Chevrolet

Silverado Truck

2002

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Product Information

An American Icon: The Chevrolet Silverado

The Chevrolet Silverado full-size pickup begins another year as General Motors' best-selling vehicle, and the 2002 model year marks the first full production year of a half-ton heavy-duty Crew Cab model. Also for 2002, Chevy conveniently repackages options for more customer value, upgrades its emission control systems and improves its compressed natural gas fuel capabilities.

"Chevy Silverado isn't resting on its reputation for 2002 as the most dependable, longest-lasting full-size pickup," said Brand Manager Rick Scheidt. "We continue to refine Silverado for the very competitive full-size pickup market."

Half-Ton H.D. Model

Introduced midway through the 2001 model year, the Silverado 1500 H.D. combines the look of Chevrolet's popular half-ton pickup (in LS or LT trim) with the strength of its three-quarter-ton model frame, plus the convenience of its Crew Cab model. The Silverado 1500 H.D. is the only Chevy half-ton pickup model available with a Crew Cab (four full doors).

The 1500 H.D. is hearty, with a 300 hp Vortec 6000 V8 as the standard engine. The model's gross combination weight rating is 16,000 pounds, and its payload is as much as 3143 pounds. Maximum trailer weight is 10,300 pounds.

Chevrolet also responded to customer preferences by combining option group packages (previously 1SA and 1SG) as standard equipment on the base Silverado. Such items as chrome bumper and grille are now included on all models. Optional remote keyless entry and door locks, and cruise control are also combined as a package in 2002 for base models. Silverado LS models group optional fog lamps, compass and temperature gauge together for easier customer ordering.

Also for convenience, Silverado's radio lineup has been streamlined. A CD player is optional for the first time in 2002 on the base model, and the cassette player is no longer a free-flow option. The base model features an AM/FM radio with a CD player optional; LS trim continues to offer a CD player standard; and LT has a cassette and a CD player as standard equipment.

Quadrasteer Interim Introduction

Chevrolet will also enhance select Silverado models by introducing a four-wheel-steering system after the start of the 2002 model year. Called Quadrasteer, the system will offer unparalleled low-speed maneuverability and high-speed stability, handling and control. For more information about Quadrasteer, see the "Applied Technology" section of the Corporate press kit.

Automatic Transmission Standard

Silverado's popular extended cab model gives customers an automatic transmission as standard equipment – as it is most often ordered – with no manual transmission available.

Emission Refinements

Emission refinements for the 2002 Silverado include the addition of multi-port fuel injection to its Vortec 4300 V6 for better fuel control to meet California emissions requirements. The Vortec 5300 V8 also benefits from refined emissions for most regular cab and extended cab models. To meet the state's Low Emission Vehicle requirements, similar refinements have been made to Silverado's Vortec 6000 V8 engine.

Multiple Configurations

With half-ton and three-quarter-ton offerings in fleetside or sportside trim, Silverado offers a model for virtually any use in 2WD and 4WD and in regular, extended and crew cabs. Customers can also choose a short or long box, and trim levels are standard, LS and LT. Silverado also features an impressive Vortec gasoline engine lineup: 4300 V6, 4800 V8, 5300 V8 and 6000 V8. Horsepower for the engine lineup ranges from 200 hp to 300 hp.

With that power availability, Silverado was meant to work. Payload capacities range from 1593 to 3224 pounds, and Gross Vehicle Weight Ratings extend from 6100 to 8600 pounds.

Enhanced Traction

Silverado also takes good care of its passengers. For maximum traction, an optional Autotrac active transfer case (4WD models) automatically shifts power between two- and four-wheel drive when roads get slick. Two-wheel drive Silverados offer Electronic Traction Control (ETC) to enhance surefootedness on models with a V8 engine, automatic transmission and locking rear differential.

Safety and security features also include antilock brakes, child restraint top-tether anchors, the PASSLock II theft-deterrent system and steel side-door beams. Driver and front-passenger air bags with a passenger-side deactivation switch are standard. The OnStar system is standard on LT models, and provides customers with peace-of-mind features such as automatic air bag notification and emergency assistance with automatic location. For more information about OnStar, see the "OnStar" section of the Corporate press kit.

Z71 Off-Road Package

Silverado even offers the ultimate in four-wheeling fun and capability, 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.

Silverado continues to offer a full-size pickup for virtually any customer in 2002 – plus the improvements that enhance its reputation as being most dependable and longest lasting.

2002 Chevrolet Silverado Available GM Accessories

Customers wanting to personalize their Chevrolet Silverado can do so with genuine GM Accessories available from GM Service Parts Operations (SPO) through all GMC dealers. All GM Accessories are designed specifically for GM vehicles and validated to GM Engineering Standards.

Truck Bed Accessories

GM Accessories offer skid resistant polyethylene bedliners to reduce cargo movement and allow for easy two-tier loading with patented vertical and horizontal board holders. Also offered is a nylon-reinforced rubber mat with a non-skid surface that prevents cargo from moving and protects and preserves the truck bed. A bed extender adds hauling capabilities and easily swings out over the open tailgate for additional length or swings into the truck bed to provide a stable cargo area.

Tonneau Covers

GM Accessories offer hard and soft tonneau covers for Silverado trucks. Polystyrene-filled aluminum panels firmly clamp to the bed rails and fold back in seconds to allow easy access to the truck's cargo area. This lockable hard UV protected cover folds up to a compact position behind the cab for hauling items in the truck bed. With the soft snapless tonneau cover, cargo may be accessed through the tailgate without removing the cover.

Exterior Functional Accessories

Tubular side steps provide sure footing for Silverado driver and passengers. The side steps meet GM Accessories Engineering standards for corrosion resistance, paint adhesion and color retention. Molded hood deflectors have a sleek, low-profile aerodynamic design for protection against stone chips and insects. Molded splash guards, available in injection molded thermal plastic olefin, include a hot-stamped Chevy bowtie logo. These splash guards are contoured to the wheel opening area and help protect the vehicle from stone chips, gravel and mud. They maintain flexibility and withstand extreme temperatures.

GM Accessories permanently installed on a new GM vehicle at vehicle delivery are covered under the GM New Vehicle Limited Bumper to Bumper Warranty. GM Accessories permanently installed after vehicle purchase are covered for the balance of the New Vehicle Warranty, but in no event less than 12 months or 12,000 miles.

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

New For 2002

- First full-production year of 1500 H.D. model
- Repackaging options for customer ordering convenience and more value
- Upgraded emission control systems
- Improved compressed natural gas fuel capabilities

Model Lineup

	Engines				Transmissions			
	Vortec 4300	Vortec 4800	Vortec 5300	Vortec 6000	4-spd auto	4-spd HD auto	5-spd man	5-spd HD man
	V6 (L35)	V8 (LR4)	V8 (LM7)	V8 (LQ4)	OD (4L60-E)	OD (4L80-E)	OD (MG5)	OD (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*	–	O	–	S	–
2500 Regular Cab, Fleetside Long Box	–	–	–	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

Overview

Model:	Chevrolet Silverado 1500 and 2500
Trim levels:	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

Engine

	Vortec 4300 V8 (L35)	**Vortec 4800 V8 (L4R)**	**Vortec 5300 V8 (LM7)**	**Vortec 6000 V8 (LQ4)**
Type:	4.3-liter, OHV V8 with cast iron block	4.8-liter, OHV V8 with cast iron block	5.3-liter, OHV V8 with cast iron block	6.0-liter, OHV V8 with cast iron block
Displacement (cu in / cc):	262 / 4293	294 / 4807	327 / 5328	366 / 5998
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
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	composite distributor, platinum-tipped spark plugs, low-resistance spark plug wires	composite distributor, platinum-tipped spark plugs, low-resistance spark plug wires	direct composite distributor, 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	275 / 201 @ 5200	285 / 213 @ 5200	300 / 224 @ 4400
Torque (lb-ft / Nm @ rpm):	260 / 352 @ 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	6000	6000	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

Transmission

	(MG5) 1500 NV3500 5-speed	(MW3) 2500 NV4500 5-speed	(M30) 1500 4L60-E 4-speed	(MT1) 2500 4L80-E 4-speed
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

Chassis/Suspension

Front:	independent with computer selected torsion bars for 1500 4x4 and all 2500 models, computer-selected coil springs for 1500 2WD models, gas-pressurized shock absorbers, maintenance-free wheel bearings, 32-mm stabilizer bar for 2WD models, 30-mm stabilizer bar for 4x4 models
Rear:	solid axle with semi-elliptic, variable-rate, two-stage multileaf springs, gas-pressurized shock absorbers
Steering type:	1500 4WD & 2500: power recirculating ball
	1500 2WD: power rack-and-pinion
Ratio:	14.2:1
Steering wheel turns, lock-to-lock:	3.0

Brakes

Type:	power-assisted disc with ABS, front and rear
Rotor diameter x thickness (in / mm):	front: 12.01 x 1.14 / 305 x 29; rear: 12.80 x 0.78 / 325 x 20

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
Tire size & type:	P235/75R-16 all-season steel-belted radial
	P265/75R-16 all-season steel-belted radial
	LT 225/75R-16 all-season steel-belted radial
	LT 245/75R-16 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):	119.0 / 3023	133.0 / 3378	143.5 / 3644	157.5 / 4001	153.0 / 3884.7
Overall length (in / mm):	203.1 / 5158	222.0 / 5644	227.6 / 5781	246.7 / 6261	237.2 / 6025
Overall width (in / mm):	78.5 / 1994	78.5 / 1994	78.5 / 1994	78.5 / 1994	78.5 /1994
Overall height (in / mm):					
2WD:	71.2 / 1808	71.0 / 1803	71.2 / 1808	70.8 / 1798	77.0 / 1956
4WD:	73.8 / 1875	73.7 / 1872	73.9 / 1877	73.7 / 1872	77.3 / 1963
Track (in / mm):					
Front:	65.0 / 1651	65.0 / 1651	65.0 / 1651	65.0 / 1651	68.6 / 1899
Rear:	66.0 / 1676	66.0 / 1676	66.0 / 1676	66.0 / 1676	66.0 / 1676
Min. ground clearance (in / mm):					
2WD:	8.1 / 205	8.1 / 205	8.1 / 205	8.1 / 205	—
4WD:	8.8 / 223	8.8 / 223	8.7 / 220	8.7 / 220	
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:	19.0 / 482	19.0 / 482	19.0 / 482	19.0 / 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°	—
Base curb weight (lbs / kg):					
2WD:	3956 / 1794	4066 / 1844	4289 / 1945	4511 / 2046	—
4WD:	4246 / 1926	4374 / 1984	4720 / 2141	4807 / 2180	

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 wheelhousing (in / mm):	50.0 / 1270	50.0 / 1270	50.0 / 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

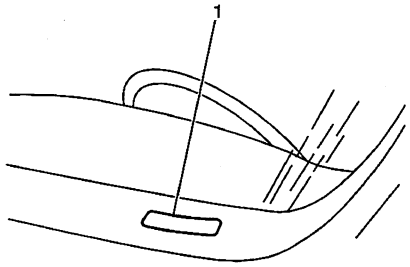
	Regular Cab	Extended Cab, Front	Extended Cab, Rear
Head room (in / mm):	41.0 / 1041	41.0 / 1041	38.4 / 975
Leg room (in / mm):	41.3 / 1049	41.3 / 1049	33.7 / 856
Shoulder room (in / mm):	65.2 / 1656	65.2 / 1656	66.3 / 1684
Hip room (in / mm):	61.4 / 1560	61.4 / 1560	61.5 / 1562

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
GVWR, standard (lbs / kg):					
2WD:	6100 / 2767	6400 / 2903	6200 / 2813	6400 / 2903	—
4WD:	6100 / 2767	6400 / 2903	6400 / 2903	6400 / 2903	
Payload, base (lbs / kg):					
2WD:	2145 / 972	2334 / 1058	1911 / 866	1689 / 766	—
4WD:	1854 / 840	2027 / 919	1680 / 762	1593 / 722	
Fuel tank (gal / liters):	26 / 98.4	34 / 128.7	26 / 98.4	34 / 128.7	26 /98.4
Engine oil (qts / liters):	4.5 / 4.3	4.5 / 4.3	6 / 5.7	6 / 5.7	—
Engine coolant (qts / liters):					
Manual transmission:	12.9 / 12.2	12.9 / 12.2	13.7 / 13	13.4 / 12.7	—
Auto transmission:	12.6 / 11.9	12.6 / 11.9	13.4 / 12.7	14.9 / 14.1	
Maximum trailer weight (lbs / kg):					
Regular Cab 2WD:	5200 / 2359	5200 / 2359	7600 / 3447	8600 / 3901	—
Regular Cab 4WD:	5200 / 2359	5400 / 2449	8300 / 3765	9300 / 4218	
Extended Cab 2WD:	—	—	7300 / 3311	8300 / 3765	
Extended Cab 4WD:	—	—	8000 / 3629	9000 / 4082	

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	6001-7000/Hydraulic 7001-8000/Hydraulic 8001-9000/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	T U V G Z	GM 5.3L V8 FI (LM7) GM 6.0L V8 FI (LQ4) GM 4.8L V8 FI (LR4) GM 8.1L V8 MFI (L18) GM 5.3L V8 MFI Flex Fuel (L59)
9	Check Digit	--	Check Digit
10	Model Year	2	2002
11	Plant Location	1 E F Z	Oshawa, Ontario Pontiac, Michigan Flint, Michigan Fort Wayne, Indiana
12-17	Plant Sequence Number	--	Plant Sequence Number

VIN Derivative

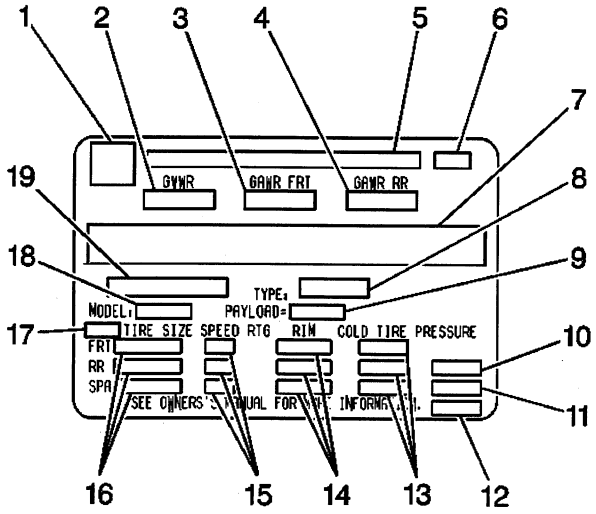
All engines and transmissions are stamped or laser etched with a partial vehicle identification number (VIN), which was derived from the complete VIN. A VIN derivative contains the following nine positions:

Position	Definition	Character	Description
1	Division	B C D T	Chevrolet Incomplete Chevrolet Truck Gmc Incomplete Gmc Truck
2	Model Year	2	2002
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.

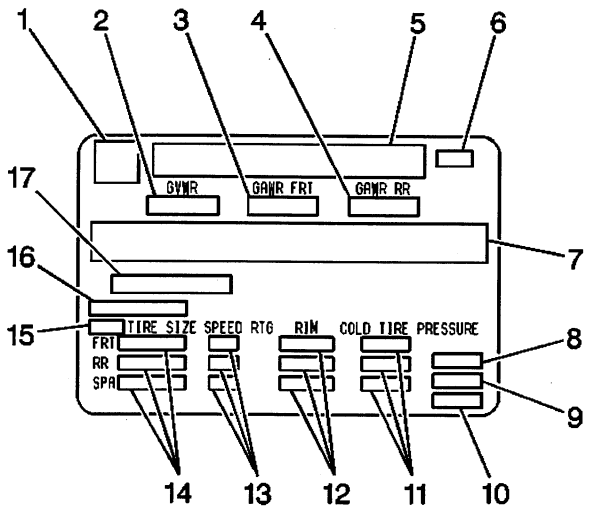
The front gross axle weight rating (GAWR FRT) is the weight exerted on the front axle. The rear gross axle weight rating (GAW RR) is the weight exerted on the rear axle. The front and rear gross axle weights must not exceed the front and rear gross axle weight ratings.

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
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(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

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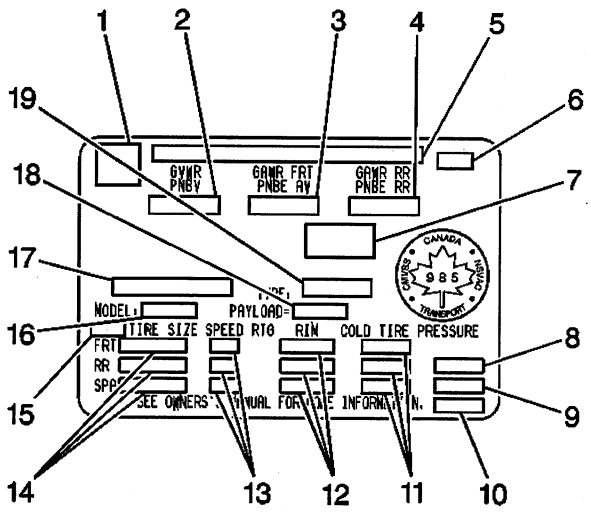
Label Certification with RPO Z49



(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

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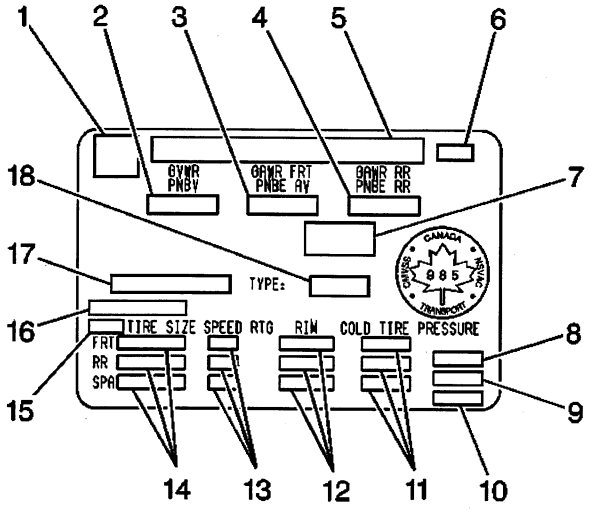

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(8) DUAL - When Equipped
(9) Front Axle Reserve - When Required
(10) Total Capacity - When Required
(11) Tire Pressure - Spare Optional
(12) Rim Size - Spare Optional
(13) Speed Rating - When Required - Spare Optional
(14) Tire Size - Spare Optional
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(17) Vehicle Identification Number
(18) Model Designation

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

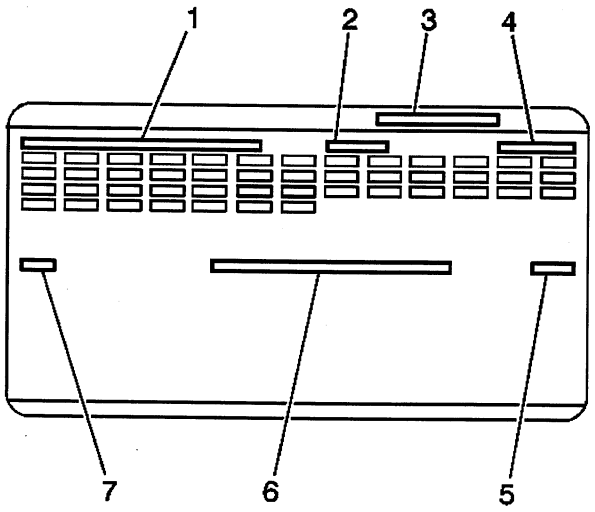
Gross vehicle weight (GVW) is the weight of the vehicle and everything it carries. Include the following items when figuring the GVW:

- 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)

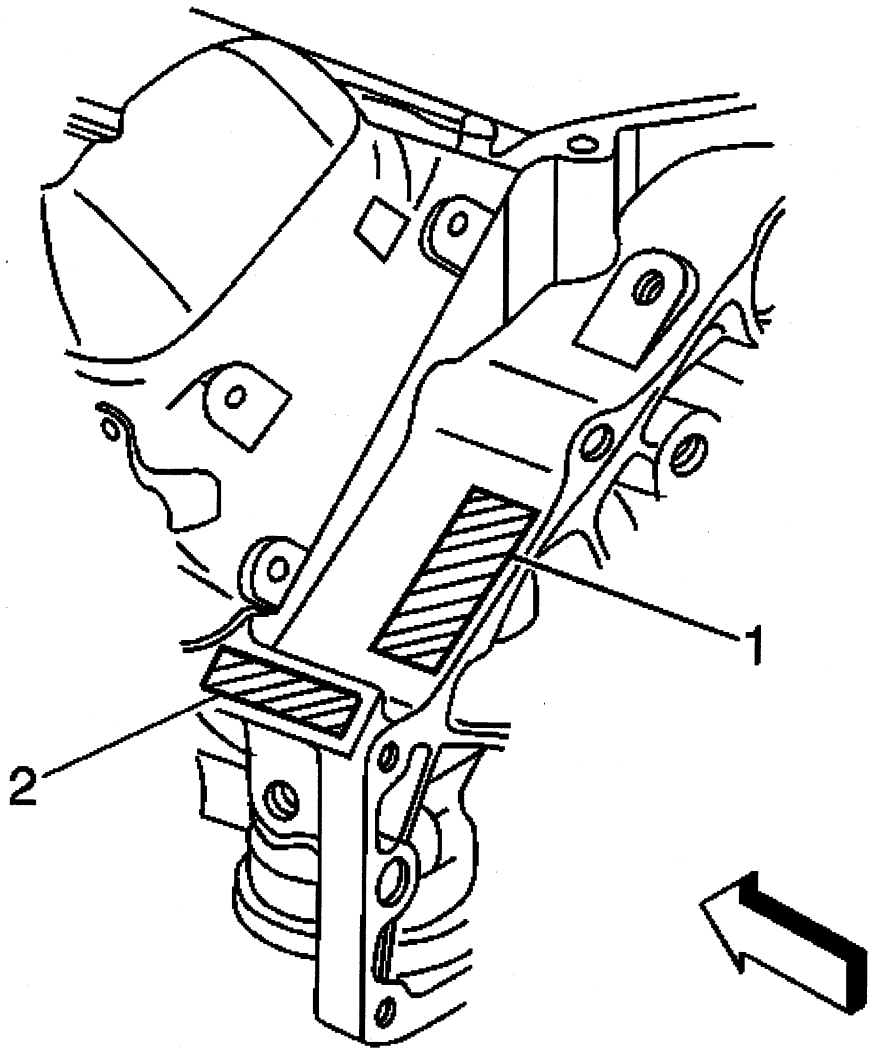


(1) Vehicle Identification Number
(2) Wheel Base
(3) Part Number Location
(4) Model Designation
(5) Order Number
(6) Exterior Color
(7) Paint Technology

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.

