Chevrolet

SSR

2004

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Product Information

Chevrolet SSR Delivers Roadster Handling, Boulevard Ride

Extensive helpings of heritage, technical innovation and striking design all work in an intricate recipe to create the all-new Chevy SSR, the world's first convertible sport pickup truck

"No other manufacturer has a vehicle like SSR," said Brent Dewar, Chevrolet general manager "And no one has this much fun and function in one package We've combined the heritage of the 1947-1953 advanced design pickup with the latest in product and manufacturing technology to enhance the Chevrolet brand "

This convertible roadster/pickup features large, flared fenders, a sculpted hood and bold stance The frame and chassis of the SSR are similar in design to Chevy's mid-size TrailBlazer family of sport utilities All exterior panels are of stamped steel Power comes from a new aluminum block version of GM's Vortec 5300 5 3L small-block V-8 and drives the rear wheels through a four-speed automatic transmission Rounding out the sporty street machine appearance of the SSR are 19-inch front and 20-inch rear tires and wheels

Innovative retractable hardtop

The most distinguishing feature of the all-new Chevrolet SSR is an ingenious power-retractable hardtop system that assures an open-air driving experience without compromising the vehicle's cargo carrying capacity

Also called a "top stack," the retractable hardtop on the SSR is the first ever applied on a pickup-styled vehicle It is the only system of its kind where the roof panels move independently to "stack" vertically behind the passenger compartment - a design that ensures quick operation and minimal stowage requirements

A single button on the console transforms the SSR from an enclosed roadster to a convertible in 25 seconds, neatly tucking the roof panels rearward in waterfall fashion between the passenger compartment and pickup bed The unique vertical storage system is an important enabler for the vehicle's ability to emulate the utility of a pickup - even with the top down, the SSR's bed capacity remains unchanged

Distinctive interior

The interior theme is Chevrolet's twin cockpit approach, with a horizontal cross-car bar and body-colored accents bringing much of the vehicle's exterior theme to the interior The billet aluminum look used on elements of the exterior continues on the door trim and instrument panel bezels The clean instrument panel features gauges with bold graphics, audio controls hidden behind a moveable panel and a simple three-dial design for all climate controls

Precision formed chassis

The striking flared fenders linking the 2004 Chevrolet SSR to its innovative pickup past are the result of a process that very appropriately combines a contemporary forming technology with one used to produce the original 1947-1953 Advanced Design Chevy lineup of trucks - the inspiration for the SSR

The stamping process used to produce the dramatic fenders and quarter panels is unique - an inverted toggle draw - that is really a marriage between old and new the original toggle draw stamping process and the more recent stretch draw concept Without new Grade 5 deep-draw quality steels, the material wouldn't be forgiving enough to be drawn to those depths without splitting

The SSR incorporates a body-on-frame construction - basically an upper steel unibody mounted on a frame Fully hydroformed steel side rails provide the boxed frame with strength and stiffness, relatively low weight, and precise quality The laser-cut, dimensional accuracy of the holes for suspension attachments permit maximum control of suspension components during manufacturing, providing consistent tuning for every vehicle built A total of seven cross members, more than the traditional four or six, boost structural strength for ride quality, handling control, and reduced noise and vibration

The upper unibody helps support the structure for the SSR's retractable roof system, it minimizes the loss of structure typically associated with convertibles and open-top vehicles by augmenting the stiffness of the entire vehicle with special cross members

Powertrain with a legend

The rich heritage of the Chevy SSR is much more than skin deep A peek under the hood reveals the latest version of the small block Chevy V-8 that's been the legendary leader of the street cruiser pack since 1955

Chevy's new roadster is powered by an all-aluminum Vortec 5300 V-8 It's the latest iteration of Chevy's small block V-8 engine that's been the performance benchmark ever since it debuted October 28, 1954, in the '55 Chevrolet Bel Air

The use of cast aluminum 319-T7 alloy reduces the overall weight of the engine by 100 pounds compared to the cast iron version The engine capitalizes on the lower mass and superior thermal efficiency of aluminum, enhancing both performance and fuel efficiency over its proven cast-iron counterpart

Aluminum's improved heat rejection also results in cleaner emissions from faster catalytic converter "light off," faster heater core warm-up for vehicle occupants, and cooler piston and oil temperatures for improved durability

The new quiet-profile pistons are polymer-coated to reduce cold scuffing and engine noise Polymer-coated pistons, long a mainstay in luxury car engines, enable tighter bore clearances, provide enduring wear surfaces between pistons and cylinder walls, and further reduce piston motion

Just as the small block V-8 provides a heritage of power, the SSR's transmission is a proven performer It's GM's Hydra-Matic 4L60-E, an electronically controlled, four-speed rear-wheel-drive, automatic overdrive transmission with a torque converter clutch

The electronic controls are calibrated to give the dependability of a pickup and the performance of a super sport vehicle

A well-mannered ride

With its boulevard-cruiser ride and refined roadster handling, the all-new Chevrolet SSR's road manners are a perfect complement to its heritage and unique sporty truck design

The SSR's vertical stiffness (vertical bend in the total structure), targeted at 17 5 Hertz (Hz), exceeds that of most other convertibles, whose ratings can be as low as 9 or 12 Hz Torsional frequency with the top up is approximately 16 Hz, with the top down, it is approximately 13 8 Hz These ratings are highly competitive with those of unibody construction convertibles

The 116-inch (2,946-mm) wheelbase is optimized to maintain truck functionality and to offer exceptional passenger room, yet it also allows for a tight turning radius generally associated with a smaller-sized vehicle

In another innovation, the battery is relocated to the rear, helping to create a better overall weight distribution, while preserving the front styling The rear-mounted battery emulates what "street rodders" have done for years and - since it is located away from the heat of the engine - the battery lasts longer

Uniquely modified suspension system

A world-class independent front double-A arm/five-link live axle rear suspension is specifically tailored and tuned for the SSR's ride and handling characteristics, while providing robustness and durability for on-road truck use

The front suspension incorporates upper and lower control arms for superior kinematics, damping, and stability, which - when combined with hydraulically assisted rack-and-pinion steering - provide smooth, precise control

The rear suspension includes monotube shock absorbers for superior damping, shock absorber mountings outboard of the frame to enhance body and wheel control, steel coil springs for consistent ride

height, and a microcellular urethane auxiliary spring for enhanced ride comfort and stability in fully loaded conditions

Standard electronic traction control, a Torsen differential, and 20-inch tires on the rear axle ensure the Vortec 5300 V-8's great power getting to the ground with exceptional traction and control

The Torsen differential, a true performance car proven system, works seamlessly with the traction assist to maximize performance in driving maneuvers, such as aggressive acceleration and cornering, and over differing road conditions It is a close relative to the rear differential developed for the Chevrolet Camaro and the technology of choice for numerous racing teams

Four-wheel disc brakes with four-wheel ABS and Dynamic Rear Proportioning provide outstanding stopping performance and world-class levels of brake "feel," wear resistance and low noise

The brakes are sized to the SSR's weight, trailering and cargo-carrying capabilities Their non-asbestos organic compound lining extends brake life to 40,000 miles, depending on how the vehicle is used and at what payload

Chevrolet SSR features Goodyear Eagle RS-A (Rally Sport-Asymmetric) all-season performance tires P255/45R19 for the front and P295/40R20 for the rear

A large 25-gallon fuel tank provides an extensive driving range between fill-ups

A comprehensive program of regular production options and accessories are available for the 2004 SSR, with additional accessories being added in subsequent model years

Accessories Complement Chevrolet SSR Versatility

Chevrolet Accessories and Chevy SSR offer consumers endless opportunities to personalize their vehicles to fit their lifestyles With various accessory packages, Chevrolet Accessories enhance the flexibility and look of the SSR, which has attracted the attention of automotive enthusiasts since it first appeared on the show circuit

Over the next four years, the SSR will offer consumers nearly 50 accessories to personalize the vehicle A few examples include a cargo-area speaker system, head and taillamp treatments, power remote cargo cover and engine beautification packages

"We've worked closely with the SSR vehicle development team to ensure the accessories complement the SSR design and functionality, and appeal to its market segment," said Nancy Philippart, GM Service and Parts Operations (SPO) executive director - GM Accessories Business Channel "From the outset, the GM Design Center has been involved in all accessory designs and has ensured the accessories not only fit properly and look right, but also truly enhance the vehicle's image "

Creative customization accessories

The auxiliary gauge package consists of a cluster of three gauges - a voltmeter, instantaneous fuel consumption, and a transmission oil temperature gauge - with a satin chrome appearance This package is seamlessly integrated and ergonomically positioned into the space between the console and lower instrument panel

For customers who seek more storage, locking and form-fitted integrated side-saddle storage boxes are available The ebony-finished storage boxes attach to the floor and side tracks of the vehicle and incorporate a highly durable exterior with a smooth-finished, easy-to-clean interior The interior compartment for each box is approximately 12-inches deep, 40-inches long and 9-inches wide (305-mm deep, 1016-mm long and 229-mm wide) The storage box secures everything from tools and trailer hitch inserts to fishing equipment, car waxes and polishes

The cargo netting package is another handy addition to help secure items that would otherwise slide around in the cargo area The package includes a cross bar positioned between the upper rails, combined with cargo netting that attaches to the tailgate and four tie-down rings The netting package is completely adjustable to the length of the cargo area

Not just for appearance, integrated running boards provide additional protection against stone chips and scratches to the front surfaces of the SSR's wide-flared rear fenders The running boards have a satin chrome appearance, incorporate a non-slip surface and attach directly to the vehicle frame

The key to the accessory offering is a track system integrated into the cargo area of the SSR The system consists of four tracks that enable easy and configurable application of current and future SSR accessory items

"Creative, intuitive accessories that evoke emotion are what's going to keep the SSR fresh throughout its lifecycle The accessory program is a key aspect behind the overall strategy of the vehicle," Philippart said

Available at Chevrolet dealers

All Chevrolet Accessories can be purchased through GM dealerships

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

Please visit www.gmaccessorieszone.com or call toll-free 866-901-9001 to speak to one of GM's knowledgeable accessory agents

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

Vehicle Highlights

- Powerful Vortec 5300 5 3L V-8 cast aluminum powerplant with 300 hp (224 kw) and 331 lb -ft (449 Nm) of torque
- Hydroformed steel frame
- Innovative top-stack retractable hardtop
- Unique design features large, flared fenders, sculpted hood and bold stance
- Distinctive 19-inch front wheels, 20-inch rear wheels

Model Lineup

	Engines	Transmission
	Vortec 5300 5.3L V8	**4-spd auto (Hydra-Matic 4L60-E)**
SSR	S	S

Standard s

Specifications

Overview	
Models.	SSR
Body style / driveline.	2-seat convertible pickup with retractable hardtop / rear-wheel drive
Construction.	2-sided galvanized steel on exterior panels
EPA vehicle class.	mid-size truck
Manufacturing location.	Lansing, Michigan
Engines	**Vortec 5300 V-8**
Type.	5.3L OHV V-8
Displacement (cu in / cc).	325 / 5326
Bore & stroke (in / mm).	3.78 / 96 x 3.27 / 92
Block material.	Die-cast aluminum
Cylinder head material.	Die-cast aluminum
Valvetrain.	OHV 2 valves per cylinder, camshaft in block, hydraulic roller lifters
Ignition system.	Electronic direct
Fuel delivery.	Sequential fuel injection
Compression ratio.	9.5. 1
Horsepower (hp / kw @ rpm).	300 / 224 @ 5200
Torque (lb-ft / Nm @ rpm).	331 / 449 @ 4000
Recommended fuel.	Regular unleaded
Maximum engine speed (rpm).	6000
Exhaust system.	stainless steel with single muffler and dual tailpipes
Emissions controls	evaporative system, catalytic converter, exhaust gas recirculation, positive crankcase ventilation
Estimated fuel economy (mpg city / hwy / combined).	15 / 19 / 17
Transmission	
Type.	Hydra-Matic 4L60-E4-speed automatic w/overdrive, rear-wheel drive
	Gear ratios (:1):
First.	3.06
Second.	1.62
Third.	1.00
Fourth.	0.70
Reverse.	2.29
Final drive ratio.	3.73.1
Chassis/Suspension	
Front.	Double-A arm
Rear.	five-link solid axle
Steering type.	Hydraulically assisted rack and pinion
Steering ratio.	16.0.1
Steering wheel turns, lock-to-lock.	3.05
Turning circle, curb-to-curb (ft / m).	38.1 / 11.6

