Chevrolet

S-10

2000

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Product Information

The 2000 Chevy S-10 Pickup Features Performance And Exterior Improvements

DETROIT — With a new Base model Extended Cab, an improved powertrain and some tasteful exterior enhancements, the 2000 S-10 Pickup will continue to draw buyers in the compact pickup segment.

This year's Vortec 4300 V6 engine provides quieter operation and greater durability than before. The standard 5-speed manual overdrive transmission also features quieter operation and extended gear life. The optional ZR2 Suspension Package (LS Extended Cab models) includes a revised rear axle for better performance, while the standard antilock brake system (ABS) uses a new controller for more reliable antilock performance.

Extended Cab models will now be available with Base trim — a feature many commercial truck buyers will appreciate. LS models offer an Exterior Appearance Package that features a gray grille with attractive chrome accents. Also available on LS models are body-side moldings and new Space Blue Metallic paint.

"S-10 Pickup has a kind of split personality — but in the most positive sense," says Debra Kelly-Ennis, S-10 Pickup brand manager. "It's a durable, rugged pickup, yet it has comfortable, car-like qualities. Now, with the new Base trim level available on Extended Cab models, it will appeal to even more work truck buyers."

The driver and front-passenger air bags* receive sensing and diagnostic enhancements for added reliability. Carry-over safety features include: standard Daytime Running Lamps (DRL) with Automatic Exterior Lamp Control, four-wheel antilock brakes, three-point safety belt systems, side door beams, reinforced safety-cage construction, front and rear crush zones and an energy-absorbing steering column and instrument panel..

S-10 Pickup continues to offer a choice of Regular or Extended Cab models. The available third door on the Extended Cab provides easy access to the roomy rear seating area. The powerful Vortec 4300 V6 (standard on 4x4 models) returns with a stout 190 horsepower (180 hp with 2WD) and torque ratings of 245 lb.-ft. and 250 lb.-ft. respectively. A 2200 L4 engine with Sequential Fuel Injection remains standard on 2WDmodels.

"GM will offer a flexible fuel version of its compact pickups in the year 2000. The Chevy S-10 will come equipped with a standard four-cylinder engine that features alternative fuel technology making the trucks capable of running on ethanol-based fuel, as well as conventional gasoline. The flexible-fuel version of the GM 2.2-liter L43 engine will be the base powerplant for the Chevy S-10 in early calendar year 2000."

"The technology allows the pickups to be powered by E85, an alternative fuel comprised of 85 percent ethanol and 15 percent gasoline. E85 is a renewable fuel comprised of alcohol produced from grain or agricultural waste. Customers will not experience any significant drivability differences between either fuel."

The available Insta-Trac four-wheel-drive system returns for 2000. In addition to its handy push-button actuation, Insta-Trac includes a 4WD Low gear for more demanding conditions such as climbing steep grades or driving through deep snow or mud.

"With four available suspension packages, S-10 Pickup buyers have quite a bit of choice. They can choose from the standard independent front suspension with its rear variable-rate multileaf springs, to an available 4x4 ZR2 Wide Stance Sport Performance Package," said Kelly-Ennis. Not only does this package give the S-10 a bold, authoritative look, it includes special high-pressure shock absorbers, a wider frame stance and unique performance axles —all designed with the off-road enthusiast in mind.

On the outside, S-10 Pickup is all truck functionality, with sturdy cargo tie-down loops, two-tier loading capability and a rear step bumper for easy cargo bed access. A unique look can be acquired with the optional ZR2 or Xtreme Sport Appearance Package. The Xtreme Sport Appearance Package features

such items as: a monochromatic paint scheme, a ground effects package, 16-inch cast-aluminum wheels and a capable Sport Suspension.

Convenient interior features help provide a comfortable, car-like driving experience, with such items as delayed interior lighting which automatically keeps the dome lamp on for fifteen seconds or until the ignition is turned on after the front doors are closed. The retained accessory power feature allows the stereo, available power windows and other power features to operate for up to 20 minutes after the ignition has been turned off or until a door is opened.

With its variety of body styles, suspension packages and trim levels, the 2000 Chevy S-10 Pickup remains the compact pickup of choice for those seeking a rugged, hard-working truck that allows for personal expression and comfort.

* 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 information.

What's New And Highlights

Models

- Extended Cab now available with Base trim.

Exterior

- Space Blue Metallic paint
- Redesigned molding package available with LS trim.

Safety and Security

- Air bag diagnostic module enhancements.

Engines

- Vortec 4300 V6 (RPO L35) engine enhancements
- Alternate fuel E-85 4-cylinder engine (available 12/1/99)
- Exhaust system enhancements.

Suspension

- ZR2 rear axle enhancements.

Transmission

- Manual transmission enhancements.

Brakes

- Antilock brake system controller enhancements.

Highlights

Xtreme Appearance Package

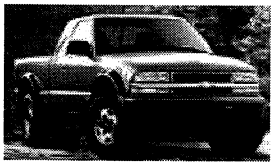
The Xtreme Appearance Package gives S-10 Pickup an attractive "street rod" look.

Flash to Pass

Flash-to-pass feature helps provide added driver convenience.

Third Door

The Extended Cab available third door makes cargo loading and passenger entering and exiting easy.



Four-Wheel-Drive System

Insta-Trac four-wheel-drive helps keep S-10 Pickup moving even under difficult road conditions.

Model Summary

2WD models

- 2WD Regular Cab Short Box
- 2WD Regular Cab Long Box
- 2WD Extended Cab Short Box.*

4x4 models

- 4x4 Regular Cab Short Box
- 4x4 Extended Cab Short Box.*

Trim Levels

- Base
- LS

Marketplace

S-10 Pickup has carved its niche in the compact truck segment as a rugged truck for which its owners are proud. Now, with this year's availability of a Base model Extended Cab, S-10 Pickup will expand its already attractive lineup and draw buyers who are planning to work their trucks.

Competitors:

- Ford Ranger
- Mazda B-Series
- Toyota Tacoma
- Dodge Dakota
- Nissan Frontier

1999 Awards

- WE — Top Ten Vehicles
- IntelliChoice — The Best Overall Value of the Year, S-10 LS 2-Door Regular and Extended Cab, Compact 4WD†
- IntelliChoice — A Best Overall Value of the Year, S-10 2-Door Regular Cab, Compact Pickup 2WD†
- IntelliChoice —ABest Overall Value of the Year, S-10 4WD 2-Door Regular Cab, Compact Pickup 4WD†

Buyer Demographics

- Median Age: Mid-20s to late 30s
- Median Household Income: $45,000+
- Purchaser: 80% male — Predominantly single, attended college

* Jump seat behind driver is deleted with optional third door.

† 1999, The Complete Small Truck Cost Guide™, IntelliChoice, Inc.®, www.IntelliChoice.com.

Vehicle Overview

Interior Overview

Key Standard Features*

Base Model:

- Driver and right front-passenger air bags.† Passenger-side has deactivation switch for use with rear-facing infant restraints
- PASSlock® theft-deterrent system
- Flash-to-pass feature activates high beam lamps to alert the driver of a vehicle in front of an intent to pass
- Vinyl floor covering
- Custom Vinyl or Custom Cloth bench seat (Regular Cab)
- Deluxe Cloth 60/40 split-bench (2WD Extended Cab)
- Deluxe Cloth high-back bucket seats (4WD Extended Cab)
- ETR AM/FM stereo with seek-scan and digital clock
- Intermittent windshield wipers
- Retained accessory power allows the stereo, power windows and other power features to remain operable for up to 20 minutes after the ignition has been turned off or until a door is opened
- Battery-rundown protection turns off interior lights left on for longer than 20 minutes with the ignition off
- Delayed interior lighting automatically keeps dome lamp on for fifteen seconds, or until the ignition is turned on after front doors are closed
- Headlamps-on reminder
- Turn signal-on reminder
- Low fuel indicator light.

LS Trim Adds The Following, In Addition To Or Replacing Base Model Features:

- Deluxe Cloth 60/40 split-bench seat (2WD)
- Deluxe Cloth high-back bucket seats (4x4)
- ETR AM/FM stereo with cassette player, seek-scan, digital clock, TheftLock, speed-compensated volume and auto tone control
- Color-keyed molded plastic door trim panels with cloth inserts
- Color-keyed carpeting
- Dual reading lamps on rearview mirror
- Two front auxiliary 12-volt electrical power outlets
- Center console, with available front high-back bucket seats, features storage area, coin or CD holder, dual cup holders and optional remote CD player.

* See Feature Availability chart for additional features.
† Always use safety belts and proper child restraints, even with air bags. See the owner's manual for more safety information.

Exterior/Structural Overview

Key Standard Features*

Base Model:

- Composite halogen headlamps
- Dual folding rearview mirrors
- Daytime Running Lamps (DRL) with Automatic Exterior Lamp Control
- Argent and chrome grille
- Argent-painted wheels with black center cap
- Dark gray front and rear bumpers
- Rear-quarter swing-out windows (Extended Cab only)
- Stiff, ladder-type frame with bolted and riveted cross members provides a solid foundation. The front box section has added strength to support the engine and front suspension
- Drop-center frame design helps make entry and exit easy, without sacrificing ground clearance. This design also helps the vehicle maintain a low center of gravity
- Double-wall cargo box construction
- Two-tier loading
- Welded cargo box eliminates bolts that can damage cargo or cause rust
- Cargo tie-down loops
- Removable tailgate
- Rear step bumper
- Semi-flush door glass and double-sealed doors help reduce wind noise while contributing to a sleek appearance
- Solar-Ray tinted glass.

LS Trim Adds The Following, In Addition To Or Replacing Base Model Features:

- Body-color bumpers.

LS Exterior Appearance Package Adds The Following, In Addition To Or Replacing LS Trim Features:

- Argent-color body-side moldings with bright inserts
- Bright wheel opening moldings
- Chrome bumpers with rub strips.

Key Optional Features*

- **NEW** Molding package available with LS trim provides a more refined look.
- Driver-side third door (Extended Cab models) provides versatility and convenience in allowing S-10 Pickup owners to easily store and remove items from the rear seat area
- Foglamps (with LS trim)
- Sliding rear window
- Full-size spare tire
- Short or Long Box models
- Sportside Box (with LS trim).

* See Feature Availability chart for additional features.

Exterior Paint

Standard basecoat/clearcoat paint on S-10 Pickup helps resist fading and provides a high gloss shine for long-lasting exterior beauty.

Paint Colors

- Space Blue Metallic*
- Onyx Black
- Sunset Gold Metallic*
- Meadow Green Metallic
- Medium Beige Mystique Metallic*
- Victory Red
- Summit White
- Dark Cherry Red Metallic*
- Light Pewter Metallic*
- Indigo Blue Metallic.

* LS Trim only.

Functional Overview

Key Standard Features*

- Vortec 2200 L4 SFI engine (2WD)
- Power-assisted steering
- Battery-rundown protection
- 4-wheel antilock brake system (ABS)
- 5-speed manual transmission with overdrive.

Key Optional Features*

- 4-speed automatic transmission
- Vortec 4300 V6 SFI engine
- ZR2 Wide Stance Sport Suspension Package (LS Extended Cab models).

* See Feature Availability Chart for additional features.

Optional Packages

S-10 Xtreme Sport Appearance Package

The Xtreme Sport Appearance Package is ideal for owners who want a factory-built-and-backed street rod look. Xtreme hugs the ground, thanks to its ZQ8 Suspension and 2-inch-lower ride height. This sharp, two-wheel-drive vehicle includes eye-catching 270-degree ground effects. Xtreme is available with Base trim as a Regular Cab Fleetside, or with LS trim as a Regular or Extended Cab, Fleetside or Sportside.

Interior

- Air conditioning
- Tachometer
- Leather-wrapped steering wheel.

Exterior

- 270 degree ground effects
- Body-color front air dam with front integrated foglamps
- Monochromatic paint scheme in Victory Red, Onyx Black or Summit White
- Body-color front grille and bumpers
- Unique 16-inch wheels and tires
- Wheel flares.

Functional

- Vortec 2200 L4 or Vortec 4300 V6 (L35) engines
- 5-speed manual or 4-speed automatic with OD
- ZQ8 Sport Suspension, which includes: 46mm de Carbon shock absorbers, 33mm front stabilizer bar, 23mm rear stabilizer bar and two-stage multi-leaf rear springs
- 2-inch-lower ride height
- 16" x 8" cast-aluminum wheels
- P235/55R-16 tires.

S-10 4x4 Pickup with ZR2 Package

The 4x4 ZR2 S-10 Pickup is created by adding the ZR2 Wide-Stance Sport Performance Package to an S-10 Pickup Extended Cab Pickup with LS trim.

Exterior

- Unique front fenders and pickup box outer panels with extra-wide wheel flares.

Functional

- Special wide-stance ZR2 chassis
- 190-hp L35 Vortec 4300 V6 SFI engine
- Choice of 4-speed automatic overdrive transmission or 5-speed manual transmission.

* Always use safety belts and proper child restraints, even with air bags. Never place a rear facing infant restraint in the front seat of any vehicle equipped with an active air bag. See the owner's manual for more safety information.

† Parking brake must be disengaged for the system to operate.

Safety And Security*

Crash Avoidance Features

- Daytime Running Lamps* (DRL) with Automatic Exterior Lamp Control
- 4-wheel antilock brake system
- Brake/transmission shift interlock or starter safety switch.

Occupant Protection Features

- Driver and right front-passenger air bags†
- Side door beams
- Reinforced safety cage
- Standard three-point safety belt system
- Front and rear crush zones
- Energy-absorbing steering column and instrument panel.

Security Features

- PASSlock® theft-deterrent system. If an attempt is made to start the vehicle without the proper key, the fuel system is disabled
- Single two-sided key helps make S-10 Pickup's key easier to handle. Its large head lessens the chance of it being misplaced.

Key Optional Features

- Power Convenience Group includes power door locks, power windows, power remote exterior heated mirrors and Remote Keyless Entry with content theft alarm. Content theft alarm triggers horn and exterior lighting if unauthorized entry is attempted at any passenger door
- Lockout provision (on vehicles with the Power Convenience Group) prevents doors from locking if key is inadvertently left in the ignition.

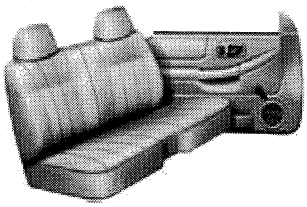
* For additional safety information, see the Chevrolet section of this Guide.

† Parking brake must be disengaged for the system to operate.

** Always use safety belts and proper child restraints, even with air bags. Never place a rear facing infant restraint in the front seat of any vehicle equipped with an active air bag. See the owner's manual for more safety information.

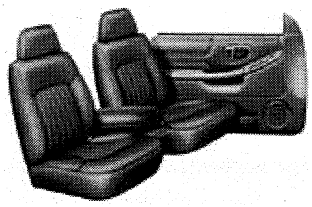
Seats

"Prescription templates" calibrated to actual body configurations, were used to design the universal lumbar supports for S-10 Pickup seats.



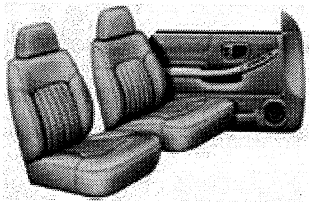
Regular Cab Base Model:

Custom Vinyl bench seat with folding seatback. Custom Cloth is optional.



2WD Extended Cab Model:

Reclining Deluxe Cloth 60/40 split-bench seat.



4WD Extended Cab Model:

Reclining Deluxe Cloth high-back bucket seats.

Extended Cab Seat Features:

- Extended Cab models feature custom folding standard rear jump seats that easily accommodate two passengers
- Extended Cab front-passenger seat slides forward to provide easy access to the rear-cargo area.

Interior Colors

Cloth And Vinyl:

- Beige (cloth only)
- Graphite (cloth only)
- Medium Gray.

Sound Systems

Base and LS Models

Standard:

- ETR AM/FM stereo with seek-scan and digital clock.

Optional:*

- ETR AM/FM stereo with cassette player, seek-scan and digital clock
- ETR AM/FM stereo with cassette player, seek-scan, digital clock, TheftLock, speed-compensated volume and auto tone control
- ETR AM/FM stereo with compact disc player, seek-scan, digital clock, TheftLock, speed-compensated volume and auto tone control
- ETR AM/FM stereo with compact disc and cassette players, TheftLock, speed-compensated volume and auto tone control (requires high-back bucket seats and automatic transmission).