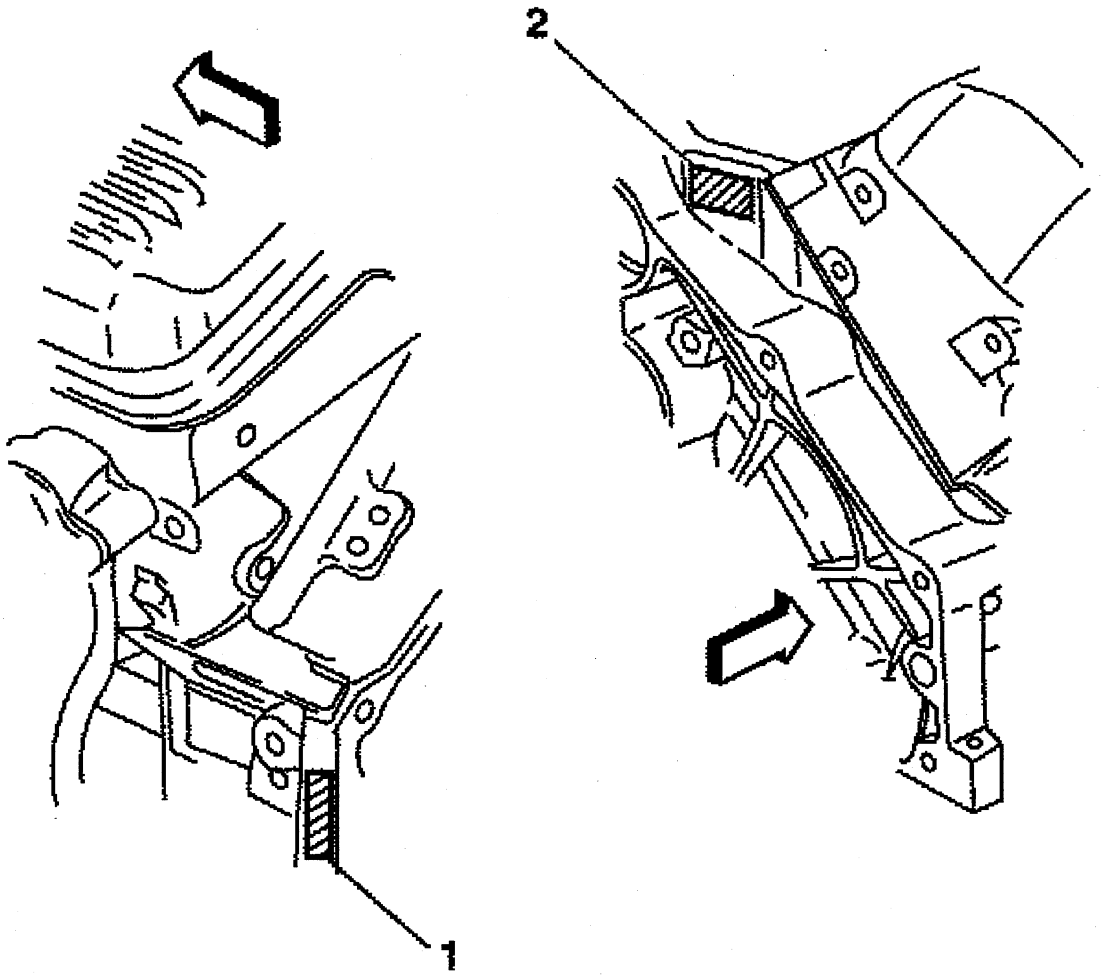
Engine ID and VIN Derivative Location

4.3L V-6 Engine



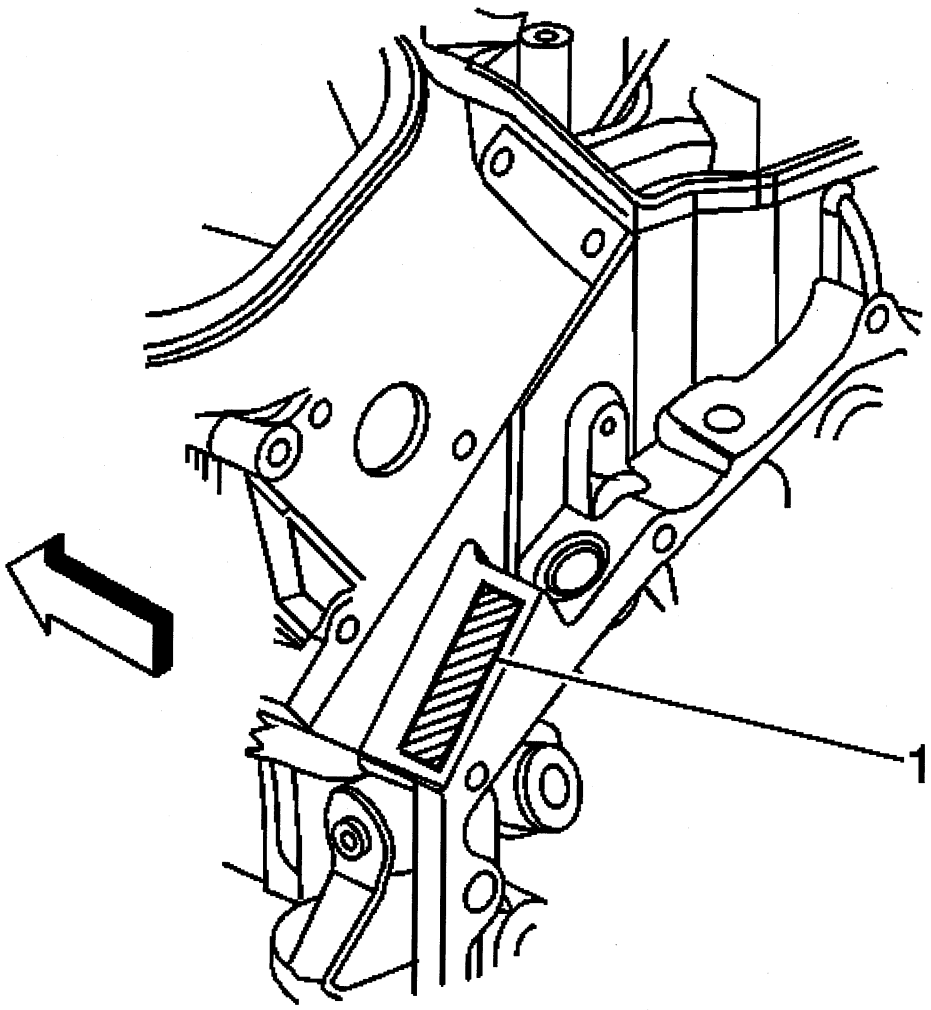
(1) Primary Engine Identification Number Location
(2) Secondary Engine Identification Number Location

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



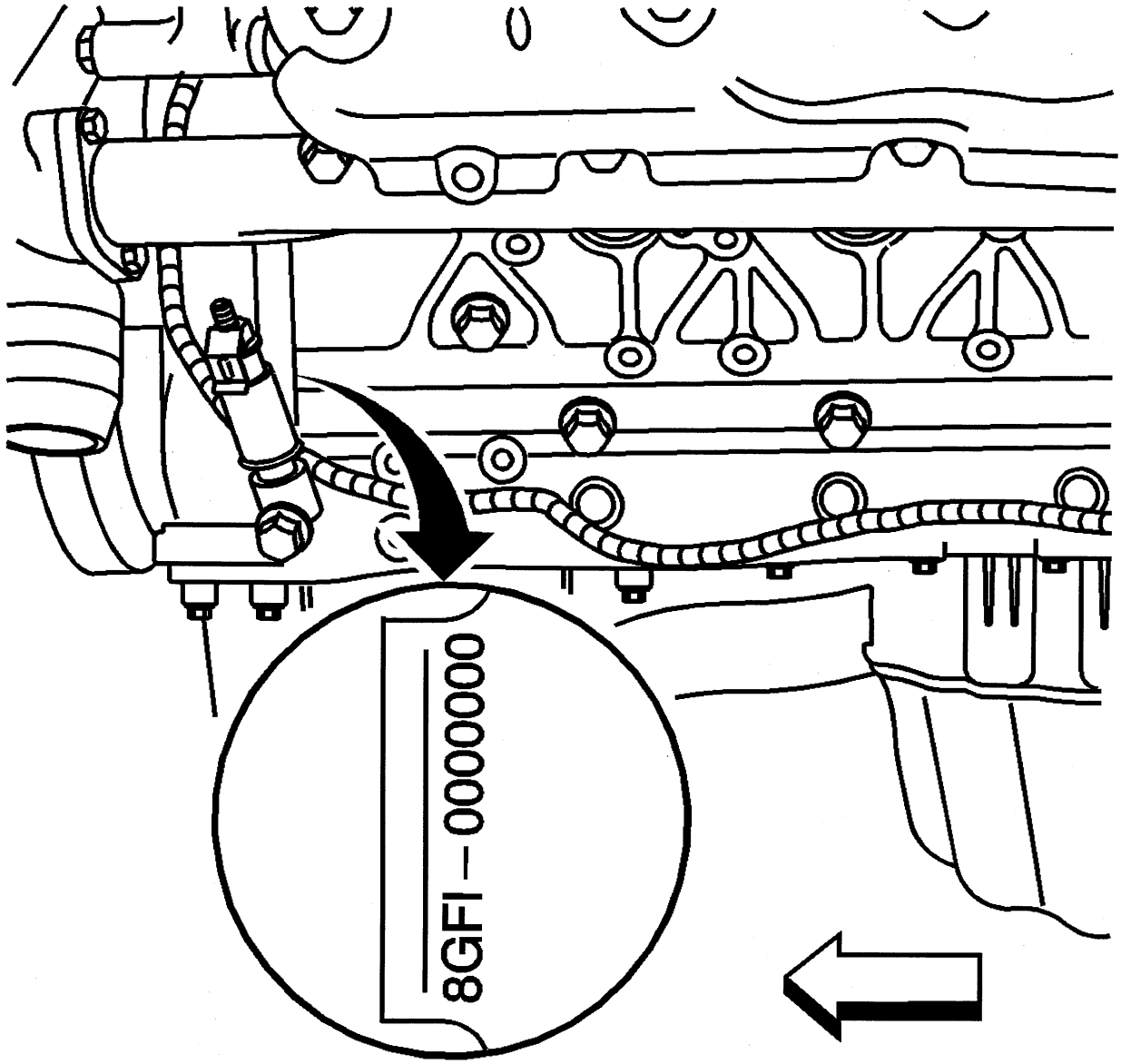
(1) Primary Engine Identification Number Location
(2) Secondary Engine Identification Number Location

8.1L V-8 Engine



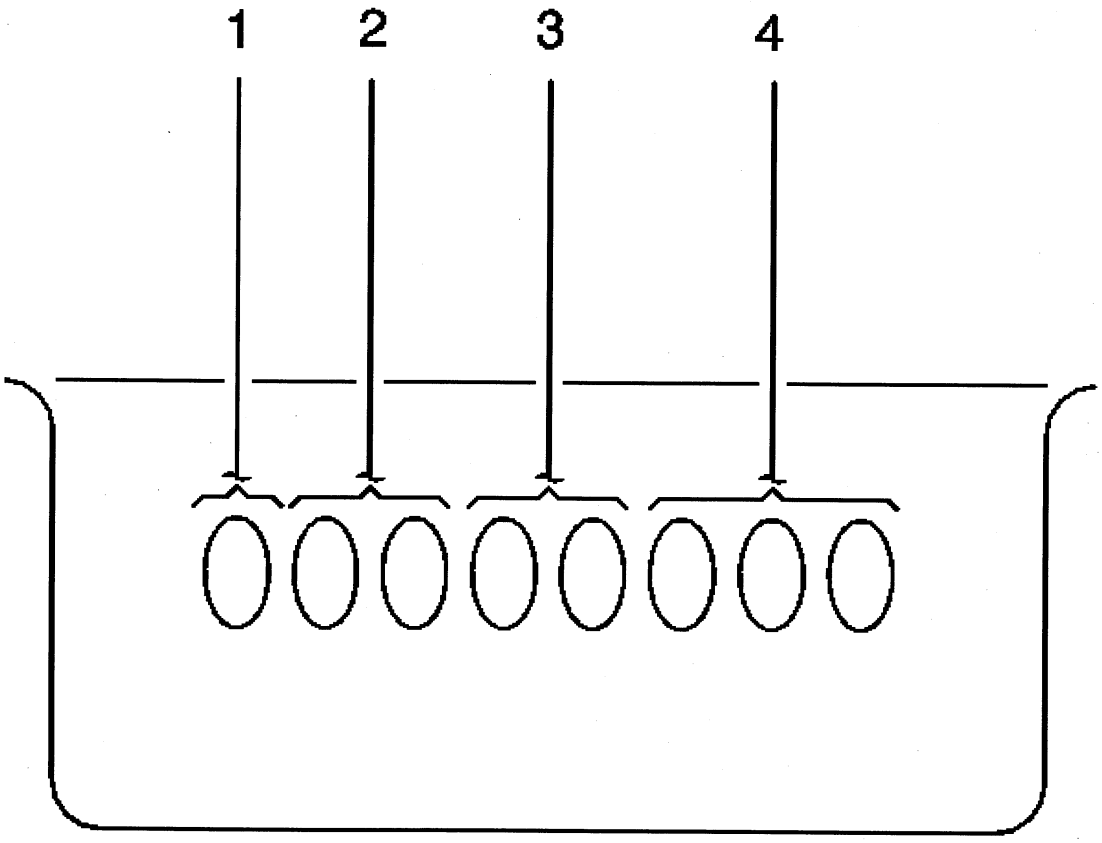
(1) Engine Identification Number Location

6.6L Diesel Engine



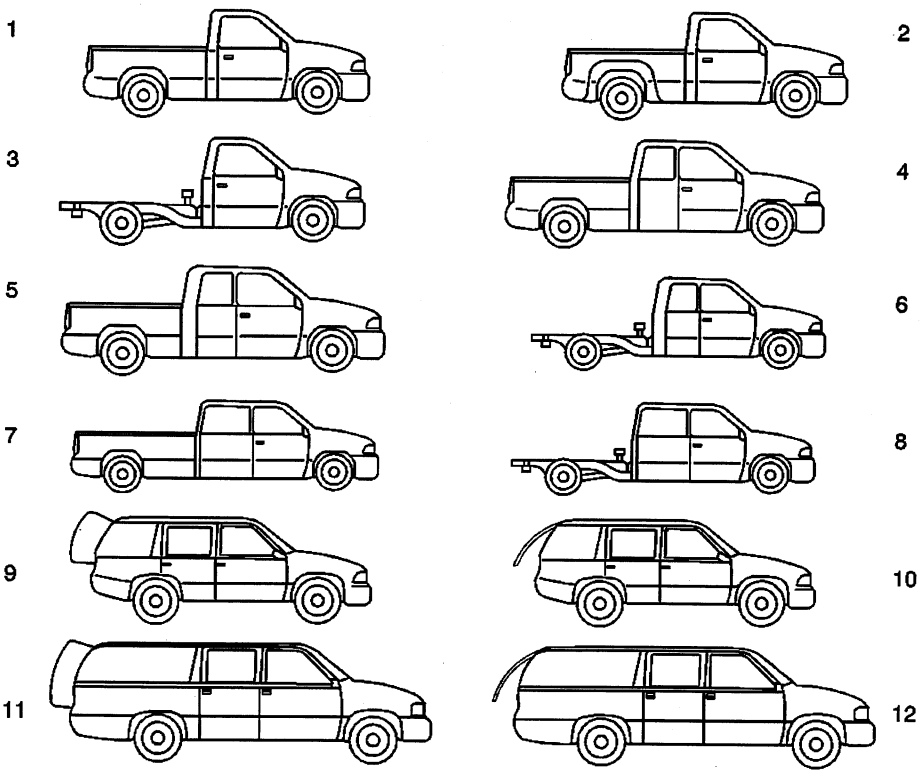
(1) Engine Identification Number Location

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
(9) 4-Door Utility Rear Cargo Doors
(10) 4-Door Utility Liftgate/Glass
(11) 4-Door Suburban with Rear Cargo Doors
(12) 4-Door Suburban Liftgate/Glass

Engine and Transmission Usage

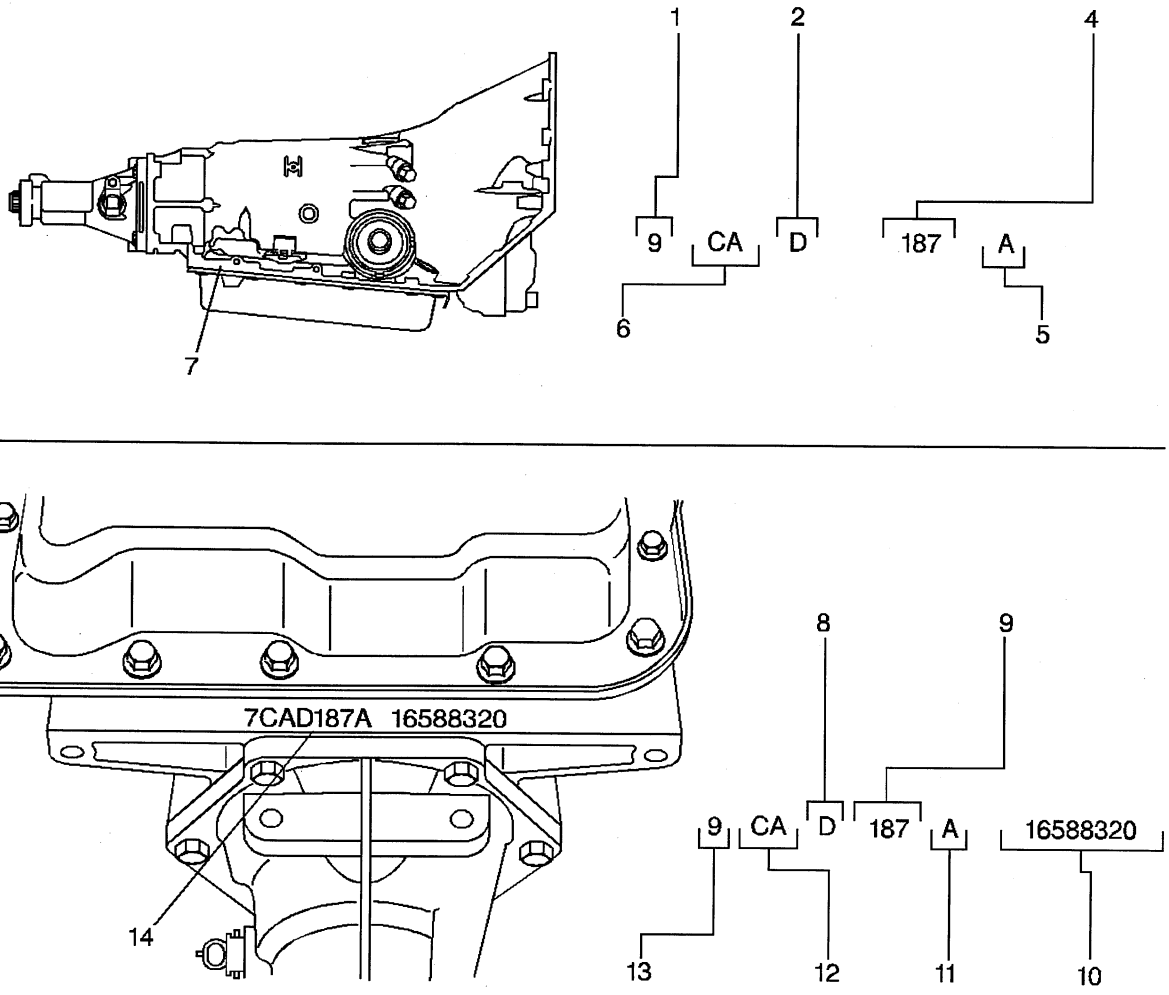
Model	Engine		Transmission	
	Base	Option	Base	Option
C157 (03) w/E62 and E63	4.3L V6(L35)	4.3L V6(LU3) 4.8L V8(LR4) 5.3L V8(LM7)	5 Spd. Manual (MG5) w/L35, LU3, LR4 4 Spd. Auto(M30) w/LM7	4 Spd. Auto. (M30) w/L35, LU3, LR4 5 Spd. Manual (MG5) w/LM7
C157 (53) w/E62 and E63	4.3L V6(L35)	4.3L V6(LU3) 4.8L V8(LR4) 5.3L V8(LM7)	5 Spd. Manual (MG5) w/L35, LU3, LR4 4 Spd. Auto. (M30) w/LM7	5 Spd. Manual (MG5) W/LM7 4 Spd. Auto. (M30) w/L35, LU3, LR4
C159 (03) w/E63	4.3L V6(L35)	4.3L V6(LU3) 4.8L V8(LR4) 5.3L V8(LM7)	5 Spd. Manual (MG5) w/L35, LU3, LR4 4 Spd. Auto. (M30) w/LM7	5 Spd. Manual (MG5) w/L35, LU3, LR4 4 Spd. Auto. (M30) w/LM7
C159 (53) w/E63	4.8L V8(LR4)	5.3L V8(LM7)	5 Spd. Manual (MG5) w/LR4 4 Spd. Auto (M30) w/LM7	5 Spd. Manual (MG5) w/LR4 4 Spd. Auto. (M30) w/LM7
C259 (03) w/E63	6.0L V8(LQ4)	N/A	4 Spd. Auto (MT1)	N/A
C259 (03) w/ZW9	6.0L V8(LQ4)	N/A	5 Spd. Manual (MW3)	4 Spd. Auto (MT1)
C259 (53) w/E63	6.0L V8(LQ4)	6.6L V8(LB7) 8.1L V8(L18)	5 Spd. Manual (MW3) w/LQ4 6 Spd. Manual (ML6) w/LB7 and L18	4 Spd. Auto (MT1) w/LQ4 5 Spd Auto (M74) w/LB7 and L18
K157 (03) w/E62 and E63	4.3L V6(L35)	4.3L V6(LU3) 4.8L V8(LR4) 5.3L V8(LM7)	5 Spd. Manual (MG5) w/L35, LU3, LR4 4 Spd Auto (MT1) w/LM7	5 Spd. Manual (MG5) w/LM7 4 Spd. Auto. (MT1) w/L35, LU3, LR4
K157(53) w/E62 and E63	4.8L V8(LR4)	5.3L V8(LM7)	5 Spd. Manual (MG5) w/LR4 4 Spd. Auto. (M30) w/LM7	5 Spd. Manual (MG5) w/LR4 4 Spd. Auto (M32) w/LM7
K157 (53) w/E63	6.0L V8(LQ4)	N/A	4 Spd. Auto (M30)	N/A
K159 (03) w/E63	4.3L V6(L35)	4.3L V6(LU3) 4.8L V8(LR4) 5.3L V8(LM7)	5 Spd. Manual (MG5) w/L35, LU3, LR4 4 Spd. Auto (M30) w/LM7	5 Spd. Manual (MG5) w/LM7 4 Spd. Auto. (M30) w/L35, LU3, LR4
K159 (53) w/E63	4.8L V8(LR4)	5.3L V8(LM7)	5 Spd. Manual (MG5) w/LM7 4 Spd. Auto. (M30) w/LM7	5 Spd. Manual (MG5) w/LR4 4 Spd. Auto. (M30)w/LM7
K257 (53) w/E63	6.0L V8(LQ4)	N/A	5 Spd. Manual (MG5)	4 Spd. Auto (M30)
K259 (03) w/E63	6.0L V8(LQ4)	6.6L V8(LB7) 8.1L V8(L18)	5 Spd. Manual (MW3) w/LQ4 6 Spd. Manual (ML6) w/LB7 and L18	4 Spd. Auto (MT1) w/LQ4 5 Spd. Auto (M74) w/LB7 and L18
K259 (53)	6.0L V8(LQ4)	6.6L V8(LB7) 8.1L V8(L18)	5 Spd. Manual (MW3) w/LQ4 6 Spd. Manual (ML6) w/LB7 and L18	4 Spd Auto (MT1) w/LQ4 5 Spd Auto (M74) w/LB7 and L18

Model Codes

- C--Rear wheel drive
- K--Selectable four wheel drive
- 03--Regular cab
- 06--Utility
- 43--Crew Cab
- 53--Extended cab
- 15--1/2 ton
- 25--3/4 ton
- 35--1 ton Standard cab
- 36--1 ton 4-Door Crew cab
- 57--Short bed
- 59--Long bed
- 60--Standard cabin chassis
- 64--4-Door Extended cab

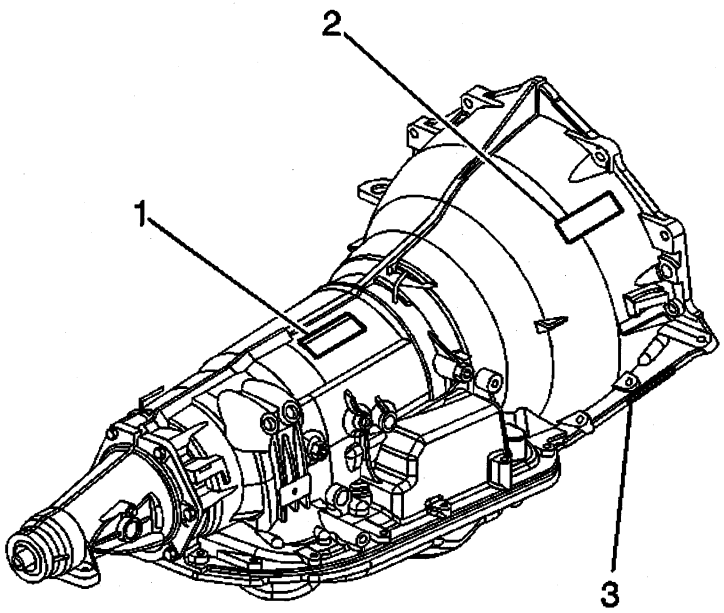
Transmission ID and VIN Derivative Location

