Chevrolet

Silverado Truck

SS

2003

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Product Information

2003 Chevrolet Silverado Raises The Bar - Again

The Chevrolet Silverado full-size pickup - GM's best-selling vehicle - continues to set new standards for performance and capability in 2003. Bold new exterior design only hints at Silverado's more than 40 new features/enhancements, ranging from expanded availability of the Quadrasteer four-wheel steering system and a hot new Silverado SS to the segment's first-ever Bose audio systems.

"Silverado already has a reputation as the most dependable, longest-lasting full-size pickup," said Marketing Director Rick Scheidt. "But we're not resting on our laurels. New features that speak directly to customer needs and wants enhance Silverado's ability to get the job done."

Dramatic New Styling

The 2003 Silverado receives an expressive new front-end design. The look shares a strong family resemblance with other Chevy trucks such as TrailBlazer and Avalanche, yet strongly differentiates Silverado from anything else on the road. The hood evokes Chevy power and strength, and the grille is smoothly integrated into the front end. The bumper offers larger, recessed fog lamps, while the front and rear fenders feature crisp lines and angular wheel openings. New body-side moldings add protection, and restyled taillamps complete the design. Two new exterior colors - Dark Gray Metallic and Arrival Blue - are also available.

Expanded Quadrasteer

The Quadrasteer four-wheel-steering system - which offers low-speed maneuverability and high-speed stability, handling and control that are ideal for pulling a trailer - was introduced on 2002 Silverado extended-cab short-box pickups. For 2003, the 1500HD short-box pickups become the industry's first full-size crew cabs to offer this revolutionary system.

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. The turning diameter of 1500HD models is reduced 21 percent, from 49.6 feet to 37.4 feet.

Silverado SS Highlights Performance

Extending its rich "Super Sport" heritage, Chevy is introducing a 2003 Silverado SS, which will be available in all 50 states and Canada beginning in the first quarter of 2003.

Dating back to the 1961 Impala, Chevy SS vehicles have provided on-road enthusiasts with outstanding performance, great handling and sleek, muscular designs. The Silverado SS is a contemporary expression of Chevy muscle that responds to enthusiasts who have migrated to full-size pickups. The Silverado SS, created from a 1500 extended-cab short bed, adds fun and excitement without forfeiting Silverado's proven strengths and capabilities.

A standard high output LQ9 version of the Vortec 6000 V8, with 345 horsepower and 380 lb-ft of torque, provides Silverado SS with exhilarating off-line acceleration and relaxed cruising. It mates to a Hydra-Matic 4L85-E four-speed automatic overdrive transmission, whose 3.06 first gear and 0.70 final gear contribute to the truck's impressive performance.

A standard full-time, all-wheel-drive (AWD) viscous-coupled transfer case provides exceptional on-road, wet or dry pavement handling. It requires no driver intervention, automatically and continuously transferring torque from slipping wheels to those with a firmer grip.

A unique Z60 high-performance chassis package, including Silverado's largest-ever 20-inch wheel and tire combination, provides exceptional road holding and cornering capability. A 2-inch lower ride height, 18mm wider track and P275/55R20 Goodyear Eagle radials provide exceptional stability.

The exterior of the SS shows it is no ordinary Silverado. With its trim, aggressive stance, monochromatic color scheme and specially styled aluminum wheels, Silverado SS conveys performance from any angle. The custom interior is Dark Charcoal and equipped with uplevel LT trim and leather bucket seats with

special "SS" embroidered headrests. The Silverado SS will be offered in Black, Arrival Blue Metallic or Victory Red. The SS appearance is refined and dramatic - an instant classic.

New Entertainment Systems

Impressive new entertainment systems on all models - from available Bose sound systems to a Panasonic DVD Passenger Entertainment System that includes a DVD player with a flip-down screen for Crew Cab models - 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 new 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.

The 2003 Silverado also offers XM Satellite Radio as an option. XM Radio features 100 coast-to-coast digital channels, including 71 music channels (more than 30 of them commercial free) from hip hop to opera, classical to country, bluegrass to blues and 29 channels of sports, talk, children's and entertainment programming. XM also brings to the car, for the first time on radio, a diverse selection of 24-hour news sources previously available only in the home. XM's next-generation sound-quality technology provides superior sound remarkably close to compact disc.

A Safe & Secure Environment

Additional new safety enhancements for 2003 include a passenger-sensing system and dual-level air bags. The passenger-sensing air-bag system automatically deactivates the passenger-side air bag under certain conditions to protect children. The system assesses whether the occupant in the seat is an adult or child, based on the measured weight in the seat cushion and tension in the belt system, if any. If these measurements are typical for a child, the air bag is disabled. If they are typical for an adult, the air bag is enabled.

A dual-level air-bag system (not available on 1500HD Crew Cab and 2500HD and 3500 Series models) is a supplemental restraint system designed to detect vehicle deceleration and, based on the deceleration data, provides an appropriate amount of air-bag inflation. Sensors located in the front of the vehicle work with the sensing diagnostic module (SDM) to measure the severity of the impact. The SDM uses the data to determine the type of air-bag deployment (first stage or second stage) or non-deploy. Dual-stage air bags are designed to help reduce the occurrence of inflation-induced injuries by deploying the air bag less forcefully in lower-speed crashes.

Engine Improvements Across The Board

Electronic Throttle Control (ETC) now provides more precise, consistent throttle operation on all Silverado small-block V8 engines. New oxygen sensors provide enhanced durability and reduced emissions during engine warmup. All Silverado models with the Vortec 4300 4.3L V6 and those sold in California with the Vortec 4800 4.8L or Vortec 5300 5.3L V8 engines feature a more robust catalytic converter system that meets Ultra Low Emissions Vehicle (ULEV) standards.

The Vortec 4300 V6 with multi-port fuel injection (previously available in California) is expanded to all 50 states. A central fuel injector delivers a separate flow of fuel to six individual hybrid injectors for better performance and improved emissions.

Getting A Grip

The Autotrac electric shift, part-time 4WD transfer case, available in 1500/2500 light-duty Silverado models, gets improved fuel economy when operating in 2WD, as well as improved customer feel when in the "Auto" mode during parking lot and other low-speed maneuvers. Two-wheel-drive Silverados offer electronic traction control to enhance surefootedness on models with a V8 engine, automatic transmission and locking rear differential.

All light-duty 2003 Silverado models feature improved brake performance, "pedal feel" and quieter operation.

More Alternative Fuel Models

Alternative fuel systems are now available on more Silverado models and GVW ratings (see Silverado HD section below). Equipped with a Vortec 6000 V8, these models come with a dedicated compressed natural gas (CNG) or a bi-fuel system that can run on CNG or gasoline. Light-duty Silverado models with the Vortec 5300 V8 offer an option that allows them to run on varying blends of ethanol and gasoline, to a maximum of 85% ethanol.

Smarter Electrical Systems

An advanced new multiplexed electrical architecture makes Silverado even "smarter" so it can provide more functions for 2003. A communication network transfers data throughout the vehicle. It enables the driver information center to monitor and to report on as many as 34 system functions, including new service indicators for "Ice Possible" and "Door Ajar." Silverado's instrument panel and cluster have been redesigned to accommodate these new features. The new architecture reduces materials for improved quality and less weight. Available redundant steering wheel controls allow owners to personalize several functions and safely access new infotainment systems.

A new 145-amp generator is standard on Silverado models equipped with Quadrasteer and on models featuring V8 engines with the Snowplow Prep Package. The more powerful generator provides a quicker battery charge, and slows battery discharge during vehicle operation. A memory subsystem can remember preferences for seat and mirror positions. "Smart" also means the battery-rundown protection feature now automatically turns off the headlamps, park lamps and interior lights after 10 minutes if left on inadvertently.

More Cabin Comforts

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

Redesigned seats and center console enhance Silverado's interior look. Dark Charcoal Gray is a new interior color.

Additional Features

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

Silverado 1500 Extended Cab Short Box models (except those with Quadrasteer) feature an available PRO-TEC pickup box and tailgate. The injection-molded composite material resists scratches and dents, and never rusts.

Multiple Configurations

As always, Silverado offers a variety of configurations to fit customers' specific needs - with half-ton and three-quarter-ton offerings in fleetside or sportside trim and in 2WD/4WD regular, extended and crew cabs. Customers can also choose a short or long box. Silverado features an impressive Vortec gasoline engine lineup - Vortec 4300 V6, Vortec 4800 V8, Vortec 5300 V8 and Vortec 6000 V8 - ranging from 200 hp to 300 hp. Payload capacities range from 1,593 to 3,224 pounds, and Gross Vehicle Weight Ratings extend from 6,100 to 8,600 pounds.

The Silverado 1500HD has the strength of a three-quarter-ton model frame, plus a crew cab's four full doors. The 1500HD has a standard 300 hp Vortec 6000 V8 engine with a gross combination weight rating of 16,000 pounds, and a payload of as much as 3,143 pounds. Maximum trailer weight is 10,300 pounds.

Silverado offers the ultimate in four-wheeling fun and capability with a Z71 Off-Road Package on half-ton 4x4 models. The Z71 package includes 46mm 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.

New For 2003

- Bolder and more expressive exterior styling
- Interior refinements
- New high-performance Silverado SS (available first quarter of 2003)
- Quadrasteer available on 1500 Extended Cab and 1500 Heavy-Duty Crew Cab
- Passenger-sensing system
- Dual-level air bags
- XM Satellite Radio option
- Dual-zone heating, ventilation and air conditioning
- New entertainment systems, including segment's first-ever Bose audio systems
- Advanced new electrical system
- More than 40 new major features or improvements

Model Lineup

	Engines				Transmissions			
	Vortec 4300 4.3L V6	Vortec 4800 4.8L V8	Vortec 5300 5.3L V8	Vortec 6000 6.0L V8	4-spd auto (Hydra-Matic 4L60-E)	4-spd auto (Hydra-Matic 4L80-E)	5-spd man (MG5)	5-spd HD man (MW3)
1500 Regular Cab, Sportside Box	s	o	o*	-	o	-	s	-
1500 Regular Cab, Fleetside Short Box	s	o	o*	-	o	-	s	-
1500 Regular Cab, Fleetside Long Box	s	o	o*	-	p	-	s	-
2500 Regular Cab, Fleetside Long Box	-	-	-	s	s	o	-	s
1500 Extended Cab, Sportside Box	-	s**	s	-	s	-	-	-
1500 Extended Cab, Fleetside Short Box	s	o	o*	-	s	-	s	-
2500 Extended Cab, Fleetside Short Box	-	-	-	s	-	o	-	-
1500 Extended Cab, Fleetside Long Box	-	s**	o*	-	s	-	s***	*

Standard s
Optional o
Not available –

* Available only with four-speed automatic overdrive transmission
** Vortec 5300 V8 is included with LT trim
*** Not available with LT trim

Specifications

Specifications

Overview				
Models:	• Chevrolet Silverado 1500, including 1500HD and 2500 • Regular Cab Fleetside / Sportside Short Box, 2WD and 4WD: Base & LS • Regular Cab Fleetside Longbox, 2WD and 4WD: Base & LS • Extended Cab Fleetside/Sportside Short Box, 2WD and 4WD: Base, LS & LT • Extended Cab Fleetside Long Box, 2WD & 4WD: Base LS & LT • Crew Cab Fleetside Short Box, 2WD & 4WD, LS & LT			
Body style / driveline:	2/3 passenger Regular Cab or 5/6 passenger Extended Cab, two- and four-wheel-drive pickup			
EPA vehicle class:	full-size truck			
Manufacturing location:	Oshawa, Ontario, Canada; Fort Wayne, Indiana; Pontiac, Michigan			
Key competitors:	Ford F-Series Pickup, Dodge Ram Pickup, Toyota Tundra Pickup			
Engines				
	Vortec 4300 4.3L V6 (LU3)	**Vortec 4800 4.8L V8 (L4R)**	**Vortec 5300 5.3L V8 (LM7)**	**Vortec 6000 6.0L V8 (LQ4)**
Type:	4.3-liter V6	4.8-liter V8	5.3-liter V8	6.0-liter V8
Displacement (cu in / cc):	262 / 4293	294 / 4807	327 / 5328	364 / 5967
Bore & stroke (in / mm):	4 x 3.48 / 101.6 x 88.4	3.78 x 3.27 / 96.0 x 83	3.78 x 3.62 / 96.0 x 92	4 x 3.62 / 101.6 x 92
Block material:	cast iron	cast iron	cast iron	cast iron
Cylinder head material:	cast iron	cast aluminum	cast aluminum	cast aluminum
Valvetrain:	OHV	OHV	OHV	OHV
Ignition system:	direct composite distributor, platinum-tipped spark plugs, low-resistance spark plug wires	coil near plug, platinum-tipped spark plugs, low-resistance spark plug wires	coil near plug, platinum-tipped spark plugs, low-resistance spark plug wires	coil near plug, platinum-tipped spark plugs, low-resistance spark plug wires
Fuel delivery:	sequential fuel injection	sequential fuel injection	sequential fuel injection	sequential fuel injection
Compression ratio:	9.2:1	9.5:1	9.5:1	9.4:1
Horsepower (hp / kw @ rpm):	200 / 149 @ 4600	270/201 @ 5200	285 / 213 @ 5200	300 / 224 @ 4400
Torque (lb-ft / Nm @ rpm):	260 / 353 @ 2800	285 / 386 @ 4000	325 / 441 @ 4000	360 / 488 @ 4000
Recommended fuel:	87 octane	87 octane	87 octane	87 octane
Maximum engine speed (rpm):				
Manual:	5600	5600	5600	5600
Automatic:	5600	5900	5900	5600
Emissions controls:	three-way catalytic converter, exhaust gas recirculation, positive crankcase ventilation, evaporative collection system	three-way catalytic converter, exhaust gas recirculation, positive crankcase ventilation, evaporative collection system	three-way catalytic converter, exhaust gas recirculation, positive crankcase ventilation, evaporative collection system	three-way catalytic converter, exhaust gas recirculation, positive crankcase ventilation, evaporative
	C1500 Series (2WD)		**K1500 Series (4WD)**	
Estimated fuel economy (mpg city / highway / combined):	auto trans, 4.3L: 16 / 20 / 18 man trans, 4.3L: 17 / 23 / 20 auto trans, 4.8L: 16 / 21 /18 man trans, 4.8L: 16 / 20 / 18 auto trans, 5.3L: 16 / 21 / 18		auto trans, 4.3L: 16 / 20 / 18 man trans, 4.3L: 15 / 18 / 16 auto trans, 4.8L:15 / 18 / 16 man trans, 4.8L: 15 / 19 / 17 auto trans, 5.3L: 15 / 18 / 16	

Transmissions				
	NV3500 (MG5)	NV4500 (MW3)	Hydra-Matic 4L60-E	Hydra-Matic 4L80-E
Type:	5-speed manual	5-speed manual	4-speed automatic	4-speed automatic
Gear ratios (:1):				
First:	4.02	5.61	3.06	2.48
Second:	2.32	3.04	1.63	1.48
Third:	1.40	1.67	1.00	1.00
Fourth:	1.00	1.00	0.70	0.75
Fifth:	0.73	0.75	-	-
Reverse:	3.55	5.61	2.29	2.08
Final drive ratio:	3.08 3.42 3.73 4.10	3.42 3.73 4.10 -	3.08 3.42 3.73 4.10	3.42 3.73 4.10 -

Chassis/Suspension	
Front:	1500 4WD, 2500: independent with computer-selected torsion bars, 30mm stabilizer bar 1500 2WD: computer-selected coil springs; gas-pressurized shocks; 32mm stabilizer bar
Rear:	solid axle with semi-elliptic, variable-rate, two-stage multileaf springs; gas-pressurized shocks
Traction control:	2WD only
Steering type	
1500 4WD & 2500:	power recirculating ball
1500 2WD:	power rack-and-pinion
With Quadrasteer four-wheel steering:	front: hydraulic power, recirculating ball; rear: electrically powered (system also uses front steering-wheel position sensor, steerable solid hypoid rear axle, electric motor-drive actuator and control unit)
Steering ratio:	14.2:1
Steering wheel turns, lock-to-lock:	3
Turning circle,curb-to-curb (ft / m):	
Ext. Cab Short Box with Quadrasteer:	37.4 / 11.4
2WD Reg. Cab Short Box:	40.1 / 12.2
2WD Ext. Cab Short Box:	46.6 / 14.2
4WD Ext. Cab Short Box:	47.3/14.4

Brakes	
Type:	(all) vacuum booster, power, four-wheel disc, four-wheel ABS, DRP
Rotor diameter x thickness (in / mm)	
1500 up to 6400 GVWR:	front: 12.01 x 1.14 / 305 x 29 rear: 12.80 x 0.78 / 325 x 20
1500 with Quadrasteer:	front: 12.01 x 1.14 / 305 x 29 rear: 13.00 x 1.18 / 330 x 30
1500 HD, 1500 HD with Quadrasteer, 2500:	front: 12.80 x 1.50 / 325 x 38 rear: 1300 x 1.14 / 330 x 29
Total swept area (sq in / sq cm)	
1500 up to 6400 GVWR:	front: 213.6 / 1378 rear: 211.1 / 1362
1500 with Quadrasteer:	front: 213.6 / 1378 rear: 223.7 / 1443
1500 HD, 1500 HD with Quadrasteer, 2500:	front: 245.5 / 1584 rear: 236.5 / 1526

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

Dimensions

Exterior	Short Box Regular Cab	Long Box Regular Cab	Short Box Extended Cab	Long Box Extended Cab	Short Box Crew Cab
Wheelbase (in / mm):	119 / 3023	133 / 3378	143.5 / 3644	157.5 / 4001	153 / 3884.7
Overall length (in / mm):	203.1 / 5158	222 / 5644	227.6 / 5781	246.7 / 6261	237.2 / 6025
Overall width (in / mm) Base/fleet:	78.5 / 1994	78.5 / 1994	78.5 / 1994	78.5 / 1994	78.5 / 1994
With YE9 package opt. mirrors folded:	81.5 / 2070	81.5 / 2070	81.5 / 2070	81.5 / 2070	81.5 / 2070
With YE9 package opt. mirrors extended:	93.1 / 2363	93.1 / 2363	93.1 / 2363	93.1 / 2363	93.1 / 2363
Quadrasteer models w/YE9 opt. mirrors folded:	-	-	83.5 / 2102.7	-	83.5 / 2102.7
Overall height (in / mm) 2WD:	71.2 / 1808	71 / 1803	71.2 / 1808	70.8 / 1798	77 / 1956
4WD:	73.8 / 1875	73.7 / 1872	73.9 / 1877	73.7 / 1872	77.3 / 1963
Track (in / mm)					
All except Quadrasteer models					
Front:	65 / 1651	65 / 1651	65 / 1651	65 / 1651	68.6 / 1899
Rear	66 / 1676	66 / 1676	66 / 1676	66 / 1676	66 / 1676
Quadrasteer models					
Front:	-	-	65.0 / 1651	-	65.0 / 1651
Rear:	-	-	71 /1804	-	71 /1804
Min. ground clearance (in / mm):					
2WD:	8.1 / 205	8.1 / 205	8.1 / 205	8.1 / 205	8.7 / 221
4WD:	8.8 / 223	8.8 / 223	8.7 / 220	8.7 / 220	8.9 / 226.1
Ground to top of load floor (in / mm):					
2WD:	31.6 / 803	31.6 / 803	31.6 / 803	31.6 / 803	-
4WD:	33.7 / 856	33.7 / 856	33.7 / 856	33.7 / 856	-
Step-in height:					
2WD:	19 / 482	19 / 482	19 / 482	19 / 482	24.6/ 624.8
4WD:	21.3 / 540	21.3 / 540	21.3 / 540	21.3 / 540	25.1 / 637.5
Approach angle:	25.4°	25.4°	25.4°	25.4°	-
Breakover angle:	12.4°	12.4°	12.4°	12.4°	-
Departure angle:	27.5°	27.5°	27.5°	27.5°	-

Weights	GVW (lbs / kg)	Curb Weight (lbs / kg)	Payload (lbs / kg)	Weight Distribution (% front / rear)
2WD pickups				
C15703 Reg. Cab Short Box:	6100 / 2766.4	4142 / 1878.5	1958 / 888	57 / 43
C15753 Ext. Cab Short Box:	6200 / 2811.8	4548 / 2062.6	1652 / 749.2	57 / 43
C15743 Crew Cab Short Box:	8600 / 3900.2	5506 / 2497.1	3094 / 1403.2	57 / 43
C15903 Reg. Cab Long Box:	6400 / 2902.5	4277 / 1939.7	2123 / 962.8	57 / 43
C15953 Ext. Cab Long Box:	6400 / 2902.5	4810 / 2181.4	1590 / 721.1	59 / 41

	GVW (lbs / kg)	Curb Weight (lbs / kg)	Payload (lbs / kg)	Weight Distribution (% front / rear)
4WD pickups				
K15703 Reg. Cab Short Box:	6400 / 2902.5	4439 / 2013.2	1661 / 753.3	58 / 42
K15753 Ext. Cab Short Box:	6400 / 2902.5	4919 / 2230.8	1481 / 671.7	60 / 40
K15743 Crew Cab Short Box:	8600 / 3900.2	5817 / 2638.1	2783 / 1262.1	59 / 41
K15903 Reg. Cab Long Box:	6400 / 2902.5	4579 / 2076.6	1821 / 825.9	59 / 41
K2500 Ext. Cab Long Box:	6400 / 2902.5	5097 / 2311.6	1303 / 590.9	60 / 40

Cargo box	Short Box Sportside	Short Box Fleetside	Long Box Fleetside
Cargo volume (cu ft / liters):	43.5 / 1231.7	56.9 / 1611.2	70.7 / 2002
Length at floor (in / mm):	78.7 / 1998	78.7 / 1998	97.6 / 2479
Width at floor (in / mm):	49.1 / 1247	60.2 / 1529	60.2 / 1529
Width at top (in / mm):	49.1 / 1247	61.9 / 1572	61.9 / 1572
Width between wheelhousings (in / mm):	50 / 1270	50 / 1270	50 / 1270
Tailgate width (in / mm):	49.9 / 1267	60.6 / 1539	60.6 / 1539
Inside height (in / mm):	19.5 / 495	19.5 / 495	19.5 / 495

Interior	Regular Cab	Extended Cab, Front	Extended Cab, Rear
Head room (in / mm):	41 / 1041	41 / 1041	38.4 / 975
Leg room (in / mm):	41.3 / 1049	41.3 / 1049	33.7 / 856
Shoulder room (in / mm):	65.2 / 1656	65.2 / 1656	66.3 / 1684
Hip room (in / mm):	61.4 / 1560	61.4 / 1560	61.5 / 1562

Capacities

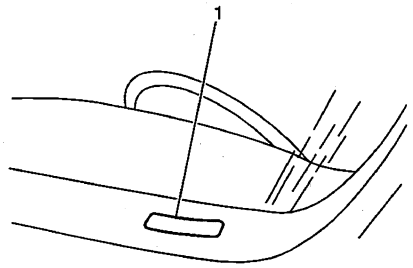
	Short Box Regular Cab	Long Box Regular Cab	Short Box Extended Cab	Long Box Extended Cab	Short Box Crew Cab
Seating:	2 / 3	2 / 3	5 / 6	5 / 6	6
Fuel tank (gals / liters):	26 / 98.4	34 / 128.7	26 / 98.4	34 / 128.7	26 /98.4
	Vortec 4300	**Vortec 4800**	**Vortec 5300**	**Vortec 6000**	
Engine oil (qts / liters):	4.5 / 4.3	6 / 5.7	6 / 5.7	6 / 5.7	
Cooling system (qts / liters)					
Manual trans:	12.9 / 12.2	13.7 / 13	13.4 / 12.7	15.2 / 14.4	
Automatic trans:	12.6 / 11.9	13.4 / 12.7	14.9 / 14.1	14.4 / 13.6	

Maximum trailer weight (lbs / kg)	
1500 Series w/Vortec 5300:	8400 / 3809.5 with weight-distributing hitch and sway control
1500 Series w/Vortec 5300 & Quadrasteer:	8600 / 3900.2 with weight-distributing hitch and sway control
1500 HD (std. Vortec 6000):	10,200 / 4625 with weight-distributing hitch and sway control
2500 Series (std. Vortec 6000):	10,700 / 4852.6 with weight-distributing hitch and sway control

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

Vehicle Identification

Vehicle Identification Number (VIN)



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

Position	Definition	Character	Description
1	Country of Origin	1 2	United States Canada
2	Manufacturer	G	General Motors
3	Make	B C D T	Chevrolet Incomplete Chevrolet Truck GMC Incomplete GMC Truck
4	GVWR/Brake System	E F G H J	6001-7000/Hydraulic 7001-8000/Hydraulic 8001-9000/Hydraulic 9001-10000/Hydraulic 10001-14000/Hydraulic
5	Truck Line/Chassis Type	C K	4x2 4x4
6	Series	1 2 6	Half Ton Nominal ¾ Ton Nominal 1/2 Ton Luxury
7	Body Type	3 4 9	Four-Door Crew Cab or Utility Two-Door Cab Extended Cab
8	Engine Type	X V Z T U N 1 G	4.3L V6 MFI (LU3) 4.8L V8 MFI (LR4) 5.3L V8 MFI (L59) 5.3L V8 MFI (LM7) 6.0L V8 MFI (LQ4) 6.0L V8 MFI (LQ9) 6.6L V8 DSL (LB7) 8.1L V8 MFI (L18)
9	Check Digit	--	Check Digit
10	Model Year	3	2003
11	Plant Location	1 E F Z G	Oshawa, Ontario Pontiac, Michigan Flint, Michigan Fort Wayne, Indiana Silao
12-17	Plant Seq. Number	--	Plant Sequence Number

VIN Derivative

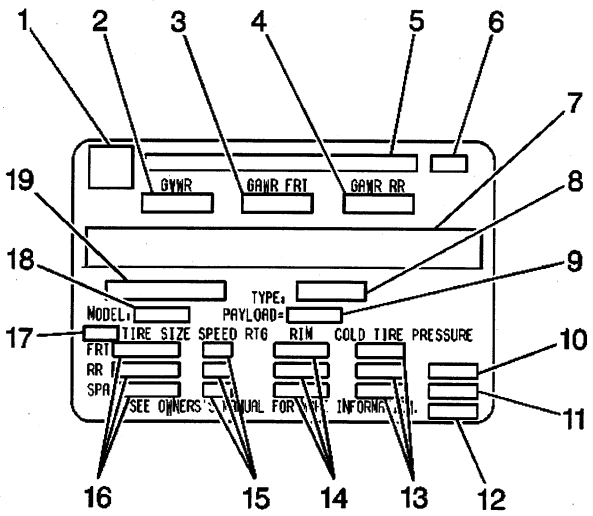
All engines and transmissions are stamped or laser etched with a partial vehicle identification number (VIN), which was derived from the complete VIN. A VIN derivative contains the following nine positions:

Position	Definition	Character	Description
1	Division	B C D T	Chevrolet Incomplete Chevrolet Truck Gmc Incomplete Gmc Truck
2	Model Year	3	2003
3	Plant Location	1 E Z J G F X	Oshawa, Ontraio Pontiac, Michigan Fort Wayne, Indiana Janesville Silao Flint Experimental Engineering Manufacturing
4-9	Plant Sequence Number	--	--

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

VIN Derivative Position	Equivalent VIN Position
1	3
2	10
3	11
4-9	12-17

Label Certification w/o RPO Z49



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

The vehicle certification label displays the following assessments:

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

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

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

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

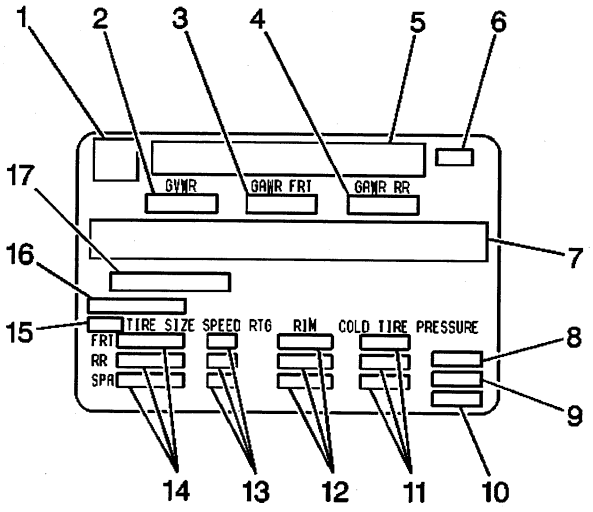
The front gross axle weight rating (GAWR FRT) is the weight exerted on the front axle. The rear gross axle weight rating (GAW RR) is the weight exerted on the rear axle. The front and rear gross axle weights must not exceed the front and rear gross axle weight ratings.

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

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

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

Label Certification w/o RPO Z49 – Incomplete Vehicle



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

The vehicle certification label displays the following assessments:

- The Gross Vehicle Weight Rating (GVWR)
- The Gross Axle Weight Rating (GAWR) -- Front and Rear

- The vehicle's payload rating
- The original equipment tire sizes and the recommended tire pressures

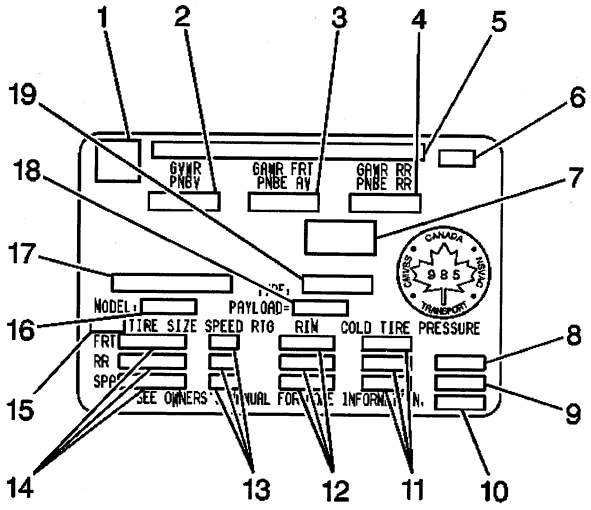
Gross vehicle weight (GVW) is the weight of the vehicle and everything it carries. Include the following items when figuring the GVW:

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

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

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

Label Certification with RPO Z49



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

The vehicle certification label displays the following assessments:

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

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

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

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

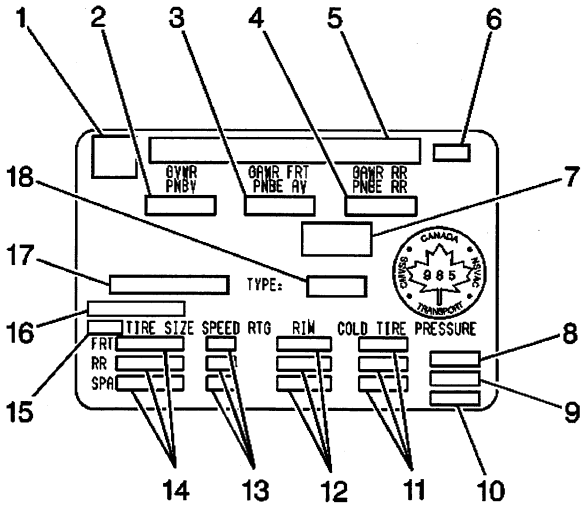
The front gross axle weight rating (GAWR FRT) is the weight exerted on the front axle. The rear gross axle weight rating (GAW RR) is the weight exerted on the rear axle. The front and rear gross axle weights must not exceed the front and rear gross axle weight ratings.