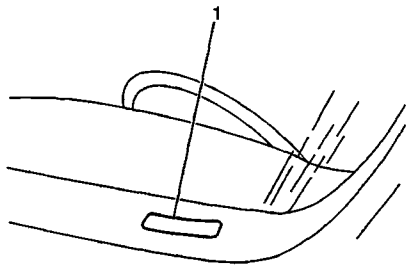
Brakes	
Type	power-assisted front disc, rear vented disc with 4-wheel anti-lock braking system
Front rotor (diameter x thickness, in / mm).	12 x 1 14 / 305 x 29, discs
Rear rotor (diameter x thickness, in / mm).	12 8 x 0 78 / 325 x 20, vented discs
Total swept area (sq in / sq cm)	front 207 8 / 1340, rear. 216.6 / 1397
Wheels/Tires	
Wheel size and type	front 19-inch x 8-inch aluminum rear. 20-inch x 10-inch aluminum
Tires	front P255/45R19 Goodyear rear P295/40R20 Goodyear no spare. repair and inflation kit provided

Dimensions

Exterior	
Wheelbase (in / mm).	116 / 2946
Overall length (in / mm).	191.4 / 4862
Overall width (in / mm).	78.6 / 1996
Overall height (in / mm).	64.2 / 1631
Track (in / mm)	front 64 1 / 1628 rear. 64.9 / 1648
Minimum ground clearance (in / mm).	6 1 / 154
Curb weight (lb / kg).	base. 4760 / 2159
Weight distribution (% front / rear).	52 / 48
Interior	
Seating capacity.	2
Head room (in / mm).	40 / 1016
Leg room (in / mm).	42.1 / 1069
Shoulder room (in / mm).	53.5 / 1359
Hip room (in / mm).	51.3 / 1303
Capacities	
EPA interior volume (cu ft / L).	39.9 / 1130
Cargo volume (cu ft / L)	23 7 / 671
Trailer towing maximum (lb / kg).	2500 / 1134
Fuel tank (gal / L).	25 / 94.6
Engine oil (qt / L)	6 3 / 6
Cooling system (qt / L).	16.1 / 15.2
Cargo Area	
Bed Length.	48.7"
Bed Width (maximum, at floor).	56.6"
Bed Width (minimum, at floor).	39.8"
Bed Height.	17.8"
Capacity	est 23 7 cu ft (even though it realistically does hold more)

Vehicle Identification

Vehicle Identification Number (VIN)



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

Position	Definition	Character	Description
1	Country of Origin	1	U.S. Built
2	Manufacturer	G	General Motors
3	Make	C	Chevrolet Truck
4	GVWR/Brake System	E	6,001-7,000 HYD Brakes
5	Truck Line/Chassis Type	S	Sm Conventional Cab--4x2
6	Series	1	½ Ton
7	Body Type	4	Two Door Cab
8	Engine Type	P	GM 5.3L Aluminum V8 (LM4)
9	Check Digit	--	Check Digit
10	Model Year	4	2004
11	Plant Location	B	Lansing, MI
12-17	Plant Sequence Number	--	Plant Sequence Number

VIN Derivative

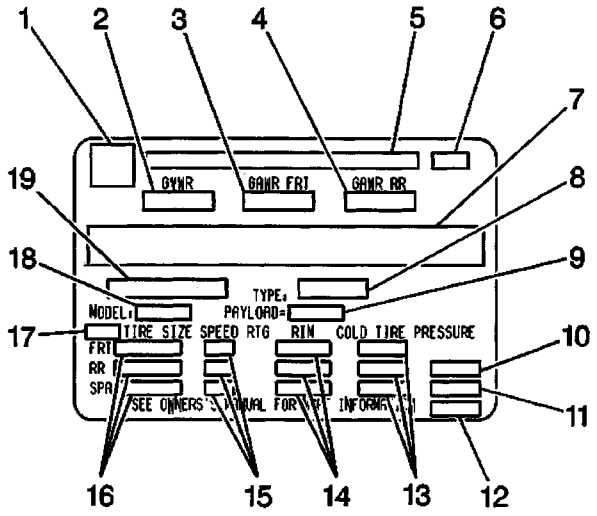
All engines and transmissions are stamped or laser etched with a partial vehicle identification number (VIN), which was derived from the complete VIN A VIN derivative contains the following nine positions

Position	Definition	Character	Description
1	GM Division Identifier	C	Chevrolet Truck
2	Model Year	4	2004
3	Assembly Plant	B	Lansing, MI
4-9	Plant Sequence Number	--	Plant Sequence Number

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

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

Label Certification w/o RPO Z49



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

The vehicle certification label displays the following assessments

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

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

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

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

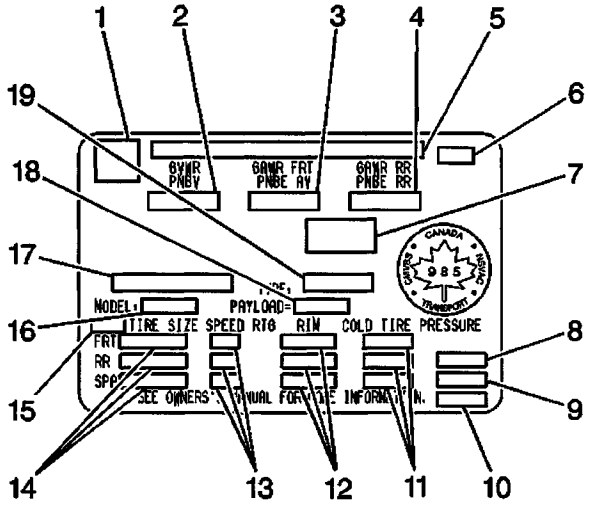
The front gross axle weight rating (GAWR FRT) is the weight exerted on the front axle The rear gross axle weight rating (GAW RR) is the weight exerted on the rear axle The front and rear gross axle weights must not exceed the front and rear gross axle weight ratings

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

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

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

Label Certification with RPO Z49



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

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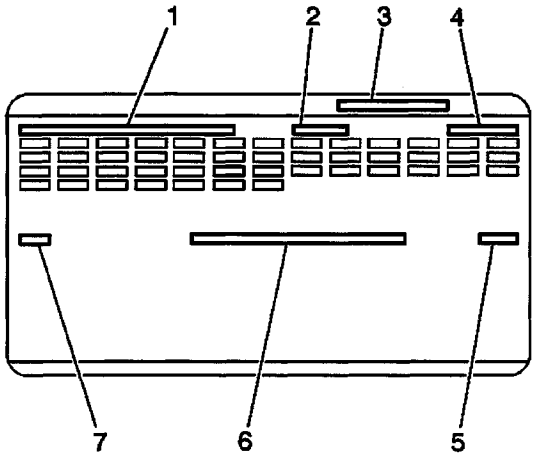
The vehicle may have a Gross Combination Weight Rating (GCWR) The Gross Combination Weight Rating refers to the total maximum weight of the loaded tow vehicle including driver and passengers and a loaded trailer

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

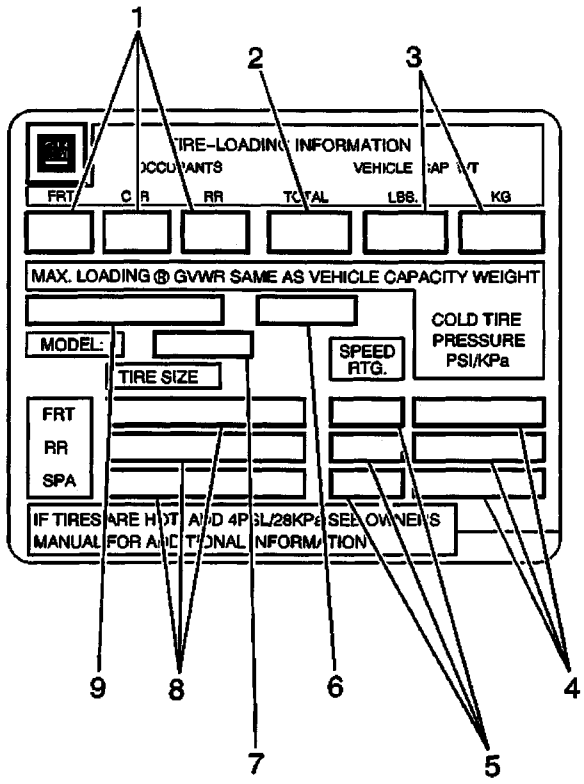
Service Parts Identification Label (SPID)



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

The service parts identification label is located on the instrument panel storage compartment door in order to help service and parts personnel identify the vehicle's original parts and the vehicle's original options

Tire Placard



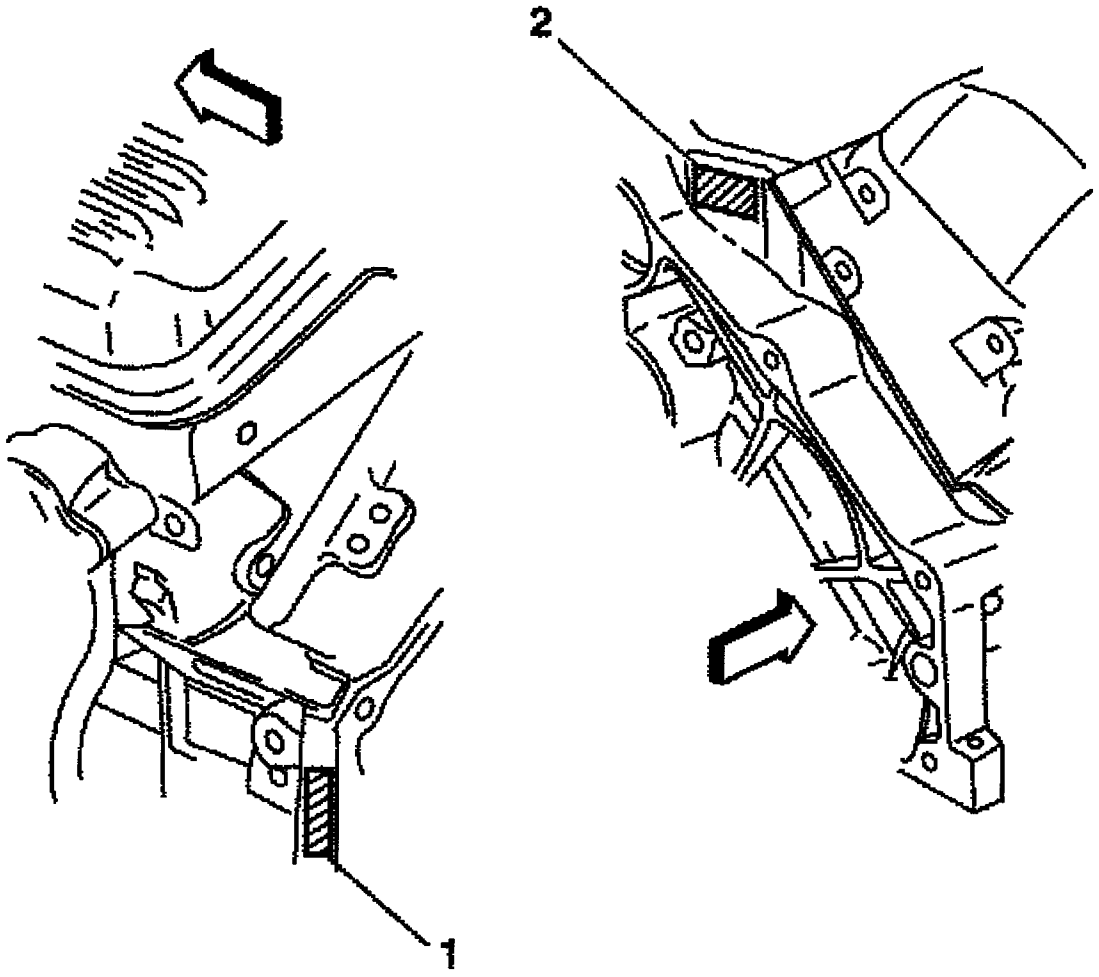
(1) Specified Occupant Seating Positions
(2) Total Occupant Seating
(3) Maximum Vehicle Capacity Weight
(4) Tire Pressures, Front, Rear, and Spare
(5) Tire Speed Rating, Front, Rear, and Spare
(6) Tire Label Code
(7) Engineering Model Minus First Character
(8) Tire Sizes, Front, Rear, and Spare
(9) Vehicle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