4L60-E Transmission ID Location

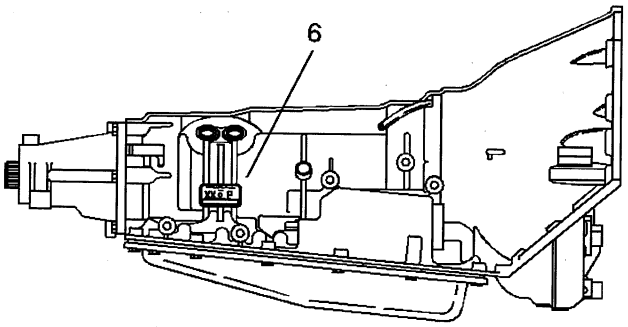


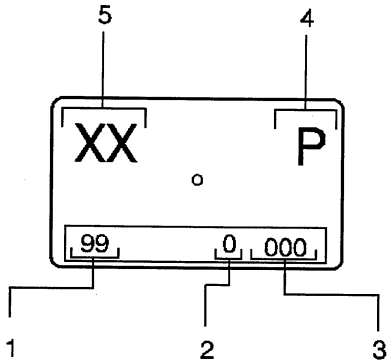
(1) Model Year
(2) Hydra-Matic 4L60-E
(4) Julian Date (or Day of the Year)
(5) Shift Built (A, B, J = First Shift; C, H, W = Second Shift)
(6) Model
(7) Transmission ID Location
(8) Hydra-Matic 4L60-E
(9) Julian Date (or Day of the Year)
(10) Serial No.
(11) Shift Built (A, B, J = First Shift; C, H,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

4L80-E Transmission ID Location



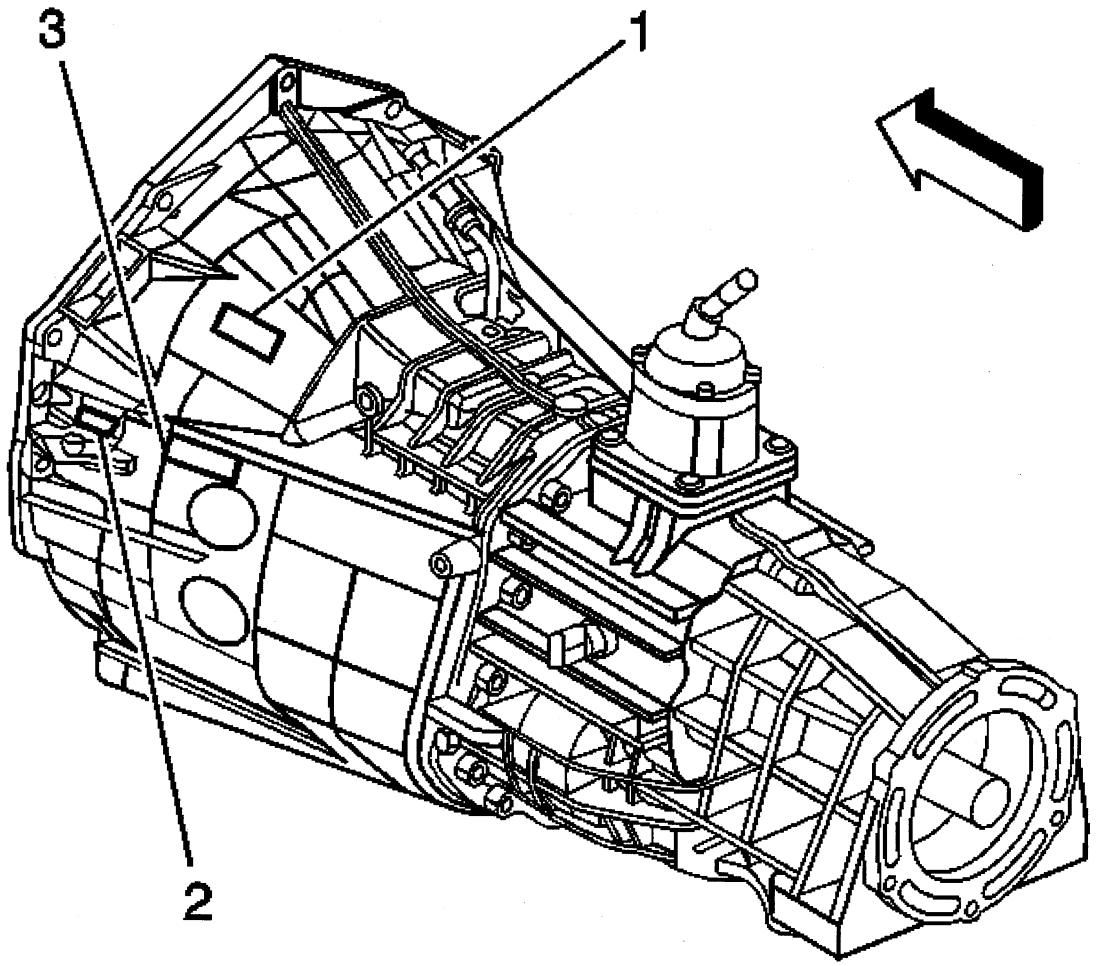
Transmission ID and VIN derivative locations (1, 2). The right hand stamping is shown, left hand is opposite. Pin or hand stamp location (3) for the transmission ID or VIN derivative.





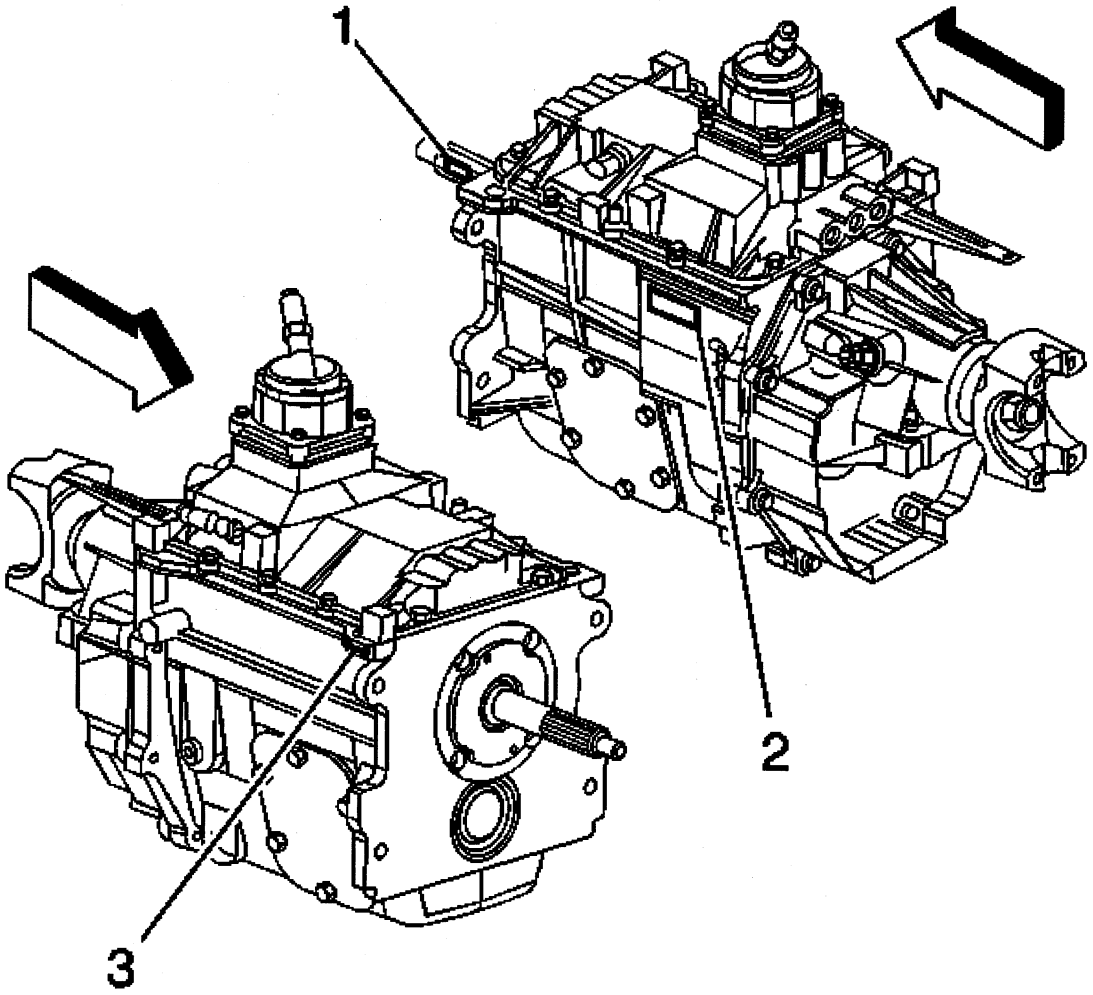
1. Calendar Year
2. Julian Date of the Year
3. Shift and Line Number
4. Plant
5. Model
6. Location on Transmission

5-Speed Getrag



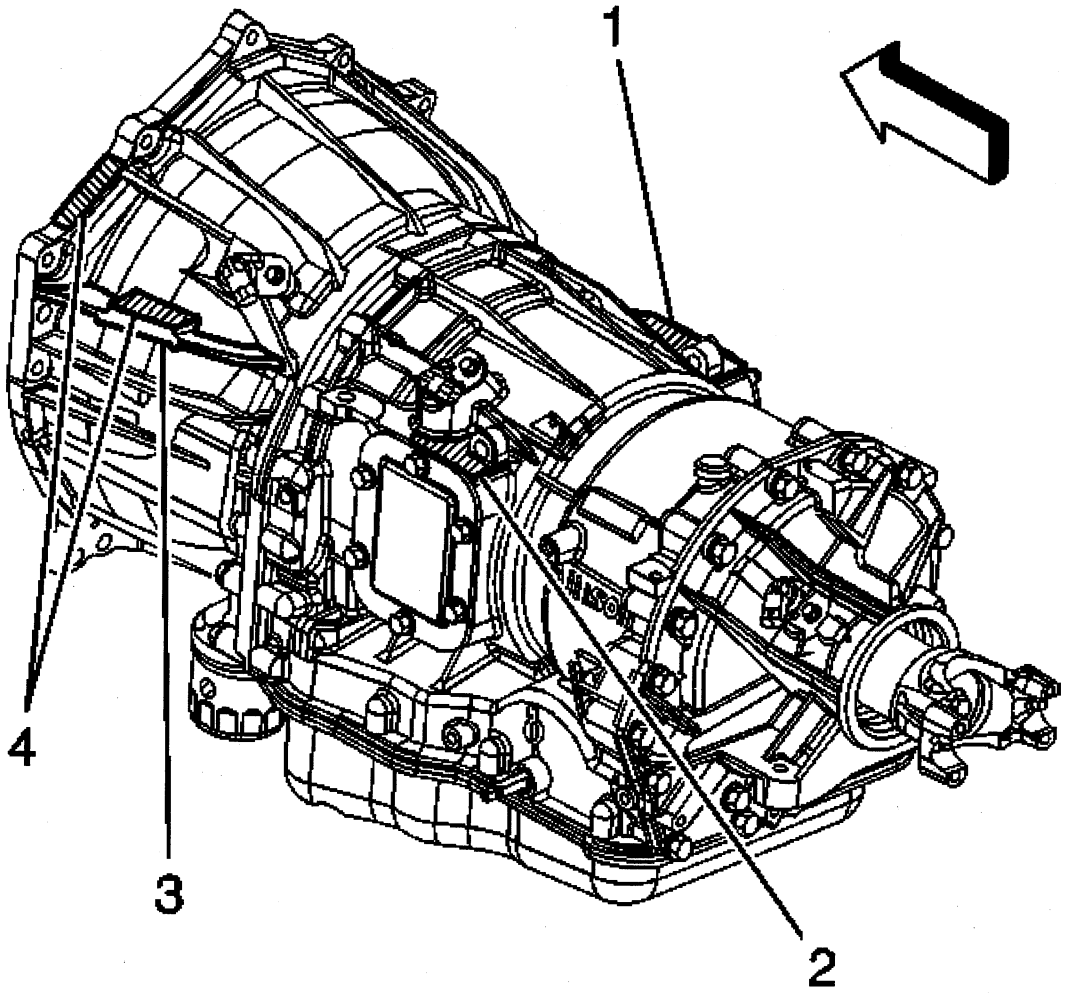
Vehicle identification number location PIN stamp only (1). Vehicle identification number location optional PIN or Hand Stamp (2). Vehicle identification number location optional Pin stamp only (3).

5-Speed Manual



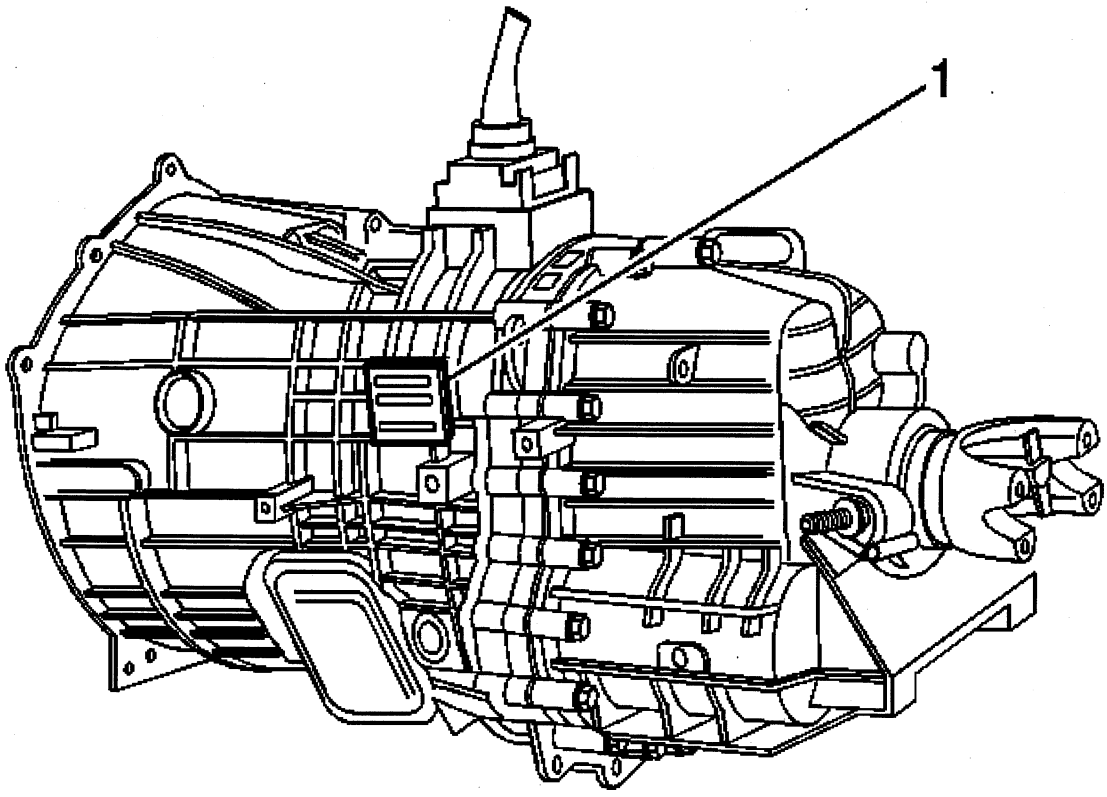
The transmission vehicle identification number location PIN or hand stamp (1, 3). Vehicle identification number location PIN or hand stamp (2).

Allison Transmission



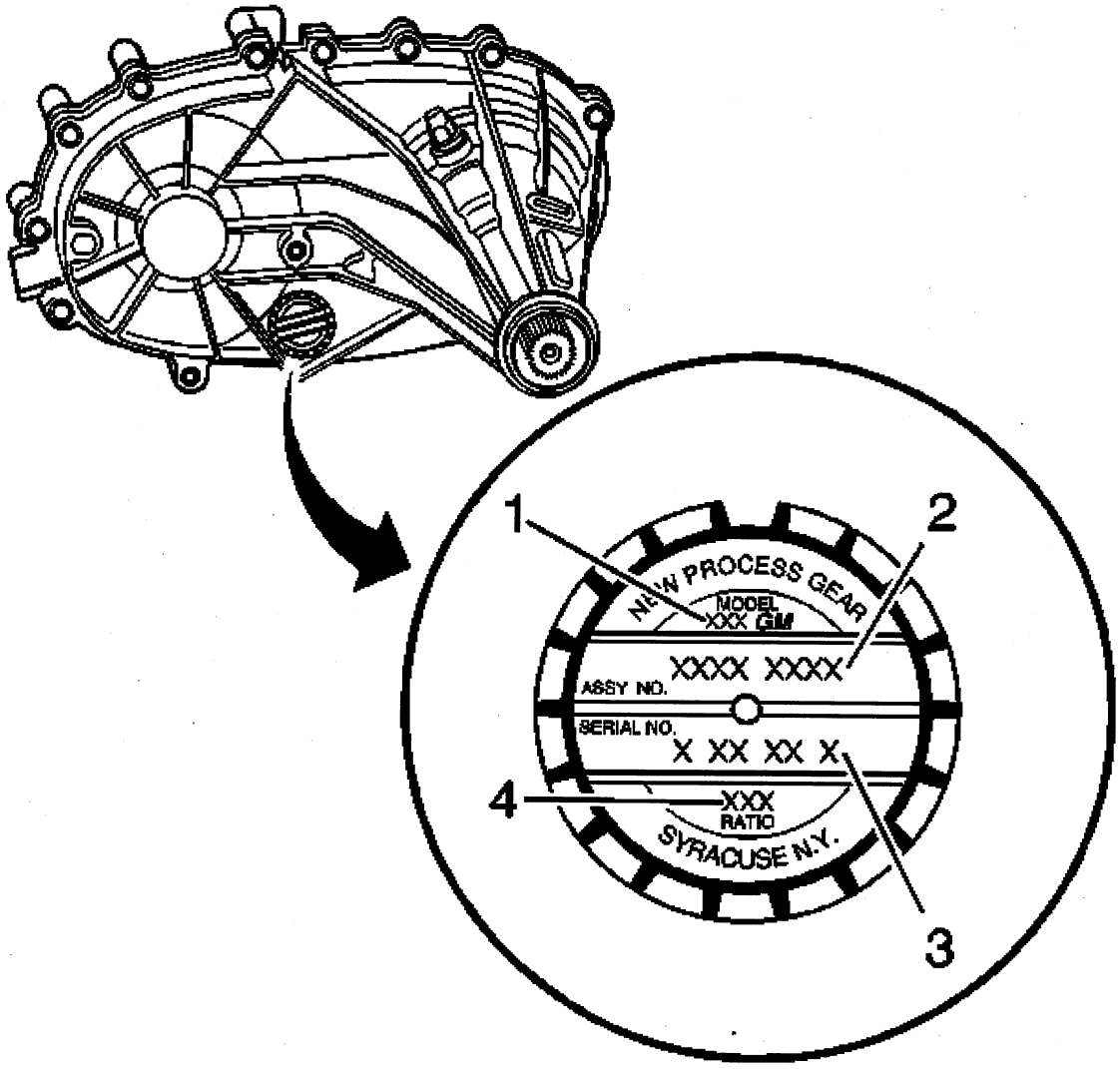
Vehicle identification number location for PIN stamp (3). Optional hand stamp locations (1, 2, 4)

ZF Transmission



(1) Engine identification tag location.

Transfer Case Identification

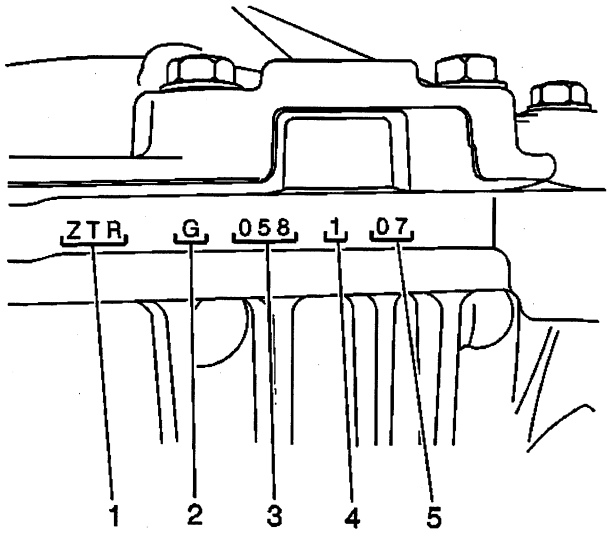


An identification tag is attached to the rear half of the transfer case. The tag provides the following information:

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

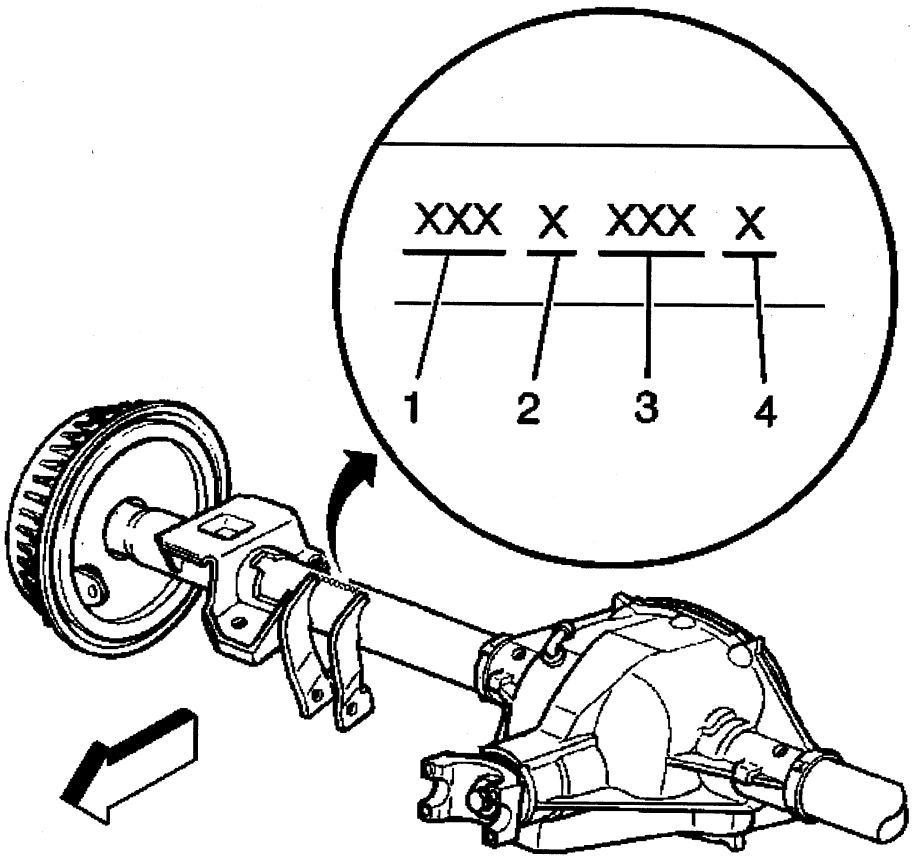
Front axle identification information is stamped on the top of the differential carrier assembly.