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

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

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

Label Certification with RPO Z49 – Incomplete Vehicle



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

The vehicle certification label displays the following assessments:

- The Gross Vehicle Weight Rating (GVWR)

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

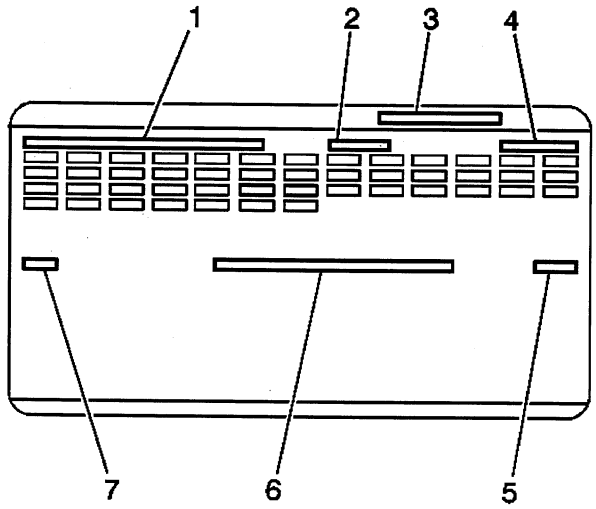
Gross vehicle weight (GVW) is the weight of the vehicle and everything it carries. Include the following items when figuring the GVW:

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

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

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

Service Parts Identification Label (SPID)

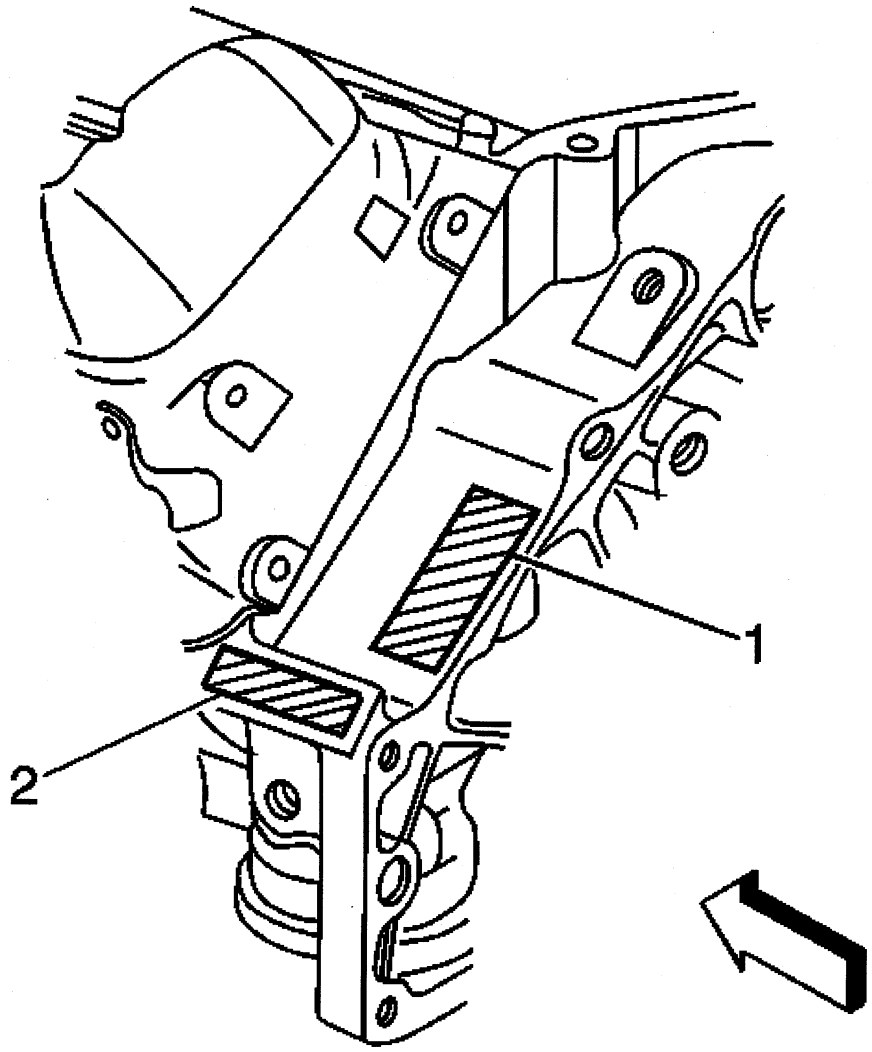


(1) Vehicle Identification Number
(2) Wheel Base
(3) Part Number Location
(4) Model Designation
(5) Order Number
(6) Exterior Color
(7) Paint Technology

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

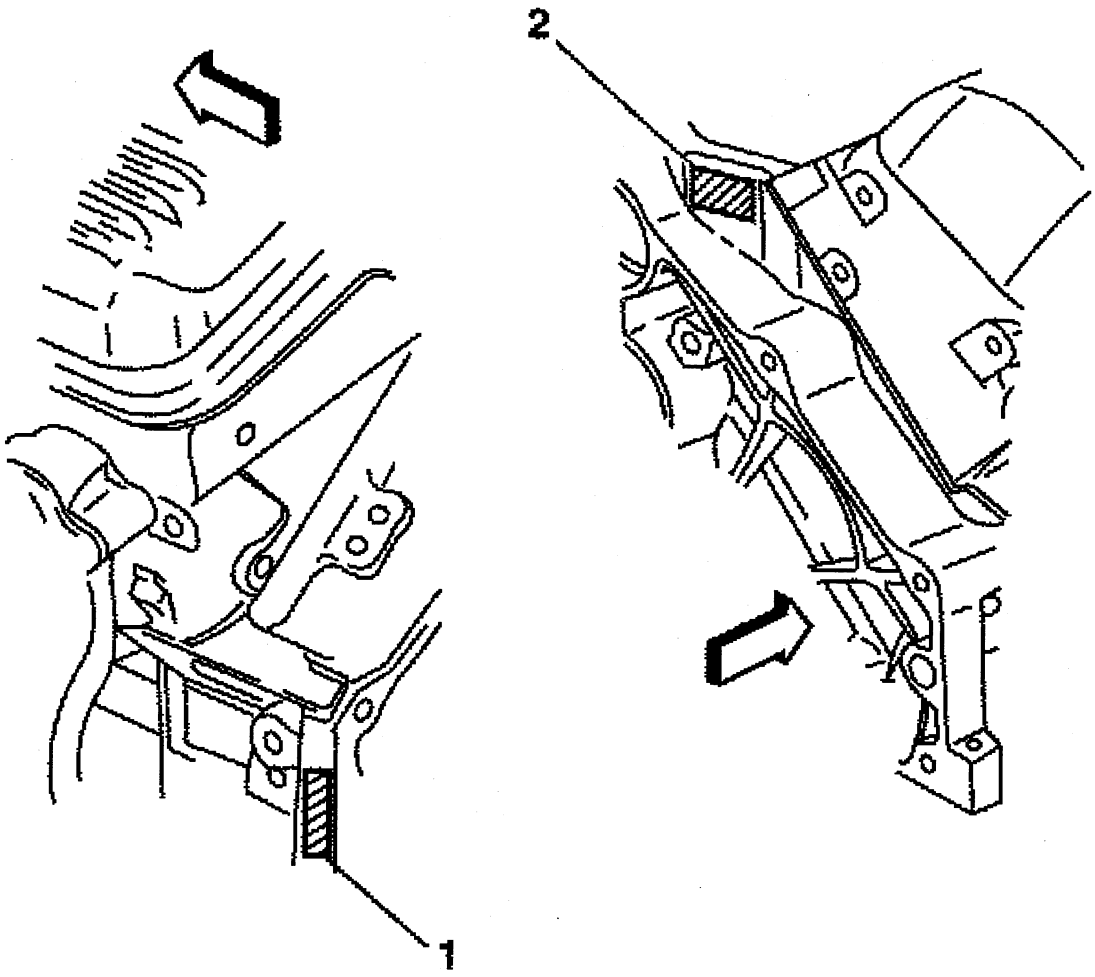
Engine ID and VIN Derivative Location

4.3L V-6 Engine



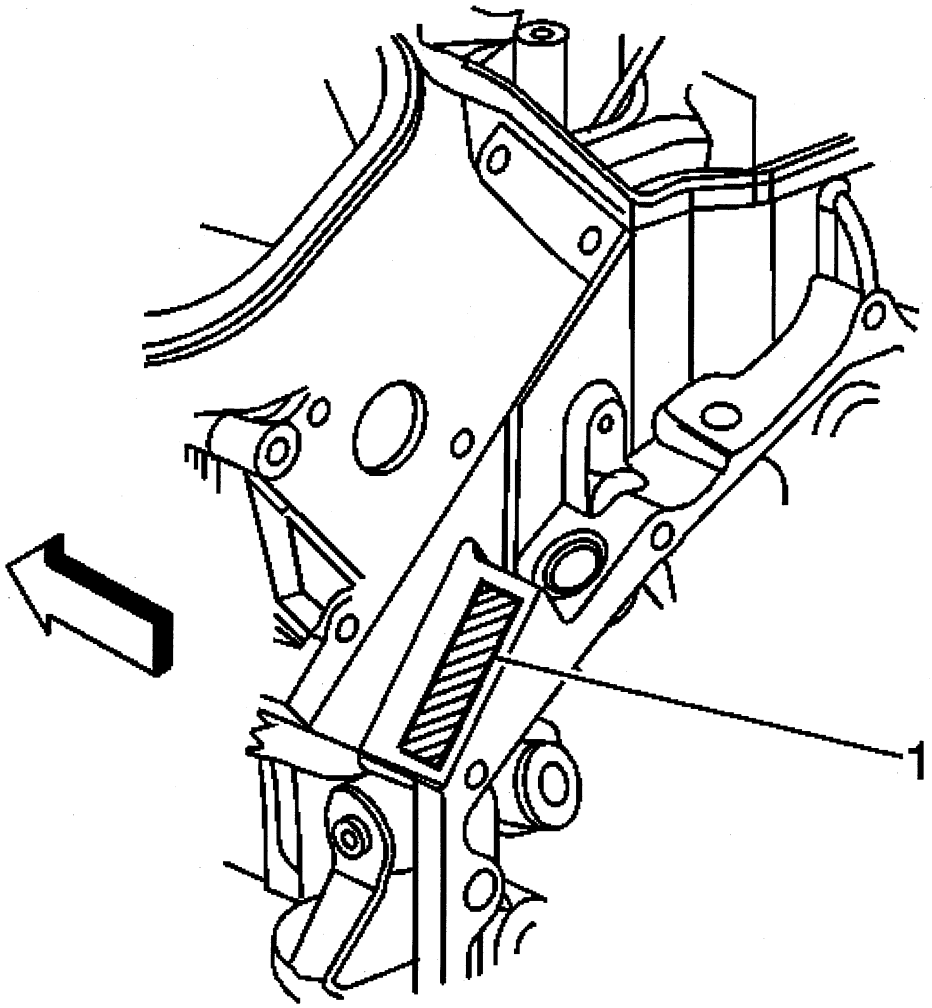
(1) Primary Engine Identification Number Location
(2) Secondary Engine Identification Number Location

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



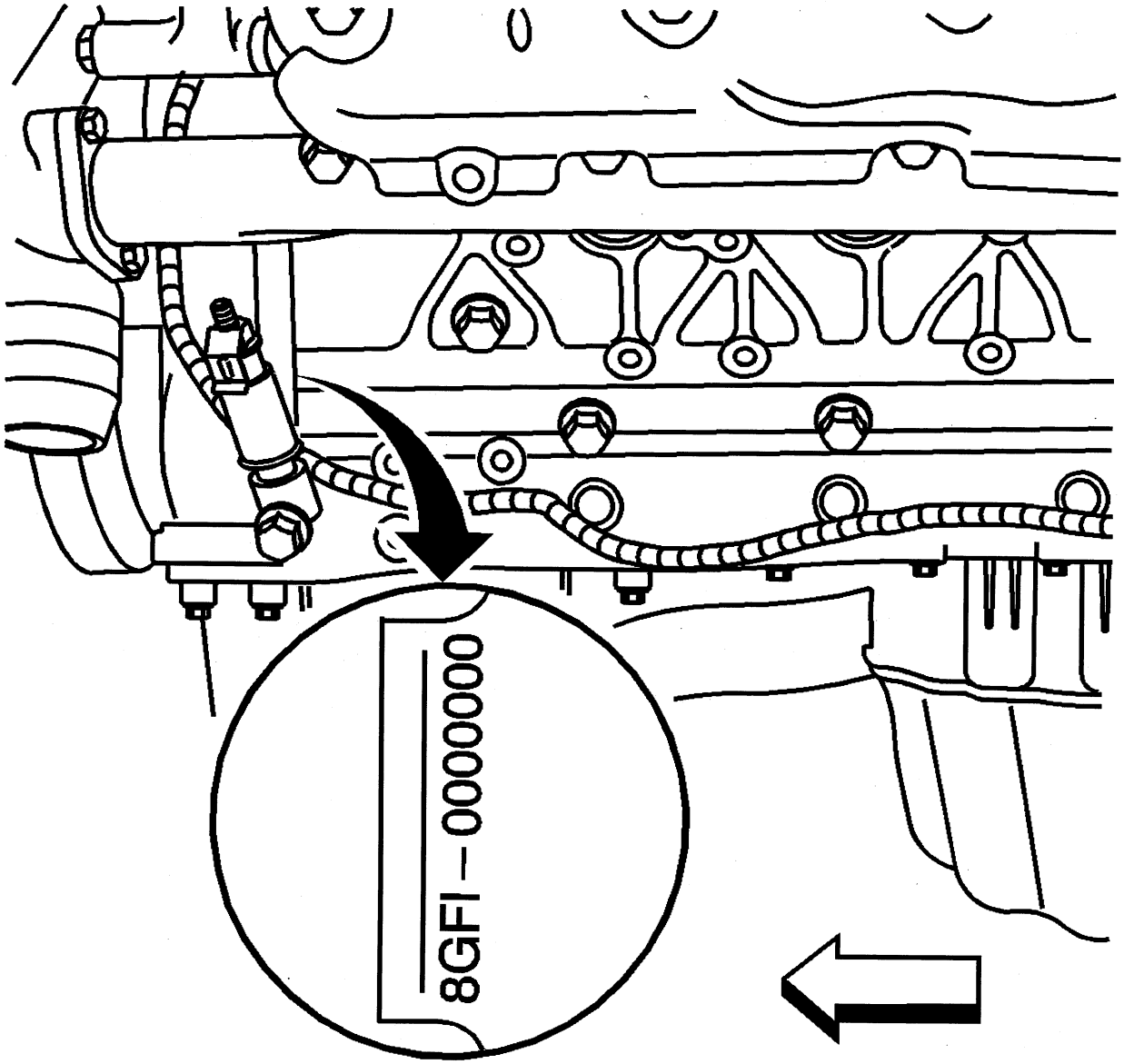
(1) Primary Engine Identification Number Location
(2) Secondary Engine Identification Number Location

8.1L V-8 Engine



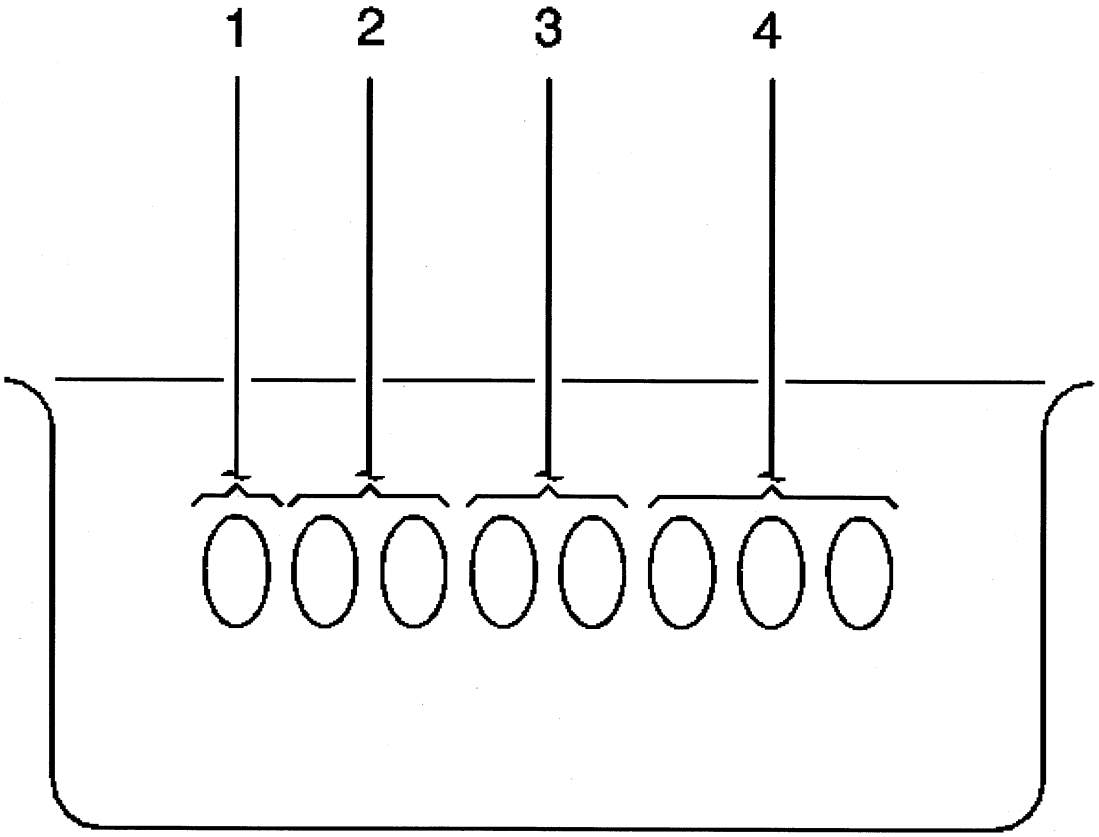
(1) Engine Identification Number Location

6.6L Diesel Engine



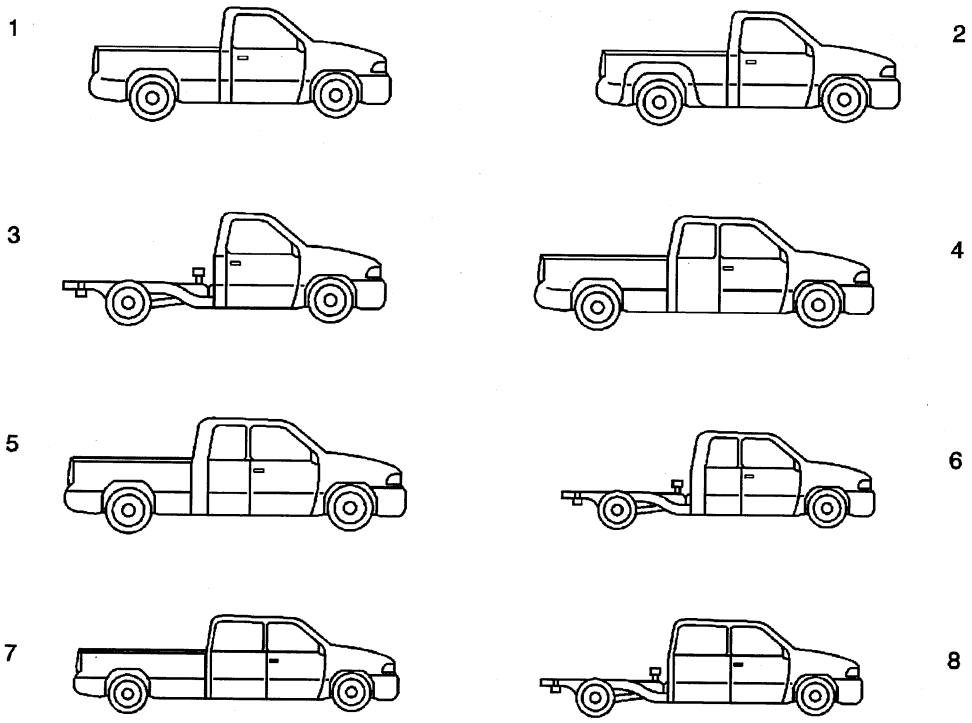
(1) Engine Identification Number Location

Engine ID Legend



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

Model Identification



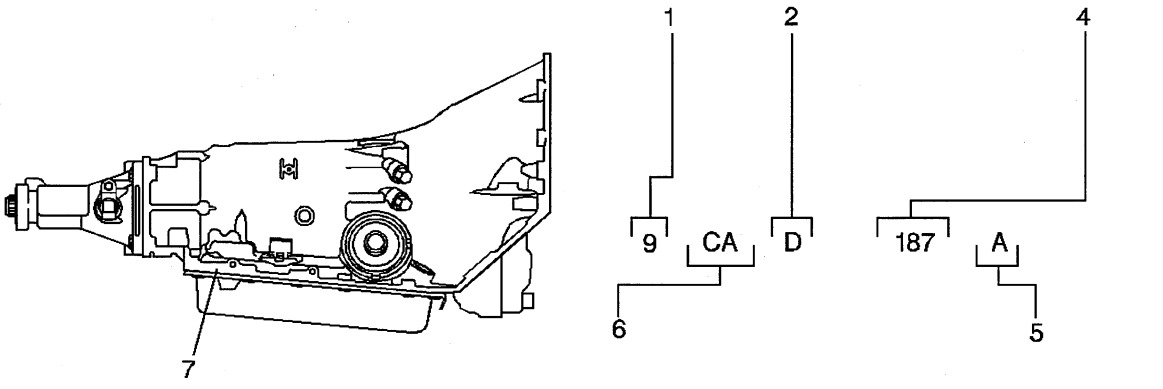
(1) 2-Door Pickup Fleetside/Wideside
(2) 2-Door Pickup Sportside
(3) 2-Door Chassis Cab
(4) 4-Door Extended Cab Fleetside/Wideside
(5) 4-Door Extended Cab Sportside
(6) 4-Door Extended Chassis Cab
(7) 4-Door Crew Cab Fleetside/Wideside
(8) 4-Door Crew Cab Chassis Cab

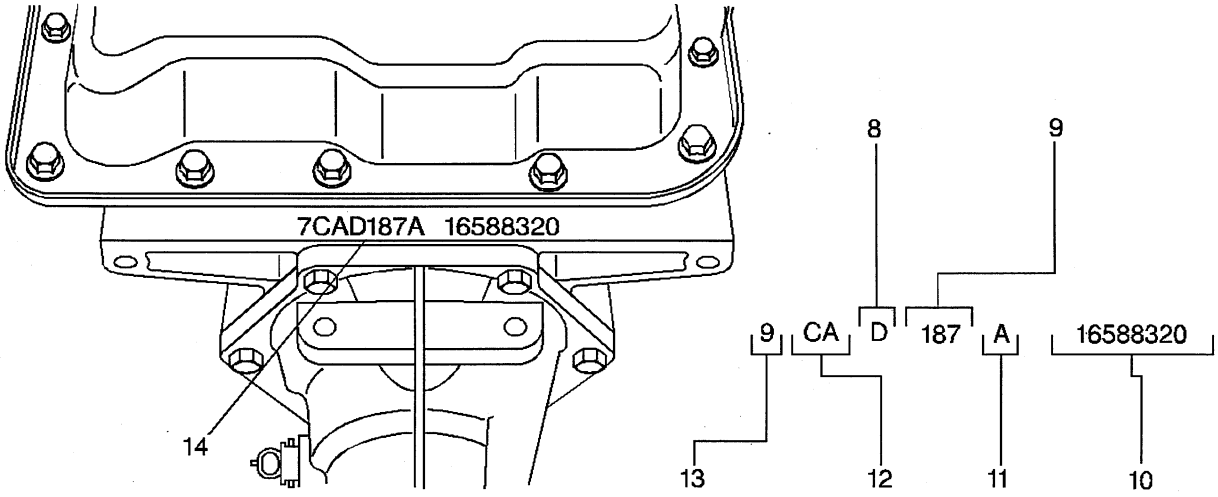
Engine and Transmission Usage

Engine/RPO	Transmission	
	Automatic/RPO	Manual/RPO
4.3L V6 Gasoline/LU3	4L60E/M30	5 Speed/MG5
4.8L V8 Gasoline/LR4	4L60E/M30	5 Speed/MG5
5.3L V8 Gasoline/L59	4L60E/M30	Unavailable
5.3L V8 Gasoline/LM7	4L60E/M30	Unavailable
6.0L V8 Gasoline/LQ4	4L60E/M30 4L60E HD/M32 4L80E/MT1	5 Speed/MW3
6.0L V8 Gasoline/LQ9	4L60E HD/M32	Unavailable
6.6L V8 Diesel/LB7	LCT 1000/M74	6 Speed/ML6
8.1L V8 Gasoline/L18	LCT 1000/M74 4L80E HD/MN8	6 Speed/ML6

Transmission ID and VIN Derivative Location

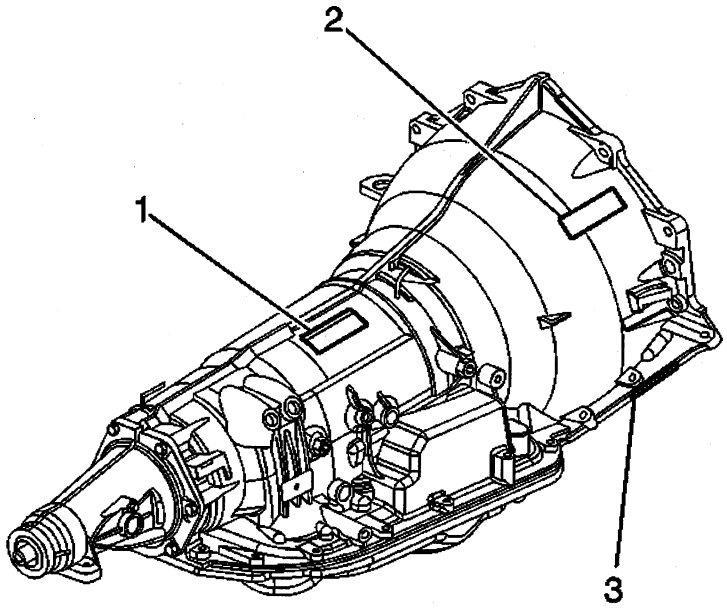
4L60-E Transmission ID Location



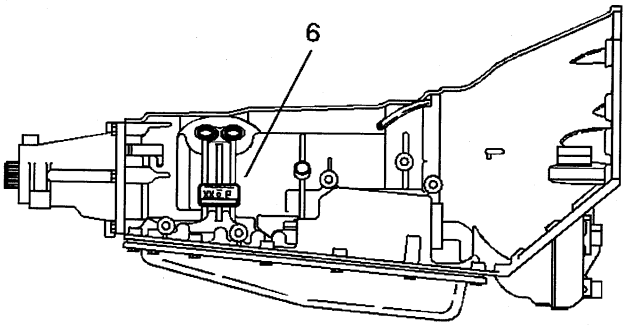


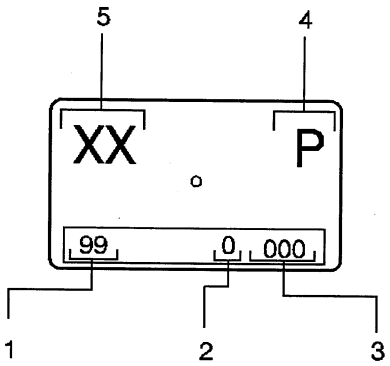
(1) Model Year
(2) Hydra-Matic 4L60-E
(4) Julian Date (or Day of the Year)
(5) Shift Built (A, B, J = First Shift; C, H, W = Second Shift)
(6) Model
(7) Transmission ID Location
(8) Hydra-Matic 4L60-E
(9) Julian Date (or Day of the Year)
(10) Serial No.
(11) Shift Built (A, B, J = First Shift; C, H,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

4L80-E Transmission ID Location



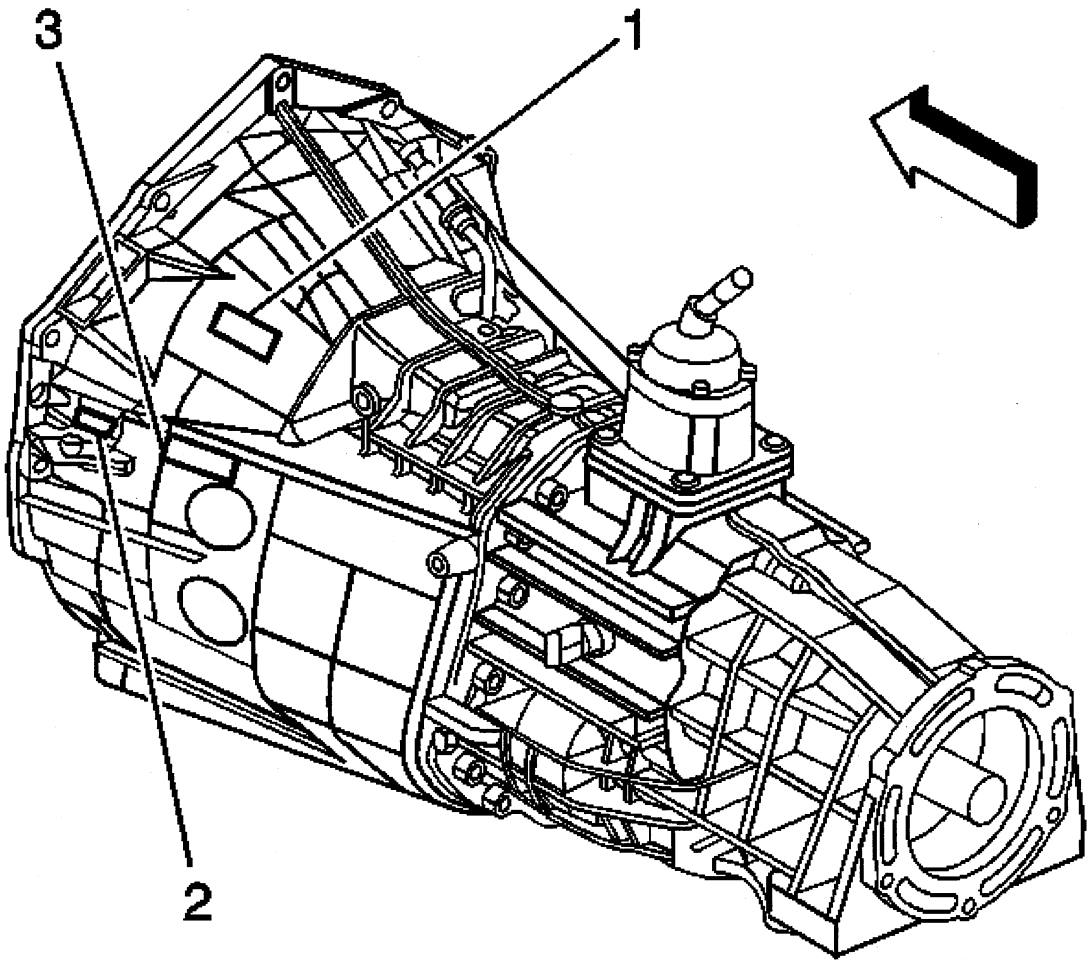
Transmission ID and VIN derivative locations (1, 2). The right hand stamping is shown, left hand is opposite. Pin or hand stamp location (3) for the transmission ID or VIN derivative.





