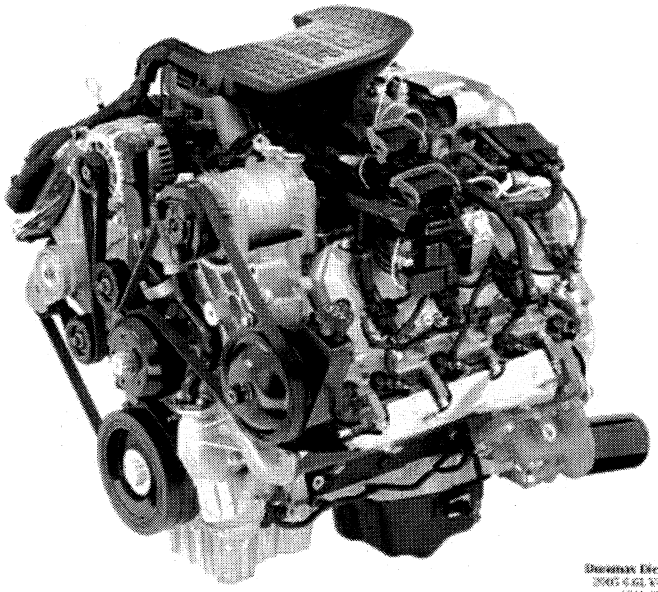
Chevrolet

Silverado 3500 HD Chassis Cab



2005

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Product Information

Chevy Silverado: For Every Personal and Professional Truck Need

As General Motors' best selling vehicle, the Chevrolet Silverado has an unequaled reputation for outstanding performance, dependability and capability. Silverado also is known for having one of the broadest model ranges in the entire industry, to meet every personal and professional need in the full-size pickup truck market.

Silverado's extensive range of 1500 and 2500 light duty models is expanded even further for 2005, with the introduction of a gas-electric hybrid version of the 1500 Series Extended Cab for the retail market. Hybrid models are powered by a standard Vortec 5300 V-8 and Hydra-Matic 4L60-E four-speed automatic transmission coupled with the segment's first hybrid propulsion technology, to provide up to 10 percent better fuel economy; 120-volt electrical power with ground fault detection; and unique accessory powering capability.

In addition to the hybrid-powered Silverado, an even more potent 310 horsepower (231 kw) version of GM's Vortec 5300 5.3L V-8 is available for 2005 on 4WD Silverado 1500 Extended Cabs with a standard cargo box.

Other functional changes for 2005 include the availability of a power sunroof on all Extended Cab and Crew Cab models. Front-disc, rear-drum anti-lock brakes are now standard on all light duty models except those equipped with GM's innovative Quadrasteer four-wheel steering system.

A new 3.23 rear axle ratio is standard on 2WD models, while a more powerful 145-amp alternator is standard on all models for 2005. (A 160-amp alternator comes with the optional Snow Plow prep package.)

New tire choices for 2005 include P245/70R17-108S all-season blackwall tires as standard on 2WD models, with P245/70R17-108S all-season white-outlined letter tires as an option. P265/70R17 all-season blackwall tires are now standard on 4WD Regular and Extended Cab models, while P265/70R17 all-season white outlined-letter tires are available.

Revised wheel combinations include six-lug painted 17 x 7-inch steel wheels standard on Work Truck Models, and six-lug chrome-styled steel 17 x 7.5-inch wheels on all models except 2WD Extended Cab and 2WD/4WD Crew Cab models.

Dark Blue Metallic is a new color for 2005 across all light and heavy duty models except Silverado SS.

Unmatched power and selection

Within the light duty lineup, Silverado can be ordered in an almost unlimited number of configurations to suit any requirement: Regular, Extended or Crew Cab body styles; standard 6.5-foot (2-m) or extended 8-foot (2.4-m) cargo boxes in either Fleetside or Sportside style; 1500 half-ton or 2500 three-quarter-ton models; and either 2WD or 4WD systems.

An impressive array of Vortec engines is offered: a 4300 4.3 L V-6; 4800 4.8L V-8; two models of the Vortec 5300 5.3L V-8; and the powerful Vortec 6000 6.0L V-8. Engine output ranges from 195 hp (145 kw) all the way up to 330 hp (246 kw).

In addition to the new hybrid version, Silverado can be ordered in several reduced-emissions or alternative-fuel variations. All Silverados 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, have a robust catalytic converter system that meets Ultra Low Emission Vehicle (ULEV) standards. Models equipped with the Vortec 6000 6.0L V-8 come with a dedicated compressed natural gas (CNG) or bi-fuel system that can run on CNG or gasoline.

Light-duty Silverado models with the Vortec 5300 5.3L V-8 offer an option that enables owners to operate them on varying blends of ethanol and gasoline, up to a maximum of 85 percent ethanol.

Silverado can be equipped to meet any personal requirement or professional demand when it comes to hauling or towing. Payload capacities range from 1,295 pounds (587 kg) all the way to 4,047 pounds

(1,836 kg) for 2500 heavy duty models. Gross Vehicle Weight Ratings range from 6,100 pounds (2,767 kg) to 9,200 pounds (4,173 kg) on properly equipped heavy duty versions.

Improved fuel economy

Already best in class in terms of fuel economy, the 2005 Silverados receive four major enhancements that lead to a nearly one-mile-per-gallon fuel economy improvement.

The 2005 model Silverados feature an all-electric cooling system (compared to fan and fan clutch on 2004 models). The all-electric cooling system consists of two 200-watt electric fan packages and an improved dissipation radiator. The new cooling system provides a number of advantages:

A reduction in parasitic losses due to disengaged fan speed with a corresponding increase in combined city/highway fuel economy

A significant improvement in idle A/C performance (driver/passenger comfort) as well as an ability to idle with A/C on for extended periods in very high ambient temperatures

A reduction in customer complaints normally attributed to unusual engine noise or transmission noise/delayed shift, which are actually fan noise issues.

A new voltage control system monitors the battery's charge status and controls the vehicle's generator to minimize parasitic voltage loss.

Other changes designed to improve fuel economy include improved sealing of the vehicles' front end. For example, tow hook and fog light openings are now sealed when those items are not ordered on the vehicle. In addition, the center hole in the front air deflector has been sealed; an extension has been added to the front air deflector; the aerodynamics for the running boards have been improved and the center high mounted stop lamp (CHMSL) – which was previously roof-mounted – is now recessed into the liftgate glass for improved vehicle aerodynamics.

Hybrid highlights

Introduced during the 2004 model year, Silverado 1500 Hybrid promises up to 10 percent improvement in fuel economy and returns all the performance and capability expected in a full-size pickup. The Vortec 5300 V-8 engine delivers 295 horsepower (220 kw) and 335 lb.-ft. (463 Nm) of torque – the same as its non-hybrid counterpart. Yet there's something the Sierra Hybrid provides that standard models do not: it is essentially a mobile power-generating station, with four 120-volt/20-amp electrical auxiliary power outlets (APO). The power outlets are located under the rear seat of the cab and in the pickup bed. Customers can conveniently operate power equipment without taking up the bed space typical portable generators would use.

A key contributor to the Hybrid's fuel efficiency is its ability to automatically stop and restart the engine under different operating circumstances. Instead of a conventional starter motor and alternator, Hybrid pickups use 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/starts to conserve fuel. It also smoothes out any driveline surges; generates electrical current to charge the batteries and run auxiliary power outlets; and provides coast-down regenerative braking, as an aid to fuel economy.

Safety and security across the range

Silverados are equipped with GM's Passenger Sensing System (PSS). PSS uses the latest sensing technology to turn the front passenger air bag on or off. If the sensor system detects an unoccupied front passenger seat or the presence of a smaller occupant, the front passenger air bag is designed to automatically turn off so it would not deploy in the event of a frontal collision. A status indicator on the instrument panel alerts occupants that the passenger air bag is on or off. Even with this system, GM strongly recommends to restrain child passengers in an appropriate child seat placed in the second or third row of the vehicle. Never install a rear-facing infant seat in front of an active air bag. GM also recommends that all children 12 and under ride in the rear seat when possible.

The Silverado also has dual-stage frontal air bags (not available on 1500 HD Crew Cab and 2500 HD and 3500 Series models) for supplemental protection for front seat passengers. Dual-stage frontal air bags are designed to help reduce the risk of air bag-induced injury. When the air bag system's control unit detects an impact, it determines whether the crash is severe enough to trigger a deployment, and whether the primary amount of inflation is sufficient. The primary stage alone will deploy in most frontal impacts requiring the supplemental protection of an air bag, while a secondary stage is designed to deploy in more severe frontal collisions.

GM's OnStar safety and security system is standard on LT and available on LS light duty models. In the heavy duty range, OnStar is standard on Silverado LT Extended Cab and Crew Cab models, and available on 2500 HD and 3500 models.

Silverados feature OnStar's new sixth-generation hardware with digital and analog coverage. The Gen 6 hardware also includes upgraded hands-free voice recognition capabilities including more intuitive continuous digit dialing and improved voice recognition accuracy. OnStar is the leading provider of in-vehicle safety, security and information services in the United States and Canada. Using the GPS satellite network and wireless technology, OnStar features core safety services and OnStar Personal Calling that allows drivers to make and receive hands-free, voice-activated phone calls using a powerful three-watt digital/analog system and external antenna for greater reception.

Additional safety and security systems include electronic traction control on 2WD Silverados to enhance handling and response on models equipped with a V-8 engine, automatic transmission and locking rear differential. All models come standard with PASSLock II theft deterrent system, and a driver information center that monitors and reports on up to 34 vehicle system functions.

Air conditioning, chrome front bumpers, tinted glass, power steering with tilt-adjustable column, a full-size spare tire and heavy-duty battery also are standard on all Silverado models.

Quadrasteer for added maneuverability

GM's exclusive 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. At low speeds, Quadrasteer 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. At higher speeds, the system reduces vehicle yaw, or rotational motion, for more control during lane changes and demanding conditions.

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. On Crew Cab models, available rear-seat audio controls allow second-row passengers to enjoy a separate audio source from front-seat occupants.

XM (continental U.S. only) provides more than 120 coast-to-coast, digital-quality channels of original commercial-free music and premier news, sports and talk as well as advanced traffic and weather information for select major metropolitan areas nationwide. Consumers can subscribe to the basic service for $9.99 a month. In addition, GM customers with GMAC financing can choose to include the XM subscription in their car payments.

Silverado SS, Z71 Off-Road Package

Among the wide selection of Silverado models are two versions that offer the ultimate for either highway cruising or off-road fun.

Silverado SS, based on a 1500 Series Extended Cab with a short bed, is a contemporary expression of Chevy power for those muscle car enthusiasts who want the added versatility of a muscle truck. A high-output version of GM's Vortec 6000 V-8 pumps out 345 horsepower (257 kw) and 380 lb.-ft. (515 Nm) of torque. Bolted to a Hydra-Matic 4L85-E four-speed automatic overdrive transmission equipped with a

3.06 first gear and 0.70 final gear, this potent powertrain delivers both rapid acceleration and relaxed highway cruising.

Keeping all this power connected to the pavement is a standard full-time, electronic all-wheel-drive (AWD) viscous-coupled transfer case for enhanced wet or dry pavement handling, along with an innovative Z60 high-performance chassis and tire package that includes Silverado's largest ever 20-inch wheel and tire combination for exceptional road holding and cornering capabilities.

For 2005, Silverado SS is available with a power sunroof option. Silver Birch Metallic is offered in addition to Victory Red.

For those interested more in four-wheeling fun and capability, the Silverado Z71 Off-Road Package is available on half-ton 4WD 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.

Silverado Z71 can be equipped with features such as cruise control, rear defogger, power door locks, 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.

Silverado Heavy Duty – For any power and performance need

Featuring a redesigned hood and grille for 2005, Chevy Silverado Heavy Duty pickups comprise the segment's most diverse lineup, with a wide selection of weight ratings, body styles and powertrain combinations including diesel and compressed natural gas (CNG) models.

GM's Duramax 6600 6.6L (V-8) turbo-diesel was already legendary for its awesome performance, but engineers decided to make it even better. Both hardware and software were upgraded in '04, resulting in a 10 horsepower (7.5 kw) increase. Not satisfied with "good enough," the engineers went back to work and the result is a 70 lb.-ft. (97 Nm) torque increase for 2005. The revised powerplant delivers 310 horsepower (231 kw) at 3000 rpm and 605 lb.-ft. (836 Nm) of torque at 1600 rpm when equipped with the Allison automatic transmission.

At the top of the gasoline engine range is an optional Vortec 8100 8.1L V-8, rated at 330 hp (246 kw) and 450 lb.-ft. (610 Nm) of torque. The Vortec 6000 6.0L V-8 produces 300 hp (224 kw) and 360 lb.-ft. (488 Nm) of torque.

No fewer than 14 different Silverado HD models can run on dedicated (CNG) or bi-fuel systems, the latter which operates on either CNG or gasoline when equipped with a Vortec 6000 6.0L V-8 with hardened valves and seats to withstand CNG's lack of lubricity and cooling. Special versions with reduced gross vehicle weight ratings (8,500 pounds or 3,825 kg) enable customers to meet fleet requirements in "non-attainment" areas, while GVWR ratings of up to 9,200 pounds (4,173 kg) are available.

Impressive and tough

With impressive power, tough frames, advanced suspensions and high-capacity brakes, the 2500HD/3500 Series provides outstanding payload capacities as well as outstanding hauling and towing capabilities. The three-quarter-ton models have a GVWR as much as 9,200 pounds (4,173 kg), and payloads up to 3,964 pounds (1,798 kg). The one-ton pickup models have a GVWR up to 11,400 pounds (5,171 kg) and payloads up to 5,753 pounds (2,610 kg).

For chassis cab models, Silverado HD has an 11,400-pound (5,171-kg) GVWR for 2WD versions and a 12,000-pound (5,443 kg) GVWR when equipped with 4WD. Chassis cabs provide payloads up to 6,089 pounds (2,762 kg).

Capable smooth-shifting transmissions

Duramax 6600 and Vortec 8100 are mated to smooth-shifting, high-capacity transmissions with close-ratio gearing to provide optimum 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 gear 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.

New For 2005

- Hybrid version of half-ton 1500 Extended Cab model
- Higher output (310 hp/231 kw) Vortec 5300 5.3L V-8 (available on 4WD Extended Cab w/standard box)
- Power sunroof package (available late 2004 on Extended and Crew Cab models with Universal Transmitter and overhead console)
- Front disc/rear drum anti-lock brakes standard on all models except with Quadrasteer
- (QPR) P245/70R17-108S all-season blackwall tires standard on 2WD models
- (QPO) P245/70R17-108S all-season, white-outlined letter tires available on 2WD models
- (QVL) P265/70R17, all-season, blackwall tires standard on 4WD Regular/Extended Cab models
- (QVM) P265/70R17, all-season, white outlined-letter tires available on 4WD Regular/Extended Cab models
- Six -lug painted 17-inch x 7-inch steel wheels standard on Work Truck Models
- Six-lug chrome-styled steel 17-inch x 7.5-inch (except 2WD Extended Cab and 2WD/4WD Crew Cab models)
- 3.23 rear axle ratio standard on 2WD models
- 145-amp alternator standard
- Snow Plow prep package includes 160-amp alternator
- New hood and grille design for Heavy Duty models
- New exterior colors: Dark Blue Metallic (all except Silverado SS), Silver Birch Metallic (Silverado SS)

OnStar driver safety and security system, featuring Gen 6 hardware with analog/digital coverage and upgraded hands-free capabilities. Standard on light-duty LT, available on LS; standard on heavy-duty Silverado LT Extended Cab and Crew Cab, available on 2500HD and 3500 models.

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/K35903 2WD/4WD Regular Cab, Wideside Long Box	s	o	o	s	o	o	o
C/K25753 HD 2WD/4WD Extended Cab, Wideside Short Box	s	o	o	s	o	o	o
C/K25953 HD, C/K35953 2WD/4WD Extended Cab, Wideside Long Box	s	o	o	s	o	o	o
C/K25743 HD 2WD/4WD Crew Cab, Wideside Short Box	s	o	o	s	o	o	o
C/K25943, C/K35943 2WD/4WD Crew Cab, Wideside Long Box	s	o	o	s	o	o	o
Chassis Cabs							
C/K36003, C/K36403 2WD/4WD Regular Cab	s	o	o	s	o	o	o
C/K36053, C/K36453 2WD/4WD Extended Cab	s	o	o	s	o	o	o

Key:

Standard	s
Optional	o
Not available	--

Specifications – Silverado HD

Overview

Models:	Chevy Silverado
	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 3.9 / 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	330 / 246 @ 4200 (L18)	310 / 231 @ 3000 (auto trans)
		325 / 242 @ 4000 (MD L18 with LRW option)	
		295 / 220 @ 3600 (MD L18 with LRZ option)	300 / 224 @ 3000 (man trans)
		225 / 168 @ 3600 (MD L18 with LQR option)	
Torque (lb-ft / Nm @ rpm):	360 / 488 @ 4000	450/ 610 @ 3200 (L18)	605 / 820 @ 1600 (auto trans)
		450 / 610 @ 2800 (MD L18 with LRW option)	
		440 / 597 @ 3200 (MD L18 with LRZ option)	520 / 705 @ 1800 (man trans)
		350 / 475 @ 1200 (MD L18 with LQR option)	
Recommended fuel:	87 octane	87 octane	diesel
Maximum engine speed (rpm):	manual: 5600	manual: 5000	3250
	auto: 5600	auto: 4000	

	Vortec 6000 6.0L V-8 (LQ4)	Vortec 8100 8.1L V-8 (L18)	Duramax 6600 6.6L V-8 (LB7)
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: 3500 Chassis Cabs:	semi-elliptic 2-stage multileaf spring 3-stage multileaf spring		
Steering type:	integral power recirculating ball		
Steering ratio:	24:1		
Steering wheel turns, lock-to-lock	3.14		
	Regular Cab	**Extended Cab**	**Crew Cab**
Turning circle, curb-to-curb (ft / m):			
2500HD Series single-wheel pickups:	2WD: 43.8 / 13.4	2WD: 46.8 / 14.3	2WD: 49.6 / 15.1
	4WD: 43.8 / 13.4	4WD: 50.8 / 15.5	4WD: 49.6 / 15.1
3500 Series dual-wheel pickups:	2WD: 43.7 / 13.3	2WD: 50.7 / 15.5	2WD: 53.5 / 16.3
	4WD: 43.7 / 13.3	4WD: 50.7 / 15.5	4WD: 53.5 / 16.3
3500 Series single-wheel pickups:	4WD: 43.8 / 13.4	4WD: 50.8 / 15.5	4WD: 49.6 / 15.1

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 / 1584 rear: 235.1 / 1517

Wheels/Tires

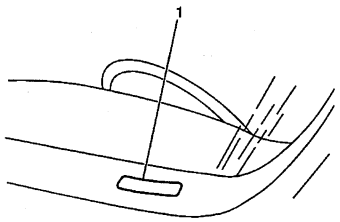
Wheel size and type:	8-bolt 16 x 6.5-inch steel wheels std; opt on 2500HD models: chrome center cap, chrome steel wheels with chrome center cap and polished forged aluminum wheels
	Chassis Cab wheels redesigned to display more surface area and provide increased corrosion resistance (compared to previous 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

See attached documentation for specific dimensions, specifications, capacities and trailering information for your model vehicle.

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	Chevrolet Incomplete Chevrolet 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	U N 1 G 2	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)
9	Check Digit	--	Check Digit
10	Model Year	5	2005
11	Plant Location	1 E F Z G	Oshawa, Ontario Pontiac, Michigan Flint, Michigan Fort Wayne, Indiana Silao, Mexico
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:

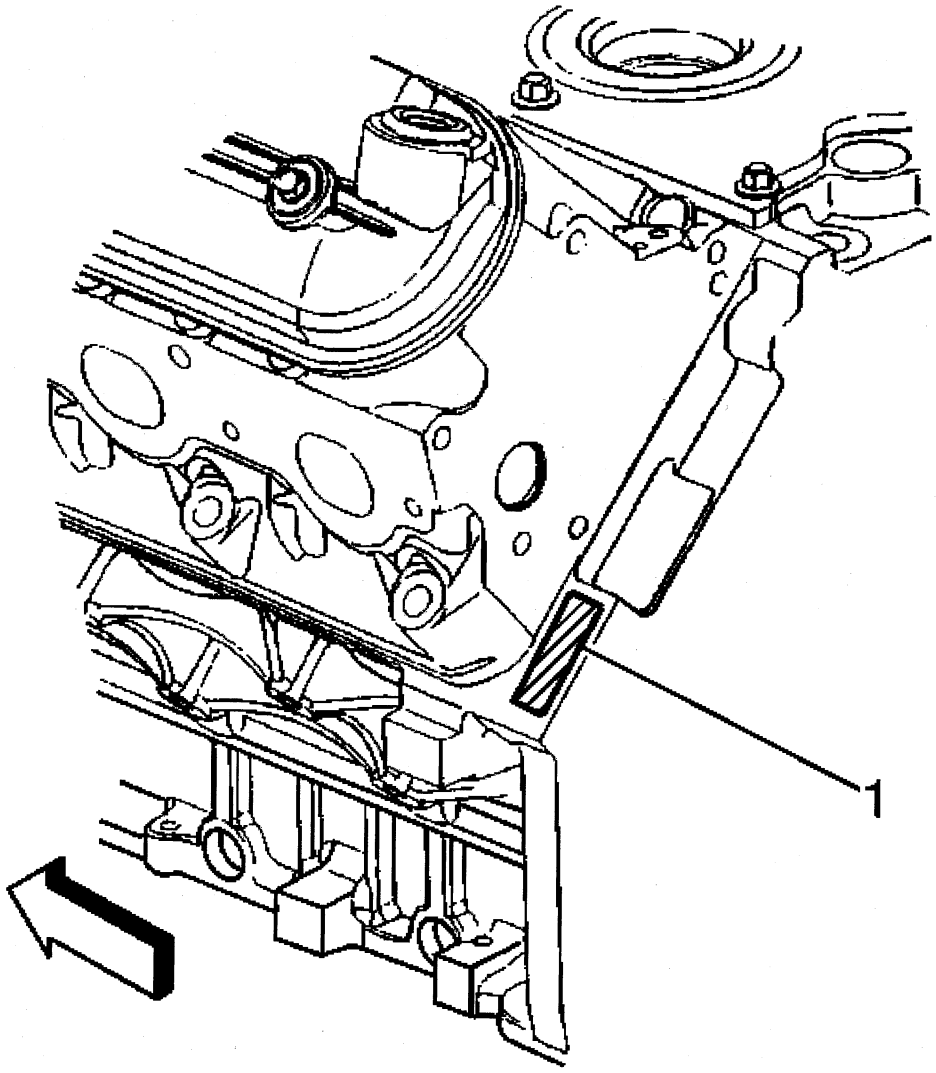
Position	Definition	Character	Description
1	Division	B C	Chevrolet Incomplete Chevrolet Truck
2	Model Year	5	2005
3	Plant Location	1 E Z J G F	Oshawa, Ontraio Pontiac, Michigan Fort Wayne, Indiana Janesville Silao Flint
4-9	Plant Sequence Number	--	--

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

Engine ID and VIN Derivative Location

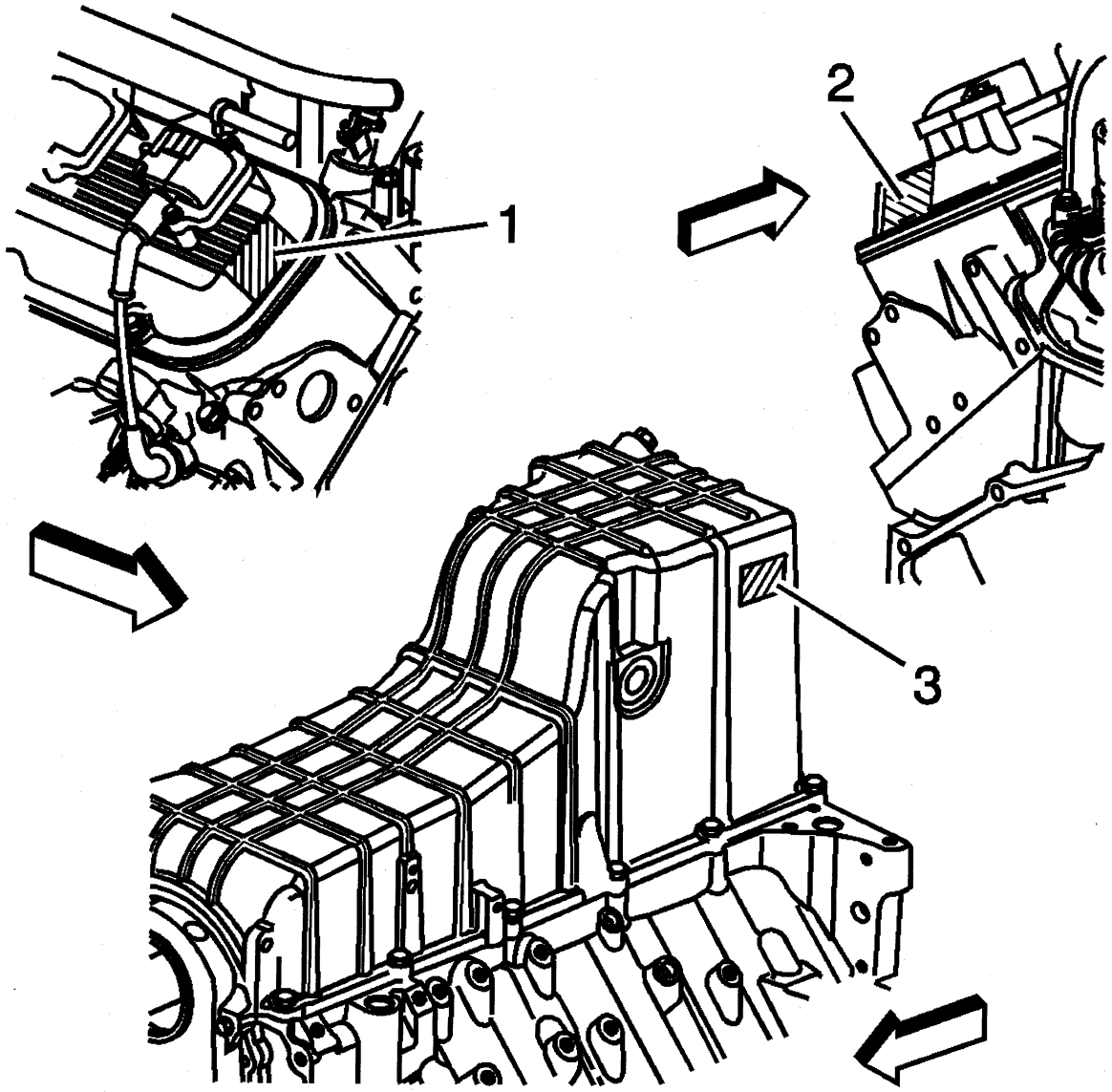
6.0L V-8 Engines



The vehicle identification number (VIN) is located on the left side rear of the engine block (1) and is typically a nine digit number stamped or laser-etched onto the engine at the vehicle assembly plant.