The Tire Placard is permanently located on the edge of the driver's door Refer to the placard in order to obtain the following information

- 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

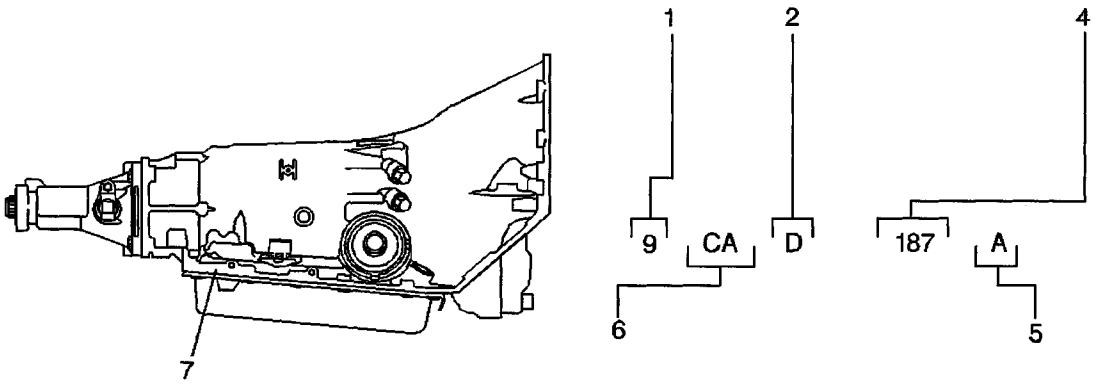
5.3L V-8 Engine

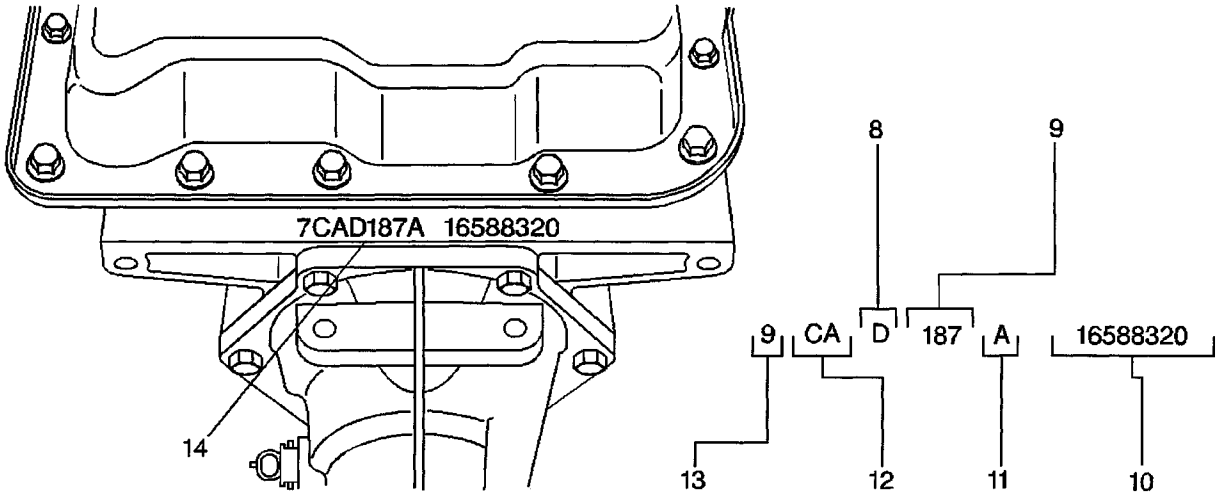


(1) Primary Engine Identification Number Location
(2) Secondary Engine Identification Number Location

Transmission ID and VIN Derivative Location

4L60-E Transmission ID Location





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

Plant and Shift Build Chart

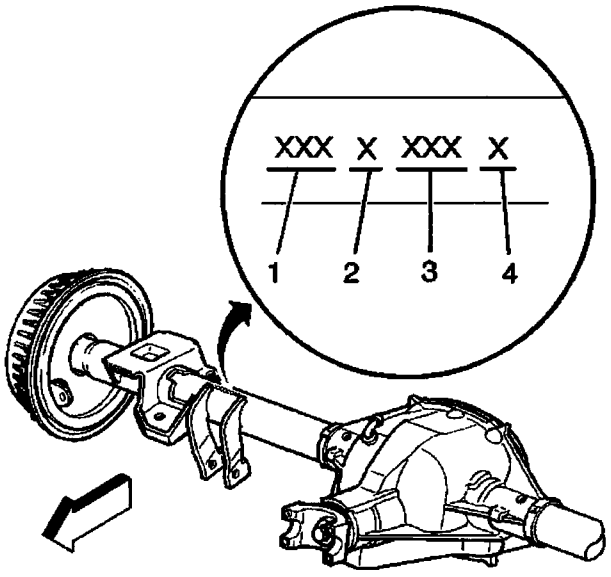
Plant	Build Line	1st Shift	2nd Shift	3rd Shift
Toledo, OH	ML1	J	W	X
	ML2	A	C	Not Used
	ML3	B	H	Not Used
	ML4	S	L	V
	ML5	K	E	Z
Romulus, MI	1	A	--	B
Ramos Arizpe, Mexico	1	A	--	--

Engine and Transmission Usage

Model	Engine		Transmission	
	Base	Option	Base	Option
S157 (03)	5 3L Aluminum V8 (LM4)	--	4 Speed Automatic w/Overdrive (M30)	--

Model Codes: S-Two-Wheel Drive
03--Super Sports Roadster

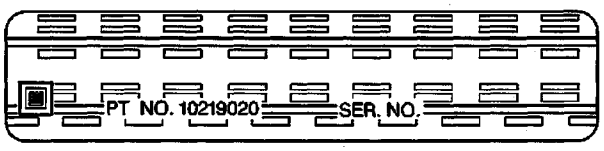
Axle Identification – Rear



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

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

Labeling - Anti-Theft



Notice

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

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

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

RPO Code List

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

RPO	Description
AAB	Memory Driver Convenience Package
AJ1	Window Tinted, Deep Tint
AJ7	Restraint System Seat, Inflatable, Driver and Passenger, Front and Side
AK5	Restraint System Seat, Inflatable, Driver and Passenger
AU0	Remote Keyless Entry
A31	Window Power Operated, Side
A95	Front Bucket Seat, High Back, Driver and Passenger Reclining
BKF	Covering Front Floor Mats, Auxiliary, Custom
BVE	Steps, Runningboard, Side
B30	Covering, Floor Carpet
B32	Covering Floor Mats, Front Auxiliary
CJ3	HVAC System Air Conditioner, Front, Manual Temperature Control, Auxiliary Temperature Control
CTD	Equipment, Cargo Tie Down - Movable
C44	Deflector Air, Interior
C49	Defogger Rear Window, Electric
DF4	Mirrors, Inside, Rear View, Light Sensitive, Compass, Dual Reading
DNR	Equipment Dealer Installed
D25	Mirror, Outside Left and Right, Remote Control, Electric, Heated, Light Sensitive, Manual Folding, Turn Signal Indicator, Color
EB6	GVW Rating 6,050 lb
ERG	Equipment Group, Auxiliary Gage, Customized Shifter Knob, Engine Cover
ERJ	Equipment Cargo, Trim Compartment Package, Aluminum
E55	Body Equipment End Gate
E8A	Cover, Rear Compartment Tonneau, Rear Compartment - Delete
GT4	Axle Rear 3.73 Ratio
G80	Axle Positraction Limited, Slip
JF8	Brake Vacuum Power, 4 Wheel Disc
KA1	Heater Seat
KG3	Generator 145 amp
K34	Cruise Control Automatic, Electronic
LM4	Engine, Gas, 8 Cylinder, 5.3L, SFI, Aluminum, GM
M30	Transmission, Automatic 4 Speed, 4L60E, Electronic
NC1	Emission System, California, LEV
NF2	Emission System, Federal, Tier 1
NW7	Traction Control Powertrain Management Only
N40	Steering Power, Non-Variable Ration
OLF	Plant Code Lansing, MI, USA - Craft Center
PD7	Spare Wheel - Delete
PZ7	Wheel 19 x 8 - Front and 20 x 10 - Rear, Painted Aluminum
QMX	Tire All Mixed Sizes - Front and Rear
RAE	Equipment Cargo Management System
STW	Steering Wheel Leather Wrapped with Redundant Controls
T61	Lamp System, Daytime Running
T96	Lamp, Fog, Front
UA6	Theft Deterrent System
UB0	Radio AM/FM Stereo, Seek/Scan, CD, Auto Tone, Data System,, Clock, ETR

RPO	Description
UC6	Radio AM/FM Stereo, Seek/Scan, RDS, Multiple Compact Disc, Auto Tone Control, Clock, ETR
UG1	Garage Door Opener, Universal
UQA	Speaker System Premium Performance Enhanced Audio
U19	Metric Scale Instrument Cluster
U68	Display Driver Info Center
U73	Antenna, Fixed, Radio
VC4	Label Price/Fuel Economy, Puerto Rico
VG8	Vehicle Buyer Notice Label
VK3	License Plate Front Mounting Package
VR4	Trailer Hitch Weight Distributing Platform
VXS	Vehicle Complete
V73	Vehicle Statement USA/Canada
X88	Market Brand Chevrolet
YC5	Convenience Package Decor Level #5
ZQ8	Chassis Package Sport
ZY1	Color Combination - Solid
Z49	Export Canadian Modified Mandatory Base Equipment
Z82	Trailer Provisions Special Equipment, H.D.

Technical Information

Maintenance and Lubrication

Capacities - Approximate Fluid

Application	Specification	
	Metric	English
Axles		
Rear Axle	2.03 Liters	2.4 Quarts
Engine Cooling System	14 5 Liters	15 3 Quarts
Engine Crankcase	5 7 Liters	6 0 Quarts
Fuel Tank	94 6 Liters	25 0 Gallons
Transmission		
After Filter/Pan Removal	4.7 Liters	5.0 Quarts
After Complete Overhaul	10.6 Liters	11 Quarts

Maintenance Items

Application	Part Number
Automatic Transmission Filter Kit	GM P/N 24200796
Air Cleaner	AC Delco P/N A2014C GM P/N 15036141
Engine Oil Filter	AC Delco P/N PF44 GM P/N 25010633
Spark Plugs	AC Delco P/N 41-985 GM P/N 12571164
Fuel Filter	AC Delco P/N GF831 GM P/N 88983068
Windshield Wiper Blades	Trico 51 cm (20 in)

Fluid and Lubricant Recommendations

Usage	Fluid/Lubricant
Engine Oil	Engine oil with the American Petroleum Institute Certified for Gasoline Engines starburst symbol of the proper viscosity.
Engine Coolant	50/50 mixture of clean, drinkable water and use only GM Goodwrench® DEX-COOL® or Havoline® DEX-COOL® Coolant.
Hydraulic Brake System	Delco Supreme II® Brake Fluid or equivalent DOT-3 brake fluid.
Windshield Washer Solvent	GM Optikleen® Washer Solvent or equivalent.
Parking Brake Cable Guides	Chassis Lubricant GM P/N 12377985 (Canadian P/N 88901242) or equivalent, or lubricant meeting requirements of NLGI #2, Category LB or GC-LB.
Power Steering System	GM Power Steering Fluid GM P/N 1052884 (Canadian P/N 993294) or equivalent.
Automatic Transmission	DEXRON® III Automatic Transmission Fluid.
Key Lock Cylinders	Multi-Purpose Lubricant, Superlube® GM P/N 12346241 (Canadian P/N 10953474) or equivalent.
Chassis Lubrication	Chassis Lubricant (GM P/N 12377985 (Canadian P/N 88901242) 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 1052349 (Canadian P/N 992723) or equivalent, or lubricant meeting requirements of NLGI #2, Category LB or GC-LB.
Hood and Door Hinges	Multi-Purpose Lubricant, Superlube® GM P/N 12346241 (Canadian P/N 10953474) or equivalent.
Outer Tailgate Handle Pivot Points and Hinges	Multi-Purpose Lubricant, Superlube® GM P/N 12346241 (Canadian P/N 10953474) or equivalent.
Weatherstrip Conditioning	Dielectric Silicone Grease GM P/N 12345579 (Canadian P/N 1974984) or equivalent.
Weatherstrip Squeaks	Synthetic Grease with Teflon, Superlube® GM P/N 12371287 (Canadian P/N 10953437) or equivalent.

