Chevrolet

Silverado
&
Silverado HD

2004

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Product Information

2004 Chevrolet Silverado Is The Full-Size Leader

The 2004 Chevrolet Silverado full-size pickup - GM's best-selling vehicle - continues to set new standards for performance and capability. Silverado already has a reputation as the most dependable, longest-lasting full-size pickup, but it won't rest on its laurels. From its bold exterior design to its innovative technologies such as Quadrasteer four-wheel steering, Silverado continues to raise the bar in the full-size pickup market. New for 2004 are a roomy and comfortable 1500 Series half-ton Crew Cab in two- or four-wheel drive and a 2500 Series three-quarter-ton Crew Cab rated at 8,600 pounds (3,870 kg) GVWR and available in either in two- or four-wheel drive.

"Silverado's unmatched powerplants, ranging from 200 to 345 hp (149 to 257 kw), give it a decided edge among its full-size competitors," said Gary White, Silverado vehicle line executive. "That translates into plenty of power for pulling or payload, whether you're a rancher, a tradesperson or a stockbroker." And that unmatched leadership comes in all Silverados - from the two-door Regular Cab to the four-door Extended and Crew Cab models.

A number of standard features have been added to the base Silverado for 2004, including cruise control, power door locks, black bodyside moldings, chrome bumpers and uplevel wheels. An AM/FM radio with CD player is now standard, and all 2004 Silverado models can be fitted as work trucks, except the 2500 Crew Cab.

Expanded Quadrasteer

The Quadrasteer four-wheel steering system - which offers low-speed maneuverability and high-speed stability, handling and control ideal for pulling a trailer - is available on 1500 Extended Cab short-box and 2500 Crew Cab pickups, marking the first time this system has been available on a ¾-ton truck.

At low speeds, this revolutionary system enables the rear wheels to turn in the opposite direction of the front wheels. That helps the vehicle make tighter turns, such as when cornering or getting into a tight parking space. The turning diameter of 2500 models with Quadrasteer is reduced 21 percent, from 49.6 feet to 37.4 feet (15.1 m to 11.4 m).

Advanced safety

A passenger-sensing system and dual-level air bags are an integral part of Silverado. The automatic passenger-sensing air-bag system automatically deactivates the passenger-side front air bag under certain conditions to help protect smaller occupants.

The advanced dual-level air-bag system (not available on 1500HD Crew Cab and 2500HD and 3500 Series models) is a supplemental restraint system designed to detect vehicle deceleration and, based on the deceleration data, provide an appropriate amount of air-bag inflation. The dual-level air-bag system senses the severity of a crash and determines whether to deploy the air bag with primary or "lower" amount of inflation or with primary and secondary "higher" amount of inflation. Dual-stage air bags are designed to help reduce the occurrence of inflation-induced injuries by deploying the air bag less forcefully in lower speed crashes.

Two-wheel-drive Silverados offer electronic traction control to enhance surefootedness on models with a V-8 engine, automatic transmission and locking rear differential.

More cabin comfort and convenience

Silverado's advanced multiplexed electrical architecture enables the driver information center to monitor and report on as many as 34 system functions, including service indicators for "Ice Possible" and "Door Ajar." Available redundant steering-wheel controls allow owners to personalize several functions and safely access infotainment options and provide easy access to the OnStar system.

OnStar now is standard on LT and available on LS models. OnStar is the leading provider of in-vehicle safety, security and information services in the U.S. and Canada. Using the Global Positioning System (GPS) satellite network and wireless technology, OnStar services include automatic notification of air bag

deployment, stolen vehicle location, remote door unlock, emergency services dispatch, roadside assistance, remote diagnostics, route support, convenience services and OnStar Concierge. OnStar Personal Calling allows drivers to make and receive hands-free, voice-activated phone calls through a nationwide network in cooperation with Verizon Wireless. Virtual Advisor (U.S. only) gives subscribers access to personalized information in a hands-free, voice-activated manner with no screens or displays.

A standard dual-zone heating, ventilation and air conditioning (HVAC) system, available with both manual and automatic climate control, provides outstanding comfort.

Cleaner engines, alternative fuels

All Silverado models with the Vortec 4300 4.3L V-6 and those sold in California with the Vortec 4800 4.8L or Vortec 5300 5.3L V-8 engines feature a more robust catalytic converter system that meets Ultra Low Emission Vehicle (ULEV) standards.

Alternative-fuel systems are available on many Silverado models and GVW ratings (see Silverado HD section that follows). Equipped with a Vortec 6000 V-8, these models come with a dedicated compressed natural gas (CNG) or a bi-fuel system that can run on CNG or gasoline. Light-duty Silverado models with the Vortec 5300 V-8 offer an option that allows them to run on varying blends of ethanol and gasoline, to a maximum of 85 percent ethanol.

Quality entertainment systems

Impressive entertainment systems - from available Bose sound systems to a Panasonic DVD Passenger Entertainment System - add to Silverado's creature comforts. These systems (except the base fleet radio) feature the next-generation Radio Data System, and can interface with services such as the optional XM Satellite Radio (continental U.S. only). On Crew Cab models, available rear-seat audio controls allow second-row passengers to enjoy a separate audio source from front-seat occupants.

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

Customers can choose

Silverado consistently offers a variety of configurations to fit customers' specific needs - with half-ton and three-quarter-ton offerings in Fleetside or Sportside trim and in 2WD or 4WD Regular, Extended and Crew Cabs. Customers can also choose a 6½-foot or 8-foot (2-meter or 2.4-meter) box. Silverado features an impressive Vortec gasoline engine lineup - Vortec 4300 V-6, Vortec 4800 V-8, Vortec 5300 V-8 and Vortec 6000 V-8 - ranging from 200 hp (149 kw) to 345 hp (257 kw). Payload capacities range from 1,593 to 3,224 pounds (717 to 1,451 kg), and Gross Vehicle Weight Ratings from 6,100 to 8,600 pounds (2,745 to 3,870 kg).

Offering the strength of a three-quarter-ton model frame, plus a Crew Cab's four full doors, is the Silverado 2500. It's powered by a standard 300-hp (224-kw) Vortec 6000 V-8 engine with a gross combination weight rating of 16,000 pounds, and a payload of as much as 3,143 pounds (1,414 kg). Maximum trailer weight is 10,300 pounds (4,635 kg).

The ultimate in four-wheeling fun and capability is available on the Silverado Z71 Off-Road Package on half-ton 4x4 models. The Z71 package includes 46-mm gas-charged shock absorbers, off-road jounce bumpers, specific stabilizer bars, a skid-plate package, a high-capacity air cleaner and distinctive Z71 decals for the pickup box.

Expanded offerings for 2004 Z71 models include cruise control, high capacity air cleaner, rear defogger, power door locks, carpeting, remote keyless entry, rearview mirror, AM/FM stereo with CD and cassette player, leather-wrapped steering wheel, power windows, fog lamps, color-keyed grille and deep-tinted glass.

New tire, wheel choices

New tire choices for 2004 Sliverado include P265/70R17 on-/off-road white outlined-letter tires available on 4WD 1500 LS and LT Models and P265/70R17, on-/off-road, white outlined-letter tires available on 4WD 1500 LS and LT Models. A set of four six-lug polished cast aluminum 17-inch x 7.5-inch wheels, including a steel spare, is also available.

Silverado SS taps into Chevy heritage

Continuing with Chevy's "Super Sport" heritage, Chevrolet is in full production with the Silverado SS, created from a 1500 Extended Cab short-bed to add fun and excitement without forfeiting Silverado's proven strengths and capabilities.

The SS badge made its debut on the 1961 Chevy Impala. For more than four decades, SS vehicles have provided on-road enthusiasts with outstanding performance, great handling and sleek, muscular designs. The Silverado SS is a contemporary expression of Chevy muscle, responding to enthusiasts who have migrated to full-size pickups.

For power, a standard high-output LQ9 version of the Vortec 6000 V-8, with 345 horsepower (257 kw) and 380 lb.-ft. (515 Nm) of torque, provides Silverado SS with exhilarating off-line acceleration and relaxed cruising. It mates to a Hydra-Matic 4L85-E four-speed automatic overdrive transmission, whose 3.06 first gear and 0.70 final gear contribute to the truck's impressive performance.

To enhance the package, a standard full-time, all-wheel-drive (AWD) viscous-coupled transfer case provides exceptional on-road, wet or dry pavement, handling.

The innovative Z60 high-performance chassis package is also unique, and includes Silverado's largest-ever, 20-inch wheel and tire combination, providing exceptional road holding and cornering capabilities.

New Silverado 1500 Crew Cabs Expand Chevrolet's Full-Size Pickup Leadership

DETROIT - Chevrolet Silverado is again raising the bar for full-size, light-duty pickup comfort and roominess, with new 2004 half-ton 1500 Series Silverado Crew Cabs. The new models also continue to provide all the segment-leading quality, dependability and capability for which Silverado is noted.

The half-ton Crew Cabs are available in two- and four-wheel drive with uplevel LS and LT trim and in a specially equipped Z71 Off-Road model. Manufacturer's suggested retail price (MSRP) for the two-wheel-drive Silverado LS starts at $31,020, including an $850 destination charge.

"The 1500 Series Silverado Crew Cabs provide Chevrolet traditional tough, rugged dependability, but do so with the convenience of four full-sized doors and a new dimension of ride and maneuverability," said Rick Scheidt, Chevrolet Silverado marketing director. "With them, our light-duty lineup now offers three cab types and three box lengths to accommodate almost any customer need."

The 1500 Series Crew Cabs has four full doors, five- or six-passenger seating with full second-row seats and a new 5-foot, 8-inch cargo box. The cargo box has an ample 49.6 cubic feet of space, almost as much as the regular bed, and provides easy handling, parking and garageability.

The Crew Cabs' great driver and passenger environment provides more headroom than any competitor and the same generous shoulder room in both the first and second rows. Second-row seats also provide 1.5 inches more hip room (than the front) and nearly as much legroom. The interior has a total 122.6 cubic feet of volume.

LS and LT models have a standard premium Z85 suspension package with 36-mm gas-charged shocks, tuned for the same smooth, quiet ride as a Chevrolet Tahoe SUV and outstanding body roll control during trailering or heavy hauling.

The Z71's suspension includes 46-mm shocks, retuned with new valving for optimal ride and isolation. Other special standard features include off-road jounce bumpers; specific stabilizer bars; a skid plate package and high capacity air cleaner; a standard rear locking differential (available on LS and LT) for superior traction to all four wheels, when required; a 3.73:1 axle ratio (4.10:1 ratio available), wheel flares; 17-inch polished aluminum wheels; P265/70R-17 on/off road radials; and fog lamps.

Superior capability

Half-ton Crew Cabs have GM's powerful Vortec 5300 V-8, with 295 horsepower and 330 lb.-ft of torque, and a smooth shifting Hydra-Matic 4L60-E four-speed automatic with tow-haul mode as their standard powertrain. Their superior capabilities include:

The highest available payload for any light-duty Crew Cab - 1,854 and 1,756 pounds, respectively, for two- and four-wheel-drive models;

Trailer ratings of up to 8,500 and 7,800 pounds respectively for two- and four-wheel-drive models, topping those of their leading competitor;

Standard AutoTrac on four-wheel-drive models, superior to that of their nearest competitor's four-wheel-drive system because it automatically adjusts between two- and four-wheel-drive, as required.

Standard traction assist to improve the surefootedness of two-wheel-drive models;

Standard four-wheel ABS disc brakes with Dynamic Rear Proportioning, providing quick, controlled stops;

A standard 26-gallon fuel tank, which provides over 500 miles' cruising range on two-wheel-drive models, for example. The fuel system meets new LEVII evaporative emission requirements.

High value and comfort

Silverado Crew Cabs are replete with standard features for more comfort, convenience and exceptional value. The lowest-price LS, for example, has standard deluxe cloth seats and a 40/20/40 split-bench front seat; dual-zone (driver and front passenger) climate control; an ETR AM/FM stereo with integral CD player; outside power, heated, folding mirrors; cruise control; power door locks and windows; remote keyless entry; deep tinted glass and many other features as standard.

LS and Z71 models offer six-way power bucket seats in either cloth or leather; both bucket seats include a standard premium Bose sound system with six speakers and a subwoofer with their uplevel radios. LT models have standard leather, heated bucket seats with 10-way power.

All models also offer numerous individual options, such as a rear-seat entertainment system with DVD player, LCD display and wireless headphones, to maximize comfort, safety and convenience. Two convenience packages are specially tailored for Z71 customers.

Optimum safety

The Crew Cabs' many standard safety features include passenger-sensing and dual-level air bags, which automatically deactivate the passenger?side front air bag under certain conditions to help protect smaller occupants. A front passenger seat-belt reminder sounds a chime and sets off an indicator light if the belt isn't fastened.

The Crew Cabs' segment-exclusive driver information center monitors and reports on numerous system functions, including service indicators for "Ice Possible" and "Door Ajar." Available redundant steering-wheel controls allow owners to personalize several functions and safely access infotainment options. They also provide easy access to the segment-exclusive OnStar system, optional on the LS and Z71 models and standard on LT.

Silverado Crew Cabs go into production at General Motors' Oshawa, Ontario, Canada plant in January 2004.

Chevy Offers Comprehensive Lineup Of Silverado HD Models

Chevy Silverado Heavy Duty pickups continue to be the segment's most powerful lineup.

For 2004, Silverado adds a four-wheel-drive 3500 Series one-ton rated at 9,900 pounds (4,455 kg) Gross Vehicle Weight Rating (GVWR) available in Regular, Extended or Crew Cab as well as in a driver-friendly single-rear-wheel (SRW) configuration.

Silverado continues to offer a wide selection of powerful three-quarter and one-ton pickups, including 2500HD (3/4-ton) and 3500 Series (one-ton) Regular Cabs, four-door Extended Cabs, and four-door Crew Cabs and Chassis Cabs.

Power for pulling or payloads

Silverado HD offers an impressive array of powerful gasoline and diesel engines.

The Duramax 6600 6.6L diesel V-8 - with world-class performance in a remarkably quiet package - kicks out 300 hp (224 kw) at 3100 rpm and 520 lb.-ft. (705 Nm) of torque at 1800 rpm. An optional Vortec 8100 8.1L V-8 gas engine has 330 hp (246 kw) at 4200 rpm and 455 lb.-ft. (617 Nm) of torque at 3200 rpm. The Vortec 6000 V-8 produces 300 hp (224 kw) at 4400 rpm and 360 lb.-ft. (488 Nm) of torque at 4000 rpm.

No fewer than 14 different 2004 Chevy Silverado models can run on dedicated compressed natural gas (CNG) or bi-fuel systems, the latter of which operates on either CNG or gasoline when equipped with a Vortec 6000 6.0L V-8 with hardened upgraded valves and seats to withstand CNG's lack of lubricity and cooling. Special versions with reduced gross vehicle weight ratings (8,500 pounds/3,825 kg) allow customers to meet fleet requirements in "non-attainment" areas. Higher-capacity 9,200-pound/4,140-kg GVWR models are also available.

Capable smooth-shifting transmissions

Duramax 6600 and Vortec 8100 are mated to smooth-shifting, high-capacity transmissions with close-ratio gearing to provide exceptional launch, hill-climbing and towing capabilities.

The ZF S6-650 six-speed is fully synchronized in all gears. Dual cone synchronizers in second and third gear provide extra capacity. The shift lever moves forward for first and straight back for reverse, providing easy low-speed maneuvering since drivers don't have to go across the shift pattern to select reverse. Second can be used for launching unloaded or lightly loaded trucks. First gear can be used as a "creeper gear" for extra low-end performance.

The Allison 1000 was built to move big-time tonnage. It has full electronic control of shift-timing points, five forward speeds and helical-type planetary gearsets for quiet operation. It also provides two operating modes, normal and Tow/Haul. When hauling heavy loads down long, steep grades, a grade-braking mechanism automatically downshifts to help slow the vehicle when the driver applies the brakes.

A heavy-duty, five-speed manual transmission and GM's optional Hydra-Matic 4L80-E four-speed electronically controlled automatic transmission are available with the Vortec 6000. The 4L80-E also provides Passive Shift Stabilization with Tow/Haul mode and a standard temperature gauge and temperature monitoring system.

Impressive and tough

With awesome power, tough frames, advanced suspensions and high-capacity brakes, the 2500HD/3500 Series provides outstanding payload capacities as well as impressive hauling and trailering capabilities. The 3/4-ton models have a GVWR of as much as 9,200 pounds (4,173 kg), and payloads of as much as 3,964 pounds (1,798 kg). The one-ton pickup models have a GVWR of as much as 11,400 pounds (5,171 kg) GVWR and payloads of as much as 5,753 pounds (2,610 kg). Silverado HD has an 11,400-pound (5,171-kg) GVWR for 2WD chassis cabs and 12,000-pound (5,443 kg) GVWR for 4WD chassis cabs. Chassis cabs provide payloads of as much as 6,089 pounds (2,762 kg).

These heavy-duty pickups also are trailer-ready. A handling and trailering package is standard. The trailering equipment package provides the weight-distributing hitch platform, eight-wire trailer harness with mounted connector and a jumper harness with a plug-in for the electric trailer brake controller.

Comfortable, safe and secure

Whether it's a Regular two-door or a four-door Extended or Crew Cab, Silverado boasts significant interior room and outstanding seating comfort. The Extended Cab has the industry's largest rear-door openings. A standard four-wheel disc brake system features four-wheel ABS.

The dual-zone heating, ventilation and air conditioning system, available with both manual and automatic climate control, provides outstanding comfort. Dual-zone controls allow the driver and front passenger to adjust the temperature to their own comfort levels - as much as a 30-degree Fahrenheit (16.7-degree Celsius) difference between the two front zones. The optional automatic system automatically controls air delivery, fan speed, temperature and recirculating/outside air to provide faster warmups and cooldowns.

Silverado 2500 models feature a standard CD player as well as exterior mirrors with power-tilt glass/power folding, heating elements, left-side electrochromatic glass, puddle lights, turn-signal indicators and an optional memory feature. An available power-adjustable camper mirror can be extended to a vehicle width of as much as 106 inches (269 cm).

All models have standard dual air bags, with a passenger-side deactivation switch on Regular and Extended Cab models to protect small occupants.

The OnStar system, standard on uplevel Silverado LT Extended Cab and Crew Cab models, is available on 2500 HD and 3500 models. OnStar is the leading provider of in-vehicle safety, security and information services in the U.S. and Canada. Using the Global Positioning System (GPS) satellite network and wireless technology, OnStar services include automatic notification of air-bag deployment, stolen vehicle location, remote door unlock, emergency services dispatch, roadside assistance, remote diagnostics, route support, convenience services and OnStar Concierge. OnStar Personal Calling allows drivers to make and receive hands-free, voice-activated phone calls through a nationwide network in cooperation with Verizon Wireless. Virtual Advisor (U.S. only) gives subscribers access to personalized information in a hands-free, voice-activated manner with no screens or displays.

Silverado And Accessories Combine Forces To Make The Ultimate Adaptable Truck

Chevrolet Accessories are designed to add functionality and enhance the appearance of the Silverado, whether the vehicle is used as a workhorse or a truck on the town. Chevrolet Accessories help protect the aesthetic integrity of the vehicle by shielding it from potential road and cargo hazards.

"Our lineup of Silverado accessories is a direct response to truck owners' feedback," said Nancy Philippart, GM Service and Parts Operations (SPO) executive director - GM Accessories Business Channel. "They want their Silverados to be shielded from the scrapes and scratches that come from everyday work so they will look good when used as a family or weekend vehicle. They also want to customize their vehicles to enhance their attractiveness and ease of everyday use."

Work accessories

Silverado owners can leave their work debris at the site or at the car wash with the help of a Chevy Accessories bedliner. The bedliner makes cleaning work debris a snap. The fully ribbed construction allows airflow to help eliminate moisture, the culprit that can turn a little dirt in the truck bed into a giant mud bath. The ribbed construction also provides a skid-resistant floor that discourages loads from shifting. In addition, molded bed rail protectors follow the contours of the Silverado to protect the rails of the truck bed.

A lockable, folding hard tonneau cover stands up to rugged use while sheltering cargo, and is lightweight, rustproof and non-corrosive. The tonneau cover also can be unlocked and opened from the tailgate or cab area for easy access. The soft tonneau cover shields the pickup bed and cargo from inclement weather. An aluminum frame securely attaches to the truck bed with an exclusive clamp system.

To provide additional storage, Chevy Accessories offers a molded polyethylene under-seat storage box. The storage compartment converts the area under the rear seat into a secure storage area to hold anything from toys to tools. It features a locking lid with the GM logo.

Steppin' out

The Silverado works its tailgate off and yet cleans up nicely for a night on the town. Silverado owners can step out in style with Chevy Accessories stainless steel tubular assist steps. The assist steps, offered in chrome or black finish, feature sturdy tubular bars with hidden welds and large textured step pads to help drivers and passengers get in and out of the vehicle.

Available at Chevrolet dealers

All Chevy Accessories can be purchased through Chevrolet dealerships.

Chevy Accessories permanently installed on a new GM vehicle at the time of delivery will be covered under the GM New Vehicle Limited Bumper-to-Bumper Warranty. GM parts and accessories permanently installed by a GM Dealer after vehicle purchase will be covered for the balance of the new vehicle warranty, but in any event no less than 12 months or 12,000 miles.

For additional information, visit www.gmaccessorieszone.com, or call 1-866-901-9001 to speak to one of GM's knowledgeable accessories agents.

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

New For 2004 - Silverado

- New half-ton 1500 Crew Cab in either 2WD or 4WD (mid-year introduction)
- New three-quarter-ton 2500 Series short-box Crew Cab, rated at 8,600 pounds (3,870 kg) GVWR, in 2WD or 4WD
- Work Truck Package now available on all models except 2500 Crew Cab
- Base now includes cruise control, power door locks, black bodyside moldings, uplevel wheels where applicable, chrome bumper, and AM/FM stereo with CD player
- Z71 Off-road Package now includes: cruise control; high capacity air cleaner; rear defogger; power door locks; carpeting; remote keyless entry; rearview mirror; AM/FM stereo with CD and cassette player; leather-wrapped steering wheel; power windows; fog lamps; color-keyed grille; deep-tinted glass
- New exterior colors include Sandstone Metallic, Silver Birch and Sport Red Metallic (replacing Pewter Metallic and Dark Carmine Red Metallic)
- OnStar standard on LT
- P265/70R17 on-/off-road blackwall tires available on 4WD 1500 Z71 Models
- P265/70R1, on-/off-road white outlined-letter tires available on 4WD 1500 Z71 Models
- Available six-lug polished cast aluminum 17-inch x 7.5-inch wheels, including steel spare

New For 2004 – Silverado HD

- New 4WD single-rear-wheel (SRW) 3500 Series one-ton rated at 9,900 lbs. (4,455 kg) GVWR, available in Regular, Extended or Crew Cab and in long box or Chassis Cab (mid-year introduction)
- Three new exterior colors: Sandstone Metallic, Silver Birch and Sport Red Metallic (replaces Pewter Metallic and Dark Carmine Red Metallic

Model Lineup – Silverado

	Engines				Transmissions				
	Vortec 4300 4.3L V-6	Vortec 4800 4.8L V-8	Vortec 5300 5.3L V-8	Vortec 6000 6.0L V-8	4-spd auto (Hydra-Matic 4L60-E)	4-spd auto (Hydra-Matic 4L80-E)	4-spd auto (Hydra-Matic 4L85-E)	5-spd man (MG5)	5-spd HD man (MW3)
1500 Regular Cab, Sportside Short Box	s	o	o*	-	o	-	-	s	-
1500 Regular Cab, Fleetside Short Box	s	o	o*	-	o	-	-	s	-
1500 Regular Cab, Fleetside Long Box	s	o	o*	-	o	-	-	s	-
2500 Regular Cab, Fleetside Long Box	-	-	-	s	-	o	-	-	s
1500 Extended Cab, Sportside Short Box	s	o	o	-	s	-	-	-	-
1500 Extended Cab, Fleetside Short Box	s	o	o*	-	o	-	-	s	-
2500 Extended Cab, Fleetside Short Box	-	-	-	s	-	o	-	-	s
1500 Extended Cab, Fleetside Long Box	-	s**	o**	-	s	-	-	-	-
1500 Crew Cab Fleetside Short Box	-	-	s	-	s	-	-	-	-
2500 Crew CabFleetside Short Box	-	-	-	s	-	s	-	-	-
SS	-	-	-	s	-	-	s	-	-

* Available only with four-speed automatic overdrive transmission
** Vortec 5300 V-8 is included with LT trim

Model Lineup – Silverado HD

	Engines			Transmissions			
	Vortec 6000 6.0L V-8	Vortec 8100 8.1L V-8	Duramax 6600 6.6L V-8	5-spd man (MW3)	6-spd man (ML6)	4-spd auto (Hydra-Matic 4L80-E)	5-spd auto (M74)
Pickups							
C/K25903 HD, C/K359032WD/4WD Regular Cab, Wideside Long Box	s	o	o	s	o	o	o
C/K25753 HD2WD/4WD Extended Cab, Wideside Short Box	s	o	o	s	o	o	o
C/K25953 HD, C/K359532WD/4WD Extended Cab, Wideside Long Box	s	o	o	s	o	o	o
C/K25743 HD2WD/4WD Crew Cab, Wideside Short Box	s	o	o	s	o	o	o
C/K25943, C/K359432WD/4WD Crew Cab, Wideside Long Box	s	o	o	s	o	o	o

	Engines			Transmissions			
	Vortec 6000 6.0L V-8	**Vortec 8100 8.1L V-8**	**Duramax 6600 6.6L V-8**	**5-spd man (MW3)**	**6-spd man (ML6)**	**4-spd auto (Hydra-Matic 4L80-E)**	**5-spd auto (M74)**
Chassis Cab							
C/K36003, C/K364032WD/4WD Regular Cab	s	o	o	s	o	o	o
C/K36053, C/K364532WD/4WD Extended Cab	s	o	o	s	o	o	o

Key:
Standard s
Optional o
Not available -

Specifications – Silverado

Overview				
Models:	Chevrolet Silverado 1500, including 1500HD and 2500 Regular Cab Fleetside / Sportside Short Box, 2WD and 4WD: Base & LS Regular Cab Fleetside Longbox, 2WD and 4WD: Base & LS Extended Cab Fleetside/Sportside Short Box, 2WD and 4WD: Base, LS & LT Extended Cab Fleetside Long Box, 2WD & 4WD: Base LS & LT Crew Cab Fleetside Short Box, 2WD & 4WD, LS & LT			
Body style / driveline:	2/3 passenger Regular Cab or 5/6 passenger Extended Cab, 2- and 4-wheel-drive pickup			
EPA vehicle class:	full-size truck			
Manufacturing location:	Oshawa, Ontario, Canada; Fort Wayne, Indiana; Pontiac, Michigan			
Key competitors:	Ford F-Series Pickup, Dodge Ram Pickup, Toyota Tundra Pickup, Nissan Titan Pickup			
Engines	**Vortec 4300 4.3L V-6 (LU3)**	**Vortec 4800 4.8L V-8 (LR4)**	**Vortec 5300 5.3L V-8 (LM7)**	**Vortec 6000 6.0L V-8 (LQ4/LQ9)**
Type:	4.3L V-6	4.8L V-8	5.3L V-8	6.0L V-8
Displacement (cu in / cc):	262 / 4293	294 / 4807	327 / 5328	364 / 5967
Bore & stroke (in / mm):	4 x 3.48 / 101.6 x 88.4	3.78 x 3.27 / 96 x 83	3.78 x 3.62 / 96 x 92	4 x 3.62 / 101.6 x 92
Block material:	cast iron	cast iron	cast iron	cast iron
Cylinder head material:	cast iron	cast aluminum	cast aluminum	cast aluminum
Valvetrain:	OHV	OHV	OHV	OHV
Ignition system:	direct composite distributor, platinum-tipped spark plugs, low-resistance spark plug wires	coil-near-plug, platinum-tipped spark plugs, low-resistance spark plug wires	coil-near-plug, platinum-tipped spark plugs, low-resistance spark plug wires	coil-near-plug, platinum-tipped spark plugs, low-resistance spark plug wires
Fuel delivery:	sequential fuel injection	sequential fuel injection	sequential fuel injection	sequential fuel injection
Compression ratio:	9.2:1	9.5:1	9.5:1	9.4:1
Horsepower (hp / kw @ rpm):	195 / 145 @ 4600	285 / 212 @ 5200	295 / 220 @ 5200	300 / 224 @ 4400 (LQ4) SS: 345 / 257 @ 5200 (LQ9)
Torque (lb-ft / Nm @ rpm):	260 / 353 @ 2800	295 / 400 @ 4000	330 / 447 @ 4000	360 / 488 @ 4000 (LQ4) SS: 380 / 515 @ 4000 (LQ9)
Recommended fuel:	87 octane	87 octane	87 octane	87 octane
Maximum engine speed (rpm):				
Manual:	5600	5600	5600	5600
Automatic:	5900	5900	5900	5600
Emissions controls:	3-way catalytic converter, exhaust gas recirculation, positive crankcase ventilation, evaporative collection system	3-way catalytic converter, exhaust gas recirculation, positive crankcase ventilation, evaporative collection system	3-way catalytic converter, exhaust gas recirculation, positive crankcase ventilation, evaporative collection system	3-way catalytic converter, exhaust gas recirculation, positive crankcase ventilation, evaporative collection system

Fuel Economy

	C1500 Series (2WD)	K1500 Series (4WD)
Estimated fuel economy (mpg city / highway / combined):	auto 4.3L: 16 / 20 / 18	auto 4.3L: 16 / 20 / 18
	man 4.3L: 17 / 23 / 20	man 4.3L: 15 / 18 / 16
	auto 4.8L: 16 / 21 /18	auto 4.8L:15 / 18 / 16
	man 4.8L: 16 / 20 / 18	man 4.8L: 15 / 19 / 17
	auto 5.3L: 16 / 19 / 17	auto 5.3L: 15 / 18 / 16

Transmissions

Type:	NV3500 (MG5)	NV4500 (MW3)	Hydra-Matic 4L60-E	Hydra-Matic 4L80-E
	5-speed manual	5-speed manual	4-speed automatic	4-speed automatic
Gear ratios (:1):				
First:	4.02	5.61	3.06	2.48
Second:	2.32	3.04	1.62	1.48
Third:	1.40	1.67	1.00	1.00
Fourth:	1.00	1.00	0.70	0.75
Fifth:	0.73	0.75	-	-
Reverse:	3.55	5.04	2.29	2.08
Final drive ratio:	3.08 3.42 3.73 4.10	3.42 3.73 4.10 -	3.08 3.42 3.73 4.10	3.42 3.73 4.10 -

Chassis/Suspension

Front:	• 1500 4WD, 2500: independent with computer-selected torsion bars, 30-mm stabilizer bar • 1500 2WD: computer-selected coil springs; gas-pressurized shocks; 32-mm stabilizer bar • 1500 4WD, 2500: independent with computer-selected torsion bars, 30-mm stabilizer bar • 1500 2WD: computer-selected coil springs; gas-pressurized shocks; 32-mm stabilizer bar
Rear:	solid axle with semi-elliptic, variable-rate, two-stage multileaf springs; gas-pressurized shocks
Traction control:	2WD only

Steering type	
1500 4WD & 2500:	power recirculating ball
1500 2WD:	power rack-and-pinion
With Quadrasteer four-wheel steering:	front: hydraulic power, recirculating ball; rear: electrically powered (system also uses front steering-wheel position sensor, steerable solid hypoid rear axle, electric motor-drive actuator and control unit)
Steering ratio:	14.2:1
Steering wheel turns, lock-to-lock:	3

Turning circle, curb-to-curb (ft / m):	
Ext. Cab Short Box with Quadrasteer:	37.4 / 11.4
2WD Reg. Cab Short Box:	40.1 / 12.2
2WD Ext. Cab Short Box:	46.6 / 14.2
4WD Ext. Cab Short Box:	47.3 / 14.4

Brakes	
Type:	(all) vacuum booster, power, 4-wheel disc, 4-wheel ABS, DRP
Rotor diameter x thickness (in / mm):	
1500 up to 6400 GVWR:	front: 12.01 x 1.14 / 305 x 29; rear: 12.8 x 0.78 / 325 x 20
1500 with Quadrasteer:	front: 12.01 x 1.14 / 305 x 29; rear: 13 x 1.18 / 330 x 30
1500 HD, 1500 HD with Quadrasteer, 2500:	front: 12.8 x 1.5 / 325 x 38; rear: 1300 x 1.14 / 330 x 29
Total swept area (sq in / sq cm):	
1500 up to 6400 GVWR:	front: 213.6 / 1378; rear: 211.1 / 1362
1500 with Quadrasteer:	front: 213.6 / 1378; rear: 223.7 / 1443
1500 HD, 1500 HD with Quadrasteer, 2500:	front: 245.5 / 1584; rear: 236.5 / 1526

Wheels/Tires	
Wheel size & type:	• Base: std: 16-inch steel; opt: 16-inch chrome-styled steel • LS: std: 16-inch chrome-styled steel; opt: 16-inch cast-aluminum • LT: std: 16-inch cast-aluminum
Tires:	• P235/75R16 all-season steel-belted radial • P265/75R16 all-season steel-belted radial • LT 225/75R16 all-season steel-belted radial • LT 245/75R16 all-season steel-belted radial

Dimensions – Silverado

Exterior	**Short Box Regular Cab**	**Long Box Regular Cab**	**Short Box Extended Cab**	**Long Box Extended Cab**	**Short Box Crew Cab**
Wheelbase (in / mm):	119 / 3023	133 / 3378	143.5 / 3644	157.5 / 4001	153 / 3886
Overall length (in / mm):	203.2 / 5161	222 / 5644	227.6 / 5781	246.6 / 6264	237.2 / 6025
Overall width (in / mm)					
Base/fleet:	78.5 / 1994	78.5 / 1994	78.5 / 1994	78.5 / 1994	79.7 / 2034
With YE9 package opt. mirrors folded:	81.5 / 2070	81.5 / 2070	81.5 / 2070	81.5 / 2070	81.5 / 2070
With YE9 package opt. mirrors extended:	93.1 / 2363	93.1 / 2363	93.1 / 2363	93.1 / 2363	93.1 / 2363
Quadrasteer models w/YE9 opt. mirrors folded:	-	-	83.5 / 2103	-	83.5 / 2103
Overall height (in / mm)					
2WD:	71.2 / 1808	71.2 / 1808	71.2 / 1808	70.8 / 1798	74.5 / 1892
4WD:	73.8 / 1875	73.7 / 1872	73.9 / 1877	73.7 / 1872	76.2 / 1935
Track (in / mm)					
All except Quadrasteer models					
Front:	65 / 1651	65 / 1651	65 / 1651	65 / 1651	68.6 / 1899
Rear:	66 / 1676	66 / 1676	66 / 1676	66 / 1676	66 / 1676
Quadrasteer models					
Front:	-	-	65 / 1651	-	65 / 1651
Rear:	-	-	71 / 1804	-	71 / 1804
Min. ground clearance (in / mm):					
2WD:	8 / 203.2	8 / 203.2	8 / 203.2	8 / 203.2	9.1 / 230
4WD:	8.4 / 213	8.4 / 213	8.7 / 221	8.4 / 213	10.6 / 269

Exterior	Short Box Regular Cab	Long Box Regular Cab	Short Box Extended Cab	Long Box Extended Cab	Short Box Crew Cab
Ground to top of load floor (in / mm):					
2WD:	31.6 / 803	31.6 / 803	31.6 / 803	31.6 / 803	-
4WD:	33.7 / 856	33.7 / 856	33.7 / 856	33.7 / 856	-
Step-in height:					
2WD:	19 / 482	19 / 482	19 / 482	19 / 482	24.6 / 624.8
4WD:	21.3 / 540	21.3 / 540	21.3 / 540	21.3 / 540	25.1 / 637.5
Approach angle:	25.4°	25.4°	25.4°	25.4°	-
Breakover angle:	12.4°	12.4°	12.4°	12.4°	-
Departure angle:	27.5°	27.5°	27.5°	27.5°	-

Weights	GVW (lb / kg)	Curb Weight (lb / kg)	Payload (lb / kg)	Weight Distribution (% front / rear)
2WD pickups*:				
C15703 Reg. Cab Short Box:	6100 / 2767	4142 / 1879	1958 / 888	57 / 43
C15753 Ext. Cab Short Box:	6200 / 2812	4555 / 2066	1645 / 746	57 / 43
C15743 Crew Cab Short Box:	8600 / 3900	5506 / 2497	3094 / 1403	57 / 43
C15903 Reg. Cab Long Box:	6400 / 2903	4227 / 1917	2123 / 963	57 / 43
C15953 Ext. Cab Long Box:	6400 / 2903	4828 / 2190	1572 / 713	59 / 41
4WD pickups*:				
K15703 Reg. Cab Short Box:	6100 / 2767	4439 / 2013	1661 / 753	58 / 42
K15753 Ext. Cab Short Box:	6400 / 2903	4925 / 2234	1475 / 669	60 / 40
K15743 Crew Cab Short Box:	8600 / 3900	5817 / 2639	2783 / 1262	59 / 41
K15903 Reg. Cab Long Box:	6400 / 2903	4579 / 2077	1821 / 826	59 / 41
K2500 Ext. Cab Long Box:	6400 / 2903	5112 / 2319	1288 / 584	60 / 40

Cargo box	Short Box Sportside	Short Box Fleetside	Long Box Fleetside
Cargo volume (cu ft / L):	43.5 / 1231.7	56.9 / 1611	70.7 / 2002
Length at floor (in / mm):	78.6 / 1996	78.7 / 1999	97.6 / 2479
Width at floor (in / mm):	49.1 / 1247	64.8 / 1646	64.8 / 1646
Width at top (in / mm):	49.1 / 1247	61.9 / 1572	61.9 / 1572
Width between wheelhousings (in / mm):	50 / 1270	50 / 1270	50 / 1270
Tailgate width (in / mm):	49.1 / 1247	63.8 / 1621	63.8 / 1621
Inside height (in / mm):	19.7 / 500	19.5 / 495	19.5 / 495

Interior	Regular Cab	Extended Cab, Front	Extended Cab, Rear	Crew Cab, Front	Crew Cab, Rear
Head room (in / mm):	41 / 1041	41 / 1041	38.4 / 975	41 / 1041	39.9 / 1018
Leg room (in / mm):	41.3 / 1049	41.3 / 1049	33.7 / 856	41.3 / 1049	38.8 / 990
Shoulder room (in / mm):	65.2 / 1656	65.2 / 1656	66.3 / 1684	65.2 / 1656	65.1 / 1661
Hip room (in / mm):	61.4 / 1560	61.4 / 1560	61.4 / 1560	61.4 / 1560	62.9 / 1598

Capacities	Short Box Regular Cab	Long Box Regular Cab	Short Box Extended Cab	Long Box Extended Cab	Short Box Crew Cab
Seating:	2 / 3	2 / 3	5 / 6	5 / 6	5 / 6
Fuel tank (gal / L):	26 / 98.4	34 / 128.7	26 / 98.4	34 / 128.7	26 / 98.4
	Vortec 4300	**Vortec 4800**	**Vortec 5300**	**Vortec 6000**	
Engine oil (qt / L):	4.5 / 4.3	6 / 5.7	6 / 5.7	6 / 5.7	
Cooling system (qt / L)					
Manual trans:	12.9 / 12.2	13.7 / 13	13.4 / 12.7	15.2 / 14.4	
Automatic trans:	12.6 / 11.9	13.4 / 12.7	14.9 / 14.1	14.4 / 13.6	
Maximum trailer weight (lb / kg)					
1500 Series w/Vortec 5300:	8400 / 3809.5 with weight-distributing hitch and sway control				
1500 Series w/Vortec 5300	8600 / 3900.2 with weight-distributing hitch and sway control				
Quadrasteer:					
1500 HD (std Vortec 6000):	10,200 / 4625 with weight-distributing hitch and sway control				
2500 Series (std Vortec 6000):	10,700 / 4852.6 with weight-distributing hitch and sway control				

2WD/4WD 1500 Series models limited to 5,000-pound (2,250-kg) trailer ratings unless equipped with Z85 Increased Capacity or ZX3 Manual Select Damping or Z71 Off-Road Suspension Package. Z82 Heavy Duty Trailering Package includes trailer hitch platform, trailer electrical connector and suspension upgrade, if necessary

Specifications – Silverado HD

Overview			
Models:	2500HD, 3500 Reg. Cab, Fleetside, Long Box-Standard and LS 2500HD Ext. Cab, Fleetside, Short Box-Standard LS and LT 2500HD, 3500 Ext. Cab, Fleetside, Long Box-Standard, LS and LT Crew Cab, Fleetside, Short Box-Standard, LS and LT Crew Cab, Fleetside, Long Box-Standard, LS and LT Chassis Cab		
Body style / driveline:	2/3 passenger Regular Cab or 5/6 passenger Extended Cab, 5-6-passenger Crew Cab 3/4- and 1-ton, 2- and 4-wheel-drive heavy-duty pickup		
Construction:	body on frame		
EPA vehicle class:	full-size truck		
Manufacturing location:	Fort Wayne, Indiana; Pontiac, Michigan; Flint, Michigan		
Key competitors:	Ford Superduty Series Pickup, Dodge Ram Heavy Duty Pickup		
Engines	**Vortec 6000 6.0L V-8 (LQ4)**	**Vortec 8100 8.1L V-8 (L18)**	**Duramax 6600 6.6L V-8 (LB7)**
Type:	6.0L V-8	8.1L V-8	6.6L V-8
Displacement (cu in / cc):	364 / 5967	496 / 8128	403 / 6599
Bore & stroke (in / mm):	4 x 3.62 / 101.6 x 92	4.25 x 4.37 / 107.9 x 111	4.06 x 3.90 / 103 x 99
Block material:	cast iron	cast iron	cast iron
Cylinder head material:	cast aluminum	cast iron	cast aluminum
Valvetrain:	OHV	OHV	OHV
Ignition system:	coil-near-plug, platinum- tipped spark plugs, low-resistance spark plug wires	coil-near-plug, platinum-tipped spark plugs, low-resistance spark plug wires	compression, glow plug start aid; low-resistance spark plug wires
Fuel delivery:	sequential fuel injection	sequential fuel injection	direct injection diesel with high pressure common rail
Compression ratio:	9.4:1	9.1:1	17.5:1
Horsepower (hp / kw @ rpm):	300 / 224 @ 4400	340 / 254 @ 4200 (L18) 325 / 242 @ 4000 (MD L18 with LRW option) 295 / 220 @ 3600 (MD L18 with LRZ option) 225 / 168 @ 3600 (MD L18 with LQR option)	300 / 224 @ 3100
Torque (lb-ft / Nm @rpm):	360 / 488 @ 4000	455 / 617 @ 3200 (L18) 450 / 610 @ 2800 (MD L18 with LRW option) 440 / 597 @ 3200 (MD L18 with LRZ option) 350 / 475 @ 1200 (MD L18 with LQR option)	520 / 705 @ 1800
Recommended fuel:	87 octane	87 octane	diesel
Maximum engine speed (rpm):	manual: 5600 auto: 5600	manual: 5600 auto: 4000	3250

Emissions controls:	3-way catalytic converter, exhaust gas recirculation, positive crankcase ventilation, evaporative collection system	3-way catalytic converter, exhaust gas recirculation, positive crankcase ventilation, evaporative collection system		turbocharged, intercooled, catalytic converter system
Transmissions	**Hydra-Matic 4L80-E**	**NVG 3500 (MW3)**	**ZF S6-650 (ML6)**	**Allison 1000 (M74)**
Type:	4-speed automatic	5-speed manual	6-speed manual	5-speed automatic
Gear ratios (:1):				
First:	2.48	5.61	5.79	3.10
Second:	1.48	3.04	3.31	1.81
Third:	1.00	1.67	2.10	1.41
Fourth:	0.75	1.00	1.31	1.00
Fifth:	-	0.75	1.00	0.71
Sixth:	-	-	0.76	-
Reverse:	2.08	5.61	5.23	4.49
Final drive ratio (with all transmissions):	Vortec 6000: 4.10 standard on all models Vortec 8100: (opt) 3.73 or 4.10 on 2500HD; 4.10 std on 3500 Series Duramax 6600: 3.73 ratio standard on all models			
Chassis/Suspension				
Front:	(all models) std long- and short-arm independent front torsion bar suspension			
Rear:				
2500HD Pickups:	semi-elliptic 2-stage multileaf spring			
3500 Chassis Cabs:	3-stage multileaf spring			
Steering type:	integral power recirculating ball			
Steering ratio:	24:1			
Steering wheel turns, lock-to-lock:	3.14			
	Regular	**Extended**	**Crew**	
Turning circle, curb-to-curb (ft / m):				
2500HD Series single-wheel pickups:	2WD: 43.8 / 13.4 4WD: 43.8 / 13.4	2WD: 46.8 / 14.3 4WD: 50.8 / 15.5	2WD: 49.6 / 15.1 4WD: 49.6 / 15.1	
3500 Series dual-wheel pickups:	2WD: 43.7 / 13.3 4WD: 43.7 / 13.3	2WD: 50.7 / 15.5 4WD: 50.7 / 15.5	2WD: 53.5 / 16.3 4WD: 53.5 / 16.3	
Brakes				
Type:	power, Hydroboost brake-apply system, 4-wheel disc, 4-wheel ABS			
Rotor diameter x thickness (in / mm):	front: 12.8 x 1.5 / 325 x 38; rear: 12.8 x 1.2 / 325 x 30			
Total swept area (sq in / sq cm):	front: 245.5 x 1584; rear: 235.1 / 1517			

Wheels/Tires	
Wheel size and type:	• 8-bolt 16 x 6.5-inch steel wheels std; opt on 2500HD models: chrome center cap, chrome steel wheels with chrome center cap and polished forged aluminum wheels • Chassis Cab wheels redesigned to display more surface area and provide increased corrosion resistance (compared to previous designs)
Tires:	• 2500HD models: LT245/75R16E radials, with either all-season or on-/off-road design, depending on model • 3500-Series: LT215/85R16-E highway or on-/off-road tires; tire size and inflation pressure geared to specific load ratings

Dimensions – Silverado HD

Exterior	2500HD / 3500 Regular Cab Long Box	2500HD Extended Cab Short Box	2500HD / 3500 Extended Cab Long Box	2500HD Crew Cab Short Box
Wheelbase (in/mm):	133 / 3378	143.5 / 3645	157.5 / 4001	153 / 3886
Overall length (in / mm):				
2WD:	222.1 / 5641	227.7 / 5784	246.6 / 6264	237.3 / 6027
4WD:	222.1 / 5641		246.6 / 6264	237.3 / 6027
Overall width (in / mm):				
2WD:	79.7 / 2024	79.7 / 2024	79.7 / 2024	79.7 / 2024
4WD:	96.1 / 2441		96.1 / 2441	79.7 / 2024
Overall height: (in / mm):				
2WD:	2500HD: 76.2 / 1935 3500: 76.7 / 1948	76.2 / 1935	2500HD: 76.2 / 1935 3500: 76.3 / 1938	77 / 1956
4WD:	2500HD: 76.5 / 1943 3500: 76.7 / 1948	76.5 / 1943	76.5 / 1943 3500: 76.7 / 1948	77.4 / 1966
Track (in / mm):				
Front:	all models: 68.6 / 1742			
Rear:	2500HD: 66 / 1676 3500: 74.7 / 1897			
Minimum ground clearance (in / mm):				
2WD (front):	2500HD: 8.6 / 218.4 3500: 8.8 / 223.5	8.5 / 216	2500HD: 8.5 / 216 3500: 8.7 / 221	8.7 / 221
(rear):	2500HD: 7.5 / 190.5 3500: 7.6 / 193	7.4 / 188	2500HD: 7.4 / 188	7.4 / 188 3500: 7.5 / 190.4
4WD (front):	2500HD: 8.9 / 226.1 3500: 8.8 / 223.5	8.8 / 223.5	2500HD: 8.8 / 223.5 3500: 8.8 / 223.5	8.9 / 226.1
(rear):	2500HD: 7.5 / 190.5 3500: 7.6 / 193	7.4 / 188	2500HD: 7.4 / 188 3500: 7.6 / 193	7.4 / 188
Step-in height (in / mm):				
2WD:	2500HD: 24.9 / 632.5 3500: 25.4 / 645.2	24.4 / 619.8	2500HD: 24.4 / 619.8 3500: 24.9 / 632.5	24.6 / 624.8
4WD:	25.4 / 645.2	24.6 / 624.8	2500HD: 24.6 / 624.8 3500: 24.9 / 632.5	25.1 / 637.5

Exterior	Crew Cab Long Box	Crew Cab Chassis Cab	Reg. Cab Chassis Cab DRW	Extended Cab Chassis Cab DRW
Wheelbase (in / mm):				
2WD:	167 / 4242	167 / 4242	137 / 3480	161.5 / 4102
4WD:	167 / 4242	167 / 4242	161.5 / 4102	185.5 / 4712
Overall length (in / mm):				
2WD:	256.2 / 6507	246.7 / 6266	225 / 5715	249.5 / 6637
4WD:	256.2 / 6507	246.7 / 6266	249.5 / 6637	273.5 / 6947
Overall width (in / mm):				
2WD:	79.7 / 2024	79.7 / 2024	94 / 2388	94 / 2388
4WD:	79.7 / 2024	94 / 2388	94 / 2388	94 / 2388
Overall height (in / mm):				
2WD:	2500HD: 77 / 1956 3500: 77.3 / 1963	2500HD: 77 / 1956 3500: 77.3 / 1963	76 / 1930	76 / 1930
4WD:	2500HD: 77 / 1956 3500: 77.3 / 1963	2500HD: 77 / 1956 3500: 77.3 / 1963	76 / 1930	76 / 1930
Step-in height (in / mm):				
2WD:	2500HD: 24.6 / 625 3500: 24.7 / 627	2500HD: 24.6 / 625 3500: 24.7 / 627	25 / 635	25 / 635
4WD:	2500HD: 25.1 / 638 3500: 24.8 / 630	2500HD: 25.1 / 638 3500: 24.8 / 630	25 / 635	25 / 635

Weights	GVW (lb / kg)	CurbWeight (lb / kg)	Payload (lb / kg)	Weight Distribution (% front / rear)
C25903 Reg. Cab long box:	8600 / 3901	5059 / 2295	3541 / 1606	57 / 43
C25903HD Reg. Cab long box:	9200 / 4173	5153 / 2337	4047 / 1836	55 / 45
C25753HD Ext. Cab short box:	9200 / 4173	5402 / 2450	3798 / 1723	56 / 44
C25953HD Ext. Cab long box:	9200 / 4173	5556 / 2520	3644 / 1653	56 / 44
C25743HD Crew Cab short box:	9200 / 4173	5614 / 2547	3585 / 1626	55 / 45
C25943HD Crew Cab long box:	9200 / 4173	5779 / 2621	3421 / 1552	55 / 45
C35943 Crew Cab long box:	11400 / 5171	6168 / 2798	5232 / 2373	52 / 48
C35953 Ext. Cab long box:	11400 / 5171	5951 / 2699	5449 / 2472	53 / 47
C35003 Reg. Cab chassis cab:	11400 / 5171	5530 / 2508	5870 / 2662	53 / 47
C35053 Ext. Cab chassis cab:	11400 / 5171	5971 / 2708	5129 / 2327	54 / 46
C35403 Reg. Cab chassis cab:	11400 / 5171	5612 / 2545	5788 / 2625	55 / 45
C35453 Ext. Cab chassis cab:	11400 / 5171	6057 / 2747	5343 / 2423	55 / 45
K25753 Ext. Cab short box:	8600 / 3901	5524 / 2506	3076 / 1395	59 / 41
K25903HD Reg. Cab long box:	9200 / 4173	5440 / 2468	3760 / 1706	57 / 43

Weights	GVW (lb / kg)	CurbWeight (lb / kg)	Payload (lb / kg)	Weight Distribution (% front / rear)
K25753HD Ext. Cab short box:	9200 / 4173	5631 / 2554	3569 / 1619	58 / 42
K25743HD Crew Cab short box:	9200 / 4173	5892 / 2673	3308 / 1500	57 / 43
K25943HD Crew Cab long box:	9200 / 4173	6056 / 2747	3144 / 1426	57 / 43
K25953HD Ext. Cab long box:	9200 / 4173	5828 / 2644	3372 / 1530	58 / 42
K35903 Reg. Cab long box:	11400 / 5171	5841 / 2649	5559 / 2522	54 / 46
K35943 Crew Cab long box:	11400 / 5171	6459 / 2930	4941 / 2241	54 / 46
K35953 Ext. Cab long box:	11400 / 5171	6231 / 2826	5169 / 2345	54 / 46
K35003 Reg. Cab chassis cab:	12000 / 5443	5800 / 2630	6200 / 2812	55 / 45
K35053 Ext. Cab chassis cab:	12000 / 5443	6262 / 2840	5738 / 2602	55 / 45
K35403 Reg. Cab chassis cab:	12000 / 5443	5906 / 2679	6094 / 2764	57 / 43
K35453 Ext. Cab chassis cab:	12000 / 5443	6341 / 2876	5659 / 2566	56 / 44

Cargo box	Long Box	Short Box
Cargo volume (cu ft / L):	70.7 / 2002	56.9 / 1611
Length at floor (in / mm):	97.6 / 2479	78.7 / 1999
Width at floor (in / mm):	64.8 / 1646	64.8 / 1646
Opening width rear at top (in / mm):	61.9 / 1572	61.9 / 1572
Width between wheelhousings (in/mm):	50 / 1270	50 / 1270
Inside height (in / mm):	19.5 / 495	19.5 / 495

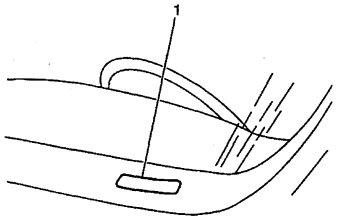
Interior	Regular Cab	Extended Cab	Crew Cab
Head room (in / mm):	41 / 1041	front: 41 / 1041 rear: 38.4 / 975	front: 41 / 1041 rear: 39 / 991
Leg room (in / mm):	41.3 / 1049	front: 41.3 / 1049 rear: 33.7 / 856	front: 41.3 / 1049 rear: 39.1 / 993
Shoulder room (in / mm):	65.2 / 1656	front: 65.2 / 1656 rear: 66.3 / 1684	front: 65.2 / 1656 rear: 65.1 / 1654
Hip room (in / mm):	61.4 / 1560	front: 61.4 / 1560 rear: 61.5 / 1562	front: 61.4 / 1560 rear: 62.9 / 1598

Capacities			
Fuel tank (gal / L):	short box, all models (except diesel): 35.9 / 135.9; long box, all models (plus all diesels): 34 / 128.7; DRW chassis cab: 50 / 189.3		
Trailer towing maximum (lb / kg):			
2500HD alt fuel w/6.0L V-8 auto trans:	8200 / 3719 with weight-distributing hitch and sway bar; alt fuel vehicles are neither designed nor intended to tow 5th-wheel or gooseneck trailers		
2500HD w/6.0L V-8manual or auto trans:	10600 / 4807 with weight-distributing hitch and sway control or with 5th wheel or gooseneck trailer		
2500HD w/8.1L V-8 or Duramax 6.6L V-8 turbo diesel, manual or auto trans:	12000 / 5442 with weight-distributing hitch and sway control. Increases to 16100 lb. (7303 kg) for 8.1L and 16000 lb. (7257 kg) for Duramax with 5th wheel or gooseneck trailer		
3500 w/6.0L V-8, manual or auto trans:	9900 / 4490 with weight-distributing hitch and sway control or 5th-wheel or gooseneck trailers		
3500 w/8.1L V-8 or Duramax 6.6L Turbo Diesel, manual or auto trans:	12000 / 5442 with weight-distributing hitch and sway control; increases to 15500 lb. (7031 kg) for 8.1L and 15400 lb. (6985 kg) for Duramax with 5th-wheel or gooseneck trailers		
	Regular Cab	**Extended Cab**	**Crew Cab**
Seating:	2 / 3	5 / 6	5 / 6
Engine oil (qt / L):	6.0 / 5.7	6.0 / 5.7	9.3 / 9.8
Cooling system (qt / L):			
Man trans:	15.2 / 14.4	23.6 / 22.3	21.8 / 20.7
Auto trans:	14.4 / 13.6	23.1 / 21.9	21.4 / 20.3

* For alternative-fuel vehicles, trailer tongue weight should be 10 to 15 percent of total-loaded trailer weight. On other models, trailer tongue weight should be 10 to 15 percent of total-loaded trailer weight up to 1,500 lb. (675 kg). On all models, the base cooling system includes all content required to attain maximum trailering rating, and the Z82 Heavy Duty trailering package includes the trailer hitch platform and trailer electrical connector.

