, or LOW to HIGH, represents one degree of steering wheel rotation. The sensor may also be utilized by other optional systems.

## Rear Wheel Position Sensor

The rear wheel position sensor has 2 signal circuits: position 1 and position 2. Position 1 is a linear measurement of voltage per degree. The voltage range for position 1 is from 0.25-4.75 volts, and the angular measurement range is from -620 degrees to +620 degrees. At 0.25 volts the steering wheel has been rotated -600 degrees past center. At 4.75 volts the steering wheel has been rotated +600 degrees past center. Position 2 circuit is a linear measurement of voltage per degree. The voltage for position 2 increases or decreases from 0.25-4.75 volts every 180 degrees. When the steering wheel is 0 degrees enter, position 1 and position 2 output signals measure 2.5 volts respectively.

## Steerable Rear Axle

The steerable rear axle has a rack and pinon style actuator mounted to the differential cover, specially designed axle shafts, and movable hub and bearing assemblies mounted by upper and lower ball joints. The actuator housing is part of the differential cover. In the event of a system malfunction, the actuator returns the rear wheels to the center position through internal springs. The actuator has specially designed inner and outer tie rods ends . There are inner tie rod boots to prevent contaminants from entering the actuator. Long term exposure to moisture due to a damaged boot or components can result in an internal malfunction or damage. The actuator has the rear wheel steering motor assembly attached to the upper housing. There are shields and a skid plate on the rear axle to protect the actuator. There are no internal adjustments to the actuator. It is mandatory to perform a four wheel alignment if any hard parts , such as tie rods, ball joints or wheel bearings are serviced . The axle shafts are a heavy duty design with a specially designed CV joint and boot at the wheel end of the axle to provide up to

15 degrees of movement. The axle assembly is a heavier duty version of the standard rear axle used on a non rear wheel steer truck.

You must consult the owners manual and the trailer towing guide for specific towing capacities.

# Suspension Description and Operation

## Front Suspension

The front suspension has 2 primary purposes:

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

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

All pickup models and 25 series Suburban/Yukon XL models use a rear spring suspension system and a solid rear axle suspension system. The rear axle is attached to the multi-rear springs by U-bolts. The front of the spring ends are attached to the frame at the front hangers through rubber bushings. The rear of the spring ends are attached to the frame with shackles that allow the springs to change their length, due to the spring compressing, while the vehicle is in motion. The ride control is provided by 2 identical direct dual-action shock absorbers that are angle-mounted between the frame and the brackets which are attached to the axle tubes.

All 15 series utility vehicles use a 5-link rear suspension system. The rear axle is attached to the frame with the upper control arms, lower control arms, and a track bar. Two coil springs and a link mounted rear stabilizer shaft complete the system.

## Real Time Damping Description

The RTD system is bi-state real time damping system. The Electronic Suspension Control (ESC) module controls the suspension damper solenoids and suspension position sensors, along with parts of the automatic level control (ALC) system and electronic variable orifice (EVO) power steering system.

The RTD system consists of the following:

- ESC Module
- Compressor/Leveling Module
  - Air Pressure Sensor
  - Exhaust Solenoid
- Compressor Motor Relay
- Steering Handwheel Speed/Position Sensor
- Electronic Variable Orifice (EVO) Solenoid
- Suspension Damper Solenoids
- Suspension Position Sensors

The objective of the ESC module is to provide ride and handling results that are superior to a passive damper system, both on and off road at all load conditions. The ESC module monitors body-to-wheel height, vehicle speed, handwheel position/speed, lift/dive status and a driver tow/haul input switch status in real time and instantly selects a "normal" or "firm" mode. This is done for each of the front and rear shock absorbers in order to adjust the vehicle for specific road and driving conditions.

The ESC module will use the rear body-to-wheel displacements and vehicle speed inputs to keep the rear trim height of the vehicle at its desired level.

The ESC module also uses the steering handwheel position/speed sensor and vehicle speed inputs to control a power steering effort control valve.

The suspension damper solenoid is driven ON and OFF by the ESC module. To activate the solenoid, it is initially subjected to full battery voltage for a short period of time. Once the solenoid is pulled-in, the supply voltage is pulse width modulated (PWM). The amount the suspension damper solenoid is activated is based on inputs from the driver Tow/Haul switch, road inputs, position sensor inputs and the PCM. The ESC module provides a common ground for all four of the suspension damper solenoids.

The ESC module provides a common regulated voltage of approximately 5 volts to all four of the body-to-wheel suspension position sensors, air pressure sensor and the steering handwheel position/speed sensor. The ESC module receives VSS discrete output from the PCM. The suspension position sensors provide an analog signal voltage between 0.5 and 4.5 volts to the ESC module. This signal voltage represents the wheel's position relative to the body. The ESC module provides a 5 volt reference and a low reference to the suspension position sensors.

Ignition cycle counting is used by the ESC module to detect faults in the system. The objective is to eliminate false/intermittent codes while maintaining an acceptable level of system performance. The operation of the ignition cycle counting requires that a fault condition be present for four consecutive ignition cycles before it will set the fault code and display the "SERVICE RIDE CONTROL" message. If a fault code is present (without a fault being current), the system will go into one or more degraded modes without displaying a message. Resetting the ignition cycle counter is done by clearing codes with a scan tool. Clearing codes will override ignition cycle counting for one ignition cycle. Therefore, a fault condition will set the fault code immediately if it occurs on the first ignition cycle after the codes are cleared.

There are two different ESC modules being used in the 02 MY. They have the same Z55 RPO, except that one also has and additional ZK3 RPO. The module with the additional ZK3 RPO connects to the EVO solenoid.

## Automatic Level Control Description

The RTD system is bi-state real time damping system. The Suspension Control module controls the suspension damper solenoids and suspension position sensors, along with parts of the automatic level control (ALC) system and electronic variable orifice (EVO) power steering system.

The Automatic Level Control system consists of the following:

- Suspension Control Module
- Compressor/Leveling Module
  - Air Pressure Sensor
  - Exhaust Solenoid
- Compressor Motor Relay

The objective of the Automatic Level Control System is to provide constant ride height at all load conditions. The Suspension Control module monitors body-to-wheel height, and vehicle speed.

The Suspension Control module will use the rear body-to-wheel displacements and vehicle speed inputs to keep the rear trim height of the vehicle at its desired level.

## Tire Pressure Monitor Description and Operation

The Tire Pressure Monitor (TPM) System warns the driver when a significant loss of tire pressure occurs in any of the 4 tires. The system uses the passenger door module (PDM), body control module (BCM), driver information center (DIC), instrument panel cluster (IPC), a radio frequency (RF) transmitting pressure sensor inside each wheel/tire assembly, and the serial data circuit to perform the system functions. When vehicle speed is less than 32 km/h (20 mph), the sensors go into stationary mode. In this mode the sensors transmit once every 60 minutes to minimize sensor battery consumption. As vehicle speed increases, centrifugal force closes the sensors internal roll switch causing the sensors to go into drive mode. In this mode, the sensor transmits once every 60 seconds. The PDM receives and translates the data contained in each sensor RF transmission into sensor presence, sensor mode and tire pressure. When the TPM system detects a significant loss of tire pressure, the CHECK TIRE PRESSURE warning message is displayed on the DIC and the low tire pressure warning indicator is displayed on the IPC. Both the DIC message and the IPC indicator can be cleared by adjusting tire pressures to the recommended kPa/psi. Refer to Label - Vehicle Certification in General Information above. The system does not display the individual tire pressures, or their location on the DIC, nor will it indicate which tire pressure is low. The sensors pressure range is 0-351 kPa (0-51 psi). The sensors pressure accuracy from -10 to +70°C (+14 to +158°F) is plus or minus 7 kPa (1 psi). The PDM has the ability to detect malfunctions within the TPM System. Any malfunctions detected will cause the DIC to display the SERVICE TIRE MONITOR warning message. For more information on other functions of the PDM, refer to the following:

## Wheels and Tires

### Fastener Tightening Specifications

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Hoist to Crossmember Nut | 40 N·m | 30 lb ft |
| Wheel Nut Stud | 190 N·m | 140 lb ft |

### General Description

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

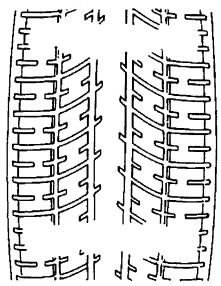
The following factors have an important influence on tire life:

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

The following factors increase tire wear:

- Heavy cornering
- Excessively rapid acceleration
- Heavy braking

## Tread Wear Indicators Description



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

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

## Metric Wheel Nuts and Bolts Description

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

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

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

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

## Tire Inflation Description

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

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

Inspect the tire pressure when the following conditions apply:

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

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

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

**Inflation Pressure Conversion (Kilopascals to PSI)**

| kPa | psi | kPa | psi |
|---|---|---|---|
| 140 | 20 | 215 | 31 |
| 145 | 21 | 220 | 32 |
| 155 | 22 | 230 | 33 |
| 160 | 23 | 235 | 34 |
| 165 | 24 | 240 | 35 |
| 170 | 25 | 250 | 36 |
| 180 | 26 | 275 | 40 |
| 185 | 27 | 310 | 45 |

| kPa | psi | kPa | psi |
|---|---|---|---|
| 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

### Tire Description

## Caution

**Do not mix different types of tires on the same vehicle such as radial, bias, and bias-belted tires except in emergencies because vehicle handling may be seriously affected and may result in loss of control and possible serious injury.**

This vehicle is equipped with speed rated tires. Listed below are the common speed rating symbols and the corresponding maximum speeds:

| Speed Symbol | Maximum Speed (km/h) | Maximum Speed (mp/h) |
|---|---|---|
| S | 180 | 112 |
| T | 190 | 118 |
| U | 200 | 124 |
| H | 210 | 130 |
| V | 240 | 149 |
| Z | Over 240 | Over 149 |

A Tire Performance Criteria (TPC) specification number is molded in the sidewall near the tire size of all original equipment tires. Usually, a specific TPC number is assigned to each tire size. The TPC specification number assures that the tire meets the following GM's performance standards.

- Meets the standards for traction.
- Meets the standards for endurance.
- Meets the standards for dimension.
- Meets the standards for noise.
- Meets the standards for handling.
- Meets the standards for rolling resistance, and others.

The following is required of replacement tires:

- Replacement tires must be of the same size as the original tires.
- Replacement tires must be of the same speed rating as the original tires.
- Replacement tires must be of the same load index as the original tires.
- Replacement tires must be of the same construction as the original tires.
- Replacement tires must have the same TPC specification number as the original tires.

The following may seriously be affected by the use of any other tire size, tire speed rating or tire type:

- May seriously affect the ride.
- May seriously affect the handling.
- May seriously affect the speedometer/odometer calibration.
- May seriously affect the antilock brake system.
- May seriously affect the vehicle ground clearance.
- May seriously affect the trailering capacity.
- May seriously affect the tire clearance to the body.
- May seriously affect the tire clearance to the chassis.

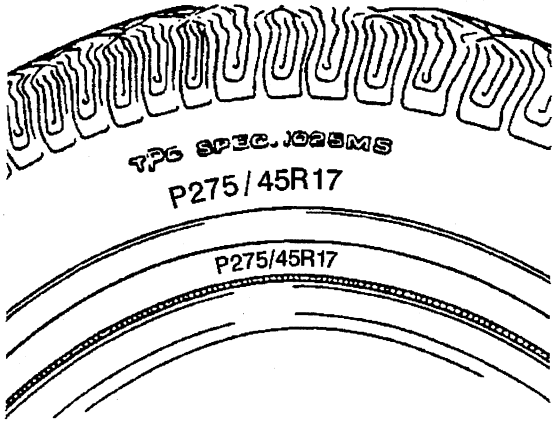
**Conditions for Tire Replacement**

Replace the tires when one and/or all of the following conditions are evident:

- When the tire(s) is worn to a point where 1.6 mm (2/32 in) or less of tread remains. The tires have built in tread wear indicators that appear between the tread grooves when the tread is worn to 1.6 mm (2/32 in) or less to help in the detection of this condition. Replace the tire when the indicators appear in two or more adjacent grooves at three spots around the tire.
- When the following conditions are evident on the tread:
  - When the tread is cracked.
  - When the tread is cut.
  - When the tread is snagged deeply enough to expose the cord.
  - When the tread is snagged deeply enough to expose the fabric.
  - When the sidewall is snagged deeply enough to expose the cord.
  - When the sidewall is snagged deeply enough to expose the fabric.
- When the following conditions are evident on the tire:
  - When the tire has a bump.
  - When the tire has a bulge (protrusion).
  - When the tire is split.
  - Please note that slight sidewall indentations are normal in radial tires.
- When the following damage is evident on the tire and the damage cannot be correctly repaired because of the size or the location of the damage:
  - When the tire has a puncture.
  - When the tire is cut, or other damage.

Always install new tires in pairs on the same axle. In the event that only one tire is replaced, then pair with the tire having the most tread.

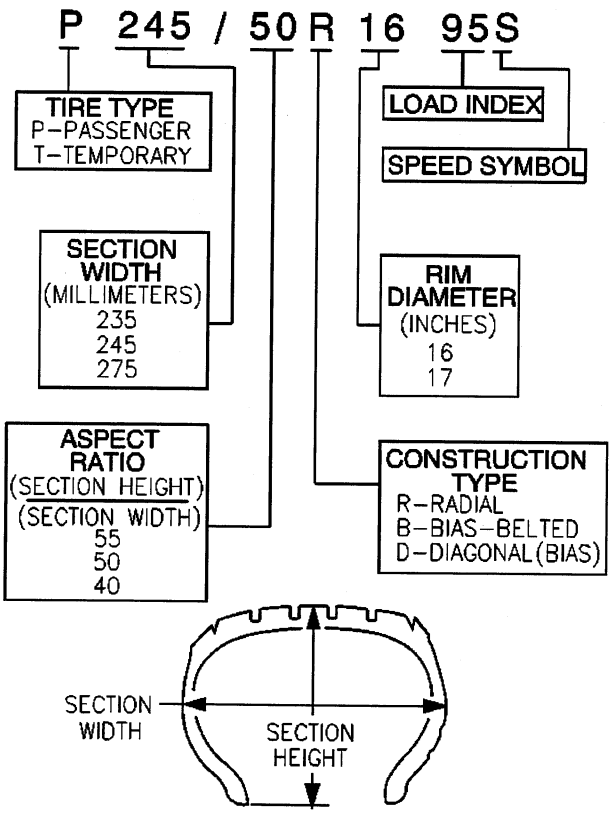
## All Seasons Tires Description




Most GM vehicles are equipped with steel belted all-season radial tires as standard equipment. These tires qualify as snow tires, with a higher than average rating for snow traction than the non-all season radial tires previously used. Other performance areas, such as wet traction, rolling resistance, tread life, and air retention, are also improved. This is done by improvements in both tread design and tread compounds. These tires are identified by an M + S molded in the tire side wall after the tire size. The suffix MS is also molded in the tire side wall after the TPC specification number.

The optional handling tires used on some vehicles now also have the MS marking after the tire size and the TPC specification number.

## 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.

### 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

### Selectable Four Wheel Drive (S4WD) Front Axle Description and Operation

The Selectable Four Wheel Drive (S4WD) Front Axle consist of the following components:

- Differential Carrier Housing
- Differential Assembly
- Output Shafts (Left and Right Side)
- Inner Axle Shaft Housing
- Inner Axle Shaft (Right Side)
- Clutch Fork
- Clutch Fork Sleeve
- Electric Motor Actuator

The front axle on Selectable Four Wheel Drive model vehicles uses a central disconnect feature in order to engage and disengage the front axle. When the driver engages the 4WD system, the Transfer Case Control Module sends a signal to the electric motor actuator to energize and extend the plunger inside. The extended plunger moves the clutch fork and clutch fork sleeve across the inner axle shaft and the clutch fork shaft and locks the two shafts together. The locking of the two shafts allows the axle to operate in the same manner as a semi-floating rear axle. A propeller shaft connects the transfer case to the front axle. The differential carrier assembly uses a conventional ring and pinion gear set 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 is located on top of the differential carrier assembly or on a label on the bottom of 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.

### Full-Time Four Wheel Drive (F4WD) Front Axle Description and Operation

The Full-Time Four Wheel Drive (F4WD) Front Axle consist of the following components:

- Differential Carrier Housing
- Differential Assembly
- Output Shaft (Left Side)
- Inner Axle Shaft Housing
- Inner Axle Shaft (Right Side)

The front axle on Full-Time Four Wheel Drive model vehicles does not have a central disconnect feature in order to engage and disengage the front axle. The left and right axle shafts are connected directly to the differential case assembly. This allows the axle shafts and the propeller shaft to spin continuously. The transfer case controls the amount of torque applied to the front axle. The remaining components are the same as the selectable four wheel drive axle.

## 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

The 800 series utility vehicles use either the 8.60, 9.50 or the 10.50 inch axles. The type of the axle can be identified by the stamping on the right side axle tube. They may also be identified by the ring gear size. The ring gear sizes include the 8.60, 9.50 and 10.50 inch axles. The locking differential information for these rear axles can be located in the locking differential section.

A open differential has a set of 4 gears. 2 are side gears and 2 are pinion gears. Each side gear is splined to an axle shaft so each axle shaft ; so 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 which is bolted to the differential case assembly. The differential pinion, as it rotates with 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 the 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. When the vehicle turns a corner the inner wheel turns slower than the outer wheel which slows the rear axles' side gear (as the shaft is splined to the side gear). The rear axle pinion gears will roll around the slower moving rear axle side gear; driving the rear axle side gear wheel faster.

## Locking/Limited Slip Rear Axle 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.

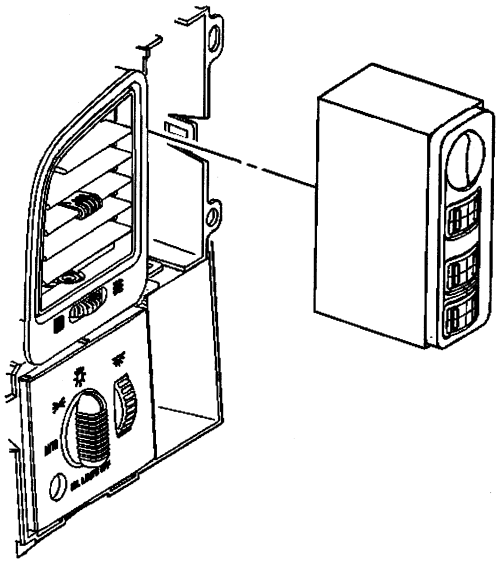
The service procedure, when the disc tangs shear, involves replacing the left-hand clutch plates and the wave spring. It is also necessary to examine the axle shafts for twisting because at high torques it is possible to not only shear the load-limiting disc, but to also twist the axle shafts.

## Transfer Case - NVG 246-NP8 (Two Speed Automatic)

### Transfer Case General Operation

The New Venture Gear model NVG 246 RPO NP8 transfer case is a two speed automatic, active, transfer case. The NVG 246 EAU provides 5 modes, Auto 4WD, 4HI, 4LO, 2HI and Neutral. The Auto 4WD position allows the capability of an active transfer case, which provides the benefits of on-demand torque biasing wet clutch and easy vehicle tuning through software calibrations. The software calibrations allow more features such as flexible adapt ready position and clutch preload torque levels. The technology allows for vehicle speed dependent clutch torque levels to enhance the performance of the system. For example, the system is calibrated to provide 0-5 ft lb of clutch torque during low speed, low engine torque operation, and predetermined higher torque for 40 km/h (25 mph) and greater. This prevents crow-hop and binding at low speeds and provides higher torque biases at higher vehicle speeds, in order to enhance stability.

### Transfer Case Shift Control Switch



The NVG 246 EAU transfer case features a 4 button shift control switch located on the instrument panel. When the ignition key is in the RUN position, the transfer case shift control module monitors the transfer case shift control switch to determine if the driver desires a new mode/range 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/range position. The lamp will continue to flash until all shifting criteria has been met and the new mode/range position has been reached, or has been engaged. Once the new mode/range 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 control actuator lever 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 ramped up to the front wheels until the front propshaft speed sensor matches that of the rear propshaft speed sensor. Torque is ramped down to the front wheels. The process would repeat if rear wheel slip is detected again.

