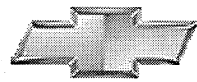
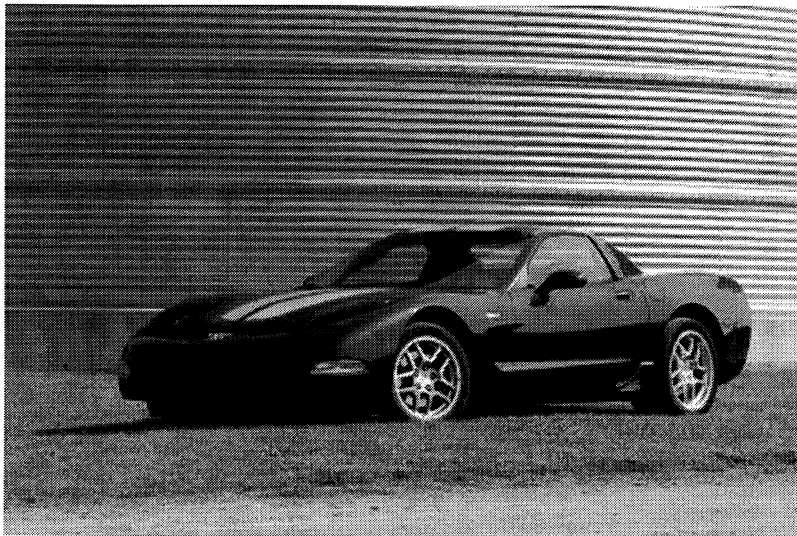


# **Chevrolet**



# **Corvette**



# **2004**



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## **Product Information**

### **Commemorative Editions Mark Corvette's Racing Success**

The Chevrolet Corvette maintains its well-earned status as the automotive and cultural icon that has been admired and sought after for a generation. For the 2004 model year, commemorative editions for each Corvette model are available so enthusiasts can celebrate the racing success of the Chevy flagship.

Also, the top-of-the-line Corvette Z06 - already hailed by enthusiast magazines as the best combination of performance, comfort and value in the automotive world - gets even better for 2004 with revised shock valving based on testing at the legendary Nürburgring race track in Germany.

Corvette also has earned two consecutive quality awards from J.D. Power and Associates and continues to win accolades for its surprising interior room, cargo space, comfort and fuel economy in a high-performance sports car.

Only a handful of cars in the history of the industry have shown the Corvette's ability to capture the fancy of so many consumers and hold it for so long. As the golden anniversary celebration continues, it is a testament to the ability of Corvette's engineers to keep the car as fresh and cutting edge as it was in 1953.

Corvette has remained relevant because it continued to embrace new designs and technologies such as those featured on the current line: Magnetic Selective Ride Control, Goodyear EMT "run-flat" tires (coupe and convertible), active handling and a rear transaxle.

### **Commemorative editions**

The commemorative editions recognize the success of the C5-R racing program. In 2002, the Corvette C5 continued to dominate the field with nine wins in 10 American Le Mans Series races, also nabbing the 2002 GTS Manufacturer Champion and GTS Team Champion awards. Combined with a second consecutive victory at the 24 Hours of Le Mans, Corvette continued to make history.

The Commemorative Edition Coupe and Convertible include new Le Mans Blue paint with Shale interior, special badges and polished wheels. The convertible's top also is Shale to match the interior.

The Commemorative Edition Z06 also is Le Mans Blue and also includes a C5-R Le Mans stripe scheme, special badges, polished Z06 wheels and a lightweight carbon fiber hood.

### **Z06 ride tempered at Nürburgring**

Over the period of a month in 2002, engineers put the Z06 through its paces at Germany's fabled Nürburgring racetrack to give the definitive street-legal sports car an even better ride. Since it was completed in 1927, the 12.8-mile (20.6 km) Nürburgring circuit has been the ultimate challenge for vehicle dynamics. The course has 177 corners, and in between them is every conceivable combination of radius, camber and gradient - not to mention altitude that varies by nearly 1,000 feet (305 m). No other track in the world places such extreme demands on a vehicle's suspension, brakes and powertrain, which is why Nürburgring is where the world's finest sports cars are regularly tested.

After a month in Germany, it was back to General Motors Milford Proving Grounds, where new shock absorber valving was "dialed in" and balanced for optimum performance on American roads.

The result is a suspension that feels "more tied down, more glued to the road," said Harlan Charles, product manager for the Corvette.

### **Magnetic Selective Ride Control**

The suspensions of the 2004 Corvette coupe and convertible continue to feature Magnetic Selective Ride Control, which debuted in 2003. It uses a revolutionary damper design that controls wheel and body motion with magneto-rheological fluid in the shocks. By controlling the current to an electromagnetic coil inside the piston of the damper, the MR fluid's consistency can be changed, resulting in continuously variable real-time damping. As a result, drivers feel a greater sense of security, a quieter, flatter ride and more precise, responsive handling, particularly during sudden, high-speed maneuvers.

The system isolates and smoothes the action of each tire, resulting in less bouncing, vibration and noise. On bumpy or slick surfaces, the system integrates with traction control to assure maximum stability. It also works with ABS to keep the vehicle balanced and poised. It is the only system without electro-mechanical valves and no small moving parts. It consists of MR fluid-based, monotube shock absorbers, a sensor set and on-board controller.

## **Chevrolet Tradition Continues at Indianapolis 500**

### **2004 Corvette Convertible Announced as Official Pace Car**

**DETROIT, March 12, 2004** – The 88<sup>th</sup> running of the Indianapolis 500 on May 30, 2004, will bring together two powerful symbols that stir the imaginations of enthusiasts around the world... Chevrolet and the Indianapolis Motor Speedway... as a 2004 Corvette Convertible will serve as the Official Pace Car of this year's Indianapolis 500.

Corvette will perform Indy 500 pace car duties for a record sixth time. This also marks the third consecutive year and 15<sup>th</sup> time overall that a Chevrolet product has served as the official pace vehicle – the most appearances by any brand.

"We're proud that this year's Memorial Day classic will showcase America's favorite sports car at the greatest spectacle in racing," said Brent Dewar, Chevrolet general manager. "As the 2004 model year is the last of Corvette's current design, pacing the Indy 500 acknowledges the significance the vehicle has played in American culture."

The Indianapolis Motor Speedway has been the site of many memorable events since the facility opened in 1909. Similarly, Chevrolet has a rich heritage in racing that extends back to company co-founder and namesake Louis Chevrolet, a gifted engineer and talented race car driver who competed in the Indy 500 four times. More recently, Chevy Indy V-8 engines have won 103 open-wheel races, including seven Indianapolis 500 victories.

"The Indianapolis 500 and Chevrolet have had a long relationship," said Tony George, president and CEO of the Indianapolis Motor Speedway. "It's an honor to have Corvette lead the field and also to have the Chevy Indy V-8 competing for the win on May 30."

The 2004 Corvette that will serve as the Indy 500 Pace Car is virtually identical to the Convertibles available today through local Chevrolet dealerships.

Like race cars, the duties of a pace car can be long and strenuous. During the last two races, for example, the Chevy pace vehicles cars led the field for a combined 84 laps (210 miles) of the total 400 race laps (1,000 miles) run, at an average lap speed of 75 mph. Even during green flag race conditions, the pace cars patiently run at idle, ready for action at a moment's notice. Very few modifications were made to the Corvette to prepare it for this year's role: heavy-duty transmission and power steering coolers, a lower restriction muffler system, four-point racing-type safety belts and a safety strobe light system.

A white and blue two-tone paint treatment incorporates Americana-themed graphics, tying into Chevrolet's new "An American Revolution" marketing theme. The theme captures Chevrolet's pride and passion for innovation, and for success not only in motorsports, but also as it launches 10 new car and truck products in 20 months.

General Motors Corp. (NYSE: GM), the world's largest vehicle manufacturer, employs about 325,000 people globally. Founded in 1908, GM has been the global automotive sales leader since 1931. GM today has manufacturing operations in 32 countries and its vehicles are sold in 192 countries. In 2003, GM sold nearly 8.6 million cars and trucks, about 15 percent of the global vehicle market. GM's global headquarters are at the GM Renaissance Center in Detroit. More information on GM and its products can be found on the company's corporate website at [www.gm.com](http://www.gm.com).

2004 Chevrolet Corvette Restoration Kit

Chevrolet has paced 14 previous Indianapolis 500 races, more than any other brand:

2003	Chevy SSR	1986	Corvette
2002	Corvette 50 <sup>th</sup> Anniversary	1982	Camaro Z28
1999	Monte Carlo	1978	Corvette
1998	Corvette	1969	Camaro
1995	Corvette	1967	Camaro
1993	Camaro Z28	1955	Bel Air
1994	Beretta	1948	Fleetmaster

**New For 2004**

- Commemorative editions of Coupe, Convertible and Z06 mark racing success
- Exterior colors: Arctic White, Machine Silver, Magnetic Red and Le Mans Blue (commemoratives only)
- Revised shock valving on Z06
- Carbon fiber hood on Z06

**Model Lineup**

	Engines		Transmissions	
	5.7-liter V8 (LS1)	5.7-liter V8 (LS6)	4L60-E 4-speed auto	6-speed manual
Coupe	S	-	S	O
Convertible	S	-	S	O
Z06	-	S	-	S

Standard           s  
 Optional           o  
 Not available     -

## Specifications

<b>Overview</b>			
Models:	Chevrolet Corvette coupe, convertible, Z06		
Body style / driveline:	2-door hatchback coupe, convertible and hardtop; rear-drive, front-engine		
Construction:	composite		
EPA vehicle class:	sports car		
Manufacturing location:	Bowling Green, Kentucky		
Key competitors:	Audi TT, BMW Z4, Dodge Viper, Porsche Boxster and Boxster S, Porsche 911		
<b>Engines</b>	<b>5.7L V-8 (LS1)</b>	<b>5.7L V-8 (LS6)</b>	
Application:	standard on coupe, convertible	standard on Z06	
Type:	5.7L V-8	5.7L V-8	
Displacement (cu in / cc):	346 / 5665	346 / 5665	
Bore & stroke (in / mm):	3.90 x 3.62 / 99 x 92	3.90 x 3.62 / 99 x 92	
Block material:	cast aluminum	cast aluminum	
Cylinder head material:	cast aluminum	cast aluminum	
Valvetrain:	OHV, 2 valves per cylinder	OHV, 2 valves per cylinder	
Fuel delivery:	sequential fuel injection	sequential fuel injection	
Compression ratio:	10.1:1	10.5:1	
Horsepower (hp / kw @ rpm):	350 / 261 @ 5200	405 / 302 @ 6000	
Torque (lb-ft / Nm @ rpm):	manual: 375 / 508 @ 4000 automatic: 360 / 489 @ 4000	400 / 542 @ 4800	
Recommended fuel:	93 octane	93 octane	
Maximum engine speed (rpm):	6000	6500	
Emissions controls:	catalytic converter AIR 4-speed automatic	catalytic converter AIR 6-speed manual	
Estimated fuel economy (mpg city / hwy / combined):	19 / 28 / 23 (manual coupe and convertible) 18 / 25 / 21 (automatic coupe and convertible)	19 / 28 / 23 (manual Z06)	
<b>Transmissions</b>	<b>Hydra-Matic 4L60-E</b>	<b>Tremec T56 (MM6)</b>	<b>Tremec T56 (M12)</b>
Type:	4-speed automatic	6-speed manual	6-speed manual
Application:	std on coupe and convertible	opt on coupe and convertible	std on Z06
<b>Gear ratios (:1):</b>			
First:	3.06	2.66	2.97
Second:	1.63	1.78	2.07
Third:	1.00	1.30	1.43
Fourth:	0.70	1.00	1.00
Fifth:	-	0.74	0.84
Sixth:	-	0.50	0.56
Reverse:	2.29	2.90	3.28
Final drive ratio:	std: 2.73:1; opt: 3.15:1	3.42:1	3.42:1

<b>Chassis/Suspension</b>		
Front:	short/long arm (SLA) double wishbone, cast aluminum upper & lower control arms, transverse-mounted composite leaf spring, monotube shock absorber	
Rear:	short/long arm (SLA) double wishbone, cast aluminum upper & lower control arms, transverse-mounted composite leaf spring, monotube shock absorber	
<b>Stabilizer bar diameter (in / mm):</b>		
Standard:	front: .90 / 23; rear: .75 / 19.1	
F55:	front: .90 / 23; rear: .75 / 19.1	
Z51:	front: 1.13 / 28.6; rear: 1.13 / 23.6	
FE4:	front: 1.18 / 30; rear: 1.13 / 23.6	
Traction control:	electronic traction control, active handling	
Steering type:	speed sensitive power-assisted rack-and-pinion	
Steering ratio:	16.1:1	
Steering wheel turns, lock-to-lock:	2.66	
Turning circle, curb-to-curb (ft/m):	40.2 / 12.1	
<b>Brakes</b>		
Type:	power-assisted disc with ABS, front and rear	
Rotor diameter x thickness (in/mm):	front: 12.6 x 1.26 / 325 x 32; rear: 11.8 x 1 / 305 x 26	
Swept area (sq in / sq cm):	front: 263 / 1696; rear: 158 / 1018	
<b>Wheels/Tires</b>	<b>Coupe and Convertible</b>	<b>Z06</b>
Wheel size and type:	<ul style="list-style-type: none"> <li>• cast aluminum</li> <li>• optional: forged aluminum high polish</li> <li>• front: 17 x 8.5; rear: 18 x 9.5</li> </ul>	<ul style="list-style-type: none"> <li>• cast spun aluminum</li> <li>• front: 17 x 9.5; rear: 18 x 10.5</li> </ul>
Tires:	Goodyear Eagle F1 GS Extended Mobility front: P245/45ZR17 rear: P275/40ZR18	Goodyear Eagle F1 SC Asymmetric Tread front: P265/40ZR17 rear: P295/35ZR18

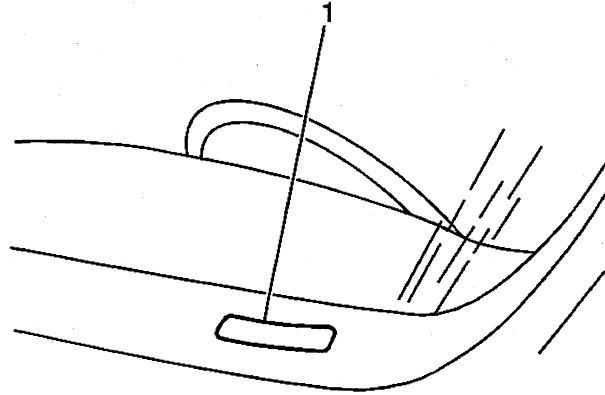
## Dimensions

<b>Exterior</b>	<b>Coupe</b>	<b>Convertible</b>	<b>Z06</b>
Wheelbase (in / mm):	104.5 / 2656	104.5 / 2656	104.5 / 2656
Overall length (in / mm):	179.7 / 4566	179.7 / 4566	179.7 / 4566
Overall width (in / mm):	73.6 / 1869	73.6 / 1869	73.6 / 1869
Overall height (in / mm):	47.7 / 1212	47.8 / 1215	47.7 / 1212
Track (in / mm):	front: 61.9 / 1572 rear: 62 / 1575	front: 61.9 / 1572 rear: 62 / 1575	front: 62.4 / 1585 rear: 62.6 / 1590
Curb weight (lb / kg):	3246 / 1458	3248 / 1456	3118 / 1414
Weight distribution (% front / rear):	51 / 49	51 / 49	53 / 47
<b>Interior</b>	<b>Coupe</b>	<b>Convertible</b>	<b>Z06</b>
Seating capacity (front / rear):	2 / 0	2 / 0	2 / 0
Head room (in / mm):	37.9 / 963	37.9 / 963	37.8 / 960
Leg room (in / mm):	42.7 / 1085	42.7 / 1085	42.7 / 1085
Shoulder room (in / mm):	55.3 / 1405	55.3 / 1405	55.3 / 1405
Hip room (in / mm):	54.2 / 1377	54.2 / 1377	54.2 / 1377

<b>Capacities</b>	
Cargo volume (cu ft / L):	coupe: 24.8 / 702; convertible: 13.9 / 394; Z06: 13.3 / 377
Fuel tank (gal / L):	18 / 68.1
Engine oil (qt / L):	6.5 / 6.15
Cooling system (qt / L):	automatic: 11.5 / 10.9; manual: 11.8 / 11.2

## Vehicle Identification

### Vehicle Identification Number (VIN) US/Canada

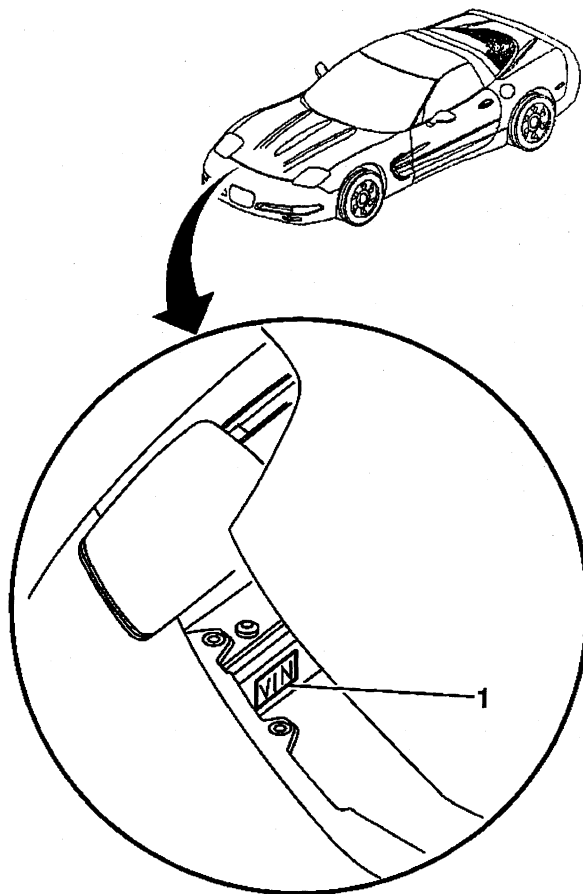


The vehicle identification number (VIN) plate is the legal identifier of the vehicle. The VIN plate is located on the upper LH corner of the instrument panel (I/P) and can be seen through the windshield from the outside of the vehicle.

The last five digits of the assembly plant sequential number are stamped onto the rear side of the front sill (tie bar). This number is the same as the last five digits on the VIN plate. The VIN plate also has bar code characteristics.

Position	Definition	Character	Description
1	Country of Origin	1	United States
2	Manufacturer	G	General Motors
3	Division	1	Chevrolet
4-5	Carline/Series	Y/Y	Corvette
6	Body Type	1	37 - Coupe, Two Door Northback, Special
		2	07 - Coupe, Two Door Plainback
		3	67 - Coupe, Two Door Convertible
7	Restraint System	2	Active (Manual) Belts with Driver and Passenger Inflatable Restraint System
		4	Active (Manual) Belts with Driver and Pass Inflatable Restraints (Frontal & Side)
8	Engine	G S	RPO LS1, V8, 5.7L, SFI, RPO LS6, V8, 5.7L, SFI HO
9	Check Digit	--	Check Digit
10	Model Year	4	2004
11	Assembly Plant	5	Bowling Green
12-17	Plant Sequence Number	--	Plant Sequence Number

### Vehicle Identification Number (VIN) Export



(1) Vehicle Identification Number Stamping (Export)

Export vehicles have the vehicle identification number (VIN) stamped onto the vehicle frame rail, as shown.



