Chevrolet

Cobalt

2006

Table of Contents

Product Information

2006 Chevrolet Cobalt: SS Sedan and Coupe Models Add More Performance Options to the Lineup

The Chevrolet Cobalt, launched in late 2004, expands its lineup in 2006 with the addition of SS coupe and sedan models, and revises the model strategy to now include the entry-level LS coupe and sedan, LT coupe and sedan, and the premium LTZ sedan. Returning for '06 is the SS Supercharged coupe. Each model includes a specific interior, exterior appearance, wheels and tires, as well as a long list of standard and available features.

The new SS sport compacts bring more options for attainable performance to the compact segment. Highlights of the SS coupe and sedan models include:

- 2.4L Ecotec VVT four-cylinder with 171 horsepower (128 kw)* and 163 lb.-ft. of torque (221 Nm)
- Standard five-speed manual transmission
- Available Hydra-Matic 4T45-E four-speed electronically controlled automatic transmission
- Seventeen-inch alloy wheels and performance tires
- Performance-tuned suspension
- Standard four-wheel disc brakes with four-channel ABS system
- SS-specific front and rear fascias, rocker moldings (similar to SS Supercharged)
- SS exterior badging
- SS-specific interior appointments, including instrument panel appearance and trim

The Cobalt range of sedan models offers stylish looks coupled with a more comfortable ride. The Cobalt coupe design mimics the sedan from the A-pillar forward, but differs from the A-pillar rearward with a tapered reverse C-pillar that leads to Corvette-inspired four round taillamps. Several wheel options also are offered, including standard 15-inch wheels and available 16-inch, 17-inch, and 18-inch wheels, all with unique designs.

For '06, Majestic Amethyst has been added to the Cobalt's exterior color choices and, later in the year, Laser Blue will replace Arrival Blue.

Interior refinement and comfort

Cobalt offers a long list of standard features including air conditioning, electric rear defogger, CD player and driver information center. Available features include heated leather seats, power sunroof, XM Satellite Radio (continental U.S. only), MP3 playback and OnStar. Additionally, Cobalt features plenty of interior flexibility, including easy access to the rear seat, 60/40 folding rear seats and interior access to the trunk area, as well as ample, versatile storage.

Separate trim levels for each model provide distinction and a tailored appearance. Surprising amenities – such as optional heated leather seats – also lend an upscale feel to the Cobalt's interior, as many of the standard and available features aren't generally found within the vehicle's competitive set. The Cobalt's interior highlights include:

- Four trim levels for four Cobalt models: LS, LT, LTZ and SS
- 60/40-split, fold-flat rear sets with trunk pass-through
- Four cupholders in the center console; two for front-seat passengers, two for rear-seat passengers
- Pivoting center armrest has contoured top to facilitate easy, comfortable manual shifting; interior of console holds five CDs
- Numerous storage areas, including large, bin-like glove box
- Driver information center (including engine coolant temperature readout)
- Unique gauge cluster with A-pillar boost gauge on SS Supercharged
- Driver's foot rest
- Height-adjustable steering wheel
- Height-adjustable driver's seat
- Available heated leather seats

- Available power sunroof
- Extensive applications of acoustic materials throughout
- Standard CD radio, with uplevel, CD/MP3 and seven-speaker Pioneer Premium Audio System available

Cobalt models' interiors reflect a focus on ride comfort, with quality materials and stylish appointments throughout. The seats are designed to reflect the performance level of each model.

Driving dynamics and safety

Cobalt's underbody uses high-strength steel as welded members in strategic locations for maximum strength, structural integrity, mass optimization and crashworthiness. The underbody boasts a rigid bending frequency of nearly 27 Hz.

All models feature a strut-type front suspension, semi-independent torsion beam rear suspension, and front and rear stabilizer bars for more exact body roll control. Speed sensitive electric power steering is tuned to match the performance levels of the various tire and suspension packages.

The Cobalt rides on a MacPherson strut front suspension and a semi-independent, torsion beam rear suspension. Front and rear stabilizer bars – uncommon features for compact cars in Cobalt's price range – are standard on all models. Suspension tuning for each model, including steering feel, spring rate and stabilizer bar diameter, is dialed in to provide distinct driving and handling characteristics. Three suspension settings are available:

- **FE1 suspension** – standard on LS, LT and LTZ models, it provides a smooth ride and includes a 19-mm front stabilizer bar and a 16-mm rear stabilizer bar
- **FE3 suspension** – standard on SS models, it delivers a firmer, more direct ride and includes 22-mm front and rear stabilizer bars, four-wheel disc brakes, monotube shocks and 17-inch wheels and performance tires
- **FE5 suspension** – standard on the SS Supercharged, it was developed on the racetrack to deliver sports car levels of handling and grip; 24-mm front stabilizer bar and 22-mm rear stabilizer bar, higher-rate springs and bushings, four-wheel disc brakes, monotube shocks and 18-inch forged aluminum wheels with complementing performance tires

Cobalt's strut-type front suspension is compact yet provides long wheel travel, with 90 mm of compression travel and 87 mm of rebound, which is substantially more than most competitors and enhances overall ride and handling. Monotube rear shocks are used for a more precise road feel. L-shaped front control arms contain a forward pivot bushing, which transmits most of the cornering force, and a larger, high-damped composite rear elastomeric bushing that allows rearward movement to minimize harshness from road surface impacts. The front control arms are made from steel on the FE1 suspension and are aluminum on the FE3 and FE5 suspensions.

The direct-acting front stabilizer bar connects to each strut for precise steering response and improved cornering agility with decreased body roll. All front suspension components are mounted to a new, rigid cradle assembly comprised of four large hydroformed steel tubes and two side members that are integrally welded to front and rear cross members. The cradle is mounted to the Cobalt's space frame at four widely spaced points.

Cobalt's torsion beam rear suspension provides excellent ride and handling, while maximizing interior space. A hydraulic rear suspension bushing is employed on the FE1 suspension to improve the ride and suppress road noise. Rear wheel travel, at 126.5 mm in jounce and 68.5 mm in rebound, is longer than most vehicles in the segment.

Vented front disc brakes with single-piston calipers and composite rear drum brakes are standard on LS models. Four-channel anti-lock brakes (ABS) are standard on LT and LTZ models. Four-wheel disc brakes with ABS are standard on SS and SS Supercharged models. Cobalt also offers an enhanced electronic traction control system on all models equipped with an automatic transmission and ABS.

The rigid body structure that lays the foundation of Cobalt's dynamic driving experience also reinforces its safety. In addition to the solid unibody structure, dual-stage frontal air bags are standard and side head

curtain air bags are available. Front seat-belt pre-tensioners, rear center shoulder belts and the LATCH child seat retention system are also standard equipment.

OnStar-equipped Cobalt models feature OnStar dual-mode (analog-digital) equipment. OnStar's digital equipment also includes enhanced hands-free voice recognition capabilities including more intuitive continuous digit dialing and improved voice recognition accuracy. OnStar is the leading provider of in-vehicle safety, security and information services in the United States and Canada . Using the GPS satellite network and wireless technology, OnStar features core safety services and OnStar Hands-Free Calling that allow drivers to make and receive voice-activated phone calls using an externally mounted antenna for greater reception.

The OnStar service standard on the 2006 Cobalt includes the General Motors Advanced Automatic Crash Notification (AACN) system (excluding SS models), making crash data available to the participating 911 centers to help them dispatch the appropriate live-saving personnel and equipment to crash scenes faster.