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 2	United States Canada
2	Manufacturer	G	General Motors
3	Make	B C D T	Chevrolet Incomplete Chevrolet Truck GMC Incomplete GMC Truck
4	GVWR/Brake System	E F G H J	6001-7000/Hydraulic 7001-8000/Hydraulic 8001-9000/Hydraulic 9001-10000/Hydraulic 10001-14000/Hydraulic
5	Truck Line/Chassis Type	C K	4x2 4x4
6	Series	1 2 6	Half Ton Nominal ¾ Ton Nominal 1/2 Ton Luxury
7	Body Type	3 4 9	Four-Door Crew Cab or Utility Two-Door Cab Extended Cab
8	Engine Type	X V Z T U N 1 G 2 --	4.3L V6 MFI (LU3) 4.8L V8 MFI (LR4) 5.3L V8 MFI (L59) 5.3L V8 MFI (LM7) 6.0L V8 MFI (LQ4) 6.0L V8 MFI (LQ9) 6.6L V8 DSL (LB7) 8.1L V8 MFI (L18) 6.6L V8 DSL (LLY) 5.7L V8 CPI (L31)
9	Check Digit	--	Check Digit
10	Model Year	4	2004
11	Plant Location	1 E F Z G	Oshawa, Ontario Pontiac, Michigan Flint, Michigan Fort Wayne, Indiana Silao
12-17	Plant Seq. Number	--	Plant Sequence Number

VIN Derivative

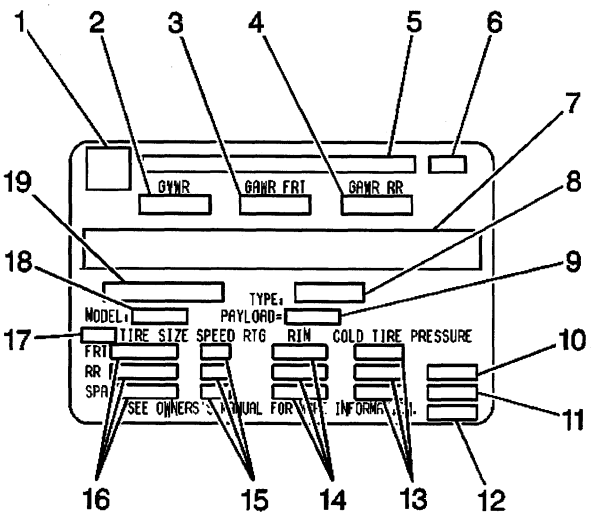
All engines and transmissions are stamped or laser etched with a partial vehicle identification number (VIN), which was derived from the complete VIN. A VIN derivative contains the following nine positions:

Position	Definition	Character	Description
1	Division	B C D T	Chevrolet Incomplete Chevrolet Truck Gmc Incomplete Gmc Truck
2	Model Year	4	2004
3	Plant Location	1 E Z J G F	Oshawa, Ontraio Pontiac, Michigan Fort Wayne, Indiana Janesville Silao Flint
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
4-9	12-17

Label Certification w/o RPO Z49



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

The vehicle certification label displays the following assessments:

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

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

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

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

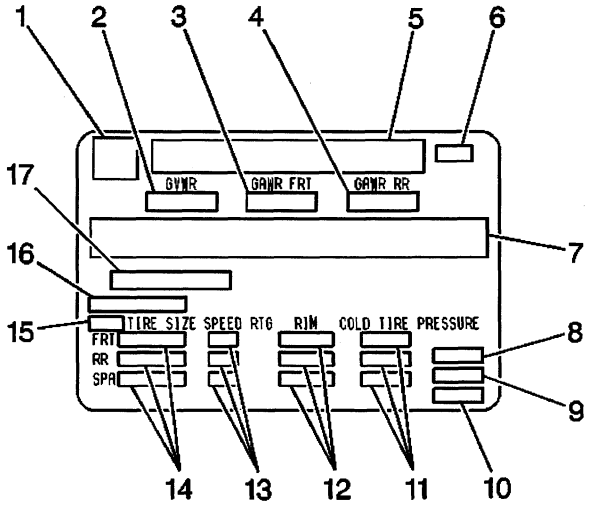
The front gross axle weight rating (GAWR FRT) is the weight exerted on the front axle. The rear gross axle weight rating (GAW RR) is the weight exerted on the rear axle. The front and rear gross axle weights must not exceed the front and rear gross axle weight ratings.

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

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

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

Label Certification w/o RPO Z49 – Incomplete Vehicle



(1) Logo
(2) Gross Vehicle Weight Rating
(3) Gross Axle Weight Rating - Front
(4) Gross Vehicle Weight Rating - Rear
(5) Name of Manufacturer
(6) Manufacturer's Date
(7) Manufacturer's Statement
(8) DUAL - When Equipped
(9) Front Axle Reserve - When Required
(10) Total Capacity - When Required
(11) Tire Pressure - Spare Optional
(12) Rim Size - Spare Optional
(13) Speed Rating - When required - Spare Optional
(14) Tire Size - Spare Optional
(15) GVW Rating Code
(16) Engineering Model
(17) 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

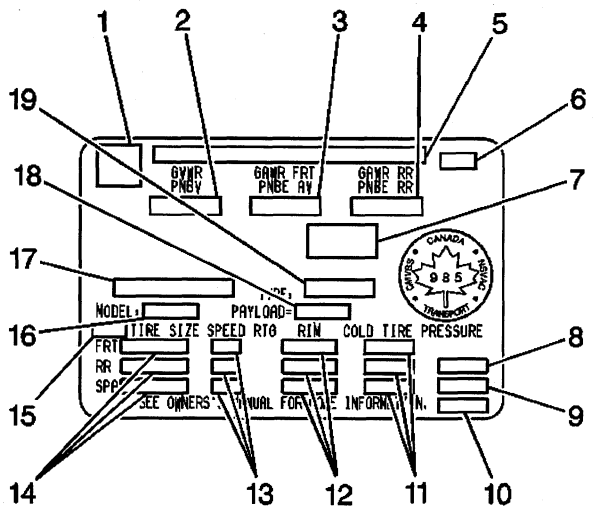
Gross vehicle weight (GVW) is the weight of the vehicle and everything it carries. Include the following items when figuring the GVW:

- 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.

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.

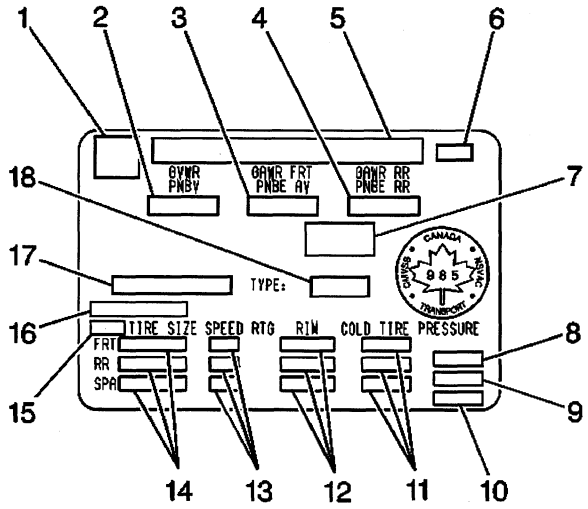
The front gross axle weight rating (GAWR FRT) is the weight exerted on the front axle. The rear gross axle weight rating (GAW RR) is the weight exerted on the rear axle. The front and rear gross axle weights must not exceed the front and rear gross axle weight ratings.

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.

Label Certification with RPO Z49 – Incomplete Vehicle



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

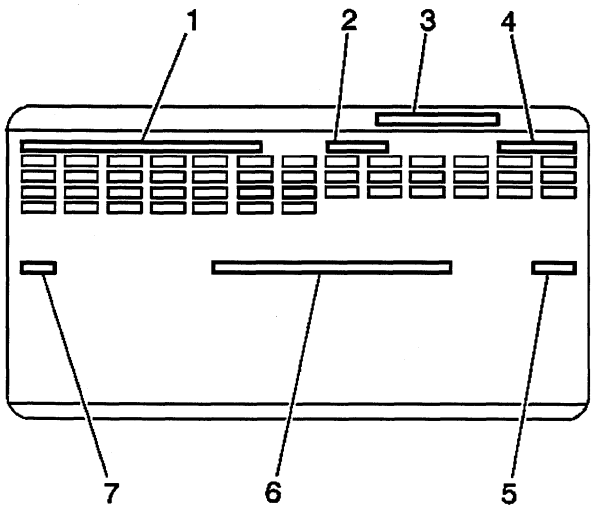
Gross vehicle weight (GVW) is the weight of the vehicle and everything it carries. Include the following items when figuring the GVW:

- 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.

Service Parts Identification Label (SPID)

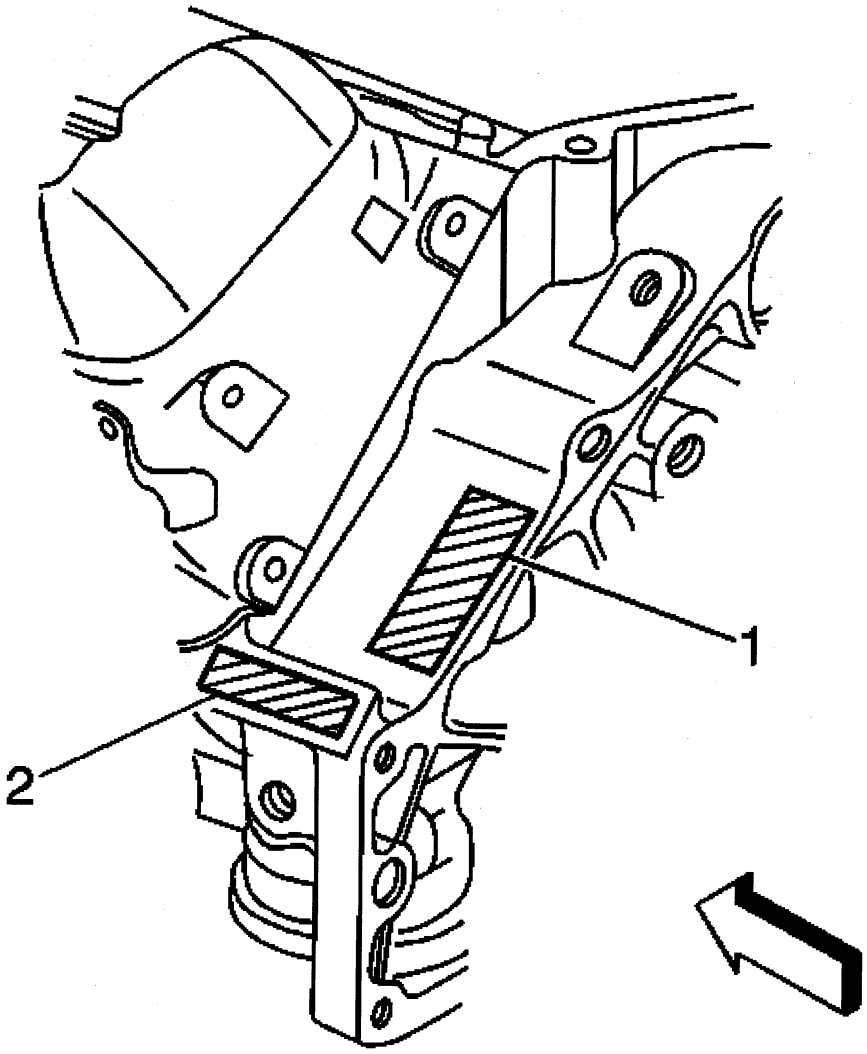


(1) Vehicle Identification Number
(2) Wheel Base
(3) Part Number Location
(4) Model Designation
(5) Order Number
(6) Exterior Color
(7) Paint Technology

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

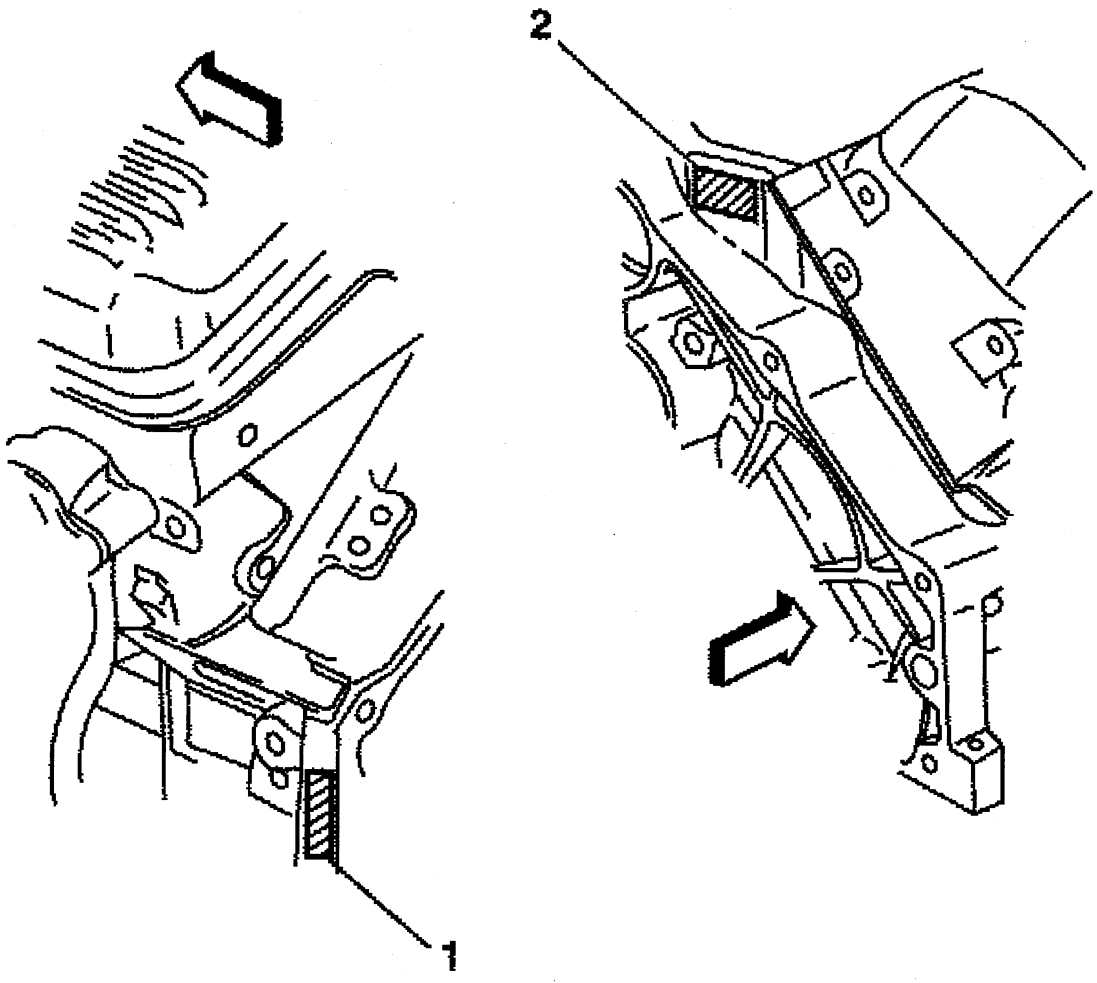
Engine ID and VIN Derivative Location

4.3L V-6 Engine



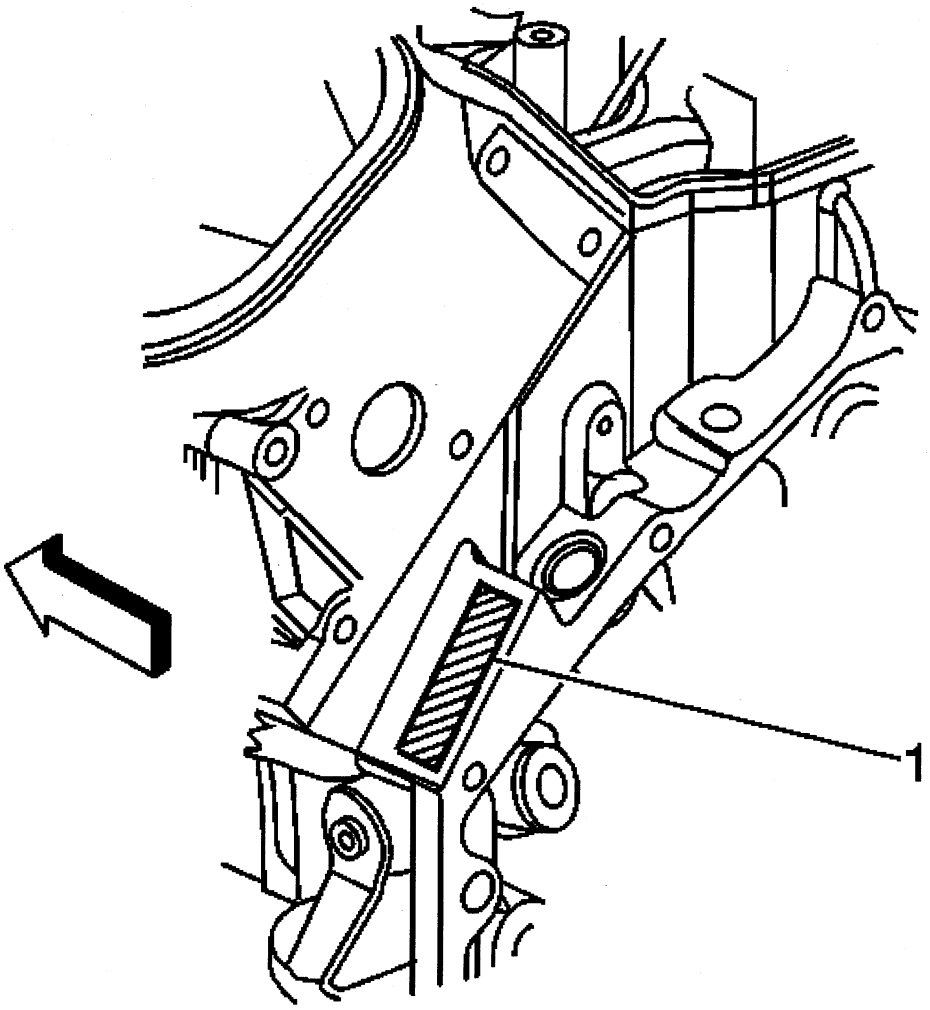
(1) Primary Engine Identification Number Location
(2) Secondary Engine Identification Number Location

4.8L, 5.3L, 6.0L V-8 Engines



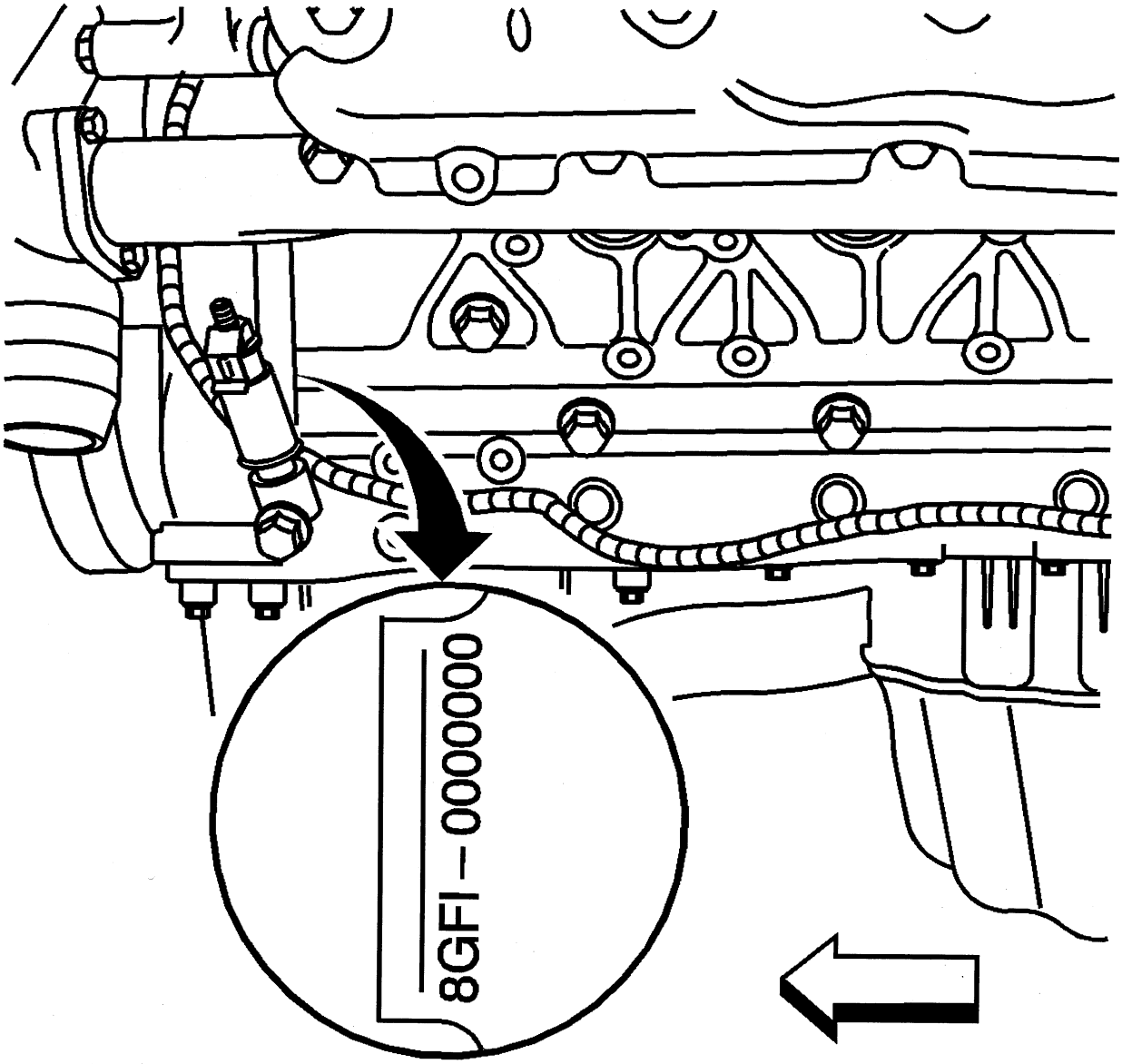
(1) Primary Engine Identification Number Location
(2) Secondary Engine Identification Number Location

8.1L V-8 Engine



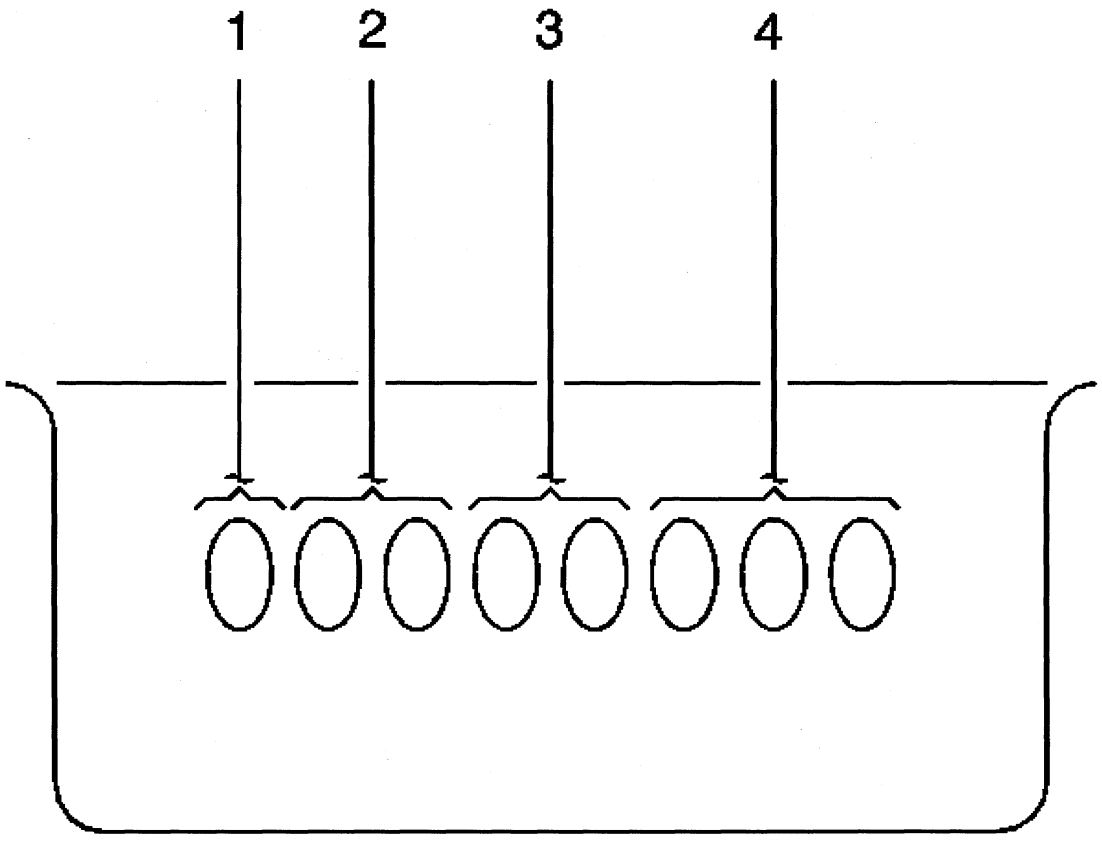
(1) Engine Identification Number Location

6.6L Diesel Engine



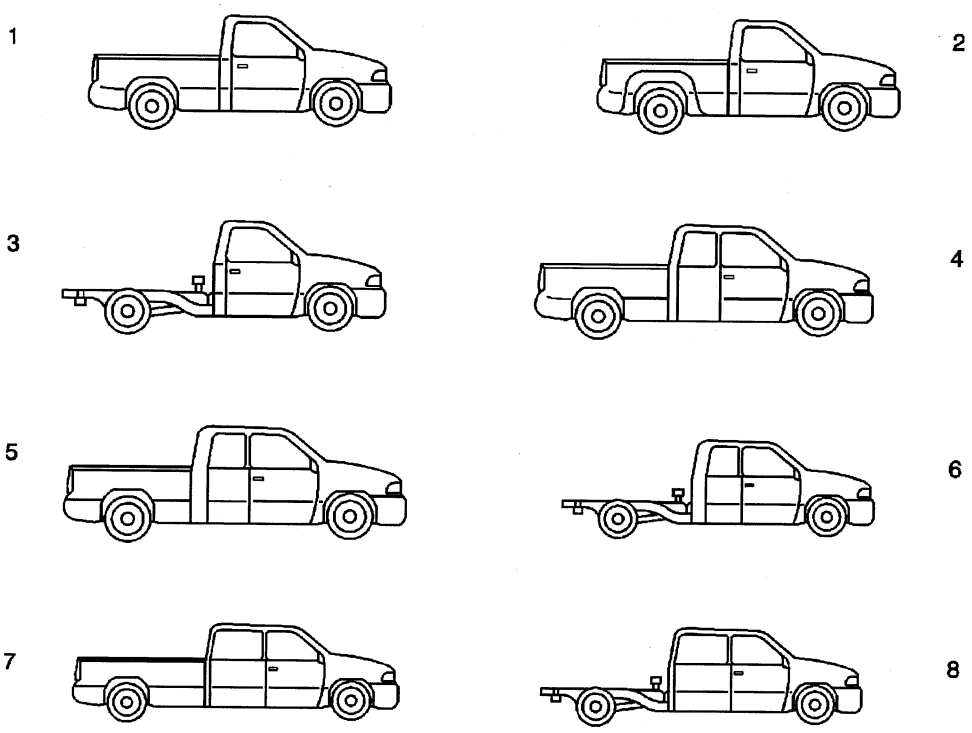
(1) Engine Identification Number Location

Engine ID Legend



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

Model Identification



(1) 2-Door Pickup Fleetside/Wideside
(2) 2-Door Pickup Sportside
(3) 2-Door Chassis Cab
(4) 4-Door Extended Cab Fleetside/Wideside
(5) 4-Door Extended Cab Sportside
(6) 4-Door Extended Chassis Cab
(7) 4-Door Crew Cab Fleetside/Wideside
(8) 4-Door Crew Cab Chassis Cab

Engine and Transmission Usage

Engine and Transmission Applications - 2-Wheel Drive

Engine/RPO	Transmission	
	Automatic/RPO	Manual/RPO
C15703 (2-Door Short Box)		
4.3L V6 Gasoline (LU3)	4L60-E 4-Speed (M30)	Getrag 5-Speed (MG5) Tremac 5-Speed (TZO)
4.8L V8 Gasoline (LR4)	4L60-E 4-Speed (M30)	Getrag 5-Speed (MG5) Tremac 5-Speed (TZO)
5.3L V8 Gasoline (L59)	4L60-E 4-Speed (M30)	N/A
5.3L V8 Gasoline (LM7)	4L60-E 4-Speed (M30)	N/A
C15743 (4-Door Crew Cab Short Box)		
6.0L V8 Gasoline (LQ4)	4L80-E 4-Speed (MT1)	N/A
C15753 (4-Door Extended Cab Short Box)		
4.3L V6 Gasoline (LU3)	4L60-E 4-Speed (M30)	Getrag 5-Speed (MG5)
4.8L V8 Gasoline (LR4)	4L60-E 4-Speed (M30)	Getrag 5-Speed (MG5)
5.3L V8 Gasoline (L59)	4L60-E 4-Speed (M30)	N/A
5.3L V8 Gasoline (LM7)	4L60-E 4-Speed (M30)	N/A
C15753 PHT (4-Door Extended Cab Short Box)		
5.3L V8 Gasoline (LM7)	4L60-E Hybrid (M33)	N/A
C15903 (2-Door Long Box)		
4.3L V6 Gasoline (LU3)	4L60-E 4-Speed (M30)	Getrag 5-Speed (MG5)
4.8L V8 Gasoline (LR4)	4L60-E 4-Speed (M30)	Getrag 5-Speed (MG5)
5.3L V8 Gasoline (L59)	4L60-E 4-Speed (M30)	N/A
5.3L V8 Gasoline (LM7)	4L60-E 4-Speed (M30)	N/A
C15953 (4-Door Extended Cab Long Box)		
4.8L V8 Gasoline (LR4)	4L60-E 4-Speed (M30)	Getrag 5-Speed (MG5)
5.3L V8 Gasoline (L59)	4L60-E 4-Speed (M30)	N/A
5.3L V8 Gasoline (LM7)	4L60-E 4-Speed (M30)	N/A
C25743 (4-Door Crew Cab Short Box)		
6.0L V8 Gasoline (LQ4)	4L80-E 4-Speed (MT1)	5-Speed NVG (MW3)
6.6L V8 Diesel (LLY)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
6.6L V8 Diesel (LB7)	Allison LCT 1000 5-Speed (M74)	6-Speed (ML6)
8.1L Gasoline (L18)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
C25753 (4-Door Extended Cab Short Box)		
6.0L V8 Gasoline (LQ4)	4L80E 4-Speed (MT1)	5-Speed NVG (MW3)
6.6L V8 Diesel (LLY)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
6.6L V8 Diesel (LB7)	Allison LCT 1000 5-Speed (M74)	6-Speed (ML6)
8.1L V8 Gasoline (L18)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
C25903 (2-Door Short Box)		
6.0L V8 Gas (LQ4)	4L80-E 4-Speed (MT1)	5-Speed NVG (MW3)
6.6L V8 Diesel (LB7)	Allison LCT 1000 5-Speed (M74)	6-Speed (ML6)
8.1L V8 Gasoline (L18)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)

Engine/RPO	Transmission	
	Automatic/RPO	Manual/RPO
C25943 (4-Door Crew Cab Long Box)		
6.0L V8 Gasoline (LQ4)	4L80-E 4-Speed (MT1)	5-Speed NVG (MW3)
6.6L V8 Diesel (LB7)	Allison LCT 1000 5-Speed (M74)	6-Speed (ML6)
8.1L V8 Gasoline (L18)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
C25953 (4-Door Extended Cab Long Box)		
6.0L V8 Gasoline (LQ4)	4L80-E 4-Speed (MT1)	5-Speed NVG (MW3)
6.6L V8 Diesel (LB7)	Allison LCT 1000 5-Speed (M74)	6-Speed (ML6)
8.1L V8 Gasoline (L18)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
C35943 (4-Door Crew Cab Long Box)		
6.0L V8 Gasoline (LQ4)	4L80-E 4-Speed (MT1)	5-Speed NVG (MW3)
6.6L V8 Diesel (LB7)	Allison LCT 1000 5-Speed (M74)	6-Speed (ML6)
8.1L V8 Gasoline (L18)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
C35953 (4-Door Extended Cab Long Box)		
6.0L V8 Gasoline (LQ4)	4L80-E 4-Speed (MT1)	5-Speed NVG (MW3)
6.6L V8 Diesel (LB7)	Allison LCT 1000 5-Speed (M74)	6-Speed (ML6)
8.1L V8 Gasoline (L18)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
C36003 (2-Door Regular Chassis Cab)		
6.0L V8 Gasoline (LQ4)	N/A	Tremec 5-Speed (M96)
6.0L V8 Gasoline (LQ4)	4L80-E 4-Speed (MT1)	5-Speed NVG (MW3)
6.6L V8 Diesel (LB7)	Allison LCT 1000 5-Speed (M74)	6-Speed (ML6)
8.1L V8 Gasoline (L18)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
C36053 (4-Door Extended Chassis Cab)		
6.0L V8 Gasoline (LQ4)	4L80-E 4-Speed (MT1)	5-Speed NVG (MW3)
6.6L V8 Diesel (LB7)	Allison LCT 1000 5-Speed (M74)	6-Speed (ML6)
8.1L V8 Gasoline (L18)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
C36403 (2-Door Reg Chassis Cab)		
6.0L V8 Gasoline (LQ4)	4L80-E 4-Speed (MT1)	5-Speed NVG (MW3)
6.6L V8 Diesel (LB7)	Allison LCT 1000 5-Speed (M74)	6-Speed (ML6)
8.1L V8 Gasoline (L18)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)

Engine and Transmission Applications - 4-Wheel Drive

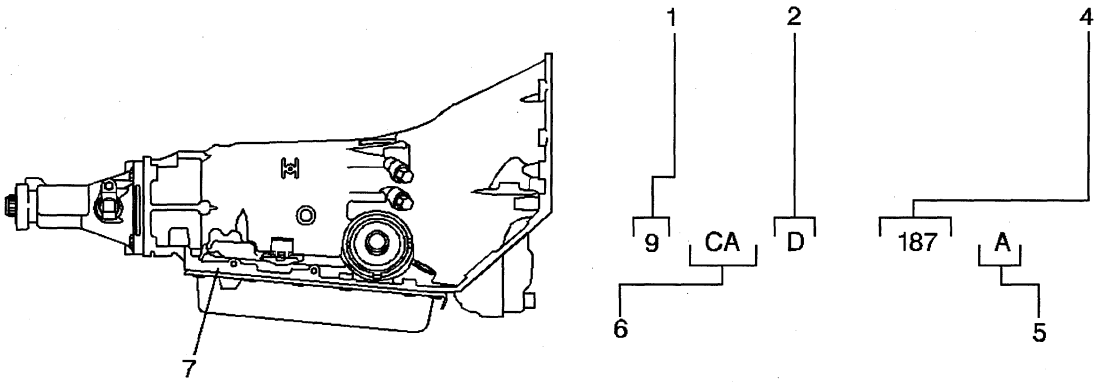
Engine/RPO	Transmission	
	Automatic/RPO	Manual/RPO
K15703 (2-Door Regular Cab Short Box)		
4.3L V6 Gasoline (LU3)	4L60-E 4-Speed (M30)	Getrag 5-Speed (MG5)
4.8L V8 Gasoline (LR4)	4L60-E 4-Speed (M30)	Getrag 5-Speed (MG5)
5.3L V8 Gasoline (L59)	4L60-E 4-Speed (M30)	N/A
5.3L V8 Gasoline (LM7)	4L60-E 4-Speed (M30)	N/A
K15743 (4-Door Crew Cab Short Box)		
6.0L V8 Gasoline (LQ4)	4L80-E 4-Speed (MT1)	N/A
K15753 (4-Door Extended Cab Short Box)		
4.8L V8 Gasoline (LR4)	4L60-E 4-Speed (M30)	Getrag 5-Speed (MG5)
5.3L V8 Aluminum Gasoline (L33)	4L60-E 4-Speed (M30)	N/A
5.3L V8 Gasoline (L59)	4L60-E 4-Speed (M30)	N/A
5.3L V8 Gasoline (LM7)	4L60-E 4-Speed (M30)	N/A
6.0L V8 Gasoline (LQ4)	4L60-E HD 4-Speed (M32)	N/A
6.0L V8 Gasoline (LQ9)	4L60-E HD 4-Speed (M32)	N/A
K15753 PHT (4-Door Extended Cab Hybrid)		
5.3L V8 Gasoline (LM7)	4L60-E Hybrid (M33)	N/A
K15903 (2-Door Regular Cab Long Box)		
4.3L V6 Gasoline (LU3)	4L60-E 4-Speed (M30)	Getrag 5-Speed (MG5)
4.8L V8 Gasoline (LR4)	4L60-E 4-Speed (M30)	Getrag 5-Speed (MG5)
5.3L V8 Gasoline (L59)	4L60-E 4-Speed (M30)	N/A
5.3L V8 Gasoline (LM7)	4L60-E 4-Speed (M30)	N/A
K15953 (4-Door Extended Cab Long Box)		
4.8L V8 Gasoline (LR4)	4L60-E 4-Speed (M30)	Getrag 5 Speed (MG5)
5.3L V8 Gasoline (L59)	4L60-E 4-Speed (M30)	N/A
5.3L V8 Gasoline (LM7)	4L60-E 4-Speed (M30)	N/A
K25743 (4-Door Crew Cab Short Box)		
6.0L V8 Gasoline (LQ4)	4L80-E 4-Speed (MT1)	5 Speed NVG (MW3)
6.6L V8 Diesel (LLY)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
6.6L V8 Diesel (LB7)	Allison LCT 1000 5-Speed (M74)	6-Speed (ML6)
8.1L V8 Gasoline (L18)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
K25753 (4-Door Extended Cab Short Box)		
6.0L V8 Gasoline (LQ4)	4L80-E 4-Speed (MT1)	5-Speed NVG (MW3)
6.6L V8 Diesel (LLY)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
6.6L V8 Diesel (LB7)	Allison LCT 1000 5-Speed (M74)	6-Speed (ML6)
8.1L V8 Gasoline (L18)	Allison LCT !000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
K25903 (2-Door Regular Cab Long Box)		
6.0L V8 Gasoline (LQ4)	4L80-E 4-Speed (MT1)	5-Speed NVG (MW3)
6.6L V8 Diesel (LLY)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
6.6L V8 Diesel (LB7)	Allison LCT 1000 5-Speed (M74)	6-Speed (ML6)

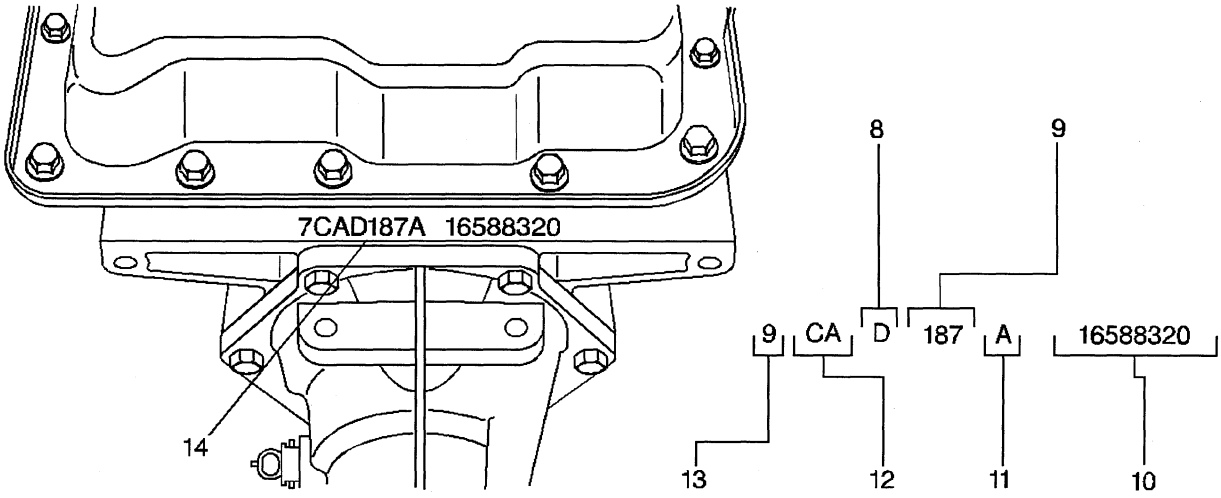
Engine/RPO	Transmission	
	Automatic/RPO	Manual/RPO
8.1L V8 Gasoline (L18)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
K25943 (4-Door Crew Cab Long Box)		
6.0L V8 Gasoline (LQ4)	4L80-E 4-Speed (MT1)	5-Speed NVG (MW3)
6.6L V8 Diesel (LLY)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
6.6L V8 Diesel (LB7)	Allison LCT 1000 5-Speed (M74)	6-Speed (ML6)
8.1L V8 Gasoline (L18)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
K25953 (4-Door Extended Cab Long Box)		
6.0L V8 Gasoline (LQ4)	4L80-E 4-Speed (MT1)	5-Speed NVG (MW3)
6.6L V8 Diesel (LLY)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
6.6L V8 Diesel (LB7)	Allison LCT 1000 5-Speed (M74)	6-Speed (ML6)
8.1L V8 Gasoline (L18)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
K35903 (2-Door Regular Cab Long Box)		
6.0L V8 Gasoline (LQ4)	4L80-E 4-Speed (MT1)	5-Speed NVG (MW3)
6.6L V8 Diesel (LLY)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
6.6L V8 Diesel (LB7)	Allison LCT 1000 5-Speed (M74)	6-Speed (ML6)
8.1L V8 Gasoline (L18)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
K35943 (4-Door Crew Cab Long Box)		
6.0L V8 Gasoline (LQ4)	4L80-E 4-Speed (MT1)	5-Speed NVG (MW3)
6.6L V8 Diesel (LLY)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
6.6L V8 Diesel (LB7)	Allison LCT 1000 5-Speed (M74)	6-Speed (ML6)
8.1L V8 Gasoline (L18)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
K35953 (4-Door Extended Cab Long Box)		
6.0L V8 Gasoline (LQ4)	4L80-E 4-Speed (MT1)	5-Speed NVG (MW3)
6.6L V8 Diesel (LLY)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
6.6L V8 Diesel (LB7)	Allison LCT 1000 5-Speed (M74)	6-Speed (ML6)
8.1L V8 Gasoline (L18)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
K36003 (2-Door Chassis Cab)		
6.0L V8 Gasoline (LQ4)	4L80-E 4-Speed (MT1)	5-Speed NVG (MW3)

Engine/RPO	Transmission	
	Automatic/RPO	Manual/RPO
6.6L V8 Diesel (LLY)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
6.6L Diesel (LB7)	Allison LCT 1000 5-Speed (M74)	6-Speed (ML6)
8.1L V8 Gasoline (L18)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
K36053 (4-Door Extended Chassis Cab)		
6.0L V8 Gasoline (LQ4)	4L80-E 4-Speed (MT1)	5-Speed NVG (MW3)
6.6L V8 Diesel (LLY)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
6.6L V8 Diesel (LB7)	Allison LCT 1000 5-Speed (M74)	6-Speed (ML6)
8.1L V8 Gasoline (L18)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
K36403 (2-Door Chassis Cab)		
6.0L V8 Gasoline (LQ4)	4L80-E 4-Speed (MT1)	5-Speed NVG (MW3)
6.6L V8 Diesel (LLY)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)
6.6L V8 Diesel (LB7)	Allison LCT 1000 5-Speed (M74)	6-Speed (ML6)
8.1L V8 Gasoline (L18)	Allison LCT 1000 5-Speed (M74) Allison LCT 1000 6-Speed (MW7)	6-Speed (ML6)

Transmission ID and VIN Derivative Location

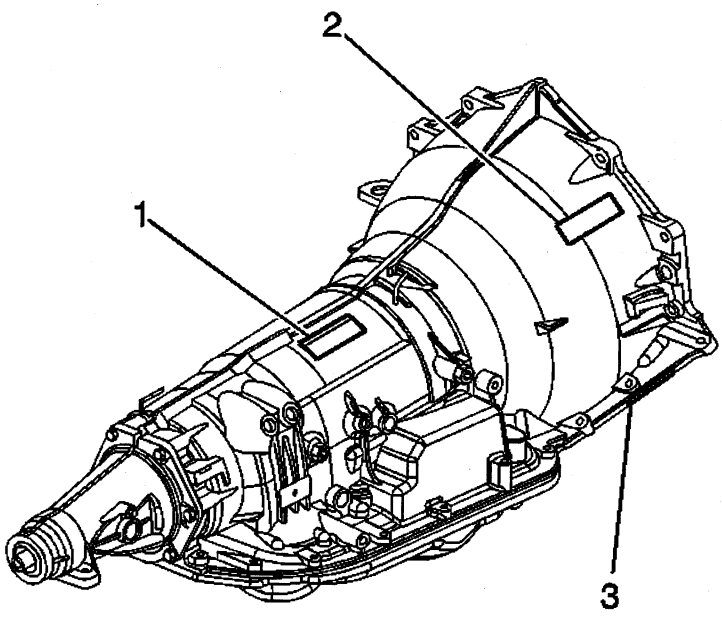
4L60-E Transmission ID Location



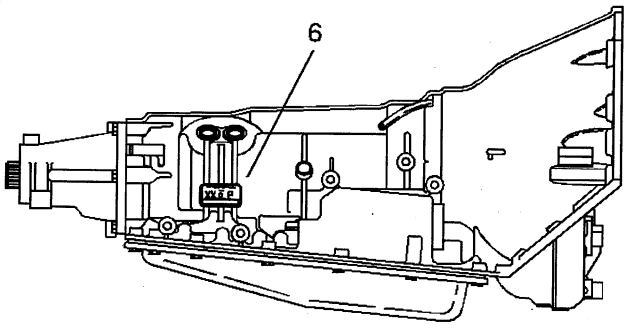


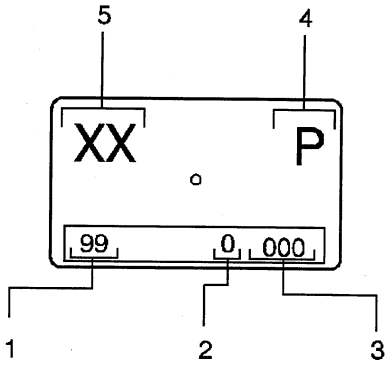
(1) Model Year
(2) Hydra-Matic 4L60-E
(4) Julian Date (or Day of the Year)
(5) Shift Built (A, B, J = First Shift; C, H, W = Second Shift)
(6) Model
(7) Transmission ID Location
(8) Hydra-Matic 4L60-E
(9) Julian Date (or Day of the Year)
(10) Serial No.
(11) Shift Built (A, B, J = First Shift; C, H,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

4L80-E Transmission ID Location



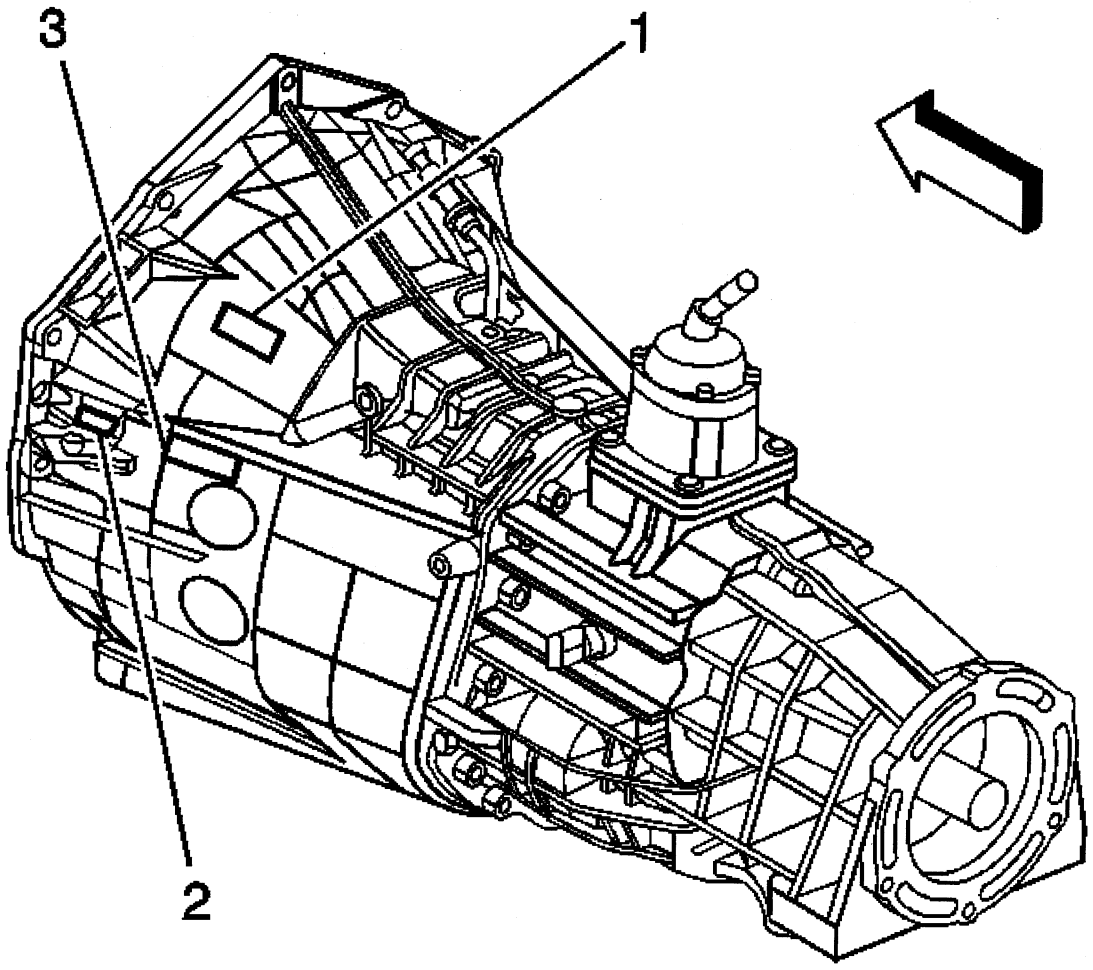
Transmission ID and VIN derivative locations (1, 2). The right hand stamping is shown, left hand is opposite. Pin or hand stamp location (3) for the transmission ID or VIN derivative.





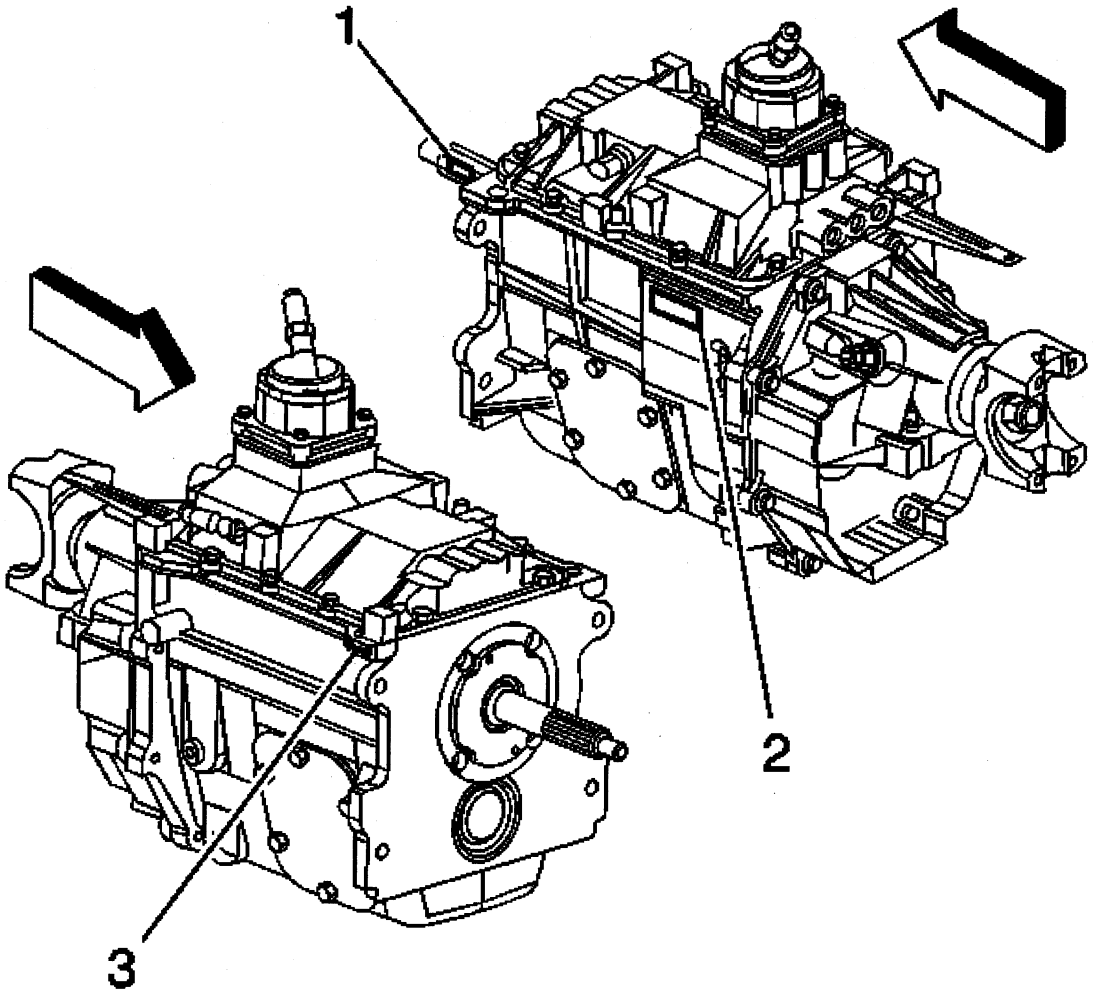
1. Calendar Year
2. Julian Date of the Year
3. Shift and Line Number
4. Plant
5. Model
6. Location on Transmission

5-Speed Getrag



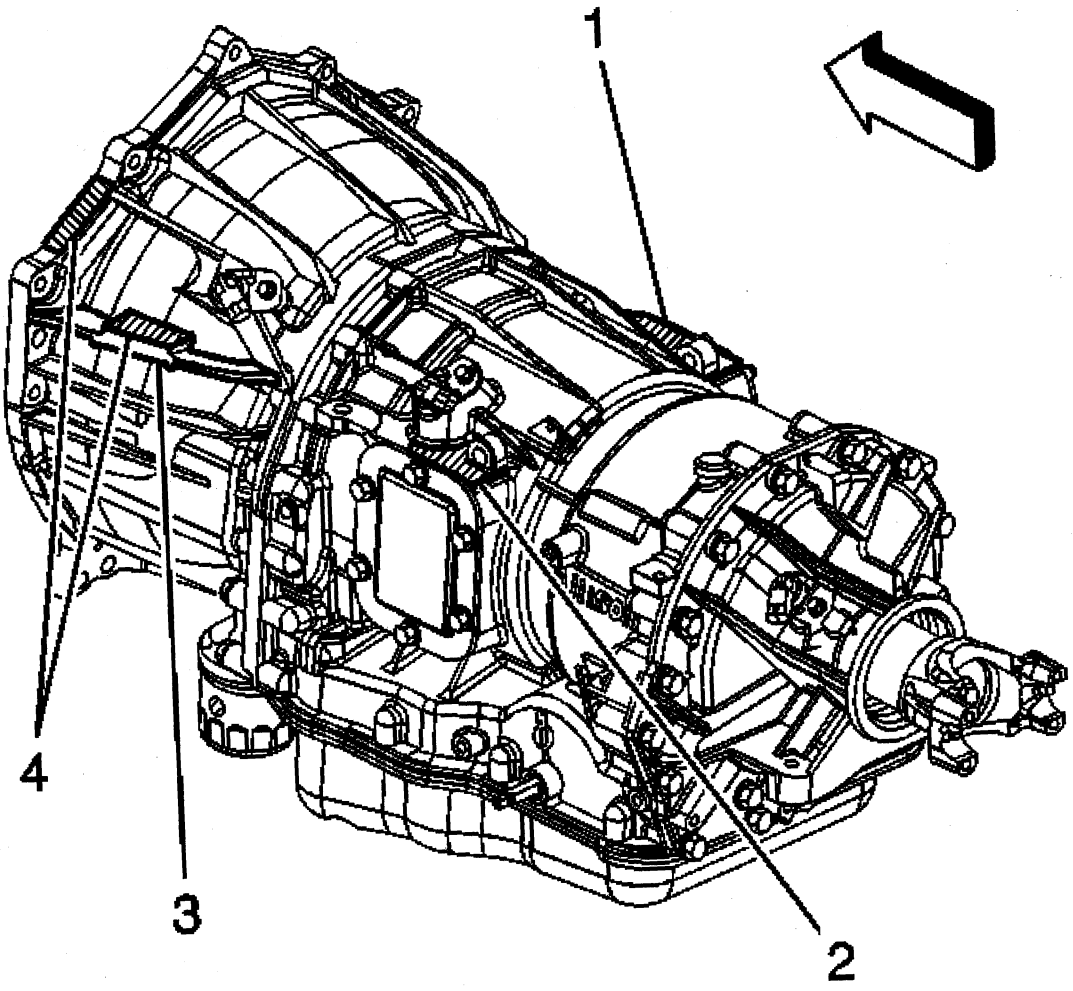
Vehicle identification number location PIN stamp only (1). Vehicle identification number location optional PIN or Hand Stamp (2). Vehicle identification number location optional Pin stamp only (3).

5-Speed Manual



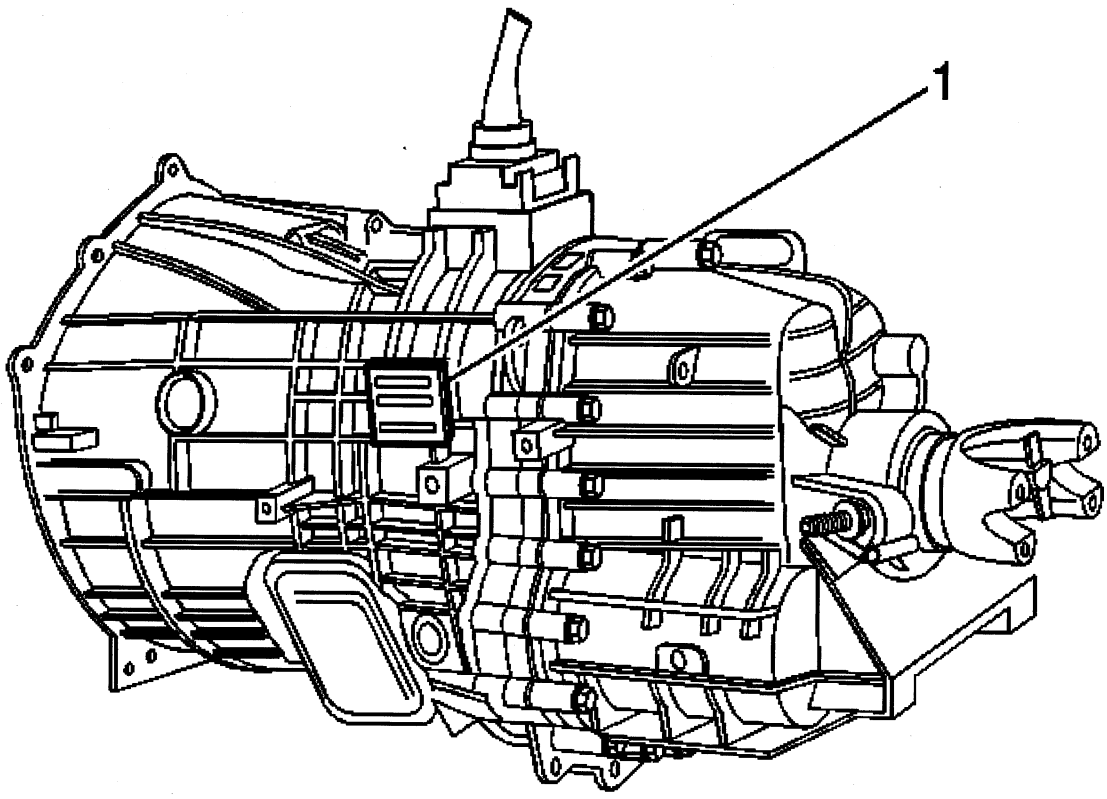
The transmission vehicle identification number location PIN or hand stamp (1, 3). Vehicle identification number location PIN or hand stamp (2).