The NVG 246 EAU transfer case has the added feature of also providing the driver with 3 manual mode/range 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/range 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.
- 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 rotating the transmission output shaft. Neutral position may be obtained only if the following criteria has been met:

- The engine is running.
- The automatic transmission is in Neutral.
- 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.

The NVG 246 EAU case halves are high-pressure die-cast magnesium. Ball bearings support the input shaft, the front output shaft, and the rear output shaft. A thrust bearing is located inside of the input shaft gear to support the front of the rear output shaft. The transfer case requires Auto Trac® II Fluid GM P/N 12378508 (Canadian P/N 10953626) which is blue in color. The fluid is designed for smooth clutch application. An oil pump, driven by the rear output shaft, pumps the fluid through the rear output shaft oil gallery to the clutch and bearings.

There are two versions of the NVG 246 EAU, which depend on the transmission applications and vehicle applications. If the vehicle is equipped with a transmission RPO M30, the transmission splines in the input gear will have 27 teeth. With this application the planetary carrier assembly will have 3 pinion gears. If the vehicle is equipped with transmission RPO MT1 or MN8, the transmission splines in the input gear will have 32 teeth. The planetary carrier assembly on this application will have 6 pinion gears.

## Transfer Case Circuit Description

### Transfer Case Shift Control Module

The transfer case shift control module uses the VIN information for calculations that are required for the different calibrations used based on axle ratio, transmission, tire size, and engine. The system does not know which calibration to use without this information.

### Transfer Case Encoder Motor

The transfer case encoder motor consists of a permanent magnet (PM) DC motor and gear reduction assembly. It is located on the left hand side (drivers side) of the transfer case. When activated it turns the sector shaft of the transfer case (clockwise or counter clockwise) to shift the transfer case. The encoder motor is controlled with a pulse width modulated (PWM) circuit within the transfer case shift control module. This circuit consists of a driver on both the Motor Feed A and Motor Feed B circuits. The encoder motor is bi-directional to allow the motor to shift the transfer case from 2HI or 4HI to NEUTRAL and 4LO positions.

### Transfer Case Encoder

The encoder is mounted to the transfer case encoder motor assembly and is replaced as an assembly. The encoder converts the sector shaft position (representing a mode or range) into electrical signals inputs to the transfer case shift control module. The module can detect what position the transfer case is in by monitoring the 4 encoder channels (P, A, B, and C). These inputs translates into AUTO 4WD, 2H, 4H, NEUTRAL, and 4L or in transition between gears.

**Transfer Case Motor Lock**

The transfer case motor lock is used to provide a 2H, 4H, and 4L lock-up feature. When the lock circuit is energized, the transfer case encoder motor is allowed to turn. When the transfer case is placed 2H, 4H, or 4L the motor lock circuit has no power provided to it and the lock is applied. This assures that the transfer case remains in the current gear position. When AUTO 4WD is selected the motor lock remains applied until an adaptive mode (torque is applied to the front propshaft) is required. During an adaptive mode the motor lock circuit is energized and the motor lock is released, enabling the encoder motor to turn and apply torque to the front propshaft.

**Transfer Case Speed Sensors**

There are three speed sensors on the automatic transfer case (ATC), two on the rear output shaft and one on the front output shaft. Each speed sensor is a permanent magnet (PM) generator. The PM generator produces a pulsing AC voltage. The AC voltage level and number of pulses increases as speed increases.

Vehicle Speed Sensor

One of the two on the rear output shaft is the vehicle speed sensor (VSS) input to the/powertrain control module (PCM). The PCM sends this information to the transfer case shift control module via the Class 2 Serial Data bus.

Rear Propshaft Speed Sensor

The transfer case shift control module converts the pulsating AC voltage from the rear transfer case speed sensor to a rear propshaft speed in RPM to be used for calculations. The rear propshaft speed can be displayed with a scan tool.

Front Propshaft Speed Sensor

The transfer case shift control module converts the pulsating AC voltage from the front transfer case speed sensor to front propshaft speed in RPM to be used for calculations, and to monitor the difference between the front and rear sensor speed. It is also used in the AUTO 4WD mode of operation to determine the amount of slip and the percent of torque to apply to the front axle. The front propshaft speed can be displayed with a scan tool.

**SERVICE indicator (4WD/AWD) Lamp**

The SERVICE indicator (4WD/AWD) lamp is an integral part of the cluster and cannot be serviced separately. This lamp is used to inform the driver of the vehicle of malfunctions within the automatic transfer case (ATC) system. The SERVICE indicator (4WD/AWD) lamp is controlled by the transfer case shift control module via a Class 2 message or by a Sevice Indicator Control Circuit.

## Transfer Case - BW 4482-NR4

The Borg Warner (BW) model 4482 NR4 transfer case is a two-speed, full time 4WD, transfer case. The transfer case has an external planetary type differential, which has two different sets of pinion gears. The planetary differential provides a 40/60 torque split front/rear full time. This means the front and rear propeller shafts are constantly being driven for maximum traction in all conditions.

While in the 4HI mode, the transfer case external type planetary differential functions the same as a typical rear axle differential. The transfer case differential pinion gears function as the spider gears, and the sun gears function as the side gears.

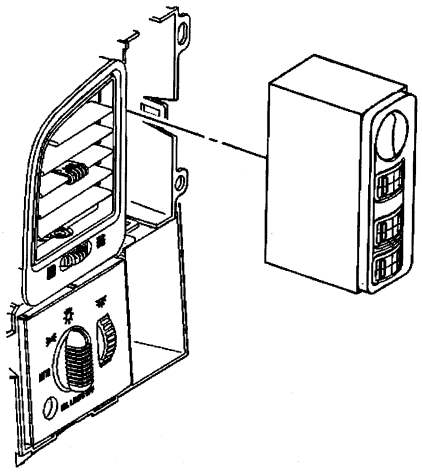
The following actions occur because of the planetary differential:

- If the vehicle is on a hoist, and in the 4HI mode, the front propeller shaft can be rotated by hand.
- The vehicle cannot be driven in the 4HI mode if one propeller shaft is removed.
- Operating the vehicle on the hoist, in the 4HI mode, can damage the differential pinion gears, by over-spinning.
- Operating the vehicle with one propeller shaft removed, in the 4HI mode, causes over-spinning of the differential pinion gears.

The BW 4482 design of the planetary differential allows use with the Vehicle Stability Enhancement System (VSES) vehicles. The VSES takes use of the planetary differential, by applying braking to a tire that has less traction and dividing the engine torque to the other axle. A high/low planetary carrier assembly provides the high and low ranges, which is a 4-pinion gear, sun gear, and annulus gear arrangement, giving a 2.64 low range reduction ratio.

The BW 4482 case halves are high-pressure die-cast magnesium. Ball bearings support the input shaft, the front output shaft, and the rear output shaft. A needle roller bearing is located inside of the input shaft gear to support the front of the mainshaft. The rear of the mainshaft is supported by a bronze bearing inside the rear output shaft. The transfer case requires DEXRON®III ATF Fluid GM P/N 12346143 (Canadian P/N 10952622), which is red in color. An oil pump pumps the fluid through the mainshaft oil gallery to the gears and bearings.

### Transfer Case Shift Control Switch



The BW 4482 transfer case features a 3-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/range 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/range position. The lamp will continue to flash until all shifting criteria have been met and

the new mode/range position has been reached, or has been engaged. Once the new mode/range position is fully active, the switch indicator lamp for the new position will remain ON constantly. In addition, the switch includes a VSES request button which sends a voltage signal to the transfer case shift control module. The transfer case shift control module in turn sends a request via the class 2 data bus to the ABS control module which controls the VSES system.

During normal driving situations, the transfer case operates in the 4HI mode. When the 4HI mode is selected, the transfer case shift control module sends 12 volts to an electrical motor, which is the transfer case encoder motor. This motor rotates the transfer case shift detent lever shaft which moves the shift forks and range sleeve to obtain different modes/ranges.

The BW 4482 transfer case has the added feature of also providing the driver with 2 selectable mode/range positions and a VSES request button:

- 4HI - Full Time 4 Wheel Drive
- 4LO - 4 Wheel Drive Low Locked
- VSES - Vehicle Stability Enhancement System

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.
- 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 transmission output shaft rotating. Refer to the Owners Manual for instructions for proper towing of the vehicle.

Neutral position may be obtained only if the following criteria have been met:

- The ignition switch is ON.
- The automatic transmission is in Neutral.
- The vehicle speed is below 5 km/h (3 mph).
- The transfer case is in the 4HI mode.

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

## 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 parking brake shoes against the drum of the rotor, locking the rear brakes.

All vehicles are equipped with a four-wheel disc braking system. The park brake system uses brake shoes which are inside a brake drum that is part of a one-piece drum/rotor casting. The brake shoes are mechanically applied to lock the rear brakes.

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 park brake lever incorporates a cable self adjusting mechanism. The park brake release handle under the instrument panel allows the driver to release the park brake and control the foot lever release velocity. The park brake lever requires minimal pedal effort to engage the park brake.

### Cable System

The park brake uses a cable system that includes a front cable, an intermediate cable with a threaded rod and an equalizer, and two rear cables. The front cable connects to the park brake lever on one end and to the intermediate cable at the other end. The rear cables attach to the equalizer on one end and to the lever on the disc brakes at the other end.

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

## Drive Belt System Description

The drive belt system consists of the following components:

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

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

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

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

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

# Engine Mechanical –5.3, 6.0L

## General Specifications 5.3L (LM7 VIN T)

| Application | Specification | |
|---|---|---|
| | Metric | English |
| **General** | | |
| Engine Type | V8 | |
| Displacement | 5.3L | 325 CID |
| RPO | LM7 | |
| VIN | T | |
| Bore | 96.0-96.018 mm | 3.779-3.78 in |
| Stroke | 92.0 mm | 3.622 in |
| Compression Ratio | 9.49:1 | |
| Firing Order | 1-8-7-2-6-5-4-3 | |
| **Spark Plug Gap** | | |
| AC Delco Type 41-974 | 1.524 mm | 0.06 in |
| AC Delco Type 41-985 | 1.016 mm | 0.04 in |
| **Block** | | |
| Camshaft Bearing Bore 1 and 5 Diameter - First Design | 59.12-59.17 mm | 2.327-2.329 in |
| Camshaft Bearing Bore 2 and 4 Diameter - First Design | 58.87-58.92 mm | 2.317-2.319 in |
| Camshaft Bearing Bore 3 Diameter - First Design | 58.62-58.67 mm | 2.307-2.309 in |
| Camshaft Bearing Bore 1 and 5 Diameter - Second Design | 59.62-59.67 mm | 2.347-2.349 in |
| Camshaft Bearing Bore 2 and 4 Diameter - Second Design | 59.12-59.17 mm | 2.327-2.329 in |
| Camshaft Bearing Bore 3 Diameter - Second Design | 58.62-58.67 mm | 2.307-2.309 in |
| Crankshaft Main Bearing Bore Diameter | 69.871-69.889 mm | 2.75-2.751 in |
| Crankshaft Main Bearing Bore Out-of-Round | 0.006 mm | 0.0002 in |
| Cylinder Bore Diameter | 96.0-96.018 mm | 3.779-3.78 in |
| Cylinder Bore Taper - Thrust Side | 0.018 mm | 0.0007 in |
| Cylinder Head Deck Height - Measuring from the Centerline of Crankshaft to the Deck Face | 234.57-234.82 mm | 9.235-9.245 in |
| Cylinder Head Deck Surface Flatness - Measured Within a 152.4 mm (6.0 in) Area | 0.11 mm | 0.004 in |
| Cylinder Head Deck Surface Flatness - Measuring the Overall Length of the Block Deck | 0.22 mm | 0.008 in |
| Valve Lifter Bore Diameter | 21.417-21.443 mm | 0.843-0.844 in |
| **Camshaft** | | |
| Camshaft End Play | 0.025-0.305 mm | 0.001-0.012 in |
| Camshaft Journal Diameter | 54.99-55.04 mm | 2.164-2.166 in |
| Camshaft Journal Out-of-Round | 0.025 mm | 0.001 in |
| Camshaft Lobe Lift - Exhaust | 6.96 mm | 0.274 in |
| Camshaft Lobe Lift - Intake | 6.82 mm | 0.268 in |
| Camshaft Runout - Measured at the Intermediate Journals | 0.05 mm | 0.002 in |
| **Connecting Rod** | | |
| Connecting Rod Bearing Clearance - Production | 0.023-0.065 mm | 0.0009-0.0025 in |
| Connecting Rod Bearing Clearance - Service | 0.023-0.076 mm | 0.0009-0.003 in |
| Connecting Rod Bore Diameter - Bearing End | 56.505-56.525 mm | 2.224-2.225 in |
| Connecting Rod Bore Out-of-Round - Bearing End - Production | 0.004-0.008 mm | 0.00015-0.0003 in |
| Connecting Rod Bore Out-of-Round - Bearing End - Service | 0.004-0.008 mm | 0.00015-0.0003 in |
| Connecting Rod Side Clearance | 0.11-0.51 mm | 0.00433-0.02 in |

| Application | Specification | |
|---|---|---|
| | Metric | English |
| **Crankshaft** | | |
| Connecting Rod Journal Diameter - Production | 53.318-53.338 mm | 2.0991-2.0999 in |
| Connecting Rod Journal Diameter - Service | 53.308 mm | 2.0987 in |
| Connecting Rod Journal Out-of-Round - Production | 0.005 mm | 0.0002 in |
| Connecting Rod Journal Out-of-Round - Service | 0.01 mm | 0.0004 in |
| Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production | 0.005 mm | 0.0002 in |
| Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service | 0.02 mm | 0.00078 in |
| Crankshaft End Play | 0.04-0.2 mm | 0.0015-0.0078 in |
| Crankshaft Main Bearing Clearance - Production | 0.02-0.052 mm | 0.0008-0.0021 in |
| Crankshaft Main Bearing Clearance - Service | 0.02-0.065 mm | 0.0008-0.0025 in |
| Crankshaft Main Journal Diameter - Production | 64.992-65.008 mm | 2.558-2.559 in |
| Crankshaft Main Journal Diameter - Service | 64.992 mm | 2.558 in |
| Crankshaft Main Journal Out-of-Round - Production | 0.003 mm | 0.000118 in |
| Crankshaft Main Journal Out-of-Round - Service | 0.008 mm | 0.0003 in |
| Crankshaft Main Journal Taper - Production | 0.01 mm | 0.0004 in |
| Crankshaft Main Journal Taper - Service | 0.02 mm | 0.00078 in |
| Crankshaft Rear Flange Runout | 0.05 mm | 0.002 in |
| Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter | 0.7 mm | 0.028 in |
| Crankshaft Thrust Surface - Production | 26.14-26.22 mm | 1.029-1.0315 in |
| Crankshaft Thrust Surface - Service | 26.22 mm | 1.0315 in |
| Crankshaft Thrust Surface Runout | 0.025 mm | 0.001 in |
| **Cylinder Head** | | |
| Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface | 120.2 mm | 4.732 in |
| Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area | 0.08 mm | 0.003 in |
| Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head | 0.1 mm | 0.004 in |
| Surface Flatness - Exhaust Manifold Deck | 0.13 mm | 0.005 in |
| Surface Flatness - Intake Manifold Deck | 0.08 mm | 0.0031 in |
| Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide | 17.32 mm | 0.682 in |
| **Intake Manifold** | | |
| Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes Two Runner Port Openings | 0.3 mm | 0.118 in |
| **Lubrication System** | | |
| Oil Capacity - with Filter | 5.68 liters | 6.0 quarts |
| Oil Capacity - without Filter | 4.73 liters | 5.0 quarts |
| Oil Pressure - Minimum - Hot | 41 kPa at 1,000 engine RPM<br>124 kPa at 2,000 engine RPM<br>165 kPa at 4,000 engine RPM | 6 psig at 1,000 engine RPM<br>18 psig at 2,000 engine RPM<br>24 psig at 4,000 engine RPM |

| Application | Specification | |
|---|---|---|
| | Metric | English |
| **Oil Pan** | | |
| Front Cover Alignment - at Oil Pan Surface | 0.0-0.5 mm | 0.0-0.02 in |
| Rear Cover Alignment - at Oil Pan Surface | 0.0-0.5 mm | 0.0-0.02 in |
| Oil Pan Alignment - to Rear of Engine Block at Transmission Bell Housing Mounting Surface | 0.0-0.25 mm | 0.0-0.01 in |
| **Piston Rings** | | |
| Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Production | 0.23-0.44 mm | 0.009-0.017 in |
| Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Service | 0.23-0.5 mm | 0.009-0.0196 in |
| Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Production | 0.44-0.7 mm | 0.017-0.027 in |
| Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Service | 0.44-0.76 mm | 0.0173-0.03 in |
| Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Production | 0.18-0.75 mm | 0.007-0.029 in |
| Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Service | 0.18-0.81 mm | 0.007-0.032 in |
| Piston Ring to Groove Clearance - First Compression Ring - Production | 0.04-0.085 mm | 0.00157-0.00335 in |
| Piston Ring to Groove Clearance - First Compression Ring - Service | 0.04-0.085 mm | 0.00157-0.00335 in |
| Piston Ring to Groove Clearance - Second Compression Ring - Production | 0.04-0.078 mm | 0.00157-0.0031 in |
| Piston Ring to Groove Clearance - Second Compression Ring - Service | 0.04-0.078 mm | 0.00157-0.0031 in |
| Piston Ring to Groove Clearance - Oil Control Ring - Production | 0.012-0.2 mm | 0.0005-0.0078 in |
| Piston Ring to Groove Clearance - Oil Control Ring - Service | 0.012-0.2 mm | 0.0005-0.0078 in |
| **Pistons and Pins** | | |
| Piston - Piston Diameter - Measured Over Skirt Coating | 96.002-96.036 mm | 3.779-3.78 in |
| Piston - Piston to Bore Clearance - Production | -0.036 to 0.016 mm | -0.0014 to 0.0006 in |
| Piston - Piston to Bore Clearance - Service Limit with Skirt Coating Worn Off | 0.071 mm | 0.0028 in |
| Pin - Piston Pin Fit in Connecting Rod Bore | 0.02-0.043 mm - interference | 0.00078-0.00169 in - interference |
| Pin - Piston Pin Clearance to Piston Pin Bore - Production | 0.007-0.02 mm | 0.00027-0.00078 in |
| Pin - Piston Pin Clearance to Piston Pin Bore - Service | 0.007-0.021 mm | 0.00027-0.00082 in |
| Pin - Piston Pin Diameter | 23.997-24.0 mm | 0.9447-0.9448 in |
| **Valve System** | | |
| Valves - Valve Face Angle | 45 degrees | |
| Valves - Valve Face Width | 1.25 mm | 0.05 in |
| Valves - Valve Lash | Net Lash - No Adjustment | |
| Valves - Valve Lift - Intake | 11.6 mm | 0.457 in |
| Valves - Valve Lift - Exhaust | 11.85 mm | 0.466 in |
| Valves - Valve Seat Angle | 46 degrees | |
| Valves - Valve Seat Runout | 0.05 mm | 0.002 in |
| Valves - Valve Seat Width - Exhaust | 1.78 mm | 0.07 in |
| Valves - Seat Width - Intake | 1.02 mm | 0.04 in |
| Valves - Valve Stem Diameter - Production | 7.955-7.976 mm | 0.313-0.314 in |

