# Chevrolet

# Astro Van

# 2001

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# Product Information

## 2001 Chevrolet Astro: Not Your Everyday Minivan

DETROIT — No minivan on the market can match the Chevrolet Astro when it comes to cargo capacity, trailering capability and comfortable eight-passenger seating. For 2001, Astro offers the very best capabilities of a Chevy Truck, the most dependable, longest-lasting trucks on the road. "Whether you're shuttling the kids around town or towing the boat to the lake, the Astro is not your everyday minivan," says Astro Brand Manager John Gaydash. "In addition to its incomparable roominess and ride, Astro's standard Vortec 4300 V6, four-wheel antilock brakes and available All- Wheel-Drive make this Chevy Truck a dependable member of the family."

### New For 2001

For 2001, Astro's rugged, yet contemporary styling is highlighted by two all-new colors: Light Pewter Metallic and Dark Carmine Red Metallic. On the inside, Astro offers a choice of two feature-packed interior trim levels.

The popular Astro LS package is ordered on the majority of Astros. It provides buyers with a long list of standard features such as: chrome-cladded steel wheels, power door locks and windows, cruise control, overhead roof console, power mirrors, tilt steering wheel, remote keyless entry and more.

The up-level Astro LT can include available luxurious leather seating surfaces, high-back reclining seats and a leather-wrapped steering wheel.

For 2001, Astro receives a new alternator rated at 105 amps to provide plenty of clean power to two covered outlets located in the front console for cell phones or laptop computers and one in the cargo area for a TV at tailgate events.

Chevrolet Astro features the largest displacement V6 engine in its class for plenty of muscle to tow and pass with ease, compliments of its standard 190 horsepower Vortec 4300 V6 engine.

Thanks to a new powertrain control module, engine performance has been enhanced. Because Chevrolet is committed to protecting the environment, Astro offers Onboard Refueling Vapor Recovery (ORVR) compliance as well as a National Low Emissions Vehicle (NLEV) system for 2001.

Astro's powerful and efficient powerplant, rear-wheel-drive configuration and 3.73:1 rear axle ratio combine to tow as much as 5,500 pounds, more than any front-wheel-drive minivan on the market

(up to 5,900 pounds on cargo model). Astro's available Dutch Doors provide easy access to more than 170 cu. ft. of cargo space. No other compact van offers more.

Chevrolet Astro's reputation as a premiere people-mover is underscored by an extensive list of safety and security features including: standard driver and front passenger air bags, child security sliding door, a lockout provision that prevents the driver door from locking if the key is inadvertently left in the ignition and an optional remote keyless entry system. Also, the All-Wheel-Drive option provides additional traction in inclement weather.From family transportation to heavy cargo hauling, Astro is the hardest working minivan on the job. Exactly what customers have come to expect from Chevrolet Trucks.

# Brand Identity

Astro provides minivan capability and the physical strength and competence of a truck, making Astro the most capable midsize van. It's the only truck tough enough to handle childhood. No minivan on the market can match Astro for trailering capacity and comfortable eight-passenger seating. In addition to the room and ride, Astro comes standard with the powerful Vortec 4300 V6, 4-speed automatic overdrive transmission and 4-wheel antilock brakes.

## What's New And Highlights

### Exterior

- Light Pewter Metallic and Dark Carmine Red Metallic

### Functional

- Powertrain Control Module (PCM) helps to enhance engine performance and fuel economy
- 105-amp alternator replaces the previous 100-amp alternator
- National Low Emissions Vehicle (NLEV) system option
- Onboard Refueling Vapor Recovery (ORVR) compliance

## Models

- Astro LS Passenger Van
- Astro LT Passenger Van
- Astro Cargo Van

## Customer Profile

### Astro Passenger Van

Owners of the Astro Passenger Van are recreationally active, choosing Astro for the minivan capability, physical strength and competence of the Chevy Truck chassis it provides.

### Astro Cargo Van

Cost-conscious fleet buyers, commercial tradesmen and small-business owners seek the Astro Cargo Van for its all-wheel drive, high towing capacity, large cargo capacity and 8-passenger seating. The Astro is a member of the Chevy Truck family – the most dependable, longest-lasting trucks on the road.*

* Dependability based on longevity: 1981—1999 full-line light-duty truck company registrations. Excludes other GM divisions.

### Astro Passenger Van Demographics:

| | |
|---|---|
| Typical buyers: | 34-54 years |
| Median income: | $50,000 |
| Purchaser: | Predominantly married college graduates with children |

### Astro Cargo Van Demographics:

Typical buyers are commercial users and fleets including building, remodeling, plumbing, electrical, security, and pickup and delivery industries.

## Competition

### Astro Passenger Van

- Ford Windstar
- Dodge Caravan and Grand Caravan

### Astro Cargo Van

- Ford Windstar (FWD) Cargo Van

# Vehicle Overview

## Astro History

Introduced in 1985 as a "midsize" alternative to minivans.

1986 – Throttle-body fuel injection on 4.3-Liter V6
1987 – New Touring Package; serpentine belt engine accessory drive
1988 – Anti-corrosion improvements
1989 – Rear-wheel antilock brakes and electronic speedometer; Goodyear GT+4 tires available
1990 – All-Wheel-Drive Passenger and Conversion Vans; extended wheelbase models debut; four-wheel antilock brakes; increased standard equipment for all trim levels
1991 – 4.3-Liter V6 engine with EFI increased to 170 horsepower
1992 – Enhanced 4.3-Liter Vortec V6 engine – optional on 2WD, standard on AWD; optional Dutch doors
1993 – Electronically controlled 4L60-E transmission introduced
1994 – Side-door beams; driver air bag; CFC-free R-134a air conditioning refrigerant introduced
1995 – Standard air conditioning
1996 – New interior; passenger-side air bag added; improved Vortec 4300 V6 engine
1997 – Daytime Running Lamps (DRL); Electronic Variable Orifice (EVO) power steering
1998 – PASSlock® theft-deterrent system
1999 – State-of-the-art active transfer case on AWD models
2000 – Retained accessory power; Tow/Haul mode; Remote Keyless Entry

## Exterior Paint

Standard basecoat/clearcoat paint on Astro helps resist fading and provides a high gloss shine for long-lasting exterior beauty.

### Paint Colors

- Light Pewter Metallic
- Dark Carmine Red Metallic
- Medium Charcoal Gray Metallic
- Medium Bronzemist Metallic
- Ivory White
- Teal Blue Metallic
- Light Carmine Red Metallic
- Medium Cadet Blue Metallic
- Dark Forest Green Metallic
- Light Autumnwood Metallic*

**Stripe Colors:**

- Pewter
- Light Autumnwood.

* See Feature Availability Chart for additional features.

## Interior Fabric and Colors (Passenger Van):

- Pewter Cloth
- Neutral Cloth
- Pewter leather seating surfaces
- Neutral leather seating surfaces

## Interior Fabric and Colors (Cargo Van):

- Pewter Vinyl
- Blue Vinyl
- Pewter Cloth
- Blue Cloth

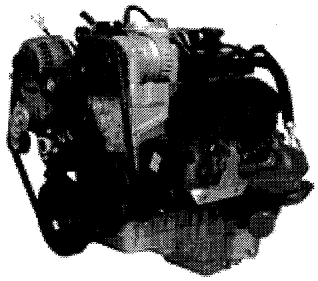
## Astro Powertrains

### Engineering

At its manufacturing plant in Baltimore, Maryland, numerous manufacturing processes help maintain quality and product consistency on every vehicle.

### Engines

**Vortec 4300 V6 SFI Engine (L35**



The Vortec 4300 V6 engine with Sequential Fuel Injection (SFI) is standard on Astro. This refined V6 engine is the largest displacement V6 in the midsize van class.*

- The Vortec V6 engine features new roller rocker arms, a new roller timing chain and powdered metal sprocket. These new components help provide quieter operation and extended durability.

**Vortec 4300 V6 Power Ratings:**

- 190 horsepower at 4400 rpm
- 250 lb.-ft. of torque at 2800 rpm.

**Vortec 4300 V6 Technical Features:**

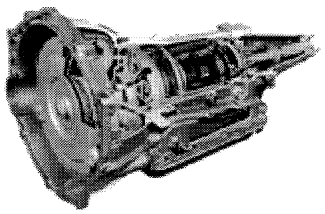
- Sequential Fuel Injection (SFI)
- High precision fuel control
- Each injector is fired sequentially and timed to the intake cycle for accuracy and metering control. This helps provide precise timing and smooth overall performance
- Mass airflow meter constantly measures the engine's air requirements under varying conditions, such as changes in load, altitude and temperature. In a SFI system, the mass airflow meter is essential for accurate fuel delivery
- Injector nozzle's design and optimum location produce an effective spray pattern that helps contribute to the engine's smooth idle and optimum fuel efficiency
- Low maintenance due to platinum-tip spark plugs which are designed to go up to 100,000 miles before the first scheduled replacement and extended-life engine coolant that is designed to last up to five years or 150,000 miles whichever comes first†
- Single accessory drive belt.

* Mid-size van class based on GM segmentation. Excludes other GM vehicles.

† Maintenance needs vary with different uses and driving conditions. See owner's manual for more information.

### Transmissions

**4L60-E 4-Speed Electronic Automatic Transmission**



The GM 4L60-E 4-speed automatic overdrive transmission is standard on Astro. The 4L60-E's "intelligent" electronic controls allow the transmission to match the engine's performance, helping to deliver optimum fuel efficiency.

**4l60-E Technical Features:**

- Vamac pump cover seals help provide good sealing properties
- Clutch plate material helps durability and performance
- Wide range of gear ratios
- Powertrain Control Module helps provide precision and flexibility. It measures key vehicle input, including throttle position, vehicle speed, gear range, temperature and engine load
- Contributing to a virtually seamless operation, the PCM acts as an interface between the engine and transmission
- Electronically-controlled shift-timing
- Brake/transmission shift interlock is standard. It requires the driver to apply the brake pedal to shift out of PARK
- Second-gear-start feature helps reduce torque to the drive wheels by moving the gear selector to the DRIVE 2 position, thereby increasing control during initial acceleration on slippery surfaces
- Automatic transmission fluid in the 4L60-E has a fluid change interval of 50,000 miles* under normal operating conditions.

* Maintenance needs vary with different uses and driving conditions. See owner's manual for more information.

### All-wheel-drive system

- All-Wheel-Drive system operates in RWD until it senses rear wheel slip, at which time it transfers torque to the front axle to help regain traction
- Transfer case assembly, control module and electrical harness are the system's components.

## Axles

- Rear axle shafts are hardened to aid in fatigue-resistance and durability
- Two axle ratios are available:
  - 3.42 for mid-range towing needs
  - 3.73 for maximum torque and towing capability
- Rear-wheel-drive models offer a choice of axle ratios

## Suspension

### Front Suspension

- Independent Short/Long Arm (SLA) with coil springs — 2WD models
- Independent Short/Long Arm (SLA) with torsion bars — AWD models
- Computer-selected coil springs and torsion bars
- Gas-pressurized 32mm shock absorbers
- Maintenance-free wheel bearings
- 28mm stabilizer bar for 2WD Cargo Van models
- 32mm stabilizer bar for 2WD Passenger Van models
- 30mm stabilizer bar for AWD models

### Rear Suspension

- Rigid axle with variable-rate, gas-charged shock absorbers and steel multileaf rear springs.

## Steering

- Variable-ratio recirculating ball-type power steering

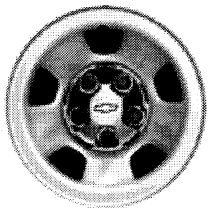
## Brakes

- Power front disc/rear drum

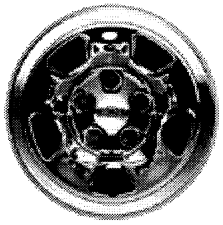
- Ventilated front rotors
- Audible pad-wear sensors
- 4-wheel ABS standard
- Cable-to-rear wheels parking brake

## Wheels and Tires

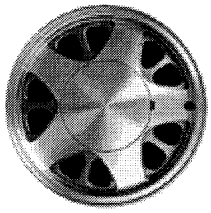
### Wheels



15-inch x 6-inch styled-steel, painted silver – standard on Astro Cargo Van



15-inch x 6.5-inch chrome-cladded, styled-steel — standard on Astro LS



15-inch x 6.5-inch brushed-aluminum – standard on LT, optional on LS and Astro Cargo Vans with YF7 Upfitter Package

### Tires

- P215/75R-15 blackwall all-season steel-belted radials are standard on Astro
- P215/75R-15 white outline-lettered all-season steel-belted radials are optional and require brushed-aluminum wheels