Power and Performance

Engineering

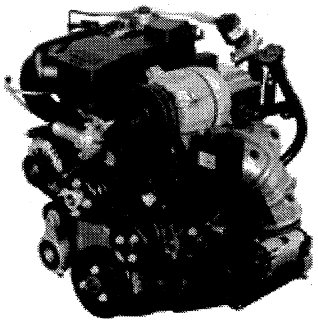
Corrosion protection and two-sided galvanized steel for all exterior body panels (except the roof and cargo box front panel) help protect S-10 Pickup from rust-through. The galvanized zinc coating helps prevent surface rust due to minor chips, scratches and holes that start from the inside.

S-10 Pickup engines feature sequential fuel injection which helps optimize fuel economy and power output while also helping to meet today's stringent emissions control requirements.

S-10 is manufactured at General Motors assembly plants in Linden, New Jersey and Shreveport, Louisiana.

Engines

Vortec 2200 L4 SFI Engine (LN2)



A Vortec 2200 L4 engine with Sequential Fuel Injection (SFI) is standard on S-10 Pickup 2WD models.

Power Ratings For The 2200 L4 Engine:

- 120 horsepower at 5000 rpm
- 140 lb.-ft. of torque at 3600 rpm.

2200 Engine Technical Features:

- Cast roller rocker arms
- Composite intake manifold
- Multec II fuel injectors
- Cast-aluminum cylinder heads
- Two resonators
- Large-volume air cleaner
- Hydraulic roller lifters
- "Assembled" steel camshaft.

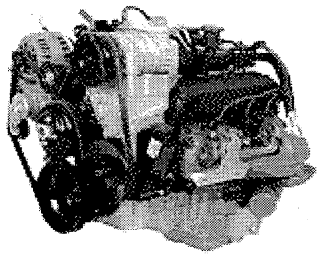
Extended-Life Service Items Include:

- Platinum-tip spark plugs
- Single accessory drive belt
- Extended-life engine coolant*

Vortec 2200 L4 SFI Alternate Fuel Engine (L43)

- NEW An alternate fuel 4-cylinder engine will be available on 2WD S-10 Pickup models approximately December 1, 1999. The engine is designed to burn cleaner and produce fewer harmful emissions through the use of an ethanol/gas mixture with up to 85 percent ethanol.

Vortec 4300 V6 Engine (L35)



The Vortec 4300 V6 engine with Sequential Fuel Injection is standard on 4x4 S-10 Pickup and optional on 2WD models.

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

Power Ratings For The Vortec 4300 V6 Engine:

- 180 horsepower at 4400 rpm (2WD)
- 245 lb.-ft. of torque at 2800 rpm (2WD)
- 190 horsepower at 4400 rpm (4x4)
- 250 lb.-ft. of torque at 2800 rpm (4x4).

Vortec 4300 Technical Features:

Sequential Fuel Injection offers the following advantages:

- High-precision fuel control — uses one injector and nozzle per cylinder for optimum cylinder-to-cylinder fuel distribution
- Each injector is fired sequentially and timed to the intake cycle for accuracy and metering control
- A mass airflow meter constantly measures the engine's air requirements under varying conditions, such as changes in load, altitude and temperature. In an SFI system, the mass airflow meter is essential for accurate fuel delivery
- The injector nozzle's design and optimum location produce a spray pattern that contributes to the engine's smooth idle and fuel efficiency.

Extended-Life Service Items Include:

- Platinum-tip spark plugs
- Engine timing never needs checking
- Extended-life engine coolant*
- Single accessory drive belt.

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

Transmissions

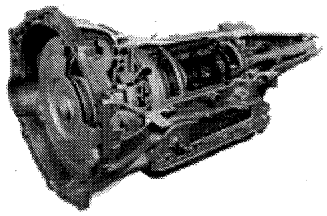
5-Speed Manual Transmission

NEW Five-speed manual transmission enhancements help provide quieter operation and extended gear life.

A five-speed manual transmission is standard in S-10 Pickup. Two versions are used, depending on the engine specified (Vortec 2200 L4 or Vortec 4300 V6). Both have fifth-gear overdrive to reduce engine speed during highway cruising which contributes to increased fuel efficiency and reduced engine wear.

- Wide range of gear ratios
- Synchronized reverse gear makes shifting easy by synchronizing the gear's speed to the speed of the transmission's output shaft
- Short-throw shifter has an ergonomically designed knob for more comfortable gripping and an "in control" shift feel
- 3.94:1 first-gear ratio provides high torque multiplication, for brisk acceleration (with Vortec 2200 L4 engine)
- Close-ratio transmissions on V6-equipped models have a 3.49:1 first-gear ratio which is designed for optimum acceleration; the fifth-gear ratio is 0.78:1.

4L60-E 4-Speed Electronic Automatic Transmission



GM's 4L60-E 4-speed automatic overdrive transmission is standard equipment on select S-10 models. The 4L60-E's "intelligent" electronic controls allow the transmission to match the engine's performance, delivering optimum fuel efficiency.

4L60-E Features:

- Vamac pump cover seals
- Clutch plate is designed for added durability and performance
- Wide range of gear ratios
- Powertrain Control Module (PCM) in the 4L60-E helps provide precision and flexibility. It measures key vehicle input, including throttle position, vehicle speed, gear range, temperature and engine load. Four solenoids connected to the PCM help control shift points for smoother shifting
- Virtually seamless operation is made possible, since the PCM acts as an interface between the engine and transmission
- Shift-timing is electronically controlled
- Brake/transmission shift interlock is standard. The interlock requires the driver to depress the brake pedal to shift out of PARK
- Second-gear-start feature helps provide an extra measure of control during slippery driving conditions. The driver can 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.

Four-Wheel-Drive Systems

Insta-Trac

The Insta-Trac system is standard on four-wheel-drive S-10 Pickup models. Insta-Trac makes it easy to shift into and out of four-wheel drive without leaving the cab.

- "On-the-fly" shifting from 2WD to 4WD High and back at any speed is possible with the Insta-Trac system. The system also includes a 4WD Low gear for more demanding 4WD maneuvers, such as climbing steep grades or driving through deep snow or mud.
- Electronic shift transfer case provides shift-on-the-fly capability from 2WD to 4WD High and back at any road speed by using an instrument panel-mounted push button.

Suspension

Front

- Independent front suspension is standard on S-10 Pickup. The suspension has upper and lower control arms and a stabilizer bar
- Friction-free coil springs on 2-wheel-drive models
- Torsion bars on 4-wheel-drive models provide efficient vehicle packaging. The torsion bars are computer-selected to help optimize ride and handling.

Rear

Two-stage, variable-rate, multi-leaf spring rear suspension is standard on S-10 Pickup. The longer set of leaves help to provide a smooth ride when the vehicle is unloaded. As additional passengers and cargo are loaded, the longer leaves flatten out and the shorter, stiffer leaves help deliver additional support, thereby contributing to a comfortable ride.

Suspension Choices

Four chassis packages are available on S-10 Pickup:

- 2WD — ZQ8, Z83, Z85
- 4x4 — Z85, ZR2

These coordinated packages allow customers to select the suspension components that suit their particular needs without having to separately order springs, shock absorbers, a stabilizer bar or tires.

This innovative approach to truck suspensions ensures that S-10 Pickup owners will have the right combination of equipment for a wide range of driving conditions.

2WD Chassis Packages Include:

- ZQ8 Sport Suspension, standard on the Xtreme and available on LS 2WD Regular Cab Short Box and LS 2WD Extended Cab S-10 Pickup models, includes the following:
    - Two-inch lower ride height
    - 46mm de Carbon front shock absorbers
    - 36mm de Carbon rear shock absorbers
    - 33mm front stabilizer bar
    - Two-stage multi-leaf rear springs
    - 23mm rear stabilizer bar
    - 16" x 8" cast-aluminum wheels
    - P235/55R-16 tires
    - Available with the Vortec 2200 4-cylinder SFI engine or the Vortec 4300 V6 SFI engine.

- Z83 Solid, Smooth Ride Package (Regular Cab Short Box) is intended primarily for use on paved roads, helping to provide a comfortable ride while offering control for light-duty hauling and trailering. The package includes:
    - 4200-lb. GVWR
    - 32mm twin tube shock absorbers
    - 25mm front stabilizer bar
    - P205/75R-15 tires.
- Z85 Increased Capacity/Firm Ride Package is optional on 2WD Regular Cab Short Box and standard on Regular Cab Long Box and Extended Cab models. Designed for heavy-duty hauling and trailering, the firm but comfortable ride characteristics of this package contribute to its intended use on pavement or gravel. The package includes:
    - 4600-lb. or 4900-lb. GVWR
    - 32mm twin tube shock absorbers
    - 29mm front stabilizer bar
    - P205/75R-15 tires.

4X4 Chassis Packages Include:

- Z85 Increased Capacity/Firm Ride Package (standard on Regular Cab Short Box and Extended Cab) is primarily used on paved/gravel roads. Recommended for heavy-duty hauling and trailering, this package is designed to provide a firm but comfortable ride. The package includes:
    - 5,150 lb. GVWR
    - 32mm twin tube shock absorbers
    - 28mm front stabilizer bar
    - P235/70R-15 ALS or P235/75R-15 on- /off-road tires.
- ZR2 Wide Stance Sport Performance Package features a track that is 100mm wider and a ride height that is 75mm higher than the standard 4x4 model. This package is designed to provide very firm ride characteristics and is designed for serious recreational off-road driving. The package is available on LS Extended Cab models only and includes:
    - 4900 lb. GVWR
    - 46mm Bilstein high pressure gas shock absorbers
    - 28mm front stabilizer bar
    - Unique rear suspension and revised rear springs
    - Rear-axle track bar
    - Front-drive axle with 7 1/4" ring gear, heat-treated driver gears and special axles
    - 3.73:1 rear-axle ratio with 8 1/2" ring gear, larger wheel bearings and axle shafts
    - Choice of 15" x 7" cast-aluminum wheels
    - 31 x 10.5R-15 tires
    - Special frame for wider track
    - 190 hp L35 Vortec 4300 V6 engine
    - 4-speed automatic transmission with overdrive or heavy-duty
    - 5-speed manual transmission
    - Special spare tire winch and jack to accommodate added height.

Other ZR2 Equipment Includes:

- Tilt-Wheel™ steering column with cruise control
    - Power windows, door locks and heated remote exterior mirrors
    - Remote Keyless Entry
    - Air conditioning
    - Stereo systems (see Sound Systems for a list of available systems)
    - Third door.

Steering

S-10 Pickup is equipped with variable-ratio, power-assisted steering as standard equipment for precise steering response. This system provides:

- 15:1 ratio (on center) for quick steering response on 2WD models
- 16:1 ratio (on center) for quick steering response on 4x4 models.

Brakes

NEW ABS controller (EBC 325) is the brain behind the antilock brake system. It measures wheel speed by using three sensors — one at each front wheel and one at the transmission output shaft. The controller helps ensure long life and reliable antilock performance

2WD Models

- Front disc/rear drum brakes are standard on 2WD S-10 Pickup models.

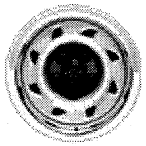
4x4 Models

- 4-wheel disc brakes are standard on all S-10 Pickup 4x4 models. This system helps provide minimal pedal effort and rust-resistant brake pads. This system features disc brakes that are designed to cool quickly for reduced brake fade.

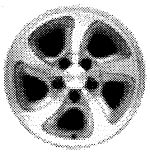
Wheels And Tires

Wheels

2WD Wheels

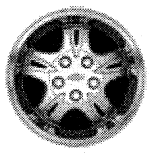


15" argent-painted steel wheel with black center cap (standard).



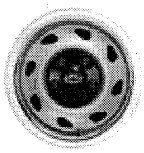
15" aluminum torqued 5-spoke wheel with bright machined-face and argent-painted ports. Included with YC5 Exterior Appearance Package.

16" aluminum wheel included with ZQ8 Sport Suspension (chrome center cap with gold bowtie).

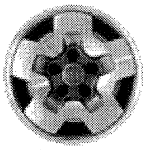


Xtreme 16" aluminum wheel (included only with Xtreme Sport Appearance Package).

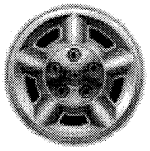
4x4 Wheels



15" argent-painted steel wheel with black center cap (standard).



15" flat 5-spoke aluminum wheel with bright machined-face and medium gray accents. (Optional on LS 4x4 models. Not available with LS Exterior Appearance Package or on Base models.



15" 5-Spoke aluminum wheel included with Exterior Appearance Package (YC5). (Optional on all 4x4 models with LS trim except ZR2).

Tires

- P205/75R-15 standard all-season steel-belted radial blackwall tires (2WD models with Z83 or Z85 Suspension)
- P205/75R-15 all-season steel-belted radial white outline-lettered tires (2WD models with Z83 or Z85 Suspension)
- P235/70R-15 all-season steel-belted radial blackwall tires (standard on 4x4 models)
- P235/70R-15 on- /off-road steel-belted radial white outline-lettered tires (optional on 4x4 models with Z85 Suspension)
- 31" x 10.5" R-15 LTC on- /off-road steel-belted radial blackwall tires (ZR2 models only)
- P235/55R-16 all-season steel-belted radial blackwall tires (included with Xtreme Sport Appearance Package and ZQ8 Suspension)
- Full-size spare standard on ZR2-equipped models and available on all others except Xtreme or ZQ8-equipped models.

Feature Availability

	Base	LS
Interior		
Air bag – driver and right front-passenger side with passenger-side deactivation switch1	S	S
Air conditioning – with CFC-free refrigerant	O	O
Flash to pass	S	S
Floor covering – vinyl, full-floor	S	NA
– carpeting, full-floor	NA	S
Headliner – full coverage, foam-backed w/color-keyed cloth cover	S	S
Gauges – fuel level, odometer, oil pressure, speedometer, temperature gauge, trip odometer, voltmeter	S	S
Lights, interior – delayed entry	S	S
PASSlock® theft-deterrent system	S	S
Power outlets, auxiliary	NA	S
Retained accessory power	S	S
Seats– custom vinyl bench w/folding back2 (Regular Cab only)	S	NA
– 2WD Regular Cab 60/40 Deluxe Custom Cloth, split-bench w/recliners (includes armrest w/storage)	NA	S
– 2WD Extended Cab 60/40 Deluxe Custom Cloth, split-bench w/recliners (includes armrest w/storage and custom vinyl folding rear jump seats)	S	S
– reclining high-back bucket seats (4x4 Regular and Extended Cab models) (includes console and adjustable manual lumbar support)	NA	S
Steering wheel – deluxe 4-spoke	S	S
– leather wrapped	NA	O
Stereo – ETR AM/FM stereo w/ seek-scan and digital clock	NA	S
– ETR AM/FM stereo w/ cassette player, seek-scan and digital clock	O	O
– ETR AM/FM stereo w/cassette player, seek-scan, digital clock TheftLock, speed-compensated volume, auto tone control	O	O
– ETR AM/FM stereo w/cassette and compact disc players, TheftLock speed-compensated volume and auto tone control	O[2]	O[2]
Sunshades– padded, color-keyed cloth	S	S
Warning tone – headlamps-on	S	S
Window – rear quarter swing-out (Extended Cab only)	S	S
– rear, sliding	O	O
Wipers – intermittent variable	S	S
Exterior		
Air dam	S	S
Bumpers, front and rear – dark gray	S	NA
– body-color	NA	S
Daytime Running Lamps w/Automatic Exterior Headlamp Control	S	S
Foglamps	NA	O
Mirrors – outside rearview w/LH & RH, below eyeline, black	S	S
Tires – P205/75-R-15	S	S
– P235/55-R-163	O	O
– P235/70-R-154 (standard on 4x4 model)	O	NA
– 31 x 10.5 R-15	NA	O
– spare, full-size	O	O
Wheels– 15" x 7" steel, painted argent w/black center cap	S	S
– 15" x 7" cast-aluminum	NA	O
– 16" x 8" cast-aluminum	O	O

Functional		
Brakes– 4-wheel antilock	S	S
– power, front disc/rear drum (2WD)	S	S
– power, 4-wheel disc (4x4)	S	S
Engine– Vortec 2200 L4 SFI (LN2/L43)	S	S
– Vortec 4300 V6 SFI (2WD) (L35)	S[5]	S[5]
Insta-Trac four-wheel-drive system (4x4 models only)	S	S
Steering, power-assisted	S	S
Third door – (Extended Cab)	O	O
Transmission – 5-speed manual w/overdrive	S	S
– 4-speed electronically controlled automatic	O	O

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. Air Bag Off Switch for use when carrying children. See the owner's manual for more safety information.
2 Requires bucket seats. No-cost cloth option available.
3 Requires ZQ8 Suspension.
4 Requires Z85 Suspension.
5 Optional on 4WD models.