## VIN Derivative

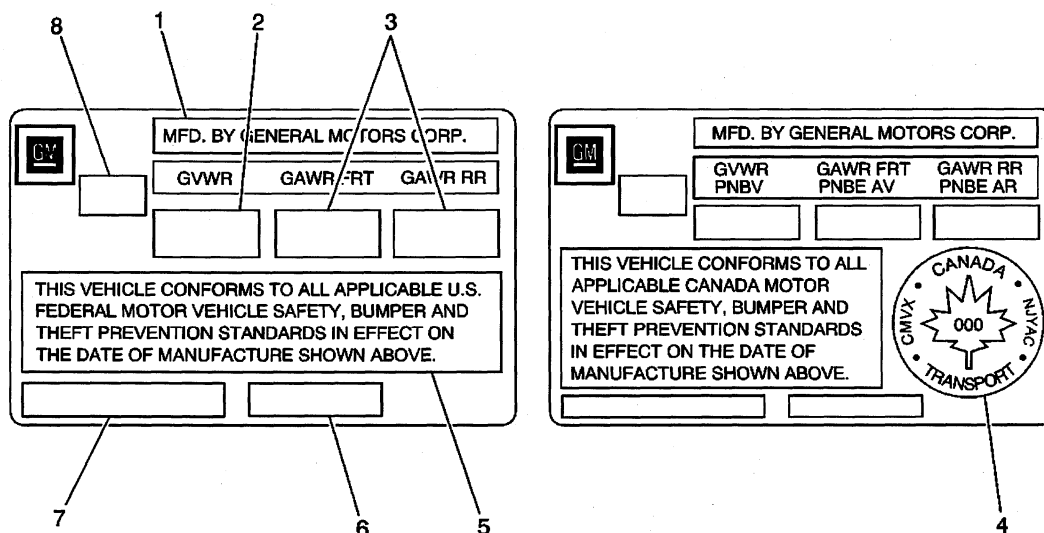
All engines and transmissions are stamped or laser etched with a partial vehicle identification number (VIN), which was derived from the complete VIN. A VIN derivative contains the following nine positions:

Position	Definition	Character	Description
1	GM Division Identifier	1	Chevrolet
2	Model Year	4	2004
3	Assembly Plant	5	Bowling Green, KY
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



- (1) Name of Manufacturer
- (2) Gross Vehicle Weight-Rating
- (3) Gross Axle Weight-Rating, Front, Rear
- (4) Canadian Safety Mark (w/RPO Z49)
- (5) Certification Statement
- (6) Vehicle Class Type (Pass Car, etc.)
- (7) Vehicle Identification Number
- (8) Date of Manufacture (Mo/Yr)

The vehicle certification label is permanently located on the edge of the driver's door. Refer to this label in order to obtain the following information:

- The Gross Vehicle Weight Rating (GVWR)
- The Gross Axle Weight Rating (GAWR), front and rear

The Gross Vehicle Weight (GVW) must not exceed the Gross Vehicle Weight Rating (GVWR).

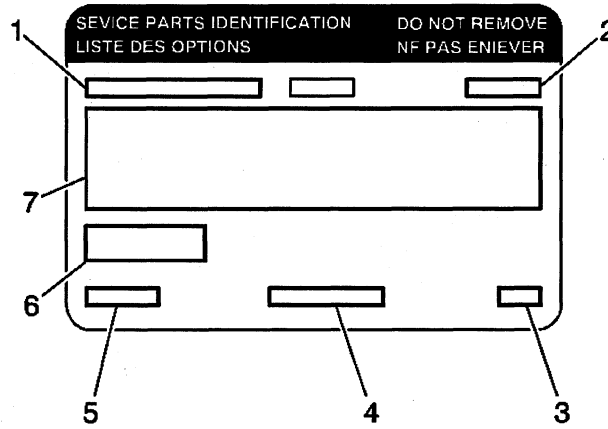
The GVW is the weight of the vehicle and everything the vehicle carries. Include the following items when figuring the GVW:

- The base vehicle weight (factory weight)
- The weight of any added vehicle accessories
- The weight of the driver and the passenger
- The weight of any cargo being carried

The front and rear Gross Axle Weights (GAW) must not exceed the Gross Axle Weight Ratings (GAWR), front and rear .

The GAW is the weight exerted on one of the axles (front or rear).

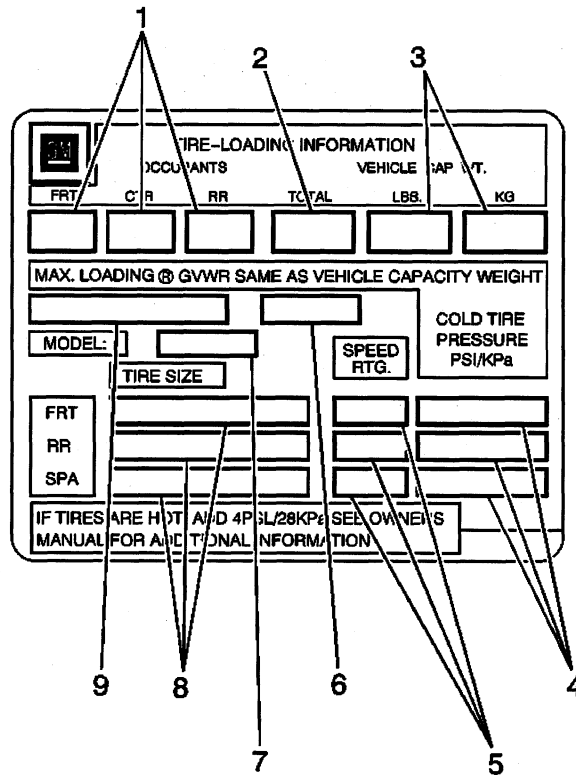
## Service Parts Identification Label (SPID)



- (1) Vehicle Identification Number
- (2) Engineering Model Number (Vehicle Division, Vehicle Line and Body Style)
- (3) Interior Trim and Decor Level
- (4) Exterior (Paint Color) WA Number
- (5) Paint Technology
- (6) Special Order Paint Colors and Numbers
- (7) Vehicle Option Content

The service parts identification label is used to identify the original equipment options built into the specific vehicle being serviced. The option content of a vehicle is very important information to properly service the vehicle.

## Tire Placard



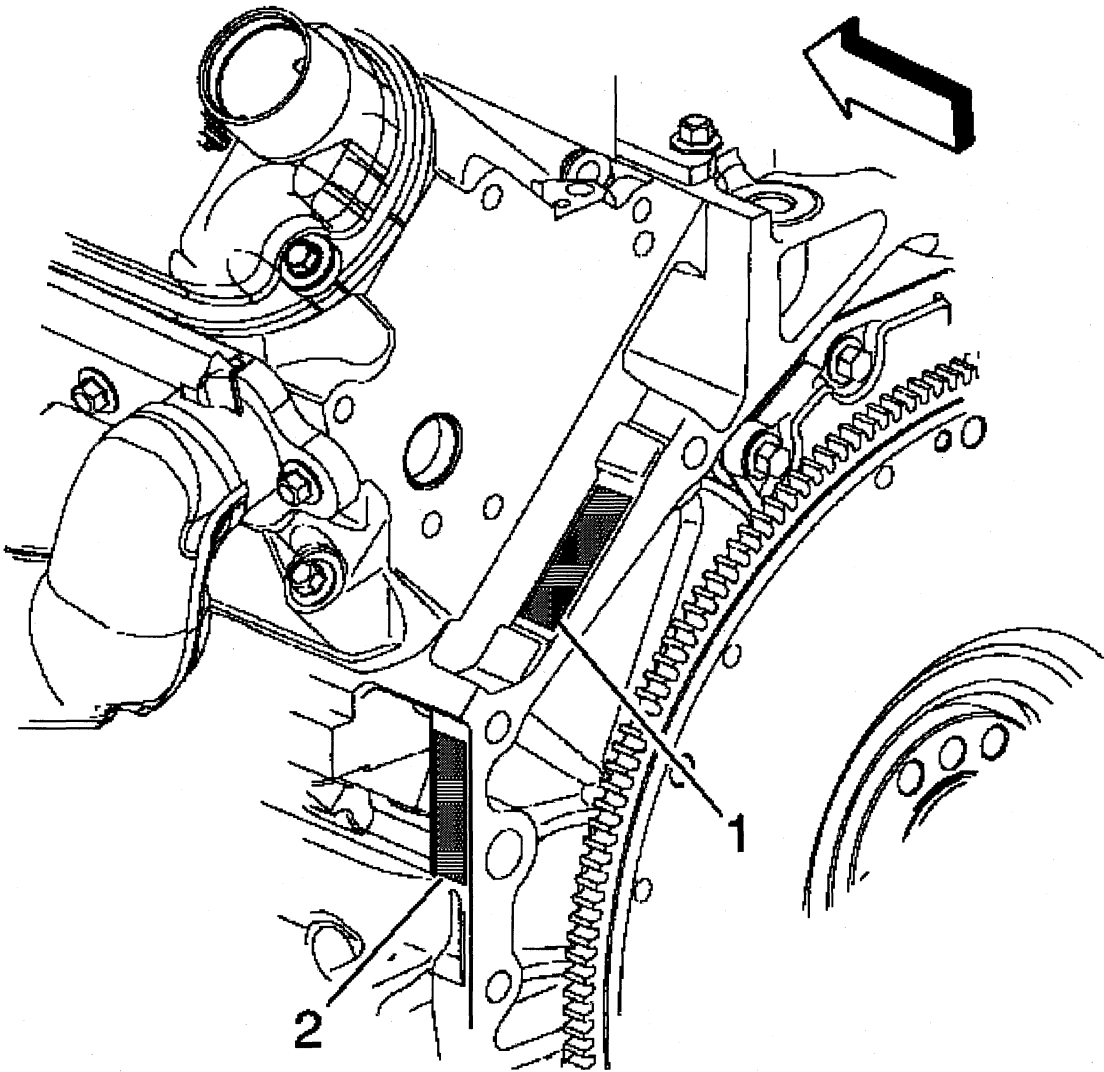
- (1) Specified Occupant Seating Positions
- (2) Total Occupant Seating
- (3) Maximum Vehicle Capacity Weight
- (4) Tire Pressures, Front, Rear, and Spare
- (5) Tire Speed Rating, Front, Rear, and Spare
- (6) Tire Label Code
- (7) Engineering Model Minus First Character
- (8) Tire Sizes, Front, Rear,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

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

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

## Engine ID and VIN Derivative Location 5.7L

### 5.7L Engine Identification Numbers, LS1<sup>(c)</sup>



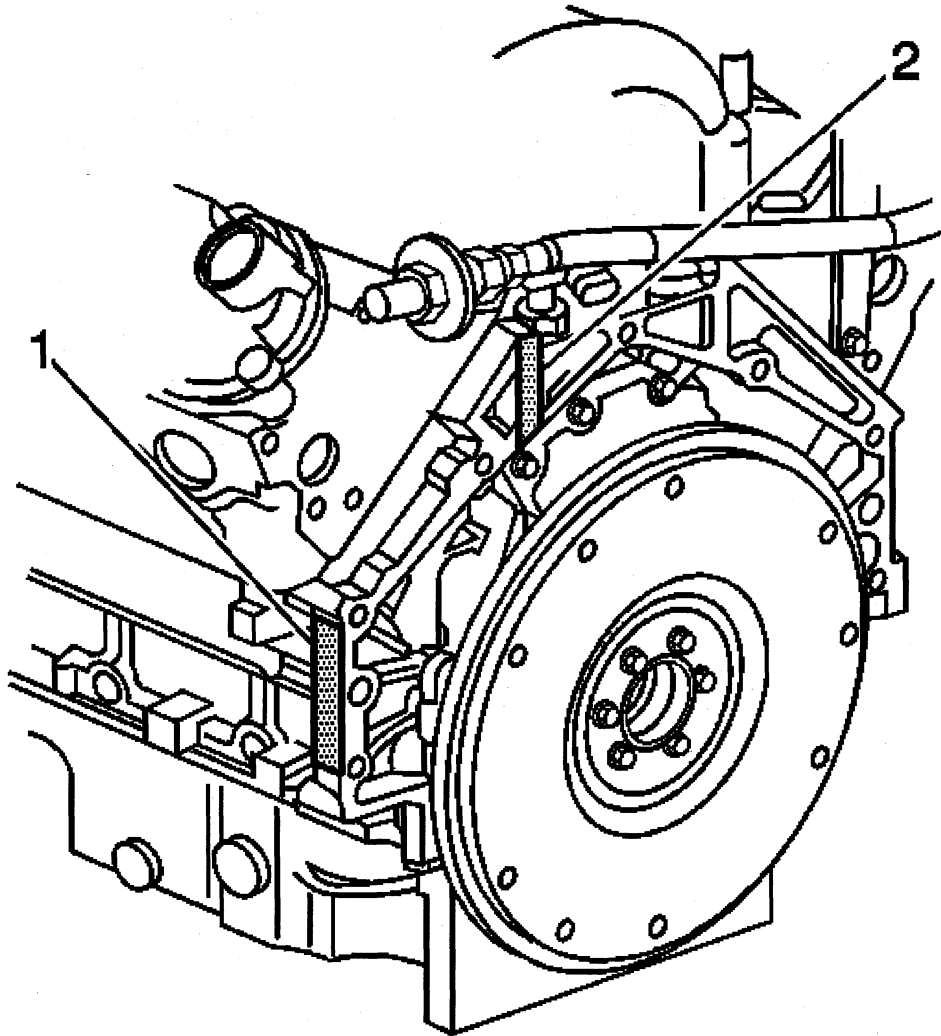
- (1) Engine ID Number, Primary Location
- (2) Engine ID Number, Secondary Location

The eighth digit of the vehicle identification number (VIN) is the engine code letter, which identifies the engine as a 5.7L V8 (VIN eighth digit: G) (RPO code LS1).

Stick-on labels attached to the engine, laser etching, or stampings in the engine block indicate the engine unit number/build date code.

The engine ID number will be located on the rear of LH cylinder head or the front part of LH oil pan rail (1).

**5.7L Engine VIN Derivative Locations, LS1<sup>(c)</sup>**

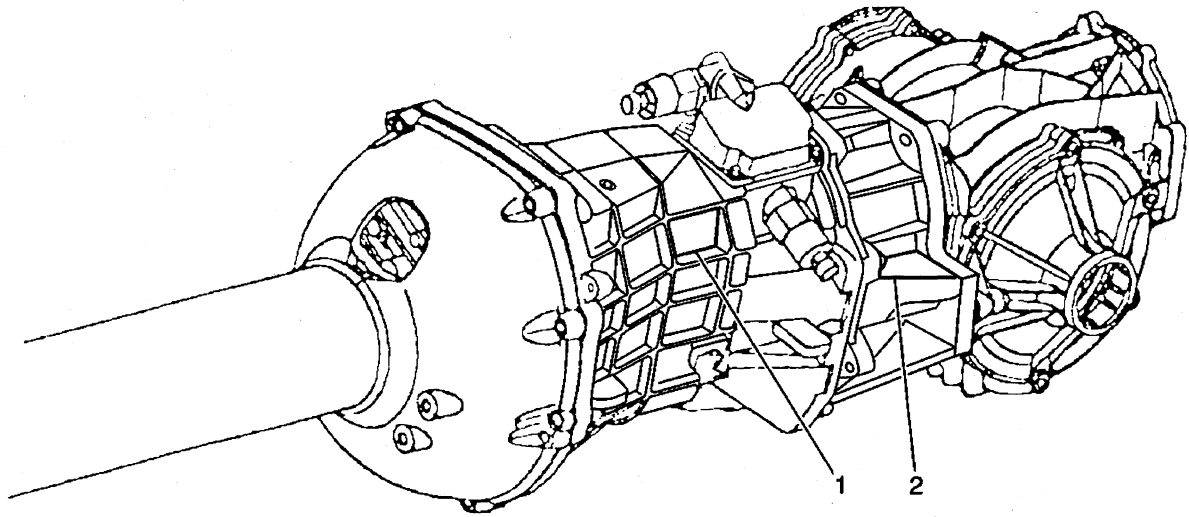


- (1) VIN Derivative, Primary Location
- (2) VIN Derivative, Secondary Location

The engine is also stamped with a VIN derivative number which will be located in either the primary or secondary location, as shown. For additional information, refer to VIN Derivative above.

## Transmission ID and VIN Derivative Location

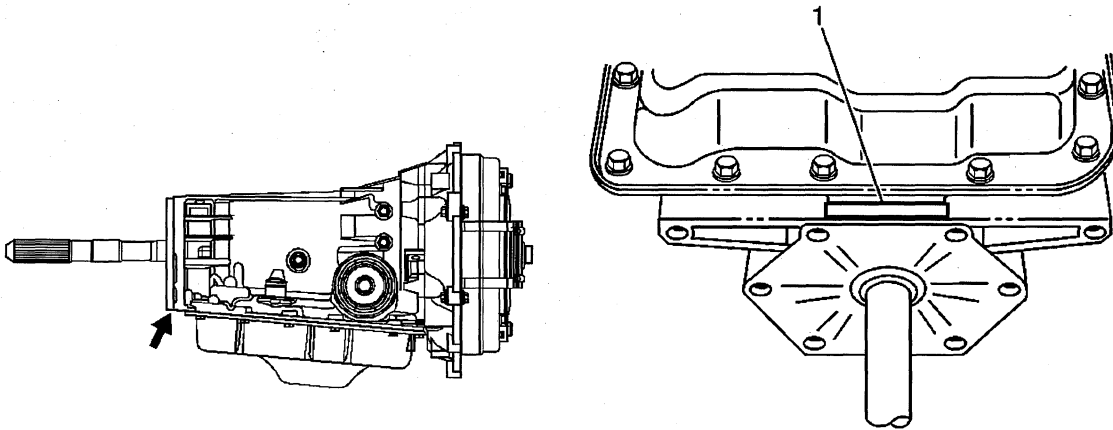
### Borg Warner T-56 Transmission ID Location



- (1) VIN Derivative, Primary Location
- (2) VIN Derivative, Secondary Location

The 6-speed manual transmission, the Borg Warner Modified T-56 (RPO MM6), is stamped with a VIN derivative, which will be located in either the primary or secondary location, as shown. For additional information, refer to VIN Derivative above.