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

8.1L V-8 Engine

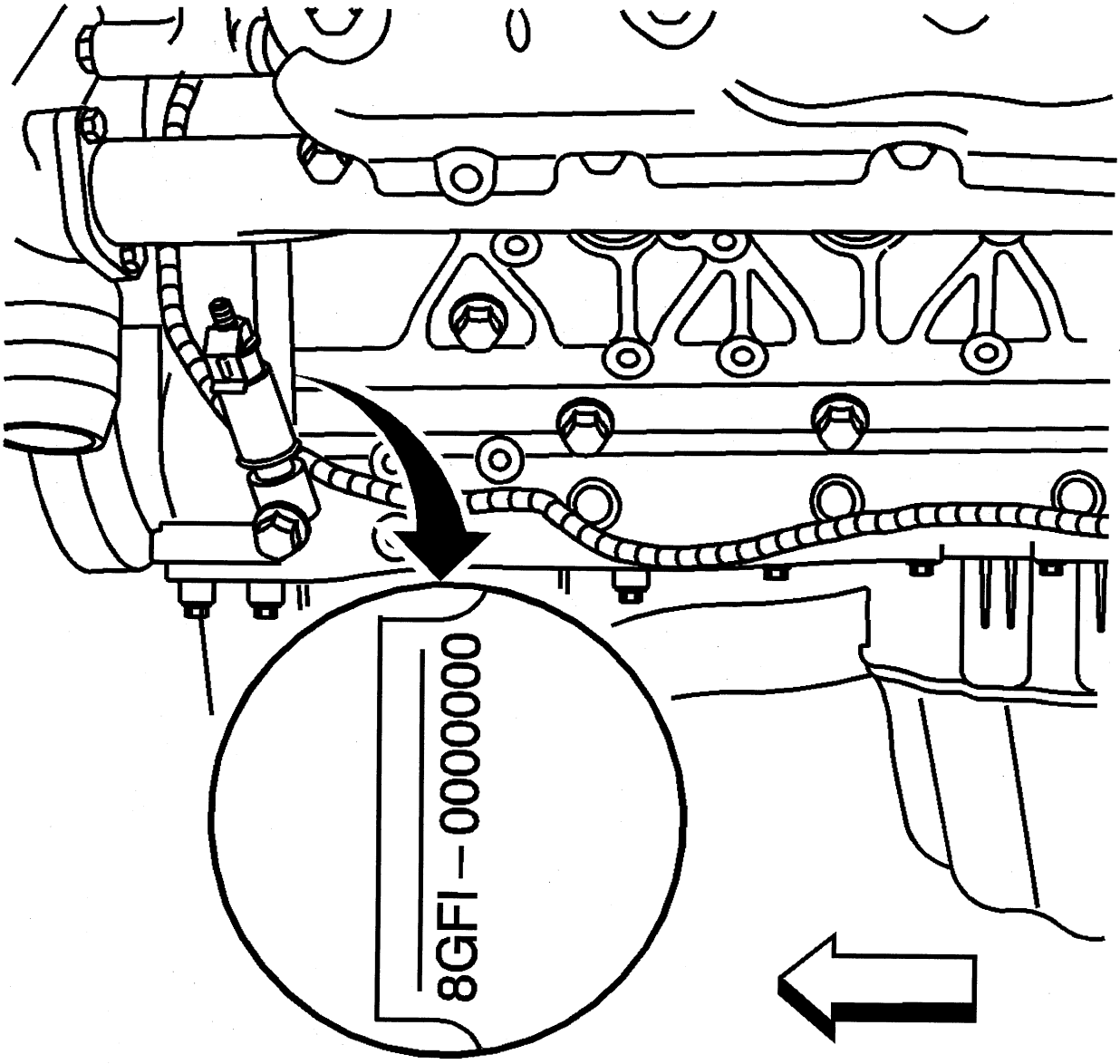


The engine identification number is located in three locations. There are labels on the front of the right rocker arm cover (1), the rear of the left rocker arm cover (2), and the right side of the engine oil pan (3). The engine identification number is used to track and identify the engine prior to installation in a vehicle.

The Vehicle Identification Number (VIN) Derivative is located on the left rear side of the engine block and is a nine digit number stamped or laser etched onto the engine at the vehicle assembly plant. If reading the identification number from the left, the following information can be obtained:

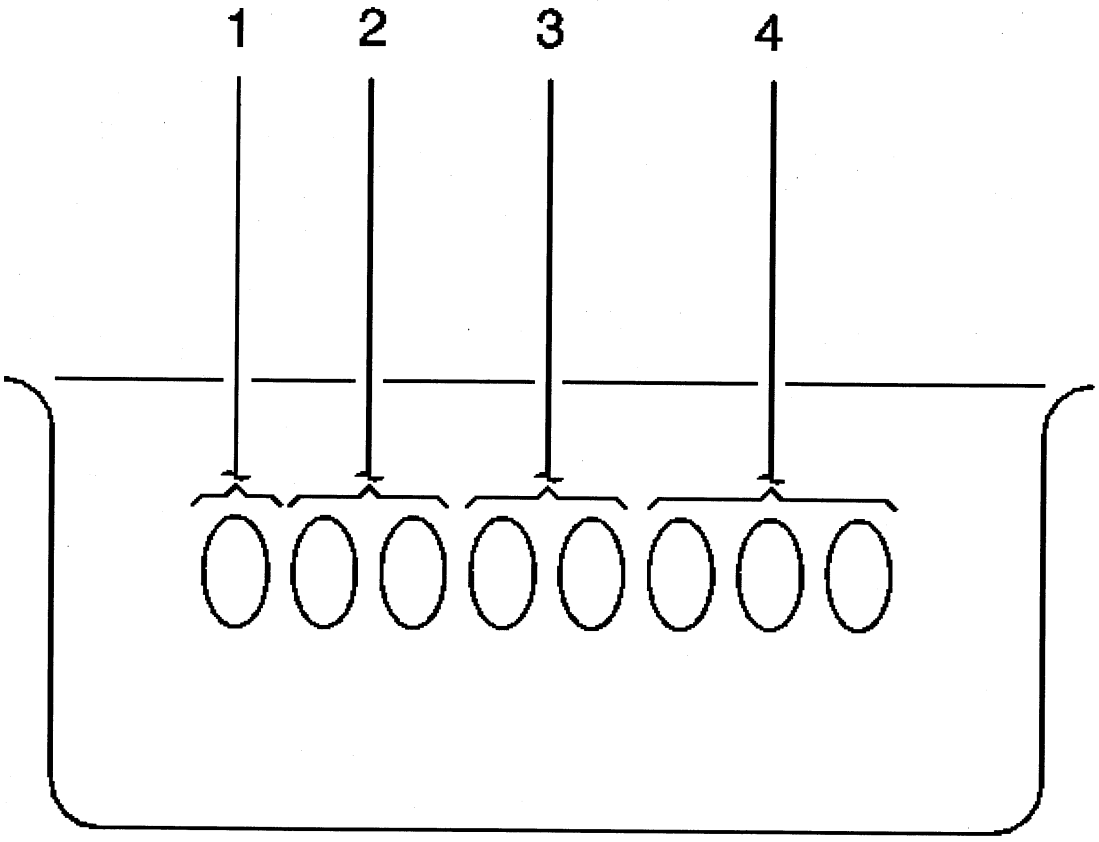
- The first digit identifies the division.
- The second digit identifies the model year.
- The third digit identifies the assembly plant.
- The fourth through ninth digits are the last six digits of the Vehicle Identification Number (VIN).

6.6L Diesel Engine



The engine identification tag is located on the left side of the block. It is on the front edge of the block.

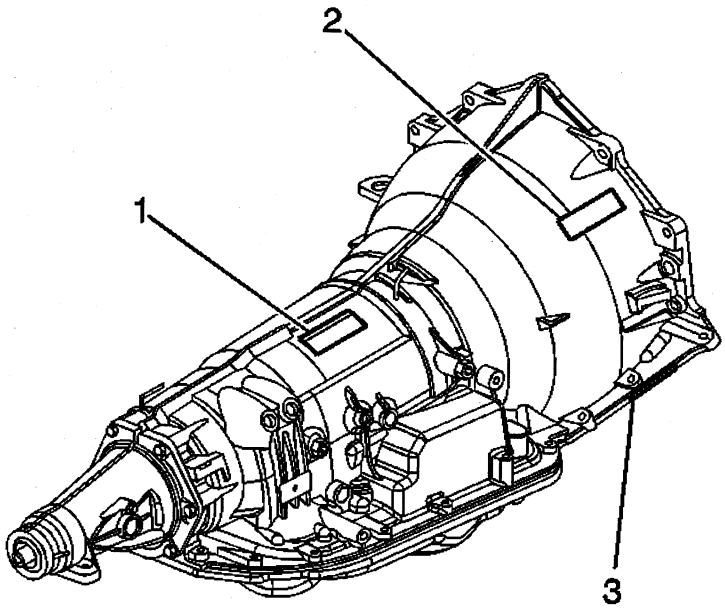
Engine ID Legend



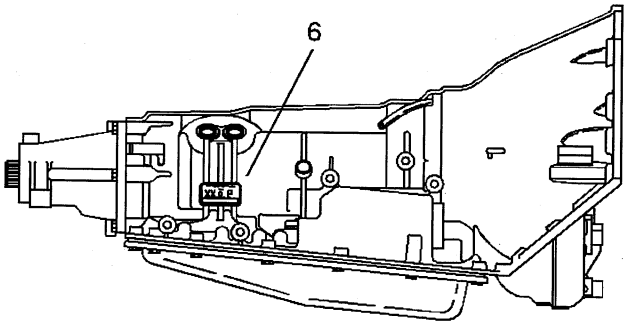
1. Source Code
2. Month of Build
3. Date of Build
4. Broadcast Code

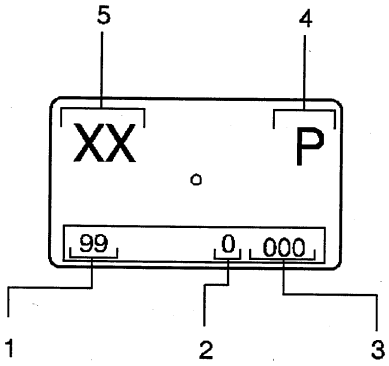
Transmission ID and VIN Derivative Location

4L80-E Transmission ID Location



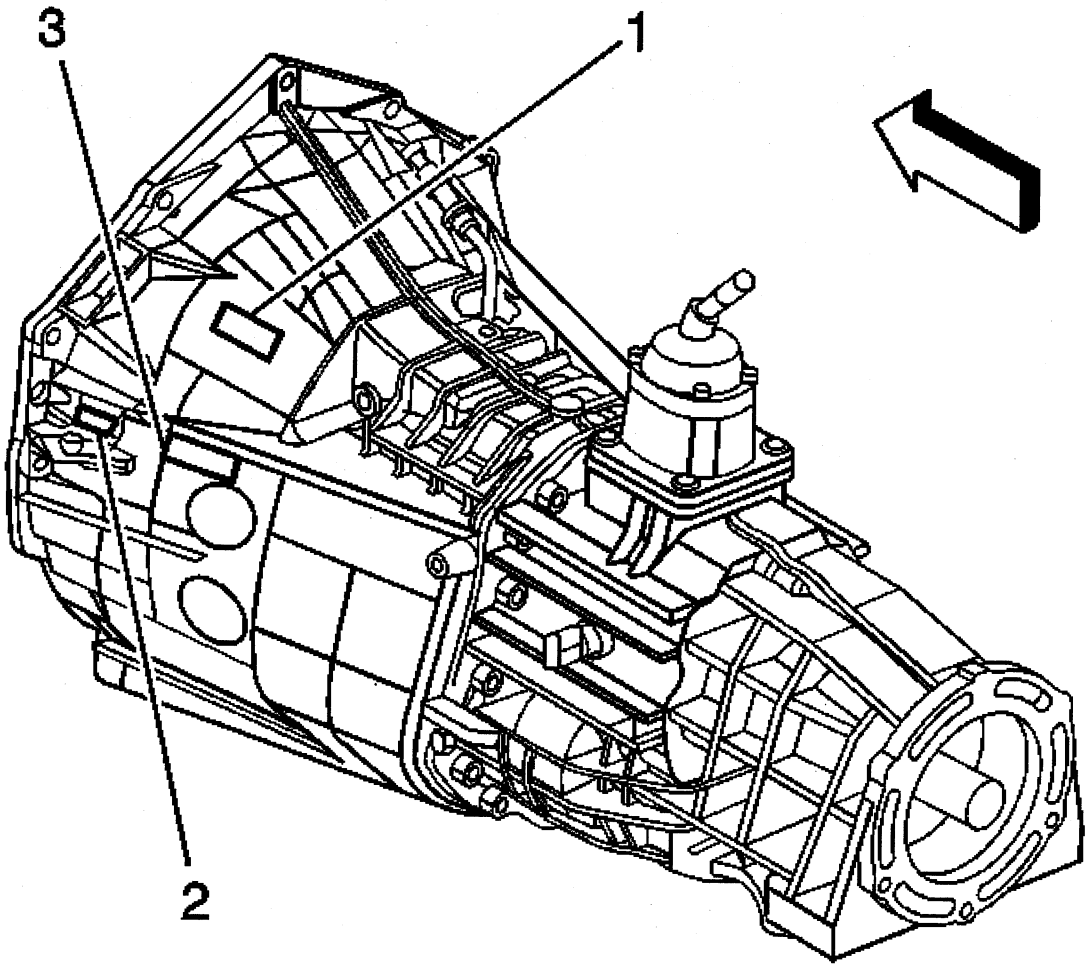
Transmission ID and VIN derivative locations (1, 2). The right hand stamping is shown, left hand is opposite. Pin or hand stamp location (3) for the transmission ID or VIN derivative.





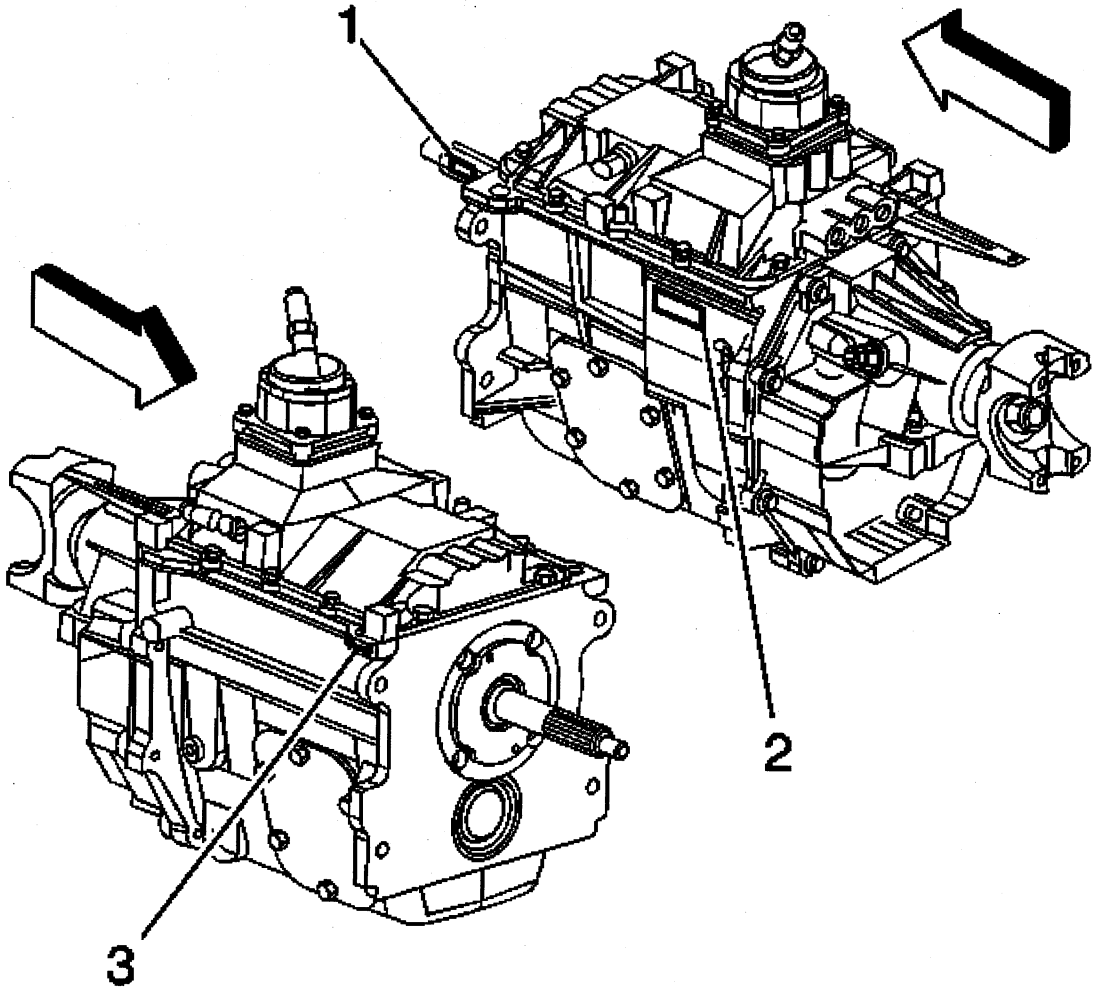
1. Calendar Year
2. Julian Date of the Year
3. Shift and Line Number
4. Plant
5. Model
6. Location on Transmission

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).

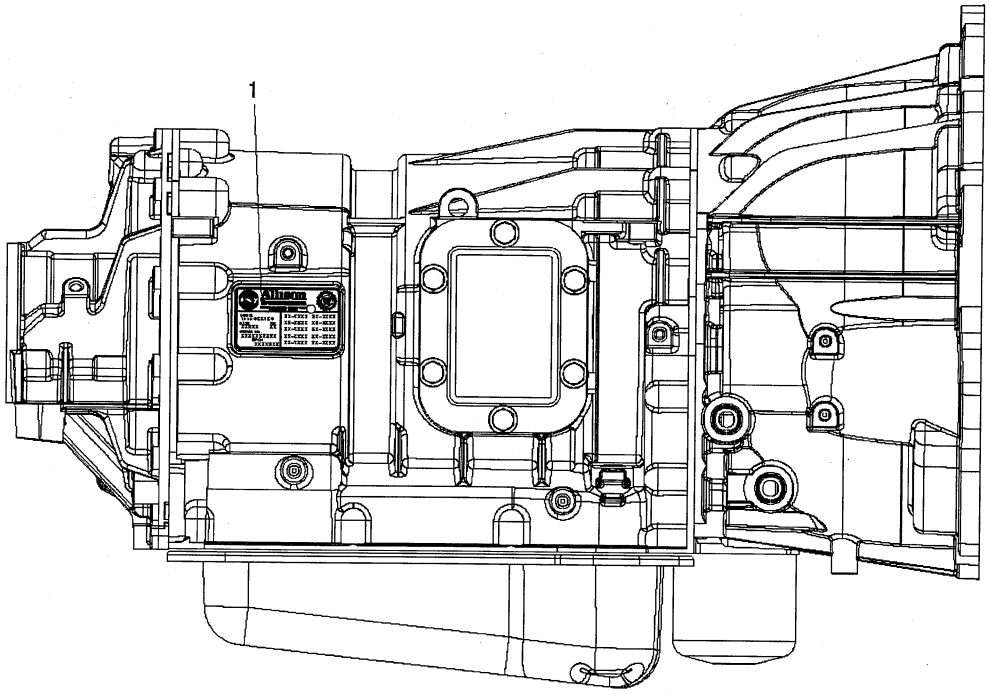
5-Speed Manual



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

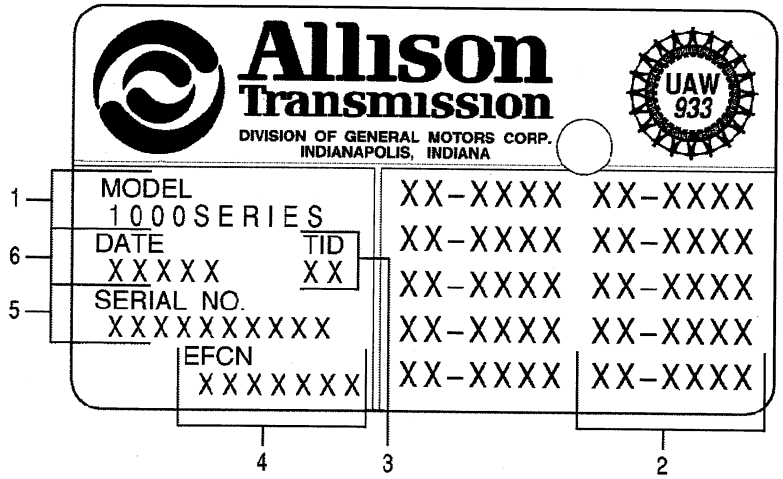
Allison Transmission

Nameplate Location



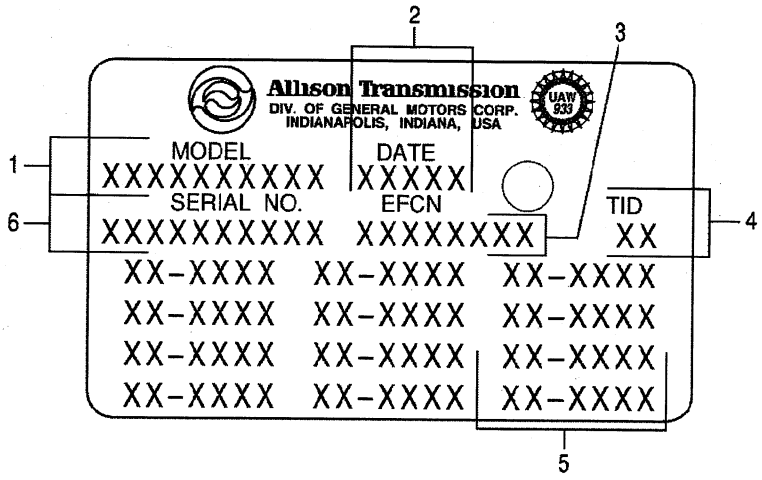
1. Nameplate

Nameplate Components with Ten Group Spaces(c)