Specifications

Models	2WD & 4x4
Passengers (Reg. Cab/Ext. Cab)	2-3/4-5
Class	Compact Pickup
Assembly plant	Linden, New Jersey, and Shreveport, Louisiana
Primary structure	Welded steel frame
Body material	Steel, two-sided galvanized*

* Except roof and pickup box front panel, which are one-sided galvanized steel.

Dimensions & Capacities (inches/millimeters, unless otherwise noted)	2WD Reg. Cab Short Box	2WD Reg. Cab Long Box	2WD Ext. Cab	4x4 Reg. Cab Short Box	4x4 Ext.Cab
Exterior Dimensions					
Wheelbase	108.3/2751	117.9/2995	122.9/3122	108.3/2750	108.3/2750
Overall length	190.1/4829	206.1/5235	204.7/5202	190.1/4829	204.7/5202
Overall height	62.0/1575	62.9/1596	62.7/1593	63.4/1610	63.4/1610
Maximum width	67.9/1725	67.9/1725	67.9/1725	67.9/1725	67.9*/1725
Ground to rear load floor	25.9/683	28.1/714	27.7/704	27.4/696	27.2/691
Ground clearance front/rear	9.1/231	8.7/221	9.1/232	8.6/218	8.5/216
Ground clearance rear	7.2/183	6.7/170	7.2/183	7.5/191	7.5/191
Cab Dimensions					
Headroom	39.5/1003	39.5/1003	39.6/1006	39.5/1003	39.6/1006
Legroom*	42.4/1077	42.4/1077	42.4/1077	42.4/1077	42.4/1077
Shoulder room	56.9/1443.	56.9/1443	56.9/1443	56.9/1443	56.9/1443
Cargo volume (max. cu. ft.) (cu. ft./cu. cm) (in-cab storage area)	-/-	-/-	17.3/492	-/-	-/-
Capacities					
Curb weight (lbs./kg)	3015/1368	3087/1401	3216/1459	3586/1627	3716/1686
Maximum GVWR (lbs./kg)	4600/1906	4900/2087	4600/1996	5150/2336	5150/2336
Base payload (std.) (lbs./kg) (based on curb wt.)	1185/538	1518/686	1184/537	1064/483	935/424
Max. trailer capacity (lbs./kg)	5500/2495	5500/2495	5500/2495	5500/2495	55000/2495
Fuel tank capacity (gal./liters)	19/72	19/72	19/72	19/72	19/72

* 43.2 (1097mm) in rearmost position.

Steering	
Type	Variable integral power recirculating ball
Steering ratio - 2WD	15:1 (on center)
Steering ratio - 4WD	16:1 (on center)
Turning diameter, curb-to-curb (ft./m)	36.9-41.6/10.6-12.7

Brakes		
	2WD and 4x4	
Type	4-wheel ABS, vacuum power, front disc/rear drum (2WD),4-wheel disc (4x4)	
	U.S. Standard	**Metric**
Front disc size	10.05 x 1.03 in.	255 x 26mm
Rear drum size 2WD	9.5 x 2.0 in.	241 x 51mm
Rear disc size 4x4	11.6 x .787 in.	295 x 20mm
Booster diameter	9.4, Tandem in	239mm
Parking brake	Cable to rear wheels	

Engines		
	L35	L35
Type	Vortec 2200 (OHV) L4	Vortec 4300 (OHV) V6
Block material	Cast iron	Cast iron
Cylinder head material	Cast aluminum	Cast iron
Bore & Stroke (in./mm)	3.50 x 3.46/89 x 88	4.00 x 3.48/101.6 x 88.4
Displacement (cu. in./cc)	134/2189	262/430
Compression ratio	9.0:1	9.2:1
Induction system	SFI	SFI
Valves/cylinder	2	2
Lifters	Hydraulic roller	Hydraulic roller
Cam drive	Chain	Chain
Horsepower/kW @ RPM (SAE net)	120 @ 5000/89 kW @ 5000	180 @ 4400/134 kW @ 4400 (2WD) 190 @ 4400/142 kW @ 4400 (4x4)
Torque/N-m @ RPM (SAE net)	140 @ 3600/190 N-m @ 3600	245 @ 2800/332 N-m @ 2800 250 @ 2800/339 N-m @ 2800 (4x4)
Redline (RPM)	6000	5600
Recommended fuel (min.)	87 octane	87 octane

Transmission Gear Ratios				
Engine	Vortec 2200 (OHV) L4		Vortec 4300 (OHV) V6	
Transmission	Manual 5-speed w/overdrive (MW2)	Auto.4-speed w/overdrive (M30)	Manual 5-speed w/overdrive (M50)	Auto 4-speed w/overdrive (M30)
1st	3.94	3.06	3.49	3.06
2nd	2.37	1.63	2.16	1.63
3rd	1.49	1.00	1.40	1.00
4th	1.00	0.70	1.00	0.70
5th	0.83	-	0.78	-
Reverse	3.65	2.29	3.55	2.29

Suspension	
	2WD and 4x4
Frame	All-welded, ladder-type channel-design w/boxed front section
Front type	Independent w/computer selected coil springs (2WD) or torsion bars (4x4)
Rear type	Semi-floating axle, 2-stage Semi-elliptic multi-leaf spring Semi-elliptic multi-leaf spring
Shocks* (front/rear) (mm)	32/32 (46/46 included with optional suspensions on 4x
Anti-roll bar* (front) (mm)	25

* See Chassis Packages for additional details.

Mileage/Performance (2WD/4x4)*								
Powertrain	4-Speed automatic w/Vortec 2200 L4		4-Speed automatic w/Vortec 2200 L4		4-Speed automatic w/Vortec 4300 V6		4-Speed automatic w/Vortec 4300 V6	
Mileage:	mpg	liters/ 100km	mpg	liters/ 100km	mpg	liters/ 100km	mpg	liters/ 100km
City	19	11.8	23	10.2	17	13.8	17	13.1
Highway	26	8.7	29	8.1	22	10.2	23	9.4
Est. cruising range:	mi.	km	mi.	km	mi.	km	mi.	km
City	361	581	437	707	323	520	323	520
Highway	494	795	551	893	418	673	437	703

* Based on 1999 information. 2000 figures not available at time of publication.

Trailering Information								
	Vortec 2200 L4		Vortec 2200 L4		Vortec 4300 V6		Vortec 4300 V6	
Transmission	Auto		Man		Auto (2WD/4WD)		Man(2WD/4WD)	
Trailer classification	Medium		Medium		Medium		Medium	
	U.S. Standard	Metric	U.S. Standard	Metric	U.S. Standard	Metric	U.S. Standard	Metric
Maximum trailer weight† (up to)	3200 lbs.	1452 kg	2300 lbs.	1043 kg	6400/ 5900 lbs.	2903/ 2676 kg	4200/ 4900 lbs.	1905/ 2222 kg

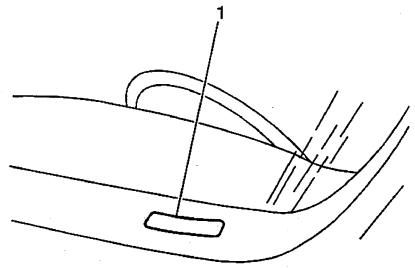
† Maximum trailer weight ratings are based on Regular Cab models and are calculated assuming a standard equipped base vehicle plus driver.

Wheels & Tires	
	2WD and 4x4
Wheel type/size (in.)	Steel/15-inch x 7-inch
Tire type	All-season steel-belted radials
Tire size	P205/7R-15 (2WD) P235/70R15 (4x4)

All specifications are preliminary and subject to change. Chevrolet Motor Division, June 1999.

Vehicle Identification

Vehicle Identification Number (VIN)



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

Position	Definition	Character	Description
1	Country of Origin	1,4	U.S. Built
2	Manufacturer	G	General Motors
3	Make	C H K N T	Chevrolet Truck Oldsmobile MPV GMC MPV Chevrolet MPV GMC Truck
4	GVWR/Brake System	B C D E F G	3,001-4,000 HYD Brakes 4,001-5,000 HYD Brakes 5,001-6,000 HYD Brakes 6,001-7,000 HYD Brakes 7,001-8,000 HYD Brakes 8,001-9,000 HYD Brakes
5	Truck Line/Chassis Type	S T	Sm Conventional Cab--4x2 Sm Conventional Cab--4x4
6	Series	1	½ Ton Nominal
7	Body Type	3 4 8 9	4-Door Cab/Utility Two-Door Cab Two-Door Utility Two-Door Extended Cab
8	Engine Type	W X 4	4.3L V6CPI 4.3L V6MFI 2.2L L4MFI
9	Check Digit	0	Check Digit
10	Model Year	Y	2000
11	Plant Location	K 8 2	Linden, NJ Shreveport, LA Moraine, OH
12-17	Plant Sequence Number	100001	Plant Sequence Number

VIN Derivative

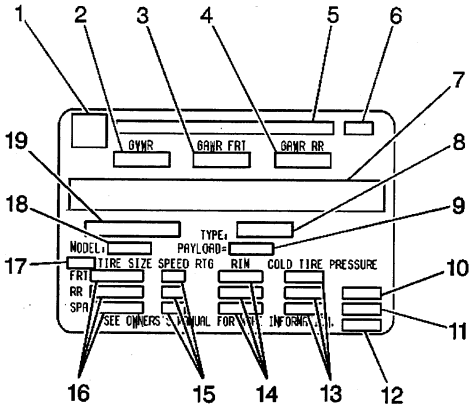
All engines and transmissions are stamped or laser etched with a partial vehicle identification number (VIN), which was derived from the complete VIN. A VIN derivative contains the following nine positions:

Position	Definition	Character	Description
1	GM Division Identifier	C,N	Chevrolet
		T,K	GMC
		H	Oldsmobile
2	Model Year	Y	2000
3	Assembly Plant	K	Linden, NJ
		8	Shreveport, LA
		2	Moraine, OH
		X	E.E.M.S
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	3
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.

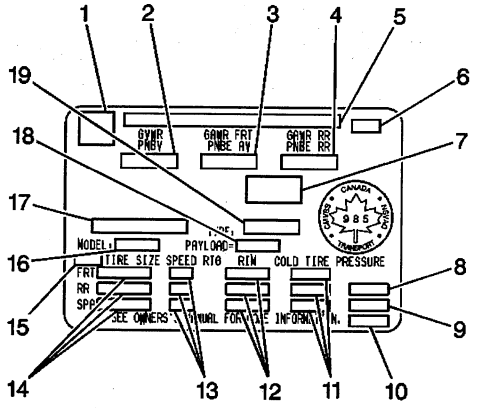
The front gross axle weight rating (GAWR FRT) is the weight exerted on the front axle. The rear gross axle weight rating (GAW RR) is the weight exerted on the rear axle. The front and rear gross axle weights must not exceed the front and rear gross axle weight ratings.

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.

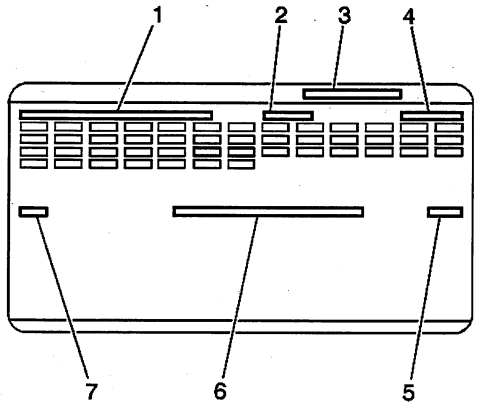
The front gross axle weight rating (GAWR FRT) is the weight exerted on the front axle. The rear gross axle weight rating (GAW RR) is the weight exerted on the rear axle. The front and rear gross axle weights must not exceed the front and rear gross axle weight ratings.

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

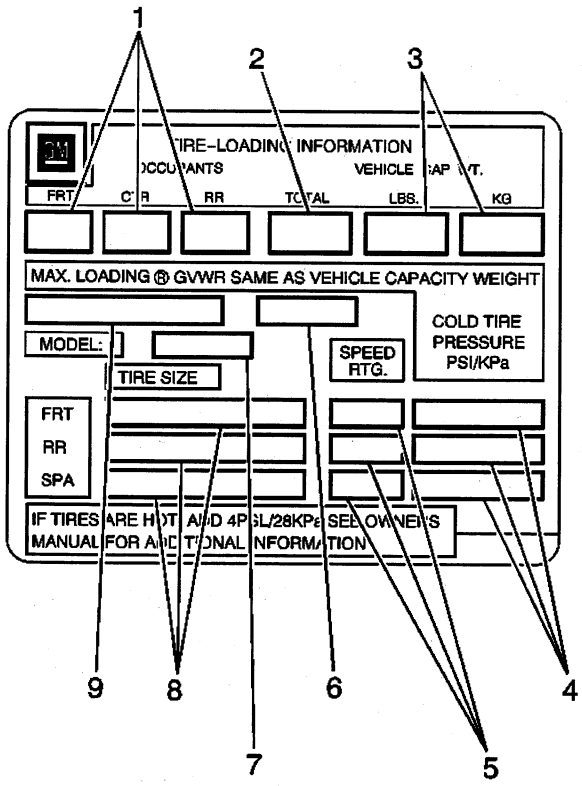
Service Parts Identification Label (SPID)



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

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

Tire Placard

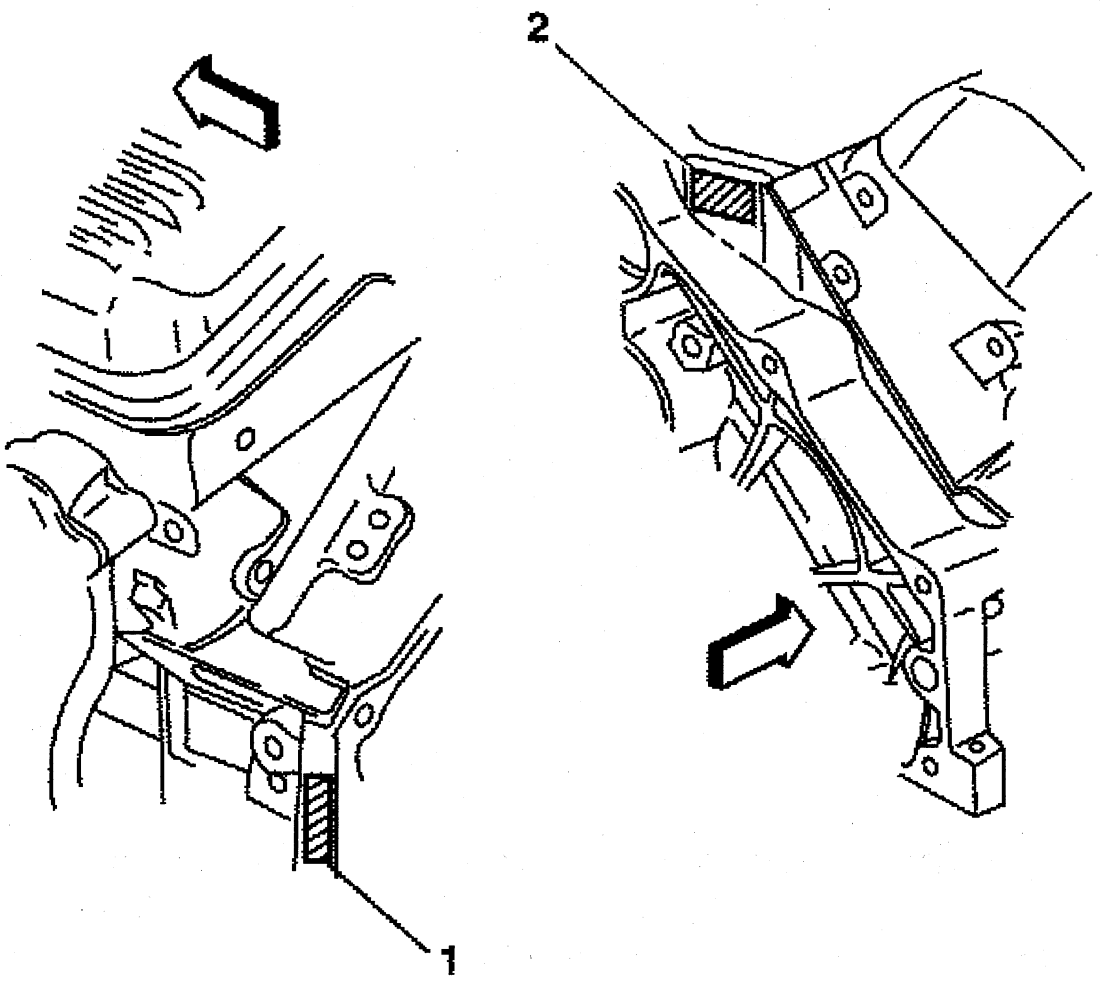


(1) Specified Occupant Seating Positions
(2) Total Occupant Seating
(3) Maximum Vehicle Capacity Weight
(4) Tire Pressures, Front, Rear, and Spare
(5) Tire Speed Rating, Front, Rear, and Spare
(6) Tire Label Code
(7) Engineering Model Minus First Character
(8) Tire Sizes, Front, Rear, and Spare
(9) Vehicle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