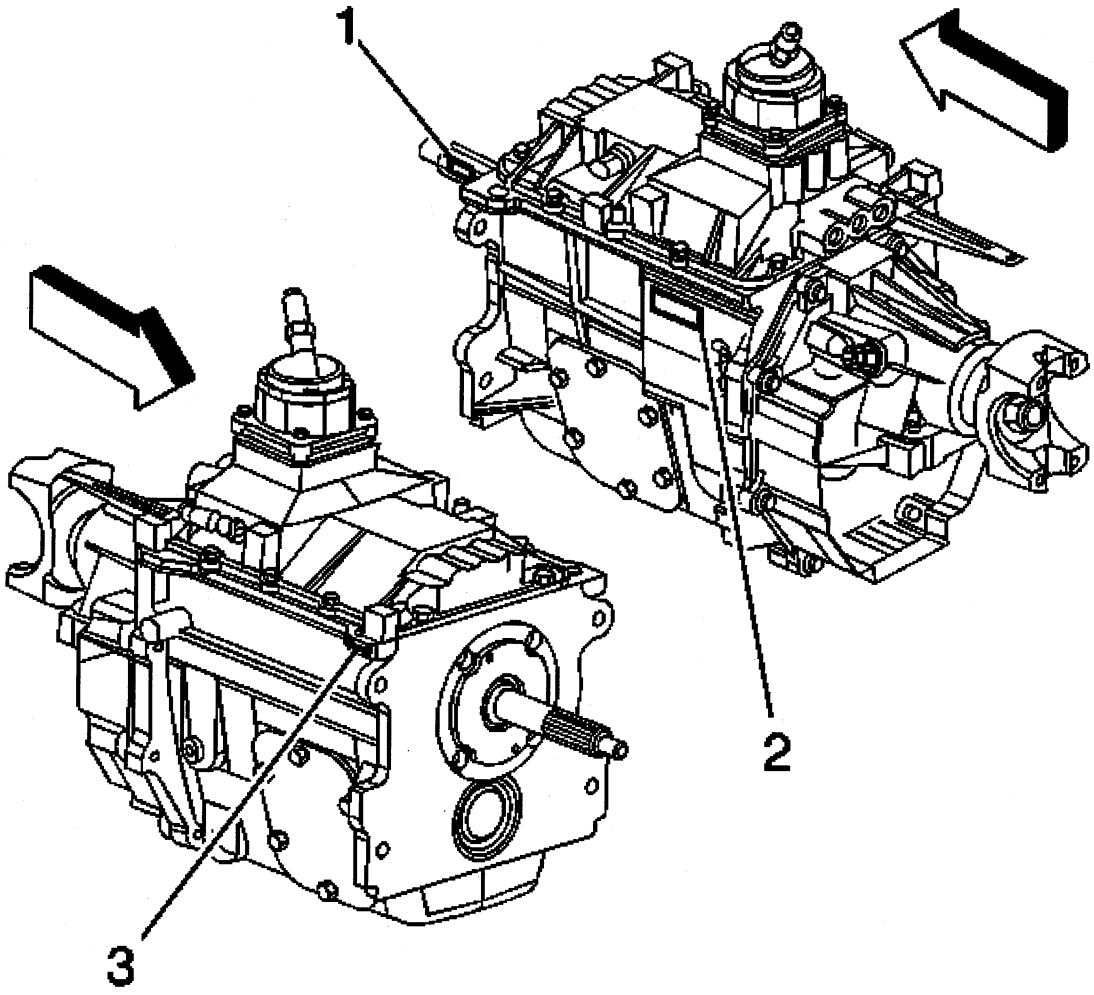
1. Calendar Year
2. Julian Date of the Year
3. Shift and Line Number
4. Plant
5. Model
6. Location on Transmission

5-Speed Getrag



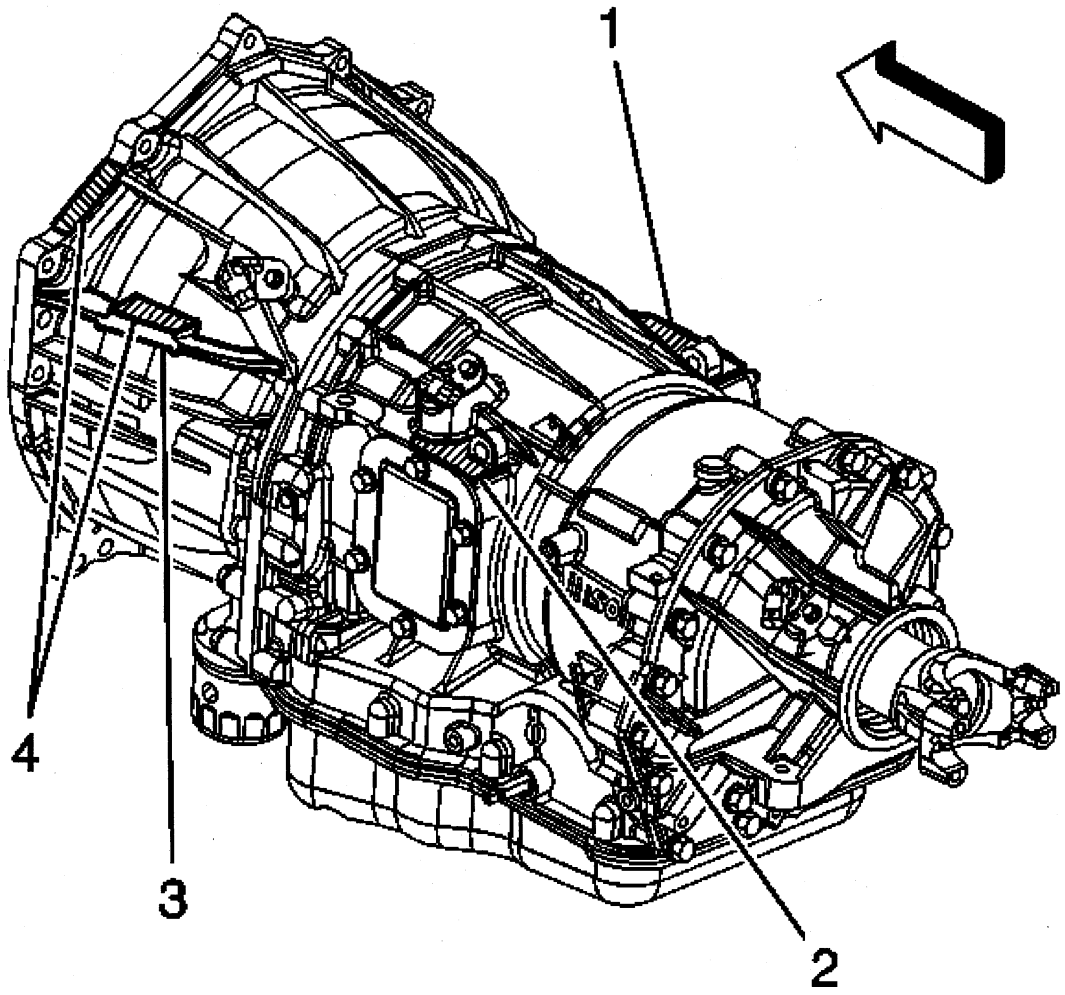
Vehicle identification number location PIN stamp only (1). Vehicle identification number location optional PIN or Hand Stamp (2). Vehicle identification number location optional Pin stamp only (3).

5-Speed Manual



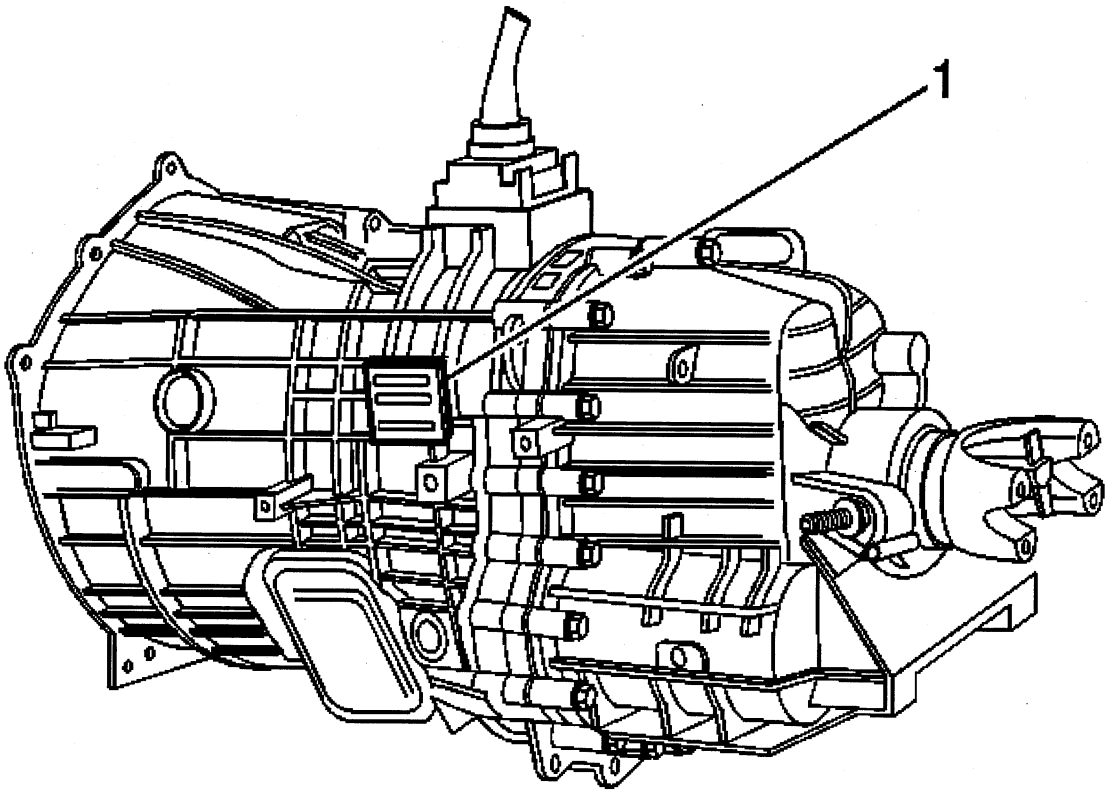
The transmission vehicle identification number location PIN or hand stamp (1, 3). Vehicle identification number location PIN or hand stamp (2).

Allison Transmission



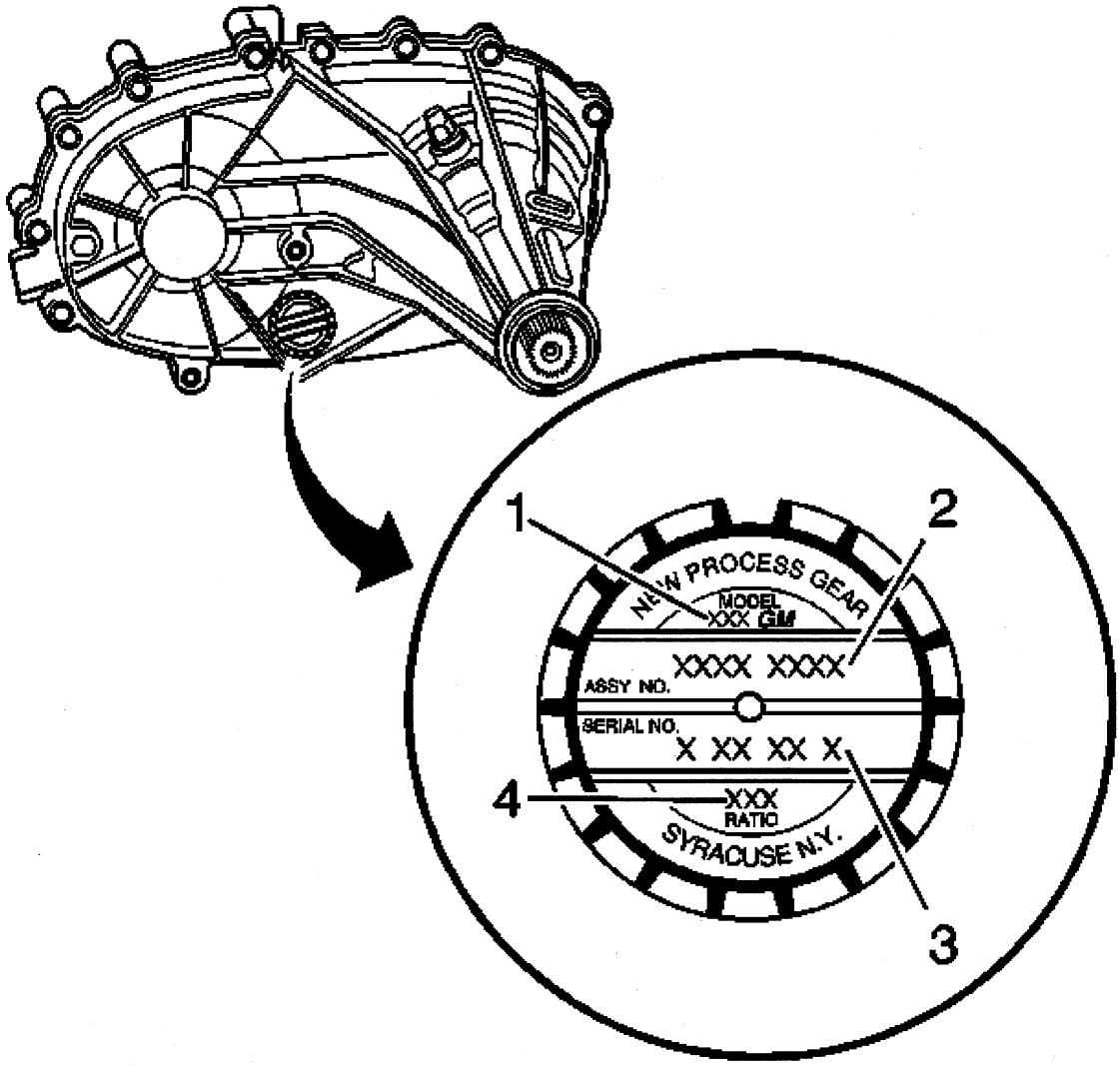
Vehicle identification number location for PIN stamp (3). Optional hand stamp locations (1, 2, 4)

ZF Transmission



(1) Engine identification tag location.

Transfer Case Identification

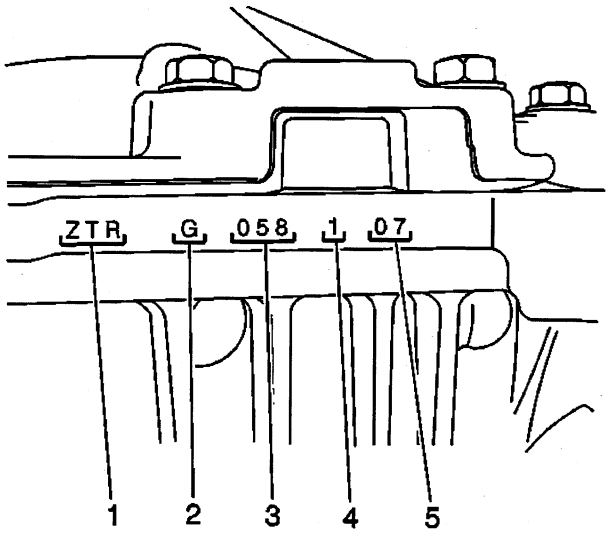


An identification tag is attached to the rear half of the transfer case. The tag provides the following information:

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

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

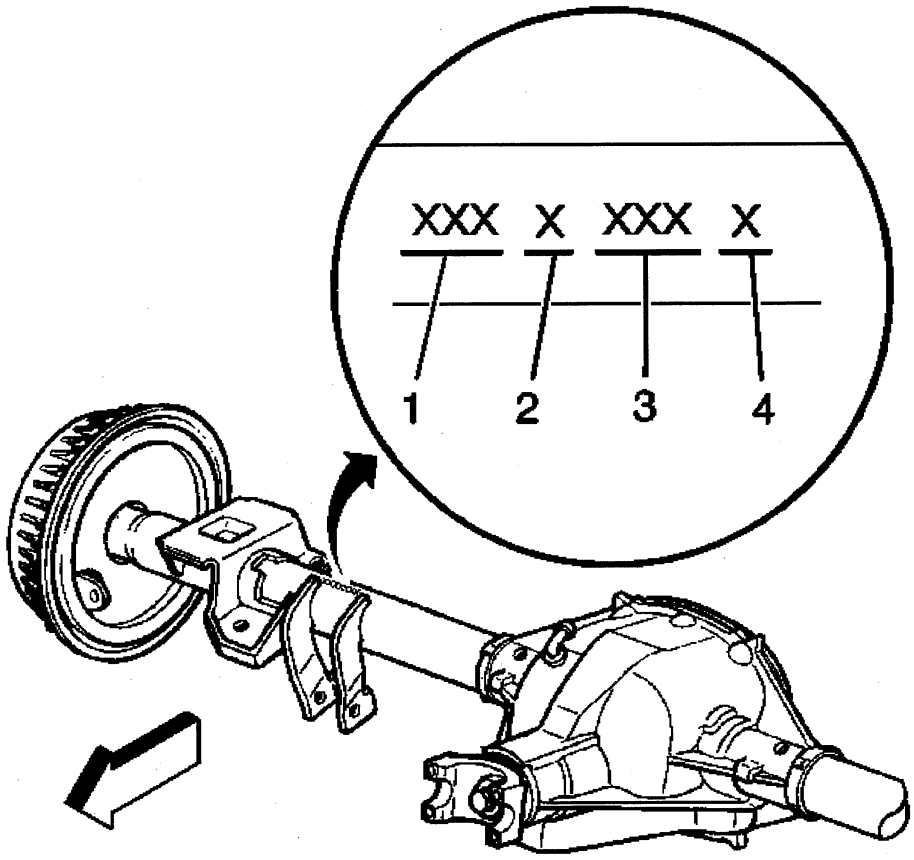
Axle Identification – Front



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

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

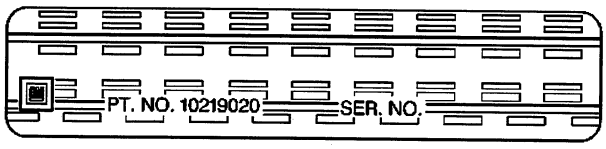
Axle Identification – Rear



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

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

Labeling - Anti-Theft



Notice

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

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

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

RPO Code List

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

RPO	Description
AC6	Window, Tinted Deep, Rear S/D
AE7	Seat Front Split, Driver, Passenger
AG1	Adjuster Front Seat Power, Multi-Directional, Driver
AG2	Adjuster Passenger Seat Power, Multi-Directional
AJ1	Windows Deep Tint, All Except W/S and DRS
AL0	Sensor Indicator Inflatable Restraint, Front Passenger/Child Presence Detector
AM7	Rear Seat Folding
AN3	Seat Front, Individual, Non-Bucket
AU0	Lock Control, Remote Entry
AU3	Lock Control Side Door, Electric
A04	Windshield Tinted, Less Upper Shadeband
A31	Window Power Operated, All Doors
A95	Seat Front Bucket, High Back, Driver and Passenger Recliner
BAG	Parts Package Export
BA5	Ornamentation Exterior, Custom
BG9	Covering, Floor, Rubber
BVF	Steps, Runningboard, Side, Color Keyed
BW2	Molding, B/S Deluxe
B30	Floor Covering, Carpet
B32	Covering Front Floor Mats, Auxiliary
B33	Covering Rear Floor Mats, Auxiliary
B34	Covering Front Floor Mats, Carpeted Insert
B4L	Label Price, Refer Geographic Chart
B4U	Performance Package, Sport
B58	Covering Floor Mat, Front and Rear, Carpeted Insert
B71	Molding, Wheel Opening, Colored
B81	Molding Body/Side - Delete
B85	Molding, Body/Side, Exterior, Bright
CF5	Sunroof, Glass, Sliding, Electric
CJ2	HVAC System, Air Conditioner Front, Automatic Temperature Control, Auxiliary Temperature Control
CJ3	HVAC System, Air Conditioner Front, Manual Temperature Control, Auxiliary Temperature Control
CKD	Vehicle Completely Knocked Down
C3J	GVW Rating 6,700 lbs
C42	HVAC System Heater, Outside Air, Deluxe
C49	Defogger Rear Window, Electric
C5F	GVW Rating 8,500 lbs
C5H	GVW Rating 6,900 lbs
C5M	GVW Rating 6,100 lbs
C5S	GVW Rating 6,600 lbs
C5Z	GVW Rating 7,200 lbs
C6P	GVW Rating 8,600 lbs (3900 kg)
C6W	GVW Rating 9,200 lbs
C7H	GVW Rating 6,400 lbs (2900 kg)
C7L	GVW Rating 12,000 lbs
C7W	GVW Rating 11,400 lbs

C86	Lamp, Manual Transmission, Shift Indicator, Tell-tale Suppression
DE2	Mirror, Outside Left and Right, Manual Control, Folding, Color
DF2	Mirror, Outside Left and Right, Wide Load, Folding, Stainless Steel
DF5	Mirror, Inside Rearview, Light Sensitive, Compass, Outside Temperature Display
DG5	Mirror, Outside Left and Right, Wide Load, Large
DH6	Mirror, Inside Front Van, Left and Right, Sunshade, Illumination
DK7	Console Roof Interior, Custom
DL3	Mirror, Outside Left and Right, Remote Control, Electric, Heated, Power Folding, Turn Signal Indicator, Light Sensitive, Color
DL8	Mirror, Outside Left and Right, Remote Control, Electric, Heated
DPF	Mirror, Outside Left and Right, Wide Load, Remote Control, Electric, Heated
DT4	Ashtray Cigarette Lighter
D07	Console, Front Compartment, Floor, Custom
D44	Mirror, Outside, Color
ESC	Equipment, Individual Front seats with Front Floor Compartment Console Provisions
EVA	Test DVT, EVAP Emission Requirement
E37	Pickup Box Inner DK Composite
E62	Body Equipment Step Side, Pick-up Box
E63	Body Equipment Fleetside, Pick-up Box
E95	Cover Tonneau, Rear Compartment
FW1	Manual Electric Control, Ride and Handling
F60	Spring Front Heavy Duty
GTY	Axle Wide Track
GT4	Axle Rear 3.73 Ratio
GT5	Axle Rear 4.10 Ratio (DUP With GT8)
GU4	Axle Rear 3.08 Ratio
GU6	Axle Rear 3.42 Ratio
G80	Axle Positraction Limited Slip
G86	Axle Limited-Slip
HOT	Appearance Package GMC "Hot Truck"
HVY	Identification 2-inch Body Raise, HD Model
JC3	Brake Vac Power, Disc/Disc, 6,400 lb
JC4	Brake Vac Power, Disc/Disc, 7,200 lb
JH6	Brake Hydraulic Power, 4-Wheel Disc, 9,900 lbs
JH7	Brake Hydraulic Power, 4-Wheel Disc, 12,300 lbs (Dup with JH9)
JVA	Brake System, Antilock Brake - Delete
J81	Indicator Switch, Export
KC4	Engine Oil Cooling System
KG3	Generator 145 Amp
KL5	Modification Engine, Natural Gas
KL6	Provisions, Natural Gas
KL8	Conversion Natural Gas (CNG Gas)
KNP	Cooling System Transmission, HD
KUP	Throttle Control Electronic
K05	Heater Engine Block
K34	Cruise Control, Automatic, Electronic
K47	Air Cleaner High Capacity
K53	Fuel Sender Assembly, Robust Fuel System
K65	Generator, 105 Amp, Dual
K68	Generator, 105 Amp
LB7	Engine, Diesel, 8 Cylinder, 6.6L, DI, V8, Turbo, HO, Duramax
LM7	Engine Gas, 8 Cylinder, 5.3L, MFI, Iron, GM
LQ4	Engine Gas, 8 Cylinder, 6.0L, MFI, Iron, GM
LR4	Engine Gas, 8 Cylinder, 4.8L MFI, Iron, GM

LU3	Engine Gas, 6 Cylinder, 4.3L, MFI, V6, 90 DEG
L18	Engine Gas, 8 Cylinder, 8.1L, MFI
L31	Engine Gas, 8 Cylinder, 5.7L, CPI
MG5	Transmission Manual 5-Speed, Getrag, 84mm, 4.00 1st, O/D
ML6	Transmission Manual 6-Speed ZF, 105mm, 5.79 1st, 0.72 6th, O/D
MT1	Transmission Auto 4-Speed HMD 4L80-E
MW3	Transmission Manual, 5-Speed, NVG, 109mm, 5.61 1st, O/D
M1F	Power Take Off Rear PTO
M30	Transmission Auto 4-Speed, HMD, 4L60-E, Electronic
M32	Transmission Auto 4-Speed, HMD, 4L60-E, Electronic, HD
M74	Transmission Auto 5-Speed, Allison, LCT 1000, 3.10 1st, 1.00 4th, 0.71 5th, O/D, Conversion Clutch
M96	Transmission Manual 5-Speed, Tremec, 109mm, 5.81 1st, 0.77 5th
NA1	Emission System GVW less than 8,500 lb
NA4	Emission System GVW greater than 8,500 lb
NC1	Emission System California, LEV
NC8	Emission System California, ULEV
NF2	Emission System Federal, Tier 1
NF4	Emission System Clean Fuel, Fleet
NF9	Emission System General Unleaded
NP1	Transfer Case, Electric Shift Control, 2 Speed
NP2	Transfer Case, Manual Shift Control, 2 Speed
NP3	Transfer Case, All-Wheel Drive
NP5	Steering Wheel, Leather Wrapped
NP8	Transfer Case Active, 2 Speed Push Button Control
NQZ	Fuel Tank Auxiliary, Rear Mounted, 18 gallon - Delete
NW7	Traction Control, Powertrain Management Only
NYS	Steering 4-Wheel
NZZ	Sales Package, Skid Plate Off-Road Spot
N05	Lock Control Fuel Filler Cap
N12	Rear Exit Exhaust System
N93	Wheel - Aluminum - Chrome - 17 X 7.5
OSG	Plant Code Oshawa, Ont, Canada (TRK)
PF4	Wheel - Aluminum - 16 X 7.0
PF9	Wheel - Aluminum Cast - 16 X 7.0
PRO	Appearance Package Sierra Professional
PTO	Provisions, Power Take Off (PTO) Controls
PY0	Wheel - Aluminum - 16 X 6.5
PY2	Wheel - Chrome Appearance - 16 X 6.5
P03	Wheel Cover, Var 3
P06	Trim Discs Wheel
P96	Equipment, Mexican Modified, Mandatory Base Equipment
QAN	Tire All P265/70R 17 - 113S BW R/PE ST TL AL2
QBN	Tire All LT245/75R16/C BW R/PE ST TL 00R
QBX	Tire All LT245/75R16/C WOL R/PE ST TL OOR
QCC	Tire ALL P255/70R16 BW R/PE ST TL ALS
QCJ	Tire All P255/70R16 WOL R/PE ST TL ALS
QCP	Tire All P255/70R16 - 109H BW R/PE ST TL ALS
QC3	Wheel 16 x 7, Aluminum, Special
QC4	Wheel 16 x 7, Aluminum, Custom
QGC	Tire All P265/75R16 - 114S BW R/PE ST TL AT
QGD	Tire All P265/75R16 - 114S WOL R/PE ST TL AT
QHS	Tire All P265/75R16 - 114H BW R/PE ST TL AT "A" TEMP Rating
QIW	Tire All LT245/75R16/E BW R/PE ST TL OOR 120Q

QIX	Tire All LT245/75R16/C BW R/PE ST TL OOR 120Q
QIZ	Tire All LT245/75R16/E BW R/PE ST TL ALS 12OQ
QNL	Tire All P245/75R16 - 109S WOL R/PE ST TL ALS
Q4B	GVW Rating 6,200 lbs
SAF	Lock Spare Tire, Hoist Shaft
TL1	Grille Special
TP2	Battery Auxiliary
TQ3	Battery 770 CCA (Dual)
TRW	Provisions Lamp, Roof Mounted
TR3	Grille Radiator, Body Color, w/Chrome Emblem
TZ0	Transmission Manual 5-Speed, Tremac, 85mm, 3.82 1st, 0.83 5th
T2H	Exterior Ornamentation, Export Unique Requirements
T62	Lamp System Daytime Running - Delete
T64	Battery - Delete
T78	Headlamps Control - Delete
T96	Fog Lamps, Front
UB0	Radio AM/FM Stereo, Seek/Scan, CD, Auto Tone, Data System Clock, ETR
UB1	Radio AM/FM Stereo, Seek/Scan, Auto Reverse Music Search Cassette, CD, Auto Tone, Data System Clock, ETR
UC2	Speedometer Instrument, Kilo and Miles, Kilo Odometer, Positive Bias
UC6	Radio AM/FM Stereo, Seek/Scan, RDS, Multiple Compace Disc, Auto Tone Control, Clock, ETR
UD4	Alarm Vehicle Speed, 120 km/h
UE1	Communication System Vehicle, G.P.S. 1
UG1	Universal Garage Door Opener
UK3	Accessory Steering Wheel Control
UK6	Radio Control Rear Seat and Earphone Jacks
UL2	Frequencies, European
UL4	Frequencies, South American
UL5	Radio - Delete
UL8	Frequencies, Saudi Arabian
UM7	Radio AM/FM Stereo, Seek/Scan, Clock, ETR
UQ3	Speaker System, Performance Enhanced Audio
UQ5	Speaker System 4, Dual Front Door Mounted, Dual Extended Range Quarter Mounted
UQ7	Speaker System Premium Performance, Enhanced Audio, Bose®
UQ9	Speaker System - Delete
UY2	Wiring Provisions for Camper/5th Wheel Trailer
U01	Lamp Five, Roof Marker, Truck
U1S	Player Multiple Compace Disc
U19	Speedometer Instrument, Kilo and Miles, Kilo Odometer
U2K	Digital Audio System S-Band
U2L	Digital Audio System L-Band
U42	Entertainment Package Rear Seat
VBX	Language Label Arabic
VB3	Bumper Rear Step, Chrome, Impact Strip
VC0	Label, Noise Control Information
VC4	Label Price/Fuel Economy, Puerto Rico and Virgin Islands
VC5	Label Shipping, Except US, US Possessions, or Japan
VC7	Label Price/Fuel Economy, Guam
VF7	Bumper Rear Step - Delete
VGC	Protector Film, Paint Etch Preventive
VG3	Bumper Front Impact Strip
VG8	Vehicle Label, Notice to Buyer
VJ3	Label, Plate ECE Approval and Vehicle Identification

VK3	License Plate, Front Mounting Package
VPH	Vehicle Preparation Overseas Delivery
VR4	Trailer Hitch Weight Distributing Platform
VR6	Hook Tie-Down Shipping
VT4	Bumper Front Color Keyed
VT5	Bumper Rear Color Keyed
VYU	Provisions, Snow Plow Preparation
VZ2	Calibration Speedometer A
V10	Cold Weather Options Provision
V22	Grille Radiator, Chrome
V43	Bumper, Rear Step, Color
V60	Vehicle Statement Gulf States Organization, Incomplete Vehicle
V73	Vehicle Statement, USA/ Canada
V76	Front Towing Hook
V78	Vehicle Statement - Delete
V87	Vehicle Statement Gulf States Organization
W86	Equipment: Miscellaneous Equipment for Venezuela (GMV Controlled)
W99	Equipment: Miscellaneous Equipment for Venezuela (GM Platform Controlled)
XCC	Tire Front P255/70R16 BW R/PE ST TL ALS
XEC	Tire Front LT215/85R16/E BW R/ST TL Highway
XEF	Tire Front LT215/85R16/E BW R/PE ST TL OOR
XGD	Tire Front P265/75R16-114S WOL R/PE ST TL AT
XNF	Tire Front P235/75R16-106S BW R/PE ST TL ALS
XYK	Tire Front LT215/85R16/D BL R/PE ST TL HWY
XYL	Tire Front LT215/85R16/D BL R/PE ST TL OOR
X44	Parts, North American Sourced and Shipped to Outside Supplier and Checked (GMCL Controlled)
X52	Miscellaneous Equipment for Guam, Puerto Rico/US Virgin Islands
X88	Conversion Name Plate Chevrolet
YB3	Plate Clutch Driven, Part of English - Delete
YCC	Tire Rear P255/70R16 BW R/PE ST TL ALS
YE9	Convenience Package Comfort and Decor Level #3
YF2	Sales Package Ambulance Upfitter
YGD	Tire Rear P265/75R16-114S WOL R/PE ST TL AT
YNF	Tire Rear P235/75R16-106S BW R/PE ST TL ALS
YYK	Tire Rear LT215/85R16/D BL R/PE ST TL HWY
Y91	Merchandised Package Luxury Edition
ZCC	Tire Spare P255/70R16 BW R/PE ST TL ALS
ZGD	Tire Spare P265/75R16-114S WOL R/PE ST TL AT
ZNF	Tire Spare P235/75R16-106S BW R/PE ST TL ALS
ZW9	Body Equipment, Base Body or Chassis
ZX3	Chassis Package Manual Select Damping
ZYK	Tire Spare LT215/85R16/D BL R/PE ST TL HWY
ZY1	Color Combination, Solid
ZY2	Color Combination, 2-Tone
Z49	Export Canadian Modification Mandatory Base Equipment
Z5X	Mirror Provisions Arabic Language
Z71	Chassis Package "Off Road"
Z82	Trailer Provisions Special Equipment, H. D.
Z83	Chassis Package Solid Smooth Ride
Z85	Chassis Package Increased Capacity
Z88	Conversion Name Plate GMC

Technical Information

Maintenance and Lubrication

Capacities - Approximate Fluid

Application	Specification	
	Metric	English
Axle Capacities		
• Front Drive Axle (8.25")	1.66 liters	1.75 quarts
• Front Drive Axle (9.25")	1.73 liters	1.83 quarts
• Rear Drive Axle (8.6")	2.03 liters	2.15 quarts
• Rear Drive Axle (9.5")	2.6 liters	2.75 quarts
• Rear Drive Axle (9.75")	2.84 liters	3.00 quarts
• Rear Drive Axle (10.5")	2.6 liters	2.75 quarts
• Rear Drive Axle (11.5")	3.62 liters	3.83 quarts
Engine Cooling System		
• 4.3L (VIN W) Automatic Transmission	11.9 liters	12.6 quarts
• 4.3L (VIN W) Manual Transmission	12.2 liters	12.9 quarts
• 4.8L (VIN V) Automatic Transmission	12.7 liters	13.4 quarts
• 4.8L (VIN V) Manual Transmission	13.0 liters	13.7 quarts
• 4.8L (VIN V) Automatic with front A/C	13.7 liters	14.4 quarts
• 4.8L (VIN V) Automatic with front and rear A/C	15.0 liters	15.8 quarts
• 5.3L (VIN T) Automatic Transmission	12.7 liters	13.4 quarts
• 5.3L (VIN T) Automatic Transmission with optional Air Conditioning	14.1 liters	14.9 quarts
• 5.3L (VIN T) Automatic Transmission with front A/C	13.6 liters	14.4 quarts
• 5.3L (VIN T) Automatic Transmission with front and rear A/C	15.0 liters	15.8 quarts
• 6.0L (VIN V) Automatic Transmission	14.0 liters	14.8 quarts
• 6.0L (VIN V) Automatic Transmission with opt Engine Oil Cooler	13.6 liters	14.4 quarts
• 6.0L (VIN V) Manual Transmission	14.4 liters	15.2 quarts
• 6.0L (VIN V) Manual Transmission with optional Engine Oil Cooler	14.0 liters	14.8 quarts
• 6.6L (VIN 1) Manual Transmission	19.5 liters	20.7 quarts
• 6.6L (VIN 1) Automatic Transmission	19.2 liters	20.3 quarts
• 8.1L (VIN G) Manual Transmission	20.0 liters	21.1 quarts
• 8.1L (VIN G) Automatic Transmission	19.6 liters	20.7 quarts
Engine Crankcase		
• 4.3L (VIN W) With Filter	4.3 liters	4.5 quarts
• 4.8L (VIN V) With Filter	5.7 liters	6.0 quarts
• 5.3L (VIN T) With Filter	5.7 liters	6.0 quarts
• 6.0L (VIN U) With Filter	5.7 liters	6.0 quarts
• 6.6L (VIN 1) with Filter	9.5 liters	10.0 quarts
• 8.1L (VIN G) With Filter	6.2 liters	6.5 quarts
Transmission		
• 4L60-E 4 Spd. HMD Auto (M30)	4.7 liters	5.0 quarts
• 4L60-E 4 Spd. HMD Auto (M30) After Complete Overhaul	10.6 liters	11.2 quarts
• 4L60-E 4 Spd HM Auto (M32)	4.7 liters	5.0 quarts
• 4L60-E 4 Spd HM Auto (M32) After Complete Overhaul	10.6 liters	11.2 quarts
• 4L80-E Auto (MT1)	7.3 liters	7.7 quarts
• 4L80-E Auto (MT1) After Complete Overhaul	12.8 liters	13.5 quart
• 5 Spd. Auto Allison (M74)	7.0 liters	7.4 quarts