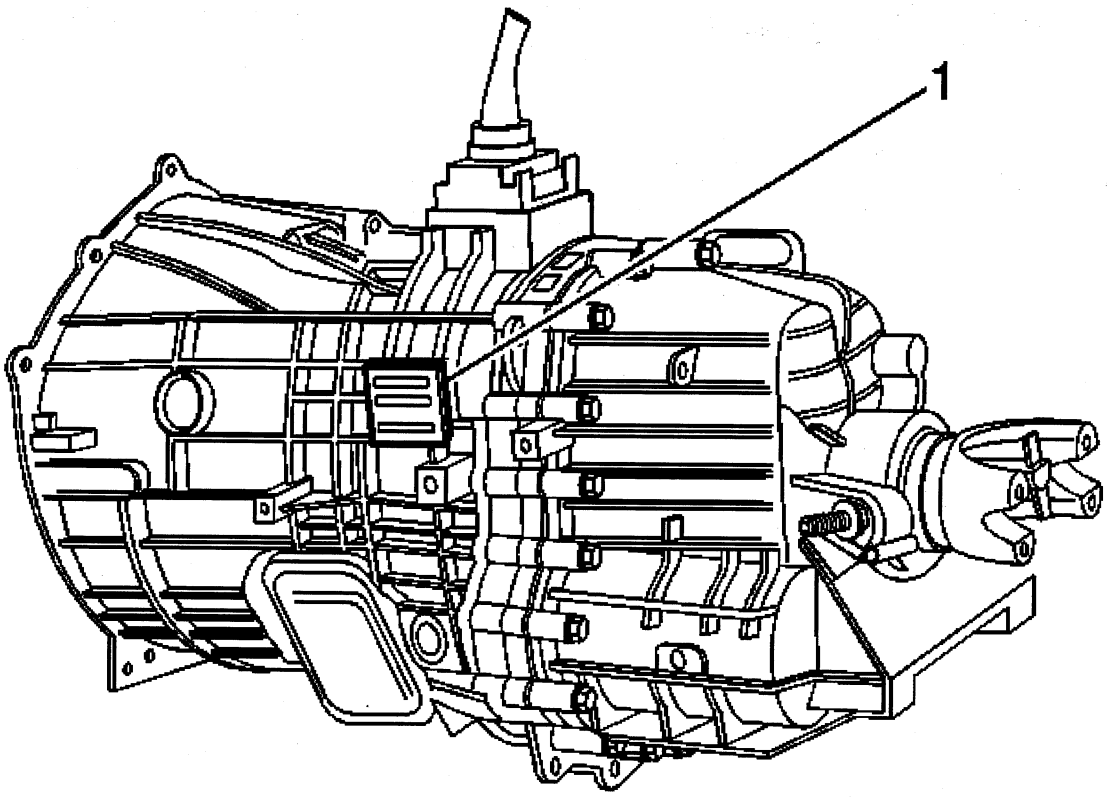
(1) Model (Series)
(2) Engineering Group Number
(3) Transmission Identification Number
(4) Engineering Feature Configuration Number
(5) Serial Number
(6) Date of Manufacture

Nameplate Components with Twelve Group Spaces(c)



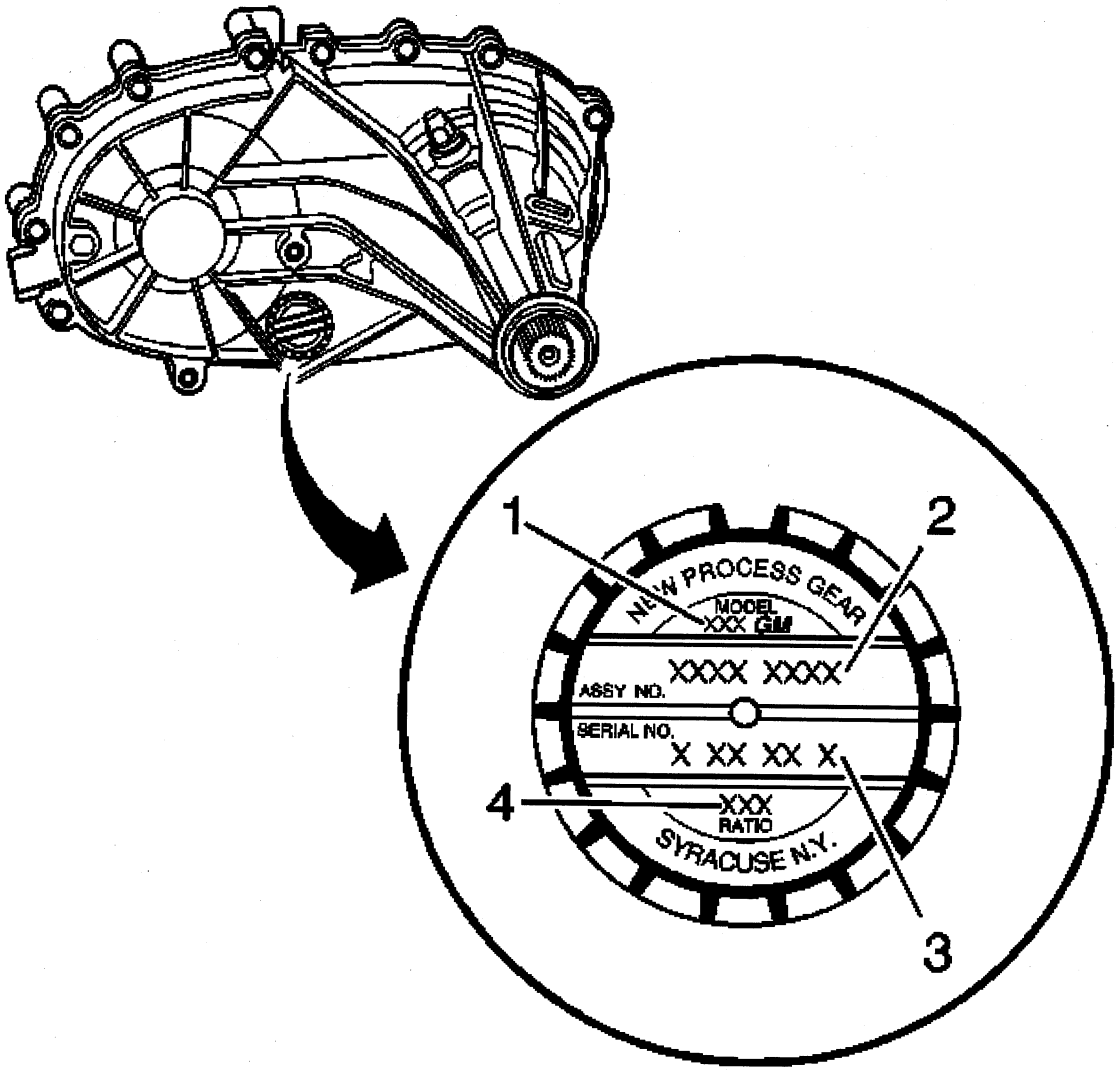
(1) Model (Series)
(2) Date of Manufacture
(3) Engineering Feature Configuration Number
(4) Transmission Identification Number
(5) Engineering Group Number
(6) Serial Number

ZF Transmission



(1) Engine identification tag location.

Transfer Case Identification

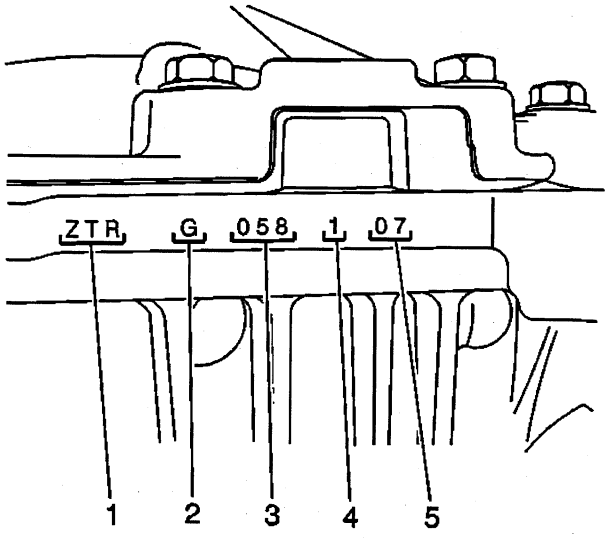


An identification tag is attached to the rear half of the transfer case. The tag provides the following information:

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.

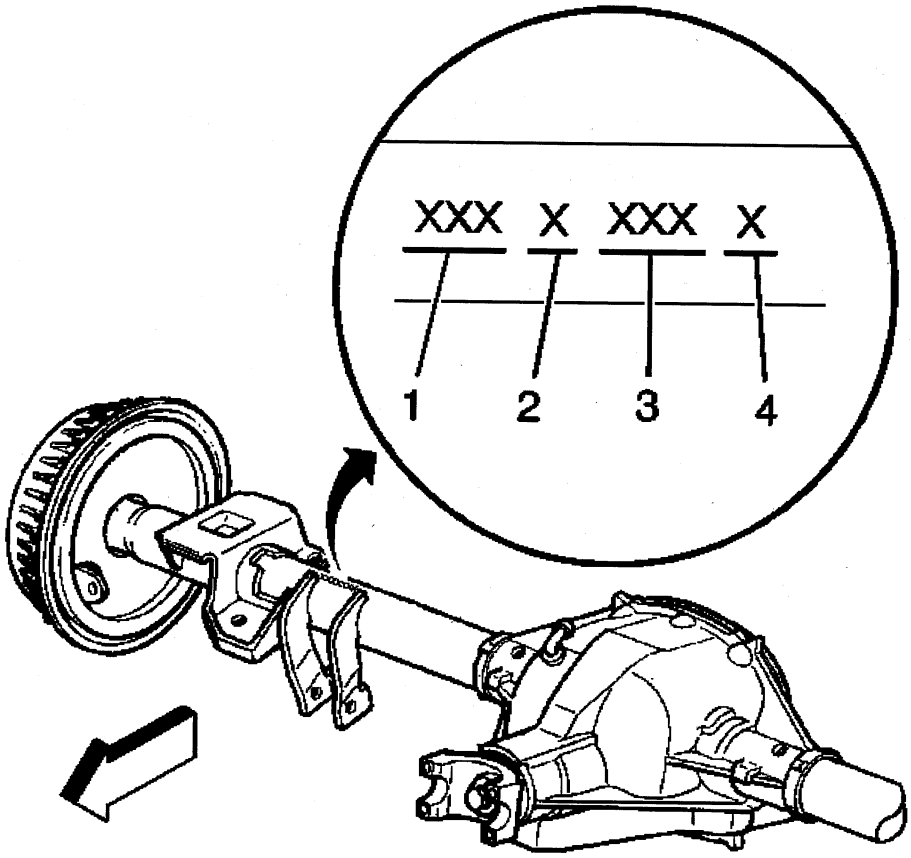
Axle Identification – Front



(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.

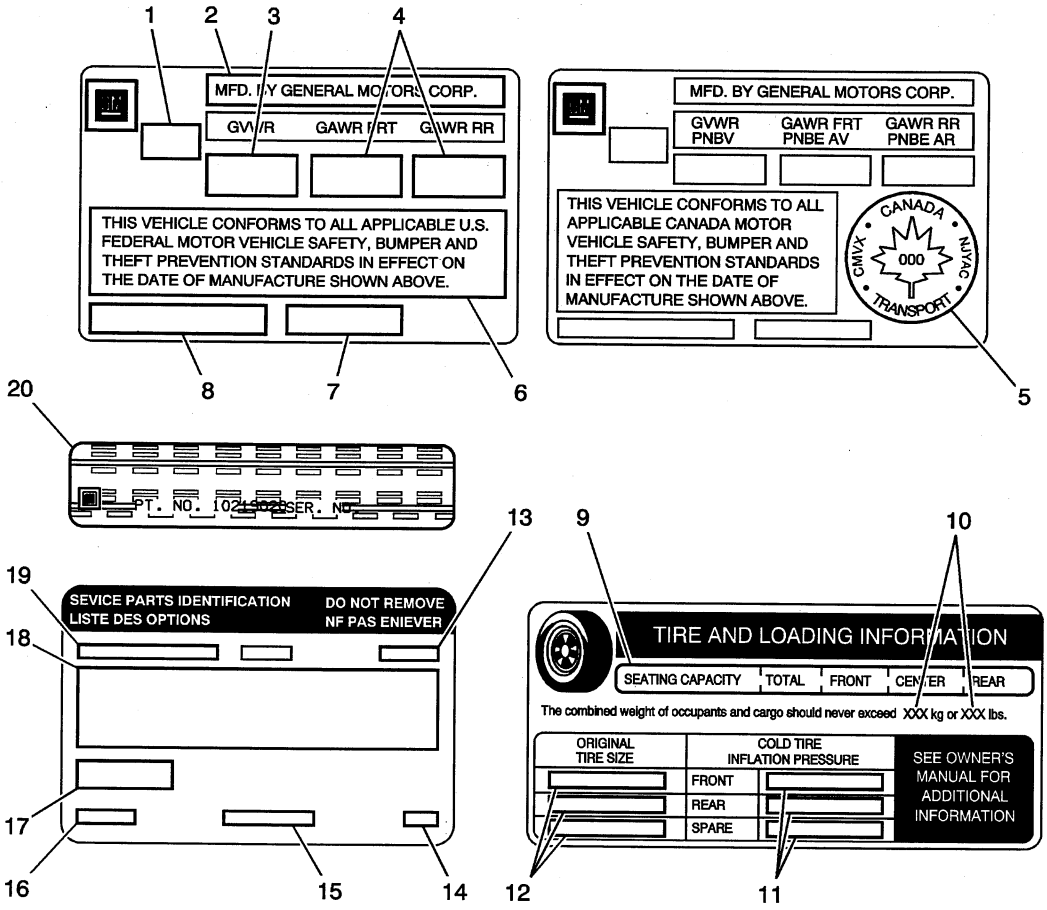
Axle Identification – Rear



(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.

Label - Vehicle Certification, Tire Place Card, Anti-Theft and Service Parts ID



Callout	Description
Vehicle Certification Label	The vehicle certification label is located on the driver door and displays the following assessments: Gross Vehicle Weight Rating (GVWR) Gross Axle Weight Rating (GAWR), front and rear The gross vehicle weight (GVW) is the weight of the vehicle and everything it carries. The GVW must not exceed the GVWR. Include the following items when figuring the GVW: The base vehicle weight (factory weight) The weight of all vehicle accessories The weight of the driver and the passengers The weight of the cargo
1	Name of Manufacturer
2	Gross Vehicle Weight Rating
3	Gross Axle Weight Rating (Front, Rear)
4	Canadian Safety Mark (w/RPO Z49)
5	Certification Statement
6	Vehicle Class Type (Pass Car, etc.)
7	Vehicle Identification Number
8	Date of Manufacture (Mo/Yr)

Callout	Description
Tire Placard	
The tire placard label is located on the driver door and displays the following assessments:	
9	Specified Occupant Seating Positions
10	Maximum Vehicle Capacity Weight
11	Original Equipment Tires Size
12	Tire Pressure, Front, Rear, and Spare (Cold)
Service Parts ID Label	
The vehicle service parts identification label is located in the glove compartment. The label is used to help identify the vehicle original parts and options.	
13	Vehicle Identification Number
14	Engineering Model Number (Vehicle Division, Line and Body Style)
15	Interior Trim Level and Decor
16	Exterior (Paint Color) WA Number
17	Paint Technology
18	Special Order Paint Colors and Numbers
19	Vehicle Option Content
Anti-Theft Label	
20	The Federal law requires that General Motors label certain body parts on this vehicle with the VIN. The purpose of the law is to reduce the number of motor vehicle thefts by helping in the tracing and recovery of parts from stolen vehicles. Labels are permanently affixed to an interior surface of the part. The label on the replacement part contains the letter R, the manufacturer's logo, and the DOT symbol. The anti-theft label must be covered before any painting, and rustproofing procedures, and uncovered after the procedures. Failure to follow the precautionary steps may result in liability for violation of the Federal Vehicle Theft Prevention Standard and possible suspicion to the owner that the part was stolen.

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:

See the attached documentation for the appropriate RPO code list for your model vehicle.

Technical Information

Maintenance and Lubrication

Capacities - Approximate Fluid

Application	Capacities	
	English	Metric
Axle Capacities		
• Front Drive Axle (8.25")	1.51 quarts	1.43 liters
• Front Drive Axle (9.25")	1.83 quarts	1.73 liters
• Rear Drive Axle (8.6")	2.15 quarts	2.03 liters
• Rear Drive Axle (9.5")	2.75 quarts	2.6 liters
• Rear Drive Axle (9.75")	3.00 quarts	2.84 liters
• Rear Drive Axle (10.5")	2.75 quarts	2.6 liters
• Rear Drive Axle (11.5")	3.17 quarts	3.0 liters
Cooling System		
• VORTEC 6000 V8 Automatic*	16.2 quarts	15.3 liters
• VORTEC 6000 V8 Automatic**	16.7 quarts	15.8 liters
• VORTEC 6000 V8 Manual*	16.7 quarts	15.8 liters
• VORTEC 6000 V8 Manual**	16.7 quarts	15.8 liters
• VORTEC 8100 V8 HD Automatic*	25.0 quarts	23.7 liters
• VORTEC 8100 V8 Automatic*	26.9 quarts	25.5 liters
• VORTEC 8100 V8 Automatic**	--	--
• VORTEC 8100 V8 Manual*	27.1 quarts	25.6 liters
* Engine Fan Driven cooling system ** Electric Cooling Fan system		
Engine Oil with Filter		
• 4800 V8; 5300 V8; 6000 V8	6.0 quarts	5.7 liters
• 8100 V8	6.5 quarts	6.1 liters
Fuel Tank		
• Short Bed and 2500 LD	26.0 gallons	98.0 liters
• Long Bed and Chassis Cab (Pickup Box Delete)	36.0 gallons	136.0 liters
• Chassis Cab 3500 and 3500HD -- front	27.0 gallons	102.0 liters
• Chassis Cab 3500 and 3500HD -- rear	23.0 gallons	87.0 liters
Transfer Case		
• New Venture Gear 261 (NP2)	2.0 quarts	1.9 liters
• New Venture Gear 263 (NP1)	2.0 quarts	1.9 liters
Transmission		
• 4L80-E Auto (MT1)	7.7 quarts	7.3 liters
• 4L80-E Auto (MT1) After Complete Overhaul	13.5 quarts	12.8 liters
• 5 Spd. Auto Allison (M74) Fluid and Filter Change	7.4 quarts	7.0 liters
• 5 Spd. Auto Allison (M74) After Complete Overhaul	12.7 quarts	12.0 liters
• New Venture Gear 4500 Manual Transmission	4.0 quarts	3.8 liters
• 6 Spd. Manual (ZF) (ML6)	6.3 quarts	6.0 liters

Maintenance Items – Gasoline Engine

Part	GM Part Number	ACDelco Part Number
Engine Air Cleaner/Filter		
High Capacity	25313349	A1518C
Standard	25313348*	A1519C*
Oil Filter		
4800 V8; 5300 V8; 6000 V8	88984215	PF46
8100 V8	25324052	PF454
Spark Plugs		
4800 V8; 5300 V8; 6000 V8	12571164	41-985
8100 V8	12578277	41-983
Wiper Blades (ITTA Type) 22 inches (56.0 cm)	15153642	--

* A1518C high-capacity air cleaner filter may be substituted.

Fluid and Lubricant Recommendations – Gasoline Engine

Usage	Fluid/Lubricant
Engine Oil	Engine oil which meets GM Standard GM6094M and displays the American Petroleum Institute Certified for Gasoline Engines starburst symbol. GM Goodwrench® oil meets all the requirements for your vehicle.
Engine Coolant	50/50 mixture of clean, drinkable water and use only DEX-COOL® coolant.
Hydraulic Brake System	Delco® Supreme 11 Brake Fluid or equivalent DOT-3 brake fluid.
Windshield Washer	GM Optikleen Washer Solvent.
Hydraulic Clutch System (5-Speed Trans.)	Hydraulic Clutch Fluid (GM Part No. U.S. 12345347, in Canada 10953517) or equivalent DOT-3 brake fluid.
Hydraulic Clutch System (6-Speed Trans.)	Hydraulic Clutch Fluid. Use only GM Part No. U.S. 88958860, in Canada 88901244, Super DOT-4 brake fluid.
Power Steering System	GM Power Steering Fluid (GM Part No. U.S. 89021184, in Canada 89021186).
Manual Transmission (5-Speed with Low Gear, RPO MW3)	GM Goodwrench® Synthetic Manual Transmission Fluid (GM Part No. U.S. 12346190, in Canada 10953477) or equivalent SAE 75W-85 GL-4 gear oil.
Manual Transmission (5-Speed without Low Gear, RPO MG5)	Synchromesh Transmission Fluid (GM Part No. U.S. 12345349, in Canada 10953465).
Manual Transmission (6-Speed)	Synthetic Transmission Fluid approved to Allison Transmission® specification TES-295 (GM Part No. U.S. 12378515, in Canada 88900701).
Automatic Transmission	DEXRON®-III Automatic Transmission Fluid. Look for "Approved for the H-Specification" on the label.
Key Lock Cylinders	Multi-Purpose Lubricant, Superlube (GM Part No. U.S. 12346241, in Canada 10953474).
Floor Shift Linkage	Lubriplate Lubricant Aerosol (GM Part No. U.S. 12346293, in Canada 992723) or lubricant meeting requirements of NLGI #2 Category LB or GC-LB.
Chassis Lubrication	Chassis Lubricant (GM Part No. U.S. 12377985, in Canada 88901242) or lubricant meeting requirements of NLGI #2, Category LB or GC-LB.
Front Axle (Four-Wheel Drive)	SAE 80W-90 Axle Lubricant (GM Part No. U.S. 1052271, in Canada 10950849).

Usage	Fluid/Lubricant
Front Axle (All-Wheel Drive)	SAE 75W-90 Synthetic Axle Lubricant (GM Part No. U.S. 12378261, in Canada 10953455) meeting GM Specification 9986115.
Front Axle	SAE 80W-90 Axle Lubricant (GM Part No. U.S. 1052271, in Canada 10950849).
Rear Axle	SAE 75W-90 Synthetic Axle Lubricant (GM Part No. U.S. 12378261, in Canada 10953455) meeting GM Specification 9986115.
Rear Axle (Steerable)	Synthetic Axle Lubricant; use only GM Part No. U.S. 12378557, in Canada 88901362.*Do not add friction modifier.*
Manual Transfer Case	DEXRON®-III Automatic Transmission Fluid. Look for "Approved for the H-Specification" on the label.
Automatic Transfer Case (Four-Wheel Drive)	AUTO-TRAK II Fluid (GM Part No. U.S. 12378508, in Canada 10953626).
Transfer Case (All-Wheel Drive)	DEXRON®-III Automatic Transmission Fluid. Look for "Approved for the H-Specification" on the label.
Front Axle Propshaft Spline or One-Piece Propshaft Spline (Two-Wheel Drive with Auto. Trans.)	Spline Lubricant, Special Lubricant (GM Part No. U.S. 12345879, in Canada 10953511) or lubricant meeting requirements of GM 9985830.
Rear Driveline Center Spline	Chassis Lubricant (GM Part No. U.S. 12377985, in Canada 88901242) or lubricant meeting requirements of NLGI #2, Category LB or GC-LB.
Hood Hinges	Multi-Purpose Lubricant, Superlube (GM Part No. U.S. 12346241, in Canada 10953474).
Body Door Hinge Pins, Tailgate Hinge and Linkage, Folding Seats, and Fuel Door Hinge	Multi-Purpose Lubricant, Superlube (GM Part No. U.S. 12346241, in Canada 10953474).
Tailgate Handle Pivot Points, Hinges, Latch Bolt, and Linkage	Multi-Purpose Lubricant, Superlube (GM Part No. U.S. 12346241, in Canada 10953474).
Weatherstrip Conditioning	Dielectric Silicone Grease (GM Part No. U.S. 12345579, in Canada 992887).
Weatherstrip Squeaks	Synthetic Grease with Teflon, Superlube (GM Part No. U.S. 12371287, in Canada 10953437).