Allison Transmission



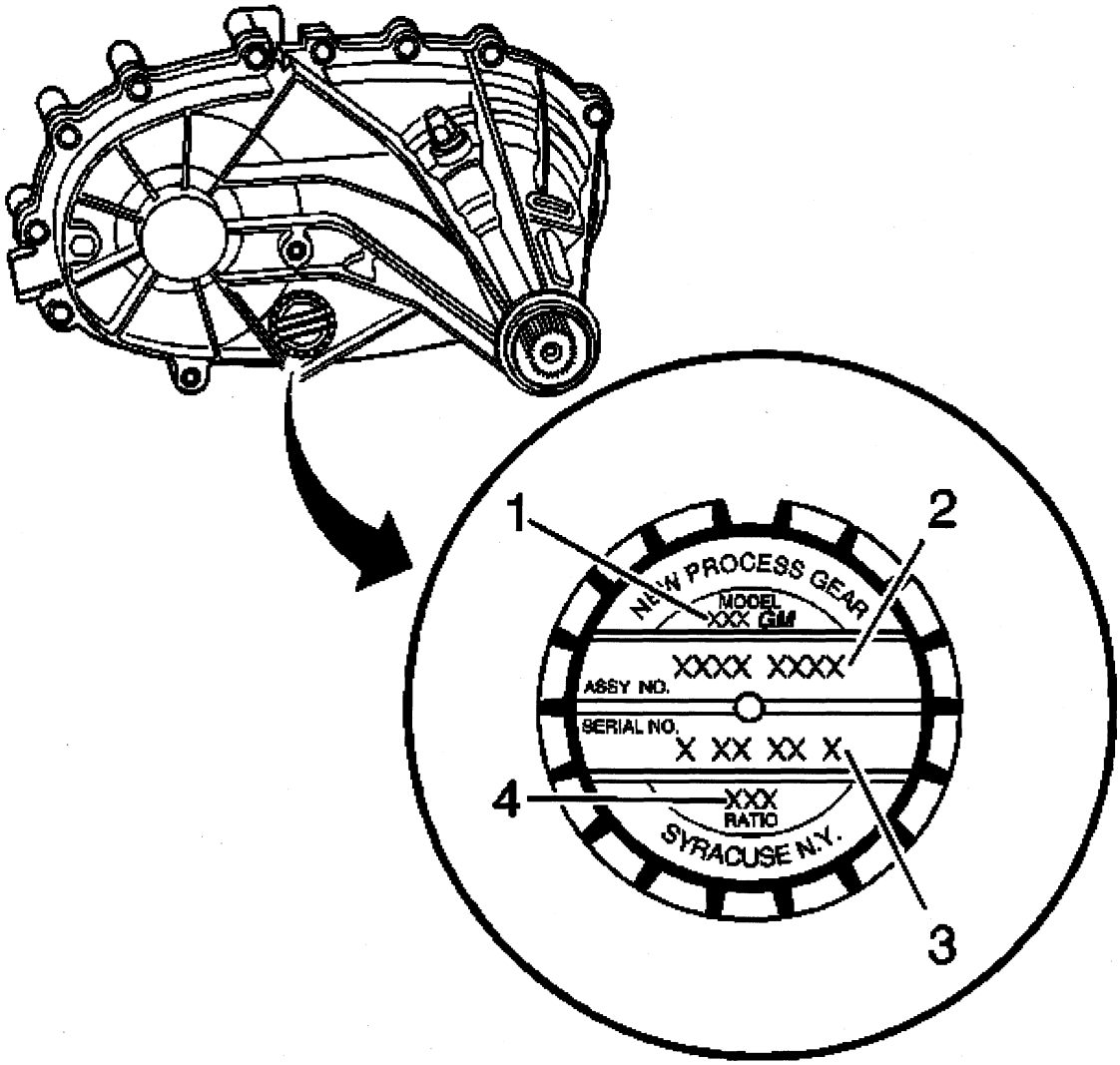
Vehicle identification number location for PIN stamp (3). Optional hand stamp locations (1, 2, 4)

ZF Transmission



(1) Engine identification tag location.

Transfer Case Identification

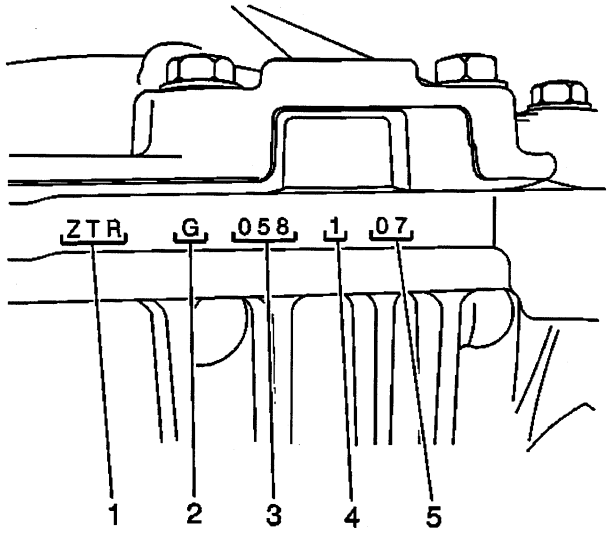


An identification tag is attached to the rear half of the transfer case. The tag provides the following information:

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

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

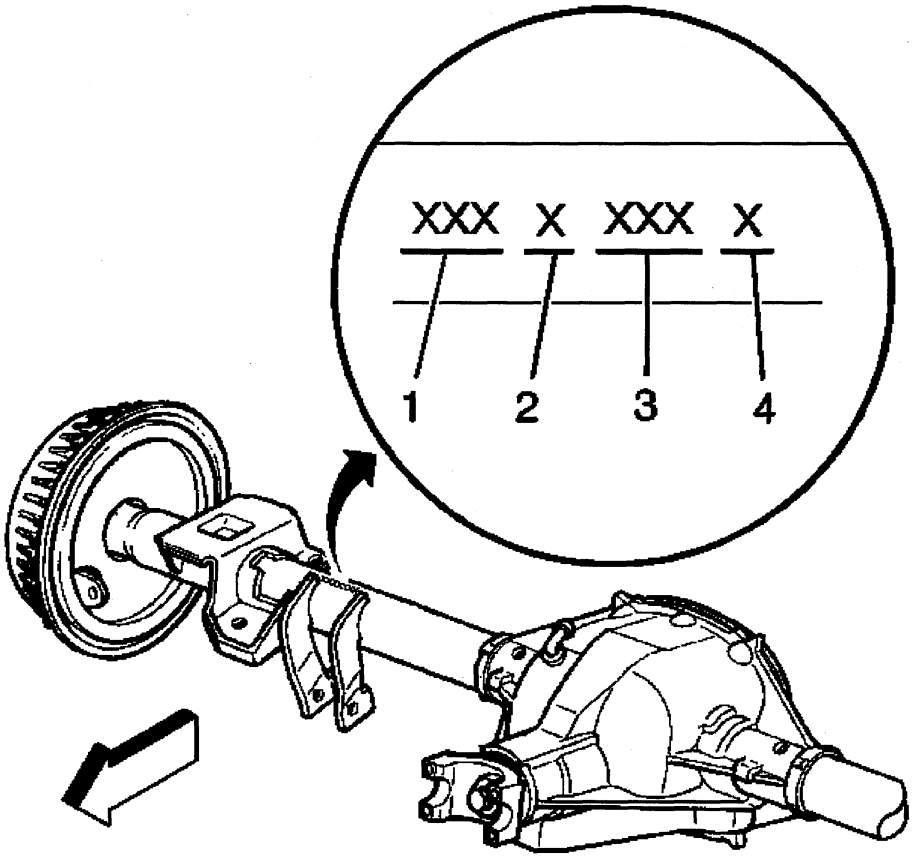
Axle Identification – Front



(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.

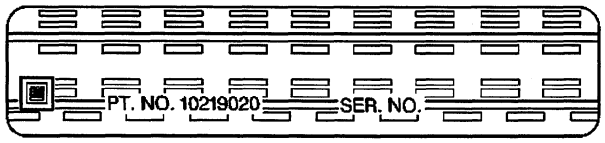
Axle Identification – Rear



(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
The production/process codes provide the description of the Regular Production Options (RPOs). The RPO list is printed on the Service Parts Identification Label.	
AE7	Seat Front Split, Driver, Passenger
AG1	Adjuster Front Seat Power, Multi-Directional, Driver
AG2	Adjuster Passenger Seat Power, Multi-Directional
AJ1	Windows Deep Tint, All Except W/S and DRS
AL0	Sensor Indicator Inflatable Restraint, Front Passenger/Child Presence Detector
AM7	Rear Seat Folding
AN3	Seat Front, Individual, Non-Bucket
AU0	Lock Control, Remote Entry
AU3	Lock Control Side Door, Electric
A04	Windshield Tinted, Less Upper Shadeband
A31	Window Power Operated, All Doors
A95	Seat Front Bucket, High Back, Driver and Passenger Recliner
BAG	Parts Package Export
BA5	Ornamentation Exterior, Custom
BD2	Ornamentation Exterior - Delete
BG9	Covering, Floor, Rubber
BPH	Appearance Package Chevrolet - Off Road
BS1	Insulation Acoustical Package
BVE	Steps, Runningboard, Side
BVF	Steps, Runningboard, Side, Color Keyed
BVS	Steps, Runningboard, Side, Color
BW2	Molding, B/S Deluxe
B30	Floor Covering, Carpet
B32	Covering Front Floor Mats, Auxiliary
B33	Covering Rear Floor Mats, Auxiliary
B34	Covering Front Floor Mats, Carpeted Insert
B4L	Label Price, Refer Geographic Chart
B4U	Performance Package, Sport
B58	Covering Floor Mat, Front and Rear, Carpeted Insert
B71	Molding, Wheel Opening, Colored
B81	Molding Body/Side - Delete
B82	Ornamentation Exterior, Emblem - Delete
B85	Molding, Body/Side, Exterior, Bright
CJ2	HVAC System, Air Conditioner Front, Automatic Temperature Control, Auxiliary Temperature Control
CJ3	HVAC System, Air Conditioner Front, Manual Temperature Control, Auxiliary Temperature Control
CKD	Vehicle Completely Knocked Down
CMD	Plant Code, Flint, MI, USA - Truck
C3J	GVW Rating 6,700 lbs
C4M	GVW Rating 9,900 lbs
C42	HVAC System Heater, Outside Air, Deluxe
C49	Defogger Rear Window, Electric
C5F	GVW Rating 8,500 lbs
C5H	GVW Rating 6,900 lbs

RPO	Description
C5M	GVW Rating 6,100 lbs
C5S	GVW Rating 6,600 lbs
C5U	GVW Rating 6,800 lbs
C5Z	GVW Rating 7,200 lbs
C6P	GVW Rating 8,600 lbs (3900 kg)
C6W	GVW Rating 9,200 lbs
C7H	GVW Rating 6,400 lbs (2900 kg)
C7L	GVW Rating 12,000 lbs
C7W	GVW Rating 11,400 lbs
C86	Lamp, Manual Transmission, Shift Indicator, Tell-tale Suppression
DE2	Mirror, Outside Left and Right, Manual Control, Folding, Color
DF2	Mirror, Outside Left and Right, Wide Load, Folding, Stainless Steel
DF5	Mirror, Inside Rearview, Light Sensitive, Compass, Outside Temperature Display
DG5	Mirror, Outside Left and Right, Wide Load, Large
DH6	Mirror, Inside Front Van, Left and Right, Sunshade, Illumination
DK7	Console Roof Interior, Custom
DL3	Mirror, Outside Left and Right, Remote Control, Electric, Heated, Power Folding, Turn Signal Indicator, Light Sensitive, Color and Electrochromic Feature on Drivers Side w/Standard Convex Glass on Passengers Side
DL8	Mirror, Outside Left and Right, Remote Control, Electric, Heated
DNR	Equipment Dealer Installed
DPF	Mirror, Outside Left and Right, Wide Load, Remote Control, Electric, Heated
DT4	Ashtray Cigarette Lighter
D07	Console, Front Compartment, Floor, Custom
D44	Mirror, Outside, Color
EN6	Cover, Rear Compartment Hard Folding, Rear Compartment, Cargo
ESC	Equipment, Individual Front seats with Front Floor Compartment Console Provisions
EVA	Test DVT, EVAP Emission Requirement
E37	Pickup Box Inner DK Composite
E62	Body Equipment Step Side, Pick-up Box
E63	Body Equipment Fleetside, Pick-up Box
E95	Cover Tonneau, Rear Compartment
FF4	Left Arm Torsion Bar Spring Adjusted (C)
FF5	Right Arm Torsion Bar Spring Adjusted (D)
FF6	Left Arm Torsion Bar Spring Adjusted (E)
FF7	Right Arm Torsion Bar Spring Adjusted (F)
FF8	Left Arm Torsion Bar Spring Adjusted (G)
FF9	Right Arm Torsion Bar Spring Adjusted (H)
FK2	Left Arm Torsion Bar Spring Adjusted (A)
FK3	Right Arm Torsion Bar Spring Adjusted (B)
FNF	Floor Power Take Off (PTO) Front
FT2	Left Arm Torsion Bar Spring Adjusted (FT2)
FT3	Right Arm Torsion Bar Spring Adjusted (FT3)
FWI	Plant Code Fort Wayne, IN, USA
FW1	Manual Electric Control, Ride and Handling
F0F	Fleet Incentive Tourism Industry Inc. DBA Budget Sales & Leasing
F60	Spring Front Heavy Duty
GMC	Plant Code Pontiac, MI, USA
GTY	Axle Wide Track
GT4	Axle Rear 3.73 Ratio
GT5	Axle Rear 4.10 Ratio (DUP With GT8)
GU4	Axle Rear 3.08 Ratio

RPO	Description
GU6	Axle Rear 3.42 Ratio
G80	Axle Positraction Limited Slip
G86	Axle Limited-Slip
HOT	Appearance Package GMC "Hot Truck"
HP2	Hybrid Propulsion Electric, Parallel, 14V/42V with 120V-2400W Outlets, Idle Engine Off
HVY	Identification 2-inch Body Raise, HD Model
JC3	Brake Vac Power, Disc/Disc, 6,400 lb
JC4	Brake Vac Power, Disc/Disc, 7,200 lb
JH1	Brake Hydraulic Powe, Disc/Disc, 6,400 lbs
JH6	Brake Hydraulic Power, 4-Wheel Disc, 9,900 lbs
JH7	Brake Hydraulic Power, 4-Wheel Disc, 12,300 lbs (Dup with JH9)
JL4	Control Active Brake
JVA	Brake System, Antilock Brake - Delete
KC4	Engine Oil Cooling System
KG3	Generator 145 Amp
KL5	Modification Engine, Natural Gas
KL6	Provisions, Natural Gas
KL8	Conversion Natural Gas (CNG Gas)
KNP	Cooling System Transmission, HD
KUP	Throttle Control Electronic
K05	Heater Engine Block
K34	Cruise Control, Automatic, Electronic
K47	Air Cleaner High Capacity
K53	Fuel Sender Assembly, Robust Fuel System
K65	Generator, 105 Amp, Dual
K68	Generator, 105 Amp
LB7	Engine, Diesel, 8 Cylinder, 6.6L, DI, V8, Turbo, HO, Duramax
LLY	Engine, Diesel, 8 Cylinder, 6.6L, DI, V8, Turbo-High, Duramax
LM7	Engine Gas, 8 Cylinder, 5.3L, MFI, Iron, GM
LQ4	Engine Gas, 8 Cylinder, 6.0L, MFI, Iron, GM
LQ9	Engine Gas, 8 Cylinder, 6.0L, MFI, Iron, GM, Ho
LR4	Engine Gas, 8 Cylinder, 4.8L MFI, Iron, GM
LU3	Engine Gas, 6 Cylinder, 4.3L, MFI, V6, 90 DEG
L18	Engine Gas, 8 Cylinder, 8.1L, MFI
L31	Engine Gas, 8 Cylinder, 5.7L, CPI
L59	Engine Flexible Fuel - Gas/ALC, 8 Cylinder, 5.3L, MFI, V8, GM
MEX	Plant Code Toluca, Mexico
MG5	Transmission Manual 5-Speed, Getrag, 84mm, 4.00 1st, O/D
ML6	Transmission Manual 6-Speed ZF, 105mm, 5.79 1st, 0.72 6th, O/D
MTF	Provisions - Fire Extinguisher Mounting
MT1	Transmission Auto 4-Speed HMD 4L80-E
MW3	Transmission Manual, 5-Speed, NVG, 109mm, 5.61 1st, O/D
M1F	Power Take Off Rear PTO
M30	Transmission Auto 4-Speed, HMD, 4L60-E, Electronic
M32	Transmission Auto 4-Speed, HMD, 4L60-E, Electronic, HD
M33	Transmission Auto 4-Speed, HMD, 4L60-E, Electronic, Hybrid
M74	Transmission Auto 5-Speed, Allison, LCT 1000, 3.10 1st, 1.00 4th, 0.71 5th, O/D, Conversion Clutch
NA1	Emission System GVW less than 8,500 lb
NA4	Emission System GVW greater than 8,500 lb
NC1	Emission System California, LEV
NC8	Emission System California, ULEV

RPO	Description
NF2	Emission System Federal, Tier 1
NF4	Emission System Clean Fuel, Fleet
NF9	Emission System General Unleaded
NPL	Plate Name - Delete
NP1	Transfer Case, Electric Shift Control, 2 Speed
NP2	Transfer Case, Manual Shift Control, 2 Speed
NP3	Transfer Case, All-Wheel Drive
NP5	Steering Wheel, Leather Wrapped
NP8	Transfer Case Active, 2 Speed Push Button Control
NQZ	Fuel Tank Auxiliary, Rear Mounted, 18 gallon - Delete
NR4	Transfer Case Four Wheel Drive (4WD), Open Differential, 2-Speed
NT8	Emission System Federal, Tier 2 A
NT9	Emission System Federal, Tier 2 Phase-out
NU4	Emission System California Level 2 Plus
NW7	Traction Control, Powertrain Management Only
NYS	Steering 4-Wheel
NZZ	Sales Package, Skid Plate Off-Road Spot
N05	Lock Control Fuel Filler Cap
N12	Rear Exit Exhaust System
N93	Wheel - Aluminum - Chrome - 17 X 7.5
OSG	Plant Code Oshawa, Ont, Canada (TRK)
PF4	Wheel - Aluminum - 16 X 7.0
PF9	Wheel - Aluminum Cast - 16 X 7.0
PPB	Equipment PUBX Extender
PRO	Appearance Package Sierra Professional
PTO	Provisions, Power Take Off (PTO) Controls
PUB	Cap PUBX Bed Ral
PY0	Wheel - Aluminum - 16 X 6.5
PY2	Wheel - Chrome Appearance - 16 X 6.5
P03	Wheel Cover, Var 3
P06	Trim Discs Wheel
P25	Wheel 17 x 7.5, Aluminum, 5 Spoke Premium
P27	Wheel 17 x 7.5, Aluminum, 6 Spoke Premium
P30	Wheel 20x8.5, Aluminum, Sport
P96	Equipment, Mexican Modified, Mandatory Base Equipment
QAN	Tire All P265/70R 17 - 113S BW R/PE ST TL AL2
QBX	Tire All LT245/75R16/C WOL R/PE ST TL OOR
QCC	Tire ALL P255/70R16 BW R/PE ST TL ALS
QCJ	Tire All P255/70R16 WOL R/PE ST TL ALS
QCP	Tire All P255/70R16 - 109H BW R/PE ST TL ALS
QC1	Wheel 16 x 7, Steel
QC4	Wheel 16 x 7, Aluminum, Custom
QER	Tire All LT265/75R16/E BW R/PE ST TL OOR (123/120Q)
QE4	Wheel Spare 16 x 6.5, Aluminum
QGC	Tire All P265/75R16 - 114S BW R/PE ST TL AT
QGD	Tire All P265/75R16 - 114S WOL R/PE ST TL AT
QHS	Tire All P265/75R16 - 114H BW R/PE ST TL AT "A" TEMP Rating
QIW	Tire All LT245/75R16/E BW R/PE ST TL OOR 120Q
QIZ	Tire All LT245/75R16/E BW R/PE ST TL ALS 12OQ
QJM	Tire All P265/70R17 - 113S WOL R/PE ST TL OOR
QJP	Tire All P265/70R17 - 113S BW R/PE ST TL OOR
QLP	Tire All LT245/75R16/E BW R/PE ST TL ALS 120/116S

RPO	Description
QNF	Tire All P235/75R16 - 106S BW R/PE ST TL ALS
QNG	Tire All P235/75R16 - 106S WOL R/PE ST TL ALS
QNK	Tire All P245/75R16 - 109S BW R/PE ST TL ALS
QNL	Tire All P245/75R16 - 109S WOL R/PE ST TL ALS
QSS	Tire All P275/55R20 - 111S BW TL ST AL2
QVL	Tire All P265/70R17 - 113S BW R/PE ST TL ALS
QVM	Tire All P265/70R17 - 113S WOL R/PE ST TL ALS
Q4B	GVW Rating 6,200 lbs
R4Y	Tire Brand All Goodyear
R5C	Tire Brand All Bridgestone
SAF	Lock Spare Tire, Hoist Shaft
SRW	Chassis 9,900 lbs GVW, Single Rear Wheel Ride and Handling
SSL	Ornamentation, Exterior, Nameplate, GMC Sierra SL
TL1	Grille Special
TP2	Battery Auxiliary
TQ3	Battery 770 CCA (Dual)
TRB	Grille Radiator, Body Color
TRW	Provisions Lamp, Roof Mounted
TR3	Grille Radiator, Body Color, w/Chrome Emblem
TS9	Lamp Stop, High Level - Delete
TZ0	Transmission Manual 5-Speed, Tremac, 85mm, 3.82 1st, 0.83 5th
T07	Generator - Delete
T2H	Exterior Ornamentation, Export Unique Requirements
T62	Lamp System Daytime Running - Delete
T64	Battery - Delete
T7L	Equipment: Miscellaneous Equipment for Central America - GMM Controlled
T78	Headlamps Control - Delete
T8Z	Emission System: Low Emissions Vehicle - Mexico
T96	Fog Lamps, Front
UB0	Radio AM/FM Stereo, Seek/Scan, CD, Auto Tone, Data System Clock, ETR
UB1	Radio AM/FM Stereo, Seek/Scan, Auto Reverse Music Search Cassette, CD, Auto Tone, Data System Clock, ETR
UC2	Speedometer Instrument, Kilo and Miles, Kilo Odometer, Positive Bias
UC6	Radio AM/FM Stereo, Seek/Scan, RDS, Multiple Compace Disc, Auto Tone Control, Clock, ETR
UD4	Alarm Vehicle Speed, 120 km/h
UE1	Communication System Vehicle, G.P.S. 1
UG1	Universal Garage Door Opener
UK3	Accessory Steering Wheel Control
UK6	Radio Control Rear Seat and Earphone Jacks
UL4	Frequencies, South American
UL5	Radio - Delete
UL8	Frequencies, Saudi Arabian
UM7	Radio AM/FM Stereo, Seek/Scan, Clock, ETR
UQ3	Speaker System, Performance Enhanced Audio
UQ5	Speaker System 4, Dual Front Door Mounted, Dual Extended Range Quarter Mounted
UQ7	Speaker System Premium Performance, Enhanced Audio, Bose®
UQ9	Speaker System - Delete
UY2	Wiring Provisions for Camper/5th Wheel Trailer
U01	Lamp Five, Roof Marker, Truck
U1S	Player Multiple Compace Disc
U19	Speedometer Instrument, Kilo and Miles, Kilo Odometer

RPO	Description
U2K	Digital Audio System S-Band
U42	Entertainment Package Rear Seat
VBX	Language Label Arabic
VB3	Bumper Rear Step, Chrome, Impact Strip
VC0	Label, Noise Control Information
VC4	Label Price/Fuel Economy, Puerto Rico and Virgin Islands
VC5	Label Shipping, Except US, US Possessions, or Japan
VC7	Label Price/Fuel Economy, Guam
VFF	Video Format Region 1, NTSC
VFJ	Video Format Region w PAL
VFM	Video Format Region 4, NTSC
VFP	Video Format Region 5, PAL
VF7	Bumper Rear Step - Delete
VGC	Protector Film, Paint Etch Preventive
VG3	Bumper Front Impact Strip
VG8	Vehicle Label, Notice to Buyer
VK3	License Plate, Front Mounting Package
VPH	Vehicle Preparation Overseas Delivery
VP6	Noise Control
VR4	Trailer Hitch Weight Distributing Platform
VR6	Hook Tie-Down Shipping
VSP	Box Dual Rear Wheels
VT4	Bumper Front Color Keyed
VT5	Bumper Rear Color Keyed
VXS	Vehicle Complete
VXT	Vehicle Incomplete
VYU	Provisions, Snow Plow Preparation
VZ2	Calibration Speedometer A
VZ3	Label Mercury Disposal Notification
V10	Cold Weather Options Provision
V22	Grille Radiator, Chrome
V43	Bumper, Rear Step, Color
V60	Vehicle Statement Gulf States Organization, Incomplete Vehicle
V73	Vehicle Statement, USA/ Canada
V76	Front Towing Hook
V78	Vehicle Statement - Delete
V87	Vehicle Statement Gulf States Organization
V98	Factory Delivery Processing
W86	Equipment: Miscellaneous Equipment for Venezuela (GMV Controlled)
W99	Equipment: Miscellaneous Equipment for Venezuela (GM Platform Controlled)
XAN	Tire Front P265/70R17 - 113S BW R/PE ST TL AL2
XBX	Tire Front LT245/75R16/C WOL R/PE ST TL OOR
XCC	Tire Front P255/70R16 BW R/PE ST TL ALS
XCJ	Tire Front P255/70R16 WOL R/PE ST TL ALS
XCP	Tire Front P255/70R16 - 109H BW R/PE ST TL ALS
XEC	Tire Front LT215/85R16/E BW R/ST TL Highway
XEF	Tire Front LT215/85R16/E BW R/PE ST TL OOR
XER	Tire Front LT265/75R16/E BW R/PE ST TL OOR (123/120Q)
XGC	Tire Front P265/75R16 - 114S BW R/PE ST TL AT
XGD	Tire Front P265/75R16-114S WOL R/PE ST TL AT
XGK	Tire Front LT245/75R16/E BW R/PE ST TL OOR 120Q
XHH	Tire Front LT245/75R16/E BW R/PE ST TL LS 120QT

RPO	Description
XHS	Tire Front P265/75R16-114H BW R/PE ST TL AT "A" Temp Rating
XJM	Tire Front P265/70R17-113S WOL R/PE ST TL OOR
XJP	Tire Front P265/70R17-113S BP R/PE ST TL OOR
XLP	Tire Front LT245/75R16/E BW R/PE ST TL ALS 120/116S
XNF	Tire Front P235/75R16-106S BW R/PE ST TL ALS
XNG	Tire Front P235/75R16-106S WOL R/PE ST TL ALS
XNK	Tire Front P245/75R16-109S BW R/PE ST TL ALS
XNL	Tire Front P245/75R16-109S WOL R/PE ST TL ALS
XSS	Tire Front P275/55R20-111S BW TL ST AL2
XVL	Tire Front P265/70R17-113S BW R/PE ST TL ALS
XVM	Tire Front P265/70R17-113S WOL R/PE ST TL ALS
XYK	Tire Front LT215/85R16/D BL R/PE ST TL HWY
XYL	Tire Front LT215/85R16/D BL R/PE ST TL OOR
X52	Miscellaneous Equipment for Guam, Puerto Rico/US Virgin Islands
X88	Conversion Name Plate Chevrolet
YAN	Tire Rear P265/70R17 - 113S BW R/PE ST TL AL2
YBX	Tire Rear LT245/75R16/C WOL R/PE ST TL OOR
YB3	Plate Clutch Driven, Part of English - Delete
YCC	Tire Rear P255/70R16 BW R/PE ST TL ALS
YCJ	Tire Rear P255/70R16 WOL R/PE ST TL ALS
YCP	Tire Rear P255/70R16 - 109H BW R/PE ST TL ALS
YEC	Tire Rear LT215/85R16/E BW R/PE ST TL HWY
YEF	Tire Rear LT215/85R16/E BW R/PE ST TL OOR
YER	Tire Rear LT265/75R16/E BW R/PE ST TL OOR (123/120Q)
YE9	Convenience Package Comfort and Decor Level #3
YF2	Sales Package Ambulance Upfitter
YGC	Tire Rear P265/75R16-114S BW R/PE ST TL AT
YGD	Tire Rear P265/75R16-114S WOL R/PE ST TL AT
YGK	Tire Rear LT245/75R16/E BW R/PE ST TL OOR 120Q
YHH	Tire Rear LT245/75R16/E BW R/PE ST TL ALS 120Q
YHS	Tire Rear P265/75R16-114H BW R/PE ST TL AT "A" Temp
YJM	Tire Rear P265/70R17-113S WOL R/PE ST TL OOR
YJP	Tire Rear P265/70R17-113S BW R/PE ST TL OOR
YLP	Tire Rear LT245/75R16/E BW R/PE ST TL ALS 120Q/116S
YNF	Tire Rear P235/75R16-106S BW R/PE ST TL ALS
YNG	Tire Rear P235/75R16-106S WOL R/PE ST TL ALS
YNK	Tire Rear P245/75R16-109S BW R/PE ST TL ALS
YNL	Tire Rear P245/75R16-109S WOL R/PE ST TL ALS
YSS	Tire Rear P275/55R20-111S BW TL ST AL2
YVL	Tire Rear P265/70R17-113S BW R/PE ST TL ALS
YVM	Tire Rear P265/70R17-113S WOL R/PE ST TL ALS
YYK	Tire Rear LT215/85R16/D BL R/PE ST TL HWY
YYL	Tire Rear LT215/85R16/D BL R/PE ST TL OOR
Y91	Merchandised Package Luxury Edition
ZBX	Tire Spare LT245/75R16/C WOL R/PE ST TL OOR
ZCC	Tire Spare P255/70R16 BW R/PE ST TL ALS
ZCJ	Tire Spare P255/70R16 WOL R/PE ST TL ALS
ZCP	Tire Spare P255/70R16-109H BW R/PE ST TL ALS
ZEC	Tire Spare LT215/85R16/E BW R/PE ST TL HWY
ZEF	Tire Spare LT215/85R16/E BW R/PE ST TL OOR
ZER	Tire Spare LT265/75R16/E BW R/PE ST TL OOR (123/120Q)
ZGC	Tire Spare P265/75R16-114S BW R/PE ST TL AT

RPO	Description
ZGD	Tire Spare P265/75R16-114S WOL R/PE ST TL AT
ZGK	Tire Spare LT245/75R16/E BW R/PE ST TL OOR 120Q
ZHH	Tire Spare LT245/75R16/E BW R/PE ST TL ALS 120Q
ZHS	Tire Spare P265/75R16-114H BW R/PE ST TL AT "A" Temp Rating
ZLP	Tire Spare LT245/75R16/E BW R/PE ST TL ALS 120/116S
ZNF	Tire Spare P235/75R16-106S BW R/PE ST TL ALS
ZNG	Tire Spare P235/75R16-106S WOL R/PE ST TL ALS
ZNK	Tire Spare P245/75R16-109S BW R/PE ST TL ALS
ZNL	Tire Spare P245/75R16-109S WOL R/PE ST TL ALS
ZW9	Body Equipment, Base Body or Chassis
ZX3	Chassis Package Manual Select Damping
ZYK	Tire Spare LT215/85R16/D BL R/PE ST TL HWY
ZYL	Tire Spare LT215/85R16/D BL R/PE ST TL OOR
ZY1	Color Combination, Solid
ZY2	Color Combination, 2-Tone
Z49	Export Canadian Modification Mandatory Base Equipment
Z5X	Mirror Provisions Arabic Language
Z60	Chassis Package High Performance
Z71	Chassis Package "Off Road"
Z75	Conversion Name Plate Cadillac
Z82	Trailer Provisions Special Equipment, H. D.
Z83	Chassis Package Solid Smooth Ride
Z85	Chassis Package Increased Capacity
Z88	Conversion Name Plate GMC
01L	Secondary Color Exterior, Special (96)
01U	Primary Color Exterior, Special (02)

Technical Information

Maintenance and Lubrication

Capacities - Approximate Fluid

Application	Specification	
	Metric	English
Axle Capacities		
Front Drive Axle (8.25")	1.43 liters	1.51 quarts
Front Drive Axle (9.25")	1.73 liters	1.83 quarts
Rear Drive Axle (8.6")	2.03 liters	2.15 quarts
Rear Drive Axle (9.5")	2.6 liters	2.75 quarts
Rear Drive Axle (9.75")	2.84 liters	3.00 quarts
Rear Drive Axle (10.5")	2.6 liters	2.75 quarts
Rear Drive Axle (11.5")	3.0 liters	3.17 quarts
Engine Cooling System		
4.3L (VIN W) Automatic Transmission	14.0 liters	15.0 quarts
4.3L (VIN W) Manual Transmission	14.0 liters	15.0 quarts
4.8L (VIN V) Automatic Transmission	14.0 liters	15.0 quarts
4.8L (VIN V) Manual Transmission	15.0 liters	15.5 quarts
5.3L (VIN T)	12.7 liters	15.0 quarts
6.0L (VIN V) Automatic Transmission	14.0 liters	14.8 quarts
6.0L (VIN V) Automatic Transmission with Optional Engine Oil Cooler	15.5 liters	16.0 quarts
6.0L (VIN V) Manual Transmission	14.4 liters	15.2 quarts
6.0L (VIN V) Manual Transmission with Optional Engine Oil Cooler	15.5 liters	16.0 quarts
6.6L (VIN 1) Manual Transmission	19.5 liters	20.7 quarts
6.6L (VIN 1) Automatic Transmission	19.2 liters	20.3 quarts
8.1L (VIN G) Manual Transmission	20.0 liters	21.1 quarts
8.1L (VIN G) Automatic Transmission	19.6 liters	20.7 quarts
Engine Crankcase		
4.3L (VIN X) with Filter (RPO LU3)	4.3 liters	4.5 quarts
4.8L (VIN V) with Filter (RPO LR4)	5.7 liters	6.0 quarts
5.3L (VIN T) with Filter (RPO LM7)	5.7 liters	6.0 quarts
6.0L (VIN U) with Filter (RPO LQ4)	5.7 liters	6.0 quarts
6.0L (VIN N) with Filter (RPO LQ9)	5.7 liters	6.0 quarts
6.6L (VIN 1, 2) with Filter (RPO LB7)	9.5 liters	10.0 quarts
6.6L (VIN --) (RPO LLY)	9.5 liters	10.0 quarts
8.1L (VIN G) with Filter (RPO L18)	6.1 liters	6.5 quarts
Transmission		
4L60-E 4 Spd. HMD Auto Pan Removal	4.7 liters	5.0 quarts
4L60-E 4 Spd. HMD Auto After Complete Overhaul	10.6 liters	11.2 quarts
4L80-E Auto Pan Removal (MT1)	7.3 liters	7.7 quarts
4L80-E Auto (MT1) After Complete Overhaul	12.8 liters	13.5 quarts
5 Spd. Auto Allison Fluid and Filter Change (M74)	7.0 liters	7.4 quarts
5 Spd. Auto Allison (M74) After Complete Overhaul	12.0 liters	12.7 quarts
New Venture Gear 3500 Manual Transmission	2.3 liters	2.4 quarts
New Venture Gear 4500 Manual Transmission	3.8 liters	4.0 quarts
6 Spd. Manual (ZF) (ML6)	6.0 liters	6.3 quarts

Application	Specification	
	Metric	English
Fuel Tank		
Short Bed Models and 1500 Crew Cab	98.0 liters	26 gallons
Long Bed Models	136.0 liters	36.0 gallons
4 Door Utility	98.4 liters	26.0 gallons
XL (1500 Series)	123.0 liters	32.5 gallons
XL (2500 Series)	147.6 liters	38.5 gallons
Chassis Cab (Single Tank)	128.0 liters	34.0 gallons
Fuel Tank - Federal		
Chassis Cab (Standard Side Tank)	102.2 liters	27.0 gallons
Chassis Cab (Optional Rear Tank)	87.0 liters	23.0 gallons
Fuel Tank - California		
Chassis Cab (Standard Side Tank)	91.0 liters	24.0 gallons
Chassis Cab (Rear Tank)	102.2 liters	23.0 gallons
Chassis Cab (Optional Rear Tank)	102.2 liters	27.0 gallons
Fuel Tank - Diesel		
Chassis Cab (Standard Side Tank)	102.2 liters	27.0 gallons
Chassis Cab (Optional Rear Tank)	87.0 liters	23.0 gallons
Transfer Case		
Borg Warner 4482 (NR4)	1.4 liters	1.5 quarts
New Venture Gear 149 (NP3)	2.1 liters	22.2 quarts
New Venture Gear 246 (NP8)	1.9 liters	2.0 quarts
New Venture Gear 261 (NP2)	1.9 liters	2.0 quarts
New Venture Gear 263 (NP1)	1.9 liters	2.0 quarts

Maintenance Items

Usage	Type/Part Number
Oil Filter	
4.3L V6 (VIN X)	AC Delco/PF47
4.8L V8 (VIN V)	AC Delco/PF44
5.3L V8 (VIN Z, T)	AC Delco/PF44
6.0L V8 (VIN U, N)	AC Delco/PF44
8.1L V8 (VIN G)	AC Delco/PF454
6.6L V8 Diesel (VIN 1)	AC Delco/PF2232
Engine Air Cleaner/Filter	
4.3L V6 (VIN X)	AC Delco/A1519C
4.8L V8 (VIN V)	AC Delco/A1519C
5.3L V8 (VIN Z, T)	AC Delco/A1519C
6.0L V8 (VIN U, N)	AC Delco/A1518C
8.1L V8 (VIN G)	AC Delco/A1518C
6.6L V8 Diesel (VIN 1)	AC Delco/A1618C
Passenger Compartment Air Filter Kit	
4.3L V6 (VIN X)	GM Part/52485513
4.8L V8 (VIN V)	GM Part/52485513
5.3L V8 (VIN Z, T)	GM Part/52485513
6.0L V8 (VIN U, N)	GM Part/52485513
8.1L V8 (VIN G)	GM Part/52485513
6.6L V8 Diesel (VIN 1)	--

Usage	Type/Part Number
PCV Valve	
4.3L V6 (VIN X)	AC Delco/CV769C
4.8L V8 (VIN V)	AC Delco/CV948C
5.3L V8 (VIN Z, T)	AC Delco/CV948C
6.0L V8 (VIN U, N)	AC Delco/CV948C
8.1L V8 (VIN G)	AC Delco/CV948C
6.6L V8 Diesel (VIN 1)	--
Spark Plugs	
4.3L V6 (VIN X)	AC Delco/41-932
4.8L V8 (VIN V)	AC Delco/41-985
5.3L V8 (VIN Z & T)	AC Delco/41-985
6.0L V8 (VIN U & N)	AC Delco/41-985
8.1L V8 (VIN G)	AC Delco/41-985
Fuel Filter	
4.3L V6 (VIN X)	AC Delco/GF626
4.8L V8 (VIN V)	AC Delco/GF626
5.3L V8 (VIN Z & T)	AC Delco/GF626
6.0L V8 (VIN U & N)	AC Delco/GF626
8.1L V8 (VIN G)	AC Delco/GF626
6.6L V8 (VIN 1)	GM P/N 97256734
Wiper Blades	ITTA/56.0 cm (22 in)

Fluid and Lubricant Recommendations

Usage	Fluid/Lubricant
Automatic Transfer Case (NP8 Only)	AUTO-TRAK® II Fluid GM P/N 12378508 (Canadian P/N 10953626)
Engine Oil	Engine oil with the American Petroleum Institute Certified For Gasoline Engines STARBURST symbol of the proper viscosity.
Engine Oil (Diesel Engine)	Engine oil with the letters CH-4 or CG-4 is best for this vehicle. The CH-4 or CG-4 designation may appear either alone, or in combination with other API designations, such as API CH-4/SJ, CG-4/SH or CH-4/CG-4/SJ. These letters show American Petroleum Institute (API) level of quality.
Engine Coolant	50/50 mixture of clean drinkable water and use only GM Goodwrench® DEX-COOL® or Havoline® DEX-COOL® coolant
Hydraulic Brake System	Delco Supreme 11® Brake Fluid GM P/N 12377967 (Canadian P/N 992667) or equivalent DOT-3 brake fluid
Windshield Washer Solvent	GM Optikleen ® Washer Solvent GM P/N 1051515 (Canadian P/N 993033) or equivalent
Hydraulic Clutch System (5-Speed Trans.)	Hydraulic Clutch Fluid GM P/N 12345347 (Canadian P/N 10953517) or equivalent DOT-3 brake fluid
Hydraulic Clutch System (6-Speed Trans.)	Hydraulic Clutch Fluid GM P/N 88958860 (Canadian P/N 88901244)
Power Steering System	GM Power Steering Fluid GM P/N 1052884 - 1 pint, 1050017 - 1 quart, (Canadian P/N 993294 - 1 pint, 993353 - 1 quart) or equivalent
Manual Transmission (5-Speed with Low Gear, RPO MW3)	GM Goodwrench Synthetic Manual Transmission Fluid GM P/N 12346190 (Canadian P/N 10953477) or equivalent SAE 75W-85 GL-4 gear oil
Manual Transmission (5-Speed without Low Gear, RPO MG5)	Synchromesh Transmission Fluid GM P/N 12345349 (Canadian P/N 10953465) or equivalent

Usage	Fluid/Lubricant
Manual Transmission (6-Speed)	TransSynd ™ Synthetic Automatic Transmission Fluid GM P/N 12378515 (Canadian P/N 88900701)
Automatic Transmission	DEXRON®-III, Automatic Transmission Fluid
Key Lock Cylinders	Multi-Purpose Lubricant, Superlube® GM P/N 12346241 (Canadian P/N 10953474) or equivalent
Floor Shift Linkage	Lubriplate® Lubricant Aerosol GM P/N 1052349 (Canadian P/N 992723) or equivalent or lubricant meeting requirements of NLGI # 2 Category LB or GC-LB
Chassis Lubrication	Chassis Lubricant GM P/N 12377985 or equivalent or lubricant meeting requirements of NLGI # 2 Category LB or GC-LB
Front Axle	SAE 80W-90 Axle Lubricant GM P/N 1052271 (Canadian P/N 10950849) or equivalent
Rear Axle	SAE 75W-90 Synthetic Axle Lubricant GM P/N 12378261 (Canadian P/N 10953455) or equivalent meeting GM Specification 9986115
Rear Axle (with QS4 Axle Only)	SAE 75W-90 Synthetic Axle Lubricant GM P/N 12378557 (Canadian P/N 88901362) or equivalent
Manual Transfer Case (NP1, NP2, and NP3)	DEXRON®-III Automatic Transmission Fluid
Front Axle Propshaft Spline or One-Piece Propshaft Spline (Two-Wheel Drive with Auto. Trans.)	Spline Lubricant, Special Lubricant GM P/N 12345879 (Canadian P/N 10953511) or lubricant meeting requirements of GM 9985830
Rear Drive line Center Spline	Chassis Lubricant GM P/N 12377985 or equivalent or lubricant meeting requirements of NLGI # 2, Category LB or GC-LB
Hood Hinges	Multi-Purpose lubricant, Superlube ® GM P/N 12346241 (Canadian P/N 10953474) or equivalent
Body Door Hinge Pins, Tailgate Hinge and Linkage, Folding Seat and Fuel Door Hinge	Multi-Purpose lubricant, Superlube® GM P/N 12346241 (Canadian P/N 10953474) or equivalent
Outer Tailgate Handle Pivot Points, Hinges, Latch Bolt and Linkage	Multi-Purpose lubricant, Superlube® GM P/N 12346241 (Canadian P/N 10953474) or equivalent
Weatherstrip Conditioning	Dielectric Silicone Grease GM P/N 12345579 (Canadian P/N 1974984) or equivalent
Weatherstrip Squeaks	Synthetic Grease with Teflon, Superlube® GM P/N 12371287 (Canadian P/N 10953437) or equivalent

GM Oil Life System - Resetting

The engine oil life monitor will indicate when to change the engine oil - usually between 5 000 km (3,000 miles) and 16 000 km (10,000 miles) since the last oil change. Under severe conditions, the CHANGE OIL SOON light may be displayed before 5 000 km (3,000 miles). The vehicle must not be driven more than 16 000 km (10,000 miles) or 12 months without an oil change.

Reset the oil life monitor when the oil has been changed, use the following procedure.

1. Turn the ignition key to the RUN position.
2. Fully push and release the accelerator pedal 3 times within 5 seconds.
3. If the Change Oil Soon light flashes, the system is resetting.
4. Start the vehicle.
5. The oil life will change to 100%.
6. If the Change Oil Soon light comes back on, the system has not reset. Repeat the procedure.

Descriptions and Operations

Power Steering System

Without Electro-Hydraulic Steering

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

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

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

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

- A recirculating ball system
- A rack and pinion system

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

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

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

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

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

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

With Electro-Hydraulic Steering

The electro-hydraulic power steering (EHPS) module controls the power steering motor which has the function of providing hydraulic power to the brake booster and the steering gear. A secondary function includes the ability to improve fuel economy by operating on a demand basis and the ability to provide speed-dependent variable-effort steering.

The EHPS module controls the EHPS powerpack, an integrated assembly consisting of the following components:

- The electric motor
- The hydraulic pump
- The fluid reservoir
- The reservoir cap
- The reservoir baffles, if required
- The fluid level sensor, if required
- The electronic controller
- The electrical connectors

EHPS Module

The elector-hydraulic power steering (EHPS) module shall interface with the vehicle electrical subsystem to provide connections for the +36-volt (nominal) power supply, for signal inputs necessary to control the EHPS module output and for serial communications. If the 125 A EHPS fuse or the +36-volt circuit supplying the EHPS module is open, the EHPS system will not operate and only communication codes will be set by modules which communicate with the EHPS module. The powertrain control module (PCM) shall act as the gateway to translate controller area network (CAN) messages into class 2 messages when required for diagnostic purposes.

The EHPS module shall receive the following messages from the CAN bus:

- Vehicle speed (direct signal in km/h)
- Service disconnect status
- PRNDL (shift lever) position
- Torque converter clutch (TCC)/Cruise Dump signal (gives zero-adjust brake switch position)

The EHPS module shall output the following messages to the CAN bus:

- Brake pedal rate, position, in-range rationality, and out-of-range diagnosis
- EHPS system status
- Diagnostic messages to driver information center (DIC) via hybrid control module (HCM)
- Diagnostic information requested by service technicians via Tech 2 link (class 2 via PCM)
- Steering wheel sensor diagnostic message (in-range, out-or-range failure)

The EHPS module receives several hardwire signals. Digital steering wheel speed signals from the steering wheel sensor mounted on the steering column and an analog brake pedal position signal from the brake-pedal mounted brake pedal position (BPP) sensor .

The steering wheel speed sensor outputs 3 digital signals characterizing the steering wheel position. The digital output consist of 3 open collector output data lines referred to as phase A, phase B, and Index. The normal operating range of the digital signals is plus or minus 720 degrees of steering wheel rotation. Phase A and phase B are 90 degrees out of phase to provide quadrature pulsed data corresponding to steering shaft rotational displacement and direction. The signal is resolved to within 1 mechanical degree of resolution. The index output references a steering wheel mechanical position of 0° plus or minus 10 degrees (steering wheel centered) and is repeated every 360 degrees of steering wheel rotation.

The BPP sensor outputs an analog signal, referenced to 5 volts, which may increase or decrease monotonically with brake pedal depression. The sensor analog output shall have a specified electrical output over a mechanical range of 32 degrees (rotation of the brake pedal pivot). Out-of-range values will

be provided outside of the 32 degrees range. The electrical range of the BPP sensor motion is -55 degrees to +25 degrees . The mechanical range of the BPP sensor is -70 degrees to +40 degrees.

The EHPS module also receives ignition key position signals. These signals are the ignition signal and the accessory signal. The EHPS module receives an ignition input (ignition 1) on the 24-way signal connector. Ignition signal logic is defined as follows:

- When the ignition switch is in the RUN or CRANK positions, then Ignition 1 = high, greater than 6 volts for more the 50 milliseconds.
- When the ignition switch is in the LOCK/OFF or ACCY positions, then Ignition 1 = low, less than 3 volts for more than 0.5 milliseconds.

The EHPS module receives an input from the ignition 0 circuit indicating when the key is in the ACCY position. This input has 2 functions, to provide an independent wake-up signal in the event of loss of the ignition input, and to activate the EHPS module when the key remains in the ACCY position. The ACCY signal logic is defined as follow:

- When the ignition switch is in the ACC or RUN positions, then Ignition 0 = high, greater than 6 volts for more than 50 milliseconds.
- When the ignition switch is in the LOCK/OFF or CRANK positions, the Ignition 0 = low, less than 3 volts for more than 5 milliseconds.

The EHPS module will function normally when the voltage at the EHPS connector is in the range of 34-50 volts. If the supply voltage at the EHPS connector drops below 18 volts for more than 10 ms, the EHPS module shall go into the Standby mode (power stage turned OFF). Once the supply voltage rises above 22 volts again, the power stage shall be turned back ON without a key cycle being required. If the supply voltage drops below 12 volts, the EHPS module drivers shall shut down and a key cycle will be required to reset. The EHPS module shall withstand voltage up to a transient voltage of 58 volts for 400 milliseconds. If the supply voltage exceeds 55 volts, the EHPS module drivers shall shut down and a key cycle will be required to reset.

EHPS system performance may be reduced with power steering fluid temperature change. The temperature range at which full performance is achieved is approximately -20 to +105°C (-4 to +220°F). The EHPS system performance will be affected as follows:

- At approximately less than -40°C (-40°F), the system will be disabled.
- At approximately -40 to -29°C (-40 to -20°F), the hydraulic output power reduction less than 50 percent.
- At approximately -29 to -20°C (-20 to -4°F), the hydraulic output power reduction less than 20 percent.
- At approximately -20 to +105°C (-4 to +221°F), the hydraulic output power is at full performance.
- At approximately 105-135°C (220-275°F), the hydraulic output power reduction less than 20 percent.
- At approximately greater than 135°C (275°F), the system will be disabled.

EHPS system performance may also be reduced with voltage change. The voltage range at which full performance is achieved is approximately 34-50 volts. The EHPS system performance will be affected as follows:

- At approximately less than 18 volts, the EHPS system will be disabled.
- At approximately 18-33 volts, the EHPS system performance is reduced.
- At approximately 34-50 volts, the EHPS module will be at full performance.
- At approximately greater than 55 volts, the EHPS module will be disabled.

Whenever a replacement EHPS powerpack is installed, reprogramming is necessary. If the EHPS powerpack is not programmed, DTC C0564 will be set.

Steering Linkage (Non-Rack and Pinion)

The steering linkage consists of the following components:

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

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

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

Steering Wheel and Column

The steering wheel and column has 4 primary functions:

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

Vehicle Steering

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

Vehicle Security

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

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

Driver Convenience

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

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

Driver Safety

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

Rear Wheel Steering Description and Operation

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

- A steerable, solid hypoid rear axle.
- A steering wheel position sensor located at the base of the steering column.
- A rear wheel position sensor located below the rear wheel steering motor on the rear steering gear.
- An electric motor driven actuator.
- A rear wheel steering control module.
- A combined yaw rate sensor/ lateral accelerometer sensor.
- Three hall effect switches in the motor assembly.
- A mode select switch on the dash.
- A heavy duty wiring harness and fuse .
- A Service 4 Wheel Steer indicator in the IPC.
- A shorting relay in the rear wheel steering gear motor .
- A power relay in the rear wheel steering control module.

Rear Wheel Steering Control Module

The rear wheel steering control module controls all functions of the rear wheel steering system . The module has a dedicated power feed line from the under hood fuse holder. The fuse is a 125 amp mega fuse . The wiring is routed to the rear of the vehicle. The rear wheel steering control module is located above the rear mounted spare tire. The rear wheel steering control module uses the inputs listed above to determine when and how far to turn the rear wheels. The rear wheel steering control module also uses the hall switches in the steering gear motor , shorting relay , and motor control relay to monitor and control the direction and speed the motor operates. The rear wheel control module also controls the duty cycle of the phase leads to the motor . The motor control relay is part of the rear wheel steering control module and is not serviceable . The rear wheel steering control module uses both a class 2 and a discrete vehicle speed sensor signal . The system will not function without a discrete vehicle speed sensor signal . The rear wheel steering control module uses the 2 vehicle speed sensor signals for comparison purposes. The rear wheel steering control module uses inputs from the steering wheel position sensor to determine steering wheel position and rate of change. The rear wheel position sensor signals provide the rear wheel steering control module with rear wheel position data. The rear wheel steering control module will send out a class 2 message to the IPC to turn on and off the amber Service 4-Wheel Steering System Indicator. The rear wheel steering control module controls the indicators in the mode switch on the dash.

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

Important

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

Rear Wheel Steering Mode Switch

The mode switch located on the instrument panel allows the driver the option of selecting 2-wheel steering, 4-wheel steering, or 4-wheel steering tow operation. The mode switch also has indicators that show which mode the rear wheel steering system is in . When all indicators are lit the rear wheel steering control module has lost it's memory settings and the scan tool must be used to re-calibrate the rear wheel steering control module . When the indicators are flashing the rear wheel steering control module is waiting for the steering wheel to pass the center position before changing to the selected mode . The indicators on the mode switch are led's , the switch is also back lit .

The system operates in 3 principal modes, as follows:

2-Wheel Steer Mode

Normal steering operation; rear wheel steering is disabled while in this mode.

4-Wheel Steer Mode

The 4-wheel steering mode provides the 3 principal phases of steering: negative phase, neutral phase, and positive phase. In the negative phase the rear wheels turn opposite of the front wheels. In the neutral phase the rear wheels are centered and do not turn in or out. In the positive phase the rear wheels turn the same direction as the front wheels.

4-Wheel Steer Tow Mode

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

NOTE: There is also a cross-over speed. This is the speed that the control module transitions from a negative phase to a positive phase status. In 4-Wheel Steer mode, this transition occurs when the vehicle obtains a speed of 65 km/h (40 mph).

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

Rear Wheel Steering Gear Motor

The rear steering gear motor is a 3 phase, 6 pole brushless, DC motor. The rear wheel steering gear motor is located on the top of the rear steering gear. The motor transmits it's power through a planetary gear set inside the rear steering gear. There are 3 hall switches inside the motor, hall A, hall B, and hall C. They are not serviceable. There is a motor phase shorting relay located inside the motor assembly, it is not serviceable. The motor leads are not to be spliced or damaged in any way. If there is damage to the wiring the motor must be replaced. If there is any damage to the wiring it is possible for water to get inside the rear steering gear. The rear wheel steering control module uses the hall switch inputs to monitor motor position, speed, and direction.

Steering Wheel Position Sensor

The steering wheel position sensor inputs to the rear wheel steering control module consists of 3 digital input circuits. The steering wheel position sensor supply voltage is between 4.9-5.1 volts. Phase A and phase B circuits are digital pulse signals whose output represents one degree of steering wheel rotation. When observing the phase A and phase B data parameters on the scan tool, the parameters will not have the same value at the same time. When the steering wheel is rotated, the phase A and phase B data parameters will be shown as high or low on the scan tool. The marker pulse is a digital pulse that is displayed as high on the scan tool for 20 ° only when the steering wheel angle is between -10 and +10 °. The steering wheel position sensor analog signal voltage is at or near 2.5 volts with the wheels at center. Voltage increases/decreases for less than 1 full turn (+/- 225°) then plateaus for remainder of wheel travel.

Rear Wheel Steering Position Sensor

The rear wheel position sensor has 2 signal circuits: position 1 and position 2. Position 1 is a linear measurement of voltage per degree. The voltage range for position 1 is from 0.25 to 4.75 volts, and the

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

Combined Yaw Rate Sensor / Lateral Accelerometer Sensor

The combined yaw rate sensor / lateral accelerometer sensor is located under the passenger front seat . Yaw rate is a rotational force on a horizontal plane. Lateral acceleration is a measure of forward motion on a horizontal plane . The inputs to the rear wheel steering controller are bias compensated. This compensates for variations in manufacturing, temperature, and mounting. With the vehicle at rest the sensor should have a voltage output on both circuits of approximately 2.5 volts .

Steerable Rear Axle

The steerable rear axle has a rack and pinon mounted to the differential cover, and half shafts with upper and lower ball joints on movable hub and bearings assemblies . The rack is part of the differential cover. If a system malfunction occurs the rear wheels are moved back to center via an internal spring. The rack has redundant inner and outer tie rods ends . There are inner tie rod boots on the rack to prevent water and dirt from getting inside. Long term exposure to moisture due to a damaged boot or components can result in an internal malfunction. The rear wheel steering gear has the rear wheel steering gear motor attached to the upper rack . There are shields and a skid plate type shield on the rear axle assembly to protect the steering gear. There are no internal adjustments to the rack . It is mandatory to preform a 4 wheel alignment if any hard parts , such as tie rods or ball joints or wheel bearings are serviced . The axle assembly is a heavier duty version of the standard rear axle on a non rear wheel steer truck . You must consult the owners manual and the trailer towing guide for specific towing capacities . The carrier contains 9.74 inch ring and pinon gear set. The quarter shafts are a special heavy duty design with up to 15 ° of movement and a special designed CV joint and boot at the wheel end of the axle .

Suspension Description and Operation

Front Suspension

Coil Spring

The front suspension has 2 primary purposes:

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

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

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

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

lower control arms are allowed to pivot at the vehicle frame in a vertical fashion. The ball joint allows the steering knuckle to maintain the perpendicular relationship to the road surface.

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

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

Torsion Bar

The front suspension has 2 primary purposes:

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

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

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

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

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

Rear Suspension

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

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

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

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

- The rubber insulators
- The clamps
- The link assemblies

Selectable Ride Description and Operation

The selectable ride (SR) suspension system allows the driver to choose between 2 distinct damping levels, firm and normal.

The SR dampers are gas charged units which provide damping by forcing hydraulic fluid through internal orifices within each shock in order to resist suspension movement. Each shock contains an internal solenoid actuator that the SR switch controls. This solenoid actuator controls the size of the orifice that the hydraulic fluid is forced through, thus altering the ride characteristics of the vehicle.