• 5 Spd. Auto Allison (M74) after complete overhaul	12.0 liters	12.7 quarts
• New Venture Gear 3500 Manual Transmission	2.3 liters	2.4 quarts
• New Venture Gear 4500 Manual Transmission	3.8 liters	4.0 quarts
• 6 Spd Manual (ZF) (ML6)	6.0 liters	6.3 quarts
Fuel Tank		
• Short Bed Models	98.0 liters	26 gallons
• Long Bed Models	128.0 liters	34.0 gallons
• 4 Door Utility	98.4 liters	26.0 gallons
• XL (1500 Series)	123.0 liters	32.5 gallons
• XL (2500 Series)	147.6 liters	38.5 gallons
• Chassis Cab (Single Tank)	128.0 liters	34.0 gallons
Fuel Tank-Federal		
• Chassis Cab (Standard Side Tank)	102.2 liters	27.0 gallons
• Chassis Cab (Optional Rear Tank)	87.0 liters	23.0 gallons
Fuel Tank-California		
• Chassis Cab (Standard Side Tank)	91.0 liters	24.0 gallons
• Chassis Cab (Rear Tank)	102.2 liters	23.0 gallons
• Chassis Cab (Optional Rear Tank)	102.2 liters	27.0 gallons
Fuel Tank-Diesel		
• Chassis Cab (Standard Side Tank)	102.2 liters	27.0 gallons
• Chassis Cab (Optional Rear Tank)	87.0 liters	23.0 gallons
• Power Steering Capacities (approximate)	.77L-1.25L	.81-1.32 qts
Transfer Case		
New Venture Gear 149 (NP3)	2.1 liters	2.22 quarts
New Venture Gear 246 (NP8)	1.9 liters	2.0 quarts
New Venture Gear 261 (NP2)	1.9 liters	2.0 quarts
New Venture Gear 263 (NP1)	1.9 liters	2.0 quarts

Maintenance Items

Usage	Type/Part Number
Oil Filter	
• 4.3L V6 (VIN X)	AC Delco/PF47
• 4.8L V8 (VIN V)	AC Delco/PF44
• 5.3L V8 (VIN Z & T)	AC Delco/PF44
• 6.0L V8 (VIN U & N)	AC Delco/PF44
• 8.1L V8 (VIN G)	AC Delco/PF454
• 6.6L V8 Diesel (VIN 1)	Part. No. 97214983
Engine Air Cleaner/Filter	
• 4.3L V6 (VIN X)	AC Delco/A1519C
• 4.8L V8 (VIN V)	AC Delco/A1519C
• 5.3L V8 (VIN Z & T)	AC Delco/A1519C
• 6.0L V8 (VIN U & N)	AC Delco/A1518C
• 8.1L V8 (VIN G)	AC Delco/A1518C
• 6.6L V8 Diesel (VIN 1)	AC Delco/PF1618C
Passenger Compartment Air Filter Kit	
• 4.3L V6 (VIN X)	GM Part/52485513
• 4.8L V8 (VIN V)	GM Part/52485513
• 5.3L V8 (VIN Z & T)	GM Part/52485513
• 6.0L V8 (VIN U & N)	GM Part/52485513
• 8.1L V8 (VIN G)	GM Part/52485513
• 6.6L V8 Diesel (VIN 1)	--
PCV Valve	
• 4.3L V6 (VIN X)	CV769C
• 4.8L V8 (VIN V)	CV948C
• 5.3L V8 (VIN Z & T)	CV948C
• 6.0L V8 (VIN U & N)	CV948C
• 8.1L V8 (VIN G)	CV948C
Spark Plugs	
• 4.3L V6 (VIN X)	AC Delco/41-932
• 4.8L V8 (VIN V)	Denso/J14R15 NGK/TR5A15
• 5.3L V8 (VIN Z & T)	Denso/J14R15 NGK/TR5A15
• 6.0L V8 (VIN U & N)	Denso/PTZ16R15 NGK/PZTR5A15
• 8.1L V8 (VIN G)	Denso/PTJ14R15
Fuel Filter	
• 4.3L V6 (VIN X)	AC Delco/GF626
• 4.8L V8 (VIN V)	AC Delco/GF626
• 5.3L V8 (VIN Z & T)	AC Delco/GF626
• 6.0L V8 (VIN U & N)	AC Delco/GF626
• 8.1L V8 (VIN G)	AC Delco/GF626
• Wiper Blades	ITTA/56.0 cm (22 in)

Fluid and Lubricant Recommendations

Usage	Fluid/Lubricant
Automatic Transfer Case (NP8 Only)	AUTO-TRAK® II Fluid GM P/N 12378508 (Canadian P/N 10953626)
Engine Oil	Engine oil with the American Petroleum Institute Certified For Gasoline Engines STARBURST symbol of the proper viscosity.
Engine Oil (Diesel Engine)	Engine oil with the letters CH-4 or CG-4 is best for this vehicle. The CH-4 or CG-4 designation may appear either alone, or in combination with other API designations, such as API CH-4/SJ, CG-4/SH or CH-4/CG-4/SJ. These letters show American Petroleum Institute (API) level of quality.
Engine Coolant	50/50 mixture of clean drinkable water and use only GM Goodwrench® DEX-COOL® or Havoline® DEX-COOL® coolant
Hydraulic Brake System	Delco Supreme 11® Brake Fluid GM P/N 12377967 (Canadian P/N 992667) or equivalent DOT-3 brake fluid
Windshield Washer Solvent	GM Optikleen ® Washer Solvent GM P/N 1051515 (Canadian P/N 993033) or equivalent
Hydraulic Clutch System (5-Speed Trans.)	Hydraulic Clutch Fluid GM P/N 12345347 (Canadian P/N 10953517) or equivalent DOT-3 brake fluid
Hydraulic Clutch System (6-Speed Trans.)	Hydraulic Clutch Fluid GM P/N 88958860 (Canadian P/N 88901244)
Power Steering System	GM Power Steering Fluid GM P/N 1052884 - 1 pint, 1050017 - 1 quart, (Canadian P/N 993294 - 1 pint, 993353 - 1 quart) or equivalent
Manual Transmission (5-Speed with Low Gear, RPO MW3)	GM Goodwrench Synthetic Manual Transmission Fluid GM P/N 12346190 (Canadian P/N 10953477) or equivalent SAE 75W-85 GL-4 gear oil
Manual Transmission (5-Speed without Low Gear, RPO MG5)	Synchromesh Transmission Fluid GM P/N 12345349 (Canadian P/N 10953465) or equivalent
Manual Transmission (6-Speed)	TransSynd ™ Synthetic Automatic Transmission Fluid GM P/N 12378515 (Canadian P/N 88900701)
Automatic Transmission	DEXRON®-III, Automatic Transmission Fluid
Key Lock Cylinders	Multi-Purpose Lubricant, Superlube® GM P/N 12346241 (Canadian P/N 10953474) or equivalent
Floor Shift Linkage	Lubriplate® Lubricant Aerosol GM P/N 1052349 (Canadian P/N 992723) or equivalent or lubricant meeting requirements of NLGI # 2 Category LB or GC-LB
Chassis Lubrication	Chassis Lubricant GM P/N 12377985 or equivalent or lubricant meeting requirements of NLGI # 2 Category LB or GC-LB
Front Axle	SAE 80W-90 Axle Lubricant GM P/N 1052271 (Canadian P/N 10950849) or equivalent
Rear Axle	SAE 75W-90 Synthetic Axle Lubricant GM P/N 12378261 (Canadian P/N 10953455) or equivalent meeting GM Specification 9986115
Rear Axle (with QS4 Axle Only)	SAE 75W-90 Synthetic Axle Lubricant GM P/N 12378557 (Canadian P/N 88901362) or equivalent
Manual Transfer Case (NP1, NP2, and NP3)	DEXRON®-III Automatic Transmission Fluid
Front Axle Propshaft Spline or One-Piece Propshaft Spline (Two-Wheel Drive with Auto. Trans.)	Spline Lubricant, Special Lubricant GM P/N 12345879 (Canadian P/N 10953511) or lubricant meeting requirements of GM 9985830
Rear Drive line Center Spline	Chassis Lubricant GM P/N 12377985 or equivalent or lubricant meeting requirements of NLGI # 2, Category LB or GC-LB

Hood Hinges	Multi-Purpose lubricant, Superlube ® GM P/N 12346241 (Canadian P/N 10953474) or equivalent
Body Door Hinge Pins, Tailgate Hinge and Linkage, Folding Seat and Fuel Door Hinge	Multi-Purpose lubricant, Superlube® GM P/N 12346241 (Canadian P/N 10953474) or equivalent
Outer Tailgate Handle Pivot Points, Hinges, Latch Bolt and Linkage	Multi-Purpose lubricant, Superlube® GM P/N 12346241 (Canadian P/N 10953474) or equivalent
Weatherstrip Conditioning	Dielectric Silicone Grease GM P/N 12345579 (Canadian P/N 1974984) or equivalent
Weatherstrip Squeaks	Synthetic Grease with Teflon, Superlube® GM P/N 12371287 (Canadian P/N 10953437) or equivalent

Descriptions and Operations

Power Steering System

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

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

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

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

- A recirculating ball system
- A rack and pinion system

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

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

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

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

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

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

Steering Linkage (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
- The HVAC controls

Driver Safety

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

Rear Wheel Steering Description and Operation

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

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

- A Service 4 Wheel Steer indicator in the IPC.
- A shorting relay in the rear wheel steering gear motor .
- A power relay in the rear wheel steering control module.

Rear Wheel Steering Control Module

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

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

Important

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

Rear Wheel Steering Mode Switch

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

The system operates in 3 principal modes, as follows:

2-Wheel Steer Mode

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

4-Wheel Steer Mode

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

4-Wheel Steer Tow Mode

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

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

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

Rear Wheel Steering Gear Motor

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

Steering Wheel Position Sensor

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

Rear Wheel Steering Position Sensor

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

Combined Yaw Rate Sensor / Lateral Accelerometer Sensor

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

Steerable Rear Axle

The steerable rear axle has a rack and pinon mounted to the differential cover, and half shafts with upper and lower ball joints on movable hub and bearings assemblies . The rack is part of the differential cover. If a system malfunction occurs the rear wheels are moved back to center via an internal spring. The rack has redundant inner and outer tie rods ends . There are inner tie rod boots on the rack to prevent water and dirt from getting inside. Long term exposure to moisture due to a damaged boot or components can result in an internal malfunction. The rear wheel steering gear has the rear wheel steering gear motor

attached to the upper rack . There are shields and a skid plate type shield on the rear axle assembly to protect the steering gear. There are no internal adjustments to the rack . It is mandatory to preform a 4 wheel alignment if any hard parts , such as tie rods or ball joints or wheel bearings are serviced . The axle assembly is a heavier duty version of the standard rear axle on a non rear wheel steer truck . You must consult the owners manual and the trailer towing guide for specific towing capacities . The carrier contains 9.74 inch ring and pinon gear set. The quarter shafts are a special heavy duty design with up to 15 ° of movement and a special designed CV joint and boot at the wheel end of the axle .

Suspension Description and Operation

Front Suspension

Coil Spring

The front suspension has 2 primary purposes:

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

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

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

This up and down motion of the steering knuckle as the vehicle travels over bumps is absorbed predominantly by the coil spring. The vertical movement of the steering knuckle as the vehicle travels over irregular road surfaces will tend to compress the spring and spring tension will lead the spring to return to the original, at-rest state. This action isolates the vehicle from the road surface. The upper and lower control arms are allowed to pivot at the vehicle frame in a vertical fashion. The ball joint allows the steering knuckle to maintain the perpendicular relationship to the road surface.

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

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

Torsion Bar

The front suspension has 2 primary purposes:

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

The front suspension absorbs the impact of the tires travelling over irregular road surfaces and dissipates this energy throughout the suspension system. This process isolates the vehicle occupants from the road

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

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

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

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

Rear Suspension

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

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

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

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

- The rubber insulators
- The clamps
- The link assemblies

Selectable Ride Description and Operation

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

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

Wheels and Tires

Fastener Tightening Specifications

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

General Description

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

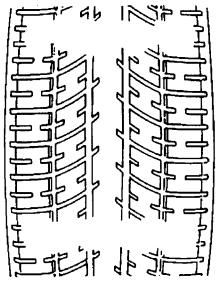
The following factors have an important influence on tire life:

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

The following factors increase tire wear:

- Heavy cornering
- Excessively rapid acceleration
- Heavy braking

Tread Wear Indicators Description



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

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

Metric Wheel Nuts and Bolts Description

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

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

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

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

Tire Inflation Description

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

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

Inspect the tire pressure when the following conditions apply:

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

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

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

Inflation Pressure Conversion (Kilopascals to PSI)

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

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

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

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

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

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

- Uneven braking
- Steering lead
- Reduced vehicle handling

Tire Description

Caution

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

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

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

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

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

The following is required of replacement tires:

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

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

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

Conditions for Tire Replacement

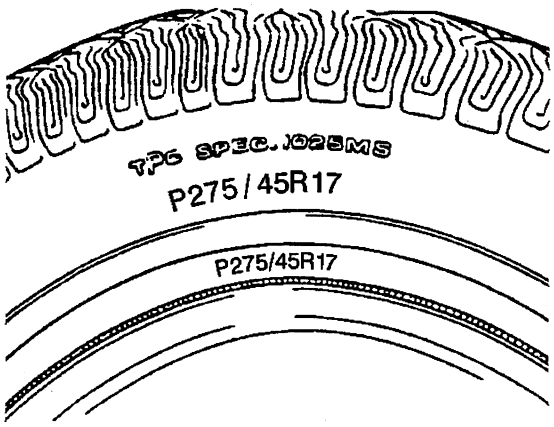
Replace the tires when one and/or all of the following conditions are evident:

- When the tire(s) is worn to a point where 1.6 mm (2/32 in) or less of tread remains. The tires have built in tread wear indicators that appear between the tread grooves when the tread is worn to 1.6 mm (2/32 in) or less to help in the detection of this condition. Replace the tire when the indicators appear in two or more adjacent grooves at three spots around the tire.
- When the following conditions are evident on the tread:
  - When the tread is cracked.
  - When the tread is cut.

  - When the tread is snagged deeply enough to expose the cord.
  - When the tread is snagged deeply enough to expose the fabric.
  - When the sidewall is snagged deeply enough to expose the cord.
  - When the sidewall is snagged deeply enough to expose the fabric.
- When the following conditions are evident on the tire:
  - When the tire has a bump.
  - When the tire has a bulge (protrusion).
  - When the tire is split.
  - Please note that slight sidewall indentations are normal in radial tires.
- When the following damage is evident on the tire and the damage cannot be correctly repaired because of the size or the location of the damage:
  - When the tire has a puncture.
  - When the tire is cut, or other damage.

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

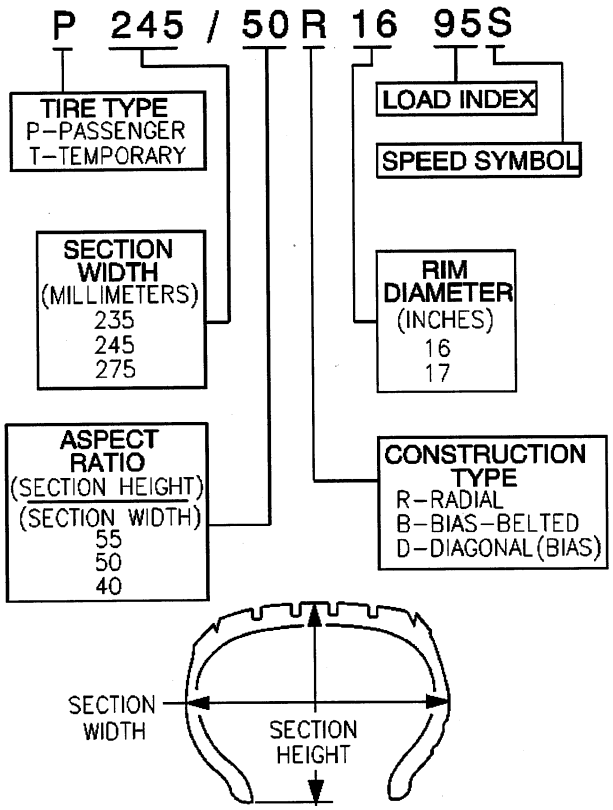
All Seasons Tires Description



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

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

P-Metric Sized Tires Description



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

Driveline System Description and Operation

Driveline/Axle – Propeller Shaft

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

Front Propeller Shaft Description

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

One Piece Propeller Shaft Description

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

Two Piece Propeller Shaft Description

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

Propeller Shaft Phasing Description

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

Universal Joint Description

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

Center Bearing Description

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

Wheel Drive Shafts Description and Operation

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

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

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

Front Drive Axle Description and Operation

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

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

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

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

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

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

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

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

Rear Drive Axle Description and Operation

Rear Axles for this vehicle consist of the following components:

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

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

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

Locking/Limited Slip Rear Axle Description and Operation

The locking differential consists of the following components:

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

- Differential pinion gears
- Differential pinion gear thrust washers

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

Limited-Slip Function

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

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

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

Locking Function

Locking action occurs through the use of some special parts:

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

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

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

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

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

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

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

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

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

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

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

Locking Differential Torque-Limiting Disc

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

NVG 261 Variations

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

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

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

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

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

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

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

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

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

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

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

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

Front Axle Actuator

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

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

Transfer Case Shift Control Module

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

Transfer Case Encoder Motor

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

Transfer Case Encoder

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

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

Vehicle Speed Sensor

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

SERVICE Indicator (4WD) Lamp

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Braking System Description and Operation

Hydraulic Brake System Description and Operation

System Component Description

The hydraulic brake system consists of the following:

Hydraulic Brake Master Cylinder Fluid Reservoir

Contains supply of brake fluid for the hydraulic brake system.

Hydraulic Brake Master Cylinder

Converts mechanical input force into hydraulic output pressure.

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

Hydraulic Brake Pressure Balance Control System

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

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

Hydraulic Brake Pipes and Flexible Brake Hoses

Carries brake fluid to and from hydraulic brake system components.

Hydraulic Brake Wheel Apply Components

Converts hydraulic input pressure into mechanical output force.

System Operation

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

Brake Assist System Description and Operation

System Component Description

The brake assist system consists of the following:

Brake Pedal

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

Brake Pedal Pushrod

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

Vacuum Brake Booster

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

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

Vacuum Source

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

Vacuum Source Delivery System

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

System Operation

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

Disc Brake System Description and Operation

System Component Description

The disc brake system consists of the following components:

Disc Brake Pads

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

Disc Brake Rotors

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

Disc Brake Pad Hardware

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

Disc Brake Caliper Hardware

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

System Operation

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

Park Brake System Description and Operation

General Description

The park brake system consists of the following:

Park Brake Pedal Assembly

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

Park Brake Release Handle Assembly

Releases applied park brake system when pulled.

Park Brake Cables

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

Park Brake Cable Equalizer

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

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

Park Brake Apply Lever

Multiplies and transfers input force to park brake actuator.

Park Brake Actuator/Adjuster

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

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

Park Brake Shoe

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

System Operation

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

ABS Description and Operation

Antilock Brake System

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

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

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

Engine Description and Operation

Engine Mechanical – 4.3L

General Specifications

Application	Specification	
	Metric	English
General		
• Engine Type	90 degree V6	
• Displacement	4.3 L	262 CID
• RPO	LU3	
• VIN	X	
• Bore	101.60 mm	4.012 in
• Stroke	88.39 mm	3.480 in
• Compression Ratio	9.2:1	
• Firing Order	1-6-5-4-3-2	
• Spark Plug Gap	1.52 mm	0.060 in
Balance Shaft		
• Bearing Journal Diameter - Rear	38.085-38.100 mm	1.4994-1.500 in
• Bushing Bore Diameter - Rear	0.050-0.088 mm	0.0020-0.0035 in
Block		
• Crankshaft Main Bearing Bore Out-of-Round	0.050 mm	0.002 in
• Cylinder Bore Diameter	101.618-101.643 mm	4.0007-4.0017 in
• Cylinder Bore Out-of-Round - Production	0.017 mm	0.0007 in
• Cylinder Bore Out-of-Round - Service	0.05 mm	0.002 in
• Cylinder Bore Taper - Production Relief Side	0.025 mm	0.0010 in
• Cylinder Bore Taper - Production Thrust Side	0.012 mm	0.0005 in
• Cylinder Bore Taper - Service	0.025 mm	0.0010 in
• Cylinder Head Deck Surface Flatness	0.050-0.152 mm	0.002-0.006 in
Camshaft		
• Camshaft End Play	0.0254-0.2286 mm	0.0010-0.0090 in
• Camshaft Journal Diameter	47.440-47.490 mm	1.8677-1.8696 in
• Camshaft Journal Out-of-Round	0.025 mm	0.001 in
• Camshaft Lobe Lift - Exhaust	7.20-7.30 mm	0.283-0.287 in
• Camshaft Lobe Lift - Intake	6.97-7.07 mm	0.274-0.278 in
• Camshaft Runout	0.065 mm	0.0026 in
Connecting Rod		
• Connecting Rod Bearing Clearance - Production	0.038-0.078 mm	0.0015-0.0031 in
• Connecting Rod Bearing Clearance - Service	0.025-0.063 mm	0.0010-0.0025 in
• Connecting Rod Side Clearance	0.15-0.44 mm	0.006-0.017 in
Crankshaft		
• Connecting Rod Journal Diameter	57.116-57.148 mm	2.2487-2.2497 in
• Connecting Rod Journal Out-of-Round - Production	0.008 mm	0.0003 in
• Connecting Rod Journal Out-of-Round - Service	0.025 mm	0.0010 in
• Connecting Rod Journal Taper - Production	0.010 mm	0.0004 in
• Connecting Rod Journal Taper - Service	0.025 mm	0.0010 in
• Crankshaft End Play	0.050-0.20 mm	0.002-0.008 in
• Crankshaft Main Bearing Clearance #1 - Production	0.02-0.05 mm	0.0008-0.0020 in

• Crankshaft Main Bearing Clearance #2, #3, and #4 - Production	0.028-0.058 mm	0.0011-0.0023 in
• Crankshaft Main Bearing Clearance #1 - Service	0.0254-0.05 mm	0.0010-0.0020 in
• Crankshaft Main Bearing Clearance #2, #3, and #4 - Service	0.025-0.063 mm	0.0010-0.0025 in
• Crankshaft Main Journal Diameter #1	62.199-62.217 mm	2.4488-2.4495 in
• Crankshaft Main Journal Diameter #2 and #3	62.191-62.215 mm	2.4485-2.4494 in
• Crankshaft Main Journal Diameter #4	62.179-62.203 mm	2.4480-2.4489 in
• Crankshaft Main Journal Out-of-Round - Production	0.005 mm	0.0002 in
• Crankshaft Main Journal Out-of-Round - Service	0.025 mm	0.0010 in
• Crankshaft Main Journal Taper	0.007 mm	0.0003 in
Exhaust Manifold		
• Surface Flatness - Flange to Flange	0.25 mm	0.010 in
• Surface Flatness - Individual Flange	0.05 mm	0.002 in
Intake Manifold		
• Surface Flatness	0.10 mm	0.004 in
Lubrication System		
• Oil Capacity for C/K, G/H with Filter	4.3 L	4.5 qt
• Oil Capacity for C/K, G/H without Filter	3.8 L	4 qt
• Oil Capacity for S/T, M/L with Filter	4.7 L	5 qt
• Oil Capacity for S/T, M/L without Filter	4.3 L	4.5 qt
• Oil Pressure - at 1,000 RPM	42 kPa	6 psi
• Oil Pressure - at 2,000 RPM	125 kPa	18 psi
• Oil Pressure - at 4,000 RPM	166 kPa	24 psi
Piston Rings		
• Piston Ring End Gap - First Compression Ring - Production	0.25-0.40 mm	0.010-0.016 in
• Piston Ring End Gap - Second Compression Ring - Production	0.38-0.58 mm	0.015-0.023 in
• Piston Ring End Gap - Oil Control Ring - Production	0.25-0.76 mm	0.010-0.029 in
• Piston Ring End Gap - First Compression Ring - Service	0.25-0.50 mm	0.010-0.020 in
• Piston Ring End Gap - Second Compression Ring - Service	0.38-0.80 mm	0.015-0.031 in
• Piston Ring End Gap - Oil Control Ring - Service	0.005-0.090 mm	0.0002-0.0035 in
• Piston Ring to Groove Clearance - First Compression Ring - Production	0.030-0.070 mm	0.0012-0.0027 in
• Piston Ring to Groove Clearance - Second Compression Ring - Production	0.076-0.280 mm	0.0030-0.0110 in
• Piston Ring to Groove Clearance - Oil Control Ring - Production	0.046-0.196 mm	0.0018-0.0077 in
• Piston Ring to Groove Clearance - First Compression Ring - Service	0.030-0.085 mm	0.0012-0.0033 in
• Piston Ring to Groove Clearance - Second Compression Ring - Service	0.030-0.085 mm	0.0012-0.0033 in
• Piston Ring to Groove Clearance - Oil Control Ring - Service	0.076-0.200 mm	0.0030-0.0079 in
Pistons and Pins		
• Piston - Piston to Bore Clearance - Production	0.018-0.061 mm	0.0007-0.0024 in
• Piston - Piston to Bore Clearance - Service	0.075 mm	0.0029 in

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

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accelerator Control Cable Bracket Nut to Stud	12 N·m	106 lb in
Accelerator Control Cable Bracket Nut to Throttle Body	9 N·m	80 lb in
Accelerator Control Cable Bracket Stud to Intake Manifold	6 N·m	53 lb in
Accelerator Control Cable Bracket Stud to Throttle Body	12 N·m	106 lb in
Air Cleaner Adapter Stud	8 N·m	71 lb in
Balance Shaft Driven Gear Bolt		
• First Pass	20 N·m	15 lb ft
• Final Pass	35 degrees	
Balance Shaft Retainer Bolt	12 N·m	106 lb in
Battery Cable Bracket Bolt to Oil Pan	12 N·m	106 lb in
Battery Negative Cable Bolt to Engine	25 N·m	18 lb ft
Battery Positive Cable Junction Block Bracket Bolt	25 N·m	18 lb ft
Belt Idler Pulley Bolt	50 N·m	37 lb ft
Camshaft Retainer Bolt	12 N·m	106 lb in
Camshaft Sprocket Bolt	25 N·m	18 lb ft
Connecting Rod Nut		
• First Pass	27 N·m	20 lb ft
• Final Pass	70 degrees	
Crankshaft Balancer Bolt	95 N·m	70 lb ft

Crankshaft Bearing Cap Bolt - Preferred Method		
• First Pass	20 N·m	15 lb ft
• Final Pass	73 degrees	
Crankshaft Bearing Cap Bolt	105 N·m	77 lb ft
Crankshaft Position Sensor Bolt	9 N·m	80 lb in
Crankshaft Pulley Bolt	58 N·m	43 lb ft
Crankshaft Rear Oil Seal Housing Bolt and Nut	12 N·m	106 lb in
Crankshaft Rear Oil Seal Housing Retainer Stud	6 N·m	53 lb in
Crossmember Bolt	100 N·m	74 lb ft
Cylinder Head Bolt - Preferred Method		
• All Bolts First Pass in Sequence	30 N·m	22 lb ft
• Long Bolts Final Pass in Sequence	75 degrees	
• Medium Bolts Final Pass in Sequence	65 degrees	
• Short Bolts Final Pass in Sequence	55 degrees	
Cylinder Head Core Hole Plug	20 N·m	15 lb ft
Distributor Cap Bolt	2.4 N·m	21 lb in
Distributor Clamp Bolt	25 N·m	18 lb ft
Drive Belt Idler Pulley Bolt	50 N·m	37 lb ft
Drive Belt Tensioner Bolt	50 N·m	37 lb ft
Engine Block Left Side Oil Gallery Plug	20 N·m	15 lb ft
Engine Block Left Rear Oil Gallery Plug	30 N·m	22 lb ft
Engine Block Right Rear Oil Gallery Plug	20 N·m	15 lb ft
Engine Block Coolant Drain Hole Plug	20 N·m	15 lb ft
Engine Block Oil Gallery Plug	20 N·m	15 lb ft
Engine Coolant Heater Bolt/Screw	2 N·m	18 lb in
Engine Coolant Temperature (ECT) Sensor	20 N·m	15 lb ft
Engine Flywheel Bolt	100 N·m	74 lb ft
Engine Front Cover Bolt	12 N·m	106 lb in
Engine Lift Front Bracket Stud	35 N·m	26 lb ft
Engine Mount Bolt to Engine Bracket	50 N·m	37 lb ft
Engine Mount Engine Bracket Bolt to Engine	50 N·m	37 lb ft
Engine Mount Frame Bracket Through-bolt	75 N·m	55 lb ft
Engine Mount Frame Side Mount Bolt	65 N·m	50 lb ft
Engine Oil Level Sensor	13 N·m	115 lb in
Engine Oil Pressure Gage Sensor	30 N·m	22 lb ft
Engine Oil Pressure Gage Sensor Fitting - Plus Required Angle	15 N·m	11 lb ft
Engine Shield Bolt	20 N·m	15 lb ft
Engine Wiring Harness Bracket Bolt to Battery Positive Cable Junction Block Bracket	9 N·m	80 lb in
Engine Wiring Harness Bracket Bolt to Generator and Drive Belt Tensioner Bracket	25 N·m	18 lb ft
Engine Wiring Harness Bracket Nut to Evaporative Emission (EVAP) Canister Purge Solenoid Valve Stud	9 N·m	80 lb in
Engine Wiring Harness Bracket Nut to Intake Manifold Stud	12 N·m	106 lb in
Engine Wiring Harness Bracket Stud	25 N·m	18 lb ft
Engine Wiring Harness Clip Bolt	9 N·m	80 lb in
Engine Wiring Harness Ground Nut	16 N·m	12 lb ft
Evaporative Emission (EVAP) Canister Purge Solenoid Valve Stud to Intake Manifold	10 N·m	89 lb in
Exhaust Manifold Bolt/Stud		
• First Pass	15 N·m	11 lb ft
• Final Pass	30 N·m	22 lb ft
Exhaust Manifold Heat Shield Bolt	9 N·m	80 lb in

Fan and Water Pump Pulley Bolt	25 N·m	18 lb ft
Frame Cross Bar Bolt	100 N·m	74 lb ft
Fuel Meter Body Bracket Bolt	10 N·m	89 lb in
Fuel Pipe Bracket Bolt	6 N·m	53 lb in
Fuel Pipe Retainer Nut	3 N·m	27 lb in
Fuel Supply Pipe Nut - Fuel Tank Side	30 N·m	22 lb ft
Generator and Drive Belt Tensioner Bracket Bolt to Engine	41 N·m	30 lb ft
Generator and Drive Belt Tensioner Bracket Stud to Engine	20 N·m	15 lb ft
Generator and Drive Belt Tensioner Bracket Stud Nut	41 N·m	30 lb ft
Ground Wire Bolt to Rear of Left Side Cylinder Head	16 N·m	12 lb ft
Ground Wire Nut to Rear of Right Side Cylinder Head	16 N·m	12 lb ft
Heater Hose Bracket Bolt to Generator and Drive Belt Tensioner Bracket	25 N·m	18 lb ft
Hood Hinge Bolt	25 N·m	18 lb ft
Ignition Coil Stud	12 N·m	106 lb in
Junction Block Bracket Bolt	25 N·m	18 lb ft
Knock Sensor	25 N·m	18 lb ft
Lift Bracket Bolts	15 N·m	11 lb ft
Lower Intake Manifold Bolt		
• First Pass in Sequence	3 N·m	27 lb in
• Second Pass in Sequence	12 N·m	106 lb in
• Final Pass in Sequence	15 N·m	11 lb ft
Oil Cooler Pipe Bracket to Oil Pan Bolt	12 N·m	106 lb in
Oil Filter	30 N·m	22 lb ft
Oil Filter Adapter	55 N·m	41 lb ft
Oil Filter Fitting	55 N·m	41 lb ft
Oil Level Indicator Tube Bolt	12 N·m	106 lb in
Oil Pan Baffle Bolt	12 N·m	106 lb in
Oil Pan Bolt and Nut	25 N·m	18 lb ft
Oil Pan Drain Plug	25 N·m	18 lb ft
Oil Pan Skid Plate Bolt	20 N·m	15 lb ft
Oil Pump Bolt to Rear Crankshaft Bearing Cap	90 N·m	66 lb ft
Oil Pump Cover Bolt	12 N·m	106 lb in
Positive Battery Cable Clip Bolt	9 N·m	80 lb in
Positive Cable Generator Nut	18 N·m	13 lb ft
Power Steering Pump Bracket Bolt to Engine	41 N·m	30 lb ft
Power Steering Pump Bracket Stud to Engine	20 N·m	15 lb ft
Power Steering Pump Bracket Stud Nut	41 N·m	30 lb ft
Power Steering Pump Bolt	50 N·m	37 lb ft
Power Steering Pump Nut to Engine - Rear Bracket to Engine	41 N·m	30 lb ft
Power Steering Pump Rear Bracket Nut	50 N·m	37 lb ft
Secondary Air Injection (AIR) Check Valve Pipe Bracket Bolt to Exhaust Manifold	10 N·m	89 lb in
Secondary Air Injection (AIR) Check Valve Pipe Stud Nut	25 N·m	18 lb ft
Spark Plug		
• Initial Installation - NEW Cylinder Head	30 N·m	22 lb ft
• All Subsequent Installations	15 N·m	11 lb ft
Spark Plug Wire Support Bolt	12 N·m	106 lb in
Starter Motor Wiring Harness/Transmission Cooler Pipe Bracket to Oil Pan Bolt	9 N·m	80 lb in
Throttle Body Stud	9 N·m	80 lb in
Torque Converter Bolt	63 N·m	47 lb ft
Transmission Bolt	50 N·m	37 lb ft

Transmission Cover Bolt	12 N·m	106 lb in
Transmission Oil Cooler Line Bracket	9 N·m	80 lb in
Transmission to Oil Pan Bolt	47 N·m	35 lb ft
Upper Intake Manifold Stud		
• First Pass	5 N·m	44 lb in
• Final Pass	9 N·m	80 lb in
Valve Lifter Pushrod Guide Bolt	16 N·m	12 lb ft
Valve Rocker Arm Bolt	30 N·m	22 lb ft
Valve Rocker Arm Cover Bolt	12 N·m	106 lb in
Water Outlet Stud	25 N·m	18 lb ft
Water Pump Bolt	45 N·m	33 lb ft

Engine Component Description

Balance Shaft

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

Camshaft

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

Crankshaft

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

Cylinder Heads

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

Engine Block

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

Exhaust Manifolds

The cast iron exhaust manifolds direct exhaust gases from the combustion chambers to the exhaust system.