## Feature Availability

| Interior Features | LS | LT | Cargo Van |
|---|---|---|---|
| Air bags — driver and front-passenger1 | S | S | S |
| Air conditioning | | | |
| — front | S | S | S |
| — front and rear | O | S | NA |
| Console overhead with trip computer | S | S | O |
| Convenience Group | | | |
| — Tilt-Wheel™ and cruise control | S | S | O |
| — power door locks and power windows | S | S | O |
| Cup holders | S | S | S |
| Door trim — driver and passenger, color-keyed cloth/carpet | S | S | NA |
| Flash-to-pass | S | S | S |
| Floor mats — rubber | S | S | NA |
| Gauges — fuel level, odometer, oil pressure, speedometer, temperature gauge, trip odometer, voltmeter | S | S | S |
| Heating — rear | O | S | NA |
| Lights, interior — delayed entry | S | S | S |
| Locks — power door | S | S | O |
| Retained accessory power | S | S | S |
| Seating | | | |
| — 8-passenger | S | S | NA |
| — 7-passenger | NA | O | NA |
| — 2-passenger | NA | NA | S |
| Seats | | | |
| — cloth front reclining buckets and two three-passenger bench seats | S | NA | NA |
| — special cloth front reclining buckets and two split-bench seats | NA | S | NA |
| — special leather front reclining buckets and two split-bench seats | NA | O | NA |
| — vinyl front reclining buckets | NA | NA | S |
| — cloth front reclining buckets | NA | NA | O |
| Steering wheel | | | |
| — black four-spoke | S | NA | S |
| — black leather-wrapped | NA | S | NA |
| Storage compartment — left rear quarter, third-seat area | S | S | NA |
| Sunshades | | | |
| — cloth with lighted mirrors, extenders (dual blade with LT trim) | S | S | NA |
| — vinyl color-keyed | NA | NA | S |
| Trailering — Tow/Haul mode | S | S | S |
| Windows — swing-out on sliding door, LH quarter panel | S | S | NA |
| **Sound Systems** | **LS** | **LT** | **Cargo Van** |
| NOTE: All sound systems feature an Electronically Tuned Receiver (ETR) and include a digital clock and seek-scan. | | | |
| AM/FM stereo | NA | NA | S |
| AM/FM stereo with compact disc player, TheftLock, speed-compensated volume and auto tone control | S | NA | O |

| | | | |
|---|---|---|---|
| AM/FM stereo with cassette player, remote compact disc player, TheftLock, speed-compensated volume and auto tone control | O1 | S | O(2) |
| **Exterior Features** | **LS** | **LT** | **Cargo Van** |
| Daytime Running Lamps with Automatic Exterior Lamp Control | S | S | S |
| Doors — sliding RH side, RH and LH rear loading | S | S | S |
| Doors — rear Dutch with liftglass and rear-window defogger | O | S | NA |
| Luggage carrier | S | S | NA |
| Mirrors | | | |
| — below eyeline, foldaway, black | NA | NA | S |
| — below eyeline, electric remote control, black | S | S | NA |
| Running boards | O | O | NA |
| Tires | | | |
| — P215/75R-15 all-season blackwall | S | S | S |
| — P215/75R-15 all-season white-lettered | O | O | O(2) |
| Wheels | | | |
| — styled-steel 15-inch x 6.5-inch silver-painted | NA | NA | S |
| — styled-steel 15-inch x 6.5-inch chrome-cladded | S | NA | NA |
| — brushed-aluminum 15-inch x 6.5-inch | O | S | O(2) |
| Wipers — intermittent variable | S | S | S |
| 1 Requires optional Preferred Equipment Group 1SD. 2 Available only with optional Upfitter Package (RPO YF7). | | | |
| **Functional Features** | **LS** | **LT** | **Cargo Van** |
| Battery-rundown protection | S | S | S |
| Brake system | | | |
| — 4-wheel antilock (ABS) | S | S | S |
| — power front disc/rear drum | S | S | S |
| Engine — Vortec 4300 V6 SFI | S | S | S |
| Lockout protection | S | S | O(2) |
| PASSlock® theft-deterrent system | S | S | S |
| Remote Keyless Entry with panic alarm | S | S | O(2) |
| Transmission — 4-speed electronically controlled automatic | S | S | S |
| **Safety and Security Features** | **LS** | **LT** | **Cargo Van** |
| Air bags — driver and front-passenger(1) | S | S | S |
| Battery-rundown protection | S | S | S |
| Brake system — 4-wheel antilock (ABS) | S | S | S |
| Child security sliding-door lock | S | S | S |
| Daytime Running Lamps with Automatic Exterior Lamp Control | S | S | S |
| Lockout protection | S | S | O(2) |
| PASSlock® theft-deterrent system | S | S | S |

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

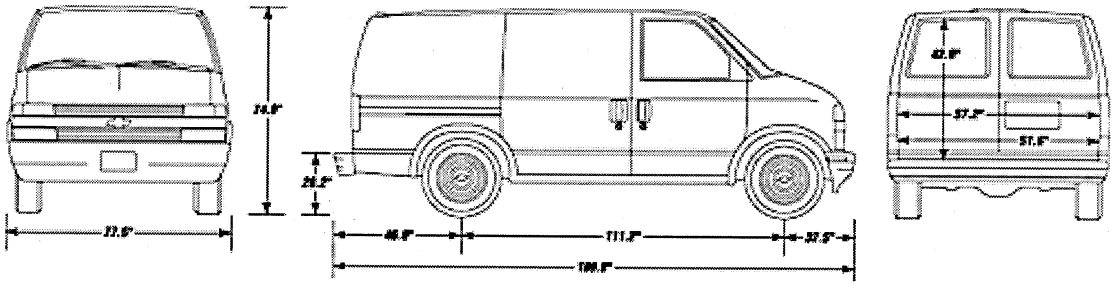
# Specifications

| Engine Specifications | |
|---|---|
| RPO | L35 |
| Displacement (cu. in./liters) | 262/4.3 |
| Bore x stroke(in.) | 4.00 x 3.48 |
| (mm.) | 101 x 88 |
| Compression ratio | 9.2:1 |
| Cylinder block material | cast-iron |
| Cylinder head material | cast-iron |
| Valvetrain configuration | OHV |
| Valves/cylinder | 2 |
| Induction system | SFI |
| Ignition system | direct |
| Lifters | hydraulic roller |
| Cam drive | chain |
| Coolant capacity (quarts/liters) | 13.5/12.8(1) |
| Oil capacity (quarts/liters) | 4.5/4.3 |
| Alternator rating (amps) | 105 |
| Battery (SAE rating, cca) | 600 |
| Recommended unleaded fuel | 87 octane |
| Maximum engine speed (RPM) | 5600 |
| Horsepower/kW @ engine RPM | 190/142 @ 4400 |
| Torque (lb.-ft./N-m @ engine RPM) | 250/339 @ 2800 |
| (1) 16.5/15.6 with rear heater. | |

| Transmission Specifications | | |
|---|---|---|
| Model availability | RWD & AWD | |
| Transmission type | 4-speed electronically controlled automatic with overdrive & torque converter | |
| RPO | M30 | |
| | First gear | 3.06 |
| | Second gear | 1.63 |
| | Third gear | 1.00 |
| | Fourth gear | 0.70 |
| | Reverse | 2.29 |
| Fluid capacity (quarts/liters) | 5.0/4.7 | |
| Case material | die-cast aluminum | |

| Steering Specifications | | |
|---|---|---|
| | **RWD** | **AWD** |
| Type | Integral power | Integral power |
| Ratio (overall) | 16/13:1 | 16/13:1 |
| Turning diameter curb-to-curb (ft./m) | 40.5/13.7 | 43.8/14.8 |

| Brake Specifications | | |
|---|---|---|
| Front Brakes | U.S. Standard | Metric |
| — rotor size (diam. x thick.) | | |
| Rear-wheel drive | 11.86 x 1.04 in. | 301 x 26 mm |
| All-Wheel-Drive | 11.57 x 1.25 in. | 294 x 32 mm |
| — swept area | 239.6 sq. in. | 1545.9 sq. cm |
| Rear Brakes | Standard | Metric |
| — drum size (diam. x width) | 9.5 x 2.0 in. | 241 x 51 mm |
| — swept area | 119.4 sq. in. | 770 sq. cm |



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

| Exterior | |
|---|---|
| Wheelbase | 111.2/2825 |
| Length | 189.8/4821 |
| Height | 74.9/1903 |
| Maximum width | 77.5/1987 |
| Side-door load opening | |
| — height | 46.8 |
| — width | 34.5 |
| Rear-door load opening | |
| — height | 42.0 |
| — width | 57.2 |
| Ground-to-rear load floor | 25.9/660 |
| Ground clearance | |
| — front | 6.8/173 |
| — rear | 7.4/188 |
| Tread width | |
| — front | 65.1/1654 |
| — rear | 65.1/1654 |

**Interior***

| | Front | Middle | Rear |
|---|---|---|---|
| Headroom | 39.2/996 | 37.9/963 | 38.7/983 |
| Legroom | 41.6/1057 | 36.5/927 | 38.5/978 |
| Shoulder room | 64.0/1626 | 67.1/1704 | 67.1/1704 |
| Hip room | 64.9/1649 | 50.9/1293 | 57.11450 |

* Front interior dimensions also apply for Astro Cargo Van models.

| Cargo Area | |
|---|---|
| Cargo volume (cu. ft./liters) | |
| — behind rear seat | 41.3/1169.5 |
| — behind second seat | 104.4/2956.3 |
| — maximum (middle and rear seat removed) | 170.4/4825.2 |
| Width between wheelhousings | 51.6/1310 |
| Load floor length | |
| — to console | 126.0/3200 |
| — to back of front seats | 98.6/2504 |
| — to back of middle seats | 61.7/1567 |
| — to back of rear seats | 28.4/722 |
| Interior height | 47.2/1199 |

| Capacities and Weights | | |
|---|---|---|
| | Rear-wheel drive | All-Wheel-Drive |
| Seating* | 7/8 | 7/8 |
| Fuel tank, approximate | | |
| (gallons/liters) | 27.0/102.2 | 27.0/102.2 |
| Curb weights, estimated (lbs./kg) | | |
| — Passenger Van | 4323/1960 | 4593/2083 |
| — Cargo Van | 3915/1775 | 4184/1897 |
| Maximum GVWR (lbs./kg) | | |
| — Passenger Van | 5950/2699 | 6100/2767 |
| — Cargo Van | 5600/2540 | 5850/2653 |
| Base payload (lbs/kg) | | |
| — Passenger Van | 1764/801 | 1667/759 |
| — Cargo Van | 1713/777 | 1715/777 |

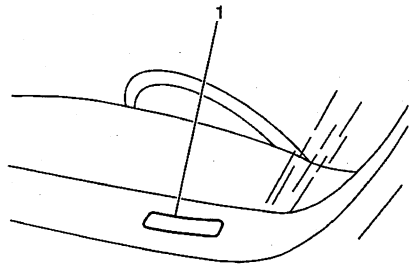
* Astro Cargo Van provides seating for two.

| Trailering(1) | | |
|---|---|---|
| Maximum Trailer Weight Ratings (lbs./kg) | RWD | AWD |
| Passenger Van | 5500/2494 | 5200/2358 |
| Cargo Van | 5900/2676 | 5600/2540 |

(1) Properly equipped. Maximum trailer weight is calculated by assuming only the driver is in the tow vehicle. Optional equipment, passengers or cargo will reduce the trailer weight rating. Trailer tongue weight should be 10 to 15 percent of total loaded trailer weight (up to 750 lbs.).

# 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 | Division | C,T | C - Chevrolet Truck<br>T - GMC Truck |
| 4 | GVWR/Brake System | B<br>C<br>D<br>E<br>F<br>G | B - 3001-4000/Hydraulic<br>C - 4001-5000/Hydraulic<br>D - 5001-6000/Hydraulic<br>E - 6001-7000/Hydraulic<br>F - 7001-8000/Hydraulic<br>G - 8001-9000/Hydraulic |
| 5 | Truck Line/Chassis Type | M,L | M - Small Van - 4x2<br>L - Small Van - 4x4 |
| 6 | Series | 1,2 | 1 - ½ Ton<br>2 - ¾ Ton |
| 7 | Body Type | 9 | Extended Van |
| 8 | Engine Type | W | 4.3L V6 CPI (L35) |
| 9 | Check Digit | -- | -- |
| 10 | Model Year | 1 | 2001 |
| 11 | Plant Location | B | Baltimore, MD |
| 12-17 | Plant Sequence Number | -- | -- |

## VIN Derivative

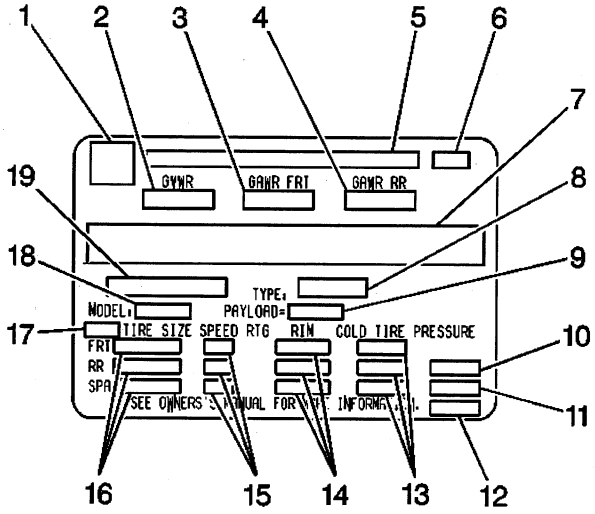
All engines and transmissions are stamped or laser etched with a partial vehicle identification number (VIN), which was derived from the complete VIN. A VIN derivative contains the following nine positions:

| Position | Definition | Character | Description |
|---|---|---|---|
| 1 | GM Division Identifier | G | General Motors |
| 2 | Model Year | 1 | 2001 |
| 3 | Assembly Plant | B | Baltimore, MD |
| 4-9 | Plant Sequence Number | -- | -- |

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

| VIN Derivative Position | Equivalent VIN Position |
|---|---|
| 1 | 2 |
| 2 | 10 |
| 3 | 11 |
| 4-5 | 12-17 |

## Label Certification w/o RPO Z49




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

The vehicle certification label displays the following assessments:

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

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

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

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

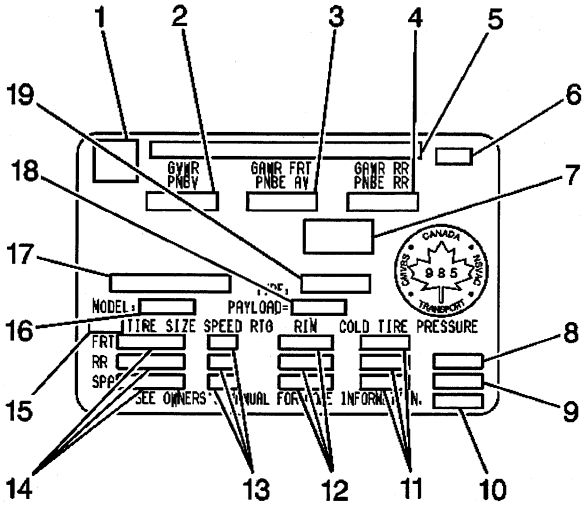
The front gross axle weight rating (GAWR FRT) is the weight exerted on the front axle. The rear gross axle weight rating (GAW RR) is the weight exerted on the rear axle. The front and rear gross axle weights must not exceed the front and rear gross axle weight ratings.