Plentiful powertrains

Cobalt offers buyers a variety of powertrain and suspension combinations that deliver distinct levels ranging from maximized economy to race-inspired performance. The 2.2L engine of the LS, LT and LTZ models is rated at 145 horsepower (108 kw) at 5400 rpm and 155 lb.-ft. of torque (210 Nm) at 4000 rpm. The new SS models receive a 2.4L engine that rated at 171 horsepower (128 kw) and 163 lb.-ft. (221 Nm) of torque, at 5000 rpm. The 2.0L SC engine of the Cobalt SS Supercharged produces 205 horsepower (152 kw) and 5600 rpm and 200 lb.-ft. of torque (271 Nm) at 4400 rpm.

At the heart of the Ecotec 2.0L SC is an Eaton M62 supercharger. Maximum supercharger boost pressure is 12 pounds per square inch (psi), and the system includes an air-to-water intercooler that cools the incoming air charge to increase intake-charge density, which in turn enhances power and reduces the engine's propensity to "knock" at high boost levels.

All Cobalt engines are from the technically sophisticated Ecotec family. Each has distinct performance and hardware differences, but all share a basic all-aluminum architecture and construction that includes:

- Dual overhead camshafts (DOHC) and four valves per cylinder
- Twin counter-rotating balance shafts
- Low-friction, roller-finger follower valvetrain with hydraulic lash adjusters
- Zero-maintenance chain camshaft drive
- Extremely compact dimensions and low mass
- Direct mounting of all accessories to the engine structure to eliminate common sources of noise, vibration and harshness
- Full circle transmission attachment is more rigid than most 4-cylinder powertrains for reduced noise and vibration
- GM Oil Life System for optimum oil change frequency
- No routine maintenance apart from oil/oil filter changes
- Catalyst located close to the exhaust manifold to speed catalyst "light-off" and reduce hydrocarbon emissions
- Innovative cast-in oil filter housing eliminates crawling under the car to perform oil changes. The design also eliminates throwaway oil-filter "cans" that retain used oil and typically end up in landfills

The Cobalt's standard transmission is an F23 five-speed manual, which is known for smooth shifting. The F35 five-speed manual transmission in the SS Supercharged has a higher torque capacity than the manual transmission found in other Cobalt models. A 4.05:1 axle ratio complements the performance-oriented transmission and performance characteristics of the engine, giving the Cobalt SS Supercharged exhilarating acceleration.

Available in LS, LT, LTZ and the new SS models is the 4T45-E electronically controlled four-speed automatic transmission. Like the standard F23 manual transmission, the 4T45-E is renowned for its smooth and durable operation. In the Cobalt, this transmission uses full perimeter fastening directly to the engine block and oil pan to increase driveline stiffness, resulting in reduced noise and vibration. The

4T45-E uses the new Dexron VI fluid and is "filled for life," meaning there is no scheduled maintenance required for the transmission under normal operating conditions.

Enhanced traction system (ETS) is integral with automatic-equipped Cobalts with ABS. ETS enhances traction by adjusting engine torque if wheel slip is detected.

* *Preliminary, pending certification. A new voluntary power and torque certification procedure developed by the SAE Engine Test Code committee was approved March 31, 2005 . This procedure (J2723) ensures fair, accurate ratings for horsepower and torque by allowing manufacturers to certify their engines through third-party witness testing. GM was the first auto manufacturer to begin using the procedure and expects to use it for all newly rated engines in the future.*

New for 2006

- SS coupe and sedan models with 171-hp (128 kw)* 2.4L Ecotec VVT 4-cyl., 17-in. wheels, FE3 performance suspension, unique exterior and interior appointments
- Model lineup includes LS coupe and sedan, LT coupe and sedan, LTZ sedan, SS coupe and sedan and SS Supercharged coupe
- Two new colors: Majestic Amethyst and Laser Blue (replaces Arrival Blue – late availability)

Model Lineup

	Engines			Transmissions	
	Ecotec 2.2L I-4	**Ecotec 2.4L VVT I-4**	**Ecotec 2.0L SC**	**5-speed manual**	**4-speed automatic**
Cobalt LS coupe & sedan	s	–	–	s	o
Cobalt LT coupe & sedan	s	–	–	s	o
Cobalt LTZ sedan	s	–	–	s	o
Cobalt SS coupe & sedan	–	s	–	s	o
Cobalt SS Supercharged coupe	–	–	s	s	–

Standard S
Optional O
Not available –

Specifications

Overview	
Models:	LS coupe and sedan, LT coupe and sedan, LTZ sedan, SS coupe and sedan, SS Supercharged coupe
Body style / driveline:	5-passenger sedan and coupe, unitized frame, front engine, front-wheel drive
Construction:	2-sided galvanized steel on exterior panels (except roof)
EPA vehicle class:	compact-size car
Manufacturing location:	Lordstown, Ohio
Key competitors:	Honda Civic, Volkswagen Jetta, Ford Focus, Toyota Corolla, Mazda 3

Engines

	Ecotec 2.2L (L61)	Ecotec 2.4L VVT (LE5)	Ecotec 2.0L SC (LSJ)
Application:	std on LS, LT and LTZ	std on Cobalt SS	std on SS Supercharged
Type:	2.2L DOHC I-4	2.4L DOHC VVT I-4	2.0L DOHC SC I-4
Displacement (cu in / cc):	134 / 2189	145 / 2384	122 / 1998
Bore & stroke (in / mm):	3.39 x 3.72 / 86 x 94.6	3.46 x 3.85 / 88 x 98	3.39 x 3.39 / 86 x 86
Block material:	cast aluminum	cast aluminum	cast aluminum
Cylinder head material:	cast aluminum	cast aluminum	cast aluminum
Valvetrain:	overhead camshafts, 4 valves per cylinder	overhead camshafts, 4 valves per cylinder; variable valve timing	overhead camshafts, 4 valves per cylinder
Ignition system:	electronic direct	electronic direct, coil-on-plug	electronic direct
Fuel delivery:	sequential multi-port fuel injection with electronic throttle control	sequential multi-port fuel injection with high-flow injectors and electronic throttle control	sequential multi-port fuel injection with high-flow injectors and electronic throttle control
Compression ratio:	10:1	10.4:1	9.5:1
Horsepower (hp / kw @ rpm):	145 / 108 @ 5600	171 / 128 @ 6200*	205 / 152 @ 5600
Torque (lb-ft / Nm @ rpm):	155 / 210 @ 4000	163 / 221 @ 5000*	200 / 230 @ 4400
Recommended fuel:	regular unleaded	premium recommended but not required	premium recommended but not required
Maximum engine speed (rpm):	6500	6750	6450
Exhaust system:	stainless steel with aluminized coating on the muffler and tailpipe	stainless steel with aluminized coating on the muffler and tailpipe	stainless steel with aluminized coating on the muffler and tailpipe
Emissions controls:	close-coupled catalytic converters; Quick-Sync 24X ignition system; returnless fuel delivery system; fast-response O 2 sensor	close-coupled catalytic converters; High Resolution 58X ignition system; returnless fuel delivery system; fast-response O 2 sensor	close-coupled catalytic converters; High Resolution 58X ignition system; returnless fuel delivery system; fast-response O 2 sensor
Estimated fuel economy (mpg city / hwy):	manual: 25 / 34 automatic: 24 / 32	manual: TBD automatic: TBD	manual: 23 / 29