Intake Manifold

The intake manifold is a two-piece design. The upper portion is made from a composite material and the lower portion is cast aluminum. The throttle body attaches to the upper manifold. The Central Multipoint Flexible Injection system uses multiple fuel injectors to meter and distribute fuel to each engine cylinder. The Central (MFI) is retained by a bracket bolted to the lower intake manifold. The fuel meter body also houses the pressure regulator. Metal inlet and outlet fuel lines and nylon delivery tubes connect to the Central (MFI) unit. The delivery tubes independently distribute fuel to each cylinder through injectors located at the port entrance of each manifold runner where the fuel is atomized.

Piston and Connecting Rod Assemblies

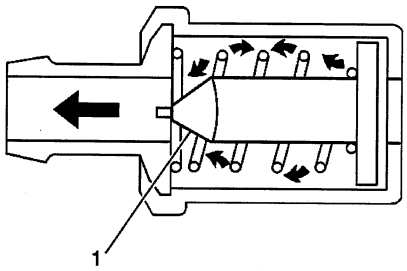
The cast aluminum pistons use two compression rings and one oil control assembly. The piston is a low friction, lightweight design with a flat top and barrel shaped skirt. The piston pins are offset 0.9 mm (0.0354 in) toward the major thrust side (right side) to reduce piston slap as the connecting rod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

Valve Train

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

Crankcase Ventilation System Description

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



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

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

Drive Belt System Description

The drive belt system consists of the following components:

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

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

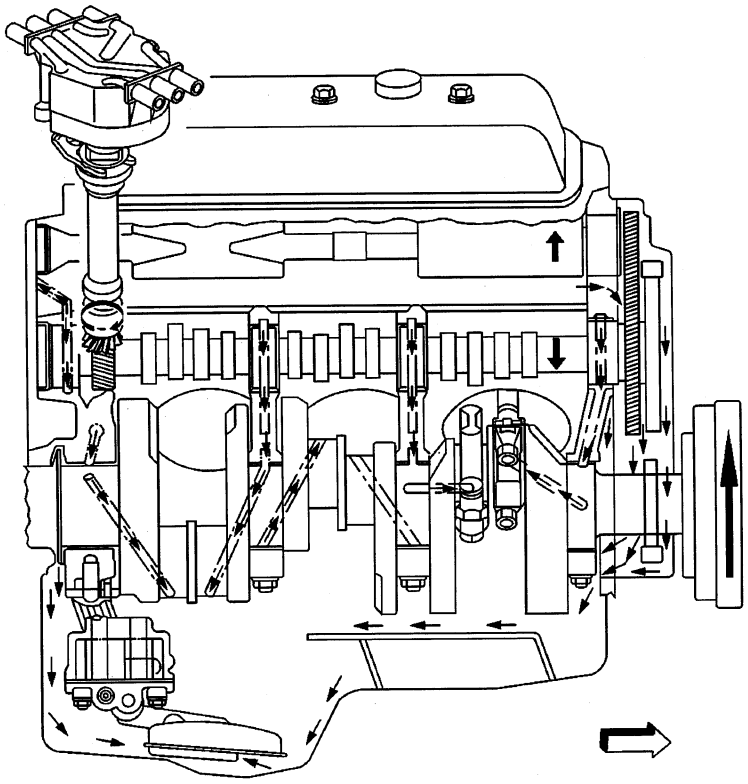
(chloroprene or EPDM) and have different layers or plys containing either fiber cloth or cords for reinforcement.

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

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

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

Lubrication Description



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

Engine Mechanical – 4.8, 5.3, 6.0L

General Specifications 4.8L (LR4 VIN V)

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

Crankshaft		
• Connecting Rod Journal Diameter - Production	53.318-53.338 mm	2.0991-2.0999 in
• Connecting Rod Journal Diameter - Service	53.308 mm	2.0987 in
• Connecting Rod Journal Out-of-Round - Production	0.005 mm	0.0002 in
• Connecting Rod Journal Out-of-Round - Service	0.01 mm	0.0004 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production	0.005 mm	0.0002 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service	0.02 mm	0.00078 in
• Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
• Crankshaft Main Bearing Clearance - Production	0.02-0.052 mm	0.0008-0.0021 in
• Crankshaft Main Bearing Clearance - Service	0.02-0.065 mm	0.0008-0.0025 in
• Crankshaft Main Journal Diameter - Production	64.993-65.007 mm	2.558-2.559 in
• Crankshaft Main Journal Diameter - Service	64.993 mm	2.558 in
• Crankshaft Main Journal Out-of-Round - Production	0.003 mm	0.000118 in
• Crankshaft Main Journal Out-of-Round - Service	0.008 mm	0.0003 in
• Crankshaft Main Journal Taper - Production	0.01 mm	0.0004 in
• Crankshaft Main Journal Taper - Service	0.02 mm	0.00078 in
• Crankshaft Rear Flange Runout	0.05 mm	0.002 in
• Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter	0.7 mm	0.028 in
• Crankshaft Thrust Surface - Production	26.14-26.22 mm	1.029-1.0315 in
• Crankshaft Thrust Surface - Service	26.22 mm	1.0315 in
• Crankshaft Thrust Surface Runout	0.025 mm	0.001 in
Cylinder Head		
• Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface	120.2 mm	4.732 in
• Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
• Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head	0.1 mm	0.004 in
• Surface Flatness - Exhaust Manifold Deck	0.13 mm	0.005 in
• Surface Flatness - Intake Manifold Deck	0.08 mm	0.0031 in
• Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide	17.32 mm	0.682 in
Intake Manifold		
• Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes Two Runner Port Openings	0.3 mm	0.118 in
Lubrication System		
• Oil Capacity - with Filter	5.68 Liters	6.0 Quarts
• Oil Capacity - without Filter	4.73 Liters	5.0 Quarts
• Oil Pressure - Minimum - Hot	41 kPa at 1,000 engine RPM 124 kPa at 2,000 engine RPM 165 kPa at 4,000 engine RPM	6 psig at 1,000 engine RPM 18 psig at 2,000 engine RPM 24 psig at 4,000 engine RPM

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

• Valves - Valve Seat Width - Exhaust	1.78 mm	0.07 in
• Valves - Seat Width - Intake	1.02 mm	0.04 in
• Valves - Valve Stem Diameter - Production	7.955-7.976 mm	0.313-0.314 in
• Valves - Valve Stem Diameter - Service	7.95 mm	0.313 in
• Valves - Stem-to-Guide Clearance - Production - Intake	0.025-0.066 mm	0.001-0.0026 in
• Valves - Stem-to-Guide Clearance - Service - Intake	0.093 mm	0.0037 in
• Valves - Stem-to-Guide Clearance - Production - Exhaust	0.025-0.066 mm	0.001-0.0026 in
• Valves - Stem-to-Guide Clearance - Service - Exhaust	0.093 mm	0.0037 in
• Rocker Arms - Valve Rocker Arm Ratio	1.70:1	
• Valve Springs - Valve Spring Free Length	52.9 mm	2.08 in
• Valve Springs - Installed Height	45.75 mm	1.8 in
• Valve Springs - Valve Spring Load - Closed	340 N at 45.75 mm	76 lb at 1.8 in
• Valve Springs - Valve Spring Load - Open	980 N at 33.55 mm	220 lb at 1.32 in

General Specifications 5.3L (LM7 VIN T)

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

• Connecting Rod Journal Out-of-Round - Service	0.01 mm	0.0004 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production	0.005 mm	0.0002 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service	0.02 mm	0.00078 in
• Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
• Crankshaft Main Bearing Clearance - Production	0.02-0.052 mm	0.0008-0.0021 in
• Crankshaft Main Bearing Clearance - Service	0.02-0.065 mm	0.0008-0.0025 in
• Crankshaft Main Journal Diameter - Production	64.993-65.007 mm	2.558-2.559 in
• Crankshaft Main Journal Diameter - Service	64.993 mm	2.558 in
• Crankshaft Main Journal Out-of-Round - Production	0.003 mm	0.000118 in
• Crankshaft Main Journal Out-of-Round - Service	0.008 mm	0.0003 in
• Crankshaft Main Journal Taper - Production	0.01 mm	0.0004 in
• Crankshaft Main Journal Taper - Service	0.02 mm	0.00078 in
• Crankshaft Rear Flange Runout	0.05 mm	0.002 in
• Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter	0.7 mm	0.028 in
• Crankshaft Thrust Surface - Production	26.14-26.22 mm	1.029-1.0315 in
• Crankshaft Thrust Surface - Service	26.22 mm	1.0315 in
• Crankshaft Thrust Surface Runout	0.025 mm	0.001 in
Cylinder Head		
• Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface	120.2 mm	4.732 in
• Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
• Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head	0.1 mm	0.004 in
• Surface Flatness - Exhaust Manifold Deck	0.13 mm	0.005 in
• Surface Flatness - Intake Manifold Deck	0.08 mm	0.0031 in
• Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide	17.32 mm	0.682 in
Intake Manifold		
• Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes Two Runner Port Openings	0.3 mm	0.118 in
Lubrication System		
• Oil Capacity - with Filter	5.68 Liters	6.0 Quarts
• Oil Capacity - without Filter	4.73 Liters	5.0 Quarts
• Oil Pressure - Minimum - Hot	41 kPa at 1,000 engine RPM 124 kPa at 2,000 engine RPM 165 kPa at 4,000 engine RPM	6 psig at 1,000 engine RPM 18 psig at 2,000 engine RPM 24 psig at 4,000 engine RPM
Oil Pan		
• Front Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
• Rear Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
• Oil Pan Alignment - to Rear of Engine Block at Transmission Bell Housing Mounting Surface	0.0-0.25 mm	0.0-0.01 in

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

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

General Specifications 5.3L (L59 VIN Z)

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

• Connecting Rod Journal Out-of-Round - Service	0.01 mm	0.0004 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production	0.005 mm	0.0002 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service	0.02 mm	0.00078 in
• Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
• Crankshaft Main Bearing Clearance - Production	0.02-0.052 mm	0.0008-0.0021 in
• Crankshaft Main Bearing Clearance - Service	0.02-0.065 mm	0.0008-0.0025 in
• Crankshaft Main Journal Diameter - Production	64.993-65.007 mm	2.558-2.559 in
• Crankshaft Main Journal Diameter - Service	64.993 mm	2.558 in
• Crankshaft Main Journal Out-of-Round - Production	0.003 mm	0.000118 in
• Crankshaft Main Journal Out-of-Round - Service	0.008 mm	0.0003 in
• Crankshaft Main Journal Taper - Production	0.01 mm	0.0004 in
• Crankshaft Main Journal Taper - Service	0.02 mm	0.00078 in
• Crankshaft Rear Flange Runout	0.05 mm	0.002 in
• Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter	0.7 mm	0.028 in
• Crankshaft Thrust Surface - Production	26.14-26.22 mm	1.029-1.0315 in
• Crankshaft Thrust Surface - Service	26.22 mm	1.0315 in
• Crankshaft Thrust Surface Runout	0.025 mm	0.001 in
Cylinder Head		
• Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface	120.2 mm	4.732 in
• Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
• Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head	0.1 mm	0.004 in
• Surface Flatness - Exhaust Manifold Deck	0.13 mm	0.005 in
• Surface Flatness - Intake Manifold Deck	0.08 mm	0.0031 in
• Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide	17.32 mm	0.682 in
Intake Manifold		
• Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes Two Runner Port Openings	0.3 mm	0.118 in
Lubrication System		
• Oil Capacity - with Filter	5.68 Liters	6.0 Quarts
• Oil Capacity - without Filter	4.73 Liters	5.0 Quarts
• Oil Pressure - Minimum - Hot	41 kPa at 1,000 engine RPM 124 kPa at 2,000 engine RPM 165 kPa at 4,000 engine RPM	6 psig at 1,000 engine RPM 18 psig at 2,000 engine RPM 24 psig at 4,000 engine RPM
Oil Pan		
• Front Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
• Rear Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
• Oil Pan Alignment - to Rear of Engine Block at Transmission Bell Housing Mounting Surface	0.0-0.25 mm	0.0-0.01 in

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

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

General Specifications 6.0L (LQ4 VIN U)

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

• Connecting Rod Bore Out-of-Round - Bearing End - Production	0.006 mm	0.0002 in
• Connecting Rod Bore Out-of-Round - Bearing End - Service	0.006 mm	0.0002 in
• Connecting Rod Side Clearance	0.11-0.51 mm	0.00433-0.02 in
Crankshaft		
• Connecting Rod Journal Diameter - Production	53.318-53.338 mm	2.0991-2.0999 in
• Connecting Rod Journal Diameter - Service	53.308 mm	2.0987 in
• Connecting Rod Journal Out-of-Round - Production	0.005 mm	0.0002 in
• Connecting Rod Journal Out-of-Round - Service	0.01 mm	0.0004 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production	0.005 mm	0.0002 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service	0.02 mm	0.00078 in
• Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
• Crankshaft Main Bearing Clearance - Production	0.02-0.052 mm	0.0008-0.0021 in
• Crankshaft Main Bearing Clearance - Service	0.02-0.065 mm	0.0008-0.0025 in
• Crankshaft Main Journal Diameter - Production	64.993-65.007 mm	2.558-2.559 in
• Crankshaft Main Journal Diameter - Service	64.993 mm	2.558 in
• Crankshaft Main Journal Out-of-Round - Production	0.003 mm	0.000118 in
• Crankshaft Main Journal Out-of-Round - Service	0.008 mm	0.0003 in
• Crankshaft Main Journal Taper - Production	0.01 mm	0.0004 in
• Crankshaft Main Journal Taper - Service	0.02 mm	0.00078 in
• Crankshaft Rear Flange Runout	0.05 mm	0.002 in
• Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter	0.7 mm	0.028 in
• Crankshaft Thrust Surface - Production	26.14-26.22 mm	1.029-1.0315 in
• Crankshaft Thrust Surface - Service	26.22 mm	1.0315 in
• Crankshaft Thrust Surface Runout	0.025 mm	0.001 in
Cylinder Head		
• Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface	120.2 mm	4.732 in
• Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
• Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head	0.1 mm	0.004 in
• Surface Flatness - Exhaust Manifold Deck	0.13 mm	0.005 in
• Surface Flatness - Intake Manifold Deck	0.08 mm	0.0031 in
• Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide	17.32 mm	0.682 in
Intake Manifold		
• Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes Two Runner Port Openings	0.3 mm	0.118 in
Lubrication System		
• Oil Capacity - with Filter	5.68 Liters	6.0 Quarts
• Oil Capacity - without Filter	4.73 Liters	5.0 Quarts

• Oil Pressure - Minimum - Hot	41 kPa at 1,000 engine RPM 124 kPa at 2,000 engine RPM 165 kPa at 4,000 engine RPM	6 psig at 1,000 engine RPM 18 psig at 2,000 engine RPM 24 psig at 4,000 engine RPM
Oil Pan		
• Front Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
• Rear Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
• Oil Pan Alignment - to Rear of Engine Block at Transmission Bell Housing Mounting Surface	0.0-0.25 mm	0.0-0.01 in
Piston Rings		
• Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Production	0.31-0.52 mm	0.012-0.02 in
• Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Service	0.31-0.59 mm	0.0122-0.023 in
• Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Production	0.51-0.77 mm	0.02-0.03 in
• Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Service	0.51-0.84 mm	0.02-0.033 in
• Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Production	0.31-0.87 mm	0.0122-0.034 in
• Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Service	0.31-0.94 mm	0.0122-0.037 in
• Piston Ring to Groove Clearance - First Compression Ring - Production	0.04-0.08 mm	0.00157-0.0031 in
• Piston Ring to Groove Clearance - First Compression Ring - Service	0.04-0.08 mm	0.00157-0.0031 in
• Piston Ring to Groove Clearance - Second Compression Ring - Production	0.039-0.079 mm	0.0015-0.0031 in
• Piston Ring to Groove Clearance - Second Compression Ring - Service	0.039-0.079 mm	0.0015-0.0031 in
• Piston Ring to Groove Clearance - Oil Control Ring - Production	0.015-0.199 mm	0.0006-0.0078 in
• Piston Ring to Groove Clearance - Oil Control Ring - Service	0.015-0.199 mm	0.0006-0.0078 in
Pistons and Pins		
• Piston - Piston Diameter - Measured Over Skirt Coating	101.606-101.640 mm	4.0002-4.0016 in
• Piston - Piston to Bore Clearance - Production	-0.022 to +0.03 mm	-0.0009 to +0.0012 in
• Piston - Piston to Bore Clearance - Service Limit with Skirt Coating Worn Off	0.07 mm	0.0028 in
• Pin - Piston Pin Fit in Connecting Rod Bore	0.02-0.043 mm - interference	0.00078-0.00169 in - interference
• Pin - Piston Pin Clearance to Piston Pin Bore - Production	0.011-0.018 mm	0.0004-0.0007 in
• Pin - Piston Pin Clearance to Piston Pin Bore - Service	0.011-0.02 mm	0.0004-0.0008 in
• Pin - Piston Pin Diameter	23.997-24.0 mm	0.9447-0.9448 in

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

General Specifications 6.0L (LQ9 VIN N)

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

Crankshaft		
• Connecting Rod Journal Diameter - Production	53.318-53.338 mm	2.0991-2.0999 in
• Connecting Rod Journal Diameter - Service	53.308 mm	2.0987 in
• Connecting Rod Journal Out-of-Round - Production	0.005 mm	0.0002 in
• Connecting Rod Journal Out-of-Round - Service	0.01 mm	0.0004 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production	0.005 mm	0.0002 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service	0.02 mm	0.00078 in
• Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
• Crankshaft Main Bearing Clearance - Production	0.02-0.052 mm	0.0008-0.0021 in
• Crankshaft Main Bearing Clearance - Service	0.02-0.065 mm	0.0008-0.0025 in
• Crankshaft Main Journal Diameter - Production	64.993-65.007 mm	2.558-2.559 in
• Crankshaft Main Journal Diameter - Service	64.993 mm	2.558 in
• Crankshaft Main Journal Out-of-Round - Production	0.003 mm	0.000118 in
• Crankshaft Main Journal Out-of-Round - Service	0.008 mm	0.0003 in
• Crankshaft Main Journal Taper - Production	0.01 mm	0.0004 in
• Crankshaft Main Journal Taper - Service	0.02 mm	0.00078 in
• Crankshaft Rear Flange Runout	0.05 mm	0.002 in
• Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter	0.7 mm	0.028 in
• Crankshaft Thrust Surface - Production	26.14-26.22 mm	1.029-1.0315 in
• Crankshaft Thrust Surface - Service	26.22 mm	1.0315 in
• Crankshaft Thrust Surface Runout	0.025 mm	0.001 in
Cylinder Head		
• Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface	120.2 mm	4.732 in
• Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
• Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head	0.1 mm	0.004 in
• Surface Flatness - Exhaust Manifold Deck	0.13 mm	0.005 in
• Surface Flatness - Intake Manifold Deck	0.08 mm	0.0031 in
• Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide	17.32 mm	0.682 in
Intake Manifold		
• Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7.87 in) Area that Includes Two Runner Port Openings	0.3 mm	0.118 in
Lubrication System		
• Oil Capacity - with Filter	5.68 Liters	6.0 Quarts
• Oil Capacity - without Filter	4.73 Liters	5.0 Quarts
• Oil Pressure - Minimum - Hot	41 kPa at 1,000 engine RPM 124 kPa at 2,000 engine RPM 165 kPa at 4,000 engine RPM	6 psig at 1,000 engine RPM 18 psig at 2,000 engine RPM 24 psig at 4,000 engine RPM

Oil Pan		
• Front Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
• Rear Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
• Oil Pan Alignment - to Rear of Engine Block at Transmission Bell Housing Mounting Surface	0.0-0.25 mm	0.0-0.01 in
Piston Rings		
• Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Production	0.31-0.52 mm	0.012-0.02 in
• Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Service	0.31-0.59 mm	0.0122-0.023 in
• Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Production	0.51-0.77 mm	0.02-0.03 in
• Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Service	0.51-0.84 mm	0.02-0.033 in
• Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Production	0.31-0.87 mm	0.0122-0.034 in
• Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Service	0.31-0.94 mm	0.0122-0.037 in
• Piston Ring to Groove Clearance - First Compression Ring - Production	0.035-0.08 mm	0.0014-0.0031 in
• Piston Ring to Groove Clearance - First Compression Ring - Service	0.035-0.08 mm	0.0014-0.0031 in
• Piston Ring to Groove Clearance - Second Compression Ring - Production	0.034-0.079 mm	0.0013-0.003 in
• Piston Ring to Groove Clearance - Second Compression Ring - Service	0.034-0.079 mm	0.0013-0.003 in
• Piston Ring to Groove Clearance - Oil Control Ring - Production	0.012-0.2 mm	0.00047-0.00078 in
• Piston Ring to Groove Clearance - Oil Control Ring - Service	0.012-0.2 mm	0.00047-0.00078 in
Pistons and Pins		
• Piston - Piston Diameter - Measured Over Skirt Coating	101.611-101.642 mm	4.0-4.001 in
• Piston - Piston to Bore Clearance - Production	-0.022 to +0.030 mm	-0.009 to +0.0012 in
• Piston - Piston to Bore Clearance - Service Limit with Skirt Coating Worn Off -	0.08 mm	0.0031 in
• Pin - Piston Pin Fit in Connecting Rod Bore - Production	0.007-0.02 mm	0.00027-0.00078 in
• Pin - Piston Pin Fit in Connecting Rod Bore - Service	0.007-0.022 mm	0.00027-0.00086 in
• Pin - Piston Pin Clearance to Piston Pin Bore - Production	0.002-0.01 mm	0.00008-0.0004 in
• Pin - Piston Pin Clearance to Piston Pin Bore - Service	0.002-0.015 mm	0.0008-0.0006 in
• Pin - Piston Pin Diameter	23.952-23.955 mm	0.943-0.943 in
Valve System		
• Valves - Valve Face Angle	45 degrees	
• Valves - Valve Face Width	1.25 mm	0.05 in
• Valves - Valve Lash	Net Lash - No Adjustment	
• Valves - Valve Lift - Intake	11.79 mm	0.464 in
• Valves - Valve Lift - Exhaust	12.16 mm	0.479 in
• Valves - Valve Seat Angle	46 degrees	

• Valves - Valve Seat Runout	0.05 mm	0.002 in
• Valves - Valve Seat Width - Exhaust	1.78 mm	0.07 in
• Valves - Valve Seat Width - Intake	1.02 mm	0.04 in
• Valves - Valve Stem Diameter - Production	7.955-7.976 mm	0.313-0.314 in
• Valves - Valve Stem Diameter - Service	7.95 mm	0.313 in
• Valves - Valve Stem-to-Guide Clearance - Production - Intake	0.025-0.066 mm	0.001-0.0026 in
• Valves - Valve Stem-to-Guide Clearance - Service - Intake	0.093 mm	0.0037 in
• Valves - Valve Stem-to-Guide Clearance - Production - Exhaust	0.025-0.066 mm	0.001-0.0026 in
• Valves - Valve Stem-to-Guide Clearance - Service - Exhaust	0.093 mm	0.0037 in
• Rocker Arms - Valve Rocker Arm Ratio	1.70:1	
• Valve Springs - Valve Spring Free Length	52.9 mm	2.08 in
• Valve Springs - Valve Spring Installed Height	45.75 mm	1.8 in
• Valve Springs - Valve Spring Load - Closed	340 N at 45.75 mm	76 lb at 1.8 in
• Valve Springs - Valve Spring Load - Open	980 N at 33.55 mm	220 lb at 1.32 in

Fastener Tightening Specifications

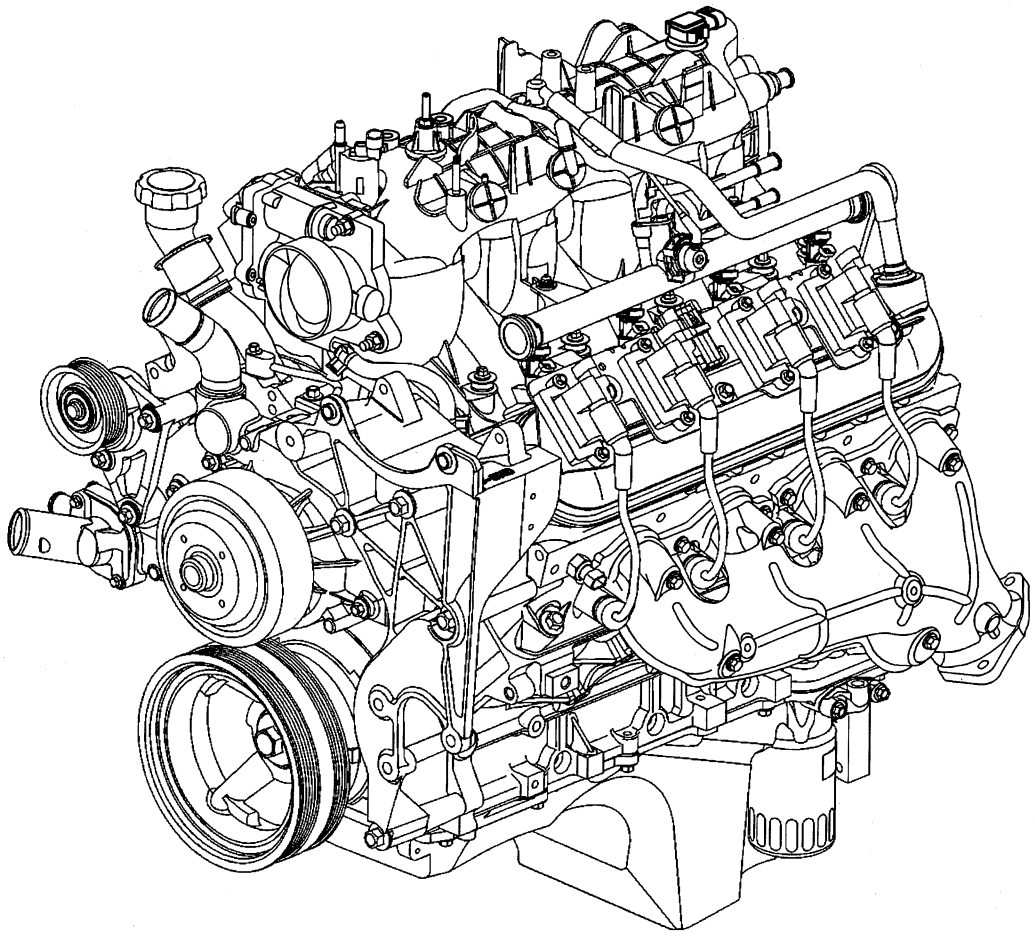
Application	Specification	
	Metric	English
Air Cleaner Outlet Duct Clamp	7 N·m	62 lb in
Air Conditioning Belt Tensioner Bolt	50 N·m	37 lb ft
Battery Cable Channel Bolt	12 N·m	106 lb in
Camshaft Retainer Bolts	25 N·m	18 lb ft
Camshaft Sensor Bolt	25 N·m	18 lb ft
Camshaft Sprocket Bolts	35 N·m	26 lb ft
Connecting Rod Bolts - First Pass	20 N·m	15 lb ft
Connecting Rod Bolts - Final Pass	75 degrees	
Coolant Temperature 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 Pass all M11 Bolts in Sequence	30 N·m	22 lb ft
Cylinder Head Bolts - Second Pass all M11 Bolts in Sequence	90 degrees	
Cylinder Head Bolts - Final Pass all M11 Bolts in Sequence	90 degrees	
Cylinder Head Bolts - M8 Inner Bolts in Sequence	30 N·m	22 lb ft
Cylinder Head Coolant Plug	20 N·m	15 lb ft
Differential Carrier Lower Mounting Bolt/Nut	100 N·m	74 lb ft
Drive Belt Idler Pulley Bolt	50 N·m	37 lb ft
Drive Belt Tensioner Bolt	50 N·m	37 lb ft
Engine Block Coolant Drain Plugs	60 N·m	44 lb ft
Engine Block Heater	40 N·m	30 lb ft
Engine Block Oil Gallery Plugs	60 N·m	44 lb ft
Engine Coolant Air Bleed Pipe and Cover Bolts	12 N·m	106 lb in
Engine Flywheel Bolts - First Pass	20 N·m	15 lb ft
Engine Flywheel Bolts - Second Pass	50 N·m	37 lb ft
Engine Flywheel Bolts - Final Pass	100 N·m	74 lb ft
Engine Front Cover Bolts	25 N·m	18 lb ft
Engine Harness Ground Bolt - Right Rear	16 N·m	12 lb ft
Engine Harness Ground Bolt-to-Block	25 N·m	18 lb ft
Engine Mount Bolt-to-Engine Bracket	50 N·m	37 lb ft
Engine Mount Frame Bracket Through Bolt	75 N·m	55 lb ft
Engine Mount Frame Side Mount Bolt	65 N·m	50 lb ft
Engine Mount-to-Engine Bracket Bolt	50 N·m	37 lb ft
Engine Rear Cover Bolts	25 N·m	18 lb ft
Engine Service Lift Bracket M10 Bolts	50 N·m	37 lb ft
Engine Service Lift Bracket M8 Bolt	25 N·m	18 lb ft
Engine Shield Bolt	20 N·m	15 lb ft
Engine Valley Cover Bolts	25 N·m	18 lb ft
Engine Wiring Harness Bracket Nut	5 N·m	44 lb in

Evaporative Emission (EVAP) Purge Solenoid Bolt	10 N·m	89 lb in
Exhaust Manifold Bolts - First Pass	15 N·m	11 lb ft
Exhaust Manifold Bolts - Final Pass	25 N·m	18 lb ft
Exhaust Manifold Heat Shield Bolts	9 N·m	80 lb in
Fuel Rail Bolts	10 N·m	89 lb in
Fuel Rail Cover Bolt	9 N·m	80 lb in
Fuel Rail Crossover Tube Bolts	3.8 N·m	34 lb in
Fuel Rail Stop Bracket Bolt	50 N·m	37 lb ft
Generator Bracket Bolt	50 N·m	37 lb ft
Generator Cable Nut	9 N·m	80 lb in
Heater Hose Bracket Nut	9 N·m	80 lb in
Hood Hinge Bolt	25 N·m	18 lb ft
Ignition Coil-to-Bracket Bolts	10 N·m	89 lb in
Ignition Coil Bracket-to-Valve Rocker Arm Cover Bolts	12 N·m	106 lb in
Inner Axle Housing Nut	100 N·m	74 lb ft
Intake Manifold Bolts - First Pass in Sequence	5 N·m	44 lb in
Intake Manifold Bolts - Final Pass in Sequence	10 N·m	89 lb in
Intake Manifold Sight Shield Bolts	10 N·m	89 lb in
Intake Manifold Sight Shield Bracket Bolts	5 N·m	45 lb in
Intake Manifold Sight Shield Retainer Bolt	5 N·m	44 lb in
Intake Manifold Wiring Harness Stud	10 N·m	89 lb in
Knock Sensors	20 N·m	15 lb ft
Mass Airflow/Intake Air Temperature (MAF/IAT) Sensor Clamp	7 N·m	62 lb in
Oil Filter	30 N·m	22 lb ft
Oil Filter Fitting	55 N·m	40 lb ft
Oil Level Indicator Tube Bolt	25 N·m	18 lb ft
Oil Level Sensor	13 N·m	115 lb in
Oil Pan Baffle Bolts	12 N·m	106 lb in
Oil Pan Closeout Cover Bolt - Left Side	9 N·m	80 lb in
Oil Pan Closeout Cover Bolt - Right Side	9 N·m	80 lb in
Oil Pan Cover Bolts	12 N·m	106 lb in
Oil Pan Drain Plug	25 N·m	18 lb ft
Oil Pan M8 Bolts - Oil Pan-to-Engine Block and Oil Pan-to-Front Cover	25 N·m	18 lb ft
Oil Pan M6 Bolts - Oil Pan-to-Rear Cover	12 N·m	106 lb in
Oil Pan Skid Plate Bolt	20 N·m	15 lb ft
Oil Pressure Sensor	20 N·m	15 lb ft
Oil Pump-to-Engine Block Bolts	25 N·m	18 lb ft
Oil Pump Cover Bolts	12 N·m	106 lb in
Oil Pump Relief Valve Plug	12 N·m	106 lb in
Oil Pump Screen Nuts	25 N·m	18 lb ft
Oil Pump Screen-to-Oil Pump Bolt	12 N·m	106 lb in
Positive Battery Cable Clip Bolt	9 N·m	80 lb in
Power Steering Pump Rear Bolt	50 N·m	37 lb ft
Spark Plugs - New Cylinder Heads	20 N·m	15 lb ft
Spark Plugs - All Subsequent Installations	15 N·m	11 lb ft
Throttle Body Nuts	10 N·m	89 lb in
Throttle Body Studs	6 N·m	53 lb in
Torque Converter Bolt - 4L60-E/4L65-E Transmissions	63 N·m	47 lb ft
Torque Converter Bolt - 4L80-E/4L85-E Transmissions	60 N·m	44 lb ft
Transmission Bolt/Stud	50 N·m	37 lb ft
Transmission Cover Bolt	12 N·m	106 lb in
Transmission Oil Level Indicator Tube Nut	18 N·m	13 lb ft
Valve Lifter Guide Bolts	12 N·m	106 lb in

Valve Rocker Arm Bolts	30 N·m	22 lb ft
Valve Rocker Arm Cover Bolts	12 N·m	106 lb in
Water Inlet Housing Bolts	15 N·m	11 lb ft
Water Pump Bolts - First Pass	15 N·m	11 lb ft
Water Pump Bolts - Final Pass	30 N·m	22 lb ft
Water Pump Cover Bolts	15 N·m	11 lb ft

Engine Component Description

The 4.8, 5.3, and 6.0 Liter V8 Engines



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

Camshaft and Drive System

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

Crankshaft

The crankshaft is cast nodular iron. The crankshaft is supported by five crankshaft bearings. The bearings are retained by crankshaft bearing caps which are machined with the engine block for proper alignment

and clearance. The crankshaft journals are undercut and rolled. The center main journal is the thrust journal. A crankshaft position reluctor ring is press fit mounted at the rear of the crankshaft. The reluctor ring is not serviceable separately. All crankshafts will have a short rear flange, at the crankshaft rear oil seal area. Certain 4.8L manual transmissions and 6.0L applications require a spacer between the rear of the crankshaft and the flywheel for proper flywheel positioning. Longer bolts are required in applications using the spacer.