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

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

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

## Label Certification with RPO Z49




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

The vehicle certification label displays the following assessments:

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

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

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

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

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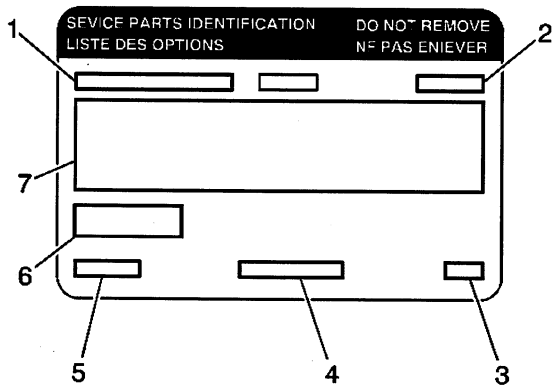
The vehicle may have a Gross Combination Weight Rating (GCWR). The Gross Combination Weight Rating refers to the total maximum weight of the loaded tow vehicle including driver and passengers and a loaded trailer.

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

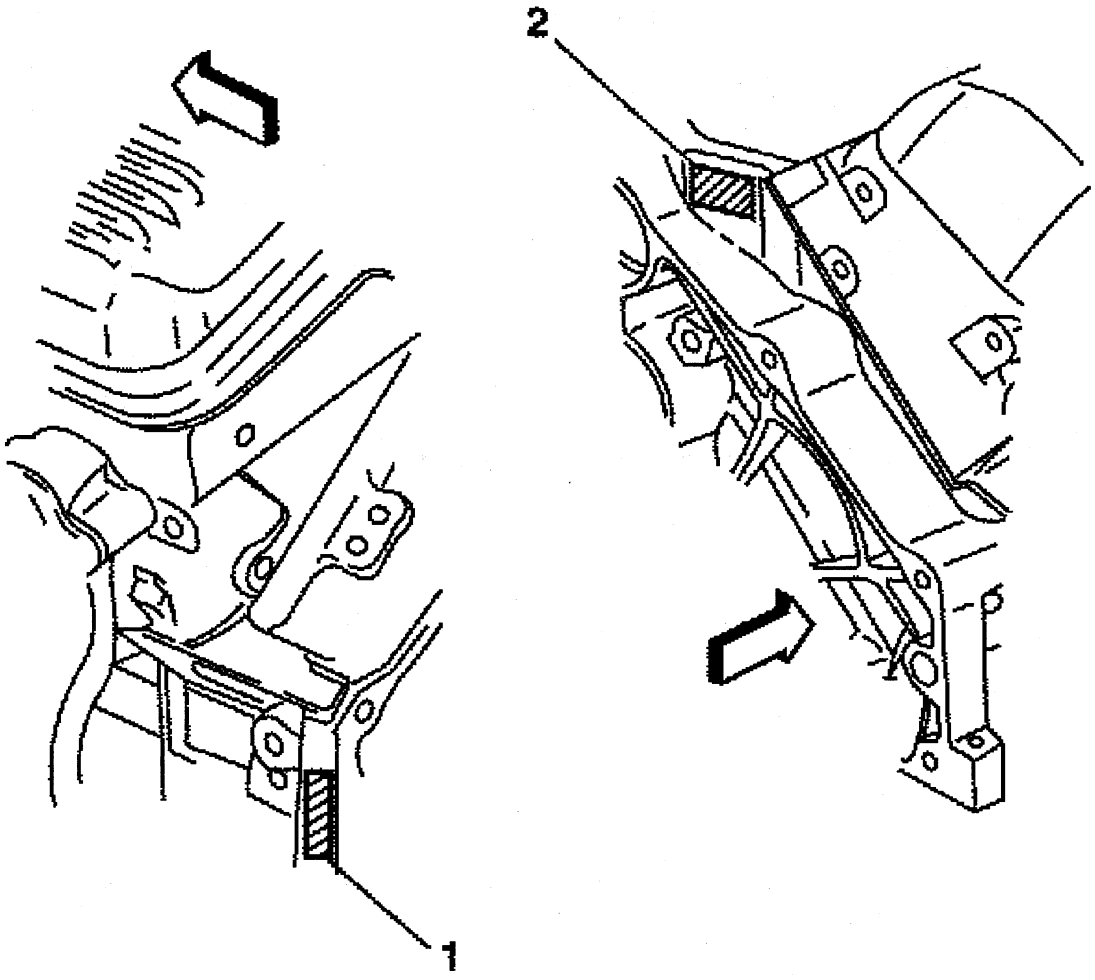
## Service Parts Identification Label (SPID)




1. Vehicle Identification Number
2. Engineering Model Number (Vehicle Division, Vehicle Line and Body Style)
3. Interior Trim and Decor Level
4. Exterior (Paint Color) WA Number
5. Paint Technology
6. Special Order Paint Colors and Numbers
7. Vehicle Option Content

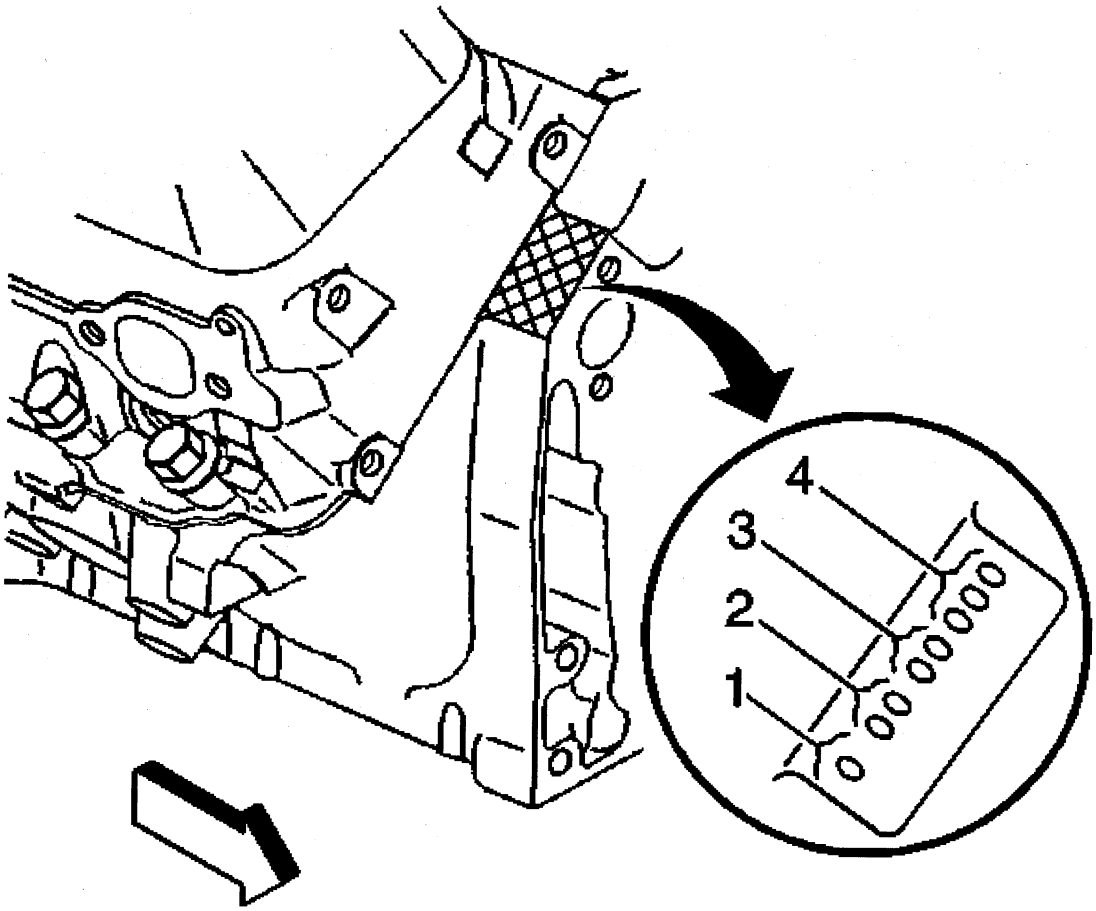
The service parts identification label is placed on the vehicle in order to help service and parts personnel identify the vehicle's original parts and the vehicle's original options.

## Engine ID and VIN Derivative Location 4.3L



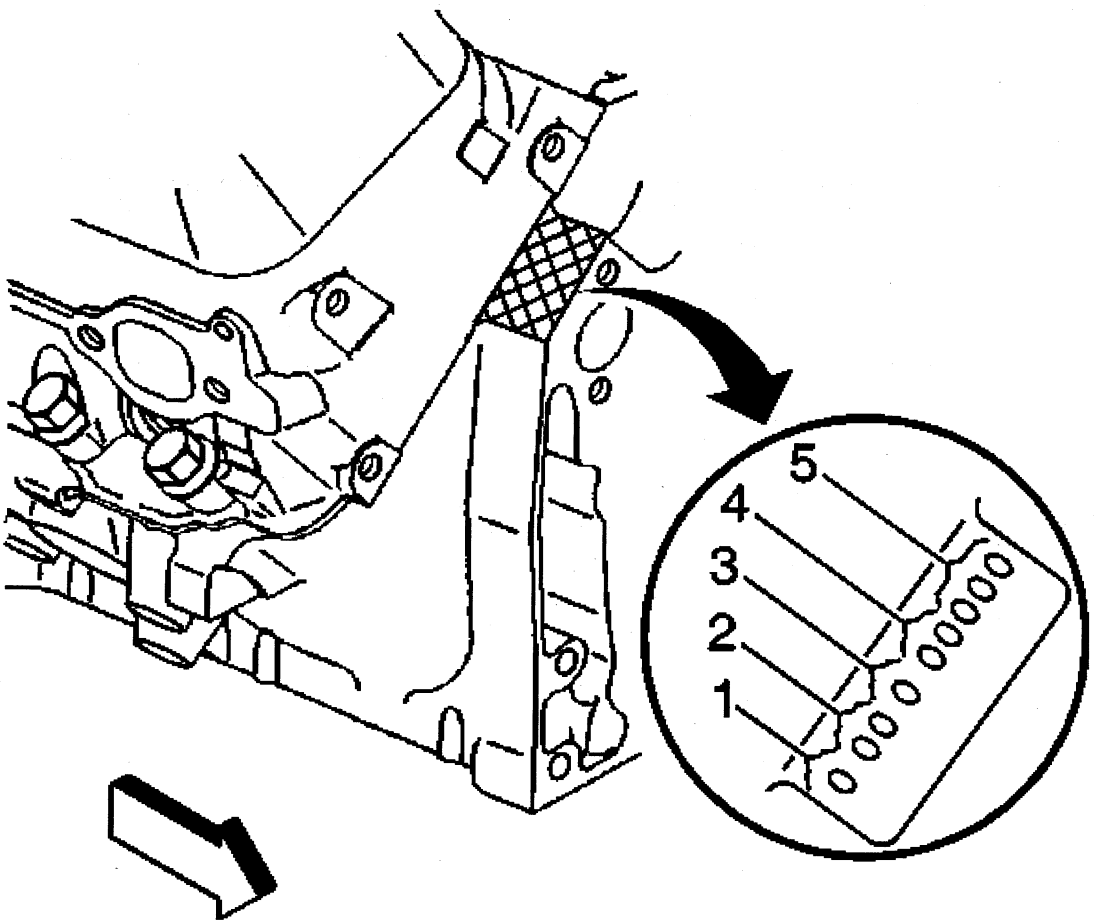

The Vehicle Identification Number (VIN) Derivative is located on the left side rear of the engine block (1) or on the right side rear (2) and typically is a nine digit number stamped or laser etched onto the engine at the vehicle assembly plant.