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Valves - Valve Stem Diameter - Service | 7.95 mm | 0.313 in |
| Valves - Valve Stem-to-Guide Clearance - Production - Intake | 0.025-0.066 mm | 0.001-0.0026 in |
| Valves - Valve Stem-to-Guide Clearance - Service - Intake | 0.093 mm | 0.0037 in |
| Valves - Valve Stem-to-Guide Clearance - Production - Exhaust | 0.025-0.066 mm | 0.001-0.0026 in |
| Valves - Valve Stem-to-Guide Clearance - Service - Exhaust | 0.093 mm | 0.0037 in |
| Rocker Arms - Valve Rocker Arm Ratio | 1.70:1 | |
| Valve Springs - Valve Spring Free Length | 52.9 mm | 2.08 in |
| Valve Springs - Valve Spring Installed Height | 45.75 mm | 1.8 in |
| Valve Springs - Valve Spring Load - Closed | 340 N at 45.75 mm | 76 lb at 1.8 in |
| Valve Springs - Valve Spring Load - Open | 980 N at 33.55 mm | 220 lb at 1.32 in |

## Engine Mechanical Specifications (L59 VIN Z)

| Application | Specification | |
|---|---|---|
| | Metric | English |
| **General** | | |
| Engine Type | V8 | |
| Displacement | 5.3L | 325 CID |
| RPO | L59 | |
| VIN | Z | |
| Bore | 96.0-96.018 mm | 3.779-3.78 in |
| Stroke | 92.0 mm | 3.622 in |
| Compression Ratio | 9.49:1 | |
| Firing Order | 1-8-7-2-6-5-4-3 | |
| Spark Plug Gap | 1.524 mm | 0.06 in |
| **Block** | | |
| Camshaft Bearing Bore 1 and 5 Diameter - First Design | 59.12-59.17 mm | 2.327-2.329 in |
| Camshaft Bearing Bore 2 and 4 Diameter - First Design | 58.87-58.92 mm | 2.317-2.319 in |
| Camshaft Bearing Bore 3 Diameter - First Design | 58.62-58.67 mm | 2.307-2.309 in |
| Camshaft Bearing Bore 1 and 5 Diameter - Second Design | 59.62-59.67 mm | 2.347-2.349 in |
| Camshaft Bearing Bore 2 and 4 Diameter - Second Design | 59.12-59.17 mm | 2.327-2.329 in |
| Camshaft Bearing Bore 3 Diameter - Second Design | 58.62-58.67 mm | 2.307-2.309 in |
| Crankshaft Main Bearing Bore Diameter | 69.871-69.889 mm | 2.75-2.751 in |
| Crankshaft Main Bearing Bore Out-of-Round | 0.006 mm | 0.0002 in |
| Cylinder Bore Diameter | 96.0-96.018 mm | 3.779-3.78 in |
| Cylinder Bore Taper - Thrust Side | 0.018 mm | 0.0007 in |
| Cylinder Head Deck Height - Measuring from the Centerline of Crankshaft to the Deck Face | 234.57-234.82 mm | 9.235-9.245 in |
| Cylinder Head Deck Surface Flatness - Measured Within a 152.4 mm (6.0 in) Area | 0.11 mm | 0.004 in |
| Cylinder Head Deck Surface Flatness - Measuring the Overall Length of the Block Deck | 0.22 mm | 0.008 in |
| Valve Lifter Bore Diameter | 21.417-21.443 mm | 0.843-0.844 in |
| **Camshaft** | | |
| Camshaft End Play | 0.025-0.305 mm | 0.001-0.012 in |
| Camshaft Journal Diameter | 54.99-55.04 mm | 2.164-2.166 in |
| Camshaft Journal Out-of-Round | 0.025 mm | 0.001 in |
| Camshaft Lobe Lift - Exhaust | 6.96 mm | 0.274 in |
| Camshaft Lobe Lift - Intake | 6.82 mm | 0.268 in |
| Camshaft Runout - Measured at the Intermediate Journals | 0.05 mm | 0.002 in |
| **Connecting Rod** | | |
| Connecting Rod Bearing Clearance - Production | 0.023-0.065 mm | 0.0009-0.0025 in |
| Connecting Rod Bearing Clearance - Service | 0.023-0.076 mm | 0.0009-0.003 in |
| Connecting Rod Bore Diameter - Bearing End | 56.505-56.525 mm | 2.224-2.225 in |
| Connecting Rod Bore Out-of-Round - Bearing End - Production | 0.004-0.008 mm | 0.00015-0.0003 in |
| Connecting Rod Bore Out-of-Round - Bearing End - Service | 0.004-0.008 mm | 0.00015-0.0003 in |
| Connecting Rod Side Clearance | 0.11-0.51 mm | 0.00433-0.02 in |
| **Crankshaft** | | |
| Connecting Rod Journal Diameter - Production | 53.318-53.338 mm | 2.0991-2.0999 in |
| Connecting Rod Journal Diameter - Service | 53.308 mm | 2.0987 in |
| Connecting Rod Journal Out-of-Round - Production | 0.005 mm | 0.0002 in |
| Connecting Rod Journal Out-of-Round - Service | 0.01 mm | 0.0004 in |

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production | 0.005 mm | 0.0002 in |
| Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service | 0.02 mm | 0.00078 in |
| Crankshaft End Play | 0.04-0.2 mm | 0.0015-0.0078 in |
| Crankshaft Main Bearing Clearance - Production | 0.02-0.052 mm | 0.0008-0.0021 in |
| Crankshaft Main Bearing Clearance - Service | 0.02-0.065 mm | 0.0008-0.0025 in |
| Crankshaft Main Journal Diameter - Production | 64.992-65.008 mm | 2.558-2.559 in |
| Crankshaft Main Journal Diameter - Service | 64.992 mm | 2.558 in |
| Crankshaft Main Journal Out-of-Round - Production | 0.003 mm | 0.000118 in |
| Crankshaft Main Journal Out-of-Round - Service | 0.008 mm | 0.0003 in |
| Crankshaft Main Journal Taper - Production | 0.01 mm | 0.0004 in |
| Crankshaft Main Journal Taper - Service | 0.02 mm | 0.00078 in |
| Crankshaft Rear Flange Runout | 0.05 mm | 0.002 in |
| Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter | 0.7 mm | 0.028 in |
| Crankshaft Thrust Surface - Production | 26.14-26.22 mm | 1.029-1.0315 in |
| Crankshaft Thrust Surface - Service | 26.22 mm | 1.0315 in |
| Crankshaft Thrust Surface Runout | 0.025 mm | 0.001 in |
| **Cylinder Head** | | |
| Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface | 120.2 mm | 4.732 in |
| Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area | 0.08 mm | 0.003 in |
| Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head | 0.1 mm | 0.004 in |
| Surface Flatness - Exhaust Manifold Deck | 0.13 mm | 0.005 in |
| Surface Flatness - Intake Manifold Deck | 0.08 mm | 0.0031 in |
| Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide | 17.32 mm | 0.682 in |
| **Intake Manifold** | | |
| Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes Two Runner Port Openings | 0.3 mm | 0.118 in |
| **Lubrication System** | | |
| Oil Capacity - with Filter | 5.68 liters | 6.0 quarts |
| Oil Capacity - without Filter | 4.73 liters | 5.0 quarts |
| Oil Pressure - Minimum - Hot | 41 kPa at 1,000 engine RPM<br>124 kPa at 2,000 engine RPM<br>165 kPa at 4,000 engine RPM | 6 psig at 1,000 engine RPM<br>18 psig at 2,000 engine RPM<br>24 psig at 4,000 engine RPM |
| **Oil Pan** | | |
| Front Cover Alignment - at Oil Pan Surface | 0.0-0.5 mm | 0.0-0.02 in |
| Rear Cover Alignment - at Oil Pan Surface | 0.0-0.5 mm | 0.0-0.02 in |
| Oil Pan Alignment - to Rear of Engine Block at Transmission Bell Housing Mounting Surface | 0.0-0.25 mm | 0.0-0.01 in |

| Application | Specification | |
|---|---|---|
| | Metric | English |
| **Piston Rings** | | |
| Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Production | 0.23-0.44 mm | 0.009-0.017 in |
| Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Service | 0.23-0.5 mm | 0.009-0.0196 in |
| Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Production | 0.44-0.7 mm | 0.017-0.027 in |
| Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Service | 0.44-0.76 mm | 0.0173-0.03 in |
| Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Production | 0.18-0.75 mm | 0.007-0.029 in |
| Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Service | 0.18-0.81 mm | 0.007-0.032 in |
| Piston Ring to Groove Clearance - First Compression Ring - Production | 0.04-0.085 mm | 0.00157-0.00335 in |
| Piston Ring to Groove Clearance - First Compression Ring - Service | 0.04-0.085 mm | 0.00157-0.00335 in |
| Piston Ring to Groove Clearance - Second Compression Ring - Production | 0.04-0.078 mm | 0.00157-0.0031 in |
| Piston Ring to Groove Clearance - Second Compression Ring - Service | 0.04-0.078 mm | 0.00157-0.0031 in |
| Piston Ring to Groove Clearance - Oil Control Ring - Production | 0.012-0.2 mm | 0.0005-0.0078 in |
| Piston Ring to Groove Clearance - Oil Control Ring - Service | 0.012-0.2 mm | 0.0005-0.0078 in |
| **Pistons and Pins** | | |
| Piston - Piston Diameter - Measured Over Skirt Coating | 96.002-96.036 mm | 3.779-3.78 in |
| Piston - Piston to Bore Clearance - Production | -0.036 to 0.016 mm | -0.0014 to 0.0006 in |
| Piston - Piston to Bore Clearance - Service Limit with Skirt Coating Worn Off | 0.071 mm | 0.0028 in |
| Pin - Piston Pin Fit in Connecting Rod Bore | 0.02-0.043 mm - interference | 0.00078-0.00169 in - interference |
| Pin - Piston Pin Clearance to Piston Pin Bore - Production | 0.007-0.02 mm | 0.00027-0.00078 in |
| Pin - Piston Pin Clearance to Piston Pin Bore - Service | 0.007-0.021 mm | 0.00027-0.00082 in |
| Pin - Piston Pin Diameter | 23.997-24.0 mm | 0.9447-0.9448 in |
| **Valve System** | | |
| Valves - Valve Face Angle | 45 degrees | |
| Valves - Valve Face Width | 1.25 mm | 0.05 in |
| Valves - Valve Lash | Net Lash - No Adjustment | |
| Valves - Valve Lift - Intake | 11.6 mm | 0.457 in |
| Valves - Valve Lift - Exhaust | 11.85 mm | 0.466 in |
| Valves - Valve Seat Angle | 46 degrees | |
| Valves - Valve Seat Runout | 0.05 mm | 0.002 in |
| Valves - Valve Seat Width - Exhaust | 1.78 mm | 0.07 in |
| Valves - Seat Width - Intake | 1.02 mm | 0.04 in |
| Valves - Valve Stem Diameter - Production | 7.955-7.976 mm | 0.313-0.314 in |
| Valves - Valve Stem Diameter - Service | 7.95 mm | 0.313 in |
| Valves - Valve Stem-to-Guide Clearance - Production - Intake | 0.025-0.066 mm | 0.001-0.0026 in |
| Valves - Valve Stem-to-Guide Clearance - Service - Intake | 0.093 mm | 0.0037 in |
| Valves - Valve Stem-to-Guide Clearance - Production - Exhaust | 0.025-0.066 mm | 0.001-0.0026 in |

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Valves - Valve Stem-to-Guide Clearance - Service - Exhaust | 0.093 mm | 0.0037 in |
| Rocker Arms - Valve Rocker Arm Ratio | 1.70:1 | |
| Valve Springs - Valve Spring Free Length | 52.9 mm | 2.08 in |
| Valve Springs - Valve Spring Installed Height | 45.75 mm | 1.8 in |
| Valve Springs - Valve Spring Load - Closed | 340 N at 45.75 mm | 76 lb at 1.8 in |
| Valve Springs - Valve Spring Load - Open | 980 N at 33.55 mm | 220 lb at 1.32 in |

## General Specifications 6.0L (LQ4 VIN U)

| Application | Specification | |
|---|---|---|
| | Metric | English |
| **General** | | |
| Engine Type | V8 | |
| Displacement | 6.0L | 364 CID |
| RPO | LQ4 | |
| VIN | U | |
| Bore | 101.618-101.636 mm | 4.0007-4.0014 in |
| Stroke | 92.0 mm | 3.622 in |
| Compression Ratio | 9.41:1 | |
| Firing Order | 1-8-7-2-6-5-4-3 | |
| **Spark Plug Gap** | | |
| AC Delco Type 41-974 | 1.524 mm | 0.06 in |
| AC Delco Type 41-985 | 1.016 mm | 0.04 in |
| **Block** | | |
| Camshaft Bearing Bore 1 and 5 Diameter - First Design | 59.12-59.17 mm | 2.327-2.329 in |
| Camshaft Bearing Bore 2 and 4 Diameter - First Design | 58.87-58.92 mm | 2.317-2.319 in |
| Camshaft Bearing Bore 3 Diameter - First Design | 58.62-58.67 mm | 2.307-2.309 in |
| Camshaft Bearing Bore 1 and 5 Diameter - Second Design | 59.62-59.67 mm | 2.347-2.349 in |
| Camshaft Bearing Bore 2 and 4 Diameter - Second Design | 59.12-59.17 mm | 2.327-2.329 in |
| Camshaft Bearing Bore 3 Diameter - Second Design | 58.62-58.67 mm | 2.307-2.309 in |
| Crankshaft Main Bearing Bore Diameter | 69.871-69.889 mm | 2.75-2.751 in |
| Crankshaft Main Bearing Bore Out-of-Round | 0.006 mm | 0.0002 in |
| Cylinder Bore Diameter | 101.618-101.636 mm | 4.0007-4.0017 in |
| Cylinder Bore Taper - Thrust Side | 0.018 mm | 0.0007 in |
| Cylinder Head Deck Height - Measuring from the Centerline of Crankshaft to the Deck Face | 234.57-234.82 mm | 9.235-9.245 in |
| Cylinder Head Deck Surface Flatness - Measured within a 152.4 mm (6.0 in) Area | 0.11 mm | 0.004 in |
| Cylinder Head Deck Surface Flatness - Measuring the Overall Length of the Block Deck | 0.22 mm | 0.008 in |
| Valve Lifter Bore Diameter | 21.417-21.443 mm | 0.843-0.844 in |
| **Camshaft** | | |
| Camshaft End Play | 0.025-0.305 mm | 0.001-0.012 in |
| Camshaft Journal Diameter | 54.99-55.04 mm | 2.164-2.166 in |
| Camshaft Journal Out-of-Round | 0.025 mm | 0.001 in |
| Camshaft Lobe Lift - Exhaust | 7.13 mm | 0.281 in |
| Camshaft Lobe Lift - Intake | 6.96 mm | 0.274 in |
| Camshaft Runout - Measured at the Intermediate Journals | 0.05 mm | 0.002 in |
| **Connecting Rod** | | |
| Connecting Rod Bearing Clearance - Production | 0.023-0.065 mm | 0.0009-0.0025 in |
| Connecting Rod Bearing Clearance - Service | 0.023-0.076 mm | 0.0009-0.003 in |
| Connecting Rod Bore Diameter - Bearing End | 56.505-56.525 mm | 2.224-2.225 in |
| Connecting Rod Bore Out-of-Round - Bearing End - Production | 0.006 mm | 0.0002 in |
| Connecting Rod Bore Out-of-Round - Bearing End - Service | 0.006 mm | 0.0002 in |
| Connecting Rod Side Clearance | 0.11-0.51 mm | 0.00433-0.02 in |

| Application | Specification | |
|---|---|---|
| | Metric | English |
| **Crankshaft** | | |
| Connecting Rod Journal Diameter - Production | 53.318-53.338 mm | 2.0991-2.0999 in |
| Connecting Rod Journal Diameter - Service | 53.308 mm | 2.0987 in |
| Connecting Rod Journal Out-of-Round - Production | 0.005 mm | 0.0002 in |
| Connecting Rod Journal Out-of-Round - Service | 0.01 mm | 0.0004 in |
| Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production | 0.005 mm | 0.0002 in |
| Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service | 0.02 mm | 0.00078 in |
| Crankshaft End Play | 0.04-0.2 mm | 0.0015-0.0078 in |
| Crankshaft Main Bearing Clearance - Production | 0.02-0.052 mm | 0.0008-0.0021 in |
| Crankshaft Main Bearing Clearance - Service | 0.02-0.065 mm | 0.0008-0.0025 in |
| Crankshaft Main Journal Diameter - Production | 64.992-65.008 mm | 2.558-2.559 in |
| Crankshaft Main Journal Diameter - Service | 64.992 mm | 2.558 in |
| Crankshaft Main Journal Out-of-Round - Production | 0.003 mm | 0.000118 in |
| Crankshaft Main Journal Out-of-Round - Service | 0.008 mm | 0.0003 in |
| Crankshaft Main Journal Taper - Production | 0.01 mm | 0.0004 in |
| Crankshaft Main Journal Taper - Service | 0.02 mm | 0.00078 in |
| Crankshaft Rear Flange Runout | 0.05 mm | 0.002 in |
| Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter | 0.7 mm | 0.028 in |
| Crankshaft Thrust Surface - Production | 26.14-26.22 mm | 1.029-1.0315 in |
| Crankshaft Thrust Surface - Service | 26.22 mm | 1.0315 in |
| Crankshaft Thrust Surface Runout | 0.025 mm | 0.001 in |
| **Cylinder Head** | | |
| Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface | 120.2 mm | 4.732 in |
| Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area | 0.08 mm | 0.003 in |
| Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head | 0.1 mm | 0.004 in |
| Surface Flatness - Exhaust Manifold Deck | 0.13 mm | 0.005 in |
| Surface Flatness - Intake Manifold Deck | 0.08 mm | 0.0031 in |
| Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide | 17.32 mm | 0.682 in |
| **Intake Manifold** | | |
| Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes Two Runner Port Openings | 0.3 mm | 0.118 in |
| **Lubrication System** | | |
| Oil Capacity - with Filter | 5.68 liters | 6.0 quarts |
| Oil Capacity - without Filter | 4.73 liters | 5.0 quarts |
| Oil Pressure - Minimum - Hot | 41 kPa at 1,000 engine RPM<br>124 kPa at 2,000 engine RPM<br>165 kPa at 4,000 engine RPM | 6 psig at 1,000 engine RPM<br>18 psig at 2,000 engine RPM<br>24 psig at 4,000 engine RPM |

| Application | Specification | |
|---|---|---|
| | Metric | English |
| **Oil Pan** | | |
| Front Cover Alignment - at Oil Pan Surface | 0.0-0.5 mm | 0.0-0.02 in |
| Rear Cover Alignment - at Oil Pan Surface | 0.0-0.5 mm | 0.0-0.02 in |
| Oil Pan Alignment - to Rear of Engine Block at Transmission Bell Housing Mounting Surface | 0.0-0.25 mm | 0.0-0.01 in |
| **Piston Rings** | | |
| Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Production | 0.31-0.52 mm | 0.012-0.02 in |
| Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Service | 0.31-0.59 mm | 0.0122-0.023 in |
| Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Production | 0.51-0.77 mm | 0.02-0.03 in |
| Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Service | 0.51-0.84 mm | 0.02-0.033 in |
| Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Production | 0.31-0.87 mm | 0.0122-0.034 in |
| Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Service | 0.31-0.94 mm | 0.0122-0.037 in |
| Piston Ring to Groove Clearance - First Compression Ring - Production | 0.04-0.08 mm | 0.00157-0.0031 in |
| Piston Ring to Groove Clearance - First Compression Ring - Service | 0.04-0.08 mm | 0.00157-0.0031 in |
| Piston Ring to Groove Clearance - Second Compression Ring - Production | 0.039-0.079 mm | 0.0015-0.0031 in |
| Piston Ring to Groove Clearance - Second Compression Ring - Service | 0.039-0.079 mm | 0.0015-0.0031 in |
| Piston Ring to Groove Clearance - Oil Control Ring - Production | 0.015-0.199 mm | 0.0006-0.0078 in |
| Piston Ring to Groove Clearance - Oil Control Ring - Service | 0.015-0.199 mm | 0.0006-0.0078 in |
| **Pistons and Pins** | | |
| Piston - Piston Diameter - Measured Over Skirt Coating | 101.606-101.640 mm | 4.0002-4.0016 in |
| Piston - Piston to Bore Clearance - Production | 0.022-0.03 mm - interference | 0.0009-0.0012 in - interference |
| Piston - Piston to Bore Clearance - Service Limit with Skirt Coating Worn Off | 0.07 mm | 0.0028 in |
| Pin - First Design Press Fit Pin Fit in Connecting Rod Bore | 0.02-0.043 mm - Interference | 0.00078-0.00169 in - Interference |
| Pin - First Design Press Fit Pin Clearance to Piston Pin Bore - Production | 0.01-0.02 mm | 0.0004-0.00078 in |
| Pin - First Design Press Fit Pin Clearance to Piston Pin Bore - Service | 0.01-0.022 mm | 0.0004-0.00086 in |
| Pin - First Design Press Fit Pin Diameter | 23.997-24.0 mm | 0.9447-0.9448 in |
| Pin - Second Design Full Floating Pin Fit in Connecting Rod Bore - Production | 0.007-0.02 mm | 0.00027-0.00078 in |
| Pin - Second Design Full Floating Pin Fit in Connecting Rod Bore - Service | 0.007-0.022 mm | 0.00027-0.00086 in |
| Pin - Second Design Full Floating Pin Clearance to Piston Pin Bore - Production | 0.002-0.01 mm | 0.00008-0.0004 in |
| Pin - Second Design Full Floating Pin Clearance to Piston Pin Bore - Service | 0.002-0.015 mm | 0.00008-0.0006 in |