Cylinder Heads

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

Engine Block

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

Exhaust Manifolds

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

Intake Manifold

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

Oil Pan

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

Piston and Connecting Rod Assembly

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

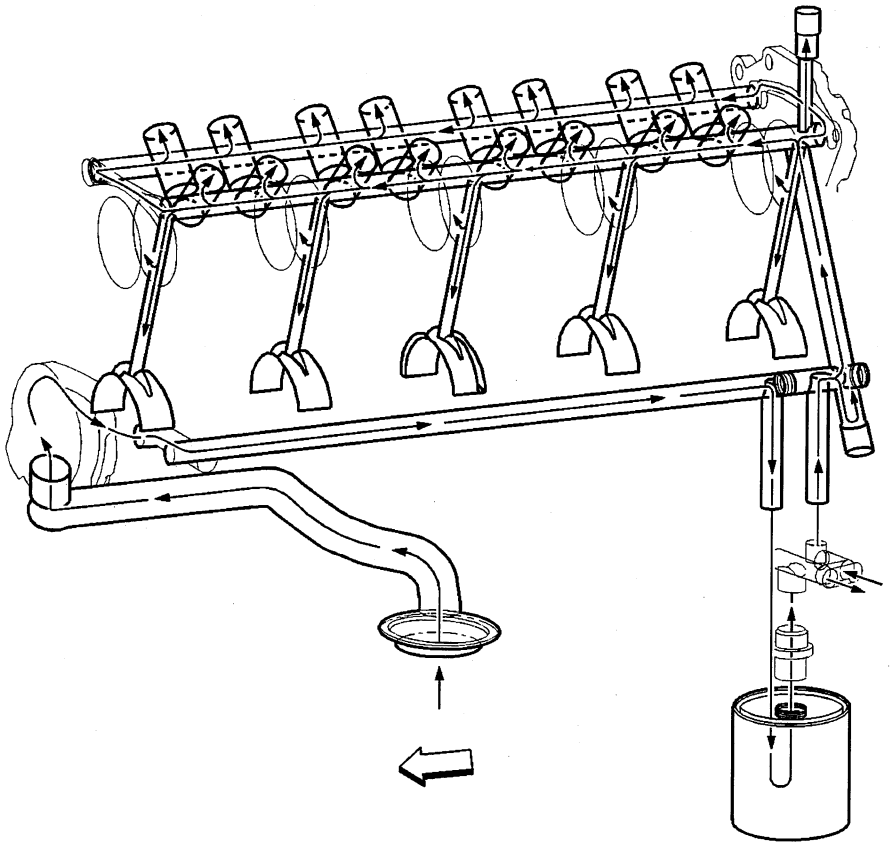
Valve Rocker Arm Cover Assemblies

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

Valve Train

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

Lubrication Description



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

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

Drive Belt System Description

See Drive Belt System Description above.

Crankcase Ventilation System Description

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

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

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

Engine Mechanical –6.6L Diesel (RPO LB7)

Engine Mechanical Specifications

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

• Crankshaft End Play - Production Value	0.04-0.205 mm	0.0016-0.0081 in
• Crankshaft Main Bearing Clearance - Service Limit	0.014 mm	0.0055 in
• Crankshaft Main Bearing Clearance - Production Value	0.037-0.072 mm	0.0015-0.0028 in
• Crankshaft Main Journal Diameter - Service Limit	79.89 mm	3.1453 in
• Crankshaft Main Journal Diameter - Production Value	79.905-79.925 mm	3.1459-3.1466 in
• Crankshaft Runout - Service Limit	0.44 mm	0.0173 in
• Crankshaft Runout - Production Value	0.05 mm	0.0020 in
Cylinder Head		
• Surface Flatness - Block Deck - Service Limit	0.2 mm	0.0079 in
• Surface Flatness - Block Deck - Production Value	0.075 mm	0.0030 in
• Surface Flatness - Exhaust Manifold Deck - Production Value	0.1 mm	0.0039 in
• Surface Flatness - Intake Manifold Deck - Production Value	0.1 mm	0.0039 in
Exhaust Manifold		
• Surface Flatness- Production Value	0.3 mm	0.0118 in
Intake Manifold		
• Surface Flatness - Production Value	0.3 mm	0.0118 in
Lubrication System		
• Oil Capacity - with Filter	10 qt	9.5 L
• Oil Capacity - without Filter	9.2 qt	8.7 L
• Oil Pressure - Minimum- Hot - at idle	98 KPa	14 psi
• Oil Pressure - Minimum - 1800 RPM	294 KPa	42 psi
• Oil Relief Valve Opening Pressure	441 KPa	64 psi
• Piston Cooling Jet Valve Opening Pressure	196 KPa	29 psi
Oil Pump		
• Gear Shaft Outside Diameter - Drive - Service Limit	19.86 mm	0.7819 in
• Gear Shaft Outside Diameter - Drive - Production Value	19.947-19.960 mm	0.7853-0.7858 in
• Gear Shaft Outside Diameter - Driven - Service Limit	19.86 mm	0.7819 in
• Gear Shaft Outside Diameter - Driven - Production Value	19.947-19.960 mm	0.7853-0.7858 in
• Gear Shaft-to-Bushing - Service Limit Clearance	0.14 mm	0.0055 in
• Gear-to-Cover Clearance - Drive/Driven - Service Limit	0.109 mm	0.0043 in
• Gear-to-Cover Clearance - Drive/Driven - Production Value	0.064-0.109 mm	0.0025-0.0043 in
• Gear-to-Housing Clearance - Drive/Driven - Service Limit	0.22 mm	0.0087 in
• Gear-to-Housing Clearance - Drive/Driven - Production Value	0.125-0.221 mm	0.0049-0.0087 in
Piston Rings		
• Piston Ring End Gap-First Compression Ring - Service Limit	1.37 mm	0.0539 in
• Piston Ring End Gap-First Compression Ring - Production Value	0.3-0.45 mm	0.0118-0.0177 in
• Piston Ring End Gap-Second Compression Ring - Service Limit	1.35 mm	0.0531 in
• Piston Ring End Gap-Second Compression Ring - Production Value	0.50-0.65 mm	0.0197-0.0256 in
• Piston Ring End Gap-Oil Control Ring - Service Limit	1.20 mm	0.0472 in
• 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	0.26 mm	0.0102 in

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

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

Fastener Tightening Specifications

Application	Specification	
	Metric	English
A/C Compressor Bolt	50 N·m	37 lb ft
Air Cleaner Outlet Duct Clamp	8 N·m	71 lb in
Air Conditioning Compressor/Power Steering Pump Bracket Bolt	46 N·m	34 lb ft
Battery Cable Bracket Bolt	12 N·m	106 lb in
Battery Cable Bracket Nut	8 N·m	71 lb in
Bypass Pipe Bolt	21 N·m	15 lb ft
Camshaft Gear Bolt	234 N·m	173 lb ft
Camshaft Position Sensor Bolt	10 N·m	89 lb in
Camshaft Position Sensor Exciter Ring Bolt	9 N·m	80 lb in
Camshaft Thrust Plate Bolt	22 N·m	16 lb ft
Charged Air Cooler Bolt	21 N·m	15 lb ft
Charged Air Cooler Clamp	8 N·m	71 lb in
Connecting Rod Cap Bolt - Angular Tightening Method	1st Step 64 N·m	1st Step 47 lb ft
	2nd Step 30 degrees	2nd Step 30 degrees
	3rd Step 30 degrees	3rd Step 30 degrees
Coolant Pipe to Water Pump Nut	25 N·m	18 lb ft
Cooling Fan Pulley	41 N·m	30 lb ft
Crankshaft Balancer Bolt	353 N·m	260 lb ft
Crankshaft Bearing Cap Bolt - Angular Tightening Method	1st Step 98 N·m	1st Step 72 lb ft
	2nd Step 132 N·m	2nd Step 97 lb ft
	3rd Step 30 degrees	3rd Step 30 degrees
Crankshaft Bearing Cap Side Bolt	78 N·m	58 lb ft
Crankshaft Position Sensor Bolt	10 N·m	89 lb in
Crankshaft Position Sensor Spacer Bolt	10 N·m	89 lb in
Crossmember Bolt	100 N·m	74 lb ft
Cylinder Head M12 Bolt - Angular Tightening Method	1st Step 50 N·m	1st Step 37 lb ft
	2nd Step 80 N·m	2nd Step 59 lb ft
	3rd Step 90 degrees	
	4th Step 75 degrees	
Cylinder Head M8 Bolt	25 N·m	18 lb ft
Drive Belt Tensioner Pulley Bolt	41 N·m	30 lb ft
EGR Bolt - California Emissions	20 N·m	15 lb ft

EGR Bracket Bolt - California Emissions	20 N·m	15 lb ft
EGR Valve Nut - California Emissions	19 N·m	14 lb ft
Engine Block Coolant Plug	18 N·m	13 lb ft
Engine Block Ground Bolt	34 N·m	25 lb ft
Engine Mount Through Bolt to Frame	75 N·m	55 lb ft
Engine Mount to Block Bolts	58 N·m	43 lb ft
Engine Mount to Frame Bolt	65 N·m	48 lb ft
Engine Shield Bolt	20 N·m	15 lb ft
Exhaust Heat Shield Nut	9 N·m	80 lb in
Exhaust Manifold Bolt/Nut	38 N·m	28 lb ft
Exhaust Manifold Heat Shield Bolts	8 N·m	71 lb in
Exhaust Outlet Heat Shield Bolts	8 N·m	71 lb in
Exhaust Outlet Pipe Bolt	53 N·m	39 lb ft
Exhaust Pipe Bolt	53 N·m	39 lb ft
Exhaust Pipe Bracket Bolt	34 N·m	25 lb ft
Exhaust Pipe Clamp	40 N·m	30 lb ft
Exhaust Pipe Heat Shield Bolts	8 N·m	71 lb in
Fan Pulley Bracket Bolt	46 N·m	34 lb ft
Flywheel Bolt - Angular Tightening Method	1st Step 79 N·m	1st Step 58 lb ft
	2nd Step 60 degrees	2nd Step 60 degrees
	3rd Step 60 degrees	3rd Step 60 degrees
Flywheel Housing Bolt - Black Circle Mark	80 N·m	60 lb ft
Flywheel Housing to Upper Oil Pan Bolt - Black Triangle Mark	50 N·m	37 lb ft
Front Engine Cover Bolt	21 N·m	15 lb ft
Fuel Block Bolt	25 N·m	18 lb ft
Fuel Filter Bracket Bolt	21 N·m	15 lb ft
Fuel Injection Control Module Bolt	20 N·m	15 lb ft
Fuel Injection Control Module Bracket Bolt	21 N·m	15 lb ft
Fuel Injection Control Module Connector Bolt	10 N·m	89 lb in
Fuel Injection Control Module Connector Bracket Bolt	21 N·m	15 lb ft
Fuel Injection Control Module Cooler Eye Bolt	27 N·m	20 lb ft
Fuel Injection Pipe Nut	41 N·m	30 lb ft
Fuel Inlet Pipe Bracket Bolt	21 N·m	15 lb ft
Fuel Pipes Bracket Bolt	25 N·m	18 lb ft
Fuel Rail Assembly Bolt	25 N·m	18 lb ft
Fuel Rail Connector	45 N·m	33 lb ft
Fuel Return Pipe Eye Bolt - Cylinder Head Side	17 N·m	12 lb ft
Fuel Return Pipe Eye Bolt - Injector Side	16 N·m	12 lb ft
Fuel Return Pipe Sleeve Nut	41 N·m	30 lb ft
Fuel Return Sleeve Unit	41 N·m	30 lb ft
Fuel Injection Pump Assembly to Cylinder Block Bolt	21 N·m	15 lb ft
Fuel Injection Pump to Bracket Bolt	21 N·m	15 lb ft
Fuel Injection Pump Drive Gear Nut	70 N·m	52 lb ft
Fuel Line Bracket Nut	21 N·m	15 lb ft
Fuel Temperature Sensor Eye Bolt	15 N·m	11 lb ft
Function Block Nut	25 N·m	18 lb ft
Function Block to Injection Pipe Nut	41 N·m	30 lb ft
Generator Bracket Bolt	50 N·m	37 lb ft
Generator Positive Cable Nut	9 N·m	80 lb in
Glow Plug	18 N·m	13 lb ft
Glow Plug Connector Nut	2 N·m	18 lb in
Glow Plug Power Feed Nut	15 N·m	11 lb ft

Glow Plug Relay Assembly Bolt	25 N·m	18 lb ft
Heater Outlet Pipe/Nose Bolt	25 N·m	18 lb ft
Heater Outlet Pipe/Hose Nut	9 N·m	80 lb in
Heater Pipe Bolt	21 N·m	15 lb ft
Hood Hinge Bolt	25 N·m	18 lb ft
Idle Pulley Bolt/Screw	37 N·m	27 lb ft
Injector Bracket Bolt	50 N·m	37 lb ft
Injector Harness Bracket Bolt	9 N·m	80 lb in
Injector Terminal Nut	2 N·m	18 lb in
Injector Pipe Lock Plate Screws	4 N·m	35 lb in
Intake Air Heater	50 N·m	37 lb ft
Intake Air Heater Terminal Nut	4 N·m	35 lb in
Intake Manifold Bolts/Nuts	21 N·m	15 lb ft
Intake Manifold Tube Bolts/Nuts	9 N·m	80 lb in
Oil Cooler Adapter Bolts	21 N·m	15 lb ft
Oil Cooler Adapter Nuts	25 N·m	18 lb ft
Oil Cooler Assembly Bolts	25 N·m	18 lb ft
Oil Cooler Adapter Stud	10 N·m	89 lb in
Oil Drain Plug	84 N·m	62 lb ft
Oil Fill Tube Bolt	21 N·m	15 lb ft
Oil Filter	24 N·m	18 lb ft
Oil Gallery Plugs	53 N·m	39 lb ft
Oil Level Indicator Tube Bolt	21 N·m	15 lb ft
Oil Level Sensor Bolt	10 N·m	89 lb in
Oil Pan Bolts/Nuts - Lower	10 N·m	89 lb in
Oil Pan Bolt - Upper	20 N·m	15 lb ft
Oil Pan Skid Plate Bolt	20 N·m	15 lb ft
Oil Pressure Sensor Unit	30 N·m	22 lb ft
Oil Pressure Relief Valve	39 N·m	29 lb ft
Oil Pump Bolt	21 N·m	15 lb ft
Oil Pump Driven Gear Nut	100 N·m	74 lb ft
Oil Pump Gear Cover Bolt	21 N·m	15 lb ft
Oil Strainer Bolts/Nuts	25 N·m	18 lb ft
Piston Cooling Nozzle Eye Bolt	21 N·m	15 lb ft
Positive Cable Junction Block Bracket to Power Steering Pump Bolt	9 N·m	80 lb in
Positive Crankcase Ventilation Cover Screws	4 N·m	35 lb in
Positive Crankcase Ventilation Oil Seperator Bracket Nut	25 N·m	18 lb ft
Power Steering Pump Bracket Bolt	50 N·m	37 lb ft
Power Steering Pump Bolt	50 N·m	37 lb ft
Power Steering Pump Bracket Bolt	46 N·m	34 lb ft
Rocker Arm Shaft Bracket Bolt	41 N·m	30 lb ft
Starter Motor Bolt	78 N·m	58 lb ft
Transmission Fill Tube Nut	18 N·m	13 lb ft
Thermostat Housing Bolts/Nuts	25 N·m	18 lb ft
Thermostat Cover Bolt	21 N·m	15 lb ft
Torque Converter Bolt	60 N·m	44 lb ft
Transmission Oil Cooler Clip Nut	9 N·m	80 lb in
Turbocharger Bolt	108 N·m	80 lb ft
Turbocharger Boost Sensor Bolt	10 N·m	89 lb in
Turbocharger Coolant Outlet Pipe Bracket Bolts	21 N·m	15 lb ft
Turbocharger Heat Shield Bolts	9 N·m	80 lb in
Turbocharger Inlet Duct to Turbocharger Bolt	9 N·m	80 lb in
Turbocharger Oil Return Pipe Stud	10 N·m	89 lb in

Turbocharger Oil Supply Hose Eye Bolt	34 N·m	25 lb ft
Turbocharger Oil Return Pipe Bolts/Nuts	21 N·m	15 lb ft
Turbocharger Thermostatic Coolant Valve	60 N·m	44 lb f
UpperOil Pan to Flywheel Housing Screws	20 N·m	15 lb ft
Vacuum Pump Nuts - California Emissions	22 N·m	16 lb ft
Valve Adjusting Screw Nut	22 N·m	16 lb ft
Valve Lifter Holdown Bracket Bolt	11 N·m	97 lb in
Valve Rocker Arm Cover Bolt - Lower	10 N·m	89 lb in
Valve Rocker Arm Cover Bolt - Upper	8 N·m (Two Times)	71 lb in (Two Times)
Water Outlet Bolts	25 N·m	18 lb ft
Water Pump Bolt	21 N·m	15 lb ft

Drive Belt System Description

See Drive Belt System Description above.

Engine Component Description

Engine Block

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

Upper Oil Pan

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

Crankshaft

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

Connecting Rods

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

Pistons

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

Cylinder Heads

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

Valve Train

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

Fuel System

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

Fuel Injection Control Module

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

Turbocharger

The turbocharger is water cooled for improved durability.

Oil Cooler

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

Oil Pump

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

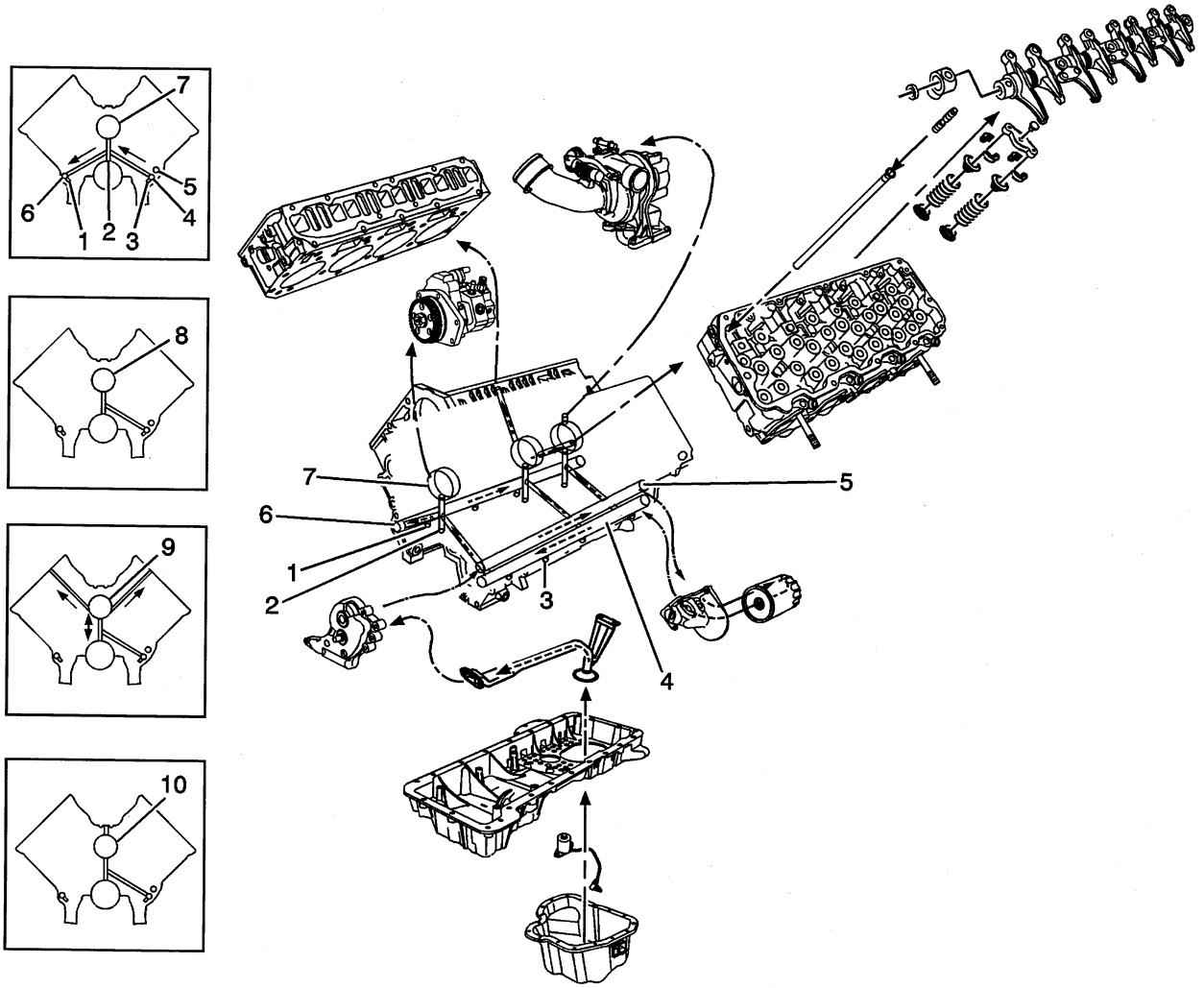
Water Pump

The water pump is gear driven for improved reliability.

Engine Covers

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

Lubrication Description



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

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

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

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

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

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

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

Engine Mechanical – 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

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
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

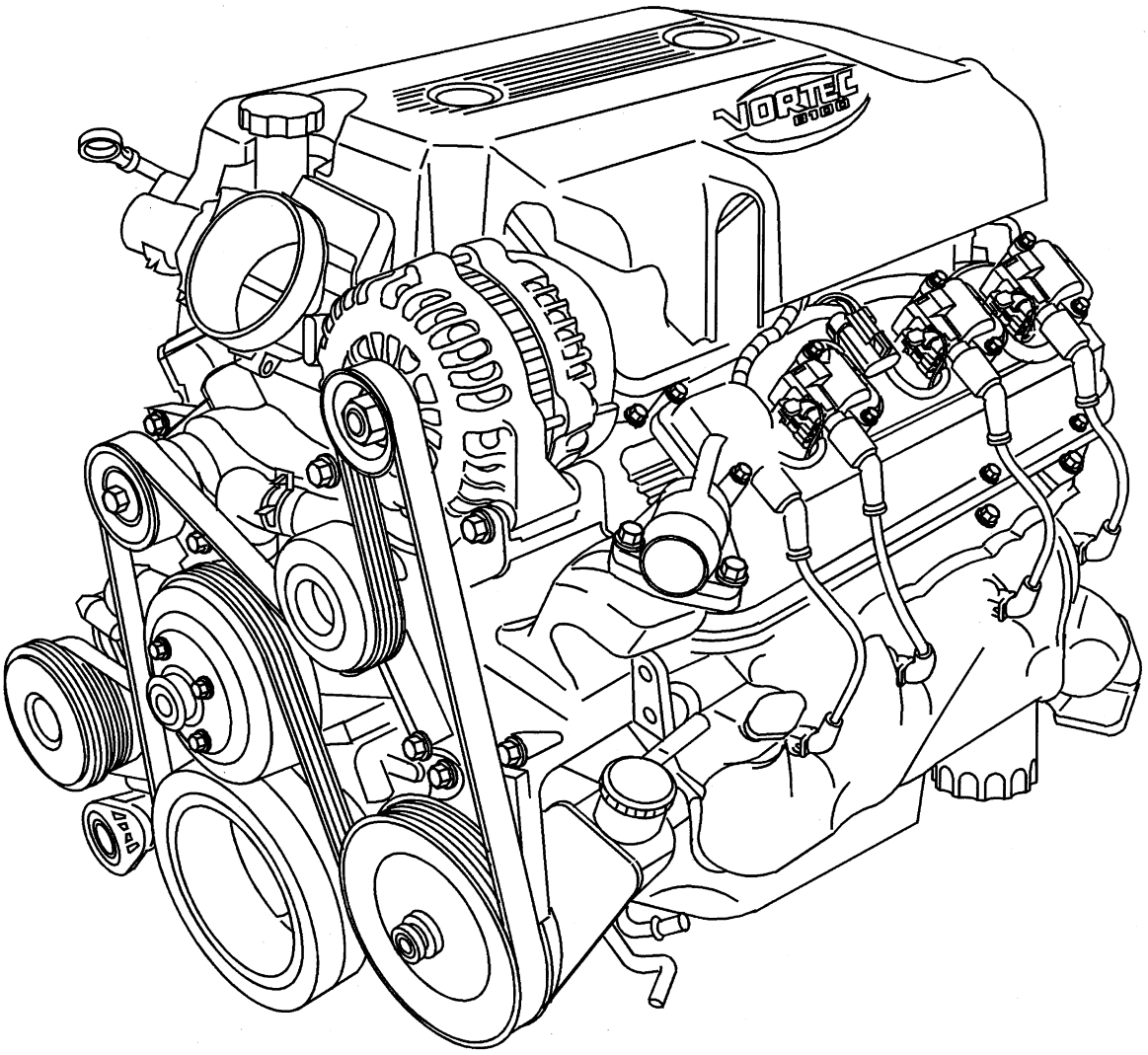
Engine Wiring Harness Bolt	16 N·m	12 lb ft
Exhaust Manifold		
• Center Bolt	35 N·m	26 lb ft
• Nut	16 N·m	12 lb ft
• Stud	20 N·m	15 lb ft
Exhaust Manifold Heat Shield		
• Bolt	25 N·m	18 lb ft
• Nut	25 N·m	18 lb ft
Flywheel Bolt		
• First Pass	40 N·m	30 lb ft
• Second Pass	80 N·m	59 lb ft
• Final Pass	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
Power Steering Pump Bracket Bolt/Nut	50 N·m	37 lb ft
Power Steering Pump Bracket Stud	20 N·m	15 lb ft

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

Drive Belt System Description

See Drive Belt System Description above.