Descriptions and Operations

Power Steering System

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

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

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

The 2 basic types of power steering gears are listed below

- A recirculating ball system
- A rack and pinion system

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

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

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

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

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

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

Steering 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 navigation/OnStar® features
- The HVAC controls

Driver Safety

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

Ignition Lock Cylinder Control Actuator

If the vehicle is equipped with a floor mounted console gear shifter, it has a ignition lock cylinder control actuator system in the steering column as an added safety feature The ignition lock cylinder control actuators purpose is to prevent the steering wheel from being locked when the transmission is in gear and the vehicle may still be moving The column ignition lock system consists of a ignition lock cylinder control acutator, and a park position switch that is located in the A/T shift lock control switch The ignition lock cylinder control acutator contains a pin that is spring loaded out to mechanically prevent the ignition key cylinder from being turned to the lock position when vehicle transmission is not in the Park position If vehicle power is lost, and/or the transmission is not in the Park position the operator will not be able to turn the ignition key to the lock position and will not be able to remove the ignition key from the column

Suspension Description and Operation

Front Suspension

The front suspension has 2 primary purposes

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

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

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

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

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

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

Rear Suspension

These vehicles use either a coil spring suspension or an air suspension configuration that utilizes two air springs On vehicles equipped with the air springs, two separate height sensors control the air springs, one for the left spring and one for the right spring

A separate air compressor is used to inflate the air springs and maintain proper ride height

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

The rear spring steel stabilizing bar helps minimize body roll and sway during cornering The rear stabilizer shaft is connected to the rear axle and the frame

The rear suspension system on this vehicle consists of the following components

- The rear axle
- Two coil springs or two air springs

- Two height sensors, air suspension only
- Air compressor, air suspension only
- Air supply lines, air suspension only
- Two shock absorbers
- The rear axle tie rod
- Two upper control arms
- Two lower control arms

Air Suspension

The primary mission of the Air Suspension System is the following for the rear suspension under loaded and unloaded conditions

- Keep the vehicle visually level
- Provide optimal headlight aiming
- Maintain optimal ride height

The Air Suspension System consists of the following items

- Air Suspension Compressor Assembly
- Air Suspension Sensors
- Rear Air Springs

The Air Suspension Compressor Assembly has the ability to detect faults and indicate the appropriate fault code via a blink code on the inflator switch LED The Air Suspension Compressor Assembly will indicate the code when the condition to cause the code becomes current

During compressor activation the exhaust valve will be activated for a calibrated length of time to provide compressor head relief After a calibrated length of time the compressor relay will activate to start the compressor When trim height is achieved the relay will be deactivated The exhaust valve and compressor relay are part of the air suspension compressor assembly The Air Suspension System shall maintain the rear trim height within 4 mm (0 15 in)in all loading conditions and the leveling function shall deactivate if the vehicle is overloaded The side to side variation has to be maintained within 8 mm (0 31 in) After ignition is turned off, the module will stay awake for between 30 minutes and 2 1/2 hours The system will exhaust pressure within 30 minutes after ignition is turned off to lower the vehicle after unloading The leakage of the complete load leveling system shall not result in more than 1 4 mm (0 05 in) drop of rear suspension height at GVWR during a 24 hour period

There are software Leveling Sequence Timers that detect conditions of excessive output at which no leveling is accruing These timers shall keep track of conditions which cause excessive run time or no calibratable change in trim height These timers are defined in more detail below

Accumulator Timer

The primary purpose of the accumulator timer is to detect conditions in which excessive activity may occur The conditions are generally as follows in the compress mode the existences of pneumatic leaks in the system, in the exhaust mode the existence of pneumatic blockage or unloaded vehicle conditions The accumulator shall keep track of the accumulated run time of the compressor If the accumulator timer reaches its calibratable limit the output function will be disabled until the accumulator is reset The accumulator timer will be reset with each transition into the RUN power mode or if the complementary output activation is required

Progress Timer

The primary propose of the progress timer is to quickly detect conditions in which excessive output activity may occur at zero vehicle speed condition If the Air Suspension System does not detect a calibratable change in position within a calibratable time period, the output function will be disabled The timer will be reset with each ignition switch cycle into the RUN position

Air Suspension Sensors

The air suspension sensor arm is attached to an armature that rotates inside a coil The inductance of the coil, not the resistance, changes dependant on the position of the armature in the coil The air suspension

module determines the angle of the sensor arm by sending a pulse width modulated supply voltage through the coil and measuring the response time The sensors must be calibrated to the correct D height and are not adjustable

Rear Air Springs

The air springs are mounted in the frame in the same location were the coil spring is mounted for a vehicle without air suspension Support pieces are affixed to the axle for the air springs

Wheels and Tires

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Wheel Nut (In Sequence)	140 N m	100 lb ft

General Description

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

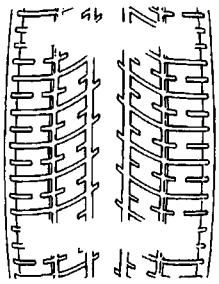
The following factors have an important influence on tire life

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

The following factors increase tire wear

- Heavy cornering
- Excessively rapid acceleration
- Heavy braking

Tread Wear Indicators Description



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

The location of these indicators are at 72 degree intervals around the outer diameter of the tire The indicators appear as a 6 mm (0 25 in) wide band when the tire tread depth becomes 1 6 mm (2/32 in)

Metric Wheel Nuts and Bolts Description

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

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

The thread sizes of metric wheel/nuts and the bolts are indicated by the following example M12 x 1 5

- M = Metric
- 12 = Diameter in millimeters
- 1 5 = Millimeters gap per thread

Tire Inflation Description

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

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

Inspect the tire pressure when the following conditions apply

- The vehicle has been sitting at least 3 hours
- The vehicle has not been driven for more than 1 6 km (1 mi)
- The tires are cool

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

The kilopascal (kPa) is the metric term for pressure The tire pressure may be printed in both kilopascal (kPa) and psi One psi equals 6 9 kPa

Inflation Pressure Conversion (Kilopascals to PSI)

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

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

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

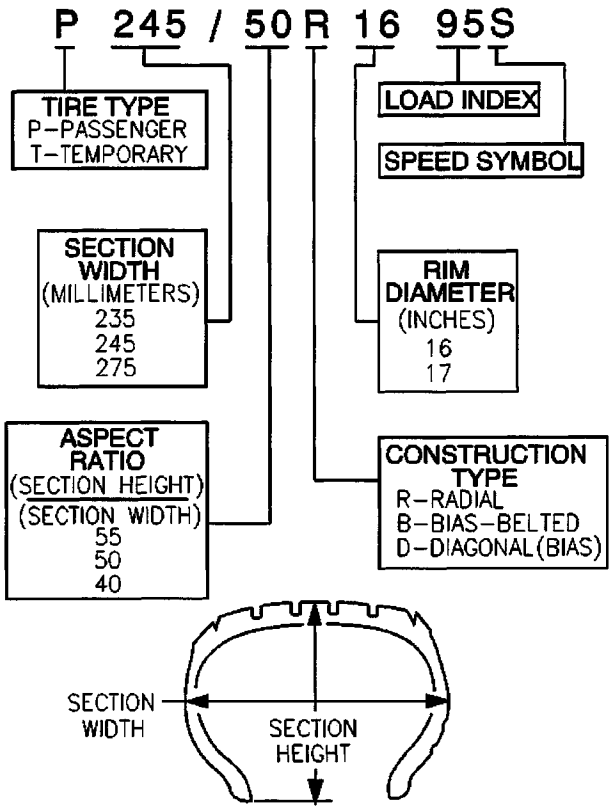
Tires with a lower than recommended pressure can cause the following conditions

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

Unequal pressure on the same axle can cause the following conditions

- Uneven braking
- Steering lead
- Reduced vehicle handling

P-Metric Sized Tires Description



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

Driveline System Description and Operation

Driveline/Axle – Propeller Shaft

The propeller shaft is a tube with universal joints at both ends which do not require periodic maintenance, that transmit power from the transfer case or transmission output shaft to the differential

One Piece Propeller Shaft Description

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

Universal Joint Description

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

Rear Drive Axle Description and Operation

Rear Axle Assembly Description

The rear axle for this vehicle consist of the following components

- Aluminum Differential Carrier Housing
- Torsen® Limited Slip Differential Assembly
- Ring Gear and Drive Pinion Shaft
- Left and right axle shaft tubes
- Left and right axle shafts
- Fill Plug
- Drain Plug

Rear Axle Assembly Operation

The rear axle receives torque from the propeller shaft and transfers it to the axle's pinion gear through the universal joint and the pinion yoke The pinion gear transfers torque to the ring gear, which is splined to the drive pinion at a 90 degree angle The ring gear is attached to the differential assembly The only differential assembly available is the Torsen® limited slip differential

Torsen® Limited Slip Differential Description

The Torsen® limited slip differential assembly consists of the following components

- Eight helical planet gears
- Two helical side gears
- Two thrust washers
- Thrust block
- Thrust block lock bolt
- Two piece differential case
- Torsen® Limited Slip Differential Operation

The Torsen® limited slip differential combines the function of an open differential and a limited slip differential through the use of helical cut side gears and planet gears The left side gear has helical teeth cut in the left-hand direction and the right side gear has helical teeth cut in the right-hand direction The eight planet gears also have helical teeth, and are arranged within the differential case in pairs, which lie parallel to the axle shafts In each pair, there is one left-hand helix gear and one right-hand helix gear This arrangement allows the planet gears to

- Mesh with the corresponding planet gear
- Mesh only with left or right side gear

This design allows only the four right-hand planet gears to mesh with the left side gear and the four left-hand planet gears to mesh with the right side gear The planet gears in each pair also mesh with each other With the gearing arranged as such, turning one rear wheel on the vehicle will result in the opposite rear wheel turning in the same amount, but in the opposite direction, as with an open differential As a result, each wheel is able to compensate or differentiate for the different axle shaft and wheel speeds that occur when the wheel is turning without causing the tires to chip or hop

The majority of limited slip devices function by generating internal friction - it is that friction which provides resistance to wheel spin With a Torsen® differential, friction is generated when torque is applied to the helical shaped gear teeth When torque is applied, an axial thrust force on the side gears will result and the side gears are literally pushed sideways apart from each other and against the inner walls of the differential case At the same time, the loading on the gear teeth tries to separate the side gears and the planet gears This pushes the planet gears outward against the walls of the differential case Since the gears are being pushed against the differential case under load, friction is created Because the friction that is created is a direct result of the torque applied to the differential by the drive train, the amount of friction that is generated is always in proportion to the amount of torque applied This allows the Torsen® to differentiate freely when low or no torque is applied Under power, the differential is essentially locked, allowing variations in traction under each tire to occur without spin or slip

There is enough friction in the Torsen® differential to allow it to transfer approximately 65-70 percent of the total axle torque to the wheel with the greater amount of traction when the traction surfaces are unequal between the rear wheels When this limit is reached, wheel spin may occur However, the Torsen® will continue to send 65-70 percent of the available torque to the wheel with better traction, which allows the vehicle to move off of a slippery surface In normal cornering there is enough of a difference in the load on each wheel to overcome the friction of the Torsen®, allowing the unit to differentiate while sending 65-70 percent of the total axle torque to the slower turning wheel

The components of the Torsen® limited slip differential are not serviceable, the only repair is the replacement of the differential assembly

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 to expand park brake shoe (rear disc, drum-in-hat system), or drum brake shoes toward the friction surface of the drum-in-hat of the rear brake rotor, or the brake drum