The following broadcast codes identifies the axle ratio:

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

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

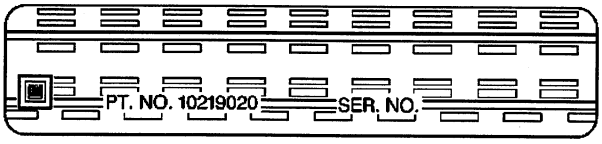
Axle Identification – Rear



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

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

Labeling - Anti-Theft



Notice

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

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

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

RPO Code List

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

RPO	Description
AC7	Pipe Fuel Tank Fill Vent-Unrestricted
AE7	Seat FRT Split, Driver, PASS
AG1	Adjuster FRT ST Power, Multi-Directional, Driver
AG2	Adjuster PASS ST Power, Multi-Directional
AJ1	Windows Deep Tint, All Except W/S and DRS
AM7	Rear Seat Folding
AN3	Seat FRT, Individual (Non BKT)
ARL	Plant Code, Arlington, TX, USA
AU0	Remote Function Actuation - Keyless Entry (Domestic)
AU8	Remote Function Actuation, Specific Frequency
AX4	Restraint Conversion Seat, MAN, European
A04	Windshield Tinted, Less Upper Shadeband
A31	Window Power Operated, All Doors
A95	Seat FRT BKT, High Back, Driver and PASS RECL
BAG	Parts Package Export
BA5	Ornamentation EXTR, Custom
BG9	Covering Floor Rubber
BPH	Appearance Package Chevrolet "Off Road"
BVF	Steps Runningboard, Side, Color Keyed
B30	Floor Covering Carpet
B32	Covering FRT Floor Mats, AUX
B33	Covering Rear Floor Mats, AUX
B35	Covering Rear Floor Mats, Carpeted Insert
B37	Covering Floor Mat, FRT and RR, AUX
B39	Covering Floor Carpet, Load Floor
B58	Covering Floor Mat, FRT and RR, Carpeted Insert
B85	Molding - Body Side , Exterior, Bright
B96	Molding Wheel Opening
CF5	Roof Sun, Glass, Sliding, Electric
C36	Heater Auxiliary
C49	Defogger RR Window, Electric
C5F	GVW Rating 8, 500 LBS
C5H	GVW Rating 6, 900 LBS
C5M	GVW Rating 6, 100 LBS
C5U	GVW Rating 6, 800 LBS
C6P	GVW Rating 8, 600 LBS/3, 900KG
C60	HVAC System Air Conditioner FRT, MAN Controls
C7H	GVW Rating 6, 400 LBS/2, 900KG
DE2	Mirror, O/S LH and RH, Manual Control, Folding, Color
DF2	Mirror, O/S LH and RH, Wide Load, Folding, Stainless Steel
DF5	Mirror, I/S R/V LT Sensitive, Compass, O/S Temp Display
DG5	Mirror, O/S LH and RH, Wide Load, Large
DH2	Mirror, I/S Front Van, LH and RH, Illumination with Dual Sunshade
DK2	Mirror, O/S, LH and RH, Remote Control, Electric, Heated, Color
DK6	Console Roof Interior
DK7	Console Roof Interior, Custom
DL8	Mirror, O/S LH and RH, Remote Control, Electric, Heated

D44	Mirror, O/S, Color
D48	Mirror, O/S LH and RH, Remote Control, Electric, Color
D55	Console Front Compartment, Floor
EVA	Test DVT, EVAP Emission Requirement
E37	Pickup Box Inner DK Composite
E62	Body Equipment Step Side, PUBX
E63	Fleetside/Wideside Pickup Box (6 1/2 Foot and 8 Foot)
E95	Cover Tonneau, Rear Compartment
FF4	Arm LH Torsion Bar Spring Adj (C)
FF5	Arm RH Torsion Bar Spring Adj (D)
FF6	Arm LH Torsion Bar Spring Adj (E)
FF7	Arm RH Torsion Bar Spring Adj (F)
FK2	Arm LH Torsion Bar Spring Adj (A)
FK3	Arm RH Torsion Bar Spring Adj (B)
FT2	Arm LH Torsion Bar Spring Adj (FT2)
FT3	Arm RH Torsion Bar Spring Adj (FT3)
FWI	Plant Code Fort Wayne, IN, USA
FW1	Manual Electric Control, Ride and Handling
F60	Spring Front Heavy Duty
GMC	Plant Code Pontiac, MI, USA
GT4	Axle Rear 3.73 Ratio (DUP With 5 x 1)
GT5	Axle Rear 4.10 Ratio (DUP With GT8)
GU6	Axle Rear 3.42 Ratio
G80	Axle Positraction Limited Slip
G86	Axle, Rear, Limited-Slip
HOT	Appearance Package GMC "Hot Truck"
JC5	Brake Vac Power, 4-Wheel Disc, 7,200 lb
JE1	Brake System, Europe
JH5	Brake Hyd Power, 4-Wheel Disc, 7,200 lbs
JH6	Brake Hyd Power, 4-Wheel Disc, 9,900 lbs
J81	Indicator Switch, Export
KC4	Heavy Duty Engine Oil Cooling
KG8	Generator 130 Amp
KL7	Conversion Propane Gas (LP Gas)
KNP	Cooling System Trans, 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
K68	Generator, 105 Amp
LB7	Engine, Diesel, 8 CYL, 6.6, DI, V8, Turbo, HO, Duramax
LM7	Engine Gas, 8 CYL, 5.3L, MFI, Iron, GM
LQ4	Engine Gas, 8 CYL, 6.0L, MFI, Iron, GM
LQ9	Engine Gas, 8 CYL, 6.0L, MFI, Iron, GM, HO
LR4	Engine Gas, 8 CYL, 4.8L MFI, Iron, GM
LU3	Engine Gas, 6 CYL, 4.3L, MFI, V6, 90 DEG
L18	Engine Gas, 8 CYL, 8.1L, MFI
L35	Engine Gas, 6 CYL, 4.3L, CPI, V6, 90 DEG, HO
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 4-Speed Auto W/Elect Controls H.D. (Hydra - Matic 4L80 - E
MW3	Transmission Manual, 5-Speed, NVG, I109mm, 5.61 1st, O/D

M30	Transmission Auto 4-Speed, HMD, 4L60-E, Electronic
M32	Transmission - 4 Speed Auto W/Electric Controls L.D. (Hydra-Matic 4L60-E)
NA1	Emission System GVW less than 8,500 lb
NA4	Emission System GVW greater than 8,500 lb
NC1	Emission System California, LEV
NF2	Emission System Federal Tier 1
NF4	Emission System Clean Fuel FLeet
NP1	Transfer Case - (Electric) - Full Range
NP2	Transfer Case- (Manual) - Full Range
NP5	Steering Wheel Leather Wrapped
NP8	Transfer Case - (Active) - Push Button Control, 2 Speed
NW7	Traction Control - Electronic
NYS	Steering 4-Wheel
NZZ	Skid Plate Off-Road
N05	Locking Fuel Filler Cap
N12	Rear Exit Tail Pipe
OSG	Plant COde Oshawa, Ont, Canada (TRK)
PF4	Wheel - Cast - Aluminum- 16 X 7.0
PF9	Wheel - Cast - Aluminum- 16 X 7.0
PR0	Appearance Package Sierra Professional
PY0	Wheel - New - Aluminum - 16 X 6.5
PY2	Wheel - Bright Chrome Appearance- 16 X 6.5
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
QGA	Tire All P245/75R16 R/PE ST TL AT 109S BW
QGB	Tire All P245/75R16 - 109S WOL R/PE ST TL AT
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 LT245/75R16E R/PE ST TL OOR BL
QIZ	Tire All LT245/75R16/E BW R/PE ST TL OOR 12OQ
QJP	Tire All P265/70R17 - 113S BW R/PE ST TL OOR
QMJ	Tire All P265/70R16 - 111S BW R/PE ST TL AL2
QNF	Tire All P235/75R16 - 106S ALS BW R/PE ST TL ALS
QNG	Tire All P235/75R16 - 106S WOL R/PE ST TL ALS
QNK	Tire All P245/75R16 - 109S BW R/PE ST TL ALS
QNL	Tire All P245/75R16 - 109S WOL R/PE ST TL ALS
Q4B	GVW Rating 6, 200 LBS
R4W	Tire Brand All Michelin
TL1	Grille Special
TP2	Battery Auxiliary
TRB	Grille Radiator, Body Color
TRW	Provisions Lamp, Roof Mounted
TR2	Lamp Turn Signal, Enlarged
TR6	Hedadlamps Control Leveling System, Manual
T62	Lamp System Daytime Running - Delete
T78	Headlamps Control - Delete
T84	Headlamps RH Rule of the Road, E Mark

T89	Lamp Tail and Stop, Export
T96	Fog Lamps - Front
UC2	Speedometer INST, Kilo and Miles, Kilo Odometer, Positive Bias
UD4	Alarm Vehicle Speed, 120 K/H
UD7	Sensor Indicator Rear Parking Assist
UE1	Communication System Vehicle, G.P.S. 1
UK6	Radio Control RR Seat and Earphone Jacks
UL0	Radio - AM/FM Stereo, Cass. (Europe Compliant)
UL9	Radio - AM/FM Stereo, Seek/Scan, Auto Reverse Music Search CASS, CD, Auto Tone, Clock, ETR, Bose
UM7	Radio - AM/FM Stereo, Seek/Scan Clock, and ETR (Base On All Models)
UN0	Radio - AM/FM Stereo, Seek/Scan, Compact Disc, Auto Tone Control, Clock, and ETR (Radio Will Not Snap Fit Into I/P - No Attaching Fasteners)
UP0	Radio - AM/FM Stereo, Seek/Scan, Auto Reverse Music Search Cassette, Compact Disc, Auto Tone Control, Clock, and ETR (Radio Will Not Snap Fit Into IP- No Attaching Fasteners, CD Will Be Remote Mounted Other than the IP)
UQ3	Speaker System, Performance Enganced Audio
UQ5	Speaker System 4, Dual Front Door Mounted, Dual Extended Range Quarter Mounted
UQ7	Speaker System Premium Performance, Enhanced Audio, Bose®
UW3	Radio AM/FM Stereo, Seek/Scan, Auto REV Music Search Cassette, Data System, Clock, ETR
UY2	Wiring Provisions for Camper/5th Wheel Trailer
UY7	Wiring Harness Truck Trailer, HD
U1Z	Player Multiple Compace Disc, Passenger Compartment
U19	Speedometer INST, Kilo and Miles, Kilo Odometer
VBX	Language Label Arabic
VB3	Bumper Rear Step, Chrome, Impact Strip
VC4	Label Price/Fuel Economy, Puerto Rico and Virgin Islands
VC5	Label Shipping, Except US, US Possessins, or Japan
VC7	Label Price/Fuel Economy, Guam
VD1	Provisions Options Europe
VF7	Bumper Rear Step - Delete
VGC	Protector Film, Paint Etch Preventive
VG3	Bumper Front Impact Strip
VJ3	Label, Plate ECE Approval and Vehicle Identification
VJ4	Label, Export Child Seat Location
VJ7	Label, Fuel Unleaded Only
VK3	License Plate, Front Mounting Package
VPH	Vehicle Preparation Overseas Delivery
VP3	Noise Control - European Provisions
VP6	Noise Control
VR4	Trailer Hitch Weight Distributing Platform
VR6	Hook Tie-Down Shipping
VT4	Bumper Front Color Keyed
VT5	Bumper Rear Color Keyed
VXS	Vehicle Complete
VYU	Provisions, Snow Plow Preparation
VZ2	Calibration Speedometer A
V10	Cold Climate Package
V22	Grille Radiator, Chrome
V43	Bumper - Painted, Rear Step - With Step Pad
V73	Vehicle Statement, USA/ Canada
V76	Front Towing Hook
V78	Vehicle Statement - Delete

V98	Factory Delivery Processing
W86	Equipment: Misc Equipment for Venezuela (GMV Contolled)
W87	Parts: North American Parts Sourced in Venezuela (GMV Controlled)
W99	Equipment: Misc Equipment for Venezuela (GM Platform Contolled)
XAN	Tire Front P265/70R17-113S BW R/PE ST TL AL2
XAQ	Tire Front P265/70R17-113H BW R/PE ST TL AL2
XBN	Tire Front LT245/75R16/C BW R/PE ST TL OOR
XBX	Tire Front LT245/75R16/C WOL R/PE ST TL OOR
XCC	Tire Front P255/70R16 BW R/PE ST TL ALS
XCJ	Tire Front P255/70R16 WOL R/PE ST TL ALS
XCP	Tire Front P255/70R16-109H BW R/PE ST TL ALS
XGA	Tire Front P245/75R16-109S BW R/PE ST TL AT
XGB	Tire Front P245/75R16-109S WOL R/PE ST TL AT
XGC	Tire Front P265/75R16-114S BW R/PE ST TL AT
XGD	Tire Front P265/75R16-114S WOL R/PE ST TL AT
XGK	Tire Front LT245/75R16/E BW R/PE ST TL OOR 120Q
XGL	Tire Front LT265/75R16/C BL R/PE ST OOR
XHH	Tire Front LT245/75R16/E BW R/PE ST TL ALS 120Q
XHS	Tire Front P265/75R16-114H BW R/PE ST TL AT "A" Temp Rating
XNF	Tire Front P235/75R16-106S BW R/PE ST TL ALS
XNG	Tire Front P235/75R16-106S WOL R/PE ST TL ALS
XNK	Tire Front P245/75R16-109S BW R/PE ST TL ALS
XNL	Tire Front P245/75R16-109S WOL R/PE ST TL ALS
X88	Conversion Name Plate Chevrolet
YAN	Tire Rear P265/70R17-113S BW R/PE ST TL AL2
YAQ	Tire Rear P265/70R17-113H BW R/PE ST TL AL2
YBN	Tire Rear LT245/75R16/C BW R/PE ST TL OOR
YBX	Tire Rear LT245/75R16/C WOL R/PE ST TL OOR
YCC	Tire Rear P255/70R16 BW R/PE ST TL ALS
YCJ	Tire Rear P255/70R16 WOL R/PE ST TL ALS
YCP	Tire Rear P255/70R16-109H BW R/PE ST TL ALS
YE9	Convenience Package Comfort and Decor Level #3
YGA	Tire Rear P245/75R16-109S BW R/PE ST TL AT
YGB	Tire Rear P245/75R16-109S WOL R/PE ST TL AT
YGC	Tire Rear P265/75R16-114S BW R/PE ST TL AT
YGD	Tire Rear P265/75R16-114S WOL R/PE ST TL AT
YGK	Tire Rear LT245/75R16/E BW R/PE ST TL OOR 120Q
YGL	Tire Rear LT265/75R16/C BL R/PE ST OOR
YHH	Tire Rear LT245/75R16/E BW R/PE ST TL ALS 120Q
YHS	Tire Rear P265/75R16-114H BW R/PE ST TL AT "A" Temp Rating
YNF	Tire Rear P235/75R16-106S BW R/PE ST TL ALS
YNG	Tire Rear P235/75R16-106S WOL R/PE ST TL ALS
YNK	Tire Rear P245/75R16-109S BW R/PE ST TL ALS
YNL	Tire Rear P245/75R16-109S WOL R/PE ST TL ALS
ZGL	Tire Spare LT265/75R16/C BL R/PE ST OOR
ZW9	Base Body or Chassis
ZX3	Adjustable Electronic (Selectable) Suspension
Z49	Export Canadian Modification Mandatory Base Equipment
Z5X	Mirror Provisions Arabic Language
Z71	Chassis Package "Off Road"
Z75	Conversion Name Plate Cadillac
Z82	Trailer Provisions Special Equipment, H. D.
Z83	Chassis Package Solid Smooth Ride

Z85	Chassis Package Increased Capacity
Z88	Conversion Name Plate GMC

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")	2.28 liters	2.41 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

Maintenance Items

Usage	Type
Air Cleaner	
• 4.3L (VIN W)	A1519
• 4.8L (VIN V)	A1519C
• 5.3L (VIN T)	A1519C
• 6.0L (VIN U)	A1518C
• 8.1L (VIN G)	A917C
Engine Oil Filter	
• 4.3L (VIN W)	PF47
• 4.8L (VIN V)	PF59
• 5.3L (VIN T)	PF59
• 6.0L (VIN U)	PF59
• 6.6L (VIN 1)	P/N 97214983
• 8.1L (VIN G)	PF454
PCV Valve	
• 4.3L (VIN W)	CV769C
• 4.8L (VIN V)	CV948C
• 5.3L (VIN T)	CV948C
• 6.0L (VIN U)	CV948C
Spark Plugs and Gaps	
• 4.3L (VIN W)	PTJ16R15 (GAP 1.52 mm, 0.060 in)
• 4.8L (VIN V)	PTJ16R15 (GAP 1.52 mm, 0.060 in)
• 5.3L (VIN T)	PTJ16R15 (GAP 1.52 mm, 0.060 in)
• 6.0L (VIN U)	PTJ16R15 (GAP 1.52 mm, 0.060 in)
• 8.1L (VIN G)	TJ14R-P15 (GAP 1.52 mm, 0.060 in)
Fuel Filter	
• 4.3L (VIN W)	GF-626
• 4.8L (VIN V)	GF-626
• 5.3L (VIN T)	GF-626
• 6.0L (VIN U)	GF-626
• 8.1L (VIN G)	GF-626
Wiper Blades	P/N 15706394
Passenger Compartment Air Filter	P/N 52485513

Fluid and Lubricant Recommendations

Usage	Fluid/Lubricant
Automatic Transfer Case	Automatic transfer case fluid AUTO-TRAK II Fluid (GM P/N 12378508)
Automatic Transfer Case (Diesel Engine)	Automatic transfer case fluid (GM P/N 12378396)
Transfer Case (Pickup)	DEXRON®-III, Automatic Transmission Fluid
Automatic Transmission	DEXRON®-III, Automatic Transmission Fluid
Body Door Hinge Pins, Tailgate Hinge and Linkage, Folding Seat and Fuel Door Hinge	Multi-Purpose lubricant, Superlube® (GM P/N 12346241 or equivalent).
Chassis Lubrication	Chassis Lubricant (GM Part No. 12377985 or equivalent) or lubricant meeting requirements of NLGI # 2 Category LB or GC-LB.
Engine Coolant	50/50 mixture of clean drinkable water and use only GM Goodwrench® DEX-COOL® or Havoline® DEX-COOL® coolant.
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.
Floor Shift Linkage	Lubriplate ® Lubricant Aerosol (GM Part No. 12346293 or equivalent) or lubricant meeting requirements of NLGI # 2 Category LB or GC-LB.
Front Axle (S4WD)	SAE 80W-90 Axle Lubricant (GM P/N 1052271 or equivalent).
Front Axle (F4WD)	SAE 75W-90 Synthetic Axle Lubricant (GM part No. 12378261) or equivalent meeting GM Specification 9986115.
Front Axle Propshaft Spline or One-Piece Propshaft Spline (Two-Wheel Drive with Auto. Trans.)	Spline Lubricant, Special Lubricant (GM Part No. 12345879) or lubricant meeting requirements of GM 9985830.
Hood Hinges	Multi-Purpose lubricant, Superlube ® (GM Part No. 12346241 or equivalent).
Hood Latch Assembly, Secondary Latch, Pivots, Spring Anchor and Release Pawl	Lubriplate ® Lubricant Aerosol (GM Part No. 12346293 or equivalent) or lubricant meeting requirements of NLGI # 2, Category LB or GC-LB.
Hydraulic Brake System	Delco Supreme 11® Brake Fluid (GM P/N 12377967 or equivalent DOT-3 brake fluid).
Hydraulic Clutch System	Hydraulic Clutch Fluid (GM Part No. 12345347 or equivalent DOT-3 brake fluid).
Key Lock Cylinders	Multi-Purpose Lubricant, Superlube® (GM P/N 12346241 or equivalent).
Manual Transfer Case	DEXRON®-III Automatic Transmission Fluid
Manual Transmission (5-Speed with Low Gear, RPO MW3	GM Goodwrench Synthetic Manual Transmission Fluid (GM Part No. 12346190-1 qt.) or equivalent SAE 75W-85 GL-4 gear oil.
Manual Transmission (5-Speed without Low Gear, RPO MG5)	Synchromesh Transmission Fluid (GM Part No. 12345349 or equivalent).
Manual Transmission (6-Speed)	TransSynd ™ Synthetic Automatic Transmission Fluid (GM Par No. 12378515).
Outer Tailgate Handle Pivot Points	Multi-Purpose lubricant, Superlube® (GM P/N 12346241 or equivalent).

Parking Brake Cable Guides	Chassis Lubricant (GM Part No. 12377985 or equivalent) or lubricant meeting requiremetns of NLGI # 2, Category LB or GC-LB.
Power Steering System	GM Power Steering Fluid (GM P/N 1052884 - 1 pint, 1050017 - 1 quart, or equivalent).
Weatherstrip Conditioning	Dielectric Silicone Grease (GM P/N 12345579 or equivalent).
Windshield Washer Solvent	GM Optikleen ® Washer Solvent (GM Part No. 1051515) or equivalent.
Weatherstrip Squeaks	Synthetic Grease with Teflon, Superlube ® (GM Part No. 12371287 or equivalent).
Tailgate Handle Pivot Points, Hinges, Latch Bolt and Linkage	Multi-Purpose lubricant, Superlube® (GM P/N 12346241 or equivalent).
Rear Axle	SAE 75W-90 Synthetic Axle Lubricant, GM Part No. 12378261 (in Canada use Part No. 10953455) or equivalent meeting GM Specification 9986115.
Rear Driveline Center Spline	Chassis Lubricant (GM Par No. 12377985 or equivalent) or lubricant meeting requirements of NLGI # 2, Category LB or GC-LB.

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.

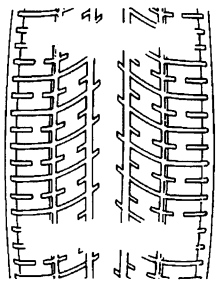
The following factors have an important influence on tire life:

- 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

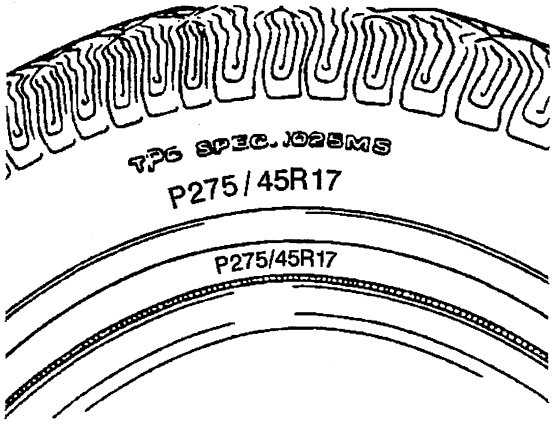
Replace the tires when one and/or all of the following conditions are evident:

- 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.

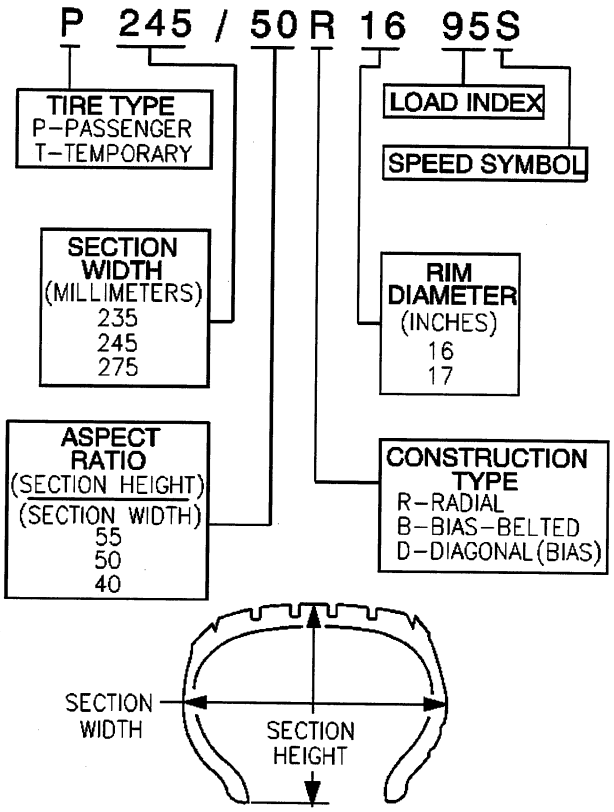
All Seasons Tires Description



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-NP (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 236/246-NP8 (Two Speed Automatic)

The NVG 236/246 transfer case features a 4 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.

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 sector 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 then ramped up to the front wheels until the front propshaft speed sensor matches that of the rear propshaft speed sensor. Torque is then ramped down until torque is completely removed from the front wheels or until rear wheel slip is once again detected. The process would then repeat.

The NVG 236/246 transfer case has the added feature of also providing the driver with 3 manual mode/gear 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/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 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 the rear axle rotating the transfer case main shaft and the transmission output shaft. Neutral position may be obtained only if the following criteria has been met:

- The key is ON.
- The automatic transmission is in Neutral, clutch depressed on manual transmissions.
- 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.

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

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).

The transfer case shift control module monitors front and rear propshaft speed as well as controlling the operation of the transfer case encoder motor assembly and the engaging and disengaging of the front axle.