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

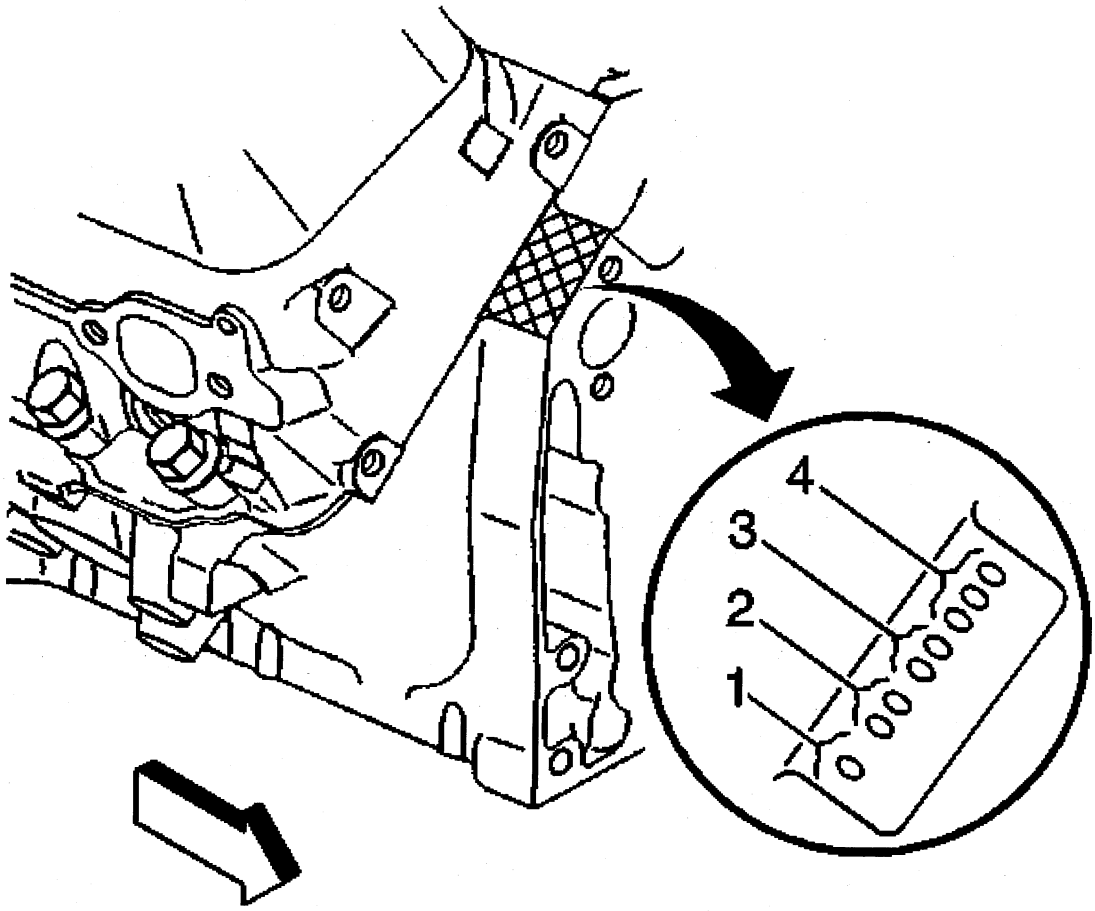
- The maximum vehicle capacity weight
- The cold tire inflation pressures
- The tire sizes (original equipment tires)
- The tire speed ratings (original equipment tires)

Engine ID and VIN Derivative Location 4.3L



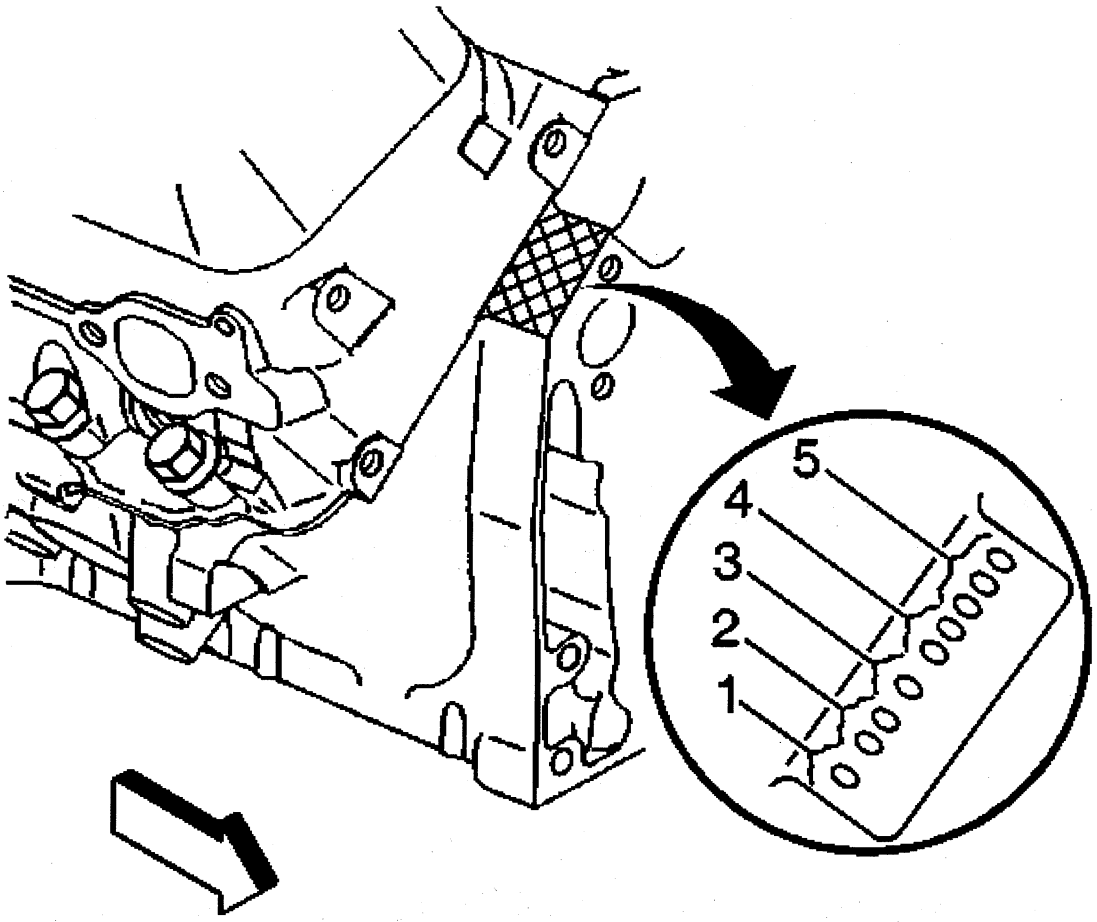
The Vehicle Identification Number (VIN) Derivative is located on the left side rear of the engine block (1) or on the right side rear (2) and typically is a nine digit number stamped or laser etched onto the engine at the vehicle assembly plant.

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



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

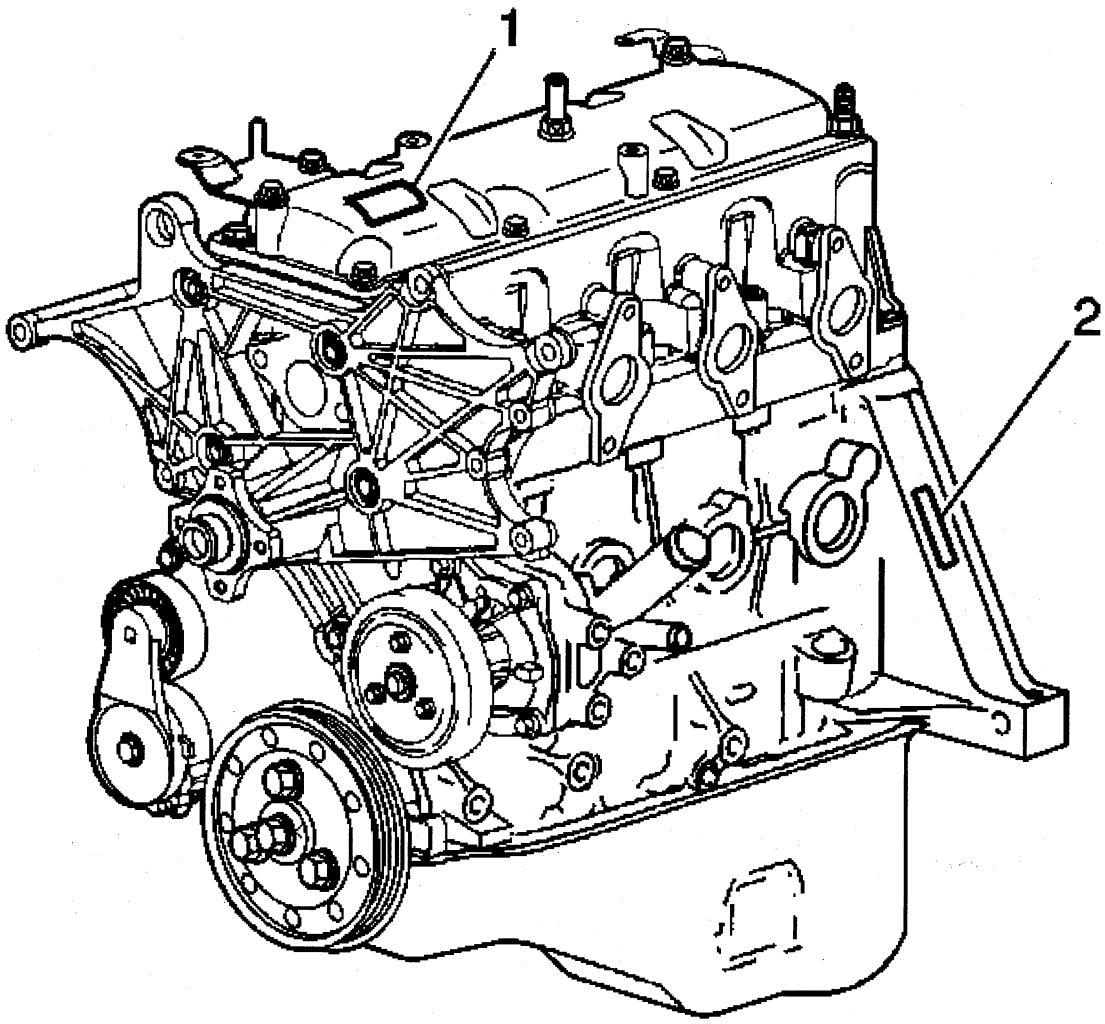
- The first digit (1) is the source code.
- The second and third digits (2) are the month of build.
- The fourth and fifth digits (3) are the date of build.
- The sixth, seventh, and eighth digits (4) are the broadcast code.



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

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

Engine ID and VIN Derivative Location 2.2L

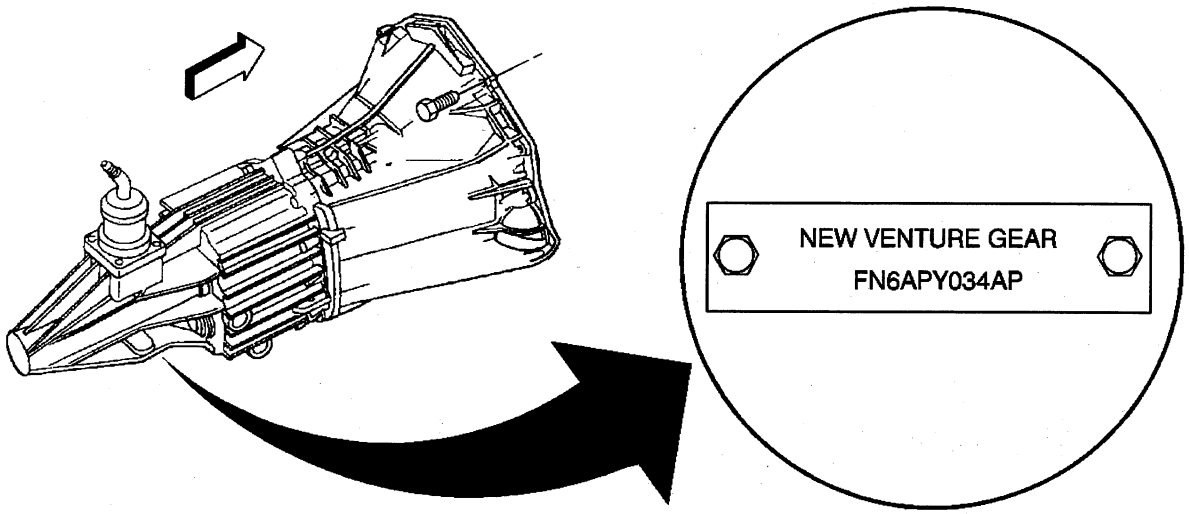


Identification can be made through the use of the Broadcast Code label on the valve rocker arm cover (1) and the use of the partial VIN etched on the left side of the engine block above the starter (2).

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

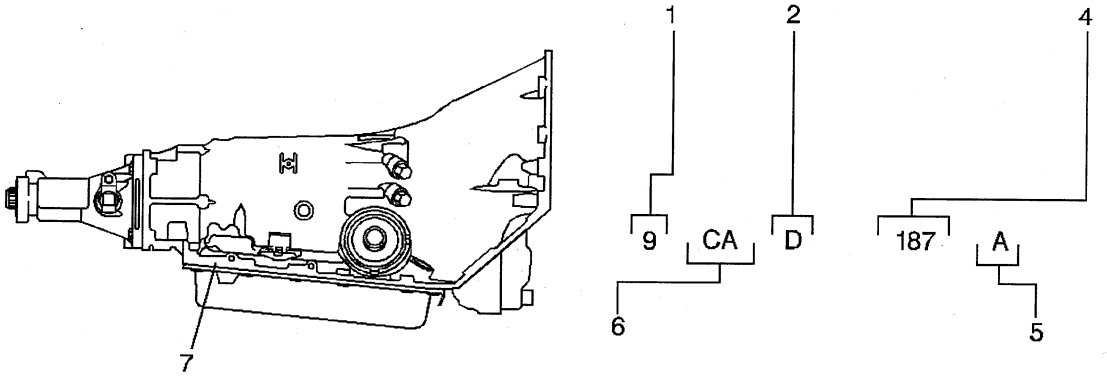
Transmission ID and VIN Derivative Location