**4L60-E Automatic Transmission ID Number Location, M30<sup>(c)</sup>**



**(1) Automatic Transmission ID Number Location**

The 4-speed overdrive automatic transmission, the Hydra-Matic 4L60-E (RPO M30), has two indentifying stampings or laser etchings:

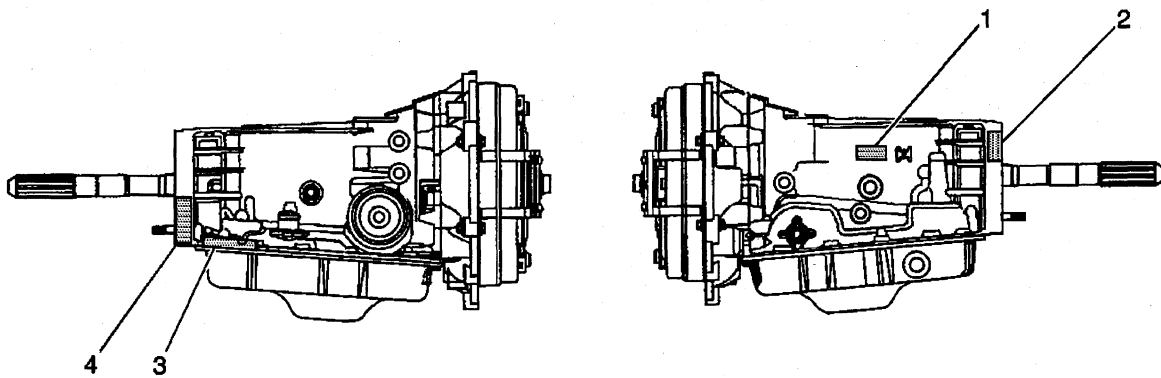
The transmission identification (ID) number indicates the transmission model type and when the unit was built. The transmission ID number is located on the bottom of the case just rear of the oil pan.

**Automatic Transmission Identification Number System**

Position	Definition	Character	Description
1	Model Year	4	2004
2-3	Model	Y	Corvette
4	Transmission Type	D	HYDRA-MATIC 4L60-E
5	Calendar Year	4	2004
6-8	Julian Date (or Day of the Year)	--	--
9	Shift Build	--	--



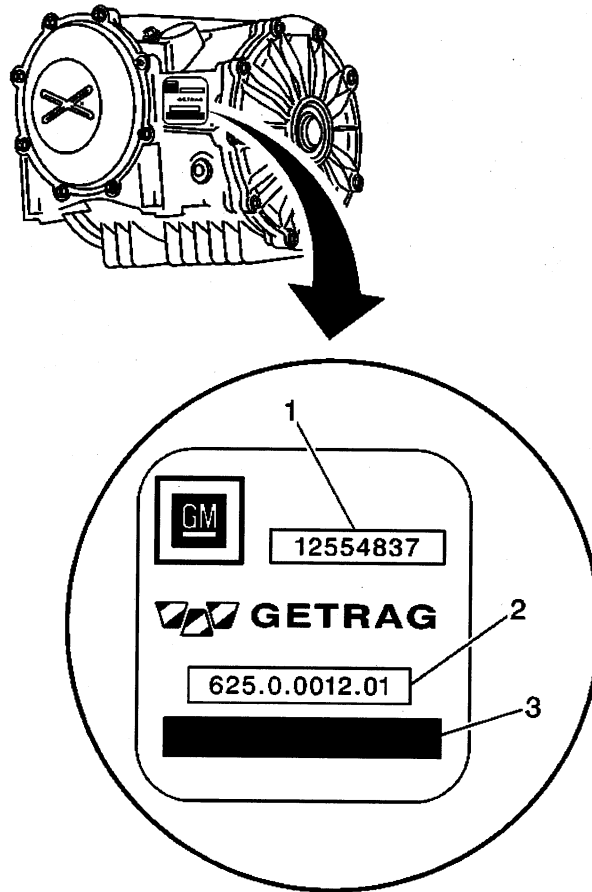
**4L60-E Automatic Transmission VIN Derivative Locations, M30<sup>(c)</sup>**



- (1) VIN Derivative, Primary Location
- (2) VIN Derivative, Secondary Location
- (3) VIN Derivative, Optional Location
- (4) VIN Derivative, Optional Location

A VIN derivative will be located in either the primary or secondary locations, or the optional locations as shown. For additional information, refer to VIN Derivative above.

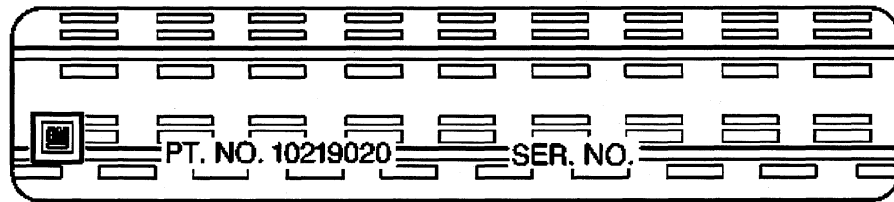
### Axle Identification – Rear



- (1) GM Part Number
- (2) Getrag Part Number
- (3) Serial Number

The rear axle ID tag is located on the RH rear of the differential.

## 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
AAB	Memory, Driver Convenience Package
AK5	Inflatable Restraint System, Driver and Passenger
AQ9	Reclining Bucket Seat, Driver and Passenger
AR9	Reclining Bucket Seat, Driver and Passenger, European Style
AX4	Conversion, Seat Belt, Manual, European
BAG	Parts Package, Export
BCC	Cylinder Unit Passenger Door
BGR	Plant Code Bowling Green, KY, USA
BW3	Bumper Provisions Canadian Requirements
B4H	Modification Noise Control, Export
B84	Molding B/S Exterior
CC3	Roof Panel, Removable
CF7	Roof Panel, Removable
CJ2	HVAC System, Air Conditioning, Automatic Temperature Control
C05	Roof, Convertible Folding
C2L	Roof Package, Dual Removable
DD0	Mirror, Outside, LH & RH, Remote Control, Electric, Heated, Light Sensitive
DD8	Mirror, Inside, R/V Light Sensitive
DL5	Decal Roadside Service Information
DL8	Mirrors, Outside, LH/RH Remote Control Electric, Heated
D24	Mirror O/S LH and RH, Remote Control, Electric, Heated LT Sensitive, Power Folding
ECM	Module Inflatable Restraint, European Complaint
FE1	Suspension System
FE3	Suspension System, Sport
FE4	Suspension System, Special Ride and Handling
F55	Chassis Continuously Variable Real Time Damping Magneto Rheological
GU2	Axle, Rear, 2.73 Ratio
GU6	Axle, Rear, 3.42 Ratio
G90	Axle, Rear, 3.15 Ratio
G92	Axle, Rear, Performance Ratio
JL9	Brake System, Power, Front & Rear Disc, Antilock, 4-Wheel
KG4	Generator 150 AMP
K05	Heater, Engine Block
K63	Generator, 110 Amp
LMS	Ornamentation Emblem Lemans 3RD GTS WIN
LS1	Engine, Gas, 8-Cylinder, 5.7L, SFI, Aluminum
LS6	Engine, Gas, 8-Cylinder, 5.7L, SFI, Aluminum HO
MM6	Transmission, Manual 6-Speed, 85 mm, 2.66 1st, 0.50 6th, O/D
MN6	Merchandised Transmission, Manual 6-Speed Provisions
MX0	Merchandised Transmission, Automatic O/D Provisions
M12	Transmission, Manual 6-Speed, 85 mm, 2.97 1st, 0.57 6th, O/D
M30	Transmission, Automatic 4-Speed, 4L60-E, Electronic
NA3	Emission System, Japan
NC1	Emission System, California LEV
NF9	Emission System Federal, NLEV
NK4	Steering Wheel, Sport Leather
NP7	Steering Column, EEC Approved

2004 Chevrolet Corvette Restoration Kit

NT3	Emission System EEC 00
N37	Steering Column, Tilt, Telescoping
N73	Wheel Custom Sport, VAR 4
P12	Wheel 17 x 9.5 Front and 18 x 10.5 Rear, Cast Aluminum
P36	Wheel 17 X 9.5 FRT and 18 x 10.5 RR, Alum Polished
QF5	Wheel, 17.0 x 8.5" Front and 18.0 x 9.5" Rear, Aluminum, Polished
QG1	Wheel, 17.0 x 8.5" Front and 18.0 x 9.5" Rear, Aluminum, Painted
RPA	Rear Parking Assist
T2F	Brake Provisions Special
T82	Headlamp Control, Automatic On-Off
T84	Headlamps, RH Rule of Road, E Mark
T85	Headlamps, LH Rule of Road, E Mark
T89	Lamps, Tail & Stop, Export
T90	Lamps, Signaling & Marker, Front, Export
T93	Lamps, Tail & Stop, Special
UD4	Alarm, Vehicle Speed, 120 km/h
UH3	Indicator Low Tire Press, Var 2
UK1	Radio Frequencies, Japanese
UL0	Radio, AM/FM Stereo, Seek/Scan, Auto Reverse Music Search Cassette, Auto Tone, Clock, Electronically Tuned Receiver (ETR)
UL2	Radio Frequencies, European
UN0	Radio, AM/FM Stereo, Seek/Scan, Compact Disc, Auto Tone, Clock, (ETR)
UV6	Display, Head Up
UV7	Antenna, Windshield, Rear Window, Radio
UZ6	Speaker System 6, Quad Front Door Mounted, Dual Quarter Mounted
U1S	Player, Multiple Compact Disc
U19	Instrument Cluster, Speedometer, Metric (Canadian, Export)
U52	Instrument Cluster, Electronic
U73	Antenna, Fixed, Radio
U75	Antenna Power, Radio
VD1	Provision Options, Europe
VE1	Provision Options, Japan
VG1	Protector Underhood Compound, Corrosion Preventive, Water Based, Clear
VG8	Vehicle Label, Notice to Buyer
VG9	Protector, Wax, Exterior Body
VH5	Plate, Vehicle Identification
VL4	License Plate Mounting Package, Front, EEC
V49	License Plate Frame
V73	Vehicle Statement, US/Canada
V76	Tow Hooks
V87	Vehicle Statement, Gulf States Organization
XAB	Tire Front 245/40ZR17-95Y BW
XFW	Tire, Front, P265/40R17 BW R/PE ST TL HW4
XGG	Tire, Front, P245/45R17-89Y, BW TL SBR HW4, EMT
XMC	Tire, Front, P245/45R17-89Y,BW R/PE ST TL HW4
YAC	Tire Rear P245/40ZR18-94Y BW ST TL HW4
YFU	Tire, Rear, P295/35R18-91Y, BW R/PE ST TL HW4
YGH	Tire, Rear, P275/40R18-94Y,BW TL HW4 SBR, EMT
YME	Tire, Rear, P275/40R18-94Y, BW TL HW4 SBR
Z16	Performance Package European Commemorative Edition
Z18	Performance Package Z06 Commemorative Edition
Z49	Modifications, Canadian, Mandatory Base Equipment
Z5X	Mirror Provisions, Arabic Language
Z51	Performance Package, Handling

## Technical Information

### Maintenance and Lubrication

#### Capacities - Approximate Fluid

Application	Specification	
	Metric	English
Air Conditioning Refrigerant R134a	0.79 kg	1.75 lbs
Cooling System	11.9 L	12.6 qts
Engine Oil with Filter	6.1 L	6.5 qts
Fuel Tank	68.0 L	18.0 gals
Rear Axle Differential		
• Lubricant	1.6 L	1.69 qts
• Limited-Slip Additive	118 ml	4.0 ounces
Transmission Fluid		
• Drain and Fill Automatic Transmission	4.7 L	5.0 qts
• Overhaul Automatic Transmission	10.2 L	10.8 qts
• Overhaul Manual Transmission	3.8 L	4.1 qts
Power Steering Approximate	0.81 L	1.7 pts
Wheel Nut Torque	140 N·m	100 lb ft

#### Engine Specifications

Engine	VIN Code	Transmission	Spark Plug Gap	Firing Order
LS1 V8	G	Automatic	1.0 mm (0.040 in)	1-8-7-2-6-5-4-3
LS1 V8	G	Manual	1.0 mm (0.040 in)	1-8-7-2-6-5-4-3
LS6 V8	S	Manual	1.0 mm (0.040 in)	1-8-7-2-6-5-4-3

#### Engine Data

Engine	Horsepower	Torque	Displacement	Compression Ratio
LS1 Automatic Trans	350 @ 5200 RPM	360 lb ft @ 4000 RPM	5.7 L	10.1:1
LS1 Manual Trans	350 @ 5200 RPM	375 lb ft @ 4400 RPM	5.7 L	10.1:1
LS6	405 @ 6000 RPM	400 lb ft @ 4800 RPM	5.7 L	10.5:1

#### Maintenance Items

Part	GM Part Number	AC Delco Part Number
Air Cleaner Filter	25042562	A917C
Coolant Surge Cap	10296465 15 psi (105 kPa)	--
Engine Oil Filter	25010633	PF4
Fuel Filter	25121293	GF-819
Passenger Compartment Air Filter (2)	52482929	--
PCV Valve	25179136	CV948C
Spark Plugs	12571164	41-985
Windshield Wiper Blades (Hook Type)	Length: 55.9 cm (22 inches) Type: 9 mm x 3 mm Shephard's Hook	

#### Tire Inflation Pressure Specifications

Application	Specification	
	Metric	English
Tires, Front and Rear	210 kPa	30 psi
Compact Spare	420 kPa	60 psi

**Fluid and Lubricant Recommendations**

<b>Application</b>	<b>Fluid/Lubricant</b>
Automatic Transmission	DEXRON®-III Automatic Transmission Fluid
Engine Coolant	A 50/50 mixture of clean, drinkable water and use only GM Goodwrench® DEX-COOL® or Havoline® DEX-COOL® silicate-free coolant
Engine Oil	The engine requires a special oil meeting GM Specification 4718M. Oils meeting this specification may be identified as synthetic, and should also be identified with the American Petroleum Institute (API) Certified for Gasoline Engines STARBURST symbol. However, not all Synthetic API oils with the STARBURST symbol will meet this GM Specification. Look for and use ONLY an oil that meets GM Specification 4718M.
Engine Oil Export	In areas of the world other than North America, it may be difficult to find oils that display the API STARBURST symbol and that are labeled as meeting the GM4718M Specification. If you cannot find API STARBURST displaying oils identified as meeting the GM4718M requirements, look for oils that meet the API Service SJ and ACEA A3-96 requirements
Hinges, Hood and Door	Lubriplate® Lubricant Aerosol GM P/N 12346293 or equivalent or lubricant meeting requirements of NLGI #2, Category LB or GC-LB
Hood Latch Assembly, Secondary Latch, Pivots, Spring Anchor and Release Pawl	Lubriplate® Lubricant Aerosol GM P/N 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 P/N 12345347 or equivalent DOT-3 Brake Fluid
Key Lock Cylinders	Multi-Purpose Lubricant, Superlube® GM P/N 12346241 or equivalent
Manual Transmission	DEXRON®-III Automatic Transmission Fluid
Power Steering System	GM Power Steering Fluid GM P/N 1052884 pint or GM P/N 1050017 quart, or equivalent
Rear Axle Limited-Slip Differential	SAE 75W-90 Synthetic Axle Lubricant, GM P/N 12378261 in Canada use GM P/N 10953455 or equivalent meeting GM Specification 9986115. With a complete drain and refill add 118 ml (4 oz) of Limited-Slip Differential Lubricant Additive GM P/N 1052358 or equivalent
Weatherstrip Conditioning	Dielectric Silicone Grease GM P/N 12345579 or equivalent
Windshield Washer Solvent	GM Optikleen® Washer Solvent GMP/N 1051515 or equivalent

## **Descriptions and Operations**

### **Power Steering System**

#### **Power Steering Pump Description**

The constant displacement vane type pump provides hydraulic pressure and flow for the steering system. The pump is belt driven by the power steering pump pulley and crankshaft pulley. The opening at the rear of the pump housing contains:

- The pump ring
- The pressure plate
- The thrust plate
- The rotor
- The vanes
- The end plate

A small opening on the side of the housing contains the pressure line fitting. A pressure relief valve inside the flow control valve limits the pump pressure.

#### **Power Steering Gear Description**

The Magnasteer® system is a speed-dependent power steering system. The system provides power assist at varying levels depending on need. A bi-directional magnetic rotary actuator in the steering gear adjusts the amount of torque (driver effort) necessary in order to turn the steering wheel. This module varies the torque by adjusting the current flow through the actuator. The amount of adjustment is directly related to vehicle speed. The module receives speed-related input signals from the vehicle speed sensor.

The major internal components of the steering gear are:

- The power steering gear pinion and valve shaft assembly
- The steering rack and pinion assembly
- The steering linkage tie rod assemblies (inner and outer tie rods)

The steering gear rack and pinion assembly is supported at its ends in the steering gear housing and sealed to prevent both external and internal leakage across the piston. The pinion and valve assembly intersects and meshes directly with the teeth of the rack and pinion assembly. Movement of the steering wheel is transferred through the pinion to the teeth on the rack and pinion assembly.

The movement of the steering gear assembly is aided by hydraulic pressure and fluid flow supplied by the power steering pump assembly. Pressurized fluid is directed by the steering gear valve to the rack and piston assembly through external lines. When the steering wheel is turned to the right, the steering gear valve is opened and routes pressurized fluid to the left side of the piston, while allowing fluid to escape from the right side and return to the valve area. The pressure of the fluid is converted to a mechanical force applied to the piston and the difference in force across the piston causes the rack to move to the right. The opposite occurs when the steering wheel is turned to the left.

Manual steering is maintained in the event of power steering pump or accessory drive belt failure. Under these conditions the steering effort will be increased.

#### **Variable Effort Steering Description**

The variable assist magnetic steering system (Magna Steer) varies the driver effort required to steer the vehicle as speed changes. At low speeds, the system requires minimum steering effort for easy turning and parking maneuvers. Steering effort is increased at higher speeds in order to provide the driver with firmer steering (road feel) and directional stability. The EBCM controls a bi-directional magnetic rotary solenoid. The solenoid is located in the steering gear. The EBCM varies the steering assist by adjusting the current flow through the solenoid. The solenoid adjusts the amount of power steering assist in order to achieve a given level of driver effort to turn the vehicle.



Magna Steer accomplishes this by adding or subtracting torque on the rotary input shaft to the power rack and pinion. The amount of steering assist is dependent upon vehicle speed. As the vehicle speed increases, the following actions occur:

- The steering assist decreases.
- The driver effort increases.

As the vehicle speed decreases, the following actions occur:

- The steering assist increases.
- The driver effort decreases.

The scan tool can be used to adjust the amount of steering assist if the customer requests. The steering assist has 3 settings:

- Factory calibration
- More firm
- Less firm

### **Variable Effort Steering Components**

The MAGNASTEER® system consists of the following components:

- The electronic brake control module (EBCM).
- The MAGNASTEER® actuator
- The power rack gear
- The power steering pump

### **The Electronic Brake Control Module (EBCM)**

Refer to ABS Description .

### **The MAGNASTEER® Actuator**

The MAGNASTEER® is an integral part of the power steering gear. The MAGNASTEER® actuator consists of the following components:

- A rotary valve
- A permanent magnet that is attached to the input shaft of the rotary valve
- Two pole pieces that are attached to the output side of the valve (the pinion)
- An electromagnetic coil mounted in the gear housing

When the coil is energized, a magnetic field is formed between the permanent magnet and the pole pieces, which increases the torque on the input shaft to the steering gear. The EBCM controls the current flow to the coil. As the vehicle speed increases, the EBCM increases the current flow. The increased current flow results in an increase in steering effort.