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Pin - Second Design Full Floating Pin Diameter | 23.952-23.955 mm | 0.943-0.943 in |
| **Valve System** | | |
| Valves - Valve Face Angle | 45 degrees | |
| Valves - Valve Face Width | 1.25 mm | 0.05 in |
| Valves - Valve Lash | Net Lash - No Adjustment | |
| Valves - Valve Lift - Intake | 11.79 mm | 0.464 in |
| Valves - Valve Lift - Exhaust | 12.16 mm | 0.479 in |
| Valves - Valve Seat Angle | 46 degrees | |
| Valves - Valve Seat Runout | 0.05 mm | 0.002 in |
| Valves - Valve Seat Width - Exhaust | 1.78 mm | 0.07 in |
| Valves - Valve Seat Width - Intake | 1.02 mm | 0.04 in |
| Valves - Valve Stem Diameter - Production | 7.955-7.976 mm | 0.313-0.314 in |
| Valves - Valve Stem Diameter - Service | 7.95 mm | 0.313 in |
| Valves - Valve Stem-to-Guide Clearance - Production - Intake | 0.025-0.066 mm | 0.001-0.0026 in |
| Valves - Valve Stem-to-Guide Clearance - Service - Intake | 0.093 mm | 0.0037 in |
| Valves - Valve Stem-to-Guide Clearance - Production - Exhaust | 0.025-0.066 mm | 0.001-0.0026 in |
| Valves - Valve Stem-to-Guide Clearance - Service - Exhaust | 0.093 mm | 0.0037 in |
| Rocker Arms - Valve Rocker Arm Ratio | 1.70:1 | |
| Valve Springs - Valve Spring Free Length | 52.9 mm | 2.08 in |
| Valve Springs - Valve Spring Installed Height | 45.75 mm | 1.8 in |
| Valve Springs - Valve Spring Load - Closed | 340 N at 45.75 mm | 76 lb at 1.8 in |
| Valve Springs - Valve Spring Load - Open | 980 N at 33.55 mm | 220 lb at 1.32 in |

## General Specifications 6.0L (LQ9 VIN N)

| Application | Specification | |
|---|---|---|
| | Metric | English |
| **General** | | |
| Engine Type | V8 | |
| Displacement | 6.0L | 364 CID |
| RPO | LQ9 | |
| VIN | N | |
| Bore | 101.618-101.636 mm | 4.0007-4.0014 in |
| Stroke | 92.0 mm | 3.622 in |
| Compression Ratio | 10.08:1 | |
| Firing Order | 1-8-7-2-6-5-4-3 | |
| Spark Plug Gap | 1.524 mm | 0.06 in |
| **Block** | | |
| Camshaft Bearing Bore 1 and 5 Diameter - First Design | 59.12-59.17 mm | 2.327-2.329 in |
| Camshaft Bearing Bore 2 and 4 Diameter - First Design | 58.87-58.92 mm | 2.317-2.319 in |
| Camshaft Bearing Bore 3 Diameter - First Design | 58.62-58.67 mm | 2.307-2.309 in |
| Camshaft Bearing Bore 1 and 5 Diameter - Second Design | 59.62-59.67 mm | 2.347-2.349 in |
| Camshaft Bearing Bore 2 and 4 Diameter - Second Design | 59.12-59.17 mm | 2.327-2.329 in |
| Camshaft Bearing Bore 3 Diameter - Second Design | 58.62-58.67 mm | 2.307-2.309 in |
| Crankshaft Main Bearing Bore Diameter | 69.871-69.889 mm | 2.75-2.751 in |
| Crankshaft Main Bearing Bore Out-of-Round | 0.006 mm | 0.0002 in |
| Cylinder Bore Diameter | 101.618-101.636 mm | 4.0007-4.0017 in |
| Cylinder Bore Taper - Thrust Side | 0.018 mm | 0.0007 in |
| Cylinder Head Deck Height - Measuring from the Centerline of Crankshaft to the Deck Face | 234.57-234.82 mm | 9.235-9.245 in |
| Cylinder Head Deck Surface Flatness - Measured within a 152.4 mm (6.0 in) Area | 0.11 mm | 0.004 in |
| Cylinder Head Deck Surface Flatness - Measuring the Overall Length of the Block Deck | 0.22 mm | 0.008 in |
| Valve Lifter Bore Diameter | 21.417-21.443 mm | 0.843-0.844 in |
| **Camshaft** | | |
| Camshaft End Play | 0.025-0.305 mm | 0.001-0.012 in |
| Camshaft Journal Diameter | 54.99-55.04 mm | 2.164-2.166 in |
| Camshaft Journal Out-of-Round | 0.025 mm | 0.001 in |
| Camshaft Lobe Lift - Exhaust | 7.13 mm | 0.281 in |
| Camshaft Lobe Lift - Intake | 6.96 mm | 0.274 in |
| Camshaft Runout - Measured at the Intermediate Journals | 0.05 mm | 0.002 in |
| **Connecting Rod** | | |
| Connecting Rod Bearing Clearance - Production | 0.023-0.065 mm | 0.0009-0.0025 in |
| Connecting Rod Bearing Clearance - Service | 0.023-0.076 mm | 0.0009-0.003 in |
| Connecting Rod Bore Diameter - Bearing End | 56.505-56.525 mm | 2.224-2.225 in |
| Connecting Rod Bore Out-of-Round - Bearing End - Production | 0.006 mm | 0.00023 in |
| Connecting Rod Bore Out-of-Round - Bearing End - Service | 0.004-0.008 mm | 0.00015-0.0003 in |
| Connecting Rod Side Clearance | 0.11-0.51 mm | 0.00433-0.02 in |
| **Crankshaft** | | |
| Connecting Rod Journal Diameter - Production | 53.318-53.338 mm | 2.0991-2.0999 in |
| Connecting Rod Journal Diameter - Service | 53.308 mm | 2.0987 in |

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Connecting Rod Journal Out-of-Round - Production | 0.005 mm | 0.0002 in |
| Connecting Rod Journal Out-of-Round - Service | 0.01 mm | 0.0004 in |
| Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production | 0.005 mm | 0.0002 in |
| Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service | 0.02 mm | 0.00078 in |
| Crankshaft End Play | 0.04-0.2 mm | 0.0015-0.0078 in |
| Crankshaft Main Bearing Clearance - Production | 0.02-0.052 mm | 0.0008-0.0021 in |
| Crankshaft Main Bearing Clearance - Service | 0.02-0.065 mm | 0.0008-0.0025 in |
| Crankshaft Main Journal Diameter - Production | 64.992-65.008 mm | 2.558-2.559 in |
| Crankshaft Main Journal Diameter - Service | 64.992 mm | 2.558 in |
| Crankshaft Main Journal Out-of-Round - Production | 0.003 mm | 0.000118 in |
| Crankshaft Main Journal Out-of-Round - Service | 0.008 mm | 0.0003 in |
| Crankshaft Main Journal Taper - Production | 0.01 mm | 0.0004 in |
| Crankshaft Main Journal Taper - Service | 0.02 mm | 0.00078 in |
| Crankshaft Rear Flange Runout | 0.05 mm | 0.002 in |
| Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter | 0.7 mm | 0.028 in |
| Crankshaft Thrust Surface - Production | 26.14-26.22 mm | 1.029-1.0315 in |
| Crankshaft Thrust Surface - Service | 26.22 mm | 1.0315 in |
| Crankshaft Thrust Surface Runout | 0.025 mm | 0.001 in |
| **Cylinder Head** | | |
| Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface | 120.2 mm | 4.732 in |
| Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area | 0.08 mm | 0.003 in |
| Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head | 0.1 mm | 0.004 in |
| Surface Flatness - Exhaust Manifold Deck | 0.13 mm | 0.005 in |
| Surface Flatness - Intake Manifold Deck | 0.08 mm | 0.0031 in |
| Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide | 17.32 mm | 0.682 in |
| **Intake Manifold** | | |
| Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes Two Runner Port Openings | 0.3 mm | 0.118 in |
| **Lubrication System** | | |
| Oil Capacity - with Filter | 5.68 liters | 6.0 quarts |
| Oil Capacity - without Filter | 4.73 liters | 5.0 quarts |
| Oil Pressure - Minimum - Hot | 41 kPa at 1,000 engine RPM<br>124 kPa at 2,000 engine RPM<br>165 kPa at 4,000 engine RPM | 6 psig at 1,000 engine RPM<br>18 psig at 2,000 engine RPM<br>24 psig at 4,000 engine RPM |
| **Oil Pan** | | |
| Front Cover Alignment - at Oil Pan Surface | 0.0-0.5 mm | 0.0-0.02 in |
| Rear Cover Alignment - at Oil Pan Surface | 0.0-0.5 mm | 0.0-0.02 in |

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Oil Pan Alignment - to Rear of Engine Block at Transmission Bell Housing Mounting Surface | 0.0-0.25 mm | 0.0-0.01 in |
| **Piston Rings** | | |
| Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Production | 0.31-0.52 mm | 0.012-0.02 in |
| Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Service | 0.31-0.59 mm | 0.0122-0.023 in |
| Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Production | 0.51-0.77 mm | 0.02-0.03 in |
| Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Service | 0.51-0.84 mm | 0.02-0.033 in |
| Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Production | 0.31-0.87 mm | 0.0122-0.034 in |
| Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Service | 0.31-0.94 mm | 0.0122-0.037 in |
| Piston Ring to Groove Clearance - First Compression Ring - Production | 0.035-0.08 mm | 0.0014-0.0031 in |
| Piston Ring to Groove Clearance - First Compression Ring - Service | 0.035-0.08 mm | 0.0014-0.0031 in |
| Piston Ring to Groove Clearance - Second Compression Ring - Production | 0.034-0.079 mm | 0.0013-0.003 in |
| Piston Ring to Groove Clearance - Second Compression Ring - Service | 0.034-0.079 mm | 0.0013-0.003 in |
| Piston Ring to Groove Clearance - Oil Control Ring - Production | 0.012-0.2 mm | 0.00047-0.00078 in |
| Piston Ring to Groove Clearance - Oil Control Ring - Service | 0.012-0.2 mm | 0.00047-0.00078 in |
| **Pistons and Pins** | | |
| Piston - Piston Diameter - Measured Over Coating - at Size Point | 101.611-101.642 mm | 4.0-4.001 in |
| Piston - Piston to Bore Clearance - Production | -0.022 to 0.030 mm | -0.0009 to 0.0012 in |
| Piston - Piston to Bore Clearance - With Skirt Coating Worn Off - Service | 0.024-0.08 mm | 0.00094-0.0031 in |
| Pin - First Design Press Fit Pin Fit in Connecting Rod Bore | 0.02-0.043 mm - Interference | 0.00078-0.00169 in - Interference |
| Pin - First Design Press Fit Pin Clearance to Piston Pin Bore - Production | 0.01-0.02 mm | 0.0004-0.00078 in |
| Pin - First Design Press Fit Pin Clearance to Piston Pin Bore - Service | 0.01-0.022 mm | 0.0004-0.00086 in |
| Pin - First Design Press Fit Pin Diameter | 23.997-24.0 mm | 0.9447-0.9448 in |
| Pin - Second Design Full Floating Pin Fit in Connecting Rod Bore - Production | 0.007-0.02 mm | 0.00027-0.00078 in |
| Pin - Second Design Full Floating Pin Fit in Connecting Rod Bore - Service | 0.007-0.022 mm | 0.00027-0.00086 in |
| Pin - Second Design Full Floating Pin Clearance to Piston Pin Bore - Production | 0.002-0.01 mm | 0.00008-0.0004 in |
| Pin - Second Design Full Floating Pin Clearance to Piston Pin Bore - Service | 0.002-0.015 mm | 0.00008-0.0006 in |
| Pin - Second Design Full Floating Pin Diameter | 23.952-23.955 mm | 0.943-0.943 in |
| **Valve System** | | |
| Valves - Valve Face Angle | 45 degrees | |
| Valves - Valve Face Width | 1.25 mm | 0.05 in |

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Valves - Valve Lash | Net Lash - No Adjustment | |
| Valves - Valve Lift - Intake | 11.79 mm | 0.464 in |
| Valves - Valve Lift - Exhaust | 12.16 mm | 0.479 in |
| Valves - Valve Seat Angle | 46 degrees | |
| Valves - Valve Seat Runout | 0.05 mm | 0.002 in |
| Valves - Valve Seat Width - Exhaust | 1.78 mm | 0.07 in |
| Valves - Valve Seat Width - Intake | 1.02 mm | 0.04 in |
| Valves - Valve Stem Diameter - Production | 7.955-7.976 mm | 0.313-0.314 in |
| Valves - Valve Stem Diameter - Service | 7.95 mm | 0.313 in |
| Valves - Valve Stem-to-Guide Clearance - Production - Intake | 0.025-0.066 mm | 0.001-0.0026 in |
| Valves - Valve Stem-to-Guide Clearance - Service - Intake | 0.093 mm | 0.0037 in |
| Valves - Valve Stem-to-Guide Clearance - Production - Exhaust | 0.025-0.066 mm | 0.001-0.0026 in |
| Valves - Valve Stem-to-Guide Clearance - Service - Exhaust | 0.093 mm | 0.0037 in |
| Rocker Arms - Valve Rocker Arm Ratio | 1.70:1 | |
| Valve Springs - Valve Spring Free Length | 52.9 mm | 2.08 in |
| Valve Springs - Valve Spring Installed Height | 45.75 mm | 1.8 in |
| Valve Springs - Valve Spring Load - Closed | 340 N at 45.75 mm | 76 lb at 1.8 in |
| Valve Springs - Valve Spring Load - Open | 980 N at 33.55 mm | 220 lb at 1.32 in |

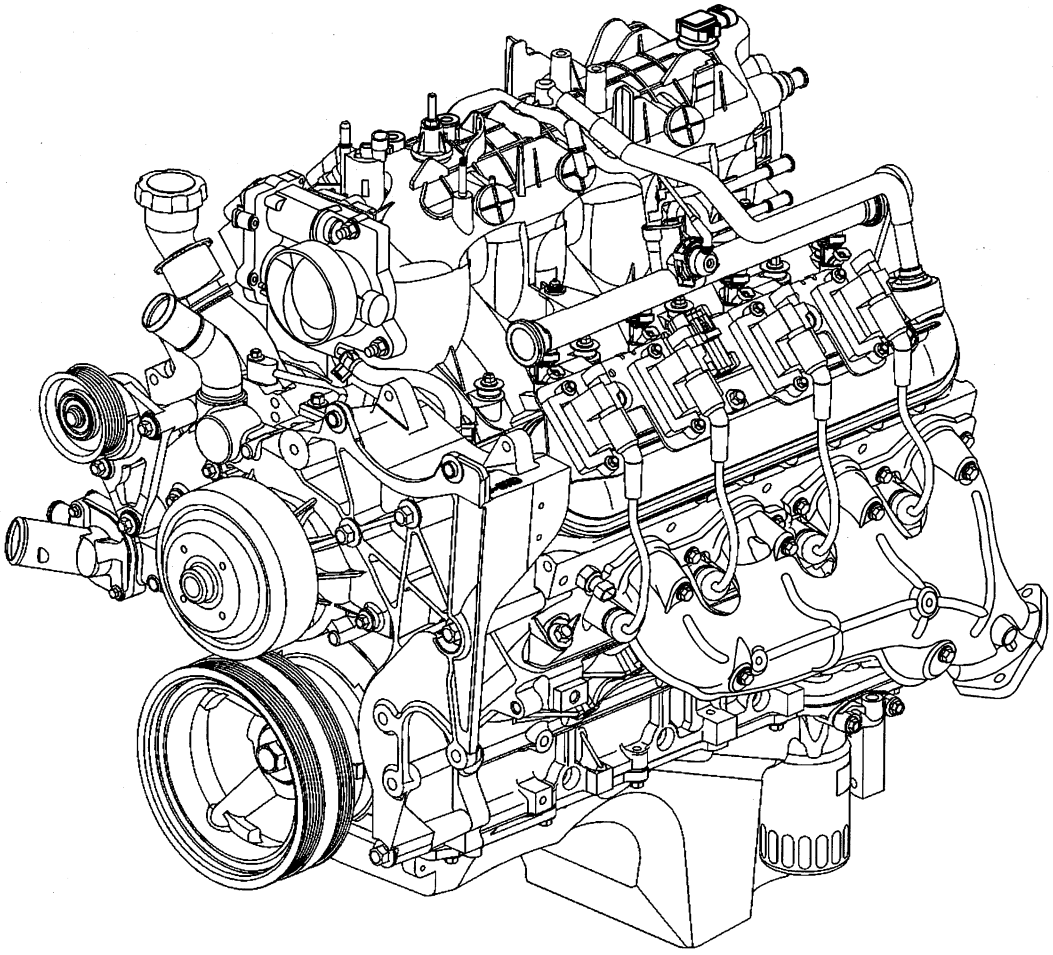
## Fastener Tightening Specifications

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Air Cleaner Outlet Duct Clamp | 7 N·m | 62 lb in |
| Air Conditioning Belt Tensioner Bolt | 50 N·m | 37 lb ft |
| Battery Cable Channel Bolt | 12 N·m | 106 lb in |
| Camshaft Retainer Bolts | 25 N·m | 18 lb ft |
| Camshaft Sensor Bolt | 25 N·m | 18 lb ft |
| Camshaft Sprocket Bolts | 35 N·m | 26 lb ft |
| Connecting Rod Bolts - First Pass | 20 N·m | 15 lb ft |
| Connecting Rod Bolts - Final Pass | 75 degrees | |
| Coolant Temperature Gage Sensor | 20 N·m | 15 lb ft |
| Crankshaft Balancer Bolt - Installation Pass - to Ensure the Balancer is Completely Installed | 330 N·m | 240 lb ft |
| Crankshaft Balancer Bolt - First Pass - Install a NEW Bolt After the Installation Pass and Tighten as Described in the First and Final Passes | 50 N·m | 37 lb ft |
| Crankshaft Balancer Bolt - Final Pass | 140 degrees | |
| Crankshaft Bearing Cap Bolts - Inner Bolts - First Pass in Sequence | 20 N·m | 15 lb ft |
| Crankshaft Bearing Cap Bolts - Inner Bolts - Final Pass in Sequence | 80 degrees | |
| Crankshaft Bearing Cap Bolts - Outer Bolts - First Pass in Sequence | 20 N·m | 15 lb ft |
| Crankshaft Bearing Cap Bolts - Outer Bolts - Final Pass in Sequence | 51 degrees | |
| Crankshaft Bearing Cap Side Bolts | 25 N·m | 18 lb ft |
| Crankshaft Oil Deflector Nuts | 25 N·m | 18 lb ft |
| Crankshaft Position Sensor Bolt | 25 N·m | 18 lb ft |
| Crossbar Bolt | 100 N·m | 74 lb ft |
| Cylinder Head Bolts - First Design - First Pass all M11 Bolts in Sequence | 30 N·m | 22 lb ft |
| Cylinder Head Bolts - First Design - Second Pass all M11 Bolts in Sequence | 90 degrees | |
| Cylinder Head Bolts - First Design - Final Pass all M11 Bolts in Sequence - Excluding the Medium Length Bolts at the Front and Rear of Each Cylinder Head | 90 degrees | |
| Cylinder Head Bolts - First Design - Final Pass M11 Medium Length Bolts at the Front and Rear of Each Cylinder Head | 50 degrees | |
| Cylinder Head Bolts - Second Design - First Pass all M11 Bolts in Sequence | 30 N·m | 22 lb ft |
| Cylinder Head Bolts - Second Design - Second Pass all M11 Bolts in Sequence | 90 degrees | |
| Cylinder Head Bolts - Second Design - Final Pass all M11 Bolts in Sequence | 70 degrees | |
| Cylinder Head Bolts - M8 Inner Bolts in Sequence | 30 N·m | 22 lb ft |
| Cylinder Head Coolant Plug | 20 N·m | 15 lb ft |
| Differential Carrier Lower Mounting Bolt/Nut | 100 N·m | 74 lb ft |
| Drive Belt Idler Pulley Bolt | 50 N·m | 37 lb ft |
| Drive Belt Tensioner Bolt | 50 N·m | 37 lb ft |
| Engine Block Coolant Drain Plugs | 60 N·m | 44 lb ft |
| Engine Block Heater | 40 N·m | 30 lb ft |
| Engine Block Oil Gallery Plugs | 60 N·m | 44 lb ft |
| Engine Coolant Air Bleed Pipe and Cover Bolts | 12 N·m | 106 lb in |
| Engine Flywheel Bolts - First Pass | 20 N·m | 15 lb ft |
| Engine Flywheel Bolts - Second Pass | 50 N·m | 37 lb ft |
| Engine Flywheel Bolts - Final Pass | 100 N·m | 74 lb ft |
| Engine Front Cover Bolts | 25 N·m | 18 lb ft |
| Engine Harness Ground Bolt - Right Rear | 16 N·m | 12 lb ft |
| Engine Harness Ground Bolt-to-Block | 25 N·m | 18 lb ft |
| Engine Mount Bolt-to-Engine Bracket | 50 N·m | 37 lb ft |
| Engine Mount Frame Bracket Through Bolt | 75 N·m | 55 lb ft |