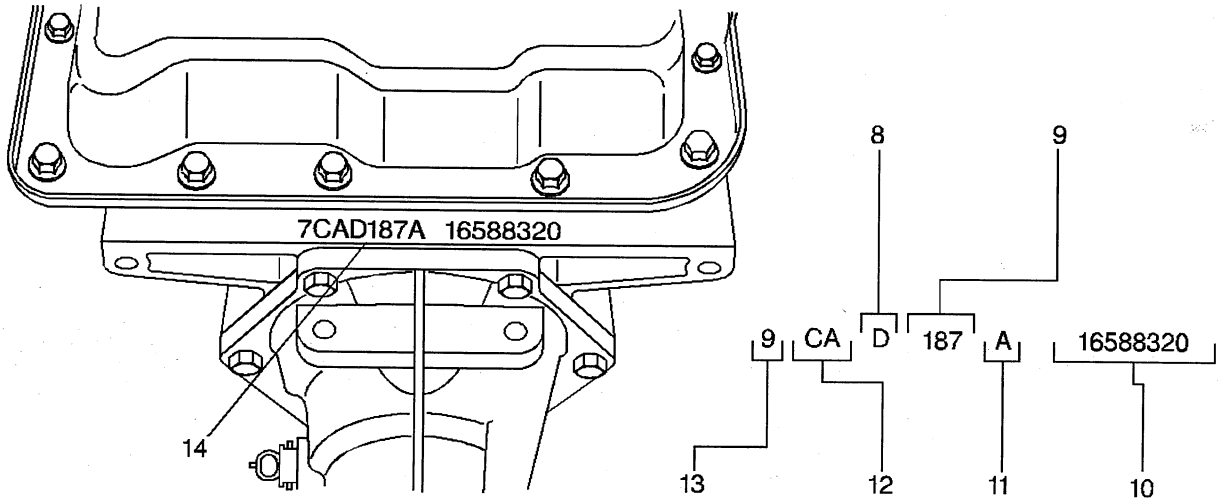
Manual Transmission



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

4L60-E Transmission ID Location





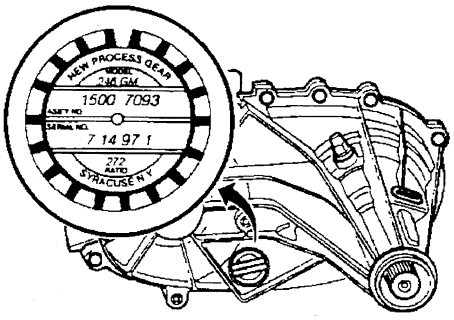
(1) Model Year
(2) Hydra-Matic 4L60-E
(4) Julian Date (or Day of the Year)
(5) Shift Built (A, B, J = First Shift; C, H, W = Second Shift)
(6) Model
(7) Transmission ID Location
(8) Hydra-Matic 4L60-E
(9) Julian Date (or Day of the Year)
(10) Serial No.
(11) Shift Built (A, B, J = First Shift; C, H,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

Transmission Usage

Model	Engine		Transmission	
	Base	Option	Base	Option
S105 (06)	4.3L V6 (L35)	--	5 Spd. Manual (M50)	4 Spd. Auto. (M30)
S105 (16)	4.3L V6 (L35)	--	5 Spd. Manual (M50)	4 Spd. Auto. (M30)
S106 (03)	2.2L L4 (LN2)	4.3L V6 (LF6) 4.3L V6 (L35)	5 Spd. Manual (MW2)	5 Spd. Manual (M50) 4 Spd. Auto. (M30)
S106 (53)	2.2L L4 (LN2)	4.3L V6 (LF6) 4.3L V6 (L35)	5 Spd. Manual (MW2)	5 Spd. Manual (M50) 4 Spd. Auto. (M30)
S108 (03)	2.2L L4 (LN2)	4.3L V6 (LF6) 4.3L V6 (L35)	5 Spd. Manual (MW2)	4 Spd. Auto. (M30)
T105 (06)	4.3L V6 (L35)	--	5 Spd. Manual (M50)	4 Spd. Auto. (M30)
T105 (16)	4.3L V6 (L35)	--	5 Spd. Manual (M50)	4 Spd. Auto. (M30)
T106 (03)	4.3L V6 (LF6)	4.3L V6 (L35)	5 Spd. Manual (M50)	4 Spd. Auto. (M30)
T106 (53)	4.3L V6 (LF6)	4.3L V6 (L35)	5 Spd. Manual (M50)	4 Spd. Auto. (M30)
T108 (03)	4.3L V6 (LF6)	4.3L V6 (L35)	5 Spd. Manual (M50)	4 Spd. Auto. (M30)

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

Transfer Case Identification



NV MODEL IDENTIFICATION KEY

246

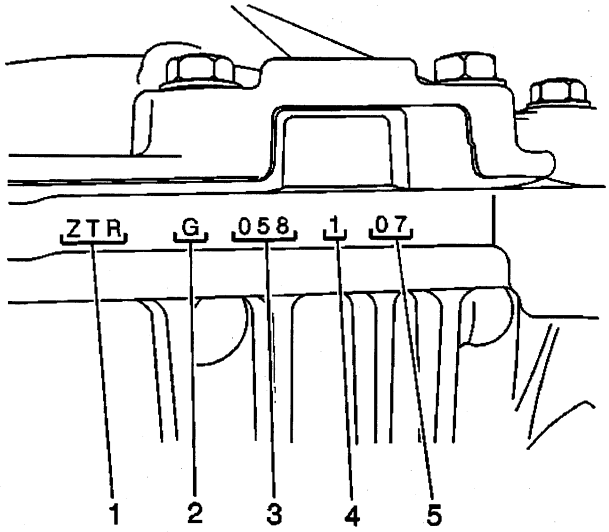
1	Single Speed	3	T – Truck/L – Van	1	Manual
2	2 Speed	4	K – Truck	3	Selectable
				6	Automatic

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

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

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

Axle Identification – Front



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

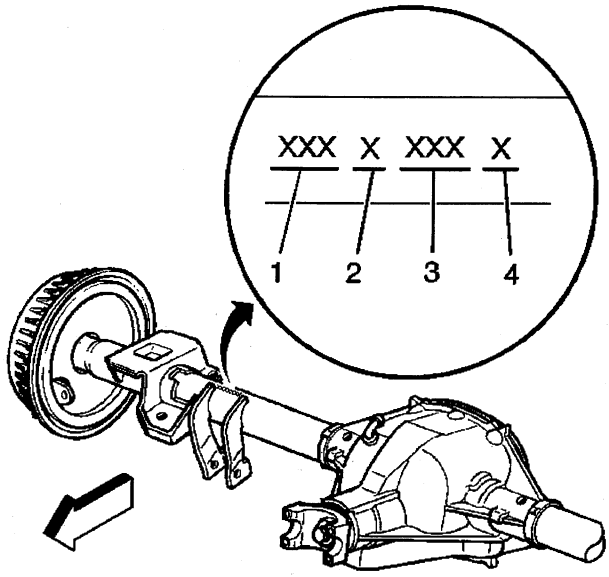
Front axle identification information is stamped on the top of the differential carrier assembly.

The following broadcast codes identifies the axle ratio:

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

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

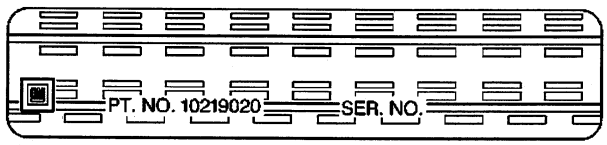
Axle Identification – Rear



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

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

Labeling - Anti-Theft



Notice

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

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

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

RPO Code List

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

RPO	Description
AA3	Windows: Deep Tint 1/4 Window; Light Tint Rear Window
AG0	Seat Adjuster: Power/Memory, Eight-Way, Two-Position, Driver
AG1	Seat Adjuster: Power, Six-Way, Driver
AG2	Seat Adjuster: Power, Six-Way, Passenger
AH8	Seat Adjuster: Power, Eight-Way, Passenger
AJ1	Windows: Deep Tint, all Except W/S and DRS
AM6	Seat: Front Split, 3 Passenger, Center Armrest
AM7	Seat: Rear Folding
ANL	Sales Package: Air Deflector and Fog Lamps
AN3	Seat: Driver, Pass, Elect. Body Support
AP9	Convenience Net
AU0	Lock Control, Remote Entry
AU3	Lock Control, Side Door, Electric
AV5	Seat: Front Bucket, High Back
AXP	Vin Ident Position, Multi-Purpose Vehicle, Requires AM7 Rear Seat
AX4	Restraint Conversion Seat, Man, European
A26	Window, European Glazing, All
A28	Window: Sliding Rear, Full Width
A31	Window: Power Operated, Side
A52	Seat: Front Bench
BAG	Parts Package Export
BG9	Covering: Floor, Rubber
BNB	Ornamentation, Exterior, Unpainted, Export
B30	Covering: Floor, Carpet
B32	Covering: Front Floor Mats, Aux
B84	Molding: B/S Exterior
B94	Appearance Package: Bravada, Gold Package Content
CE4	Washer, Headlamp, High Pressure, Export
CF5	Roof, Sun, Glass, Sliding Electric
CKD	Vehicle Knocked Down
CR0	Lamp Interior, Eng Compt, Courtesy - Delete
CTB	Appearance Package: Chevrolet Trailblazer Sport
C25	Wiper System: Rear Window, Intermittent
C3A	4400 Lbs. GVW Rating
C3G	4450 Lbs. GVW Rating
C3T	5350 Lbs. GVW Rating
C42	HVAC System: Heater, Deluxe, Outside Air
C49	Defogger, Rear Window, Electric
C5A	4900 Lbs. GVW Rating
C5C	5000 Lbs. GVW Rating
C5D	4600 Lbs. GVW Rating
C5T	4200 Lbs. GVW Rating
C5X	4650 Lbs. GVW Rating
C6F	5150 Lbs. GVW Rating
C6I	4850 Lbs. GVW Rating
C60	HVAC System: Air Conditioner, Front, Manual Controls

C68	HVAC System: Air Conditioner: Front, Automatic, Electronic Controls
DD0	Mirror: O/S, LH & RH, Rem. Control, Heated, LH LT Sensitive, Color
DH6	Mirror: I/S, Sunshade, Illum., LH & RH
DK2	Mirror: O/S, LH & RH, Rem. Control, Electric, Heated, Color
DK7	Console: Roof, Interior, Custom
DK8	Console: Roof, Interior, Deluxe
DR4	Mirror: O/S, LH & RH, Rem. Control, Heated, Electric, Dual Pwr. Folding, LT Sensitive, Color
D07	Console: Front Compartment Floor, Custom
D34	Mirror: Inside, Sunshade
D44	Mirror: O/S, LH & RH, Man. Control, Color
D55	Console: Front Compartment Floor
D88	Stripe: Decal, Sport
D96	Stripe: Body Side, Upper
EXP	Export, I.E.S.
E09	Equipment, Country, Europe
E24	Door: Side Cargo, Hinged
E55	Body Equipment: End Gate
E62	Body Equipment: Stepside, PUBX
E63	Pickup Box: Fleetside, PUBX
FE9	Certification: Emission, Federal
F46	Chassis: All Wheel Drive
GT4	Rear Axle: 3.73 Ratio
GT5	Rear Axle: 4.10 Ratio
GU4	Rear Axle: 3.08 Ratio
GU6	Rear Axle: 3.42 Ratio
G67	Level Control: Automatic, Air
G80	Rear Axle: Positraction, Limited Slip
JC1	Brake: Vac. Power, 4 Whl Disc, 5500 Lbs.
JM3	Brake Booster: 260 MM, Tandem High Flow
KA1	Heater: Seat
K05	Heater: Engine Block
K18	Reactor System Air Injection, Electric
K34	Cruise Control: Automatic, Electronic
K42	Air Cleaner "Off Road" Package
K53	Fuel Sender Asm, Robust Fuel System
K55	Fuel Sender Asm, Low Lubricity
K60	Generator: 100 Amp
LF6	Engine: Gas, 6 Cyl, 4.3L, CPI, V6, 90 Deg.
LN2	Engine: Gas, 4 Cyl, 2.2L, MFI
L35	Engine: Gas, 6 Cyl, 4.3L, CPI, V6, 90 Deg, HO
MW2	Transmission: Manual 5 Speed, New Venture Gear, 76mm, 3.94 1st
M30	Transmission: Auto 4 Speed, 4L60-E, Electronic
M50	Transmission, Manual 5-Speed, NVG, 85 mm, 3.49 1st, O/D
NA7	Emission System, European
NB7	Emission System: California, TLEV
NB8	Emission Override, California System
NC1	Emission System: California, LEV
NC7	Emission Override, Federal System
NF2	Emission System: Federal, Tier 1
NG1	Certification Emission, Geographically Restricted Registration
NM8	Leaded Fuel System Compatible
NN8	Emission Override, Unleaded Fuel, Export
NP1	Transfer Case: Electrical Shift, Two Speed

NP4	Transfer Case: Active 4WD, All Wheel Drive (AWD)
NP5	Steering Wheel: Leather Wrapped
NP6	Provisions, Transfer Case, Export
NP8	Transfer Case: Active, Two-Speed, Push button Control
N12	Exhaust System, Rear Exit
N33	Steering Column: Tilt Type
N40	Steering: Power, Non-Variable Ratio
N60	Wheel: Aluminum, Painted
N90	Wheel: 15 multiplied by 7, Aluminum Cast, 4.75 Inch Bolt Circle
N96	Wheel: 16 multiplied by 8, Cast Aluminum
PA3	Wheel: 15 multiplied by 7, Aluminum, Styled
PF2	Wheel: 15 multiplied by 7, Aluminum
PH1	Wheel: 15 multiplied by 7, Steel
PNV	Carrier: Inside, Spare Tire
P16	Carrier: RR Mounted, Spare Tire
QBF	Tire, All: P235/70R15, BW
QBG	Tire, All: P235/70R15, WOL
QCA	Tire, All: P205/75R15, WOL
QCB	Tire, All: P235/55R16, BW
QCE	Tire, All: P205/75R15, BL
QEB	Tire, All: P235/75R15, WOL
QJJ	Tire, All: 31 Multiplied by 10.5 R15LT/C, BW
QLN	Tire, All: P235/70R15, BW TL HWY
RYJ	Covering: Cargo Area, Retractable
TB4	Body Equipment: Liftgate
TR6	Headlamps Control Leveling System, Manual
TT6	Headlamps: High Intensity Discharge
T37	Foglamps: Deluxe
T61	Daytime Running Lamps
T62	Daytime Running Lamps - Delete
T84	Headlamps, RH Rule of Road, E-Mark, Rectangular
T89	Tail Lamp and Stop, Export
T90	Lamp Signaling and Marker, Export
T98	Stamping Vehicle Identification Number
UA1	Battery: High Capacity, Wet
UC2	Speedometer Inst, Kilo & Miles, Kilo Odometer, Positive Bias
UC4	Speedometer Inst, Kilo & Miles, Miles Odometer, Positive Bias
UD4	Alarm, Vehicle Speed, 120 K/H
UK3	Steering Wheel Radio Controls
UK6	Radio Control: Rear Seat and Ear Phone Jacks
UL0	Radio: AM/FM Stereo, Seek/ Scan, Auto Rev Music Search Cass.
UL2	Frequencies, European Radio
UL5	Radio: Delete
UM6	Radio: AM/FM Stereo, Seek/Scan, Auto Reverse Cassette, Clock, ETR
UM7	Radio: AM/FM Stereo, Seek/Scan, Clock, ETR
UN0	Radio: AM/FM. Seek, Scan, Compact Disc, Auto Tone, Clock
UP0	Radio: AM/FM Stereo, Seek/Scan, Auto Rev. Music Search Cass, CD, Auto Tone, Clock, ETR
UP8	Provisions: Stereo Radio
UQ3	Speaker System: Performance Enhanced Audio
UW3	Radio: AM/FM Stereo, Seek/Scan, Auto Rev Music Search Cassette
UY7	Wiring Harness: Heavy Duty, Trailer
U1F	Radio: AM/Fm Stereo, Seek/Scan, Compact Disc, Clock, ETR, HPS, Auto Rev Music Search Cassette

U1Z	Multiple Compact Disc Player, Passenger Compartment
U16	Tachometer, Engine
U19	Tachometer, Engine
U73	Speedometer Inst, Kilo & Miles, Kilo Odometer
U75	Antenna, Fixed, Radio
UB1	Wiring Harness: Light Duty, Trailer
VF6	Bumper: Rear Step
VF7	Bumper: Rear Step, Delete
VGC	Protector Film, Paint Etch Preventative
VJ4	Label, Export Child Seat Location
VL4	License Plate Front Mounting Package, EEC
VR4	Trailer Hitch: Weight Distributing Platform
VR6	Hook, Tie Down, Shipping
VXS	Vehicle Complete
V10	Provisions: Cold Climate
V37	Bumper: Front and Rear, Chrome
V4A	Performance Package: Chevrolet X-Treme
V54	Luggage Carrier: Roof, Painted
WJ7	Trim Override Interior: Leather, Oldsmobile Only
WXS	Provisions; Wiring, For Communications System
WX7	Provisions, Wiring, Export
X88	Conversion Name Plate: Chevrolet
YC3	Convenience Package: Level #3
YC5	Convenience Package: Level #5
YC6	Convenience Package: Level #6
YC7	Convenience Package: Level #7-GMC Only, Envoy
YE2	Convenience Package: Level 2, Low Trim, Export
YE3	Convenience Package: Level 3, High Trim, Export
YG4	Optional Seats Not Desired
ZAA	Compact Spare Tire
ZA6	Canadian Sales Package, Price Leader
ZA7	Canadian Sales Package, Value Leader
ZM5	Sales Package: Underbody Shield
ZM6	Chassis Package: Off-Road Suspension
ZM8	Sales Package: Combination, Elect. Tailgate Release/Rear Window Defogger
ZQ1	Chassis Package: Smooth Ride
ZQ2	Sales Package: Driver Convenience I
ZQ3	Sales Package: Driver Convenience II
ZQ6	Sales Package: Driver Convenience III
ZQ8	Package: Sport Chassis
ZR2	Chassis Package: High Rider Performance, 4X4 Sport
ZW7	Chassis: Premium Smooth Ride
ZY1	Color Combination: Solid
ZY2	Color Combination: Two-Tone, GMC Only
ZY7	Color Combination: Lower Accent, Two Tone
Z49	Base Equipment: Canadian Mandatory
Z5X	Mirror Provisions, Arabic Language
Z70	Conversion Nameplate: Oldsmobile
Z82	Trailering Provisions, Special Equipment, Heavy Duty
Z83	Chassis Package: Solid Smooth Ride
Z85	Chassis Package: Increased Capacity
Z88	Conversion Nameplate: GMC Truck
01L	Secondary Color Exterior: Special