Transmission			
Type:	**Getrag F23/M86 5-speed manual, front-wheel drive (LS, LT, LTZ, SS)**	**Hydra-Matic 4T45-E 4-speed automatic w/overdrive, front-wheel drive (LS, LT, LTZ, SS)**	**FPG F35 5-speed manual, front-wheel drive (SS Supercharged)**
Gear ratios (:1):			
First:	3.58	2.95	3.38
Second:	2.02	1.62	1.76
Third:	1.35	1.00	1.18
Fourth:	0.98	0.68	0.89
Fifth:	0.69	-	0.70
Reverse:	3.31	2.14	3.17
Final drive ratio:	3.84:1	3.63:1	4.05:1

Chassis/Suspension	
Front:	independent strut-type suspension with stabilizer bar
Rear:	semi-independent torsion beam with stabilizer bar
Steering type:	electric, power-assisted variable-speed rack-and-pinion
Steering ratio:	16.63:1
Steering wheel turns, lock-to-lock:	3.6 (LS, LT, LTZ and SS); 3.38 (SS Supercharged)
Turning circle, curb-to-curb (ft / m):	37.4 / 11.4 (LS, LT, LTZ and SS); 40.7 / 12.4 (SS Supercharged)

Brakes	
Type:	power-assisted front disc, rear drum (LS, LT and LTZ); power-assisted 4-wheel discs (SS and SS Supercharged)
Front rotor (diameter x thickness, in / mm):	LS, LT and LTZ: 10.7 x .94 / 256 x 24; vented discs SS and SS Supercharged: 11.6 x 1.02 / 295 x 26; vented discs
Rear (diameter x thickness in / mm):	LS, LT and LTZ: 0.5 / 12; drums SS and SS Supercharged : 10.6 x .55 / 270 x 14; solid discs
Front total swept area (sq in / sq cm):	LS, LT and LTZ: 47 / 303.17 SS and SS Supercharged: 63.9 / 408.3
Rear total swept area (sq in / sq cm):	LS, LT and LTZ: 45.2 / 292.07 SS and SS Supercharged: 43.48 / 280.55

Wheels/Tires	
Wheel size and type:	LS: 15 x 6
	LT: 15 x 6
	LTZ: 16 x 6
	SS: 17 x 7
	SS Supercharged: 18 x 7
Tires:	LS: P195/60R15 touring
	LT: P195/60R15 touring
	LTZ: P205/55R16 touring
	SS: P205/50R17 performance
	SS Supercharged: P215/45ZR18 performance, W-rated

Dimensions

Exterior	Sedan	Coupe
Wheelbase (in / mm):	103.3 / 2624	103.3 / 2624
Overall length (in / mm):	180.5 / 4584	180.3 / 4580
Overall width (in / mm):	67.9 / 1725	67.9 / 1725
Overall height (in / mm):	57.1 / 1450	55.7 / 1415.4
Track (in / mm):	front: 58.7 / 1492 rear: 58.1 / 1476	front: 57.1 / 1449.7 rear: 58.1 / 1476
Minimum ground clearance (in/mm):	5.36 / 136.2	5.36 / 136.2
Curb weight (lb / kg):	LS: 2780 / 1261 LT: 2793 / 1267 LTZ: 2905 / 1318 SS: 2871 / 1302	LS: 2730 / 1239 LT: 2742 / 1244 SS: 2815 / 1277 SS Supercharged: 2925 / 1327
Weight distribution (% front / rear):	59 / 41	60 / 40

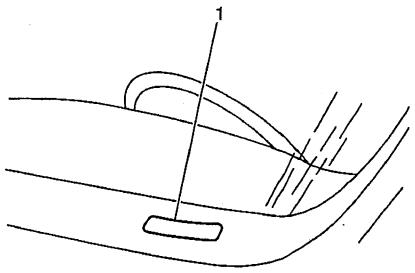
Interior	Sedan		Coupe	
	Front	Rear	Front	Rear
Seating capacity:	2	3	2	3
Head room (in / mm):	38.5 / 979	37.7 / 958.4	38.7 / 984	35.7 / 905.7
Leg room (in / mm):	41.8 / 1062.7	33.7 / 852.6	42 / 1066.5	32.2 / 817.5
Shoulder room (in / mm):	53 / 1345.8	51.4 / 1305.4	53 / 1346.5	49 / 1245.8
Hip room (in / mm):	49.5 / 1257.1	49.6 / 1261.1	49.5 / 1257.1	46.1 / 1171.8

Capacities	
EPA passenger volume (cu ft/L):	Coupe: 83 / 2350 Sedan: 87.1 / 2469.3
EPA interior volume (cu ft/L):	Coupe: 97 / 2747 Sedan: 101 / 2863
Cargo volume (cu ft):	13.9
Trailer towing maximum (lb/kg):	LS, LT, LTZ and SS: 1000 / 454
Fuel tank (gal/L):	13.2 / 49
Engine oil (qt/L):	2.2L: 5 / 4.7 2.4L: 5 / 4.7 2.0 SC: 6 / 5.6
Cooling system (qt/L):	2.2L: 6.9 / 6.5 2.4L: 7.4 / 7 2.0L SC: 9.25 / 8.75 (includes intercooler circuit)

* *Preliminary, pending certification. A new voluntary power and torque certification procedure developed by the SAE Engine Test Code committee was approved March 31, 2005 . This procedure (J2723) ensures fair, accurate ratings for horsepower and torque by allowing manufacturers to certify their engines through third-party witness testing. GM was the first auto manufacturer to begin using the procedure and expects to use it for all newly rated engines in the future.*

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	United States
2	Manufacturer	G	General Motors
3	Make	1 2	Chevrolet Pontiac
4 5	Carline/Series	AK, AL, AM, AP AJ, AL, AN	Chevrolet LS, LT, SS, SSI Pontiac SE, GT
6	Body Style	1	Two-Door Coupe (37) Four-Door Sedan (69)
7	Restraint System	2	Active (Manual) Belts W/Driver and Passenger Inflatable Restraint System - Frontal
8	Engine Type	F P B	RPO L61, 2.2L, L4, MFI RPO LSJ, 2.0L, MFI, 4 CYL., SC RPO LE5, 2.4L, L4, MFI
9	Check Digit	--	Check Digit
10	Model Year	6	2006
11	Plant Location	7	Lordstown, OH. USA
12-17	Plant Sequence Number	--	Plant Sequence Number