Threaded park brake actuators/adjusters are also used to control clearance between the park brake shoe (rear disc, drum-in-hat system), or the drum brake shoes and the friction surface of the drum-in-hat (of the rear brake rotor), or the brake drum

Park Brake Shoe (Rear Disc, Drum-In-Hat System)

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

System Operation

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

ABS Description and Operation

Antilock Brake System

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

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

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

Engine Description and Operation

Engine Mechanical Specifications 5.3L

Application	Specification	
	Metric	English
General		
Engine Type	V8	
Displacement	5.3L	325 CID
RPO	LM4	
VIN	P	
Bore	96.0-96.018 mm	3.779-3.78 in
Stroke	92.0 mm	3.622 in
Compression Ratio	9.49.1	
Firing Order	1-8-7-2-6-5-4-3	
Spark Plug Gap	1.524 mm	0.06 in
Block		
Camshaft Bearing Bore 1 and 5 Diameter - 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	0.006 mm	0.0002 in
Cylinder Bore Diameter	96.0-96.018 mm	3.779-3.78 in
Cylinder Bore Taper - Thrust Side	0.018 mm	0.0007 in
Cylinder Head Deck Height - Measuring from the Centerline of Crankshaft to the Deck Face	234 57-234 82 mm	9 235-9 245 in
Cylinder Head Deck Surface Flatness - Measured Within a 152.4 mm (6.0 in) Area	0 11 mm	0 004 in
Cylinder Head Deck Surface Flatness - Measuring the Overall Length of the Block Deck	0 22 mm	0 008 in
Valve Lifter Bore Diameter	21.417-21.443 mm	0.843-0.844 in
Camshaft		
Camshaft End Play	0.025-0.305 mm	0.001-0.012 in
Camshaft Journal Diameter	54.99-55.04 mm	2.164-2.166 in
Camshaft Journal Out-of-Round	0.025 mm	0.001 in
Camshaft Lobe Lift - Exhaust	6.96 mm	0.274 in
Camshaft Lobe Lift - Intake	6.82 mm	0.268 in
Camshaft Runout - Measured at the Intermediate Journals	0.05 mm	0.002 in
Connecting Rod		
Connecting Rod Bearing Clearance - Production	0.023-0.065 mm	0.0009-0.0025 in
Connecting Rod Bearing Clearance - Service	0.023-0.076 mm	0.0009-0.003 in
Connecting Rod Bore Diameter - Bearing End	56.505-56.525 mm	2.224-2.225 in
Connecting Rod Bore Out-of-Round - Bearing End - Production	0 004-0 008 mm	0 00015-0 0003 in
Connecting Rod Bore Out-of-Round - Bearing End - Service	0.004-0.008 mm	0.00015-0.0003 in
Connecting Rod Side Clearance	0.11-0.51 mm	0.00433-0.02 in
Crankshaft		
Connecting Rod Journal Diameter - Production	53.318-53.338 mm	2.0991-2.0999 in
Connecting Rod Journal Diameter - Service	53.308 mm	2.0987 in

Application	Specification	
	Metric	English
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
Cylinder Head		
Cylinder Head Height/Thickness - Measured from the Cylinder Head Deck to the Valve Rocker Arm Cover Seal Surface	120 2 mm	4 732 in
Surface Flatness - Block Deck - Measured Within a 152 4 mm (6.0 in) Area	0 08 mm	0 003 in
Surface Flatness - Block Deck - Measuring the Overall Length of the Cylinder Head	0 1 mm	0 004 in
Surface Flatness - Exhaust Manifold Deck	0.13 mm	0.005 in
Surface Flatness - Intake Manifold Deck	0.08 mm	0.0031 in
Valve Guide Installed Height - Measured from the Spring Seat Surface to the Top of the Guide	17 32 mm	0 682 in
Intake Manifold		
Surface Flatness - Measured at Gasket Sealing Surfaces and Measured Within a 200 mm (7 87 in) Area that Includes Two Runner Port Openings	0 3 mm	0 118 in
Lubrication System		
Oil Capacity - with Filter	5.68 liters	6.0 quarts
Oil Capacity - without Filter	5.20 liters	5.5 quarts
Oil Pressure - Minimum - Hot	41 kPa at 1,000 engine RPM 124 kPa at 2,000 engine RPM 165 kPa at 4,000 engine RPM	6 psig at 1,000 engine RPM 18 psig at 2,000 engine RPM 24 psig at 4,000 engine RPM
Oil Pan		
Front Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
Rear Cover Alignment - at Oil Pan Surface	0.0-0.5 mm	0.0-0.02 in
Oil Pan Alignment - to Rear of Engine Block at Transmission Bell Housing Mounting Surface	0 0-0 25 mm	0 0-0 01 in

Application	Specification	
	Metric	English
Piston Rings		
Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Production	0 23-0 44 mm	0 009-0 017 in
Piston Ring End Gap - First Compression Ring - Measured in Cylinder Bore - Service	0 23-0 5 mm	0 009-0 0196 in
Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Production	0 44-0 7 mm	0 017-0 027 in
Piston Ring End Gap - Second Compression Ring - Measured in Cylinder Bore - Service	0 44-0 76 mm	0 0173-0 03 in
Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Production	0 18-0 75 mm	0 007-0 029 in
Piston Ring End Gap - Oil Control Ring - Measured in Cylinder Bore - Service	0 18-0 81 mm	0 007-0 032 in
Piston Ring to Groove Clearance - First Compression Ring - Production	0 04-0 085 mm	0 00157-0 00335 in
Piston Ring to Groove Clearance - First Compression Ring - Service	0 04-0 085 mm	0 00157-0 00335 in
Piston Ring to Groove Clearance - Second Compression Ring - Production	0 04-0 078 mm	0 00157-0 0031 in
Piston Ring to Groove Clearance - Second Compression Ring - Service	0 04-0 078 mm	0 00157-0 0031 in
Piston Ring to Groove Clearance - Oil Control Ring - Production	0 012-0 2 mm	0 0005-0 0078 in
Piston Ring to Groove Clearance - Oil Control Ring - Service	0.012-0.2 mm	0.0005-0.0078 in
Pistons and Pins		
Piston - Piston Diameter - Measured Over Skirt Coating	96.002-96.036 mm	3.779-3.78 in
Piston - Piston to Bore Clearance - Production	-0.036-0.016 mm	-0.0014-0.0006 in
Piston - Piston to Bore Clearance - Service Limit with Skirt Coating Worn Off	0 071 mm	0 0028 in
Pin - Piston Pin Fit in Connecting Rod Bore	0 02-0 043 mm - Interference	0 00078-0 00169 in - Interference
Pin - Piston Pin Clearance to Piston Pin Bore - Production	0 007-0 02 mm	0 00027-0 00078 in
Pin - Piston Pin Clearance to Piston Pin Bore - Service	0 007-0 021 mm	0 00027-0 00082 in
Pin - Piston Pin Diameter	23.997-24.0 mm	0.9447-0.9448 in
Valve System		
Valves - Valve Face Angle	45 degrees	
Valves - Valve Face Width	1.25 mm	0.05 in
Valves - Valve Lash	Net Lash - No Adjustment	
Valves - Valve Lift - Intake	11.6 mm	0.457 in
Valves - Valve Lift - Exhaust	11.85 mm	0.466 in
Valves - Valve Seat Angle	46 degrees	
Valves - Valve Seat Runout	0.05 mm	0.002 in
Valves - Valve Seat Width - Exhaust	1.78 mm	0.07 in
Valves - Seat Width - Intake	1.02 mm	0.04 in
Valves - Valve Stem Diameter - Production	7.955-7.976 mm	0.313-0.314 in
Valves - Valve Stem Diameter - Service	7.95 mm	0.313 in
Valves - Valve Stem-to-Guide Clearance - Production - 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

Application	Specification	
	Metric	English
Valves - Valve Stem-to-Guide Clearance - Production - Exhaust	0 025-0 066 mm	0 001-0 0026 in
Valves - Valve Stem-to-Guide Clearance - Service - Exhaust	0.093 mm	0.0037 in
Rocker Arms - Valve Rocker Arm Ratio	1.70.1	
Valve Springs - Valve Spring Free Length	52.9 mm	2.08 in
Valve Springs - Valve Spring Installed Height	45.75 mm	1.8 in
Valve Springs - Valve Spring Load - Closed	340 N at 45.75 mm	76 lb at 1.8 in
Valve Springs - Valve Spring Load - Open	980 N at 33.55 mm	220 lb at 1.32 in

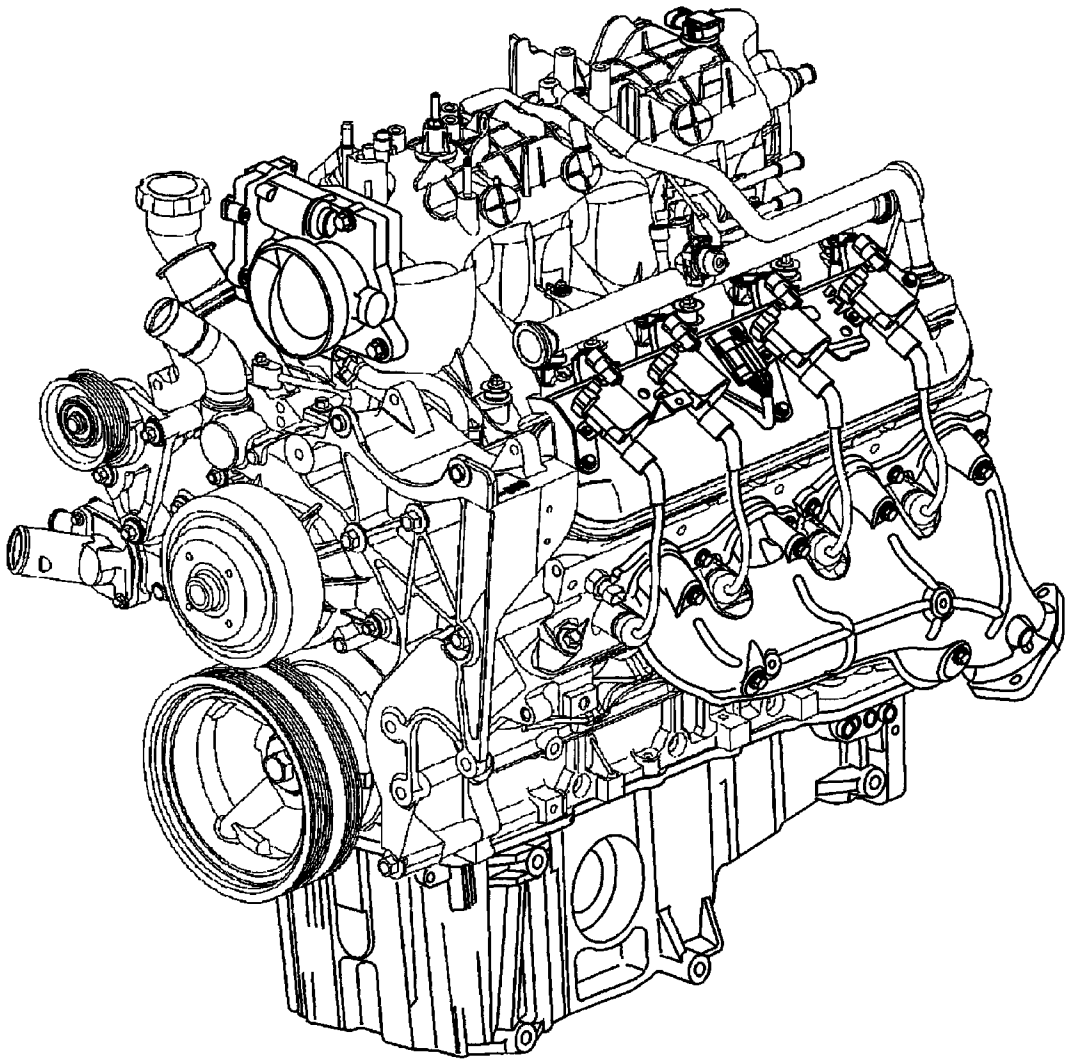
Fastener Tightening Specifications – 5.3L