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 of the transfer case. When activated it turns the sector shaft of the transfer case, clockwise or counterclockwise to shift the transfer case and to apply the clutch that applies the front propshaft. The encoder motor is controlled with a pulse width modulated (PWM) circuit provided by 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.

The transfer case encoder motor can be turned ON and OFF using a scan tool. You may also monitor Motor Control A and B circuits using a scan tool.

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 AUTO 4WD, 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.

Transfer Case Motor Lock

The transfer case motor lock is used to prevent the transfer case from changing mode/gear positions or popping out of position when the vehicle is in 2HI, 4HI, and 4LO. When the lock circuit is energized, the transfer case encoder motor is allowed to rotate. When the transfer case is placed 2HI, 4HI, or 4LO the motor lock circuit has no voltage provided to it, applying the lock which assures that the transfer case remains in the current mode/gear position. When AUTO 4WD is selected the motor lock remains applied until an adaptive mode, torque being applied to the front propshaft is required. During an adaptive mode the motor lock circuit is energized, the locking mechanism is released, enabling the encoder motor to turn and apply torque to the front propshaft.

The transfer case motor lock circuit can be turned ON and OFF using a scan tool. You may also monitor the lock circuit using a scan tool.

Transfer Case Speed Sensors

There are three speed sensors mounted on the transfer case, two on the rear output shaft and one on the front output shaft. Each 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.

Vehicle Speed Sensor

One of the two speed sensors on the rear output shaft is the vehicle speed sensor (VSS) 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.

Rear Propshaft Speed Sensor

The transfer case shift control module converts the pulsating AC voltage from the rear transfer case speed sensor to a rear propshaft speed in RPM to be used for calculations. The rear propshaft speed can be displayed with a scan tool.

Front Propshaft Speed Sensor

The transfer case shift control module converts the pulsating AC voltage from the front transfer case speed sensor to front propshaft speed in RPM to be used for calculations, and to monitor the difference between the front and rear sensor speed. It is also used in the AUTO 4WD mode to determine the amount of slip and the percent of torque to apply to the front axle. The front propshaft speed can be displayed with a scan tool.

SERVICE 4WD Indicator

The SERVICE 4WD message is displayed on the driver information center and is an integral part of the cluster and cannot be serviced separately. This message is used to inform the driver of the vehicle of malfunctions within the automatic transfer case (ATC) system. The SERVICE 4WD message is controlled by the transfer case shift control module via a Class 2 message.

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 Data		
• Engine Type	V6	
• RPO Code	L35/LU3	
• VIN Code	W	
• Displacement	4.3 L	262 CID
• Bore	101.60 mm	4.012 in
• Stroke	88.39 mm	3.480 in
• Compression Ratio	9.2:1	
• Firing Order	1-6-5-4-3-2	
• Spark Plug Gap	1.52 mm	0.060 in
• Oil Pressure - Min - at Normal Operating Temperature	42 kPa at 1,000 RPM 125 kPa at 2,000 RPM 166 kPa at 4,000 RPM	6 psig at 1,000 RPM 18 psig at 2,000 RPM 24 psig at 4,000 RPM
Balance Shaft		
• Rear Bearing Journal Clearance	0.050-0.088 mm	0.0020-0.0035 in
• Rear Bearing Journal Diameter	38.085-38.100 mm	1.4994-1.500 in
Camshaft		
• End Play	0.0254-0.2286 mm	0.0010-0.0090 in
• Journal Diameter	47.440-47.490 mm	1.8677-1.8696 in
• Journal Diameter Out-of-Round	0.025 mm - Max	0.0010 in - Max
• Lobe Lift - Exhaust	7.20-7.30 mm	0.283-0.287 in
• Lobe Lift - Intake	6.97-7.07 mm	0.274-0.278 in
• Runout	0.065 mm	0.0026 in
Connecting Rod		
• Connecting Rod Bearing Clearance - Production	0.038-0.078 mm	0.0015-0.0031 in
• Connecting Rod Bearing Clearance - Service	0.025-0.063 mm	0.0010-0.0025 in
• Connecting Rod Journal Diameter	57.116-57.148 mm	2.2487-2.2497 in
• Connecting Rod Journal Out-of-Round - Production	0.007 mm - Max	0.0002 in - Max
• Connecting Rod Journal Out-of-Round - Service	0.025 mm - Max	0.0010 in - Max
• Connecting Rod Journal Taper - Production	0.00508 mm - Max	0.00030 in - Max
• Connecting Rod Journal Taper - Service	0.025 mm - Max	0.0010 in - Max
• Connecting Rod Side Clearance	0.15-0.44 mm	0.006-0.017 in
Crankshaft		
• Crankshaft Bearing Clearance - Journal #1-Production	0.02-0.508 mm	0.0008-0.0020 in
• Crankshaft Bearing Clearance - Journal #2, #3, and #4-Production	0.028-0.058 mm	0.0011-0.0023 in
• Crankshaft Bearing Clearance - Journal #1-Service	0.0254-0.05 mm	0.0010-0.0020 in
• Crankshaft Bearing Clearance - Journal #2, #3, and #4-Service	0.025-0.063 mm	0.0010-0.0250 in
• Crankshaft End Play	0.050-0.20 mm	0.002-0.008 in
• Crankshaft Journal Diameter - Journal #1	62.199-62.217 mm	2.4488-2.4495 in

• Crankshaft Journal Diameter - Journal #2 and #3	62.191-62.215 mm	2.4485-2.4494 in
• Crankshaft Journal Diameter - Journal #4	62.179-62.203 mm	2.4480-2.4489 in
• Crankshaft Journal Out-of-Round - Production	0.005 mm - Max	0.0002 in - Max
• Crankshaft Journal Out-of-Round - Service	0.025 mm - Max	0.0010 in - Max
• Crankshaft Journal Taper - Production	0.007 mm - Max	0.0003 in - Max
• Crankshaft Runout	0.025 mm - Max	0.0010 in - Max
Cylinder Bore		
• Diameter	101.618-101.643 mm	4.0007-4.0017 in
• Out-of-Round - Production	0.0127 mm - Max	0.00050 in - Max
• Out-of-Round - Service	0.05 mm - Max	0.002 in - Max
• Taper - Production Relief Side	0.025 mm - Max	0.0010 in - Max
• Taper - Production Thrust Side	0.012 mm - Max	0.0005 in - Max
• Taper - Service	0.025 mm - Max	0.0010 in - Max
Cylinder Head		
• Surface Flatness	0.10 mm - Max	0.004 in - Max
Exhaust Manifold		
• Surface Flatness - Flange to Flange	0.25 mm - Max	0.010 in - Max
• Surface Flatness - Individual Flange	0.05 mm - Max	0.002 in - Max
Intake Manifold		
• Surface Flatness	0.10 mm - Max	0.004 in - Max
Oil Pan		
• Oil Pan Alignment at Rear of Engine Block	0.3 mm - Max	0.011 in - Max
Piston		
• Piston Bore Clearance - Production	0.018-0.061 mm	0.0007-0.0024 in
• Piston Bore Clearance - Service	0.075 mm - Max	0.0029 in - Max
Piston Pin		
• Clearance in Piston - Production	0.013-0.023 mm	0.0005-0.0009 in
• Clearance in Piston - Service	0.025 mm - Max	0.0010 in - Max
• Diameter	23.545-23.548 mm	0.9270-0.9271 in
• Fit in Connecting Rod	0.012-0.048 mm - Interference	0.0005-0.0019 in - Interference
Piston Rings - End Gap Measured in Cylinder Bore		
• Piston Compression Ring Gap - Production-Top Groove	0.25-0.40 mm	0.010-0.016 in
• Piston Compression Ring Gap - Production-2nd Groove	0.38-0.58 mm	0.015-0.023 in
• Piston Compression Ring Gap - Service-Top Groove	0.25-0.50 mm	0.010-0.020 in
• Piston Compression Ring Gap - Service-2nd Groove	0.38-0.80 mm	0.015-0.031 in
• Piston Compression Ring Groove Clearance - Production-Top Groove	0.030-0.070 mm	0.0012-0.0027 in
• Piston Compression Ring Groove Clearance - Production-2nd Groove	0.040-0.080 mm	0.0015-0.0031 in
• Piston Compression Ring Groove Clearance - Service	0.030-0.085 mm	0.0012-0.0033 in
• Piston Oil Ring Gap - Production	0.25-0.76 mm	0.010-0.029 in
• Piston Oil Ring Gap - Service	0.005-0.090 mm	0.0002-0.0035 in
• Piston Oil Ring Groove Clearance - Production	0.046-0.196 mm	0.0018-0.0077 in
• Piston Oil Ring Groove Clearance - Service	0.046-0.200 mm	0.0018-0.0079 in

Valve System		
• Valve Face Angle	45 degrees	
• Valve Head Edge Margin	0.79 mm - Min	0.031 in - Min
• Valve Lash	Net Lash--No Adjustment	
• Valve Lift - Exhaust	10.879 mm	0.4280 in
• Valve Lift - Intake	10.527 mm	0.4140 in
• Valve Lifter	Hydraulic Roller Type	
• Valve Rocker Arm	Roller Pivot Type	
• Valve Rocker Arm Ratio	1.5:1	
• Valve Seat Angle	46 degrees	
• Valve Seat Runout	0.05 mm - Max	0.002 in - Max
• Valve Seat Width - Exhaust	1.651-2.489 mm	0.065-0.098 in
• Valve Seat Width - Intake	1.016-1.651 mm	0.040-0.065 in
• Valve Spring Free Length	51.3 mm	2.02 in
• Valve Spring Installed Height - Exhaust	42.92-43.43 mm	1.670-1.700 in
• Valve Spring Installed Height - Intake	42.92-43.43 mm	1.670-1.700 in
• Valve Spring Pressure - Closed	338-374 N at 43.2 mm	76-84 lb at 1.70 in
• Valve Spring Pressure - Open	832-903 N at 32.3 mm	187-203 lb at 1.27 in
• Valve Stem Clearance - Exhaust-Production	0.025-0.069 mm	0.0010-0.0027 in
• Valve Stem Clearance - Exhaust-Service	0.025-0.094 mm	0.0010-0.0037 in
• Valve Stem Clearance - Intake-Production	0.025-0.069 mm	0.0010-0.0027 in
• Valve Stem Clearance - Intake-Service	0.025-0.094 mm	0.0010-0.0037 in
• Valve Stem Oil Seal Installed Height - Measured from the Top of the Large Diameter Valve Guide Bevel to the Bottom of the Valve Stem Oil Seal	1-2 mm	0.03937-0.07874 in

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accelerator Control Cable Bracket Nut 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
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
Camshaft Retainer Bolt	12 N·m	106 lb in
Camshaft Sprocket Bolt	25 N·m	18 lb ft
Crankshaft Balancer Bolt	95 N·m	70 lb ft
Crankshaft Pulley Bolt	58 N·m	43 lb ft
Crankshaft Rear Oil Seal Housing Bolt and Nut	12 N·m	106 lb in
Cylinder Head Bolt (Preferred Method)		
• All Bolts First Pass in Sequence	30 N·m	22 lb ft
• Long Bolts Final Pass in Sequence	75 degrees	
• Medium Bolts Final Pass in Sequence	65 degrees	
• Short Bolts Final Pass in Sequence	55 degrees	

Drive Belt Idler Pulley Bolt	50 N·m	37 lb ft
Drive Belt Tensioner Bolt	50 N·m	37 lb ft
EGR Valve Inlet Pipe Clamp Bolt	25 N·m	18 lb ft
EGR Valve Inlet Pipe Nut at Intake Manifold	25 N·m	18 lb ft
EGR Valve Inlet Pipe Nut at Exhaust Manifold	30 N·m	22 lb ft
Engine Coolant Temperature (ECT) Sensor	20 N·m	15 lb ft
Engine Flywheel Bolt	100 N·m	74 lb ft
Engine Front Cover Bolt	12 N·m	106 lb in
Engine Lift Bracket Bolt (Special Tool J 41427)	15 N·m	11 lb ft
Engine 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 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 Bolt to Rear Right Side Cylinder Head	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
Frame Cross Bar Bolt	100 N·m	74 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
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 Fitting	55 N·m	41 lb ft
Oil Level Indicator Tube 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
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
Transmission to Oil Pan Bolt	47 N·m	35 lb ft
Transmission Cover Bolt	12 N·m	106 lb in
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

Drive Belt System Description

The drive belt system consists of the following components:

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

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

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

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

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

Engine Mechanical – 4.8, 5.3, 6.0L

General Specifications 4.8L (LR4 VIN V)

Application	Specification	
	Metric	English
General Data		
• Engine Type	V8	
• Displacement	4.8L	293 CID
• Bore	96.000-96.018 mm	3.779-3.78 in
• Stroke	83.0 mm	3.268 in
• Compression Ratio	9.45:1	
• Firing Order	1-8-7-2-6-5-4-3	
• Spark Plug Gap	1.524 mm	0.06 in
Lubrication System		
• Oil Capacity (without Oil Filter Change)	4.73 Liters	5.0 Quarts
• Oil Capacity (with Oil Filter Change)	5.68 Liters	6.0 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 Type	5W-30	
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 Diameter Out-of-Round	0.025 mm	0.001 in
• Camshaft Lobe Lift (Intake)	6.82 mm	0.268 in
• Camshaft Lobe Lift (Exhaust)	6.96 mm	0.274 in
• Camshaft Runout (Measured at the Intermediate Journals)	0.05 mm	0.002 in
Connecting Rod		
• Connecting Rod Bearing Bore Diameter	56.505-56.525 mm	2.224-2.225 in
• Connecting Rod Bearing Bore Out-of-Round	0.004-0.008 mm	0.00015-0.0003 in
• Connecting Rod Bearing Clearance (Production)	0.023-0.065 mm	0.0009-0.0025 in
• Connecting Rod Bearing Clearance (Service Limit)	0.023-0.076 mm	0.0009-0.003 in
• Connecting Rod Side Clearance	0.11-0.51 mm	0.0043-0.02 in
Crankshaft		
• Crankshaft Bearing Clearance (Production)	0.020-0.052 mm	0.0008-0.0021 in
• Crankshaft Bearing Clearance (Service)	0.020-0.065 mm	0.0008-0.0025 in
• Crankshaft Connecting Rod Journal Diameter (Production)	53.318-53.338 mm	2.099-2.1 in
• Crankshaft Connecting Rod Journal Diameter (Service Limit)	53.308 mm (Minimum)	2.0987 in (Minimum)
• Crankshaft Connecting Rod Journal Taper (Production)	0.005 mm (Maximum for one half of the Journal Length)	0.0002 in (Maximum for one half of the Journal Length)
• Crankshaft Connecting Rod Journal Taper (Service Limit)	0.02 mm (Maximum)	0.00078 in (Maximum)

• Crankshaft Connecting Rod Journal Out-of-Round (Production)	0.005 mm	0.0002 in
• Crankshaft Connecting Rod Journal Out-of-Round (Service Limit)	0.01 mm	0.0004 in
• Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
• Crankshaft Main Journal Diameter (Production)	64.993-65.007 mm	2.558-2.5593 in
• Crankshaft Main Journal Diameter (Service Limit)	64.993 mm (Minimum)	2.558 in (Minimum)
• Crankshaft Main Journal Out-of-Round (Production)	0.003 mm	0.0001 in
• Crankshaft Main Journal Out-of-Round (Service Limit)	0.008 mm	0.0003 in
• Crankshaft Main Journal Taper (Production)	0.01 mm	0.0004 in
• Crankshaft Main Journal Taper (Service Limit)	0.02 mm	0.00078 in
• Crankshaft Reluctor Ring Runout (Measured 1.0 mm (0.04 in) Below the Tooth Diameter)	0.7 mm (Maximum)	0.028 in (Maximum)
• Crankshaft Runout (at Rear Flange)	0.05 mm (Maximum)	0.002 in (Maximum)
• Crankshaft Thrust Wall Runout	0.025 mm	0.001 in
• Crankshaft Thrust Wall Width (Production)	26.14-26.22 mm	1.029-1.032 in
• Crankshaft Thrust Wall Width (Service)	26.2 mm (Maximum)	1.0315 in (Maximum)
Cylinder Bore		
• Cylinder Bore Diameter (Production)	96.0-96.018 mm	3.779-3.78 in
Cylinder Head		
• Cylinder Head Engine Block Deck Flatness (Measured within a 152.4 mm (6.0 in) area)	0.08 mm	0.003 in
• Cylinder Head Engine Block Deck Flatness (Measuring the Overall Length of the Cylinder Head)	0.1 mm	0.004 in
• Cylinder Head Exhaust Manifold Deck Flatness	0.22 mm	0.008 in
• Cylinder Head Height (Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface)	120.2 mm (Minimum)	4.732 in (Minimum)
• Cylinder Head Intake Manifold Deck Flatness	0.22 mm	0.008 in
Engine 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
• Engine Block Cylinder Head Deck Surface Flatness (Measured within a 152.4 mm (6.0 in) area)	0.11 mm	0.004 in
• Engine Block Cylinder Head Deck Surface Flatness (Measuring the Overall Length of the Block Deck)	0.22 mm	0.008 in
• Engine Block Cylinder Head Deck Height (Measuring from the Centerline of Crankshaft to the Deck Face)	234.57-234.82 mm	9.235-9.245 in
• Main Bearing Bore Diameter (Production)	69.871-69.889 mm	2.750-2.751 in
• Main Bearing Bore Diameter Out-of-Round	0.005 mm	0.0002 in
• Valve Lifter Bore Diameter (Production)	21.417-21.443 mm	0.843-0.844 in

Intake Manifold		
• Intake Manifold Cylinder Head Deck Flatness (Measured within a 200 mm (7.87 in) Area that Includes Two Runner Port Openings)	3.0 mm	0.118 in
Oil Pan and Front/Rear Cover Alignment		
• Oil Pan to Rear of Engine Block Alignment (at Transmission Bellhousing Mounting Surface)	0.0-0.25 mm (Maximum)	0.0-0.01 in (Maximum)
• 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
Piston		
• Piston - Piston Diameter Measured Over Skirt Coating	96.002-96.036 mm	3.779-3.78 in
• Piston Out-of-Round Service Limit	0.018 mm	0.0007 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
Piston Pin		
• Piston Pin Clearance to Piston Bore (Production)	0.012-0.022 mm	0.00047-0.00086 in
• Piston Pin Clearance to Piston Bore (Service Limit)	0.012-0.024 mm (Maximum)	0.00047-0.00094 in (Maximum)
• Piston Pin Diameter	23.997-24.0 mm	0.9447-0.9448 in
• Piston Pin Fit in Connecting Rod	0.02-0.043 mm (Interference)	0.00078-0.00169 in (Interference)
Piston Rings		
• Piston Compression Ring End Gap (Production--Top) (Measured in Cylinder Bore)	0.23-0.38 mm	0.009-0.0149 in
• Piston Compression Ring End Gap (Production--2nd) (Measured in Cylinder Bore)	0.44-0.64 mm	0.0173-0.0251 in
• Piston Oil Ring End Gap (Production) (Measured in Cylinder Bore)	0.18-0.69 mm	0.0070-0.0271 in
• Piston Compression Ring End Gap (Service--Top) (Measured in Cylinder Bore)	0.3-0.45 mm (Maximum)	0.012-0.018 in (Maximum)
• Piston Compression Ring End Gap (Service--2nd) (Measured in Cylinder Bore)	0.51-0.71 mm (Maximum)	0.02-0.028 in (Maximum)
• Piston Oil Ring End Gap-Service Limit (Measured in Cylinder Bore)	0.25-0.76 mm (Maximum)	0.01-0.03 in (Maximum)
• Piston Compression Ring Groove Clearance (Production--Top)	0.04-0.085 mm	0.00157-0.003346 in
• Piston Compression Ring Groove Clearance (Production--2nd)	0.04-0.08 mm	0.00157-0.003149 in
• Piston Oil Ring Groove Clearance (Production)	0.01-0.22 mm	0.0004-0.00866 in
• Piston Compression Ring Groove Clearance (Service--Top)	0.04-0.085 mm (Maximum)	0.00157-0.003346 in (Maximum)
• Piston Compression Ring Groove Clearance (Service--2nd)	0.04-0.08 mm (Maximum)	0.00157-0.003149 in (Maximum)
• Piston Oil Ring Groove Clearance (Service Limit)	0.01-0.22 mm (Maximum)	0.0004-0.00866 in (Maximum)

Valve System		
• Valve Face Angle	45 degrees	
• Valve Guide Installed Height (Aluminum Head-Measured from the Cylinder Head Spring Seat Surface to the Top of the Valve Guide)	17.32 mm	0.682 in
• Valve Lash	Net Lash-No Adjustment	
• Valve Lift (Exhaust)	11.85 mm	0.466 in
• Valve Lift (Intake)	11.6 mm	0.457 in
• Valve Lifter	Hydraulic Roller	
• Valve Margin	1.25 mm	0.05 in
• Valve Rocker Arm Ratio	1.70:1	
• Valve Seat Angle	46 degrees	
• Valve Seat Runout	0.05 mm (Maximum)	0.002 in (Maximum)
• Valve Seat Width (Exhaust)	1.78 mm	0.07 in
• Valve Seat Width (Intake)	1.02 mm	0.04 in
• Valve Spring Free Length	52.9 mm	2.08 in
• Valve Spring Installed Height (Exhaust)	45.75 mm	1.8 in
• Valve Spring Installed Height (Intake)	45.75 mm	1.8 in
• Valve Spring Pressure (Closed)	340 N at 45.75 mm	76 lb at 1.8 in
• Valve Spring Pressure (Open)	980 N at 33.55 mm	220 lb at 1.32 in
• Valve Stem Clearance (Production--Exhaust)	0.025-0.066 mm	0.001-0.0026 in
• Valve Stem Clearance (Production--Intake)	0.025-0.066 mm	0.001-0.0026 in
• Valve Stem Clearance (Service--Exhaust)	0.093 mm (Maximum)	0.0037 in (Maximum)
• Valve Stem Clearance (Service--Intake)	0.093 mm (Maximum)	0.0037 in (Maximum)
• Valve Stem Diameter (Production)	7.955-7.976 mm	0.3132-0.314 in
• Valve Stem Diameter (Service)	7.95 mm (Minimum)	0.313 in (Minimum)
• Valve Stem Oil Seal Installed Height (Measured from the Valve Spring Shim to Top Edge of Seal Body - First Design Seal)	18.1-19.1 mm	0.712-0.752 in

General Specifications 5.3L (LM7 VIN T/L59 VIN Z)

Application	Specification	
	Metric	English
General Data		
• Engine Type	V8	
• Displacement	5.3L	325 CID
• Bore	96.000-96.018 mm	3.779-3.78 in
• Stroke	92.0 mm	3.622 in
• Compression Ratio	9.45:1	
• Firing Order	1-8-7-2-6-5-4-3	
• Spark Plug Gap	1.524 mm	0.06 in
Lubrication System		
• Oil Capacity (without Oil Filter Change)	4.73 Liters	5.0 Quarts
• Oil Capacity (with Oil Filter Change)	5.68 Liters	6.0 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 Type	5W-30	
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 Diameter Out-of-Round	0.025 mm	0.001 in
• Camshaft Lobe Lift (Intake)	6.82 mm	0.268 in
• Camshaft Lobe Lift (Exhaust)	6.96 mm	0.274 in
• Camshaft Runout (Measured at the Intermediate Journals)	0.05 mm	0.002 in
Connecting Rod		
• Connecting Rod Bearing Bore Diameter	56.505-56.525 mm	2.224-2.225 in
• Connecting Rod Bearing Bore Out-of-Round	0.004-0.008 mm	0.00015-0.0003 in
• Connecting Rod Bearing Clearance (Production)	0.023-0.065 mm	0.0009-0.0025 in
• Connecting Rod Bearing Clearance (Service Limit)	0.023-0.076 mm	0.0009-0.003 in
• Connecting Rod Side Clearance	0.11-0.51 mm	0.00433-0.02 in
Crankshaft		
• Crankshaft Bearing Clearance (Production)	0.020-0.052 mm	0.0008-0.0021 in
• Crankshaft Bearing Clearance (Service)	0.020-0.065 mm	0.0008-0.0025 in
• Crankshaft Connecting Rod Journal Diameter (Production)	53.318-53.338 mm	2.099-2.1 in
• Crankshaft Connecting Rod Journal Diameter (Service Limit)	53.308 mm (Minimum)	2.0987 in (Minimum)
• Crankshaft Connecting Rod Journal Taper (Production)	0.005 mm (Maximum for one half of the Journal Length)	0.0002 in (Maximum for one half of the Journal Length)
• Crankshaft Connecting Rod Journal Taper (Service Limit)	0.02 mm (Maximum)	0.00078 in (Maximum)
• Crankshaft Connecting Rod Journal Out-of-Round (Production)	0.005 mm	0.0002 in