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Engine Mount Frame Side Mount Bolt | 65 N·m | 50 lb ft |
| Engine Mount-to-Engine Bracket Bolt | 50 N·m | 37 lb ft |
| Engine Rear Cover Bolts | 25 N·m | 18 lb ft |
| Engine Service Lift Bracket M10 Bolts | 50 N·m | 37 lb ft |
| Engine Service Lift Bracket M8 Bolt | 25 N·m | 18 lb ft |
| Engine Shield Bolt | 20 N·m | 15 lb ft |
| Engine Valley Cover Bolts | 25 N·m | 18 lb ft |
| Engine Wiring Harness Bracket Nut | 5 N·m | 44 lb in |
| Evaporative Emission (EVAP) Purge Solenoid Bolt | 10 N·m | 89 lb in |
| Exhaust Manifold Bolts - First Pass | 15 N·m | 11 lb ft |
| Exhaust Manifold Bolts - Final Pass | 25 N·m | 18 lb ft |
| Exhaust Manifold Heat Shield Bolts | 9 N·m | 80 lb in |
| Fuel Rail Bolts | 10 N·m | 89 lb in |
| Fuel Rail Cover Bolt | 9 N·m | 80 lb in |
| Fuel Rail Crossover Tube Bolts | 3.8 N·m | 34 lb in |
| Fuel Rail Stop Bracket Bolt | 50 N·m | 37 lb ft |
| Generator Bracket Bolt | 50 N·m | 37 lb ft |
| Generator Cable Nut | 9 N·m | 80 lb in |
| Heater Hose Bracket Nut | 9 N·m | 80 lb in |
| Hood Hinge Bolt | 25 N·m | 18 lb ft |
| Ignition Coil-to-Bracket Bolts | 8 N·m | 71 lb in |
| Ignition Coil Bracket-to-Valve Rocker Arm Cover Bolts | 12 N·m | 106 lb in |
| Inner Axle Housing Nut | 100 N·m | 74 lb ft |
| Intake Manifold Bolts - First Pass in Sequence | 5 N·m | 44 lb in |
| Intake Manifold Bolts - Final Pass in Sequence | 10 N·m | 89 lb in |
| Intake Manifold Sight Shield Bolts | 10 N·m | 89 lb in |
| Intake Manifold Sight Shield Bracket Bolts | 5 N·m | 45 lb in |
| Intake Manifold Sight Shield Retainer Bolt | 5 N·m | 44 lb in |
| Intake Manifold Wiring Harness Stud | 10 N·m | 89 lb in |
| Knock Sensors | 20 N·m | 15 lb ft |
| Mass Airflow/Intake Air Temperature (MAF/IAT) Sensor Clamp | 7 N·m | 62 lb in |
| Oil Filter | 30 N·m | 22 lb ft |
| Oil Filter Fitting | 55 N·m | 40 lb ft |
| Oil Level Indicator Tube Bolt | 25 N·m | 18 lb ft |
| Oil Level Sensor | 13 N·m | 115 lb in |
| Oil Pan Baffle Bolts | 12 N·m | 106 lb in |
| Oil Pan Closeout Cover Bolt - Left Side | 9 N·m | 80 lb in |
| Oil Pan Closeout Cover Bolt - Right Side | 9 N·m | 80 lb in |
| Oil Pan Cover Bolts | 12 N·m | 106 lb in |
| Oil Pan Drain Plug | 25 N·m | 18 lb ft |
| Oil Pan M8 Bolts - Oil Pan-to-Engine Block and Oil Pan-to-Front Cover | 25 N·m | 18 lb ft |
| Oil Pan M6 Bolts - Oil Pan-to-Rear Cover | 12 N·m | 106 lb in |
| Oil Pan Skid Plate Bolt | 20 N·m | 15 lb ft |
| Oil Pressure Sensor | 20 N·m | 15 lb ft |
| Oil Pump-to-Engine Block Bolts | 25 N·m | 18 lb ft |
| Oil Pump Cover Bolts | 12 N·m | 106 lb in |
| Oil Pump Relief Valve Plug | 12 N·m | 106 lb in |
| Oil Pump Screen Nuts | 25 N·m | 18 lb ft |
| Oil Pump Screen-to-Oil Pump Bolt | 12 N·m | 106 lb in |
| Positive Battery Cable Clip Bolt | 9 N·m | 80 lb in |
| Power Steering Pump Rear Bolt | 50 N·m | 37 lb ft |

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Spark Plugs - New Cylinder Heads | 20 N·m | 15 lb ft |
| Spark Plugs - All Subsequent Installations | 15 N·m | 11 lb ft |
| Throttle Body Nuts | 10 N·m | 89 lb in |
| Throttle Body Studs | 6 N·m | 53 lb in |
| Torque Converter Bolt - 4L60-E/4L65-E Transmissions | 63 N·m | 47 lb ft |
| Torque Converter Bolt - 4L80-E/4L85-E Transmissions | 60 N·m | 44 lb ft |
| Transmission Bolt/Stud | 50 N·m | 37 lb ft |
| Transmission Cover Bolt | 12 N·m | 106 lb in |
| Transmission Oil Level Indicator Tube Nut | 18 N·m | 13 lb ft |
| Valve Lifter Guide Bolts | 12 N·m | 106 lb in |
| Valve Rocker Arm Bolts | 30 N·m | 22 lb ft |
| Valve Rocker Arm Cover Bolts | 12 N·m | 106 lb in |
| Water Inlet Housing Bolts | 15 N·m | 11 lb ft |
| Water Pump Bolts - First Pass | 15 N·m | 11 lb ft |
| Water Pump Bolts - Final Pass | 30 N·m | 22 lb ft |
| Water Pump Cover Bolts | 15 N·m | 11 lb ft |

## Engine Component Description



The 4.8, 5.3, and 6.0 Liter V8 engines are identified as RPO LR4 VIN V (4.8L), RPO LM7 VIN T (5.3L), RPO L59 VIN Z (5.3L), RPO LQ4 VIN U (6.0L), and RPO LQ9 VIN N (6.0L).

### Camshaft and Drive System

A billet steel one piece camshaft is supported by five bearings pressed into the engine block. The camshaft has a machined camshaft sensor reluctor ring incorporated between the fourth and fifth bearing journals. The camshaft timing sprocket is mounted to the front of the camshaft and is driven by the crankshaft sprocket through the camshaft timing chain. The splined crankshaft sprocket is positioned to the crankshaft by a key and keyway. The crankshaft sprocket splines drive the oil pump driven gear. A retaining plate mounted to the front of the engine block maintains camshaft location.

### Crankshaft

The crankshaft is cast nodular iron. The crankshaft is supported by five crankshaft bearings. The bearings are retained by crankshaft bearing caps which are machined with the engine block for proper alignment and clearance. The crankshaft journals are undercut and rolled. The center main journal is the thrust journal. A crankshaft position reluctor ring is press fit mounted at the rear of the crankshaft. The reluctor ring is not serviceable separately. All crankshafts will have a short rear flange, at the crankshaft rear oil seal area. Certain 4.8L manual transmissions and 6.0L applications require a spacer between the rear of the crankshaft and the flywheel for proper flywheel positioning. Longer bolts are required in applications using the spacer.

### Cylinder Heads

The cylinder heads are cast aluminum and have pressed in place powdered metal valve guides and valve seats. Passages for the engine coolant air bleed system are at the front of each cylinder head. The valve rocker arm covers are retained to the cylinder head by four center mounted rocker arm cover bolts.

### Engine Block

The engine block is a cam-in-block deep skirt 90 degree V configuration with five crankshaft bearing caps. The engine block is cast iron. The five crankshaft bearing caps each have four vertical M10 and two horizontal M8 mounting bolts. The camshaft is supported by five camshaft bearings pressed into the block. First design engine blocks have different drill and tap depths using both medium length 100 mm (3.94 in) and long 155 mm (6.1 in) M11 cylinder head bolts. Second design engine blocks use only the medium length 100 mm (3.94 in) bolt with a common drill and tap depth.

### Exhaust Manifolds

The exhaust manifolds are a one piece cast iron design. The exhaust manifolds direct exhaust gasses from the combustion chambers to the exhaust system. Each manifold also has an externally mounted heat shield that is retained by bolts.

### Intake Manifold

The intake manifold is a one piece composite design that incorporates brass threaded inserts for mounting the fuel rail, throttle body, evaporative emission (EVAP) solenoid, wire harness stud, engine sight shield and sight shield bracket. Each side of the intake manifold is sealed to the cylinder head by a nonreusable silicone sealing gasket and nylon carrier assembly. The electronically actuated throttle body bolts to the front of the intake manifold. The throttle body is sealed by a one piece push in place silicone gasket. The fuel rail assembly with eight separate fuel injectors is retained to the intake by four bolts. The injectors are seated into their individual manifold bores with O-ring seals to provide sealing. A fuel rail stop bracket is retained to the rear of the left cylinder head by a mounting bolt. The manifold absolute pressure (MAP) sensor is installed and retained to the top rear of the intake manifold and sealed by an O-ring seal. The EVAP solenoid is mounted to the top front of the intake manifold and retained by one bolt. There are no coolant passages within the intake manifold.

### Oil Pan

The structural oil pan is cast aluminum. Incorporated into the design are the oil filter mounting boss, drain plug opening, oil level sensor mounting bore, and oil pan baffle. The oil pan transfer cover and oil level sensor mount to the sides of the oil pan. The alignment of the structural oil pan to the rear of the engine block and transmission bell housing is critical.

### Piston and Connecting Rod Assembly

The pistons are cast aluminum. The pistons use 2 compression rings and a 3-piece oil control ring assembly. The piston is a low friction, lightweight design with a barrel shaped skirt. All applications use pistons with graphite-coated skirts. The piston pins are chromium steel. First design applications use a piston pin that is floating fit to the piston and press fit to the connecting rod. Second design applications use a pin that is full-floating to both the piston and connecting rod. The connecting rods are powdered metal. The connecting rods are fractured at the connecting rod journal and then machined for the proper clearance. The first design piston, pin, and connecting rod are to be serviced as an assembly.

### Valve Rocker Arm Cover Assemblies

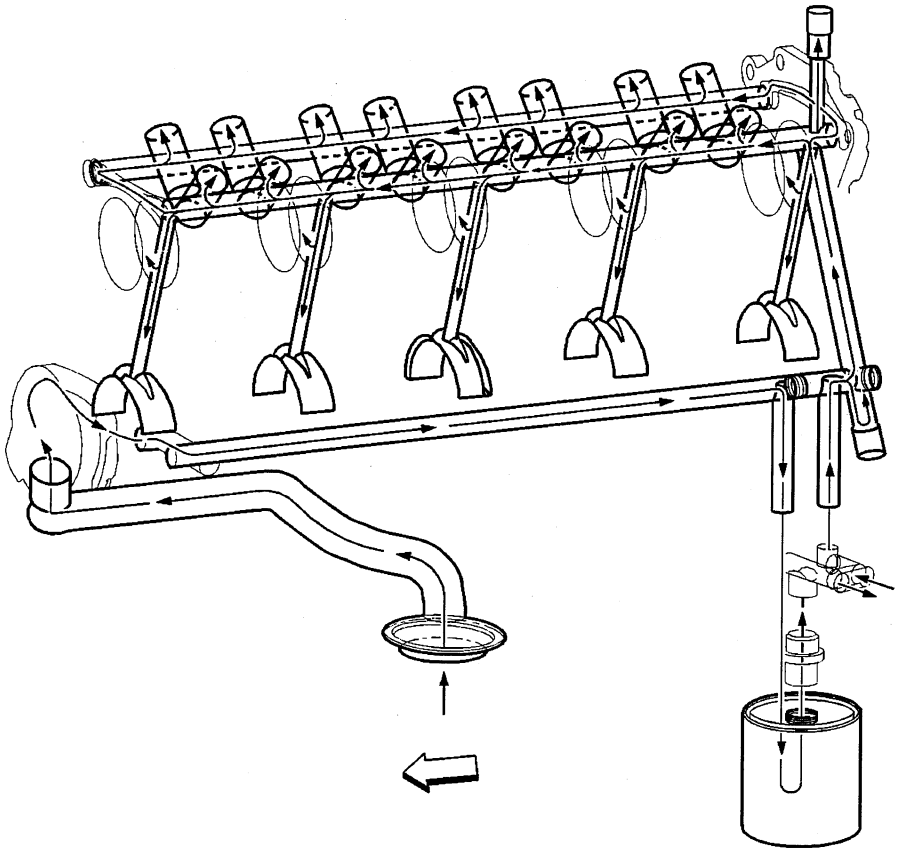
The valve rocker arm covers are cast aluminum and use a pre-molded silicon gasket for sealing. Mounted to each rocker cover are the coil and bracket assemblies. Incorporated into the left cover is the positive crankcase ventilation (PCV) system passage. Incorporated into the right cover is the oil fill tube and engine fresh air passage.

### Valve Train

Motion is transmitted from the camshaft through the hydraulic roller valve lifters and tubular pushrods to the roller type rocker arms. The nylon valve lifter guides position and retain the valve lifters. The valve

rocker arms for each bank of cylinders are mounted on pedestals, pivot supports. Each rocker arm is retained on the pivot support and cylinder head by a bolt. Valve lash is net build.

## Lubrication Description



Engine lubrication is supplied by a gerotor type oil pump assembly. The pump is mounted on the front of the engine block and driven directly by the crankshaft sprocket. The pump gears rotate and draw oil from the oil pan sump through a pick-up screen and pipe. The oil is pressurized as it passes through the pump and is sent through the engine block oil galleries. Contained within the oil pump assembly is a pressure relief valve that maintains oil pressure within a specified range. Pressurized oil is directed through the lower gallery to the full flow oil filter where harmful contaminants are removed. A bypass valve is incorporated into the oil pan, at the oil filter boss, which will permit oil flow in the event the filter becomes restricted. At the rear of the block, oil is then directed to the upper main oil galleries which are drilled just above the camshaft assembly. From there oil is then directed to the crankshaft and camshaft bearings. Oil that has entered the upper main oil galleries also pressurizes the valve lifter assemblies and is then pumped through the pushrods to lubricate the valve rocker arms and valve stems. Oil returning to the pan is directed by the crankshaft oil deflector. Oil pressure and crankcase level are each monitored by individual sensors.

An external oil cooler is available on certain applications, all 6.0L. Oil is directed from the oil pump, through the lower main oil gallery to the full flow oil filter. Oil is then directed through the oil pan outlet oil gallery, located in the left rear of the oil pan, and to the external oil cooler via a hose assembly. Oil flows through the oil cooler and returns to the engine at the oil pan inlet oil gallery, located in the left rear of the oil pan. Oil is then directed to the upper main oil galleries and the remainder of the engine assembly.

## Crankcase Ventilation System Description

A closed crankcase ventilation system is used in order to provide a more complete scavenging of the crankcase vapors. Fresh air from the throttle body is supplied to the crankcase, mixed with blow-by gases, and then passed through a crankcase ventilation valve into the intake manifold.

The primary control is through the crankcase ventilation valve which meters the flow at a rate depending on manifold vacuum. To maintain idle quality, the crankcase ventilation valve restricts the flow when intake manifold vacuum is high. If abnormal operating conditions arise, the system is designed to allow excessive amounts of blow-by gases to back flow through the crankcase vent tube into the engine air inlet to be consumed by normal combustion.

Filtered fresh air is routed from up-stream of the throttle blade to the front of the right rocker arm cover via a formed rubber hose. To reduce the potential of oil pullover into the throttle bore area due to back flow of the ventilation system, the fitting in the right rocker arm cover is shielded from the rocker arms. From there fresh air and gases are routed through the crankcase and up to the opposite rocker arm cover where the positive crankcase ventilation (PCV) valve is located. Gases are then routed through a hose to the intake manifold.