Wheels and Tires

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Spare Tire Hoist Retaining Bolt	40 N·m	30 lb ft
Wheel Nuts	190 N·m	140 lb ft

General Description

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

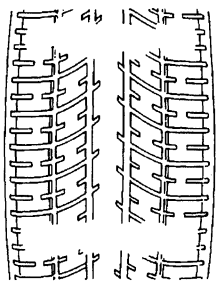
The following factors have an important influence on tire life:

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

The following factors increase tire wear:

- Heavy cornering
- Excessively rapid acceleration
- Heavy braking

Tread Wear Indicators Description



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

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

Metric Wheel Nuts and Bolts Description

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

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

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

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

Tire Inflation Description

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

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

Inspect the tire pressure when the following conditions apply:

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

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

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

Inflation Pressure Conversion (Kilopascals to PSI)

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

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

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

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

- A tire squeal on turns
- Hard steering

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

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

- Uneven braking
- Steering lead
- Reduced vehicle handling

Tire Description

Caution

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

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

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

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

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

The following is required of replacement tires:

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

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

- May seriously affect the ride.
- May seriously affect the handling.
- May seriously affect the speedometer/odometer calibration.
- May seriously affect the antilock brake system.
- May seriously affect the vehicle ground clearance.

- May seriously affect the trailering capacity.
- May seriously affect the tire clearance to the body.
- May seriously affect the tire clearance to the chassis.

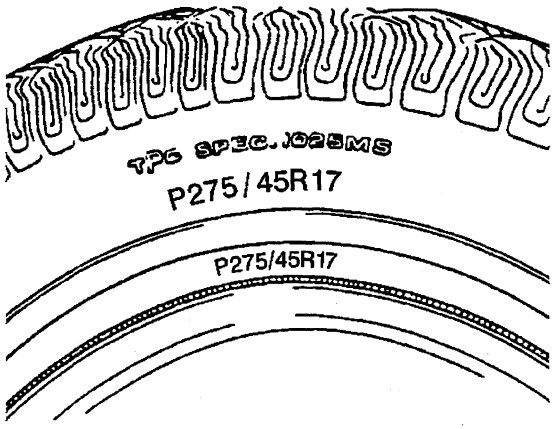
Conditions for Tire Replacement

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

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

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

All Seasons Tires Description

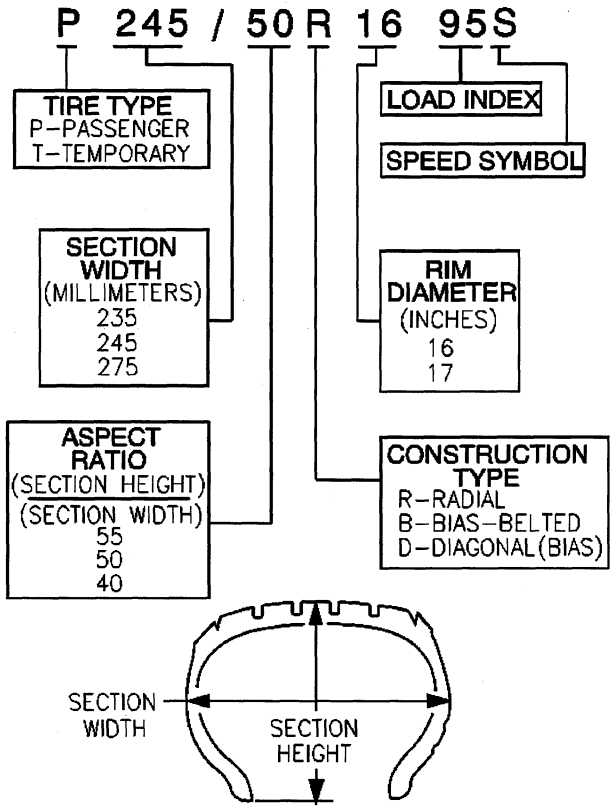


Most GM vehicles are equipped with steel belted all-season radial tires as standard equipment. These tires qualify as snow tires, with a higher than average rating for snow traction than the non-all season radial tires previously used. Other performance areas, such as wet traction, rolling resistance, tread life, and air retention, are also improved. This is done by improvements in both tread design and tread

compounds. These tires are identified by an M + S molded in the tire side wall after the tire size. The suffix MS is also molded in the tire side wall after the TPC specification number.

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

P-Metric Sized Tires Description



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

Driveline System Description and Operation

Driveline/Axle – Propeller Shaft

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

Front Propeller Shaft Description

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

One Piece Propeller Shaft Description

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

Two Piece Propeller Shaft Description

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

Propeller Shaft Phasing Description

The driveline components in this vehicle have been system balanced at the factory. System balance provides for a smoother running driveline. These components include the propeller shafts, drive axles, pinion shafts and output shafts. Affixed to the rear axle is a system balanced driveline notice indicating that the driveline components have been factory tested. The propeller shaft is designed and built with the yoke lugs/ears in line with each other. This produces the smoothest running shaft possible. A propeller shaft designed with built in yoke lugs in line is known as in -- phase. An out of phase propeller shaft often causes vibration. The propeller shaft generates vibration from speeding up and slowing down each time the universal joint goes around. The vibration is the same as a person snapping a rope and watching the wave reaction flow to the end. An in phase propeller shaft is similar to 2 persons snapping a rope at the same time and watching the waves meet and cancel each other out. A total cancellation of vibration produces a smooth flow of power in the drive line. All splined shaft slip yokes are keyed in order to ensure proper phasing.

Universal Joint Description

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

Center Bearing Description

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

Wheel Drive Shafts Description and Operation

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

- Front wheel drive shaft constant velocity joint outer joint.
- Front wheel drive shaft tri-pot joint inner joint.
- The front wheel drive shaft connects the front wheel drive shaft tri-pot joint and the front wheel drive shaft constant velocity joint.
- Wheel Drive Shaft Seal Cover 15 Series
- The front wheel drive shaft tri-pot joint is completely flexible, and moves with an in and out motion.
- The front wheel drive shaft constant velocity joint is flexible but can not move in and out.

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

Front Drive Axle Description and Operation

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

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

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

The front axle on Selectable Four Wheel Drive model vehicles uses a central disconnect feature in order to engage and disengage the front axle. When the driver engages the 4WD system, the Transfer Case Control Module sends a signal to the electric motor actuator to energize and extend the plunger inside. The extended plunger moves the clutch fork and clutch fork sleeve across the inner axle shaft and the clutch fork shaft and locks the two shafts together. The locking of the two shafts allows the axle to operate in the same manner as a semi-floating rear axle. A propeller shaft connects the transfer case to the front axle. The differential carrier assembly uses a conventional ring and pinion gear set to transmit the driving force of the engine to the wheels. The open differential allows the wheels to turn at different rates of speed while the axle continues to transmit the driving force. This prevents tire scuffing when going around corners and premature wear on internal axle parts. The ring and pinion set and the differential are contained within the carrier. The axle identification number is located on top of the differential carrier assembly or on a label on the bottom of the right half of differential carrier assembly. The drive axles are completely flexible assemblies consisting of inner and outer constant velocity CV joints protected by thermoplastic boots and connected by a wheel drive shaft.

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

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

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

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

Rear Drive Axle Description and Operation

Rear Axles for this vehicle consist of the following components:

- Differential Axle Housing
- Differential Carrier
- Right and left Axle tubes
- Right and left axle shafts

These axles are either Full-Floating or Semi-Floating. These axles can be identified as follows: The Semi-Floating Axle has axle shafts with C-Clips inside the differential carrier on the inner ends of the axle shafts. The Full-Floating Axle has bolts at the hub retaining the axle shafts to the hub assembly. The axles can be identified by the stamping on the right side axle tube They may also be identified by the ring gear size. The ring gear sizes include 8.60, 9.50, 9.75, 10.50 and 11.50 inch axles. The limited slip/locking differential information for these rear axles can be located in the limited slip/locking differential section.

A open differential has a set of four gears. Two are side gears and two are pinion gears. Some differentials have more than two pinion gears. Each side gear is splined to an axle shaft so each axle shaft ; so each axle shaft turns when it's 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 two 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 it's 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/Limited Slip Rear Axle Description and Operation

The locking differential consists of the following components:

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

- Differential pinion gears
- Differential pinion gear thrust washers

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

Limited-Slip Function

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

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

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

Locking Function

Locking action occurs through the use of some special parts:

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

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

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

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

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

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

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

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

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

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

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

Locking Differential Torque-Limiting Disc

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

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

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

Transfer Case - NVG 149-NP3 (One Speed Automatic)

The NVG 149 RPO NP3 is a single speed, single mode transfer case. The mode is full-time all wheel drive. It has a planetary differential gear set that splits the torque, normally 38 percent to the front wheels and 62 percent to the rear wheels.

The NVG 149 utilizes magnesium housings. Proper fasteners, brackets, and fill/drain plugs must be used to prevent galvanic corrosion. The planetary differential uses the carrier as the input. The annulus gear (4) connects to the rear output shaft and rear wheels. The sun gear connects to the front output shaft and front wheels through the chain and sprockets. The viscous coupling consists of a sealed housing filled with a high viscosity silicone fluid and thin steel plates alternately splined to the inner and outer drum. The inner drum is connected to the input shaft, and the outer drum to the sun gear. Whenever there is a speed difference between the front and rear wheels, the inner and outer plates of the viscous coupling spin relative to each other and the silicone fluid provides resistance. The resistance was tuned to be high enough to bias power quickly to the wheels with traction, and low enough to prevent binding in a tight turn on dry surfaces. This is the most common way the viscous coupling is activated, the shear mode. If the speed difference is high, the coupling can lock or hump. This "hump" occurs when the heat generated, expands the fluid inside the housing, changing the fluid dynamics between the plates. This results in pressure between the plates, forcing them into contact with each other, similar to a clutch pack. In the hump mode, the coupling can bias torque 100 percent to one axle, if required. Situations requiring this are extreme such as backing up a steep gravel grade or climbing over off-road obstacles. The viscous coupling is not serviceable; it must be replaced if defective. This is because each viscous coupling is calibrated for optimum vehicle performance for both the shear and hump modes. If the viscous coupling is in the "hump" mode too long, severe damage will occur. To prevent damage to the viscous coupling, DO NOT:

- Tow with only two wheels down
- Drive without one propshaft
- Drive with a "donut" spare tire for an extended period of time

Transfer Case - NVG 261-NP2 (Two Speed Manual)

The New Venture Gear (NVG) 261, RPO NP2 transfer case is a two-speed, part-time with "mode shift-on-the-fly" capability. It has a chain driven front output shaft and an epicyclical low range planetary arrangement. The NVG 261 transfer case features a four position shift lever control located in the vehicle floor plan. As required, the operator can select 4HI position from 2HI "on-the-fly," as described in the owners manual. A dash 4WD lamp will continue flashing during shifting, until all criteria have been met and the new mode/range position has been reached. Once the new mode/range position is fully engaged and the front axle disconnect locks in, the dash light 4WD indicator lamp will remain ON constantly. Range shifting functions similarly, although it should be limited to speeds 8 km/h (5 mph) or less.

The four manual mode, or range gear positions, of the NVG 261 transfer case are:

- 2HI - 2 wheel drive high range
- 4HI - 4 wheel drive high range, part-time
- 4LO - 4 wheel drive low range, 2.72:1 gear ratio reduction
- N - Neutral, 4 wheel

When the ignition switch is placed in the run position and the 4WD shift lever is in the 4WD position, the transfer case switch closes, supplying a ground to the axle actuator control circuit. With the ground applied, the logic of the front axle actuator actuates a DC motor to engage the front axle and supply voltage to the axle switch signal circuit. The axle switch signal circuit notifies the powertrain control module (PCM) and the Anti-Lock Brake System that the vehicle is in the 4WD mode. The 4WD indicator is commanded on via a Class 2 serial data signal from the PCM. When the 4WD shift lever is in the 4WD low range position, the transfer case switch closes and supplies a ground on the 4WD low signal circuit. This informs the PCM that the vehicle transfer case is in low range. When the vehicle is in low range, the PCM changes the shift pattern of the automatic transmission.

During normal driving situations, the transfer case can operate in the 2WD mode. The driver may choose to select any of the mode/range gear positions while driving the vehicle. However, the transfer case should not be shifted into or out of 4LO unless the following criteria have been met:

- The automatic transmission is in neutral or the clutch pedal is depressed.
- The vehicle speed is less than 3 mph (5 km/h).

This transfer case also has a neutral position. A shift to the neutral position allows the vehicle to be towed without rotating the transmission output shaft. In the neutral position, the rear propeller shaft will rotate the transfer case rear output shaft, in turn rotating the oil pump, providing constant lubrication during towing. Note, this neutral position is a 4WD neutral, meaning the front and rear outputs of the transfer case are engaged as though in 4HI. With a disconnecting front axle, there is no power flow to the front wheels, allowing towing with the front wheels off the ground or flat towing without driveline binding. Again, the transfer case should not be shifted into or out of neutral unless the following criteria have been met:

- The automatic transmission is in neutral or the clutch pedal is depressed.
- The vehicle speed is less than 3 mph (5 km/h).

The NVG 261 transfer case is available in 5 variations, depending on the engine and transmission configurations. The variations allow the transfer case to handle different torque loads. When servicing the transfer case it is important to understand which variation is being serviced because of the difference in parts.

There are some product improvement changes being released during the model year. The early production transfer case has a separate cup plug and a needle bearing in the input gear. The later production transfer case has a new input gear and uses a cup plug style bearing. The oil pump on the LD, HD1, and HD2 version is being changed to be the same as the SHD version. This oil pump change also includes a new rear output shaft. When servicing an early release model, only the later release parts will be available.

NVG 261 Variations

Model	Transmission	Input Gear	Output Shaft	Chain Size	Hi/Low Planetary	Application
Light Duty (LD)	M30 - 4L60E	27T Spline	32T Spline	3/8 X 1.25 in	4 Pinion	K1
Light Duty (LD)	MG5 - NV 3500	32T Spline	32T Spline	3/8 X 1.25 in	4 Pinion	K1
Heavy Duty 1 (HD1)	MT1 - 4L80E MW3 - NV 4500	32T Spline	32T Spline	3/8 X 1.5 in	6 Pinion	K2 Non Heavy Duty
Heavy Duty 2 (HD2)	MT1 - 4L80E MW3 - NV 4500	32T Spline	32T Spline	7/16 X 1.5 in	6 Pinion	K2 Heavy Duty
Super Heavy Duty (SHD)	ML6 - ZF S6-650 M74 - Allison	29T Spline	31T Spline	7/16 X 1.5 in	6 Pinion	K3

The HD2 and the SHD model share many of the same components but the increased torque capacity of the SHD requires a double row input bearing, larger diameter rear output shaft, rear output shaft bearing higher capacity, larger rear seal, case halves machined differently, and a different speed reluctor wheel.

Transfer Case - NVG 263-NP1 (Two Speed Selectable)

The NVG 263 transfer case features a three button shift control switch located on the instrument panel. When the vehicle has the ignition key in the RUN position, the transfer case shift control module starts monitoring the transfer case shift control switch to determine if the driver desires a new mode/gear position. At a single press of the transfer case shift control switch, the lamp of the new desired position will begin flashing to inform the driver that the transfer case shift control module has received the request for a new mode/gear position. The lamp will continue to flash until all shifting criteria has been met and the new mode/gear position has been reached (or has been engaged). Once the new mode/gear position is fully active, the switch indicator lamp for the new position will remain ON constantly.

The NVG 263 transfer case provides the driver with 3 manual mode/gear positions:

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

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

- The engine is running.
- The automatic transmission is in Neutral - clutch depressed on manual transmissions.
- The vehicle speed is below 3 MPH.

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

- The engine is running.
- The automatic transmission is in Neutral (clutch depressed on manual transmissions).
- The vehicle speed is below 3 MPH.
- The transfer case is in 2HI mode.

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

View the list of major components that make up the automatic transfer case (ATC) system below.

Front Axle Actuator

The front axle actuator engages and disengages the front axle. The front axle actuator consists of a Permanent Magnetic (PM) motor, a worm gear controlled plunger, a front axle switch and an electronic control circuit. Whenever a shift to 4HI, or 4LO is requested, the transfer case shift control module

engages the front axle by grounding the axle actuator control circuit through a current limiting driver. The front axle actuator also sends a signal to the PCM indicating when the 4WD is engaged.

Transfer Case Shift Control Module

The transfer case shift control module uses the VIN information for calculations that are required for the different calibrations used based on axle ratio, transmission, tire size, and engine. The system does not know which calibration to use without this information. This information is provided to the transfer case shift control module via Class 2 data bus from the powertrain control module (PCM).

Transfer Case Encoder Motor

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

Transfer Case Encoder

The encoder is mounted to the transfer case encoder motor assembly and is replaced only as an assembly. The encoder converts the sector shaft position (representing a mode or range) into electrical signal inputs to the transfer case shift control module. The module detects what position the transfer case is in by monitoring the 4 encoder channels (P, A, B, and C). These inputs translate into 2HI, 4HI, NEUTRAL, and 4LO or whether the motor is still in transition between gears.

The transfer case encoder channel circuits may be monitored using a scan tool.

Vehicle Speed Sensor

There is a vehicle speed sensor mounted to the transfer case on the rear output shaft. The speed sensor is a permanent magnet (PM) generator. The PM generator produces a AC voltage. The AC voltage level and number of pulses increases as speed increases. The VSS is an input to the powertrain control module (PCM). The PCM sends this information to the transfer case shift control module via the Class 2 serial data bus.

SERVICE Indicator (4WD) Lamp

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

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

The New Venture Gear model NVG 246 RPO NP8 transfer case is a two speed automatic, active, transfer case. The NVG 246 transfer case has many changes from prior years. The NVG 246 is now classified as an Electronic Architect Upgrade (EAU). The upgrades to the NVG 246 EAU include some of the following internal changes:

- A new encoder motor for faster operation in the AWD mode.
- The control actuator lever (3) is a new design with different cam angles.
- The shift detent plunger and spring is no longer used.
- The clutch assembly (1) uses a new style return spring and clutch washer.
- A new rear output shaft (2) no longer uses a retaining ring by the oil pump.
- The range shift fork (4) is a newer design.

The NVG 246 EAU provides 5 modes, Auto 4WD, 4HI, 4LO, 2HI and Neutral. The Auto 4WD position allows the capability of an active transfer case, which provides the benefits of on-demand torque biasing wet clutch and easy vehicle tuning through software calibrations. The software calibrations allow more

features such as flexible adapt ready position and clutch preload torque levels. The technology allows for vehicle speed dependent clutch torque levels to enhance the performance of the system. For example, the system is calibrated to provide 0-5 ft lb of clutch torque during low speed, low engine torque operation, and predetermined higher torque for 40 km/h (25 mph) and greater. This prevents crow-hop and binding at low speeds and provides higher torque biases at higher vehicle speeds, in order to enhance stability.

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

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

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

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

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

- The engine is running.
- The automatic transmission is in Neutral.
- The vehicle speed is below 5 km/h (3 mph).

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

- The engine is running.
- The automatic transmission is in Neutral.
- The vehicle speed is below 5 km/h (3 mph).
- The transfer case is in 2HI mode.

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

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

There are two versions of the NVG 246 EAU, which depend on the transmission applications and vehicle applications. If the vehicle is equipped with a transmission RPO M30, the transmission splines in the input gear will have 27 teeth. With this application the planetary carrier assembly will have 4 pinion gears. If the

vehicle is equipped with transmission RPO MT1 or MN8, the transmission splines in the input gear will have 32 teeth. The planetary carrier assembly on this application will have 6 pinion gears.

Braking System Description and Operation

Hydraulic Brake System Description and Operation

System Component Description

The hydraulic brake system consists of the following:

Hydraulic Brake Master Cylinder Fluid Reservoir

Contains supply of brake fluid for the hydraulic brake system.

Hydraulic Brake Master Cylinder

Converts mechanical input force into hydraulic output pressure.

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

Hydraulic Brake Pressure Balance Control System

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

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

Hydraulic Brake Pipes and Flexible Brake Hoses

Carries brake fluid to and from hydraulic brake system components.

Hydraulic Brake Wheel Apply Components

Converts hydraulic input pressure into mechanical output force.

System Operation

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

Brake Assist System Description and Operation

System Component Description

The brake assist system consists of the following:

Brake Pedal

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

Brake Pedal Pushrod

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

Vacuum Brake Booster

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

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

Vacuum Source

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

Vacuum Source Delivery System

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

System Operation

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

Disc Brake System Description and Operation

System Component Description

The disc brake system consists of the following components:

Disc Brake Pads

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

Disc Brake Rotors

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

Disc Brake Pad Hardware

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

Disc Brake Caliper Hardware

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

System Operation

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

Park Brake System Description and Operation

General Description

The park brake system consists of the following:

Park Brake Pedal Assembly

Receives and transfers park brake system apply input force from driver to park brake cable system.

Park Brake Release Handle Assembly

Releases applied park brake system when pulled.

Park Brake Cables

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

Park Brake Cable Equalizer

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

Threaded park brake cable equalizers are also used to remove slack in park brake cables.

Park Brake Apply Lever

Multiplies and transfers input force to park brake actuator.

Park Brake Actuator/Adjuster

Uses multiplied input force from apply lever to expand park brake shoe toward the friction surface of the drum-in-hat portion of the rear brake rotor.

Threaded park brake actuators are also used to control clearance between the park brake shoe and the friction surface of the drum-in-hat portion of the rear brake rotor.

Park Brake Shoe

Applies mechanical output force from park brake actuator to friction surface of the drum-in-hat portion of the rear brake rotor.

System Operation

Park brake apply input force is received by the park brake pedal assembly being depressed, transferred and evenly distributed, through the park brake cables and the park brake cable equalizer, to the left and right park brake apply levers. The park brake apply levers multiply and transfer the apply input force to the park brake actuators which expand the park brake shoe toward the friction surface of the drum-in-hat portion of the rear brake rotor in order to prevent the rotation of the rear tire and wheel assemblies. The park brake release handle assembly releases an applied park brake system when it is pulled rearward.

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 – 4.3L

General Specifications

Application	Specification	
	Metric	English
General		
• Engine Type	90 degree V6	
• Displacement	4.3 L	262 CID
• RPO	LU3	
• VIN	X	
• 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
Balance Shaft		
• Bearing Journal Diameter - Rear	38.085-38.100 mm	1.4994-1.500 in
• Bushing Bore Diameter - Rear	0.050-0.088 mm	0.0020-0.0035 in
Block		
• Crankshaft Main Bearing Bore Out-of-Round	0.050 mm	0.002 in
• Cylinder Bore Diameter	101.618-101.643 mm	4.0007-4.0017 in
• Cylinder Bore Out-of-Round - Production	0.017 mm	0.0007 in
• Cylinder Bore Out-of-Round - Service	0.05 mm	0.002 in
• Cylinder Bore Taper - Production Relief Side	0.025 mm	0.0010 in
• Cylinder Bore Taper - Production Thrust Side	0.012 mm	0.0005 in
• Cylinder Bore Taper - Service	0.025 mm	0.0010 in
• Cylinder Head Deck Surface Flatness	0.050-0.152 mm	0.002-0.006 in
Camshaft		
• Camshaft End Play	0.0254-0.2286 mm	0.0010-0.0090 in
• Camshaft Journal Diameter	47.440-47.490 mm	1.8677-1.8696 in
• Camshaft Journal Out-of-Round	0.025 mm	0.001 in
• Camshaft Lobe Lift - Exhaust	7.20-7.30 mm	0.283-0.287 in
• Camshaft Lobe Lift - Intake	6.97-7.07 mm	0.274-0.278 in
• Camshaft 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 Side Clearance	0.15-0.44 mm	0.006-0.017 in
Crankshaft		
• Connecting Rod Journal Diameter	57.116-57.148 mm	2.2487-2.2497 in
• Connecting Rod Journal Out-of-Round - Production	0.008 mm	0.0003 in
• Connecting Rod Journal Out-of-Round - Service	0.025 mm	0.0010 in
• Connecting Rod Journal Taper - Production	0.010 mm	0.0004 in
• Connecting Rod Journal Taper - Service	0.025 mm	0.0010 in
• Crankshaft End Play	0.050-0.20 mm	0.002-0.008 in
• Crankshaft Main Bearing Clearance #1 - Production	0.02-0.05 mm	0.0008-0.0020 in

Application	Specification	
	Metric	English
• Crankshaft Main Bearing Clearance #2, #3, and #4 - Production	0.028-0.058 mm	0.0011-0.0023 in
• Crankshaft Main Bearing Clearance #1 - Service	0.0254-0.05 mm	0.0010-0.0020 in
• Crankshaft Main Bearing Clearance #2, #3, and #4 - Service	0.025-0.063 mm	0.0010-0.0025 in
• Crankshaft Main Journal Diameter #1	62.199-62.217 mm	2.4488-2.4495 in
• Crankshaft Main Journal Diameter #2 and #3	62.191-62.215 mm	2.4485-2.4494 in
• Crankshaft Main Journal Diameter #4	62.179-62.203 mm	2.4480-2.4489 in
• Crankshaft Main Journal Out-of-Round - Production	0.005 mm	0.0002 in
• Crankshaft Main Journal Out-of-Round - Service	0.025 mm	0.0010 in
• Crankshaft Main Journal Taper	0.007 mm	0.0003 in
Exhaust Manifold		
• Surface Flatness - Flange to Flange	0.25 mm	0.010 in
• Surface Flatness - Individual Flange	0.05 mm	0.002 in
Intake Manifold		
• Surface Flatness	0.10 mm	0.004 in
Lubrication System		
• Oil Capacity for C/K, G/H with Filter	4.3 L	4.5 qt
• Oil Capacity for C/K, G/H without Filter	3.8 L	4 qt
• Oil Capacity for S/T, M/L with Filter	4.7 L	5 qt
• Oil Capacity for S/T, M/L without Filter	4.3 L	4.5 qt
• Oil Pressure - at 1,000 RPM	42 kPa	6 psi
• Oil Pressure - at 2,000 RPM	125 kPa	18 psi
• Oil Pressure - at 4,000 RPM	166 kPa	24 psi
Piston Rings		
• Piston Ring End Gap - First Compression Ring - Production	0.25-0.40 mm	0.010-0.016 in
• Piston Ring End Gap - Second Compression Ring - Production	0.38-0.58 mm	0.015-0.023 in
• Piston Ring End Gap - Oil Control Ring - Production	0.25-0.76 mm	0.010-0.029 in
• Piston Ring End Gap - First Compression Ring - Service	0.25-0.50 mm	0.010-0.020 in
• Piston Ring End Gap - Second Compression Ring - Service	0.38-0.80 mm	0.015-0.031 in
• Piston Ring End Gap - Oil Control Ring - Service	0.005-0.090 mm	0.0002-0.0035 in
• Piston Ring to Groove Clearance - First Compression Ring - Production	0.030-0.070 mm	0.0012-0.0027 in
• Piston Ring to Groove Clearance - Second Compression Ring - Production	0.076-0.280 mm	0.0030-0.0110 in
• Piston Ring to Groove Clearance - Oil Control Ring - Production	0.046-0.196 mm	0.0018-0.0077 in
• Piston Ring to Groove Clearance - First Compression Ring - Service	0.030-0.085 mm	0.0012-0.0033 in
• Piston Ring to Groove Clearance - Second Compression Ring - Service	0.030-0.085 mm	0.0012-0.0033 in
• Piston Ring to Groove Clearance - Oil Control Ring - Service	0.076-0.200 mm	0.0030-0.0079 in

Application	Specification	
	Metric	English
Pistons and Pins		
• Piston - Piston to Bore Clearance - Production	0.018-0.061 mm	0.0007-0.0024 in
• Piston - Piston to Bore Clearance - Service	0.075 mm	0.0029 in
• Pin - Piston Pin Clearance to Connecting Rod Bore - Press Fit	0.012-0.048 mm	0.0005-0.0019 in
• Pin - Piston Pin Clearance to Piston Pin Bore - Production	0.013-0.023 mm	0.0005-0.0009 in
• Pin - Piston Pin Clearance to Piston Pin Bore - Service	0.025 mm	0.0010 in
• Pin - Piston Pin Diameter	23.545-23.548 mm	0.9270-0.9271 in
Valve System		
• Valves - Valve Face Angle	45 degrees	
• Valves - Valve Seat Angle	46 degrees	
• Valves - Valve Seat Runout	0.05 mm	0.002 in
• Valves - Valve Seat Width - Intake	1.016-1.651 mm	0.040-0.065 in
• Valves - Valve Seat Width - Exhaust	1.651-2.489 mm	0.065-0.098 in
• Valves - Valve Stem Oil Seal Installed Height	1-2 mm	0.03937-0.07874 in
• Valves - Valve Stem-to-Guide Clearance - Intake - Production	0.025-0.069 mm	0.0010-0.0027 in
• Valves - Valve Stem-to-Guide Clearance - Intake - Service	0.025-0.094 mm	0.0010-0.0037 in
• Valves - Valve Stem-to-Guide Clearance - Exhaust - Production	0.025-0.069 mm	0.0010-0.0027 in
• Valves - Valve Stem-to-Guide Clearance - Exhaust - Service	0.025-0.094 mm	0.0010-0.0037 in
• Rocker Arms - Valve Rocker Arm Ratio	1.5:1	
• Valve Springs - Valve Spring Free Length	51.3 mm	2.02 in
• Valve Springs - Valve Spring Installed Height - Intake	42.92-43.43 mm	1.670-1.700 in
• Valve Springs - Valve Spring Installed Height - Exhaust	42.92-43.43 mm	1.670-1.700 in
• Valve Springs - Valve Spring Load - Closed	338-374 N @ 43.2 mm	76-84 lb @ 1.70 in
• Valve Springs - Valve Spring Load - Open	832-903 N @ 32.3 mm	187-203 lb @ 1.27 in

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accelerator Control Cable Bracket Nut to Stud	12 N·m	106 lb in
Accelerator Control Cable Bracket Nut to Throttle Body	9 N·m	80 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
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
Battery Cable Bracket Bolt to Oil Pan	12 N·m	106 lb in
Battery Negative Cable Bolt to Engine	25 N·m	18 lb ft
Battery Positive Cable Junction Block Bracket Bolt	25 N·m	18 lb ft
Belt Idler Pulley Bolt	50 N·m	37 lb ft
Camshaft Retainer Bolt	12 N·m	106 lb in

Application	Specification	
	Metric	English
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	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
Crossmember Bolt	100 N·m	74 lb ft
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 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 Idler Pulley Bolt	50 N·m	37 lb ft
Drive Belt Tensioner Bolt	50 N·m	37 lb ft
Engine Block Left Side Oil Gallery Plug	20 N·m	15 lb ft
Engine Block Left Rear Oil Gallery Plug	30 N·m	22 lb ft
Engine Block Right Rear Oil Gallery Plug	20 N·m	15 lb ft
Engine Block Coolant Drain Hole Plug	20 N·m	15 lb ft
Engine Block 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 Front Bracket Stud	35 N·m	26 lb ft
Engine Mount Bolt to Engine Bracket	50 N·m	37 lb ft
Engine Mount Engine Bracket Bolt to Engine	50 N·m	37 lb ft
Engine Mount Frame Bracket Through-bolt	75 N·m	55 lb ft
Engine Mount Frame Side Mount Bolt	65 N·m	50 lb ft
Engine Oil Level Sensor	13 N·m	115 lb in
Engine Oil Pressure Gage Sensor	30 N·m	22 lb ft
Engine Oil Pressure Gage Sensor Fitting - Plus Required Angle	15 N·m	11 lb ft
Engine Shield Bolt	20 N·m	15 lb ft
Engine Wiring Harness Bracket Bolt to Battery Positive Cable Junction Block Bracket	9 N·m	80 lb in
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 Stud	9 N·m	80 lb in
Engine Wiring Harness Bracket Nut to Intake Manifold Stud	12 N·m	106 lb in
Engine Wiring Harness Bracket Stud	25 N·m	18 lb ft
Engine Wiring Harness Clip Bolt	9 N·m	80 lb in

Application	Specification	
	Metric	English
Engine Wiring Harness Ground Nut	16 N·m	12 lb ft
Evaporative Emission (EVAP) Canister Purge Solenoid Valve Stud 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
Exhaust Manifold Heat Shield Bolt	9 N·m	80 lb in
Fan and Water Pump Pulley Bolt	25 N·m	18 lb ft
Frame Cross Bar Bolt	100 N·m	74 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 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 to Engine	20 N·m	15 lb ft
Generator and Drive Belt Tensioner Bracket Stud Nut	41 N·m	30 lb ft
Ground Wire Bolt to Rear of Left Side Cylinder Head	16 N·m	12 lb ft
Ground Wire Nut to Rear of Right Side Cylinder Head	16 N·m	12 lb ft
Heater Hose Bracket Bolt to Generator and Drive Belt Tensioner Bracket	25 N·m	18 lb ft
Hood Hinge Bolt	25 N·m	18 lb ft
Ignition Coil Stud	12 N·m	106 lb in
Junction Block Bracket Bolt	25 N·m	18 lb ft
Knock Sensor	25 N·m	18 lb ft
Lift Bracket Bolts	15 N·m	11 lb ft
Lower Intake Manifold Bolt		
• First Pass in Sequence	3 N·m	27 lb in
• Second Pass in Sequence	12 N·m	106 lb in
• Final Pass in Sequence	15 N·m	11 lb ft
Oil Cooler Pipe Bracket to Oil Pan Bolt	12 N·m	106 lb in
Oil Filter	30 N·m	22 lb ft
Oil Filter Adapter	55 N·m	41 lb ft
Oil Filter Fitting	55 N·m	41 lb ft
Oil Level Indicator Tube Bolt	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 Pan Skid Plate Bolt	20 N·m	15 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
Positive Battery Cable Clip Bolt	9 N·m	80 lb in
Positive Cable Generator Nut	18 N·m	13 lb ft
Power Steering Pump Bracket Bolt to Engine	41 N·m	30 lb ft
Power Steering Pump Bracket Stud to Engine	20 N·m	15 lb ft
Power Steering Pump Bracket Stud Nut	41 N·m	30 lb ft
Power Steering Pump Bolt	50 N·m	37 lb ft
Power Steering Pump Nut to Engine - Rear Bracket to Engine	41 N·m	30 lb ft
Power Steering Pump Rear Bracket Nut	50 N·m	37 lb ft
Secondary Air Injection (AIR) Check Valve Pipe Bracket Bolt to Exhaust Manifold	10 N·m	89 lb in
Secondary Air Injection (AIR) Check Valve Pipe Stud Nut	25 N·m	18 lb ft

Application	Specification	
	Metric	English
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 to Oil Pan Bolt	9 N·m	80 lb in
Throttle Body Stud	9 N·m	80 lb in
Torque Converter Bolt	63 N·m	47 lb ft
Transmission Bolt	50 N·m	37 lb ft
Transmission Cover Bolt	12 N·m	106 lb in
Transmission Oil Cooler Line Bracket	9 N·m	80 lb in
Transmission to Oil Pan Bolt	47 N·m	35 lb ft
Upper Intake Manifold Stud		
• First Pass	5 N·m	44 lb in
• Final Pass	9 N·m	80 lb in
Valve Lifter Pushrod Guide Bolt	16 N·m	12 lb ft
Valve Rocker Arm Bolt	30 N·m	22 lb ft
Valve Rocker Arm Cover Bolt	12 N·m	106 lb in
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.

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 Central Multipoint Flexible Injection system uses multiple fuel injectors to meter and distribute fuel to each engine cylinder. The Central (MFI) 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 (MFI) unit. The delivery tubes independently distribute fuel to each cylinder through injectors located at the port entrance of each manifold runner where the fuel is atomized.

Piston and Connecting Rod Assemblies

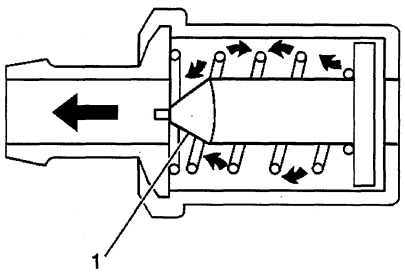
The cast aluminum pistons use two compression rings and one oil control assembly. The piston is a low friction, lightweight design with a flat top and barrel shaped skirt. The piston pins are offset 0.9 mm (0.0354 in) toward the major thrust side (right side) to reduce piston slap as the connecting rod 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.

Crankcase Ventilation System Description

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



The primary control is through the crankcase ventilation valve (1), which meters the flow at a rate depending on the manifold vacuum.

In order to maintain an idle quality, the crankcase ventilation valve restricts the flow when the intake manifold vacuum is high. If abnormal operating conditions arise, the system is designed in order to allow the excessive amounts of blow-by gases to back flow through the crankcase vent tube into the air cleaner in order to be consumed by normal combustion.

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

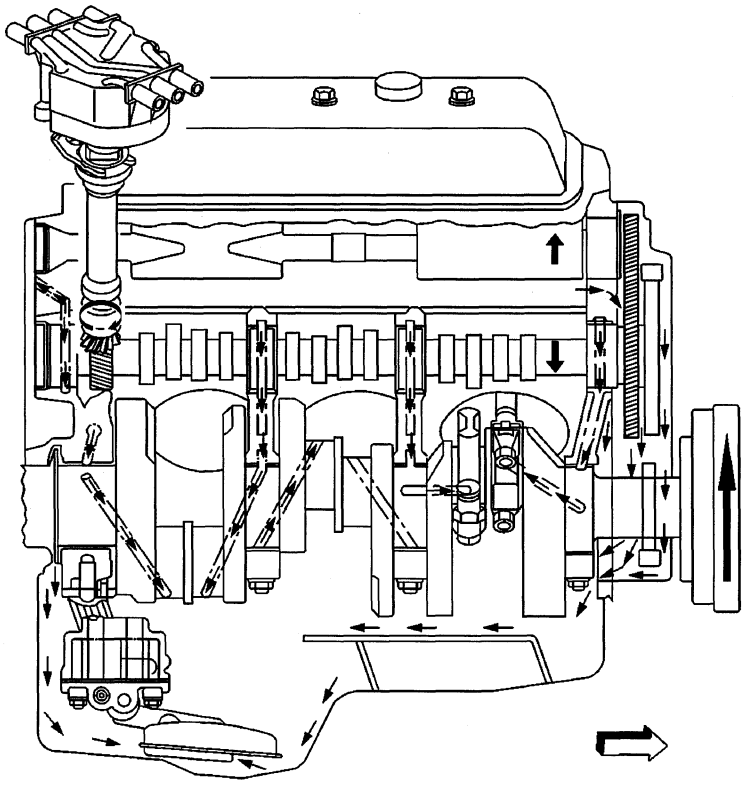
The drive belt system may use one belt or two belts. The drive belt is thin so that it can bend backwards and has several ribs to match the grooves in the pulleys. There also may be a V-belt style belt used to drive certain accessory drive components. The drive belts are made of different types of rubbers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



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 – 4.8, 5.3, 6.0L

General Specifications 4.8L (LR4 VIN V)

Application	Specification	
	Metric	English
General		
• Engine Type	V8	
• Displacement	4.8L	293 CID
• RPO	LR4	
• VIN	V	
• Bore	96.0-96.018 mm	3.779-3.78 in
• Stroke	83.0 mm	3.268 in
• Compression Ratio	9.47:1	
• Firing Order	1-8-7-2-6-5-4-3	
• Spark Plug Gap	1.524 mm	0.06 in
Block		
• Camshaft Bearing Bore 1 and 5 Diameter	59.12-59.17 mm	2.327-2.329 in
• Camshaft Bearing Bore 2 and 4 Diameter	58.87-58.92 mm	2.317-2.319 in
• Camshaft Bearing Bore 3 Diameter	58.62-58.67 mm	2.307-2.309 in
• Crankshaft Main Bearing Bore Diameter	69.871-69.889 mm	2.75-2.751 in
• Crankshaft Main Bearing Bore Out-of-Round	0.006 mm	0.0002 in
• Cylinder Bore Diameter	96.0-96.018 mm	3.779-3.78 in
• Cylinder Bore Taper - Thrust Side	0.018 mm	0.0007 in
• Cylinder Head Deck Height - Measuring from the Centerline of Crankshaft to the Deck Face	234.57-234.82 mm	9.235-9.245 in
• Cylinder Head Deck Surface Flatness - Measured Within a 152.4 mm (6.0 in) Area	0.11 mm	0.004 in
• Cylinder Head Deck Surface Flatness - Measuring the Overall Length of the Block Deck	0.22 mm	0.008 in
• Valve Lifter Bore Diameter	21.417-21.443 mm	0.843-0.844 in
Camshaft		
• Camshaft End Play	0.025-0.305 mm	0.001-0.012 in
• Camshaft Journal Diameter	54.99-55.04 mm	2.164-2.166 in
• Camshaft Journal Out-of-Round	0.025 mm	0.001 in
• Camshaft Lobe Lift - Exhaust	6.96 mm	0.274 in
• Camshaft Lobe Lift - Intake	6.82 mm	0.268 in
• Camshaft Runout - Measured at the Intermediate Journals	0.05 mm	0.002 in
Connecting Rod		
• Connecting Rod Bearing Clearance - Production	0.023-0.065 mm	0.0009-0.0025 in
• Connecting Rod Bearing Clearance - Service	0.023-0.076 mm	0.0009-0.003 in
• Connecting Rod Bore Diameter - Bearing End	56.505-56.525 mm	2.224-2.225 in
• Connecting Rod Bore Out-of-Round - Bearing End - Production	0.004-0.008 mm	0.00015-0.0003 in
• Connecting Rod Bore Out-of-Round - Bearing End - Service	0.004-0.008 mm	0.00015-0.0003 in
• Connecting Rod Side Clearance	0.11-0.51 mm	0.00433-0.02 in

Application	Specification	
	Metric	English
Crankshaft		
• Connecting Rod Journal Diameter - Production	53.318-53.338 mm	2.0991-2.0999 in
• Connecting Rod Journal Diameter - Service	53.308 mm	2.0987 in
• Connecting Rod Journal Out-of-Round - Production	0.005 mm	0.0002 in
• Connecting Rod Journal Out-of-Round - Service	0.01 mm	0.0004 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production	0.005 mm	0.0002 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service	0.02 mm	0.00078 in
• Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
• Crankshaft Main Bearing Clearance - Production	0.02-0.052 mm	0.0008-0.0021 in
• Crankshaft Main Bearing Clearance - Service	0.02-0.065 mm	0.0008-0.0025 in
• Crankshaft Main Journal Diameter - Production	64.993-65.007 mm	2.558-2.559 in
• Crankshaft Main Journal Diameter - Service	64.993 mm	2.558 in
• Crankshaft Main Journal Out-of-Round - Production	0.003 mm	0.000118 in
• Crankshaft Main Journal Out-of-Round - Service	0.008 mm	0.0003 in
• Crankshaft Main Journal Taper - Production	0.01 mm	0.0004 in
• Crankshaft Main Journal Taper - Service	0.02 mm	0.00078 in
• Crankshaft Rear Flange Runout	0.05 mm	0.002 in
• Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter	0.7 mm	0.028 in
• Crankshaft Thrust Surface - Production	26.14-26.22 mm	1.029-1.0315 in
• Crankshaft Thrust Surface - Service	26.22 mm	1.0315 in
• Crankshaft Thrust Surface Runout	0.025 mm	0.001 in
Cylinder Head		
• Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface	120.2 mm	4.732 in
• Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
• Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head	0.1 mm	0.004 in
• Surface Flatness - Exhaust Manifold Deck	0.13 mm	0.005 in
• Surface Flatness - Intake Manifold Deck	0.08 mm	0.0031 in
• Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide	17.32 mm	0.682 in
Intake Manifold		
• Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes Two Runner Port Openings	0.3 mm	0.118 in

Application	Specification	
	Metric	English
Lubrication System		
• Oil Capacity - with Filter	5.68 Liters	6.0 Quarts
• Oil Capacity - without Filter	4.73 Liters	5.0 Quarts
• Oil Pressure - Minimum - Hot	41 kPa at 1,000 engine RPM 124 kPa at 2,000 engine RPM 165 kPa at 4,000 engine RPM	6 psig at 1,000 engine RPM 18 psig at 2,000 engine RPM 24 psig at 4,000 engine RPM
Oil Pan		
• Front Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
• Rear Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
• Oil Pan Alignment - to Rear of Engine Block at Transmission Bell Housing Mounting Surface	0.0-0.25 mm	0.0-0.01 in
Piston Rings		
• Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Production	0.23-0.44 mm	0.009-0.017 in
• Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Service	0.23-0.5 mm	0.009-0.0196 in
• Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Production	0.44-0.7 mm	0.017-0.027 in
• Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Service	0.44-0.76 mm	0.0173-0.03 in
• Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Production	0.18-0.75 mm	0.007-0.029 in
• Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Service	0.18-0.81 mm	0.007-0.032 in
• Piston Ring to Groove Clearance - First Compression Ring - Production	0.04-0.085 mm	0.00157-0.00335 in
• Piston Ring to Groove Clearance - First Compression Ring - Service	0.04-0.085 mm	0.00157-0.00335 in
• Piston Ring to Groove Clearance - Second Compression Ring - Production	0.04-0.078 mm	0.00157-0.0031 in
• Piston Ring to Groove Clearance - Second Compression Ring - Service	0.04-0.078 mm	0.00157-0.0031 in
• Piston Ring to Groove Clearance - Oil Control Ring - Production	0.012-0.2 mm	0.0005-0.0078 in
• Piston Ring to Groove Clearance - Oil Control Ring - Service	0.012-0.2 mm	0.0005-0.0078 in
Pistons and Pins		
• Piston - Piston Diameter - Measured Over Skirt Coating	96.002-96.036 mm	3.779-3.78 in
• Piston - Piston to Bore Clearance - Production	-0.036 to +0.016 mm	-0.0014 to +0.0006 in
• Piston - Piston to Bore Clearance - Service Limit with Skirt Coating Worn Off	0.07 mm	0.0028 in
• Pin - Piston Pin Fit in Connecting Rod Bore	0.02-0.043 mm - interference	0.00078-0.00169 in - interference

Application	Specification	
	Metric	English
• Pin - Piston Pin Clearance to Piston Pin Bore - Production	0.007-0.02 mm	0.00027-0.00078 in
• Pin - Piston Pin Clearance to Piston Pin Bore - Service	0.007-0.021 mm	0.00027-0.00082 in
• Pin - Piston Pin Diameter	23.997-24.0 mm	0.9447-0.9448 in
Valve System		
• Valves - Valve Face Angle	45 degrees	
• Valves - Valve Face Width	1.25 mm	0.05 in
• Valves - Valve Lash	Net Lash - No Adjustment	
• Valves - Valve Lift - Intake	11.6 mm	0.457 in
• Valves - Valve Lift - Exhaust	11.85 mm	0.466 in
• Valves - Valve Seat Angle	46 degrees	
• Valves - Valve Seat Runout	0.05 mm	0.002 in
• Valves - Valve Seat Width - Exhaust	1.78 mm	0.07 in
• Valves - Seat Width - Intake	1.02 mm	0.04 in
• Valves - Valve Stem Diameter - Production	7.955-7.976 mm	0.313-0.314 in
• Valves - Valve Stem Diameter - Service	7.95 mm	0.313 in
• Valves - Stem-to-Guide Clearance - Production - Intake	0.025-0.066 mm	0.001-0.0026 in
• Valves - Stem-to-Guide Clearance - Service - Intake	0.093 mm	0.0037 in
• Valves - Stem-to-Guide Clearance - Production - Exhaust	0.025-0.066 mm	0.001-0.0026 in
• Valves - Stem-to-Guide Clearance - Service - Exhaust	0.093 mm	0.0037 in
• Rocker Arms - Valve Rocker Arm Ratio	1.70:1	
• Valve Springs - Valve Spring Free Length	52.9 mm	2.08 in
• Valve Springs - Installed Height	45.75 mm	1.8 in
• Valve Springs - Valve Spring Load - Closed	340 N at 45.75 mm	76 lb at 1.8 in
• Valve Springs - Valve Spring Load - Open	980 N at 33.55 mm	220 lb at 1.32 in

General Specifications 5.3L (LM7 VIN T)

Application	Specification	
	Metric	English
General		
• Engine Type	V8	
• Displacement	5.3L	325 CID
• RPO	LM7	
• VIN	T	
• Bore	96.0-96.018 mm	3.779-3.78 in
• Stroke	92.0 mm	3.622 in
• Compression Ratio	9.49:1	
• Firing Order	1-8-7-2-6-5-4-3	
• Spark Plug Gap	1.524 mm	0.06 in
Block		
• Camshaft Bearing Bore 1 and 5 Diameter	59.12-59.17 mm	2.327-2.329 in
• Camshaft Bearing Bore 2 and 4 Diameter	58.87-58.92 mm	2.317-2.319 in
• Camshaft Bearing Bore 3 Diameter	58.62-58.67 mm	2.307-2.309 in
• Crankshaft Main Bearing Bore Diameter	69.871-69.889 mm	2.75-2.751 in
• Crankshaft Main Bearing Bore Out-of-Round	0.006 mm	0.0002 in
• Cylinder Bore Diameter	96.0-96.018 mm	3.779-3.78 in
• Cylinder Bore Taper - Thrust Side	0.018 mm	0.0007 in
• Cylinder Head Deck Height - Measuring from the Centerline of Crankshaft to the Deck Face	234.57-234.82 mm	9.235-9.245 in
• Cylinder Head Deck Surface Flatness - Measured Within a 152.4 mm (6.0 in) Area	0.11 mm	0.004 in
• Cylinder Head Deck Surface Flatness - Measuring the Overall Length of the Block Deck	0.22 mm	0.008 in
• Valve Lifter Bore Diameter	21.417-21.443 mm	0.843-0.844 in
Camshaft		
• Camshaft End Play	0.025-0.305 mm	0.001-0.012 in
• Camshaft Journal Diameter	54.99-55.04 mm	2.164-2.166 in
• Camshaft Journal Out-of-Round	0.025 mm	0.001 in
• Camshaft Lobe Lift - Exhaust	6.96 mm	0.274 in
• Camshaft Lobe Lift - Intake	6.82 mm	0.268 in
• Camshaft Runout - Measured at the Intermediate Journals	0.05 mm	0.002 in
Connecting Rod		
• Connecting Rod Bearing Clearance - Production	0.023-0.065 mm	0.0009-0.0025 in
• Connecting Rod Bearing Clearance - Service	0.023-0.076 mm	0.0009-0.003 in
• Connecting Rod Bore Diameter - Bearing End	56.505-56.525 mm	2.224-2.225 in
• Connecting Rod Bore Out-of-Round - Bearing End - Production	0.004-0.008 mm	0.00015-0.0003 in
• Connecting Rod Bore Out-of-Round - Bearing End - Service	0.004-0.008 mm	0.00015-0.0003 in
• Connecting Rod Side Clearance	0.11-0.51 mm	0.00433-0.02 in
Crankshaft		
• Connecting Rod Journal Diameter - Production	53.318-53.338 mm	2.0991-2.0999 in
• Connecting Rod Journal Diameter - Service	53.308 mm	2.0987 in
• Connecting Rod Journal Out-of-Round - Production	0.005 mm	0.0002 in

Application	Specification	
	Metric	English
• Connecting Rod Journal Out-of-Round - Service	0.01 mm	0.0004 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production	0.005 mm	0.0002 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service	0.02 mm	0.00078 in
• Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
• Crankshaft Main Bearing Clearance - Production	0.02-0.052 mm	0.0008-0.0021 in
• Crankshaft Main Bearing Clearance - Service	0.02-0.065 mm	0.0008-0.0025 in
• Crankshaft Main Journal Diameter - Production	64.993-65.007 mm	2.558-2.559 in
• Crankshaft Main Journal Diameter - Service	64.993 mm	2.558 in
• Crankshaft Main Journal Out-of-Round - Production	0.003 mm	0.000118 in
• Crankshaft Main Journal Out-of-Round - Service	0.008 mm	0.0003 in
• Crankshaft Main Journal Taper - Production	0.01 mm	0.0004 in
• Crankshaft Main Journal Taper - Service	0.02 mm	0.00078 in
• Crankshaft Rear Flange Runout	0.05 mm	0.002 in
• Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter	0.7 mm	0.028 in
• Crankshaft Thrust Surface - Production	26.14-26.22 mm	1.029-1.0315 in
• Crankshaft Thrust Surface - Service	26.22 mm	1.0315 in
• Crankshaft Thrust Surface Runout	0.025 mm	0.001 in
Cylinder Head		
• Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface	120.2 mm	4.732 in
• Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
• Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head	0.1 mm	0.004 in
• Surface Flatness - Exhaust Manifold Deck	0.13 mm	0.005 in
• Surface Flatness - Intake Manifold Deck	0.08 mm	0.0031 in
• Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide	17.32 mm	0.682 in
Intake Manifold		
• Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes Two Runner Port Openings	0.3 mm	0.118 in
Lubrication System		
• Oil Capacity - with Filter	5.68 Liters	6.0 Quarts
• Oil Capacity - without Filter	4.73 Liters	5.0 Quarts
• Oil Pressure - Minimum - Hot	41 kPa at 1,000 engine RPM 124 kPa at 2,000 engine RPM 165 kPa at 4,000 engine RPM	6 psig at 1,000 engine RPM 18 psig at 2,000 engine RPM 24 psig at 4,000 engine RPM
Oil Pan		
• Front Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
• Rear Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in

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

Application	Specification	
	Metric	English
• Valves - Seat Width - Intake	1.02 mm	0.04 in
• Valves - Valve Stem Diameter - Production	7.955-7.976 mm	0.313-0.314 in
• Valves - Valve Stem Diameter - Service	7.95 mm	0.313 in
• Valves - Valve Stem-to-Guide Clearance - Production - Intake	0.025-0.066 mm	0.001-0.0026 in
• Valves - Valve Stem-to-Guide Clearance - Service - Intake	0.093 mm	0.0037 in
• Valves - Valve Stem-to-Guide Clearance - Production - Exhaust	0.025-0.066 mm	0.001-0.0026 in
• Valves - Valve Stem-to-Guide Clearance - Service - Exhaust	0.093 mm	0.0037 in
• Rocker Arms - Valve Rocker Arm Ratio	1.70:1	
• Valve Springs - Valve Spring Free Length	52.9 mm	2.08 in
• Valve Springs - Valve Spring Installed Height	45.75 mm	1.8 in
• Valve Springs - Valve Spring Load - Closed	340 N at 45.75 mm	76 lb at 1.8 in
• Valve Springs - Valve Spring Load - Open	980 N at 33.55 mm	220 lb at 1.32 in

General Specifications 5.3L (L59 VIN Z)

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

Application	Specification	
	Metric	English
• Connecting Rod Journal Out-of-Round - Service	0.01 mm	0.0004 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production	0.005 mm	0.0002 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service	0.02 mm	0.00078 in
• Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
• Crankshaft Main Bearing Clearance - Production	0.02-0.052 mm	0.0008-0.0021 in
• Crankshaft Main Bearing Clearance - Service	0.02-0.065 mm	0.0008-0.0025 in
• Crankshaft Main Journal Diameter - Production	64.993-65.007 mm	2.558-2.559 in
• Crankshaft Main Journal Diameter - Service	64.993 mm	2.558 in
• Crankshaft Main Journal Out-of-Round - Production	0.003 mm	0.000118 in
• Crankshaft Main Journal Out-of-Round - Service	0.008 mm	0.0003 in
• Crankshaft Main Journal Taper - Production	0.01 mm	0.0004 in
• Crankshaft Main Journal Taper - Service	0.02 mm	0.00078 in
• Crankshaft Rear Flange Runout	0.05 mm	0.002 in
• Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter	0.7 mm	0.028 in
• Crankshaft Thrust Surface - Production	26.14-26.22 mm	1.029-1.0315 in
• Crankshaft Thrust Surface - Service	26.22 mm	1.0315 in
• Crankshaft Thrust Surface Runout	0.025 mm	0.001 in
Cylinder Head		
• Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface	120.2 mm	4.732 in
• Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
• Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head	0.1 mm	0.004 in
• Surface Flatness - Exhaust Manifold Deck	0.13 mm	0.005 in
• Surface Flatness - Intake Manifold Deck	0.08 mm	0.0031 in
• Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide	17.32 mm	0.682 in
Intake Manifold		
• Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes Two Runner Port Openings	0.3 mm	0.118 in
Lubrication System		
• Oil Capacity - with Filter	5.68 Liters	6.0 Quarts
• Oil Capacity - without Filter	4.73 Liters	5.0 Quarts
• Oil Pressure - Minimum - Hot	41 kPa at 1,000 engine RPM 124 kPa at 2,000 engine RPM 165 kPa at 4,000 engine RPM	6 psig at 1,000 engine RPM 18 psig at 2,000 engine RPM 24 psig at 4,000 engine RPM
Oil Pan		
• Front Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
• Rear Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in

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

Application	Specification	
	Metric	English
• Valves - Seat Width - Intake	1.02 mm	0.04 in
• Valves - Valve Stem Diameter - Production	7.955-7.976 mm	0.313-0.314 in
• Valves - Valve Stem Diameter - Service	7.95 mm	0.313 in
• Valves - Valve Stem-to-Guide Clearance - Production - Intake	0.025-0.066 mm	0.001-0.0026 in
• Valves - Valve Stem-to-Guide Clearance - Service - Intake	0.093 mm	0.0037 in
• Valves - Valve Stem-to-Guide Clearance - Production - Exhaust	0.025-0.066 mm	0.001-0.0026 in
• Valves - Valve Stem-to-Guide Clearance - Service - Exhaust	0.093 mm	0.0037 in
• Rocker Arms - Valve Rocker Arm Ratio	1.70:1	
• Valve Springs - Valve Spring Free Length	52.9 mm	2.08 in
• Valve Springs - Valve Spring Installed Height	45.75 mm	1.8 in
• Valve Springs - Valve Spring Load - Closed	340 N at 45.75 mm	76 lb at 1.8 in
• Valve Springs - Valve Spring Load - Open	980 N at 33.55 mm	220 lb at 1.32 in

General Specifications 6.0L (LQ4 VIN U)