01U	Primary Color Exterior: Special
1SH	Diamond Edition: Standard Equipment Package
1SJ	Diamond Edition: Luxury Equipment Package
1SK	Diamond Edition: Special Equipment Package
11A	Stripe: Color Accent, Pewter
11L	Secondary Color Exterior: Pewter Met.
11U	Primary Color Exterior: Pewter Met.
12D	Trim Combination: Cloth, Graphite (D)
12H	Trim Combination: Cloth, Graphite(H)
12I	Interior Trim: Graphite
122	Trim Combination: Leather, Graphite
23U	Primary Color Exterior: Space Blue Met.
37U	Primary Color Exterior: Green Tintcoat Met.
39L	Secondary Color Exterior: Indigo Met.
39U	Primary Color Exterior: Indigo Met.
41L	Secondary Color Exterior: Black
41U	Primary Color Exterior: Black
44U	Primary Color Exterior: Medium Red Met.
50U	Primary Color Exterior: Olympic White
54A	Stripe: Accent, Brt Gold
55A	Stripe: Accent, Lt. Autumwood Met.
60L	Secondary Color Exterior: Gold Met.
60U	Primary Color Exterior: Gold Met.
61A	Stripe: Accent, Gold Met.
64D	Trim Combination: Cloth, Light Beige
64H	Trim Combination: Cloth, Light Beige
64I	Interior Trim: Light Beige
642	Trim Combination: Leather, Smokey Carmel Tin
65U	Primary Color Exterior: Smokey Carmel
68U	Primary Color Exterior: Copper Met.
74U	Primary Color: Exterior, Victory Red
8E1	Fuel Additional: Three Gallons
90A	Stripe: Color Accent, Medium Gray
90L	Secondary Color: Exterior, Gray Met.
91A	Stripe: Color Accent, Spectre Gray Met.
92D	Trim Combination: Cloth, Med. Dk. Pewter (D)
92H	Trim Combination: Cloth, Med. Dk. Pewter (H)
92I	Interior Trim: Med. Dk. Pewter
92W	Trim Combination: Vinyl, Med. Dk. Pewter
922	Trim Combination: Leather, Med. Dk. Pewter
94U	Primary Color: Exterior, Cherry Red Metallic
96A	Stripe: Color Accent, Silver

Technical Information

Maintenance and Lubrication

Capacities - Approximate Fluid

Application	Specification	
	Metric	English
Engine Cooling System		
• 2.2L (VIN 4)	11.0 L	11.5 qt
• 4.3L (VIN X)	11.5 L	12.1 qt
• 4.3L (VIN W)	11.5 L	12.1 qt
Engine Crankcase		
• 2.2L (VIN 4)	4.26 L	4.5 qt
• 4.3L (VIN Xand W)	4.26 L	4.5 qt
Fuel Tank		
Fuel Tank-Steel	71.9 L	19 Gal
Fuel Tank-Plastic	68.1 L	18 Gal
Transmission		
• 4L60-E After Filter/Pan Removal	4.7 L	5 qt
• After Complete Overhaul-4L60-E	10.6 L	11 qt
• New Venture Gear 1500 Manual Transmission	2.7 L	2.9 qt
• New Venture Gear 3500 Manual Transmission	2.0 L	2.2 qt
Transfer Case		
• New Venture 136	1.9 L	2.0 qt
• New Venture 233	1.0 L	1.06 qt
• New Venture 236	1.9 L	2.0 qt
Axle		
Front Axle	1.2 L	1.5 qt
Rear Axle-7.625	1.655 L	1.75 qt
Rear Axle-8.6	1.85 L	2.0 qt

Maintenance Items

Application	Part Number
Air Cleaner	
• 2.2L (VIN 4)	AC Type A1163C
• 4.3L (VIN X)	AC Type A773C
• 4.3L (VIN W)	AC Type 1163C
Engine Oil Filter	
• 2.2L (VIN 4)	AC Type PF-47
• 4.3L (VIN X and W)	AC Type PF-52
PCV Valve	
• 4.3L (VIN X)	AC Type CV789C
• 4.3L (VIN W)	AC Type CV769C

Spark Plugs	
• 2.2L (VIN 4)	AC Type 41-948 (GAP 1.27 mm, 0.050 in)
• 4.3L (VIN X)	AC Type CR43TSM (GAP 1.14 mm, 0.045 in)
• 4.3L (VIN W)	AC Type CR43TSM (GAP 1.52 mm, 0.060 in)
Fuel Filter	
• 2.2L (VIN 4)	AC Type GF-645
• 4.3L (VIN X)	AC Type GF-481
• 4.3L (VIN W)	AC Type GF-645
Radiator Cap	
• 2.2L (VIN 4)	AC Type R27
• 4.3L (VIN X)	AC Type R27
• 4.3L (VIN W)	AC Type R27

Fluid and Lubricant Recommendations

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

Transfer Case	DEXRON®-III Automatic Transmission Fluid.
Automatic Transfer Case	Automatic Transfer Case Fluid (GM P/N 12378396 or equivalent).
Column Shift Linkage	Chassis Lubricant (GM P/N 12377985 or equivalent) meeting requirements of NLGI Grade 2, Category LB or GC-LB.
Floor Shift Linkage	Chassis Lubricant (GM P/N 12377985 or equivalent) meeting requirements of NLGI Grade 2, Category LB or GC-LB.
Propeller Shaft Slip Splines and Universal Joints	Chassis Lubricant (GM P/N 12377985 or equivalent) or lubricant meeting requirements of NLGI Grade 2, Category LB or GC-LB.
Clutch Pushrod to Fork Joint	Chassis Lubricant (GM P/N 12377985 or equivalent) or lubricant meeting requirements of NLGI Grade 2, Category LB or GC-LB.
Constant Velocity Universal Joint	Chassis Lubricant (GM P/N 12377895 or equivalent) or lubricant meeting requirements of NLGI Grade 2, Category LB or GC-LB.
Hood Latch Assembly, Pivots and Spring Anchor, Release Pawl	Lubriplate® Lubricant Aerosol (GM P/N 12346293 or equivalent) or lubricant meeting requirements of NLGI Grade 2, Category LB or GC-LB.
Hood and Door Hinges	Multi-Purpose Lubricant, Superlube® (GM P/N 12346241 or equivalent).
Endgate Mounted Spare Tire Carrier (if equipped), Outer Endgate Handle Pivot Points and Hinges	Multi-Purpose Lubricant, Superlube® (GM P/N 12346241 or equivalent).
Weatherstrip conditioning	Dielectric Silicone Grease (GM P/N 12345579 or equivalent).
Weatherstrip squeaks	Synthetic Grease with Teflon, Loctite Superlube® (GM P/N 12371287 or equivalent).

Descriptions and Operations

Power Steering System Description and Operation

The hydraulic power steering system consists of the following components:

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

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

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

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

The smaller opening contains the following components:

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

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

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

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

Steering Linkage Description and Operation

The steering linkage connects both front wheels to the steering gear through the pitman arm.

The following components form a parallel type steering linkage:

- The pitman arm
- The idler arm
- The relay rod

The right and left tie rods are attached to the relay rod by ball studs.

On some four wheel drive models, a steering shock absorber is attached to the relay rod.

The tie rods have adjuster tubes for toe adjustments.

There are lubrication fittings at each joint.

Prevailing torque nuts are used at the inner tie rod joints.

Castle nuts secured with cotter pins at the outer tie rod joints.

Tie Rod Description

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

Steering Wheel and Column - Standard Description and Operation

The steering wheel and column has 4 primary functions:

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

Vehicle Steering

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

Vehicle Security

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

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

Driver Convenience

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

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

Driver Safety

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

Suspension Description and Operation

Front Suspension

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 arms 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 two-wheel drive vehicles have coil chassis springs. These springs are mounted between the spring housings on the frame and the lower control arms. Double, direct acting shock absorbers are inside the coil springs. The coil springs attach to the lower control arms and offer ride control.

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

A spring stabilizer shaft controls the side roll of the front suspension. This shaft is mounted in rubber bushings 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 grommets isolate these link bolts. Rubber bushings attach the upper control arm to a cross shaft. Frame brackets bolt the cross shaft.

A ball joint assembly is riveted to the outer end of the upper control arm. A rubber spring in the control arm assures that the ball seats properly in the socket. 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 damage to the bearing surfaces.

Four-wheel drive models have a front suspension that consists of the control arms, a stabilizer bar, a shock absorber, and right and left torsion bars. 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 adjustable arm at the crossmember. This arm adjustment controls the vehicle trim height.

Two-wheel drive vehicles have tapered roller sheel bearings. These bearings are adjustible and need lubrication.

Four-wheel drive models and RWD Utilities have sealed front-wheel bearings. These bearings are pre-adjusted and need no lubrication.

Heat treatment may create darkened areas on the bearing assembly. This discoloration does not signal a need for replacement.

Rear Suspension

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

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

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

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

- The rubber insulators
- The clamps
- The link assemblies

Automatic Level Control General Description

The function of the Automatic Level Control (ALC) system is maintaining a constant trim height at the rear suspension when the vehicle is loaded beyond a predetermined amount. The ALC system is active with the vehicle ignition switch in the ON position. The system consists of the following components:

- An automatic level control sensor
- Air shocks
- Automatic level control air lines
- An automatic level control air compressor assembly, consisting of the following components:
  - Automatic level control air compressor motor and head
  - Automatic level control air compressor bracket
  - Automatic level control air dryer
  - Automatic level control Air dryer filter
  - Exhaust solenoid
  - Automatic level control air compressor relay
  - Automatic level control air compressor filter

An inflator system is included as part of the overall ALC system. The function of the inflator system is to provide air under pressure up to 482 kPa (70 psi) to an automatic level control solenoid valve for the purpose of inflating items other than the vehicle air shocks, such as sports balls, bicycle tires, automobile tires, etc. The automatic level control solenoid valve and the automatic level control inflator air switch are located behind the passenger-side body-side trim panel. The inflator system is active with the vehicle ignition switch in the ON position. The inflator system consists of the following components:

- An automatic level control solenoid valve
- An automatic level control inflator air switch
- An automatic level control timer relay
- An accessory kit

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.

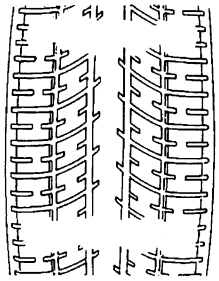
The following factors have an important influence on tire life:

- 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:

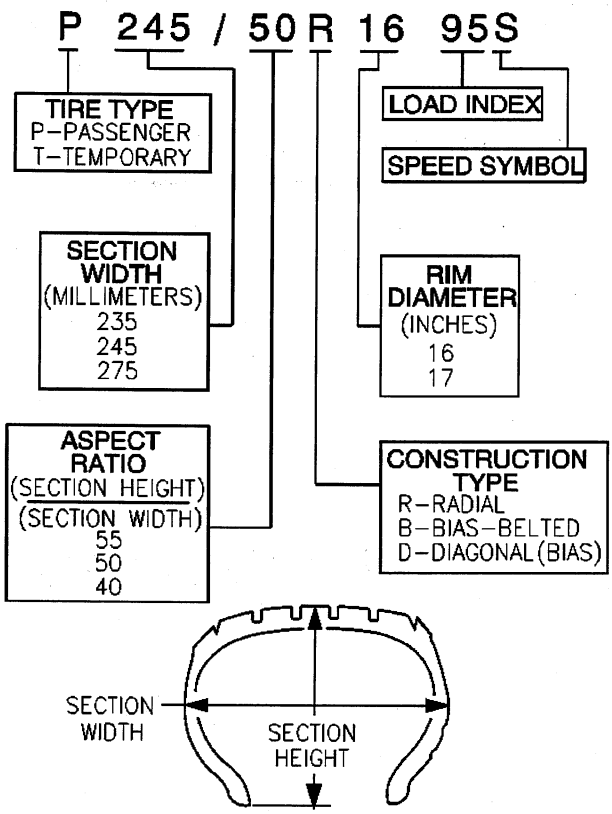
- A tire squeal on turns
- Hard steering
- Rapid wear and uneven wear on the edge of the tread
- Tire rim bruises and tire rim rupture
- Tire cord breakage
- High tire temperatures

- 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

The constant velocity (CV) joint allows the driveline angle adjustment with up and down movement of the vehicle without disturbing the power flow. The CV joint is composed of the following components:

- An outer bearing retainer
- A flange
- A spring
- A cap
- A circlip
- An inner bearing assembly
- A wire ring

The inner bearing assembly includes the following components:

- A bearing cage
- Six ball bearings
- 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.

Front Drive Axle Description and Operation

The Front Drive Axle consist of the following components:

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

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

Rear Drive Axle Description and Operation

Rear Axles for this vehicle consist of the following components:

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

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

Locking Differential Description and Operation

The locking differential consists of the following components:

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

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

Limited-Slip Function

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

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

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

Locking Function

Locking action occurs through the use of some special parts:

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

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

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

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

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

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

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

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

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

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

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

Locking Differential Torque-Limiting Disc

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

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

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

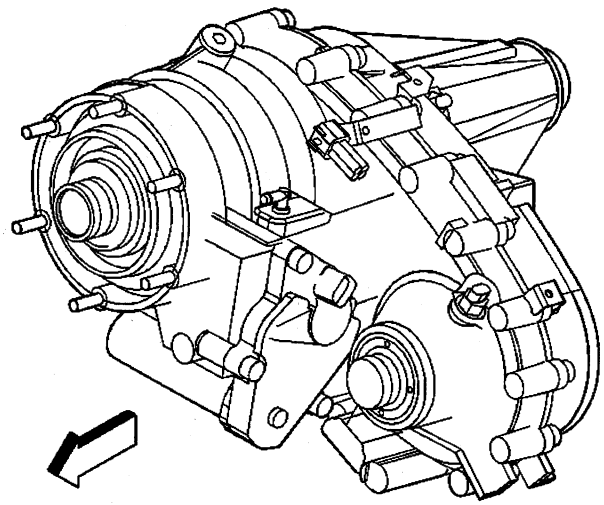
Transfer Case Description – NV233

Range Shifting

The New Venture Gear NV233 is an electronic shift transfer, with the following three modes of operation, Two-wheel drive high range, Four-wheel drive high range, Four-wheel drive low range. The gear

reduction for low range is provided by a planetary gear set. The floor-mounted shifter has been eliminated. A switch, located on the upper right side of the instrument panel, is used to select the operating range. The indicator lamps on the switch show the current mode of operation. When the four-wheel drive has been selected, the four-wheel drive indicator lamp on the switch is designed to turn on when the front axle has engaged.

Transfer Case Description – NV236



The NV236 transfer case is an automatic transfer case with three drive ranges. Shifting from rear wheel drive to four wheel drive is done automatically when the transfer case shift control module receives wheel rotating slip information from the speed sensors. The transfer case shift control module then engages the transfer case motor/encoder to position the transfer case from rear to four wheel drive. When the transfer case shift control module receives information that the wheel rotation is the same on both axles, the transfer case shift control module sends position information to the motor/encoder to put the transfer case back into rear wheel drive. The three drive ranges are 2HI, 4HI, and 4LO. The 2HI position is for normal driving with the rear wheels pushing the vehicle. The 4HI, position is for driving through sand, snow, mud, gravel, or heavy rain at normal or slightly below normal speeds. The 4HI engages the front axle to allow for four wheel drive. The front axle is pulling the vehicle, and the rear axle is pushing the vehicle. The 4LO range is used for off road driving, heavy snow, deep mud, or shallow fording. The 4LO is similar to the 4HI except that the gearing in the transfer case is set for low speed and high torque. The NV236 is manufactured at Syracuse New York by New Venture Gear a division of New Process Gear for General Motors.