Engine Component Description



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

Cylinder Head

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

Camshaft

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

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

Crankshaft

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

Pistons and Connecting Rods

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

Valve Train

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

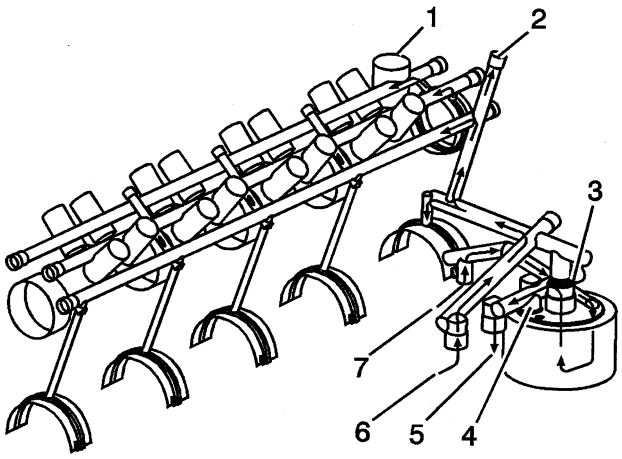
Intake Manifold

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

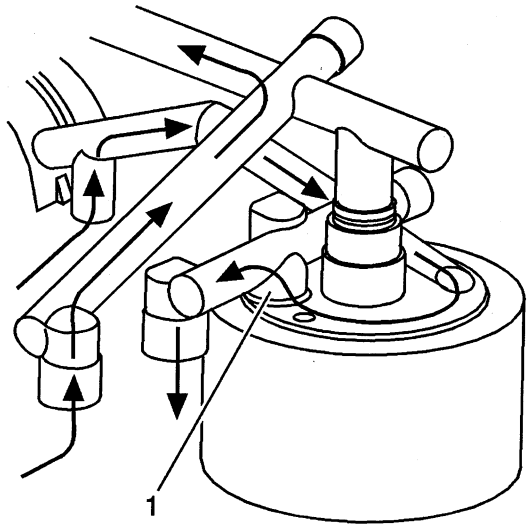
Exhaust Manifold

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

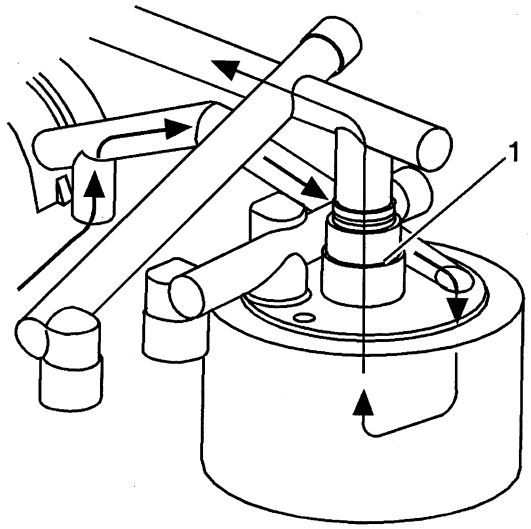
Lubrication Description



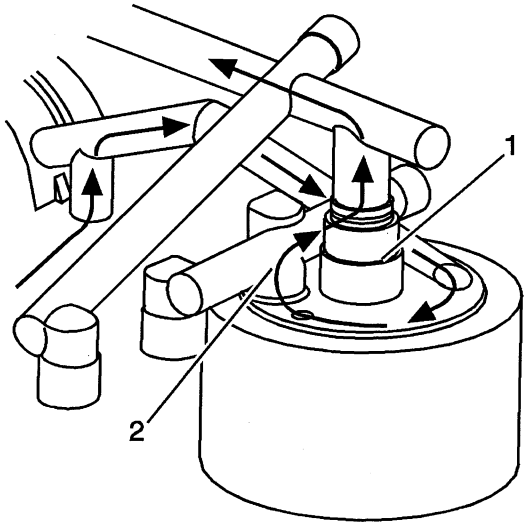
The gear-type oil pump is driven through an extension driveshaft. The extension driveshaft is driven by the oil pump drive, which is gear driven by the camshaft. The oil is drawn from the oil pan through a pickup screen and tube, into the oil pump (7). Pressurized oil flows through the oil filter, into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



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



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



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

Engine Cooling

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Air Cleaner Outlet Duct Clamp (6.6L)	6 N·m	53 lb in
Air Cleaner Outlet Duct Clamp Screw (4.8L, 5.3L, and 6.0L)	7 N·m	62 lb in
Air Conditioning (A/C) Compressor Mounting Bolt (6.6L)	50 N·m	37 lb ft
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 Stud/Bolt (4.8L, 5.3L, and 6.0L)	12 N·m	106 lb in
Coolant Crossover Bolt (8.1L)	50 N·m	37 lb ft
Coolant Heater Bolt (6.6L)	2 N·m	18 lb in
Coolant Heater Cord Bolt	8 N·m	71 lb in
Coolant Heater Bolt (4.3L)	2 N·m	18 lb in
Coolant Heater (4.8L, 5.3L, and 6.0L)	50 N·m	37 lb ft
Coolant Heater (8.1L)	60 N·m	47 lb ft
Engine Block Coolant Drain Plug (4.3L)	20 N·m	15 lb ft
Engine Block Coolant Drain Plug (4.8L, 5.3L, 6.0L, and 8.1L)	60 N·m	44 lb ft
Engine Block Coolant Drain Plug (6.6L)	18 N·m	13 lb ft
Engine Coolant Temperature (ECT) Sensor (6.6L)	33 N·m	24 lb ft
Engine Shield Bolt	20 N·m	15 lb ft
Exhaust Manifold Pipe Nut (4.8L, 5.3L, and 6.0L)	50 N·m	37 lb ft
Fan Clutch Bolt	23 N·m	17 lb ft
Fan Clutch Nut	56 N·m	41 lb ft
Fan Pulley Bolt/Nut (6.6L)	46 N·m	34 lb ft
Fan Shroud Bolt	9 N·m	80 lb in
Fan and Water Pump Pulley Bolt (4.3L)	25 N·m	18 lb ft
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)	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 Pipe to Fuel Filter Bolt (6.6L)	21 N·m	16 lb ft
Heater 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
Idler Pulley Bolt (6.6L)	43 N·m	32 lb ft
Junction Block Bracket Bolt (6.6L)	9 N·m	80 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
Thermostat Housing Cover Bolt (6.6L)	21 N·m	16 lb ft
Thermostat Housing Bolt (4.8L, 5.3L, and 6.0L)	15 N·m	11 lb ft
Thermostat Housing Bolt (8.1L)	37 N·m	27 lb ft
Thermostat Crossover Bolt (6.6L)	21 N·m	16 lb ft
Transmission Control Module (TCM) Cover Bolt	9 N·m	80 lb in
Transmission Control Module (TCM) Electrical Connector Bolt	8 N·m	71 lb in
Turbocharger Coolant Bypass Valve (6.6L)	60 N·m	44 lb ft
Turbocharger Outlet Coolant Pipe to Pipe Bracket Bolt (6.6L)	21 N·m	16 lb ft

Turbocharger Outlet Coolant Pipe Nut (6.6L)	9 N·m	80 lb in
Water Outlet Bolt (8.1L)	30 N·m	22 lb ft
Water Outlet Stud (4.3L)	25 N·m	18 lb ft
Water Outlet Tube to Thermostat Housing Bolt (6.6L)	21 N·m	16 lb ft
Water Outlet Tube to Valve Rocker Arm Cover Bolt (6.6L)	21 N·m	16 lb ft
Water Pump Bolt (4.3L)	45 N·m	33 lb ft
Water Pump Bolt (First Pass) (4.8L, 5.3L, and 6.0L)	15 N·m	11 lb ft
Water Pump Bolt (Final Pass) (4.8L, 5.3L, and 6.0L)	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 to Water Pump Housing Bolt (6.6L)	21 N·m	16 lb ft
Water Pump to Water Pump Outlet Pipe Nuts (6.6L)	21 N·m	16 lb ft
Wiring Harness Bracket to Thermost Housing Bolt (6.6L)	8 N·m	71 lb in

Cooling System Description and Operation

Coolant Heater

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

Cooling System

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

Cooling Cycle

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

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

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

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

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

Coolant

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

Radiator

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

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

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

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

Pressure Cap

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

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

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

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

Coolant Recovery System

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

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

Air Baffles and Seals

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

Water Pump

The water pump is a centrifugal vane impeller type pump. The pump consists of a housing with coolant inlet and outlet passages and an impeller. The impeller is mounted on the pump shaft and consists of a

series of flat or curved blades or vanes on a flat plate. When the impeller rotates, the coolant between the vanes is thrown outward by centrifugal force.

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

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

Thermostat

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

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

Engine Oil Cooler

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

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

Transmission Oil Cooler

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

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

Engine Electrical

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Auxiliary Battery Cable Clip Bolt	10 N·m	89 lb in
Auxiliary Battery Relay Nut	9 N·m	80 lb in
Auxiliary Battery Tray Nut	25 N·m	18 lb ft
Auxiliary Generator Bolt (6.6L)	50 N·m	37 lb ft
Auxiliary Generator Bracket Bolt (6.6L)	50 N·m	37 lb ft
Auxiliary Negative Battery Cable Bolt	17 N·m	13 lb ft
Auxiliary Positive Battery Cable Bolt	17 N·m	13 lb ft
Auxiliary Positive Battery Cable Nut	8 N·m	71 lb in
Auxiliary Positive Cable to Relay Nut	9 N·m	80 lb in
Battery Cable Bracket Bolt	25 N·m	18 lb ft
Battery Cable Channel Bolt	12 N·m	106 lb in
Battery Cable Channel Bolt (6.6L)	8 N·m	71 lb in
Battery Cable Junction Block Bracket Bolt (4.8L, 5.3L, and 6.0L)	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
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
Engine Wiring Harness Retainer Bolt (6.6L)	21 N·m	15 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 and Positive Crankcase Ventilation (PCV) Oil Separator Bracket Nut (6.6L)	25 N·m	18 lb ft
Generator Bracket Bolt (4.8L, 5.3L, 6.0L, 6.6L, and 8.1L)	50 N·m	37 lb ft
Generator Bolt (4.8L, 5.3L, 6.0L, 6.6L, and 8.1L)	50 N·m	37 lb ft
Generator Bolt (4.3L)	50 N·m	37 lb ft
Generator Bracket Bolt/Nut (4.3L)	41 N·m	30 lb ft
Generator Bracket Nut (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
Heater Hose Bracket Bolt (4.3L)	25 N·m	18 lb ft
Heater Outlet Pipe Bolt (6.6L)	25 N·m	18 lb ft
Idler Pulley Bolt (6.6L)	43 N·m	32 lb ft
Negative Battery Cable Bolt	17 N·m	13 lb ft
Positive Battery Cable Bolt	17 N·m	13 lb ft
Positive Battery Cable Nut (6.6L)	9 N·m	80 lb in
Positive Cable Clip Nut (8.1L)	8 N·m	71 lb in
Positive Cable at Underhood Bussed Electrical Center (UBEC) Bolt	9 N·m	80 lb in
Starter Bolt (4.3L)	43 N·m	32 lb ft
Starter Bolt (4.8L, 5.3L, 6.0L, and 8.1L)	50 N·m	37 lb ft
Starter Bolt (6.6L)	78 N·m	58 lb ft
Starter 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 Nut	3.4 N·m	30 lb in

Surge Tank Bolt/Nut	9 N·m	80 lb in
Transmission Cover Bolt (4.8L, 5.3L, and 6.0L)	9 N·m	80 lb in
Wiring Harness Bracket Bolt (4.3L)	25 N·m	18 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
4.3L (L35) 4.8L (LR4) 5.3L (LM7)	PG-260G
6.0L (LQ4) 8.1L (L18)	PG-260L
6.6L Diesel	Hitachi-S14-100B

Generator Usage

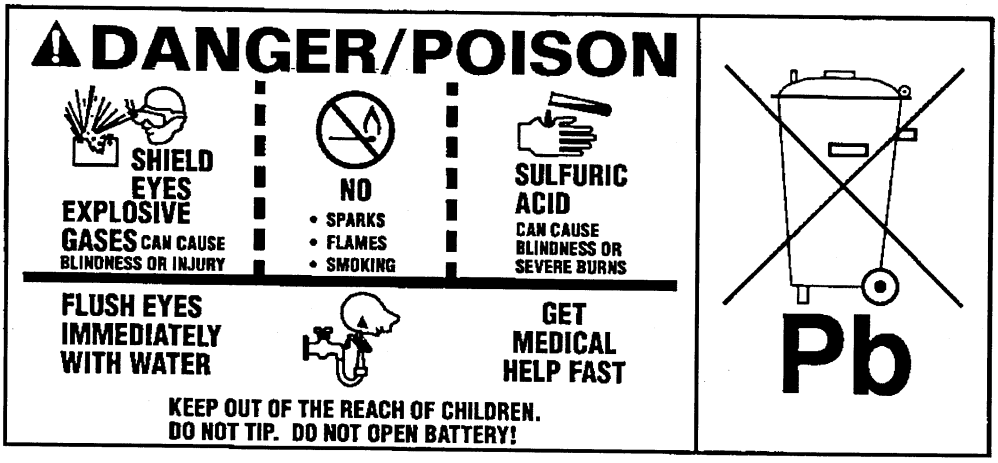
Base	
Generator Model	Delphi AD230
Rated Output	102 A
Load Test Output	71 A
Optional (Dual)	
Generator Model	Delphi AD244
Rated Output	130 A
Load Test Output	91 A
Bosch® Generator	
Generator Model	Bosch® 15755900
Rated Output	130 A
Load Test Output	91 A

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.**



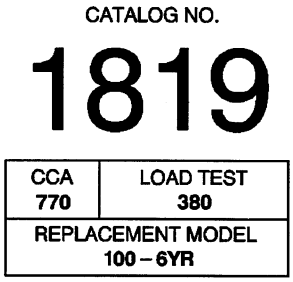
The maintenance free battery is standard. There are no vent plugs in the cover. The battery is completely sealed except for two small vent holes in the side. These vent holes allow the small amount of gas that is produced in the battery to escape.

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

Generator

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

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

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

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

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

Regulator

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

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

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

Auxiliary Battery Charging

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

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

The auxiliary battery relay coil is energized with the engine running through the fuse block and wiring, thus closing the relay contacts which allow the battery to be charged from the vehicle's generator via the

battery junction block. The auxiliary battery relay is permanently grounded so any time the ignition switch is in the run position the relay will be energized.

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

Engine Controls

Engine Controls – 4.3L

Ignition System Specifications

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

Fastener Tightening Specifications

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

Rotor Screw	2 N·m	18 lb in
Spark Plug (New AluminumHead)	20 N·m	15 lb ft
Spark Plug (New Iron Head)	30 N·m	22 lb ft
Spark Plug (Used Head)	15 N·m	11 lb ft
Throttle Body Stud	9 N·m	80 lb in
Throttle Position (TP) Sensor Screw	2 N·m	18 lb in

Fuel System Specifications

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

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

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

Notice

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

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

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

Engine Controls – 4.8, 5.3 & 6.0L

Ignition System Specifications

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

Fastener Tightening Specifications

Application	Specifications	
	Metric	English
Accelerator Pedal Nut	20 N·m	15 lb ft
Air Cleaner Outlet Duct Clamp	7 N·m	62 lb in
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
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 Bracket Bolt	25 N·m	18 lb ft
EVAP Canister Nuts	10 N·m	89 lb in
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, EVAP, and Return Pipe Assembly Nut	12 N·m	106 lb in
Fuel Fill and Vent Hose Clamp	2.5 N·m	22 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 Fill Pipe Clamp	2.5 N·m	22 lb in
Fuel Line Fitting	25 N·m	18 lb ft
Fuel Pipe Bracket Bolt	12 N·m	106 lb in
Fuel Rail Bolts	10 N·m	89 lb in
Fuel Return Pipe Attaching Screw	5 N·m	44 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 Airflow/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		
• Used Head	15 N·m	11 lb ft
• New Head	20 N·m	15 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 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 Vacuum Pump Bolt	22 N·m	16 lb ft
Exhaust Gas Recirculation Valve Vent Solenoid Bolt	10 N·m	89 lb in
Fuel Bundle Nut	16 N·m	12 lb ft
Fuel Bundle Bracket 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 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 Injection Pump Bolt	20 N·m	15 lb ft
Fuel Injector Return Pipe Bolt	16 N·m	12 lb ft
Fuel Injector Return Pipe to Cylinder Head Bolt	16 N·m	12 lb ft
Fuel Inlet Pipe to Fuel Injection Control Module Bolt	12 N·m	106 lb in
Fuel Junction Block Bolt	25 N·m	18 lb ft

Fuel Leak-off Block Pipe to Cylinder Head	15 N·m	11 lb ft
Fuel Pipe Clip Bolt	16 N·m	11 lb ft
Fuel Pipe Retainer Nut	8 N·m	70 lb in
Fuel Pressure Regulator Screws		
• First Pass	4 N·m	35 lb in
• Final Pass	7 N·m	62 lb in
Fuel Pump Fitting	30 N·m	22 lb ft
Fuel Rail Bolt	26 N·m	19 lb ft
Fuel Rail Feed Pipe Fitting	41 N·m	30 lb ft
Fuel Rail Pressure Sensor	70 N·m	52 lb ft
Fuel Return Line Banjo Bolt	15 N·m	11 lb ft
Fuel Return Pipe Bolt	27 N·m	19 lb ft
Fuel Return Pipe Bolt to Cylinder Head	15 N·m	11 lb ft
Fuel Tank Fill Pipe Clamp	2.5 N·m	22 lb in
Fuel Tank Filler 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 Temperature Sensor	22 N·m	16 lb ft
Fuel Tank Shield Bolt	18 N·m	13 lb ft
Fuel Tank Strap Bolt	40 N·m	30 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 Fitting	25 N·m	18 lb ft
Junction Block to Fuel Injection Pump Pipe Fitting	41 N·m	30 lb ft
Junction Block Bracket Bolt	9 N·m	80 lb in
Junction Block Nut	25 N·m	18 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 in
Water Outlet Tube to Valve Rocker Arm Cover Bolt	21 N·m	16 lb in

Fuel System Specifications

Some states and provinces have restrictions on the purchase of diesel fuel for light duty vehicles and require you to buy permits or pay special taxes. Some of these restrictions apply to residents, and others apply to both residents and visitors. These restrictions can change. To learn the current restrictions in any state or province, contact your auto club, the police or other officials.

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 it stays below 0°F or -18°C); 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 isn't 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 0°F or -18°C); 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 0°F (-18°C). The emission control system requires the use of diesel fuel with low sulfur (0.05% 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. It is important that diesel-powered trucks are 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't 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 0°F (-18°C), because the fuel economy and lubricating qualities of kerosene isn't 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 32°-50°F (0°-10°C). Replacing the filter is not necessary.

Water in Fuel

Sometimes, water can be pumped into the fuel tank along with diesel fuel. This can happen if the service station doesn't 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.

The water in fuel light also should illuminate briefly when the engine is started as a check. If the light doesn't illuminate, the problem should be fixed to identify a water in fuel condition correctly.

Engine Controls – 8.1L

Ignition System Specifications

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

Fastener Tightening Specifications

Application	Specifications	
	Metric	English
Accelerator Pedal Nut	20 N·m	15 lb ft
Air Cleaner Resonator Outlet Duct Clamp	4 N·m	35 lb in
Camshaft Position (CMP) Sensor Bolt	12 N·m	106 lb in
Crankshaft Position (CKP) Sensor Bolt	12 N·m	106 lb in
Engine Coolant Temperature (ECT) Sensor	50 N·m	37 lb ft
Engine Wire Harness Bolt/Stud	10 N·m	89 lb in
Exhaust Gas Recirculation (EGR) Valve Adapter Nut	22 N·m	16 lb ft
Exhaust Gas Recirculation (EGR) Valve Nut	22 N·m	16 lb ft
Exhaust Gas Recirculation (EGR) Valve Pipe-to-Adapter Bolt	25 N·m	18 lb ft
Exhaust Gas Recirculation (EGR) Valve Pipe-to-Cylinder Head Bolts	50 N·m	37 lb ft
Exhaust Gas Recirculation (EGR) Valve Pipe-to-Exhaust Manifold Nuts	25 N·m	18 lb ft
Evaporative Emission (EVAP) Canister Bracket Bolt	25 N·m	18 lb ft
Evaporative Emission (EVAP) Canister Purge Valve Bolt	10 N·m	89 lb in
Evaporative Emission (EVAP) Canister Nut	10 N·m	89 lb in
Evaporative Emission (EVAP) Canister Vent Valve Bracket Bolt	12 N·m	106 lb in
Evaporative Emission (EVAP) Canister Vent Valve Bolt	12 N·m	106 lb in
Fuel Feed, EVAP, and Return Pipe Nut	12 N·m	106 lb in
Fuel Fill and Vent Hose Clamp	2.5 N·m	22 lb in
Fuel Fill Pipe Clamp	2.5 N·m	22 lb in
Fuel Filter Fitting	25 N·m	18 lb ft
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
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
Engine Shield Bolt	20 N·m	15 lb ft
Exhaust Gas Recirculation (EGR) Cooler Tube Nut (6.6L)	30 N·m	22 lb ft
Exhaust Gas Recirculation (EGR) Pipe Bracket Bolt (8.1L)	50 N·m	37 lb ft
Exhaust Gas Recirculation (EGR) Pipe Nut (8.1L)	30 N·m	22 lb ft
Exhaust Heat Shield Bolt	9 N·m	80 lb in
Exhaust Heat Shield Nut (Body Panel)	9 N·m	80 lb in
Exhaust Manifold Bolts (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 Hanger Bracket Bolt	12 N·m	106 lb in
Exhaust Manifold Pipe Nut	50 N·m	37 lb ft
Exhaust Muffler Clamp Bolt	30 N·m	22 lb ft
Exhaust Muffler Hanger Nut	50 N·m	39 lb ft
Exhaust Muffler Nut	40 N·m	30 lb ft
Exhaust Pipe Clamp	40 N·m	30 lb ft
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
Oil Level Indicator Tube Bracket Bolt (6.6L)	21 N·m	15 lb ft
Oil Pan Skid Plate Bolt	20 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
Turbocharger Exhaust Pipe Bolt/Nut (6.6L)	53 N·m	39 lb ft
Turbocharger Exhaust Pipe Heat Shield Bolt (6.6L)	8 N·m	71 lb in
Turbocharger Heat Shield Bolt (6.6L)	9 N·m	80 lb in

Exhaust System Description

Important

Use of non-OEM parts may cause driveability concerns.

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

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

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

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

Resonator

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

Catalytic Converter

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

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

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

The catalyst in the converter is not serviceable.

Muffler

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

Transmission/Transaxle Description and Operation

Manual Transmission - NV 3500

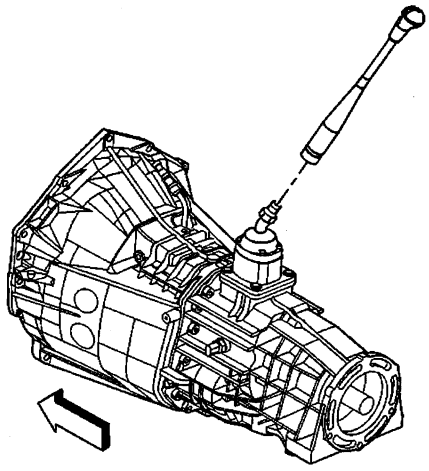
Fastener Tightening Specifications

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

Lubrication Specifications

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

Description and Operation



The New Venture Gear NV3500 (85 mm) is a 5 speed manual transmission used on light duty truck with 4.3 L, 5.0 L, and 5.7 L engines. This manual transmission is identified by the RPO's M50 and MG5. The reason for 2 different RPO codes is because of the different first speed gear ratios that the transmission can contain. The shift assembly design inside the transmission for NV3500 installed on C/K (GMT400 and GMT 800) trucks are different from that of NV3500 transmissions that are installed in smaller S/T trucks. The 85 mm is the distance between the inputshaft and the counter shaft. The transmission is available in rear wheel and four wheel drive versions. The NV3500 transmission is built in Muncie, Indiana by New Venture Gear, (a division of New Process Gear) for General Motors Powertrain.

The transmission has the following features:

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

Manual Transmission - NV 4500

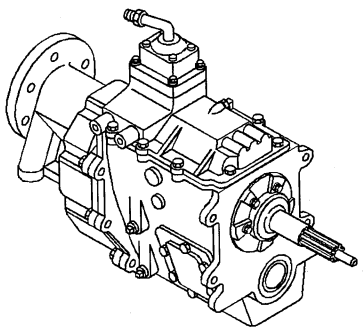
Fastener Tightening Specifications

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

Lubrication Specifications

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

Description and Operation



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

The transmission has the following features:

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

Manual Transmission - ZF S6-650

Fastener Tightening Specifications

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

Lubrication Specifications

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

Description and Operation

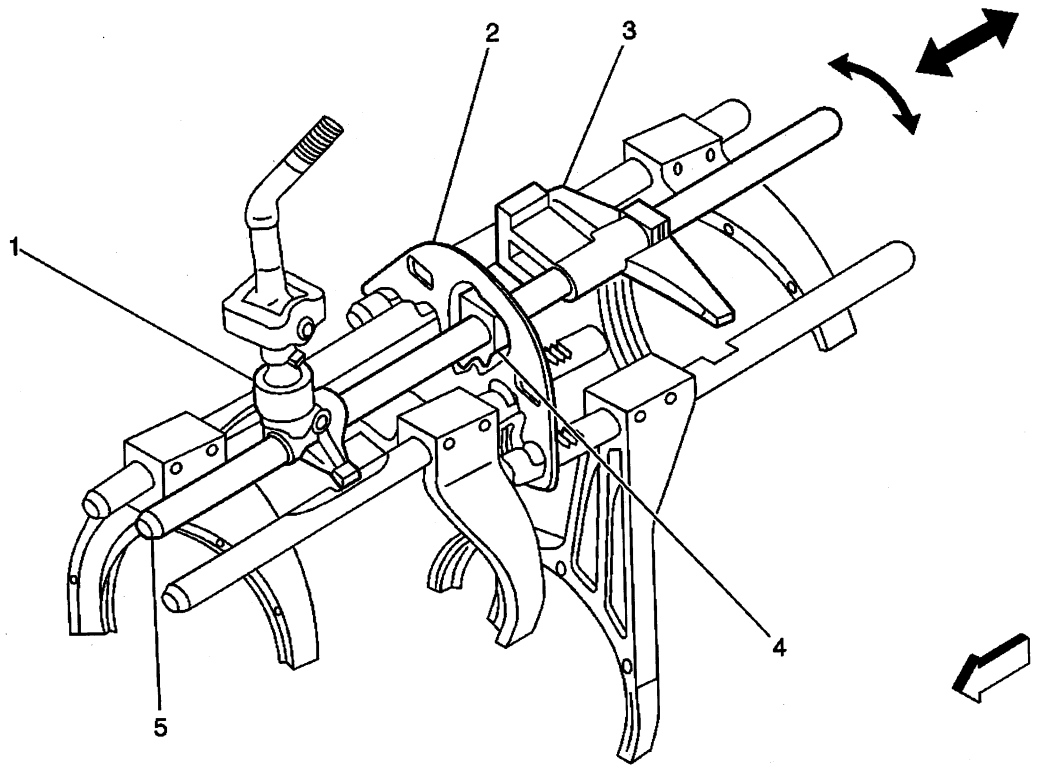
The ZF S6-650 is a six-speed transmission. All of the six forward gears and the reverse gear are fully synchronized. The six-speed gear is an overdrive ratio. The six-speed gear is located on the rear of the countershaft.

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

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

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

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



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

Automatic Transmission – 4L60E

Transmission General Specifications

Name	Hydra-matic 4L60-E
RPO Codes	M30
Production Location	Toledo, Ohio Romulus, MI Ramos Arizpe, Mexico
Vehicle Platform (Engine/Transmission) Usage	C/K 800
Transmission Drive	Longitudinally-Mounted Rear Wheel Drive
1st Gear Ratio	3.059:1
2nd Gear Ratio	1.625:1
3rd Gear Ratio	1.000:1
4th Gear Ratio	0.696:1
Reverse	2.294:1
Torque Converter Size (Diameter of Torque Converter Turbine)	300 mm
Pressure Taps	Line Pressure
Transmission Fluid Type	DEXRON® III
Transmission Fluid Capacity (Approximate)	300 mm Converter Dry: 11.50 l (12.1 qt)
Transmission Type: 4	Four Forward Gears
Transmission Type: L	Longitudinal Mount
Transmission Type: 60	Product Series
Transmission Type: E	Electronic Controls
Position Quadrant	P, R, N, Overdrive, D, 2, 1 P, R, N, Overdrive, 3, 2, 1
Case Material	Die Cast Aluminum
Transmission Weight Dry (Approximate)	300 mm Converter 86.17 kg (190.5 lb)
Transmission Weight Wet (Approximate)	300 mm Converter 98.4 kg (218.0 lb)
Maximum Trailer Towing Capacity	6 130 kg (13,500 lb)
Maximum Gross Vehicle Weight (GVW)	3 900 kg (8,600 lb)

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accumulator Cover to Case Bolt	8.0-14.0 N·m	6-10 lb ft
Case Extension to Case Bolt	42.0-48.0 N·m	31-35 lb ft
Case Extension to Case Bolt (4WD Shipping)	11.2-22.6 N·m	8.3-16.7 lb ft
Converter Cover Bolt	10 N·m	89 lb in
Converter Housing to Case Screw	65.0-75.0 N·m	48-55 lb ft
Cooler Pipe Connector	35.0-41.0 N·m	26-30 lb ft
Detent Spring to Valve Body Bolt	20.0-27.0 N·m	15-20 lb ft
Floorshift Control Bolt	10 N·m	89 lb in
Flywheel to Torque Converter Bolt	63 N·m	46 lb ft
Forward Accumulator Cover to Valve Body Bolt	8.0-14.0 N·m	6-10 lb ft
Heat Shield to Transmission Bolt	17 N·m	13 lb ft
Line Pressure Plug	8.0-14.0 N·m	6-10 lb ft
Manual Shaft to Inside Detent Lever Nut	27.0-34.0 N·m	20-25 lb ft
Negative Battery Cable Bolt	15 N·m	11 lb ft
Oil Level Indicator Bolt	47 N·m	35 lb ft
Oil Pan to Transmission Case Bolt	11 N·m	97 lb in

Oil Passage Cover to Case Bolt	8-14.0 N·m	6-10 lb ft
Park Brake Bracket to Case Bolt	27.0-34.0 N·m	20-25 lb ft
Park/Neutral Position Switch Screw	3 N·m	27 lb in
Plate to Case Bolt (Shipping)	27.0-34.0 N·m	20-25 lb ft
Plate to Converter Bolt (Shipping)	27.0-34.0 N·m	20-25 lb ft
Plug Assembly, Automatic Transmission Oil Pan (C/K)	30-40 N·m	22.1-29.5 lb ft
Plug Assembly, Automatic Transmission Oil Pan (Y)	28-32 N·m	20.7-23.6 lb ft
Pressure Control Solenoid Bracket to Valve Body Bolt	8.0-14.0 N·m	6-10 lb ft
Pump Assembly to Case Bolt	26.0-32.0 N·m	19-24 lb ft
Pump Cover to Pump Body Bolt	20.0-27.0 N·m	15-20 lb ft
Shift Cable Grommet Screw	1.7 N·m	15 lb in
Shift Control Cable Attachment	20 N·m	15 lb ft
Speed Sensor Retainer Bolt	10.5-13.5 N·m	7.7-10 lb ft
Stud, Automatic Transmission Case Extension (Y-car)	18.0-22.0 N·m	13-16 lb ft
TCC Solenoid Assembly to Case Bolt	8.0-14.0 N·m	6-10 lb ft
Trans Mount to Transmission Bolt	25 N·m	18 lb ft
Transmission Fluid Pressure Manual Valve Position Switch to Valve Body Bolt	8.0-14.0 N·m	6-10 lb ft
Transmission Oil Cooler Pipe Fitting	35.0-41.0 N·m	26-30 lb ft
Transmission Oil Pan to Case Bolt	9.5-13.8 N·m	7-10 lb ft
Transmission to Engine Bolt	47 N·m	35 lb ft
Valve Body to Case Bolt	8.0-14.0 N·m	6-10 lb ft

Fluid Capacity Specifications

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

Transmission Component and System Description

The 4L60E transmission consists primarily of the following components:

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

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

- 1-2 and 2-3 shift solenoid valves
- 3-2 shift solenoid valve assembly
- Transmission pressure control (PC) solenoid
- Torque converter clutch (TCC) solenoid valve
- TCC pulse width modulation (PWM) solenoid valve

- Automatic transmission fluid pressure (TFP) manual valve position switch
- Automatic transmission fluid temperature (TFT) sensor
- Vehicle speed sensor assembly

Adapt Function

Transmission Adapt Function

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

- The clutch fiber plates
- The seals
- The springs

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

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

Automatic Transmission Shift Lock Control Description

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

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

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

Automatic Transmission – 4L80E

Transmission General Specifications

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

Fastener Tightening Specifications

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

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

Fluid Capacity Specifications Overhaul

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

Transmission General Description

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

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

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

Automatic Transmission - Allison

Transmission General Specifications

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

Fastener Tightening Specifications

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

Fluid Capacity Specifications

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

Description and Operation

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

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

Component and System Description

Engine/Transmission Connection

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

Torque Converter

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

Gear Sets

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

Clutches

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

Hydraulic System

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

Transmission Fluid Filtration

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

Electro-Hydraulic Control Valve Assembly

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

Remote Oil Cooler Provision

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

Fill Tube/Dipstick Provision

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

Park Pawl

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

PTO Provision

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

Output Yoke/Flange

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

Tow/Haul Mode

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

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

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

Activation

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

Clutch

Fastener Tightening Specifications

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

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.

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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.

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Hydraulic Clutch Description

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

Abbreviations and Meanings

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

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

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

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

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

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

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

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

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

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

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

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Conversion - English/Metric

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

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

Equivalents - Decimal and Metric

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

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

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Fasteners

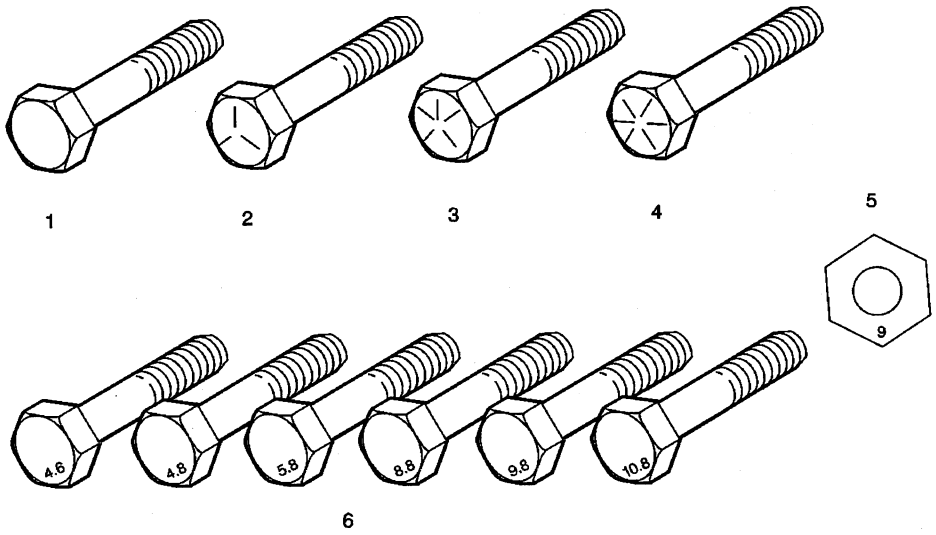
Metric Fasteners

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

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

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

Fastener Strength Identification



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

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

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

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

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

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

Prevailing Torque Fasteners

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

All Metal Prevailing Torque Fasteners

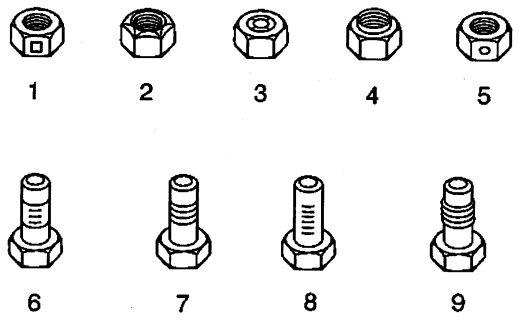
These fasteners accomplish the thread interface by a designed distortion or deformation in the fastener.