• Crankshaft Connecting Rod Journal Out-of-Round (Service Limit)	0.01 mm	0.0004 in
• Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
• Crankshaft Main Journal Diameter (Production)	64.993-65.007 mm	2.558-2.5593 in
• Crankshaft Main Journal Diameter (Service Limit)	64.993 mm	2.558 in
• Crankshaft Main Journal Out-of-Round (Production)	0.003 mm	0.0001 in
• Crankshaft Main Journal Out-of-Round (Service Limit)	0.008 mm	0.0003 in
• Crankshaft Main Journal Taper (Production)	0.01 mm	0.0004 in
• Crankshaft Main Journal Taper (Service Limit)	0.02 mm	0.00078 in
• Crankshaft Reluctor Ring Runout (Measured 1.0 mm (0.04 in) Below the Tooth Diameter)	0.7 mm (Maximum)	0.028 in (Maximum)
• Crankshaft Runout (at Rear Flange)	0.05 mm (Maximum)	0.002 in (Maximum)
• Crankshaft Thrust Wall Runout	0.025 mm	0.001 in
• Crankshaft Thrust Wall Width (Production)	26.14-26.32 mm	1.029-1.032 in
• Crankshaft Thrust Wall Width (Service)	26.2 mm (Maximum)	1.0315 in (Maximum)
Cylinder Bore		
• Cylinder Bore Diameter (Production)	96.0-96.018 mm	3.779-3.78 in
Cylinder Head		
• Cylinder Head Engine Block Deck Flatness (Measured within a 152.4 mm (6.0 in) area)	0.08 mm	0.003 in
• Cylinder Head Engine Block Deck Flatness (Measuring the Overall Length of the Cylinder Head)	0.1 mm	0.004 in
• Cylinder Head Exhaust Manifold Deck Flatness	0.22 mm	0.008 in
• Cylinder Head Height (Measured from the Head Deck to the Valve Rocker Arm Cover Seal Surface)	120.2 mm	4.732 in
• Cylinder Head Intake Manifold Deck Flatness	0.22 mm	0.008 in
Engine 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
• Engine Block Cylinder Head Deck Surface Flatness (Measured within a 152.4 mm (6.0 in) area)	0.11 mm	0.004 in
• Engine Block Cylinder Head Deck Surface Flatness (Measuring the Overall Length of the Block Deck)	0.22 mm	0.008 in
• Engine Block Cylinder Head Deck Height (Measuring from the Centerline of Crankshaft to the Deck Face)	234.57-234.82 mm	9.235-9.245 in
• Main Bearing Bore Diameter (Production)	69.871-69.889 mm	2.750-2.751 in
• Main Bearing Bore Diameter Out-of-Round	0.005 mm	0.0002 in
• Valve Lifter Bore Diameter (Production)	21.417-21.443 mm	0.843-0.844 in
Intake Manifold		
• Intake Manifold Cylinder Head Deck Flatness (Measured within a 200 mm (7.87 in) Area that Includes Two Runner Port Openings)	0.3 mm	0.118 in

Oil Pan and Front/Rear Cover Alignment		
• Oil Pan to Rear of Engine Block Alignment (at Transmission Bellhousing Mounting Surface)	0.0-0.25 mm (Maximum)	0.0-0.01 in (Maximum)
• 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
Piston		
• Piston - Piston Diameter - Measured Over Skirt Coating	96.002-96.036 mm	3.779-3.78 in
• Piston Out-of-Round (Service Limit)	0.018 mm	0.0007 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
Piston Pin		
• Piston Pin Clearance to Piston Bore (Production)	0.012-0.022 mm	0.00047-0.00086 in
• Piston Pin Clearance to Piston Bore (Service Limit)	0.012-0.024 mm (Maximum)	0.00047-0.00094 in (Maximum)
• Piston Pin Diameter	23.997-24.0 mm	0.9447-0.9448 in
• Piston Pin Fit in Connecting Rod	0.02-0.043 mm (Interference)	0.00078-0.00169 in (Interference)
Piston Rings		
• Piston Compression Ring End Gap (Production--Top) (Measured in Cylinder Bore)	0.23-0.38 mm	0.009-0.0149 in
• Piston Compression Ring End Gap (Production--2nd) (Measured in Cylinder Bore)	0.44-0.64 mm	0.0173-0.0251 in
• Piston Oil Ring End Gap (Production) (Measured in Cylinder Bore)	0.18-0.69 mm	0.0070-0.0271 in
• Piston Compression Ring End Gap (Service--Top) (Measured in Cylinder Bore)	0.3-0.45 mm (Maximum)	0.012-0.018 in (Maximum)
• Piston Compression Ring End Gap (Service--2nd) (Measured in Cylinder Bore)	0.51-0.71 mm (Maximum)	0.02-0.028 in (Maximum)
• Piston Oil Ring End Gap-Service Limit (Measured in Cylinder Bore)	0.25-0.76 mm (Maximum)	0.01-0.03 in (Maximum)
• Piston Compression Ring Groove Clearance (Production--Top)	0.04-0.085 mm	0.00157-0.003346 in
• Piston Compression Ring Groove Clearance (Production--2nd)	0.04-0.08 mm	0.00157-0.003149 in
• Piston Oil Ring Groove Clearance (Production)	0.01-0.22 mm	0.0004-0.00866 in
• Piston Compression Ring Groove Clearance (Service--Top)	0.04-0.085 mm (Maximum)	0.00157-0.003346 in (Maximum)
• Piston Compression Ring Groove Clearance (Service--2nd)	0.04-0.08 mm (Maximum)	0.00157-0.003149 in (Maximum)
• Piston Oil Ring Groove Clearance (Service Limit)	0.01-0.22 mm (Maximum)	0.0004-0.00866 in (Maximum)
Valve System		
• Valve Face Angle	45 degrees	
• Valve Guide Installed Height (Measured from the Cylinder Head Spring Seat Surface to the Top of the Valve Guide)	17.32 mm	0.682 in
• Valve Lash	Net Lash - No Adjustment	
• Valve Lift (Exhaust)	11.85 mm	0.466 in
• Valve Lift (Intake)	11.6 mm	0.457 in

• Valve Lifter	Hydraulic Roller	
• Valve Margin	1.25 mm	0.05 in
• Valve Rocker Arm Ratio	1.70:1	
• Valve Seat Angle	46 degrees	
• Valve Seat Runout	0.05 mm (Maximum)	0.002 in (Maximum)
• Valve Seat Width (Exhaust)	1.78 mm	0.07 in
• Valve Seat Width (Intake)	1.02 mm	0.04 in
• Valve Spring Free Length	52.9 mm	2.08 in
• Valve Spring Installed Height (Exhaust)	45.75 mm	1.8 in
• Valve Spring Installed Height (Intake)	45.75 mm	1.8 in
• Valve Spring Pressure (Closed)	340 N at 45.75 mm	76 lb at 1.8 in
• Valve Spring Pressure (Open)	980 N at 33.55 mm	220 lb at 1.32 in
• Valve Stem Clearance (Production--Exhaust)	0.025-0.066 mm	0.001-0.0026 in
• Valve Stem Clearance (Production--Intake)	0.025-0.066 mm	0.001-0.0026 in
• Valve Stem Clearance (Service--Exhaust)	0.093 mm (Maximum)	0.0037 in (Maximum)
• Valve Stem Clearance (Service--Intake)	0.093 mm (Maximum)	0.0037 in (Maximum)
• Valve Stem Diameter (Production)	7.955-7.976 mm	0.3132-0.314 in
• Valve Stem Diameter (Service)	7.95 mm (Minimum)	0.313 in (Minimum)
• Valve Stem Oil Seal Installed Height (Measured from the Valve Spring Shim to Top Edge of Seal Body - First Design Seal)	18.1-19.1 mm	0.712-0.752 in

General Specifications 6.0L (LQ4 VIN U /LQ9 VIN N)

Application	Specification	
	Metric	English
General Data		
• Engine Type	V8	
• Displacement	6.0L	364 CID
• Bore	101.618-101.636 mm	4.0007-4.0014 in
• Stroke	92.0 mm	3.622 in
• Compression Ratio - LQ4 VIN U	9.40:1	
• Compression Ratio - LQ9 VIN N	10.0:1	
• Firing Order	1-8-7-2-6-5-4-3	
• Spark Plug Gap	1.524 mm	0.06 in
Lubrication System		
• Oil Capacity (without Oil Filter Change)	4.73 Liters	5.0 Quarts
• Oil Capacity (with Oil Filter Change)	5.68 Liters	6.0 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 Type	5W-30	
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 Diameter Out-of-Round	0.025 mm	0.001 in
• Camshaft Lobe Lift (Intake)	6.96 mm	0.274 in
• Camshaft Lobe Lift (Exhaust)	7.13 mm	0.281 in
• Camshaft Runout (Measured at the Intermediate Journals)	0.05 mm	0.002 in
Connecting Rod		
• Connecting Rod Bearing Bore Diameter	56.505-56.525 mm	2.224-2.225 in
• Connecting Rod Bearing Bore Out-of-Round - LQ4	0.004-0.008 mm	0.00015-0.0003 in
• Connecting Rod Bearing Bore Out-of-Round - LQ9	0.006 mm	0.00023 in
• Connecting Rod Bearing Clearance (Production)	0.023-0.065 mm	0.0009-0.0025 in
• Connecting Rod Bearing Clearance (Service Limit)	0.023-0.076 mm	0.0009-0.003 in
• Connecting Rod Side Clearance	0.11-0.51 mm	0.00433-0.02 in
Crankshaft		
• Crankshaft Bearing Clearance (Production)	0.020-0.052 mm	0.0008-0.0021 in
• Crankshaft Bearing Clearance (Service)	0.020-0.065 mm	0.0008-0.0025 in
• Crankshaft Connecting Rod Journal Diameter (Production)	53.318-53.338 mm	2.099-2.1 in
• Crankshaft Connecting Rod Journal Diameter (Service Limit)	53.308 mm (Minimum)	2.0987 in (Minimum)
• Crankshaft Connecting Rod Journal Taper (Production)	0.005 mm (Maximum for one half of the Journal Length)	0.0002 in (Maximum for one half of the Journal Length)

• Crankshaft Connecting Rod Journal Taper (Service Limit)	0.02 mm (Maximum)	0.00078 in (Maximum)
• Crankshaft Connecting Rod Journal Out-of-Round (Production)	0.005 mm	0.0002 in
• Crankshaft Connecting Rod Journal Out-of-Round (Service Limit)	0.01 mm	0.0004 in
• Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
• Crankshaft Main Journal Diameter (Production)	64.993-65.007 mm	2.558-2.5593 in
• Crankshaft Main Journal Diameter (Service Limit)	64.993 mm	2.558 in
• Crankshaft Main Journal Out-of-Round (Production)	0.003 mm	0.0001 in
• Crankshaft Main Journal Out of Round (Service Limit)	0.008 mm	0.0003 in
• Crankshaft Main Journal Taper (Production)	0.01 mm	0.0004 in
• Crankshaft Main Journal Taper (Service Limit)	0.02 mm	0.00078 in
• Crankshaft Reluctor Ring Runout (Measured 1.0 mm (0.04 in) Below the Tooth Diameter)	0.7 mm (Maximum)	0.028 in (Maximum)
• Crankshaft Runout (at Rear Flange)	0.05 mm (Maximum)	0.02 in (Maximum)
• Crankshaft Thrust Wall Runout	0.025 mm	0.001 in
• Crankshaft Thrust Wall Width (Production)	26.14-26.22 mm	1.029-1.0315 in
• Crankshaft Thrust Wall Width (Service)	26.2 mm (Maximum)	1.0315 in (Maximum)
Cylinder Bore		
• Cylinder Bore Diameter (Production)	101.618-101.636 mm	4.0007-4.0014 in
Cylinder Head		
• Cylinder Head Engine Block Deck Flatness (Measured within a 156 mm (6.1 in) area)	0.08 mm	0.003 in
• Cylinder Head Engine Block Deck Flatness (Measuring the Overall Length of the Cylinder Head)	0.1 mm	0.004 in
• Cylinder Head Exhaust Manifold Deck Flatness	0.13 mm	0.005 in
• Cylinder Head Height (Measured from the Head Deck to the Valve Rocker Arm Cover Seal Surface)	120.2 mm (Minimum)	4.732 in (Minimum)
• Cylinder Head Intake Manifold Deck Flatness	0.08 mm	0.003 in
Engine 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
• Engine Block Cylinder Head Deck Surface Flatness (Measured within a 156 mm (6.1 in) area)	0.11 mm	0.004 in
• Engine Block Cylinder Head Deck Surface Flatness (Measuring the Overall Length of the Block Deck)	0.22 mm	0.008 in
• Engine Block Cylinder Head Deck Height (Measuring from the Centerline of Crankshaft to the Head Deck)	234.57-234.82 mm	9.235-9.245 in
• Main Bearing Bore Diameter (Production)	69.871-69.889 mm	2.750-2.751 in
• Main Bearing Bore Diameter Out-of-Round	0.006 mm	0.0002 in
• Valve Lifter Bore Diameter (Production)	21.417-21.443 mm	0.843-0.844 in

Intake Manifold		
• Intake Manifold Cylinder Head Deck Flatness (Measured within a 200 mm Area that Includes Two Runner Port Openings)	0.3 mm	0.118 in
Oil Pan and Front/Rear Cover Alignment		
• Oil Pan to Rear of Engine Block Alignment (at Transmission Bellhousing Mounting Surface)	0.0-0.25 mm (Maximum)	0.0-0.01 in (Maximum)
• 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
Piston		
• Piston - Piston Diameter - LQ4 Measured Over Skirt Coating	101.606-101.640 mm	4.0002-4.0016 in
• Piston - Piston Diameter - LQ9 Measured Over Skirt Coating	101.611-101.642 mm	4.0-4.001 in
• Piston - Piston-to-Bore Clearance - LQ4 Production	-0.022 to +0.03 mm	-0.0009 to +0.0012 in
• Piston - Piston-to-Bore Clearance - LQ9 Production	-0.022 to +0.030 mm	-0.009 to +0.0012 in
• Piston - Piston-to-Bore Clearance - LQ4 Service Limit with Skirt Coating Worn Off	0.07 mm	0.0028 in
• Piston - Piston-to-Bore Clearance -LQ9 Service Limit with Skirt Coating Worn Off	0.08 mm	0.0031 in
Piston Pin		
• Piston Pin Diameter - Press Fit Pin	23.997-24.0 mm	0.9447-0.9448 in
• Piston Pin Diameter - Full-Floating Pin	23.952-23.955 mm	0.943-0.943 in
• Piston Pin Fit in Connecting Rod - Press Fit Pin	0.020-0.043 mm (Interference)	0.00078-0.00169 in (Interference)
• Piston Pin Fit in Connecting Rod - Full-Floating Pin Production	0.007-0.020 mm	0.00027-0.00078 in
• Piston Pin Fit in Connecting Rod - Full-Floating Pin Service Limit	0.007-0.022 mm	0.00027-0.00086 in
• Piston Pin to Piston Bore Clearance - LQ4 Production	0.007-0.020 mm	0.00027-0.00078 in
• Piston Pin to Piston Bore Clearance - LQ4 Service Limit	0.007-0.021 mm	0.00027-0.00082 in
• Piston Pin to Piston Bore Clearance - LQ9 Production Measured at Pin End	0.002-0.010 mm	0.00008-0.0004 in
• Piston Pin to Piston Bore Clearance - LQ9 Service Limit Measured at Pin End	0.002-0.015 mm	0.00008-0.0006 in
Piston Rings		
• Piston Compression Ring End Gap - LQ4 Production - Top Measured in Cylinder Bore	0.31-0.52 mm	0.0122-0.02 in
• Piston Compression Ring End Gap - LQ4 Production - 2nd Measured in Cylinder Bore	0.51-0.77 mm	0.02-0.03 in
• Piston Oil Ring End Gap - LQ4 Production Measured in Cylinder Bore	0.31-0.87 mm	0.0122-0.034 in
• Piston Compression Ring End Gap - LQ4 Service - Top Measured in Cylinder Bore	0.31-0.59 mm	0.0122-0.023 in
• Piston Compression Ring End Gap - LQ4 Service - 2nd Measured in Cylinder Bore	0.51-0.84 mm	0.02-0.033 in
• Piston Oil Ring End Gap - LQ4 Service Measured in Cylinder Bore	0.31-0.94 mm	0.0122-0.037 in

• Piston Compression Ring End Gap - LQ9 Production - Top Measured in Cylinder Bore	0.31-0.52 mm	0.0122-0.020 in
• Piston Compression Ring End Gap - LQ9 Production - 2nd Measured in Cylinder Bore	0.51-0.77 mm	0.020-0.030 in
• Piston Oil Ring End Gap - LQ9 Production Measured in Cylinder Bore	0.31-0.87 mm	0.0122-0.034 in
• Piston Compression Ring End Gap - LQ9 Service - Top Measured in Cylinder Bore	0.31-0.59 mm	0.0122-0.023 in
• Piston Compression Ring End Gap - LQ9 Service - 2nd Measured in Cylinder Bore	0.51-0.84 mm	0.020-0.033 in
• Piston Oil Ring End Gap - LQ9 Service Measured in Cylinder Bore	0.31-0.94 mm	0.0122-0.037 in
• Piston Compression Ring Groove Clearance - LQ4 Production - Top	0.04-0.08 mm	0.00157-0.0031 in
• Piston Compression Ring Groove Clearance - LQ4 Production - 2nd	0.039-0.079 mm	0.0015-0.0031 in
• Piston Oil Ring Groove Clearance - LQ4 Production	0.015-0.2 mm	0.0006-0.0079 in
• Piston Compression Ring Groove Clearance - LQ4 Service - Top	0.04-0.08 mm	0.00157-0.0031 in
• Piston Compression Ring Groove Clearance - LQ4 Service - 2nd	0.039-0.079 mm	0.0015-0.0031 in
• Piston Oil Ring Groove Clearance - LQ4 Service	0.015-0.2 mm	0.0006-0.0079 in
• Piston Compression Ring Groove Clearance - LQ9 Production - Top	0.035-0.080 mm	0.0014-0.0031 in
• Piston Compression Ring Groove Clearance - LQ9 Production - 2nd	0.034-0.079 mm	0.0013-0.0030 in
• Piston Oil Ring Groove Clearance - LQ9 Production	0.012-0.20 mm	0.00047-0.00078 in
• Piston Compression Ring Groove Clearance - LQ9 Service - Top	0.035-0.080 mm	0.0014-0.0031 in
• Piston Compression Ring Groove Clearance - LQ9 Service - 2nd	0.034-0.079 mm	0.0013-0.0030 in
• Piston Oil Ring Groove Clearance - LQ9 Service	0.012-0.20 mm	0.00047-0.0078 in
Valve System		
• Valve Face Angle	45 degrees	
• Valve Lash	Net Lash-No Adjustment	
• Valve Lift (Exhaust)	12.16 mm	0.479 in
• Valve Lift (Intake)	11.79 mm	0.464 in
• Valve Lifter	Hydraulic Roller	
• Valve Margin	1.25 mm	0.05 in
• Valve Rocker Arm Ratio	1.70:1	
• Valve Seat Angle	46 degrees	
• Valve Seat Runout	0.05 mm (Maximum)	0.002 in (Maximum)
• Valve Seat Width (Exhaust)	1.78 mm	0.07 in
• Valve Seat Width (Intake)	1.02 mm	0.04 in
• Valve Spring Free Length	52.9 mm	2.08 in
• Valve Spring Installed Height (Exhaust)	45.75 mm	1.8 in
• Valve Spring Installed Height (Intake)	45.75 mm	1.8 in
• Valve Spring Pressure (Closed)	340 N at 45.75 mm	76 lb at 1.8 in

• Valve Spring Pressure (Open)	980 N at 33.55 mm	220 lb at 1.32 in
• Valve Stem Clearance (Production--Exhaust)	0.025-0.066 mm	0.001-0.0026 in
• Valve Stem Clearance (Production--Intake)	0.025-0.066 mm	0.001-0.0026 in
• Valve Stem Clearance (Service--Exhaust)	0.093 mm (Maximum)	0.0037 in (Maximum)
• Valve Stem Clearance (Service--Intake)	0.093 mm (Maximum)	0.0037 in (Maximum)
• Valve Stem Diameter (Production--Exhaust)	7.955-7.976 mm	0.3132-0.314 in
• Valve Stem Diameter (Production--Intake)	7.955-7.976 mm	0.3132-0.314 in
• Valve Stem Diameter (Service--Exhaust)	7.95 mm (Minimum)	0.313 in (Minimum)
• Valve Stem Diameter (Service--Intake)	7.95 mm (Minimum)	0.313 in (Minimum)
• Valve Stem Oil Seal Installed Height (Measured from the Valve Spring Seat to Top Edge of Seal Body - First Design Seal)	18.1-19.1 mm	0.712-0.752 in

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accelerator Control Cable Bracket Bolt	10 N·m	89 lb in
Accessory Drive Belt Tensioner Bolt	50 N·m	37 lb ft
Air Conditioning (A/C) Belt Tensioner Bolt	50 N·m	37 lb ft
Automatic Transmission Oil Level Indicator Tube Nut	18 N·m	13 lb ft
Battery Cable Channel Bolt	12 N·m	106 lb in
Camshaft Retainer Bolt	25 N·m	18 lb ft
Camshaft Sensor Bolt	25 N·m	18 lb ft
Camshaft Sprocket Bolt	35 N·m	26 lb ft
Clutch Pressure Plate Bolt	70 N·m	52 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 Oil Deflector Nut	25 N·m	18 lb ft
Crossbar Bolt	100 N·m	74 lb ft
Cylinder Head Bolt (First Pass all M11 Bolts in Sequence)	30 N·m	22 lb ft
Cylinder Head Bolt (Second Pass all M11 Bolts in Sequence)	90 degrees	
Cylinder Head Bolt (Final Pass all M11 Bolts in Sequence-Excluding the Medium Length Bolts at the Front and Rear of Each Cylinder Head)	90 degrees	
Cylinder Head Bolt (Final Pass M11 Medium Length Bolts at the Front and Rear of Each Cylinder Head in Sequence)	50 degrees	
Cylinder Head Bolt (M8 Inner Bolts in Sequence)	30 N·m	22 lb ft
Drive Belt Idler Pulley Bolt	50 N·m	37 lb ft
Engine Flywheel Bolt (First Pass)	20 N·m	15 lb ft
Engine Flywheel Bolt (Second Pass)	50 N·m	37 lb ft
Engine Flywheel Bolt (Final Pass)	100 N·m	74 lb ft
Engine Front Cover Bolt	25 N·m	18 lb ft
Engine Mount Bolt	50 N·m	37 lb ft
Engine Mount Bracket Bolt	75 N·m	55 lb ft
Engine Mount-to-Engine Mount Bracket Bolt	50 N·m	37 lb ft
Engine Rear Cover Bolt	25 N·m	18 lb ft
Engine Service Lift Bracket (M10 Bolt)	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 Sight Shield Bolt (4.8 L, 5.3 L, and 6.0 L without RPO's Y91 and Z88)	10 N·m	89 lb in
Engine Sight Shield Bolt (6.0 L with RPO's Y91 and Z88)	9 N·m	80 lb in
Engine Sight Shield Retainer Bolt	5 N·m	44 lb in
Engine Wiring Harness Bracket Nut	5 N·m	44 lb in
Engine Valley Cover Bolt	25 N·m	18 lb ft
EGR Valve Pipe-to-Cylinder Head Bolt	50 N·m	37 lb ft
EGR Valve Pipe-to-Exhaust Manifold Bolt	30 N·m	22 lb ft
EGR Valve Pipe-to-Intake Manifold Bolt	10 N·m	89 lb in
Evaporative Emission (EVAP) Purge Solenoid Bolt	10 N·m	89 lb in
Fuel Rail Cover Bolt	9 N·m	80 lb in
Generator Bracket Bolt	50 N·m	37 lb ft

Generator Output Terminal Nut	9 N·m	80 lb in
Harness Ground Bolt	25 N·m	18 lb ft
Harness Ground Bolt (ar Rear of Block)	16 N·m	12 lb ft
Hood Hinge Bolt	25 N·m	18 lb ft
Ignition Coil Bracket Stud	12 N·m	106 lb in
Intake Manifold Bolt (First Pass in Sequence)	5 N·m	44 lb in
Intake Manifold Bolt (Final Pass in Sequence)	10 N·m	89 lb in
Knock Sensor	20 N·m	15 lb ft
Oil Filter	30 N·m	22 lb ft
Oil Level Indicator Tube Bolt	25 N·m	18 lb ft
Oil Level Sensor	13 N·m	115 lb in
Oil Pan Drain Plug	25 N·m	18 lb ft
Oil Pan Bolt	25 N·m	18 lb ft
Oil Pan (to Front Cover)	25 N·m	18 lb ft
Oil Pan (to Rear Cover)	12 N·m	106 lb in
Oil Pan Skid Plate Bolt	20 N·m	15 lb ft
Oil Pump Bolt	25 N·m	18 lb ft
Oil Pump Screen Nut	25 N·m	18 lb ft
Oil Pump Screen 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
Secondary Air Injection (AIR) Pipe Bolt	25 N·m	18 lb ft
Spark Plug	15 N·m	11 lb ft
Transmission Bolt/Stud	50 N·m	37 lb ft
Transmission Cover Bolt	12 N·m	106 lb in
Valve Lifter Guide Bolt	12 N·m	106 lb in
Valve Rocker Arm Bolt	30 N·m	22 lb ft
Valve Rocker Arm Cover Bolt	12 N·m	106 lb in

Drive Belt System Description

See Drive Belt System Description above.