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




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

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

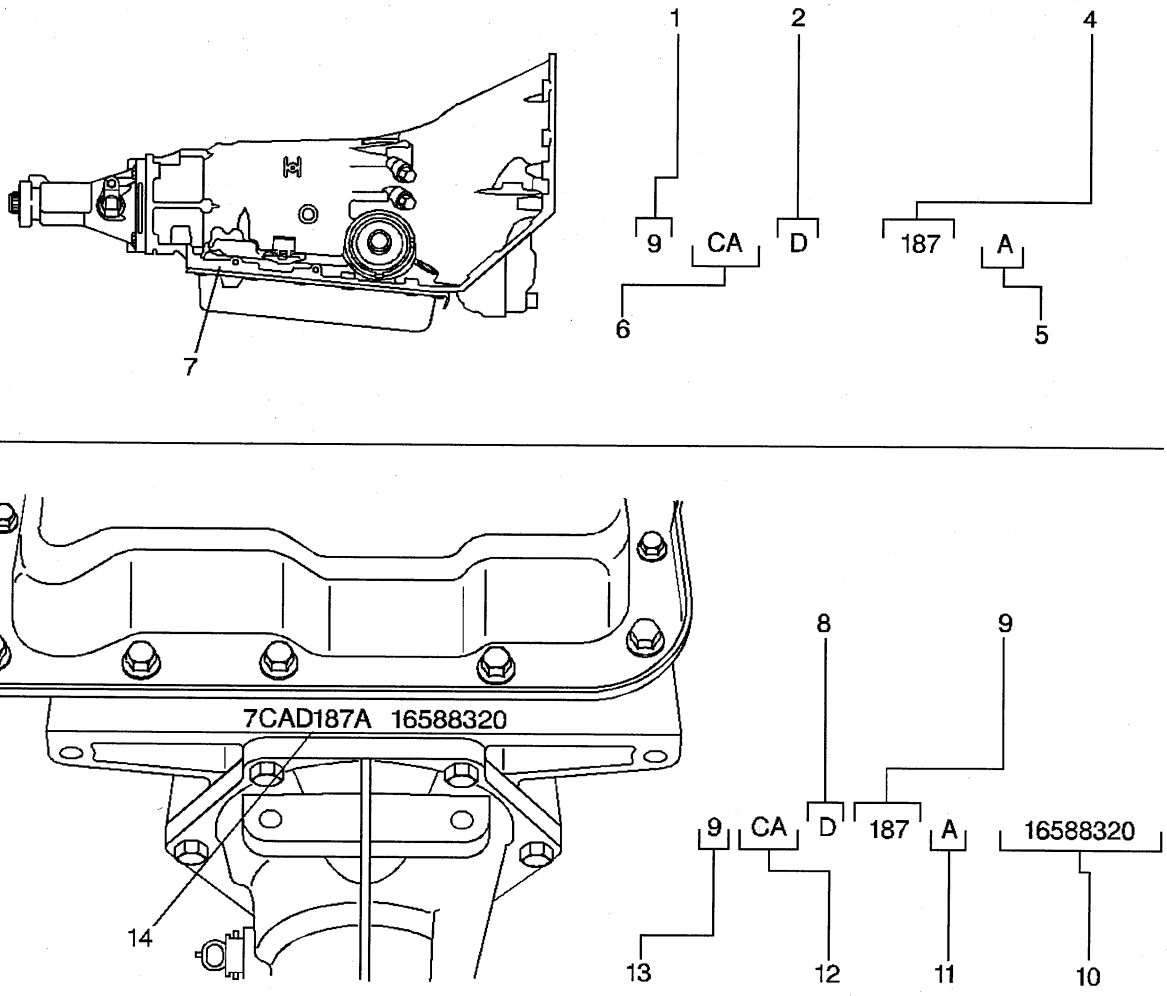



Engines built at the Romulus engine plant have the engine identification number located at the right front top of the engine block.

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

## Transmission ID and VIN Derivative Location

### 4L60-E Transmission ID Location



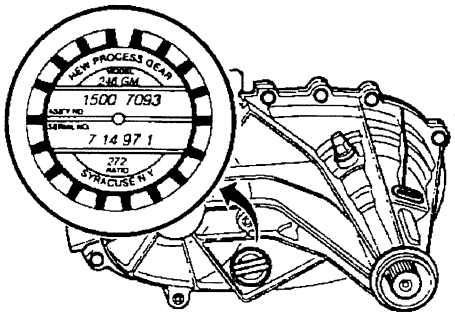

(1) Model Year
(2) Hydra-Matic 4L60-E
(4) Julian Date (or Day of the Year)
(5) Shift Built (A, B, J = First Shift; C, H, W = Second Shift)
(6) Model
(7) Transmission ID Location
(8) Hydra-Matic 4L60-E
(9) Julian Date (or Day of the Year)
(10) Serial No.
(11) Shift Built (A, B, J = First Shift; C, H,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

## Engine and Transmission Usage

| Model | Engine | Transmission |
|---|---|---|
| M110 (05) | 4.3L V6 (L35) | 4 Spd. Auto. (M30) |
| M110 (06) | 4.3L V6 (L35) | 4 Spd. Auto. (M30) |
| L110 (05) | 4.3L V6 (L35) | 4 Spd. Auto. (M30) |
| L110 (06) | 4.3L V6 (L35) | 4 Spd. Auto. (M30) |

Model Codes:
M--Rear Wheel Drive
L--Automatic Four Wheel Drive
05--Cargo Van
06--Passenger Van

## Transfer Case Identification




NV MODEL IDENTIFICATION KEY

246

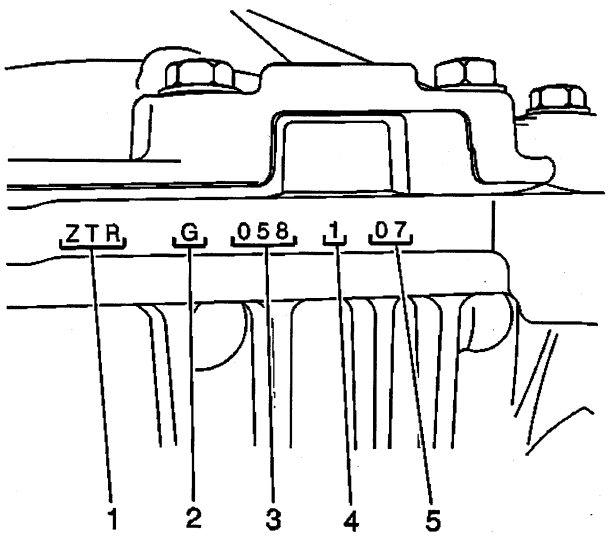
| | | | | | |
|---|---|---|---|---|---|
| 1 | Single Speed | 3 | T – Truck/L – Van | 1 | Manual |
| 2 | 2 Speed | 4 | K – Truck | 3 | Selectable |
| | | | | 6 | Automatic |

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

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

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

## Axle Identification – Front




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

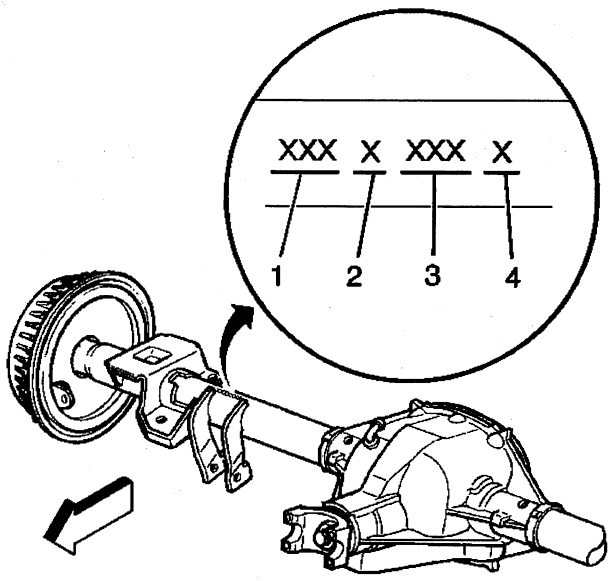
Front axle identification information is stamped on the top of the differential carrier assembly.

The following broadcast codes identifies the axle ratio:

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

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

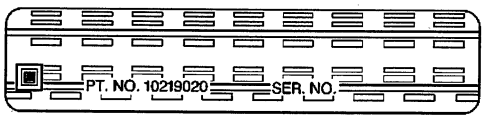
## Axle Identification – Rear




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

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

## Labeling - Anti-Theft




### Notice

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

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

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

## RPO Code List

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

| RPO Code | Description |
|---|---|
| AB2 | Window: Side Body, Stationary, Left Side |
| AG1 | Seat Adjuster: Power, 6-way, Driver |
| AG2 | Seat Adjuster: Power, 6-way, Passenger |
| AJ1 | Windows: Deep Tint, all Except W/S and DRS |
| AL4 | Seat: Rear Bucket |
| ANO | Seat Adjuster: Manual, 6-way, Lumbar, Driver and Passenger |
| AP9 | Net: Convenience |
| AQ4 | Seat: Rear |
| AU0 | Lock Control: Remote Entry |
| AU3 | Lock Control: Side Door, Electric |
| AU5 | Lock Control: Remote Entry, Low Power |
| AV5 | Seat: Front Bucket, High Back |
| A08 | Window: Body, Right Side |
| A12 | Window: Rear, Stationary, Back Door |
| A13 | Window: Side Door, Stationary |
| A18 | Window: Rear Door, Swing Out |
| A19 | Window: Rear Side Door, Swing Out |
| A31 | Window: Power Operated, Side |
| A57 | Seat: Passenger, Auxiliary, Folding |
| BAG | Parts Package: Export |
| BAL | Plant Code: Baltimore, MD, GM T&B |
| BA8 | Compartment: Front Seat, Stowage, Passenger |
| BVE | Running Boards: Side |
| BX2 | Molding: Body Side, Lower, Extra Wide |
| B37 | Covering: Floor Mats, Front & Rear, Auxiliary |
| B88 | Molding: B/S Custom |
| C36 | Heater: Auxiliary |
| C49 | Defogger: Rear Window, Electric |
| C5G | 5600 Lbs. GVW Rating |
| C5M | 6100 Lbs. GVW Rating |
| C6M | 5950 Lbs. GVW Rating |
| C69 | Air Conditioning: Rear |
| C7X | 5850 Lbs. GVW Rating |
| C95 | Lamp: Interior, Roof, Courtesy and Dual Reading |
| DH2 | Mirror: I/S, Front Vanity LH & RH , Illum., with Dual Sunshade |
| DK6 | Console: Roof, Interior |
| DK8 | Console: Roof Interior, Deluxe |
| D34 | Mirror: Inside, Sunshade |
| D44 | Mirror: Outside, Painted |
| D48 | Mirror: Outside, Remote Control, Electric, Painted |
| E54 | Body Equipment: Rear Door, w/End Gate Window |
| FE9 | Certification Emissions, Federal |
| GT4 | Rear Axle: 3.73 Ratio |
| GU5 | Rear Axle: 3.23 Ratio |
| GU6 | Rear Axle: 3.42 Ratio |
| G80 | Rear Axle: Positraction |

| | |
|---|---|
| JM4 | Brake System: Power, Front Disc, Rear Drum, Antilock Front & Rear |
| K05 | Heater: Engine Coolant |
| K34 | Cruise Control: Automatic, Electronic |
| K53 | Fuel Sender Robust Fuel System |
| K60 | Generator: 100 Ampere |
| K68 | Generator: 105 Ampere |
| L35 | Engine: 4.3 Liter V6, CPI |
| M1J | Lamp Fog, RR Additional |
| M30 | Transmission: Hydra-Matic 4L60-E, 4-Speed Automatic, Electronic |
| NA3 | Emission System: Japan |
| NB7 | Emission System: California, TLEV |
| NC1 | Emission System: California, LEV |
| NF2 | Emission System: Federal, Tier 1 |
| NM2 | Emission System: Export |
| NN8 | Emission System: Override Unleaded Fuel, Export |
| NP5 | Steering Wheel: Leather Wrapped |
| N12 | Exhaust System: Rear Exit |
| N33 | Steering Column: Tilt Type |
| N46 | Steering Wheel: Four Spokes |
| PA6 | Wheel: Styled, Painted |
| PC2 | Wheel: 15 x 6.5, Chrome, Styled |
| PF3 | Wheel, 15 x 6.5, Aluminum |
| QCM | Tire: All, P215/75/R15 WOL R/PE ST TL ALS 100S |
| QCU | Tire: All, P215/75/R15/N BL R/PE ST TL ALS |
| TL1 | Grille: Special |
| TR2 | Lamp Turn Signal: Enlarged |
| TR8 | Reflector Warming, Disabled Vehicle |
| T62 | Lighting: Daytime Running, Delete |
| T72 | Headlamps LH Rule of the Road |
| T84 | Headlamps: RH Rule of Road, E Mark |
| T89 | Lamp: Tail & Stop, Export |
| UC2 | Speedometer: Instrument, Kilo & Miles, Kilo Odometer, Positive Bias |
| UD4 | Alarm: Vehicle Speed, 120 KPH |
| UG1 | Opener: Garage Door, Universal |
| UK1 | Radio: Frequencies, Japan |
| UK6 | Radio Control: Rear Seat & Earphone Jacks |
| UL0 | Radio: AM/FM Stereo, Seek/Scan, Auto Reverse Cassette, Auto Tone, Music Search |
| UL2 | Radio: Frequencies, Europe |
| UL5 | Radio: Delete |
| UL8 | Frequencies Saudi Arabian |
| UM6 | Radio: AM/FM Stereo, Seek/Scan, Auto Reverse Cassette, Clock, ETR |
| UM7 | Radio: AM/FM Stereo, Seek/Scan, Clock, ETR |
| UNO | Radio: AM/FM Stereo, Seek/Scan, Compact Disc, Auto Tone, Clock, ETR |
| UP0 | Radio: AM/FM Stereo, Seek/Scan, Auto Reverse, Music Search, Cassette, Compact Disc Player, Auto Tone, Clock, ETR |
| UQ1 | Radio: Provisions for Stereo |
| UY7 | Wiring Harness: Truck Trailer HD |
| U19 | Speedometer: Instrument, Kilo & Miles, Kilo Odometer |
| U73 | Antenna: Fixed, Radio |
| VE6 | Bumper: Front & Rear, Impact, Painted |
| VJ1 | License Plate: RR Mounting Pkg, Japanese |
| VK5 | Seat: Temporary, For Shipping |
| VL6 | License Plate: Front Mounting Pkg, Japanese |
| VPH | Vehicle Preparation: Overseas Delivery |