Nylon Interface Prevailing Torque Fasteners

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

Adhesive Coated Fasteners

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



1. Prevailing Torque Nut, Center Lock Type
2. Prevailing Torque Nut, Top Lock Type
3. Prevailing Torque Nut, Nylon Patch Type
4. Prevailing Torque Nut, Nylon Washer Insert Type
5. Prevailing Torque Nut, Nylon Insert Type

6. Prevailing Torque Bolt, Dry Adhesive Coating Type
7. Prevailing Torque Bolt, Thread Profile Deformed Type
8. Prevailing Torque Bolt, Nylon Strip Type
9. Prevailing Torque Bolt, Out-of-Round Thread Area Type

A prevailing torque fastener may be reused ONLY if:

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

Metric Prevailing Torque Fastener Minimum Torque Development

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

English Prevailing Torque Fastener Minimum Torque Development

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

S = Standard Equipment A = Available n/a = Not Available
I = Included with another feature ■ = 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.

Options listed in the shaded column titled Ref. Only RPO Code are either included in a package or are 'base' equipment and cannot be ordered as a free flow option.

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment group 1SS available on CK15753 Models.	Ext. Cab High-Performance Package 1SS[1]
		Air bags, frontal, driver and right front passenger, includes Passenger Sensing System	S
	CJ3	NEW! **Air conditioning,** dual-zone, manual, individual climate settings for driver and right front passenger **1 - Upgradeable to (CJ2) Air conditioning, dual-zone, automatic.**	S[1]
		Assist handles, front passenger and outboard rear seats	S
		Cigarette lighter, on instrument panel	S
		Coat hooks, driver and passenger side	S
	D07	**Console,** floor, includes CD carrier, storage bin, rear cupholders, rear seat HVAC air duct and outlets	S
	DK7	**Console,** overhead mini, includes map lights	S
	K34	**Cruise control**, electronic with set and resume speed, includes telltale in instrument panel cluster	S
		Cupholders, in console	S
	C49	**Defogger,** rear-window, electric	S
	AU3	**Door locks,** power programmable	S
		Driver Information Center, monitors numerous systems depending on vehicle equipment **1 - With (UK3) Sound system feature, steering wheel mounted radio controls, includes trip and fuel information selections and programmable personalization features.**	S[1]
	B30	**Floor covering,** color-keyed carpeting, includes carpeted floormats	S
		Headliner, Shale-colored cloth, with matching retainer moldings	S
		Instrumentation, analog, includes speedometer, odometer with trip odometer, fuel level, voltmeter, engine hour meter, temperature, oil pressure, transmission temperature gauge, tachometer and white instrument cluster	S
	AU0	**Keyless entry,** remote, includes 2 transmitters, panic button and content theft alarm	S
		Lighting, dome lamp, driver and passenger side door switch with delayed entry feature, cargo lamps, door handle or keyless remote activated illuminated entry with ground illumination, map lights in front and 2nd seat positions, door handle-activated, reading, courtesy, illuminated entry feature, rear map lights and ground illumination	S
	DF5	**Mirror,** inside rearview, electrochromic (light-sensitive auto dimming), 8-point compass, passenger sensing system indicator light, and outside temperature indicator	S
		Power outlets, auxiliary, covered, 2 in instrument panel, 12-volt	S

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment group 1SS available on CK15753 Models.	Ext. Cab High-Performance Package 1SS[1]
	AN3	**Seats,** front leather seat inserts, power reclining full-feature buckets, head restraints, overhead console, floor console, power lumbar, dual inboard armrests, heated driver and passenger cushion backs, 2-position driver-side memory and storage pockets **1 - Includes (AG1) Seat adjuster, power, driver 6-way and (AG2) Seat adjuster, front passenger 6-way.**	S[1]
		Seats, rear leather seat inserts bench, folding, 3-passenger	S
	AG1	**Seat adjuster,** power, driver 6-way	S
	AG2	**Seat adjuster,** power, front passenger 6-way	S
	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) (includes Bose speaker system, Bose amplifier and Bose subwoofer) **1 - Upgradeable to (UC6) Sound system, ETR AM/FM stereo with 6-disc CD changer.**	S[1]
	UK3	**Sound system feature,** steering wheel mounted radio controls, Radio and Driver Information Center (DIC) **1 - Provides access to enhanced Driver Information Center (DIC) features and information.**	S[1]
		Steering column, Tilt-Wheel, adjustable, includes brake/transmission shift interlock	S
	NP5	**Steering wheel,** leather-wrapped rim, Black, includes theft-deterrent locking feature	S
		Theft-deterrent system, PASSlock II	S
		Tools, mechanical jack and wheel wrench, gloves, courtesy mat, spare tire assist hook, floor-mounted in back of cab	S
		Visors, padded, Shale-colored, driver and passenger side with cloth trim, extenders, pocket on driver side and vanity mirror on passenger side	S
		Warning tones, headlamp on, key-in-ignition, driver safety belt unfasten, turn signal on	S
	A31	**Windows,** power, includes driver and passenger express-down	S
		Windows, rear quarter swing-out	S
	VF1	**Bumper,** front, integrated, with color-keyed front fascia	S
	VF3	**Bumper,** rear, integrated, with color-keyed rear fascia	S
		Daytime running lamps, includes automatic exterior lamp control	S
		Glass, Solar-Ray light tinted, all windows	S
	AJ1	**Glass,** Solar-Ray deep tinted (all windows except light tinted glass on windshield, driver and front passenger)	S
	TRB	**Grille,** color-keyed	S
		Headlamps, dual halogen composite, includes flash-to-pass feature and automatic lamp control	S
		Lamps, dual cargo area lamps	S
	DL3	**Mirrors,** outside rearview, power folding, power adjustable, heated, color-keyed, driver side electrochromic (light-sensitive auto dimming), turn signal in glass, with ground illumination and curb-tilt	S
	ZY1	**Paint,** solid	S

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment group 1SS available on CK15753 Models.	Ext. Cab High-Performance Package 1SS[1]
	E63	**Pickup bed,** Fleetside, all-welded steel with double wall construction and corrosion protection with 8 cargo tie-downs and tailgate, locking, 2-position	S
		Tailgate protection, top of tailgate protection cap, color-keyed	S
		Tire carrier, outside spare, winch-type mounted under frame at rear, steel wheel located at rear underbody of vehicle	S
	QSS	**Tires,** P275/55R20, touring, blackwall	S
		Tire, spare, P265/75R16, blackwall, steel wheel located at rear underbody of vehicle	S
	P30	**Wheels,** 4-20" x 8.5" (50.8 cm x 21.6 cm) aluminum, sport	S
		Wheel, spare, 16" x 6.5" (40.6 cm x 16.5 cm) steel	S
		Wipers, intermittent, front, wet-arm with pulse washers	S
	K68	**Alternator,** 105 amps	S
		Battery, heavy-duty, 600 cold-cranking amps, includes rundown protection and retained accessory power	S
	JC4	**Brakes,** 4-wheel antilock, 4-wheel disc, heavy-duty	S
	KC4	**Cooling,** external engine oil cooler, heavy-duty air-to-oil, integral to driver side of radiator tank	S
	KNP	**Cooling,** external transmission oil cooler, auxiliary, heavy-duty air-to-oil	S
	G80	**Differential,** locking, heavy-duty, rear	S
		Exhaust, high-performance "throaty" exhaust with NASCAR inspired exhaust tip	S
		Frame, ladder-type	S
	C7H	**GVWR,** 6400 lbs. (2903 kg)	S
	GT5	**Rear axle,** 4.10 ratio	S
		Steering, power	S
		Suspension, front, independent torsion bar, and stabilizer bar	S
		Suspension, rear, semi-elliptic 2-stage multi-leaf springs	S
	Z60	**Suspension Package,** High-performance	S
	NP3	**Transfer case,** AWD electronic automatic system	S

S = Standard Equipment A = Available n/a = Not Available

I = Included with another feature ■ = 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.

Options listed in the shaded column titled Ref. Only RPO Code are either included in a package or are 'base' equipment and cannot be ordered as a free flow option.

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment group 1SS available on CK15753 Models.	Ext. Cab High-Performance Package 1SS[1]
	B4U	**Silverado SS**	■

S = Standard Equipment A = Available n/a = Not Available
I = Included with another feature ■ = 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.

Options listed in the shaded column titled Ref. Only RPO Code are either included in a package or are 'base' equipment and cannot be ordered as a free flow option.

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment group 1SS available on CK15753 Models.	Ext. Cab High-Performance Package 1SS[1]
	B4U	**Silverado SS**	■
		ADDITIONAL OPTIONS	
Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment group 1SS available on CK15753 Models.	Ext. Cab High-Performance Package 1SS[1]
CJ2		**Air conditioning,** dual-zone, automatic, individual climate settings for driver and right front passenger	A
UE1		**OnStar**, 1-year Safe & Sound Service, includes Emergency Assistance Services, Air Bag Deployment Notification, AccidentAssist, Roadside Assistance, Stolen-Vehicle Tracking, Remote Diagnostics, Remote Door Lock and Unlock, Remote Vehicle Alert: horn and lights activation, online concierge services, Virtual Advisor and Personal Calling access	A
DNH		NEW! **Underseat storage,** rear, lockable (RPA). This is dealer installed and shipped separately from vehicle to parts department with VIN identification on packaging.	A
UC6		**Sound system,** ETR AM/FM stereo with 6-disc CD changer, includes seek-and-scan, digital clock, auto-tone control, Radio Data System (RDS) and Bose speaker system (includes 6-speakers, Bose amplifier and Bose Subwoofer)	A
U2K		**Sound system feature,** XM Satellite Radio is 100 channels of digital quality sound that goes wherever you go - coast to coast. GM maintains exclusivity for factory installed satellite radio for 2003 Model year. **1 - Subscription fees apply. Available only in the 48 contiguous U.S.**	A[1]
E95		**Tonneau cover,** Black, soft (RPA). The cover is dealer installed and shipped separately from vehicle to parts department with VIN identification on packaging.	A
EN6		**Tonneau cover,** Black, hard, folding, lockable (RPA). The cover is dealer installed and shipped separately from vehicle to parts department with VIN identification on packaging.	A
YF5		**Emissions,** California state requirements	A
FE9		**Emissions,** Federal requirements	A
NE1		**Emissions,** Maine or Massachusetts state requirements	A
NG1		**Emissions,** New York or Vermont state requirements	A

ADDITIONAL OPTIONS			
Free Flow RPO Code	Ref. Only RPO Code	**Description** **1 - Equipment group 1SS available on CK15753 Models.**	Ext. Cab High-Performance Package 1SS[1]
NB8		**Emissions override,** California, Maine, Massachusetts, New York or Vermont (for vehicles ordered by dealers in states of California, New York, Vermont, Massachusetts or Maine with Federal emissions) **1 - Requires (FE9) Emissions, Federal requirements.**	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 requirements, (NE1) Emissions, Massachusetts or Maine state requirements or (NG1) Emissions, New York or Vermont sate requirements.**	A[1]
K05		**Engine block heater**	A
LQ9		**Engine,** Vortec high-output 6000 V8 SFI	A
Z82		**Trailering equipment,** heavy-duty, includes trailering hitch platform, 7-wire harness (harness includes wires for: park lamps, backup lamps, right turn, left turn, electric brake lead, battery and ground) with independent fused trailering circuits mated to a 7-way sealed connector. Also includes (K47) Air cleaner, high capacity	A
M32		**Transmission,** 4-speed automatic, heavy-duty, electronically controlled with overdrive, tow/haul mode and external transmission oil cooler (Must specify)	A

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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.

Options listed in the shaded column titled Ref. Only RPO Code are either included in a package or are 'base' equipment and cannot be ordered as a free flow option.

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment group 1SS available on CK15753 Models.	Ext. Cab High-Performance Package 1SS[1]
	B4U	**Silverado SS**	■

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Options listed in the shaded column titled Ref. Only RPO Code are either included in a package or are 'base' equipment and cannot be ordered as a free flow option.

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment group 1SS available on CK15753 Models.	Ext. Cab High-Performance Package 1SS[1]
		Air bags, frontal, driver and right front passenger, includes Passenger Sensing System	S
	CJ3	NEW! **Air conditioning,** dual-zone, manual, individual climate settings for driver and right front passenger **1 - Upgradeable to (CJ2) Air conditioning, dual-zone, automatic.**	S[1]
CJ2		**Air conditioning,** dual-zone, automatic, individual climate settings for driver and right front passenger	A
		Assist handles, front passenger and outboard rear seats	S
		Cigarette lighter, on instrument panel	S
		Coat hooks, driver and passenger side	S
	D07	**Console,** floor, includes CD carrier, storage bin, rear cupholders, rear seat HVAC air duct and outlets	S
	DK7	**Console,** overhead mini, includes map lights	S
	K34	**Cruise control**, electronic with set and resume speed, includes telltale in instrument panel cluster	S
		Cupholders, in console	S
	C49	**Defogger,** rear-window, electric	S
	AU3	**Door locks,** power programmable	S
		Driver Information Center, monitors numerous systems depending on vehicle equipment **1 - With (UK3) Sound system feature, steering wheel mounted radio controls, includes trip and fuel information selections and programmable personalization features.**	S[1]
	B30	**Floor covering,** color-keyed carpeting, includes carpeted floormats	S
		Headliner, Shale-colored cloth, with matching retainer moldings	S
		Instrumentation, analog, includes speedometer, odometer with trip odometer, fuel level, voltmeter, engine hour meter, temperature, oil pressure, transmission temperature gauge, tachometer and white instrument cluster	S
	AU0	**Keyless entry,** remote, includes 2 transmitters, panic button and content theft alarm	S
		Lighting, dome lamp, driver and passenger side door switch with delayed entry feature, cargo lamps, door handle or keyless remote activated illuminated entry with ground illumination, map lights in front and 2nd seat positions, door handle-activated, reading, courtesy, illuminated entry feature, rear map lights and ground illumination	S
	DF5	**Mirror,** inside rearview, electrochromic (light-sensitive auto dimming), 8-point compass, passenger sensing system indicator light, and outside temperature indicator	S

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment group 1SS available on CK15753 Models.	Ext. Cab High-Performance Package 1SS[1]
UE1		**OnStar**, 1-year Safe & Sound Service, includes Emergency Assistance Services, Air Bag Deployment Notification, AccidentAssist, Roadside Assistance, Stolen-Vehicle Tracking, Remote Diagnostics, Remote Door Lock and Unlock, Remote Vehicle Alert: horn and lights activation, online concierge services, Virtual Advisor and Personal Calling access	A
		Power outlets, auxiliary, covered, 2 in instrument panel, 12-volt	S
	AN3	**Seats,** front leather seat inserts, power reclining full-feature buckets, head restraints, overhead console, floor console, power lumbar, dual inboard armrests, heated driver and passenger cushion backs, 2-position driver-side memory and storage pockets **1 - Includes (AG1) Seat adjuster, power, driver 6-way and (AG2) Seat adjuster, front passenger 6-way.**	S[1]
		Seats, rear leather seat inserts bench, folding, 3-passenger	S
	AG1	**Seat adjuster,** power, driver 6-way	S
	AG2	**Seat adjuster,** power, front passenger 6-way	S
DNH		NEW! **Underseat storage,** rear, lockable (RPA). This is dealer installed and shipped separately from vehicle to parts department with VIN identification on packaging.	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) (includes Bose speaker system, Bose amplifier and Bose subwoofer) **1 - Upgradeable to (UC6) Sound system, ETR AM/FM stereo with 6-disc CD changer.**	S[1]
UC6		**Sound system,** ETR AM/FM stereo with 6-disc CD changer, includes seek-and-scan, digital clock, auto-tone control, Radio Data System (RDS) and Bose speaker system (includes 6-speakers, Bose amplifier and Bose Subwoofer)	A
	UK3	**Sound system feature,** steering wheel mounted radio controls, Radio and Driver Information Center (DIC) **1 - Provides access to enhanced Driver Information Center (DIC) features and information.**	S[1]
U2K		**Sound system feature,** XM Satellite Radio is 100 channels of digital quality sound that goes wherever you go - coast to coast. GM maintains exclusivity for factory installed satellite radio for 2003 Model year. **1 - Subscription fees apply. Available only in the 48 contiguous U.S.**	A[1]
		Steering column, Tilt-Wheel, adjustable, includes brake/transmission shift interlock	S
	NP5	**Steering wheel,** leather-wrapped rim, Black, includes theft-deterrent locking feature	S
		Theft-deterrent system, PASSlock II	S
		Tools, mechanical jack and wheel wrench, gloves, courtesy mat, spare tire assist hook, floor-mounted in back of cab	S
		Visors, padded, Shale-colored, driver and passenger side with cloth trim, extenders, pocket on driver side and vanity mirror on passenger side	S
		Warning tones, headlamp on, key-in-ignition, driver safety belt unfasten, turn signal on	S
	A31	**Windows,** power, includes driver and passenger express-down	S
		Windows, rear quarter swing-out	S

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Options listed in the shaded column titled Ref. Only RPO Code are either included in a package or are 'base' equipment and cannot be ordered as a free flow option.

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment group 1SS available on CK15753 Models.	Ext. Cab High-Performance Package 1SS[1]
	VF1	**Bumper,** front, integrated, with color-keyed front fascia	S
	VF3	**Bumper,** rear, integrated, with color-keyed rear fascia	S
		Daytime running lamps, includes automatic exterior lamp control	S
		Glass, Solar-Ray light tinted, all windows	S
	AJ1	**Glass,** Solar-Ray deep tinted (all windows except light tinted glass on windshield, driver and front passenger)	S
	TRB	**Grille,** color-keyed	S
		Headlamps, dual halogen composite, includes flash-to-pass feature and automatic lamp control	S
		Lamps, dual cargo area lamps	S
	DL3	**Mirrors,** outside rearview, power folding, power adjustable, heated, color-keyed, driver side electrochromic (light-sensitive auto dimming), turn signal in glass, with ground illumination and curb-tilt	S
	ZY1	**Paint,** solid	S
	E63	**Pickup bed,** Fleetside, all-welded steel with double wall construction and corrosion protection with 8 cargo tie-downs and tailgate, locking, 2-position	S
	B4U	**Silverado SS**	■
		Tailgate protection, top of tailgate protection cap, color-keyed	S
		Tire carrier, outside spare, winch-type mounted under frame at rear, steel wheel located at rear underbody of vehicle	S
	QSS	**Tires,** P275/55R20, touring, blackwall	S
		Tire, spare, P265/75R16, blackwall, steel wheel located at rear underbody of vehicle	S
E95		**Tonneau cover,** Black, soft (RPA). The cover is dealer installed and shipped separately from vehicle to parts department with VIN identification on packaging.	A
EN6		**Tonneau cover,** Black, hard, folding, lockable (RPA). The cover is dealer installed and shipped separately from vehicle to parts department with VIN identification on packaging.	A
	P30	**Wheels,** 4-20" x 8.5" (50.8 cm x 21.6 cm) aluminum, sport	S
		Wheel, spare, 16" x 6.5" (40.6 cm x 16.5 cm) steel	S
		Wipers, intermittent, front, wet-arm with pulse washers	S

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Options listed in the shaded column titled Ref. Only RPO Code are either included in a package or are 'base' equipment and cannot be ordered as a free flow option.

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment group 1SS available on CK15753 Models.	Ext. Cab High-Performance Package 1SS[1]
	K47	**Air cleaner,** high-capacity **1 - Available and only included with (Z82) Trailering equipment, heavy-duty.**	I[1]
	K68	**Alternator,** 105 amps	S
		Battery, heavy-duty, 600 cold-cranking amps, includes rundown protection and retained accessory power	S
	JC4	**Brakes,** 4-wheel antilock, 4-wheel disc, heavy-duty	S
	KC4	**Cooling,** external engine oil cooler, heavy-duty air-to-oil, integral to driver side of radiator tank	S
	KNP	**Cooling,** external transmission oil cooler, auxiliary, heavy-duty air-to-oil	S
	G80	**Differential,** locking, heavy-duty, rear	S
YF5		**Emissions,** California state requirements	A
FE9		**Emissions,** Federal requirements	A
NE1		**Emissions,** Maine or Massachusetts state requirements	A
NG1		**Emissions,** New York or Vermont state requirements	A
NB8		**Emissions override,** California, Maine, Massachusetts, New York or Vermont (for vehicles ordered by dealers in states of California, New York, Vermont, Massachusetts or Maine with Federal emissions) **1 - Requires (FE9) Emissions, Federal requirements.**	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 requirements, (NE1) Emissions, Massachusetts or Maine state requirements or (NG1) Emissions, New York or Vermont sate requirements.**	A[1]
K05		**Engine block heater**	A
LQ9		**Engine,** Vortec high-output 6000 V8 SFI	A
		Exhaust, high-performance "throaty" exhaust with NASCAR inspired exhaust tip	S
		Frame, ladder-type	S
	C7H	**GVWR,** 6400 lbs. (2903 kg)	S
	GT5	**Rear axle,** 4.10 ratio	S
		Steering, power	S
		Suspension, front, independent torsion bar, and stabilizer bar	S
		Suspension, rear, semi-elliptic 2-stage multi-leaf springs	S

Free Flow RPO Code	Ref. Only RPO Code	Description 1 - Equipment group 1SS available on CK15753 Models.	Ext. Cab High-Performance Package 1SS[1]
	Z60	**Suspension Package,** High-performance	S
Z82		**Trailering equipment,** heavy-duty, includes trailering hitch platform, 7-wire harness (harness includes wires for: park lamps, backup lamps, right turn, left turn, electric brake lead, battery and ground) with independent fused trailering circuits mated to a 7-way sealed connector. Also includes (K47) Air cleaner, high capacity	A
	NP3	**Transfer case,** AWD electronic automatic system	S
M32		**Transmission,** 4-speed automatic, heavy-duty, electronically controlled with overdrive, tow/haul mode and external transmission oil cooler (Must specify)	A

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		Transmissions	Axles	GVWR lbs. (kg)
Model	**Engine**	**M32 4-Speed Automatic**	**GT5 4.10**	**C7H 6400 (2903)**
CK15753	LQ9 Vortec high-output 6000 V8 SFI	S	S	S

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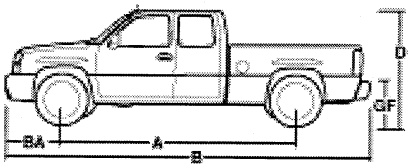
*Indicates availability of feature on multiple models. For example, it indicates feature availability on 2WD and 4WD Models or Rear wheel drive and All-wheel drive Models.

Decor Level	Seat Type	Seat Code	Seat Trim	Interior
				Dark Charcoal
SS	Front full-feature reclining buckets	AN3	Leather seat inserts	692

Exterior Solid Paint	Color Code	WA-Number	Interior
			Dark Charcoal
Black	41U	WA-8555	A
Victory Red	74U	WA-7260	A
Arrival Blue Metallic	91U	WA-815K	A

All dimensions in inches (mm) unless otherwise stated.



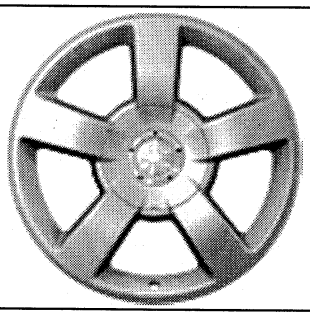
	Specifications	Ext. Cab Short Box AWD CK15753
A	**Wheelbase**	143.50 (3645)
B	**Overall length** (without rear bumper)	227.70 (5784)
C	**Body width**	78.50 (1994)
D	**Overall height**	73.90 (1877)
	Head room, front	41.00 (1041)
	Head room, rear	38.40 (975)
	Shoulder room, front	65.20 (1656)
	Hip room, front	61.40 (1560)
	Hip room, rear	61.50 (1562)
	Leg room, front	41.30 (1049)
	Leg room, rear	33.70 (856)
CA	**Cab to axle**	41.90 (1064)
BA	**Front bumper to axle**	36.90 (937)
BBC	**Front bumper to rear of cab**	138.50 (3518)
	Rear bumper to axle	47.00 (1194)
GF	**Ground to top of rear load floor**	32.90 (836)
IWR	**Opening width,** tailgate, top	63.80 (1621)
ILF	**Inside length,** at floor	68.70 (1745)
	Inside height	19.50 (495)
	Shoulder room, rear	66.30 (1684)
	Inside width, at floor	64.80 (1646)

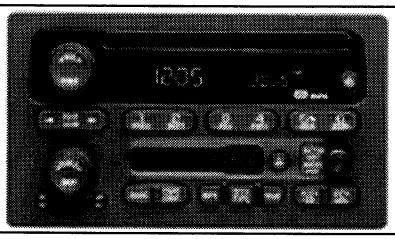
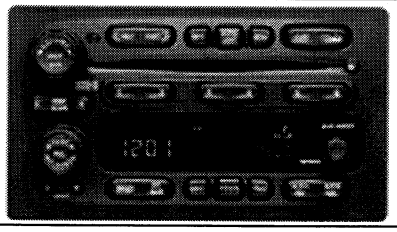
All dimensions in inches (mm) unless otherwise stated.

	Specifications		Ext. Cab Short Box AWD CK15753
		Ground clearance, front	8.00 (203)
		Ground clearance, rear	8.30 (211)
	IWW	**Inside width,** between wheelhousing	50.00 (1270)

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.

	Ext. Cab Short Box AWD CK15753
Specifications	
Front Shock Absorbers Diameter, in. (mm)	1.26 (32)
Front Stabilizer Bar Diameter, in. (mm)	28.60 (726)
Rear Shock Absorber Diamaeter, in. (mm)	1.26 (32)
Rear Stabilizer Bar Diameter, in. (mm)	TBD
Turning diameter, curb-to-curb, ft. (m)	47.3 (14.4)
Capacities	
Front Axle, lbs. (kg)	3925 (1780)
Front Springs, lbs. (kg)	3925 (1780)
Rear Axle, lbs. (kg)	3750 (1701)
Rear Springs, lbs. (kg)	3750 (1701)
Curb Weight, lbs. (kg)	5013 (2274)
Cargo Volume, cargo box, cu. ft. (liters)	113.6 (3217.2)
Payload[1], lbs. (kg)	1787 (811)
Gross Vehicle Weight Rating, lbs. (kg)	6400 (2903)
Front Gross Axle Weight Rating, lbs. (kg)	3650 (1656)
Rear Gross Axle Weight Rating, lbs. (kg)	3600 (1633)
Fuel capacity, gallon (liters)	26 (98)
Seating capacity, max. (front/rear)	2/3
1. Maximum payload capacity includes weight of driver, passengers, optional equipment and cargo	

	P30 **Wheels,** 4-20" x 8.5" (50.8 cm x 21.6 cm) aluminum, sport

	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) (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, Radio Data System (RDS) and Bose speaker system (includes 6-speakers, Bose amplifier and Bose Subwoofer)

New Features

- New vehicle for 2003
- (B4U) Silverado SS package
- (LQ9) Vortec high-output 6000 SFI V8 engine (345 hp and 380 lb-ft of torque)
- (M32) 4L85E HD heavy duty automatic transmission
- All-wheel drive system
- High performance suspension package
- Heavy-duty 4-wheel anti-lock disc brakes
- High performance "throaty" exhaust with NASCAR inspired exhaust tip
- (QSS) P275/55/R20 Performance-rated touring blackwall tires
- (P30) Wheels, 4-20" x 8.5" (50.8 cm x 21.6 cm) aluminum, sport
- (CJ3) Air conditioning, dual zone, manual (standard)
- (CJ2) Air conditioning, dual zone, automatic (available)
- Color-keyed door handles and exterior mirrors
- Color-keyed unique front and rear fascia and ground effects
- Color-keyed grille, bumpers, tailgate protector and tailgate handles
- (UB1) ETR AM/FM stereo with CD and cassette player (standard)
- (UC6) ETR AM/FM stereo with 6-disc CD changer (available)
- (U2K) XM Satellite Digital Sound System (available)
- (UK3) Steering wheel with radio controls (standard)
- (UE1) OnStar with Safe and Sound service (available)
- (AN3) Full-feature seats with leather inserts (standard)
- SS Embroidery on headrests
- Newly expanded Driver Message Center with scrolling message center
- White SS instrument cluster with transmission temperature gauge
- SS badging, right and left side door and tailgate
- (DL3) Outside rearview, power folding, power, heated, Black, driver side electrochromic (light-sensitive auto-dimming), turn signal in glass, with ground illumination and curb-tilt (standard)
- 3 Exterior Colors:(41) Black, (74) Victory Red, and (91) Arrival Blue Metallic
- (69) Dark Charcoal Interior Trim

Option Code	Description
A31	Windows, power
AG1	Seat adjuster, power, driver 6-way
AG2	Seat adjuster, power, front passenger 6-way
AJ1	Glass, Solar-Ray deep tinted
AN3	Seats, front leather seat inserts, power reclining full-feature buckets
AU0	Keyless entry, remote
AU3	Door locks, power programmable
B30	Floor covering, color-keyed carpeting
B4U	Silverado SS
C49	Defogger, rear-window, electric
C7H	GVWR, 6400 lbs. (2903 kg)
CJ2	Air conditioning, dual-zone, automatic
CJ3	Air conditioning, dual-zone, manual
D07	Console, floor
DF5	Mirror, inside rearview, electrochromic
DK7	Console, overhead mini
DL3	Mirrors, outside rearview
DNH	Underseat storage, rear
E63	Pickup bed, Fleetside
E95	Tonneau cover, Black
EN6	Tonneau cover, Black, hard, folding, lockable (RPA).
FE9	Emissions, Federal requirements
G80	Differential, locking, heavy-duty, rear
GT5	Rear axle, 4.10 ratio
JC4	Brakes, 4-wheel antilock, 4-wheel disc
K05	Engine block heater
K34	Cruise control
K47	Air cleaner, high-capacity
K68	Alternator, 105 amps
KC4	Cooling, external engine oil cooler, heavy-duty air-to-oil, integral to driver side of radiator tank
KNP	Cooling, external transmission oil cooler, auxiliary, heavy-duty air-to-oil
LQ9	Engine, Vortec high-output 6000 V8 SFI
M32	Transmission, 4-speed automatic, heavy-duty
NB8	Emissions override, California, Maine, Massachusetts, New York or Vermont
NC7	Emissions override, Federal
NE1	Emissions, Maine or Massachusetts state requirements
NG1	Emissions, New York or Vermont state requirements
NP3	Transfer case, AWD electronic automatic system
NP5	Steering wheel, leather-wrapped rim
P30	Wheels, 4-20" x 8.5" (50.8 cm x 21.6 cm) aluminum, sport
QSS	Tires, P275/55R20, touring, blackwall
TRB	Grille, color-keyed
U2K	Sound system feature, XM Satellite Radio
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
VF1	Bumper, front, integrated, with color-keyed front fascia

Option Code	Description
VF3	Bumper, rear, integrated, with color-keyed rear fascia
YF5	Emissions, California state requirements
Z60	Suspension Package, High-performance
Z82	Trailering equipment, heavy-duty
ZY1	Paint, solid

2003 Chevrolet Truck Silverado SS TRAILERING SPECS

Maximum trailer ratings are calculated assuming standard equipped vehicle, driver and required trailering equipment. The weight of optional equipment, passengers and cargo will reduce the maximum trailer weight your vehicle can tow. 10 to 15% of the trailer weight is the recommended trailer tongue load.

Automatic Transmission Ratings with Ball Hitch		
Model	(LQ9) Vortec high-output 6000 V8 SFI	
	Axle Ratio	Maximum Trailer Weight lbs. (kg)
CK15753	4.10	7400 (3357)

Addition of trailer tongue weight cannot cause vehicle weights to exceed Rear Gross Axle Weight Rating (RGAWR) of Gross Vehicle Weight Rating (GVWR).

5th wheel hitch is available as a dealer installed accessory

GCWR For Engine/Rear Axle Ratio Combination with Automatic Transmission	
Engine	(GCWR) Gross Combination Weight Ratings lbs. (kg)
	13000 (5897)
(LQ9) Vortec high-output 6000 V8 SFI	4.10