Engine Mechanical –6.6L Diesel

Engine Mechanical Specifications

Application	Specification	
	Metric	English
General		
• Engine Type	90 degree V-8	
• Displacement	6.6 Liter	403 cu in
• Idle Speed	600 RPM	
• Compression Ratio	17.5	
• Compression Pressure (Production)	2069 KPa	300 psi
• Fuel Injection	High Pressurized Direct Injection	
• Maximum Pressure	23,206 psi	
• Air Intake System	Turbocharged, Charge Air Cooled	
• Firing Order	1-2-7-8-4-5-6-3	
• Oil Pump, Type	Gear	
• Oil Pressure	294 KPA, 42 PSI @ 1800 RPM	
• Oil Pressure @ Engine Operating Temperature	98 KPA, 14 PSI @ Idle	
• Oil Capacity	9.5 L (w/Filter Change), 8.7 L (w/o Filter Change)	
• Oil Filter Type	Full-Flow Throwaway Type	

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Air Cleaner Outlet Duct Clamp	6 N·m	53 lb in
Air Condition (A/C) Compressor Bolt	50 N·m	37 lb ft
Auxiliary Generator Bolt	50 N·m	37 lb ft
Auxiliary Generator Mounting Bracket Bolt	50 N·m	37 lb ft
Auxiliary Negative Battery Cable to Engine Bolt	34 N·m	25 lb ft
Battery Cable Bracket to Lower Crankcase Nut	8 N·m	71 lb in
Battery Cable Channel Retainer to Lower Crankcase Bolts	12 N·m	106 lb in
Battery Positive Cable Junction Block Bracket Bolt	9 N·m	80 lb in
Bypass Pipe to Water Pump 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 Reluctor Bolt	9 N·m	80 lb in
Camshaft Thrust Plate Bolt	26 N·m	19 lb ft
Charged Air Cooler Bolts	21 N·m	15 lb ft
Charged Air Cooler Duct Hose Clamps	6 N·m	53 lb in
Clutch Bolts	40 N·m	30 lb ft
Coolant Duct to Flywheel Housing Nuts	21 N·m	15 lb ft
Coolant Duct to Oil Cooler Bolts	21 N·m	15 lb ft
Cooling Fan Pulley Bolts	41 N·m	30 lb ft
Crankshaft Reluctor Bolt	8 N·m	71 lb in
Crankshaft Balancer Bolt	363 N·m	278 lb ft
Crankshaft Position Sensor Bolt	10 N·m	89 lb in
Crankshaft Position Sensor Spacer Bolt	10 N·m	89 lb in
Crossbar Bolts	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 150 degrees	3rd Step 150 degrees
Cylinder Head M8 Bolt	25 N·m	18 lb ft
Drive Belt Tensioner Bolt	41 N·m	30 lb ft
Engine Block Coolant Drain Plug	18 N·m	13 lb ft
Engine Coolant Heater Screw	2 N·m	18 lb ft
Engine Coolant Temperature (ECT) Sensor	33 N·m	24 lb ft
Engine Front Cover Bolt to Engine Block	21 N·m	15 lb ft
Engine Mount to Engine Bolts	58 N·m	43 lb ft
Engine Mount to Engine Mount Frame Bracket Bolts	65 N·m	50 lb ft
Engine Mount Frame Bracket to Frame Through-Bolts	75 N·m	55 lb ft
Engine Protection Shield Bolts	20 N·m	15 lb ft
Engine Oil Level Sensor Bolt	9 N·m	80 lb in
Engine Wiring Harness Ground Wire Bolt	34 N·m	25 lb ft
Engine Wiring Harness Retainer to Generator Mounting Bracket Bolt	21 N·m	15 lb ft
Engine Wiring Harness Bracket to Thermostat Housing Crossover Bolt	8 N·m	71 lb in
Exhaust Heat Shield at Dash Panel Nuts	9 N·m	80 lb in
Exhaust Manifold Bolt/Nut	34 N·m	25 lb ft
Exhaust Manifold Pipe Clamp	40 N·m	30 lb ft
Exhaust Manifold Heat Shield Bolts	8 N·m	71 lb in
Exhaust Outlet Bolt/Nut	53 N·m	39 lb ft
Exhaust Outlet Heat Shield Bolts	8 N·m	71 lb in
Exhaust Outlet to Exhaust Manifold Pipe Clamp	40 N·m	30 lb ft
Exhaust Pipe Bolts	53 N·m	39 lb ft
Exhaust Pipe Heat Shield Bolts	8 N·m	71 lb in
Flywheel Bolt (Angular Tightening Method)	1st Step 78 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 to Engine Block Bolt (Black Circle Mark)	97 N·m	72 lb ft
Flywheel Housing to Upper Oil Pan Bolt (Black Triangle Mark)	50 N·m	37 lb ft
Fuel Filter Bracket Bolt	21 N·m	15 lb ft
Fuel Hose Bracket to Valve Rocker Arm Cover Nut	21 N·m	15 lb ft
Fuel Injector Control Module Wiring Harness Connector Bolt	10 N·m	89 lb in
Fuel Injector Control Module Wiring Harness Connector Bracket Bolt	21 N·m	15 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)	15 N·m	133 lb in
Fuel Return Pipe Eye Bolt (Injector Side)	15 N·m	133 lb in
Fuel Supply Pump Assembly to Cylinder Block Bolt	21 N·m	15 lb ft
Generator Bolt	50 N·m	37 lb ft
Generator Mounting 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 Relay Bracket Bolt	21 N·m	15 lb ft
Ground Strap Bolt to Left Cylinder Head	25 N·m	18 lb ft

Hood Hinge Bolts	25 N·m	18 lb ft
Inlet Heater Pipe to Thermostat Housing Crossover Bolt	21 N·m	15 lb ft
Inlet Heater Pipe Bracket to Fuel Filter bolt	21 N·m	15 lb ft
Idler Pulley Bolt (All)	43 N·m	32 lb ft
Injector Bracket Bolt	50 N·m	37 lb ft
Injector Harness Bracket Bolt	9 N·m	80 lb in
Injector Harness Nut	3 N·m	26 lb in
Intake Heater	50 N·m	37 lb ft
Intake Heater Relay Terminal Nut	21 N·m	16 lb ft
Intake 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
Lower Oil Pan Bolts/Nuts	10 N·m	89 lb in
Lower Valve Rocker Arm Cover	10 N·m	89 lb in

Drive Belt System Description

See Drive Belt System Description above.

Engine Mechanical – 8.1L

General Specifications

Application	Specification	
	Metric	English
General Data		
• Engine Type	V8	
• Regular Production Option (RPO)	L18	
• Displacement	8.1 Liter	496 CID
• 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	
Lubrication System		
Oil Filter Type	PF454	
Oil Type	5W-30	
Oil Capacity		
• With Filter Change	6.1 Liters	6.5 Quarts
• Without Filter Change	5.7 Liters	6.0 Quarts
Oil Pressure - Hot		
• Minimum	34 kPa @ 1,000 RPM	5 psi @ 1,000 RPM
• Minimum	69 kPa @ 2,000 RPM	10 psi @ 2,000 RPM

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 (CMP) Sensor Bolt	12 N·m	106 lb in
Camshaft Retainer Bolt	12 N·m	106 lb in
Camshaft Sprocket Bolt		
• First Pass	30 N·m	22 lb ft
• Final Pass	30 N·m	22 lb ft
Crankshaft Balancer Bolt	255 N·m	189 lb ft
Crankshaft Oil Deflector Nut	50 N·m	37 lb ft
Crossbar Bolt	100 N·m	74 lb ft
Cylinder Head Bolt		
• First Pass	30 N·m	22 lb ft
• Second Pass	30 N·m + additional 120 degrees	22 lb ft + additional 120 degrees
• Final Pass		
• Bolts 1, 2, 3, 6, 7, 8, 9, 10, 11, 14, 16, and 17	+ additional 60 degrees	
• Bolts 15 and 18	+ additional 45 degrees	
• Bolts 4, 5, 12, and 13	+ additional 30 degrees	
Drive Belt Idler Pulley Bolt	50 N·m	37 lb ft
Engine Coolant Temperature (ECT) Sensor Bracket Bolt	50 N·m	37 lb ft
Engine Coolant Temperature (ECT) Sensor	20 N·m	15 lb ft

Engine Front Cover Bolt		
• First Pass	6 N·m	53 lb in
• Final Pass	12 N·m	106 lb in
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 Bracket Through Bolt	75 N·m	55 lb ft
Engine Mount-to-Engine Bolt	50 N·m	37 lb ft
Engine Mount-to-Engine Mount Bracket Bolt	65 N·m	48 lb ft
Engine Shield Bolt	20 N·m	15 lb ft
Engine Wiring Harness Bolt	16 N·m	12 lb ft
Exhaust Gas Recirculation (EGR) Pipe Bolt	30 N·m	22 lb ft
Fuel Rail Stud	12 N·m	106 lb in
Flywheel Bolt		
• First Pass	80 N·m	59 lb ft
• Final Pass	100 N·m	74 lb ft
Heater Hose Bracket Bolt	50 N·m	37 lb ft
Hood Hinge Bolt	25 N·m	18 lb ft
Ignition Coil Harness Bolt	12 N·m	106 lb in
Intake Manifold Bolt		
• First Pass	5 N·m	44 lb in
• Second Pass	5 N·m	44 lb in
• Third Pass	10 N·m	89 lb in
• Final Pass	12 N·m	106 lb in
Intake Manifold Sight Shield Bolt	10 N·m	89 lb in
Intake Manifold Sight Shield Bracket Nut	5 N·m	44 lb in
J 42847 Flywheel Holding Tool Bolt	50 N·m	37 lb ft
Lift Bracket Bolt	40 N·m	30 lb ft
Oil Filter Fitting	66 N·m	49 lb ft
Oil Level Indicator Tube Nut	18 N·m	13 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 Pump Bolt	75 N·m	56 lb ft
Oil Pump Drive Bolt	25 N·m	18 lb ft
Power Steering Pump Bracket Bolt/Nut	50 N·m	37 lb ft
Secondary Air Injection (AIR) Pipe Bolt	25 N·m	18 lb ft
Secondary Air Injection Pump Pipe Bolt	50 N·m	37 lb ft
Secondary Air Injection Pipe Nut	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	25 N·m	18 lb ft
Valve Rocker Arm Stud	50 N·m	37 lb ft

Drive Belt System Description

See Drive Belt System Description above.

Engine Cooling

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Air Cleaner Outlet Duct Clamp (6.6L Engine)	6 N·m	53 lb in
Air Cleaner Outlet Duct Clamp Screw (4.8L, 5.3L, and 6.0L Engines)	7 N·m	62 lb in
Air Cleaner Outlet Duct Wingnut (4.3L Engine)	3 N·m	27 lb in
Air Conditioning (A/C) Compressor Mounting Bolt (6.6L Engine)	50 N·m	37 lb ft
Bypass Pipe to Water Pump Bolt (6.6L Engine)	21 N·m	16 lb ft
Charged Air Cooler Duct Clamp (6.6L Engine)	6 N·m	53 lb in
Coolant Air Bleed Pipe Stud/Bolt (4.8L, 5.3L, and 6.0L Engines)	12 N·m	106 lb in
Coolant Crossover Bolt (8.1L Engine)	50 N·m	37 lb ft
Cooling Fan Pulley/Nut (6.6L Engine)	41 N·m	30 lb ft
Coolant Heater Bolt (6.6L Engine)	2 N·m	18 lb in)
Coolant Heater Cord Bolt	8 N·m	71 lb in
Coolant Heater Bolt (4.3L Engine)	2 N·m	18 lb in
Coolant Heater (4.8L, 5.3L, 6.0L, and 8.1L Engines)	50 N·m	37 lb ft
Engine Block Coolant Drain Plug (4.3L Engine)	20 N·m	15 lb ft
Engine Block Coolant Drain Plug (4.8L, 5.3L, 6.0L, and 8.1L Engines)	60 N·m	44 lb ft
Engine Block Coolant Drain Plug (6.6L Engine)	18 N·m	13 lb ft
Engine Coolant Temperature Sensor (6.6L Engine)	33 N·m	24 lb ft
Fan Clutch Bolt	23 N·m	17 lb ft
Fan Clutch Nut	56 N·m	41 lb ft
Fan Shroud Bolt	9 N·m	80 lb in
Fan and Water Pump Pulley Bolt (4.3L Engine)	25 N·m	18 lb ft
Generator Mounting Bracket Bolt (6.6L Engine)	50 N·m	37 lb ft
Generator Positive Cable Nut (6.6L Engine)	9 N·m	80 lb in)
Heater Pipe Bolt (6.6L Engine)	21 N·m	16 lb ft
Heater Pipe Bracket Bolt (6.6L Engine)	21 N·m	16 lb ft
Idler Pulley Bolt (6.6L Engine)	37 N·m	27 lb ft
Junction Block Bracket Bolt (6.6L Engine)	9 N·m	80 lb in)
Oil Cooler Hose Adapter Bolt (6.0L Engine)	12 N·m	106 lb in
Oil Cooler Hose Bracket Bolt (6.0L Engine)	25 N·m	18 lb ft
Positive Crankcase Ventilation (PCV) Oil Separator Bracket Nut (6.6L Engine)	21 N·m	16 lb ft
Power Steering Pump Mounting Bracket Bolt (6.6L Engine)	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 Cover Bolt (6.6L Engine)	21 N·m	16 lb ft
Thermostat Housing Bolt (4.8L, 5.3L, and 6.0L Engines)	15 N·m	11 lb ft
Thermostat Housing Bolt (8.1L Engine)	37 N·m	27 lb ft
Thermostat Housing Crossover Bolt (6.6L Engine)	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 Engine)	60 N·m	44 lb ft
Turbocharger Outlet Coolant Pipe Bracket Bolt (6.6L Engine)	21 N·m	16 lb ft
Turbocharger Outlet Coolant Pipe Nut (6.6L Engine)	21 N·m	16 lb ft
Upper Intake Manifold Sight Shield Bolt (6.6L Engine)	9 N·m	80 lb in
Water Outlet Bolt (8.1L Engine)	30 N·m	22 lb ft
Water Outlet Stud (4.3L Engine)	25 N·m	18 lb ft
Water Outlet Tube to Water Outlet Bolt (6.6L Engine)	21 N·m	16 lb ft
Water Outlet Tube to Valve Rocker Arm Cover Bolt (6.6L Engine)	21 N·m	16 lb ft

Water Pump Bolt (4.3L Engine)	45 N·m	33 lb ft
Water Pump Bolt (First Pass) (4.8L, 5.3L, and 6.0L Engines)	15 N·m	11 lb ft
Water Pump Bolt (Final Pass) (4.8L, 5.3L, and 6.0L Engines)	30 N·m	22 lb ft)
Water Pump Bolt (6.6L Engine)	21 N·m	16 lb ft
Water Pump Bolt (8.1L Engine)	50 N·m	37 lb ft
Water Pump to Water Pump Housing Bolt (6.6L Engine)	21 N·m	16 lb ft
Water Pump to Water Pump Outlet Pipe Nuts (6.6L Engine)	21 N·m	16 lb ft
Wiring Harness Bracket Bolt (6.6L Engine)	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 Generator Bolt (6.6 L Engine)	50 N·m	37 lb ft
Auxiliary Generator Bracket Bolt (6.6 L Engine)	50 N·m	37 lb ft
Auxiliary Negative Battery Cable Bolt	17 N·m	13 lb ft
Auxiliary Negative Battery Cable Bolt (6.6 L Engine)	16 N·m	12 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 Junction Block Bracket Bolt	9 N·m	80 lb in
Battery Cable Retainer Nut (6.6 L Engine)	8 N·m	71 lb in
Battery Hold Down Retainer Bolt	25 N·m	18 lb ft
Battery Positive Cable Nut (8.1 L Engine)	10 N·m	89 lb in
Battery Terminal Nut (8.1 L Engine)	8 N·m	71 lb in
Battery Tray Bolt	9 N·m	80 lb in
Battery Tray Nut	25 N·m	18 lb ft
Engine Harness Ground Nut (8.1 L Engine)	3.4 N·m	30 lb in
Engine Wiring Harness Auxiliary Negative Battery Cable Bolt	16 N·m	12 lb ft
Engine Wiring Harness Ground Bolt	16 N·m	12 lb ft
Engine Wiring Harness Ground/Negative Cable Bolt	25 N·m	18 lb ft
Engine Wiring Warness Ground/Negative Cable Bolt to Engine (6.6 L Engine)	34 N·m	25 lb ft
Front Axle Mounting Bracket Nut	95 N·m	70 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
Generator Bracket Bolt (4.8 L, 5.3 L, and 6.0 L Engines)	50 N·m	37 lb ft
Generator Bracket Bolt/Nut (8.1 L Engine)	50 N·m	37 lb ft
Generator Bracket Stud (8.1 L Engine)	20 N·m	15 lb ft
Generator Bolt (4.8 L, 5.3 L, 6.0 L, 6.6 L, and 8.1 L, Engines)	50 N·m	37 lb ft
Generator Cable Nut	9 N·m	80 lb in
Generator Mounting Bolt (Right and Rear) (4.3 L Engine)	25 N·m	18 lb ft
Generator Mounting Bolt (Left) (4.3 L Engine)	50 N·m	37 lb ft
Generator Mounting Bracket Bolt/Nut (4.3 L Engine)	41 N·m	30 lb ft
Ground Strap Nut	9 N·m	80 lb in
Heater Hose Bracket Bolt (4.3 L Engine)	25 N·m	18 lb ft
Ignition Switch Wires to Solenoid (8.1 L Engine)	2 N·m	18 lb in
Negative Battery Cable Bolt	17 N·m	13 lb ft
Negative Battery Cable to Block Bolt (4.3 L Engine)	16 N·m	12 lb ft
Negative Battery Cable to Frame (4.3 L Engine)	9 N·m	80 lb in
Positive Battery Cable Bolt	17 N·m	13 lb ft
Positive Battery Cable Nut (6.6 L and 8.1 L Engine)	9 N·m	80 lb in
Positive Battery Cable to Engine Bolt (4.3 L Engine)	12 N·m	106 lb in
Positive Battery Cable to Engine Wiring Harness Junction Block Bolt (4.3 L Engine)	9 N·m	80 lb in
Positive Battery Cable to Generator Nut (4.3 L Engine)	18 N·m	13 lb ft
Positive Battery Cable to Starter Nut (4.3 L Engine)	16 N·m	12 lb ft

Positive Cable Clip Nut (8.1 L Engine)	8 N·m	71 lb in).
Positive Cable at Underhood Bussed Electrical Center (UBEC) Bolt	9 N·m	80 lb in
Starter Battery Positive Cable Nut (6.6 L Engine)	9 N·m	80 lb in
Starter Bolt (4.3 L)	43 N·m	32 lb ft
Starter Bolt (4.8 L, 5.3 L, 6.0 L, and 8.1 L Engines)	50 N·m	37 lb ft
Starter Bolt (6.6 L Engine)	78 N·m	58 lb ft
Starter Heat Shield Bolt (8.1 L Engine)	3 N·m	35 lb in
Starter Heat Shield Nut (8.1 L Engine)	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	9 N·m	80 lb in
Wiring Harness Bracket Bolt (4.3 L Engine)	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

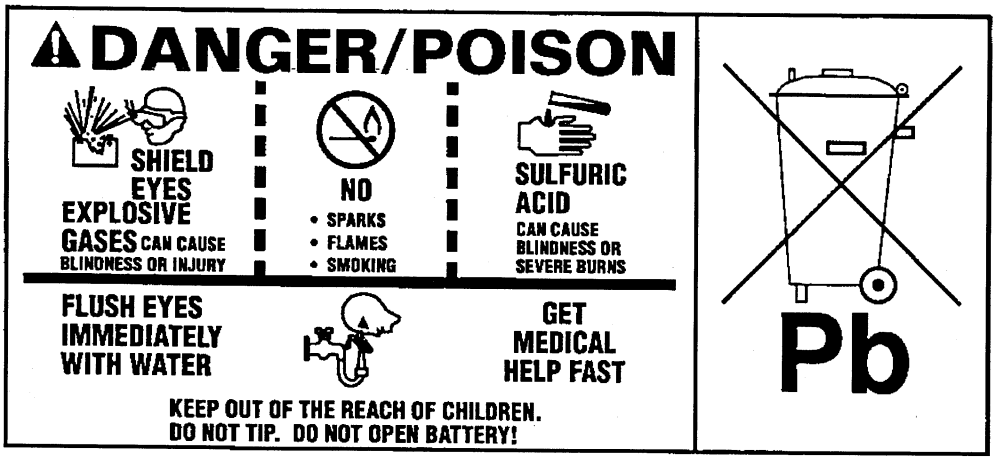
Base	
Generator Model	Delphi AD230
Rated Output	102 A
Load Test Output	71 A
Optional (Dual)	
Generator Model	Delphi AD244
Rated Output	130 A
Load Test Output	91 A
Bosch® Generator	
Generator Model	Bosch® 15755900
Rated Output	130 A
Load Test Output	91 A

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.