Application	Specification	
	Metric	English
Air Cleaner Outlet Duct Clamp	7 N m	62 lb in
Air Conditioning Belt Tensioner Bolt	50 N m	37 lb ft
Air Conditioning Bracket Bolt	50 N m	37 lb ft
Air Conditioning Compressor Line-to-Condenser Bolt	16 N m	12 lb ft
Air Conditioning Compressor Line-to-Thermal Expansion Valve (TXV) Nut	20 N m	15 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 Bolts - Outer Bolts - First Pass in Sequence	20 N m	15 lb ft
Crankshaft Bearing Cap Bolts - Outer Bolts - Final Pass in Sequence	51 degrees	
Crankshaft Bearing Cap Side Bolts	25 N m	18 lb ft
Crankshaft Oil Deflector Nuts	25 N m	18 lb ft
Crankshaft Position Sensor Bolt	25 N m	18 lb ft
Cylinder Head Bolts - First Design - First Pass all M11 Bolts in Sequence	30 N m	22 lb ft
Cylinder Head Bolts - First Design - Second Pass all M11 Bolts in Sequence	90 degrees	
Cylinder Head Bolts - First Design - Final Pass all M11 Bolts in Sequence - Excluding the Medium Length Bolts at the Front and Rear of Each Cylinder Head	90 degrees	
Cylinder Head Bolts - First Design - Final Pass M11 Medium Length Bolts at the Front and Rear of Each Cylinder Head	50 degrees	
Cylinder Head Bolts - Second Design - First Pass all M11 Bolts in Sequence	30 N m	22 lb ft
Cylinder Head Bolts - Second Design - Second Pass all M11 Bolts in Sequence	90 degrees	
Cylinder Head Bolts - Second Design - Final Pass all M11 Bolts in Sequence	70 degrees	
Cylinder Head Bolts - M8 Inner Bolts in Sequence	30 N m	22 lb ft
Cylinder Head Coolant Plug	20 N m	15 lb ft
Drive Belt Idler Pulley Bolt	50 N m	37 lb ft

Application	Specification	
	Metric	English
Drive Belt Tensioner Bolt	50 N m	37 lb ft
Engine Block Coolant Drain Plugs	60 N m	44 lb ft
Engine Block Heater	40 N m	30 lb ft
Engine Block Oil Gallery Plugs	60 N m	44 lb ft
Engine Coolant Air Bleed Pipe and Cover Bolts	12 N m	106 lb in
Engine Flywheel Bolts - First Pass	20 N m	15 lb ft
Engine Flywheel Bolts - Second Pass	50 N m	37 lb ft
Engine Flywheel Bolts - Final Pass	100 N m	74 lb ft
Engine Flywheel Cover Bolts	10 N m	89 lb in
Engine Front Cover Bolts	25 N m	18 lb ft
Engine Ground Strap-to-Frame Nut	25 N m	18 lb ft
Engine Ground-to-Engine Block Bolts	16 N m	12 lb ft
Engine Harness Bracket Nut	10 N m	89 lb in
Engine Mount Bracket Spacer	50 N m	37 lb ft
Engine Mount Frame Bracket	100 N m	74 lb ft
Engine Mount Nuts	50 N m	37 lb ft
Engine Rear Cover Bolts	25 N m	18 lb ft
Engine Service Lift Bracket M10 Bolts	50 N m	37 lb ft
Engine Service Lift Bracket M8 Bolt	25 N m	18 lb ft
Engine Sight Shield Bolt	10 N m	89 lb in
Engine Sight Shield Bracket Bolt	5 N m	44 lb in
Engine Valley Cover Bolts	25 N m	18 lb ft
Evaporative (EVAP) Emission - Purge Solenoid Bolt	10 N m	89 lb in
Exhaust Manifold Bolts - First Pass	15 N m	11 lb ft
Exhaust Manifold Bolts - Final Pass	25 N m	18 lb ft
Exhaust Manifold Heat Shield Bolts	9 N m	80 lb in
Fuel Rail Bolts	10 N m	89 lb in
Fuel Rail Crossover Tube Bolts	3.8 N m	34 lb in
Fuel Rail Stop Bracket Bolt	50 N m	37 lb ft
Generator Power Lead Nut	9 N m	80 lb in
Ignition Coil-to-Bracket Bolts	8 N m	71 lb in
Ignition Coil Bracket-to-Valve Rocker Arm Cover 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
Intake Manifold Wiring Harness Stud	10 N m	89 lb in
J 42386-A Bolt	50 N m	37 lb ft
Knock Sensors	20 N m	15 lb ft
Oil Filter	30 N m	22 lb ft
Oil Filter Fitting	55 N m	40 lb ft
Oil Level Indicator Tube Bolt	25 N m	18 lb ft
Oil Pan Baffle Bolts	12 N m	106 lb in
Oil Pan Closeout Cover Bolt - Left Side	9 N m	80 lb in
Oil Pan Closeout Cover Bolt - Right Side	9 N m	80 lb in
Oil Pan Cover Bolts	12 N m	106 lb in
Oil Pan Drain Plug	25 N m	18 lb ft
Oil Pan M8 Bolts - Oil Pan-to-Engine Block and Oil Pan-to-Front Cover	25 N m	18 lb ft
Oil Pan M6 Bolts - Oil Pan-to-Rear Cover	12 N m	106 lb in
Oil Pressure Sensor	20 N m	15 lb ft
Oil Pump-to-Engine Block Bolts	25 N m	18 lb ft
Oil Pump Cover Bolts	12 N m	106 lb in
Oil Pump Relief Valve Plug	12 N m	106 lb in

Application	Specification	
	Metric	English
Oil Pump Screen Nuts	25 N m	18 lb ft
Oil Pump Screen-to-Oil Pump Bolt	12 N m	106 lb in
Spark Plugs - New Cylinder Heads	20 N m	15 lb ft
Spark Plugs - All Subsequent Installations	15 N m	11 lb ft
Throttle Body Nuts	10 N m	89 lb in
Throttle Body Studs	6 N m	53 lb in
Upper Engine Mount Bracket	50 N m	37 lb ft
Valve Lifter Guide Bolts	12 N m	106 lb in
Valve Rocker Arm Bolts	30 N m	22 lb ft
Valve Rocker Arm Cover Bolts	12 N m	106 lb in
Water Inlet Housing Bolts	15 N m	11 lb ft
Water Pump Bolts - First Pass	15 N m	11 lb ft
Water Pump Bolts - Final Pass	30 N m	22 lb ft
Water Pump Cover Bolts	15 N m	11 lb ft

Engine Component Description



The 5 3 Liter V8 engine is identified as RPO LM4 VIN P (5 3L)

Camshaft and Drive System

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

Crankshaft

The crankshaft is cast nodular iron The crankshaft is supported by five crankshaft bearings The bearings are retained by crankshaft bearing caps which are machined with the engine block for proper alignment and clearance The crankshaft journals are undercut and rolled The center main journal is the thrust journal A crankshaft position reluctor ring is press fit mounted at the rear of the crankshaft The reluctor ring is not serviceable separately All crankshafts will have a short rear flange at the crankshaft rear oil seal area

Cylinder Heads

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

Engine Block

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

Exhaust Manifolds

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

Intake Manifold

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

Oil Pan

The structural oil pan is cast aluminum Incorporated into the design are the oil filter mounting boss, drain plug opening, oil level indicator tube opening, and oil pan baffle An internal tube assembly directs pressurized oil from the engine block to the oil filter which is mounted in the center area of the pan Filtered oil is then returned to the engine block through the tube assembly into the engine block oil galleries The alignment of the structural oil pan to the rear of the engine block and transmission bell housing is critical

Piston and Connecting Rod Assembly

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

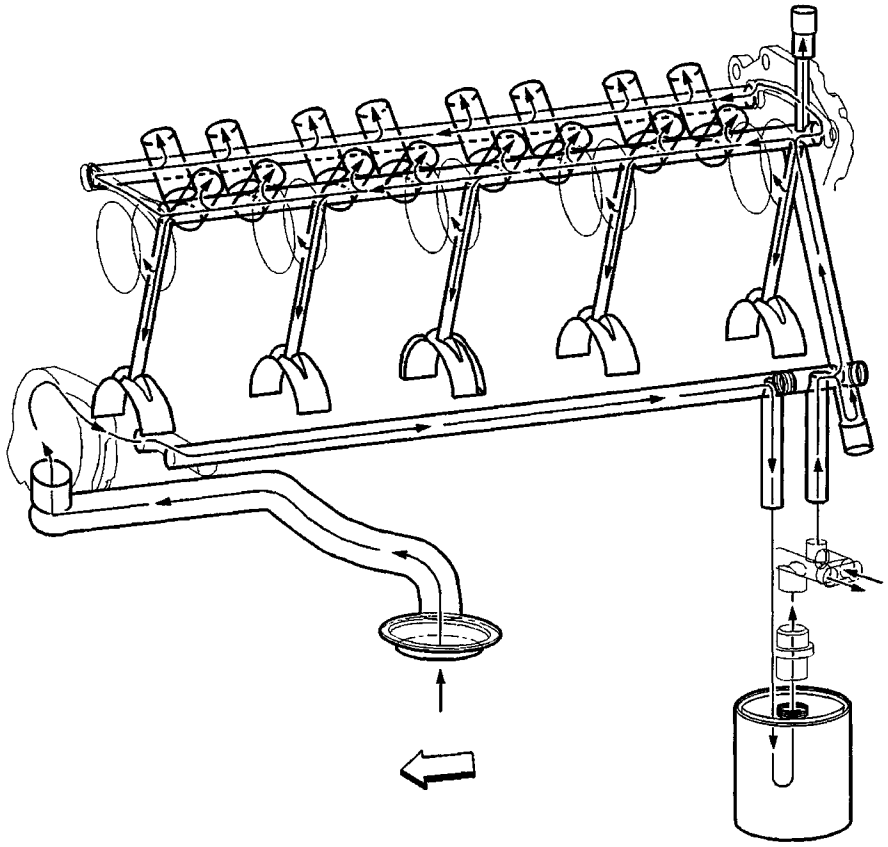
Valve Rocker Arm Cover Assemblies

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

Valve Train

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

Lubrication Description



Engine lubrication is supplied by a gerotor type oil pump assembly The pump is mounted on the front of the engine block and driven directly by the crankshaft sprocket The pump gears rotate and draw oil from the oil pan sump through a pick-up screen and pipe The oil is pressurized as it passes through the pump and is sent through the engine block oil galleries Contained within the oil pump assembly is a pressure relief valve that maintains oil pressure within a specified range Pressurized oil is directed through the

lower gallery to the full flow oil filter where harmful contaminants are removed A bypass valve is incorporated into the oil pan, at the oil filter boss, which will permit oil flow in the event the filter becomes restricted At the rear of the block, oil is then directed to the upper main oil galleries which are drilled just above the camshaft assembly From there oil is then directed to the crankshaft and camshaft bearings Oil that has entered the upper main oil galleries also pressurizes the valve lifter assemblies and is then pumped through the pushrods to lubricate the valve rocker arms and valve stems Oil returning to the pan is directed by the crankshaft oil deflector Oil pressure and crankcase level are each monitored by individual sensors

An external oil cooler is available on certain applications, all 6 0L Oil is directed from the oil pump, through the lower main oil gallery to the full flow oil filter Oil is then directed through the oil pan outlet oil gallery, located in the left rear of the oil pan, and to the external oil cooler via a hose assembly Oil flows through the oil cooler and returns to the engine at the oil pan inlet oil gallery, located in the left rear of the oil pan Oil is then directed to the upper main oil galleries and the remainder of the engine assembly

Drive Belt System Description

See Drive Belt System Description above

Crankcase Ventilation System Description

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

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

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

Engine Cooling

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Air Cleaner Outlet Duct Clamp Screw	7 N m	62 lb in
Coolant Air Bleed Pipe Stud/Bolt	12 N m	106 lb in
Coolant Heater Cord Bolt	8 N m	71 lb in
Coolant Heater	50 N m	37 lb ft
Engine Block Coolant Drain Plug	60 N m	44 lb ft
Fan Clutch Bolt	23 N m	17 lb ft
Fan Clutch Nut	56 N m	41 lb ft
Fan Shroud Bolt	9 N m	80 lb in
Radiator Bolt	25 N m	18 lb ft
Surge Tank Bolt/Nut	9 N m	80 lb in
Thermostat Housing Bolt	15 N m	11 lb ft
Transmission Control Module (TCM) Cover Bolt	9 N m	80 lb in
Transmission Control Module (TCM) Electrical Connector Bolt	8 N m	71 lb in
Water Pump Bolt (First Pass)	15 N m	11 lb ft
Water Pump Bolt (Final Pass)	30 N m	22 lb ft