Braking System Description and Operation

Hydraulic Brake System Description and Operation

System Component Description

The hydraulic brake system consists of the following:

Hydraulic Brake Master Cylinder Fluid Reservoir

Contains supply of brake fluid for the hydraulic brake system.

Hydraulic Brake Master Cylinder

Converts mechanical input force into hydraulic output pressure.

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

Hydraulic Brake Pressure Balance Control System

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

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

Hydraulic Brake Pipes and Flexible Brake Hoses

Carries brake fluid to and from hydraulic brake system components.

Hydraulic Brake Wheel Apply Components

Converts hydraulic input pressure into mechanical output force.

System Operation

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

Brake Assist System Description and Operation

System Component Description

The brake assist system consists of the following:

Brake Pedal

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

Brake Pedal Pushrod

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

Vacuum Brake Booster

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

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

Vacuum Source

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

Vacuum Source Delivery System

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

System Operation

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

Disc Brake System Description and Operation

System Component Description

The disc brake system consists of the following components:

Disc Brake Pads

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

Disc Brake Rotors

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

Disc Brake Pad Hardware

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

Disc Brake Caliper Hardware

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

System Operation

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

Drum Brake System Description and Operation

System Component Description

The drum brake system consists of the following:

Drum Brake Shoes

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

Brake Drums

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

Drum Brake Hardware

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

Drum Brake Adjusting Hardware

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

System Operation

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

Park Brake System Description and Operation

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

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

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

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

Park Brake Lever

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

Cable System

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

Notice

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

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

ABS Description and Operation

Antilock Brake System

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

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

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

Engine Description and Operation

Engine Mechanical 2.2L

Mechanical Specifications

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

• Gear Lash	0.094-0.195 mm	0.004-0.008 in
• Gear Pocket Depth	30.36-30.44 mm	1.195-1.198 in
• Gear Pocket Diameter	38.18-38.25 mm	1.503-1.506 in
• Gear Length (Drive Gear)	30.45-30.48 mm	1.199-1.20 in
• Gear Length (Idler)	30.45-30.48 mm	1.199-1.20 in
• Gear Diameter (Drive Gear)	38.05-38.10 mm	1.498-1.50 in
• Gear Diameter (Idler)	38.05-38.10 mm	1.498-1.5 in
• Gear Side Clearance (Drive Gear)	0.038-0.102 mm	0.001-0.004 in
• Gear Side Clearance (Idler)	0.038-0.102 mm	0.001-0.004 in
• End Clearance	0.05-0.18 mm	0.002-0.007 in
Crankshaft		
• Main Journal Diameter	63.360-63.384 mm	2.4945-2.4954 in
• Main Journal Taper	0.005 mm	0.00019 in
• Main Journal Out Of Round	0.005 mm	0.00019 in
• Main Bearing Clearance	0.015-0.047 mm	0.0006-0.0019 in
• Crankshaft End Play	0.0511-0.1780 mm	0.002-0.007 in
• Rod Bearing Journal Diameter	50.758-50.784 mm	1.9983-1.9994 in
• Rod Bearing Journal Taper	0.005 mm	0.00019 in
• Rod Bearing Journal Out Of Round	0.005 mm	0.00019 in
• Rod Bearing Journal Clearance	0.025-0.079 mm	0.00098-0.0031 in
• Rod Side Clearance	0.10-0.38 mm	0.0039-0.0149 in
Camshaft		
• Lobe Lift (Inlet and Exhaust)	6.687 mm	0.2633 in
• Journal Diameter	47.453-47.478 mm	1.868-1.869 in
• Journal Clearance	0.038-0.088 mm	0.0015-0.0035 in
Valve System		
• Rocker Arm Ratio	40.64 mm	1.6
• Valve Face Angle	--	45°
• Valve Face Runout	0.038 mm	0.0014 in
• Valve Margin (Exhaust)	2.21-1.79 mm	0.087-0.080 in
• Valve Margin (Inlet)	1.96-1.16 mm	0.061-0.04 in
• Valve Head Diameter (Inlet)	44 mm	1.73 in
• Valve Head Diameter (Exhaust)	37 mm	1.45 in
• Valve Overall Length (Inlet)	134.23 mm	5.28 in
• Valve Overall Length (Exhaust)	127 mm	5.00 in
• Valve Stem to Guide Clearance (Inlet)	0.019-0.053 mm	0.0007-0.0020 in
• Valve Stem to Guide Clearance (Exhaust)	0.035-0.075 mm	0.0014-0.0029 in
• Valve Guide Inside Diameter	7.000-7.020 mm	0.275-0.276 in
• Valve Tip to Retainer Groove Centerline (Exhaust)	5.38-5.90 mm	0.212-0.232 in
• Valve Tip to Retainer Groove Centerline (Intake)	4.94-5.46 mm	0.194-0.215 in
• Valve Springs Free Length	48.7 mm	1.91 in
• Valve Seat Width (Inlet)	2.80 mm	0.110 in
• Valve Seat Width (Exhaust)	3.51 mm	0.138 in
• Valve Springs Load (Closed)	361-325 N @ 40.64 mm	81.2-73.1 lb @ 1.600 in
• Valve Springs Load (Open)	957-893 N @ 29.85 mm	215-201 lb @ 1.175 in

Fastener Tightening Specifications

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

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

Engine Component Description

Engine Block

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

Cylinder Head

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

Crankshaft

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

Piston and Connecting Rod Assemblies

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

The connecting rods are forged steel. The connecting rods are machined with the rod cap installed for proper clearances and alignments.

Camshaft

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

Valve Train

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

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

The valve seals are integral with the valve spring seats.

Intake Manifold and Fuel Rail

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

Exhaust Manifold

The exhaust manifold is cast iron.

Drive Belt System Description

The drive belt system consists of the following components:

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

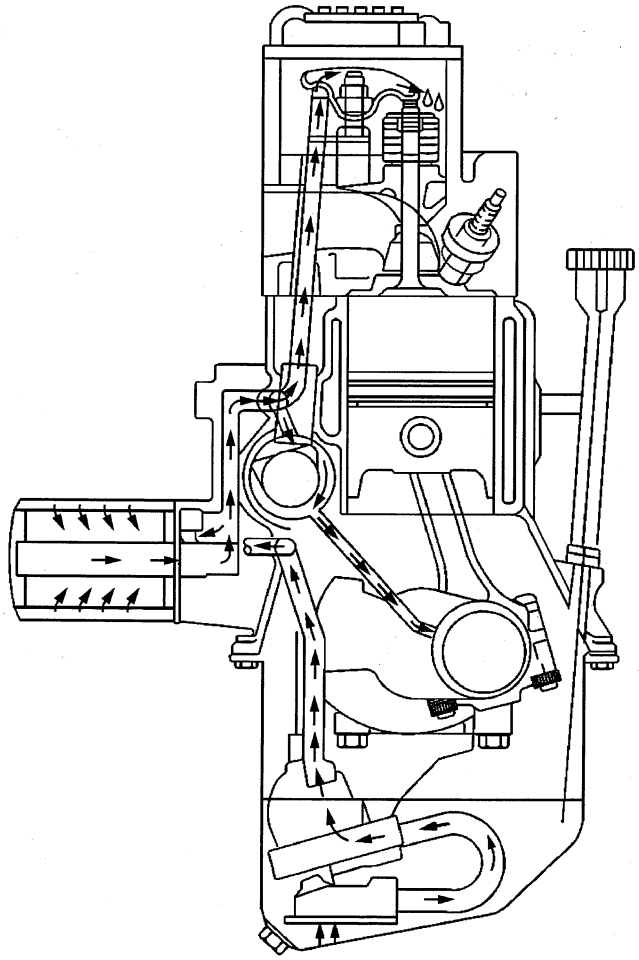
The drive belt system may use 1 belt or 2 belts. The drive belt is thin so that it can bend backwards and has several ribs to match the grooves in the pulleys. There also may be a V-belt style belt used to drive certain accessory drive components. The drive belts are made of different types of rubbers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

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

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

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

Lubrication



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

Engine Mechanical – 4.3L

Mechanical Specifications

Application	Specification	
	Metric	English
General Data		
• Engine Type	V6	
• RPO Code	L35	
• 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 125 kPa at 2,000 RPM 166 kPa at 4,000 RPM	6 psig at 1,000 RPM 18 psig at 2,000 RPM 24 psig at 4,000 RPM
Balance Shaft		
• Rear Bearing Journal Clearance	0.050-0.088 mm	0.0020-0.0035 in
• Rear Bearing Journal Diameter	38.085-38.100 mm	1.4994-1.500 in
Camshaft		
• End Play	0.0254-0.2286 mm	0.0010-0.0090 in
• Journal Diameter	47.440-47.490 mm	1.8677-1.8696 in
• Journal Diameter Out-of-Round	0.025 mm - Maximum	0.0010 in - Maximum
• Lobe Lift - Exhaust	7.20-7.30 mm	0.283-0.287 in
• Lobe Lift - Intake	6.97-7.07 mm	0.274-0.278 in
• Runout	0.065 mm	0.0026 in
Connecting Rod		
• Connecting Rod Bearing Clearance - Production	0.038-0.078 mm	0.0015-0.0031 in
• Connecting Rod Bearing Clearance - Service	0.025-0.063 mm	0.0010-0.0025 in
• Connecting Rod Journal Diameter	57.116-57.148 mm	2.2487-2.2497 in
• Connecting Rod Journal Out-of-Round - Production	0.007 mm - Maximum	0.0002 in - Maximum
• Connecting Rod Journal Out-of-Round - Service	0.025 mm - Maximum	0.0010 in - Maximum
• Connecting Rod Journal Taper - Production	0.00508 mm - Maximum	0.00030 in - Maximum
• Connecting Rod Journal Taper - Service	0.025 mm - Maximum	0.0010 in - Maximum
• Connecting Rod Side Clearance	0.15-0.44 mm	0.006-0.017 in
Crankshaft		
• Crankshaft Bearing Clearance - Journal #1-Production	0.02-0.508 mm	0.0008-0.0020 in
• Crankshaft Bearing Clearance - Journal #2, #3, and #4-Production	0.028-0.058 mm	0.0011-0.0023 in
• Crankshaft Bearing Clearance - Journal #1-Service	0.0254-0.05 mm	0.0010-0.0020 in

• Crankshaft Bearing Clearance - Journal #2, #3, and #4-Service	0.025-0.063 mm	0.0010-0.0250 in
• Crankshaft End Play	0.050-0.20 mm	0.002-0.008 in
• Crankshaft Journal Diameter - Journal #1	62.199-62.217 mm	2.4488-2.4495 in
• Crankshaft Journal Diameter - Journal #2 and #3	62.191-62.215 mm	2.4485-2.4494 in
• Crankshaft Journal Diameter - Journal #4	62.179-62.203 mm	2.4480-2.4489 in
• Crankshaft Journal Out-of-Round - Production	0.005 mm - Maximum	0.0002 in - Maximum
• Crankshaft Journal Out-of-Round - Service	0.025 mm - Maximum	0.0010 in - Maximum
• Crankshaft Journal Taper - Production	0.007 mm - Maximum	0.0003 in - Maximum
• Crankshaft Runout	0.025 mm - Maximum	0.0010 in - Maximum
Cylinder Bore		
• Diameter	101.618-101.643 mm	4.0007-4.0017 in
• Out-of-Round - Production	0.0127 mm - Maximum	0.00050 in - Maximum
• Out-of-Round - Service	0.05 mm - Maximum	0.002 in - Maximum
• Taper - Production Relief Side	0.025 mm - Maximum	0.0010 in - Maximum
• Taper - Production Thrust Side	0.012 mm - Maximum	0.0005 in - Maximum
• Taper - Service	0.025 mm - Maximum	0.0010 in - Maximum
Cylinder Head		
• Surface Flatness	0.10 mm - Maximum	0.004 in - Maximum
Exhaust Manifold		
• Surface Flatness - Flange to Flange	0.25 mm - Maximum	0.010 in - Maximum
• Surface Flatness - Individual Flange	0.05 mm - Maximum	0.002 in - Maximum
Intake Manifold		
• Surface Flatness	0.10 mm - Maximum	0.004 in - Maximum
Oil Pan		
• Oil Pan Alignment at Rear of Engine Block	0.3 mm - Maximum	0.011 in - Maximum
Piston		
• Piston Bore Clearance - Production	0.018-0.061 mm	0.0007-0.0024 in
• Piston Bore Clearance - Service	0.075 mm - Maximum	0.0029 in - Maximum
Piston Pin		
• Clearance in Piston - Production	0.013-0.023 mm	0.0005-0.0009 in
• Clearance in Piston - Service	0.025 mm - Maximum	0.0010 in - Maximum
• Diameter	23.545-23.548 mm	0.9270-0.9271 in
• Fit in Connecting Rod	0.012-0.048 mm - Interference	0.0005-0.0019 in - Interference
Piston Rings - End Gap Measured in Cylinder Bore		
• Piston Compression Ring Gap - Production-Top Groove	0.25-0.40 mm	0.010-0.016 in
• Piston Compression Ring Gap - Production-2nd Groove	0.38-0.58 mm	0.015-0.023 in
• Piston Compression Ring Gap - Service-Top Groove	0.25-0.50 mm	0.010-0.020 in
• Piston Compression Ring Gap - Service-2nd Groove	0.38-0.80 mm	0.015-0.031 in

• Piston Compression Ring Groove Clearance - Production-Top Groove	0.030-0.070 mm	0.0012-0.0027 in
• Piston Compression Ring Groove Clearance - Production-2nd Groove	0.040-0.080 mm	0.0015-0.0031 in
• Piston Compression Ring Groove Clearance - 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

Engine Component Description

Balance Shaft

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

Camshaft

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

Crankshaft

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

Cylinder Heads

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

Engine Block

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

Exhaust Manifolds

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

Intake Manifold

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

Piston and Connecting Rod Assemblies

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

Valve Train

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

Drive Belt System Description

The drive belt system consists of the following components:

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

The drive belt system may use one belt or two belts. The drive belt is thin so that it can bend backwards and has several ribs to match the grooves in the pulleys. There also may be a V-belt style belt used to drive certain accessory drive components. The drive belts are made of different types of rubbers

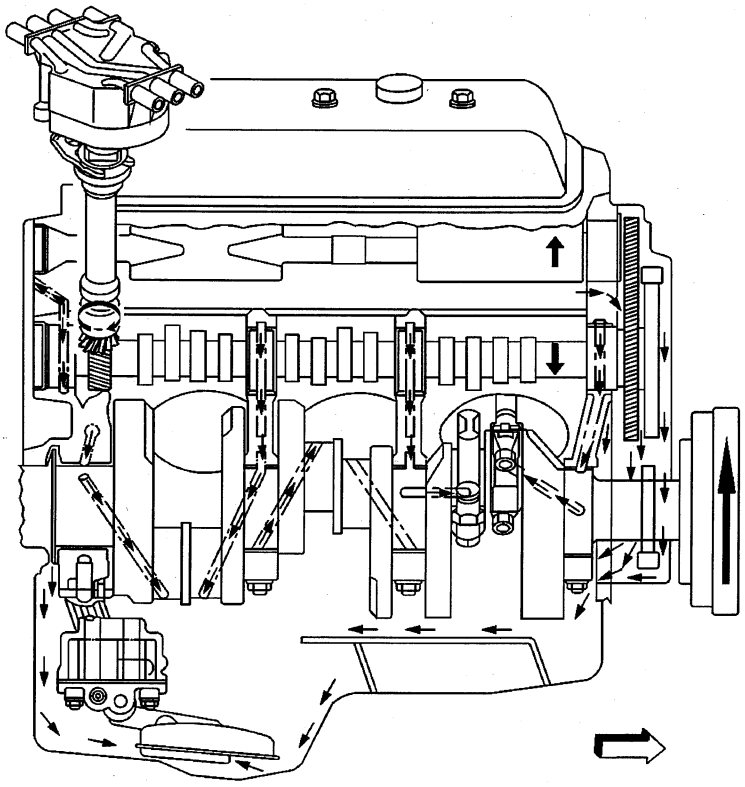
(chloroprene or EPDM) and have different layers or plys containing either fiber cloth or cords for reinforcement.