Other power steering system components, while specially modified for use with MAGNASTEER®, are similar to non-MAGNASTEER® power steering components.

### **The Power Rack Gear**

The design of the MAGNASTEER® power rack and pinion assembly is the same for a non-MAGNASTEER® system except for valve machining differences. The steering wheel movement transfers to the pinion. The pinion moves the rack left or right by meshing the pinion and rack teeth. The force transmits through the tie rod ends and the steering knuckles to turn the wheels.

The power rack and pinion steering system has a rotary control valve. The rotary control valve directs hydraulic fluid from the power steering pump to the two sides of the rack piston. The piston attaches to the rack. The attached piston uses hydraulic pressure to move the rack left or right. The rotary control valve regulates the amount of effort by responding to the driver's torque input.

More control is maintained when the hydraulic assist is not available. More steering effort is required with manual control.

### **The Power Steering Pump**

A constant displacement van-type pump performs the following services for the steering system:

- Provides hydraulic pressure
- Provides flow

The power steering pump and the engine crankshaft pulleys drives the pump. The opening at the rear of the pump housing contains the following components:

- The pump ring
- The pressure plate
- The thrust plate
- The rotor
- The vanes
- The end plate

The pump housing side contains the pressure line fitting. The pressure relief valve inside the flow control valve limits the pump pressure.

### **Electronic Brake Traction Control Description**

The MAGNASTEER system has software contained in the Electronic Brake Traction Control Module (EBTCM). The EBTCM processes vehicle speed information from the ABS wheel speed sensors and the steering wheel position sensor to provide a control signal to the MAGNASTEER actuator located in the power steering gear.

### **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.

## **Tilt\Telescoping Description**

The tilt - telescoping steering column uses the same tilt lever as the non-telescoping column and functions in the same manner. The telescoping function of this column consists of the telescoping drive motor, the telescoping actuator assembly and the telescoping actuator switch. The telescoping actuator assembly is cable driven by the telescoping drive motor. The telescoping actuator switch operates the inward or outward movement of the steering wheel.

## **Tilt\Telescoping Operation**

The telescoping steering column in/out switch is an input to the seat control module. The telescoping drive motor is an output function of the seat control module. The telescoping actuator assembly is cable driven by the telescoping drive motor.

Steering column memory settings are stored in the seat control module. The steering column position sensor is an internal part of the telescoping actuator assembly, and is an input to the seat control module. The seat control module uses the position sensor input when storing and recalling memory settings.

Memory steering column, and the easy enter/exit operations are performed by the seat control module. However the left door control module assumes control when memory settings are stored and recalled, by use of the serial data link. The body control module assumes control when the easy enter/exit operation occurs, by use of the serial data link.

The body control module stores the RPO code configuration which signals to the seat control module whether or not the telescoping steering column option is active. This RPO code configuration must be correct, and received by the seat control module, or power seat, and telescoping steering column operation will be inoperative or incorrect.

## **Suspension Description and Operation**

### **Front Suspension**

The front suspension uses a single lightweight fiberglass transverse spring mounted to the lower control arms.

The upper control arms are made of high-strength forged aluminum. The lower control arms, the crossmember and the steering knuckles are made of cast aluminum.

The hub and bearing assembly is a sealed unit. The hub and bearing assembly eliminates the need for wheel bearing adjustment. The hub and bearing assembly requires no maintenance.

The high-strength tubular steel stabilizer shaft provides stability.

The shock absorbers attach at the upper end to the frame and attach at the lower control arm. The shock absorber helps keep the wheel in contact with the road surface under most road conditions. The shock absorber reduces crash-through at full jounce and rebound.

The standard gas shocks and the optional Real Time Damping (RTD) shock absorbers are gas charged to reduce aeration (foaming) of the shock fluid. Aeration of the shock fluid results in unlimited damping control.

## Rear Suspension

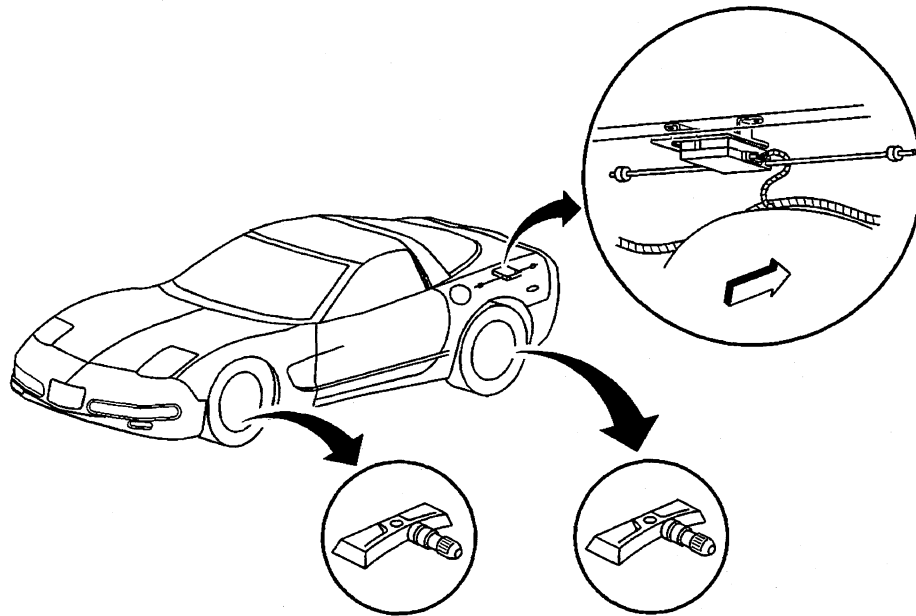
The rear suspension uses a single lightweight fiberglass transverse spring mounted to the crossmember and lower control arms. The following lightweight aluminum components are used throughout the rear suspension:

- Rear suspension knuckles
- Upper control arms
- Lower control arms
- Rear suspension toe links
- Crossmember
- Drive shaft support tube

The shock absorbers attach at the upper end to the frame and at the lower end, to the lower control arm. Shock absorbers help keep the wheels in contact with the road surface under most road conditions. Shock absorbers reduce crash-through at full jounce and rebound.

The standard gas shock and the optional Real Time Damping (RTD) shock absorbers are gas charged to reduce aeration (foaming) of the shock fluid. Aeration of the shock fluid results in poor damping control.

## Tire Pressure Monitor System Description



The Tire Pressure Monitoring (TPM) system allows the driver to monitor the tire pressure in all four tires. Pressing the GAGE 2 button on the DIC will display the tire pressure on the IPC. The TPM also warns the driver of under and over inflation condition with the following IPC messages:

- HIGH TIRE PRESSURE
- LOW TIRE PRESSURE
- FLAT TIRE

The TPM system consists of four battery powered, water resistant, radio frequency signal generator sensors and a receiver with self diagnostic capabilities. A sensor is mounted on each wheel on the back of each valve stem. The valve stem and the sensor battery are integrated and are not serviceable. The receiver is located over the LH rear wheelhouse. The TPM system uses the same receiver as the RFA system.

The TPM system receives the information to monitor the tire pressure in all four wheels through each of the sensors. The vehicle must be traveling 16-24 km/h (10-15 mph) before the sensors will transmit the tire pressure information. At this speed, the sensor roll switches activate in order to transmit each unique

location identification code to the receiver. The TPM sensors also send the tire pressure information to the receiver within the range of 0-427 kPa (0-60 psi). The receiver interprets this data and sends a message on the serial data line to the IPC. The IPC then displays the tire pressure information for each tire. Holding a magnet over the valve stem will manually override the sensor for programming or testing purposes. When the vehicle has been stationary for more than 1 minute, the sensors enter a power down or sleep mode and stop transmitting tire pressure information. This minimizes the battery consumption rate.

The TPM system uses barometric pressure information in order to determine how to compensate tire pressure readings for different altitudes. The receiver requests the information from the Powertrain Control Module (PCM) when the ignition is first turned to ON. If the receiver is unable to receive the information from the PCM, the receiver will substitute a default value and no compensation will occur.

The receiver also warns the driver of a tire over or under inflation condition. If the TPM sensors transmit a reading of over 289 kPa (42 psi), the receiver will send a message to the IPC to display the HIGH TIRE PRESSURE warning message. If a tire pressure reading between 34-172 kPa (5-25 psi) is sent, the receiver sends a message to the IPC to display the LOW TIRE PRESSURE warning message. If the reading sent is under 34 kPa (5 psi), a FLAT TIRE message will appear.

### **Electronic Suspension Control Description**

The Electronic Suspension Control system, also known as the Magneto-Rheological Real Time Damping (MRRTD) system independently controls the fluid viscosity in each of the four shock absorbers in order to control the vehicle ride characteristics. The ESC system is capable of making these changes within milliseconds. The ESC system consists of the following major components:

- The electronic suspension (ESC) module
- The front/rear position sensors
- The front/rear adjustable shock absorbers
- The shock absorber electrical actuators, which are integrated within the shock absorbers.

The ESC controls the damping mode selection according to the following factors:

- The vehicle speed
- The chassis pitch input
- The steering position
- The body to wheel displacement

The ESC module evaluates these inputs in order to separately control the shock absorbers, providing an enhanced ride and comfort level over the widest possible range of operating conditions.

### **Electronic Suspension Control Module**

The ESC module provides electronic control logic and output drive for each shock absorber. The ESC module makes decisions due to road and driving conditions based on various inputs. The ESC module receives input information by sensors that are directly connected to the ESC module or by other systems through the serial data line.

The ESC module uses these inputs in order to independently control the shock absorbers at each corner. The ESC module is located in the LH rear storage.

### **Electronic Suspension Control Position Sensors**

The ESC position sensors provide the ESC module with the body to wheel displacement input. The ESC module uses this and other inputs in order to control the position of the shock absorber. If any body or wheel motion is detected, the ESC module will determine how soft or firm each shock absorber should be to provide the best ride. The ESC position sensors are mounted at each corner of the vehicle between the control arm and the body.

### **Electronic Suspension Control Shock Absorber or Strut**

The ESC shock absorbers are monotube type which provide damping by increasing magnetic flux to magnetic particles to resist suspension movement. The ESC shock absorber has the capability of

providing multiple modes or values of damping forces, in both compression and rebound direction. The damping forces are achieved by increasing or decreasing the magnetic flux to shock absorbers.

The front ESC actuator connector is located at the base of the shock absorber. The rear ESC actuator connector is at the top of the shock absorber. Both front and rear shock absorbers have jumper harnesses for ease of maintenance.

### **Electronic Suspension Control Operation**

The ESC system uses the information from other systems in order to execute certain functions.

The ESC system does not have a malfunction indicator lamp, but instead uses the Instrument Panel Cluster (IPC) for the display functions. When the ESC system detects a malfunction that sets a DTC, the ESC system sends a message on the serial data line directly or through the PCM to the IPC, which will display one of the following messages:

- SHOCKS INOPERATIVE
- SERVICE RIDE CONTROL
- MAXIMUM SPEED

The SHOCKS INOPERATIVE message will only be displayed if the ESC system detects a malfunction that sets a DTC and causes the ESC system to disable all four shock absorbers. The ESC system will send a message on the serial data line to the IPC to display this message.

The SERVICE RIDE CONTROL message will only be displayed if the ESC system detects any malfunction that sets a DTC. The ESC system will send a message on the serial data line to the IPC to display this message.

The MAXIMUM SPEED message will only be displayed if the ESC system detects a malfunction that sets a DTC and causes the ESC system to disable all four shock absorbers. The ESC system will send a message on the serial data line to the PCM indicating that all four shock absorbers were disabled. The PCM then sends a message to the IPC to display this message.

The ESC module has the ability to store Diagnostic Trouble Codes (DTCs) as current or history codes. Most ESC system malfunctions will display a message in the IPC and set a DTC. The message will remain ON until the RESET button is pressed on the Driver Information Center (DIC). As long as the DTC is current, the message will be displayed after every ignition cycle and the RESET button must be pressed to bypass the message.

The ESC system uses an ignition cycling diagnostic approach in order to reduce the occurrence of false or intermittent DTCs that do not affect the functionality of the ESC system. This allows for the fail-soft actions to be taken whenever a malfunction condition is current, but requires the malfunction to be current for a certain number of ignition cycles before the corresponding malfunction code and message will be stored or displayed.

If the ESC detects a malfunction, the ESC system defaults with a fail-soft action. A fail-soft action refers to any specific action the ESC system takes in order to compensate for a detected malfunction. A typical ESC fail-soft action would be if the ESC system detects a malfunction with the ride control switch, the ESC system will ignore this input and fail-soft to the TOUR ride setting.

## **Wheels and Tires**

### **General Description**

Factory installed tires and wheels are designed to operate satisfactorily with loads up to and including the full load capacity when inflated to the recommended tire pressures. Correct tire pressure and correct driving techniques have an important influence on tire life. Heavy cornerings, excessively rapid accelerations, and unnecessary sharp braking increase tire wear.

The Tire Pressure Monitoring system (TPM), required with extended mobility tires (EMT), continuously monitors system components and air pressure in each road tire while the vehicle is being driven. When the vehicle is being driven the system notifies the driver through the digital display message in the instrument cluster of system failure or low tire pressure.

### Tires Description

The vehicle is equipped with Extended Mobility Tires (EMT) as standard equipment. The EMT is a runflat tire that can be driven on for up to 200 miles at speeds up to 55 miles per hour with zero inflation pressure.

### Passenger Tire Service Description

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

### 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)**

<b>kPa</b>	<b>psi</b>	<b>kPa</b>	<b>psi</b>
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
<b>Conversion: 6.9 kPa = 1 psi</b>			

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

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

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

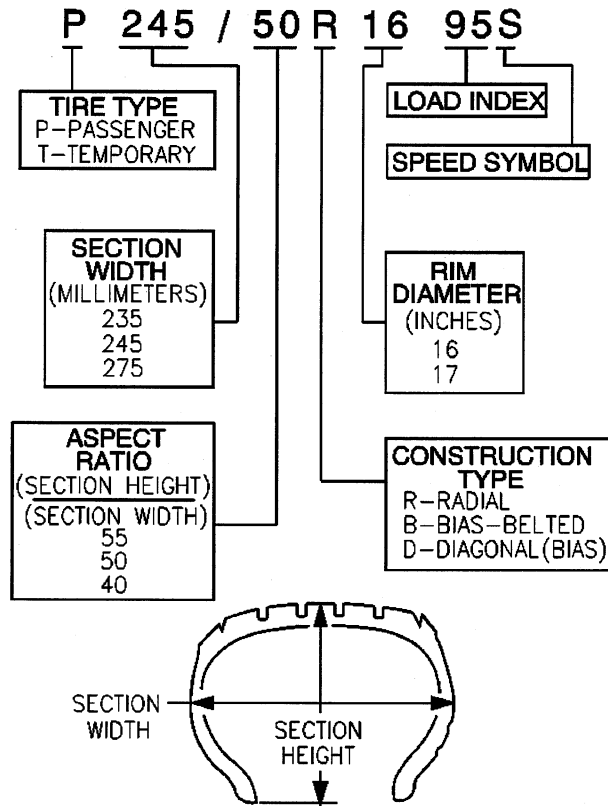
- A tire squeal on turns
- Hard steering
- Rapid wear and uneven wear on the edge of the tread
- Tire rim bruises and tire rim rupture
- Tire cord breakage
- High tire temperatures
- Reduced vehicle handling
- High fuel consumption
- Soft riding

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

- Uneven braking
- Steering lead
- Reduced vehicle handling



### P-Metric Sized Tires Description

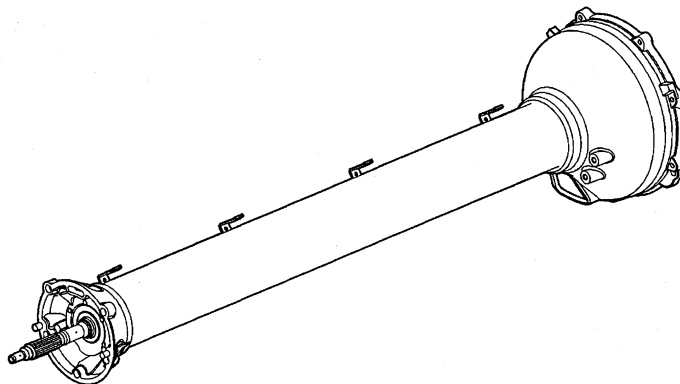


Most P-metric tire sizes do not have exact corresponding alphanumeric tire sizes. Replacement tires should be of the same tire performance criteria (TPC) specification number including the same size, the same load range, and the same construction as those originally installed on the vehicle. Consult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

## Driveline System Description and Operation

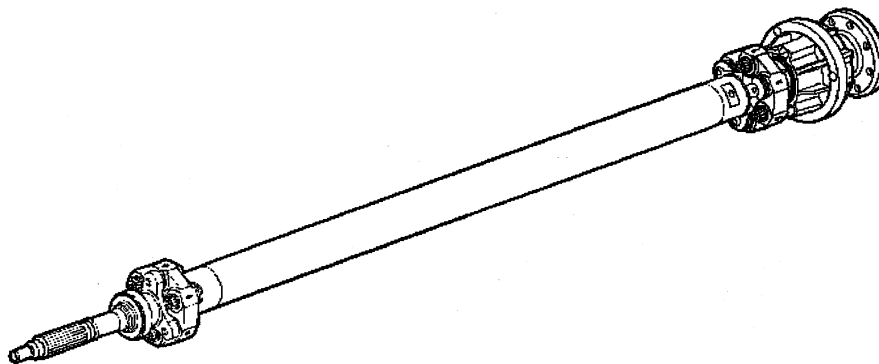
### Driveline/Axle – Propeller Shaft

#### Driveline Support Assembly Description



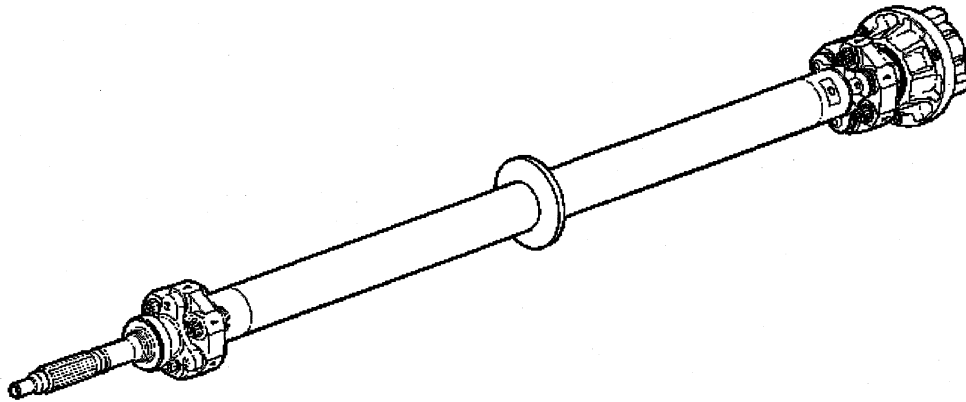
The driveline support assembly consists of a driveline support tube (with rear bell housing) and an internal propeller shaft assembly. The front of the driveline assembly mounts to the engine bellhousing. In manual transmission applications, the clutch actuator is retained to the front of the tube and the shifter linkage is mounted to brackets at the top center area. The driveline support assembly is specific for each vehicle as equipped (either automatic or manual transmission applications).