| | |
|---|---|
| VP6 | Noise Control |
| VR4 | Trailer Hitch: Weight Distributing Platform |
| VR6 | Hook: Tie Down |
| VT3 | Bumper: RR Export |
| VXS | Vehicle: Complete |
| VXT | Vehicle: Incomplete |
| V10 | Provisions: Cold Climate |
| V54 | Luggage Carrier: Roof, Painted |
| V73 | Vehicle Statement: US/Canada |
| V78 | Vehicle Statement: Delete |
| V87 | Vehicle Statement, Gulf States Organization |
| V98 | Factory Delivery Processing |
| WX7 | Wiring Provisions |
| XCM | Tire: Front, P215/75/R15 WOL R/PE ST TL ALS 100S |
| XCU | Tire: Front, P215/75/R15/N BL R/PE ST TL ALS |
| X88 | Conversion Nameplate: Chevrolet |
| YB9 | Paint: Interior, Delete |
| YCM | Tire: Rear, P215/75/R15 WOL R/PE ST TL ALS 100S |
| YCU | Tire: Rear, P215/75/R15/N BL R/PE ST TL ALS |
| YC5 | Convenience Package: Decor Level #5 |
| YC6 | Convenience Package: Decor Level #6 |
| YC7 | Convenience Package: Decor Level #7 |
| YF7 | Sales Package: Recreational Vehicle Upfitter |
| YG6 | HVAC System: Air Conditioning, Not Desired |
| ZA6 | Package Price Leader |
| ZA7 | Package Price Leader: Canadian |
| ZP0 | Seating Arrangement: Temporary Driver |
| ZP7 | Seating Arrangement: Seven Passenger |
| ZP8 | Seating Arrangement: Eight Passenger |
| ZW2 | Window Package: RR Doors |
| ZW3 | Window Pkg: Side RR DR, RR DR |
| ZW6 | Window Pkg: Complete Body |
| ZW9 | Body Equipment: Base Body or Chassis |
| ZX2 | Seating Arrangement: Driver & Passenger, Highback |
| ZY1 | Color Combination: Solid |
| ZY2 | Color Combination: Two-Tone |
| Z49 | Base Equipment: Canadian Mandatory |
| Z5X | Mirror Provisions, Arabic Language |
| Z82 | Trailering Provisions: Special Equipment, Heavy Duty |
| Z88 | Conversion Nameplate: GMC |
| 2CU | Tire: Front P215/75R15/N BW R/PE ST TL ALS |
| 3CU | Tire: Rear P215/75R15/N BW R/PE ST TL ALS |
| 5CU | Tire: All P215/75R15/N BW R/PE ST TL ALS |

# Technical Information

## Maintenance and Lubrication

### Capacities - Approximate Fluid

| Application | Specification | |
|---|---|---|
| | Metric | English |
| **Axles** | | |
| • Front Axle | 1.2 liters | 2.6 pints |
| • Rear Axle - Standard | 1.7 liters | 3.5 pints |
| • Rear Axle - Locking | 1.7 liters | 3.5 pints |
| **Engine Cooling System** | | |
| • 4.3L (VIN W) - w/ C36 (Rear Heater) | 15.6 liters | 16.5 quarts |
| • 4.3L (VIN W) - w/o C36 (Rear Heater) | 12.8 liters | 13.5 quarts |
| **Engine Crankcase** | | |
| • 4.3L (VIN W) | 4.3 liters* | 4.5 quarts* |
| • Fuel Tank | 101.8 liters | 27 gallons |
| **Transmission** | | |
| • 4L60-E (Drain and Refill) | 4.7 liters* | 5 quarts* |
| • 4L60-E (Complete Overhaul) | 10.6 liters* | 11 quarts* |
| Power Steering Capacity | 0.99 liters*-1.360 liters* | 1.05 quarts*-1.44 quarts* |

* Approximate

### Maintenance Items

| Usage | Type |
|---|---|
| Air Cleaner Filter | AC Type 1163C |
| Engine Oil Filter | AC Type PF-47 |
| Fuel Filter | AC Type GF-481 |
| Positive Crankcase Ventilation (PCV) Valve | AC Type CV769C |
| Spark Plugs | AC Type 41-932<br>(GAP 1.52 mm, 0.060 in) |
| Wiper Blades | |
| • Front | Trico 22110158, Pin Type 18 in (45 .7 cm) Length |
| • Rear | Trico 22154396, Pin Type 14 in (35.5 cm) Length |

## Fluid and Lubricant Recommendations

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

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

## Tire Inflation Pressure Specifications

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Front and Rear Tires | 240 kPa | 35 psi |
| Compact spare | 420 kPa | 60 psi |

# Descriptions and Operations

## Power Steering System Description and Operation w/o Electro-Hydraulic Steering

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 Description and Operation

The steering linkage connects both of the front wheels to the steering gear through the pitman arm. The steering linkage consists of the following components:

- The inner tie rod
- The outer tie rod
- The relay rod
- The connecting rod
- The idler arm(s)

- The pitman arm

The inner and the outer tie rods attach to the steering knuckle and the relay rod by ball studs. The two idler arms support the relay rod. The idler arms pivot on a support that is attached to the frame rail. The idler arm support is threaded in order to allow the height adjustment of the arm on the support. The height adjustment allows the linkage to clear the suspension as the linkage moves from lock to lock. The original equipment is installed at a preset specification.

The relay rod is attached to the connecting rod. The connecting rod is used in order to maintain the proper geometry in the steering linkage. The connecting rod attaches to, and is supported by, the pitman arm.

The pitman arm is driven by the steering gear. Each joint has a lubrication fitting. The inner pivots use prevailing torque nuts, the outer tie rods use castellated nuts. Replace the prevailing torque nuts and cotter pins any time service removal is necessary.

The overall condition of the steering linkage affects the steering performance. Improper, and possibly dangerous steering action will result if any of the steering linkage displays the following conditions:

- Bent
- Damaged
- Worn
- Poorly lubricated

Check the steering geometry and the front wheel alignment whenever any steering linkage components are repaired or replaced.

## Steering Wheel and Column - Standard Description and Operation

The steering wheel and column has 4 primary functions:

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

### Vehicle Steering

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

### Vehicle Security

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

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

### Driver Convenience

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

- The turn signal switch
- The hazard switch

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

### Driver Safety

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

## Suspension Description and Operation

### Front Suspension

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 allows each wheel to compensate for changes in the road surface without affecting the opposite wheel. Each wheel independently connects to the frame with a steering knuckle, ball joint assemblies, and upper and lower control arms.

The control specifically allow the steering knuckles to move in a three-dimensional arc. Two tie rods connect to steering arms on the knuckles and an intermediate rod. These operate the front wheels.

The rear wheel drive vehicles have coil chassis springs. These springs are mounted between the spring housings on the frame and the lower control arms. Shock absorbers are mounted inside the coil springs. The coil springs attach to the lower control arms with bolts and nuts.

The upper part of each shock absorber extends through the upper control arm frame bracket, and the shock absorber secures with two grommets, two retainers, and a nut.

A spring stabilizer shaft controls the side roll of the front suspension. This shaft is mounted in rubber insulators that are held by brackets to the frame side rails. The ends of the stabilizer shaft connect to the lower control arms with link bolts. Rubber insulators isolate these link bolts.

A ball joint assembly is riveted and bolted to the outer end of the upper control arm. A castellated nut and a cotter pin join the steering knuckle to the upper ball joint.

The inner ends of the lower control arm have pressed-in bushings. The bolts pass through the bushings and join the arm to the frame. The lower ball joint assembly is a press fit in the lower control arm and attaches to the steering knuckle with a castellated nut and a cotter pin.

Ball socket assemblies have rubber grease seals. These seals prevent entry of moisture and dirt, and these seals prevent damage to the bearing surfaces.

Automatic Four Wheel Drive models have a front suspension that consists of the control arms, a stabilizer shaft, a shock absorber, and a right and left side torsion bar. The torsion bars replace the conventional coil springs. The lower control arm attaches to the front end of the torsion bar. The rear end of the torsion bar mounts on an adapter and adjustable arm at the torsion bar crossmember. This arm adjustment controls the vehicle trim height.

## Rear Suspension

The components of the rear suspension use a leaf spring and solid rear axle suspension system.

The front ends of the springs are attached to the frame at the hangers, through rubber bushings. The rear ends of the leaf springs are connected to the frame with shackle assemblies. The shackle assemblies allow the leaf springs to change positions in response to different road and payload conditions. The leaf springs are connected to the rear axle with an anchor plate, the lower plate, the U-bolts, and the attaching hardware. The shock absorbers are attached to the rear axle and the frame. The shock absorbers dampen or smooth road inputs.

An optional spring steel stabilizer shaft helps minimize body roll and is available as part of the sport suspension package. The stabilizer shaft is connected to the rear axle and the frame with the rubber insulators, the clamps, and the link assemblies.

## Wheels and Tires

### General Description

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

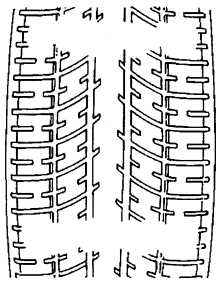
The following factors have an important influence on tire life:

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

The following factors increase tire wear:

- Heavy cornering
- Excessively rapid acceleration
- Heavy braking

### Tread Wear Indicators Description



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

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

### Metric Wheel Nuts and Bolts Description

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

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

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

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

## Tire Inflation Description

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

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

Inspect the tire pressure when the following conditions apply:

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

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

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

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

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

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

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

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

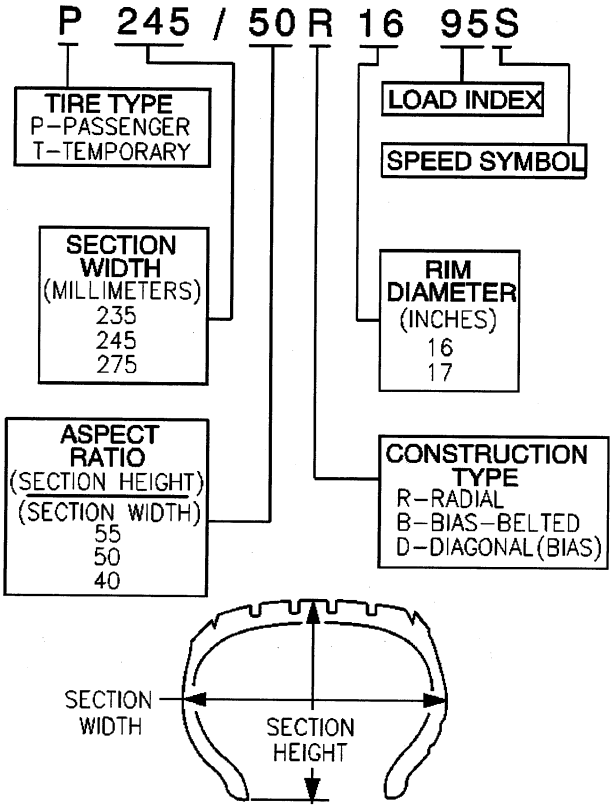
- A tire squeal on turns
- Hard steering

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

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

- Uneven braking
- Steering lead
- Reduced vehicle handling

**P-Metric Sized Tires Description**

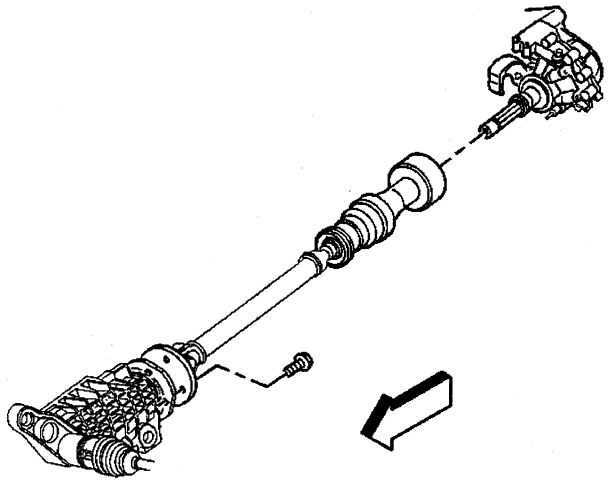



Most P-metric tire sizes do not have exact corresponding alphanumeric tire sizes. Replacement tires should be of the same tire performance criteria (TPC) specification number including the same size, the same load range, and the same construction as those originally installed on the vehicle. Consult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

# Driveline System Description and Operation

## Driveline/Axle – Propeller Shaft

### Constant Velocity Joint Description



A Constant Velocity (CV) universal joint propeller shaft transmits power from the transfer case to the front differential.

The constant velocity joint allows the driveline angle to adjust according to the up and down movement of the vehicle without disturbing the power flow. The joint consists of an outer bearing retainer and flange, spring, cap, circlip, inner bearing assembly, and wire ring. The inner bearing assembly includes a bearing cage, six ball bearings, and an inner race.

### Propeller Shaft Description and Operation

The front propeller shaft consists of the following components:

- Propeller shaft tube
- Universal joint
- Flange yoke
- Constant velocity joint

The rear propeller shaft consists of the following components:

- Propeller shaft tube
- 2 universal joints
- Slip yoke

#### Front Propeller Shaft Operation

The front propeller shaft connects the transfer case to the front axle. It transmits the rotating force from the transfer case to the front axle when the transfer case is engaged.

### Rear Propeller Shaft Operation

The rear propeller shaft connects the transmission or transfer case to the rear axle. It transmits the rotating force from the transmission or transfer case to the rear axle.

### Propeller Shaft Phasing Description

The propeller shaft is designed and built with the yoke lugs or 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. 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.