VIN Derivative

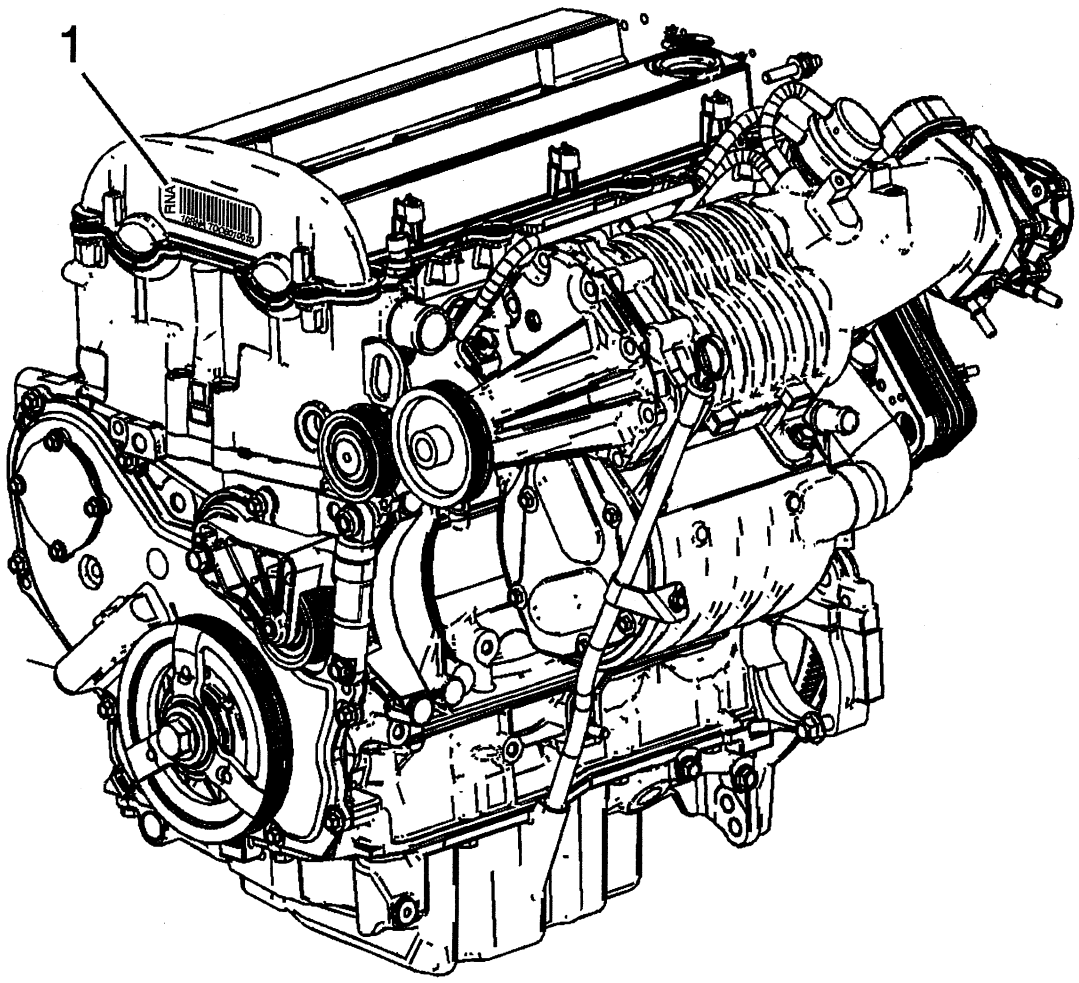
All engines and transmissions are stamped or laser etched with a partial vehicle identification number (VIN), which was derived from the complete VIN. A VIN derivative contains the following nine positions:

Position	Definition	Character	Description
1	GM Division Identifier	1	Chevrolet
		2	Pontiac
2	Model Year	6	2006
3	Assembly Plant	7	Lordstown, OH
4-9	Plant Sequence Number	--	--

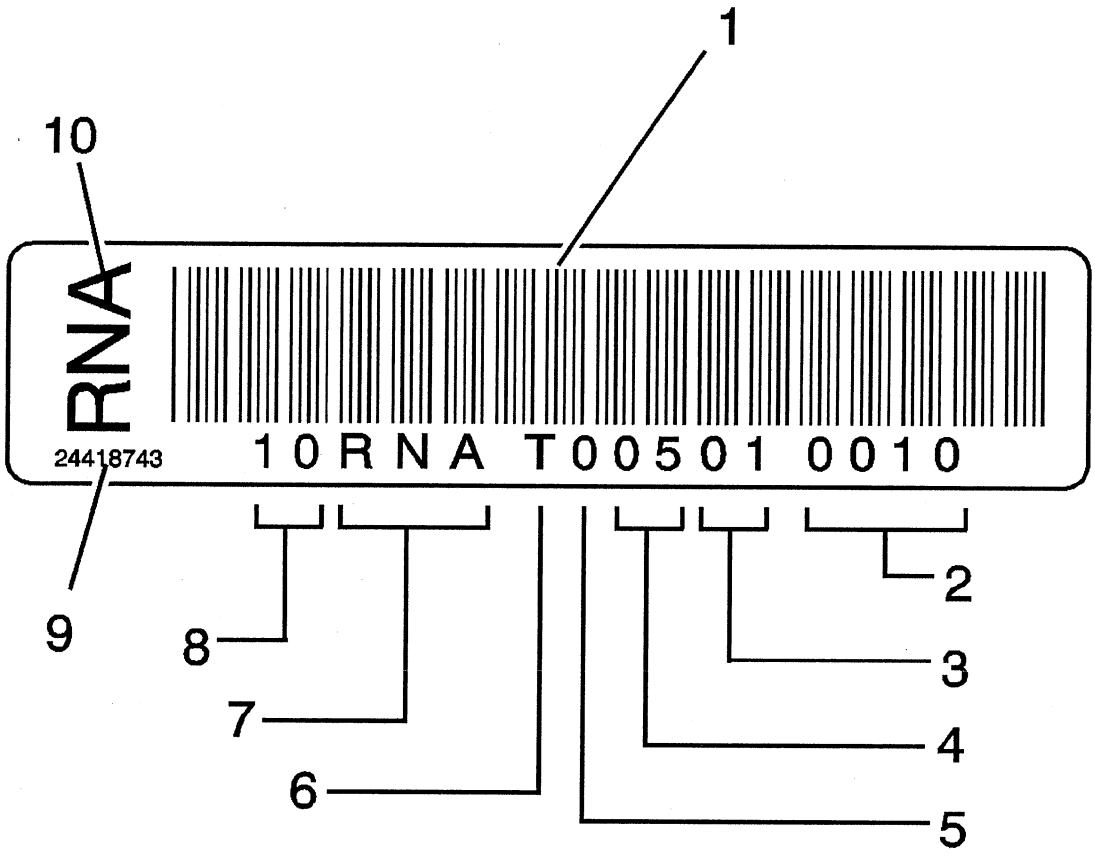
A VIN derivative can be used to determine if a vehicle contains the original engine or transmission, by matching the VIN derivative positions to their accompanying positions in the complete VIN:

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

Engine ID and VIN Derivative Location



Identification can be made through the use of the Broadcast Code label on the engine front cover (1) and the use of the partial VIN etched on the oil filter bowl (2).

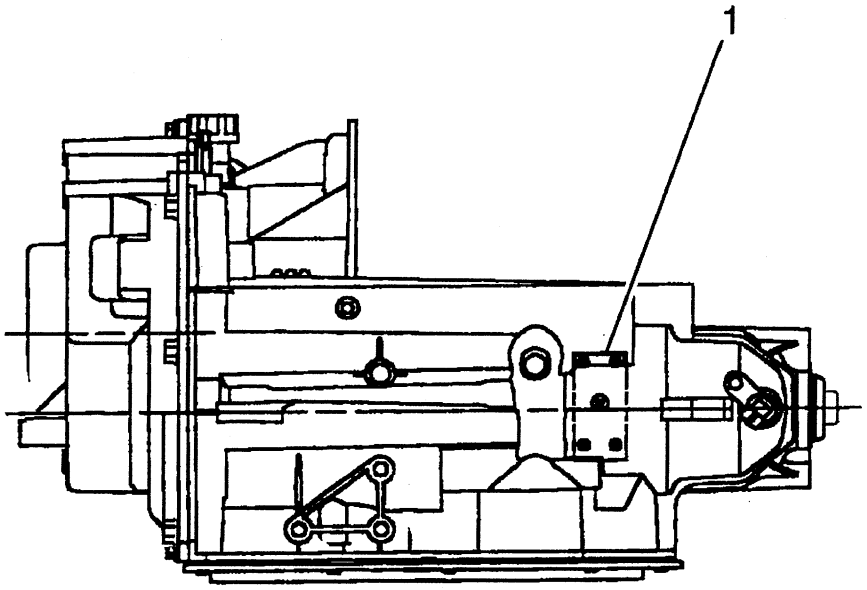


- Barcode (1)
- Sequence Number (2)
- Day (3)
- Month (4)
- Year (5)
- Engine Assembly Plant (6)
- Broadcast Code (7)
- Part Designation (8)
- Engine Assembly Number (9)
- Broadcast Code (10)