## Engine Mechanical – 8.1L

### General Specifications

| Application | Specification | |
|---|---|---|
| | Metric | English |
| **General** | | |
| Engine Type | V8 | |
| Displacement | 8.1L | 496 CID |
| RPO | L18 | |
| VIN | G | |
| Bore | 107.95 mm | 4.25 in |
| Stroke | 111.0 mm | 4.37 in |
| Compression Ratio | 9.1:1 | |
| Firing Order | 1-8-7-2-6-5-4-3 | |
| Spark Plug Gap | 1.52 mm | 0.06 in |
| **Block** | | |
| Crankshaft Main Bearing Bore Diameter | 74.606-74.622 mm | 2.9372-2.9379 in |
| Cylinder Bore Diameter - Production | 107.95-107.968 mm | 4.25-4.2507 in |
| Cylinder Bore Diameter - Service | 107.94-107.99 mm | 4.2496-4.2516 in |
| Cylinder Bore Out-of-Round - Production, Maximum Minus Minimum Bore Diameter | 0.018 mm | 0.0007 in |
| Cylinder Bore Out-of-Round - Service, Maximum Minus Minimum Bore Diameter | 0.05 mm | 0.002 in |
| Cylinder Bore Taper - Production | 0.018 mm | 0.0007 in |
| Cylinder Bore Taper - Service Thrust Axis | 0.05 mm | 0.002 in |
| Cylinder Bore Taper - Service Pin Axis | 0.05 mm | 0.002 in |
| Cylinder Head Deck Height - from Centerline of Crankshaft | 259.875-260.125 mm | 10.231-10.241 in |
| Cylinder Head Deck Surface Flatness - Entire Face | 0.1 mm | 0.004 in |
| Cylinder Head Deck Surface Flatness - Within 150 mm (6 in) | 0.05 mm | 0.002 in |
| Valve Lifter Bore Diameter | 21.417-21.443 mm | 0.843-0.844 in |
| **Camshaft** | | |
| Camshaft Bearing Inside Diameter | 49.548-49.573 mm | 1.9507-1.9517 in |
| Camshaft Journal Diameter | 49.472-49.522 mm | 1.9477-1.9497 in |
| Camshaft Lobe Lift - Exhaust | 6.973-7.075 mm | 0.2745-0.2785 in |
| Camshaft Lobe Lift - Intake | 6.924-7.026 mm | 0.2726-0.2766 in |
| Camshaft Runout - Production | 0.051 mm | 0.002 in |
| Camshaft Runout - Service | 0.076 mm | 0.003 in |
| **Connecting Rod** | | |
| Connecting Rod Bearing Clearance - Production | 0.033-0.068 mm | 0.0013-0.0027 in |
| Connecting Rod Bearing Clearance - Service | 0.033-0.081 mm | 0.0013-0.0032 in |
| Connecting Rod Side Clearance | 0.384-0.686 mm | 0.0151-0.027 in |
| **Crankshaft** | | |
| Connecting Rod Journal Diameter | 55.854-55.87 mm | 2.199-2.1996 in |
| Connecting Rod Journal Out-of-Round - Production | 0.0102 mm | 0.0004 in |
| Connecting Rod Journal Taper - Production | 0.0102 mm | 0.0004 in |
| Crankshaft End Play | 0.127-0.35 mm | 0.005-0.0138 in |
| Crankshaft Main Bearing Clearance - #1, #2, #3, #4 Production | 0.022-0.057 mm | 0.0008-0.0022 in |
| Crankshaft Main Bearing Clearance - #5 Production | 0.034-0.069 mm | 0.0013-0.0027 in |

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Crankshaft Main Bearing Clearance - #1, #2, #3, #4 Service | 0.022-0.089 mm | 0.0008-0.0035 in |
| Crankshaft Main Bearing Clearance - #5 Service Limit | 0.035-0.102 mm | 0.0014-0.004 in |
| Crankshaft Main Journal Diameter | 69.805-69.822 mm | 2.7482-2.7489 in |
| Crankshaft Main Journal Out-of-Round - Production | 0.0102 mm | 0.0004 in |
| Crankshaft Main Journal Taper - Production | 0.0102 mm | 0.0004 in |
| Crankshaft Runout - Production | 0.05 mm | 0.002 in |
| Crankshaft Runout - Service | 0.065 mm | 0.0026 in |
| Cylinder Head | | |
| Cylinder Head Height/Thickness | 259.875-260.125 mm | 10.231-10.241 in |
| Surface Flatness - Block Deck | 0.05 mm | 0.002 in |
| Surface Flatness - Exhaust Manifold Deck | 0.102 mm | 0.004 in |
| Surface Flatness - Intake Manifold Deck | 0.08 mm | 0.003 in |
| **Exhaust Manifold** | | |
| Surface Flatness | 0.254 mm | 0.01 in |
| **Lubrication System** | | |
| Oil Capacity - Without Filter | 5.7L | 6.0 Qts |
| Oil Capacity - With Filter | 6.15L | 6.5 Qts |
| Oil Pressure - Minimum | 34 kPa @ 1,000 RPM | 5 psi @ 1,000 RPM |
| Oil Pressure - Minimum | 69 kPa @ 2,000 RPM | 10 psi @ 2,000 RPM |
| **Piston Rings** | | |
| Piston Ring End Gap | | |
| First Compression Ring - Production | 0.3-0.45 mm | 0.012-0.018 in |
| First Compression Ring - Service | 0.45-0.675 mm | 0.018-0.027 in |
| Second Compression Ring - Production | 0.45-0.65 mm | 0.017-0.025 in |
| Second Compression Ring - Service | 0.675-0.975 mm | 0.026-0.039 in |
| Oil Control Ring - Production | 0.249-0.759 mm | 0.0098-0.0299 in |
| Oil Control Ring - Service | 0.373-1.138 mm | 0.015-0.045 in |
| Piston Ring-to-Groove Clearance | | |
| First Compression Ring | 0.031-0.074 mm | 0.0012-0.0029 in |
| Second Compression Ring | 0.031-0.074 mm | 0.0012-0.0029 in |
| Oil Control Ring | 0.051-0.203 mm | 0.002-0.008 in |
| **Piston and Pins** | | |
| Piston | | |
| Piston Diameter | Not Measurable | Not Measurable |
| Piston-to-Bore Clearance | Interference Fit | Interference Fit |
| Pin | | |
| Pin-Piston Pin Fit in Connecting Rod Bore-Production | 0.010-0.023 mm | 0.0004-0.0009 in |
| Pin-Piston Pin Fit in Connecting Rod Bore-Service | 0.010-0.023 mm | 0.0004-0.0009 in |
| Pin-Piston Pin Clearance-to-Piston Pin Bore-Production | 0.003-0.011 mm | 0.00019-0.00043 in |
| Pin-Piston Pin Clearance-to-Piston Pin Bore-Service | 0.003-0.011 mm | 0.00019-0.00043 in |
| Pin-Piston Pin Diameter | 26.416-26.419 mm | 1.039-1.040 in |

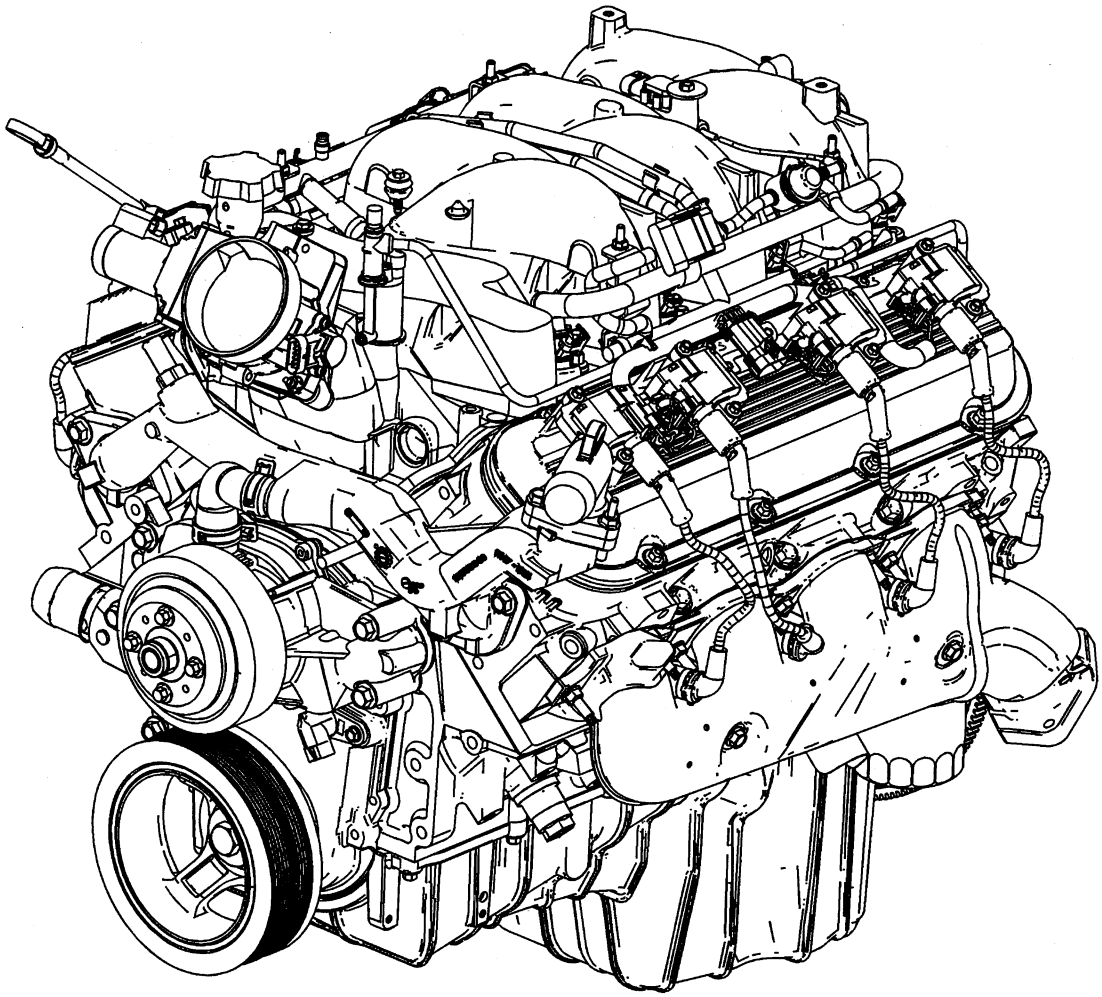
| Application | Specification | |
|---|---|---|
| | Metric | English |
| **Valve System** | | |
| **Valves** | | |
| Valve Face Angle - Exhaust | 45 degrees | |
| Valve Face Angle - Intake | 45 degrees | |
| Valve Head Diameter - Exhaust | 43.69 mm | 1.72 in |
| Valve Head Diameter - Intake | 55.63 mm | 2.19 in |
| Valve Lash - Exhaust | Net Lash | Net Lash |
| Valve Lash - Intake | Net Lash | Net Lash |
| Valve Seat Angle - Exhaust | 46 degrees | |
| Valve Seat Angle - Intake | 46 degrees | |
| Valve Seat Runout - Exhaust | 0.05 mm | 0.002 in |
| Valve Seat Runout - Intake | 0.05 mm | 0.002 in |
| Valve Seat Width - Exhaust | 1.651-2.159 mm | 0.060-0.095 in |
| Valve Seat Width - Intake | 0.8-1.2 mm | 0.03-0.06 in |
| Valve Stem Diameter - Exhaust | 9.431-9.449 mm | 0.3713-0.372 in |
| Valve Stem Diameter - Intake | 9.436-9.454 mm | 0.3715-0.3722 in |
| Valve Stem-to-Guide Clearance - Exhaust - Production | 0.03-0.079 mm | 0.0012-0.0031 in |
| Valve Stem-to-Guide Clearance - Intake - Production | 0.025-0.074 mm | 0.001-0.0029 in |
| Valve Stem-to-Guide Clearance - Exhaust - Service | 0.03-0.104 mm | 0.0012-0.0041 in |
| Valve Stem-to-Guide Clearance - Intake - Service | 0.025-0.099 mm | 0.001-0.0039 in |
| **Rocker Arms** | | |
| Valve Rocker Arm Ratio | 1.7:1 | |
| **Valve Springs** | | |
| Valve Spring Free Length | 56.35 mm | 2.218 in |
| Valve Spring Installed Height | 45.92-46.69 mm | 1.808-1.838 in |
| Valve Spring Load - Closed | 381-419 N at 45.92 mm | 86-94 lb at 1.808 in |
| Valve Spring Load - Open | 964-1056 N at 33.99 mm | 216-236 lb at 1.338 in |

## Fastener Tightening Specifications

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Air Cleaner Outlet Duct Clamp | 4 N·m | 35 lb in |
| Air Conditioning (A/C) Belt Tensioner Bolt | 50 N·m | 37 lb ft |
| Battery Cable Channel Bolt | 9 N·m | 80 lb in |
| Camshaft Position (CMP) Sensor Bolt | 12 N·m | 106 lb in |
| Camshaft Retainer Bolt | 12 N·m | 106 lb in |
| Camshaft Sprocket Bolt | 30 N·m | 22 lb ft |
| Connecting Rod Nut - First Pass | 30 N·m | 22 lb ft |
| Connecting Rod Nut - Final Pass | 90 degrees | |
| Crankshaft Balancer Bolt | 255 N·m | 189 lb ft |
| Crankshaft Bearing Cap Inner Bolts - First Pass | 30 N·m | 22 lb ft |
| Crankshaft Bearing Cap Inner Bolts - Final Pass | 90 degrees | |
| Crankshaft Bearing Cap Outer Bolts/Studs - First Pass | 30 N·m | 22 lb ft |
| Crankshaft Bearing Cap Outer Bolts/Studs - Final Pass | 80 degrees | |
| Crankshaft Oil Deflector Nut | 50 N·m | 37 lb ft |
| Crankshaft Position (CKP) Sensor Bolt | 12 N·m | 106 lb in |
| Crossbar Bolt | 100 N·m | 74 lb ft |
| Cylinder Head Bolts - In Sequence | | |
| First Pass | 30 N·m | 22 lb ft |
| Second Pass | 30 N·m + 120 degrees | 22 lb ft + 120 degrees |
| Final Pass - Long Bolts #1, 2, 3, 6, 7, 8, 9, 10, 11, 14, 16, 17 | 60 degrees | |
| Final Pass - Medium Bolts #15, 18 | 45 degrees | |
| Final Pass - Short Bolts #4, 5, 12, 13 | 30 degrees | |
| Cylinder Head Coolant Hole Plug | 50 N·m | 37 lb ft |
| Drive Belt Idler Pulley Bolt | 50 N·m | 37 lb ft |
| Drive Belt Tensioner Bolt | 50 N·m | 37 lb ft |
| Engine Block Coolant Drain M28 Plug - Left Front | 60 N·m | 44 lb ft |
| Engine Block Coolant Drain Plug - Sides | 30 N·m | 22 lb ft |
| Engine Block Heater | 50 N·m | 37 lb ft |
| Engine Block Oil Gallery Front Plug | 20 N·m | 15 lb ft |
| Engine Block Oil Gallery Rear Plug | 30 N·m | 22 lb ft |
| Engine Block Oil Gallery Side Plug | 30 N·m | 22 lb ft |
| Engine Block Oil Gallery Top Plug | 20 N·m | 15 lb ft |
| Engine Coolant Temperature (ECT) Sensor | 50 N·m | 37 lb ft |
| Engine Coolant Temperature (ECT) Sensor Bracket Bolt | 50 N·m | 37 lb ft |
| Engine Harness Bolt | 5 N·m | 44 lb in |
| Engine Harness Ground Bolt | 16 N·m | 12 lb ft |
| Engine Harness Stud | 10 N·m | 89 lb in |
| Engine Mount-to-Engine Bolt | 50 N·m | 37 lb ft |
| Engine Mount Bracket Thru Bolt | 75 N·m | 55 lb ft |
| Engine Mount-to-Engine Mount Bracket Bolt | 65 N·m | 50 lb ft |
| Engine Shield Bolt | 20 N·m | 15 lb ft |
| Engine Sight Shield Bracket Nut | 5 N·m | 44 lb in |
| Engine Wiring Harness Bolt | 16 N·m | 12 lb ft |
| Evaporative Emission (EVAP) Purge Valve Bolt | 8 N·m | 71 lb in |
| Exhaust Gas Recirculation (EGR) Cover Nut | 22 N·m | 16 lb ft |
| Exhaust Gas Recirculation (EGR) Cover Stud | 7 N·m | 62 lb in |
| Exhaust Manifold Center Bolt | 35 N·m | 26 lb ft |
| Exhaust Manifold Nut | 16 N·m | 12 lb ft |
| Exhaust Manifold Stud | 20 N·m | 15 lb ft |

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Exhaust Manifold Heat Shield Bolt | 25 N·m | 18 lb ft |
| Exhaust Manifold Heat Shield Nut | 25 N·m | 18 lb ft |
| Flywheel Bolt - First Pass | 40 N·m | 30 lb ft |
| Flywheel Bolt - Second Pass | 80 N·m | 59 lb ft |
| Flywheel Bolt - Final Pass | 100 N·m | 74 lb ft |
| Front Cover Bolt - First Pass | 6 N·m | 53 lb in |
| Front Cover Bolt - Final Pass | 12 N·m | 106 lb in |
| Fuel Rail Bolt/Stud | 12 N·m | 106 lb in |
| Heater Hose Bracket Bolt | 50 N·m | 37 lb ft |
| Hood Hinge Bolt | 25 N·m | 18 lb ft |
| Ignition Coil Bolt | 12 N·m | 106 lb in |
| Ignition Coil Wiring Harness Bolt | 12 N·m | 106 lb in |
| Intake Manifold Bolts - In Sequence - First Pass | 5 N·m | 44 lb in |
| Intake Manifold Bolts - In Sequence - Second Pass | 8 N·m | 71 lb in |
| Intake Manifold Bolts - In Sequence - Third Pass | 12 N·m | 106 lb in |
| Intake Manifold Bolt - In Sequence - Final Pass | 15 N·m | 11 lb ft |
| J 36857 Lift Bracket Bolt | 40 N·m | 30 lb ft |
| J 42847 Flywheel Holding Tool Bolt | 50 N·m | 37 lb ft |
| Knock Sensor | 20 N·m | 15 lb ft |
| Knock Sensor Heat Shield Bolt | 12 N·m | 106 lb in |
| Lift Bracket Bolt | 40 N·m | 30 lb ft |
| Manifold Absolute Pressure (MAP) Sensor Bolt | 12 N·m | 106 lb in |
| Oil Cooler Hose Fittings | 23 N·m | 17 lb ft |
| Oil Fill Tube Bolt | 12 N·m | 106 lb in |
| Oil Filter | 38 N·m | 28 lb ft |
| Oil Filter Fitting | 66 N·m | 49 lb ft |
| Oil Level Indicator Tube Bolt | 25 N·m | 18 lb ft |
| Oil Level Sensor | 20 N·m | 15 lb ft |
| Oil Pan Bolt - First Pass | 10 N·m | 89 lb in |
| Oil Pan Bolt - Final Pass | 25 N·m | 18 lb ft |
| Oil Pan Drain Plug | 28 N·m | 21 lb ft |
| Oil Pan Skid Plate Bolt | 20 N·m | 15 lb ft |
| Oil Pressure Sensor | 30 N·m | 22 lb ft |
| Oil Pump Bolt | 75 N·m | 56 lb ft |
| Oil Pump Cover Bolt | 12 N·m | 106 lb in |
| Oil Pump Drive Bolt | 25 N·m | 18 lb ft |
| Power Steering Pump Bracket Bolt/Nut | 50 N·m | 37 lb ft |
| Power Steering Pump Bracket Stud | 20 N·m | 15 lb ft |
| Spark Plug | 30 N·m | 22 lb ft |
| Thermostat Housing Bolt/Stud | 30 N·m | 22 lb ft |
| Throttle Body Nut | 10 N·m | 89 lb in |
| Throttle Body Stud | 12 N·m | 106 lb in |
| Valve Lifter Guide Retainer Bolt | 25 N·m | 18 lb ft |
| Valve Rocker Arm Cover Bolt - First Pass | 6 N·m | 53 lb in |
| Valve Rocker Arm Cover Bolt - Final Pass | 12 N·m | 106 lb in |
| Valve Rocker Arm Nut | 35 N·m | 26 lb ft |
| Valve Rocker Arm Stud | 50 N·m | 37 lb ft |
| Water Crossover Bolt | 50 N·m | 37 lb ft |
| Water Pump Bolt - First Pass | 25 N·m | 18 lb ft |
| Water Pump Bolt - Final Pass | 50 N·m | 37 lb ft |
| Water Pump Pulley Bolt | 25 N·m | 18 lb ft |

## Engine Component Description



### Cylinder Block

The engine block is made of cast iron and it has eight cylinders arranged in a 90 degree V shape with four cylinders in each bank. The engine block is a one piece casting with the cylinders encircled by coolant jackets.

### Cylinder Head

The cylinder heads are made of cast iron and have parent metal intake valve guides and intake valve seats. The cast iron exhaust valve guides and powdered metal valve seats are pressed into the exhaust ports. A spark plug is located between the valves in the side of the cylinder head. The water crossover pipe attaches to the front of each cylinder head.

### Camshaft

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

Motion from the camshaft is transmitted to the valves by hydraulic roller valve lifters, valve push rods, and ball-pivot type rocker arms. Gear teeth are machined into the camshaft near the rear journal in order to drive a shaft assembly which operates the oil pump driveshaft. Ignition synchronization with the camshaft is provided by a physical feature integral with the camshaft sprocket.