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

Application	Specification	
	Metric	English
• Connecting Rod Bore Out-of-Round - Bearing End - Production	0.006 mm	0.0002 in
• Connecting Rod Bore Out-of-Round - Bearing End - Service	0.006 mm	0.0002 in
• Connecting Rod Side Clearance	0.11-0.51 mm	0.00433-0.02 in
Crankshaft		
• Connecting Rod Journal Diameter - Production	53.318-53.338 mm	2.0991-2.0999 in
• Connecting Rod Journal Diameter - Service	53.308 mm	2.0987 in
• Connecting Rod Journal Out-of-Round - Production	0.005 mm	0.0002 in
• Connecting Rod Journal Out-of-Round - Service	0.01 mm	0.0004 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production	0.005 mm	0.0002 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service	0.02 mm	0.00078 in
• Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
• Crankshaft Main Bearing Clearance - Production	0.02-0.052 mm	0.0008-0.0021 in
• Crankshaft Main Bearing Clearance - Service	0.02-0.065 mm	0.0008-0.0025 in
• Crankshaft Main Journal Diameter - Production	64.993-65.007 mm	2.558-2.559 in
• Crankshaft Main Journal Diameter - Service	64.993 mm	2.558 in
• Crankshaft Main Journal Out-of-Round - Production	0.003 mm	0.000118 in
• Crankshaft Main Journal Out-of-Round - Service	0.008 mm	0.0003 in
• Crankshaft Main Journal Taper - Production	0.01 mm	0.0004 in
• Crankshaft Main Journal Taper - Service	0.02 mm	0.00078 in
• Crankshaft Rear Flange Runout	0.05 mm	0.002 in
• Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter	0.7 mm	0.028 in
• Crankshaft Thrust Surface - Production	26.14-26.22 mm	1.029-1.0315 in
• Crankshaft Thrust Surface - Service	26.22 mm	1.0315 in
• Crankshaft Thrust Surface Runout	0.025 mm	0.001 in
Cylinder Head		
• Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface	120.2 mm	4.732 in
• Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
• Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head	0.1 mm	0.004 in
• Surface Flatness - Exhaust Manifold Deck	0.13 mm	0.005 in
• Surface Flatness - Intake Manifold Deck	0.08 mm	0.0031 in
• Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide	17.32 mm	0.682 in
Intake Manifold		
• Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes Two Runner Port Openings	0.3 mm	0.118 in

Application	Specification	
	Metric	English
Lubrication System		
• Oil Capacity - with Filter	5.68 Liters	6.0 Quarts
• Oil Capacity - without Filter	4.73 Liters	5.0 Quarts
• Oil Pressure - Minimum - Hot	41 kPa at 1,000 engine RPM 124 kPa at 2,000 engine RPM 165 kPa at 4,000 engine RPM	6 psig at 1,000 engine RPM 18 psig at 2,000 engine RPM 24 psig at 4,000 engine RPM
Oil Pan		
• Front Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
• Rear Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
• Oil Pan Alignment - to Rear of Engine Block at Transmission Bell Housing Mounting Surface	0.0-0.25 mm	0.0-0.01 in
Piston Rings		
• Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Production	0.31-0.52 mm	0.012-0.02 in
• Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Service	0.31-0.59 mm	0.0122-0.023 in
• Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Production	0.51-0.77 mm	0.02-0.03 in
• Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Service	0.51-0.84 mm	0.02-0.033 in
• Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Production	0.31-0.87 mm	0.0122-0.034 in
• Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Service	0.31-0.94 mm	0.0122-0.037 in
• Piston Ring to Groove Clearance - First Compression Ring - Production	0.04-0.08 mm	0.00157-0.0031 in
• Piston Ring to Groove Clearance - First Compression Ring - Service	0.04-0.08 mm	0.00157-0.0031 in
• Piston Ring to Groove Clearance - Second Compression Ring - Production	0.039-0.079 mm	0.0015-0.0031 in
• Piston Ring to Groove Clearance - Second Compression Ring - Service	0.039-0.079 mm	0.0015-0.0031 in
• Piston Ring to Groove Clearance - Oil Control Ring - Production	0.015-0.199 mm	0.0006-0.0078 in
• Piston Ring to Groove Clearance - Oil Control Ring - Service	0.015-0.199 mm	0.0006-0.0078 in
Pistons and Pins		
• Piston - Piston Diameter - Measured Over Skirt Coating	101.606-101.640 mm	4.0002-4.0016 in
• Piston - Piston to Bore Clearance - Production	-0.022 to +0.03 mm	-0.0009 to +0.0012 in
• Piston - Piston to Bore Clearance - Service Limit with Skirt Coating Worn Off	0.07 mm	0.0028 in
• Pin - Piston Pin Fit in Connecting Rod Bore	0.02-0.043 mm - interference	0.00078-0.00169 in - interference

Application	Specification	
	Metric	English
• Pin - Piston Pin Clearance to Piston Pin Bore - Production	0.011-0.018 mm	0.0004-0.0007 in
• Pin - Piston Pin Clearance to Piston Pin Bore - Service	0.011-0.02 mm	0.0004-0.0008 in
• Pin - Piston Pin Diameter	23.997-24.0 mm	0.9447-0.9448 in
Valve System		
• Valves - Valve Face Angle	45 degrees	
• Valves - Valve Face Width	1.25 mm	0.05 in
• Valves - Valve Lash	Net Lash - No Adjustment	
• Valves - Valve Lift - Intake	11.79 mm	0.464 in
• Valves - Valve Lift - Exhaust	12.16 mm	0.479 in
• Valves - Valve Seat Angle	46 degrees	
• Valves - Valve Seat Runout	0.05 mm	0.002 in
• Valves - Valve Seat Width - Exhaust	1.78 mm	0.07 in
• Valves - Valve Seat Width - Intake	1.02 mm	0.04 in
• Valves - Valve Stem Diameter - Production	7.955-7.976 mm	0.313-0.314 in
• Valves - Valve Stem Diameter - Service	7.95 mm	0.313 in
• Valves - Valve Stem-to-Guide Clearance - Production - Intake	0.025-0.066 mm	0.001-0.0026 in
• Valves - Valve Stem-to-Guide Clearance - Service - Intake	0.093 mm	0.0037 in
• Valves - Valve Stem-to-Guide Clearance - Production - Exhaust	0.025-0.066 mm	0.001-0.0026 in
• Valves - Valve Stem-to-Guide Clearance - Service - Exhaust	0.093 mm	0.0037 in
• Rocker Arms - Valve Rocker Arm Ratio	1.70:1	
• Valve Springs - Valve Spring Free Length	52.9 mm	2.08 in
• Valve Springs - Valve Spring Installed Height	45.75 mm	1.8 in
• Valve Springs - Valve Spring Load - Closed	340 N at 45.75 mm	76 lb at 1.8 in
• Valve Springs - Valve Spring Load - Open	980 N at 33.55 mm	220 lb at 1.32 in

General Specifications 6.0L (LQ9 VIN N)

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

Application	Specification	
	Metric	English
Crankshaft		
• Connecting Rod Journal Diameter - Production	53.318-53.338 mm	2.0991-2.0999 in
• Connecting Rod Journal Diameter - Service	53.308 mm	2.0987 in
• Connecting Rod Journal Out-of-Round - Production	0.005 mm	0.0002 in
• Connecting Rod Journal Out-of-Round - Service	0.01 mm	0.0004 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production	0.005 mm	0.0002 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service	0.02 mm	0.00078 in
• Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
• Crankshaft Main Bearing Clearance - Production	0.02-0.052 mm	0.0008-0.0021 in
• Crankshaft Main Bearing Clearance - Service	0.02-0.065 mm	0.0008-0.0025 in
• Crankshaft Main Journal Diameter - Production	64.993-65.007 mm	2.558-2.559 in
• Crankshaft Main Journal Diameter - Service	64.993 mm	2.558 in
• Crankshaft Main Journal Out-of-Round - Production	0.003 mm	0.000118 in
• Crankshaft Main Journal Out-of-Round - Service	0.008 mm	0.0003 in
• Crankshaft Main Journal Taper - Production	0.01 mm	0.0004 in
• Crankshaft Main Journal Taper - Service	0.02 mm	0.00078 in
• Crankshaft Rear Flange Runout	0.05 mm	0.002 in
• Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter	0.7 mm	0.028 in
• Crankshaft Thrust Surface - Production	26.14-26.22 mm	1.029-1.0315 in
• Crankshaft Thrust Surface - Service	26.22 mm	1.0315 in
• Crankshaft Thrust Surface Runout	0.025 mm	0.001 in
Cylinder Head		
• Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface	120.2 mm	4.732 in
• Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
• Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head	0.1 mm	0.004 in
• Surface Flatness - Exhaust Manifold Deck	0.13 mm	0.005 in
• Surface Flatness - Intake Manifold Deck	0.08 mm	0.0031 in
• Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide	17.32 mm	0.682 in
Intake Manifold		
• Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes Two Runner Port Openings	0.3 mm	0.118 in

Application	Specification	
	Metric	English
Lubrication System		
• Oil Capacity - with Filter	5.68 Liters	6.0 Quarts
• Oil Capacity - without Filter	4.73 Liters	5.0 Quarts
• Oil Pressure - Minimum - Hot	41 kPa at 1,000 engine RPM 124 kPa at 2,000 engine RPM 165 kPa at 4,000 engine RPM	6 psig at 1,000 engine RPM 18 psig at 2,000 engine RPM 24 psig at 4,000 engine RPM
Oil Pan		
• Front Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
• Rear Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
• Oil Pan Alignment - to Rear of Engine Block at Transmission Bell Housing Mounting Surface	0.0-0.25 mm	0.0-0.01 in
Piston Rings		
• Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Production	0.31-0.52 mm	0.012-0.02 in
• Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Service	0.31-0.59 mm	0.0122-0.023 in
• Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Production	0.51-0.77 mm	0.02-0.03 in
• Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Service	0.51-0.84 mm	0.02-0.033 in
• Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Production	0.31-0.87 mm	0.0122-0.034 in
• Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Service	0.31-0.94 mm	0.0122-0.037 in
• Piston Ring to Groove Clearance - First Compression Ring - Production	0.035-0.08 mm	0.0014-0.0031 in
• Piston Ring to Groove Clearance - First Compression Ring - Service	0.035-0.08 mm	0.0014-0.0031 in
• Piston Ring to Groove Clearance - Second Compression Ring - Production	0.034-0.079 mm	0.0013-0.003 in
• Piston Ring to Groove Clearance - Second Compression Ring - Service	0.034-0.079 mm	0.0013-0.003 in
• Piston Ring to Groove Clearance - Oil Control Ring - Production	0.012-0.2 mm	0.00047-0.00078 in
• Piston Ring to Groove Clearance - Oil Control Ring - Service	0.012-0.2 mm	0.00047-0.00078 in
Pistons and Pins		
• Piston - Piston Diameter - Measured Over Skirt Coating	101.611-101.642 mm	4.0-4.001 in
• Piston - Piston to Bore Clearance - Production	-0.022 to +0.030 mm	-0.009 to +0.0012 in
• Piston - Piston to Bore Clearance - Service Limit with Skirt Coating Worn Off -	0.08 mm	0.0031 in
• Pin - Piston Pin Fit in Connecting Rod Bore - Production	0.007-0.02 mm	0.00027-0.00078 in
• Pin - Piston Pin Fit in Connecting Rod Bore - Service	0.007-0.022 mm	0.00027-0.00086 in

Application	Specification	
	Metric	English
• Pin - Piston Pin Clearance to Piston Pin Bore - Production	0.002-0.01 mm	0.00008-0.0004 in
• Pin - Piston Pin Clearance to Piston Pin Bore - Service	0.002-0.015 mm	0.0008-0.0006 in
• Pin - Piston Pin Diameter	23.952-23.955 mm	0.943-0.943 in
Valve System		
• Valves - Valve Face Angle	45 degrees	
• Valves - Valve Face Width	1.25 mm	0.05 in
• Valves - Valve Lash	Net Lash - No Adjustment	
• Valves - Valve Lift - Intake	11.79 mm	0.464 in
• Valves - Valve Lift - Exhaust	12.16 mm	0.479 in
• Valves - Valve Seat Angle	46 degrees	
• Valves - Valve Seat Runout	0.05 mm	0.002 in
• Valves - Valve Seat Width - Exhaust	1.78 mm	0.07 in
• Valves - Valve Seat Width - Intake	1.02 mm	0.04 in
• Valves - Valve Stem Diameter - Production	7.955-7.976 mm	0.313-0.314 in
• Valves - Valve Stem Diameter - Service	7.95 mm	0.313 in
• Valves - Valve Stem-to-Guide Clearance - Production - Intake	0.025-0.066 mm	0.001-0.0026 in
• Valves - Valve Stem-to-Guide Clearance - Service - Intake	0.093 mm	0.0037 in
• Valves - Valve Stem-to-Guide Clearance - Production - Exhaust	0.025-0.066 mm	0.001-0.0026 in
• Valves - Valve Stem-to-Guide Clearance - Service - Exhaust	0.093 mm	0.0037 in
• Rocker Arms - Valve Rocker Arm Ratio	1.70:1	
• Valve Springs - Valve Spring Free Length	52.9 mm	2.08 in
• Valve Springs - Valve Spring Installed Height	45.75 mm	1.8 in
• Valve Springs - Valve Spring Load - Closed	340 N at 45.75 mm	76 lb at 1.8 in
• Valve Springs - Valve Spring Load - Open	980 N at 33.55 mm	220 lb at 1.32 in

Fastener Tightening Specifications

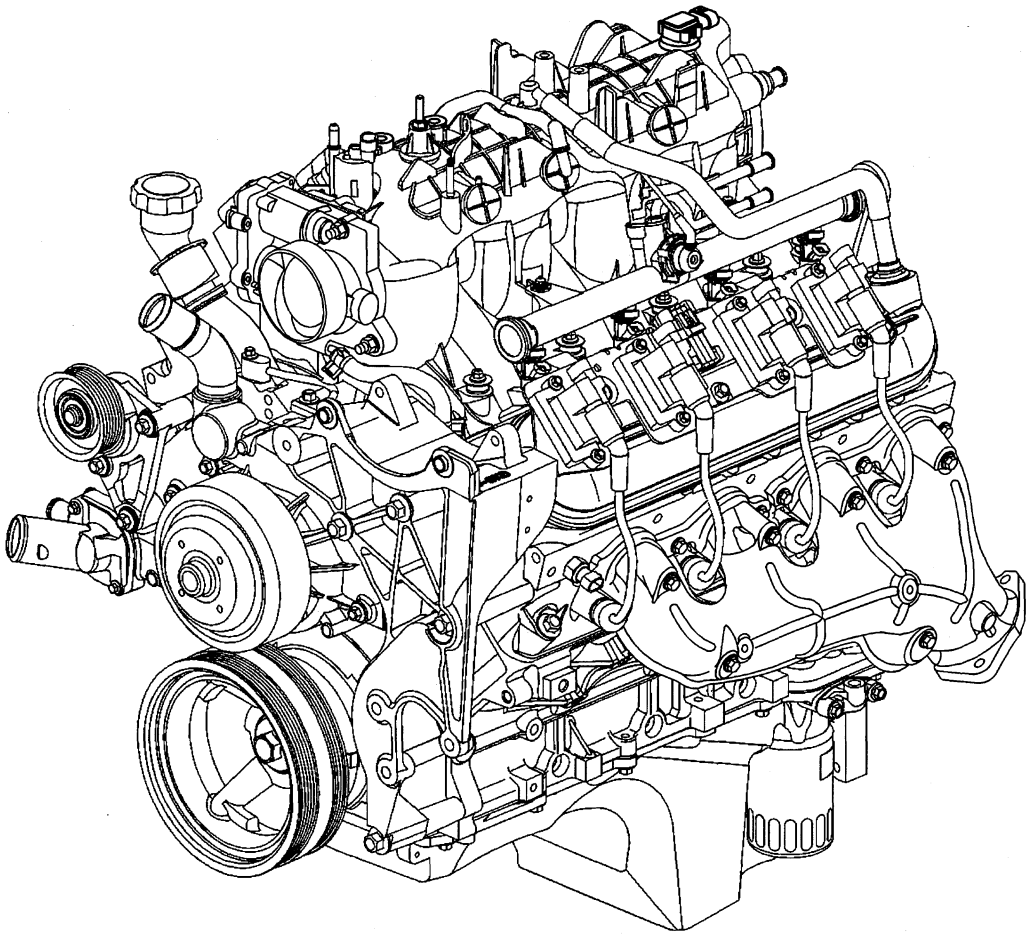
Application	Specification	
	Metric	English
3-Phase Cable Bracket Cover Bolt - RPO HP2	9 N·m	80 lb in
3-Phase Cable Bracket Nut - RPO HP2	15 N·m	11 lb ft
3-Phase Cable Nut-to-Starter/Generator - RPO HP2	14 N·m	10 lb ft
3-Phase Cable Nut-to-Starter/Generator Control Module (SGCM) - RPO HP2	12 N·m	106 lb in
Air Cleaner Outlet Duct Clamp Screw	7 N·m	62 lb in
Air Conditioning (A/C) Belt Tensioner Bolt	50 N·m	37 lb ft
Air Conditioning (A/C) Compressor Bolt	50 N·m	37 lb ft
Air Conditioning (A/C) Discharge Hose Bolt	16 N·m	12 lb ft
Air Conditioning (A/C) Suction Hose Bolt	16 N·m	12 lb ft
Auxiliary Heater Water Pump Bracket Bolt - RPO HP2	15 N·m	11 lb ft
Battery Cable Channel Bolt	12 N·m	106 lb in
Battery Cable Junction Block Bracket Bolt - RPO HP2	9 N·m	80 lb in
Camshaft Retainer Bolts	25 N·m	18 lb ft
Camshaft Sensor Bolt	25 N·m	18 lb ft
Camshaft Sprocket Bolts	35 N·m	26 lb ft
Clutch Pressure Plate Bolt	70 N·m	53 lb ft
Connecting Rod Bolts - First Pass	20 N·m	15 lb ft
Connecting Rod Bolts - Final Pass	75 degrees	
Coolant Temperature Sensor	20 N·m	15 lb ft
Crankshaft Balancer Bolt - Installation Pass - to Ensure the Balancer is Completely Installed	330 N·m	240 lb ft
Crankshaft Balancer Bolt - First Pass - Install a NEW Bolt After the Installation Pass and Tighten as Described in the First and Final Passes	50 N·m	37 lb ft
Crankshaft Balancer Bolt - Final Pass	140 degrees	
Crankshaft Bearing Cap Bolts - Inner Bolts - First Pass in Sequence	20 N·m	15 lb ft
Crankshaft Bearing Cap Bolts - Inner Bolts - Final Pass in Sequence	80 degrees	
Crankshaft Bearing Cap Bolts - Outer Bolts - First Pass in Sequence	20 N·m	15 lb ft
Crankshaft Bearing Cap Bolts - Outer Bolts - Final Pass in Sequence	51 degrees	
Crankshaft Bearing Cap Side Bolts	25 N·m	18 lb ft
Crankshaft Oil Deflector Nuts	25 N·m	18 lb ft
Crankshaft Position Sensor Bolt	25 N·m	18 lb ft
Crossbar Bolt	100 N·m	74 lb ft
Cylinder Head Bolts - First Design - First Pass all M11 Bolts in Sequence	30 N·m	22 lb ft
Cylinder Head Bolts - First Design - Second Pass all M11 Bolts in Sequence	90 degrees	
Cylinder Head Bolts - First Design - Final Pass all M11 Bolts in Sequence - Excluding the Medium Length Bolts at the Front and Rear of each Cylinder Head	90 degrees	
Cylinder Head Bolts - First Design - Final Pass M11 Medium Length Bolts at the Front and Rear of each Cylinder Head	50 degrees	
Cylinder Head Bolts - Second Design - First Pass all M11 Bolts in Sequence	30 N·m	22 lb ft
Cylinder Head Bolts - Second Design - Second Pass all M11 Bolts in Sequence	90 degrees	
Cylinder Head Bolts - Second Design - Final Pass all M11 Bolts in Sequence	70 degrees	
Cylinder Head Bolts - M8 Inner Bolts in Sequence	30 N·m	22 lb ft
Cylinder Head Coolant Plug	20 N·m	15 lb ft
Differential Carrier Lower Mounting Bolt/Nut	100 N·m	74 lb ft

Application	Specification	
	Metric	English
Drive Belt Idler Pulley Bolt	50 N·m	37 lb ft
Drive Belt Tensioner Bolt	50 N·m	37 lb ft
Engine Block Coolant Drain Plugs	60 N·m	44 lb ft
Engine Block Heater	40 N·m	30 lb ft
Engine Block Oil Gallery Plugs	60 N·m	44 lb ft
Engine Coolant Air Bleed Pipe and Cover Bolts	12 N·m	106 lb in
Engine Coolant Fitting - RPO HP2	35 N·m	26 lb ft
Engine Flywheel Bolts - First Pass	20 N·m	15 lb ft
Engine Flywheel Bolts - Second Pass	50 N·m	37 lb ft
Engine Flywheel Bolts - Final Pass	100 N·m	74 lb ft
Engine Front Cover Bolts	25 N·m	18 lb ft
Engine Harness Ground Bolt - Right Rear	16 N·m	12 lb ft
Engine Harness Ground Bolt-to-Block	25 N·m	18 lb ft
Engine Mount Bracket Through Bolt	75 N·m	55 lb ft
Engine Mount-to-Engine Mount Bracket Bolt	65 N·m	50 lb ft
Engine Mount Bolt	50 N·m	37 lb ft
Engine Rear Cover Bolts	25 N·m	18 lb ft
Engine Service Lift Bracket M10 Bolts	50 N·m	37 lb ft
Engine Service Lift Bracket M8 Bolt	25 N·m	18 lb ft
Engine Shield Bolt	20 N·m	15 lb ft
Engine Valley Cover Bolts	25 N·m	18 lb ft
Engine Wiring Harness Bracket Nut	5 N·m	44 lb in
Evaporative Emission (EVAP) Purge Solenoid Bolt	10 N·m	89 lb in
Exhaust Manifold Bolts - First Pass	15 N·m	11 lb ft
Exhaust Manifold Bolts - Final Pass	25 N·m	18 lb ft
Exhaust Manifold Heat Shield Bolts	9 N·m	80 lb in
Flexplate/Rotor Bolts - RPO HP2	100 N·m	74 lb ft
Fuel Rail Bolts	10 N·m	89 lb in
Fuel Rail Cover Bolt	9 N·m	80 lb in
Fuel Rail Crossover Tube Bolts	3.8 N·m	34 lb in
Fuel Rail Stop Bracket Bolt	50 N·m	37 lb ft
Generator Bracket Bolt	50 N·m	37 lb ft
Generator Cable Nut	9 N·m	80 lb in
Generator Coolant Inlet Hose Bolt - RPO HP2	10 N·m	89 lb in
Generator Coolant Outlet Pipe Stud - RPO HP2	6 N·m	53 lb in
Heater Hose Bracket Nut	9 N·m	80 lb in
Hood Hinge Bolt	25 N·m	18 lb ft
Ignition Coil-to-Bracket Bolts	10 N·m	89 lb in
Ignition Coil Bracket-to-Valve Rocker Arm Cover Stud	12 N·m	106 lb in
Inner Axle Housing Nut	100 N·m	74 lb ft
Intake Manifold Bolts - First Pass in Sequence	5 N·m	44 lb in
Intake Manifold Bolts - Final Pass in Sequence	10 N·m	89 lb in
Intake Manifold Sight Shield Bolt	10 N·m	89 lb in
Intake Manifold Sight Shield Retainer Bolt	5 N·m	44 lb in
Intake Manifold Wiring Harness Stud	10 N·m	89 lb in
J 42286-A Bolt	50 N·m	37 lb ft
J 46093 Bolt	50 N·m	37 lb ft
Knock Sensors	20 N·m	15 lb ft
Oil Filter	30 N·m	22 lb ft
Oil Filter Fitting	55 N·m	40 lb ft
Oil Level Indicator Tube Bolt	25 N·m	18 lb ft

Application	Specification	
	Metric	English
Oil Level Sensor	13 N·m	115 lb in
Oil Pan Baffle Bolts	12 N·m	106 lb in
Oil Pan Closeout Cover Bolt - Left Side	12 N·m	106 lb in
Oil Pan Closeout Cover Bolt - Right Side	12 N·m	106 lb in
Oil Pan Cover Bolts	12 N·m	106 lb in
Oil Pan Drain Plug	25 N·m	18 lb ft
Oil Pan M8 Bolts - Oil Pan-to-Engine Block and Oil Pan-to-Front Cover	25 N·m	18 lb ft
Oil Pan M6 Bolts - Oil Pan-to-Rear Cover	12 N·m	106 lb in
Oil Pan Skid Plate Bolt	20 N·m	15 lb ft
Oil Pressure Sensor	20 N·m	15 lb ft
Oil Pump-to-Engine Block Bolts	25 N·m	18 lb ft
Oil Pump Cover Bolts	12 N·m	106 lb in
Oil Pump Relief Valve Plug	12 N·m	106 lb in
Oil Pump Screen Nuts	25 N·m	18 lb ft
Oil Pump Screen-to-Oil Pump Bolt	12 N·m	106 lb in
Positive Battery Cable Clip Bolt	9 N·m	80 lb in
Power Steering Pump Bolt - RPO HP2	25 N·m	18 lb ft
Power Steering Pump Bracket Bolt - RPO HP2	25 N·m	18 lb ft
Power Steering Pump Harness Bolt - RPO HP2	25 N·m	18 lb ft
Power Steering Pump Harness Ground Bolt - RPO HP2	25 N·m	18 lb ft
Power Steering Pump Rear Bolt	50 N·m	37 lb ft
Spark Plugs - New Cylinder Heads	20 N·m	15 lb ft
Spark Plugs - All Subsequent Installations	15 N·m	11 lb ft
Starter/Generator Control Module (SGCM) Cover Bolts - RPO HP2	9 N·m	80 lb in
Stator Stud - RPO HP2	16 N·m	12 lb ft
Throttle Body Nuts	10 N·m	89 lb in
Throttle Body Studs	6 N·m	53 lb in
Torque Converter Bolt - 4L60-E/4L65-E Transmissions	63 N·m	47 lb ft
Torque Converter Bolt - 4L80-E/4L85-E Transmissions	60 N·m	44 lb ft
Transmission Bolt/Stud	50 N·m	37 lb ft
Transmission Cover Bolt	12 N·m	106 lb in
Transmission Nut - RPO HP2	12 N·m	106 lb in
Transmission Oil Level Indicator Tube Nut	18 N·m	13 lb ft
Valve Lifter Guide Bolts	12 N·m	106 lb in
Valve Rocker Arm Bolts	30 N·m	22 lb ft
Valve Rocker Arm Cover Bolts	12 N·m	106 lb in
Water Inlet Housing Bolts	15 N·m	11 lb ft
Water Pump Bolts - First Pass	15 N·m	11 lb ft
Water Pump Bolts - Final Pass	30 N·m	22 lb ft
Water Pump Cover Bolts	15 N·m	11 lb ft

Engine Component Description

The 4.8, 5.3, and 6.0 Liter V8 Engines



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

Camshaft and Drive System

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

Crankshaft

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

Cylinder Heads

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

Engine Block

The engine block is a cam-in-block deep skirt 90 degree V configuration with five crankshaft bearing caps. The engine block is cast iron. The five crankshaft bearing caps each have four vertical M10 and two horizontal M8 mounting bolts. The camshaft is supported by five camshaft bearings pressed into the block.

Exhaust Manifolds

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

Intake Manifold

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

Oil Pan

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

Piston and Connecting Rod Assembly

The pistons are cast aluminum. The pistons use two compression rings and one oil control ring assembly. The piston is a low friction, lightweight design with a flat or recessed top and barrel shaped skirt. The piston pins are chromium steel, have floating fit in the piston, and are retained by a press fit in the connecting rod. 6.0L LQ9 applications will have full-floating pistons/pins retained by internal clips. The connecting rods are powdered metal. The connecting rods are fractured at the connecting rod journal and then machined for the proper clearance. 2003 applications use a piston with a graphite coated skirt. The piston, pin, and connecting rod are to be serviced as an assembly.

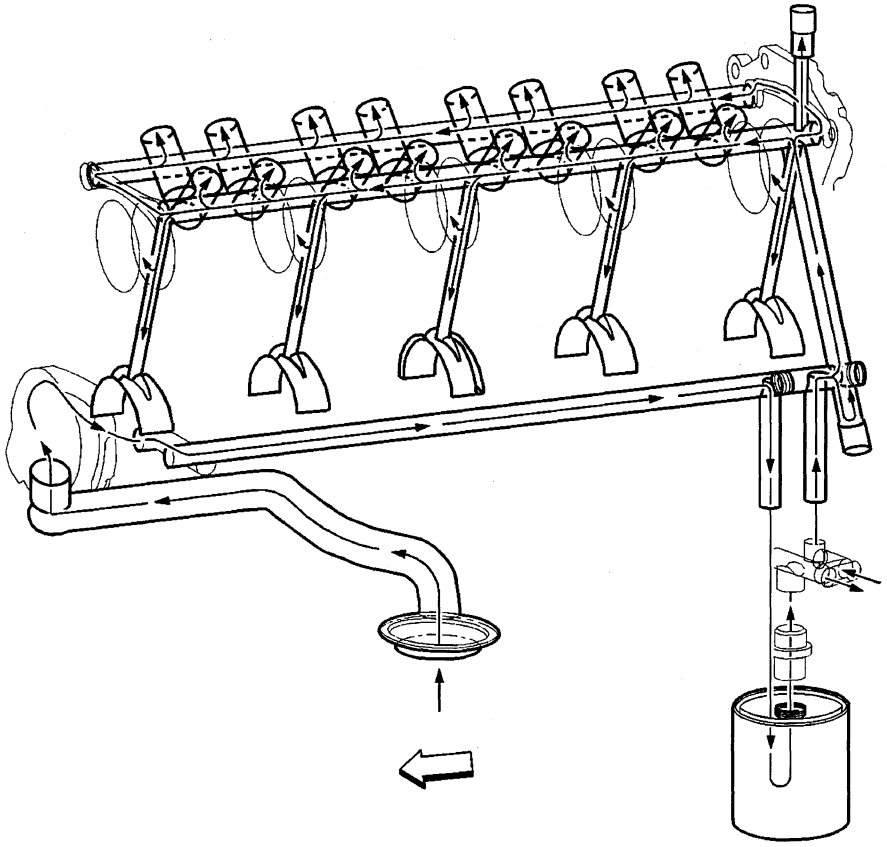
Valve Rocker Arm Cover Assemblies

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

Valve Train

Motion is transmitted from the camshaft through the hydraulic roller valve lifters and tubular pushrods to the roller type rocker arms. The nylon valve lifter guides position and retain the valve lifters. The valve rocker arms for each bank of cylinders are mounted on pedestals, pivot supports. Each rocker arm is retained on the pivot support and cylinder head by a bolt. Valve lash is net build.

Lubrication Description



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

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

Drive Belt System Description

See Drive Belt System Description above.

Crankcase Ventilation System Description

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

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

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

Engine Mechanical –6.6L Diesel (RPO LB7)

Engine Mechanical Specifications

Application	Specification	
	Metric	English
General		
• Engine Type	90 degree V-8	
• Displacement	6.6 Liter	402 cu in
• RPO	LB7	
• Bore	103 mm	4.0551 in
• Stroke	99 mm	3.8976 in
• Compression Ratio	17.5:1	
• Engine Compression Test - Minimum	2069 KPa	300 psi
• Idle Speed	680 RPM	
• Firing Order	1-2-7-8-4-5-6-3	
Block		
• Cylinder Bore Diameter - Service Limits	103.11 mm	4.0594 in
• Cylinder Bore Diameter - Production Value	103.0-103.014 mm	4.0551-4.0557 in
• Cylinder Bore Out-of-Round - Production Value	0.015 mm	0.0006 in
• Cylinder Bore Taper - Production Value	0.015 mm	0.0006 in
Camshaft		
• Camshaft Bearing Inside Diameter - Service Limit	61.07 mm	2.4043 in
• Camshaft Bearing Inside Diameter - Production Value	61.00-61.03 mm	2.4016-2.4028 in
• Camshaft End Play - Service Limit	0.2 mm	0.0079 in
• Camshaft Journal Diameter - Service Limit	60.92 mm	2.3984 in
• Camshaft Journal Diameter - Production Value	60.932-60.962 mm	2.3990-2.4001 in
• Camshaft Lobe Lift - Exhuast - Production Value	5.907 mm	0.2326 in
• Camshaft Lobe Lift - Intake - Production Value	7.273 mm	0.2863 in
• Camshaft Runout - Service Limit	0.05 mm	0.0020 in
Cooling System		
• Capacity @ Engine RPM	270 L/min @ 3172 RPM	
• Thermostat Full Open Temperature	110 degrees C	230 degrees F
• Turbocharger Coolant Bypass Valve	60 degrees C	140 degrees F
Connecting Rod		
• Connecting Rod Bearing Clearance - Service Limit	0.10 mm	0.0039 in
• Connecting Rod Bearing Clearance - Production Value	0.036-0.077 mm	0.0014-0.0030 in
• Connecting Rod Bore Diameter - Bearing End - Production Value	62.958-62.979 mm	2.4789-2.4795 in
• Connecting Rod Bore Diameter - Pin End - Service Limit	34.53 mm	1.3594 in
• Connecting Rod Bore Diameter - Pin End - Production Value	34.512-34.522 mm	1.3587-1.3591 in
• Connecting Rod Length	163.0 mm	6.42 in
• Connecting Rod Side Clearance - Service Limit	0.54 mm	0.0213 in
• Connecting Rod Side Clearance - Production Value	0.31-0.49 mm	0.0122-0.0193 in
Crankshaft		
• Connecting Rod Journal Diameter - Service Limit	62.88 mm	2.4756 in
• Connecting Rod Journal Diameter - Production Value	62.902-62.922 mm	2.4764-2.4772 in
• Crankshaft End Play - Service Limit	0.54 mm	0.0213 in

Application	Specification	
	Metric	English
• Crankshaft End Play - Production Value	0.04-0.205 mm	0.0016-0.0081 in
• Crankshaft Main Bearing Clearance - Service Limit	0.014 mm	0.0055 in
• Crankshaft Main Bearing Clearance - Production Value	0.037-0.072 mm	0.0015-0.0028 in
• Crankshaft Main Journal Diameter - Service Limit	79.89 mm	3.1453 in
• Crankshaft Main Journal Diameter - Production Value	79.905-79.925 mm	3.1459-3.1466 in
• Crankshaft Runout - Service Limit	0.44 mm	0.0173 in
• Crankshaft Runout - Production Value	0.05 mm	0.0020 in
Cylinder Head		
• Surface Flatness - Block Deck - Service Limit	0.2 mm	0.0079 in
• Surface Flatness - Block Deck - Production Value	0.075 mm	0.0030 in
• Surface Flatness - Exhaust Manifold Deck - Production Value	0.1 mm	0.0039 in
• Surface Flatness - Intake Manifold Deck - Production Value	0.1 mm	0.0039 in
Exhaust Manifold		
• Surface Flatness- Production Value	0.3 mm	0.0118 in
Intake Manifold		
• Surface Flatness - Production Value	0.3 mm	0.0118 in
Lubrication System		
• Oil Capacity - with Filter	10 qt	9.5 L
• Oil Capacity - without Filter	9.2 qt	8.7 L
• Oil Pressure - Minimum- Hot - at idle	98 KPa	14 psi
• Oil Pressure - Minimum - 1800 RPM	294 KPa	42 psi
• Oil Relief Valve Opening Pressure	441 KPa	64 psi
• Piston Cooling Jet Valve Opening Pressure	196 KPa	29 psi
Oil Pump		
• Gear Shaft Outside Diameter - Drive - Service Limit	19.86 mm	0.7819 in
• Gear Shaft Outside Diameter - Drive - Production Value	19.947-19.960 mm	0.7853-0.7858 in
• Gear Shaft Outside Diameter - Driven - Service Limit	19.86 mm	0.7819 in
• Gear Shaft Outside Diameter - Driven - Production Value	19.947-19.960 mm	0.7853-0.7858 in
• Gear Shaft-to-Bushing - Service Limit Clearance	0.14 mm	0.0055 in
• Gear-to-Cover Clearance - Drive/Driven - Service Limit	0.109 mm	0.0043 in
• Gear-to-Cover Clearance - Drive/Driven - Production Value	0.064-0.109 mm	0.0025-0.0043 in
• Gear-to-Housing Clearance - Drive/Driven - Service Limit	0.22 mm	0.0087 in
• Gear-to-Housing Clearance - Drive/Driven - Production Value	0.125-0.221 mm	0.0049-0.0087 in
Piston Rings		
• Piston Ring End Gap-First Compression Ring - Service Limit	1.37 mm	0.0539 in
• Piston Ring End Gap-First Compression Ring - Production Value	0.3-0.45 mm	0.0118-0.0177 in
• Piston Ring End Gap-Second Compression Ring - Service Limit	1.35 mm	0.0531 in
• Piston Ring End Gap-Second Compression Ring - Production Value	0.50-0.65 mm	0.0197-0.0256 in
• Piston Ring End Gap-Oil Control Ring - Service Limit	1.20 mm	0.0472 in

Application	Specification	
	Metric	English
• Piston Ring End Gap-Oil Control Ring - Production Value	0.15-0.35 mm	0.0059-0.0138 in
• Piston Ring to Groove Clearance-First Compression Ring - Service Limit	0.26 mm	0.0102 in
• Piston Ring to Groove Clearance-First Compression Ring - Production Value	0.08-0.17 mm	0.0030-0.0067 in
• Piston Ring to Groove Clearance-Second Compression Ring - Service Limit	0.10 mm	0.0039 in
• Piston Ring to Groove Clearance-Second Compression Ring - Production Value	0.01-0.03 mm	0.0004-0.0012 in
• Piston Ring to Groove Clearance-Oil Control Ring - Service Limit	0.12 mm	0.0047 in
• Piston Ring to Groove Clearance-Oil Control Ring - Production Value	0.01-0.03 mm	0.0004-0.0012 in
Pistons and Pins		
• Piston-Piston Diameter	102.948-102.960 mm	4.0531-4.0535 in
• Piston-Piston Pin Bore Diameter	34.504-34.512 mm	1.3584-1.3587 in
• Pin-Piston Pin Clearance to Piston Pin Bore - Service Limit	0.017 mm	0.0007 in
• Pin-Piston Pin Clearance to Piston Pin Bore - Production Value	0.004-0.017 mm	0.0002-0.0007 in
• Pin-Piston Pin Diameter - Service Limit	34.45 mm	1.3563 in
• Pin-Piston Pin Diameter - Production Value	34.495-34.5 mm	1.3581-1.3583 in
Starter		
• Rated Output	3.5 KW	
Turbocharger		
• Axial Play	0.11 mm	0.0043 in
• Radial Play	0.20 mm	0.0079 in
Valve System		
• Valves-Valve Face Angle - Production Value	45 degrees	
• Valves-Valve Face Runout	--	--
• Valves-Valve Face Width - Service Limit	2.5 mm	0.0984 in
• Valves-Valve Face Width - Production Value	2.1 mm	0.0827 in
• Valves-Valve Head Diameter - Exhaust	31.0 mm	1.22 in
• Valves-Valve Head Diameter - Intake	33.0 mm	1.30 in
• Valves-Valve Seat Angle	45 degrees	
• Valves-Valve Stem Diameter	7.0 mm	0.28 in
• Valves-Valve Stem Oil Seal Installed Height	6.05 mm	0.2382 in
• Valves-Valve Stem-to-Guide Clearance - Service Limit	0.20 mm	0.0079 in
• Valves-Valve Stem-to-Guide Clearance - Exhaust - Production Value	0.038-0.071 mm	0.0015-0.0028 in
• Valves-Valve Stem-to-Guide Clearance - Intake - Production Value	0.030-0.063 mm	0.0012-0.0025 in
• Valves-Valve Stem-to-Guide Clearance	0.20 mm	0.0079 in
• Valve Lifters/Push Rods-Push Rod Straightness	0.8 mm	0.0315 in
• Rocker Arms-Valve Rocker Arm Bore Diameter	22.010-22.035 mm	0.8665-0.8675 in
• Rocker Arms-Valve Rocker Arm Bore-to-Shaft Clearance - Service Limit	0.20 mm	0.0079 in

Application	Specification	
	Metric	English
• Rocker Arms-Valve Rocker Arm Bore-to-Shaft Clearance - Production Value	0.010-0.056 mm	0.0004-0.0022 in
• Rocker Arms-Valve Rocker Arm Ratio - Exhaust	1.69:1	
• Rocker Arms-Valve Rocker Arm Ratio - Intake	1.36:1	
• Rocker Arms-Valve Rocker Arm Shaft Diameter - Service Limit	21.85 mm	0.8602 in
• Rocker Arms-Valve Rocker Arm Shaft Diameter - Production Value	21.979-22.000 mm	0.8653-0.8661 in
• Valve Springs-Valve Spring Free Length - Production Value	56.6 mm	2.2283 in
• Valve Springs-Valve Spring Installed Height - Production Value	41 mm	1.6142 in
• Valve Springs-Valve Spring Load - Exhaust - Service Limit	275 N at 41 mm	61.8 lb at 1.61 in
• Valve Springs-Valve Spring load - Exhaust - Production Value	315-363 N at 41 mm	71-81.6 lb at 1.61 in
• Valve Springs-Valve Spring Load - Intake - Service Limit	306 N at 41 mm	68.8 lb at 1.61 in
• Valve Springs-Valve Spring Load - Intake - Production Value	315-363 N at 41 mm	71-81.6 lb at 1.61 in

Fastener Tightening Specifications

Application	Specification	
	Metric	English
A/C Compressor Bolt	50 N·m	37 lb ft
Air Cleaner Outlet Duct Clamp	8 N·m	71 lb in
Air Conditioning Compressor/Power Steering Pump Bracket Bolt	46 N·m	34 lb ft
Battery Cable Bracket Bolt	12 N·m	106 lb in
Battery Cable Bracket Nut	8 N·m	71 lb in
Bypass Pipe Bolt	21 N·m	15 lb ft
Camshaft Gear Bolt	234 N·m	173 lb ft
Camshaft Position Sensor Bolt	10 N·m	89 lb in
Camshaft Position Sensor Exciter Ring Bolt	9 N·m	80 lb in
Camshaft Thrust Plate Bolt	22 N·m	16 lb ft
Charged Air Cooler Bolt	21 N·m	15 lb ft
Charged Air Cooler Clamp	8 N·m	71 lb in
Connecting Rod Cap Bolt - Angular Tightening Method	1st Step 64 N·m	1st Step 47 lb ft
	2nd Step 30 degrees	2nd Step 30 degrees
	3rd Step 30 degrees	3rd Step 30 degrees
Coolant Pipe to Water Pump Nut	25 N·m	18 lb ft
Cooling Fan Pulley	41 N·m	30 lb ft
Crankshaft Balancer Bolt	353 N·m	260 lb ft
Crankshaft Bearing Cap Bolt - Angular Tightening Method	1st Step 98 N·m	1st Step 72 lb ft
	2nd Step 132 N·m	2nd Step 97 lb ft
	3rd Step 30 degrees	3rd Step 30 degrees
Crankshaft Bearing Cap Side Bolt	78 N·m	58 lb ft
Crankshaft Position Sensor Bolt	10 N·m	89 lb in
Crankshaft Position Sensor Spacer Bolt	10 N·m	89 lb in
Crossmember Bolt	100 N·m	74 lb ft
Cylinder Head M12 Bolt - Angular Tightening Method	1st Step 50 N·m	1st Step 37 lb ft

Application	Specification	
	Metric	English
	2nd Step 80 N·m	2nd Step 59 lb ft
	3rd Step 90 degrees	
	4th Step 75 degrees	
Cylinder Head M8 Bolt	25 N·m	18 lb ft
Drive Belt Tensioner Pulley Bolt	41 N·m	30 lb ft
EGR Bolt - California Emissions	20 N·m	15 lb ft
EGR Bracket Bolt - California Emissions	20 N·m	15 lb ft
EGR Valve Nut - California Emissions	19 N·m	14 lb ft
Engine Block Coolant Plug	18 N·m	13 lb ft
Engine Block Ground Bolt	34 N·m	25 lb ft
Engine Mount Through Bolt to Frame	75 N·m	55 lb ft
Engine Mount to Block Bolts	58 N·m	43 lb ft
Engine Mount to Frame Bolt	65 N·m	48 lb ft
Engine Shield Bolt	20 N·m	15 lb ft
Exhaust Heat Shield Nut	9 N·m	80 lb in
Exhaust Manifold Bolt/Nut	38 N·m	28 lb ft
Exhaust Manifold Heat Shield Bolts	8 N·m	71 lb in
Exhaust Outlet Heat Shield Bolts	8 N·m	71 lb in
Exhaust Outlet Pipe Bolt	53 N·m	39 lb ft
Exhaust Pipe Bolt	53 N·m	39 lb ft
Exhaust Pipe Bracket Bolt	34 N·m	25 lb ft
Exhaust Pipe Clamp	40 N·m	30 lb ft
Exhaust Pipe Heat Shield Bolts	8 N·m	71 lb in
Fan Pulley Bracket Bolt	46 N·m	34 lb ft
Flywheel Bolt - Angular Tightening Method	1st Step 79 N·m	1st Step 58 lb ft
	2nd Step 60 degrees	2nd Step 60 degrees
	3rd Step 60 degrees	3rd Step 60 degrees
Flywheel Housing Bolt - Black Circle Mark	80 N·m	60 lb ft
Flywheel Housing to Upper Oil Pan Bolt - Black Triangle Mark	50 N·m	37 lb ft
Front Engine Cover Bolt	21 N·m	15 lb ft
Fuel Block Bolt	25 N·m	18 lb ft
Fuel Filter Bracket Bolt	21 N·m	15 lb ft
Fuel Injection Control Module Bolt	20 N·m	15 lb ft
Fuel Injection Control Module Bracket Bolt	21 N·m	15 lb ft
Fuel Injection Control Module Connector Bolt	10 N·m	89 lb in
Fuel Injection Control Module Connector Bracket Bolt	21 N·m	15 lb ft
Fuel Injection Control Module Cooler Eye Bolt	27 N·m	20 lb ft
Fuel Injection Pipe Nut	41 N·m	30 lb ft
Fuel Inlet Pipe Bracket Bolt	21 N·m	15 lb ft
Fuel Pipes Bracket Bolt	25 N·m	18 lb ft
Fuel Rail Assembly Bolt	25 N·m	18 lb ft
Fuel Rail Connector	45 N·m	33 lb ft
Fuel Return Pipe Eye Bolt - Cylinder Head Side	17 N·m	12 lb ft
Fuel Return Pipe Eye Bolt - Injector Side	16 N·m	12 lb ft
Fuel Return Pipe Sleeve Nut	41 N·m	30 lb ft
Fuel Return Sleeve Unit	41 N·m	30 lb ft
Fuel Injection Pump Assembly to Cylinder Block Bolt	21 N·m	15 lb ft
Fuel Injection Pump to Bracket Bolt	21 N·m	15 lb ft
Fuel Injection Pump Drive Gear Nut	70 N·m	52 lb ft
Fuel Line Bracket Nut	21 N·m	15 lb ft

Application	Specification	
	Metric	English
Fuel Temperature Sensor Eye Bolt	15 N·m	11 lb ft
Function Block Nut	25 N·m	18 lb ft
Function Block to Injection Pipe Nut	41 N·m	30 lb ft
Generator Bracket Bolt	50 N·m	37 lb ft
Generator Positive Cable Nut	9 N·m	80 lb in
Glow Plug	18 N·m	13 lb ft
Glow Plug Connector Nut	2 N·m	18 lb in
Glow Plug Power Feed Nut	15 N·m	11 lb ft
Glow Plug Relay Assembly Bolt	25 N·m	18 lb ft
Heater Outlet Pipe/Nose Bolt	25 N·m	18 lb ft
Heater Outlet Pipe/Hose Nut	9 N·m	80 lb in
Heater Pipe Bolt	21 N·m	15 lb ft
Hood Hinge Bolt	25 N·m	18 lb ft
Idle Pulley Bolt/Screw	37 N·m	27 lb ft
Injector Bracket Bolt	50 N·m	37 lb ft
Injector Harness Bracket Bolt	9 N·m	80 lb in
Injector Terminal Nut	2 N·m	18 lb in
Injector Pipe Lock Plate Screws	4 N·m	35 lb in
Intake Air Heater	50 N·m	37 lb ft
Intake Air Heater Terminal Nut	4 N·m	35 lb in
Intake Manifold Bolts/Nuts	21 N·m	15 lb ft
Intake Manifold Tube Bolts/Nuts	9 N·m	80 lb in
Oil Cooler Adapter Bolts	21 N·m	15 lb ft
Oil Cooler Adapter Nuts	25 N·m	18 lb ft
Oil Cooler Assembly Bolts	25 N·m	18 lb ft
Oil Cooler Adapter Stud	10 N·m	89 lb in
Oil Drain Plug	84 N·m	62 lb ft
Oil Fill Tube Bolt	21 N·m	15 lb ft
Oil Filter	24 N·m	18 lb ft
Oil Gallery Plugs	53 N·m	39 lb ft
Oil Level Indicator Tube Bolt	21 N·m	15 lb ft
Oil Level Sensor Bolt	10 N·m	89 lb in
Oil Pan Bolts/Nuts - Lower	10 N·m	89 lb in
Oil Pan Bolt - Upper	20 N·m	15 lb ft
Oil Pan Skid Plate Bolt	20 N·m	15 lb ft
Oil Pressure Sensor Unit	30 N·m	22 lb ft
Oil Pressure Relief Valve	39 N·m	29 lb ft
Oil Pump Bolt	21 N·m	15 lb ft
Oil Pump Driven Gear Nut	100 N·m	74 lb ft
Oil Pump Gear Cover Bolt	21 N·m	15 lb ft
Oil Strainer Bolts/Nuts	25 N·m	18 lb ft
Piston Cooling Nozzle Eye Bolt	21 N·m	15 lb ft
Positive Cable Junction Block Bracket to Power Steering Pump Bolt	9 N·m	80 lb in
Positive Crankcase Ventilation Cover Screws	4 N·m	35 lb in
Positive Crankcase Ventilation Oil Seperator Bracket Nut	25 N·m	18 lb ft
Power Steering Pump Bracket Bolt	50 N·m	37 lb ft
Power Steering Pump Bolt	50 N·m	37 lb ft
Power Steering Pump Bracket Bolt	46 N·m	34 lb ft
Rocker Arm Shaft Bracket Bolt	41 N·m	30 lb ft
Starter Motor Bolt	78 N·m	58 lb ft
Transmission Fill Tube Nut	18 N·m	13 lb ft

Application	Specification	
	Metric	English
Thermostat Housing Bolts/Nuts	25 N·m	18 lb ft
Thermostat Cover Bolt	21 N·m	15 lb ft
Torque Converter Bolt	60 N·m	44 lb ft
Transmission Oil Cooler Clip Nut	9 N·m	80 lb in
Turbocharger Bolt	108 N·m	80 lb ft
Turbocharger Boost Sensor Bolt	10 N·m	89 lb in
Turbocharger Coolant Outlet Pipe Bracket Bolts	21 N·m	15 lb ft
Turbocharger Heat Shield Bolts	9 N·m	80 lb in
Turbocharger Inlet Duct to Turbocharger Bolt	9 N·m	80 lb in
Turbocharger Oil Return Pipe Stud	10 N·m	89 lb in
Turbocharger Oil Supply Hose Eye Bolt	34 N·m	25 lb ft
Turbocharger Oil Return Pipe Bolts/Nuts	21 N·m	15 lb ft
Turbocharger Thermostatic Coolant Valve	60 N·m	44 lb f
UpperOil Pan to Flywheel Housing Screws	20 N·m	15 lb ft
Vacuum Pump Nuts - California Emissions	22 N·m	16 lb ft
Valve Adjusting Screw Nut	22 N·m	16 lb ft
Valve Lifter Holdown Bracket Bolt	11 N·m	97 lb in
Valve Rocker Arm Cover Bolt - Lower	10 N·m	89 lb in
Valve Rocker Arm Cover Bolt - Upper	8 N·m (Two Times)	71 lb in (Two Times)
Water Outlet Bolts	25 N·m	18 lb ft
Water Pump Bolt	21 N·m	15 lb ft

Valve Clearance Adjustment Specifications

Cylinder		Adjust at No 1 Compression Stroke TDC		Adjust at No 1 Exhaust Stroke TDC	
Left Bank	Right Bank	Intake	Exhaust	Intake	Exhaust
	1	X	X		
2			X	X	
	3	X			X
4				X	X
	5	X			X
6		X			X
	7		X	X	
8			X	X	

Drive Belt System Description

See Drive Belt System Description above.

Engine Component Description

Engine Block

The engine block utilizes a deep skirt design for increased rigidity. The cylinders are positioned in a 90 degree "V" orientation with the number one cylinder being the right front. The block is induction hardened for increased durability. The crankshaft bearing caps are cross-bolted to enhance structural rigidity.

Upper Oil Pan

A single piece cast aluminum upper oil pan contributes to crankshaft and block rigidity while reducing overall weight.

Crankshaft

The crankshaft is a nitride hardened steel design with five main bearings. Crankshaft thrust is controlled by the number 5 bearing.

Connecting Rods

The connecting rods are one-piece hot forged steel. The connecting rods and caps are of a fractured split design to improve durability and reduce internal friction. The connecting rod small end is tapered cut for reduced weight and improved durability.

Pistons

The pistons are a full-floating design. The piston pins are a slip fit in the bronze bushed connecting rod and are retained in the piston by round wire retainers. The pistons have a piston cooling oil channel cast inside of the piston. These cooling oil channels utilize an oil jet located at the bottom of the cylinder bore to direct oil into the piston channel. There are two compression rings and one oil control ring. There is a groove machined into the pistons between the first and second compression rings. This groove reduces compression ring leakage by providing an empty space for expanding gases, reducing the combustion gas pressure on the second compression ring.

Cylinder Heads

The cylinder heads are made of aluminum for lighter weight and rapid heat dissipation. There are 4 valves per cylinder and the ports are of a high swirl design for improved combustion. The cylinder head gaskets consist of an all steel laminated construction.

Valve Train

The engine utilizes a mechanical roller lifter for valve operation. The shaft mounted rocker arms have roller tips for reduced friction and wear. One rocker arm operates two valves simultaneously through a valve bridge.

Fuel System

The fuel system is of a direct injection fuel rail design. A high pressure pump mounted within the valley is gear driven directly from the camshaft. This pump provides a continuous and constant high pressure fuel supply to the fuel rails. The electronically controlled fuel injectors receive their fuel supply from these fuel rails. The fuel injection control utilizes a pilot injection method to reduce the combustion noise that is common in traditional diesel engines. The pilot injection method reduces noise by supplying a small amount of fuel to the cylinder just before the normal combustion timing.

Fuel Injection Control Module

The fuel injection control module is mounted on the right front valve rocker arm cover. It is fuel cooled.

Turbocharger

The turbocharger is water cooled for improved durability.

Oil Cooler

The oil cooler lowers engine temperature by cooling the oil with engine coolant. Engine coolant is directed from the water pump to the oil cooler by a coolant tube. The oil filter attaches directly to the oil cooler.

Oil Pump

The oil pump is gear driven directly from the crankshaft. The oil pump drive gear is a slip fit to the crankshaft.

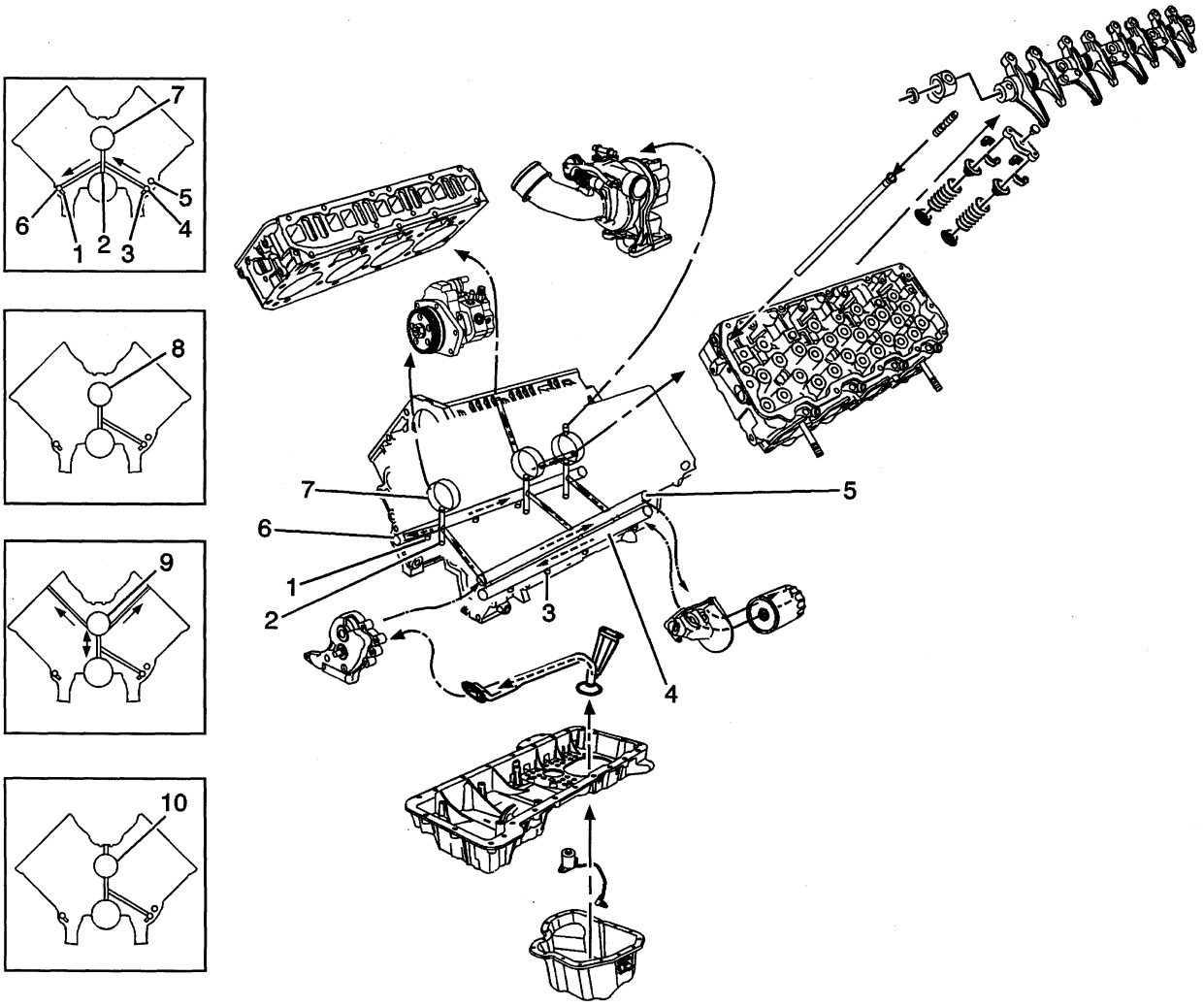
Water Pump

The water pump is gear driven for improved reliability.

Engine Covers

There is a front engine cover and a flywheel housing, both are made of aluminum. The full bell flywheel housing is cross bolted to the upper oil pan. The flywheel housing also supplies a crossover passage for engine coolant. The front engine cover houses the gear train and provides a mounting surface for the cooling fan pulley assembly.