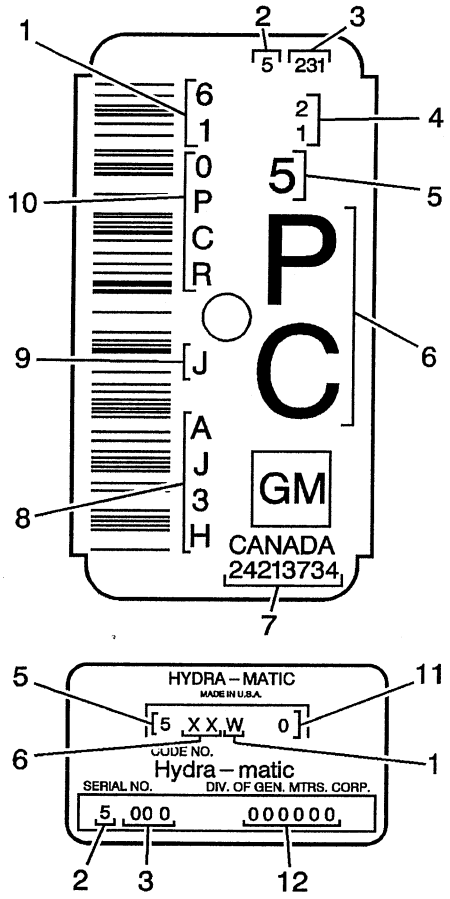
The partial VIN identifies the specific vehicle by sequence number.

Transmission ID and VIN Derivative Location

4T40-E/4T45-E Transmission ID Location



All automatic transmissions have a metal identification (ID) nameplate (1) attached to the case exterior.



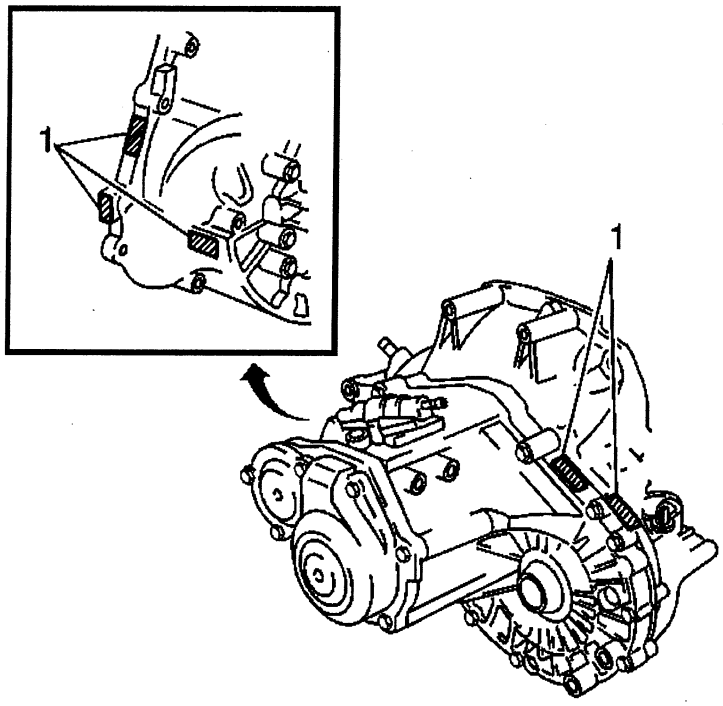
(1) Transaxle
(2) Calendar Year
(3) Julian Date or Day of the Year
(4) Shift and Line Number
(5) Model Year
(6) Model
(7) Part Number
(8) Serial Number in Base Code 34
(9) Plant
(10) Broadcast Code
(11) Control Number
(12) Serial Number

The Hydra-Matic 4T40-E transmission has a metal identification nameplate (1) attached to the case exterior.

The information on the nameplate assists the technician in servicing the transmission and ordering replacement parts from a GM Parts Catalog.

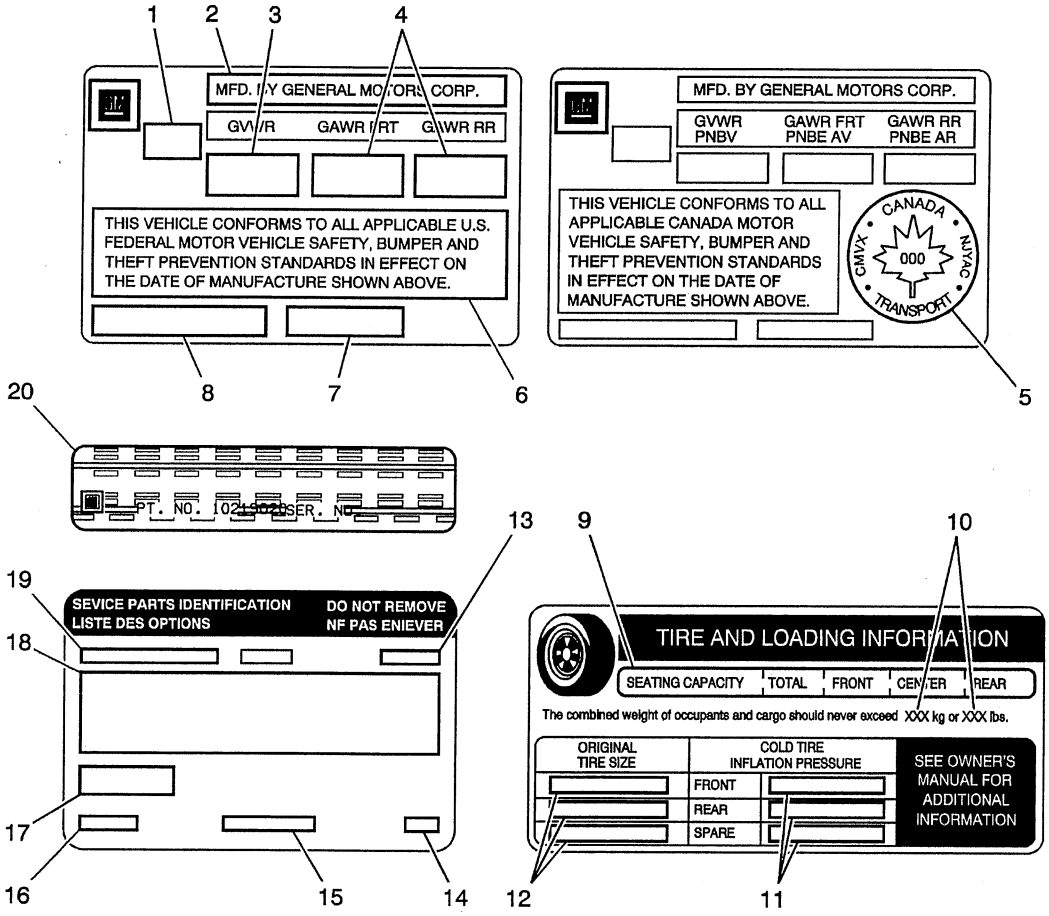
Additional transmission identification information is provided on the Service Parts Identification label. This label shows the Regular Production Options (RPO) as well as the standard and mandatory options. This label is affixed to the inside of each vehicle at the assembly plant.