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

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

## Front Drive Axle Description and Operation

The Front Drive Axle consist of the following components:

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

The front axle on the four-wheel-drive model vehicle does not have a central disconnect feature. The axle uses a conventional ring and pinion gear set in order to transmit the driving force of the engine to the

wheels. The open differential allows the wheels to turn at different rates of speed while the axle continues to transmit the driving force. This prevents tire scuffing when going around corners and premature wear on internal axle parts. The ring and pinion set and the differential are contained within the carrier. The axle identification number on top of the differential carrier assembly or on a label on the right half of differential carrier assembly. The drive axles are completely flexible assemblies consisting of inner and outer constant velocity CV joints protected by thermoplastic boots and connected by a wheel drive shaft.

## Rear Drive Axle Description and Operation

Rear Axles for this vehicle consist of the following components:

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

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

### Locking Differential Description and Operation

The locking differential consists of the following components:

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

The optional locking differential (RPO G80) enhances the traction capability of the rear axle by combining the characteristics of a limited-slip differential and the ability of the axle shafts to "lock" together when

uneven traction surfaces exist. The differential accomplishes this in 2 ways. First by having a series of clutch plates at each side of the differential case to limit the amount of slippage between each wheel. Second, by using a mechanical locking mechanism to stop the rotation of the right differential side gear, or the left differential side gear on the 10.5 inch axle, in order to transfer the rotating torque of the wheel without traction to the wheel with traction. Each of these functions occur under different conditions.

**Limited-Slip Function**

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

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

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

**Locking Function**

Locking action occurs through the use of some special parts:

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

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

As the side gear rotates at a speed different than that of the differential case, the shaft of the governor rotates with enough speed to force the flyweights outward against spring tension. One of the flyweights catches its edge on the closest edge of the latching bracket, which is stationary in the differential case. This latching process triggers a chain of events.

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

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

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

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

The entire locking process occurs in less than 1 second. The process works with either the left or right wheel spinning, due to the design of the governor and cam mechanism. A torque reversal of any kind will

unlatch the governor, causing the cam plate to ride back down to its detent position. Cornering or deceleration during a transmission shift will cause a torque reversal of this type. The differential unit returns to its limited-slip function.

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

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

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

**Locking Differential Torque-Limiting Disc**

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

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

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

# Braking System Description and Operation

## Hydraulic Brake System Description and Operation

### System Component Description

The hydraulic brake system consists of the following:

**Hydraulic Brake Master Cylinder Fluid Reservoir**

Contains supply of brake fluid for the hydraulic brake system.

**Hydraulic Brake Master Cylinder**

Converts mechanical input force into hydraulic output pressure.

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

**Hydraulic Brake Pressure Balance Control System**

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

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

**Hydraulic Brake Pipes and Flexible Brake Hoses**

Carries brake fluid to and from hydraulic brake system components.

#### Hydraulic Brake Wheel Apply Components

Converts hydraulic input pressure into mechanical output force.

### System Operation

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

## Brake Assist System Description and Operation

### System Component Description

The brake assist system consists of the following:

#### Brake Pedal

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

#### Brake Pedal Pushrod

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

#### Vacuum Brake Booster

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

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

#### Vacuum Source

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

#### Vacuum Source Delivery System

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

### System Operation

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

## Disc Brake System Description and Operation

### System Component Description

The disc brake system consists of the following components:

#### Disc Brake Pads

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

#### Disc Brake Rotors

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

#### Disc Brake Pad Hardware

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

#### Disc Brake Caliper Hardware

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

### System Operation

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

## Drum Brake System Description and Operation

### System Component Description

The drum brake system consists of the following:

#### Drum Brake Shoes

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

#### Brake Drums

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

#### Drum Brake Hardware

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

#### Drum Brake Adjusting Hardware

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

### System Operation

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

# Park Brake System Description and Operation

## System Component Description

The park brake system consists of the following:

**Park Brake Lever Assembly**

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

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

**Park Brake Cables**

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

**Park Brake Cable Equalizer**

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

**Park Brake Apply Lever**

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

**Park Brake Actuator/Adjuster**

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

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

**Drum Brake Shoes**

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

## System Operation

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

# ABS Description and Operation

## Antilock Brake System

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

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

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

# Engine Description and Operation

## Engine Component Description

### Balance Shaft

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

### Camshaft

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

### Crankshaft

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

### Cylinder Heads

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

### Engine Block

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

### Exhaust Manifolds

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

### Intake Manifold

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

### Piston and Connecting Rod Assemblies

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

### Valve Train

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

## Engine Mechanical – 4.3L - Specifications

| Application | Specification | |
|---|---|---|
| | Metric | English |
| **General Data** | | |
| • Engine Type | V6 | |
| • RPO Code | L35 | |
| • VIN Code | W | |
| • Displacement | 4.3 L | 262 CID |
| • Bore | 101.60 mm | 4.012 in |
| • Stroke | 88.39 mm | 3.480 in |
| • Compression Ratio | 9.2:1 | |
| • Firing Order | 1-6-5-4-3-2 | |
| • Spark Plug Gap | 1.52 mm | 0.060 in |
| • Oil Pressure - Minimum - at Normal Operating Temperature | 42 kPa at 1,000 RPM<br>125 kPa at 2,000 RPM<br>166 kPa at 4,000 RPM | 6 psig at 1,000 RPM<br>18 psig at 2,000 RPM<br>24 psig at 4,000 RPM |
| **Balance Shaft** | | |
| • Rear Bearing Journal Clearance | 0.050-0.088 mm | 0.0020-0.0035 in |
| • Rear Bearing Journal Diameter | 38.085-38.100 mm | 1.4994-1.500 in |
| **Camshaft** | | |
| • End Play | 0.0254-0.2286 mm | 0.0010-0.0090 in |
| • Journal Diameter | 47.440-47.490 mm | 1.8677-1.8696 in |
| • Journal Diameter Out-of-Round | 0.025 mm - Maximum | 0.0010 in - Maximum |
| • Lobe Lift - Exhaust | 7.20-7.30 mm | 0.283-0.287 in |
| • Lobe Lift - Intake | 6.97-7.07 mm | 0.274-0.278 in |
| • Runout | 0.065 mm | 0.0026 in |

| | | |
|---|---|---|
| **Connecting Rod** | | |
| • Connecting Rod Bearing Clearance - Production | 0.038-0.078 mm | 0.0015-0.0031 in |
| • Connecting Rod Bearing Clearance - Service | 0.025-0.063 mm | 0.0010-0.0025 in |
| • Connecting Rod Journal Diameter | 57.116-57.148 mm | 2.2487-2.2497 in |
| • Connecting Rod Journal Out-of-Round - Production | 0.007 mm - Maximum | 0.0002 in - Maximum |
| • Connecting Rod Journal Out-of-Round - Service | 0.025 mm - Maximum | 0.0010 in - Maximum |
| • Connecting Rod Journal Taper - Production | 0.00508 mm - Maximum | 0.00030 in - Maximum |
| • Connecting Rod Journal Taper - Service | 0.025 mm - Maximum | 0.0010 in - Maximum |
| • Connecting Rod Side Clearance | 0.15-0.44 mm | 0.006-0.017 in |
| **Crankshaft** | | |
| • Crankshaft Bearing Clearance - Journal #1-Production | 0.02-0.508 mm | 0.0008-0.0020 in |
| • Crankshaft Bearing Clearance - Journal #2, #3, and #4-Production | 0.028-0.058 mm | 0.0011-0.0023 in |
| • Crankshaft Bearing Clearance - Journal #1-Service | 0.0254-0.05 mm | 0.0010-0.0020 in |
| • Crankshaft Bearing Clearance - Journal #2, #3, and #4-Service | 0.025-0.063 mm | 0.0010-0.0250 in |
| • Crankshaft End Play | 0.050-0.20 mm | 0.002-0.008 in |
| • Crankshaft Journal Diameter - Journal #1 | 62.199-62.217 mm | 2.4488-2.4495 in |
| • Crankshaft Journal Diameter - Journal #2 and #3 | 62.191-62.215 mm | 2.4485-2.4494 in |
| • Crankshaft Journal Diameter - Journal #4 | 62.179-62.203 mm | 2.4480-2.4489 in |
| • Crankshaft Journal Out-of-Round - Production | 0.005 mm - Maximum | 0.0002 in - Maximum |
| • Crankshaft Journal Out-of-Round - Service | 0.025 mm - Maximum | 0.0010 in - Maximum |
| • Crankshaft Journal Taper - Production | 0.007 mm - Maximum | 0.0003 in - Maximum |
| • Crankshaft Runout | 0.025 mm - Maximum | 0.0010 in - Maximum |
| **Cylinder Bore** | | |
| • Diameter | 101.618-101.643 mm | 4.0007-4.0017 in |
| • Out-of-Round - Production | 0.0127 mm - Maximum | 0.00050 in - Maximum |
| • Out-of-Round - Service | 0.05 mm - Maximum | 0.002 in - Maximum |
| • Taper - Production Relief Side | 0.025 mm - Maximum | 0.0010 in - Maximum |
| • Taper - Production Thrust Side | 0.012 mm - Maximum | 0.0005 in - Maximum |
| • Taper - Service | 0.025 mm - Maximum | 0.0010 in - Maximum |
| **Cylinder Head** | | |
| • Surface Flatness | 0.10 mm - Maximum | 0.004 in - Maximum |
| **Exhaust Manifold** | | |
| • Surface Flatness - Flange to Flange | 0.25 mm - Maximum | 0.010 in - Maximum |
| • Surface Flatness - Individual Flange | 0.05 mm - Maximum | 0.002 in - Maximum |
| **Intake Manifold** | | |
| • Surface Flatness | 0.10 mm - Maximum | 0.004 in - Maximum |
| **Oil Pan** | | |
| • Oil Pan Alignment at Rear of Engine Block | 0.3 mm - Maximum | 0.011 in - Maximum |

| | | |
|---|---|---|
| **Piston** | | |
| • Piston Bore Clearance - Production | 0.018-0.061 mm | 0.0007-0.0024 in |
| • Piston Bore Clearance - Service | 0.075 mm - Maximum | 0.0029 in - Maximum |
| **Piston Pin** | | |
| • Clearance in Piston - Production | 0.013-0.023 mm | 0.0005-0.0009 in |
| • Clearance in Piston - Service | 0.025 mm - Maximum | 0.0010 in - Maximum |
| • Diameter | 23.545-23.548 mm | 0.9270-0.9271 in |
| • Fit in Connecting Rod | 0.012-0.048 mm - Interference | 0.0005-0.0019 in - Interference |
| **Piston Rings - End Gap Measured in Cylinder Bore** | | |
| • Piston Compression Ring Gap - Production-Top Groove | 0.25-0.40 mm | 0.010-0.016 in |
| • Piston Compression Ring Gap - Production-2nd Groove | 0.38-0.58 mm | 0.015-0.023 in |
| • Piston Compression Ring Gap - Service-Top Groove | 0.25-0.50 mm | 0.010-0.020 in |
| • Piston Compression Ring Gap - Service-2nd Groove | 0.38-0.80 mm | 0.015-0.031 in |
| • Piston Compression Ring Groove Clearance - Production-Top Groove | 0.030-0.070 mm | 0.0012-0.0027 in |
| • Piston Compression Ring Groove Clearance - Production-2nd Groove | 0.040-0.080 mm | 0.0015-0.0031 in |
| • Piston Compression Ring Groove Clearance - Service | 0.030-0.085 mm | 0.0012-0.0033 in |
| • Piston Oil Ring Gap - Production | 0.25-0.76 mm | 0.010-0.029 in |
| • Piston Oil Ring Gap - Service | 0.005-0.090 mm | 0.0002-0.0035 in |
| • Piston Oil Ring Groove Clearance - Production | 0.046-0.196 mm | 0.0018-0.0077 in |
| • Piston Oil Ring Groove Clearance - Service | 0.046-0.200 mm | 0.0018-0.0079 in |
| **Valve System** | | |
| • Valve Face Angle | 45 degrees | |
| • Valve Head Edge Margin | 0.79 mm - Minimum | 0.031 in - Minimum |
| • Valve Lash | Net Lash--No Adjustment | |
| • Valve Lift - Exhaust | 10.879 mm | 0.4280 in |
| • Valve Lift - Intake | 10.527 mm | 0.4140 in |
| • Valve Lifter | Hydraulic Roller Type | |
| • Valve Rocker Arm | Roller Pivot Type | |
| • Valve Rocker Arm Ratio | 1.5:1 | |
| • Valve Seat Angle | 46 degrees | |
| • Valve Seat Runout | 0.05 mm - Maximum | 0.002 in - Maximum |
| • Valve Seat Width - Exhaust | 1.651-2.489 mm | 0.065-0.098 in |
| • Valve Seat Width - Intake | 1.016-1.651 mm | 0.040-0.065 in |
| • Valve Spring Free Length | 51.3 mm | 2.02 in |
| • Valve Spring Installed Height - Exhaust | 42.92-43.43 mm | 1.670-1.700 in |
| • Valve Spring Installed Height - Intake | 42.92-43.43 mm | 1.670-1.700 in |
| • Valve Spring Pressure - Closed | 338-374 N at 43.2 mm | 76-84 lb at 1.70 in |
| • Valve Spring Pressure - Open | 832-903 N at 32.3 mm | 187-203 lb at 1.27 in |
| • Valve Stem Clearance - Exhaust-Production | 0.025-0.069 mm | 0.0010-0.0027 in |
| • Valve Stem Clearance - Exhaust-Service | 0.025-0.094 mm | 0.0010-0.0037 in |

| | | |
|---|---|---|
| • Valve Stem Clearance - Intake-Production | 0.025-0.069 mm | 0.0010-0.0027 in |
| • Valve Stem Clearance - Intake-Service | 0.025-0.094 mm | 0.0010-0.0037 in |
| • Valve Stem Oil Seal Installed Height - Measured from the Top of the Large Diameter Valve Guide Bevel to the Bottom of the Valve Stem Oil Seal | 1-2 mm | 0.03937-0.07874 in |