Lubrication Description



Engine lubrication is supplied by a gear type oil pump assembly. The pump is mounted on the front of the engine block and driven by the oil pump drive gear on the crankshaft. The pump gears rotate and draw oil from the oil pan sump through a pick-up screen and pipe. The oil is pressurized as it passes through the pump and is sent through the engine block oil galleries. Contained within the oil pump assembly is a safety relief valve that eliminates overpressurization. Pressurized oil is directed through the sub oil gallery (5) to the full flow oil filter where harmful contaminants are removed. Two bypass valves are incorporated into the oil cooler assembly which will permit oil flow in the event the filter or the oil cooler become restricted.

The oil is directed to the main oil gallery (4), and from the main oil gallery it flows to the piston cooling channel left bank (3), and the sub oil gallery (6) on the right bank. The sub oil gallery on the right bank supplies oil to the right bank piston cooling channel (1). Located in the front cover at the sub oil gallery (6) is an oil pressure relief valve which regulates oil pressure within operating range.

Oil flows from the main gallery (4) to the vertical crankshaft/camshaft bearing galleries (2). From the crankshaft/camshaft bearing galleries (2), the oil flows to both the camshaft bearings and the crankshaft main bearings. Oil flows from the crankshaft main bearings to the connecting rod big end.

Oil flows from the crankshaft/camshaft bearing galleries (2) to the number 1 camshaft bearing (7), where it splash lubricates the fuel injection pump gear.

Oil flows from the crankshaft/camshaft bearing galleries (2) to the number 2 and 5 camshaft bearings (8).

Oil flows from the crankshaft/camshaft bearing galleries (2) to the number 3 camshaft bearing (9), where it exits to both cylinder heads and enters the hollow rocker arm shafts. Oil flows through the rocker arm shafts and rocker arms where it lubricates the upper valve train components. Oil also flows through the rocker arms, through the passage in the valve adjusting screw, and into the hollow pushrods where it is directed to the valve lifters.

Oil flows from the crankshaft/camshaft bearing galleries (2) to the number 4 camshaft (10), where it exits into the turbocharger oil supply line to lubricate the turbocharger. Oil exiting the turbocharger is routed through the turbocharger oil return pipe and into the flywheel housing.

Engine Mechanical – 6.6L Turbo-Diesel (RPO LLY)

Engine Mechanical Specifications

Application	Specification	
	Metric	English
General		
Engine Type	90 degree V-8	
Displacement	6.6 Liter	402 cu in
RPO	LLY	
Bore	103 mm	4.0551 in
Stroke	99 mm	3.8976 in
Compression Ratio	17.5:1	
Engine Compression Test - Minimum	2069 KPa	300 psi
Idle Speed	680 RPM	
Firing Order	1-2-7-8-4-5-6-3	
Block		
Cylinder Bore Diameter - Service Limits	103.11 mm	4.0594 in
Cylinder Bore Diameter - Production Value	103.0-103.014 mm	4.0551-4.0557 in
Cylinder Bore Out-of-Round - Production Value	0.015 mm	0.0006 in
Cylinder Bore Taper - Production Value	0.015 mm	0.0006 in
Camshaft		
Camshaft Bearing Inside Diameter - Service Limit	61.07 mm	2.4043 in
Camshaft Bearing Inside Diameter - Production Value	61.00-61.03 mm	2.4016-2.4028 in
Camshaft End Play - Service Limit	0.2 mm	0.0079 in
Camshaft Journal Diameter - Service Limit	60.92 mm	2.3984 in
Camshaft Journal Diameter - Production Value	60.932-60.962 mm	2.3990-2.4001 in
Camshaft Lobe Lift - Exhuast - Production Value	5.907 mm	0.2326 in
Camshaft Lobe Lift - Intake - Production Value	7.273 mm	0.2863 in
Camshaft Runout - Service Limit	0.05 mm	0.0020 in
Cooling System		
Capacity @ Engine RPM	270 L/min @ 3172 RPM	
Thermostat Full Open Temperature	110 degrees C	230 degrees F
Turbocharger Coolant Bypass Valve	60 degrees C	140 degrees F
Connecting Rod		
Connecting Rod Bearing Clearance - Service Limit	0.10 mm	0.0039 in
Connecting Rod Bearing Clearance - Production Value	0.036-0.077 mm	0.0014-0.0030 in
Connecting Rod Bore Diameter - Bearing End - Production Value	62.958-62.979 mm	2.4789-2.4795 in
Connecting Rod Bore Diameter - Pin End - Service Limit	34.53 mm	1.3594 in
Connecting Rod Bore Diameter - Pin End - Production Value	34.512-34.522 mm	1.3587-1.3591 in
Connecting Rod Length	163.0 mm	6.42 in

Application	Specification	
	Metric	English
Connecting Rod Side Clearance - Service Limit	0.54 mm	0.0213 in
Connecting Rod Side Clearance - Production Value	0.31-0.49 mm	0.0122-0.0193 in
Crankshaft		
Connecting Rod Journal Diameter - Service Limit	62.88 mm	2.4756 in
Connecting Rod Journal Diameter - Production Value	62.902-62.922 mm	2.4764-2.4772 in
Crankshaft End Play - Service Limit	0.54 mm	0.0213 in
Crankshaft End Play - Production Value	0.04-0.205 mm	0.0016-0.0081 in
Crankshaft Main Bearing Clearance - Service Limit	0.014 mm	0.0055 in
Crankshaft Main Bearing Clearance - Production Value	0.039-0.070 mm	0.0015-0.0028 in
Crankshaft Main Journal Diameter - Service Limit	79.89 mm	3.1453 in
Crankshaft Main Journal Diameter - Production Value	79.905-79.925 mm	3.1459-3.1466 in
Crankshaft Runout - Service Limit	0.44 mm	0.0173 in
Crankshaft Runout - Production Value	0.05 mm	0.0020 in
Cylinder Head		
Surface Flatness - Block Deck - Service Limit	0.2 mm	0.0079 in
Surface Flatness - Block Deck - Production Value	0.075 mm	0.0030 in
Surface Flatness - Exhaust Manifold Deck - Production Value	0.1 mm	0.0039 in
Surface Flatness - Intake Manifold Deck - Production Value	0.1 mm	0.0039 in
Exhaust Manifold		
Surface Flatness- Production Value	0.3 mm	0.0118 in
Intake Manifold		
Surface Flatness - Production Value	0.3 mm	0.0118 in
Lubrication System		
Oil Capacity - with Filter	10 qt	9.5 L
Oil Capacity - without Filter	9.2 qt	8.7 L
Oil Pressure - Minimum- Hot - at idle	98 KPa	14 psi
Oil Pressure - Minimum - 1800 RPM	294 KPa	42 psi
Oil Relief Valve Opening Pressure	441 KPa	64 psi
Piston Cooling Jet Valve Opening Pressure	196 KPa	29 psi
Oil Pump		
Gear Shaft Outside Diameter - Drive - Service Limit	19.86 mm	0.7819 in
Gear Shaft Outside Diameter - Drive - Production Value	19.947-19.960 mm	0.7853-0.7858 in
Gear Shaft Outside Diameter - Driven - Service Limit	19.86 mm	0.7819 in
Gear Shaft Outside Diameter - Driven - Production Value	19.947-19.960 mm	0.7853-0.7858 in
Gear Shaft-to-Bushing - Service Limit Clearance	0.14 mm	0.0055 in
Gear-to-Cover Clearance - Drive/Driven - Service Limit	0.109 mm	0.0043 in
Gear-to-Cover Clearance - Drive/Driven - Production Value	0.064-0.109 mm	0.0025-0.0043 in
Gear-to-Housing Clearance - Drive/Driven - Service Limit	0.22 mm	0.0087 in
Gear-to-Housing Clearance - Drive/Driven - Production Value	0.125-0.221 mm	0.0049-0.0087 in
Piston Rings		
Piston Ring End Gap-First Compression Ring - Service Limit	1.37 mm	0.0539 in
Piston Ring End Gap-First Compression Ring - Production Value	0.3-0.45 mm	0.0118-0.0177 in
Piston Ring End Gap-Second Compression Ring - Service Limit	1.35 mm	0.0531 in
Piston Ring End Gap-Second Compression Ring - Production Value	0.50-0.65 mm	0.0197-0.0256 in
Piston Ring End Gap-Oil Control Ring - Service Limit	1.20 mm	0.0472 in

Application	Specification	
	Metric	English
Piston Ring End Gap-Oil Control Ring - Production Value	0.15-0.35 mm	0.0059-0.0138 in
Piston Ring to Groove Clearance-First Compression Ring - Service Limit	0.26 mm	0.0102 in
Piston Ring to Groove Clearance-First Compression Ring - Production Value	0.08-0.17 mm	0.0030-0.0067 in
Piston Ring to Groove Clearance-Second Compression Ring - Service Limit	0.10 mm	0.0039 in
Piston Ring to Groove Clearance-Second Compression Ring - Production Value	0.01-0.03 mm	0.0004-0.0012 in
Piston Ring to Groove Clearance-Oil Control Ring - Service Limit	0.12 mm	0.0047 in
Piston Ring to Groove Clearance-Oil Control Ring - Production Value	0.01-0.03 mm	0.0004-0.0012 in
Pistons and Pins		
Piston-Piston Diameter	102.948-102.960 mm	4.0531-4.0535 in
Piston-Piston Pin Bore Diameter	34.504-34.512 mm	1.3584-1.3587 in
Pin-Piston Pin Clearance to Piston Pin Bore - Service Limit	0.017 mm	0.0007 in
Pin-Piston Pin Clearance to Piston Pin Bore - Production Value	0.004-0.017 mm	0.0002-0.0007 in
Pin-Piston Pin Diameter - Service Limit	34.45 mm	1.3563 in
Pin-Piston Pin Diameter - Production Value	34.495-34.5 mm	1.3581-1.3583 in
Starter		
Rated Output	3.5 KW	
Turbocharger		
Axial Play	0.11 mm	0.0043 in
Radial Play	0.20 mm	0.0079 in
Valve System		
Valves-Valve Face Angle - Production Value	45 degrees	
Valves-Valve Face Width - Service Limit	2.5 mm	0.0984 in
Valves-Valve Face Width - Production Value	2.1 mm	0.0827 in
Valves-Valve Head Diameter - Exhaust	31.0 mm	1.22 in
Valves-Valve Head Diameter - Intake	33.0 mm	1.30 in
Valves-Valve Seat Angle	45 degrees	
Valves-Valve Stem Diameter	7.0 mm	0.28 in
Valves-Valve Stem Oil Seal Installed Height	6.05 mm	0.2382 in
Valves-Valve Stem-to-Guide Clearance - Service Limit	0.20 mm	0.0079 in
Valves-Valve Stem-to-Guide Clearance - Exhaust - Production Value	0.038-0.071 mm	0.0015-0.0028 in
Valves-Valve Stem-to-Guide Clearance - Intake - Production Value	0.030-0.063 mm	0.0012-0.0025 in
Valves-Valve Stem-to-Guide Clearance	0.20 mm	0.0079 in
Valve Lifters/Push Rods-Push Rod Straightness	0.8 mm	0.0315 in
Rocker Arms-Valve Rocker Arm Bore Diameter	22.010-22.035 mm	0.8665-0.8675 in
Rocker Arms-Valve Rocker Arm Bore-to-Shaft Clearance - Service Limit	0.20 mm	0.0079 in
Rocker Arms-Valve Rocker Arm Bore-to-Shaft Clearance - Production Value	0.010-0.056 mm	0.0004-0.0022 in
Rocker Arms-Valve Rocker Arm Ratio - Exhaust	1.69:1	
Rocker Arms-Valve Rocker Arm Ratio - Intake	1.36:1	

Application	Specification	
	Metric	English
Rocker Arms-Valve Rocker Arm Shaft Diameter - Service Limit	21.85 mm	0.8602 in
Rocker Arms-Valve Rocker Arm Shaft Diameter - Production Value	21.979-22.000 mm	0.8653-0.8661 in
Valve Springs-Valve Spring Free Length - Production Value	56.6 mm	2.2283 in
Valve Springs-Valve Spring Installed Height - Production Value	41 mm	1.6142 in
Valve Springs-Valve Spring Load - Exhaust - Service Limit	275 N at 41 mm	61.8 lb at 1.61 in
Valve Springs-Valve Spring load - Exhaust - Production Value	315-363 N at 41 mm	71-81.6 lb at 1.61 in
Valve Springs-Valve Spring Load - Intake - Service Limit	306 N at 41 mm	68.8 lb at 1.61 in
Valve Springs-Valve Spring Load - Intake - Production Value	315-363 N at 41 mm	71-81.6 lb at 1.61 in

Fastener Tightening Specifications

Application	Specification	
	Metric	English
A/C Compressor Bolt	50 N·m	37 lb ft
Air Cleaner Outlet Duct Clamp	8 N·m	71 lb in
Air Conditioning Compressor/Power Steering Pump Bracket Bolt	46 N·m	34 lb ft
Air Inlet Tube Nut	25 N·m	18 lb ft
Battery Cable Bracket Bolt	12 N·m	106 lb in
Battery Cable Bracket Nut	8 N·m	71 lb in
Bypass Pipe Bolt	25 N·m	18 lb ft
Camshaft Gear Bolt	234 N·m	173 lb ft
Camshaft Position Sensor Bolt	10 N·m	89 lb in
Camshaft Position Sensor Exciter Ring Bolt	9 N·m	80 lb in
Camshaft Thrust Plate Bolt	22 N·m	16 lb ft
Charged Air Cooler Bolt	21 N·m	15 lb ft
Charged Air Cooler Clamp	8 N·m	71 lb in
Connecting Rod Cap Bolt - Angular Tightening Method	1st Step 64 N·m	1st Step 47 lb ft
	2nd Step 30 degrees	2nd Step 30 degrees
	3rd Step 30 degrees	3rd Step 30 degrees
Coolant Pipe Bolt and Nut	25 N·m	18 lb ft
Coolant Tube to Water Pump Nut	25 N·m	18 lb ft
Cooling Fan Pulley	41 N·m	30 lb ft
Crankshaft Balancer Bolt	1st Step 100 N·m	1st Step 74 lb ft
	2nd Step 90 degrees	2nd Step 90 degrees
Crankshaft Bearing Cap Bolt	1st Step 98 N·m	1st Step 72 lb ft
	2nd Step 132 N·m	2nd Step 97 lb ft
	3rd Step 30 degrees	3rd Step 30 degrees
Crankshaft Bearing Cap Bolt - Angular Tightening Method	1st Step 100 N·m	1st Step 74 lb ft
	2nd Step 90 degrees	2nd Step 90 degrees
Crankshaft Bearing Cap Side Bolt	70 N·m	52 lb ft
Crankshaft Position Sensor Bolt	10 N·m	89 lb in
Crankshaft Position Sensor Spacer Bolt	10 N·m	89 lb in
Crossmember Bolt	100 N·m	74 lb ft

Application	Specification	
	Metric	English
Cylinder Head M12 Bolt - Angular Tightening Method	1st Step 50 N·m	1st Step 37 lb ft
	2nd Step 80 N·m	2nd Step 59 lb ft
	3rd Step 60 degrees	
	4th Step 90 degrees	
Cylinder Head M8 Bolt	25 N·m	18 lb ft
Drive Belt Tensioner Pulley Bolt	50 N·m	37 lb ft
EGR Bracket	25 N·m	18 lb ft
EGR Bracket Bolt	25 N·m	18 lb ft
EGR Bracket to Cooler Bolt	25 N·m	18 lb ft
Electrical Harness Bracket Bolt	10 N·m	89 lb in
Engine Block Coolant Plug	18 N·m	13 lb ft
Engine Block Ground Bolt	34 N·m	25 lb ft
Engine Mount Through Bolt to Frame	75 N·m	55 lb ft
Engine Mount to Block Bolts	58 N·m	43 lb ft
Engine Mount to Frame Bolt	65 N·m	48 lb ft
Engine Shield Bolt	20 N·m	15 lb ft
Exhaust Heat Shield Nut	10 N·m	89 lb in
Exhaust Manifold Bolt/Nut	38 N·m	28 lb ft
Exhaust Manifold Heat Shield Bolts	10 N·m	89 lb in
Exhaust Outlet Heat Shield Bolts	10 N·m	89 lb in
Exhaust Pipe Bracket Nut	53 N·m	39 lb ft
Exhaust Pipe Clamp	53 N·m	39 lb ft
Exhaust Pipe Heat Shield Bolts	10 N·m	89 lb in
Fan Pulley Bracket Bolt	50 N·m	37 lb ft
Flywheel Bolt - Angular Tightening Method	1st Step 79 N·m	1st Step 58 lb ft
	2nd Step 60 degrees	2nd Step 60 degrees
	3rd Step 60 degrees	3rd Step 60 degrees
Flywheel Housing Bolt	80 N·m	60 lb ft
Flywheel Housing to Upper Oil Pan Bolt	50 N·m	37 lb ft
Front Engine Cover Bolt	25 N·m	18 lb ft
Fuel Filter Bracket Bolt	30 N·m	22 lb ft
Fuel Injection Control Module Bolt	20 N·m	15 lb ft
Fuel Injection Control Module Bracket Bolt	21 N·m	15 lb ft
Fuel Injection Control Module Connector Bolt	10 N·m	89 lb in
Fuel Injection Control Module Connector Bracket Bolt	21 N·m	15 lb ft
Fuel Injection Control Module Cooler Eye Bolt	27 N·m	20 lb ft
Fuel Injection Pipe Nut	41 N·m	30 lb ft
Fuel Injector Bracket Bolt	30 N·m	22 lb ft
Fuel Inlet Pipe Bracket Bolt	21 N·m	15 lb ft
Fuel Injection Pump Assembly to Cylinder Block Bolt	25 N·m	18 lb ft
Fuel Injection Pump to Bracket Bolt	28 N·m	20 lb ft
Fuel Injection Pump Drive Gear Nut	70 N·m	52 lb ft
Fuel Line Bracket Nut	21 N·m	15 lb ft
Fuel Temperature Sensor	22 N·m	16 lb ft
Fuel Pipes Bracket Bolt	25 N·m	18 lb ft
Fuel Rail Assembly Bolt	25 N·m	18 lb ft
Fuel Rail Balance Pipe Bolt	21 N·m	15 lb ft
Generator Bracket Bolt and Nut	50 N·m	37 lb ft
Generator Positive Cable Nut	9 N·m	80 lb in
Glow Plug	18 N·m	13 lb ft

Application	Specification	
	Metric	English
Glow Plug Controller Bolt	10 N·m	89 lb in
Glow Plug Harness Bracket Bolt	10 N·m	89 lb in
Glow Plug Nut	2 N·m	18 lb in
Glow Plug Power Feed Nut	15 N·m	11 lb ft
Glow Plug Relay Assembly Bolt	10 N·m	89 lb in
Heater Outlet Pipe Bolt	25 N·m	18 lb ft
Heater Pipe Bolt	25 N·m	18 lb ft
Hood Hinge Bolt	25 N·m	18 lb ft
Idle Pulley Bolt	50 N·m	37 lb ft
Injector Bracket Bolt	23 N·m	16 lb ft
Intake Manifold Bolts/Nuts	25 N·m	18 lb ft
Oil Cooler Adapter Bolts	25 N·m	18 lb ft
Oil Cooler Adapter Nuts	25 N·m	18 lb ft
Oil Cooler Assembly Bolts	25 N·m	18 lb ft
Oil Cooler Adapter Stud	10 N·m	89 lb in
Oil Drain Plug	84 N·m	62 lb ft
Oil Fill Tube Bolt	25 N·m	18 lb ft
Oil Filter	24 N·m	18 lb ft
Oil Gallery Plugs	53 N·m	39 lb ft
Oil Level Indicator Tube Bolt	21 N·m	15 lb ft
Oil Level Sensor Bolt	10 N·m	89 lb in
Oil Level Sensor Harness Bolt	40 N·m	29 lb ft
Oil Pan Bolts/Nuts - Lower	10 N·m	89 lb in
Oil Pan Bolt - Upper	20 N·m	15 lb ft
Oil Pan Skid Plate Bolt	20 N·m	15 lb ft
Oil Pressure Sensor Unit	41 N·m	30 lb ft
Oil Pressure Relief Valve	39 N·m	29 lb ft
Oil Pump Bolt	21 N·m	15 lb ft
Oil Pump Driven Gear Nut	100 N·m	74 lb ft
Oil Pump Gear Cover Bolt	21 N·m	15 lb ft
Oil Pump Pipe and Screen Assembly Bolts and Nuts	25 N·m	18 lb ft
Piston Cooling Nozzle Eye Bolt	21 N·m	15 lb ft
Positive Cable Junction Block Bracket to Power Steering Pump Bolt	9 N·m	80 lb in
Positive Crankcase Ventilation Cover Screws	4 N·m	35 lb in
Positive Crankcase Ventilation Oil Seperator Bracket Nut	25 N·m	18 lb ft
Power Steering Pump Bracket Bolt	50 N·m	37 lb ft
Power Steering Pump Bolt	50 N·m	37 lb ft
Rocker Arm Shaft Bracket Bolt	41 N·m	30 lb ft
Starter Motor Bolt	78 N·m	58 lb ft
Transmission Fill Tube Nut	18 N·m	13 lb ft
Thermostat Housing Bolts/Nuts	25 N·m	18 lb ft
Thermostat Cover Bolt	25 N·m	18 lb ft
Torque Converter Bolt	60 N·m	44 lb ft
Transmission Oil Cooler Clip Nut	9 N·m	80 lb in
Turbocharger Bolt	108 N·m	80 lb ft
Turbocharger Boost Sensor Bolt	10 N·m	89 lb in
Turbocharger Coolant Outlet Pipe Bracket Nut	10 N·m	89 lb in
Turbocharger Heat Shield Bolts	10 N·m	89 lb in
Turbocharger Oil Return Pipe Stud	10 N·m	89 lb in
Turbocharger Oil Supply Hose Eye Bolt	26 N·m	19 lb ft
Turbocharger Oil Return Pipe Bolts/Nuts	25 N·m	18 lb ft

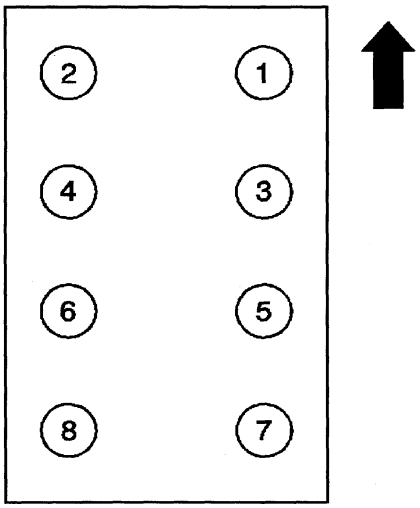
Application	Specification	
	Metric	English
UpperOil Pan to Flywheel Housing Screws	20 N·m	15 lb ft
Valve Adjusting Nut	22 N·m	16 lb ft
Valve Lifter Holdown Bracket Bolt	11 N·m	97 lb in
Valve Rocker Arm Cover Bolt - Lower	10 N·m	89 lb in
Valve Rocker Arm Cover Bolt - Upper	8 N·m (Two Times)	71 lb in (Two Times)
Water Outlet Bolts	25 N·m	18 lb ft
Water Pump Bolt	25 N·m	18 lb ft
Water Pump Inlet Pipe Bolts	25 N·m	18 lb ft

Valve Clearance Adjustment Specifications

Cylinder		Adjust at No 1 Compression Stroke TDC		Adjust at No 1 Exhaust Stroke TDC	
Left Bank	Right Bank	Intake	Exhaust	Intake	Exhaust
	1	X	X		
2			X	X	
	3	X			X
4				X	X
	5	X			X
6		X			X
	7		X	X	
8			X	X	

Engine Component Description

Engine Block



The engine block utilizes a deep skirt design for increased rigidity. The cylinders are positioned in a 90 degree "V" orientation with the number one cylinder being the right front. The block is induction hardened for increased durability. The crankshaft bearing caps are cross-bolted to enhance structural rigidity.

Upper Oil Pan

A single piece cast aluminum upper oil pan contributes to crankshaft and block rigidity while reducing overall weight.

Crankshaft

The crankshaft is a nitride hardened steel design with five main bearings. Crankshaft thrust is controlled by the number 5 bearing.

Connecting Rods

The connecting rods are one-piece hot forged steel. The connecting rods and caps are of a fractured split design to improve durability and reduce internal friction. The connecting rod small end is tapered cut for reduced weight and improved durability.

Pistons

The pistons are a full-floating design. The piston pins are a slip fit in the bronze bushed connecting rod and are retained in the piston by round wire retainers. The pistons have a piston cooling oil channel cast inside of the piston. These cooling oil channels utilize an oil jet located at the bottom of the cylinder bore to direct oil into the piston channel. There are two compression rings and one oil control ring. There is a groove machined into the pistons between the first and second compression rings. This groove reduces compression ring leakage by providing an empty space for expanding gases, reducing the combustion gas pressure on the second compression ring.

Cylinder Heads

The cylinder heads are made of aluminum for lighter weight and rapid heat dissipation. There are 4 valves per cylinder and the ports are of a high swirl design for improved combustion. The cylinder head gaskets consist of an all steel laminated construction.

Valve Train

The engine utilizes a mechanical roller lifter for valve operation. The shaft mounted rocker arms have roller tips for reduced friction and wear. One rocker arm operates two valves simultaneously through a valve bridge.

Fuel System

The fuel system is of a direct injection fuel rail design. A high pressure pump mounted within the valley is gear driven directly from the camshaft. This pump provides a continuous and constant high pressure fuel supply to the fuel rails. The electronically controlled fuel injectors receive their fuel supply from these fuel rails. The fuel injection control utilizes a pilot injection method to reduce the combustion noise that is common in traditional diesel engines. The pilot injection method reduces noise by supplying a small amount of fuel to the cylinder just before the normal combustion timing.

Fuel Injection Control Module

The fuel injection control module is mounted on the right front valve rocker arm cover. It is fuel cooled.

Turbocharger

The turbocharger is water cooled for improved durability.

Oil Cooler

The oil cooler lowers engine temperature by cooling the oil with engine coolant. Engine coolant is directed from the water pump to the oil cooler by a coolant tube. The oil filter attaches directly to the oil cooler.

Oil Pump

The oil pump is gear driven directly from the crankshaft. The oil pump drive gear is a slip fit to the crankshaft.

Water Pump

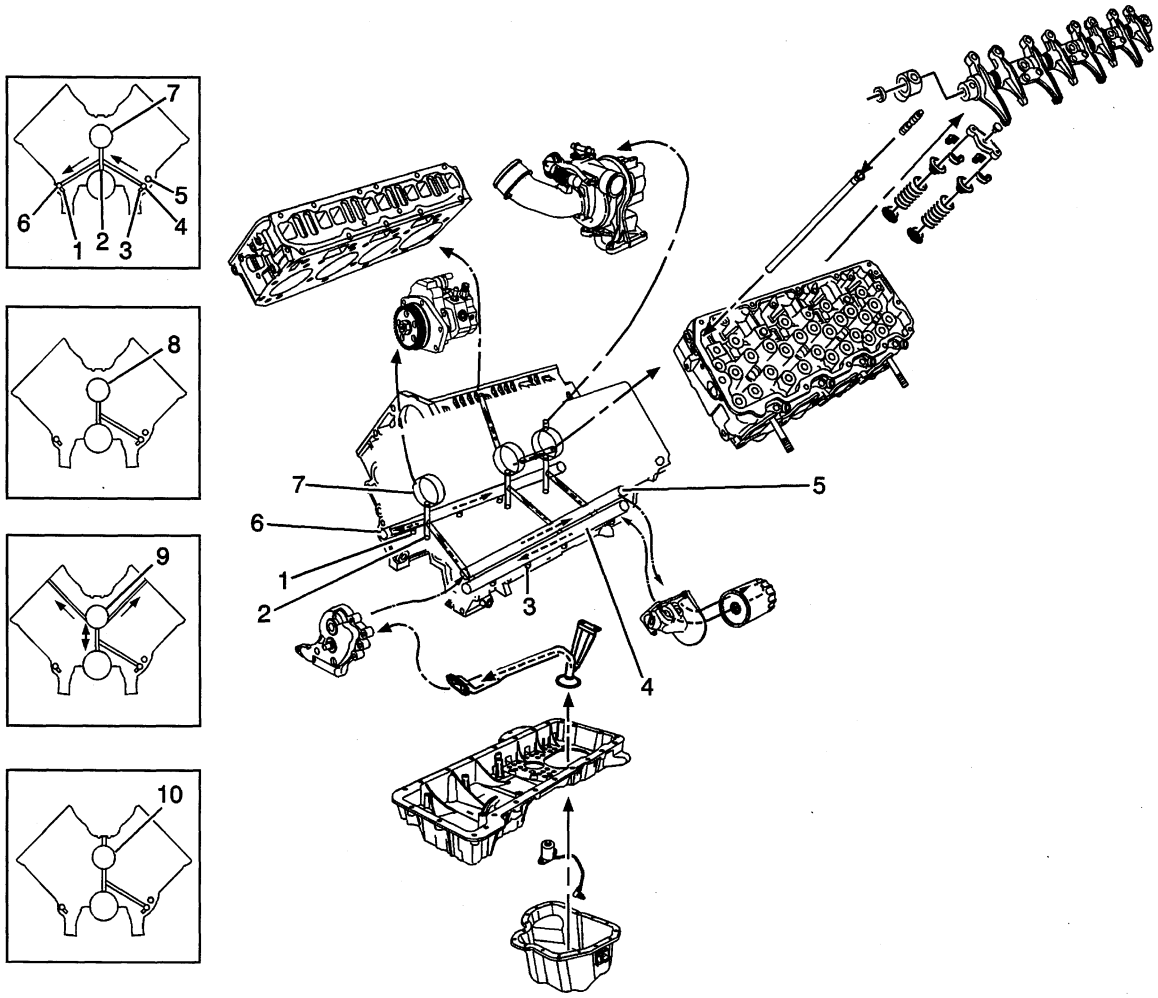
The water pump is gear driven for improved reliability.

Engine Covers

There is a front engine cover and a flywheel housing, both are made of aluminum. The full bell flywheel housing is cross bolted to the upper oil pan. The flywheel housing also supplies a crossover passage for engine coolant. The front engine cover houses the gear train and provides a mounting surface for the cooling fan pulley assembly.

Lubrication Description

Lubrication Flow Schematic



Engine lubrication is supplied by a gear type oil pump assembly. The pump is mounted on the front of the engine block and driven by the oil pump drive gear on the crankshaft. The pump gears rotate and draw oil from the oil pan sump through a pick-up screen and pipe. The oil is pressurized as it passes through the pump and is sent through the engine block oil galleries. Contained within the oil pump assembly is a safety relief valve that eliminates overpressurization. Pressurized oil is directed through the sub oil gallery (5) to the full flow oil filter where harmful contaminants are removed. Two bypass valves are incorporated into the oil cooler assembly which will permit oil flow in the event the filter or the oil cooler become restricted.

The oil is directed to the main oil gallery (4), and from the main oil gallery it flows to the piston cooling channel left bank (3), and the sub oil gallery (6) on the right bank. The sub oil gallery on the right bank

supplies oil to the right bank piston cooling channel (1). Located in the front cover at the sub oil gallery (6) is an oil pressure relief valve which regulates oil pressure within operating range.

Oil flows from the main gallery (4) to the vertical crankshaft/camshaft bearing galleries (2). From the crankshaft/camshaft bearing galleries (2), the oil flows to both the camshaft bearings and the crankshaft main bearings. Oil flows from the crankshaft main bearings to the connecting rod big end.

Oil flows from the crankshaft/camshaft bearing galleries (2) to the number 1 camshaft bearing (7), where it splash lubricates the fuel injection pump gear.

Oil flows from the crankshaft/camshaft bearing galleries (2) to the number 2 and 5 camshaft bearings (8).

Oil flows from the crankshaft/camshaft bearing galleries (2) to the number 3 camshaft bearing (9), where it exits to both cylinder heads and enters the hollow rocker arm shafts. Oil flows through the rocker arm shafts and rocker arms where it lubricates the upper valve train components. Oil also flows through the rocker arms, through the passage in the valve adjusting screw, and into the hollow pushrods where it is directed to the valve lifters.

Oil flows from the crankshaft/camshaft bearing galleries (2) to the number 4 camshaft (10), where it exits into the turbocharger oil supply line to lubricate the turbocharger. Oil exiting the turbocharger is routed through the turbocharger oil return pipe and into the flywheel housing.

Crankcase Ventilation System Description

A crankcase ventilation system is used in order to provide a more complete scavenging of crankcase vapors. The air cleaner supplies fresh air through a filter to the crankcase. The crankcase mixes the fresh air with blow-by gases. This mixture then passes through a crankcase depression regulator valve into the intake manifold.

The primary control is through the crankcase depression regulator valve, which meters the flow at a rate depending on the crankcase pressure.

In order to maintain an idle quality, the crankcase depression regulator valve restricts the flow when the crankcase pressure is high. If abnormal operating conditions arise, the system is designed in order to allow the excessive amounts of blow-by gases to back flow through the crankcase vent tube into the air cleaner in order to be consumed by normal combustion.

Engine Mechanical – 8.1L (RPO L18 VIN G)

General Specifications

Application	Specification	
	Metric	English
General		
• Engine Type	V-8	
• Displacement	8.1L	496 CID
• RPO	L18	
• VIN	G	
• Bore	107.950 mm	4.250 in
• Stroke	111.00 mm	4.370 in
• Compression Ratio	9.1:1	
• Firing Order	1-8-7-2-6-5-4-3	
• Spark Plug Gap	1.52 mm	0.060 in
Block		
• Crankshaft Main Bearing Bore Diameter	74.6060-74.6220 mm	2.9372-2.9379 in
• Cylinder Bore Diameter - Production	107.950-107.968 mm	4.2500-4.2507 in
• Cylinder Bore Diameter - Service	107.940-107.990 mm	4.2496-4.2516 in
• Cylinder Bore Out-of-Round - Production, Maximum Minus Minimum Bore Diameter	0.0180 mm	0.0007 in
• Cylinder Bore Out-of-Round - Service, Maximum Minus Minimum Bore Diameter	0.050 mm	0.002 in
• Cylinder Bore Taper - Production	0.0180 mm	0.0007 in
• Cylinder Bore Taper - Service Thrust Axis	0.050 mm	0.002 in
• Cylinder Bore Taper - Service Pin Axis	0.050 mm	0.002 in
• Cylinder Head Deck Height - from Centerline of Crankshaft	259.875-260.125 mm	10.231-10.241 in
• Cylinder Head Deck Surface Flatness - Entire Face	0.100 mm	0.004 in
• Cylinder Head Deck Surface Flatness - Within 150 mm (6 in)	0.050 mm	0.002 in
• Valve Lifter Bore Diameter	21.417-21.443 mm	0.843-0.844 in
Camshaft		
• Camshaft Bearing Inside Diameter	49.5480-49.5730 mm	1.9507-1.9517 in
• Camshaft Journal Diameter	49.4720-49.5220 mm	1.9477-1.9497 in
• Camshaft Lobe Lift - Exhaust	6.973-7.075 mm	0.2745-0.2785 in
• Camshaft Lobe Lift - Intake	6.924-7.026 mm	0.2726-0.2766 in
• Camshaft Runout - Production	0.051 mm	0.002 in
• Camshaft Runout - Service	0.076 mm	0.003 in
Connecting Rod		
• Connecting Rod Bearing Clearance - Production	0.021-0.064 mm	0.0008-0.0025 in
• Connecting Rod Bearing Clearance - Service	0.021-0.081 mm	0.0008-0.0032 in
• Connecting Rod Side Clearance	0.384-0.686 mm	0.0151-0.0270 in

Application	Specification	
	Metric	English
Crankshaft		
• Connecting Rod Journal Diameter	55.854-55.870 mm	2.1990-2.1996 in
• Connecting Rod Journal Out-of-Round - Production	0.0102 mm	0.0004 in
• Connecting Rod Journal Taper - Production	0.0102 mm	0.0004 in
• Crankshaft End Play	0.127-0.279 mm	0.0050-0.0110 in
• Crankshaft Main Bearing Clearance - #1, #2, #3, #4 Production	0.022-0.052 mm	0.0008-0.0020 in
• Crankshaft Main Bearing Clearance - #5 Production	0.035-0.067 mm	0.0014-0.0026 in
• Crankshaft Main Bearing Clearance - #1, #2, #3, #4 Service	0.022-0.089 mm	0.0008-0.0035 in
• Crankshaft Main Bearing Clearance - #5 Service Limit	0.035-0.102 mm	0.0014-0.0040 in
• Crankshaft Main Journal Diameter	69.805-69.822 mm	2.7482-2.7489 in
• Crankshaft Main Journal Out-of-Round - Production	0.0102 mm	0.0004 in
• Crankshaft Main Journal Taper - Production	0.0102 mm	0.0004 in
• Crankshaft Runout - Production	0.0380 mm	0.0015 in
• Crankshaft Runout - Service	0.0510 mm	0.0020 in
Cylinder Head		
• Cylinder Head Height/Thickness	259.875-260.125 mm	10.231-10.241 in
• Surface Flatness - Block Deck	0.050 mm	0.002 in
• Surface Flatness - Exhaust Manifold Deck	0.102 mm	0.004 in
• Surface Flatness - Intake Manifold Deck	0.080 mm	0.003 in
Exhaust Manifold		
• Surface Flatness	0.254 mm	0.010 in
Lubrication System		
• Oil Capacity - Without Filter	5.7L	6 Qts
• Oil Pressure - Minimum	34 kPa @ 1,000 RPM	5 psi @ 1,000 RPM
• Oil Pressure - Minimum	69 kPa @ 2,000 RPM	10 psi @ 2,000 RPM
Piston Rings		
Piston Ring End Gap		
• First Compression Ring - Production	0.300-0.450 mm	0.012-0.018 in
• First Compression Ring - Service	0.450-0.675 mm	0.018-0.027 in
• Second Compression Ring - Production	0.450-0.650 mm	0.017-0.025 in
• Second Compression Ring - Service	0.675-0.975 mm	0.026-0.039 in
• Oil Control Ring - Production	0.249-0.759 mm	0.0098-0.0299 in
• Oil Control Ring - Service	0.373-1.138 mm	0.015-0.045 in
Piston Ring to Groove Clearance		
• First Compression Ring	0.031-0.074 mm	0.0012-0.0029 in
• Second Compression Ring	0.031-0.074 mm	0.0012-0.0029 in
• Oil Control Ring	0.051-0.203 mm	0.002-0.008 in

Application	Specification	
	Metric	English
Piston and Pins		
Piston		
• Piston Diameter	Not Measurable	Not Measurable
• Piston to Bore Clearance	Interference Fit	Interference Fit
Pin		
• Piston Pin Clearance to Connecting Rod Bore	0.049-0.020 mm Interference	0.00019-0.0007 in Interference
• Piston Pin Diameter	26.416-26.419 mm	1.0400-1.0401 in
Valve System		
Valves		
• Valve Face Angle - Exhaust	45 degrees	
• Valve Face Angle - Intake	45 degrees	
• Valve Head Diameter - Exhaust	43.69 mm	1.72 in
• Valve Head Diameter - Intake	55.63 mm	2.19 in
• Valve Lash - Exhaust	Net Lash	Net Lash
• Valve Lash - Intake	Net Lash	Net Lash
• Valve Seat Angle - Exhaust	46 degrees	
• Valve Seat Angle - Intake	46 degrees	
• Valve Seat Runout - Exhaust	0.0500 mm	0.002 in
• Valve Seat Runout - Intake	0.0500 mm	0.002 in
• Valve Seat Width - Exhaust	1.651-2.159 mm	0.060-0.095 in
• Valve Seat Width - Intake	0.800-1.200 mm	0.030-0.060 in
• Valve Stem Diameter - Exhaust	9.431-9.449 mm	0.3713-0.3720 in
• Valve Stem Diameter - Intake	9.436-9.454 mm	0.3715-0.3722 in
• Valve Stem-to-Guide Clearance - Production Exhaust	0.030-0.079 mm	0.0012-0.0031 in
• Valve Stem-to-Guide Clearance - Production Intake	0.025-0.074 mm	0.0010-0.0029 in
• Valve Stem-to-Guide Clearance - Service Exhaust	0.030-0.091 mm	0.0012-0.0036 in
• Valve Stem-to-Guide Clearance - Service Intake	0.025-0.088 mm	0.0010-0.0034 in
Rocker Arms		
• Valve Rocker Arm Ratio	1.70:1	
Valve Springs		
• Valve Spring Free Length	56.35 mm	2.218 in
• Valve Spring Installed Height	45.923-46.685 mm	1.808-1.838 in
• Valve Spring Load - Closed	381-419 N·m @ 45.923 mm	86-94 lb @ 1.808 in
• Valve Spring Load - Open	962-1058 N·m @ 33.985 mm	216-236 lb @ 1.338 in

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accessory Drive Belt Tensioner Bolt	50 N·m	37 lb ft
Air Cleaner Outlet Duct Clamp	4 N·m	35 lb in
Air Conditioning (A/C) Belt Tensioner Bolt	50 N·m	37 lb ft
Battery Cable Channel Bolt	9 N·m	80 lb in
Camshaft Position Sensor Bolt	12 N·m	106 lb in
Camshaft Retainer Bolt	12 N·m	106 lb in
Camshaft Sprocket Bolt	30 N·m	22 lb ft
Connecting Rod Nut	30 N·m + 90 Degrees	22 lb ft + 90 Degrees
Coolant Crossover Pipe Bolt	50 N·m	37 lb ft
Coolant Drain Hole Plug		
• Left Front	60 N·m	44 lb ft
• Sides	30 N·m	22 lb ft
Crankshaft Balancer Bolt	255 N·m	189 lb ft
Crankshaft Bearing Cap Inner Bolts		
• First Pass	30 N·m	22 lb ft
• Final Pass	90 Degrees	
Crankshaft Bearing Cap Outer Studs		
• First Pass	30 N·m	22 lb ft
• Final Pass	80 Degrees	
Crankshaft Oil Deflector Nut	50 N·m	37 lb ft
Crankshaft Position Sensor Bolt	12 N·m	106 lb in
Crossbar Bolt	100 N·m	74 lb ft
Cylinder Head Bolt - In Sequence		
• First Pass	30 N·m	22 lb ft
• Second Pass	30 N·m + 120 Degrees	22 lb ft + 120 Degrees
• Final Pass - Long Bolts #1, 2, 3, 6, 7, 8, 9, 10, 11, 14, 16, 17	60 Degrees	
• Final Pass - Medium Bolts #15, 18	45 Degrees	
• Final Pass - Short Bolts #4, 5, 12, 13	30 Degrees	
Cylinder Head Coolant Hole Plug	35 N·m	26 lb ft
Drive Belt Idler Pulley Bolt	50 N·m	37 lb ft
EGR Adapter Nut	22 N·m	16 lb ft
EGR Valve Nut	22 N·m	16 lb ft
EGR Valve Pipe Bolt	25 N·m	18 lb ft
EGR Valve Pipe Bracket Bolt	50 N·m	37 lb ft
EGR Valve Pipe Nut	25 N·m	18 lb ft
EGR Valve Pipe Stud in Exhaust Manifold	12 N·m	106 lb in
Engine Block Heater	50 N·m	37 lb ft
Engine Coolant Temperature (ECT) Sensor	35 N·m	26 lb ft
Engine Coolant Temperature (ECT) Sensor Bracket Bolt	50 N·m	37 lb ft
Engine Harness Bolt	5 N·m	44 lb in
Engine Harness Ground Bolt	16 N·m	12 lb ft
Engine Harness Stud	10 N·m	89 lb in
Engine Mount Bolt-to-Engine Bracket	50 N·m	37 lb ft
Engine Mount-to-Engine Bracket Bolt	50 N·m	37 lb ft
Engine Mount Frame Bracket Thru Bolt	75 N·m	55 lb ft
Engine Mount Frame Side Mount Bolt	65 N·m	50 lb ft
Engine Sight Shield Bracket Nut	5 N·m	44 lb in

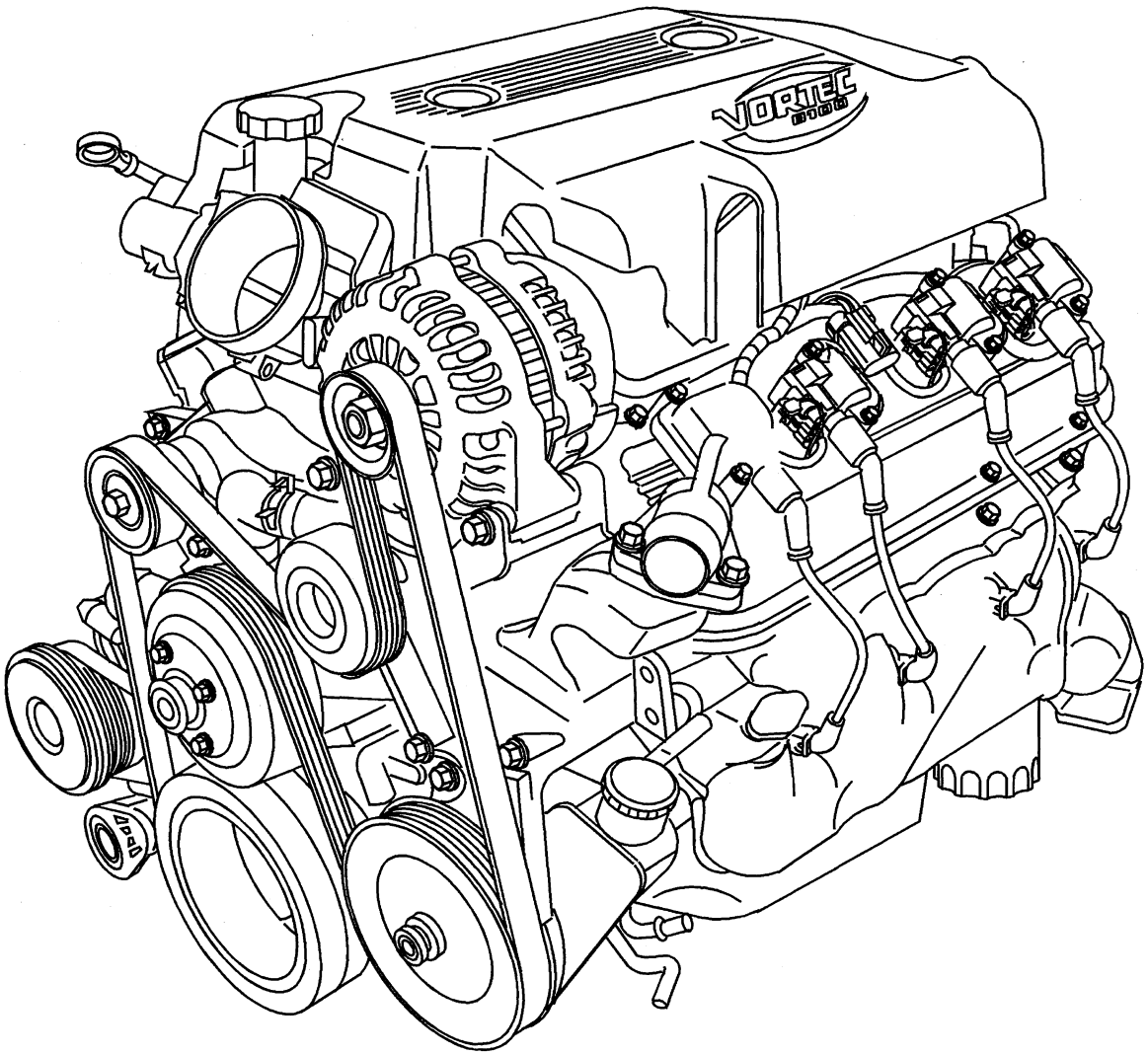
Application	Specification	
	Metric	English
Engine Wiring Harness Bolt	16 N·m	12 lb ft
Exhaust Manifold		
• Center Bolt	35 N·m	26 lb ft
• Nut	16 N·m	12 lb ft
• Stud	20 N·m	15 lb ft
Exhaust Manifold Heat Shield		
• Bolt	25 N·m	18 lb ft
• Nut	25 N·m	18 lb ft
Flywheel Bolt		
• First Pass	40 N·m	30 lb ft
• Second Pass	80 N·m	59 lb ft
• Final Pass	100 N·m	74 lb ft
Front Cover Bolt		
• First Pass	6 N·m	53 lb in
• Final Pass	12 N·m	106 lb in
Fuel Rail Stud	12 N·m	106 lb in
Heater Hose Bracket Bolt	50 N·m	37 lb ft
Hood Hinge Bolt	25 N·m	18 lb ft
Ignition Coil Bolt	12 N·m	106 lb in
Ignition Coil Wiring Harness Bolt	12 N·m	106 lb in
Intake Manifold Bolt - In Sequence		
• First Pass	5 N·m	44 lb in
• Second Pass	8 N·m	71 lb in
• Third Pass	12 N·m	106 lb in
• Final Pass	15 N·m	12 lb ft
J 42847 Flywheel Holding Tool Bolt	50 N·m	37 lb ft
Knock Sensor	20 N·m	15 lb ft
Knock Sensor Heat Shield Bolt	12 N·m	106 lb in
Lift Bracket Bolt	40 N·m	30 lb ft
MAP Sensor Bolt	12 N·m	106 lb in
Oil Cooler Hose Fittings	23 N·m	17 lb ft
Oil Fill Tube Bolt	12 N·m	106 lb in
Oil Filter	38 N·m	28 lb ft
Oil Filter Fitting	66 N·m	49 lb ft
Oil Gallery Plug		
• Front	20 N·m	15 lb ft
• Left	30 N·m	22 lb ft
• Rear	30 N·m	22 lb ft
• Top	20 N·m	15 lb ft
Oil Level Indicator Tube Bracket Bolt	25 N·m	18 lb ft
Oil Level Sensor	20 N·m	15 lb ft
Oil Pan Bolt		
• First Pass	10 N·m	89 lb in
• Final Pass	25 N·m	18 lb ft
Oil Pan Drain Plug	28 N·m	21 lb ft
Oil Pan Skid Plate Bolt	20 N·m	15 lb ft
Oil Pressure Gage Sensor	30 N·m	22 lb ft
Oil Pump Bolt	75 N·m	56 lb ft
Oil Pump Cover Bolt	12 N·m	106 lb in
Oil Pump Drive Bolt	25 N·m	18 lb ft

Application	Specification	
	Metric	English
Power Steering Pump Bracket Bolt/Nut	50 N·m	37 lb ft
Power Steering Pump Bracket Stud	20 N·m	15 lb ft
Purge Solenoid Bolt	8 N·m	71 lb in
Spark Plug	30 N·m	22 lb ft
Thermostat Housing Bolt	30 N·m	22 lb ft
Throttle Body		
• Nut	10 N·m	89 lb in
• Stud	12 N·m	106 lb in
Valve Lifter Guide Retainer Bolt	25 N·m	18 lb ft
Valve Rocker Arm Cover Bolt		
• First Pass	6 N·m	53 lb in
• Final Pass	12 N·m	106 lb in
Valve Rocker Arm Nut	35 N·m	26 lb ft
Valve Rocker Arm Stud	50 N·m	37 lb ft
Water Pump Bolt		
• First Pass	25 N·m	18 lb ft
• Final Pass	50 N·m	37 lb ft
Water Pump Pulley Bolt	25 N·m	18 lb ft

Drive Belt System Description

See Drive Belt System Description above.

Engine Component Description



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

Cylinder Head

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

Camshaft

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

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

Crankshaft

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

Pistons and Connecting Rods

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

Valve Train

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

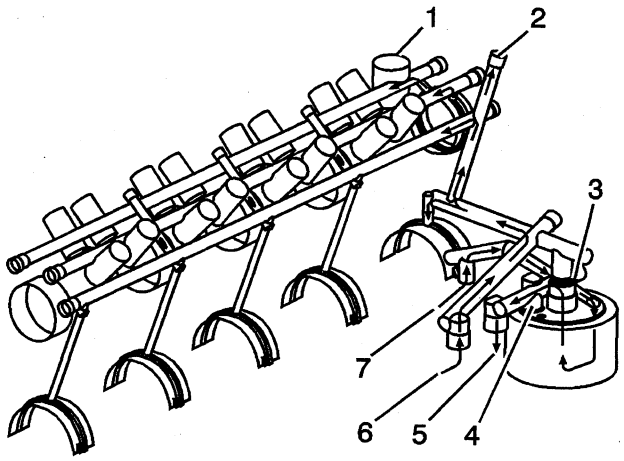
Intake Manifold

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

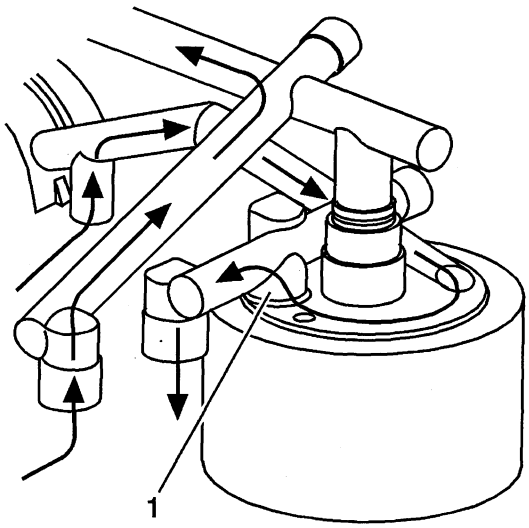
Exhaust Manifold

The two exhaust manifolds are constructed of cast stainless steel. The exhaust manifolds direct exhaust gases from the combustion chambers to the exhaust system. The right exhaust manifold has a flange for the EGR pipe.

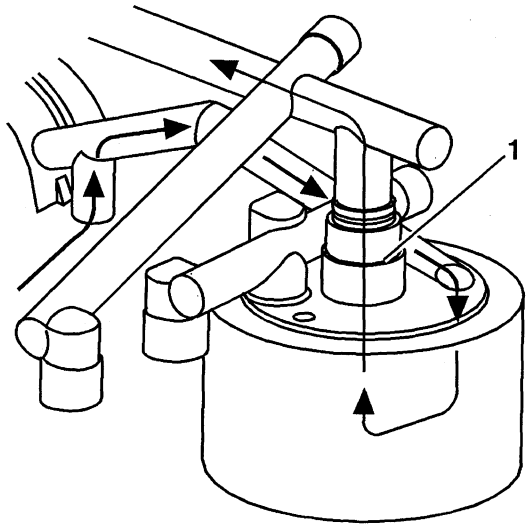
Lubrication Description



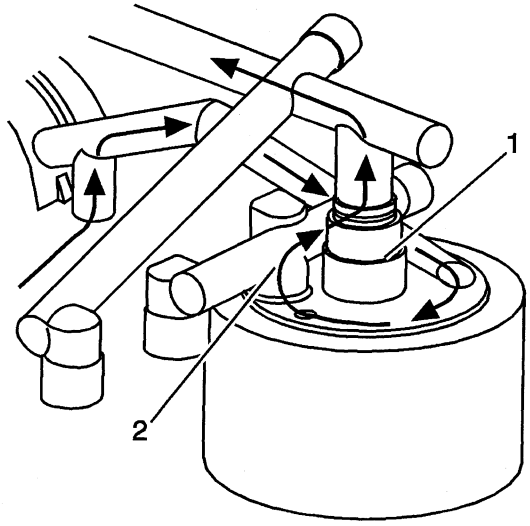
The gear-type oil pump is driven through an extension driveshaft. The extension driveshaft is driven by the oil pump drive, which is gear driven by the camshaft. The oil is drawn from the oil pan through a pickup screen and tube, into the oil pump (7). Pressurized oil flows through the oil filter, into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



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



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



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

Engine Cooling

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Air Cleaner Outlet Duct Clamp (4.8L, 5.3L, and 6.0L)	7 N·m	62 lb in
Air Cleaner Outlet Duct Clamp (6.6L)	6 N·m	53 lb in
Air Conditioning (A/C) Compressor Bolt (6.6L)	50 N·m	37 lb ft
Air Inlet Tube Nut (6.6L)	25 N·m	18 lb ft
Auxiliary Water Pump Bracket Nut	9 N·m	80 lb in
Bypass Pipe to Water Pump Bolt (6.6L)	21 N·m	16 lb ft
Charged Air Cooler Duct Clamp (6.6L)	6 N·m	53 lb in
Coolant Air Bleed Pipe Cover Bolt (4.8L, 5.3L, and 6.0L)	12 N·m	106 lb in
Coolant Air Bleed Pipe Stud/Bolt (4.8L, 5.3L, and 6.0L)	12 N·m	106 lb in
Coolant Heater (4.8L, 5.3L, and 6.0L)	50 N·m	37 lb ft
Coolant Heater (8.1L)	60 N·m	47 lb ft
Coolant Heater Bolt (4.3L)	2 N·m	18 lb in
Coolant Heater Bolt (6.6L)	2 N·m	18 lb in
Coolant Heater Cord Bolt	8 N·m	71 lb in
Coolant Outlet Pipe Clip Bolt (6.6L)	9 N·m	80 lb in
Engine Block Coolant Drain Plug	60 N·m	44 lb ft
Engine Shield Bolt	20 N·m	15 lb ft
Exhaust Gas Recirculation (EGR) Coolant Pipe Bolt (6.6L)	21 N·m	16 lb ft
Exhaust Manifold Pipe Nut (4.8L, 5.3L, and 6.0L)	50 N·m	37 lb ft
Fan Clutch Bolt	23 N·m	17 lb ft
Fan Clutch Nut	56 N·m	41 lb ft
Fan Pulley Bolt/Nut (6.6L)	46 N·m	34 lb ft
Fan Shroud Bolt	9 N·m	80 lb in
Fuel Line Bracket Bolt (6.6L)	21 N·m	15 lb ft
Fuel Line to Fuel Injection Control Module Bolt (6.6L)	35 N·m	26 lb ft
Generator Bracket Bolt (6.6L and 8.1L)	50 N·m	37 lb ft
Generator Bracket Stud (8.1L)	20 N·m	15 lb ft
Generator Positive Cable Nut (6.6L)	9 N·m	80 lb in
Heater Inlet Pipe to Fuel Filter Bolt (6.6L)	21 N·m	16 lb ft
Heater Inlet Pipe to Thermostat Bolt (6.6L)	21 N·m	16 lb ft
Heater Outlet Hose Bracket Bolt (6.6L)	21 N·m	16 lb ft
Hood Hinge Bolts	25 N·m	18 lb ft
Idler Pulley Bolt (6.6L)	43 N·m	32 lb ft
Intake Manifold Cover Clamp (6.6L)	6 N·m	53 lb in
Junction Block Bracket Bolt (6.6L)	9 N·m	80 lb in
Main Electrical Harness Bracket Bolt (6.6L)	21 N·m	15 lb ft
Main Engine Electrical Harness Connector Bolt (6.6L)	10 N·m	89 lb in
Oil Cooler Hose Adapter Bolt (6.0L)	12 N·m	106 lb in
Oil Cooler Hose Bracket Bolt (6.0L)	25 N·m	18 lb ft
Oil Cooler Hose Bracket Bolt (8.1L)	50 N·m	37 lb ft
Positive Crankcase Ventilation (PCV) Oil Separator Bracket Nut (6.6L)	21 N·m	16 lb ft
Power Steering Pump Bracket Bolt (6.6L)	46 N·m	34 lb ft
Radiator Bolt	25 N·m	18 lb ft
Starter/Generator Control Module (SGCM) Brace Bolts	25 N·m	18 lb ft
Starter/Generator Control Module (SGCM) Coolant Pump Bolts	9 N·m	80 lb in
Starter/Generator Control Module (SGCM) Coolant Tank Bolts	20 N·m	15 lb ft
Starter/Generator Control Module (SGCM) Coolant Tank Nuts	9 N·m	80 lb in
Starter/Generator Control Module (SGCM) Cooling Fan Bolt	9 N·m	80 lb in

Application	Specification	
	Metric	English
Starter/Generator Control Module (SGCM) Radiator Bolt	9 N·m	80 lb in
Starter/Generator Stator Coolant Inlet Pipe Bolt	9 N·m	80 lb in
Surge Tank Bolt/Nut	9 N·m	80 lb in
Thermal Bypass Fitting	35 N·m	26 lb ft
Thermal Bypass Hose Bolt	10 N·m	89 lb in
Thermostat Housing Bolt (4.8L, 5.3L, and 6.0L)	15 N·m	11 lb ft
Thermostat Housing Cover Bolt (6.6L)	21 N·m	16 lb ft
Thermostat Housing Crossover Bolt/Nut (6.6L)	21 N·m	16 lb ft
Transmission Control Module (TCM) Cover Bolt	9 N·m	80 lb in
Transmission Control Module (TCM) Electrical Connector Bolt	8 N·m	71 lb in
Turbocharger Coolant Bypass Valve (6.6L)	60 N·m	44 lb ft
Turbocharger Coolant Feed Pipe Bracket Bolt (6.6L)	21 N·m	16 lb ft
Turbocharger Coolant Feed Pipe Nut (6.6L)	9 N·m	80 lb in
Turbocharger Coolant Inlet Banjo Bolt (6.6L)	25 N·m	18 lb ft
Turbocharger Coolant Outlet Pipe Bolt/Nut (6.6L)	9 N·m	80 lb in
Water Crossover Bolt (8.1L)	50 N·m	37 lb ft
Water Outlet Bolt (8.1L)	30 N·m	22 lb ft
Water Outlet Stud (4.3L)	25 N·m	18 lb ft
Water Outlet Tube Bolt (6.6L)	21 N·m	16 lb ft
Water Pump Bolt (4.3L)	45 N·m	33 lb ft
Water Pump Bolt (4.8L, 5.3L, and 6.0L)		
First Pass	15 N·m	11 lb ft
Final Pass	30 N·m	22 lb ft
Water Pump Bolt (6.6L)	21 N·m	16 lb ft
Water Pump Bolt (8.1L)	50 N·m	37 lb ft
Water Pump Inlet Pipe Bolt (6.6L)	21 N·m	16 lb ft
Water Pump Pulley Bolt (4.3L)	25 N·m	18 lb ft
Water Pump to Oil Cooler Inlet Pipe Nut (6.6L)	21 N·m	16 lb ft
Wiring Harness Bracket to Thermostat Housing Bolt (6.6L)	8 N·m	71 lb in

Cooling System Description and Operation

Engine Coolant Indicators

ENGINE COOLANT HOT

The instrument panel cluster (IPC) displays ENGINE COOLANT HOT message when the IPC receives a class 2 message from the powertrain control module (PCM) requesting illumination of this driver warning.