Cooling System Description and Operation

Coolant Heater

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

Cooling System

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

Cooling Cycle

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

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

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

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

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

Coolant

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

Radiator

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

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

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

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

Pressure Cap

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

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

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

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

Coolant Recovery System

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

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

Air Baffles and Seals

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

Water Pump

The water pump is a centrifugal vane impeller type pump The pump consists of a housing with coolant inlet and outlet passages and an impeller The impeller is mounted on the pump shaft and consists of a series of flat or curved blades or vanes on a flat plate When the impeller rotates, the coolant between the vanes is thrown outward by centrifugal force

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

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

Thermostat

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

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

Engine Oil Cooler

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

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

Transmission Oil Cooler

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

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

Engine Electrical

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Battery Box Rear Cover Nuts	10 N m	89 lb in
Battery Box Slide Nuts	25 N m	18 lb ft
Battery Box to Frame Bolts	25 N m	18 lb ft
Battery Box Upper Cover Nuts	10 N m	89 lb in
Battery Hold Down Retainer Bolt	25 N m	18 lb ft
Engine Wiring Harness Auxiliary Negative Battery Cable Bolt	16 N m	12 lb ft
Engine Wiring Harness Ground Bolt	16 N m	12 lb ft
Forward Lamp Wiring Harness Ground/Negative Cable Bolt	9 N m	80 lb in
Generator Bolt	50 N m	37 lb ft
Generator Bracket Bolt	50 N m	37 lb ft
Generator Cable Nut	9 N m	80 lb in
Ground Strap Bolt to Engine	50 N m	37 lb ft
Ground Strap Nut to Frame	25 N m	18 lb ft
Negative Battery Cable Bolt	15 N m	11 lb ft
Negative Cable Nut to Frame	25 N m	18 lb ft
Positive Battery Cable at Junction Box	6 N m	53 lb in
Positive Battery Cable Bolt	15 N m	11 lb ft
Positive Cable at Underhood Bussed Electrical Center (UBEC) Bolt	9 N m	80 lb in
Starter Bolt	50 N m	37 lb ft
Starter Lead Nut	9 N m	80 lb in
Starter Solenoid Nut	3.4 N m	30 lb in
Surge Tank Bolt/Nut	9 N m	80 lb in
Transmission Cover Bolt	9 N m	80 lb in

Battery Usage

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

Battery Temperature vs Minimum Voltage

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

Starter Motor Usage

Applications	Starter Type
5.3L (LM4)	PG-260G

Generator Usage

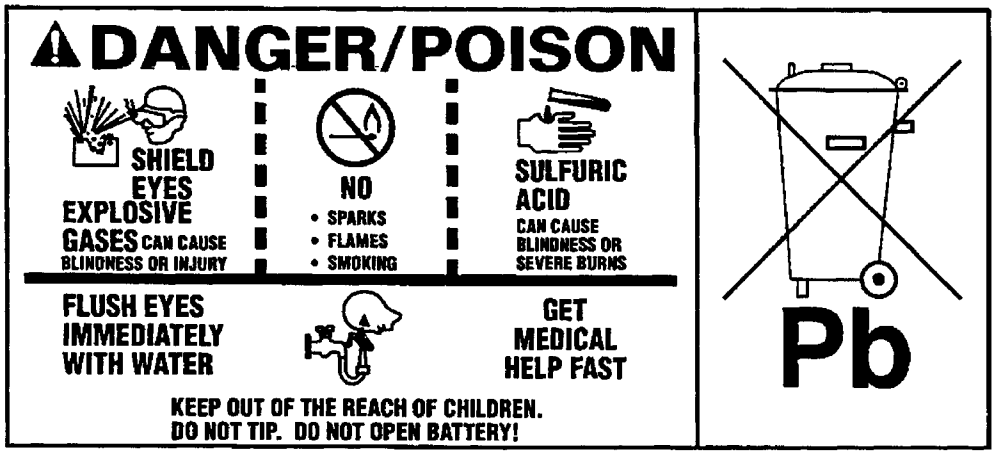
Engine	Generator Model	Rated Output AMPS	Load Test Output AMPS
Gasoline Engine	AD230	102 A	71 A

Battery Description and Operation

Caution

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

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



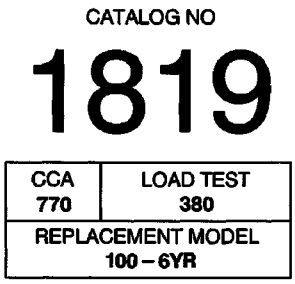
The maintenance free battery is standard There are no vent plugs in the cover The battery is completely sealed except for two small vent holes in the side These vent holes allow the small amount of gas that is produced in the battery to escape

The battery has three functions as a major source of energy

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

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

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



A battery has 2 ratings

- Reserve capacity
- Cold cranking amperage

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

Reserve Capacity

Reserve capacity is the amount of time in minutes it takes a fully charged battery, being discharged at a constant rate of 25 amperes and a constant temperature of 27°C (80°F) to reach a terminal voltage of 10 5 V Refer to Battery Usage for the reserve capacity rating of the original equipment battery

Cold Cranking Amperage

The cold cranking amperage is an indication of the ability of the battery to crank the engine at cold temperatures The cold cranking amperage rating is the minimum amperage the battery must maintain for 30 seconds at -18°C (0°F) while maintaining at least 7 2 volts Refer to Battery Usage for the cold cranking amperage rating for this vehicle

Circuit Description

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

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

Starting System Description and Operation

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

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

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

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

Charging System Description and Operation

Generator

The generator features the following major components

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

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

The generator features permanently lubricated bearings Service should only include tightening of mount components Otherwise, replace the generator as a complete unit

Regulator

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

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

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

Circuit Description

The generator provides voltage to operate the vehicle's electrical system and to charge its 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

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 current to the rotor, thereby controlling the output voltage The rotor current is proportional to the electrical pulse width 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 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 monitors the generator field duty cycle signal circuit The

system voltage sense circuit receives battery positive voltage that is Hot At All Times through a fuse link that is connected to the starter motor This voltage is used by the regulator as the reference for system voltage control

Engine Controls

Engine Controls – 5.3L V-8

Ignition System Specifications

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

Fastener Tightening Specifications

Application	Specifications	
	Metric	English
Accelerator Control Cable Bracket Bolts	10 N m	89 lb in
Accelerator Pedal Mounting Bolts	20 N m	15 lb ft
Camshaft Position (CMP) Sensor Bolt	29 N m	21 lb ft
Crankshaft Position (CKP) Sensor Bolt	25 N m	18 lb ft
Engine Coolant Temperature (ECT) Sensor	20 N m	15 lb ft
Engine Sight Shield Bolts	10 N m	89 lb in
Engine Sight Shield Bracket Bolts	10 N m	89 lb in
EGR (Exhaust Gas Recirculation) Valve Bolts (First Pass)	10 N m	89 lb in
EGR Valve Bolts (Final Pass)	25 N m	18 lb ft
EGR Valve Pipe-to-Cylinder Head Bolts	50 N m	37 lb ft
EGR Valve Pipe-to-Exhaust Manifold Bolts	25 N m	18 lb ft
EGR Valve Pipe-to-Intake Manifold	12 N m	106 lb in
Engine Wiring Harness Retaining Nut	5.5 N m	49 lb in
EVAP Canister Bracket Bolt	25 N m	18 lb ft
EVAP Canister Mounting Bolt	25 N m	18 lb ft
EVAP Canister Mounting Nuts	10 N m	89 lb in
EVAP Canister Purge Valve Shoulder Bolt	10.5 N m	93 lb in
EVAP Canister Vent Valve Bracket Mount Bolt	12 N m	106 lb in
Fuel Fill Hose Clamp	2.5 N m	22 lb in
Fuel Fill Pipe Bracket Bolt	12 N m	106 lb in
Fuel Fill Pipe Ground Strap Bolt	9 N m	80 lb in
Fuel Fill Pipe Housing to Fill Pipe Bolts	2.3 N m	20 lb in
Fuel Fill Vent Hose Clamps	2.5 N m	22 lb in
Fuel Filler Bracket Bolt	12 N m	106 lb in
Fuel Filter Bracket Bolt	12 N m	106 lb in
Fuel Filter Fitting	25 N m	18 lb ft
Fuel Rail Attaching Bolts	10 N m	89 lb in
Fuel Rail Crossover Pipe Retainer Clip Attaching Screw	3.8 N m	34 lb in
Fuel Return Pipe Attaching Screw	5 N m	44 lb in
Fuel Tank Shield-to-Frame Bolts	18 N m	13 lb ft
Fuel Tank Strap Bolts	40 N m	30 lb ft
Heated Oxygen Sensor (HO2S)	42 N m	31 lb ft
Idle Air Control (IAC) Valve Attaching Screws	3 N m	27 lb in
Ignition Coil Mounting Bolts	8 N m	71 lb in

Application	Specifications	
	Metric	English
Intake Manifold Sight Shield Fasteners	10 N m	89 lb in
Knock Sensor (KS)	20 N m	15 lb ft
Powertrain Control Module (PCM) Connector End Bolts	8 N m	71 lb in
Throttle Body Attaching Bolts and Nuts	10 N m	89 lb in
Throttle Position (TP) Sensor Attaching Screws	2 N m	18 lb in
Upper Engine Wiring Harness Nut	5.5 N m	49 lb in

Fuel System Specifications

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

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

If you are using fuel rated at 87 octane or higher and you hear heavy knocking, your engine needs service But do not worry if you hear a little pinging noise when you are accelerating or driving up a hill That is normal, and you do not have to buy a higher octane fuel to get rid of the pinging However, if there is a heavy, constant knock, that means you have a problem

Notice

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

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

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

Exhaust System

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Catalytic Converter Heat Shield Bolts	7 N m	62 lb in
Catalytic Converter to Muffler Nuts	45 N m	33 lb ft
Exhaust Manifold Bolts		
First Pass	25 N m	18 lb ft
Second Pass	25 N m	18 lb ft
Third Pass	25 N m	18 lb ft
Exhaust Manifold Heat Shield Nuts	9 N m	80 lb in
Exhaust Manifold Heat Shield Studs	10 N m	89 lb in
Exhaust Pipe to Manifold Nuts	50 N m	37 lb ft
Heated Oxygen Sensor	42 N m	31 lb ft
Left Exhaust Hanger Bolts/Nuts	25 N m	18 lb ft
Park Brake Cable to Frame Bolt	20 N m	15 lb ft
Rear Brake Hose to Frame Bolt	20 N m	15 lb ft
Rear Lower Shock Bolt	80 N m	59 lb ft
Right Exhaust Hanger Nuts	25 N m	18 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

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

The catalyst in the converter is not serviceable

Muffler

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

Transmission/Transaxle Description and Operation

Automatic Transmission - 4L60-E

Transmission General Specifications

Name	Hydra-matic 4L60-E
RPO Codes	M30
Production Location	Toledo, Ohio Romulus, MI Ramos Arizpe, Mexico
Vehicle Platform (Engine/Transmission) Usage	S/T
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)	245 mm 258 mm 298 mm 300 mm
Pressure Taps	Line Pressure
Transmission Fluid Type	DEXRON® III
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, , D, 2, 1 P, R, N, , 3, 2, 1
Case Material	Die Cast Aluminum
Transmission Weight Dry (Approximate)	245 mm Converter 65 4 kg (144 30 lbs) 258 mm Converter 79 9 kg (176 6 lbs) 298 mm Converter 70 5 kg (155 70 lbs) 300 mm Converter 86.17 kg (190.5 lbs)
Transmission Weight Wet (Approximate)	245 mm Converter 72 4 kg (159 55 lbs) 258 mm Converter 89 2 kg (197 7 lbs) 298 mm Converter 80 5 kg (176 16 lbs) 300 mm Converter 98.4 kg (218.0 lbs)
Maximum Trailer Towing Capacity	6,130 kg (13,500 lbs)
Maximum Gross Vehicle Weight (GVW)	3,900 kg (8,600 lbs)