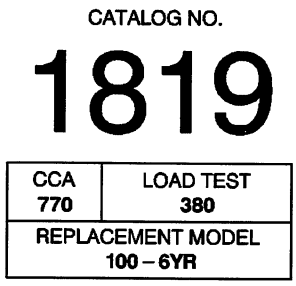
The battery has three functions as a major source of energy:

- 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 Bolt	25 N·m	18 lb ft
Accelerator Cable Bracket Nut	12 N·m	106 lb in
Accelerator Cable Routing Bracket Nut	9 N·m	80 lb in
Air Cleaner Outlet Duct Nut	2.5 N·m	22 lb in
Air Duct Adapter Stud	8 N·m	70 lb in
Camshaft Position (CMP) Sensor Screws	2.2 N·m	20 lb in
Coolant Hose Nipple	17 N·m	13 lb ft
Crankshaft Position (CKP) Sensor Mounting Bolt	9 N·m	80 lb in
Distributor 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
Exhaust Gas Recirculation (EGR) Pipe Bracket Retainer Fastener	25 N·m	18 lb ft
EGR Pipe Fitting-Exhaust Manifold	30 N·m	22 lb ft
EGR Pipe Fitting-Intake Manifold	25 N·m	18 lb ft
EGR Valve Attaching Bolts First Tighten	10 N·m	89 lb in
EGR Valve Attaching Bolts Second Tighten	25 N·m	18 lb ft
Evaporative Emission (EVAP) Canister Bracket Bolt	25 N·m	18 lb ft
EVAP Canister Purge Valve Mounting Nuts	12 N·m	106 lb in
EVAP Canister Retainer Attaching Bolt	10 N·m	89 lb in
EVAP Canister Vent Valve Bracket Mount Bolt	12 N·m	106 lb in
Fuel Feed and Return Pipes Fittings	28 N·m	21 lb ft
Fuel Fill Hose Clamp	25 N·m	18 lb ft
Fuel Fill Pipe Ground Strap Bolts	9 N·m	80 lb in
Fuel Fill Pipe Housing Screws	2.3 N·m	20 lb in
Fuel Fill Vent Hose Clamp	2.5 N·m	22 lb in
Fuel Filter Fittings	25 N·m	18 lb ft
Fuel Hose Engine Compartment	28 N·m	21 lb ft
Fuel Pipe Clip Bolt	6 N·m	53 lb in
Fuel Pipe Clip Nut	25 N·m	18 lb ft
Fuel Pipe Attaching Nuts	27 N·m	20 lb ft

Fuel Pipe to Fuel Rail Retaining Screw	3 N·m	27 lb in
Fuel Pipe Return Line Nut	3 N·m	27 lb in
Fuel Pressure Regulator Bracket	3.5 N·m	31 lb in
Fuel Rail Attaching Bolts	10 N·m	89 lb in
Fuel Tank Shield to Frame Bolts	18 N·m	13 lb ft
Fuel Tank Strap Attaching Bolts	40 N·m	30 lb ft
Fuel Tank Bracket Strap	45 N·m	33 lb ft
Heated Oxygen Sensor (HO2S)	42 N·m	31 lb ft
Idle Air Control (IAC) Valve Attaching Screws	3 N·m	27 lb in
Ignition Coil Mounting Screws	11 N·m	97 lb in
Ignition Module Mounting Screws	3.5 N·m	31 lb in
Injector Retainer Lock Nut	3 N·m	27 lb in
Knock Sensor (KS)	25 N·m	18 lb ft
Mass Air Flow/Intake Air Temperature (MAF/IAT) Hose Clamp	4 N·m	35 lb in
Power Brake Fitting	13 N·m	115 lb in
Powertrain Control Module (PCM) End Connector Fasteners	8 N·m	71 lb in
Pressure Regulator Screw	9.5 N·m	84 lb in
Purge Solenoid Mounting Nuts	12 N·m	106 lb in
Purge Valve Mounting Bracket Attaching Bolt	8 N·m	71 lb in
Rotor Hold Down Screws	2 N·m	18 lb in
Spark Plug New Aluminum Head	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
Steering Linkage Shield Mounting Bolts	33 N·m	24 lb ft
Throttle Body Assembly Retaining Studs	9 N·m	80 lb in
Throttle Cable Bracket Bolts	25 N·m	18 lb ft
Throttle Position (TP) Sensor Bolts	2 N·m	18 lb in
Upper Manifold Bolts	8 N·m	71 lb in
Upper Manifold Nuts	8 N·m	71 lb in
Vacuum Module Attaching Bolts	8 N·m	71 lb in

Fuel System Specifications

Use regular unleaded gasoline rated at 87 octane or higher. It is recommended that the gasoline meet specifications which have been developed by the American Automobile Manufacturers Association (AAMA) and endorsed by the Canadian Motor Vehicle Manufacturers Association for better vehicle performance and engine protection. Gasoline meeting the AAMA specification could provide improved driveability and emission control system performance compared to other 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 Control Cable Bracket Bolts	10 N·m	89 lb in
Accelerator Pedal Mounting Bolts	20 N·m	15 lb ft
Camshaft Position (CMP) Sensor Bolt	25 N·m	18 lb ft
Crankshaft Position (CKP) Sensor Bolt	25 N·m	18 lb ft
Engine Coolant Temperature (ECT) Sensor	20 N·m	15 lb ft
Engine Sight Shield Bolts	10 N·m	89 lb in
Engine Sight Shield Bracket Bolts	10 N·m	89 lb in
EGR (Exhaust Gas Recirculation) Valve Bolts (First Pass)	10 N·m	89 lb in
EGR Valve Bolts (Final Pass)	25 N·m	18 lb ft
EGR Valve Pipe-to-Cylinder Head Bolts	50 N·m	37 lb ft
EGR Valve Pipe-to-Exhaust Manifold Bolts	25 N·m	18 lb ft
EGR Valve Pipe-to-Intake Manifold	12 N·m	106 lb in
Engine Wiring Harness Retaining Nut	5.5 N·m	49 lb in
EVAP Canister Bracket Bolt	25 N·m	18 lb ft
EVAP Canister Mounting Bolt	25 N·m	18 lb ft
EVAP Canister Mounting Nuts	10 N·m	89 lb in
EVAP Canister Purge Valve Shoulder Bolt	10.5 N·m	93 lb in
EVAP Canister Vent Valve Bracket Mount Bolt	12 N·m	106 lb in
Fuel Fill Hose Clamp	2.5 N·m	22 lb in
Fuel Fill Pipe Bracket Bolt	12 N·m	106 lb in
Fuel Fill Pipe Ground Strap Bolt	9 N·m	80 lb in
Fuel Fill Pipe Housing to Fill Pipe Bolts	2.3 N·m	20 lb in
Fuel Fill Vent Hose Clamps	2.5 N·m	22 lb in
Fuel Filler Bracket Bolt	12 N·m	106 lb in
Fuel Filter Bracket Bolt	12 N·m	106 lb in
Fuel Filter Fitting	25 N·m	18 lb ft
Fuel Rail Attaching Bolts	10 N·m	89 lb in
Fuel Rail Crossover Pipe Retainer Clip Attaching Screw	3.8 N·m	34 lb in
Fuel Return Pipe Attaching Screw	5 N·m	44 lb in
Fuel Tank Shield-to-Frame Bolts	18 N·m	13 lb ft
Fuel Tank Strap Bolts	40 N·m	30 lb ft
Heated Oxygen Sensor (HO2S)	42 N·m	31 lb ft
Idle Air Control (IAC) Valve Attaching Screws	3 N·m	27 lb in
Ignition Coil Mounting Bolts	8 N·m	71 lb in
Intake Manifold Sight Shield Fasteners	10 N·m	89 lb in
Knock Sensor (KS)	20 N·m	15 lb ft
Powertrain Control Module (PCM) Connector End Bolts	8 N·m	71 lb in
Throttle Body Attaching Bolts and Nuts	10 N·m	89 lb in
Throttle Position (TP) Sensor Attaching Screws	2 N·m	18 lb in

Engine Controls – 6.6L Diesel

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Air Cleaner Upper Housing to Lower Housing Screws	4 N·m	35 lb in
Air Cleaner to Turbocharger Duct Clamps	4 N·m	35 lb in
Air Duct Hose Clamps	6 N·m	53 lb in
Air Inlet Duct Clamps	6 N·m	53 lb in
Air Intake Pipe to Turbo Bolts	10 N·m	89 lb in
Accelerator Pedal Position Sensor Mounting Nuts	20 N·m	15 lb ft
Battery Supply Wiring Harness Nut	5 N·m	44 lb in
Boost Sensor Retaining Nut	9 N·m	80 lb in
Camshaft Position Sensor Mounting Bolt	8 N·m	71 lb in
Charged Air Cooler Clamps	6 N·m	53 lb in
Crankshaft Position Sensor Bolt	10 N·m	89 lb in
Crankshaft Position Sensor Spacer Bolt	10 N·m	89 lb in
Driven Gear to Injection Pump Bolts	25 N·m	18 lb ft
ECM Harness Connector Screws	8 N·m	71 lb in
Engine Coolant Temperature Sensor	20 N·m	15 lb ft
Fuel Fill Hose Clamp	2 N·m	18 lb in
Fuel Fill Pipe Ground Strap Bolt	9 N·m	80 lb in
Fuel Fill Pipe Housing Screws	2 N·m	18 lb in
Fuel Fill Vent Hose Clamp	2 N·m	18 lb in
Fuel Fill Vent Pipe Clamps	2 N·m	18 lb in
Fuel Filter Housing/Heater Assembly	20 N·m	15 lb ft
Fuel Line Bundle-to-Bracket Retaining Nuts	16 N·m	12 lb ft
Fuel Line Bundle Bracket-to-Frame retaining Nuts	16 N·m	12 lb ft
Fuel Cooler Retaining Nuts (Cab Chassis)	40 N·m	30 lb ft
Fuel Cooler Bracket-to-Frame Bolts (2) (Pickup)	12 N·m	106 lb in
Fuel Cooler Bracket-to-Frame Bolts (5) (Pickup)	18 N·m	13 lb ft
Fuel Cooler-to-Bracket Bolts (2) (Pickup)	18 N·m	13 lb ft
Fuel Feed Pipe and Suction Pipe-to-Fuel Pump	30 N·m	22 lb ft
Fuel Injection Control Module Mounting Bolts	25 N·m	18 lb ft
Fuel Injection Control Module Eye Bolts	35 N·m	26 lb ft
Fuel Injection Pump Adapter Bolts	20 N·m	15 lb ft
Fuel Injection Pump Gear Nut	70 N·m	52 lb ft
Fuel Injection Pump Mounting Bolts	20 N·m	15 lb ft
Fuel Injector to Mounting Bracket Bolts	12 N·m	106 lb in
Fuel Injector Bracket Bolts	50 N·m	37 lb ft
Fuel Injector to Harness Nuts	2.5 N·m	22 lb in
Fuel Injector Return Pipe Bolts	16 N·m	12 lb ft
Fuel Injector Return Pipe to Cylinder Head Bolts	17 N·m	12 lb ft
Fuel Manager/Filter to Intake Manifold Bolts	25 N·m	18 lb ft
Fuel Pressure Lines to Junction Block	41 N·m	30 lb ft
Fuel Pump Lines	30 N·m	22 lb ft
Fuel Rail Mounting Bolts	25.5 N·m	18.8 lb ft
Fuel Rail to Fuel Lines (All) bolts	41 N·m	41 N·m
Fuel Rail Temperature Sensor	22 N·m	16 lb ft
Fuel Return Line Banjo Fitting	15 N·m	11 lb ft
Fuel Tank Filter Neck Clamp	2.5 N·m	22 lb in
Fuel Tank Off-Road Shield Bolts	35 N·m	26 lb ft
Fuel Tank Shield to Frame Bolts	18 N·m	13 lb ft
Fuel Tank Strap Attaching Bolts	40 N·m	30 lb ft

Fuel Tank Strap Bolts	40 N·m	30 lb ft
Glow Plugs	18 N·m	13 lb ft
Glow Plug Controller Mounting Bolt	20 N·m	15 lb ft
Glow Plug Relay Electrical Nuts	5 N·m	44 lb in
Glow Plug Relay Mounting Nuts	42 N·m	31 lb ft
Glow Plug Wiring Harness Nuts	1.5 N·m	13 lb in
Heater Pipe Bracket Bolt	20 N·m	15 lb in
Heater Pipe to Water Crossover Bolt	20 N·m	15 lb in
Injection Harness Bracket Bolts	8 N·m	71 lb in
Injection Lines to Common Rail Fittings	41 N·m	30 lb ft
Injection Lines to Injector Fittings	44 N·m	33 lb ft
Injection Pump Flange Nuts	40 N·m	30 lb ft
Intake Air Heater	50 N·m	37 lb ft
Intake Air Heater Nut	5 N·m	44 lb in
Intake Air Heater Relay Mounting Nuts	20 N·m	15 lb ft
Intake Air Temperature Sensor	25 N·m	18 lb ft
Junction Block Fuel Line Bolts	41 N·m	30 lb ft
Junction Block Mounting Bolts	25 N·m	18 lb ft
MAF Sensor Mounting Bolts	8 N·m	71 lb in
Spill Line Bolts	12 N·m	106 lb in
Upper Intake Manifold Sight Shield Bolt	9 N·m	80 lb in
Upper Radiator Hose Bracket Bolts	10 N·m	89 lb in
Water in Fuel Sensor Mounting Screws	2 N·m	18 lb in
Wiring Harness Connectors	5 N·m	44 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 Control Assembly to Floor Fasteners	20 N·m	15 lb ft
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	20 N·m	15 lb ft
Engine Sight Shield Bolts	10 N·m	89 lb in
Engine Sight Shield Bracket Bolts	10 N·m	89 lb in
Exhaust Gas Recirculation (EGR) Valve Bolts (First Pass)	10 N·m	89 lb in
Exhaust Gas Recirculation (EGR) Valve Bolts (Final Pass)	25 N·m	18 lb ft
Exhaust Gas Recirculation (EGR) Valve Bracket Nuts	22 N·m	16 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	30 N·m	22 lb ft
Exhaust Gas Recirculation (EGR) Valve Pipe-to-Intake Manifold	12 N·m	106 lb in
Evaporative Emission (EVAP) Canister Purge Valve Shoulder Bolt	10 N·m	89 lb in
Evaporative Emission (EVAP) Canister Vent Bracket Retaining Bolt	12 N·m	106 lb in
Evaporative Emission (EVAP) Canister Vent Valve bracket mount bolt	12 N·m	106 lb in
Evaporative Emission (EVAP) Canister Vent Valve Retaining Bolt	10 N·m	89 lb in
Fuel Fill Hose Clamp	2.5 N·m	22 lb in
Fuel Fill Pipe Ground Strap Bolt	9 N·m	80 lb in
Fuel Fill Pipe Housing to Fill Pipe Bolts	2.3 N·m	20 lb in
Fuel Filter Bracket Bolt	12 N·m	106 lb in
Fuel Filter Fitting	25 N·m	18 lb ft
Fuel Injection Sight Shield Retaining Bolt	10 N·m	89 lb in
Fuel Rail Attaching Bolts	12 N·m	106 lb in
Fuel Tank Shield to Flame Bolt	18 N·m	13 lb ft
Fuel Tank Strap Bolts	40 N·m	30 lb ft
Fuel Tank Vent Hose Clamp	2.5 N·m	22 lb in
Heated Oxygen Sensor (HO2S)	41 N·m	30 lb ft
Ignition Coil Attaching Bolts	10 N·m	89 lb in
Intake Manifold Sight Shield Bolt	12 N·m	106 lb in
Knock Sensor (KS)	19 N·m	14 lb ft
Manifold Pipe Fastener to Exhaust Manifold	25 N·m	18 lb ft
Manifold Absolute Pressure (MAP) Sensor Retaining Bolt	12 N·m	106 lb in
Manifold Pipe Fastener to Fuel Rail Stud	12 N·m	106 lb in
Powertrain Control Module (PCM) Connector End Bolts	8 N·m	71 lb in
Spark Plug Existing Iron Head	20 N·m	15 lb ft
Spark Plug New Iron Head	30 N·m	22 lb ft
Throttle Body Attaching Bolts	10 N·m	89 lb in
Upper Engine Wire Harness Retainer Stud	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 Engine)	30 N·m	22 lb ft
Exhaust Gas Recirculation (EGR) Pipe Bolt (8.1L Engine)	30 N·m	22 lb ft
Exhaust Gas Recirculation (EGR) Pipe Bracket Bolt (8.1L Engine)	50 N·m	37 lb ft
Exhaust Gas Recirculation (EGR) Pipe Nut (8.1L Engine)	30 N·m	22 lb ft
Exhaust Gas Recirculation (EGR) Valve Inlet Pipe Fitting to Exhaust Manifold (4.3L Engine)	30 N·m	22 lb ft
Exhaust Gas Recirculation (EGR) Valve Inlet Pipe Fitting to Intake Manifold (4.3L Engine)	25 N·m	18 lb ft
Exhaust Gas Recirculation (EGR) Valve Pipe to Cylinder Head Bolt	50 N·m	37 lb ft
Exhaust Gas Recirculation (EGR) Valve Pipe to Exhaust Manifold Bolt	30 N·m	22 lb ft
Exhaust Gas Recirculation (EGR) Valve Pipe to Intake Manifold Bolt	10 N·m	89 lb in
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 (First Pass in Sequence) (4.8L, 5.3L, and 6.0L Engines)	15 N·m	11 lb ft
Exhaust Manifold Bolts (Final Pass in Sequence) (4.8L, 5.3L, and 6.0L Engines)	25 N·m	18 lb ft
Exhaust Manifold Bolt/Nut (6.6L Engine)	34 N·m	25 lb ft
Exhaust Manifold Bolt/Stud (4.3L Engine)	30 N·m	22 lb ft
Exhaust Manifold Center Bolt (8.1L engine)	35 N·m	26 lb ft
Exhaust Manifold Heat Shield Bolt (4.3L, 4.8L, 5.3L, and 6.0L Engines)	9 N·m	80 lb in
Exhaust Manifold Heat Shield Bolt (6.6L Engine)	8 N·m	71 lb in
Exhaust Manifold Heat Shield Bolt/Nut (8.1L Engine)	25 N·m	18 lb ft
Exhaust Manifold Nut (8.1L Engine)	16 N·m	12 lb ft
Exhaust Manifold Pipe Bolt (6.6L Engine)	40 N·m	30 lb ft
Exhaust Manifold Pipe Clamp (6.6L Engine)	40 N·m	30 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 Engine)	8 N·m	71 lb in
Exhaust Pipe to Manifold Bolt (6.6L engine)	53 N·m	39 lb ft
Exhaust Pipe to Turbocharger Bolt (6.6L engine)	53 N·m	39 lb ft
Hood Hinge Bolts	25 N·m	18 lb ft
Oil Level Indicator Tube Bracket Bolt (6.6L Engine)	21 N·m	15 lb ft
Oxygen Sensor	42 N·m	31 lb ft
Rear Shock Absorber Lower Bolt	95 N·m	70 lb ft
Spark Plug (4.3L Engine)	15 N·m	11 lb ft
Spark Plug Wire Retainer Bolt (4.3L Engine)	12 N·m	161 lb in
Transmission Bolt	100 N·m	74 lb ft
Transmission Fluid Fill Tube Nut (6.6L Engine)	18 N·m	13 lb ft
Turbocharger Exhaust Pipe Bolt/Nut (6.6L Engine)	53 N·m	39 lb ft
Turbocharger Exhaust Pipe Heat Shield Bolt (6.6L Engine)	8 N·m	71 lb in
Turbocharger Heat Shield Bolt (6.6L Engine)	9 N·m	80 lb in
Upper Intake Manifold Sight Shield (6.6L Engine)	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

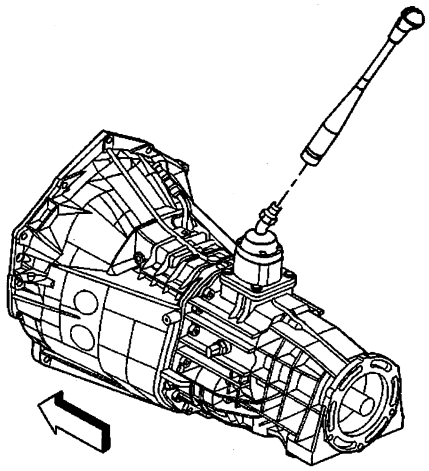
Fastener Tightening Specifications

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

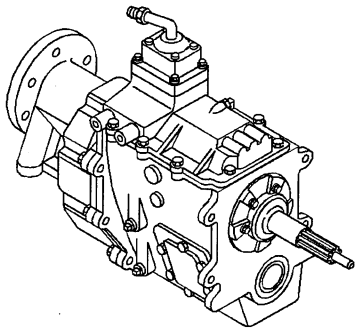
Fastener Tightening Specifications

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

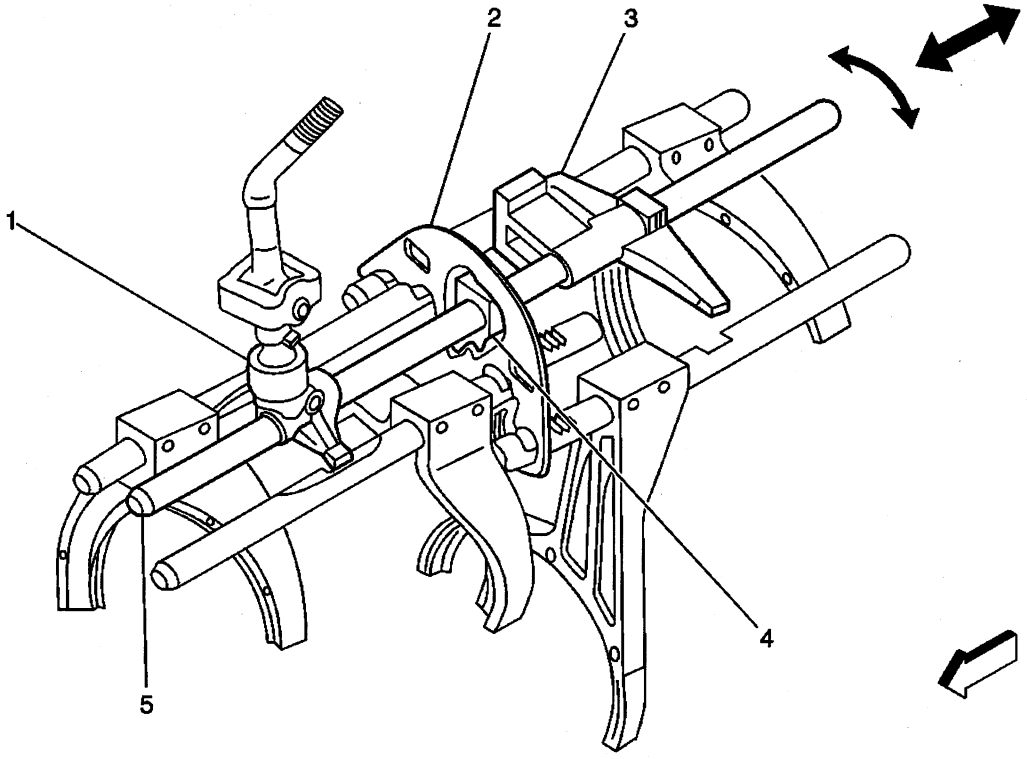
The ZF S6-650 is a six-speed transmission. All of the six forward gears and the reverse gear are fully synchronized. The six-speed gear is an overdrive ratio. The six-speed gear is located on the rear of the countershaft.

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

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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

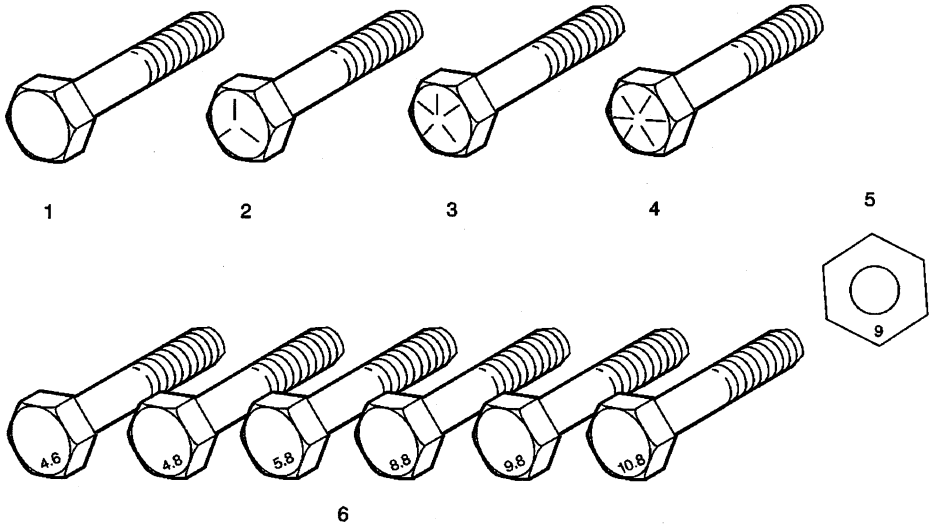
Metric Fasteners

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

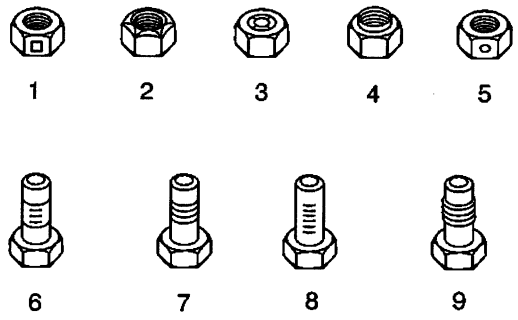
These fasteners accomplish the thread interface by a designed distortion or deformation in the fastener.

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