Maintenance Items – Diesel Engine

Part	GM Part Number	ACDelco Part Number
Oil Filter	88917036	PF2232
Engine Air Cleaner/Filter	25332443	A1618C
Fuel Filter	97382952	--

Fluid and Lubricant Recommendations – Diesel Engine

Usage	Fluid/Lubricant
Engine Oil (Diesel Engine)	Engine oils with the letters CI-4 or CH-4 are best for your vehicle. The CI-4 or CH-4 designation may appear either alone, or in combination with other API designations, such as API CI-4/SL. These letters show American Petroleum Institute (API) levels of quality. GM Goodwrench® oil meets all the requirements for your vehicle.
Engine Coolant	50/50 mixture of clean, drinkable water and use only DEX-COOL® Coolant.
Hydraulic Brake System	Delco® Supreme 11 Brake Fluid or equivalent DOT-3 brake fluid.
Windshield Washer	GM Optikleen Washer Solvent.
Hydraulic Clutch System (5-Speed Trans.)	Hydraulic Clutch Fluid (GM Part No. U.S. 12345347, in Canada 10953517) or equivalent DOT-3 brake fluid.
Hydraulic Clutch System (6-Speed Trans.)	Hydraulic Clutch Fluid. Use only GM Part No. U.S. 88958860, in Canada 88901244, Super DOT-4 brake fluid.
Power Steering System	GM Power Steering Fluid (GM Part No. U.S. 89021184, in Canada 89021186).
Manual Transmission (5-Speed with Low Gear, RPO MW3)	GM Goodwrench Synthetic Manual Transmission Fluid (GM Part No. U.S. 12346190, in Canada 10953477) or equivalent SAE 75W-85 GL-4 gear oil.
Manual Transmission (5-Speed without Low Gear, RPO MG5)	Synchromesh Transmission Fluid (GM Part No. U.S. 12345349, in Canada 10953465).
Manual Transmission (6-Speed)	Synthetic Transmission Fluid approved to Allison Transmission specification TES-295 (GM Part No. U.S. 12378515, in Canada 88900701).
Automatic Transmission	DEXRON®-III Automatic Transmission Fluid. Look for "Approved for the H-Specification" on the label.
Key Lock Cylinders	Multi-Purpose Lubricant, Superlube (GM Part No. U.S. 12346241, in Canada 10953474).
Floor Shift Linkage	Lubriplate Lubricant Aerosol (GM Part No. U.S. 12346293, in Canada 992723) or lubricant meeting requirements of NLGI #2 Category LB or GC-LB.
Chassis Lubrication	Chassis Lubricant (GM Part No. U.S. 12377985, in Canada 88901242) or lubricant meeting requirements of NLGI #2, Category LB or GC-LB.
Front Axle	SAE 80W-90 Axle Lubricant (GM Part No. U.S. 1052271, in Canada 10950849).
Rear Axle	SAE 75W-90 Synthetic Axle Lubricant (GM Part No. U.S. 12378261, in Canada 10953455) meeting GM Specification 9986115.
Manual Transfer Case	DEXRON®-III Automatic Transmission Fluid. Look for "Approved for the H-Specification" on the label.
Automatic Transfer Case	AUTO-TRAK II Fluid (GM Part No. U.S. 12378508, in Canada 10953626).
Front Axle Propshaft Spline or One-Piece Propshaft Spline (Two-Wheel Drive with Auto. Trans.)	Spline Lubricant, Special Lubricant (GM Part No. U.S. 12345879, in Canada 10953511) or lubricant meeting requirements of GM 9985830.

Usage	Fluid/Lubricant
Rear Driveline Center Spline	Chassis Lubricant (GM Part No. U.S. 12377985, in Canada 88901242) or lubricant meeting requirements of NLGI #2, Category LB or GC-LB.
Hood Hinges	Multi-Purpose Lubricant, Superlube (GM Part No. U.S. 12346241, in Canada 10953474).
Body Door Hinge Pins, Tailgate Hinge and Linkage, Folding Seats, and Fuel Door Hinge	Multi-Purpose Lubricant, Superlube (GM Part No. U.S. 12346241, in Canada 10953474).
Tailgate Handle Pivot Points, Hinges, latch Bolt, and Linkage	Multi-Purpose Lubricant, Superlube (GM Part No. U.S. 12346241, in Canada 10953474).
Weatherstrip Conditioning	Dielectric Silicone Grease (GM Part No. U.S. 12345579, in Canada 992887).
Weatherstrip Squeaks	Synthetic Grease with Teflon, Superlube (GM Part No. U.S. 12371287, in Canada 10953437).

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.

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.

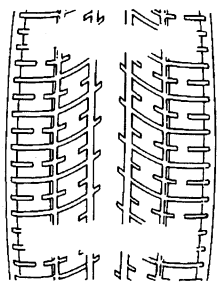
The following factors have an important influence on tire life:

- 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.

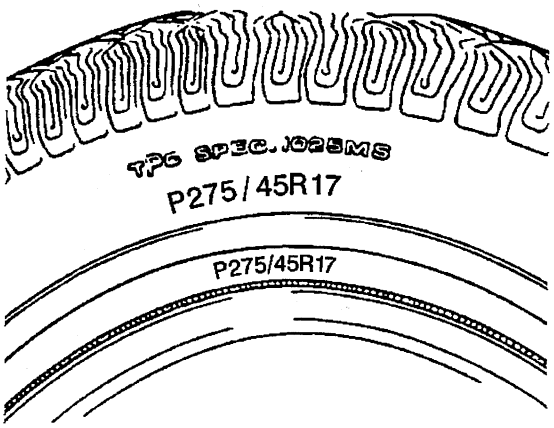
Conditions for Tire Replacement

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

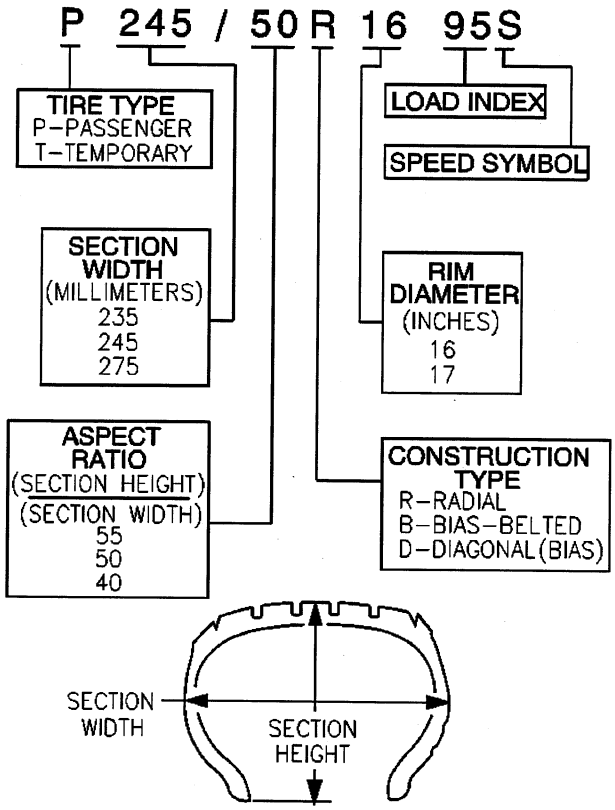


Most GM vehicles are equipped with steel belted all-season radial tires as standard equipment. These tires qualify as snow tires, with a higher than average rating for snow traction than the non-all season radial tires previously used. Other performance areas, such as wet traction, rolling resistance, 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 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
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.

Braking System Description and Operation

Hydraulic Brake System Description and Operation

System Component Description

The hydraulic brake system consists of the following:

Hydraulic Brake Master Cylinder Fluid Reservoir

Contains supply of brake fluid for the hydraulic brake system.

Hydraulic Brake Master Cylinder

Converts mechanical input force into hydraulic output pressure.

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

Hydraulic Brake Pressure Balance Control System

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

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

Hydraulic Brake Pipes and Flexible Brake Hoses

Carries brake fluid to and from hydraulic brake system components.

Hydraulic Brake Wheel Apply Components

Converts hydraulic input pressure into mechanical output force.

System Operation

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

Brake Assist System Description and Operation

System Component Description

The brake assist system consists of the following:

Brake Pedal

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

Brake Pedal Pushrod

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

Vacuum Brake Booster

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

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

Vacuum Source

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

Vacuum Source Delivery System

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

System Operation

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

Disc Brake System Description and Operation

System Component Description

The disc brake system consists of the following components:

Disc Brake Pads

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

Disc Brake Rotors

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

Disc Brake Pad Hardware

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

Disc Brake Caliper Hardware

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

System Operation

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

Drum Brake System Description and Operation

System Component Description

The drum brake system consists of the following:

Drum Brake Shoes

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

Brake Drums

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

Drum Brake Hardware

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

Drum Brake Adjusting Hardware

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

System Operation

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

Park Brake System Description and Operation w/Rear Disc

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.

Park Brake System Description and Operation (w/Rear Drum)

System Component 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.

Park Brake Apply Lever:

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

System Operation

Depressing the Park Brake Pedal creates INPUT FORCE. The INPUT FORCE is transferred and evenly distributed through the park park cables and the equalizer to the left and right rear park brake cables. The INPUT FORCE, is then transferred to the apply levers located in each of the rear brake drums. The levers then multiply the INPUT FORCE and transfer the force to the rear brake shoes. At that point, the brake shoes are forced to expand and make contact with the friction surface of the rear brake drums, preventing the rotation of the rear wheels. Use the park brake release handle to disengage the park brake.

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 – 6.0L

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

Application	Specification	
	Metric	English
Connecting Rod		
• Connecting Rod Bearing Clearance - Production	0.023-0.065 mm	0.0009-0.0025 in
• Connecting Rod Bearing Clearance - Service	0.023-0.076 mm	0.0009-0.003 in
• Connecting Rod Bore Diameter - Bearing End	56.505-56.525 mm	2.224-2.225 in
• Connecting Rod Bore Out-of-Round - Bearing End - Production	0.006 mm	0.0002 in
• Connecting Rod Bore Out-of-Round - Bearing End - Service	0.006 mm	0.0002 in
• Connecting Rod Side Clearance	0.11-0.51 mm	0.00433-0.02 in
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

Application	Specification	
	Metric	English
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
• 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

Application	Specification	
	Metric	English
• 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	0.011-0.018 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

Fastener Tightening Specifications

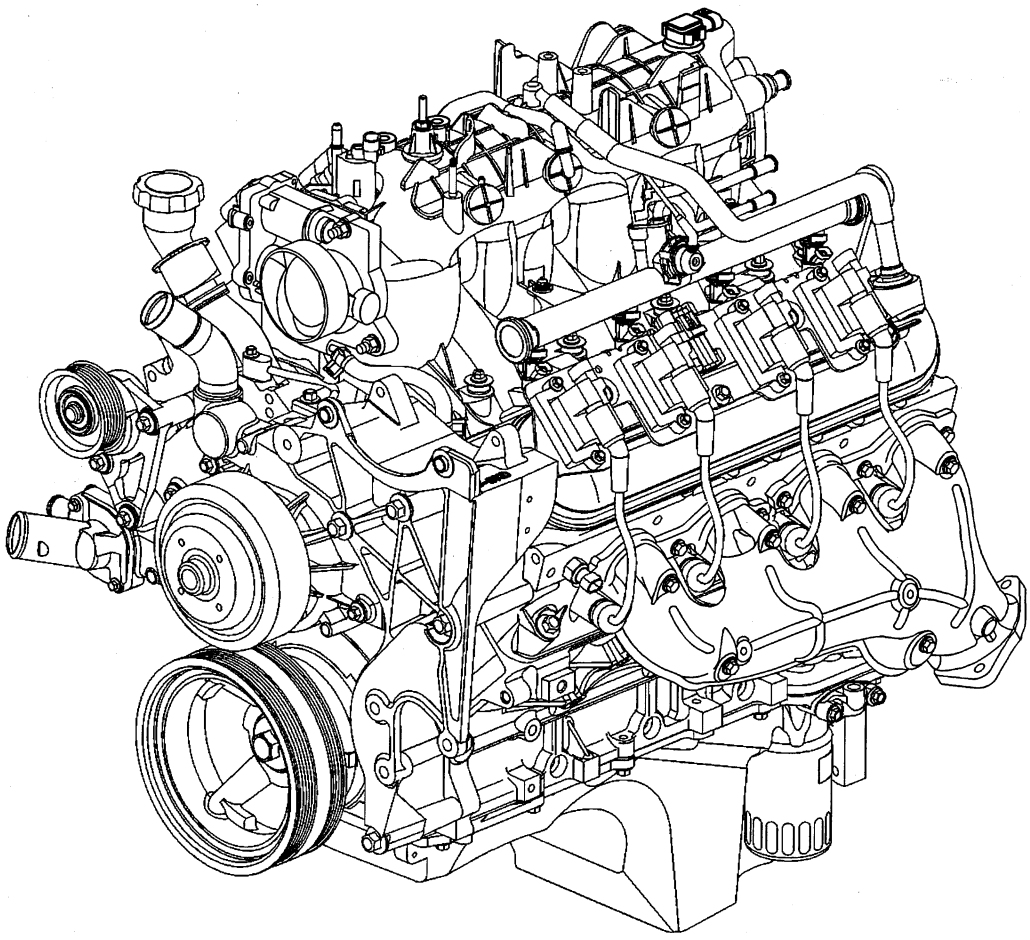
Application	Specification	
	Metric	English
Air Cleaner Outlet Duct Clamp Screw	7 N·m	62 lb in
Air Conditioning (A/C) Belt Tensioner Bolt	50 N·m	37 lb ft
Air Conditioning (A/C) Compressor Bolt	50 N·m	37 lb ft
Air Conditioning (A/C) Discharge Hose Bolt	16 N·m	12 lb ft
Air Conditioning (A/C) Suction Hose Bolt	16 N·m	12 lb ft
Battery Cable Channel Bolt	12 N·m	106 lb in
Camshaft Retainer Bolts	25 N·m	18 lb ft
Camshaft Sensor Bolt	25 N·m	18 lb ft
Camshaft Sprocket Bolts	35 N·m	26 lb ft
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
Drive Belt Idler Pulley Bolt	50 N·m	37 lb ft
Drive Belt Tensioner Bolt	50 N·m	37 lb ft
Engine Block Coolant Drain Plugs	60 N·m	44 lb ft
Engine Block Heater	40 N·m	30 lb ft
Engine Block Oil Gallery Plugs	60 N·m	44 lb ft
Engine Coolant Air Bleed Pipe and Cover Bolts	12 N·m	106 lb in
Engine Flywheel Bolts - First Pass	20 N·m	15 lb ft

Application	Specification	
	Metric	English
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
Fuel Rail Bolts	10 N·m	89 lb in
Fuel Rail Cover Bolt	9 N·m	80 lb in
Fuel Rail Crossover Tube Bolts	3.8 N·m	34 lb in
Fuel Rail Stop Bracket Bolt	50 N·m	37 lb ft
Generator Bracket Bolt	50 N·m	37 lb ft
Generator Cable Nut	9 N·m	80 lb in
Heater Hose Bracket Nut	9 N·m	80 lb in
Hood Hinge Bolt	25 N·m	18 lb ft
Ignition Coil-to-Bracket Bolts	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
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

Application	Specification	
	Metric	English
Oil Pump Cover Bolts	12 N·m	106 lb in
Oil Pump Relief Valve Plug	12 N·m	106 lb in
Oil Pump Screen Nuts	25 N·m	18 lb ft
Oil Pump Screen-to-Oil Pump Bolt	12 N·m	106 lb in
Positive Battery Cable Clip Bolt	9 N·m	80 lb in
Power Steering Pump Rear Bolt	50 N·m	37 lb ft
Spark Plugs - New Cylinder Heads	20 N·m	15 lb ft
Spark Plugs - All Subsequent Installations	15 N·m	11 lb ft
Throttle Body Nuts	10 N·m	89 lb in
Throttle Body Studs	6 N·m	53 lb in
Torque Converter Bolt - 4L80-E/4L85-E Transmissions	60 N·m	44 lb ft
Transmission Bolt/Stud	50 N·m	37 lb ft
Transmission Cover Bolt	12 N·m	106 lb in
Transmission Oil Level Indicator Tube Nut	18 N·m	13 lb ft
Valve Lifter Guide Bolts	12 N·m	106 lb in
Valve Rocker Arm Bolts	30 N·m	22 lb ft
Valve Rocker Arm Cover Bolts	12 N·m	106 lb in
Water Inlet Housing Bolts	15 N·m	11 lb ft
Water Pump Bolts - First Pass	15 N·m	11 lb ft
Water Pump Bolts - Final Pass	30 N·m	22 lb ft
Water Pump Cover Bolts	15 N·m	11 lb ft

Engine Component Description

The 6.0 Liter V8 Engine



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.

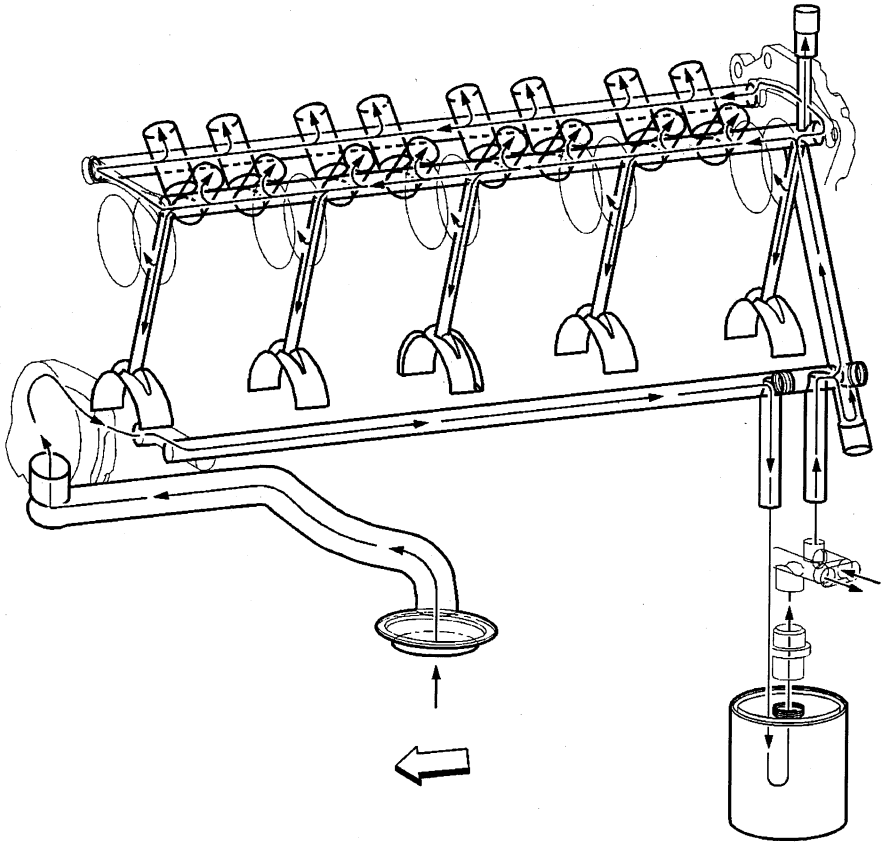
Valve Rocker Arm Cover Assemblies

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.

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 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
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

Application	Specification	
	Metric	English
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
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

Application	Specification	
	Metric	English
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	
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

Application	Specification	
	Metric	English
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
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

Application	Specification	
	Metric	English
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
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

Application	Specification	
	Metric	English
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
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

Application	Specification	
	Metric	English
Water Pump Bolt	25 N·m	18 lb ft
Water Pump Inlet Pipe Bolts	25 N·m	18 lb ft

Engine Component Description

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

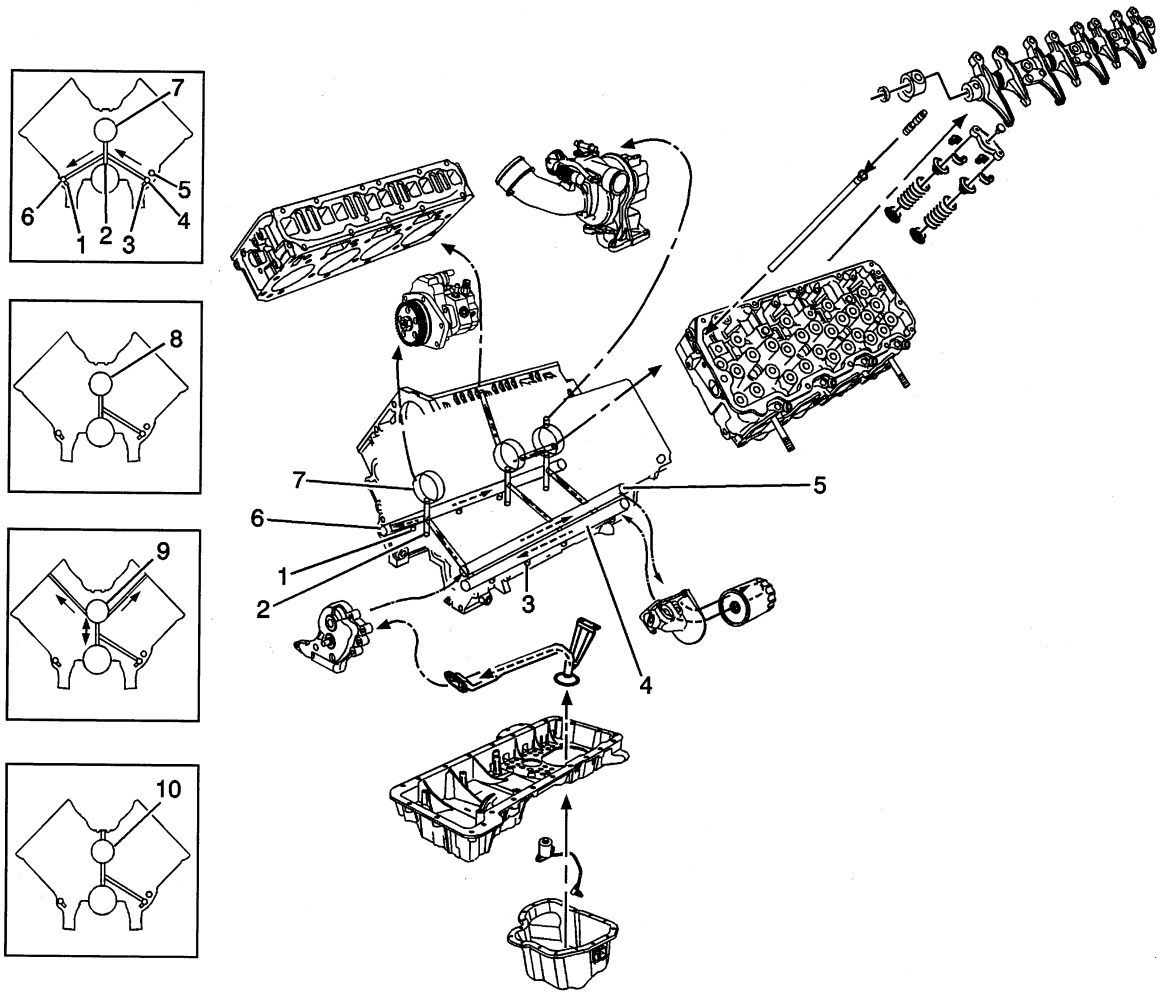
The water pump is gear driven for improved reliability.

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

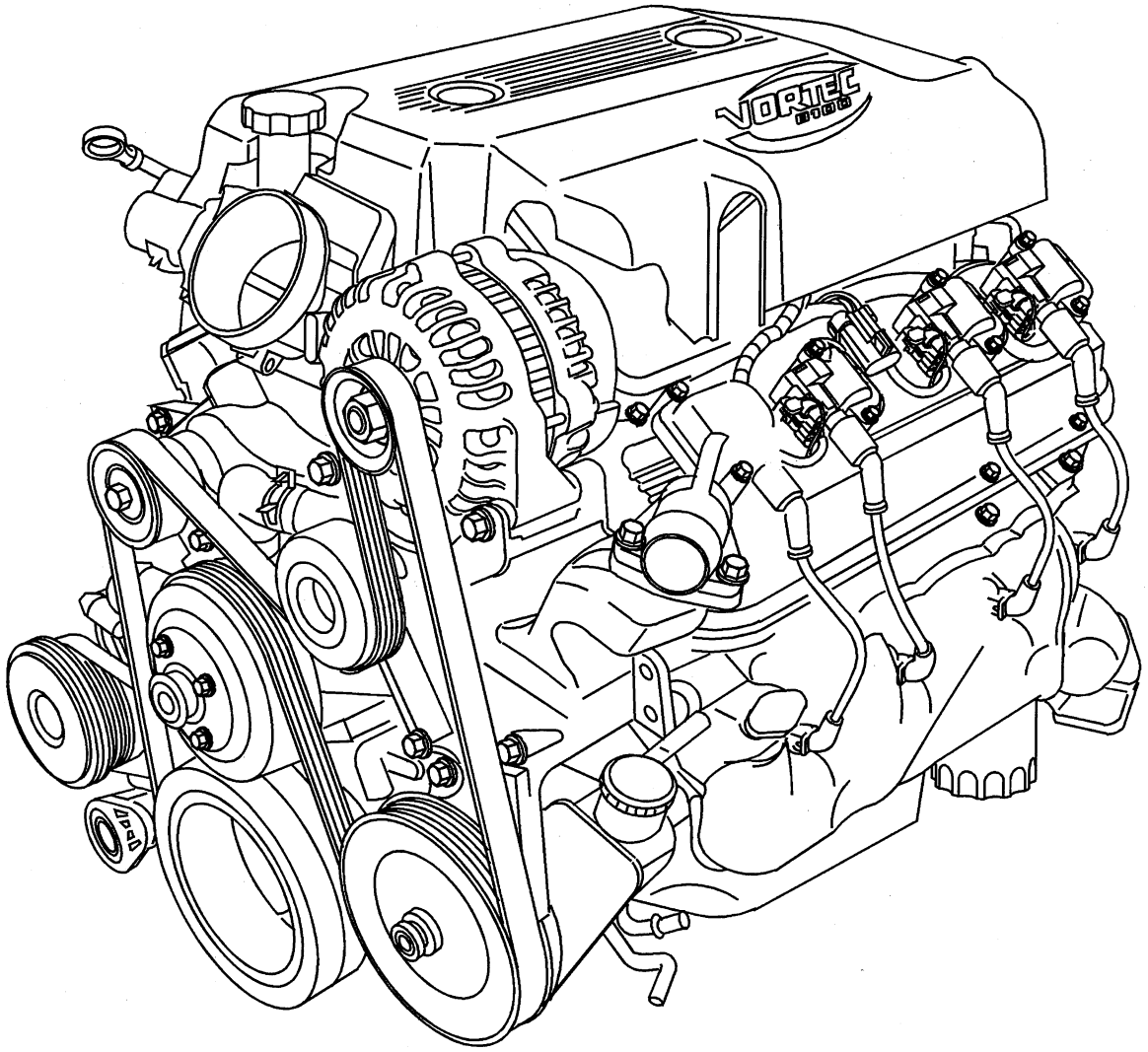
Fastener Tightening Specifications

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

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.