ENGINE OVERHEATED

The IPC displays ENGINE OVERHEATED message when the IPC receives a class 2 message from the PCM requesting illumination of this driver warning.

LOW COOLANT LEVEL B

The IPC displays LOW COOLANT LEVEL message when the IPC receives a class 2 message from the PCM requesting illumination of this driver warning.

REDUCED ENGINE POWER

The IPC displays REDUCED ENGINE POWER message when the IPC detects a reduced engine power condition from the PCM. The IPC receives a class 2 message from the PCM requesting illumination when the engine temperature reaches 132°C (270°F).

Cooling Fan Control - Two Fan System

The engine cooling fan system consists of 2 electrical cooling fans and 3 fan relays. The relays are arranged in a series/parallel configuration that allows the powertrain control module (PCM) to operate both fans together at low or high speeds. The cooling fans and fan relays receive battery positive voltage from the underhood fuse block.

During low speed operation, the PCM supplies the ground path for the low speed fan relay through the low speed cooling fan relay control circuit. This energizes the low speed fan relay coil, closes the relay contacts, and supplies battery positive voltage from the low fan fuse through the cooling fan motor supply voltage circuit to the left cooling fan. The ground path for the left cooling fan is through the cooling fan s/p relay and the right cooling fan. The result is a series circuit with both fans running at low speed.

During high speed operation the PCM supplies the ground path for the low speed fan relay through the low speed cooling fan relay control circuit. After a 3 second delay, the PCM supplies a ground path for the high speed fan relay and the cooling fan s/p relay through the high speed cooling fan relay control circuit. This energizes the cooling fan s/p relay coil, closes the relay contacts, and provides a ground path for the left cooling fan. At the same time the high speed fan relay coil is energized closing the relay contacts and provides battery positive voltage from the high fan fuse on the cooling fan motor supply voltage circuit to the right cooling fan. During high speed fan operation, both engine cooling fans have there own ground path. The result is a parallel circuit with both fans running at high speed.

Important

The right and left cooling fan connectors are interchangeable. When servicing the fans be sure that the connectors are plugged into the correct fan.

The PCM commands the low speed cooling fans ON under the following conditions:

- Engine coolant temperature exceeds approximately 94.5°C (202°F).
- A/C refrigerant pressure exceeds 1447 kPa (210 psi).
- After the vehicle is shut OFF if the engine coolant temperature at key-off is greater than 101°C (214°F) the low speed fans will run for a minimum of 60 seconds After 60 seconds, if the coolant temperature drops below 101°C (214°F) the fans will shut OFF. The fans will automatically shut OFF after 3 min. regardless of coolant temperature.

The PCM commands the high speed fans ON under the following conditions:

- Engine coolant temperature exceeds approximately 104.25°C (220°F).
- A/C refrigerant pressure exceeds approximately 1824 kPa (265 psi).
- When certain DTCs set.

At idle and very low vehicle speeds the cooling fans are only allowed to increase in speed if required. This insures idle stability by preventing the fans from cycling between high and low speed.

Coolant Level Control (If Equipped)

The engine cooling system contains an engine coolant level switch to alert the driver in the event of a coolant loss. The powertrain control module (PCM) sends out a coolant loss signal over the coolant level switch signal circuit. When the engine coolant level switch reads a low coolant level in the fill tank, the switch opens. The message center receives its power from engine wiring harness junction block on the battery positive voltage circuit. Ground is provided by the ground circuits via the body wiring harness junction block and the engine wiring harness junction block. The cluster receives the class 2 message from the PCM indicating Low Coolant and displays the LOW COOLANT LEVEL message on the driver information center (DIC).

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 is drawn from the radiator outlet and into the water pump inlet by the water pump. Coolant will then be pumped through the water pump outlet and into the engine block. In the engine block, the coolant circulates through 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.

Some coolant is also pumped from the water pump to the heater core, then back to the water pump. This provides the passenger compartment with heat and defrost.

The coolant is then forced 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.

Coolant is also directed to the throttle body. There it circulates through passages in the casting. During initial start up, the coolant assists in warming the throttle body. During normal operating temperatures, the coolant assists in regulating the throttle body temperature.

Cooling Cycle (6.6L Diesel Engine)

Coolant is drawn from the radiator outlet and into the water pump inlet by the water pump. The coolant flows to the heater core while the engine is running. This provides the passenger compartment with heat and defrost.

Coolant is then pumped through the water pump outlet and through the coolant pipe to the engine oil cooler. The coolant flows around the oil cooler element and to the rear engine cover. The rear engine cover distributes the coolant flow to both banks of the engine block. In the engine block, the coolant circulates through the water jackets surrounding the cylinders where it absorbs heat.

The coolant is then forced 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.

Coolant is also directed to the turbocharger. There it circulates through passages in the center housing. During engine warm-up cycle the bypass valve located in the turbocharger inlet hose at the outlet pipe prevents coolant flow. During normal operating temperatures, the coolant assists in keeping the turbocharger cool.

From the cylinder heads, the coolant flows to the thermostats. The coolant flows from the thermostat housing to the water pump through the bypass pipe until the enginereaches 85°C (185°F).

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.

Surge Tank

The surge tank is a plastic tank with a threaded pressure cap. The tank is mounted at a point higher than all other coolant passages. The surge tank provides an air space in the cooling system that allows the coolant to expand and contract. The surge tank provides a coolant fill point and a central air bleed location.

During vehicle use, the coolant heats and expands. The increased coolant volume flows into the surge tank. As the coolant circulates, any air is allowed to bubble out. Coolant without air bubbles absorbs heat much better than coolant with bubbles.

Pressure Cap

The pressure cap seals the cooling system. It contains a blow off or pressure relief 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.

Cooling Fan and Clutch

The engine cooling fan and clutch are driven by the crankshaft via the drive belt. The cooling fan draws air through the radiator to improve the transfer of heat from the coolant to the atmosphere. As the fan blades spin, they pull cool, outside air past the radiator core. The fan clutch drives the cooling fan. The fan clutch controls the amount of torque that is transmitted from the crankshaft to the fan blades. The clutch allows more torque to engage on the fan when the engine operating temperature increases and/or the vehicle speed is low. As the torque increases, the fan turns more quickly. The fan clutch decreases the torque applied to the cooling fan when the engine temperature decreases and/or the vehicle speed is high. As the torque decreases, the fan speed decreases.

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.

Water Pump (6.6L Diesel Engine)

The water pump is a centrifugal vane impeller type pump. The water pump is gear driven by the crankshaft gear. The pump consists of a housing with coolant inlet and outlet passages and an impeller. The impeller is a flat plate mounted on the pump shaft with a series of flat or curved blades or vanes. When the impeller rotates, the coolant between the vanes is thrown outward by centrifugal force. The impeller shaft is supported by bearings. Splash of the engine oil lubricates the bearings. The bearings and shaft are sealed to prevent engine oil to mix with the coolant. If the seal fails, coolant will leak out the vent hole in the water pump housing.

The purpose of the water pump is to circulate coolant throughout the cooling system.

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.

Thermostats (6.6L Diesel Engine)

The thermostats are coolant flow control components. The purpose of the thermostats are to regulate the correct operating temperature of the engine. The thermostats utilizes a temperature sensitive wax-pellet element. The element connects to a valve through a piston. When the element is heated, it expands and exerts pressure against a rubber 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.

The 6.6L diesel engine requires two thermostats for correct coolant flow. The front thermostat is a dual purpose thermostat. The front thermostat controls the coolant flow to the bypass port and to the water outlet. The rear thermostat only controls the coolant flow to the water outlet.

When the coolant temperature is below the rated thermostat opening temperature, the front thermostat valve remains closed to the water outlet and is opened to the bypass port. The bottom portion of the thermostat is raised off of the bypass port while at the same time the top portion closes the coolant flow to the water outlet. The rear thermostat also is closed to the water outlet during engine warm-up. This prevents circulation of the coolant to the radiator and allows the engine to warm up quickly. After the coolant temperature reaches 82°C (180°F) the front thermostat primary valve opening temperature, the front thermostat primary valve will start to open. The coolant is then allowed to circulate through the thermostat to the radiator where the engine heat is dissipated to the atmosphere. As the engine coolant

reaches 85°C (185°F) and more coolant demand is required the front thermostat secondary valve begins to close the bypass port and the rear thermostat begins to open coolant flow to the water outlet. The thermostats will continue to control the coolant flow by opening and closing. The front thermostat will be fully open when the coolant temperature reaches 95°C (203°F) the rear thermostat will be fully open when the coolant temperature reaches 100°C (212°F). The thermostat also provides a restriction in the cooling system, even after the 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.

Engine Oil Cooler (6.6L Diesel Engine)

The engine oil cooler is a heat exchanger. The engine oil cooler is mounted to the left lower corner of the engine. The oil filter is attached to the oil cooler housing. The engine coolant flows around the oil cooler element. The oil cooler element is a series of plates. The engine oil temperature is regulated by the temperature of the engine coolant that surrounds the oil cooler as the engine oil passes through the cooler.

The engine oil pump, pumps the oil through the engine oil feed line to the oil cooler. The oil then flows down through the cooler while the engine coolant absorbs heat from the oil. The oil is then pumped through the oil return line, to the oil filter, then to the main engine oil passage.

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.

Turbocharger Bypass Valve (6.6L Diesel Engine)

The turbocharger bypass valve is a temperature control valve. The valve is located in the turbocharger coolant inlet hose at the water outlet tube.

The purpose of the valve is to close the coolant flow through the turbocharger. Closing off the coolant flow through the turbocharger avoids turbocharger overcooling.

Starter Generator Control Module Cooling System Description and Operation

The starter/generator control module (SGCM) cooling system description and operation is divided into three areas:

- SGCM Cooling System Components
- SGCM Cooling System Operation
- SGCM Cooling System Coolant Cycle

SGCM Cooling System Components

SGCM

The starter/generator control module (SGCM) is a GMLAN device. The SGCM monitors 3 coolant temperature sensors that are mounted in the coolant stream, 4 coolant level sensors that are mounted in the electronics coolant of the SGCM, the SGCM coolant pump relay control circuit, and the SGCM coolant fan relay control circuit to maintain its internal cooling requirements. Internal to the SGCM are the

electronics that control the system voltage, these electronic components are immersed in a coolant. This coolant is not the coolant that is circulated though the coolant circuit, the coolant helps evenly distribute the heat of the electronics and are monitored by the 4 coolant level sensors.

SGCM Coolant Pump

The SGCM coolant pump is controlled through a relay by the SGCM. The SGCM coolant pump circulates the coolant through the SGCM cooling system.

SGCM Coolant Fan

The SGCM coolant fan is controlled through a solid state relay by the SGCM. The SGCM coolant fan is a puller type fan that draws air through the SGCM radiator.

SGCM Cooling System Operation

The purpose of the starter/generator control module (SGCM) coolant system is to cool the SGCM internal electronics. The SGCM commands the SGCM the SGCM coolant pump and coolant fan ON or OFF at the following temperatures:

- Coolant pump from OFF to ON at 60°C (140°F)
- Coolant pump from ON to OFF at 55°C (131°F)
- Coolant fan from OFF to low speed at 75°C (167°F)
- Coolant fan from low speed to high speed at 80°C (176°F)
- Coolant fan from high speed to low speed at 75°C (167°F)
- Coolant fan from low speed to OFF at 70°C (158°F)

SGCM Cooling System Coolant Cycle

The starter/generator control module (SGCM) coolant is a 50/50 mixture of DEX-COOL antifreeze and clean, drinkable water. The coolant is drawn from the SGCM coolant tank by the SGCM coolant pump. The coolant pump then forces the coolant through the SGCM coolant radiator. The coolant then is sent to the SGCM to cool the SGCM electronics.

Engine Electrical

Fastener Tightening Specifications

Application	Specification	
	Metric	English
3-Phase Cable Bracket Cover Bolt	9 N·m	80 lb in
3-Phase Cable Bracket Nut	9 N·m	80 lb in
3-Phase Cable Cover Nut	9 N·m	80 lb in
3-Phase Cable Nut to Starter Generator Control Module (SGCM)	15 N·m	11 lb ft
3-Phase Cable Nut to Stator	14 N·m	10 lb ft
Air Cleaner Outlet Duct Clamp	4 N·m	35 lb in
Accessory Power Receptacle Harness Ground Wire Bolt	9 N·m	80 lb in
Auxiliary Battery Cable Clip Bolt	10 N·m	89 lb in
Auxiliary Battery Negative Cable Bolt (6.6L)	34 N·m	25 lb ft
Auxiliary Battery Positive Cable Nut	9 N·m	80 lb in
Auxiliary Battery Relay Nut	9 N·m	80 lb in
Auxiliary Battery Tray Bolt	9 N·m	80 lb in
Auxiliary Battery Tray Nut	25 N·m	18 lb ft
Auxiliary Generator Bolt (6.6L)	50 N·m	37 lb ft
Auxiliary Generator Bracket Bolt (6.6L)	50 N·m	37 lb ft
Auxiliary Negative Battery Cable Bolt	17 N·m	13 lb ft
Auxiliary Positive Battery Cable Bolt	17 N·m	13 lb ft
Auxiliary Positive Battery Cable Nut	8 N·m	71 lb in
Auxiliary Positive Cable to Relay Nut	9 N·m	80 lb in
Battery Cable Bracket Bolt	25 N·m	18 lb ft
Battery Cable Channel Bolt	12 N·m	106 lb in
Battery Cable Channel Bolt (6.6L)	8 N·m	71 lb in
Battery Cable Junction Block Bracket Bolt (4.8L, 5.3L, 6.0L, and 8.1L)	9 N·m	80 lb in
Battery Cable Retainer Nut (6.6L)	12 N·m	106 lb in
Battery Hold Down Retainer Bolt	25 N·m	18 lb ft
Battery Tray Bolt	9 N·m	80 lb in
Crossbar Bolt	100 N·m	74 lb ft
Drive Belt Tensioner Bolt (6.6L)	41 N·m	30 lb ft
Energy Storage Box (ESB) Air Duct Hose to ESB Screw	0.5 N·m	44 lb in
Energy Storage Box (ESB) Air Duct Hose to Fan Screw	1 N·m	9 lb in
Energy Storage Box (ESB) Battery 1 to Battery 2 Power Cable Nut	10 N·m	89 lb in
Energy Storage Box (ESB) Battery 2 to Battery 3 Power Cable Nut	10 N·m	89 lb in
Energy Storage Box (ESB) Battery Cut Off Switch Nut	10 N·m	89 lb in
Energy Storage Box (ESB) Battery Hold Bracket Nut	10 N·m	89 lb in
Energy Storage Box (ESB) Carrier Nut	47 N·m	35 lb ft
Energy Storage Box (ESB) Fan Screw	1 N·m	9 lb in
Energy Storage Box (ESB) Fuse Holder Screws	2 N·m	18 lb in
Energy Storage Box (ESB) Fuse Power Cable to High Current Sensor Nut	10 N·m	89 lb in
Energy Storage Box (ESB) Ground Wire Screw	6 N·m	53 lb in
Energy Storage Box (ESB) Ground Strap Nut	10 N·m	89 lb in
Energy Storage Box (ESB) High Current Connector Screws	6 N·m	53 lb in
Energy Storage Box (ESB) High Current Connector to Battery 3 Nut	10 N·m	89 lb in
Energy Storage Box (ESB) High Current Sensor Nut	6 N·m	53 lb in
Energy Storage Box (ESB) Intermediate Cover Screw	6 N·m	53 lb in
Energy Storage Box (ESB) Maxi-Fuse Nut	10 N·m	89 lb in
Energy Storage Box (ESB) Receptacle Outlet Cover Screws	0.5 N·m	4.4 lb in
Energy Storage Box (ESB) Receptacle Outlet Screws	2 N·m	18 lb in
Energy Storage Box (ESB) Service Disconnect Switch Screw/Nut	6 N·m	53 lb in

Application	Specification	
	Metric	English
Energy Storage Box (ESB) Service Disconnect Switch Power Cable to High Current Connector Nut	10 N·m	89 lb in
Energy Storage Box (ESB) Service Disconnect Switch Power Cable to Service Disconnect Switch Nut	10 N·m	89 lb in
Energy Storage Box (ESB) Temperature Sensor Screw	0.5 N·m	4.4 lb in
Energy Storage Control Module Nut	6 N·m	53 lb in
Engine Wiring Harness/Auxiliary Negative Battery Cable Bolt	16 N·m	12 lb ft
Engine Wiring Harness Ground Bolt	16 N·m	12 lb ft
Engine Wiring Harness Ground/Negative Cable Bolt	25 N·m	18 lb ft
Engine Wiring Harness Ground/Negative Cable Bolt (6.6L)	34 N·m	25 lb ft
Exhaust Gas Recirculation (EGR) Vacuum Pump Bolt (6.6L)	22 N·m	16 lb ft
Fender to Cowl Support Brace Bolt	9 N·m	80 lb in
Flexplate Bolt	100 N·m	74 lb ft
Forward Lamp Wiring Harness Ground/Negative Cable Bolt	9 N·m	80 lb in
Front End Diagonal Brace Bolt	9 N·m	80 lb in
Fuel Bleed Valve Bracket Nut (6.6L)	25 N·m	18 lb ft
Generator Bolt (4.3L)	50 N·m	37 lb ft
Generator Bolt (4.8L, 5.3L, 6.0L, 6.6L, and 8.1L)	50 N·m	37 lb ft
Generator Bracket Bolt (4.8L, 5.3L, 6.0L, 6.6L, and 8.1L)	50 N·m	37 lb ft
Generator Bracket Bolt/Nut (4.3L)	41 N·m	30 lb ft
Generator Bracket Stud (8.1L)	20 N·m	15 lb ft
Generator Cable Nut	9 N·m	80 lb in
Ground Strap Nut	9 N·m	80 lb in
Ground Strap Nut (Energy Storage Box)	10 N·m	89 lb in
Harness Clip to Junction Block Bracket Bolt	9 N·m	80 lb in
Heater Hose Bracket Bolt (4.3L)	25 N·m	18 lb ft
Heater Outlet Pipe Bolt (6.6L)	25 N·m	18 lb ft
Hybrid Control Module (HCM) Bracket Bolt	9 N·m	80 lb in
Idler Pulley Bolt (6.6L)	43 N·m	32 lb ft
J-46093 Bolt	50 N·m	37 lb ft
M-Terminal Stud Nut (6.6L)	8 N·m	71 lb in
Negative Battery Cable Bolt	17 N·m	13 lb ft
Positive Battery Cable Bolt	17 N·m	13 lb ft
Positive Cable Clip Nut (8.1L)	8 N·m	71 lb in
Positive Cable at Underhood Bussed Electrical Center (UBEC) Bolt	9 N·m	80 lb in
Positive/Negative Battery Cable Bolt (14V)	9 N·m	80 lb in
Positive/Negative Battery Cable Channel Rear Nut (42V)	10 N·m	89 lb in
Positive/Negative Battery Cable Grommet Nut (42V)	10 N·m	89 lb in
Positive/Negative Battery Cable Ground Strap Bolt (42V)	10 N·m	89 lb in
Positive/Negative Battery Cable Retainer Nut (42V)	20 N·m	15 lb ft
Starter Bolt (4.3L)	43 N·m	32 lb ft
Starter Bolt (4.8L, 5.3L, 6.0L, and 8.1L)	50 N·m	37 lb ft
Starter Bolt (6.6L)	78 N·m	58 lb ft
Starter Generator Control Module (SGCM) Bolt	20 N·m	15 lb ft
Starter Generator Control Module (SGCM) Brace Bolt	25 N·m	18 lb ft
Starter Generator Control Module (SGCM) Bracket Bolt	9 N·m	80 lb in
Starter Generator Control Module (SGCM) Bracket Nut	25 N·m	18 lb ft
Starter Generator Control Module (SGCM) Coolant Tank Bolt	9 N·m	80 lb in
Starter Generator Control Module (SGCM) Cover Bolt	9 N·m	80 lb in
Starter/Generator Stator Stud	16 N·m	12 lb ft
Starter Heat Shield Bolt (8.1L)	3 N·m	35 lb in
Starter Heat Shield Nut (8.1L)	5 N·m	44 lb in

Application	Specification	
	Metric	English
Starter Lead Nut	9 N·m	80 lb in
Starter Solenoid Bolt (6.6L)	10 N·m	89 lb in
Starter Solenoid Nut	3.4 N·m	30 lb in
Transmission Cover Bolt (4.8L, 5.3L, and 6.0L)	9 N·m	80 lb in
Transmission Fill Tube Nut	18 N·m	13 lb ft
Transmission Heat Shield	17 N·m	13 lb ft
Transmission Mount Nut	40 N·m	29 lb ft
Transmission Support Bolts/Nuts	70 N·m	50 lb ft
Wiring Harness Bracket Bolt (4.3L)	25 N·m	18 lb ft

Battery Usage – Non HP2

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

Battery Usage (HP2)

Parallel Hybrid Truck (PHT) (HP2)	
GM Part Number	88986971
Replacement Battery Number	Panasonic HV1255

Battery Temperature vs Minimum Voltage

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

Starter Motor Usage

Applications	Starter Model
4.3L (L35) 4.8L (LR4) 5.3L (LM7) 5.3L (L59) Methanol	PG-260G
6.0L (LQ4) 8.1L (L18)	PG-260L
6.6L (LB7) Diesel	Hitachi-S14-100B

Generator Usage

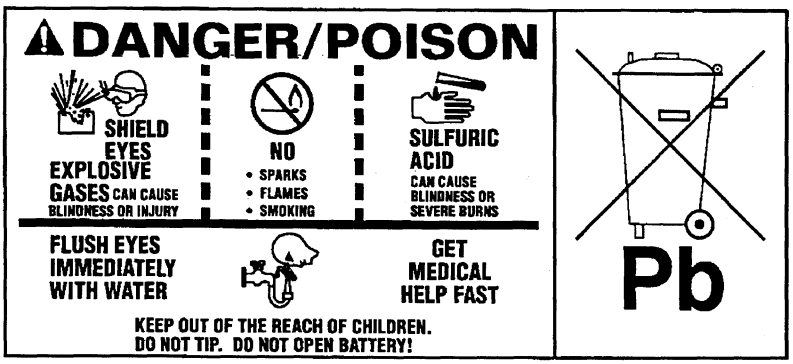
Base	
Generator Model	Delphi AD230
Rated Output	102 A
Load Test Output	71 A
Optional (Dual)	
Generator Model	Delphi AD244
Rated Output	130 A
Load Test Output	91 A
Bosch® Generator	
Generator Model	Bosch® 15755900
Rated Output	130 A
Load Test Output	91 A

Battery Description and Operation

Caution

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

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



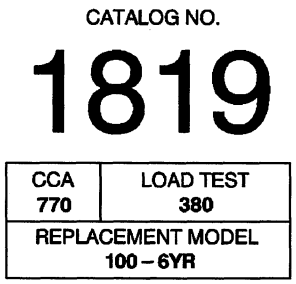
The maintenance free battery is standard. There are no vent plugs in the cover. The battery is completely sealed except for two small vent holes in the side. These vent holes allow the small amount of gas that is produced in the battery to escape.

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

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

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

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



A battery has 2 ratings:

- Reserve capacity
- Cold cranking amperage

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

Reserve Capacity

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

Cold Cranking Amperage

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

Circuit Description

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

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

Starting System Description and Operation

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

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

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

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

Charging System Description and Operation (W/O Generator/Battery Control Module)

Generator

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

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

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

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

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

Regulator

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

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

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

Auxiliary Battery Charging

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

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

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

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

Energy Storage Box (ESB) Description and Operation

Energy Storage Box (ESB)

The energy storage box (ESB) subsystem provides the capability to store electrical energy as chemical energy to provide the energy required by the Energy Management System. The ESB shall monitor the energy exchange along the 42-volt bus internal to the ESB and to provide status information to the hybrid control module (HCM). The 3 valve-regulated lead-acid batteries provide power for the 42-volt system. The "deep cycle" batteries employ Absorbent Glass Mat technology, specifically designed for hybrid vehicles, and are tailored to GM performance requirements. Lead-acid batteries are less costly to replace than nickel-metal hydride batteries or other battery technologies. They have a 50 to 55 amp hour Ahr. capacity and a projected 4-year life. The batteries are stored in a single energy storage module mounted under the rear seat. They power the electro-hydraulic power steering (EHPS) and the starter/generator. A conventional under-hood battery powers all the other electrical items, like the lighting, the driver information center (DIC) and the Infotainment system. The ESB physical content as follows:

- 3-Panasonic HV1255V valve regulated lead acid batteries, wired in series.
- Energy storage control module (ESCM)
- Service disconnect switch
- 2-120 V AC duplex outlet
- Battery module vent tubing system
- 42-volt bus fuse
- 12-volt ventilation fan and outlet duct
- Current sensor
- 42-volt harness and connector
- 12-volt connector and harness
- 120 V AC connector and harness

The ESB functional content as follows:

- Store electrical energy into chemical energy
- Receive 42-volt DC energy via the 42-volt bus for charging
- Determine appropriate power mode
- Monitor and calculates energy transfer and status
- Monitor temperature of batteries
- Monitor and control fan speed.
- Monitor and control the battery cut-off (BCO) switch.
- Provide an outlet interface to HVAC ventilation duct
- Provide removal of battery gases
- Provide a side impact 42-volt auto disconnect
- Communicate faults/information via LAN messages

Important

The Panasonic HV1255 VRLA batteries used in service will have approximately 80 percent state of charge (SOC) when shipped from the manufacture. BEFORE battery replacement, both the battery pack and faulty battery must be fully charged at the pack level (together) to ensure the vehicle battery pack will be equally balanced and charged. The new replacement battery will be charged to 100 percent SOC using the Battery Module Charger before installation.

The Panasonic batteries are designed to have a life span of approximately 62,000 amp hours.

Hybrid Control Module (HCM) Description and Operation

Hybrid Control Module (HCM)

The hybrid control module (HCM) is located on the engine fan shroud near the powertrain control module (PCM). It acts as a gateway between the high-speed GMLAN and Class 2 local area networks. If a module in the high-speed system needs to pass information to the Class II bus, it tags that message and passes it on to the HCM; the HCM reads the message and passes it along to the appropriate network. For example, if the starter generator control module (SGCM) needs to display a warning or alert the driver to a change in operating mode, the HCM would take that message from the high speed link and pass it to the display controller, which is on the Class II system. The HCM also:

- Controls automatic engine starts and stops
- Controls the energy flowing into/out of the 14-volt and 42-volt batteries
- Enables and disables power for the auxiliary power outlets
- Enables and disables surge smoothing/active damping
- Disables energy generation after airbag deployment
- Controls the auxiliary transmission pump, the power maintenance relay, and the auxiliary heater pump
- Controls starter generator speed during transmission downshift assists--The downshift assists support the engine during un-fueled downshifts from 4th to 3rd gear and 3rd to 2nd gear. The HCM calculates a target engine speed and uses the starter generator to maintain that target. The starter generator has to control engine speed, using a torque command, which is within the upper and lower torque limits specified by the HCM.

Starter/Generator Description and Operation

Instead of a conventional starter motor and generator, the PHT uses a compact 14-kW electric induction motor or starter generator integrated in a patented, space-efficient manner between the engine and transmission. The starter generator provides fast, quiet starting power and allows automatic engine stops and starts to conserve fuel. It also smooths out any driveline surges, generates electrical current to charge the batteries, runs auxiliary power outlets, and provides coast-down regenerative braking as an aid to fuel economy. The starter generator includes a rotor and stationary stator, housed inside the transmission bell housing. The stator is attached to the engine block and incorporates high efficiency/smaller package size coils formed by laser welding copper bars together instead of winding with copper wire. The rotor bolts directly to the engine crankshaft and spins inside the stator. Current flowing through the stator's electric windings generates magnetic forces in the rotor, which causes the rotor to turn, starting the engine. The starter generator is in series with the engine, connected directly to it, so that anytime the engine is turning, the Starter Generator is turning and vice versa. An auxiliary transmission oil pump helps enable the automatic start feature by assuring sufficient line pressure to allow torque transfer immediately upon driver command, when the engine is started.

Starter/Generator Control Module (SGCM) Description and Operation

The starter generator control module (SGCM) controls the flow of torque/energy into and out of the starter/generator. Overall, the SGCM controls the starter generator's engine cranking, torque control, speed control and torque smoothing/active damping functions. The SGCM also controls the four types of power:

- Perform bi-directional 36-volt DC to 12-volt DC electrical energy conversion between the 36-volt DC bus and the 12-volt DC bus for system energy management.
- Perform bi-directional DC/AC electrical energy conversion between the 36-volt DC bus and the 3-phase asynchronous machine
- Provide 120-volt 60Hz AC energy for on and off board electrical equipment.
- 28-volt AC for the starting function.

In the basic, 3-phase inversion/conversion process, 42-volt DC is converted to AC for starting, and, conversely, AC is converted to 42-volt DC for recharging. In addition, 14-volt power is converted to 42-volt for jump-starting, 42-volt power is converted to 14-volt for the battery charging function, and 42-volt power is converted to 120 volts AC for powering the auxiliary power outlets.

The SGCM has two discrete crank signal circuits inputs to calculate engine position. One is hard wired and one is a signal on the GMLAN bus. This acts as a back-up system in the event that one signal is interrupted the engine will be able to start and run although a DTC will set.

Start Here! Engine Controls

Engine Controls – 4.3L

Ignition System Specifications

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

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accelerator Cable Bracket Nut/Stud	12 N·m	106 lb in
Accelerator Control Cable Bracket Nut	10 N·m	89 lb in
Air Cleaner Outlet Duct Clamp	4 N·m	35 lb in
Air Cleaner Outlet Resonator Stud	10 N·m	89 lb in
Camshaft Position (CMP) Sensor Screws	2.2 N·m	20 lb in
Crankshaft Position (CKP) Sensor Bolt	9 N·m	80 lb in
Distributor Hold Down Bolt	25 N·m	18 lb ft
Distributor Cap Screws	2.4 N·m	21 lb in
Engine Coolant Temperature (ECT) Sensor	20 N·m	15 lb ft
Engine Shield Bolt	20 N·m	15 lb ft
Evaporative Emission (EVAP) Canister Bracket Bolt	25 N·m	18 lb ft
EVAP Canister Purge Solenoid Nut	12 N·m	106 lb in
EVAP Canister Vent Valve Bracket Bolt	12 N·m	106 lb in
Fuel Feed and Return Pipe Bracket Bolt	6 N·m	53 lb in
Fuel Feed and Return Pipe Bracket Nut to Transmission	25 N·m	18 lb ft
Fuel Feed and Return Pipes Fittings	28 N·m	21 lb ft
Fuel Feed and Return Pipe Nut	3 N·m	27 lb in
Fuel Injector Retainer Lock Nut	3 N·m	27 lb in
Fuel Tank Ground Strap Bolt	9 N·m	80 lb in
Fuel Tank Filler Housing to Body Screw	2.3 N·m	20 lb in
Fuel Tank Filler Housing to Fuel Tank Fill Pipe Screw	2.3 N·m	20 lb in
Fuel Tank Fill Pipe Clamp	2.5 N·m	22 lb in
Fuel Line Fitting	25 N·m	18 lb ft
Fuel Tank Shield Bolt	18 N·m	13 lb ft
Fuel Tank Strap Bolt	40 N·m	30 lb ft
Heated Oxygen Sensor (HO2S)	42 N·m	31 lb ft
Idle Air Control (IAC) Valve Screw	3 N·m	27 lb in
Ignition Coil Bracket Stud	11 N·m	97 lb in
Ignition Module Screw	3.5 N·m	31 lb in
Knock Sensor Bolt	25 N·m	18 lb ft
Mass Air Flow/Intake Air Temperature (MAF/IAT) Hose Clamp	4 N·m	35 lb in
Powertrain Control Module (PCM) Electrical Connector Bolt	8 N·m	71 lb in
Rotor Screw	2 N·m	18 lb in
Spark Plug (New AluminumHead)	20 N·m	15 lb ft
Spark Plug (New Iron Head)	30 N·m	22 lb ft

Spark Plug (Used Head)	15 N·m	11 lb ft
Throttle Body Stud	9 N·m	80 lb in
Throttle Position (TP) Sensor Screw	2 N·m	18 lb in

Fuel System Specifications

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

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

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

Notice

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

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

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

Engine Controls – 4.8, 5.3 & 6.0L

Ignition System Specifications

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

Fastener Tightening Specifications

Application	Specifications	
	Metric	English
3-Phase Cable Bracket Nut	15 N·m	11 lb ft
3-Phase Cable to Starter/Generator Control Module (SGCM) Nut	9 N·m	80 lb in
Accelerator Pedal Nut	20 N·m	15 lb ft
Air Cleaner Outlet Duct Clamp	7 N·m	62 lb in
Auxiliary Heater Water Pump Bracket Bolt	15 N·m	11 lb ft
Brake Pipe Fittings to Electronic Brake Control Module (EBCM)	25 N·m	18 lb ft
Camshaft Position (CMP) Sensor Bolt	29 N·m	21 lb ft
Canister Vent Solenoid (CVS) Bracket Bolt	12 N·m	106 lb in
Crankshaft Position (CKP) Sensor Bolt	25 N·m	18 lb ft
Crossover Fuel Pipe Retainer Clip Attaching Screw	3.8 N·m	34 lb in
Electro-Hydraulic Control Unit (EHCU) Bolts	25 N·m	18 lb ft
Engine Coolant Temperature (ECT) Sensor	20 N·m	15 lb ft
Engine Wiring Harness Bracket Nut	5 N·m	44 lb in
EVAP Canister Bolt/Nut	25 N·m	18 lb ft
EVAP Canister Bracket Bolt	25 N·m	18 lb ft
EVAP Canister Purge Solenoid Bolt	10.5 N·m	93 lb in
EVAP Vent Valve Bracket Bolt	12 N·m	106 lb in
Fuel Composition Sensor Nut	17 N·m	13 lb ft
Fuel Composition Sensor to Bracket Bolt	10 N·m	89 lb in
Fuel Feed and EVAP Pipe Assembly Nut	12 N·m	106 lb in
Fuel Feed, EVAP, and Return Pipe Assembly Nut	12 N·m	106 lb in
Fuel Line Fitting	25 N·m	18 lb ft
Fuel Pipe Bracket Nut	10 N·m	89 lb in
Fuel Rail Bolts	10 N·m	89 lb in
Fuel Return Pipe Attaching Screw	5 N·m	44 lb in
Fuel Tank Ground Strap Bolt	9 N·m	80 lb in
Fuel Tank Fill Pipe Clamp	2.5 N·m	22 lb in
Fuel Tank Filler Housing to Body Screw	2.3 N·m	20 lb in
Fuel Tank Filler Pipe Housing to Fuel Tank Fill Pipe Screw	2.3 N·m	20 lb in
Fuel Tank Shield Bolt	18 N·m	13 lb ft
Fuel Tank Strap Bolt	40 N·m	30 lb ft
Heated Oxygen Sensor (HO2S)	42 N·m	31 lb ft
Ignition Coil Bolt	8 N·m	71 lb in
Knock Sensor	20 N·m	15 lb ft
Mass Air Flow/Intake Air Temperature (MAF/IAT) Sensor Clamp	7 N·m	62 lb in
Powertrain Control Module (PCM) Electrical Connector Bolt	8 N·m	71 lb in
Rear Fuel Line Bundle Nut	12 N·m	106 lb in
Spark Plug		
New Head	20 N·m	15 lb ft

Application	Specifications	
	Metric	English
Used Head	15 N·m	11 lb ft
Starter/Generator Control Module (SGCM) Cover Bolt	9 N·m	80 lb in
Throttle Actuator Control (TAC) Module Nut	9 N·m	80 lb in
Throttle Body Nut	10 N·m	89 lb in

Engine Controls – 6.6L Diesel

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accelerator Pedal Nut	20 N·m	15 lb ft
Air Cleaner Housing Cover Screw	4 N·m	35 lb in
Air Conditioning Compressor Bolt	50 N·m	37 lb ft
Air Conditioning Compressor/Power Steering Bracket Bolt	46 N·m	34 lb ft
Air Intake Pipe Bolt	10 N·m	89 lb in
Battery Supply Wiring Harness to Glow Plug Relay Nut	5 N·m	44 lb in
Boost Sensor Bolt	9 N·m	80 lb in
Boost Sensor Bracket Bolt	10 N·m	89 lb in
Camshaft Position (CMP) Sensor Bolt	8 N·m	71 lb in
Charged Air Cooler Clamp	6 N·m	53 lb in
Crankshaft Position (CKP) Sensor Bolt	10 N·m	89 lb in
Crankshaft Position (CKP) Sensor Spacer Bolt	10 N·m	89 lb in
Electronic Brake Control Module Bracket Bolt	25 N·m	18 lb ft
Engine Control Module Electrical Connector Screw	8 N·m	71 lb in
Engine Coolant Temperature (ECT) Sensor	20 N·m	15 lb ft
Engine Harness Bulk Connector to Bracket Bolt	21 N·m	15 lb ft
Engine Sight Shield Hold-Down Bracket Nut	10 N·m	89 lb in
Engine Wiring Harness Bracket Bolt	10 N·m	89 lb in
Engine Wiring Harness Ground Nut	34 N·m	25 lb ft
Exhaust Gas Recirculation to Cylinder Head Bolt	20 N·m	15 lb ft
Exhaust Gas Recirculation to Exhaust Pipe Nut	20 N·m	15 lb ft
Exhaust Gas Recirculation Vacuum Pump Bolt	22 N·m	16 lb ft
Exhaust Gas Recirculation Valve Bracket Bolt	20 N·m	15 lb ft
Exhaust Gas Recirculation Valve Cooler Tube to EGR Bracket Bolt	20 N·m	15 lb ft
Exhaust Gas Recirculation Valve to EGR Cooling Tube Bolt	20 N·m	15 lb ft
Exhaust Gas Recirculation Valve to Intake Manifold Nut	19 N·m	14 lb ft
Exhaust Gas Recirculation Valve Vent Solenoid Bolt	10 N·m	89 lb in
Fuel Bundle Bracket Nut	16 N·m	12 lb ft
Fuel Bundle Nut	16 N·m	12 lb ft
Fuel Cooler Bolt	18 N·m	13 lb ft
Fuel Cooler Nut	40 N·m	30 lb ft
Fuel Feed Block Bolt/Nut	25 N·m	18 lb ft
Fuel Feed Front Pipe Bracket Nut	25 N·m	18 lb ft
Fuel Feed Line Bracket Nut	8 N·m	70 lb in
Fuel Fill Vent Hose Clamp	2.5 N·m	22 lb in
Fuel Fill and Vent Hose Clamp	2.5 N·m	22 lb in
Fuel Filter Bracket Bolt	29 N·m	15 lb ft
Fuel Filter Bracket to Fuel Filter/Heater Element Housing	20 N·m	15 lb ft
Fuel Hose Bracket nut	21 N·m	15 lb ft
Fuel Injection Control Module Bolt	25 N·m	18 lb ft
Fuel Injection Control Module Eye Bolt	35 N·m	26 lb ft
Fuel Injection Pump Bolt	20 N·m	15 lb ft

Application	Specification	
	Metric	English
Fuel Injector Bracket Bolt	50 N·m	37 lb ft
Fuel Injector Feed Pipe Fitting	41 N·m	30 lb ft
Fuel Injector Feed Pipe Retainer Bolt	4 N·m	35 lb in
Fuel Injector Return Pipe Bolt	16 N·m	12 lb ft
Fuel Injector Return Pipe to Cylinder Head Bolt	16 N·m	12 lb ft
Fuel Inlet Pipe to Fuel Injection Control Module Bolt	12 N·m	106 lb in
Fuel Junction Block Bolt	25 N·m	18 lb ft
Fuel Leak-off Block Pipe to Cylinder Head	15 N·m	11 lb ft
Fuel Pipe Clip Bolt	16 N·m	11 lb ft
Fuel Pipe Retainer Nut	8 N·m	70 lb in
Fuel Pressure Regulator Screws		
First Pass	4 N·m	35 lb in
Final Pass	7 N·m	62 lb in
Fuel Pump Fitting	30 N·m	22 lb ft
Fuel Rail Bolt	26 N·m	19 lb ft
Fuel Rail Feed Pipe Fitting	41 N·m	30 lb ft
Fuel Rail Pressure Sensor	70 N·m	52 lb ft
Fuel Return Line Banjo Bolt	15 N·m	11 lb ft
Fuel Return Pipe Bolt	27 N·m	19 lb ft
Fuel Return Pipe Bolt to Cylinder Head	15 N·m	11 lb ft
Fuel Tank Fill Pipe Clamp	2.5 N·m	22 lb in
Fuel Tank Filler Housing to Fuel Tank Fill Pipe Screw	2.3 N·m	20 lb in
Fuel Tank Filler to Body Screw	2.3 N·m	20 lb in
Fuel Tank Ground Strap Bolt	9 N·m	80 lb in
Fuel Tank Shield Bolt	18 N·m	13 lb ft
Fuel Tank Strap Bolt	40 N·m	30 lb ft
Fuel Temperature Sensor	22 N·m	16 lb ft
Generator Positive Cable Nut	9 N·m	80 lb in
Glow Plug	18 N·m	13 lb ft
Glow Plug Electrical Nut	2 N·m	18 lb in
Glow Plug Relay Nut	42 N·m	31 lb ft
Glow Plug Wiring Harness Nut	5 N·m	44 lb in
Heater Outlet Hose Bolt	21 N·m	15 lb ft
Heater Pipe Bolt	20 N·m	15 lb in
Hood Hinge Bolts	25 N·m	18 lb ft
Intake Air Heater	50 N·m	37 lb ft
Intake Air Heater Nut	5 N·m	44 lb in
Intake Air Temperature Sensor	25 N·m	18 lb ft
Junction Block Bracket Bolt	9 N·m	80 lb in
Junction Block Fitting	25 N·m	18 lb ft
Junction Block Nut	25 N·m	18 lb ft
Junction Block to Fuel Injection Pump Pipe Fitting	41 N·m	30 lb ft
Mass Airflow (MAF) Sensor Bolt	8 N·m	70 lb in
Positive Battery Cable Bolt	17 N·m	13 lb ft
Schrader Valve Bracket Nut	20 N·m	15 lb ft
Turbocharger Coolant Bypass Valve	60 N·m	44 lb ft
Upper Intake Manifold Tube Nut	10 N·m	89 lb in
Water Outlet Tube to Thermostat Housing Bolt	21 N·m	16 lb ft
Water Outlet Tube to Valve Rocker Arm Cover Bolt	21 N·m	16 lb ft

Fuel System Specifications

What Fuel to Use in the United States

In the United States, for best results use Number 2-D diesel fuel year-round, above and below freezing conditions, as oil companies blend Number 2-D fuel to address climate differences. Number 1-D diesel fuel may be used in very cold temperatures when the temperature stays below -18°C (0°F). However, the fuel will produce a power and fuel economy loss. The use of Number 1-D diesel fuel in warm or hot climates may result in stalling, poor starting when the engine is hot and may damage the fuel injection system.

Diesel fuel may foam when filling the tank. This can cause the automatic pump nozzle to shut OFF, even though the tank is not full. If this happens, just wait for the foaming to stop and then continue to fill the tank.

What Fuel to Use in Canada

Canadian fuels are blended for seasonal changes. Diesel Type A fuel is blended for better cold weather starting (when it stays below -18°C (0°F). However, the fuel will produce a power and fuel economy loss. The use of Type A diesel fuel in warmer climates may result in stalling, poor starting. Diesel Type B fuel is blended for temperatures above -18°C (0°F). The emission control system requires the use of diesel fuel with low sulfur, 0.05 percent by weight , content. Both low and higher sulfur fuels will be available in Canada. Only low sulfur diesel fuels are available in the United States. Diesel-powered trucks must be refueled only with low sulfur fuel. Use of fuels with higher-sulfur content will affect the function of the emission components and may caused reduced performance, excessive smoke and unpleasant odor.

Very Cold Weather Operation

If the vehicle is driven in very cold temperatures and can not get a winterized Number 2-D that has been adapted to cold weather or a Number 1-D, use one gallon of kerosene for every two gallons of diesel fuel. Once you add kerosene, run the engine for several minutes to mix the fuels. Only add kerosene when the temperature falls below -18°C (0°F), because the fuel economy and lubricating qualities of kerosene is not as good as that of diesel fuel.

In cold weather , the fuel filter may become clogged (waxed). To unclog the filter, move the vehicle to a warm garage area and warm the filter to a temperature between 0-10°C (32-50°F). Replacing the filter is not necessary.

Fuel Specific Gravity Testing

Use a Diesel Fuel Quality Tester to measure the fuel specific gravity (API Rating). Follow the instructions on the tool to btain the proper temerpature-adjusted value. This information must be accurate for the proper diagnosis of the fuel system.

Fuel Injector Return Flow and Fuel Pressures

The fuel return from the fuel injectors to the tank will vary based on the API value of the fuel. Measure the Fuel API with the Diesel Fuel Quality Tester. For this reason the Fuel System Diagnosis-High Pressure Side values will vary for identifying a fuel injector or fuel pump concern. Use the following tables when referred to by the diagnostic. The first table is to be used during the initial diagnosis to identify the worst fuel injectors. After the fuel injectors that fail the first part of the test are replaced, the return flow from each fuel injector must be measured again. This is because the fuel system is returning less fuel to the tank, and thus the fuel pressure is higher during the retest. Failure to use the correct table may result in the replacement of good fuel injectors.

Initial Fuel Injector Return Flow Values

API Rating	Maximum Single Fuel Injector Return Flow	Maximum Fuel Injector Bank Return Flow
30-34	3 ml	12 ml
35-39	4 ml	16 ml
40-44	5 ml	20 ml

Retesting Fuel Injector Return Flow Values

API Rating	Maximum Single Fuel Injector Return Flow	Maximum Fuel Injector Bank Return Flow	Fuel Pressure at cranking speed (FICM Disabled)
30-34	4 ml	16 ml	176-180 Mpa
35-39	5 ml	20 ml	134-178 Mpa 176-180 Mpa
40-44	5 ml	20 ml	114-135 Mpa

Water in Fuel

Sometimes, water can be pumped into the fuel tank along with diesel fuel. This can happen if the service station does not regularly inspect and clean their fuel tanks, or the fuel gets contaminated for the service stations suppliers.

If water is pumped into the fuel tank, a water in fuel light will illuminate. If the water in fuel light illuminates, the excess water must be drained from the fuel system on the vehicle.

Very Cold Weather Operation

If the vehicle is driven in very cold temperatures and can not get a winterized Number 2-D that has been adapted to cold weather or a Number 1-D, use one gallon of kerosene for every two gallons of diesel fuel. Once you add kerosene, run the engine for several minutes to mix the fuels. Only add kerosene when the temperature falls below -18°C (0°F), because the fuel economy and lubricating qualities of kerosene is not as good as that of diesel fuel.

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Water in Fuel

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Glow Plug System Description

In the diesel engine, air alone is compressed in the cylinder. Then, after the air has been compressed, a charge of fuel is sprayed into the cylinder and ignition occurs, due to the heat of compression. Eight glow plugs are used as an aid to starting.

Control of the glow plugs is accomplished by moving the logic for controlling the heat of the plugs to the engine control module (ECM). The new logic can incorporate the higher accuracy of digital processing compared to the previous analog controller. Additionally, logic involving engine speed and estimates of engine combustion can be added to the traditional time and temperature data used in the previous controller. This capability yields more optimum heat times for the glow plugs, thus pre-glow times can be kept to a minimum for short wait to crank times and maximum glow plug durability.

A normal functioning system operates as follows:

- Turn the ignition ON with the engine OFF, and at room temperature.
- The glow plugs turn ON for between 1 and 16 seconds.
- If the engine is cranked during or after the above sequence, the glow plugs may cycle ON and OFF after the engine control switch is returned from the crank position, whether the engine starts or not. The engine does not have to be running to terminate the glow plug cycling.

The glow plug initial ON time will vary based on the system voltage and temperature. Lower temperatures cause longer ON times.

The ECM provides glow plug operation after starting a cold engine. This post-start operation is initiated when the ignition switch is returned to Run, from the Start position. This function helps clean up excessive white smoke and/or poor idle quality after starting.

Glow Plugs

The glow plugs are heaters in each of the cylinders that turn ON when the ignition switch is turned to the Run position prior to starting the engine. They remain pulsing a short time after starting, then they are turned OFF.

A Wait to Start lamp on the instrument panel provides information on engine starting conditions. The Wait to Start lamp will not illuminate during post-start glow plug operation.

Glow Plug Relay/Controller

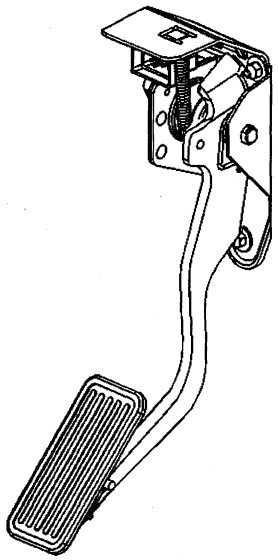
The glow plug relay is a solid state device which operates the glow plugs on Federal Emissions Vehicles. The glow plug controller is a solid state device which operates the glow plugs on California Emissions vehicles. Both components perform the same function of turning ON the glow plugs based on ECM commands

The glow plug controller or relay is connected to the following circuits:

- The fuel heater ignition 1 voltage circuit
- The battery voltage circuit
- The glow plug enable circuit located between the ECM and the glow plug relay or controller
- The engine ground circuit
- The glow plug supply voltage circuit located between the glow plug relay/controller and the glow plugs.

On the California Emissions vehicles, the glow plug diagnostic circuit connects directly from the ECM to the glow plug controller. On Federal emissions vehicles, the glow plug diagnostic circuit is spliced to the glow plug enable circuit after the relay.

Accelerator Pedal Position (APP) System Description



The accelerator pedal position (APP) system along with the vehicle electronics and components is used to calculate and control the amount of acceleration and deceleration via fuel injector control. This eliminates the need for a mechanical cable attachment from the accelerator pedal to a throttle body.

The APP system includes, but is not limited to, the following components :

- The accelerator pedal position (APP) sensor assembly
- The engine control module (ECM)

Accelerator Pedal Position (APP) Sensor

The accelerator pedal position (APP) sensor is mounted on the accelerator pedal control assembly. The sensor is made up of 3 individual sensors within one housing. Three separate signal, low reference, and 5-volt reference circuits are used in order to interface the accelerator pedal sensor assembly with the ECM. Each sensor has a unique functionality to determine pedal position. The ECM uses the APP sensor to determine the amount of acceleration or deceleration desired by the person driving the vehicle. The APP sensor 1 voltage should increase as the accelerator pedal is depressed, from below 1.0 volt at 0 pedal travel to above 2 volts at 100 percent pedal travel. APP sensor 2 voltage should decrease from above 4 volts at 0 pedal travel to below 3.0 volts at 100 percent pedal travel. APP sensor 3 voltage should decrease from above 3.8 volts at 0 percent pedal travel to below 3.3 volts at 100 percent pedal travel.

Exhaust Gas Recirculation (EGR) System Description

The exhaust gas recirculation (EGR) system is used to reduce the amount of nitrogen oxide (NOx) emission levels caused by combustion temperatures exceeding 816°C (1,500°F). It does this by introducing small amounts of exhaust gas back into the combustion chamber. The exhaust gas absorbs a portion of the thermal energy produced by the combustion process and thus decreases combustion temperature. The EGR system will only operate under specific temperature, barometric pressure and engine load conditions in order to prevent drivability concerns and to increase engine performance.

The EGR system consists of the following components:

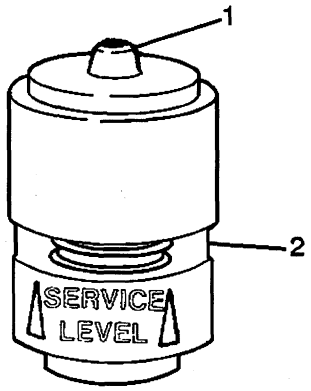
- EGR Valve The EGR valve is vacuum operated. The EGR valve is used to transmit exhaust gases from the exhaust system to the intake manifold to be recirculated into the combustion process.
- Vacuum Pump Vacuum for the EGR vacuum control system is created by a belt driven mechanical pump called a vacuum pump. When the engine is running, the vacuum pump is operating at all times.
- EGR Valve Vacuum Control Solenoid The EGR valve vacuum control solenoid is located in the EGR vacuum control system between the vacuum pump and the EGR vacuum vent solenoid. The ECM pulse width modulates (PWM) the ground path of the EGR valve vacuum control solenoid allowing metered vacuum from the vacuum pump to open the EGR valve to the desired position. The EGR valve vacuum control solenoid is supplied ignition voltage through the ignition 1 voltage circuit from the Fuel HT fuse. The EGR valve vacuum control solenoid is normally closed.
- EGR Vacuum Vent Solenoid The EGR vacuum vent solenoid is located between the EGR valve vacuum control solenoid and the EGR vacuum sensor. The ECM opens the EGR vacuum vent solenoid, allowing vacuum from the vacuum pump to build in the EGR vacuum control system. When the EGR vacuum vent solenoid is commanded closed, the EGR vacuum control system is vented to atmosphere which will cause the EGR valve to close very fast. The ECM controls the EGR vacuum vent solenoid by switching the ground path ON and OFF. Ignition voltage is supplied through the ignition 1 voltage circuit from the Fuel HT fuse. The EGR vacuum vent solenoid is normally closed.
- EGR Throttle Valve Vacuum Control Solenoid The EGR throttle valve vacuum control solenoid is located in the EGR vacuum control system between the vacuum pump and the EGR throttle valve. The ECM opens the EGR throttle valve vacuum control solenoid, allowing vacuum from the vacuum pump to close the EGR throttle valve. Diesel engines do not create enough engine vacuum on their own to allow the EGR gases into the combustion process. The EGR throttle valve, when closed, creates a restriction of incoming fresh air to the engine in order to create engine vacuum. When the ECM commands the EGR valve to open, the EGR throttle valve will be commanded closed. The ECM controls the EGR throttle valve vacuum control solenoid by switching the ground path ON and OFF. Ignition voltage is supplied through the ignition 1 voltage circuit from the Fuel HT fuse. The EGR throttle valve vacuum control solenoid is normally closed.