## Fastener Tightening Specifications

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Accelerator Control Cable Bracket Nut | 12 N·m | 106 lb in |
| Accelerator Control Cable Bracket Stud to Intake Manifold | 6 N·m | 53 lb in |
| Accelerator Control Cable Bracket Stud to Throttle Body | 12 N·m | 106 lb in |
| Air Cleaner Adapter Stud | 8 N·m | 71 lb in |
| Air Conditioning (A/C) Compressor Side Brace Bolt | 25 N·m | 18 lb ft |
| Air Conditioning (A/C) Hose Bracket Nut to Intake Manifold | 5 N·m | 44 lb in |
| Air Conditioning (A/C) Pipe Bracket Nut to Rear of Left Cylinder Head | 35 N·m | 26 lb ft |
| Balance Shaft Driven Gear Bolt | | |
| • First Pass | 20 N·m | 15 lb ft |
| • Final Pass | 35 degrees | |
| Balance Shaft Retainer Bolt | 12 N·m | 106 lb in |
| Belt Idler Pulley Bolt | 50 N·m | 37 lb ft |
| Body Bolt | | |
| • First Pass in Sequence (All Bolts) | 35 N·m | 26 lb ft |
| • Final Pass in Sequence (Center Bolts) | 155 N·m | 114 lb ft |
| • Final Pass in Sequence (Front and Rear Bolts) | 90 N·m | 66 lb ft |
| Camshaft Retainer Bolt | 12 N·m | 106 lb in |
| Camshaft Sprocket Bolt | 25 N·m | 18 lb ft |
| Connecting Rod Nut | | |
| • First Pass | 27 N·m | 20 lb ft |
| • Final Pass | 70 degrees | |
| Crankshaft Balancer Bolt | 95 N·m | 70 lb ft |
| Crankshaft Bearing Cap Bolt (Preferred Method) | | |
| • First Pass | 20 N·m | 15 lb ft |
| • Final Pass | 73 degrees | |
| Crankshaft Bearing Cap Bolt (Optional Strategy) | 105 N·m | 77 lb ft |
| Crankshaft Position Sensor Bolt | 9 N·m | 80 lb in |
| Crankshaft Pulley Bolt | 58 N·m | 43 lb ft |
| Crankshaft Rear Oil Seal Housing Bolt and Nut | 12 N·m | 106 lb in |
| Crankshaft Rear Oil Seal Housing Retainer Stud | 6 N·m | 53 lb in |
| Cylinder Head Bolt (Preferred Method) | | |
| • All Bolts First Pass in Sequence | 30 N·m | 22 lb ft |
| • Long Bolts Final Pass in Sequence | 75 degrees | |
| • Medium Bolts Final Pass in Sequence | 65 degrees | |
| • Short Bolts Final Pass in Sequence | 55 degrees | |
| Cylinder Head Bolt (Optional On-Vehicle Strategy) | | |
| • First Pass in Sequence | 35 N·m | 26 lb ft |
| • Second Pass in Sequence | 60 N·m | 44 lb ft |
| • Final Pass in Sequence | 90 N·m | 66 lb ft |
| Cylinder Head Core Hole Plug | 20 N·m | 15 lb ft |
| Distributor Cap Bolt | 2.4 N·m | 21 lb in |
| Distributor Clamp Bolt | 25 N·m | 18 lb ft |
| Drive Belt Tensioner Bolt | 50 N·m | 37 lb ft |

| | | |
|---|---|---|
| EGR Valve Bolt | | |
| • First Pass | 7 N·m | 62 lb in |
| • Final Pass | 30 N·m | 22 lb ft |
| EGR Valve Inlet Pipe Clamp Bolt | 25 N·m | 18 lb ft |
| EGR Valve Inlet Pipe Nut at Exhaust Manifold | 30 N·m | 22 lb ft |
| EGR Valve Inlet Pipe Nut at Intake Manifold | 25 N·m | 18 lb ft |
| Engine Block Coolant Drain Hole Plug | 20 N·m | 15 lb ft |
| Engine Block Left Rear Oil Gallery Plug | 30 N·m | 22 lb ft |
| Engine Block Left Side Oil Gallery Plug | 20 N·m | 15 lb ft |
| Engine Block Oil Gallery Plug | 20 N·m | 15 lb ft |
| Engine Block Right Rear Oil Gallery Plug | 20 N·m | 15 lb ft |
| Engine Coolant Heater Bolt/Screw | 2 N·m | 18 lb in |
| Engine Coolant Temperature (ECT) Sensor | 20 N·m | 15 lb ft |
| Engine Flywheel Bolt | 100 N·m | 74 lb ft |
| Engine Front Cover Bolt | 12 N·m | 106 lb in |
| Engine Lift Bracket Bolt (Special Tool J 41427) | 15 N·m | 11 lb ft |
| Engine Lift Front Bracket Stud | 35 N·m | 26 lb ft |
| Engine Mount Bolt to Frame (4WD) | 59 N·m | 44 lb ft |
| Engine Mount Bolt to Frame (RWD) | 47 N·m | 35 lb ft |
| Engine Mount Bracket Bolt to Engine | 64 N·m | 47 lb ft |
| Engine Mount Bracket to Frame Bolt (RWD) | 47 N·m | 35 lb ft |
| Engine Mount Bracket to Frame Nut (RWD) | 42 N·m | 31 lb ft |
| Engine Mount Frame Bracket Through-bolt | 68 N·m | 50 lb ft |
| Engine Mount Nut to Frame (RWD) | 42 N·m | 31 lb ft |
| Engine Oil Pressure Gauge Sensor | 30 N·m | 22 lb ft |
| Engine Oil Pressure Gauge Sensor Fitting (Plus Required Angle) | 15 N·m | 11 lb ft |
| Engine Wiring Harness Bracket Bolt to Generator and Drive Belt Tensioner Bracket | 25 N·m | 18 lb ft |
| Engine Wiring Harness Bracket Nut to Evaporative Emission (EVAP) Canister Purge Solenoid Valve | 8 N·m | 71 lb in |
| Engine Wiring Harness Bracket Nut to Intake Manifold | 12 N·m | 106 lb in |
| Engine Wiring Harness Retainer Bolt to Rear of Right Cylinder Head | 36 N·m | 27 lb ft |
| Evaporative Emission (EVAP) Canister Purge Solenoid Valve Nut to Intake Manifold | 10 N·m | 89 lb in |
| Exhaust Manifold Bolt/Stud | | |
| • First Pass | 15 N·m | 11 lb ft |
| • Final Pass | 30 N·m | 22 lb ft |
| Fan and Water Pump Pulley Bolt | 25 N·m | 18 lb ft |
| Fuel Meter Body Bracket Bolt | 10 N·m | 89 lb in |
| Fuel Pipe Bracket Bolt | 6 N·m | 53 lb in |
| Fuel Pipe Bracket Stud to Rear of Cylinder Head | 33 N·m | 24 lb ft |
| Fuel Pipe Retainer Nut | 3 N·m | 27 lb in |
| Fuel Supply Pipe Nut (Fuel Tank Side) | 30 N·m | 22 lb ft |
| Generator and Drive Belt Tensioner Bracket Bolt to Engine | 41 N·m | 30 lb ft |
| Generator and Drive Belt Tensioner Bracket Stud Nut | 41 N·m | 30 lb ft |
| Generator and Drive Belt Tensioner Bracket Stud to Engine | 20 N·m | 15 lb ft |
| Ground Wire Bolt to Rear of Cylinder Head | 35 N·m | 26 lb ft |
| Ground Wire Nut to Water Outlet Stud | 19 N·m | 14 lb ft |
| Ignition Coil Stud | 12 N·m | 106 lb in |
| Knock Sensor | 20 N·m | 15 lb ft |
| Lower Intake Manifold Bolt | | |
| • First Pass in Sequence | 3 N·m | 27 lb in |

| | | |
|---|---|---|
| • Second Pass in Sequence | 12 N·m | 106 lb in |
| • Final Pass in Sequence | 15 N·m | 11 lb ft |
| Negative Battery Cable Stud | 40 N·m | 30 lb ft |
| Oil Cooler Pipe Bracket Bolt to Oil Pan | 10 N·m | 89 lb in |
| Oil Fill Tube Bolt | 25 N·m | 18 lb ft |
| Oil Filter Adapter Bolt | 21 N·m | 15 lb ft |
| Oil Filter Fitting | 55 N·m | 41 lb ft |
| Oil Level Indicator Tube Bolt | 12 N·m | 106 lb in |
| Oil Level Indicator Tube Bolt to Transmission Fluid Fill Tube | 12 N·m | 106 lb in |
| Oil Pan Baffle Bolt | 12 N·m | 106 lb in |
| Oil Pan Bolt and Nut | 25 N·m | 18 lb ft |
| Oil Pan Drain Plug | 25 N·m | 18 lb ft |
| Oil Pump Bolt to Rear Crankshaft Bearing Cap | 90 N·m | 66 lb ft |
| Oil Pump Cover Bolt | 12 N·m | 106 lb in |
| Park Brake Bracket Bolt to Frame | 24 N·m | 18 lb ft |
| Power Steering Pump Bolt | 50 N·m | 37 lb ft |
| Power Steering Pump Bracket Bolt to Engine | 41 N·m | 30 lb ft |
| Power Steering Pump Bracket Stud Nut | 41 N·m | 30 lb ft |
| Power Steering Pump Bracket Stud to Engine | 20 N·m | 15 lb ft |
| Power Steering Pump Rear Bracket Nut to Engine | 41 N·m | 30 lb ft |
| Power Steering Pump Rear Bracket Nut to Power Steering Pump | 50 N·m | 37 lb ft |
| Spark Plug | | |
| • Initial Installation (NEW Cylinder Head) | 30 N·m | 22 lb ft |
| • All Subsequent Installations | 15 N·m | 11 lb ft |
| Spark Plug Wire Support Bolt | 12 N·m | 106 lb in |
| Starter Motor Wiring Harness/Transmission Cooler Pipe Bracket Bolt to Oil Pan | 10 N·m | 89 lb in |
| Throttle Body Stud | 9 N·m | 80 lb in |
| Transmission Bolt to Oil Pan | 47 N·m | 35 lb ft |
| Transmission Cover Bolt | 12 N·m | 106 lb in |
| Transmission Fluid Fill Tube Bolt to Accelerator Control Cable Bracket | 6 N·m | 53 lb in |
| Upper Intake Manifold Stud | | |
| • First Pass | 5 N·m | 44 lb in |
| • Final Pass | 9 N·m | 80 lb in |
| Upper Radiator Hose Support Bracket Nut to Exhaust Manifold Stud | 36 N·m | 27 lb ft |
| Valve Lifter Pushrod Guide Bolt | 16 N·m | 12 lb ft |
| Valve Rocker Arm Bolt | 30 N·m | 22 lb ft |
| Water Outlet Stud | 25 N·m | 18 lb ft |
| Water Pump Bolt | 45 N·m | 33 lb ft |

## 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 Cooling

## Engine Cooling System Approximate Capacities

| Application | Specifications | |
|---|---|---|
| | Metric | English |
| 4.3L (VIN W) w/o C36 (Rear Heater) | 13.5 L | 14.3 qt |
| 4.3L (VIN W) with C36 (Rear Heater) | 15.5 L | 16.5 qt |

## Fastener Tightening Specifications

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Coolant Outlet Bolt/Stud | 25 N·m | 18 lb ft |
| Cooling Fan Clutch to Water Pump Bolts | 56 N·m | 41 lb ft |
| Cooling Fan Blade to Fan Clutch Bolts | 33 N·m | 24 lb ft |
| Drive Belt Tensioner Bolt | 50 N·m | 37 lb ft |
| Engine Oil Cooler Line Clip Bolt | 10 N·m | 89 lb in |
| Engine Oil Cooler Lines to Oil Filter Adapter Assembly Bolt | 35 N·m | 26 lb ft |
| Upper Fan Shroud Bolts | 15 N·m | 11 lb ft |
| Coolant Pump Pulley to Water Pump Bolts | 25 N·m | 18 lb ft |
| Coolant Pump to Engine Block Bolts | 45 N·m | 33 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 Negative Cable to Engine Stud | 40 N·m | 29 lb ft |
| Battery Negative Cable Terminal Bolt | 15 N·m | 11 lb ft |
| Battery Positive Cable Terminal Bolt | 15 N·m | 11 lb ft |
| Battery Positive Cable to Starter Motor Nut | 9 N·m | 80 lb in |
| Battery Positive Cable to Underhood Electrical Center Nut | 9 N·m | 80 lb in |
| Battery Retainer Hold Down Bolt | 23 N·m | 17 lb ft |
| Battery Tray Bolts | 25 N·m | 18 lb ft |
| Distributor Cap Screws | 5 N·m | 40 lb in |
| Distributor Hold Down Bolt | 27 N·m | 20 lb ft |
| Distributor Rotor Screws | 2 N·m | 20 lb in |
| Engine Harness to Battery Negative Cable Nut | 25 N·m | 18 lb ft |
| Generator Mounting Bolts | 50 N·m | 37 lb ft |
| Generator Output (BAT) Terminal Nut | 18 N·m | 13 lb ft |
| Generator Pulley Nut | 100 N·m | 74 lb ft |
| Ground Lead to Radiator Support Stud | 45 N·m | 33 lb ft |
| Ignition Coil Hold Down Stud | 11 N·m | 97 lb in |
| Spark Plugs (New Head) | 30 N·m | 22 lb ft |
| Spark Plugs (Used Head) | 15 N·m | 11 lb ft |
| Starter Enable Relay Cable Nut | 2 N·m | 18 lb in |
| Starter Motor Mounting Bolts | 43 N·m | 32 lb ft |
| Underhood Electrical Center Mounting Bolts | 8 N·m | 60 lb in |