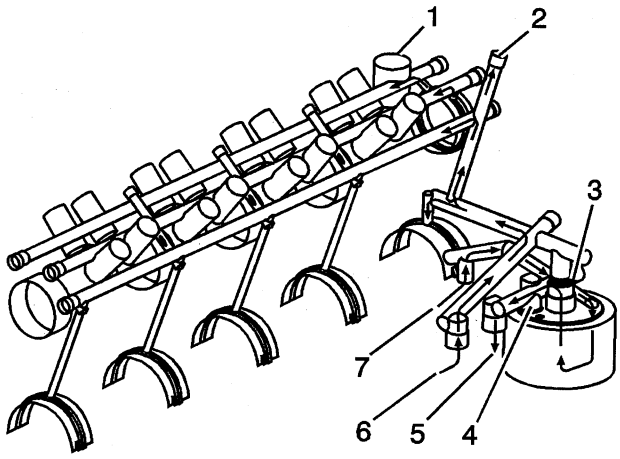
Intake Manifold

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.

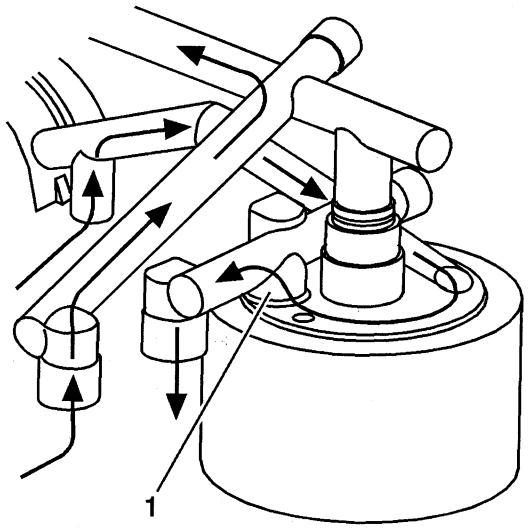
Exhaust Manifold

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.

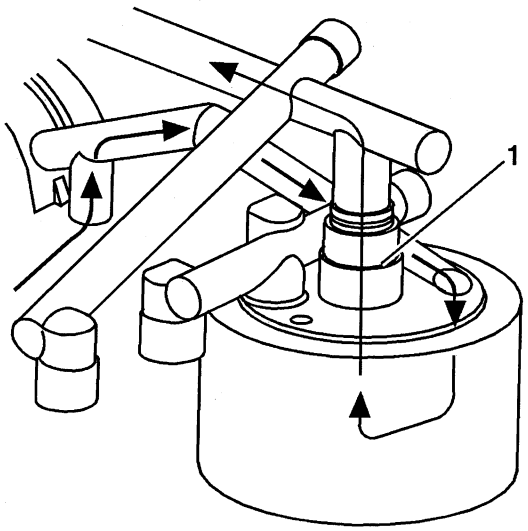
Lubrication Description



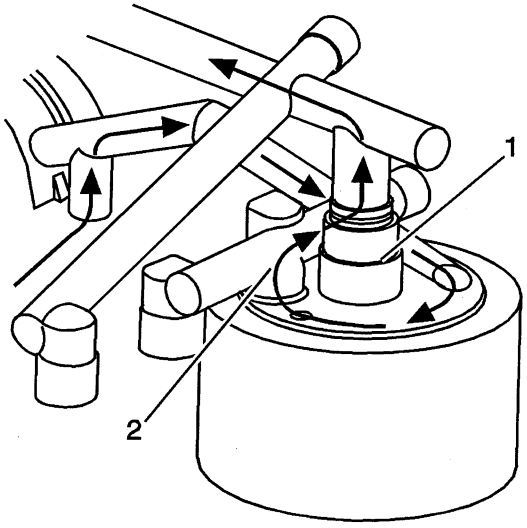
The gear-type oil pump is driven through an extension driveshaft. The extension driveshaft is driven by the oil pump drive, which is gear driven by the camshaft. The oil is drawn from the oil pan through a pickup screen and tube, into the oil pump (7). Pressurized oil flows through the oil filter, into 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 N·m	35 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 (6.0L)	12 N·m	106 lb in
Coolant Air Bleed Pipe Stud/Bolt (6.0L)	12 N·m	106 lb in
Coolant Heater (6.0L)	50 N·m	37 lb ft
Coolant Heater (8.1L)	60 N·m	47 lb ft
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
Cooling Fan Motor Bolt	10 N·m	89 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 (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
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 (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

Application	Specification	
	Metric	English
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 Tube Bolt (6.6L)	21 N·m	16 lb ft
Water Pump Bolt (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 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.

Engine Electrical

Fastener Tightening Specifications

Application	Specification	
	Metric	English
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 (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
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 (6.0L, 6.6L, and 8.1L)	50 N·m	37 lb ft
Generator Bracket Bolt (6.0L, 6.6L, and 8.1L)	50 N·m	37 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 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

Application	Specification	
	Metric	English
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
Starter Bolt (6.0L, and 8.1L)	50 N·m	37 lb ft
Starter Bolt (6.6L)	78 N·m	58 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
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 (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

Battery Usage

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 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
6.0L (LQ4) 8.1L (L18)	PG-260L
6.6L (LB7) Diesel	Hitachi-S14-100B

Generator Usage

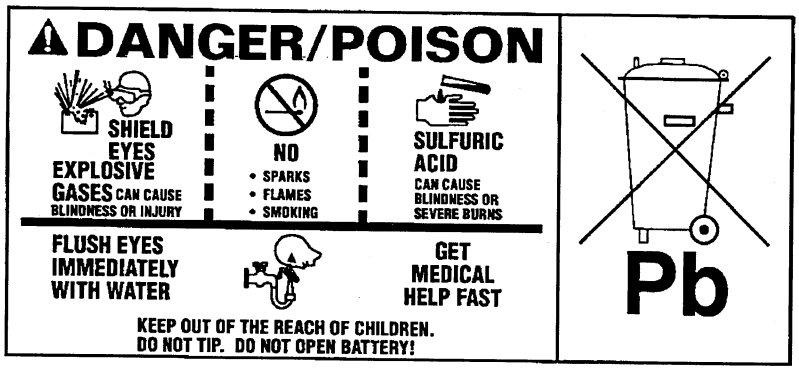
Base	
Generator Model	Delphi AD230
Rated Output	102 A
Load Test Output	71 A
Optional (Dual)	
Generator Model	Delphi AD244
Rated Output	130 A
Load Test Output	91 A
Bosch® Generator	
Generator Model	Bosch® 15755900
Rated Output	130 A
Load Test Output	91 A

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.**



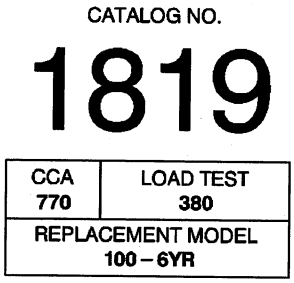
The maintenance free battery is standard. There are no vent plugs in the cover. The battery is completely sealed except for two small vent holes in the side. These vent holes allow the small amount of gas that is produced in the battery to escape.

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.

Engine Controls

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 – 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
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
Spark Plug		
New Head	20 N·m	15 lb ft
Used Head	15 N·m	11 lb ft
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
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

Application	Specification	
	Metric	English
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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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

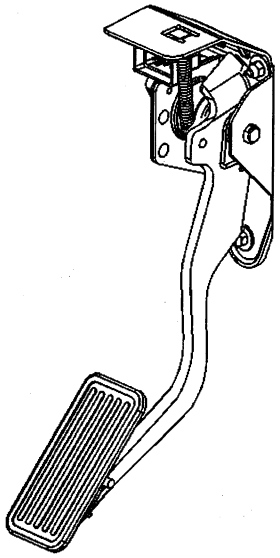
The glow plug relay is a solid state device which operates the glow plugs on Federal Emissions Vehicles. The glow plug controller is a solid state device which operates the glow plugs on California Emissions vehicles. Both components perform the same function of turning ON the glow plugs based on ECM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

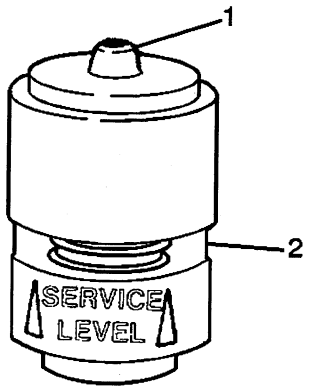
sensor to monitor the amount of vacuum that is available to the EGR valve. The ECM will make adjustments to the EGR vacuum control system in order to obtain the vacuum level necessary to achieve the proper EGR valve position. The EGR vacuum sensor is interfaced with the ECM by a 5-volt reference circuit, 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		
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

Application	Specification	
	Metric	English
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.

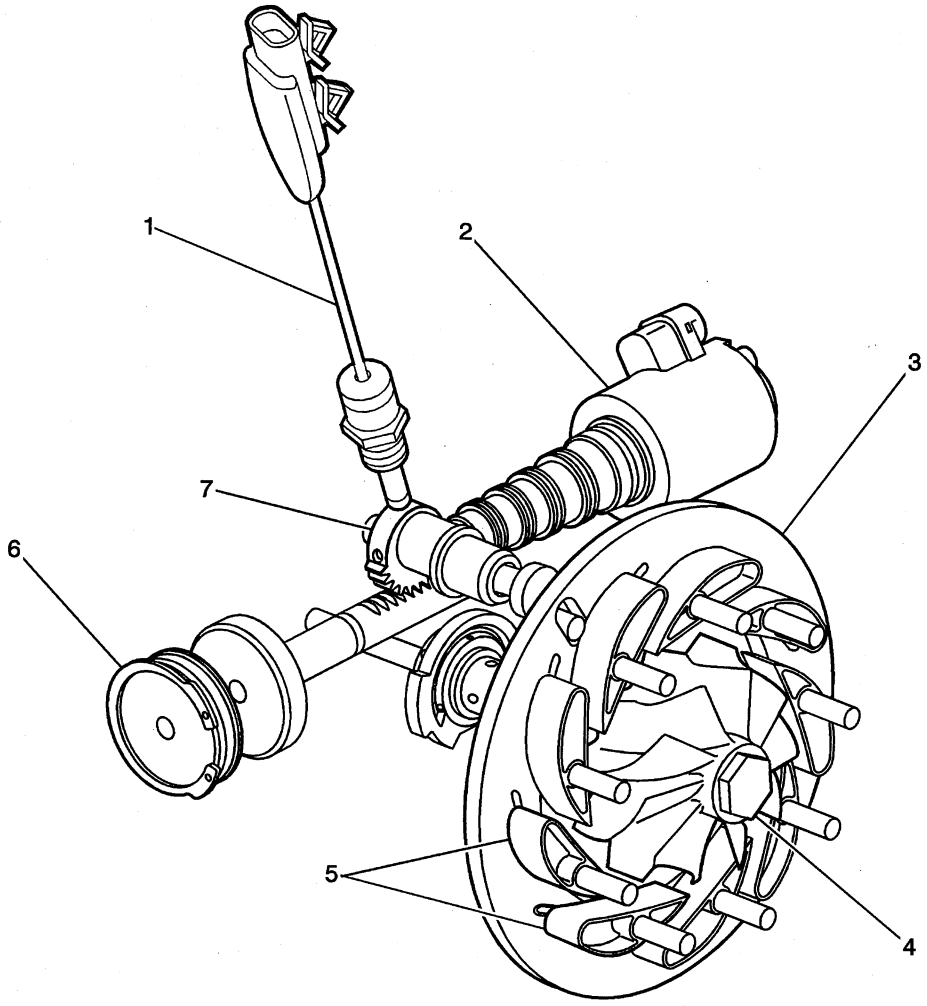
The idle speed will return to normal if any of the following conditions occur:

- 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 4500

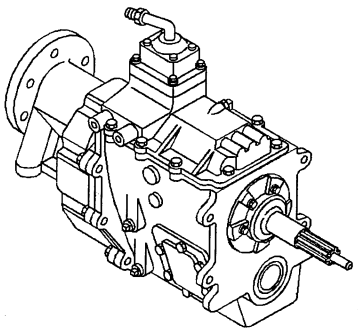
Fastener Tightening Specifications

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 NV 4500 is a 5 speed manual transmission with the fifth speed an overdrive ratio. The 5 forward gears and the reverse gear are fully synchronized. The shifting components are located in the shift cover. The shift cover is not rebuildable.

The 5th speed gear is located on the countershaft in the extension housing. There are 3 types of extension housings depending on the vehicle model.

- C 3500 HD model is cast iron
- C model is aluminum
- K model is aluminum and does not use a rear seal

The main shaft varies between models due to the extension housing configurations.

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
Shift Lever Bolt	23 N·m	17 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

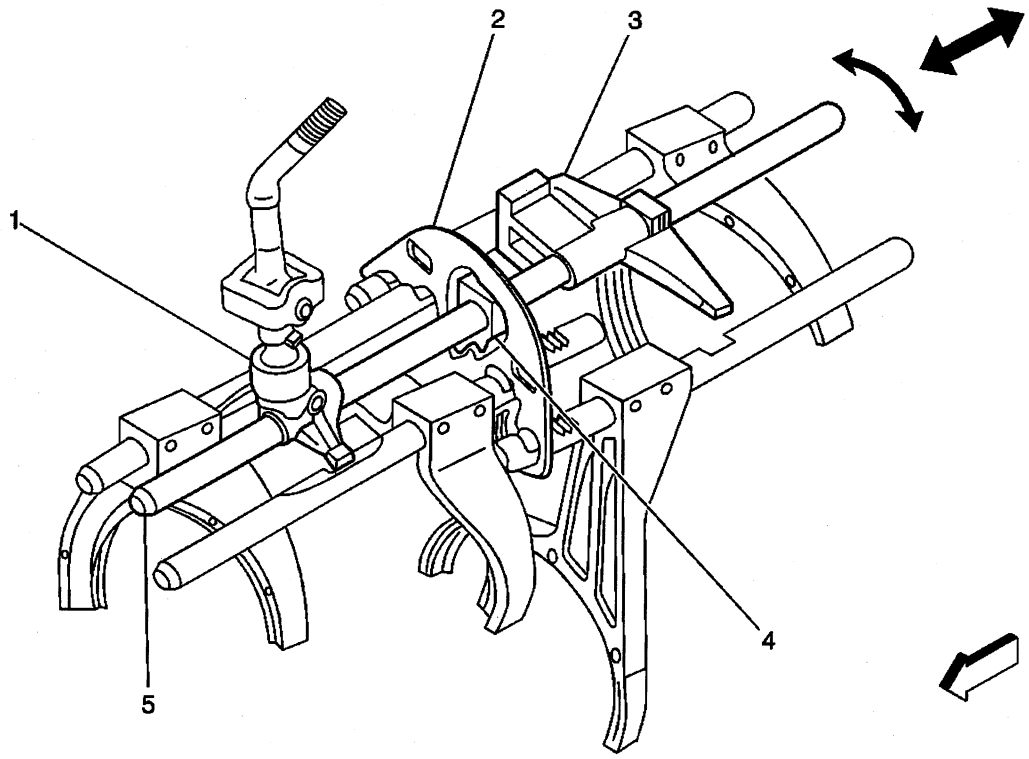
The ZF S6-650 is a six-speed transmission. All of the six forward gears and the reverse gear are fully synchronized. The six-speed gear is an overdrive ratio. The six-speed gear is located on the rear of the countershaft.

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.

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.

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

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

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.

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

Application	Specification	
	Metric	English
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
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.

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

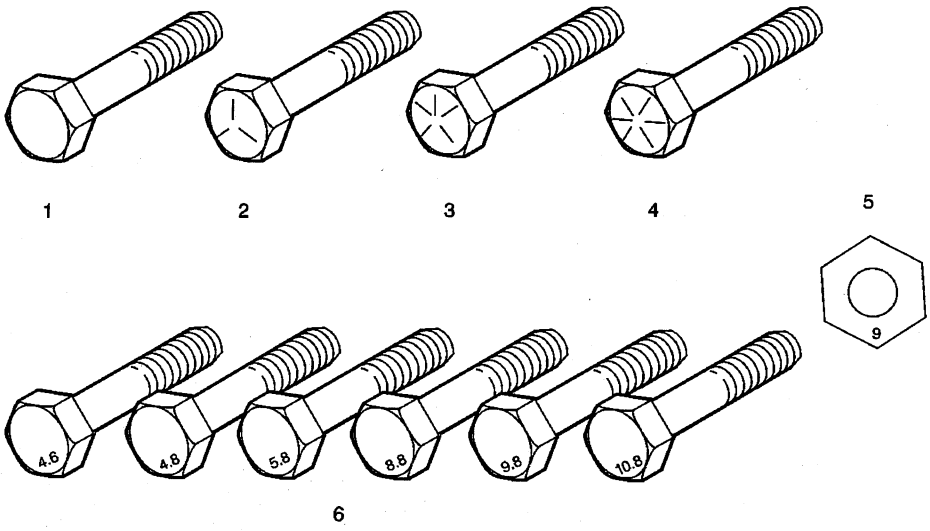
Metric Fasteners

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

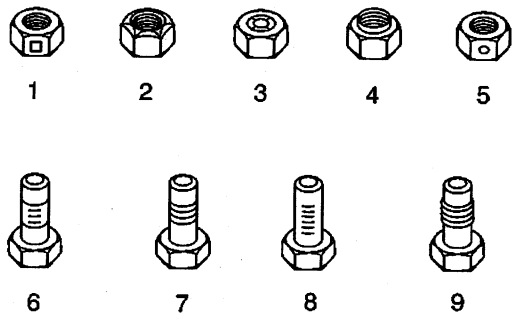
These fasteners accomplish the thread interface by a designed distortion or deformation in the fastener.

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

S = Standard Equipment A = Available -- (dashes) = Not Available
■ = Included in Equipment Group □ = Included in Equipment Group but upgradeable

*Indicates availability of feature on multiple models. For example, it indicates feature availability on 2WD and 4WD Models or Rear wheel drive and All-wheel drive Models.

Codes listed in the shaded column titled Ref. Only RPO Code are for internal use only and should not be ordered.

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.	Reg. and Ext. Cab		
			Base 1SA[1]	LS 1SB[1]	Work Truck 1SW[1]
		Air bags, frontal, driver and right front passenger, includes passenger side deactivation switch **1 - Always use safety belts and proper child restraints, even with air bags. Children are safer when properly secured in a rear seat. See the Owner's Manual for more safety information.**	S[1]	S[1]	S[1]
	CJ3	**Air conditioning,** dual-zone, manual, individual climate settings for driver and right front passenger	S	S	S
		Assist handle, front passenger **1 - Also includes rear outboard passenger assist handle on Extended Cab Models.**	S[1]	S[1]	S[1]
		Cigarette lighter, on instrument panel	S	S	S
		Coat hook, driver side **1 - Also includes passenger side coat hook on Extended Cab Models.**	S[1]	S[1]	S[1]
		Cupholders, front **1 - Also includes rear cupholders on Extended Cab Models.**	S[1]	S[1]	S[1]
		Driver Information Center, monitors numerous systems depending on vehicle equipment	S	S	S
BG9		**Floor covering,** rubberized vinyl, Black **1 - Not available with (922) Medium Gray Leather Interior Trim.**	S	A[1]	S
		Instrumentation, analog, includes speedometer, odometer with trip odometer, fuel level, voltmeter, engine temperature, oil pressure and tachometer	S	S	S
		Lighting, dome lamp, reading, backlit instrument panel switches and door handle-activated illuminated entry	S	S	S
		Mirror, inside rearview, manual day/night	S	--	S
		Power outlets, auxiliary, covered, 2 dash-mounted, 12-volt	S	S	S
	**V	**Seat trim,** vinyl	S	--	S
	**D	**Seat trim,** Custom Cloth	--	S	--
	AE7	**Seats,** front 40/20/40 split-bench, 3-passenger, driver and passenger manual reclining with outboard head restraints	S	--	S
	AE7	**Seats,** front 40/20/40 split-bench, 3-passenger, driver and passenger manual reclining, center fold-down armrest with storage, adjustable outboard head restraints and storage pockets on Extended Cab Models **1 - Not available with (UC6) Sound system, ETR AM/FM stereo with 6-disc CD changer.**	--	S[1]	--

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.	Reg. and Ext. Cab		
			Base 1SA[1]	LS 1SB[1]	Work Truck 1SW[1]
		Seat, rear bench, folding, 3-passenger (includes child seat top tether anchor) **1 - Standard with Extended Cab Models only.**	S[1]	S	S[1]
	UM7	**Sound system,** ETR AM/FM stereo, includes seek-and-scan and digital clock	--	--	S
	UQ5	**Sound system feature,** 4-speakers	S	--	S
		Steering column, Tilt-Wheel, adjustable, includes brake/transmission shift interlock	S	S	S
		Steering wheel, includes theft-deterrent locking feature	S	--	S
		Theft-deterrent system, PASSlock II	S	S	S
		Tools, mechanical jack and wheel wrench, spare tire assist hook, floor-mounted in back of cab	S	S	S
		Visors, padded, Shale-colored, driver and passenger side with cloth trim, extenders, pocket on driver side and vanity mirror on passenger side	S	S	S
		Warning tones, headlamp on, key-in-ignition, driver and passenger buckle up reminder, turn signal on	S	S	S
		Windows, rear quarter swing-out **1 - Standard with Extended Cab Models only.**	S[1]	S[1]	S[1]
		Air dam, Gray	S	S	S
	ZW9	**Body,** Chassis Cab	S	S	S
	VG3	**Bumper,** front, chrome, with Gray lower	S	S	S
		Daytime running lamps, includes automatic exterior lamp control	S	S	S
		Glass, Solar-Ray light tinted, all windows	S	S	S
	TR3	**Grille,** color-keyed surround, with chrome accent bar	S	S	S
		Headlamps, dual halogen composite, includes flash-to-pass feature and automatic lamp control	S	S	S
	U01	**Lamps,** amber roof marker	S	S	S
	TS9	**Lamp,** center high-mounted stop/brake (CHMSL) delete and cargo area, delete **1 - Standard with 4WD Models only.**	S[1]	S[1]	S[1]
	D44	**Mirrors,** outside rearview, foldaway, manual, Black, adjustable	S	--	S
	ZY1	**Paint,** solid	S	S	S
		Wheels, 6 - 16" x 6.5" (40.6 cm x 16.5 cm) 8-lug steel, painted (dual rear), includes painted center caps and steel spare	--	--	S
	B71	**Wheel flares,** front only	S	S	S
		Wipers, intermittent, front, wet-arm with pulse washers	S	S	S

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.	Reg. and Ext. Cab		
			Base 1SA[1]	LS 1SB[1]	Work Truck 1SW[1]
	K68	**Alternator,** 105 amps **1 - Not available with (VYU) Snow Plow Prep Package.**	S[1]	S[1]	S[1]
		Battery, heavy-duty, 600 cold-cranking amps, includes rundown protection and retained accessory power **1 - Not standard with (LLY) Engine, Duramax 6600 Turbo Diesel V8.**	S[1]	S[1]	S[1]
		Brakes, 4-wheel antilock, 4-wheel disc	S	S	S
	KC4	**Cooling,** external engine oil cooler, heavy-duty air-to-oil, integral to driver side of radiator tank	S	S	S
	LQ4	**Engine,** Vortec 6000 V8 SFI (300 HP [223.8 kW] @ 4400 rpm, 360 lb.-ft. [486.6 N-m] @ 4000 rpm)	S	S	S
		Exhaust, aluminized stainless-steel muffler and tailpipe	S	S	S
		Frame, ladder-type, hydroformed	S	S	S
	C7W	**GVWR,** 11,400 lbs. (5171 kg) **1 - Standard with 2WD Models only.**	S[1]	S[1]	S[1]
	C7L	**GVWR,** 12,000 lbs. (5443 kg) **1 - Standard with 4WD Models only.**	S[1]	S[1]	S[1]
	GT5	**Rear axle,** 4.10 ratio **1 - Refer to Engine/Axle chart for availability.**	S[1]	S[1]	S[1]
		Steering, power	S	S	S
		Suspension, front, independent torsion bar, and stabilizer bar	S	S	S
		Suspension, rear, 3-stage springs	S	S	S
	Z85	**Suspension Package,** Handling/Trailering, heavy-duty	S	S	S
	NP2	**Transfer case,** floor-mounted shifter **1 - Standard with 4WD Models. - Requires (AE7) Seats, front 40/20/40 split-bench.**	S[1]	S[1]	S[1]

2005 Chevrolet Truck Silverado 3500 EQUIPMENT GROUPS
CC

S = Standard Equipment A = Available -- (dashes) = Not Available
■ = Included in Equipment Group □ = Included in Equipment Group but upgradeable

No deletions allowed to Equipment Groups. Additional options may be added; check ordering information section for compatibility.