#### Propeller Shaft Assembly (Automatic Transmission)(c)



The automatic transmission propeller shaft assembly consists of a splined front input shaft, front coupling, propeller shaft, rear coupling, and bearing and housing assembly. The input shaft, propeller shaft, couplings and bearing and housing assembly are balanced as an assembly. The front of the propeller shaft assembly is supported (at the input shaft) by a ball type bearing. An O-ring, located in the front of the driveline support tube, prevents the front bearing outer race from spinning. The rear of the propeller shaft assembly is supported by a bearing and housing assembly. The bearing and housing assembly consists of a housing, internally splined input hub, externally splined flexplate spindle, O-rings, snap rings, and two ball type bearings. The propeller shaft assembly is retained in the driveline tube by an internal snap ring. The torque converter flex plate is retained to the flexplate spindle by bolts and is mated to the torque converter.

## Propeller Shaft Assembly (Manual Transmission)(c)



The manual transmission propeller shaft assembly consists of a splined front input shaft, front coupling, propeller shaft, rear coupling, and bearing and housing assembly. The input shaft, propeller shaft, couplings and bearing and housing assembly are balanced as an assembly. The front of the propeller shaft assembly is supported (at the input shaft) by a ball type bearing. An O-ring, located in the front of the driveline support tube, prevents the front bearing outer race from spinning. The rear bearing of the propeller shaft assembly is supported by a bearing and housing assembly. The bearing and housing assembly consists of a housing, internally splined hub, pilot bushings, O-rings, snap rings, a wave washer, and two ball type bearings. The bearing housing hub internal splines couple to the manual transmission splined input shaft. The propeller shaft assembly is retained in the driveline tube by an internal snap ring. The propeller shaft tube has an overspeed limiter (snubber) that prevents permanent propeller shaft damage as a result of a downshift above recommended speeds.

### Important

Disassembly and improper reassembly of the propeller shaft components may result in driveline vibration. The propeller shaft and components should be kept free of any foreign material which could upset balance and also produce driveline vibration.

When servicing the engine, transaxle, or driveline support assembly, the proper installation procedure must be followed. Automatic transmission applications have a specific installation procedure and sequence of installation steps. Failure to follow proper procedures may cause damage to other vehicle driveline components.

### Wheel Drive Shafts Description and Operation

Drive axles are flexible assemblies consisting of an inner and outer constant velocity (CV) joint connected by an axle shaft. The inner joint is completely flexible, and can move in and out. The outer joint is also flexible, but cannot move in and out. These drive axles are used to transmit rotational force from the rear axle differential to the rear tire and wheel assemblies.

### Seal and Clamp

The drive axle assemblies use inboard and outboard joint seals made of thermoplastic material, and clamps made of stainless steel. The functions of the seals are as follows:

- The seals protect the internal parts of the inboard and outboard joints.
  - They protect the joint lubricating grease from surrounding detrimental atmospheric conditions (such as extreme temperatures, ozone gas, etc.).
  - They protect the joint lubricating grease from foreign materials (such as stones, dirt, water, salt, etc.).
- The seals facilitate angular and axial movement of the inboard joint.
- The seals facilitate angular movement of the outboard joint.

The function of the clamps is as follows:

Provide a leak proof connection at both the housing and the axle shaft for the inboard and outboard joints.

The thermoplastic material performs well against normal handling, operational wear and conditions. This material however, is not strong enough to withstand abusive handling or damage due to objects such as sharp tools or the sharp edge of any other surrounding component on the vehicle.

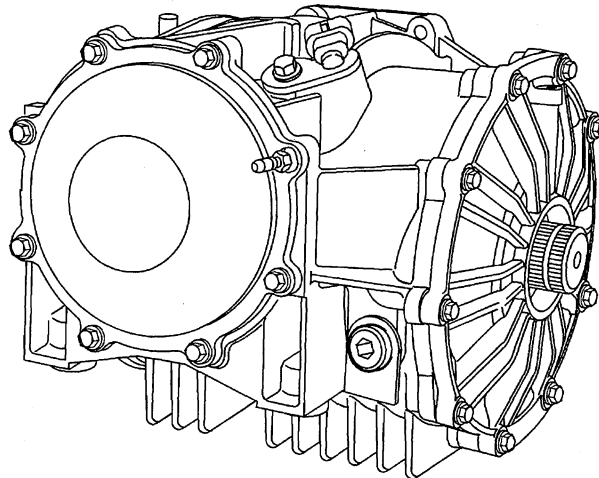
### **Inner Joint**

The inner joints are of the enhanced double offset design. The inner joints use a female spline which is installed over a stub shaft protruding from the rear axle differential.

### **Outer Joint**

The outer joints are of the Rzeppa joint design. The splined shaft end which mates with the knuckle and hub assembly, incorporates a helical spline to assure a tight, press-type fit. This design assures that no end play will exist between the hub bearing and the drive shaft assembly for added durability and reduced bearing noise.

## **Rear Drive Axle Description and Operation**



The vehicle is powered by either the LS1 or LS6 5.7 liter V-8 engine, VIN G or S. Motion is transferred from the engine crankshaft/flywheel through the driveline support, propeller shaft, assembly to either the 4L60-E (M30) automatic transmission or the ZF (MM6) 6-speed manual transmission. The splined output shaft of the transmission drives the pinion, which in turn, rotates the ring gear and differential case assembly. The limited slip differential distributes torque/power to the rear wheels via individual axle shaft assemblies. The limited-slip differential is of a conventional separator plate and friction disc type design.

The differential housing, side covers, pinion housing, and differential case halves are constructed of cast aluminum. The internal components incorporate a hypoid gear set, ring and pinion, carrier assembly, and pinion housing assembly. The pinion is supported in a pinion housing by tapered roller bearings. The pinion is positioned rearward of the ring gear centerline.

Pinion position, ring gear position, and carrier bearing preload are determined by shimming procedures.

All models have a 7 5/8 inch ring gear. Each ring gear has specific setup dimensions, A1 and A2 values, stamped onto the side area of the gear. The A1 and A2 values are unique to each ring gear/pinion and are determined during the manufacturers gear/pinion noise and vibration setup and testing. The vehicle speed sensor reluctor ring is incorporated into the outside area of the ring gear. The vehicle speed sensor

detects the rotational pulses produced by the reluctor ring and send the signal to the vehicle control module (VCM).

The differential assembly is available in three gear ratios. The 3.42 ratio axle is used in all manual transmission applications. The 2.73 ratio axle is standard equipment for automatic transmission applications with an optional 3.15 ratio axle available.

## **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**

### **System Component Description**

The park brake system consists of the following:

#### **Park Brake Lever Assembly**

Receives, multiplies, and transfers park brake system apply input force from operator to park brake cable system.

Releases applied park brake system when lever is returned to at-rest, lowered, position.

#### **Park Brake Cables**

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

#### **Park Brake Cable Equalizer**

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

#### **Park Brake Apply Lever**

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

#### **Park Brake Actuator/Adjuster**

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

Threaded park brake actuators/adjusters 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 (Rear Disc, Drum-in-Hat System)**

Applies mechanical output force from park brake actuator/adjuster 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 lever assembly being applied. The input force is multiplied by the lever assembly, 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. The park brake lever assembly releases an applied park brake system when it is returned to the at-rest, lowered, position.

## **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.

The Traction Control System (TCS) also monitors rear wheel speed and compares the speed to the speed of the front wheel. If excessive rear wheel speed is detected in either rear wheels the TCS will be activated. The TCS uses the following to improved traction and vehicle stability:

- Throttle Shutdown
- Timing control
- Rear brake intervention



## Engine Description and Operation

### Engine Mechanical – LS1 5.7L

#### General Specifications

Application	Specification	
	Metric	English
<b>General</b>		
• Engine Type	V 8	
• Displacement	5.7L - 5665 cc	346 CID
• RPO	LS1	
• VIN	G	
• Bore	99.0 -99.018 mm	3.897-3.898 in
• Stroke	92.0 mm	3.622 in
• Compression Ratio	10.1 :1	
• Firing Order	1-8-7-2-6-5-4-3	
• Spark Plug Gap	1.016 mm	0.04 in
<b>Block</b>		
• Camshaft Bearing Bore 1 and 5 Diameter - First Design	59.08-59.13 mm	2.325-2.327 in
• Camshaft Bearing Bore 2 and 4 Diameter - First Design	58.83-58.88 mm	2.316-2.318 in
• Camshaft Bearing Bore 3 Diameter - First Design	58.58-58.63 mm	2.306-2.308 in
• Camshaft Bearing Bore 1 and 5 Diameter - Second Design	59.58-59.63 mm	2.345-2.347 in
• Camshaft Bearing Bore 2 and 4 Diameter - Second Design	59.08-59.13 mm	2.325-2.327 in
• Camshaft Bearing Bore 3 Diameter - Second Design	58.58-58.63 mm	2.306-2.308 in
• Crankshaft Main Bearing Bore Diameter	69.871-69.889 mm	2.75-2.751 in
• Crankshaft Main Bearing Bore Out-of-Round	0.005 mm	0.0002 in
• Cylinder Bore Diameter	99.0-99.018 mm	3.897-3.898 in
• Cylinder Bore Taper - Thrust Side	0.018 mm	0.0007 in
• Cylinder Head Deck Height - Measuring from the Centerline of Crankshaft to the Deck Face	234.57-234.82 mm	9.235-9.245 in
• Cylinder Head Deck Surface Flatness - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
• Cylinder Head Deck Surface Flatness - Measuring the Overall Length of the Block Deck	0.22 mm	0.008 in
• Valve Lifter Bore Diameter	21.417-21.443 mm	0.843-0.844 in
<b>Camshaft</b>		
• Camshaft End Play	0.025-0.305 mm	0.001-0.012 in
• Camshaft Journal Diameter	54.99-55.04 mm	2.164-2.166 in
• Camshaft Journal Out-of-Round	0.025 mm	0.001 in
• Camshaft Lobe Lift - Exhaust	7.13 mm	0.281 in
• Camshaft Lobe Lift - Intake	6.96 mm	0.274 in
• Camshaft Runout - Measured at the Intermediate Journals	0.05 mm	0.002 in
<b>Connecting Rod</b>		
• Connecting Rod Bearing Clearance - Production	0.023-0.065 mm	0.0009-0.0025 in
• Connecting Rod Bearing Clearance - Service	0.023-0.076 mm	0.0009-0.003 in
• Connecting Rod Bore Diameter - Bearing End	56.505-56.525 mm	2.224-2.225 in

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• Connecting Rod Bore Out-of-Round - Bearing End - Production	0.006 mm	0.00023 in
• Connecting Rod Bore Out-of-Round - Bearing End - Service	0.006 mm	0.00023 in
• Connecting Rod Side Clearance	0.11-0.51 mm	0.00433-0.02 in
<b>Crankshaft</b>		
• Connecting Rod Journal Diameter - Production	53.318-53.338 mm	2.0991-2.0999 in
• Connecting Rod Journal Diameter - Service	53.308 mm	2.0987 in
• Connecting Rod Journal Out-of-Round - Production	0.005 mm	0.0002 in
• Connecting Rod Journal Out-of-Round - Service	0.01 mm	0.0004 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production	0.005 mm	0.0002 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service	0.02 mm	0.00078 in
• Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
• Crankshaft Main Bearing Clearance - Production	0.021-0.052 mm	0.0008-0.0021 in
• Crankshaft Main Bearing Clearance - Service	0.02-0.065 mm	0.0008-0.0025 in
• Crankshaft Main Journal Diameter - Production	64.993-65.007 mm	2.558-2.559 in
• Crankshaft Main Journal Diameter - Service	64.993 mm	2.558 in
• Crankshaft Main Journal Out-of-Round - Production	0.003 mm	0.000118 in
• Crankshaft Main Journal Out-of-Round - Service	0.008 mm	0.0003 in
• Crankshaft Main Journal Taper - Production	0.01 mm	0.0004 in
• Crankshaft Main Journal Taper - Service	0.02 mm	0.00078 in
• Crankshaft Rear Flange Runout	0.05 mm	0.002 in
• Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter	0.7 mm	0.028 in
• Crankshaft Thrust Surface - Production	26.14-26.22 mm	1.029-1.0315 in
• Crankshaft Thrust Surface - Service	26.22 mm	1.0315 in
• Crankshaft Thrust Surface Runout	0.025 mm	0.001 in
<b>Cylinder Head</b>		
• Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface	120.2 mm	4.732 in
• Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
• Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head	0.1 mm	0.004 in
• Surface Flatness - Exhaust Manifold Deck	0.22 mm	0.008 in
• Surface Flatness - Intake Manifold Deck	0.22 mm	0.008 in
<b>Intake Manifold</b>		
• Surface Flatness - Measured at Gasket Sealing Surfaces	0.5 mm	0.02 in

<b>Lubrication System</b>		
• Oil Capacity - with Filter	6.151 Liters	6.5 Quarts
• Oil Capacity - without Filter	5.678 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
<b>Oil Pan</b>		
• Front Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
• Rear Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
• Oil Pan Alignment - to Rear of Engine Block at Transmission Bellhousing Mounting Surface	0.0-0.25 mm	0.0-0.01 in
<b>Piston Rings</b>		
• Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Production	0.23-0.44 mm	0.009-0.017 in
• Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Service	0.23-0.5 mm	0.009-0.0196 in
• Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Production	0.44-0.7 mm	0.017-0.027 in
• Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Service	0.44-0.76 mm	0.0173-0.03 in
• Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Production	0.18-0.75 mm	0.007-0.029 in
• Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Service	0.18-0.81 mm	0.007-0.032 in
• Piston Ring to Groove Clearance - First Compression Ring - Production	0.04-0.086 mm	0.00157-0.0033 in
• Piston Ring to Groove Clearance - First Compression Ring - Service	0.04-0.068 mm	0.00157-0.0033 in
• Piston Ring to Groove Clearance - Second Compression Ring - Production	0.05-0.088 mm	0.002-0.0034 in
• Piston Ring to Groove Clearance - Second Compression Ring - Service	0.05-0.088 mm	0.002-0.0034 in
• Piston Ring to Groove Clearance - Oil Control Ring - Production	-0.008 to +0.176 mm	-0.0003 to +0.0069 in
• Piston Ring to Groove Clearance - Oil Control Ring - Service	-0.008 to +0.176 mm	-0.0003 to +0.0069 in
<b>Pistons and Pins</b>		
• Piston - Piston Diameter- Non Coated Skirt - at Size Point	98.969-98.987 mm	3.8964-3.8997 in
• Piston - Piston Diameter- Measured Over Skirt Coating	98.984-99.027 mm	3.897-3.899 in
• Piston - Piston to Bore Clearance - Non Coated Skirt - Production	0.013-0.049 mm	0.0005-0.0019 in
• Piston - Piston to Bore Clearance - Non Coated Skirt - Service	0.013-0.074 mm	0.0005-0.0029 in
• Piston - Piston to Bore Clearance - Coated Skirt - Production	-0.027 to +0.029 mm	-0.001 to +0.0011 in
• Piston - Piston to Bore Clearance - Coating Worn Off - Service Limit	0.074 mm	0.0029 in

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• Pin - First Design Press Fit Pin Fit in Connecting Rod Bore	0.02-0.043 mm - Interference	0.00078-0.00169 in - Interference
• Pin - First Design Press Fit Pin Clearance to Piston Pin Bore - Production	0.01-0.02 mm	0.0004-0.00078 in
• Pin - First Design Press Fit Pin Clearance to Piston Pin Bore - Service	0.01-0.022 mm	0.0004-0.00086 in
• Pin - First Design Press Fit Pin Diameter	23.997-24.0 mm	0.9447-0.9448 in
• Pin - Second Design Full Floating Pin Fit in Connecting Rod Bore - Production	0.007-0.02 mm	0.00027-0.00078 in
• Pin - Second Design Full Floating Pin Fit in Connecting Rod Bore - Service	0.007-0.022 mm	0.00027-0.00086 in
• Pin - Second Design Full Floating Pin Clearance to Piston Pin Bore - Production	0.002-0.01 mm	0.00008-0.0004 in
• Pin - Second Design Full Floating Pin Clearance to Piston Pin Bore - Service	0.002-0.015 mm	0.00008-0.0006 in
• Pin - Second Design Full Floating Pin Diameter	23.952-23.955 mm	0.943-0.943 in
<b>Valve System</b>		
• Valves - Valve Face Angle	45 degrees	
• Valves - Valve Face Width	1.25 mm	0.05 in
• Valves - Valve Lash	Net Lash - No Adjustment	
• Valves - Valve Lift - Intake	11.79 mm	0.464 in
• Valves - Valve Lift - Exhaust	12.16 mm	0.479 in
• Valves - Valve Seat Angle	46 degrees	
• Valves - Valve Seat Runout	0.05 mm	0.002 in
• Valves - Valve Seat Width - Exhaust	1.78 mm	0.07 in
• Valves - Valve Seat Width - Intake	1.02 mm	0.04 in
• Valves - Valve Stem Diameter- Production	7.955-7.976 mm	0.313-0.314 in
• Valves - Valve Stem Diameter- Service	7.96 mm	0.314 in
• Valves - Valve Stem-to-Guide Clearance - Production - Intake	0.025-0.066 mm	0.001-0.0026 in
• Valves - Valve Stem-to-Guide Clearance - Service - Intake	0.093 mm	0.0037 in
• Valves - Valve Stem-to-Guide Clearance - Production - Exhaust	0.025-0.066 mm	0.001-0.0026 in
• Valves - Valve Stem-to-Guide Clearance - Service - Exhaust	0.093 mm	0.0037 in
• Rocker Arms - Valve Rocker Arm Ratio	1.70:1	
• Valve Springs - Valve Spring Free Length	52.9 mm	2.08 in
• Valve Springs - Valve Spring Installed Height	45.75 mm	1.8 in
• Valve Springs - Valve Spring Load - Closed	340 N at 45.75 mm	76 lb at 1.8 in
• Valve Springs - Valve Spring Load - Open	980 N at 33.55 mm	220 lb at 1.32 in