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accumulator Cover to Case Bolt	8.0-14.0 N m	6-10 lb ft
Case Extension to Case Bolt	42.0-48.0 N m	31-35 lb ft
Case Extension to Case Bolt (4WD Shipping)	11.2-22.6 N m	8.3-16.7 lb ft
Converter Cover Bolt	10 N m	89 lb in
Converter Housing to Case Screw	65.0-75.0 N m	48-55 lb ft
Cooler Pipe Connector	35.0-41.0 N m	26-30 lb ft
Detent Spring to Valve Body Bolt	20.0-27.0 N m	15-20 lb ft
Floorshift Control Bolt	10 N m	89 lb in
Flywheel to Torque Converter Bolt	63 N m	46 lb ft
Forward Accumulator Cover to Valve Body Bolt	8.0-14.0 N m	6-10 lb ft
Heat Shield to Transmission Bolt	17 N m	13 lb ft
Line Pressure Plug	8.0-14.0 N m	6-10 lb ft
Manual Shaft to Inside Detent Lever Nut	27.0-34.0 N m	20-25 lb ft
Negative Battery Cable Bolt	15 N m	11 lb ft
Oil Level Indicator Bolt	47 N m	35 lb ft
Oil Pan to Transmission Case Bolt	11 N m	97 lb in
Oil Passage Cover to Case Bolt	8-14.0 N m	6-10 lb ft
Park Brake Bracket to Case Bolt	27.0-34.0 N m	20-25 lb ft
Park/Neutral Position Switch Screw	3 N m	27 lb in
Plate to Case Bolt (Shipping)	27.0-34.0 N m	20-25 lb ft
Plate to Converter Bolt (Shipping)	27.0-34.0 N m	20-25 lb ft
Plug Assembly, Automatic Transmission Oil Pan (C/K)	30-40 N m	22.1-29.5 lb ft
Plug Assembly, Automatic Transmission Oil Pan (Y)	28-32 N m	20.7-23.6 lb ft
Pressure Control Solenoid Bracket to Valve Body Bolt	8.0-14.0 N m	6-10 lb ft
Pump Assembly to Case Bolt	26.0-32.0 N m	19-24 lb ft
Pump Cover to Pump Body Bolt	20.0-27.0 N m	15-20 lb ft
Shift Cable Grommet Screw	1.7 N m	15 lb in
Shift Control Cable Attachment	20 N m	15 lb ft
Speed Sensor Retainer Bolt	10.5-13.5 N m	7.7-10 lb ft
Stud, Automatic Transmission Case Extension (Y-car)	18.0-22.0 N m	13-16 lb ft
TCC Solenoid Assembly to Case Bolt	8.0-14.0 N m	6-10 lb ft
Trans Mount to Transmission Bolt	25 N m	18 lb ft
Transmission Fluid Pressure Manual Valve Position Switch to Valve Body Bolt	8 0-14 0 N m	6-10 lb ft
Transmission Oil Cooler Pipe Fitting	35.0-41.0 N m	26-30 lb ft
Transmission Oil Pan to Case Bolt	9.5-13.8 N m	7-10 lb ft
Transmission to Engine Bolt	47 N m	35 lb ft
Valve Body to Case Bolt	8.0-14.0 N m	6-10 lb ft

Fluid Capacity Specifications

Application	Specification	
	Metric	English
Pan Removal	4.7 L	5 qts
Overhaul	10.6 L	11 qts
245 mm Torque Converter Approximate Fluid Capacity Dry Fill	8.3 L	8.8 qts
258 mm Torque Converter Approximate Fluid Capacity Dry Fill	8.8 L	9.3 qts
298 mm Torque Converter Approximate Fluid Capacity Dry Fill	11.25 L	11.9 qts
300 mm Torque Converter Approximate Fluid Capacity Dry Fill	11.50 L	12.1 qts

Transmission Component and System Description

The 4L60E transmission consists primarily of the following components

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

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

- 1-2 and 2-3 shift solenoid valves
- 3-2 shift solenoid valve assembly
- Transmission pressure control (PC) solenoid
- Torque converter clutch (TCC) solenoid valve
- TCC pulse width modulation (PWM) solenoid valve
- Automatic transmission fluid pressure (TFP) manual valve position switch
- Automatic transmission fluid temperature (TFT) sensor
- Vehicle speed sensor assembly

Adapt Function

Transmission Adapt Function

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

- The clutch fiber plates
- The seals
- The springs

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

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

Automatic Transmission Shift Lock Control Description

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

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

With the ignition in the ON position battery positive voltage is supplied to the park/neutral position switch With the transmission in the PARK position the contacts in the park/neutral position switch are closed This allows current to flow through the switch to the automatic transmission shift lock control switch The circuit continues through the normally-closed switch to the automatic transmission shift lock control solenoid The automatic transmission shift lock control soleniod is permanently grounded This energizes

the automatic transmission shift lock control solenoid, locking the shift linkage in the PARK position When the driver presses the brake pedal the contacts in the automatic transmission shift lock control switch open, causing the automatic transmission shift lock control solenoid to release This allows the shift lever to move from the PARK position

Abbreviations and Meanings

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

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

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

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

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

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

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

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

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

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

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

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Conversion - English/Metric

English	Multiply/ Divide by	Metric
In order to calculate English measurement, divide by the number in the center column In order to calculate metric measurement, multiply by the number in the center column		
Length		
in	25 4	mm
ft	0 3048	m
yd	0 9144	
mi	1 609	km
Area		
sq in	645 2	sq mm
	6 45	sq cm
sq ft	0 0929	sq m
sq yd	0 8361	
Volume		
cu in	16,387 00	cu mm
	16 387	cu cm
	0 0164	L
qt	0 9464	
gal	3 7854	
cu yd	0 764	cu m
Mass		
lb	0 4536	kg
ton	907 18	
	0 907	tonne (t)
Force		
Kg F	9 807	newtons (N)
oz F	0 278	
lb F	4 448	
Acceleration		
ft/s²	0 3048	m/s²
In/s²	0 0254	
Torque		
Lb in	0 11298	N m
lb ft	1 3558	
Power		
hp	0 745	kW
Pressure (Stress)		
inches of H2O	0 2488	kPa
lb/sq in	6 895	
Energy (Work)		
Btu	1055	J (J= one Ws)
lb ft	1 3558	
kW hour	3,600,000 00	
Light		
Foot Candle	10 764	lm/m²

Velocity		
mph	1 6093	km/h
Temperature		
(°F - 32) 5/9	=	°C
°F	=	(9/5 °C + 32)
Fuel Performance		
235 215/mpg	=	100 km/L

Equivalents - Decimal and Metric

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

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

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Fasteners

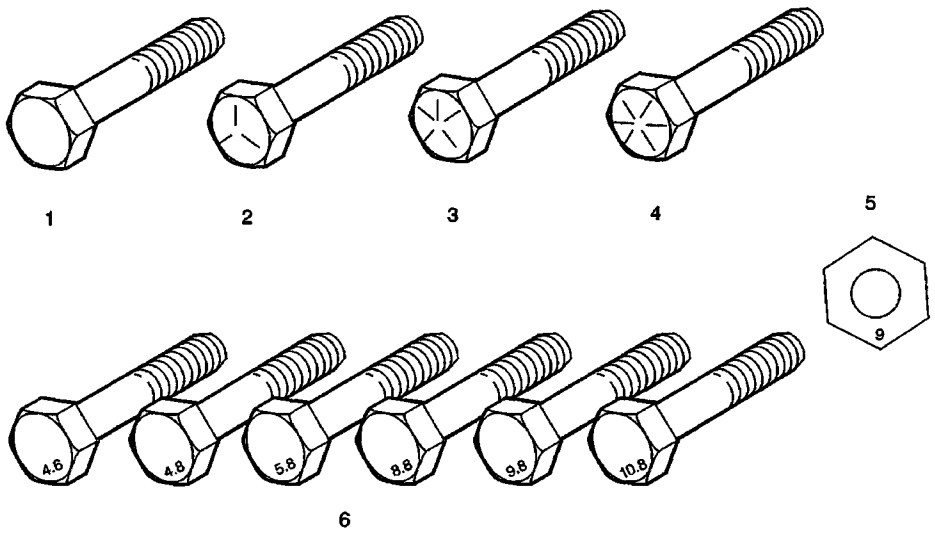
Metric Fasteners

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

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

GM Engineering Standards and North American Industries have adopted a portion of the ISO-defined standard metric fastener sizes The purpose was to reduce the number of fastener sizes used while retaining the best thread qualities in each thread size For example, the metric M6 0 X 1 screw, with nearly the same diameter and 25 4 threads per inch replaced the English 1/4-20 and 1/4-28 screws The thread pitch is midway between the English coarse and fine thread pitches

Fastener Strength Identification



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

The most commonly used metric fastener strength property classes are 9 8 and 10 9 The class identification is embossed on the head of each bolt The English, inch strength classes range from grade 2 to grade 8 Radial lines are embossed on the head of each bolt in order to identify the strength class The number of lines on the head of the bolt is 2 lines less than the actual grade For example, a grade 8 bolt will have 6 radial lines on the bolt head Some metric nuts are marked with a single digit strength identification number on the nut face

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

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

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

- M6 0 X 1
- M8 X 1 25
- M10 X 1 5
- M12 X 1 75
- M14 X 2 00
- M16 X 2 00

Prevailing Torque Fasteners

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

All Metal Prevailing Torque Fasteners

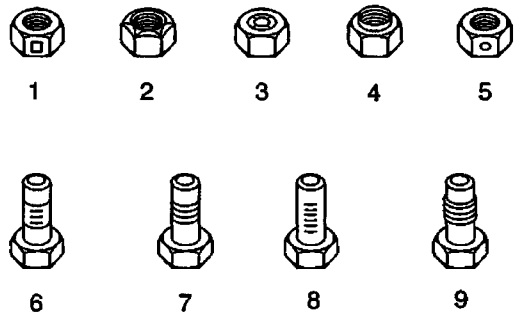
These fasteners accomplish the thread interface by a designed distortion or deformation in the fastener

Nylon Interface Prevailing Torque Fasteners

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

Adhesive Coated Fasteners

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



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

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

A prevailing torque fastener may be reused ONLY if

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

Metric Prevailing Torque Fastener Minimum Torque Development

Application	Specification	
	Metric	English
All Metal Prevailing Torque Fasteners		
6 mm	0 4 N m	4 lb in
8 mm	0 8 N m	7 lb in
10 mm	1 4 N m	12 lb in
12 mm	2 1 N m	19 lb in
14 mm	3 N m	27 lb in
16 mm	4 2 N m	37 lb in
20 mm	7 N m	62 lb in
24 mm	10 5 N m	93 lb in
Nylon Interface Prevailing Torque Fasteners		
6 mm	0 3 N m	3 lb in
8 mm	0 6 N m	5 lb in
10 mm	1 1 N m	10 lb in
12 mm	1 5 N m	13 lb in
14 mm	2 3 N m	20 lb in
16 mm	3 4 N m	30 lb in
20 mm	5 5 N m	49 lb in
24 mm	8 5 N m	75 lb in

English Prevailing Torque Fastener Minimum Torque Development

Application	Specification	
	Metric	English
All Metal Prevailing Torque Fasteners		
1/4 in	0 5 N m	4 5 lb in
5/16 in	0 8 N m	7 5 lb in
3/8 in	1 3 N m	11 5 lb in
7/16 in	1 8 N m	16 lb in
1/2 in	2 3 N m	20 lb in
9/16 in	3 2 N m	28 lb in
5/8 in	4 N m	36 lb in
3/4 in	7 N m	54 lb in
Nylon Interface Prevailing Torque Fasteners		
1/4 in	0 3 N m	3 lb in
5/16 in	0 6 N m	5 lb in
3/8 in	1 N m	9 lb in
7/16 in	1 3 N m	12 lb in
1/2 in	1 8 N m	16 lb in
9/16 in	2 5 N m	22 lb in
5/8 in	3 4 N m	30 lb in
3/4 in	5 N m	45 lb in