Getrag 5T45-E Transmission VIN Location, M86



The various possible locations for the Getrag Vehicle Identification Number (VIN) Derivative.(1)

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



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

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

RPO Code List

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

RPO	Description
AK5	Restraint System, Seat, Inflatable, Driver and Passenger
ALV	Sensor Indicator-Inflatable Restraint, FRT Pass/Child Presence Detector - Delete
AP9	Net - Convenience
AR9	Seat, FRT BKT, Deluxe
ASF	Restraint, Roof Side, LH & RH, Inflatable
AU0	Lock Control, Entry, Remote Entry
AU3	Lock Control, Side DR, ELEC
B34	Covering FRT, Floor Mats, Carpeted Insert
B35	Covering Rear, Floor Mats, Carpeted Insert
B82	Ornamentation - EXTR, Emblem - Delete
CF5	Roof Sun, Glass, Sliding Electric
CV3	Country - Mexico
C40	HVAC System, Heater, Outside Air, With Fan, Electronic Control
C67	HVAC System, Air Conditioner, FRT, Electronic Controls
DC4	Mirror I/S R/V, Tilt, Dual, Reading Lamps
DC8	Mirror O/S, LH & RH, Remote Control, Manual Folding, Black
DD8	Mirror I/S R/V LT Sensitive
DG7	Mirror O/S, LH & RH Remote Control, Electric, Color
DT4	Ashtray Cigarette Lighter
FE1	Suspension System Soft Ride
FE3	Suspension System Sport
FE5	Suspension System, Ride, Handling, Performance
FE9	Certification, Emission, Federal
FQ7	Ratio, Transaxle Final Drive, 4.05
FR6	Ratio, Transaxle Final Drive, 3.84
FX2	Ratio, Transaxle Final Drive, 3.91
FY1	Ratio, Transaxle Final Drive, 3.63
G85	Axle - Limited Slip, FWD
HJS	Parts Pkg., Sport
JL9	Brake System Power, Front and Rear Disc, Antilock, Front and Rear Wheel
JM4	Brake System, PWR, FRT DISC, RR Drum, Cast Iron, Antilock, FRT & RR WHL
J41	Brake System, PWR, FRT DISC, RR Drum, Cast Iron
KA1	Heater Seat, Front
K05	Heater ENG Block
K09	Generator, 120 AMP
K34	Cruise Control, Automatic, Electronic
K64	Generator, 115 AMP
LSJ	Engine Gas, 4 Cyl, 2.0L, MFI, L4, DOHC, SC, Alum, GM
L61	Engine Gas, 4 CYL, 2.2L, MFI, Alum, DOHC
MM5	Merchandised Trans, Man 5 SPD Provisions
MN5	Transmission Auto 4 Speed, HMD, 4T45-E
MU3	Transmission Manual 5 Speed, SAAB, 76.5 MM, 3.38 1st, 0.70 5th
MX0	Merchandised Trans, Auto Provisions, O/D
M86	Transmission, Man 5 SPD, Getrag, 5T45-E, M, F23, 75MM, 3.58 1st, 2.02 2nd, 1.35 3rd, 0.98 4th
NE1	Certification, Emission, Geographically Restricted Registration for Vehicles Up to 14,000 LBS, GVW (Use MDL Yr)

RPO	Description
NF4	Emission System, Clean Fuel Fleet
NP5	Steering Wheel Leather Wrapped
NT7	Emission System Federal, TIER 2
NT9	Emission System Federal, TIER 2 Phase-Out
NU1	Emission System California, LEV2
NU4	Emission System California LEV II Plus
NW5	Wheel, 18 x 7, Aluminum
NW7	Traction Control, Powertrain Management Only
N11	Tailpipe - Extension, Single
N46	Steering Wheel, 4 Spokes
PFD	Wheel 16 x 6, Aluminum, Machined Face
PFE	Wheel 17 x 7, Aluminum
PF7	Wheel 15 x 6, Aluminum Cast , Styled
PG1	Wheel 15 X 6 Steel Wheel Cover, Sparkle Silver & PG1 15
QBU	Tire All, P205/50R17-90H BW, ST,TL AL3
QMF	Tire All, P205/55R16-89S BW, TL AL2
QTJ	Tire All P215/45R18-89W BW ST TL AL3
QTU	Tire All P195/60R15-87S BW R/PE TL AL2
RE0	Model Conversion, Canadian Pontiac Base Coupe
RE1	Model Conversion, Canadian Pontiac Base Sedan
RE2	Model Conversion, Canadian Pontiac LS Coupe
RE3	Model Conversion, Canadian Pontiac LS Sedan
RE4	Model Conversion, Canadian Pontiac GT Coupe
RE5	Model Conversion, Canadian Pontiac GT Sedan
RE6	Model Conversion, Luxury Edition
R1V	Appearance Package
TV5	Package, Sport
TY8	Package, Luxury LT Limited
T37	Lamp, Fog, Deluxe
T43	Spoiler Rear
UE1	Communication System, Vehicle, G.P.S. 1
UJ6	Indicator Low Tire Pressure
UK3	Control, Steering Wheel, Accessory
UN0	Radio, AM/FM Stereo, Seek/Scan, CD, Auto Tone, Clock, ETR
UQ3	Speaker System, Performance Enhanced Audio
UQ4	Speaker System, 4, Base
US8	Radio, AM/FM Stereo, Seek/Scan, CD, Auto Tone, Clock, ETR, MP3, RDS
U1C	Radio, AM/FM Stereo, Seek/Scan, CD, Clock, ETR
U2K	Digital Audio System S-Band
U19	Speedometer - INST, Kilo & Miles, Kilo Odometer
VCL	Certification Emission, Clean Fuel Vehicle, Fleet
VK3	License Plate Front, FRT Mounting Package
VY7	Knob, Trans Cont Lever, Leather
V73	Vehicle Statement, USA/Canada
V78	Vehicle Statement, Delete
W2E	Seat - FRT BKT, RECARO
YF5	Certification - Emission, California
Z49	Export Canadian Modification Mandatory Base Equipment

Technical Information

Maintenance and Lubrication

Capacities - Approximate Fluid

Application	Specification	
	Metric	English
Cooling System		
2.0L L4 Engine Supercharged - RPO LSJ	5.7 liters	6.0 quarts
2.2L L4 Engine - RPO L61	6.5 liters	6.8 quarts
2.4L L4 Engine - RPO LE5	7.0 liters	7.4 quarts
Intercooler System 2.0L Engine - RPO LSJ	1.9 liters	2.0 quarts
Engine Oil With Filter		
2.2L L4 Engine - RPO L61	4.8 liters	5.0 quarts
2.0L L4 Engine Supercharged - RPO LSJ	5.7 liters	6.0 quarts
2.4L L4 Engine - RPO LE5	4.8 liters	5.0 quarts
Fuel Tank	51.1 liters	13.5 gallons
Transmission/Transaxle		
Transaxle, Automatic- Bottom Pan Removed 4T40-E	6.6 liters	7.0 quarts
Dry	12.2 liters	12.9 quarts
Complete Overhaul	9.0 liters	9.5 quarts
Transaxle, Manual - Getrag 5 Speed	1.7 liters	1.8 quarts
Transaxle, Manual - MU3	1.9 liters	2.0 quarts