**Engine Mechanical – LS6 5.7L****General Specifications**

Application	Specification	
	Metric	English
<b>General</b>		
• Engine Type	V 8	
• Displacement	5.7 L - 5665 cc	346 CID
• RPO	LS6	
• VIN	S	
• Bore	99.0-99.018 mm	3.897-3.898 in
• Stroke	92.0 mm	3.622 in
• Compression Ratio	10.5:1	
• Firing Order	1-8-7-2-6-5-4-3	
• Spark Plug Gap	1.016 mm	0.04 in
<b>Block</b>		
• Camshaft Bearing Bore 1 and 5 Diameter - First Design	59.08-59.13 mm	2.325-2.327 in
• Camshaft Bearing Bore 2 and 4 Diameter - First Design	58.83-58.88 mm	2.316-2.318 in
• Camshaft Bearing Bore 3 Diameter - First Design	58.58-58.63 mm	2.306-2.308 in
• Camshaft Bearing Bore 1 and 5 Diameter - Second Design	59.58-59.63 mm	2.345-2.347 in
• Camshaft Bearing Bore 2 and 4 Diameter - Second Design	59.08-59.13 mm	2.325-2.327 in
• Camshaft Bearing Bore 3 Diameter - Second Design	58.58-58.63 mm	2.306-2.308 in
• Crankshaft Main Bearing Bore Diameter	69.871-69.889 mm	2.75-2.751 in
• Crankshaft Main Bearing Bore Out-of-Round	0.005 mm	0.0002 in
• Cylinder Bore Diameter	99.0-99.018 mm	3.897-3.898 in
• Cylinder Bore Taper - Thrust Side	0.018 mm	0.0007 in
• Cylinder Head Deck Height - Measuring from the Centerline of Crankshaft to the Deck Face	234.57-234.82 mm	9.235-9.245 in
• Cylinder Head Deck Surface Flatness - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
• Cylinder Head Deck Surface Flatness - Measuring the Overall Length of the Block Deck	0.22 mm	0.008 in
• Valve Lifter Bore Diameter	21.417-21.443 mm	0.843-0.844 in
<b>Camshaft</b>		
• Camshaft End Play	0.025-0.305 mm	0.001-0.012 in
• Camshaft Journal Diameter	54.99-55.04 mm	2.164-2.166 in
• Camshaft Journal Out-of-Round	0.025 mm	0.001 in
• Camshaft Lobe Lift - Exhaust	8.19 mm	0.322 in
• Camshaft Lobe Lift - Intake	8.24 mm	0.324 in
• Camshaft Runout - Measured at the Intermediate Journals	0.05 mm	0.002 in
<b>Connecting Rod</b>		
• Connecting Rod Bearing Clearance - Production	0.023-0.065 mm	0.0009-0.0025 in
• Connecting Rod Bearing Clearance - Service	0.023-0.076 mm	0.0009-0.003 in
• Connecting Rod Bore Diameter - Bearing End	56.505-56.525 mm	2.224-2.225 in
• Connecting Rod Bore Out-of-Round - Bearing End	0.006 mm	0.00023 in
• Connecting Rod Bore Out-of-Round - Bearing End - Service	0.006 mm	0.00023 in

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• Connecting Rod Side Clearance	0.11-0.51 mm	0.00433-0.02 in
<b>Crankshaft</b>		
• Connecting Rod Journal Diameter - Production	53.318-53.338 mm	2.0991-2.0999 in
• Connecting Rod Journal Diameter - Service	53.308 mm	2.0987 in
• Connecting Rod Journal Out-of-Round - Production	0.005 mm	0.0002 in
• Connecting Rod Journal Out-of-Round - Service	0.01 mm	0.0004 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Production	0.005 mm	0.0002 in
• Connecting Rod Journal Taper - Maximum for 1/2 of Journal Length - Service	0.02 mm	0.00078 in
• Crankshaft End Play	0.04-0.2 mm	0.0015-0.0078 in
• Crankshaft Main Bearing Clearance - Production	0.02-0.052 mm	0.0008-0.0021 in
• Crankshaft Main Bearing Clearance - Service	0.02-0.065 mm	0.0008-0.0025 in
• Crankshaft Main Journal Diameter - Production	64.992-65.008 mm	2.558-2.559 in
• Crankshaft Main Journal Diameter - Service	64.992 mm	2.558 in
• Crankshaft Main Journal Out-of-Round - Production	0.003 mm	0.000118 in
• Crankshaft Main Journal Out-of-Round - Service	0.008 mm	0.0003 in
• Crankshaft Main Journal Taper - Production	0.01 mm	0.0004 in
• Crankshaft Main Journal Taper - Service	0.02 mm	0.00078 in
• Crankshaft Rear Flange Runout	0.05 mm	0.002 in
• Crankshaft Reluctor Ring Runout - Measured 1.0 mm (0.04 in) Below Tooth Diameter	0.7 mm	0.028 in
• Crankshaft Thrust Surface - Production	26.14-26.22 mm	1.029-1.0315 in
• Crankshaft Thrust Surface - Service	26.22 mm	1.0315 in
• Crankshaft Thrust Surface Runout	0.025 mm	0.001 in
<b>Cylinder Head</b>		
• Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface	120.2 mm	4.732 in
• Surface Flatness - Block Deck - Measured Within a 152.4 mm (6.0 in) Area	0.08 mm	0.003 in
• Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head	0.1 mm	0.004 in
• Surface Flatness - Exhaust Manifold Deck	0.22 mm	0.008 in
• Surface Flatness - Intake Manifold Deck	0.22 mm	0.008 in
<b>Intake Manifold</b>		
• Surface Flatness - Measured at Gasket Sealing Surfaces	0.5 mm	0.02 in
<b>Lubrication System</b>		
• Oil Capacity - with Filter	6.151 Liters	6.5 Quarts
• Oil Capacity - without Filter	5.678 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
<b>Oil Pan</b>		
• Front Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
• Rear Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in

• Oil Pan Alignment - to Rear of Engine Block at Transmission Bellhousing Mounting Surface	0.0-0.25 mm	0.0-0.01 in
<b>Piston Rings</b>		
• Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Production	0.23-0.44 mm	0.009-0.017 in
• Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore	0.23-0.5 mm	0.009-0.0196 in
• Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Production	0.44-0.7 mm	0.017-0.027 in
• Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore	0.44-0.76 mm	0.0173-0.03 in
• Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Production	0.18-0.75 mm	0.007-0.029 in
• Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Service	0.18-0.81 mm	0.007-0.032 in
• Piston Ring to Groove Clearance - First Compression Ring - Production	0.04-0.086 mm	0.00157-0.0033 in
• Piston Ring to Groove Clearance - First Compression Ring - Service	0.04-0.068 mm	0.00157-0.0033 in
• Piston Ring to Groove Clearance - Second Compression Ring - Production	0.05-0.088 mm	0.002-0.0034 in
• Piston Ring to Groove Clearance - Second Compression Ring - Service	0.05-0.088 mm	0.002-0.0034 in
• Piston Ring to Groove Clearance - Oil Control Ring - Production	-0.008 to +0.0176 mm	-0.0003 to +0.0069 in
• Piston Ring to Groove Clearance - Oil Control Ring - Service	-0.008 to +0.0176 mm	-0.0003 to +0.0069 in
<b>Pistons and Pins</b>		
• Piston - Piston Diameter - Non Coated Skirt - at Size Point	98.969-98.987 mm	3.8964-3.8997 in
• Piston - Piston Diameter - Measured Over Skirt Coating	98.984-99.027 mm	3.897-3.899 in
• Piston - Piston to Bore Clearance - Non Coated Skirt - Production	0.013-0.049 mm	0.0005-0.0019 in
• Piston - Piston to Bore Clearance - Non Coated Skirt - Service	0.013-0.074 mm	0.0005-0.0029 in
• Piston - Piston to Bore Clearance - Coated Skirt - Production	-0.027 to +0.029 mm	-0.001 to +0.0011 in
• Piston - Piston to Bore Clearance - Coating Worn Off - Service Limit	0.074 mm	0.0029 in
• Pin - First Design Press Fit Pin Fit in Connecting Rod Bore	0.02-0.043 mm - Interference	0.00078-0.00169 in - Interference
• Pin - First Design Press Fit Pin Clearance to Piston Pin Bore - Production	0.01-0.02 mm	0.0004-0.00078 in
• Pin - First Design Press Fit Pin Clearance to Piston Pin Bore - Service	0.01-0.022 mm	0.0004-0.00086 in
• Pin - First Design Press Fit Pin Diameter	23.997-24.0 mm	0.9447-0.9448 in
• Pin - Second Design Full Floating Pin Fit in Connecting Rod Bore - Production	0.007-0.02 mm	0.00027-0.00078 in
• Pin - Second Design Full Floating Pin Fit in Connecting Rod Bore - Service	0.007-0.022 mm	0.00027-0.00086 in
• Pin - Second Design Full Floating Pin Clearance to Piston Pin Bore - Production	0.002-0.01 mm	0.00008-0.0004 in

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• Pin - Second Design Full Floating Pin Clearance to Piston Pin Bore - Service	0.002-0.015 mm	0.00008-0.0006 in
• Pin - Second Design Full Floating Pin Diameter	23.952-23.955 mm	0.943-0.943 in
<b>Valve System</b>		
• Valves - Valve Face Angle	45 degrees	
• Valves - Valve Face Width	1.25 mm	0.05 in
• Valves - Valve Lash	Net Lash - No Adjustment	
• Valves - Valve Lift - Intake	14.02 mm	0.552 in
• Valves - Valve Lift - Exhaust	13.92 mm	0.548 in
• Valves - Valve Seat Angle	46 degrees	
• Valves - Valve Seat Runout	0.05 mm	0.002 in
• Valves - Valve Seat Width - Exhaust	1.78 mm	0.07 in
• Valves - Valve Seat Width - Intake	1.02 mm	0.04 in
• Valves - Valve Stem Diameter - Production	7.955-7.976 mm	0.313-0.314 in
• Valves - Valve Stem Diameter - Service	7.96 mm	0.314 in
• Valves - Valve Stem-to-Guide Clearance - Production - Intake	0.025-0.066 mm	0.001-0.0026 in
• Valves - Valve Stem-to-Guide Clearance - Service - Intake	0.093 mm	0.0037 in
• Valves - Valve Stem-to-Guide Clearance - Production - Exhaust	0.025-0.066 mm	0.001-0.0026 in
• Valves - Valve Stem-to-Guide Clearance - Service - Exhaust	0.093 mm	0.0037 in
• Valve Rocker Arm - Valve Rocker Arm Ratio	1.70:1	
• Valve Springs - Valve Spring Free Length	53.4 mm	2.1 in
• Valve Springs - Valve Spring Installed Height	45.75 mm	1.8 in
• Valve Springs - Valve Spring Load - Closed	400 N at 45.75 mm	90 lb at 1.8 in
• Valve Springs - Valve Spring Load- Open	1310 N at 31.75 mm	294 lb at 1.25 in



**Fastener Tightening Specifications – LS1 & LS6**

Application	Specification	
	Metric	English
Accessory Drive Belt Idler Pulley Bolt	50 N·m	37 lb ft
Accessory Drive Belt Tensioner Bolt	50 N·m	37 lb ft
Air Conditioning (A/C) Compressor and Condenser Hose Bolt	27 N·m	20 lb ft
A/C Drive Belt Idler Pulley Bolt	50 N·m	37 lb ft
A/C Drive Belt Tensioner Bolt	25 N·m	18 lb ft
Air Injection Reaction (AIR) Pipe-to-Exhaust Manifold Bolts	20 N·m	15 lb ft
AIR Right Side Pipe Bracket-to-Cylinder Head Bolt	20 N·m	15 lb ft
Automatic Transmission Fluid Cooler Line Clamp Bolt - at Oil Pan	12 N·m	106 lb in
Automatic Transmission Fluid Cooler Line Clamp Bolt - at Right Transmission Cover	2.2 N·m	19 lb in
Automatic Transmission Fluid Cooler Pipe	25 N·m	18 lb ft
Camshaft Retainer Bolts	25 N·m	18 lb ft
Camshaft Sensor Bolt	25 N·m	18 lb ft
Camshaft Sprocket Bolts	35 N·m	26 lb ft
Connecting Rod Bolts - First Pass	20 N·m	15 lb ft
Connecting Rod Bolts - Final Pass	75 degrees	
Coolant Temperature Gage Sensor	20 N·m	15 lb ft
Crankshaft Balancer Bolt - Installation Pass-to Ensure the Balancer is Completely Installed	330 N·m	240 lb ft
Crankshaft Balancer Bolt - First Pass - Install a NEW Bolt After the Installation Pass and Tighten as Described in the First and Final Passes	50 N·m	37 lb ft
Crankshaft Balancer Bolt - Final Pass	140 degrees	
Crankshaft Bearing Cap Bolts - Inner Bolts - First Pass in Sequence	20 N·m	15 lb ft
Crankshaft Bearing Cap Bolts - Inner Bolts - Final Pass in Sequence	80 degrees	
Crankshaft Bearing Cap Side Bolts	25 N·m	18 lb ft
Crankshaft Bearing Cap Studs - Outer Studs - First Pass in Sequence	20 N·m	15 lb ft
Crankshaft Bearing Cap Studs - Outer Studs - Final Pass in Sequence	53 degrees	
Crankshaft Oil Deflector Nuts	25 N·m	18 lb ft
Crankshaft Position Sensor Bolt	25 N·m	18 lb ft
Crossmember Nut	110 N·m	81 lb ft
Cylinder Head Bolts - First Pass all M11 Bolts in Sequence	30 N·m	22 lb ft
Cylinder Head Bolts - Second Pass all M11 Bolts in Sequence	90 degrees	
Cylinder Head Bolts - Final Pass all M11 Bolts in Sequence - Excluding the Medium Length Bolts at the Front and Rear of Each Cylinder Head	90 degrees	
Cylinder Head Bolts - Final Pass M11 Medium Length Bolts at the Front and Rear of Each Cylinder Head in Sequence	50 degrees	
Cylinder Head Bolts - M8 Inner Bolts in Sequence	30 N·m	22 lb ft
Cylinder Head Coolant Plug	20 N·m	15 lb ft
Cylinder Head Core Hole Plug	20 N·m	15 lb ft
Driveline Close-Out Panel Bolt	12 N·m	106 lb in
Driveline Support Bolt	50 N·m	37 lb ft
Driveline Support Plug	50 N·m	37 lb ft
Engine Block Coolant Drain Plugs	60 N·m	44 lb ft
Engine Block Heater	40 N·m	30 lb ft
Engine Block Oil Gallery Plugs	60 N·m	44 lb ft
Engine Coolant Air Bleed Pipe and Cover Bolts and Studs	12 N·m	106 lb in
Engine Flywheel Bolts - First Pass	20 N·m	15 lb ft
Engine Flywheel Bolts - Second Pass	50 N·m	37 lb ft
Engine Flywheel Bolts - Final Pass	100 N·m	74 lb ft
Engine Flywheel Hub Collar Bolt - Automatic Transmission	130 N·m	96 lb ft

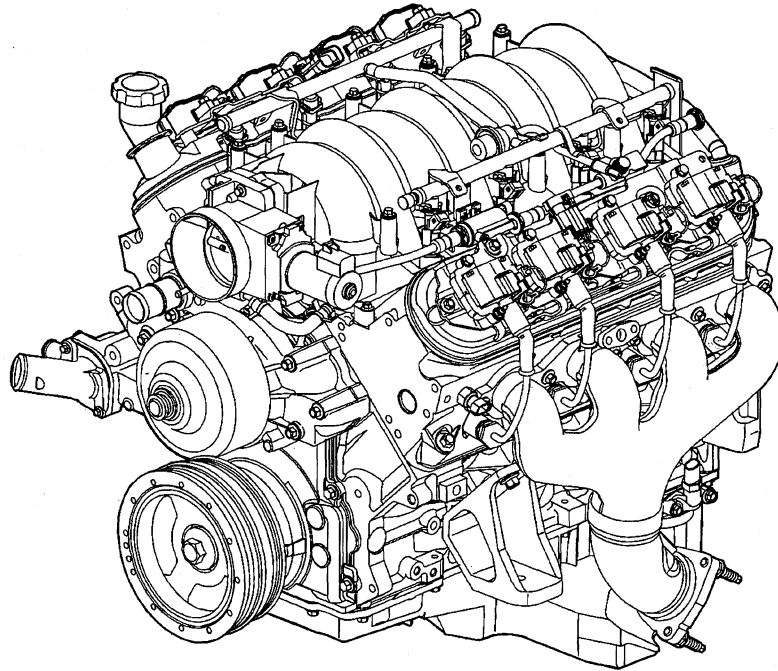
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Engine Front Cover Bolts	25 N·m	18 lb ft
Engine Mount Bracket Bolt	50 N·m	37 lb ft
Engine Mount Nut	65 N·m	48 lb ft
Engine Mount-to-Engine Mount Bracket Nut	65 N·m	48 lb ft
Engine Oil Filter	30 N·m	22 lb ft
Engine Rear Cover Bolts	25 N·m	18 lb ft
Engine Service Lift Bracket M8 Bolt	25 N·m	18 lb ft
Engine Service Lift Bracket M10 Bolts	50 N·m	37 lb ft
Engine Valley Cover Baffle Cover Bolts - LS6	5 N·m	44 lb in
Engine Valley Cover Bolts	25 N·m	18 lb ft
Engine Wiring Harness Generator Lead Nut	13 N·m	115 lb in
Engine Wiring Harness Ground Strap Bolt	32 N·m	24 lb ft
Exhaust Manifold Bolts - First Pass	15 N·m	11 lb ft
Exhaust Manifold Bolts - Final Pass	25 N·m	18 lb ft
Exhaust Manifold Heat Shield Bolts	9 N·m	80 lb in
Flywheel Housing Bolt	50 N·m	37 lb ft
Fuel Injection Fuel Rail Bolts	10 N·m	89 lb in
Generator Bracket Bolt	50 N·m	37 lb ft
Ignition Coil Bracket-to-Valve Rocker Arm Cover Bolts	12 N·m	106 lb in
Ignition Coil-to-Bracket Bolts	12 N·m	106 lb in
Intake Manifold Bolts - First Pass in Sequence	5 N·m	44 lb in
Intake Manifold Bolts - Final Pass in Sequence	10 N·m	89 lb in
Intermediate Steering Shaft Bolt	48 N·m	35 lb ft
Knock Sensors	20 N·m	15 lb ft
Oil Filter	30 N·m	22 lb ft
Oil Filter Fitting	55 N·m	40 lb ft
Oil Level Indicator Tube Bolt	25 N·m	18 lb ft
Oil Level Sensor	13 N·m	115 lb in
Oil Pan Closeout Cover Bolt - Left Side	12 N·m	106 lb in
Oil Pan Closeout Cover Bolt - Right Side	12 N·m	106 lb in
Oil Pan Cover Bolts	12 N·m	106 lb in
Oil Pan Drain Plug	25 N·m	18 lb ft
Oil Pan - Lower - Bolts	12 N·m	106 lb in
Oil Pan M8 Bolts - Oil Pan-to-Engine Block and Oil Pan-to-Front Cover	25 N·m	18 lb ft
Oil Pan M6 Bolts - Oil Pan-to-Rear Cover	12 N·m	106 lb in
Oil Pressure Sensor	20 N·m	15 lb ft
Oil Pump Cover Bolts	12 N·m	106 lb in
Oil Pump Relief Valve Plug	12 N·m	106 lb in
Oil Pump Screen Nuts	25 N·m	18 lb ft
Oil Pump Screen-to-Oil Pump Bolt	12 N·m	106 lb in
Oil Pump-to-Engine Block Bolts	25 N·m	18 lb ft
Oil Temperature Sensor	20 N·m	15 lb ft
Positive Crankcase Ventilation (PCV) System Strap Nut - at Right Front Engine Coolant Air Bleed Pipe Stud	12 N·m	106 lb in
Power Steering Pump Bolt	25 N·m	18 lb ft
Propeller Shaft Hub Collar Bolt	125 N·m	92 lb ft
Spark Plugs - Cylinder Heads - New	20 N·m	15 lb ft
Spark Plugs - all Subsequent Installations	15 N·m	11 lb ft
Steering Knuckle Nut - First Pass	20 N·m	15 lb ft
Steering Knuckle Nut - Second Pass	210 degrees	
Steering Knuckle Nut - Final Pass	55 N·m	41 lb ft
Throttle Body Bolts	12 N·m	106 lb in
Transmission Cover Bolt	12 N·m	106 lb in
Transmission Wiring Harness Bracket Bolt	50 N·m	37 lb ft

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Transmission Wiring Harness Clip Bolt - near the Harness Ground	32 N·m	23 lb ft
Transmission Wiring Harness Clip Bolt - near the Oil Pan	25 N·m	18 lb ft
Valve Lifter Guide Bolts	12 N·m	106 lb in
Valve Rocker Arm Bolts	30 N·m	22 lb ft
Valve Rocker Arm Cover Bolts	12 N·m	106 lb in
Water Inlet Housing Bolts	15 N·m	11 lb ft
Water Pump Bolts - First Pass	15 N·m	11 lb ft
Water Pump Bolts - Final Pass	30 N·m	22 lb ft
Water Pump Cover Bolts	15 N·m	11 lb ft

## Engine Component Description



### Camshaft and Drive System

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

### Crankshaft

The crankshaft is cast nodular iron. The crankshaft is supported by five crankshaft bearings. The bearings are retained by crankshaft bearing caps which are machined with the engine block for the proper alignment and clearance. The crankshaft journals are undercut and rolled. The center main journal is the thrust journal. A crankshaft position reluctor ring is mounted at the rear of the crankshaft. The reluctor ring is not serviceable separately.