## Battery Usage

| Standard | |
|---|---|
| Cold Cranking Amperage (CCA) | 600 A |
| Reserve Capacity Rating | 115 Minutes |
| Replacement Battery Number | 78-6YR |
| **Optional** | |
| Cold Cranking Amperage (CCA) | 770 A |
| Reserve Capacity | 115 Minutes |
| Replacement Model 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 Type |
|---|---|
| 4.3l (L35) | PG-260G |

## Generator Usage

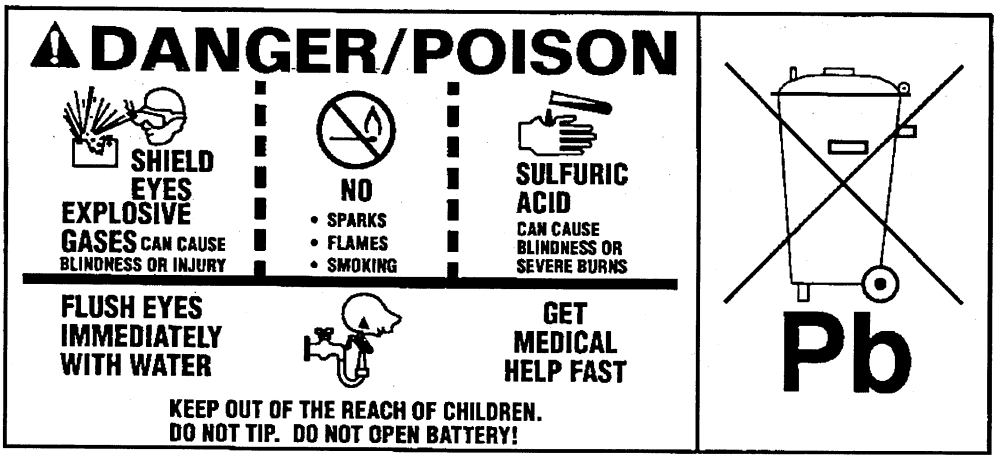
| Standard | |
|---|---|
| Generator Model | AD230 |
| Rated Output | 105 A |
| Load Test Output | 73 A |

## 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

### Cranking Circuit

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

### Starter Motor

The PG-260G is a non-repairable starter motor. 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 generator is non-repairable. They are electrically similar to earlier models. The generator(s) feature the following major components:

- The delta stator
- The rectifier bridge
- The rotor with slip rings and brushes
- A conventional pulley
- Dual internal fans
- 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 denotes the outside diameter of the stator laminations in millimeters, over 100 millimeters. The generator is rated at 105 amperes.

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

### Regulator

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

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

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

# Engine Controls

## Engine Controls – 4.3L

### Ignition System Specifications

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Firing Order | 1-6-5-4-3-2 | |
| Spark Plug Wire Resistance | 1,000 ohms per ft | |
| Spark Plug Torque | 15 N·m | 11 lb ft |
| Spark Plug Gap | 1.52 mm | 0.060 in |
| Spark Plug Type | R41-932 [AC plug type] | |

### Fastener Tightening Specifications

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Accelerator Cable Bracket Bolt | 25 N·m | 18 lb ft |
| Accelerator Cable Bracket Nut | 30 N·m | 22 lb ft |
| Air Cleaner Outlet Duct Nut | 2.5 N·m | 22 lb in |
| Crankshaft Position Sensor Mounting Bolt | 20 N·m | 15 lb ft |
| Coolant Hose Nipple | 17 N·m | 13 lb ft |
| EGR Valve Attaching Bolts | 25 N·m | 18 lb ft |
| EVAP Canister Retainer Attaching Bolt | 10 N·m | 88 lb in |
| Fuel Pipe Clip Bolt | 6 N·m | 53 lb in |
| Fuel Pipe Attaching Nuts | 27 N·m | 20 lb ft |
| Fuel Pipe to Fuel Rail Retaining Screw | 3 N·m | 27 lb in |
| Fuel Pipe Return Line Nut | 3 N·m | 27 lb in |
| Fuel Pressure Regulator Bracket | 3.5 N·m | 31 lb in |
| Fuel Rail Attaching Bolts | 10 N·m | 88 lb in |
| Fuel Tank Bracket Strap | 45 N·m | 33 lb ft |
| Idle Air Control Valve Attaching Screws | 3 N·m | 27 lb in |
| Pressure Regulator Screw | 9.5 N·m | 84 lb in |
| Power Brake Fitting | 13 N·m | 115 lb in |
| Purge Valve Mounting Bracket Attaching Bolt | 8 N·m | 71 lb in |
| Throttle Cable Bracket Bolts | 25 N·m | 18 lb ft |
| Throttle Body Retaining Studs | 25 N·m | 18 lb ft |
| TP Sensor Bolts | 2 N·m | 18 lb in |
| Upper Manifold Bolts | 8 N·m | 71 lb in |
| Upper Manifold Nuts | 8 N·m | 71 lb in |
| Vacuum Module Attaching Bolts | 8 N·m | 71 lb in |

### Fuel System Specifications

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

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

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

**Notice**

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

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

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

# Exhaust System

## Fastener Tightening Specifications

| Application | Specification | |
|---|---|---|
| | Metric | English |
| Catalytic Converter-to-Muffler Nuts | 40 N·m | 30 lb ft |
| Exhaust Pipe-to-Manifold Nuts | 53 N·m | 39 lb ft |
| Exhaust Pipe-to-Manifold Studs | 15 N·m | 11 lb ft |
| Hanger-to-Frame Nuts | 45 N·m | 33 lb ft |
| Hanger-to-Transfer Case Bolts (A4WD) | 55 N·m | 40 lb ft |
| Hanger-to-Transmission Bolts (RWD) | 45 N·m | 33 lb ft |
| Muffler Hanger-to-Frame Bolts | 25 N·m | 18 lb ft |

## Exhaust System Description

**Important**

Use of non-OEM parts may cause driveability concerns.

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

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

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

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

### Resonator

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

### Catalytic Converter

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

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

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

The catalyst in the converter is not serviceable.

### Muffler

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

# Transmission/Transaxle Description and Operation

## Automatic Transmission – 4L60E

### Fastener Tightening Specifications

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

## Transmission General Specifications

| Name | Hydra-matic 4L60-E |
|---|---|
| RPO Codes | M30 |
| Production Location | Toledo, Ohio<br>Romulus, MI<br>Ramos Arizpe, Mexico |
| Vehicle Platform (Engine/Transmission) Usage | C/K, C/K 800, F, G, M/L, S/T, Y |
| Transmission Drive | Longitudinally-Mounted Rear Wheel Drive |
| 1st Gear Ratio | 3.059:1 |
| 2nd Gear Ratio | 1.625:1 |
| 3rd Gear Ratio | 1.000:1 |
| 4th Gear Ratio | 0.696:1 |
| Reverse | 2.294:1 |
| Torque Converter Size (Diameter of Torque Converter Turbine) | 245 mm<br>258 mm<br>298 mm<br>300 mm |
| Pressure Taps | Line Pressure |
| Transmission Fluid Type | DEXRON® III |
| Transmission Fluid Capacity (Approximate) | 245 mm Converter<br>Dry: 8.3 l (8.8 qt)<br>258 mm Converter<br>Dry: 8.8 l (9.3 qt)<br>298 mm Converter<br>Dry: 11.25 l (11.9 qt)<br>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) | 245 mm Converter<br>65.4 kg (144.30 lb)<br>258 mm Converter<br>79.9 kg (176.6 lb)<br>298 mm Converter<br>70.5 kg (155.70 lb)<br>300 mm Converter<br>86.17 kg (190.5 lb) |
| Transmission Weight Wet (Approximate) | 245 mm Converter<br>72.4 kg (159.55 lb)<br>258 mm Converter<br>89.2 kg (197.7 lb)<br>298 mm Converter<br>80.5 kg (176.16 lb)<br>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) |

## Fluid Capacity Specifications

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

## Transmission Component and System Description

The 4L60E transmission consists primarily of the following components:

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

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

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

## Adapt Function

### Transmission Adapt Function

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

- The clutch fiber plates
- The seals
- The springs

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

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

## Automatic Transmission Shift Lock Control Description

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

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

With the ignition in the ON position battery positive voltage is supplied to the park/neutral position switch. With the transmission in the PARK position the contacts in the park/neutral position switch are closed. This allows current to flow through the switch to the automatic transmission shift lock control switch. The circuit continues through the normally-closed switch to the automatic transmission shift lock control solenoid. The automatic transmission 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.

# 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 |

| Fraction (in) | Decimal (in) | Metric (mm) |
|---|---|---|
| 5/8 | 0.625 | 15.875 |
| 41/64 | 0.640625 | 16.27187 |
| 21/32 | 0.65625 | 16.66875 |
| 43/64 | 0.671875 | 17.06562 |
| 11/16 | 0.6875 | 17.4625 |
| 45/64 | 0.703125 | 17.85937 |
| 23/32 | 0.71875 | 18.25625 |
| 47/64 | 0.734375 | 18.65312 |
| 3/4 | 0.75 | 19.05 |
| 49/64 | 0.765625 | 19.44687 |
| 25/32 | 0.78125 | 19.84375 |
| 51/64 | 0.796875 | 20.24062 |
| 13/16 | 0.8125 | 20.6375 |
| 53/64 | 0.828125 | 21.03437 |
| 27/32 | 0.84375 | 21.43125 |
| 55/64 | 0.859375 | 21.82812 |
| 7/8 | 0.875 | 22.225 |
| 57/64 | 0.890625 | 22.62187 |
| 29/32 | 0.90625 | 23.01875 |
| 59/64 | 0.921875 | 23.41562 |
| 15/16 | 0.9375 | 23.8125 |
| 61/64 | 0.953125 | 24.20937 |
| 31/32 | 0.96875 | 24.60625 |
| 63/64 | 0.984375 | 25.00312 |
| 1 | 1.0 | 25.4 |

# Fasteners

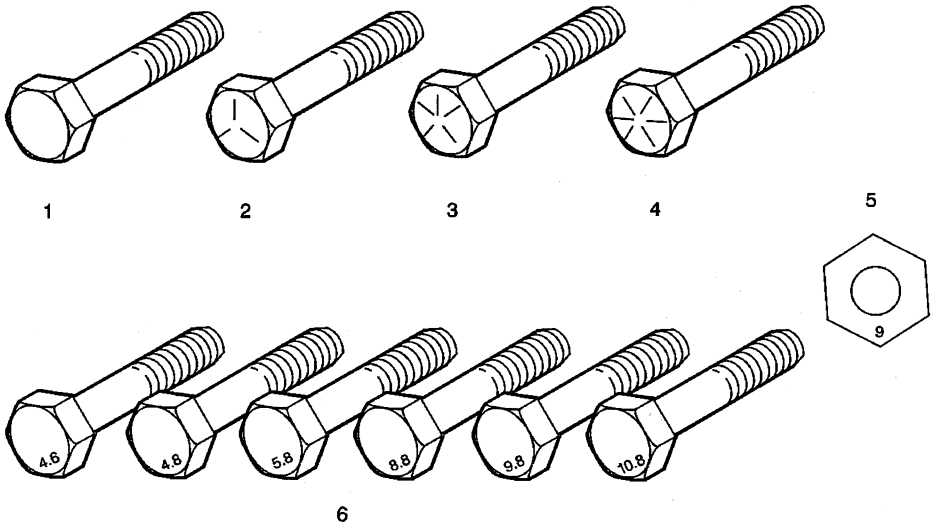
## Metric Fasteners

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

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

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

### Fastener Strength Identification




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

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

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

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

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

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

## Prevailing Torque Fasteners

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

### All Metal Prevailing Torque Fasteners

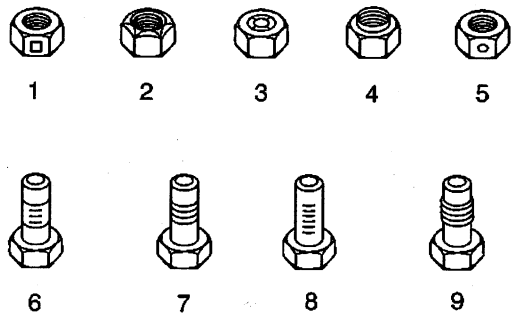
These fasteners accomplish the thread interface by a designed distortion or deformation in the fastener.

### Nylon Interface Prevailing Torque Fasteners

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

## Adhesive Coated Fasteners

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




1. Prevailing Torque Nut, Center Lock Type

2. Prevailing Torque Nut, Top Lock Type
3. Prevailing Torque Nut, Nylon Patch Type
4. Prevailing Torque Nut, Nylon Washer Insert Type
5. Prevailing Torque Nut, Nylon Insert Type
6. Prevailing Torque Bolt, Dry Adhesive Coating Type
7. Prevailing Torque Bolt, Thread Profile Deformed Type
8. Prevailing Torque Bolt, Nylon Strip Type
9. Prevailing Torque Bolt, Out-of-Round Thread Area Type

A prevailing torque fastener may be reused ONLY if:

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

## Metric Prevailing Torque Fastener Minimum Torque Development

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

## English Prevailing Torque Fastener Minimum Torque Development

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