Maintenance Items

Part	GM Part Number	ACDelco Part Number
Engine Air Cleaner/Filter		
2.2L L4 and 2.4L L4 Engine	21999324	A2956C
2.0L L4 Engine Supercharged	15239447	--
Engine Oil Filter	12579143	PF456G
Spark Plugs		
2.2L L4 and 2.4L L4 Engine	12599232	41-981
2.0L L4 Engine Supercharged	12787099	PFR6T-10G
Passenger Compartment Air Filter	52493319	CF125
Windshield Wiper Blade (Hook Type)		
Driver's Side -- 22 inches (56 cm)	15243233	--
Passenger's Side -- 17 inches (43 cm)	15243232	--

Fluid and Lubricant Recommendations

Usage	Fluid/Lubricant
Engine Oil (2.2L and 2.4L L4 engines)	Engine oil which meets GM Standard GM6094M and displays the American Petroleum Institute Certified for Gasoline Engines starburst symbol. GM Goodwrench® oil meets all the requirements for your vehicle.
Engine Oil (2.0L L4 Supercharged engine)	The engine requires a special engine oil meeting GM Standard GM4718M. Oils meeting this standard may be identified with the American Petroleum Institute Certified for Gasoline Engines starburst symbol. However, not all synthetic API oils with the starburst symbol will meet this GM standard. You should look for and use only an oil that meets GM Standard GM4718M. GM Goodwrench® oil meets all the requirements for your vehicle.
Engine Cooling System	50/50 mixture of clean, drinkable water and use only DEX-COOL® Coolant.
Intercooler System (2.0L L4 Supercharged engine)	50/50 mixture of clean, drinkable water and use only DEX-COOL® Coolant.
Hydraulic Brake System	Delco® Supreme 11 Brake Fluid or equivalent DOT-3 brake fluid.
Hydraulic Clutch System	Delco® Supreme 11 Brake Fluid or equivalent DOT-3 brake fluid.
Windshield Washer	Optikleen Washer Solvent.
Parking Brake Cable Guides	Chassis Lubricant (GM Part No. 12377985, in Canada 88901242) or lubricant meeting requirements of NLGI #2, Category LB or GC-LB.
Manual Transaxle (2.2L L4 engine)	DEXRON®-III Automatic Transmission Fluid. Look for "Approved for the H-Specification" on the label.
Manual Transaxle (2.0L L4 Supercharged engine)	Manual Transmission Fluid (Part No. 21018899).
Automatic Transaxle	DEXRON®-III Automatic Transmission Fluid. Look for "Approved for the H-Specification" on the label.
Key Lock Cylinders	Multi-Purpose Lubricant, Superlube (GM Part No. U.S. 12346241, in Canada 10953474).
Manual Transaxle Shift Linkage	Chassis Lubricant (GM Part No. U.S. 12377985, in Canada 88901242) or lubricant meeting requirements of NLGI #2, Category LB or GC-LB.
Clutch Linkage Pivot Points	Engine Oil.
Chassis Lubrication	Chassis Lubricant (GM Part No. U.S. 12377985, in Canada 88901242) or lubricant meeting requirements of NLGI #2, Category LB or GC-LB.
Hood Latch Assembly, Secondary Latch, Pivots, Spring Anchor, and Release Pawl	Lubriplate Lubricant Aerosol (GM Part No. U.S. 12346293, in Canada 992723) or lubricant meeting requirements of NLGI #2, Category LB or GC-LB.
Hood and Door Hinges	Multi-Purpose Lubricant, Superlube (GM Part No. U.S. 12346241, in Canada 10953474).
Weatherstrip Conditioning	Dielectric Silicone Grease (GM Part No. U.S. 12345579, in Canada 992887).

Descriptions and Operations

Steering

Power Steering System

The electric power steering (EPS) system reduces the amount of effort needed to steer the vehicle. The system uses the body control module (BCM), power steering control module (PSCM), torque sensor, discrete battery voltage supply circuit, EPS motor, serial data bus, and the instrument panel cluster (IPC) message center to perform the system functions. The PSCM, torque sensor, not the EPS motor are serviced separately from each other or from the steering column. Any EPS components diagnosed to be malfunctioning requires replacement of the steering column assembly, also known as the EPS assembly.

Torque Sensor

The PSCM uses a torque sensor as it's main input for determining the amount of steering assist. The steering column has an input shaft, from the steering wheel to the torque sensor, and an output shaft, from the torque sensor to the steering shaft coupler. The input and output shafts are separated by a torsion bar, where the torque sensor is located. The sensor consists of a compensation coil, detecting coil and 3 detecting rings. These detecting rings have toothed edges that face each other. Detecting ring 1 is fixed to the output shaft, detecting rings 2 and 3 are fixed top the input shaft. The detecting coil is positioned around the toothed edges of detecting rings 1 and 2. As torque is applied to the steering column shaft the alignment of the teeth between detecting rings 1 and 2 changes, which causes the detecting coil signal voltage to change. The PSCM recognizes this change in signal voltage as steering column shaft torque. The compensation coil is used to compensate for changes in electrical circuit impedance due to circuit temperature changes from the electrical current and voltage levels as well as ambient temperatures for accurate torque detection.

EPS Motor

The EPS motor is a 12 volt brushed DC reversible motor with a 58 amp rating. The motor assists steering through a worm shaft and reduction gear located in the steering column housing.

Power Steering Control Module (PSCM)

The PSCM uses a combination of torque sensor inputs, vehicle speed, calculated system temperature and the steering calibration to determine the amount of steering assist. When the steering wheel is turned, the PSCM uses signal voltage from the torque sensor to detect the amount of torque being applied to the steering column shaft and the amount of current to command to the EPS motor. The PSCM receives serial data from the engine control module (ECM) to determine vehicle speed. At low speeds more assist is provided for easy turning during parking maneuvers. At high speeds, less assist is provided for improved road feel and directional stability. The PSCM nor the EPS motor are designed to handle 58 amps continuously. The PSCM will go into overload protection mode to avoid system thermal damage. In this mode the PSCM will limit the amount of current commanded to the EPS motor which reduces steering assist levels. The PSCM also chooses which steering calibration to use when the ignition is turned ON, based on the production map number stored in the BCM. The PSCM contains all 8 of the steering calibrations which are different in relation to the vehicles RPO's. The PSCM has the ability to detect malfunctions within the EPS system. Any malfunction detected will cause the IPC message center to display PWR STR (or Power Steering) warning message.

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-Some Vehicle Models

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 tilt or tilt/telescoping functions

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. The ignition lock cylinder control actuator's purpose is to prevent the ignition key from being turned to the OFF position 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 actuator , and a park position switch that is located in the A/T shift lock control switch. The ignition lock cylinder control actuator 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 vehicles 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 a lower control arm and a strut assembly. 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 portion of the steering knuckle is attached to a strut assembly. The strut assembly then connects to the vehicle body by way of an upper bearing. The steering knuckle is allowed to travel up and down independent of the vehicle body structure and frame.