### Cylinder Heads

The cylinder head assemblies are cast aluminum and have pressed in place powdered metal valve guides and valve seats. Passages for the engine coolant air bleed system are at the front and rear of each cylinder head. There are no exhaust gas passages within the cylinder head. Valve rocker arm covers are now retained to the cylinder head by four center mounted rocker arm cover bolts.

### Engine Block

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

### **Exhaust Manifolds**

The exhaust manifolds are one piece fabricated stainless steel and are a double wall design. The exhaust manifolds direct exhaust gases from the combustion chambers to the exhaust system. Each manifold has a single inlet for the Air Injection Reaction (AIR) system and a threaded opening for oxygen sensor installation.

### **Intake Manifold**

The IAFM or integrated air fuel module is a one piece composite design that incorporates metal threaded inserts for mounting the fuel rail and throttle body. The intake manifold is sealed to the cylinder heads by eight separate nonreusable silicone sealing gaskets which press into the grooves of the intake housing. The drive by wire throttle body assembly bolts to the front of the intake manifold. The throttle body is sealed to the intake manifold by a one piece push in place silicone gasket. The fuel rail assembly with eight separate fuel injectors is retained to the intake by four bolts. The injectors are seated in their individual manifold bores with O-ring seals to provide sealing. A fuel rail stop bracket is retained at the rear of the left fuel rail by the intake manifold mounting bolts. A snap fit Manifold Absolute Pressure (MAP) sensor housing is mounted at the rear of the manifold and sealed by an O-ring seal. The MAP sensor is installed and retained to the MAP sensor housing. There are no coolant passages within the intake manifold.

### **Oil Pan**

The structural two-piece oil pan assembly has cast aluminum upper and lower halves. Incorporated into the oil pan (upper) design are the oil filter mounting boss, oil level sensor mounting bore, and a non-removable oil pan baffle. The oil pan cover, oil temperature sensor, and oil level sensor mount to the sides of the oil pan (upper). Incorporated into the oil pan (lower) design are the drain plug opening and internal oil control ribbing. A nylon carrier (with silicone bead) type gasket provides sealing between the upper and lower halves of the oil pan assembly. The alignment of the structural oil pan assembly to the rear of the engine block and transmission bell housing is critical.

### **Piston and Connecting Rod Assemblies**

The pistons are cast aluminum. The pistons use two compression rings and one oil control ring assembly. The piston is a low friction, lightweight design with a flat top and barrel shaped skirt. The piston pins are chromium steel. They have a floating fit in the piston and are retained by a press fit in the connecting rod. The connecting rods are powdered metal. The connecting rods are fractured at the connecting rod journal and then machined for the proper clearance. The piston, pin, and connecting rod are to be serviced as an assembly.

### **Valve Rocker Arm Cover Assemblies**

The valve rocker arm covers are cast aluminum and use a pre-molded silicone gasket for sealing. Mounted to each rocker cover is an ignition coil and bracket assembly. Incorporated into the covers are the oil fill tube, the Positive Crankcase Ventilation (PCV) system passages, and the engine fresh air passages.

### **Valve Train**

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

## 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

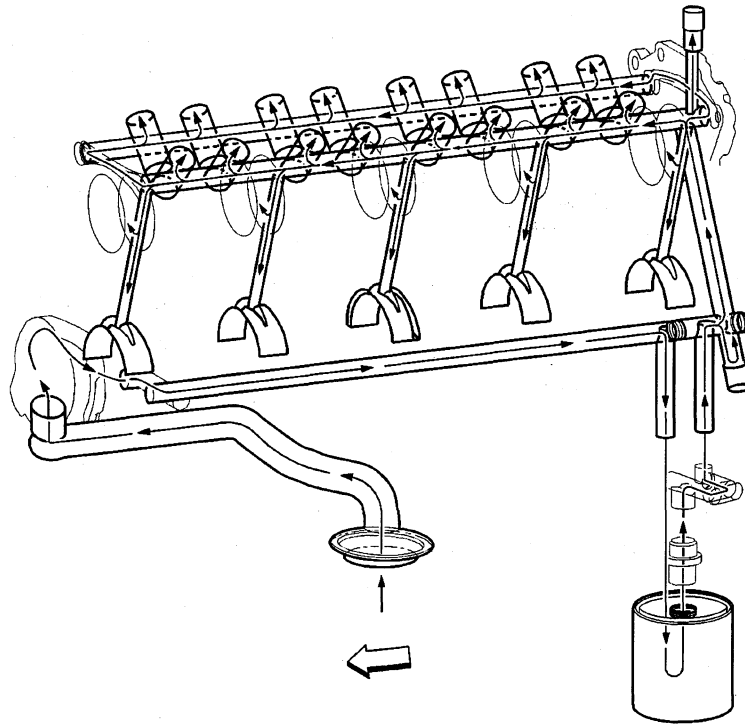
The drive belt system may use one belt or two belts. The drive belt is thin so that it can bend backwards and has several ribs to match the grooves in the pulleys. There also may be a V-belt style belt used to drive certain accessory drive components. The drive belts are made of different types of rubbers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

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

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

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

## Lubrication



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

## Engine Cooling

### Engine Cooling System Approximate Capacities

Application	Specification	
	Metric	English
<b>Coolant</b>		
• Antifreeze to Coolant Mixture (percent)	50/50	
• Antifreeze (Pure) Point of Freeze	-20°C	-8°F
• Antifreeze (50/50 Mixture) Boiling Point	128°C	262°C
• Protection Rating	-37°C	-34°F
• Type	GM-Goodwrench DEX-COOL®	
<b>Cooling Fans</b>		
• Blade Diameter	312 mm	12.3 in
• Motor Type	2-Speed	
• Number of Blades	5	
<b>Cooling System Coolant Capacity</b>		
• Automatic Transmission	11.6 liters	12.3 quarts
• Manual Transmission	11.9 liters	12.6 quarts
<b>Radiator</b>		
• Core Material	Aluminum	
• Fill Cap Pressure Rating	103 kPa	15 psi
• Fill Cap Pressure Test Rating (Max)	138 kPa	20 psi
• Type	Aluminum/Plastic Slant Back	
<b>Thermostat Test (33% Glycol Solution)</b>		
• Closed (Degrees Below Specification on Valve)	6°C	10°F
• Open (Degrees Above Specification on Valve)	11°C	22°F

### Fastener Tightening Specifications

Application	Specification	
	Metric	English
Automatic Transmission Oil Cooler Line Fitting	25 N·m	18 lb ft
Coolant Air Bleed Bolt/Stud	12 N·m	106 lb in
Cooling Fan Motor Bolt	6 N·m	53 lb in
Engine Coolant Heater	40 N·m	30 lb ft
Engine Coolant Heater Cord Clip Bolt	32 N·m	24 lb ft
Fan Blade Nut	6 N·m	53 lb in
Radiator Baffle Bolt	10 N·m	89 lb in
Radiator Support Bolt	8 N·m	71 lb in
Radiator Surge Tank Nut	10 N·m	89 lb in
Stabilizer Shaft Bracket Bolt	58 N·m	43 lb ft
Water Pump Bolt (First Pass)	15 N·m	11 lb ft
Water Pump Bolt (Final Pass)	30 N·m	22 lb ft
Water Pump Inlet	15 N·m	11 lb ft



## Cooling System Description and Operation

### General Description

The cooling system consists of the following major components:

- The radiator
- The radiator surge tank
- The cooling fans
- The thermostat
- The water pump
- The coolant air bleed pipe
- The heater pipe assembly
- The ECT sensor
- The transmission oil cooler
- All related coolant hoses
- The fan shroud
- The fan motor/blade
- Coolant Heater (optional)

The cooling system functions to maintain an efficient engine temperature during all engine operating conditions. The thermostat remains closed until the engine reaches the proper operating temperatures. When the engine is cold, the coolant does not circulate through the radiator, allowing the engine to warm up faster. When the engine reaches the normal operating temperatures, the thermostat opens and the coolant begins to circulate through the radiator in order to keep the engine from overheating.

The water pump draws the coolant from the radiator. The coolant is then circulated through the cooling jackets in the following components, then back to the radiator to be cooled:

- The cylinder heads
- The engine block
- The throttle body

The engine coolant is drawn from the water pump and circulated through internal passages in the cylinder heads and engine block. Vapor is vented off through the coolant air bleed pipe. The heated coolant is then directed back to the radiator. A separate coolant flow loop is available from the coolant pump to the heater core and back to the coolant pump to provide passenger compartment heat and defrost.

The radiator surge tank provides a coolant fill point and a central cooling system air bleed location. The tank is translucent on the lower half for coolant level viewing.

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

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

### **Engine Oil Cooler**

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

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

### **Transmission Oil Cooler**

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

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

## Engine Electrical

### Fastener Tightening Specifications

Application	Specification	
	Metric	English
Battery Hold Down Retainer Bolt	18 N·m	13 lb ft
Battery Tray Bolt	12 N·m	106 lb in
Engine Harness Cable Nut	13 N·m	10 lb ft
Generator Bolt	50 N·m	37 lb ft
Generator Bracket Bolt	50 N·m	37 lb ft
Generator Shaft Nut	75 N·m	55 lb ft
Ground Strap Bolt	32 N·m	24 lb ft
Ground Strap Nut	8 N·m	71 lb in
Instrument Panel (IP) Wiring Harness Junction Block Nut	10 N·m	89 lb in
Negative Battery Cable to Battery Bolt	15 N·m	11 lb ft
Negative Battery Cable Ground Nut	8 N·m	71 lb in
Negative Battery Cable Terminal Bolt	8 N·m	71 lb in
Positive Battery Cable Bolt	15 N·m	11 lb ft
Positive Battery Cable Nut (at solenoid)	10 N·m	89 lb in
Positive Battery Cable Nut (at fuse/relay center)	8 N·m	71 lb in
Positive Battery Cable to Starter Motor Stud Nut	15 N·m	11 lb ft
S Terminal Nut	4 N·m	35 lb in
Starter Motor Bolt	50 N·m	37 lb ft

### Battery Usage

Application	Specification
Cold Cranking Amperage (CCA)	590 A
Reserve Capacity	110 minutes
Replacement Model Number	86-3YR

### 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

Engine Type	Starter Type
LS1	PG260L

### Generator Usage

Engine	Generator Model	Rated Output AMPS	Load Test Output AMPS
LS1	Valeo TG15	140	98

### Ignition System Specifications

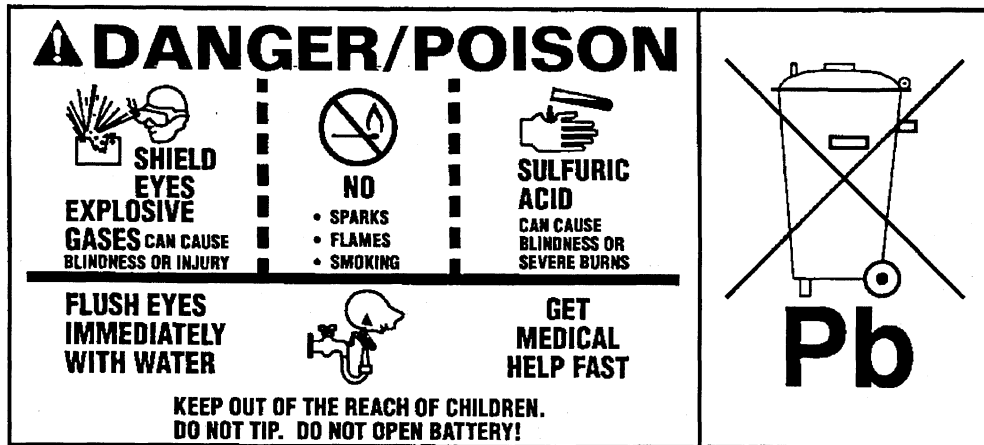
Application	Specification	
	Metric	English
Firing Order	1-8-7-2-6-5-4-3	
Spark Plug Wire Resistance	700 ohms per ft	
Spark Plug Torque	15 N·m	11 lb ft
Spark Plug Gap	1.01 mm	0.040 in
Spark Plug Type	41-952 [AC plug type]	

### 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

CATALOG NO.

1819

CCA 770	LOAD TEST 380
REPLACEMENT MODEL 100-6YR	

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] starter motors are [non-]repairable starter motors. They have 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 through 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 protects the armature from excessive speed until the switch is opened.

When the ignition switch is released from the START position, crank 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**

The generator provides voltage to operate the vehicle's electrical system and to charge the battery. A magnetic field is created when current flows through the rotor. This field rotates as the rotor is driven by the engine, creating an AC voltage in the stator windings. The AC voltage is converted to DC by the rectifier bridge and is supplied to the electrical system at the battery terminal.

The generator's digital regulator uses digital techniques to supply the rotor current and thereby control the output voltage. The rotor current is proportional to the width of the electrical pulses supplied by the digital regulator. When the ignition switch is ON, voltage is supplied to terminal L from the Powertrain Control Module (PCM), turning on the digital regulator. Narrow width pulses are supplied to the digital rotor, creating a weak magnetic field. When the engine is started, the digital regulator senses generator rotation by detecting AC voltage at the stator through an internal wire. Once the engine is running, the digital regulator varies the field current by controlling the pulse width. This regulates the generator output voltage for proper battery charging and electrical system operation.

## **Charging System Circuit Description**

The generator provides DC voltage to operate the vehicle's electrical system and to charge the battery. A magnetic field is created when current flows through the rotor windings. The rotor is belt driven by the engine creating an AC voltage as this field rotates within the stator windings. The AC voltage is converted to DC voltage by the rectifier bridge and is then supplied to the electrical system at the generator battery terminal.

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

When the ignition switch is turned to [RUN], the charge indicator turns on for a few seconds (bulb check), then turns off. The powertrain control module (PCM) commands the charge indicator ON or OFF by sending a Class 2 serial data line message to the instrument panel cluster.

## Ignition System Description

The electronic ignition system controls fuel combustion by providing a spark to ignite the compressed air/fuel mixture at the correct time. To provide optimum engine performance, fuel economy, and control of exhaust emissions, the PCM controls the spark advance of the ignition system. The electronic ignition system does not use the conventional distributor and coil. The electronic ignition system has the following advantages over a conventional mechanical distributor system:

- No moving parts
- Less maintenance required
- Remove mounting capability
- No mechanical load on the engine
- More coil cool down time between firing
- Elimination of mechanical timing adjustments
- Increased available ignition coil saturation time

The ignition system on this vehicle feature a multiple coil ignition and is known as coil near plug. The secondary ignition wires are short compared with a distributor ignition system wire. Eight ignition coils/module are individually mounted above each cylinder on the rocker covers. The coil/modules are fired sequentially. There is an Ignition Control (IC) circuit for each ignition coil/module. The eight ignition control circuits are connected to the PCM. All timing decisions are made by the PCM, which triggers each coil/module individually.

The electronic ignition system consists of the following components:

- Crankshaft position sensor
- Crankshaft position sensor reluctor wheel
- Camshaft position sensor
- Ignition coils
- Powertrain control module (PCM)



## Engine Controls

### Engine Controls – 5.7L

#### Fastener Tightening Specifications

Application	Specifications	
	Metric	English
Accelerator Control Assembly to Floor Fasteners	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
EVAP Canister Bracket Bolt	7 N·m	62 lb in
Fuel and EVAP Pipe Retainer Nut	6 N·m	53 lb in
Fuel Crossover Hose Clamps	4 N·m	35 lb in
Fuel Filter and Fuel Pressure Regulator Bracket Nut	5 N·m	44 lb in
Fuel Pipe Assembly Clip Nuts	3 N·m	27 lb in
Fuel Rail Attaching Bolts	10 N·m	89 lb in
Fuel Tank Fill and Vent Pipe Bolts	3 N·m	22 lb in
Fuel Tank Fill Hose Clamp	4 N·m	35 lb in
Fuel Tank Fill Pipe Ground Strap Bolt	8 N·m	71 lb in
Fuel Tank Strap and Shield Bolts	25 N·m	18 lb ft
Fuel Tank Shield Mount Bolt	25 N·m	18 lb in
Fuel Tank Shield Nut	12 N·m	106 lb in
Heated Oxygen Sensor (HO2S)	41 N·m	30 lb ft
Ignition Coil Harness Mounting Bolt	12 N·m	106 lb in
Ignition Coil Mounting Bolts	12 N·m	106 lb in
Knock Sensor (KS)	20 N·m	15 lb ft
Powertrain Control Module (PCM) Electrical Connector Fasteners	8 N·m	70 lb in
Powertrain Control Module (PCM) Retaining Fastener	2N·m	17 lb in
PCV Hose Assembly Mounting Cable Nut	12 N·m	106 lb in
Secondary Air Injection (AIR) Check Valves	23 N·m	17 lb ft
Secondary Air Injection (AIR) Pipe To Exhaust Manifold Bolts	20 N·m	15 lb ft
Secondary Air Injection (AIR) Pump to Bracket	9 N·m	80 lb in
Secondary Air Injection (AIR) Solenoid Valve Retaining Nut	7 N·m	62 lb in
Secondary Air Injection (AIR) Check Valve to the AIR Pipe	23 N·m	17 lb ft
Spark Plug	15 N·m	11 lb ft
Spark Plug in New Cylinder Head	20 N·m	15 lb ft
Tank Crossover Hose Clamp	4 N·m	35 lb in
Throttle Actuator Control (TAC) Module to PCM Bracket	2 N·m	17 lb in
Throttle Actuator Control (TAC) Module to PCM Bracket Fasteners	2 N·m	17 lb in
Throttle Body Attaching Bolts	10 N·m	189 lb in

#### Fuel System Specifications

Use premium unleaded gasoline rated at 91 octane or higher for best performance. You may use middle grade or regular unleaded gasolines, but your vehicle may not accelerate as well.