*Indicates availability of feature on multiple models. For example, it indicates feature availability on 2WD and 4WD Models or Rear wheel drive and All-wheel drive Models.

Codes listed in the shaded column titled Ref. Only RPO Code are for internal use only and should not be ordered.

Free Flow RPO Code	Ref. Only RPO Code	Description **1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.**	Reg. and Ext. Cab		
			Base 1SA[1]	LS 1SB[1]	Work Truck 1SW[1]
	DK7	**Console,** overhead mini, includes map lights	--	■	--
K34		**Cruise control**, electronic with set and resume speed, includes telltale in instrument panel cluster	■	■	A
C49		**Defogger,** rear-window, electric **1 - Available with Fleet and Government sales order types only.**	A	■	A[1]
AU3		**Door locks,** power **1 - Available with Fleet and Government sales order types only.**	A	■	A[1]
B30		**Floor covering,** color-keyed carpeting **1 - May be substituted with (BG9) Floor covering, rubberized vinyl.**	A	□[1]	--
	AU0	**Keyless entry,** remote, includes 2 transmitters, panic button and content theft alarm	--	■	--
	DF5	**Mirror,** inside rearview, electrochromic (light-sensitive auto dimming), 8-point compass and outside temperature indicator	--	■	--
UB0		**Sound system,** ETR AM/FM stereo with CD player, includes seek-and-scan, digital clock, auto-tone control, speed-compensated volume and Radio Data System (RDS) **1 - Requires (AE7) Seats, front 40/20/40 split-bench. - Upgradeable to (UB1) Sound system, ETR AM/FM stereo with CD and cassette player or (UC6) Sound system, ETR AM/FM stereo with 6-disc CD changer. - 4-speakers on Regular Cab and 6-speakers on Extended Cab Models.**	■	□[1]	A
	NP5	**Steering wheel,** leather-wrapped rim, Black, includes theft-deterrent locking feature	--	■	--
	A31	**Windows,** power, includes driver and passenger express-down	--	■	--
	DL8	**Mirrors,** outside rearview, manual folding, power, heated, Black **1 - Upgradeable to (DPF) Mirrors, outside rearview, power, heated, camper-style.**	--	□[1]	--
	P06	**Wheels,** 6 - 16" x 6.5" (40.6 cm x 16.5 cm) 8-lug steel, with bright metal rings and chrome center caps and steel spare	■	■	--

S = Standard Equipment A = Available -- (dashes) = Not Available
■ = Included in Equipment Group □ = Included in Equipment Group but upgradeable

No deletions allowed to Equipment Groups. Additional options may be added; check ordering information section for compatibility.

*Indicates availability of feature on multiple models. For example, it indicates feature availability on 2WD and 4WD Models or Rear wheel drive and All-wheel drive Models.

Codes listed in the shaded column titled Ref. Only RPO Code are for internal use only and should not be ordered.

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.	Reg. and Ext. Cab Base 1SA[1]	 LS 1SB[1]	 Work Truck 1SW[1]
	DK7	**Console,** overhead mini, includes map lights	--	■	--
K34		**Cruise control**, electronic with set and resume speed, includes telltale in instrument panel cluster	■	■	A
C49		**Defogger,** rear-window, electric **1 - Available with Fleet and Government sales order types only.**	A	■	A[1]
AU3		**Door locks,** power **1 - Available with Fleet and Government sales order types only.**	A	■	A[1]
B30		**Floor covering,** color-keyed carpeting **1 - May be substituted with (BG9) Floor covering, rubberized vinyl.**	A	□[1]	--
	AU0	**Keyless entry,** remote, includes 2 transmitters, panic button and content theft alarm	--	■	--
	DF5	**Mirror,** inside rearview, electrochromic (light-sensitive auto dimming), 8-point compass and outside temperature indicator	--	■	--
UB0		**Sound system,** ETR AM/FM stereo with CD player, includes seek-and-scan, digital clock, auto-tone control, speed-compensated volume and Radio Data System (RDS) **1 - Requires (AE7) Seats, front 40/20/40 split-bench. - Upgradeable to (UB1) Sound system, ETR AM/FM stereo with CD and cassette player or (UC6) Sound system, ETR AM/FM stereo with 6-disc CD changer. - 4-speakers on Regular Cab and 6-speakers on Extended Cab Models.**	■	□[1]	A
	NP5	**Steering wheel,** leather-wrapped rim, Black, includes theft-deterrent locking feature	--	■	--
	A31	**Windows,** power, includes driver and passenger express-down	--	■	--
	DL8	**Mirrors,** outside rearview, manual folding, power, heated, Black **1 - Upgradeable to (DPF) Mirrors, outside rearview, power, heated, camper-style.**	--	□[1]	--
	P06	**Wheels,** 6 - 16" x 6.5" (40.6 cm x 16.5 cm) 8-lug steel, with bright metal rings and chrome center caps and steel spare	■	■	--

ADDITIONAL OPTIONS

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.	Reg. and Ext. Cab Base 1SA[1]	 LS 1SB[1]	 Work Truck 1SW[1]
C42		**Air conditioning delete**, provides heater only **1 - Requires Regular Cab Models.**	--	--	A[1]

ADDITIONAL OPTIONS					
Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.	Reg. and Ext. Cab		
			Base 1SA[1]	LS 1SB[1]	Work Truck 1SW[1]
CJ2		**Air conditioning,** dual-zone, automatic, individual climate settings for driver and right front passenger **1 - Requires Extended Cab Models. - Not available with (VYU) Snow Plow Prep Package.**	--	A[1]	--
K34		**Cruise control**, electronic with set and resume speed, includes telltale in instrument panel cluster	■	■	A
C49		**Defogger,** rear-window, electric **1 - Available with Fleet and Government sales order types only.**	A	■	A[1]
AU3		**Door locks,** power **1 - Available with Fleet and Government sales order types only.**	A	■	A[1]
BG9		**Floor covering,** rubberized vinyl, Black **1 - Not available with (922) Medium Gray Leather Interior Trim.**	S	A[1]	S
B30		**Floor covering,** color-keyed carpeting **1 - May be substituted with (BG9) Floor covering, rubberized vinyl.**	A	□[1]	--
UE1		**OnStar**, 1-year Safe and Sound Service, includes automatic notification of air bag deployment, stolen vehicle tracking, emergency services, roadside assistance, remote door unlock, remote horn and lights, GM Goodwrench remote diagnostics, AccidentAssist and online concierge. Drivers can also obtain the available voice-activated, hands-free Personal Calling service and Virtual Advisor that provides location-based traffic and weather reports and other personalized information **1 - Requires (UK3) Sound system feature, steering wheel mounted radio controls. Visit www.onstar.com for system information and details. Not available with a ship-to of Puerto Rico or the Virgin Islands.**	--	A[1]	--
A95		**Seats,** front reclining buckets, dual adjustable head restraints, (AG1) Seat adjuster, power driver 6-way, passenger manual recline, inboard armrests, and storage pockets **1 - Not available with Regular Cab Models or (UB0) Sound system, ETR AM/FM stereo with CD player. - Requires (MT1) Transmission, 4-speed automatic, heavy-duty or (M74) Transmission, Allison 1000 5-speed automatic. - With 4WD Models, requires (NP1) Transfer case, electronic shift.**	--	A[1]	--
AG1		**Seat adjuster,** power, driver 6-way **1 - Included with (A95) Seats, front reclining buckets. - Included with (**2) Seat trim, Leather seating surfaces on Extended Cab Models.**	--	A[1]	--
UB0		**Sound system,** ETR AM/FM stereo with CD player, includes seek-and-scan, digital clock, auto-tone control, speed-compensated volume and Radio Data System (RDS) **1 - Requires (AE7) Seats, front 40/20/40 split-bench. - Upgradeable to (UB1) Sound system, ETR AM/FM stereo with CD and cassette player or (UC6) Sound system, ETR AM/FM stereo with 6-disc CD changer. - 4-speakers on Regular Cab and 6-speakers on Extended Cab Models.**	■	□[1]	A

ADDITIONAL OPTIONS					
Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.	Reg. and Ext. Cab		
			Base 1SA[1]	LS 1SB[1]	Work Truck 1SW[1]
UB1		**Sound system,** ETR AM/FM stereo with CD and cassette player, includes seek-and-scan, digital clock, auto-tone control, speed-compensated volume, TheftLock, Radio Data System (RDS) and 4-speakers on Regular Cab and 6-speakers on Extended Cab Models (with bucket seats UB1 includes Bose speaker system, Bose amplifier and Bose subwoofer)	--	A	--
UC6		**Sound system,** ETR AM/FM stereo with 6-disc CD changer, includes seek-and-scan, digital clock, auto-tone control, speed-compensated volume, TheftLock, Radio Data System (RDS), and Bose speaker system (includes 6-speakers, Bose amplifier and Bose Subwoofer) **1 - Requires (A95) Seats, front reclining buckets.**	--	A[1]	--
U2K		**Sound system feature,** XM Satellite Radio. 100% commercial-free music. Over 120 channels. In-depth local traffic and weather in major metro markets. Digital quality sound with coast-to-coast signal coverage. 3-month trial - no charge and no obligation. **1 - Subscription fees apply. Available only in the 48 contiguous U.S.**	--	A[1]	--
UK3		**Sound system feature,** steering wheel mounted radio controls, Radio and Driver Information Center (DIC). Provides access to enhanced Driver Information Center (DIC) features and information	--	A	--
T96		**Fog lamps,** front, halogen **1 - Requires (V76) Recovery hooks, front frame-mounted. Not available with 4WD Models.**	--	A[1]	--
AJ1		**Glass,** Solar-Ray deep tinted (all windows except light tinted glass on windshield, driver and front passenger)	A	A	A
DF2		**Mirrors,** outside rearview, foldaway, manual, camper-style, manual, Black, high visibility, extendable, includes dual segment mirror on driver's side that provides enhanced wide angle capacity (not recommended for bodies or trailers wider than 86" [218.4 cm])	A	--	A
DPF		**Mirrors,** outside rearview, power, heated, camper-style, includes power extending arms and turn signal in glass	--	A	--
DG5		**Mirrors,** outside rearview, right-hand and left-hand, West Coast-type, Black (7" wide x 16" high) (shipped loose for dealer installation)	A	--	A
V76		**Recovery hooks,** front, frame-mounted **1 - Standard with 4WD Models only.**	A[1]	A[1]	A[1]
XYK		**Tires,** LT215/85R16D, all-season, blackwall **1 - Requires and standard on CC36003, CC36053, CC36403 or CK36003 Models. - Not available with (VYU) Snow Plow Prep Package on CK36003 Model. - Includes 6 tires.**	A[1]	A[1]	A[1]
XYL		**Tires,** LT215/85R16D, on-/off-road, blackwall **1 - Not available for remainder of model year effective with production beginning November 8th. Please order XEF/ZEF as needed.**	A[1]	A[1]	A[1]

ADDITIONAL OPTIONS					
Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.	Reg. and Ext. Cab		
			Base 1SA[1]	LS 1SB[1]	Work Truck 1SW[1]
XEC		**Tires,** LT215/85R16E, all-season, blackwall **1 - Requires and standard on CK36003 and (VYU) Snow Plow Prep Package, CK36053 or CK36403 Models.- Includes 6 tires.**	A[1]	A[1]	A[1]
XEF		**Tires,** LT215/85R16E, on-/off-road, blackwall **1 - Includes 6 tires.**	A[1]	A[1]	A[1]
ZYK		**Tire,** spare LT215/85R16D, all-season, blackwall, located at rear underbody of vehicle **1 - Requires CC36003, CC36053, CC36403 or CK36003 Models and (XYK) Tires. - Not available with (VYU) Snow Plow Prep Package on CK36003 Models.**	A[1]	A[1]	A[1]
ZYL		**Tire,** spare LT215/85R16D, on-/off-road, blackwall **1 - Not available for remainder of model year effective with production beginning November 8th. Please order XEF/ZEF as needed.**	A[1]	A[1]	A[1]
ZEC		**Tire,** spare LT215/85R16E, all-season, blackwall, located at rear underbody of vehicle **1 - Requires CK36003 and (VYU) Snow Plow Prep Package, CK36053 or CK36403 Models and (XEC) Tires.**	A[1]	A[1]	A[1]
ZEF		**Tire,** spare LT215/85R16E, on-/off-road, blackwall, located at rear underbody of vehicle **1 - Requires (XEF) Tires, LT215/85R16E, on-/off-road, blackwall.**	A[1]	A[1]	A[1]
K47		**Air cleaner,** high-capacity **1 - Included with (LLY) Engine, Duramax 6600 Turbo Diesel V8. - Included with (VYU) Snow Plow Prep Package.**	A[1]	A[1]	A[1]
KL5		**Alternative fuel conversions,** conversion-ready engine, includes internal modifications for operation with natural or propane gas **1 - Requires (LQ4) Engine, Vortec 6000 V8 SFI and (MT1) Transmission, 4-speed automatic, heavy-duty.**	A[1]	A[1]	A[1]
TP2		**Battery,** auxiliary heavy-duty, 600 cold-cranking amps, includes rundown protection and retained accessory power **1 - Not available with (LLY) Engine, Duramax 6600 Turbo Diesel V8.**	A[1]	A[1]	A[1]
		Cooling, internal transmission oil cooler, water-to-oil, integral to driver side of radiator tank **1 - Included and only available with (MT1) Transmission, 4-speed automatic, heavy-duty or (M74) Transmission, Allison 1000 5-speed automatic.**	A[1]	A[1]	A[1]
G80		**Differential,** locking, heavy-duty, rear	A	A	A
FE9		**Emissions,** Federal requirements	A	A	A
YF5		**Emissions,** California state requirements	A	A	A
NE1		**Emissions,** Maine, Massachusetts, New York or Vermont state requirements	A	A	A

ADDITIONAL OPTIONS					
Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.	Reg. and Ext. Cab		
			Base 1SA[1]	LS 1SB[1]	Work Truck 1SW[1]
VCL		**Emissions Certification,** CFF (Clean Fuel Fleet) LEV (Low Emission Vehicle). Option (VCL) should ONLY be ordered to receive the CFF LEV certification. If (VCL) is not ordered, the vehicle will be produced with your normally selected emission system and may not be CFF LEV certified. Products ordered with the (VCL) option may not be certified to California emission requirements. Therefore, they may not be legal for registration in California, New York, Maine, Massachusetts and Vermont. Option (YF5) should be ordered for all vehicles ordered in California. Option (NE1) should be ordered for all vehicles ordered in Maine or Vermont.	A	A	A
NB8		**Emissions override,** California, Massachusetts or New York (for vehicles ordered by dealers in states of California, Massachusetts or New York with Federal emissions) **1 - Requires (FE9) Emissions, Federal requirements.**	A[1]	A[1]	A[1]
NC7		**Emissions override,** Federal (for vehicles ordered by dealers in Federal emission states with California, New York, Vermont, Massachusetts or Maine emissions; may also be used by dealers in states of California, New York, Vermont, Massachusetts or Maine to order different state-specific emissions) **1 - Requires (YF5) Emissions, California state requirements or (NE1) Emissions, New York, Vermont, Massachusetts or Maine state requirements.**	A[1]	A[1]	A[1]
K05		**Engine block heater** **1 - Included with (LLY) Engine, Duramax 6600 Turbo Diesel V8.**	A[1]	A[1]	A[1]
L18		**Engine,** Vortec 8100 V8 SFI (330 HP [245.8 kW] @ 4200 rpm, 450 lb.-ft. [607.5 N-m] @ 3200 rpm)	A	A	A
LLY		**Engine,** Duramax 6600 Turbo Diesel V8, (with Manual Transmissions 300 HP [223.8 kW] @ 3000 rpm, 520 lb.-ft. [702.0 N-m] @ 1600 rpm) (with Automatic Transmissions 310 HP [231.2 kW] @ 3000 rpm, 605 lb.-ft. [816.8 N-m] @ 1600 rpm) **1 - Includes (TQ3) Battery, heavy-duty dual 770 cold-cranking amps, (K05) Engine block heater, and (K47) Air cleaner, high capacity.**	A[1]	A[1]	A[1]
V10		**Covers,** radiator grille and front bumper openings, for diesel engines in winter weather **1 - Requires (LLY) Engine, Duramax 6600 Turbo Diesel V8, will be required on orders with "Ship To" locations within the following states: Maine, New Hampshire, Vermont, Minnesota, North Dakota, South Dakota, Montana, Alaska, Idaho, Wisconsin, Wyoming, Michigan, Colorado and New York.**	A[1]	A[1]	A[1]
NQZ		**Fuel tank delete,** rear (deletes 18 gallons [68.1L] rear fuel tank, leaves 32 gallons [121.1L] front fuel tank)	A	A	A
PDN		**Heavy-Duty Power Package,** includes (LLY) Engine, Duramax 6600 Turbo Diesel V8, (M74) Transmission, Allison 1000 5-speed automatic and (G80) Differential, locking, heavy-duty, rear	A	A	A
R6Y		**Heavy-Duty Power Package discount not desired**	A	A	A

ADDITIONAL OPTIONS					
Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.	Reg. and Ext. Cab		
			Base 1SA[1]	LS 1SB[1]	Work Truck 1SW[1]
GT4		**Rear axle,** 3.73 ratio **1 - Refer to Engine/Axle chart for availability.**	A[1]	A[1]	A[1]
GTY		**Rear axle,** wide-track **1 - Increases axle 8" to 74" wide.**	A[1]	A[1]	A[1]
NZZ		**Skid Plate Package**, includes aluminum front underbody shield starting behind front bumper and running to 1st cross-member, protecting front underbody, oil pan, differential case and transfer case, frame-mounted shields **1 - Requires 4WD Models. - Included with (VYU) Snow Plow Prep Package.**	A[1]	A[1]	A[1]
VYU		**Snow Plow Prep Package**, includes 10-amp power for backup and roof emergency light, 145-amp alternator, high-flow front bumper, forward lamp wiring harness, 1.65" (42 mm) access hole with grommet in front of dash panel, instrument panel jumper wiring harness for electric trailer brake controller, (K47) Air cleaner, high capacity and (NZZ) Skid Plate Package **1 - Requires 4WD Models. - With CK36003 requires (XEC) Tires, LT215/85R16E, all-season, blackwall or (XEF) Tires, LT215/85R16E, on-/off-road, blackwall. - With CK36053 or CK36403 Models, requires (LQ4) Engine, Vortec 6000 V8 SFI or (L18) Engine, Vortec 8100 V8 SFI. - Not available with (CJ2) Air conditioning, dual-zone, automatic.**	A[1]	A[1]	A[1]
NP1		**Transfer case,** electronic shift, includes push-button controls **1 - Requires 4WD Models. - Requires (MT1) Transmission, heavy-duty 4-speed automatic or (M74) Transmission, Allison 1000 5-speed automatic.**	--	A[1]	--
MW3		**Transmission,** 5-speed manual with overdrive **1 - Requires (LQ4) Engine, Vortec 6000 V8 SFI and (AE7) Seats, front 40/20/40 split-bench. - Standard transmission.**	A[1]	A[1]	A[1]
MT1		**Transmission,** 4-speed automatic, heavy-duty, electronically controlled with overdrive, tow/haul mode and (KNP) Cooling, external transmission oil cooler **1 - Requires (LQ4) Engine, Vortec 6000 V8 SFI.**	A[1]	A[1]	A[1]
ML6		**Transmission,** 6-speed manual, heavy-duty with overdrive **1 - Requires (AE7) Seats, front 40/20/40 split-bench and (LLY) Engine, Duramax 6600 Turbo Diesel V8 or (L18) Engine, Vortec 8100 V8 SFI.**	A[1]	A[1]	A[1]
M74		**Transmission,** Allison 1000 5-speed automatic, electronically controlled with overdrive, tow/haul mode, (KNP) Cooling, external transmission oil cooler and electronic engine grade braking **1 - Requires (LLY) Engine, Duramax 6600 Turbo Diesel V8 or (L18) Engine, Vortec 8100 V8 SFI.**	A[1]	A[1]	A[1]

2005 Chevrolet Truck Silverado 3500 PEG STAIRSTEP CC

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*Indicates availability of feature on multiple models. For example, it indicates feature availability on 2WD and 4WD Models or Rear wheel drive and All-wheel drive Models.

Codes listed in the shaded column titled Ref. Only RPO Code are for internal use only and should not be ordered.

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.	Reg. and Ext. Cab		
			Base 1SA[1]	LS 1SB[1]	Work Truck 1SW[1]
K34		**Cruise control**	■	■	
UB0		**Sound system,** ETR AM/FM stereo with CD player **1 - Requires (AE7) Seats, front 40/20/40 split-bench. - Upgradeable to (UB1) Sound system, ETR AM/FM stereo with CD and cassette player or (UC6) Sound system, ETR AM/FM stereo with 6-disc CD changer. - 4-speakers on Regular Cab and 6-speakers on Extended Cab Models.**	■	□[1]	
	P06	**Wheels,** 6 - 16" x 6.5" (40.6 cm x 16.5 cm) 8-lug steel	■	■	
	DK7	**Console,** overhead mini		■	
C49		**Defogger,** rear-window, electric		■	
AU3		**Door locks,** power		■	
B30		**Floor covering,** color-keyed carpeting **1 - May be substituted with (BG9) Floor covering, rubberized vinyl.**		□[1]	
	AU0	**Keyless entry,** remote		■	
	DF5	**Mirror,** inside rearview		■	
	DL8	**Mirrors,** outside rearview, manual folding, power, heated, Black **1 - Upgradeable to (DPF) Mirrors, outside rearview, power, heated, camper-style.**		□[1]	
	NP5	**Steering wheel,** leather-wrapped rim		■	
	A31	**Windows,** power		■	

S = Standard Equipment A = Available -- (dashes) = Not Available
■ = Included in Equipment Group □ = Included in Equipment Group but upgradeable

*Indicates availability of feature on multiple models. For example, it indicates feature availability on 2WD and 4WD Models or Rear wheel drive and All-wheel drive Models.

Codes listed in the shaded column titled Ref. Only RPO Code are for internal use only and should not be ordered.