### Crankshaft

The crankshaft is made of cast nodular iron. The crankshaft is supported by five crankshaft bearings. The crankshaft bearings are retained by the crankshaft bearing caps. The crankshaft bearing caps are machined with the engine block for proper alignment and clearance. The crankshaft bearing caps are retained by two bolts and two studs each. The number five crankshaft bearing at the rear of the engine block is the end thrust bearing. The four connecting rod journals, two rods per journal, are spaced 90 degrees apart. The crankshaft position sensor reluctor ring is pushed onto the rear of the crankshaft. The crankshaft position sensor reluctor is constructed of powdered metal. The reluctor ring has an interference fit onto the crankshaft and an internal keyway for correct positioning.

### Pistons and Connecting Rods

The pistons are cast aluminum alloy that use two compression rings and one oil control ring assembly. The piston pins are a floating fit in the pistons and the piston pins are retained by a press fit in the connecting rod assembly. The pistons are coated in order to create an interference fit into the cylinder. The connecting rods are forged steel and have precision insert type crankpin bearings. The piston and connecting rod is only serviced as an assembly.

### Valve Train

The valve train is a ball pivot type. Motion is transmitted from the camshaft through the hydraulic roller valve lifters and tubular valve push rods to the valve rocker arms. The valve rocker arm pivots on a ball in order to open the valve. The hydraulic roller valve lifters keep all parts of the valve train in constant contact. Each valve lifter acts as an automatic adjuster and maintains zero lash in the valve train. This eliminates the need for periodic valve adjustment. The valve rocker arm stud and nut retains the valve rocker arm and ball seat. The valve rocker arm stud is threaded into the cylinder head. The valve stem seal is pressed over the valve guide of the cylinder head.

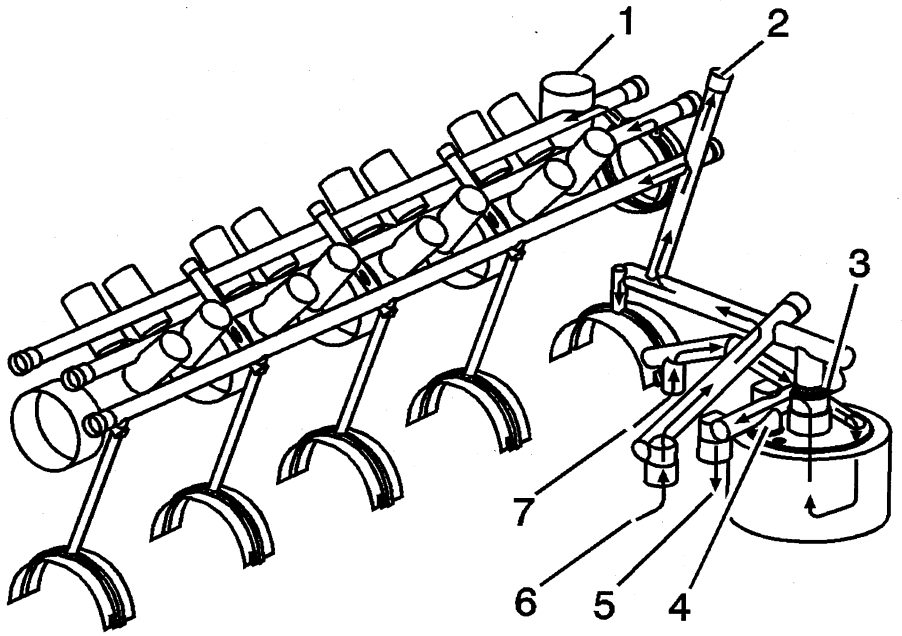
### Intake Manifold

The intake manifold is a one-piece design. The intake manifold is made of cast aluminum. The throttle body is attached to the front of the intake manifold. The fuel rail assembly with eight separate fuel injectors is retained to the intake manifold by four studs. The fuel injectors are seated in their individual manifold bores with O-ring seals to provide sealing. A Manifold Absolute Pressure (MAP) sensor is mounted on the top of the intake manifold and sealed by an O-ring seal. The MAP sensor is held in place with a retainer bolt. The evaporative emission canister solenoid is located in the front of the intake manifold. The positive crankcase ventilation (PCV) system is internally cast into the intake manifold. There is not a PCV valve. A splash shield is installed under the intake manifold. The shield prevents hot oil from contacting the bottom of the intake manifold, maintaining air inlet charge density.

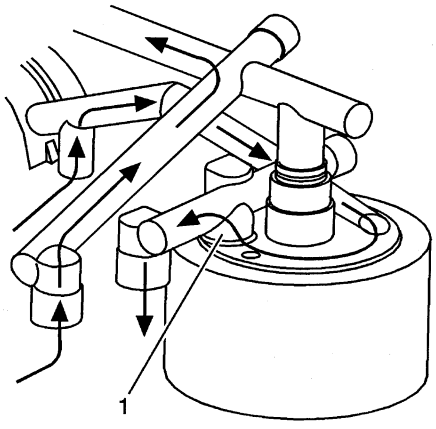
### Exhaust Manifold

The two exhaust manifolds are constructed of cast stainless steel. The exhaust manifolds direct exhaust gases from the combustion chambers to the exhaust system.

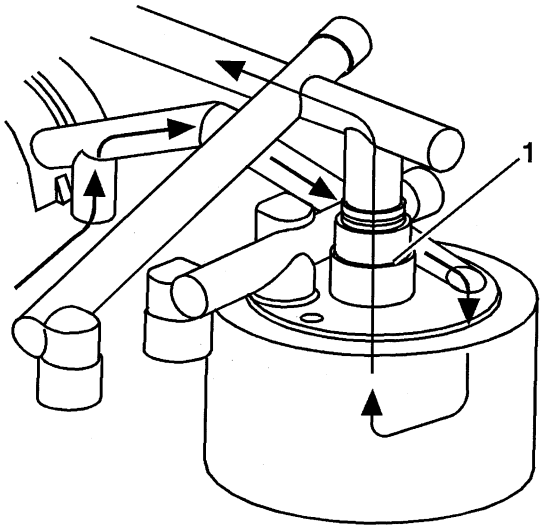
## Lubrication Description




The gear-type oil pump is driven through an extension driveshaft. The extension driveshaft is driven by the oil pump drive, which is gear driven by the camshaft. The oil is drawn from the oil pan through a pickup screen and tube, into the oil pump (7). Pressurized oil flows through the oil filter, into the oil cooler (5), back into the engine (6), up to the oil pressure gage port (2) and rear crankshaft bearing, and is then distributed to the upper oil galleries. Oil must flow around the oil pump drive (1) in order to reach the right side valve lifters properly. The oil is delivered through internal passages in order to lubricate camshaft and crankshaft bearings and to provide lash control in the hydraulic valve lifters. Oil is metered from the valve lifters through the valve push rods in order to lubricate the valve rocker arms and ball pivots. Oil returning to the oil pan from the cylinder heads and the front camshaft bearing, lubricates the camshaft timing chain and the crankshaft and the camshaft sprockets. There are two bypass valves located in the engine block, above the oil filter. The oil filter bypass valve (4) and the oil cooler bypass valve (3).

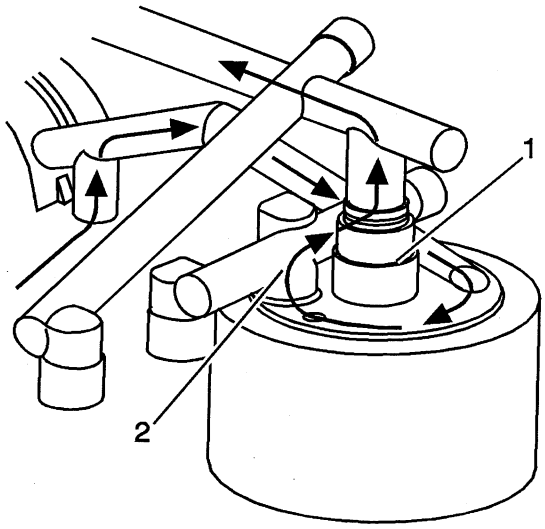



If the oil filter becomes plugged, the pressurized oil is diverted around the top of the oil filter. The oil filter bypass valve (1) is forced open, allowing the oil to continue on to the oil cooler and engine oil passages. No oil filtration occurs because the oil is not allowed into the oil filter.




If the oil cooler flow becomes blocked, either from a plugged oil cooler or blocked or kinked oil cooler line, the oil cooler bypass valve (1) is forced open, allowing oil to flow directly into the engine oil passages. Oil does not flow into or out of the engine oil cooler.

If both the oil filter and the oil cooler are plugged, the pressurized oil is routed around the top of the oil filter, through the oil filter bypass valve (2), through the oil cooler bypass valve (1) and directly into the engine oil passages. Lubrication still occurs, but the oil is not filtered or directed through the oil cooler.



### Crankcase Ventilation System Description

The crankcase ventilation system has no serviceable components so routine maintenance of the system is not required.

A closed crankcase ventilation system is used in order to provide a more complete scavenging of crankcase vapors. The air cleaner supplies the fresh air through a filter to the crankcase. The crankcase mixes the fresh air blow-by gases. This mixture then passes through a pipe/passage located in the intake manifold.

# Engine Cooling

## Fastener Tightening Specifications

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Air Cleaner Outlet Duct Clamp Screw - 5.3L and 6.0L Engines | 7 N·m | 62 lb in |
| Coolant Air Bleed Pipe Stud/Bolt - 5.3L and 6.0L Engines | 12 N·m | 106 lb in |
| Coolant Crossover Bolt - 8.1L Engine | 50 N·m | 37 lb ft |
| Coolant Heater Cord Bolt | 8 N·m | 71 lb in |
| Coolant Heater - 5.3L and 6.0L | 50 N·m | 37 lb ft |
| Coolant Heater - 8.1L | 60 N·m | 40 lb ft |
| Engine Block Coolant Drain Plug | 60 N·m | 44 lb ft |
| Fan Clutch Bolt | 23 N·m | 17 lb ft |
| Fan Clutch Nut | 56 N·m | 41 lb ft |
| Fan Shroud Bolt | 9 N·m | 80 lb in |
| Generator Bracket Stud | 20 N·m | 15 lb ft |
| Oil Cooler Hose Adapter Bolt - 6.0L Engine | 12 N·m | 106 lb in |
| Oil Cooler Hose Bracket Bolt - 6.0L Engine | 25 N·m | 18 lb ft |
| Oil Pan Skid Plate Bolt | 20 N·m | 15 lb ft |
| Radiator Bolt | 25 N·m | 18 lb ft |
| Surge Tank Bolt/Nut | 9 N·m | 80 lb in |
| Transmission Control Module (TCM) Cover Bolt | 9 N·m | 80 lb in |
| Transmission Control Module (TCM) Electrical Connector Bolt | 8 N·m | 71 lb in |
| Water Outlet Bolt - 8.1L Engine | 30 N·m | 22 lb ft |
| Water Pump Bolt - 5.3L and 6.0L Engines | | |
| First Pass | 15 N·m | 11 lb ft |
| Final Pass | 30 N·m | 22 lb ft |
| Water Pump Bolt - 8.1L Engine | 50 N·m | 37 lb ft |
| Water Pump Inlet Bolt | 15 N·m | 11 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 Cable Bracket Bolt | 25 N·m | 18 lb ft |
| Battery Cable Channel Bolt | 12 N·m | 106 lb in |
| Battery Cable Junction Block Bracket Bolt | 9 N·m | 80 lb in |
| Battery Hold Down Retainer Bolt | 25 N·m | 18 lb ft |
| Battery Tray Bolt | 9 N·m | 80 lb in |
| Battery Tray Nut | 25 N·m | 18 lb ft |
| Engine Wiring Harness Ground Bolt | 16 N·m | 12 lb ft |
| Engine Wiring Harness Ground/Negative Cable Bolt | 25 N·m | 18 lb ft |
| Front Axle Mounting Bracket Nut | 95 N·m | 70 lb ft |
| Forward Lamp Wiring Harness Ground/Negative Cable Bolt | 9 N·m | 80 lb in |
| Front End Diagonal Brace Bolt | 9 N·m | 80 lb in |
| Generator Bracket Bolt - 4.8L, 5.3L, and 6.0L Engines | 50 N·m | 37 lb ft |
| Generator Bracket Bolt/Nut - 8.1L | 50 N·m | 37 lb ft |
| Generator Bracket Stud | 20 N·m | 15 lb ft |
| Generator Bolt | 50 N·m | 37 lb ft |
| Generator Cable Nut | 9 N·m | 80 lb in |
| Ground Strap Nut | 9 N·m | 80 lb in |
| Negative Battery Cable Bolt | 17 N·m | 13 lb ft |
| Positive Battery Cable Bolt | 17 N·m | 13 lb ft |
| Positive Cable Clip Bolt - 8.1L Engine | 8 N·m | 71 lb in |
| Positive Cable Nut | 9 N·m | 80 lb in |
| Positive Cable at Underhood Bussed Electrical Center (UBEC) Bolt | 9 N·m | 80 lb in |
| Starter Bolt | 50 N·m | 37 lb ft |
| Starter Heat Shield Bolt - 8.1L Engine | 3 N·m | 35 lb in |
| Starter Heat Shield Nut - 8.1L Engine | 5 N·m | 44 lb in |
| Starter Lead Nut | 3.4 N·m | 30 lb in |
| Transmission Cover Bolt | 9 N·m | 80 lb in |

## Battery Usage

| Base | |
|---|---|
| GM Part Number | 19001810 |
| Cold Cranking Amperage (CCA) | 600 A |
| Reserve Capacity Rating | 115 Minutes |
| Replacement Battery Number | 78-6YR |
| **Optional (Dual)** | |
| GM Part Number | 19001814 |
| Cold Cranking Amperage (CCA) | 770 A |
| Reserve Capacity Rating | 115 Minutes |
| Replacement Battery Number | 78-7YR |

## 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 Model |
|---|---|
| 5.3L (LM7) | PG-260F2 |
| 6.0L (LQ4)<br>8.1L (L18) | PG-260M |

## Generator Usage

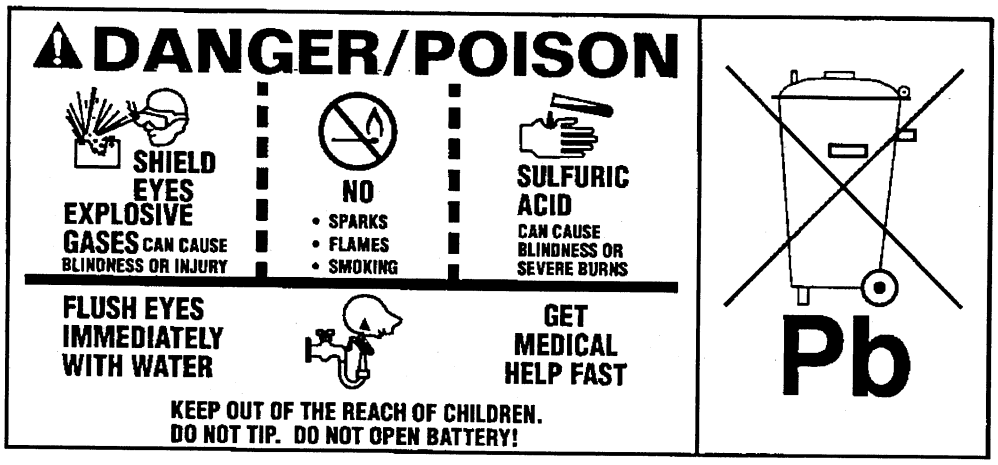
| Base | |
|---|---|
| Generator Model | Delphi AD230 |
| Rated Output | 102 A |
| Load Test Output | 71 A |
| **Optional (Dual)** | |
| Generator Model | Delphi AD244 |
| Rated Output | 130 A |
| Load Test Output | 91 A |
| **Bosch® Generator** | |
| Generator Model | Bosch® 15755900 |
| Rated Output | 130 A |
| Load Test Output | 91 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

CATALOG NO.

# 1819

| CCA | LOAD TEST |
|---|---|
| 770 | 380 |
| REPLACEMENT MODEL | |
| 100 – 6YR | |

A battery has 2 ratings:

- Reserve capacity
- Cold cranking amperage

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

### Reserve Capacity

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

### Cold Cranking Amperage

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

### Circuit Description

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

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

## Starting System Description and Operation

The PG-260M and Hitachi-S14-100B are non-repairable starter motors. It has pole pieces that are arranged around the armature within the starter housing. When the solenoid windings are energized, the pull-in winding circuit is completed to ground through the starter motor. The hold-in winding circuit is completed to ground through the solenoid. The windings work together magnetically to pull in and hold in the plunger. The plunger moves the shift lever. This action causes the starter drive assembly to rotate on the armature shaft spline as it engages with the flywheel ring gear on the engine. At the same time, the plunger closes the solenoid switch contacts in the starter solenoid. Full battery voltage is then applied directly to the starter motor and it cranks the engine.

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

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

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

## Charging System Description and Operation

### Generator

The AD-230 and AD-244 generators are non-repairable. They are electrically similar to earlier models. The generators feature the following major components:

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

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

The AD stands for Air-cooled Dual internal fan; the 2 is an electrical design designator; the 30/44 denotes the outside diameter of the stator laminations in millimeters, over 100 millimeters. The generators is rated at 102 and 130 amperes respectively.

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

### Regulator

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

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

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

### Auxiliary Battery Charging

The auxiliary battery is charged in the same manner as the primary battery with the ignition switch in the run position and the engine running. The system contains the following components:

- Auxiliary battery.
- Auxiliary battery relay.
- Mega fuse.
- Junction block battery cable.
- Associated wiring.

The auxiliary battery relay coil is energized with the engine running through the fuse block and wiring, thus closing the relay contacts which allow the battery to be charged from the vehicle's generator via the battery junction block. The auxiliary battery relay is permanently grounded so any time the ignition switch is in the run position the relay will be energized.

The auxiliary battery is only used for accessories and is not part of the vehicle starting system. However if the primary battery fails and in need of an jump start, follow the service information for Jump Starting In Case Of Emergency using appropriate battery jumper cables.