It is recommended that the gasoline meet specification 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. Gasolines meeting the AAMA specification could provide improved driveability and emission control system performance compared to other gasolines. For more information, write to : American Automobile Manufacturer's Association, 7430 Second Ave, Suite 300, Detroit MI 48202.

Be sure the posted octane for premium is at least 91 (at least 89 for middle grade and 87 for regular). If the octane is less than 87, you may get a heavy knocking noise when you drive. If it's bad enough, it can damage your engine.

If you're using fuel rated at the recommended octane or higher and you hear heavy knocking, your engine needs service. But don't worry if you hear a little pinging noise when you're accelerating or driving up a hill. That's normal, and you don't have to buy a higher octane fuel to get rid of pinging. It's 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), it 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 it is determined that the cause of the condition is the type of fuels used, repairs may not be covered by your warranty.

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

**Exhaust System**

**Fastener Tightening Specifications**

Application	Specification	
	Metric	English
Exhaust Manifold Bolt (First Pass)	15 N·m	11 lb ft
• Final Pass	25 N·m	18 lb ft
Exhaust Manifold Heat Shield Bolt	9 N·m	80 lb in
Exhaust Manifold Nut	20 N·m	15 lb ft
Exhaust Muffler Bolt	50 N·m	37 lb ft
Exhaust Muffler Hanger Nut	16 N·m	12 lb ft
Exhaust Pipe Brace Lower Bolt	50 N·m	37 lb ft
Exhaust Pipe Hanger Bolt	50 N·m	37 lb ft
Ignition Coil Bracket Stud	12 N·m	106 lb in
Oxygen Sensor	42 N·m	30 lb ft
Rear Stabilizer Shaft Bracket Bolt	65 N·m	49 lb ft
Rear Stabilizer Shaft Bracket Nut	95 N·m	70 lb ft
Secondary Air Injection (AIR) Pipe Bolt	20 N·m	15 lb ft

**Exhaust System Description**

**Important**

Use of non-OEM parts may cause driveability concerns.

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

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

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

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

### **Resonator**

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

### **Catalytic Converter**

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

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

- Platinum (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

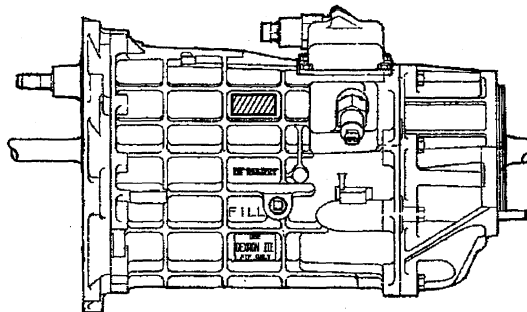
### Manual Transmission – MM6/M12

Application	Specification	
	Metric	English
Backup Lamp Switch	20 N·m	15 lb ft
Differential to Transmission Bolts and Nuts	50 N·m	37 lb ft
Differential to Transmission Lower Nut	50 N·m	37 lb ft
Driveline Support Assembly to Engine Flywheel Housing Bolts	50 N·m	37 lb ft
EBTCM LH Mounting Bracket Mounting Bolts	50 N·m	37 lb ft
Gear Select/Skip Shift Solenoid	40 N·m	30 lb ft
Intermediate Exhaust Pipe to Muffler Bolts	50 N·m	37 lb ft
Negative Battery Cable Bolt	15 N·m	11 lb ft
Rear Shock Absorber Lower Mounting Bolt	220 N·m	162 lb ft
Rear Suspension Crossmember Mounting Nuts	110 N·m	81 lb ft
Reverse Lockout Solenoid	40 N·m	30 lb ft
Shift Control Mounting Bolts	30 N·m	22 lb ft
Shift Control Closeout Boot Retaining Nuts	12 N·m	106 lb in
Transaxle Mount Bracket to Differential Bolts	50 N·m	37 lb ft
Transaxle Mount to Rear Suspension Crossmember Nuts	50 N·m	37 lb ft
Transmission to Driveline Support Assembly Bolts/Studs	50 N·m	37 lb ft
Transmission Fluid Drain Plug	27 N·m	20 lb ft
Transmission Fluid Fill Plug	27 N·m	20 lb ft
Transmission Fluid Temperature Sensor	27 N·m	20 lb ft
Transmission Shift Rod Clamp Bolt	30 N·m	22 lb ft
Transmission Vent Tube Retaining Bolt	20 N·m	15 lb ft

### Lubrication Specifications

Application	Metric	English
DEXRON® - III	3.9 liters	4.1 quarts

### Manual Transmission Description and Operation



Manual transmissions are identified by the number of forward gears and the measured distance between the centerline of the output shaft and the counter gear.

The 6-speed, manual transmission (RPO MM6/M12), used in Corvettes, incorporates the following features:

- An aluminum case.
- Fully synchronized gearing with an enhanced synchronizer cone arrangement:
  - Tripple-cone: FIRST, SECOND
  - Double-cone: THIRD, FOURTH, FIFTH, SIXTH
  - Single-cone: REVERSE
- An internal shift rail mechanism.
- A remote transmission shift control mounted forward of the transmission.
- An external transmission shift rod enabling the forward mount location of the transmission shift control.
- An extended-length transmission output shaft mating directly to the rear axle drive pinion (in the rear of the differential housing).
- Tapered roller bearings supporting the mainshaft and countershaft.
- Caged roller bearings under all speed gears.
- Solenoid inhibit of SECOND and THIRD gears.
- Solenoid inhibit of REVERSE gear during predefined forward motion.

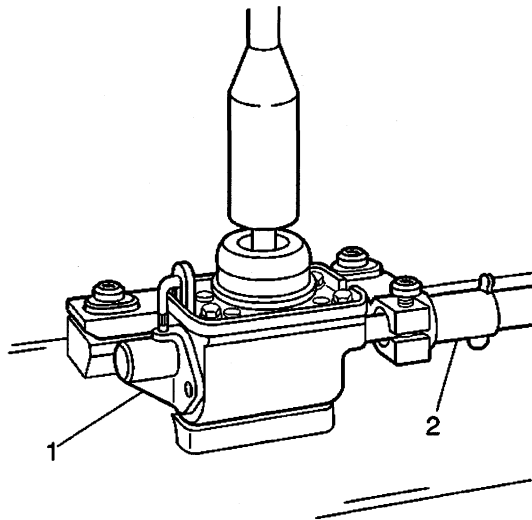
These features combine to yield a rugged, reliable system capable of handling input torques of up to 610 N·m (450 lb ft) for the MM6 and 540 N·m (400 lb ft) for the M12.

The gear ratios used in this transmission offer a wide operating range providing excellent acceleration and fuel economy.

The gear ratios are as follows:

Gear	MM6 Ratio (:1)	M12 Ratio (:1)
FIRST	2.66	2.97
SECOND	1.78	2.07
THIRD	1.30	1.43
FOURTH	1.00	1.00
FIFTH	0.74	0.84
SIXTH	0.50	0.57
REVERSE	2.90	3.28

**Shift Control and Shift Rod**



To allow the rear-of-vehicle transmission location, the transmission shift shaft has been relocated to the front of the transmission. The shift shaft is connected to a transmission shift rod (2) which contains two

sealed universal-style joints, enabling the range of motion necessary in order to shift gears. The shift rod (2) is connected to the transmission shift control (1) which is a lubricated and sealed unit, mounted to the driveline support assembly. The mounting system utilized for the shift control (1) incorporates rubber insulators. The cockpit of the vehicle is isolated from the driveline through the use of a shift control closeout boot which seals off the shift control and the driveline tunnel shift control opening.

#### **Gear Select (Skip Shift)**

To ensure good fuel economy and compliance with federal fuel economy standards, SECOND and THIRD gears are inhibited when shifting out of FIRST gear under the following conditions:

- Coolant temperature is above 50°C (122°F).
- Vehicle speed is between 20 and 29 km/h (12 and 19 mph).
- Throttle is opened 35 percent or less.

#### **Reverse Lockout**

A reverse lockout system (consisting of a reverse lockout solenoid which operates a reverse lockout mechanism) is utilized to prevent shifting into REVERSE gear when the vehicle is moving forward at a speed of 5 km/h (3 mph) or more.

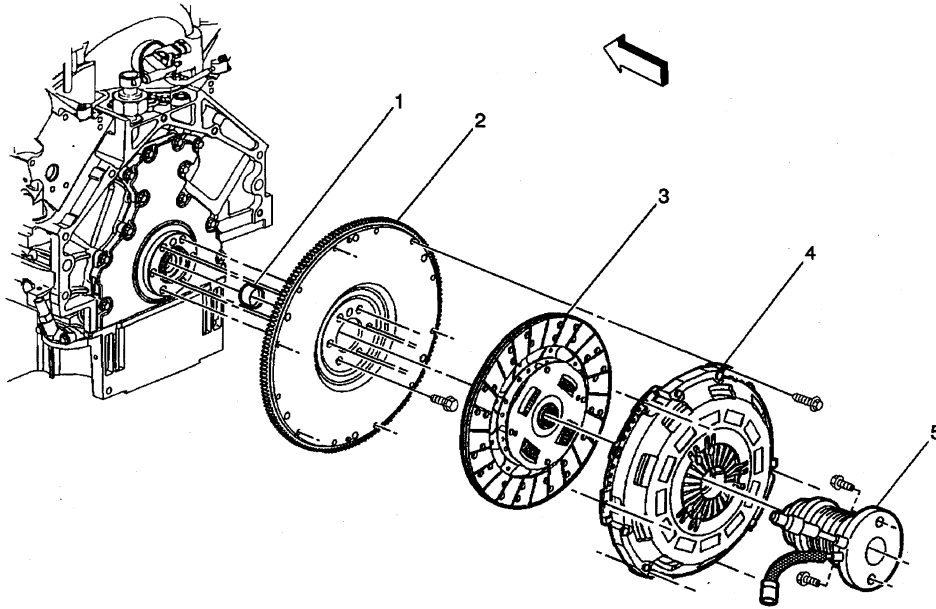
## Clutch

### Fastener Tightening Specifications

Application	Specification	
	Metric	English
Clutch Actuator Cylinder Mounting Bolts	12 N·m	106 lb in
Clutch Pedal Bracket Mounting Nuts	27 N·m	20 lb ft
Clutch Pedal Nut	50 N·m	37 lb ft
Clutch Pressure Plate Bolts <sup>1</sup>	70 N·m	52 lb ft
Cruise Control Release Switch Bracket Retaining Bolts	12 N·m	106 lb in
Driver Foot Rest Bracket Retaining Bolt	8 N·m	71 lb in
Driver Foot Rest Bracket Retaining Nut	10 N·m	89 lb in
Engine Flywheel Inspection Cover Retaining Bolts	25 N·m	18 lb ft
Negative Battery Cable Bolt	15 N·m	11 lb ft

1 Clutch pressure plate bolts must be tightened in sequence and in even increments over three passes, then tightened to final specification on the fourth pass.

### Hydraulic Clutch System Description and Operation



- (1) Clutch Pilot Bearing
- (2) Engine Flywheel
- (3) Clutch Driven Plate
- (4) Clutch Pressure Plate
- (5) Clutch Actuator Cylinder

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 driveline and transmission and turning with the driveline and transmission.
- The operating members; including the spring, the clutch hydraulic system, and the clutch pedal linkages, required to apply and release the pressure, which holds 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 (clutch disc) has a splined hub that freely slides lengthwise along the splines of the input shaft, which also drives the shaft through these same splines. Suitable friction facings are attached to each side of the plate by rivets.

In order to make the clutch engagement as smooth as possible and eliminate chatter; the steel segments driving the splined hub are slightly waved, which causes the contact pressure on the facings to rise gradually as the waved springs flatten out.

### **Clutch Operating Members**

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

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

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

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

### **Hydraulic Clutch Description**

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



plunger moves back as a result of the return pressure of the clutch. Fluid returns to the master cylinder and the final movement of the plunger opens the port to the fluid reservoir, allowing an unrestricted flow of fluid between system and reservoir.

## Automatic Transmission – 4L60E

### Fastener Tightening Specifications

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

**Transmission General Specifications**

Name	Hydramatic 4L60-E
RPO Codes	M30
Production Location	Toledo, Ohio
Vehicle Platform (Engine/Transmission) Usage	Y
Transmission Drive	Longitudinally-Mounted Rear Wheel Drive
1st Gear Ratio	3.059:1
2nd Gear Ratio	1.625:1
3rd Gear Ratio	1.000:1
4th Gear Ratio	0.696:1
Reverse	2.294:1
Torque Converter Size (Diameter of Torque Converter Turbine)	298 mm
Pressure Taps	Line Pressure
Transmission Fluid Type	DEXRON® III
Transmission Fluid Capacity (Approximate)	298 mm Converter Dry: 11.25 l (11.9 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)	298 mm Converter 70.5 kg (155.70 lb)
Transmission Weight Wet (Approximate)	298 mm Converter 80.5 kg (176.16 lb)

**Fluid Capacity Specifications**

Application	Specification	
	Metric	English
Bottom Pan Removal	4.7 liters	5 quarts
Complete Overhaul	10.2 liters	10.8 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 consists 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 transmission shift lock control solenoid 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.

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## Abbreviations and Meanings

Abbreviation	Meaning
<b>A</b>	
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</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
<b>C</b>	
°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 <sup>3</sup>	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
CO <sub>2</sub>	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)
<b>D</b>	
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
<b>E</b>	
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
<b>F</b>	
°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
<b>G</b>	
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



<b>H</b>	
H	Hydrogen
H <sub>2</sub> O	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
HO <sub>2</sub> S	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
<b>I</b>	
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
<b>K</b>	
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
<b>L</b>	
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
<b>M</b>	
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
<b>N</b>	
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
<b>O</b>	
O <sub>2</sub>	Oxygen
O <sub>2</sub> S	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)
<b>P</b>	
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
<b>Q</b>	
QDM	Quad Driver Module
qt	Quart(s)
<b>R</b>	
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
<b>S</b>	
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 <sup>2</sup>	Square Foot/Feet
sq in, in <sup>2</sup>	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
<b>T</b>	
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
<b>U</b>	
UART	Universal Asynchronous Receiver Transmitter
U/H	Underhood
U/HEC	Underhood Electrical Center
U-joint	Universal Joint
UTD	Universal Theft Deterrent
UV	Ultraviolet
<b>V</b>	
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
<b>W</b>	
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
<b>X</b>	
X-valve	Expansion Valve
<b>Y</b>	
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.		
<b>Length</b>		
in	25.4	mm
ft	0.3048	m
yd	0.9144	
mi	1.609	km
<b>Area</b>		
sq in	645.2	sq mm
	6.45	sq cm
sq ft	0.0929	sq m
sq yd	0.8361	
<b>Volume</b>		
cu in	16,387.00	cu mm
	16.387	cu cm
	0.0164	L
qt	0.9464	
gal	3.7854	cu m
cu yd	0.764	
<b>Mass</b>		
lb	0.4536	kg
ton	907.18	
		0.907
<b>Force</b>		
Kg F	9.807	newtons (N)
oz F	0.278	
lb F	4.448	
<b>Acceleration</b>		
ft/s <sup>2</sup>	0.3048	m/s <sup>2</sup>
in/s <sup>2</sup>	0.0254	
<b>Torque</b>		
Lb in	0.11298	N·m
lb ft	1.3558	
<b>Power</b>		
hp	0.745	kW
<b>Pressure (Stress)</b>		
inches of H <sub>2</sub> O	0.2488	kPa
lb/sq in	6.895	
<b>Energy (Work)</b>		
Btu	1055	J (J= one Ws)
lb ft	1.3558	
kW hour	3,600,000.00	
<b>Light</b>		
Foot Candle	10.764	lm/m <sup>2</sup>

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

### Equivalents - Decimal and Metric

<b>Fraction (in)</b>	<b>Decimal (in)</b>	<b>Metric (mm)</b>
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

<b>Fraction (in)</b>	<b>Decimal (in)</b>	<b>Metric (mm)</b>
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

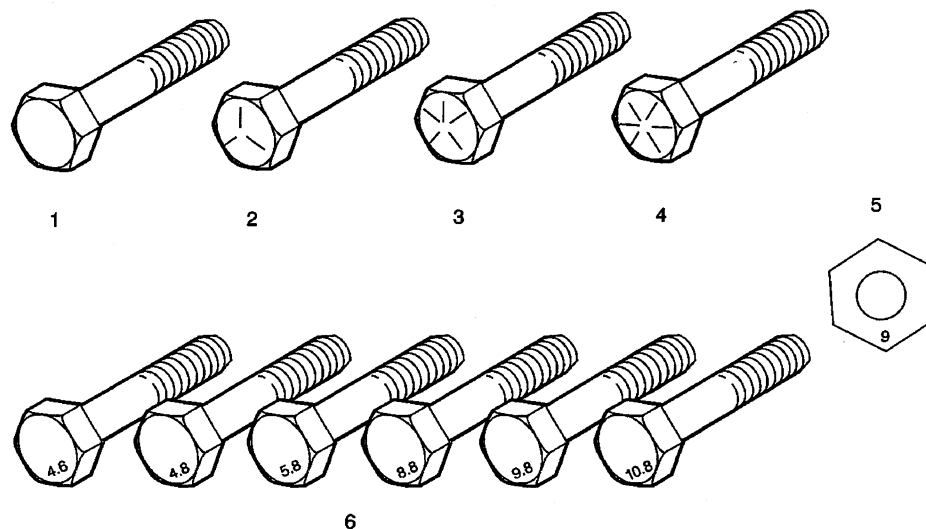
### Metric Fasteners

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

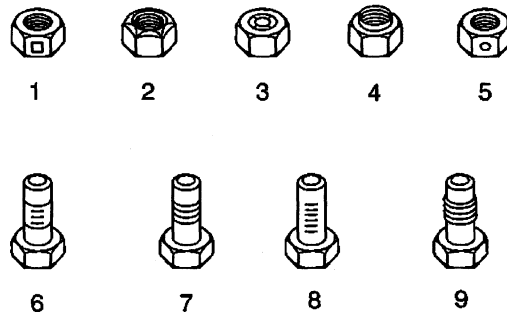
These fasteners accomplish the thread interface by a designed distortion or deformation in the fastener.

#### 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
<b>All Metal Prevailing Torque Fasteners</b>		
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
<b>Nylon Interface Prevailing Torque Fasteners</b>		
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
<b>All Metal Prevailing Torque Fasteners</b>		
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
<b>Nylon Interface Prevailing Torque Fasteners</b>		
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