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.	Reg. and Ext. Cab		
			Base 1SA[1]	LS 1SB[1]	Work Truck 1SW[1]
		Air bags, frontal, driver and right front passenger, includes passenger side deactivation switch **1 - Always use safety belts and proper child restraints, even with air bags. Children are safer when properly secured in a rear seat. See the Owner's Manual for more safety information.**	S[1]	S[1]	S[1]
	CJ3	**Air conditioning,** dual-zone, manual, individual climate settings for driver and right front passenger	S	S	S
C42		**Air conditioning delete**, provides heater only **1 - Requires Regular Cab Models.**	--	--	A[1]
CJ2		**Air conditioning,** dual-zone, automatic, individual climate settings for driver and right front passenger **1 - Requires Extended Cab Models. - Not available with (VYU) Snow Plow Prep Package.**	--	A[1]	--
		Assist handle, front passenger **1 - Also includes rear outboard passenger assist handle on Extended Cab Models.**	S[1]	S[1]	S[1]
		Cigarette lighter, on instrument panel	S	S	S
		Coat hook, driver side **1 - Also includes passenger side coat hook on Extended Cab Models.**	S[1]	S[1]	S[1]
	D07	**Console,** floor, includes storage compartment and dual cupholders **1 - Included and only available with (A95) Seats, front reclining buckets.**	--	A[1]	--
	DK7	**Console,** overhead mini, includes map lights	--	■	--
K34		**Cruise control**, electronic with set and resume speed, includes telltale in instrument panel cluster	■	■	A
		Cupholders, front **1 - Also includes rear cupholders on Extended Cab Models.**	S[1]	S[1]	S[1]
C49		**Defogger,** rear-window, electric **1 - Available with Fleet and Government sales order types only.**	A	■	A[1]
AU3		**Door locks,** power **1 - Available with Fleet and Government sales order types only.**	A	■	A[1]
		Driver Information Center, monitors numerous systems depending on vehicle equipment	S	S	S
BG9		**Floor covering,** rubberized vinyl, Black **1 - Not available with (922) Medium Gray Leather Interior Trim.**	S	A[1]	S
B30		**Floor covering,** color-keyed carpeting **1 - May be substituted with (BG9) Floor covering, rubberized vinyl.**	A	□[1]	--

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.	Reg. and Ext. Cab		
			Base 1SA[1]	LS 1SB[1]	Work Truck 1SW[1]
		Instrumentation, analog, includes speedometer, odometer with trip odometer, fuel level, voltmeter, engine temperature, oil pressure and tachometer	S	S	S
	AU0	**Keyless entry,** remote, includes 2 transmitters, panic button and content theft alarm	--	■	--
		Lighting, dome lamp, reading, backlit instrument panel switches and door handle-activated illuminated entry	S	S	S
		Mirror, inside rearview, manual day/night	S	--	S
	DF5	**Mirror,** inside rearview, electrochromic (light-sensitive auto dimming), 8-point compass and outside temperature indicator	--	■	--
UE1		**OnStar**, 1-year Safe and Sound Service, includes automatic notification of air bag deployment, stolen vehicle tracking, emergency services, roadside assistance, remote door unlock, remote horn and lights, GM Goodwrench remote diagnostics, AccidentAssist and online concierge. Drivers can also obtain the available voice-activated, hands-free Personal Calling service and Virtual Advisor that provides location-based traffic and weather reports and other personalized information **1 - Requires (UK3) Sound system feature, steering wheel mounted radio controls. Visit www.onstar.com for system information and details. Not available with a ship-to of Puerto Rico or the Virgin Islands.**	--	A[1]	--
		Power outlets, auxiliary, covered, 2 dash-mounted, 12-volt	S	S	S
	**V	**Seat trim,** vinyl	S	--	S
	**C	**Seat trim,** cloth	A	--	A
	**D	**Seat trim,** Custom Cloth	--	S	--
	**2	**Seat trim,** leather **1 - Not available with Regular Cab Models. - Extended Cab includes front leather seating surfaces with rear vinyl bench.**	--	A[1]	--
	AE7	**Seats,** front 40/20/40 split-bench, 3-passenger, driver and passenger manual reclining with outboard head restraints	S	--	S
	AE7	**Seats,** front 40/20/40 split-bench, 3-passenger, driver and passenger manual reclining, center fold-down armrest with storage, adjustable outboard head restraints and storage pockets on Extended Cab Models **1 - Not available with (UC6) Sound system, ETR AM/FM stereo with 6-disc CD changer.**	--	S[1]	--
A95		**Seats,** front reclining buckets, dual adjustable head restraints, (AG1) Seat adjuster, power driver 6-way, passenger manual recline, inboard armrests, and storage pockets **1 - Not available with Regular Cab Models or (UB0) Sound system, ETR AM/FM stereo with CD player. - Requires (MT1) Transmission, 4-speed automatic, heavy-duty or (M74) Transmission, Allison 1000 5-speed automatic. - With 4WD Models, requires (NP1) Transfer case, electronic shift.**	--	A[1]	--

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.	Reg. and Ext. Cab		
			Base 1SA[1]	LS 1SB[1]	Work Truck 1SW[1]
		Seat, rear bench, folding, 3-passenger (includes child seat top tether anchor) **1 - Standard with Extended Cab Models only.**	S[1]	S	S[1]
AG1		**Seat adjuster,** power, driver 6-way **1 - Included with (A95) Seats, front reclining buckets. - Included with (**2) Seat trim, Leather seating surfaces on Extended Cab Models.**	--	A[1]	--
	UM7	**Sound system,** ETR AM/FM stereo, includes seek-and-scan and digital clock	--	--	S
UB0		**Sound system,** ETR AM/FM stereo with CD player, includes seek-and-scan, digital clock, auto-tone control, speed-compensated volume and Radio Data System (RDS) **1 - Requires (AE7) Seats, front 40/20/40 split-bench. - Upgradeable to (UB1) Sound system, ETR AM/FM stereo with CD and cassette player or (UC6) Sound system, ETR AM/FM stereo with 6-disc CD changer. - 4-speakers on Regular Cab and 6-speakers on Extended Cab Models.**	■	□[1]	A
UB1		**Sound system,** ETR AM/FM stereo with CD and cassette player, includes seek-and-scan, digital clock, auto-tone control, speed-compensated volume, TheftLock, Radio Data System (RDS) and 4-speakers on Regular Cab and 6-speakers on Extended Cab Models (with bucket seats UB1 includes Bose speaker system, Bose amplifier and Bose subwoofer)	--	A	--
UC6		**Sound system,** ETR AM/FM stereo with 6-disc CD changer, includes seek-and-scan, digital clock, auto-tone control, speed-compensated volume, TheftLock, Radio Data System (RDS), and Bose speaker system (includes 6-speakers, Bose amplifier and Bose Subwoofer) **1 - Requires (A95) Seats, front reclining buckets.**	--	A[1]	--
	UQ5	**Sound system feature,** 4-speakers	S	--	S
U2K		**Sound system feature,** XM Satellite Radio. 100% commercial-free music. Over 120 channels. In-depth local traffic and weather in major metro markets. Digital quality sound with coast-to-coast signal coverage. 3-month trial - no charge and no obligation. **1 - Subscription fees apply. Available only in the 48 contiguous U.S.**	--	A[1]	--
UK3		**Sound system feature,** steering wheel mounted radio controls, Radio and Driver Information Center (DIC). Provides access to enhanced Driver Information Center (DIC) features and information	--	A	--
		Steering column, Tilt-Wheel, adjustable, includes brake/transmission shift interlock	S	S	S
		Steering wheel, includes theft-deterrent locking feature	S	--	S
	NP5	**Steering wheel,** leather-wrapped rim, Black, includes theft-deterrent locking feature	--	■	--
		Theft-deterrent system, PASSlock II	S	S	S
		Tools, mechanical jack and wheel wrench, spare tire assist hook, floor-mounted in back of cab	S	S	S

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.	Reg. and Ext. Cab		
			Base 1SA[1]	LS 1SB[1]	Work Truck 1SW[1]
		Visors, padded, Shale-colored, driver and passenger side with cloth trim, extenders, pocket on driver side and vanity mirror on passenger side	S	S	S
		Warning tones, headlamp on, key-in-ignition, driver and passenger buckle up reminder, turn signal on	S	S	S
	A31	**Windows,** power, includes driver and passenger express-down	--	■	--
		Windows, rear quarter swing-out **1 - Standard with Extended Cab Models only.**	S[1]	S[1]	S[1]

S = Standard Equipment A = Available -- (dashes) = Not Available
■ = Included in Equipment Group □ = Included in Equipment Group but upgradeable

*Indicates availability of feature on multiple models. For example, it indicates feature availability on 2WD and 4WD Models or Rear wheel drive and All-wheel drive Models.

Codes listed in the shaded column titled Ref. Only RPO Code are for internal use only and should not be ordered.

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.	Reg. and Ext. Cab		
			Base 1SA[1]	LS 1SB[1]	Work Truck 1SW[1]
		Air dam, Gray	S	S	S
	ZW9	**Body,** Chassis Cab	S	S	S
	VG3	**Bumper,** front, chrome, with Gray lower	S	S	S
		Daytime running lamps, includes automatic exterior lamp control	S	S	S
T96		**Fog lamps,** front, halogen **1 - Requires (V76) Recovery hooks, front frame-mounted. Not available with 4WD Models.**	--	A[1]	--
		Glass, Solar-Ray light tinted, all windows	S	S	S
AJ1		**Glass,** Solar-Ray deep tinted (all windows except light tinted glass on windshield, driver and front passenger)	A	A	A
	TR3	**Grille,** color-keyed surround, with chrome accent bar	S	S	S
		Headlamps, dual halogen composite, includes flash-to-pass feature and automatic lamp control	S	S	S
	U01	**Lamps,** amber roof marker	S	S	S
	TS9	**Lamp,** center high-mounted stop/brake (CHMSL) delete and cargo area, delete **1 - Standard with 4WD Models only.**	S[1]	S[1]	S[1]
	D44	**Mirrors,** outside rearview, foldaway, manual, Black, adjustable	S	--	S
DF2		**Mirrors,** outside rearview, foldaway, manual, camper-style, manual, Black, high visibility, extendable, includes dual segment mirror on driver's side that provides enhanced wide angle capacity (not recommended for bodies or trailers wider than 86" [218.4 cm])	A	--	A
	DL8	**Mirrors,** outside rearview, manual folding, power, heated, Black **1 - Upgradeable to (DPF) Mirrors, outside rearview, power, heated, camper-style.**	--	□[1]	--
DPF		**Mirrors,** outside rearview, power, heated, camper-style, includes power extending arms and turn signal in glass	--	A	--
DG5		**Mirrors,** outside rearview, right-hand and left-hand, West Coast-type, Black (7" wide x 16" high) (shipped loose for dealer installation)	A	--	A
	ZY1	**Paint,** solid	S	S	S
V76		**Recovery hooks,** front, frame-mounted **1 - Standard with 4WD Models only.**	A[1]	A[1]	A[1]

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.	Reg. and Ext. Cab		
			Base 1SA[1]	LS 1SB[1]	Work Truck 1SW[1]
XYK		**Tires,** LT215/85R16D, all-season, blackwall **1 - Requires and standard on CC36003, CC36053, CC36403 or CK36003 Models. - Not available with (VYU) Snow Plow Prep Package on CK36003 Model. - Includes 6 tires.**	A[1]	A[1]	A[1]
XYL		**Tires,** LT215/85R16D, on-/off-road, blackwall **1 - Not available for remainder of model year effective with production beginning November 8th. Please order XEF/ZEF as needed.**	A[1]	A[1]	A[1]
XEC		**Tires,** LT215/85R16E, all-season, blackwall **1 - Requires and standard on CK36003 and (VYU) Snow Plow Prep Package, CK36053 or CK36403 Models.- Includes 6 tires.**	A[1]	A[1]	A[1]
XEF		**Tires,** LT215/85R16E, on-/off-road, blackwall **1 - Includes 6 tires.**	A[1]	A[1]	A[1]
ZYK		**Tire,** spare LT215/85R16D, all-season, blackwall, located at rear underbody of vehicle **1 - Requires CC36003, CC36053, CC36403 or CK36003 Models and (XYK) Tires. - Not available with (VYU) Snow Plow Prep Package on CK36003 Models.**	A[1]	A[1]	A[1]
ZYL		**Tire,** spare LT215/85R16D, on-/off-road, blackwall **1 - Not available for remainder of model year effective with production beginning November 8th. Please order XEF/ZEF as needed.**	A[1]	A[1]	A[1]
ZEC		**Tire,** spare LT215/85R16E, all-season, blackwall, located at rear underbody of vehicle **1 - Requires CK36003 and (VYU) Snow Plow Prep Package, CK36053 or CK36403 Models and (XEC) Tires.**	A[1]	A[1]	A[1]
ZEF		**Tire,** spare LT215/85R16E, on-/off-road, blackwall, located at rear underbody of vehicle **1 - Requires (XEF) Tires, LT215/85R16E, on-/off-road, blackwall.**	A[1]	A[1]	A[1]
		Wheels, 6 - 16" x 6.5" (40.6 cm x 16.5 cm) 8-lug steel, painted (dual rear), includes painted center caps and steel spare	--	--	S
	P06	**Wheels,** 6 - 16" x 6.5" (40.6 cm x 16.5 cm) 8-lug steel, with bright metal rings and chrome center caps and steel spare	■	■	--
	B71	**Wheel flares,** front only	S	S	S
		Wipers, intermittent, front, wet-arm with pulse washers	S	S	S

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*Indicates availability of feature on multiple models. For example, it indicates feature availability on 2WD and 4WD Models or Rear wheel drive and All-wheel drive Models.

Codes listed in the shaded column titled Ref. Only RPO Code are for internal use only and should not be ordered.

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.	Reg. and Ext. Cab		
			Base 1SA[1]	LS 1SB[1]	Work Truck 1SW[1]
K47		**Air cleaner,** high-capacity **1 - Included with (LLY) Engine, Duramax 6600 Turbo Diesel V8. - Included with (VYU) Snow Plow Prep Package.**	A[1]	A[1]	A[1]
KL5		**Alternative fuel conversions,** conversion-ready engine, includes internal modifications for operation with natural or propane gas **1 - Requires (LQ4) Engine, Vortec 6000 V8 SFI and (MT1) Transmission, 4-speed automatic, heavy-duty.**	A[1]	A[1]	A[1]
	K68	**Alternator,** 105 amps **1 - Not available with (VYU) Snow Plow Prep Package.**	S[1]	S[1]	S[1]
	KG3	**Alternator,** 145 amps **1 - Included and only available with (VYU) Snow Plow Prep Package.**	A[1]	A[1]	A[1]
		Battery, heavy-duty, 600 cold-cranking amps, includes rundown protection and retained accessory power **1 - Not standard with (LLY) Engine, Duramax 6600 Turbo Diesel V8.**	S[1]	S[1]	S[1]
TP2		**Battery,** auxiliary heavy-duty, 600 cold-cranking amps, includes rundown protection and retained accessory power **1 - Not available with (LLY) Engine, Duramax 6600 Turbo Diesel V8.**	A[1]	A[1]	A[1]
	TQ3	**Battery,** heavy-duty dual, 770 cold-cranking amps, includes rundown protection and retained accessory power **1 - Included and only available with (LLY) Engine, Duramax 6600 Turbo Diesel V8.**	A[1]	A[1]	A[1]
		Brakes, 4-wheel antilock, 4-wheel disc	S	S	S
	KC4	**Cooling,** external engine oil cooler, heavy-duty air-to-oil, integral to driver side of radiator tank	S	S	S
	KNP	**Cooling,** external transmission oil cooler, auxiliary, heavy-duty air-to-oil **1 - Included and only available with (MT1) Transmission, 4-speed automatic, heavy-duty or (M74) Transmission, Allison 1000 5-speed automatic.**	A[1]	A[1]	A[1]
		Cooling, internal transmission oil cooler, water-to-oil, integral to driver side of radiator tank **1 - Included and only available with (MT1) Transmission, 4-speed automatic, heavy-duty or (M74) Transmission, Allison 1000 5-speed automatic.**	A[1]	A[1]	A[1]
G80		**Differential,** locking, heavy-duty, rear	A	A	A
FE9		**Emissions,** Federal requirements	A	A	A
YF5		**Emissions,** California state requirements	A	A	A
NE1		**Emissions,** Maine, Massachusetts, New York or Vermont state requirements	A	A	A

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.	Reg. and Ext. Cab		
			Base 1SA[1]	LS 1SB[1]	Work Truck 1SW[1]
VCL		**Emissions Certification,** CFF (Clean Fuel Fleet) LEV (Low Emission Vehicle). Option (VCL) should ONLY be ordered to receive the CFF LEV certification. If (VCL) is not ordered, the vehicle will be produced with your normally selected emission system and may not be CFF LEV certified. Products ordered with the (VCL) option may not be certified to California emission requirements. Therefore, they may not be legal for registration in California, New York, Maine, Massachusetts and Vermont. Option (YF5) should be ordered for all vehicles ordered in California. Option (NE1) should be ordered for all vehicles ordered in Maine or Vermont.	A	A	A
NB8		**Emissions override**, California, Massachusetts or New York (for vehicles ordered by dealers in states of California, Massachusetts or New York with Federal emissions) **1 - Requires (FE9) Emissions, Federal requirements.**	A[1]	A[1]	A[1]
NC7		**Emissions override,** Federal (for vehicles ordered by dealers in Federal emission states with California, New York, Vermont, Massachusetts or Maine emissions; may also be used by dealers in states of California, New York, Vermont, Massachusetts or Maine to order different state-specific emissions) **1 - Requires (YF5) Emissions, California state requirements or (NE1) Emissions, New York, Vermont, Massachusetts or Maine state requirements.**	A[1]	A[1]	A[1]
K05		**Engine block heater** **1 - Included with (LLY) Engine, Duramax 6600 Turbo Diesel V8.**	A[1]	A[1]	A[1]
	LQ4	**Engine,** Vortec 6000 V8 SFI (300 HP [223.8 kW] @ 4400 rpm, 360 lb.-ft. [486.6 N-m] @ 4000 rpm)	S	S	S
L18		**Engine,** Vortec 8100 V8 SFI (330 HP [245.8 kW] @ 4200 rpm, 450 lb.-ft. [607.5 N-m] @ 3200 rpm)	A	A	A
LLY		**Engine,** Duramax 6600 Turbo Diesel V8, (with Manual Transmissions 300 HP [223.8 kW] @ 3000 rpm, 520 lb.-ft. [702.0 N-m] @ 1600 rpm) (with Automatic Transmissions 310 HP [231.2 kW] @ 3000 rpm, 605 lb.-ft. [816.8 N-m] @ 1600 rpm) **1 - Includes (TQ3) Battery, heavy-duty dual 770 cold-cranking amps, (K05) Engine block heater, and (K47) Air cleaner, high capacity.**	A[1]	A[1]	A[1]
V10		**Covers,** radiator grille and front bumper openings, for diesel engines in winter weather **1 - Requires (LLY) Engine, Duramax 6600 Turbo Diesel V8, will be required on orders with "Ship To" locations within the following states: Maine, New Hampshire, Vermont, Minnesota, North Dakota, South Dakota, Montana, Alaska, Idaho, Wisconsin, Wyoming, Michigan, Colorado and New York.**	A[1]	A[1]	A[1]
		Exhaust, aluminized stainless-steel muffler and tailpipe	S	S	S
		Frame, ladder-type, hydroformed	S	S	S
NQZ		**Fuel tank delete,** rear (deletes 18 gallons [68.1L] rear fuel tank, leaves 32 gallons [121.1L] front fuel tank)	A	A	A
	C7W	**GVWR,** 11,400 lbs. (5171 kg) **1 - Standard with 2WD Models only.**	S[1]	S[1]	S[1]

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.	Reg. and Ext. Cab		
			Base 1SA[1]	LS 1SB[1]	Work Truck 1SW[1]
	C7L	**GVWR,** 12,000 lbs. (5443 kg) **1 - Standard with 4WD Models only.**	S[1]	S[1]	S[1]
PDN		**Heavy-Duty Power Package,** includes (LLY) Engine, Duramax 6600 Turbo Diesel V8, (M74) Transmission, Allison 1000 5-speed automatic and (G80) Differential, locking, heavy-duty, rear	A	A	A
R6Y		**Heavy-Duty Power Package discount not desired**	A	A	A
GT4		**Rear axle,** 3.73 ratio **1 - Refer to Engine/Axle chart for availability.**	A[1]	A[1]	A[1]
	GT5	**Rear axle,** 4.10 ratio **1 - Refer to Engine/Axle chart for availability.**	S[1]	S[1]	S[1]
GTY		**Rear axle,** wide-track **1 - Increases axle 8" to 74" wide.**	A[1]	A[1]	A[1]
NZZ		**Skid Plate Package**, includes aluminum front underbody shield starting behind front bumper and running to 1st cross-member, protecting front underbody, oil pan, differential case and transfer case, frame-mounted shields **1 - Requires 4WD Models. - Included with (VYU) Snow Plow Prep Package.**	A[1]	A[1]	A[1]
VYU		**Snow Plow Prep Package**, includes 10-amp power for backup and roof emergency light, 145-amp alternator, high-flow front bumper, forward lamp wiring harness, 1.65" (42 mm) access hole with grommet in front of dash panel, instrument panel jumper wiring harness for electric trailer brake controller, (K47) Air cleaner, high capacity and (NZZ) Skid Plate Package **1 - Requires 4WD Models. - With CK36003 requires (XEC) Tires, LT215/85R16E, all-season, blackwall or (XEF) Tires, LT215/85R16E, on-/off-road, blackwall. - With CK36053 or CK36403 Models, requires (LQ4) Engine, Vortec 6000 V8 SFI or (L18) Engine, Vortec 8100 V8 SFI. - Not available with (CJ2) Air conditioning, dual-zone, automatic.**	A[1]	A[1]	A[1]
		Steering, power	S	S	S
		Suspension, front, independent torsion bar, and stabilizer bar	S	S	S
		Suspension, rear, 3-stage springs	S	S	S
	Z85	**Suspension Package,** Handling/Trailering, heavy-duty	S	S	S
	NP2	**Transfer case,** floor-mounted shifter **1 - Standard with 4WD Models. - Requires (AE7) Seats, front 40/20/40 split-bench.**	S[1]	S[1]	S[1]
NP1		**Transfer case,** electronic shift, includes push-button controls **1 - Requires 4WD Models. - Requires (MT1) Transmission, heavy-duty 4-speed automatic or (M74) Transmission, Allison 1000 5-speed automatic.**	--	A[1]	--
MW3		**Transmission,** 5-speed manual with overdrive **1 - Requires (LQ4) Engine, Vortec 6000 V8 SFI and (AE7) Seats, front 40/20/40 split-bench. - Standard transmission.**	A[1]	A[1]	A[1]
MT1		**Transmission,** 4-speed automatic, heavy-duty, electronically controlled with overdrive, tow/haul mode and (KNP) Cooling, external transmission oil cooler **1 - Requires (LQ4) Engine, Vortec 6000 V8 SFI.**	A[1]	A[1]	A[1]

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment groups 1SA, 1SB and 1SW available on C*36003, C*36403 and C*36053 Models.	Reg. and Ext. Cab		
			Base 1SA[1]	LS 1SB[1]	Work Truck 1SW[1]
ML6		**Transmission,** 6-speed manual, heavy-duty with overdrive **1 - Requires (AE7) Seats, front 40/20/40 split-bench and (LLY) Engine, Duramax 6600 Turbo Diesel V8 or (L18) Engine, Vortec 8100 V8 SFI.**	A[1]	A[1]	A[1]
M74		**Transmission,** Allison 1000 5-speed automatic, electronically controlled with overdrive, tow/haul mode, (KNP) Cooling, external transmission oil cooler and electronic engine grade braking **1 - Requires (LLY) Engine, Duramax 6600 Turbo Diesel V8 or (L18) Engine, Vortec 8100 V8 SFI.**	A[1]	A[1]	A[1]

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		Transmissions				Axles		GVWR lbs. (kg)	
Model	**Engine**	**MW3 5-Speed Manual with OD[1]**	**MT1 4-Speed Automatic with OD**	**ML6 6-Speed Manual with OD[1]**	**M74 Allison 5-Speed Automatic with OD**	**GT4 3.73**	**GT5 4.10**	**C7W 11,400 (5171)**	**C7L 12,000 (5443)**
CC363**	LQ4 Vortec 6000 V8 gas	S	A	--	--	--	S	S	--
	L18 Vortec 8100 V8 gas	--	--	A	A	--	S	S	--
	LLY Duramax 6600 Turbo Diesel V8	--	--	A	A	A	--	S	--
CK363**	LQ4 Vortec 6000 V8 gas	S	A	--	--	--	S	--	S
	L18 Vortec 8100 V8 gas	--	--	A	A	--	S	--	S
	LLY Duramax 6600 Turbo Diesel V8	--	--	A	A	A	--	--	S

1 - Not available with (**2) Seat trim, Leather. -Requires (AE7) Seats, front 40/20/40 split-bench.

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■ = Included in Equipment Group □ = Included in Equipment Group but upgradeable

*Indicates availability of feature on multiple models. For example, it indicates feature availability on 2WD and 4WD Models or Rear wheel drive and All-wheel drive Models.