# Engine Controls

## Engine Controls – 5.3 & 6.0L

### Ignition System Specifications

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Firing Order | 1-8-7-2-6-5-4-3 | |
| Spark Plug Wire Resistance | 1000 ohms per ft | |
| Spark Plug Torque | 15 N·m | 11 lb ft |
| Spark Plug Gap | 1.52 mm | 0.060 in |
| Spark Plug Type | 25171803 [AC plug type]<br>12567759 [NGK plug type] | |

### Fastener Tightening Specifications

| Application | Specifications | |
|---|---|---|
| | Metric | English |
| Accelerator Pedal Nut | 20 N·m | 15 lb ft |
| Air Cleaner Outlet Duct Clamp | 7 N·m | 62 lb in |
| Camshaft Position (CMP) Sensor Bolt | 25 N·m | 18 lb ft |
| Crankshaft Position (CKP) Sensor Bolt | 25 N·m | 18 lb ft |
| Crossover Fuel Pipe Retainer Clip Attaching Screw | 3.8 N·m | 34 lb in |
| Engine Coolant Temperature (ECT) Sensor | 20 N·m | 15 lb ft |
| Engine Wiring Harness Bracket Nut | 5 N·m | 44 lb in |
| Evaporative Emission (EVAP) Canister Bolt | 25 N·m | 18 lb ft |
| Evaporative Emission (EVAP) Canister Bracket Bolt | 25 N·m | 18 lb ft |
| Evaporative Emission (EVAP) Canister Bracket Nut | 25 N·m | 18 lb ft |
| Evaporative Emission (EVAP) Canister Purge Solenoid Bolt | 10.5 N·m | 93 lb in |
| Fuel Composition Sensor to Bracket Bolt | 10 N·m | 89 lb in |
| Fuel Composition Sensor Bracket Nut | 17 N·m | 13 lb ft |
| Fuel Fill Pipe Bracket Bolt | 12 N·m | 106 lb in |
| Fuel Fill Pipe Ground Strap Bolt | 9 N·m | 80 lb in |
| Fuel Filter Bracket Bolt | 12 N·m | 106 lb in |
| Fuel Pipe Bracket to Bellhousing Stud Nut | 10 N·m | 89 lb in |
| Fuel Pipe/Hose Bracket Bolt | 12 N·m | 106 lb in |
| Fuel Rail Bolt | 10 N·m | 89 lb in |
| Fuel Rail Crossover Pipe Retainer Clip Attaching Screw | 3.8 N·m | 34 lb in |
| Fuel Rail Pipe Attaching Screw | 5 N·m | 44 lb in |
| Fuel Tank Filler Housing to Body Screw | 2.3 N·m | 20 lb in |
| Fuel Tank Filler Housing to Fuel Tank Fill Pipe Screw | 2.3 N·m | 20 lb in |
| Fuel Tank Fill Hose Clamp | 2.5 N·m | 22 lb in |
| Fuel Tank Shield Bolt | 15 N·m | 11 lb ft |
| Fuel Tank Strap Bolt | 40 N·m | 30 lb ft |
| Fuel Tank Vent Hose Clamp | 2.5 N·m | 22 lb in |
| Heated Oxygen Sensor (HO2S) | 42 N·m | 31 lb ft |
| Ignition Coil Bolt | 8 N·m | 71 lb in |
| Knock Sensor (KS) | 20 N·m | 15 lb ft |
| Mass Air Flow/Intake Air Temperature (MAF/IAT) Sensor Clamp | 7 N·m | 62 lb in |
| Powertrain Control Module (PCM) Connector Bolt | 8 N·m | 71 lb in |
| Sending Unit Shield Nut | 10 N·m | 89 lb in |
| Spare Tire Hoist Crossmember Bolt | 50 N·m | 37 lb ft |
| Spark Plug | | |
| New Cylinder Head | 20 N·m | 15 lb ft |
| Used Cylinder Head | 15 N·m | 11 lb ft |

| Application | Specifications | |
|---|---|---|
| | Metric | English |
| Throttle Actuator Control Module Nut | 9 N·m | 80 lb in |
| Throttle Body Nut | 10 N·m | 89 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 gasoline. For more information, write to: American Automobile Manufacturer's Association, 7430 Second Ave, Suite 300, Detroit MI 48202.

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

If you're using fuel rated at 87 octane or higher and you hear heavy knocking, your engine needs service. Don't worry if you hear a little pinging noise when you're accelerating or driving up a hill. That is normal and you don't have to buy a higher octane fuel to get rid of pinging. It is the heavy, constant knock that means you have a problem.

**Notice**

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

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

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

# Engine Controls – 8.1L

## Ignition System Specifications

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Firing Order | 1-8-7-2-6-5-4-3 | |
| Spark Plug Wire Resistance | 1,000 ohms per ft | |
| Spark Plug Torque | 20 N·m | 15 lb ft |
| Spark Plug Gap | 1.52 mm | 0.060 in |
| Spark Plug Type | TJ14R-P15 Denso plug type | |

## Fastener Tightening Specifications

| Application | Specifications | |
|---|---|---|
| | Metric | English |
| Accelerator Pedal Nut | 20 N·m | 15 lb ft |
| Air Cleaner Resonator Outlet Duct Clamp | 4 N·m | 35 lb in |
| Camshaft Position (CMP) Sensor Bolt | 12 N·m | 106 lb in |
| Crankshaft Position (CKP) Sensor Bolt | 12 N·m | 106 lb in |
| Engine Coolant Temperature (ECT) Sensor | 50 N·m | 37 lb ft |
| Evaporative Emission (EVAP) Canister Bolt | 25 N·m | 18 lb ft |
| Evaporative Emission (EVAP) Canister Bracket Nut | 25 N·m | 18 lb ft |
| Evaporative Emission (EVAP) Canister Purge Valve Solenoid Bolt | 10 N·m | 89 lb in |
| Fuel Fill Hose Clamp | 2.5 N·m | 22 lb in |
| Fuel Fill Pipe Ground Strap Bolt | 9 N·m | 80 lb in |
| Fuel Hose/Pipe Bracket Nut | 12 N·m | 106 lb in |
| Fuel Tank Filler Housing to Body Screw | 2.3 N·m | 20 lb in |
| Fuel Tank Filler Housing to Fuel Tank Fill Pipe Screw | 2.3 N·m | 20 lb in |
| Fuel Pipe Bracket Nut | 10 N·m | 89 lb in |
| Fuel Rail Stud | 12 N·m | 106 lb in |
| Fuel Tank Shield Bolt | 15 N·m | 11 lb ft |
| Fuel Tank Strap Bolt | 40 N·m | 30 lb ft |
| Heated Oxygen Sensor (HO2S) | 42 N·m | 31 lb ft |
| Ignition Coil Bolt | 12 N·m | 106 lb in |
| Knock Sensor (KS) | 20 N·m | 15 lb ft |
| Manifold Absolute Pressure (MAP) Sensor Bolt | 12 N·m | 106 lb in |
| Mass Air Flow/Intake Air Temperature (MAF/IAT) Sensor Clamp | 7 N·m | 62 lb in |
| Powertrain Control Module (PCM) Connector Bolt | 8 N·m | 71 lb in |
| Spare Tire Hoist Crossmember Bolt | 50 N·m | 37 lb ft |
| Spark Plug | | |
| Used Cylinder Head | 20 N·m | 15 lb ft |
| New Cylinder Head | 30 N·m | 22 lb ft |
| Throttle Actuator Control Module Nut | 9 N·m | 80 lb in |
| Throttle Body Nut | 10 N·m | 89 lb in |
| Engine Wire Harness Bolt/Stud | 10 N·m | 89 lb in |

## Fuel System Specifications

See Fuel System Specifications above.

# Exhaust System

## Fastener Tightening Specifications

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Engine Shield Bolt | 20 N·m | 15 lb ft |
| Engine Coolant Temperature (ECT) Sensor | 20 N·m | 15 lb ft |
| EGR Pipe Bracket Bolt - 8.1L Engine | 50 N·m | 37 lb ft |
| EGR Pipe Nut - 8.1L Engine | 30 N·m | 22 lb ft |
| Exhaust Heat Shield Bolt | 9 N·m | 80 lb in |
| Exhaust Heat Shield Nut (Body Panel) | 9 N·m | 80 lb in |
| Exhaust Manifold Bolts - 5.3L and 6.0L Engines | | |
| First Pass in Sequence | 15 N·m | 11 lb ft |
| Final Pass in Sequence | 25 N·m | 18 lb ft |
| Exhaust Manifold Center Bolt - 8.1L Engine | 35 N·m | 26 lb ft |
| Exhaust Manifold Heat Shield Bolt - 5.3L and 6.0L Engines | 9 N·m | 80 lb in |
| Exhaust Manifold Heat Shield Bolt/Nut - 8.1L Engine | 25 N·m | 18 lb ft |
| Exhaust Manifold Nut - 8.1L Engine | 16 N·m | 12 lb ft |
| Exhaust Pipe Hanger Bracket Bolt | 12 N·m | 106 lb in |
| Exhaust Manifold Pipe Nut | 50 N·m | 37 lb ft |
| Exhaust Muffler Hanger Nut | 50 N·m | 39 lb ft |
| Exhaust Muffler Nut | 40 N·m | 30 lb ft |
| Exhaust Pipe Clamp | 40 N·m | 30 lb ft |
| Oil Pan Skid Plate Bolt | 20 N·m | 15 lb ft |
| Oxygen Sensor | 42 N·m | 31 lb ft |
| Rear Shock Absorber Lower Bolt | 95 N·m | 70 lb ft |
| Transmission Mount Nut | 40 N·m | 30 lb ft |
| Transmission Support Crossmember Bolt | 70 N·m | 52 lb ft |

## Exhaust System Description

Important

Use of non-OEM parts may cause driveability concerns.

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

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

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

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

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

The exhaust system may be comprised of the following components:

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

- Exhaust hangers
- Exhaust heat shields

### Resonator

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

### Catalytic Converter

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

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

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

The catalyst in the converter is not serviceable.

### Muffler

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

# Transmission/Transaxle Description and Operation

## Automatic Transmission – 4L60E

### Transmission General Specifications

| Name | Hydra-matic 4L60-E |
|---|---|
| RPO Codes | M30, M32 |
| Production Location | Toledo, Ohio<br>Romulus, MI |
| Vehicle Platform (Engine/Transmission) Usage | C/K 800 |
| 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) | 300 mm |
| Pressure Taps | Line Pressure |
| Transmission Fluid Type | DEXRON® III |
| Transmission Fluid Capacity (Approximate) | 300 mm Converter<br>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<br>P, R, N, Overdrive, 3, 2, 1 |
| Case Material | Die Cast Aluminum |
| Transmission Weight Dry (Approximate) | 300 mm Converter<br>86.17 kg (190.5 lb) |
| Transmission Weight Wet (Approximate) | 300 mm Converter<br>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) |

### 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 |

| Application | Specification | |
|---|---|---|
| | Metric | English |
| 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 |

## 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 Identification Information

| Plant | Build Line | 1st Shift | 2nd Shift | 3rd Shift |
|---|---|---|---|---|
| Toledo, OH | ML1 | J | W | X |
| | ML2 | A | C | Not Used |
| | ML3 | B | H | Not Used |
| | ML4 | S | L | V |
| | ML5 | K | E | Z |
| Romulus, MI | 1 | A | -- | B |
| Ramos Arizpe, Mexico | 1 | A | -- | -- |

## Transmission Component and System Description

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

- A torque converter with an electronically controlled capacity clutch (ECCC) This transmission is equipped with an ECCC. The pressure plate does not fully lock to the torque converter cover. Instead, the pressure plate maintains a small amount of slippage, about 20 RPM, in SECOND, THIRD, and FOURTH gears, depending on the vehicle application. ECCC was developed to reduce the possibility of noise, vibration, or chuggle caused by TCC apply. Typical apply speeds are 49-52 km/h (30-32 mph) in THIRD gear and 65-73 km/h (40-45 mph) in FOURTH gear. Full lockup is available at highway speeds on some applications.
- 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.

# Automatic Transmission – 4L80E

## Transmission General Specifications

| Name | Hydra-matic 4L80-E |
|---|---|
| RPO Codes | MT1 |
| Production Location | Ypsilanti, MI |
| Vehicle Platform (Engine/Transmission) Usage | C/K, C/K 800, G, P32/42 |
| Transmission Drive | Longitudinally Mounted Rear Wheel Drive |
| 1st Gear Ratio | 2.482:1 |
| 2nd Gear Ratio | 1.482:1 |
| 3rd Gear Ratio | 1.000:1 |
| 4th Gear Ratio | 0.750:1 |
| Reverse | 2.077:1 |
| Torque Converter Size (Diameter of Torque Converter Turbine) | 310 mm |
| Pressure Taps | Line Pressure |
| Transmission Fluid Type | DEXRON® III |
| Transmission Fluid Capacity (Approximate) | Bottom Pan Removal: 7.3L (7.7 qts)<br>Dry: 12.8L (13.5 qts) |
| Transmission Type: 4 | Four Forward Gears |
| Transmission Type: L | Longitudinal Mount |
| Transmission Type: 80 | Product Series |
| Transmission Type: E | Electronic Controls |
| Position Quadrant | P, R, N, Overdrive, D, 2, 1 |
| Case Material | Die Cast Aluminum |
| Transmission Weight Dry | 107 kg (236 lbs) |
| Transmission Weight Wet | 118 kg (260 lbs) |
| Maximum Trailer Towing Capacity | 9,525 kg (21,000 lbs) |
| Maximum Gross Vehicle Weight (GVW) | 7,258 kg (16,000 lbs) |

## Fastener Tightening Specifications

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Accumulator Housing to Valve Body | 11 N·m | 97 lb in |
| Case Center Support | 44 N·m | 32 lb ft |
| Control Valve Assembly to Case | 11 N·m | 97 lb in |
| Cooler Pipe Connector Nut at Case and Radiator | 38 N·m | 28 lb ft |
| Engine Rear Mount to Transmission Bolt | 44 N·m | 32 lb ft |
| Engine Rear Support Bracket to Frame Nut | 44 N·m | 32 lb ft |
| Extension Housing to Case | 34 N·m | 25 lb ft |
| Flywheel Housing Cover to Transmission | 7 N·m | 62 lb in |
| Flywheel to Converter | 44 N·m | 32 lb ft |
| Fourth Clutch | 23 N·m | 17 lb ft |
| Manual Shaft to Detent Lever Nut | 24 N·m | 18 lb ft |
| Oil Pan Drain Plug | 34 N·m | 25 lb ft |
| Oil Pan to Case | 24 N·m | 18 lb ft |
| Oil Test Hole Plug | 11 N·m | 97 lb in |
| Parking Pawl Bracket to Case | 24 N·m | 18 lb ft |
| Pressure Control Solenoid Bracket to Valve Body | 8 N·m | 71 lb in |
| Pump Assembly to Case | 24 N·m | 18 lb ft |
| Pump Body to Cover | 24 N·m | 18 lb ft |
| Rear Servo Cover to Case | 24 N·m | 18 lb ft |
| Solenoid to Valve Body | 8 N·m | 71 lb in |

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Speed Sensor and Bracket Assembly to Case | 11 N·m | 97 lb in |
| Transmission Case to Engine | 44 N·m | 32 lb ft |
| Valve Body to Case/Lube Pipe | 11 N·m | 97 lb in |
| Valve Body to Case/PSM | 11 N·m | 97 lb in |

### Fluid Capacity Specifications Overhaul

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Oil Pan Removal | 7.3 liters | 7.7 quarts |
| Overhaul | 12.8 liters | 13.5 quarts |

### Transmission General Description

The 4L80-E is a fully automatic rear wheel drive electronically controlled transmission. The 4L80-E provides four forward ranges including overdrive and reverse. A gear type of oil pump controls shift points. The VCM/PCM and the pressure control (PC) solenoid (force motor) regulate these shift points. The VCM/PCM also controls shift schedules and TCC apply rates. Transmission temperature also influences shift schedules and TCC apply rates.

You can operate the transmission in any one of the following seven modes:

- P - PARK position prevents the vehicle from rolling either forward or backward on vehicles less than 15,000 G.V.W. For safety reasons, use the parking brake in addition to the park position.
- R - REVERSE allows the vehicle to be operated in a rearward direction.
- N - NEUTRAL allows the engine to be started and operated while driving the vehicle. If necessary, you may select this position in order to restart the engine with the vehicle moving.
- OD - OVERDRIVE is used for all normal driving conditions. Overdrive provides four gear ratios plus a converter clutch operation. Depress the accelerator in order to downshift for safe passing.
- D - DRIVE position is used for city traffic, and hilly terrain. Drive provides three gear ranges. Depress the accelerator in order to downshift.
- 2 - Manual SECOND provides acceleration and engine braking or greater traction from a stop. When you choose manual SECOND, the vehicle will start out in first gear and upshift to second gear. You may select this gear at a vehicle speed of up to 22 km/h (35 mph).
- 1 - Manual LOW provides maximum engine braking. You may select this gear at a vehicle speed of up to 13 km/h (20 mph).

### Transmission Component and System Description

The mechanical components of this unit are as follows:

- A torque converter with a torque converter clutch (TCC)
- A gear type oil pump
- Five multiple disk clutches
- Two band assemblies
- Three planetary gear sets
- One sprag clutch
- Two roller clutches
- A control valve body assembly

The electrical components of this unit are as follows:

- Two shift solenoid valves, 1-2 and 2-3
- A torque converter clutch (TCC) solenoid valve
- A transmission pressure control (PC) solenoid valve
- An automatic transmission fluid temperature (TFT) sensor
- An automatic transmission fluid pressure (TFP) manual valve position switch assembly
- An output speed sensor (OSS)
- An input speed sensor (ISS)

## Transmission Adaptive Functions

The 4L80-E transmission uses a line pressure control system that has the ability to adapt line pressure to compensate for normal wear of the following parts:

- The clutch fiber plates
- The springs and seals
- The apply bands

This adaptive feature is similar to the fuel and idle control systems, where the powertrain control module (PCM) has the ability to learn and adjust for monitored system changes.

The PCM maintains information for the following transmission adaptive systems:

1-2, 2-3, 3-4 Upshift Adapts -- The PCM monitors the automatic transmission input shaft speed sensor (AT ISS) and the output speed sensor (OSS), to determine when the transmission has started, and completed an upshift. The PCM looks at the time from the beginning, until the completion of the upshift. If the time of the upshift was longer than a calibrated value, then the PCM adjusts the current to the transmission pressure control (PC) solenoid to increase line pressure for the next, same, upshift under identical conditions. If the time of the upshift was shorter than a calibrated value, then the PCM adjusts the current, to the transmission PC solenoid, to decrease line pressure for the next, same, upshift under identical conditions.

## Transmission Indicators and Messages

The following transmission-related indicators and messages may be displayed on the instrument panel cluster (IPC).

**4WD**

This indicator illuminates when the powertrain control module (PCM) detects that 4WD has been requested.

**Tow/Haul**

This indicator illuminates when the PCM detects that tow/haul mode has been requested.

**Transmission Hot**

This message is displayed when the PCM detects a transmission fluid temperature (TFT) equal to or greater than 130°C (266°F) for 5 seconds.

**Trans Hot...Idle Engine**

This message is displayed when the PCM detects a TFT equal to or greater than 135°C (275°F).

# 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.<br>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

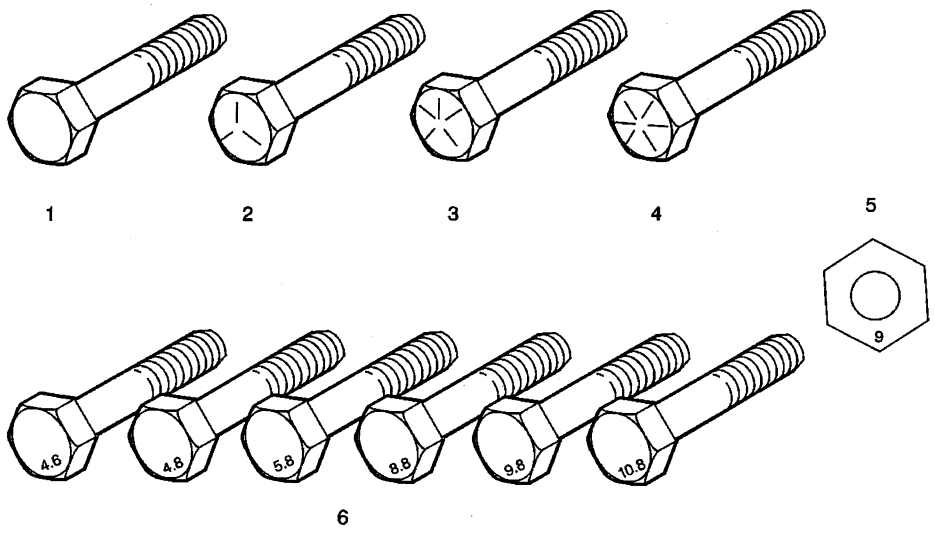
## Metric Fasteners

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

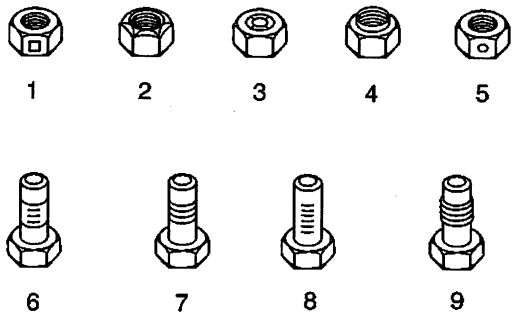
These fasteners accomplish the thread interface by a designed distortion or deformation in the fastener.

### 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 |