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

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

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

Lubrication



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

Engine Cooling

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Coolant Outlet Bolt and Stud 4.3L	19 N·m	14 lb ft
Coolant Outlet Nut 2.2L	10 N·m	89 lb in
Coolant Recovery Reservoir Nuts	8 N·m	71 lb in
Engine Coolant Heater Cord Clip Screw	1.9 N·m	17 lb in
Engine Coolant Heater Mounting Screw	1.9 N·m	17 lb in
Engine Oil Cooler Line Clamp Bolt	10 N·m	89 lb in
Engine Oil Cooler Line Nuts	31 N·m	23 lb ft
Engine Oil Cooler Line to Adapter Bolt	35 N·m	26 lb ft
Engine Oil Cooler Line to Radiator Connectors	31 N·m	23 lb ft
Engine Oil Cooler Lines to Oil Filter Adapter Retaining Bolt	35 N·m	26 lb ft
Fan Clutch Assembly Nut to Water Pump Pulley Stud	56 N·m	40 lb ft
Fan Shroud Bolts	6.5 N·m	58 lb in
Fan to Fan Clutch Bolts	33 N·m	24 lb ft
Remote Filter Housing to Bracket Nuts	25 N·m	18 lb ft
Remote Filter Housing Bracket to Radiator Core Support	30 N·m	22 lb ft
Water Pump Bolt and Stud 4.3L	41 N·m	30 lb ft
Water Pump Bolt 2.2L	25 N·m	18 lb ft

Cooling System Description and Operation

Coolant Heater

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

Cooling System

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

Cooling Cycle

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

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

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

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

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

Coolant

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

Radiator

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

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

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

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

Pressure Cap

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

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

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

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

Coolant Recovery System

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

In effect, a cooling system with a coolant recovery reservoir is a closed system. When the pressure in the cooling system gets too high, it will open the pressure valve in the pressure cap. This allows the coolant,

which has expanded due to being heated, is allowed to flow through the overflow tube and into the recovery reservoir. As the engine cools down, the temperature of the coolant drops and a vacuum is created in the cooling system. This vacuum opens the vacuum valve in the pressure cap, allowing some of the coolant in the reservoir to be siphoned back into the radiator. Under normal operating conditions, no coolant is lost. Although the coolant level in the recovery reservoir goes up and down, the radiator and cooling system are kept full. An advantage to using a coolant recovery reservoir is that it eliminates almost all air bubbles from the cooling system. Coolant without bubbles absorbs heat much better than coolant with bubbles.

Air Baffles and Seals

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

Water Pump

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

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

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

Thermostat

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

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

Engine Oil Cooler

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

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

Transmission Oil Cooler

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

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

Engine Electrical

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Battery Hold Down Retainer Nut	17 N·m	13 lb ft
Battery Positive Cable to Starter Nut	9 N·m	80 lb in
Battery Positive Cable to Underhood Fuse Block Bolt	10 N·m	89 lb in
Battery Terminal Bolts	15 N·m	11 lb ft
Battery Tray Bolts	25 N·m	18 lb ft
Camshaft Position Sensor Mounting Screws	2.2 N·m	20 lb in
Differential Carrier Shield Bolts	25 N·m	18 lb ft
Distributor Cap Screws	2.4 N·m	21 lb in
Distributor Hold Down Bolt	25 N·m	18 lb ft
Distributor Rotor Screws	1.9 N·m	17 lb in
Engine to Transmission Brace Bolts	50 N·m	37 lb ft
Engine Wiring Harness to Starter	1.9 N·m	17 lb in
Generator Mounting Bolts (4.3L)	50 N·m	37 lb ft
Generator Mounting Bolt - Front (2.2L)	25 N·m	18 lb ft
Generator Mounting Bolt - Rear (2.2L)	50 N·m	37 lb ft
Generator Mounting Brace to Air Intake Plenum Stud Nut (2.2L)	25 N·m	18 lb ft
Generator Mounting Brace to Engine Stud Nut (2.2L)	50 N·m	37 lb ft
Generator Mounting Brace to Generator Bolt (2.2L)	25 N·m	18 lb ft
Generator Output (Bat) Terminal Nut	17 N·m	12 lb ft
Heater Hose Bracket to Generator Bolt (4.3L)	25 N·m	18 lb ft
Ignition Coil Hold Down Bolts and Stud (2.2L)	27 N·m	20 lb ft
Ignition Coil Studs (4.3L)	11 N·m	97 lb in
Purge Solenoid Valve Nut	27 N·m	20 lb ft
Spark Plugs	15 N·m	11 lb ft
Starter Motor Field Lead Attaching Nut	11 N·m	97 lb in
Starter Motor Mounting Bolts (2.2L)	43 N·m	32 lb ft
Starter Motor Mounting Bolts (4.3L)	50 N·m	37 lb ft
Starter Brush End Bracket to the Engine Bolt (2.2L)	43 N·m	32 lb ft
Starter Brush End Bracket Nuts to the Starter (2.2L)	11 N·m	97 lb in
Underhood Fuse Block Connector bolts	7 N·m	62 lb in
Underhood Fuse Block to Mounting Bracket Bolts	7 N·m	62 lb in

Battery Usage

Option	Catalog No.	Cold Cranking Amps (CCA)	Reserve Capacity (Minutes)	Load Test (A)	Recommended Replacement
Std (Except Bravada)	670	525	90	260	75-60
UA1 (Std Bravada - Option All Others)	674	690	90	340	75B-84

Battery Temperature vs Minimum Voltage

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

Starter Motor Usage Load Test @ 10 Volts Specs. PG-260

Engine Type	Starter Type	Load Test @ 10 Volts AMPS Minimum	Load Test @ 10 Volts AMPS Maximum	Load Test @ 10 Volts RPM Minimum	Load Test @ 10 Volts RPM Maximum
Gasoline Engine	PG260	47 AMPS	70 AMPS	6,500 RPM	11,000 RPM

Generator Usage

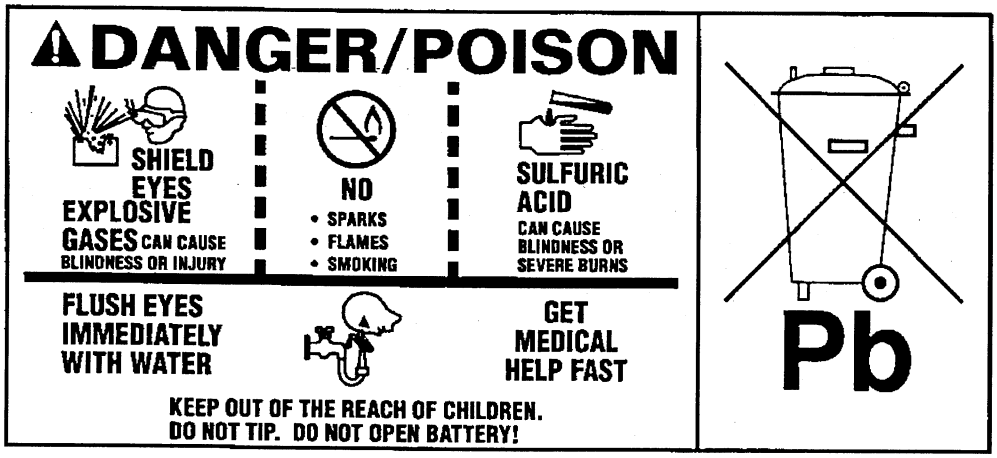
Engine	Generator Model	Option Code	Rated Output AMPS	Load Test Output AMPS
Gasoline Engine	CS130D	K60	100 A	70 A
Gasoline Engine	CS130D	K68	105 A	73 A

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.**



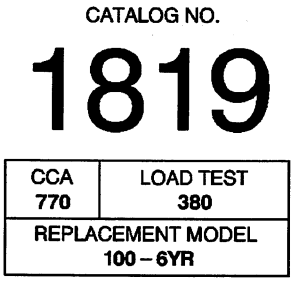
The maintenance free battery is standard. There are no vent plugs in the cover. The battery is completely sealed except for two small vent holes in the side. These vent holes allow the small amount of gas that is produced in the battery to escape.

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



A battery has 2 ratings:

- Reserve capacity
- Cold cranking amperage

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

Reserve Capacity

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

Cold Cranking Amperage

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

Circuit Description

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

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

Starting System Description and Operation

Cranking Circuit

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

Starter Motor

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

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

Charging System Description and Operation

Generator

The generator features the following major components:

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

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

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

Regulator

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

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

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

Circuit Description

The generator provides voltage to operate the vehicle's electrical system and to charge its battery. A magnetic field is created when current flows through the rotor. This field rotates as the rotor is driven by

the engine, creating an AC voltage in the stator windings. The AC voltage is converted to DC by the rectifier bridge and is supplied to the electrical system at the battery terminal.

When the engine is running, the generator turn-on signal is sent to the generator from the PCM, turning on the regulator. The generator's voltage regulator controls current to the rotor, thereby controlling the output voltage. The rotor current is proportional to the electrical pulse width supplied by the regulator. When the engine is started, the regulator senses generator rotation by detecting AC voltage at the stator through an internal wire. Once the engine is running, the regulator varies the field current by controlling the pulse width. This regulates the generator output voltage for proper battery charging and electrical system operation. The generator F terminal is connected internally to the voltage regulator and externally to the PCM. When the voltage regulator detects a charging system problem, it grounds this circuit to signal the PCM that a problem exists. The PCM monitors the generator field duty cycle signal circuit. The system voltage sense circuit receives battery positive voltage that is Hot At All Times through a fuse link that is connected to the starter motor. This voltage is used by the regulator as the reference for system voltage control.

Engine Controls

Engine Controls – 2.2L

Fastener Tightening Specifications

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

Engine Controls – 4.3L

Ignition System Specifications

Application	Specification	
	Metric	English
Firing Order	1-6-5-4-3-2	
Spark Plug Wire Resistance	12,000 ohms per ft	
Spark Plug Torque	18 N·m	13 lb ft
Spark Plug Gap	1.52 mm	0.060 in
Spark Plug Type	41-9328 [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 Exhaust Manifold studs (4.3L)	15 N·m	11 lb ft
Catalytic Converter to Exhaust Manifold Stud Nuts (4.3L)	53 N·m	39 lb ft
Catalytic Converter to Muffler flange nuts (2.2L)	35 N·m	26 lb ft
Catalytic Converter to Muffler flange nuts (4.3L)	40 N·m	30 lb ft
Exhaust Manifold Pipe to Catalytic Converter Flange Nuts (2.2L)	35 N·m	26 lb ft
Exhaust Manifold Pipe to Exhaust Manifold Bolts (2.2L)	30 N·m	22 lb ft
Hanger to Frame Bolts	17 N·m	12 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

Manual Transmission – NV 1500

Fastener Tightening Specifications

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

Lubrication Specifications

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

Transmission System Description and Operation

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

Manual Transmission – NV 3500

Fastener Tightening Specifications

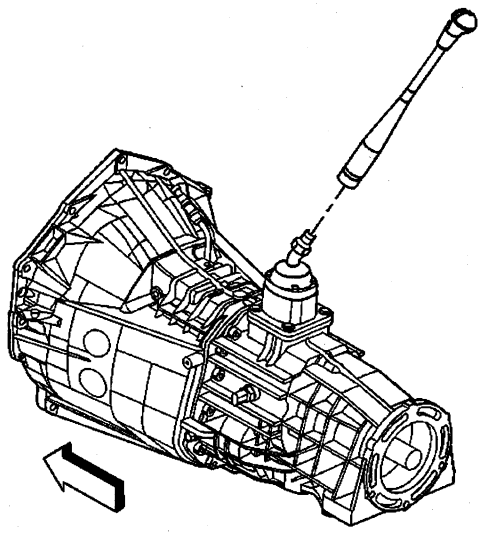
Application	Specification	
	Metric	English
Backup Lamp Switch	37 N·m	27 lb ft
Clutch Actuator Bolt	8 N·m	71 lb in
Clutch Housing Cover Bolts	14 N·m	10 lb ft
Front Bearing Retainer Bolts	14 N·m	10 lb ft
Oil Drain and Fill Plugs	30 N·m	22 lb ft
Shift Boot Screws	2 N·m	18 lb in
Shift Housing to Transmission Bolts	20 N·m	15 lb ft
Shift Lever Adjusting Nut	48 N·m	35 lb ft

Transmission-to-Engine Studs and Bolts	47 N·m	35 lb ft
Transmission Mount Bolt	50 N·m	37 lb ft
Transmission Mount Nut	50 N·m	33 lb ft
Transmission Mount to Crossmember Nut	45 N·m	33 lb ft
Transmission Mount to Transmission Bolt	50 N·m	37 lb ft
Vehicle Speed Sensor Bolt	16 N·m	12 lb ft

Lubrication Specifications

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

Transmission System Description and Operation



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

The transmission has the following features:

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

Clutch

Fastener Tightening Specifications

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

Clutch Description and Operation

Clutch Driving Members

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

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

Clutch Driven Members

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

Clutch Operating Members

Hydraulic Clutch Fluid

Notice

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

Hydraulic Clutch

The clutch release system consists of the following components:

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

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

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

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

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

Automatic Transmission - 4L60-E

Fastener Tightening Specifications

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

Transmission General Specifications

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

Fluid Capacity Specifications

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

Transmission Component and System Description

The 4L60E transmission consists primarily of the following components:

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

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

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

Adapt Function

Transmission Adapt Function

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

- The clutch fiber plates
- The seals
- The springs

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

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

Automatic Transmission Shift Lock Control Description

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

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

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

Abbreviations and Meanings

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

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

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

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

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

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

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

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

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

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

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

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

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

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Conversion - English/Metric

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

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

Equivalents - Decimal and Metric

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

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

Fasteners

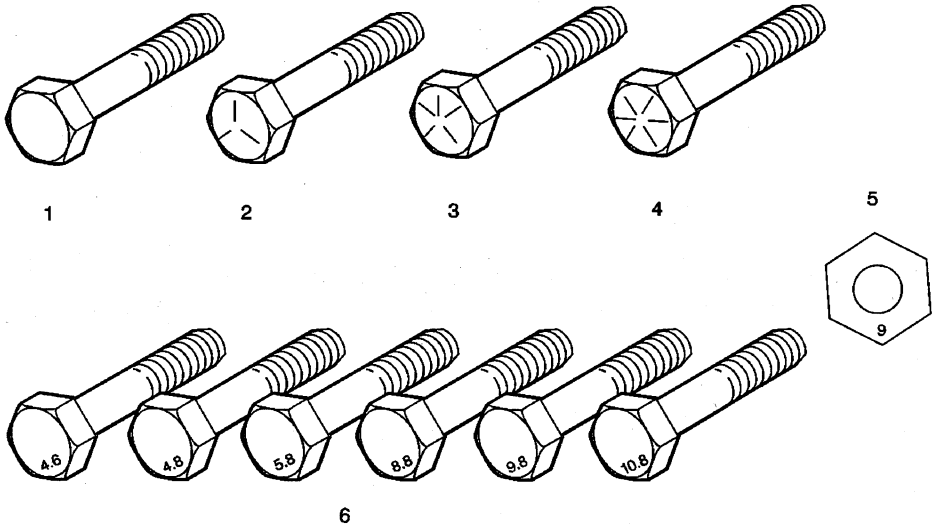
Metric Fasteners

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

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

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

Fastener Strength Identification



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

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

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

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

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

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

Prevailing Torque Fasteners

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

All Metal Prevailing Torque Fasteners

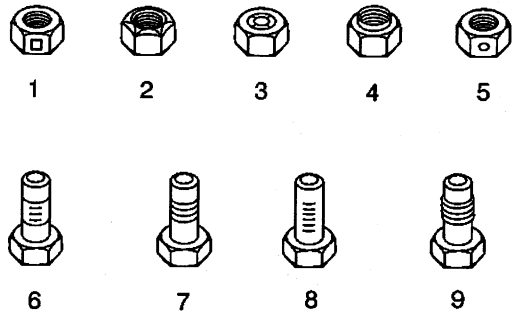
These fasteners accomplish the thread interface by a designed distortion or deformation in the fastener.

Nylon Interface Prevailing Torque Fasteners

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

Adhesive Coated Fasteners

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



1. Prevailing Torque Nut, Center Lock Type

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

A prevailing torque fastener may be reused ONLY if:

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

Metric Prevailing Torque Fastener Minimum Torque Development

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

English Prevailing Torque Fastener Minimum Torque Development

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