- EGR Vacuum Sensor The EGR vacuum sensor is located in the EGR vacuum control system between the EGR vacuum vent solenoid and the EGR valve. The ECM uses the EGR vacuum sensor to monitor the amount of vacuum that is available to the EGR valve. The ECM will make adjustments to the EGR vacuum control system in order to obtain the vacuum level necessary to achieve the proper EGR valve position. The EGR vacuum sensor is interfaced with the ECM by a 5-volt reference circuit, a low reference circuit and a signal circuit.
- MAF Sensor The MAF sensor is located in the air intake system between the air filter and the EGR valve out-take port. The ECM monitors the Mass Air Flow (MAF) sensor signal to calculate the actual amount of EGR flow into the intake manifold. When the EGR valve is opened, the MAF rate will decrease. When the EGR valve vacuum control solenoid is operated at 50-70 percent duty cycle, the MAF rate should drop at least 4 g/s.
- EGR Valve Cooler The EGR valve cooler is mounted on the right intake manifold, between the EGR valve and the exhaust pipe. Engine coolant flows through the EGR valve cooler in order to lower the exhaust gas temperatures before it enters the EGR valve and intake manifold.
- ECM The PCM calculates the amount of EGR needed based on the following inputs:
  - The accelerator pedal position (APP) sensor
  - The barometric pressure (BARO) sensor
  - The boost sensor
  - The engine coolant temperature (ECT) sensor
  - The exhaust gas recirculation (EGR) vacuum sensor
  - The intake air temperature (IAT) sensor
  - The mass airflow (MAF) sensor
  - The vehicle speed sensor (VSS)
  - The engine speed

Air Intake System Description

The air intake system is used to direct cool air from the exterior of the engine compartment to the intake manifold. An air cleaner is incorporated into the system to keep dirt from entering the engine. The system also has a turbocharger to increase power, improve driveability and reduce emissions.

Air Cleaner Restriction Indicator



(1) Reset Button
(2) Window

The air cleaner restriction indicator is located on the air cleaner housing.

If the area inside of the clear section is green, no air filter service is required. If the area inside the clear section is orange and Change Air Filter appears, replace the air filter.

Engine Controls – 6.6L Turbo-Diesel (RPO LLY)

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accelerator Pedal Nut	20 N·m	15 lb ft
Air Cleaner Housing Cover Screw	4 N·m	35 lb in
Air Cleaner Outlet Duct Clamp	4 N·m	35 lb in
Air Conditioning Compressor Bolt	50 N·m	37 lb ft
Air Conditioning Compressor/Power Steering Bracket Bolt	46 N·m	34 lb ft
Air Inlet Tube Nut	10 N·m	89 lb in
Air Inlet Tube to Intake Manifold Tube Bolt/Nut	10 N·m	89 lb in
Air Intake Pipe Clamp	4.6 N·m	41 lb in
Battery Positive Cable Junction Block Bracket Bolt	9 N·m	80 lb in
Boost Sensor Bracket Bolt	9 N·m	80 lb in
Camshaft Position (CMP) Sensor Bolt	10 N·m	89 lb in
Charged Air Cooler Duct Clamp	6 N·m	53 lb in
Crankshaft Position (CKP) Sensor Bolt	10 N·m	89 lb in
Crankshaft Position Sensor (CKP) Sensor Spacer Bolt	10 N·m	89 lb in
Distribution Block Fuel Line Clip Bolt	25 N·m	18 lb ft
Drive Belt Tensioner Bolt	50 N·m	37 lb ft
Electronic Brake Control Module Bracket Bolt	25 N·m	18 lb ft
Engine Coolant Temperature (ECT) Sensor	20 N·m	15 lb ft
Engine Harness Main Connector (to Bracket) Screw	10 N·m	89 lb ft
Engine Wiring Harness Clamp Bolt	10 N·m	89 lb in
Engine Wiring Harness Main Connector Bracket Bolt to Engine	21 N·m	15 lb ft
Engine Wiring Harness Ground Bolt	34 N·m	25 lb ft
Exhaust Gas Recirculation (EGR) Coolant Pipe Bolt	25 N·m	18 lb ft
Exhaust Gas Recirculation (EGR) Cooler Tube Bolt	50 N·m	37 lb ft
Exhaust Gas Recirculation (EGR) Cooler Tube Rear Bolt	20 N·m	15 lb ft
Exhaust Gas Recirculation (EGR) Valve/Solenoid Bolt	20 N·m	15 lb ft
Fuel Bundle Nut	16 N·m	12 lb ft
Fuel Cooler Nut	40 N·m	30 lb ft
Fuel Feed Pipe Bolt/Nut	25 N·m	18 lb ft
Fuel Feed Pipe Clip Bolt	10 N·m	89 lb in
Fuel Feed Pipe Nut	41 N·m	30 lb in
Fuel Fill Vent Hose Clamp	2.5 N·m	22 lb in
Fuel Filter Bracket Bolt	20 N·m	15 lb ft
Fuel Filter Bracket to Fuel Filter/Heater Element Housing	20 N·m	15 lb ft
Fuel Injection Control Module Bolt	20 N·m	14 lb ft
Fuel Injection Control Module Eye Bolt	34 N·m	25 lb ft
Fuel Injection Pump Adapter Bolt	20 N·m	14 lb ft
Fuel Injection Pump Bolt	21 N·m	15 lb ft
Fuel Injection Pump Gear Nut	70 N·m	52 lb ft
Fuel Injector Bracket Bolt	30 N·m	22 lb ft
Fuel Injector Feed Pipe Fitting	41 N·m	30 lb ft
Fuel Inlet Pipe to Fuel Rail Fitting	41 N·m	30 lb ft
Fuel Line Bracket Nut	16 N·m	12 lb ft
Fuel Line to Balance Pump Fitting	30 N·m	22 lb ft
Fuel Pipe Bracket Bolt	25 N·m	18 lb ft
Fuel Pressure Regulator Screws		

Application	Specification	
	Metric	English
First Pass	4 N·m	35 lb in
Final Pass	7 N·m	62 lb in
Fuel Rail Balance Pipe Bolt	25 N·m	18 lb ft
Fuel Rail Balance Pipe Fitting	41 N·m	30 lb ft
Fuel Rail Bolt	25 N·m	18 lb ft
Fuel Rail Pressure Sensor	70 N·m	52 lb ft
Fuel Tank Fill Pipe Clamp	2.5 N·m	22 lb in
Fuel Tank Filler Housing to Body Screw	2.3 N·m	20 lb in
Fuel Tank Filler Housing to Fuel Tank Fill Pipe Screw	2.3 N·m	20 lb in
Fuel Tank Ground Strap Bolt	9 N·m	80 lb in
Fuel Tank Shield Bolt	18 N·m	13 lb ft
Fuel Tank Strap Bolt	40 N·m	30 lb ft
Fuel Tank Vent Hose Clamp	2.5 N·m	22 lb in
Fuel Temperature Sensor	22 N·m	16 lb ft
Generator Bracket Bolt	46 N·m	34 lb ft
Generator Positive Cable Nut	9 N·m	80 lb in
Glow Plug	18 N·m	13 lb ft
Glow Plug Controller Bolt	10 N·m	89 lb in
Glow Plug Electrical Connector Nut	2 N·m	18 lb in
Glow Plug Harness Nut	1.7 N·m	15 lb in
Glow Plug Wiring Harness Bracket Bolt	10 N·m	89 lb in
Heater Outlet Hose Bolt	21 N·m	15 lb ft
Hood Hinge Bolts	25 N·m	18 lb ft
Intake Manifold Cover Clamp	6 N·m	53 lb in
Mass Air Flow (MAF) Sensor Screw	8 N·m	70 lb in
Oil Level Indicator Tube Bracket Bolt	21 N·m	15 lb ft
Oil Level Sensor Harness Bolt	40 N·m	30 lb ft
Positive Crankcase Ventilation (PCV) Pipe Bolt	18 N·m	13 lb ft
Power Steering Pump Bracket Rear Bolts	50 N·m	37 lb ft
Turbocharger Vane Position Control Solenoid Valve Bracket Bolt	23 N·m	17 lb ft
Turbocharger Vane Position Sensor	28 N·m	21 lb ft

Fuel System Specifications

What Fuel to Use in the United States

In the United States, for best results use Number 2-D diesel fuel year-round, above and below freezing conditions, as oil companies blend Number 2-D fuel to address climate differences. Number 1-D diesel fuel may be used in very cold temperatures when the temperature stays below -18°C (0°F). However, the fuel will produce a power and fuel economy loss. The use of Number 1-D diesel fuel in warm or hot climates may result in stalling, poor starting when the engine is hot and may damage the fuel injection system.

Diesel fuel may foam when filling the tank. This can cause the automatic pump nozzle to shut OFF, even though the tank is not full. If this happens, just wait for the foaming to stop and then continue to fill the tank.

What Fuel to Use in Canada

Canadian fuels are blended for seasonal changes. Diesel Type A fuel is blended for better cold weather starting, when it stays below -18°C (0°F). However, the fuel will produce a power and fuel economy loss. The use of Type A diesel fuel in warmer climates may result in stalling, poor starting. Diesel Type B fuel is blended for temperatures above -18°C (0°F). The emission control system requires the use of diesel fuel with low sulfur, 0.05 percent by weight , content. Both low and higher sulfur fuels will be available in Canada. Only low sulfur diesel fuels are available in the United States. Diesel-powered trucks must be

refueled only with low sulfur fuel. Use of fuels with higher-sulfur content will affect the function of the emission components and may caused reduced performance, excessive smoke and unpleasant odor.

Very Cold Weather Operation

If the vehicle is driven in very cold temperatures and can not get a winterized Number 2-D that has been adapted to cold weather or a Number 1-D, use one gallon of kerosene for every 2 gallons of diesel fuel. Once you add kerosene, run the engine for several minutes to mix the fuels. Only add kerosene when the temperature falls below -18°C (0°F), because the fuel economy and lubricating qualities of kerosene is not as good as that of diesel fuel.

In cold weather , the fuel filter may become clogged (waxed). To unclog the filter, move the vehicle to a warm garage area and warm the filter to a temperature between 0-10°C (32-50°F). Replacing the filter is not necessary.

Fuel Specific Gravity Testing

Use a Diesel Fuel Quality Tester to measure the fuel specific gravity (API Rating). Follow the instructions on the tool to btain the proper temerpature-adjusted value. This information must be accurate for the proper diagnosis of the fuel system.

Fuel Injector Return Flow and Fuel Pressures

The fuel return from the fuel injectors to the tank will vary based on the API value of the fuel. Measure the Fuel API with the Diesel Fuel Quality Tester. For this reason the Fuel System Diagnosis - High Pressure Side values will vary for identifying a fuel injector or fuel pump concern. Use the following tables when referred to by the diagnostic. The first table is to be used during the initial diagnosis to identify the worst fuel injectors. After the fuel injectors that fail the first part of the test are capped off, the return flow from each uncapped fuel injector must be measured again. This is because the fuel system is returning less fuel to the tank, and thus the fuel pressure is higher during the retest. Failure to use the correct table may result in the replacement of good fuel injectors.

Initial Fuel Injector Return Flow Values

API Rating	Maximum Single Fuel Injector Return Flow
30-34	3 ml
35-39	4 ml
40-44	5 ml

Retesting Fuel Injector Return Flow Values

API Rating	Maximum Single Fuel Injector Return Flow
30-34	4 ml
35-39	5 ml
40-44	5 ml

Water in Fuel

Sometimes, water can be pumped into the fuel tank along with diesel fuel. This can happen if the service station does not regularly inspect and clean their fuel tanks, or the fuel gets contaminated for the service stations suppliers.

If water is pumped into the fuel tank, a water in fuel light will illuminate. If the water in fuel light illuminates, the excess water must be drained from the fuel system on the vehicle.

Very Cold Weather Operation

If the vehicle is driven in very cold temperatures and can not get a winterized Number 2-D that has been adapted to cold weather or a Number 1-D, use one gallon of kerosene for every 2 gallons of diesel fuel. Once you add kerosene, run the engine for several minutes to mix the fuels. Only add kerosene when the temperature falls below -18°C (0°F), because the fuel economy and lubricating qualities of kerosene is not as good as that of diesel fuel.

In cold weather , the fuel filter may become clogged (waxed). To unclog the filter, move the vehicle to a warm garage area and warm the filter to a temperature between 0-10°C (32-50°F). Replacing the filter is not necessary.

Accelerator Pedal Position (APP) System Description

See above.

Glow Plug System Description

See above.

Exhaust Gas Recirculation (EGR) System Description

See above.

Air Intake System Description

See above.

Manual High Idle System Description

High Idle System

The diesel engine has a high idle system to improve the warm-up time of the engine in cold weather conditions. This system allows the engine control module (ECM) to increase the idle speed above the normal calibrated value. The ECM increases the idle speed using the following adjustments:

- The fuel injection timing is changed.
- The fuel injection quantity is changed.
- The turbocharger vane position is commanded closed. the vane position will be farther closed than any other normal operating condition.

The instrument panel will indicate the high idle system is active one of two ways:

- The driver information center (DIC) will indicate an active high idle system on light duty trucks.
- An indicator lamp will flash on medium duty trucks.

High Idle Speed Enable and Disable

To enable or disable the high idle system perform the following procedure:

1. Turn the ignition ON, with the engine OFF.
2. Depress the accelerator pedal to the floor and hold down.
3. While the accelerator pedal is depressed, depress the brake pedal 3 times in less than 8 seconds.
4. Release the accelerator pedal.
5. Start the engine.

When the procedure is followed the engine idle speed will slowly increased to the calibrated high idle speed. This is 1200 RPM for light duty, and 1500 RPM for medium duty trucks.

The idle speed will return to normal if any of the following conditions occur:

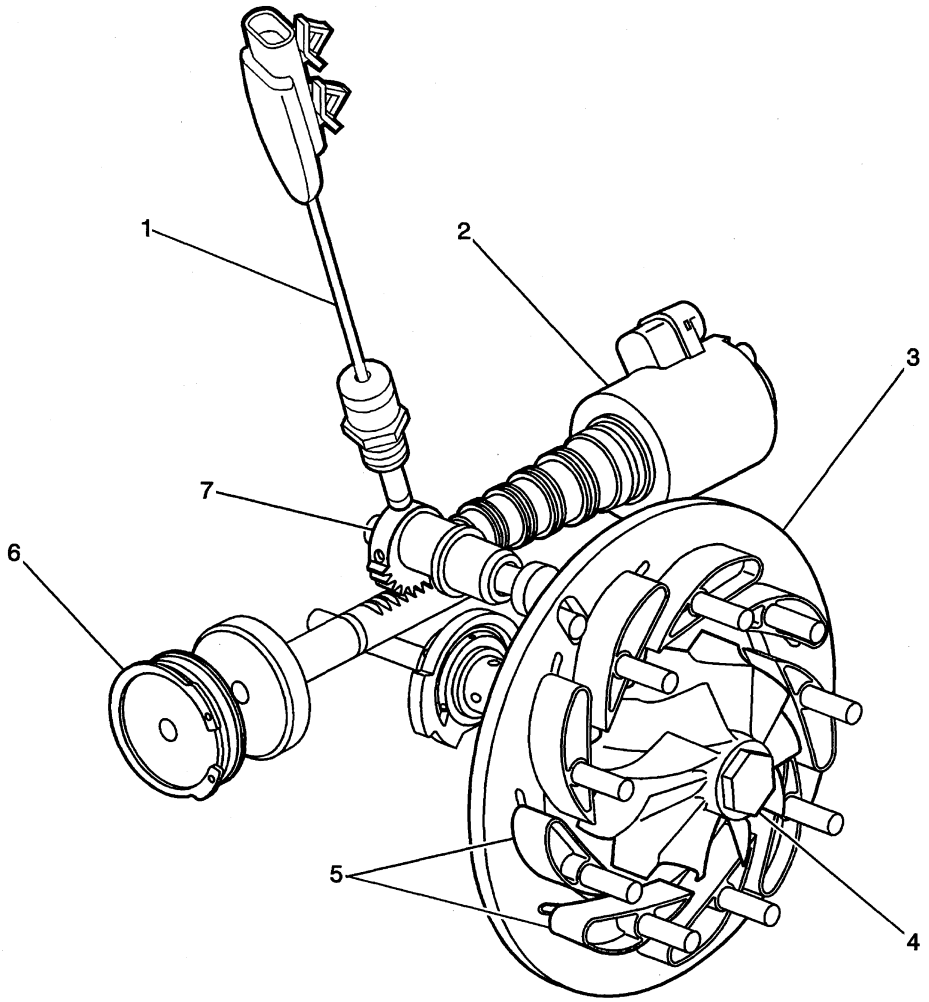
- There is brake, clutch, or throttle input from the driver.
- The automatic transmission is shifted out of Park or Neutral.
- The air temperature is more than 0°C (32°F).
- The engine coolant temperature (ECT) is more than 68°C (154°F)
- The vehicle speed exceeds 0 km/h (0 mph).

The high idle system will reactivate automatically when the following conditions occur:

- The engine has been idling for more than 30 seconds.
- The transmission is placed in Park or Neutral.
- the vehicle speed is 0 km/h (0 mph).

- The ambient air temperature is less than 0°C (32°F).
- The ECT is less than 68°C (154°F)
- The brake, clutch and throttle pedals are not depressed.

Turbocharger Description and Operation



(1) Turbocharger Vane Position Sensor
(2) Turbocharger Vane Position Control Solenoid Valve
(3) Turbocharger Vane Position Unison Ring
(4) Turbine
(5) Turbocharger Vanes
(6) Hydraulic Piston
(7) Cam

The turbocharger increases engine power by pumping compressed air into the combustion chambers, allowing a greater quantity of fuel to combust at the optimal air/fuel ratio. In a conventional turbo, the turbine (4) spins as exhaust gas flows out of the engine and over the turbine blades. This spins the compressor wheel at the other end of the turbine shaft, pumping more air into the intake system.

The turbocharger for this system has vane position control by the engine control module (ECM). The vanes (5) can be opened and closed to vary the amount of boost pressure. Thus, the boost pressure can be controlled independent of engine speed. There are 9 controllable vanes in this turbocharger. The vanes mount to a unison ring (3) that can be rotated to change the vane angle. When the engine is not

under load, the vanes are open to minimize boost and exhaust back pressure. To increase boost when the engine load requires it, the vanes are commanded closed. The ECM will vary the boost dependent upon the load requirements of the engine.

The turbocharger vanes are normally open when the engine is not under load. However, the ECM will often close the turbocharger vanes to create back pressure to drive exhaust gas through the exhaust gas recirculation (EGR) valve as required. At extreme cold temperatures, the ECM may close the vanes at low load conditions in order to accelerate engine coolant heating. The ECM may also close the turbocharger vanes under exhaust braking conditions.

The turbocharger control system utilizes the following components:

Turbocharger Vane Position Control Solenoid Valve

The vane position control solenoid valve (2) works in conjunction with oil pressure to control the turbocharger vanes. The solenoid valve uses 2 circuits; a control circuit and a low reference circuit. The engine control module (ECM) uses a pulse width modulation on the HI control circuit to control the solenoid valve. The ECM will control the solenoid valve to allow the engine oil pressure (EOP) to move a piston (6). This piston rotates the unison ring, thus controlling the engine boost dependant upon engine load.

Turbocharger Vane Position Sensor

The vane position sensor (1) uses 3 circuits: a 5-volt reference circuit, a low reference circuit, and a signal circuit. The engine control module (ECM) provides the sensor with 5 volts on the 5-volt reference circuit and a ground on the low reference circuit. Movement of the sensor from the open vane position to the closed vane position provides the ECM with a signal voltage through the position sensor signal circuit that ranges from 1 volt with the turbocharger vanes open to 3.5 volts with the turbocharger vanes completely closed.

Engine Control Module (ECM)

The engine control module (ECM) controls all turbocharger control functions. The ECM monitors information from various sensor inputs that include the following:

- The accelerator pedal position (APP) sensor
- The engine coolant temperature (ECT) sensor
- The mass airflow (MAF) sensor
- The intake air temperature (IAT) sensor
- The vehicle speed sensor (VSS)
- The transmission gear position or range information sensors
- The boost pressure sensor

Engine Controls – 8.1L

Ignition System Specifications

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

Fastener Tightening Specifications

Application	Specifications	
	Metric	English
Accelerator Pedal Nut	20 N·m	15 lb ft
Air Cleaner Resonator Outlet Duct Clamp	4 N·m	35 lb in
Brake Pipe Fitting	25 N·m	18 lb ft
Camshaft Position (CMP) Sensor Bolt	12 N·m	106 lb in
Crankshaft Position (CKP) Sensor Bolt	12 N·m	106 lb in
Electro-Hydraulic Control Unit Bracket Bolt	25 N·m	18 lb ft
Engine Coolant Temperature (ECT) Sensor	50 N·m	37 lb ft
Engine Shield Bolt	20 N·m	15 lb ft
Engine Wire Harness Bolt/Stud	10 N·m	89 lb in
Evaporative Emission (EVAP) Canister Nut	25 N·m	18 lb ft
Evaporative Emission (EVAP) Canister Purge Valve Bolt	10 N·m	89 lb in
Evaporative Emission (EVAP) Canister Vent Solenoid Bracket Bolt	12 N·m	106 lb in
Fuel Feed and EVAP Bundle Nut	12 N·m	106 lb in
Fuel Fill Pipe Clamp	2.5 N·m	22 lb in
Fuel Pipe Bracket Nut	10 N·m	89 lb in
Fuel Rail Stud	12 N·m	106 lb in
Fuel Tank Filler Housing to Body Screw	2.3 N·m	20 lb in
Fuel Tank Filler Pipe Housing to Fuel Tank Fill Pipe Screw	2.3 N·m	20 lb in
Fuel Tank Ground Strap Bolt	9 N·m	80 lb in
Fuel Tank Shield Bolt	18 N·m	13 lb ft
Fuel Tank Strap Bolt	40 N·m	30 lb ft
Heated Oxygen Sensor (HO2S)	42 N·m	31 lb ft
Ignition Coil Bolt	12 N·m	106 lb in
Knock Sensor	20 N·m	15 lb ft
Manifold Absolute Pressure (MAP) Sensor Bolt	12 N·m	106 lb in
Mass Air Flow (MAF)/Intake Air Temperature (IAT) Sensor Clamp	7 N·m	62 lb in
Powertrain Control Module (PCM) Electrical Connector Bolt	8 N·m	71 lb in
Spark Plug (Existing Head)	20 N·m	15 lb ft
Spark Plug (New Head)	30 N·m	22 lb ft
Throttle Actuator Control Module Bracket Nut	9 N·m	80 lb in
Throttle Actuator Control Module Nut	9 N·m	80 lb in
Throttle Body Nut	10 N·m	89 lb in

Exhaust System

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Exhaust Gas Recirculation (EGR) Cooler Tube Nut (6.6L)	30 N·m	20 lb ft
Exhaust Hanger Bracket Bolt	12 N·m	106 lb in
Exhaust Heat Shield Bolt (Body Panel)	9 N·m	80 lb in
Exhaust Heat Shield Nut (Body Panel)	9 N·m	80 lb in
Exhaust Manifold Bolts (4.8L, 5.3L, and 6.0L)		
First Pass	15 N·m	11 lb ft
Final Pass	25 N·m	18 lb ft
Exhaust Manifold Bolt/Nut (6.6L)	34 N·m	25 lb ft
Exhaust Manifold Bolt/Stud (4.3L)	30 N·m	22 lb ft
Exhaust Manifold Center Bolt (8.1L)	35 N·m	26 lb ft
Exhaust Manifold Heat Shield Bolt (4.3L, 4.8L, 5.3L, and 6.0L)	9 N·m	80 lb in
Exhaust Manifold Heat Shield Bolt (6.6L)	8 N·m	71 lb in
Exhaust Manifold Heat Shield Bolt/Nut (8.1L)	25 N·m	18 lb ft
Exhaust Manifold Nut (8.1L)	16 N·m	12 lb ft
Exhaust Manifold Pipe Nut	50 N·m	37 lb ft
Exhaust Muffler Hanger Nut	50 N·m	39 lb ft
Exhaust Muffler Nut	40 N·m	30 lb ft
Exhaust Outlet Pipe Clamp (6.6L)	15 N·m	11 lb ft
Exhaust Outlet to Right Exhaust Pipe Bracket Bolt (6.6L)	34 N·m	25 lb ft
Exhaust Pipe Clamp	44 N·m	33 lb ft
Exhaust Pipe Hanger Bracket Bolt	12 N·m	106 lb in
Exhaust Pipe Hanger Bracket Bolt (4L60-E)	17 N·m	13 lb if
Exhaust Pipe Heat Shield Bolt (6.6L)	8 N·m	71 lb in
Exhaust Pipe to Manifold Bolt (6.6L)	53 N·m	39 lb ft
Exhaust Pipe to Turbocharger Bolt (6.6L)	53 N·m	39 lb ft
Hood Hinge Bolt	25 N·m	18 lb ft
Intake Manifold Cover Clamp (6.6L)	6 N·m	53 lb in
Oil Level Indicator Tube Bracket Bolt (6.6L)	21 N·m	15 lb ft
Outlet Duct Clamp	6 N·m	53 lb in
Oxygen Sensor	42 N·m	31 lb ft
Rear Shock Absorber Lower Bolt	95 N·m	70 lb ft
Spark Plug (4.3L)	15 N·m	11 lb ft
Spark Plug Wire Retainer Bolt (4.3L)	12 N·m	106 lb in
Transmission Bolt	100 N·m	74 lb ft
Transmission Fluid Fill Tube Nut (6.6L)	18 N·m	13 lb ft
Transmission Mount to Support Nut	40 N·m	30 lb ft
Transmission Support Crossmember Bolt	95 N·m	70 lb ft
Turbocharger Exhaust Pipe Bolt/Nut (6.6L)	53 N·m	39 lb ft
Turbocharger Exhaust Pipe Heat Shield Bolt (6.6L)	8 N·m	71 lb in
Turbocharger Heat Shield Bolt (6.6L)	9 N·m	80 lb in

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 3500

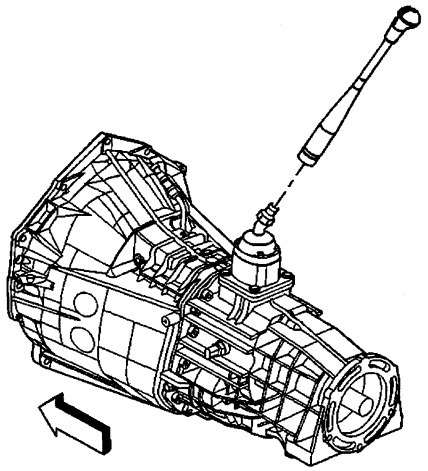
Fastener Tightening Specifications

Application	Specification	
	Metric	English
Backup Lamp Switch	37 N·m	27 lb ft
Clutch Actuator Cylinder Bolt	8 N·m	71 lb in
Control Lever Boot Screw	1.6 N·m	14 lb in
Input Shaft Bearing Retainer Bolt	14 N·m	10 lb ft
Oil Drain and Fill Plugs	30 N·m	22 lb ft
Shift Lever Assembly Nut	37 N·m	27 lb ft
Shift Lever Bolt	20 N·m	15 lb ft
Transmission Bolt/Stud	50 N·m	37 lb ft
Transmission Cover Bolt	9 N·m	80 lb in
Transmission Mount Bolt	50 N·m	37 lb ft
Transmission Mount to Crossmember Nut	40 N·m	30 lb ft
Vehicle Speed Sensor	16 N·m	12 lb ft

Lubrication Specifications

Application	Specification	
	Metric	English
Recommended Lubricant: Synchromesh Transmission Fluid GM P/N 12345349	2.0 liters	2.2 quarts

Description and Operation



The New Venture Gear NV3500 (85 mm) is a 5 speed manual transmission used on light duty truck with 4.3 L, 5.0 L, and 5.7 L 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 inputshaft and the counter shaft. The transmission is available in rear wheel and four wheel drive 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 two piece aluminum housing.
- Synchronized shifting in all forward gears.
- A shift tower mounted shift lever.
- Single rail shift system.

Manual Transmission - NV 4500

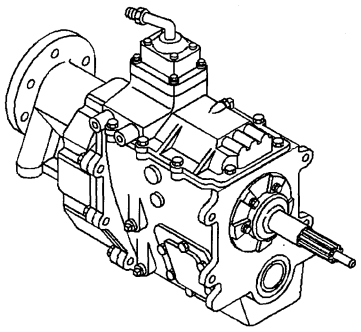
Fastener Tightening Specifications

Application	Specification	
	Metric	English
Backup Lamp Switch	28 N·m	21 lb ft
Clutch Actuator Cylinder Bolt	8 N·m	71 lb in
Clutch Housing Bolt/Stud	50 N·m	37 lb ft
Control Boot Screw	1.6 N·m	14 lb in
Input Shaft Bearing Retainer Bolt	22 N·m	16 lb ft
Main Shaft Nut	441 N·m	325 lb ft
Oil Drain and Fill Plugs	37 N·m	27 lb ft
Shift Lever Assembly Nut	37 N·m	27 lb ft
Shift Lever Bolt	20 N·m	15 lb ft
Transmission Mount Bolt	50 N·m	37 lb ft
Transmission Mount to Crossmember Nut	40 N·m	30 lb ft
Transmission to Clutch Housing Bolt	100 N·m	74 lb ft
Vehicle Speed Sensor (VSS)	16 N·m	12 lb ft

Lubrication Specifications

Recommended Lubricant	Specification	
	Metric	English
Castrol Syntorq LT Transmission Fluid GM P/N 12346190	3.78 liters	4.0 quarts

Description and Operation



The New Venture Gear NV4500 (109 mm) is a five speed manual transmission used on light duty trucks. This manual transmission is identified by the RPO MW3. The 109 mm is the distance between the input shaft and the counter shaft. The transmission is available in rear wheel and four wheel drive versions.

The transmission has the following features:

- Made from cast iron for durability
- Synchronized shifting in all forward gears
- Constant mesh helical gearing for reduced noise
- Overspeed inhibitor from low to second speed gears
- Dual cone low speed gear and 2nd speed gear synchronizer
- Multiple ring sychronizers for smooth shifting

Manual Transmission - ZF S6-650

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Backup Lamp Switch	20 N·m	15 lb ft
Clutch Actuator Cylinder Bolt	8 N·m	71 lb in
Control Lever Boot Screws	1.6 N·m	14 lb in
Exhaust Pipe Hanger Bracket Bolt	12 N·m	106 lb in
Oil Fill and Drain Plug	35 N·m	26 lb ft
Shift Lever Assembly Nut	37 N·m	27 lb ft
Transmission Bolt/Stud	50 N·m	37 lb ft
Transmission Mount Bolt	50 N·m	37 lb ft
Transmission Mount To Crossmember Nut	54 N·m	40 lb ft
Vehicle Speed Sensor Bolt	10 N·m	89 lb in
Vent Hose Clip Nut	25 N·m	18 lb ft
Yoke Nut	330 N·m	244 lb ft

Lubrication Specifications

Application	Specification	
	Metric	English
Recommended Lubricant: GM P/N 12378515	6.0 liters	6.34 quarts

Description and Operation

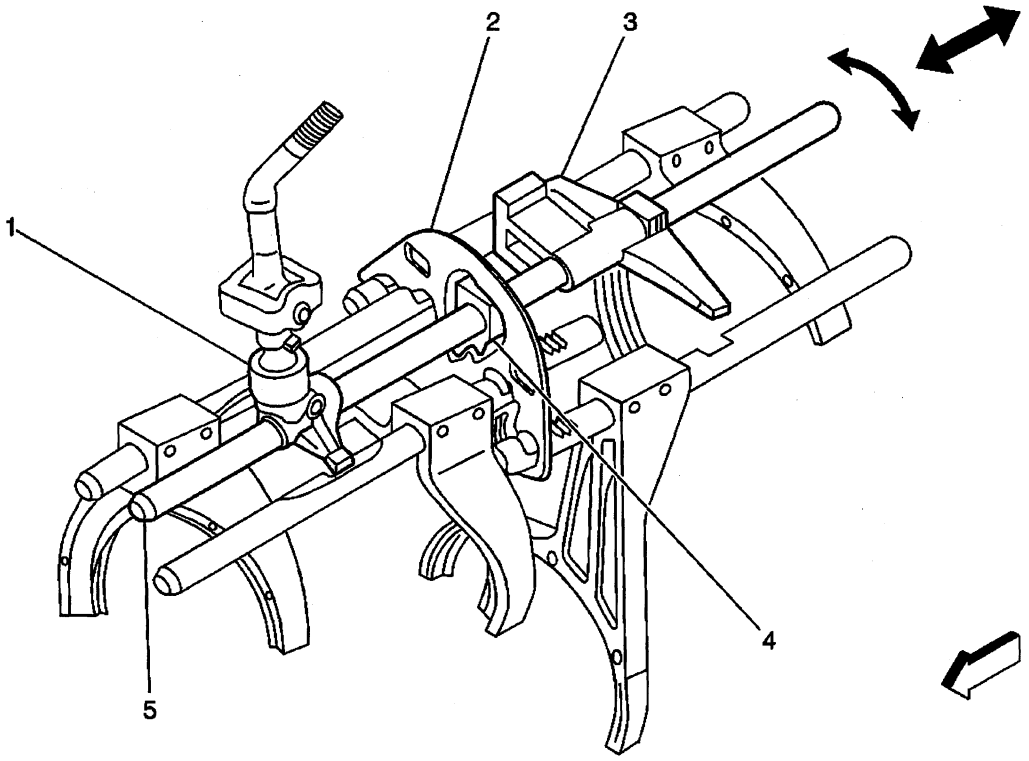
The ZF S6-650 is a six-speed transmission. All of the six forward gears and the reverse gear are fully synchronized. The six-speed gear is an overdrive ratio. The six-speed gear is located on the rear of the countershaft.

The transmission consists of three aluminum cases. The front case includes the bell housing. The main shaft and the countershaft front bearing races are installed in the front case. The bearing races are shimmed to preload the main shaft and countershaft bearings. There is also a main shift shaft bearing in the front case. The shift control lever housing mounts to the front case.

The intermediate case supports the main shaft and the countershaft. The bearing races for the main shaft and the countershaft center bearings are installed in the intermediate case. To support the shift shaft, shift shaft bearings are used in the intermediate case The shift shaft interlock plate and the shift shaft detents are located with the intermediate case.

The rear case also has bearings for the main shaft and the countershaft. The bearings are not preloaded. The rear case contains the reverse gear idler shaft and gear. The rear case also has a bearing for the main shift shaft. If the vehicle is RWD, an oil seal is used in the rear case. If the vehicle is 4WD, a sealed bearing is used on the rear of the main shaft. The six-speed gear along with the reverse/first speed gears are located in the rear case.

All of the speed gears are supported by a double row needle bearing. The inner bearing races for the needle bearings are replaceable.



The shift lever moving the main shift shaft (5) selects the transmission speeds. By moving the main shift shaft front-to-rear and side-to-side rotation will allow the levers on the front internal shift control lever (1) to engage the notches on the 4th/5th speed gears shift shaft or the 2nd/3rd speed gears shift shaft. Further movement of the main shift shaft front-to-rear and side-to-side rotation, the levers on the rear internal shift control lever (3) will engage in the notches on the reverse/1st speed gears shift shaft or the 6th speed gear shift shaft. The shift shaft block (4) on the main shift shaft, which is teeth to the interlock plate (2), moves the interlock plate to lock in the notches on the non-selected gears shift shaft, thus preventing the non-selected shift shafts from moving.

Automatic Transmission – 4L60E

Transmission General Specifications

Name	Hydra-Matic 4L60-E
RPO Codes	M30/M32/M33
Production Location	Toledo, Ohio Romulus, MI
Vehicle Platform (Engine/Transmission) Usage	C/K 800
Transmission Drive	Longitudinally-Mounted Rear Wheel Drive
1st Gear Ratio	3.059:1
2nd Gear Ratio	1.625:1
3rd Gear Ratio	1.000:1
4th Gear Ratio	0.696:1
Reverse	2.294:1
Torque Converter Size (Diameter of Torque Converter Turbine)	300 mm 258 mm
Pressure Taps	Line Pressure
Transmission Fluid Type	DEXRON® III
Transmission Fluid Capacity (Approximate)	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 as Shipped)	258 mm Converter 80.73 kg (179.0 lb) 300 mm Converter 87.3 kg (192.5 lb)
Transmission Weight Wet (Approximate)	258 mm Converter 93.0 kg (205.0 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)

Fastener Tightening Specifications (M30/M32)

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

Application	Specification	
	Metric	English
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
Transmission Fluid Pressure Manual Valve Position Switch to Valve Body Bolt	8.0-14.0 N·m	6-10 lb ft
Transmission Mount to Transmission Bolt	50 N·m	37 lb ft
Transmission Mount Retaining Nut	40 N·m	30 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

Fastener Tightening Specifications (M33)

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	16 N·m	11.8 lb ft
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

Application	Specification	
	Metric	English
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
Secondary Fluid Pump Assembly to Valve Body Bolt	11-14 N·m	8-10 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
Transmission Fluid Pressure Manual Valve Position Switch to Valve Body Bolt	8.0-14.0 N·m	6-10 lb ft
Transmission Mount to Transmission Bolt	50 N·m	37 lb ft
Transmission Mount Retaining Nut	40 N·m	30 lb ft
Transmission Oil Cooler Pipe Fitting	35.0-41.0 N·m	26-30 lb ft
Transmission Oil Pan to Case Bolt	9.5-13.8 N·m	7-10 lb ft
Transmission to Engine Bolt	47 N·m	35 lb ft
Valve Body to Case Bolt	8.0-14.0 N·m	6-10 lb ft

Fluid Capacity Specifications

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

Transmission 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.

Automatic Transmission – 4L80E

Transmission General Specifications

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

Fastener Tightening Specifications

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

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

Fluid Capacity Specifications Overhaul

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

Transmission General Description

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

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

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

Automatic Transmission - Allison

Transmission General Specifications

Name	Allison 1000 Series
First Range Ratio	3.10:1
Second Range Ratio	1.81:1
Third Range Ratio	1.41:1
Fourth Range Ratio	1.00:1
Fifth Range Ratio	0.71:1
Reverse Range Ratio	-4.49:1
Transmission Fluid Type	DEXRON® III
Maximum Gross Combined Weight (GCW)	11 800 kg (26,000 lb)*
Maximum Gross Vehicle Weight (GVW)	9 000 kg (19,850 lb)*
* Or Vehicle Manufacturers Chassis Rating, whichever is less	

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Control Module Cover to Radiator Shroud Bolts	9 N·m	80 lb in
Control Valve Assembly to Main Housing Bolts	12 N·m	108 lb in
Converter Housing to Front Support Assembly Bolts	56 N·m	41 lb ft
Detent Lever Retaining Nut	29 N·m	21 lb ft
Detent Spring Assembly to Main Valve Body Bolts	12 N·m	108 lb in
Filler Tube Bracket to Transmission Nuts	18 N·m	13 lb ft
Fuel Line Bracket to Transmission Nut	18 N·m	13 lb ft
Fuel Line Retainer to Transmission Bolts	2.5 N·m	22 lb in
Heat Shield to Transmission Bolts	17 N·m	13 lb ft
Heat Shield to Transmission Nut	25 N·m	18 lb ft
Hydraulic Connector Assembly	25 N·m	18 lb ft
Input Speed Sensor to Torque Converter Housing Bolt	12 N·m	108 lb in
Main Pressure Tap Plug	12 N·m	108 lb in
Oil Cooler Line Clip to Oil Pan Nut	9 N·m	80 lb in
Oil Cooler to Radiator Brace Bolts	12 N·m	106 lb in
Oil Pan Drain Plug	35 N·m	26 lb ft
Oil Pan to Main Housing Bolts	27 N·m	20 lb ft
Output Speed Sensor to Rear Cover Bolt	12 N·m	108 lb in
PNP Switch to Main Housing Bolts	27 N·m	20 lb ft
Transmission Fluid Pressure Switch to Main Valve Body Bolts	12 N·m	108 lb in
PTO Cover to Main Housing Bolts	43 N·m	32 lb ft
Shift Cable Bracket to Transmission Bolts	25 N·m	18 lb ft
Shift Cable Support to Steering Column Brace Bolt	10 N·m	89 lb in
Shift Lever to Shift Selector Shaft Nut	24 N·m	18 lb ft
Shipping Bracket to Torque Converter Housing Bolts	27 N·m	20 lb ft
Shipping Bracket to Torque Converter Lug Bolts	27 N·m	20 lb ft
Torque Converter to Flywheel Bolts	60 N·m	44 lb ft
Torque Converter Housing Inspection Cover to Transmission Bolts	10 N·m	89 lb in
Transmission Mount to Adapter Bolts (4WD)	47 N·m	35 lb ft
Transmission Mount to Transmission Bolts (2WD)	50 N·m	37 lb ft
Transmission Mount to Transmission Support Nuts	40 N·m	30 lb ft
Transmission Support to Frame Nuts and Bolts	70 N·m	52 lb ft
Transmission to Engine Studs and Bolts	50 N·m	37 lb ft
Turbine Speed Sensor to Main Housing Bolt	12 N·m	108 lb in
Yoke Assembly to Output Shaft Bolt	123 N·m	91 lb ft

Fluid Capacity Specifications

Condition	Liters	Quarts
(approximate)		
Fill After Rebuild	12.0	12.7
Fill After Fluid and Filter Change	7.0	7.4

Description and Operation

Allison 1000 Series Transmissions are torque converter driven, fully automatic, transmission systems. The 1000 Series transmissions have up to five forward speeds, neutral, and reverse. The fifth range has an overdrive gear ratio. The 1000 Series incorporates a variety of standard and optional design features. These design features are:

- Direct mount to engine block
- Flexplate drive
- Torque converter with a torque converter clutch (TCC) and integral vibration damper
- Three constant-mesh, planetary gear sets with helical gears
- Five multiple disk clutches--two rotating and three stationary
- Common hydraulic system for all transmission functions
- Two transmission fluid filtration systems
- Electro-Hydraulic Control Valve Assembly
- Electronically controlled automatic gear selection and clutch apply
- Provision for remote transmission fluid cooler
- Fill tube/dipstick provision on both sides of transmission
- Parking pawl
- Power takeoff (PTO) provision on both sides of transmission
- Variety of available output yokes or flanges

Component and System Description

Engine/Transmission Connection

The converter housings of 1000 Series transmissions mate directly to the engine block. Flexplate drive is used for engine-to-transmission torque transfer.

Torque Converter

Several torque converters are available to match the transmissions to a wide variety of diesel and gasoline engines. The torque converter is a single-stage, polyphase, and three-element unit, consisting of a pump, stator, and turbine. At lower output speeds, the torque converter multiplies torque and provides a fluid coupling to the engine. At higher speeds, the torque converter clutch (TCC) is automatically engaged to provide direct drive from the engine to the transmission. Hydraulic fluid for converter charging pressure comes from the sump and is supplied by the input pump. The torque converter clutch is applied or released by changing direction of fluid in the torque converter. An integral converter damper minimizes the need for additional engine vibration control.

Gear Sets

The planetary gear train includes three constant-mesh planetary gear sets containing helical gears. By the engagement of the clutches in various combinations, the planetary sets act singly or together to provide five forward ranges, neutral, and reverse.

Clutches

Five clutches (two rotating and three stationary) direct the flow of torque through the transmission. All range clutches are hydraulically actuated and spring-released, with automatic wear compensation. The transmission fluid cools the clutches. The transmission control module (TCM) signals solenoid valves to apply and release clutches based on speed and power combinations and the range selected by the operator.

Hydraulic System

A common hydraulic system serves the torque converter and the transmission. Transmission fluid for all hydraulic operations, lubrication, and cooling comes from the sump and is supplied by the charging pump.

Transmission Fluid Filtration

Fluid filtration is provided by two filter systems. A suction filter, located in the sump, provides general protection to the entire hydraulic system by filtering large particulates. A spin-on filter provides full-time protection for the control solenoids and multipass protection for the entire system. The spin-on filter is externally located on the converter housing at the lower left front of the transmission.

Electro-Hydraulic Control Valve Assembly

The control valve assembly consists of two components. The main valve body contains the trim valves, the torque converter clutch (TCC) valve, the exhaust backfill valve, and the control main relief valve. The shift valve body contains the shift valves, the control main pressure valve, and the manual selector valve. The control valve assembly attaches to the bottom of the gearbox module and is enclosed by the oil pan.

Remote Oil Cooler Provision

Ports for remote-mount oil cooler lines are located on the right side of the converter housing near the converter housing/main housing splitline. Remote oil-to-water coolers require plumbing for transmission fluid and engine-cooling water. Remote oil-to-air coolers may also be used and only transmissions fluid lines need to be provided. Heat is transferred from the transmission fluid to either water or air depending upon the cooler type used.

Fill Tube/Dipstick Provision

All 1000 Series models have a fill tube/dipstick provision on both sides of the transmission. The fill tube and dipstick are OEM-installed and adapted as specified by the vehicle manufacturer. A plug is installed in the unused location.

Park Pawl

All 1000 Series transmissions have a PARK pawl. The internal parking pawl is engaged by selection of the PARK position on the shift selector.

PTO Provision

The 1000 Series transmissions have a provision to mount and drive a power takeoff (PTO) unit on the left and/or right side of the transmission housing. The torque converter turbine drives the optional PTO drive gear. The PTO reflects engine and torque converter characteristics. The vehicle manufacturer and/or body builder provides PTO units and associated controls.

Output Yoke/Flange

A variety of output yokes or flanges are available to meet vehicle driveline requirements. Yokes or flanges are OEM-installed and are adapted as specified by the vehicle manufacturer.

Tow/Haul Mode

Tow/Haul mode significantly changes the transmission shift pattern to reduce shift cycling and to deliver better performance, control, and cooling when towing or hauling heavy loads. For instance:

- Upshift points are raised at light to mid throttle position to use more of the available engine power for acceleration. Downshift points are raised to enhance engine braking to help slow the vehicle.
- During deceleration, the torque converter clutch (TCC) remains applied at closed throttle at lower speeds to significantly improve the effect of engine braking.
- During acceleration, the TCC is applied in 2nd range and remains applied in 3rd, 4th, and 5th. This improves the drivetrain efficiency and significantly lowers transmission sump temperature when towing heavy loads. In Normal mode, the TCC generally applies only in higher ranges and is dependent on throttle position.

- Tow/haul is designed to be most effective when the vehicle and trailer combined weight is at least 75 percent of the gross combined weight rating (GCWR) of the vehicle.
- Operation of tow/haul in a lightly loaded or non-loaded vehicle will not cause damage. However, there is no benefit to the selection of tow/haul when the vehicle is unloaded. This situation will cause a firm shift. The tow/haul switch is not a performance switch.
- Selection of tow/haul when unloaded may result in unpleasant engine and transmission driving characteristics and reduced fuel economy. Tow/haul is recommended only when pulling a heavy trailer or a large or heavy load.

Activation

- Tow/Haul is selected or de-selected via a switch on the end of the transmission shift lever. A light on the instrument panel will illuminate to indicate that tow/haul has been selected.
- Tow/Haul must be selected again, every time the vehicle is started, if desired.

Clutch

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Clutch Actuator Cylinder Bolt	8 N·m	71 lb in
Clutch Pedal to Brake Module Bolt	50 N·m	37 lb ft
Clutch Pedal to Clutch Pedal Bracket Bolt	36 N·m	27 lb ft
Clutch Pressure Plate Bolt (4.3L Engine)	40 N·m	30 lb ft
Clutch Pressure Plate Bolt (4.8L, 6.0L, 6.6L, and 8.1L Engines)	70 N·m	52 lb ft

Clutch Types

The C/K model vehicle uses two different clutch hydraulic systems and five different clutch variations. The vehicles with the 5 speed transmissions RPO MW3 and MG5 use a different clutch hydraulic system than the vehicles with the 6 speed transmission RPO ML6. For the proper diagnosis, because of the clutch variations, it is important to understand which clutch system is used.

4.3L Clutch

The 4.3L clutch system is described as the following:

- Size - 280 mm (11 in)
- Clutch pressure plate - Diaphragm spring plate, non-self adjusting
- Clutch disc - Damper spring style
- Hydraulic system - 5 speed

4.8L Clutch

The 4.8L clutch system is described as the following:

- Size - 301 mm (11.85 in)
- Clutch pressure plate - Diaphragm spring plate, non-self adjusting
- Clutch disc - Damper spring style
- Hydraulic system - 5 speed

6.0L Clutch

The 6.0L clutch system is described as the following:

- Size - 297 mm (11.70 in)
- Clutch pressure plate - Diaphragm spring plate, self adjusting
- Clutch disc - Damper spring style
- Hydraulic system - 5 speed

8.1L Clutch

The 8.1L clutch system is described as the following:

- Size - 297 mm (11.7 in)
- Clutch pressure plate - Diaphragm spring plate, self adjusting
- Clutch disc - Damper spring style
- Hydraulic system - 6 speed

6.6L Clutch

The 6.6L clutch system is described as the following:

- Size - 302 mm (12 in)
- Clutch pressure plate - Diaphragm spring plate, self adjusting
- Clutch disc - No damper spring style
- Hydraulic system - 6 speed

Principal Components

The following are the principal components of the clutch system:

- The driving members; attached to the engine and turning with the engine.
- The driven member; attached to the engine driveline and transmission and turning with the driveline and transmission.
- The operating members; including the spring, the clutch hydraulic system, and the clutch pedal linkage, required to apply and release the pressure, which hold the driving and driven members in contact with each other.

Clutch Driving Members

The clutch driving members consist of two, flat surfaced, iron plates, machined to a smooth finish. One of these surfaces is the rear face of the engine flywheel and the other is a comparatively heavy flat ring, with one side machined, known as the clutch pressure plate.

Clutch Driven Members

The driven member (friction or clutch disc) consists of a hub and a plate, with facings attached to the plate. The clutch disc has cushion springs and dampening springs. The cushion springs are slightly waved, or curled. The cushion springs are attached to the plat, and the clutch facings are attached to the springs. When the clutch is engaged, the cushion springs compress slightly to take up the shock of engagement. The dampening springs are heavy coil springs set in a circle around the hub. The hub is driven through these springs. They help to smooth out the torsional vibration so that the power flow to the transmission is smooth. There are grooves in both sides of the clutch disc facings. These grooves prevent the facings from sticking to the flywheel face and pressure plate when the clutch is disengaged. The grooves break any vacuum that might form and cause the facings to stick to the flywheel ore pressure plate.

Clutch Operating Members

The driving member and the driven member are held in contact by spring pressure. This pressure is exerted by a one-piece conical or diaphragm spring.

A diaphragm spring is a conical piece of spring steel that has been specially stamped to give it greater flexibility. The diaphragm is positioned between the cover and the pressure plate so that the diaphragm spring is nearly flat when the clutch is in the engaged position. The action of this type of spring is similar to that of an ordinary oil can.

The pressure of the inner rim of the spring on the pressure plate decreases as the flat position is passed. The inner rim of the diaphragm bears on the pressure plate and is pivoted on a ring on the outer edge of the pressure plate. The application of a pulling load on the inner section of the pressure plate will cause the inner rim to move away from the flywheel and allow the pressure plate to move away from the clutch disc, thereby releasing or disengaging the clutch. When the pressure is released from the inner section, the OIL CAN action of the diaphragm causes the inner section to move in, and the movement of the inner rim forces the pressure plate against the clutch disc, thus engaging the clutch.

The clutch release bearing is moved by the actuator assembly to move the release levers which move the pressure plate to the rear, thus separating the clutch disc from the flywheel when the clutch pedal is depressed by the driver. A piston return spring in the actuator cylinder preloads the clutch linkage and assures a small load on the release bearing with the actuator assembly at all times. As the clutch disc wears, the diaphragm spring fingers move forward forcing the release bearing, actuator assembly, and pushrod to move. This movement forces the actuator cylinder piston to move forward in its bore, consuming hydraulic fluid from the master cylinder reservoir, thereby providing the SELF-ADJUSTING feature of the hydraulic clutch linkage system.

Hydraulic Clutch Description

Principal Components

The driving member and the driven member are held in contact by spring pressure. This pressure is exerted by a one-piece conical or diaphragm spring.

A diaphragm spring is a conical piece of spring steel that has been specially stamped to give it greater flexibility. The diaphragm is positioned between the cover and the pressure plate so that the diaphragm spring is nearly flat when the clutch is in the engaged position. The action of this type of spring is similar to that of an ordinary oil can.

The pressure of the inner rim of the spring on the pressure plate decreases as the flat position is passed. The inner rim of the diaphragm bears on the pressure plate and is pivoted on a ring on the outer edge of the pressure plate. The application of a pulling load on the inner section of the pressure plate will cause the inner rim to move away from the flywheel and allow the pressure plate to move away from the clutch disc, thereby releasing or disengaging the clutch. When the pressure is released from the inner section, the OIL CAN action of the diaphragm causes the inner section to move in, and the movement of the inner rim forces the pressure plate against the clutch disc, thus engaging the clutch.

The clutch release bearing is moved by the actuator assembly to move the release levers which move the pressure plate to the rear, thus separating the clutch disc from the flywheel when the clutch pedal is depressed by the driver. A piston return spring in the actuator cylinder preloads the clutch linkage and assures a small load on the release bearing with the actuator assembly at all times. As the clutch disc wears, the diaphragm spring fingers move forward forcing the release bearing, actuator assembly, and pushrod to move. This movement forces the actuator cylinder piston to move forward in its bore, consuming hydraulic fluid from the master cylinder reservoir, thereby providing the SELF-ADJUSTING feature of the hydraulic clutch linkage system.

Clutch Driving Members

The clutch driving members consist of two, flat surfaced, iron plates, machined to a smooth finish. One of these surfaces is the rear face of the engine flywheel and the other is a comparatively heavy flat ring, with one side machined, known as the clutch pressure plate.

Clutch Driven Members

The driven member (friction or clutch disc) consists of a hub and a plate, with facings attached to the plate. The clutch disc has cushion springs and dampening springs. The cushion springs are slightly waved, or curled. The cushion springs are attached to the plat, and the clutch facings are attached to the springs. When the clutch is engaged, the cushion springs compress slightly to take up the shock of engagement. The dampening springs are heavy coil springs set in a circle around the hub. The hub is driven through these springs. They help to smooth out the torsional vibration so that the power flow to the transmission is smooth. There are grooves in both sides of the clutch disc facings. These grooves prevent the facings from sticking to the flywheel face and pressure plate when the clutch is disengaged. The grooves break any vacuum that might form and cause the facings to stick to the flywheel ore pressure plate.

Clutch Operating Members

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The pressure of the inner rim of the spring on the pressure plate decreases as the flat position is passed. The inner rim of the diaphragm bears on the pressure plate and is pivoted on a ring on the outer edge of the pressure plate. The application of a pulling load on the inner section of the pressure plate will cause the inner rim to move away from the flywheel and allow the pressure plate to move away from the clutch

disc, thereby releasing or disengaging the clutch. When the pressure is released from the inner section, the OIL CAN action of the diaphragm causes the inner section to move in, and the movement of the inner rim forces the pressure plate against the clutch disc, thus engaging the clutch.

The clutch release bearing is moved by the actuator assembly to move the release levers which move the pressure plate to the rear, thus separating the clutch disc from the flywheel when the clutch pedal is depressed by the driver. A piston return spring in the actuator cylinder preloads the clutch linkage and assures a small load on the release bearing with the actuator assembly at all times. As the clutch disc wears, the diaphragm spring fingers move forward forcing the release bearing, actuator assembly, and pushrod to move. This movement forces the actuator cylinder piston to move forward in its bore, consuming hydraulic fluid from the master cylinder reservoir, thereby providing the SELF-ADJUSTING feature of the hydraulic clutch linkage system.

Hydraulic Clutch Description

The clutch hydraulic system consists of a master cylinder and an actuator cylinder. When pressure is applied to the clutch pedal (pedal depressed), the pushrod contacts the plunger and pushes it down the bore of the master cylinder. In the first 0.8 mm (0.031 in) of movement, the recuperation seal closes the port to the fluid reservoir tank, and as the plunger continues to move down the bore of the cylinder, the fluid is forced through the outlet line to the actuator cylinder. As fluid is pushed down the pipe from the master cylinder, this in turn forces the pistons in the actuator cylinder outward. As the actuator cylinder piston moves forward, it forces the release bearing to disengage the clutch pressure plate from the clutch disc. On the return stroke (pedal released), the plunger moves back as a result of the return pressure of the clutch. Fluid returns to the master cylinder and the final movement of the plunger opens the port to the fluid reservoir, allowing an unrestricted flow of fluid between system and reservoir.

Abbreviations and Meanings

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

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

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

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

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

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

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

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

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

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

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

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Conversion - English/Metric

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

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

Equivalents - Decimal and Metric

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

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

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Fasteners

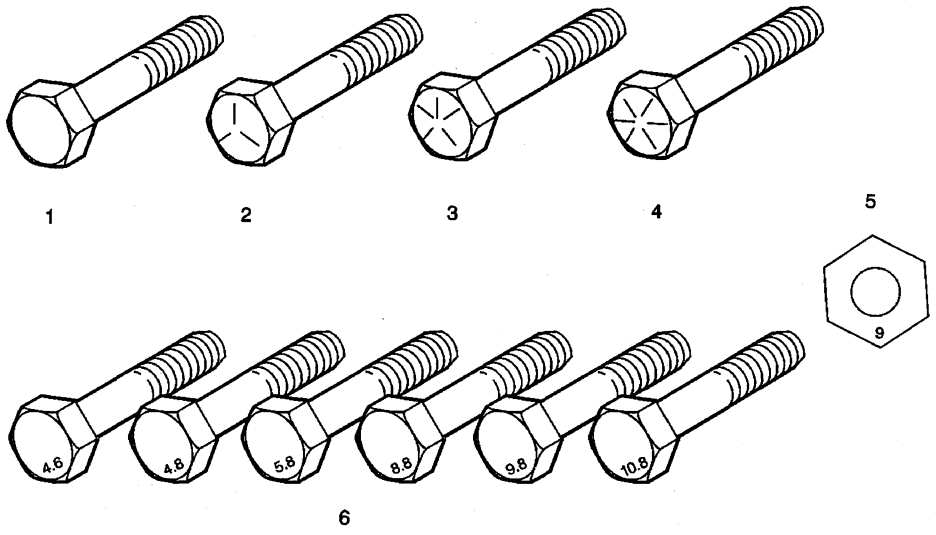
Metric Fasteners

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

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

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

Fastener Strength Identification



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

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

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

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

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

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

Prevailing Torque Fasteners

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

All Metal Prevailing Torque Fasteners

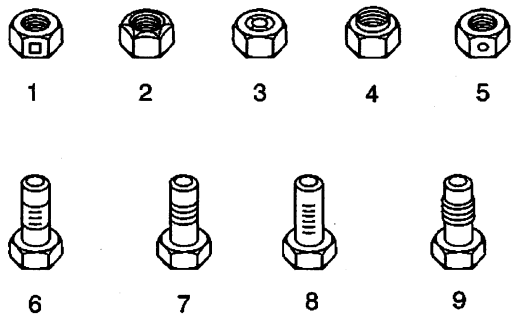
These fasteners accomplish the thread interface by a designed distortion or deformation in the fastener.

Nylon Interface Prevailing Torque Fasteners

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

Adhesive Coated Fasteners

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



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

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

A prevailing torque fastener may be reused ONLY if:

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

Metric Prevailing Torque Fastener Minimum Torque Development

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

English Prevailing Torque Fastener Minimum Torque Development

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