Decor Level	Seat Type	Seat Code	Seat Trim	Interior		
				Dark Charcoal	Tan	Medium Gray
Work Truck/Base	Front 40/20/40 split-bench without armrest	AE7	Vinyl	69V	52V	--
Work Truck/Base	Front 40/20/40 split-bench without armrest	AE7	Cloth	69C	52C	--
LS	Front 40/20/40 reclining split-bench with armrest	AE7	Custom Cloth	69D	52D	--
LS	Front power reclining buckets	A95	Custom Cloth	69D	52D	--
LS	Front 40/20/40 reclining split-bench with armrest	AE7	Custom Leather seating surfaces[1]	692	522	922
LS	Front power reclining buckets	A95	Custom Leather seating surfaces[1]	692	522	922

Exterior Solid Paint	Color Code	Touch Up Paint Number	Interior			Front Wheel Flares Color LS[2]
			Dark Charcoal	Tan	Medium Gray	
Sandstone Metallic	15U	WA-929L	A	A	A	Sandstone Metallic
NEW! Dark Blue Metallic	25U	WA-722J	A	A	A	Black
Black	41U	WA-8555	A	A	A	Black
Dark Green Metallic	47U	WA-9539	A	A	A	Dark Green Metallic
Summit White	50U	WA-8624	A	A	A	Summit White
Silver Birch Metallic	59U	WA-926L	A	--	A	Silver Birch Metallic
Dark Gray Metallic	62U	WA-805K	A	A	A	Dark Grey Metallic
Sport Red Metallic[3]	63U	WA-817K	A	A	A	Black
Victory Red	74U	WA-9260	A	A	A	Black

Above interior trim combinations are the only combinations allowed.
1 - Not available with manual transmissions or Regular Cab Models.
2 - Wheel flares on front wheels only and are Black on Base Models.
3 - Not available on Work Truck or Base Models.

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*Indicates availability of feature on multiple models. For example, it indicates feature availability on 2WD and 4WD Models or Rear wheel drive and All-wheel drive Models.

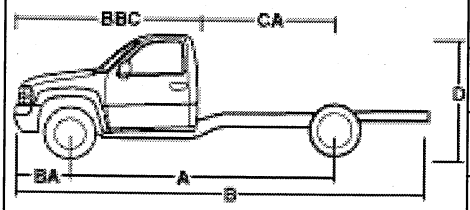
Decor Level	Seat Type	Seat Code	Seat Trim	Interior		
				Dark Charcoal	Tan	Medium Gray
Base	Front 40/20/40 split-bench without armrest	AE7	Vinyl	69V	52V	--
Base	Front 40/20/40 split-bench without armrest	AE7	Cloth	69C	52C	--
LS	Front 40/20/40 reclining split-bench with armrest	AE7	Custom Cloth	69D	52D	--
LS	Front power reclining buckets	A95	Custom Cloth	69D	52D	--
LS	Front 40/20/40 reclining split-bench with armrest	AE7	Custom Leather seat inserts[1]	692	522	922
LS	Front power reclining buckets	A95	Custom Leather seat inserts[1]	692	522	922

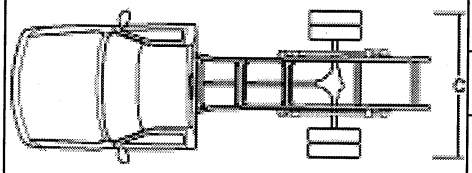
Exterior Solid Paint	Color Code	Touch Up Paint Number	Interior		
			Dark Charcoal	Tan	Medium Gray
Yellow	none	WA-5248	A	A	A
Blue Metallic	none	WA-5405	A	A	A
Yellow	none	WA-5445	A	A	A
Yellow	none	WA-5456	A	A	A
NEW! Blue	none	WA-5663	A	A	A
Green - Low Gloss	none	WA-6237	A	A	A
Tan - Low Gloss	none	WA-6238	A	A	A
NEW! Blue	none	WA-7154	A	A	A
Blue Metallic	none	WA-7159	A	A	A
Gray Metallic	none	WA-7840	A	A	A
Green	none	WA-7941	A	A	A
Green, Woodland	9V5	WA-9015	A	A	A
Doeskin Tan	9V9	WA-9403	A	A	A
Orange	none	WA-9408	A	A	A
Yellow	none	WA-9414	A	A	A
Tangier Orange	9W4	WA-9417	A	A	A
Orange	none	WA-9419	A	A	A
Indigo Blue	none	WA-9792	A	A	A

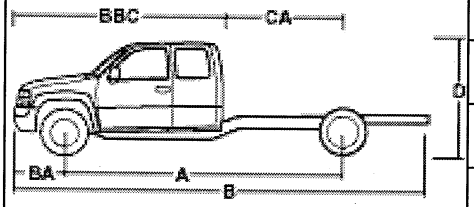
Light Autumnwood Metallic	none	WA-228A	A	A	A
Wheatland Yellow	9W3	WA-253A	A	A	A
Dark Toreador Red	none	WA-334D	A	A	A
Pewter	none	WA-382E	A	A	A
NEW! Blue	none	WA-769H	A	A	A
Orange	none	WA-770H	A	A	A
NEW! Green	none	WA-995L	A	A	--
All wheel flares will be Black. 1 - Not available with manual transmissions or Regular Cab Models.					

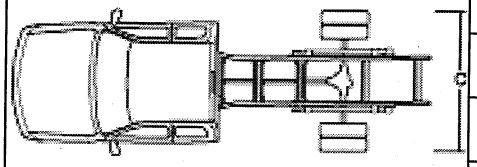
2005 Chevrolet Truck Silverado 3500 CC DIMENSIONS

All dimensions in inches (mm) unless otherwise stated.









	Specifications	Reg. Cab Short Box CC36003	Reg. Cab Short Box CK36003	Reg. Cab Long Box CC36403	Reg. Cab Long Box CK36403	Ext. Cab Short Box CC36053	Ext. Cab Short Box CK36053
A	**Wheelbase**	137.00 (3480)	137.00 (3480)	161.50 (4102)	161.50 (4102)	161.50 (4102)	161.50 (4102)
B	**Overall length**	225.00 (5715)	225.00 (5715)	249.50 (6337)	249.50 (6337)	249.50 (6337)	249.50 (6337)
C	**Body width**	86.00 (2184)	86.00 (2184)	86.00 (2184)	86.00 (2184)	86.00 (2184)	86.00 (2184)
	Body width, with (GTY) Rear axle	93.90 (2385)	93.90 (2385)	93.90 (2385)	93.90 (2385)	93.90 (2385)	93.90 (2385)
D	**Overall height**	76.00 (1930)	76.00 (1930)	76.00 (1930)	76.00 (1930)	76.00 (1930)	76.00 (1930)
	Head room, front	41.10 (1044)	41.10 (1044)	41.10 (1044)	41.10 (1044)	41.10 (1044)	41.10 (1044)
	Head room, rear	--	--	--	--	38.40 (975)	38.40 (975)
	Shoulder room, front	65.70 (1669)	65.70 (1669)	65.70 (1669)	65.70 (1669)	65.70 (1669)	65.70 (1669)
	Shoulder room, rear	--	--	--	--	66.40 (1687)	66.40 (1687)
	Hip room, front	61.50 (1562)	61.50 (1562)	61.50 (1562)	61.50 (1562)	61.50 (1562)	61.50 (1562)
	Hip room, rear	--	--	--	--	61.50 (1562)	61.50 (1562)
	Leg room, front	41.30 (1049)	41.30 (1049)	41.30 (1049)	41.30 (1049)	41.30 (1049)	41.30 (1049)
	Leg room, rear	--	--	--	--	38.40 (975)	38.40 (975)
CA	**Cab to axle**	60.40 (1534)	60.40 (1534)	84.90 (2156)	84.90 (2156)	60.40 (1534)	60.40 (1534)
BA	**Front bumper to axle**	37.00 (940)	37.00 (940)	37.00 (940)	37.00 (940)	37.00 (940)	37.00 (940)
BBC	**Front bumper to back of cab**	113.60 (2885)	113.60 (2885)	113.60 (2885)	113.60 (2885)	138.10 (3508)	138.10 (3508)

Published dimensions indicated are without optional equipment or accessories. Additional accessories or equipment ordered at the customer's request can result in a minor change in these dimensions.

2005 Chevrolet Truck Silverado 3500 CC SPECS - REGULAR CAB

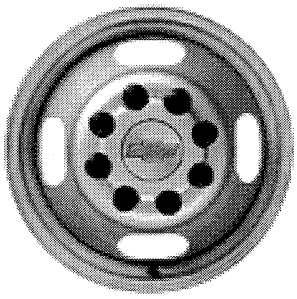
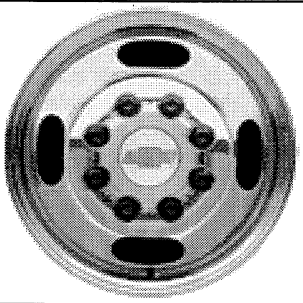
	Regular Cab 2WD CC36003	Regular Cab 2WD CC36403	Regular Cab 4WD CK36003	Regular Cab 4WD CK36403
Specifications				
Front shock absorber diameter, in. (mm)	1.38 (35)	1.38 (35)	1.38 (35)	1.38 (35)
Front stabilizer bar diameter, in. (mm)	1.25 (32)	1.25 (32)	1.25 (32)	1.25 (32)
Rear shock absorber diameter, in. (mm)	1.38 (35)	1.38 (35)	1.38 (35)	1.38 (35)
Turning diameter, curb-to-curb, ft. (m)	44.9 (13.7)	51.9 (15.8)	44.9 (13.7)	51.9 (15.8)
Capacities				
Front axle, lbs. (kg)	4800 (2177)	4800 (2177)	4800 (2177)	4800 (2177)
Front spring capacity, lbs. (kg)	4500 (2041)	4800 (2177)	4800 (2177)	4800 (2177)
Rear axle, lbs. (kg)	9200 (4173)	9200 (4173)	9200 (4173)	9200 (4173)
Rear spring capacity, lbs. (kg)	8600 (3901)	8600 (3901)	8600 (3901)	8600 (3901)
Curb weight, lbs. (kg)	5524 (2506)	5611 (2545)	5794 (2628)	5920 (2685)
Payload[1], lbs. (kg)	5876 (2665)	5789 (2626)	6206 (2815)	6080 (2758)
Gross Vehicle Weight Rating (GVWR), lbs. (kg)	11400 (5171)	11400 (5171)	12000 (5443)	12000 (5443)
Front Gross Axle Weight Rating (GAWR), lbs. (kg)	4500 (2041)	4670 (2118)	4670 (2118)	4800 (2177)
Rear Gross Axle Weight Rating (GAWR), lbs. (kg)	8550 (3878)	8550 (3878)	8600 (3901)	8600 (3901)
Fuel capacity, approximate, gallon (liters)	50 (189)	50 (189)	50 (189)	50 (189)
Seating capacity	3	3	3	3

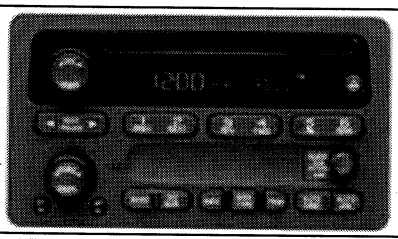
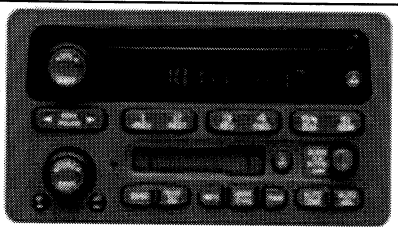
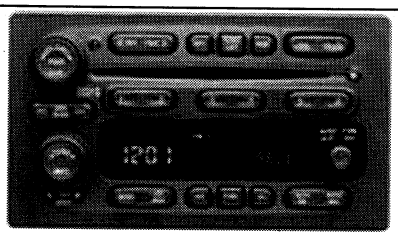
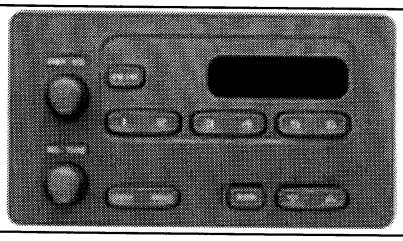
1. Maximum payload capacity includes weight of driver, passengers, optional equipment and cargo.

2005 Chevrolet Truck Silverado 3500 CC SPECS - EXTENDED CAB

	Extended Cab 2WD CC36053	Extended Cab 4WD CK36053
Specifications		
Front shock absorber diameter, in. (mm)	1.38 (35)	1.38 (35)
Front stabilizer bar diameter, in. (mm)	1.25 (32)	1.18 (30)
Rear shock absorber diameter, in. (mm)	1.38 (35)	1.38 (35)
Turning diameter, curb-to-curb, ft. (m)	51.9 (15.8)	51.9 (15.8)
Capacities		
Front axle, lbs. (kg)	4800 (2177)	4800 (2177)
Front spring capacity, lbs. (kg)	4800 (2177)	4800 (2177)
Rear axle, lbs. (kg)	9200 (4173)	9200 (4173)
Rear spring capacity, lbs. (kg)	8600 (3901)	8600 (3901)
Curb weight, lbs. (kg)	5974 (2710)	6271 (2845)
Payload[2], lbs. (kg)	5426 (2461)	5729 (2599)
Gross Vehicle Weight Rating (GVWR), lbs. (kg)	11400 (5171)	12000 (5443)
Front Gross Axle Weight Rating (GAWR), lbs. (kg)	4670 (2118)	4800 (2177)
Rear Gross Axle Weight Rating (GAWR), lbs. (kg)	8550 (3878)	8600 (3901)
Fuel capacity, approximate, gallon (liters)	50 (189)	50 (189)
Seating capacity (front/rear)	3/3	3/3
2. Maximum payload capacity includes weight of driver, passengers, optional equipment and cargo.		

2005 Chevrolet Truck Silverado 3500 CC WHEELS

	**Wheels,** 6 - 16" x 6.5" (40.6 cm x 16.5 cm) 8-lug steel, painted (dual rear), includes painted center caps and steel spare
	P06 **Wheels,** 6 - 16" x 6.5" (40.6 cm x 16.5 cm) 8-lug steel, with bright metal rings and chrome center caps and steel spare

	UB0 **Sound system,** ETR AM/FM stereo with CD player, includes seek-and-scan, digital clock, auto-tone control, speed-compensated volume and Radio Data System (RDS)
	UB1 **Sound system,** ETR AM/FM stereo with CD and cassette player, includes seek-and-scan, digital clock, auto-tone control, speed-compensated volume, TheftLock, Radio Data System (RDS) and 4-speakers on Regular Cab and 6-speakers on Extended Cab Models (with bucket seats UB1 includes Bose speaker system, Bose amplifier and Bose subwoofer)
	UC6 **Sound system,** ETR AM/FM stereo with 6-disc CD changer, includes seek-and-scan, digital clock, auto-tone control, speed-compensated volume, TheftLock, Radio Data System (RDS), and Bose speaker system (includes 6-speakers, Bose amplifier and Bose Subwoofer)
	UM7 **Sound system,** ETR AM/FM stereo, includes seek-and-scan and digital clock

2005 Chevrolet Truck Silverado 3500 CC RPO CODES

Option Code	Description
**2	Seat trim, leather
**C	Seat trim, cloth
**D	Seat trim, Custom Cloth
**V	Seat trim, vinyl
2EC	Tires, front and rear (MSRP = $55.00)
2EF	Tires, front and rear (MSRP = $66.00)
4EC	Tire, spare (MSRP = $410.00)
4EF	Tire, spare (MSRP = $421.00)
5B5	Power windows and mirrors (MSRP = $738.00)
5G2	Wheels, painted White (MSRP = $55.00)
5G4	Provision for cab roof-mounted lamp (MSRP = $103.00)
5M1	Mirror, exterior, power adjustable, manual folding, non-heated.
5M9	High level stop lamp (CHMSL) delete (MSRP = No Charge)
5Q1	Tail Lamp delete (MSRP = -$27.00 Credit)
5X7	Provision for body mounted warning lamp (MSRP = $98.00)Provides an instrument panel mounted switch and heavy duty electrical relay with hook-up terminal in the engine compartment for a body upfitter to connect a body mounted warning or emergency lamp. 40 amp nominal rating.
5X9	Provisions, wrecker package (MSRP =$25.00)
5Y0	Provision for body mounted lamp with hook-up wiring (MSRP = $88.00)Provides an instrument panel mounted switch and electrical hook-up behind the cab for a body upfitter to connect a body mounted warning or emergency lamp. 21 amp nominal rating.
5Z5	Hubcap delete (MSRP = -$18.00 Credit)Deletes decorative cap at center of wheel.
6C7	Console, roof with reading lamps (MSRP = $55.00)
6P3	Mirrors, outside rearview, power, non-heated, camper-style, includes power extending arms and turn signal in mirror glass. (MSRP = $238.00)
6R2	Mirrors, outside rearview, auxiliary-wide field of vision, manual adjust, black (MSRP = W/A)
7Y9	Battery, Single 770 CCA (MSRP = $56.00)
7Z1	Horn, high note (MSRP = $20.00)
8B0	Batteries, 770 CCA with a 600 CCA auxiliary (MSRP = $190.00)
8C6	Alternator, 145 amp (MSRP = $140.00)
8E9	Bumper, front, painted White (MSRP = $45.00)
8F2	Ornamentation, delete (MSRP = No Charge)
8G9	Mirrors, outside, convex combination, stainless steel (MSRP = $278.00)
8H5	Bumper, delete (MSRP = -$145.00 Credit)
8Q3	Rear seat delete (MSRP = -$375.00 Credit)
8R3	Tire valve stems, brass (MSRP = $50.00)Provides brass tire valve stems.
8S3	Backup alarm (MSRP = $103.00)97 decibels back-up alarm.
8V2	Jack and tools delete (MSRP = -$32.00 Credit)
8X1	Label, fasten safety belts (MSRP = $2.00)
8X5	Alternators, dual 105 amp (MSRP =$224.00)
9B4	Fuel fill cap with stainless steel tether (MSRP = $15.00)
9D9	Inside rear view mirror delete (MSRP = -$3.00 Credit)
9F2	Mirror ,outside delete (MSRP = -$25.00 Credit)
9F7	Mirrors, outside driver and passenger side West Coast type (MSRP = $125.00)Provides large West Coast style mirrors with spring loaded pre-set feature.
9H5	Roof marker lamp delete (MSRP = No Charge)
9L4	Power supply, 12 volt (MSRP = $158.00)
9N8	Mirrors, auxiliary dual spot convex, stainless steel (MSRP = $50.00)

2005 Chevrolet Truck Silverado 3500 CC RPO CODES

Option Code	Description
9R0	Sound system, ETR AM/FM stereo with cassette (MSRP = $150.00) with Work Truck and (MSRP = -$81.00 Credit) with Base and LS decorAM/FM stereo with cassette and digital clock, no CD player. Replaces the base radio.
9R3	Sound system, delete (MSRP = No Charge)
9S1	Seats, individual vinyl (MSRP = No Charge)
9U3	Seats, individual cloth (MSRP = No Charge)
9U4	Remote keyless entry (MSRP = $170.00)
9V5	Paints, solid (MSRP = No Charge), Woodland Green
9V9	Paints, solid (MSRP = No Charge), Doeskin Tan
9W3	Paints, solid (MSRP = No Charge), Wheatland Yellow
9W4	Paints, solid (MSRP = No Charge), Tangier Orange
9X5	Trim override, Custom Cloth (MSRP = $285.00) with Regular Cab and split-bench seat, (MSRP = $360.00) with Extended Cab and split-bench seat
A31	Windows, power
A95	Seats, front reclining buckets
AE7	Seats, front 40/20/40 split-bench
AE7	Seats, front 40/20/40 split-bench, 3-passenger
AG1	Seat adjuster, power, driver 6-way
AJ1	Glass, Solar-Ray deep tinted
AU0	Keyless entry, remote
AU3	Door locks, power
B30	Floor covering, color-keyed carpeting
B71	Wheel flares, front only
BG9	Floor covering, rubberized vinyl, Black
C42	Air conditioning delete
C49	Defogger, rear-window, electric
C7L	GVWR, 12,000 lbs. (5443 kg)
C7W	GVWR, 11,400 lbs. (5171 kg)
CJ2	Air conditioning, dual-zone, automatic
CJ3	Air conditioning, dual-zone, manual
D07	Console, floor
D44	Mirrors, outside rearview, foldaway, manual, Black
DF2	Mirrors, outside rearview, foldaway, manual, camper-style
DF5	Mirror, inside rearview
DG5	Mirrors, outside rearview
DK7	Console, overhead mini
DL8	Mirrors, outside rearview, manual folding, power, heated, Black
DPF	Mirrors, outside rearview, power, heated, camper-style
FE9	Emissions, Federal requirements
G80	Differential, locking, heavy-duty, rear
GT4	Rear axle, 3.73 ratio
GT5	Rear axle, 4.10 ratio
GTY	Rear axle, wide-track
K05	Engine block heater
K34	Cruise control
K47	Air cleaner, high-capacity
K68	Alternator, 105 amps
KC4	Cooling, external engine oil cooler
KG3	Alternator, 145 amps

Option Code	Description
KL5	Alternative fuel conversions, conversion-ready engine
KNP	Cooling, external transmission oil cooler
L18	Engine, Vortec 8100 V8 SFI
LLY	Engine, Duramax 6600 Turbo Diesel V8
LQ4	Engine, Vortec 6000 V8 SFI
M74	Transmission, Allison 1000 5-speed automatic
ML6	Transmission, 6-speed manual, heavy-duty
MT1	Transmission, 4-speed automatic, heavy-duty
MW3	Transmission, 5-speed manual
NB8	Emissions override
NC7	Emissions override, Federal
NE1	Emissions, Maine, Massachusetts, New York or Vermont state requirements
NP1	Transfer case, electronic shift
NP2	Transfer case, floor-mounted shifter
NP5	Steering wheel, leather-wrapped rim
NQZ	Fuel tank delete, rear
NZZ	Skid Plate Package
P06	Wheels, 6 - 16" x 6.5" (40.6 cm x 16.5 cm) 8-lug steel
PDN	Heavy-Duty Power Package, includes (LLY) Engine
R6Y	Heavy-Duty Power Package discount not desired
T96	Fog lamps, front
TGK	Solid PaintSEO solid paint, one color
TP2	Battery, auxiliary heavy-duty, 600 cold-cranking amps
TQ3	Battery, heavy-duty dual, 770 cold-cranking amps
TR3	Grille, color-keyed surround
TS9	Lamp,
U01	Lamps, amber roof marker
U2K	Sound system feature, XM Satellite Radio
UB0	Sound system, ETR AM/FM stereo with CD player
UB1	Sound system, ETR AM/FM stereo with CD and cassette player
UC6	Sound system, ETR AM/FM stereo with 6-disc CD changer
UE1	OnStar
UK3	Sound system feature, steering wheel mounted radio controls
UM7	Sound system, ETR AM/FM stereo
UQ5	Sound system feature, 4-speakers
V10	Covers, radiator grille and front bumper openings
V76	Recovery hooks, front, frame-mounted
VAB	Ship Thru for Models C*36**3 (MSRP = $100.00)Produced in Pontiac Assembly and shipped to NBC Truck Equipment
VAY	Ship Thru for Models C*36**3 (MSRP = $100.00)Produced in Pontiac Assembly and shipped to K&B Mounting
VBK	Ship Thru for Models C*36**3 (MSRP = $210.00) Produced in Pontiac Assembly and shipped to Ft. Wayne Fleet Equipment
VCL	Emissions Certification, CFF (Clean Fuel Fleet) LEV (Low Emission Vehicle).
VFI	Ship Thru for TDM Vehicle Management (MSRP = W/A)
VG3	Bumper, front, chrome
VGH	Ship Thru for Models C*36**3 (MSRP = $105.00) Produced in Pontiac Assembly and shipped to Monroe Truck Equipment
VGZ	Ship Thru for Models C*360*3 and CK36403 (MSRP = $105.00)Produced in Pontiac

Option Code	Description
	Assembly and shipped to Canfield
VWS	Ship Thru for Models C*36**3 (MSRP = $275.00)Produced in Pontiac Assembly and shipped to Buckeye Truck Equipment
VYC	Ship Thru for Models C*36**3 (MSRP = $115.00) Produced in Pontiac Assembly and shipped to Knapheide Truck Equipment
VYS	Ship Thru for Models C*360*3 and CK36403 (MSRP = $100.00) Produced in Pontiac Assembly and shipped to Masterack Truck Equipment
VYU	Snow Plow Prep Package
XEC	Tires, LT215/85R16E, all-season, blackwall
XEF	Tires, LT215/85R16E, on-/off-road, blackwall
XYK	Tires, LT215/85R16D, all-season, blackwall
XYL	Tires, LT215/85R16D, on-/off-road, blackwall
YF5	Emissions, California state requirements
Z85	Suspension Package, Handling/Trailering
ZEC	Tire, spare LT215/85R16E, all-season, blackwall
ZEF	Tire, spare LT215/85R16E, on-/off-road, blackwall
ZW9	Body, Chassis Cab
ZY1	Paint, solid
ZYK	Tire, spare LT215/85R16D, all-season, blackwall
ZYL	Tire, spare LT215/85R16D, on-/off-road, blackwall