This up and down motion of the steering knuckle as the vehicle travels over bumps is absorbed predominantly by the coil spring. This spring is retained under tension over the strut assembly. A strut is used in conjunction with this system in order to dampen out the oscillations of the coil spring. A strut is a basic hydraulic cylinder. The strut is filled with oil and has a moveable shaft that connects to a piston inside the strut. 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. Each end of the strut is designed as the connection point of the suspension system to the vehicle and acts as the coil spring seat. This allows the strut to utilize the dampening action to reduce the recoil of a spring alone. The lower control arm is 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.

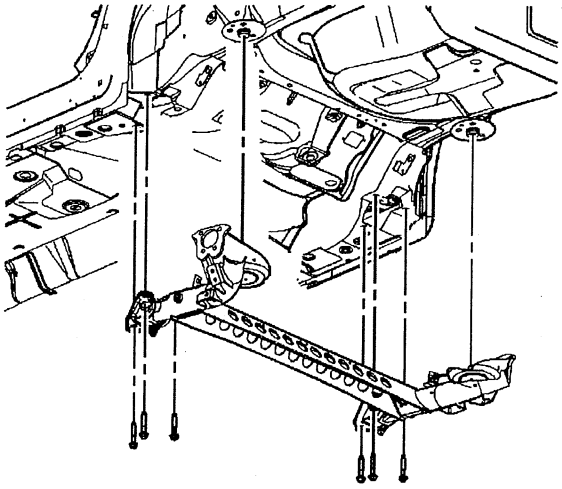
Front suspensions systems utilize a stabilizer shaft. The stabilizer bar connects between the left and right lower control arm assemblies through the stabilizer link and stabilizer shaft insulators. This bar controls the amount of independent movement of the suspension when the vehicle turns. Limiting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

Rear Suspension

This vehicle has a semi-independent twist-beam rear suspension system consisting of the following components:

- An axle with integral trailing arms
- A V shaped twisting cross beam
- Two coil springs
- Two standard shock absorbers
- An optional integrated stabilizer bar

Axle Assembly

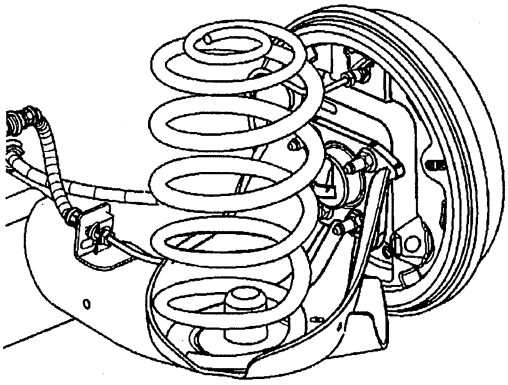


The axle assembly attaches to the underbody through a rubber bushing and bracket located at the front of each integral trailing arm. The brackets are bolted to the underbody side rails. The axle structure itself maintains the geometrical relationship of the wheels relative to the centerline of the body. The optional stabilizer shaft is welded to the inside of the "V" shaped axle beam and is non-serviceable.

Rear axle to vehicle alignment is achieved through alignment holes located in both the left and right axle bracket and underbody. Whenever the rear axle is removed for service, it is important that the rear axle is re-installed in its proper position relative to the centerline of the vehicle. Use two 12 mm rods to achieve this alignment. Insert each rod through the axle bracket into the underbody, then tighten the bracket bolts.

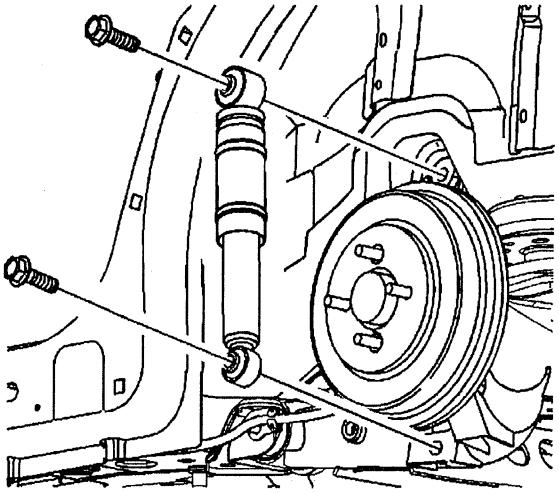
Rear camber and tow are not adjustable. Replace any damaged suspension components as necessary.

Coil Springs



The coil springs support the weight of the vehicle in the rear. Two spring rates exist on this vehicle, base and up-level, depending on the suspension option code. Rubber insulators isolate the coil spring at the upper and lower spring seat.

Shock Absorber



The shock absorbers are bolted to the rear axle and the vehicle underbody. The shock absorbers are non-adjustable and non-refillable. Service of the shocks requires replacement of the shock assembly.

Wheel Bearing/Hub Assembly

A single hub and bearing assembly is bolted to both ends of the rear axle assembly. The hub and bearing assembly is a sealed unit that eliminates the need for wheel bearing adjustment or periodic maintenance. On ABS equipped vehicles, the wheel speed sensors are integrated into the wheel bearing assemblies.

Although the rear suspension components are lubricated for life and require no routine lubrication, they should be inspected periodically for damage and wear.

Wheels and Tires

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

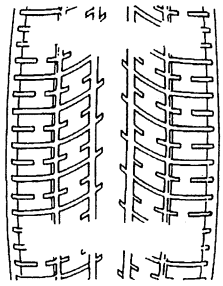
The following factors increase tire wear:

- 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:

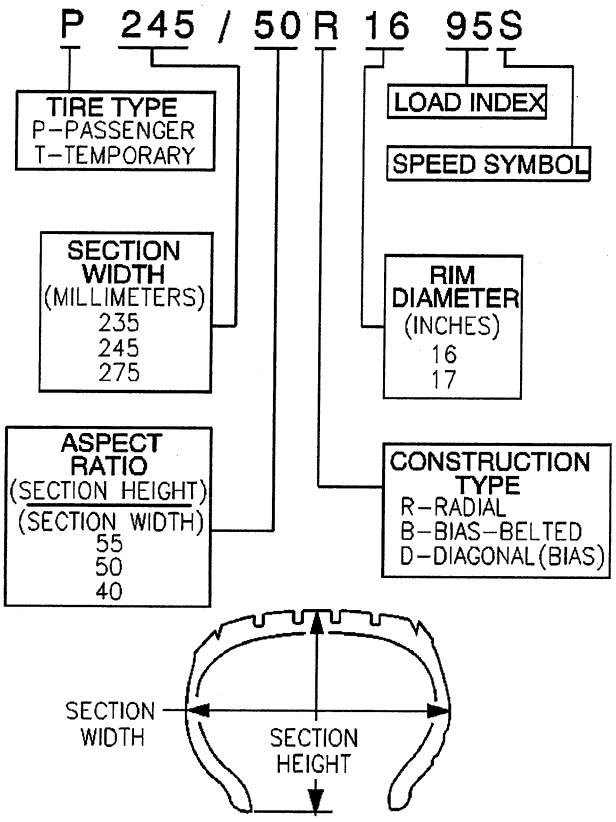
- A tire squeal on turns
- Hard steering
- Rapid wear and uneven wear on the edge of the tread
- Tire rim bruises and tire rim rupture
- Tire cord breakage
- High tire temperatures
- Reduced vehicle handling
- High fuel consumption
- Soft riding

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

- Uneven braking
- Steering lead
- Reduced vehicle handling

Refer to the Tire Placard for specific tire and wheel applications and tire pressures.

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/Axle

Wheel Driveshafts

Wheel drive shafts are flexible assemblies consisting of an inner tripot joint and an outer constant velocity joint connected by an axle shaft. The inner joint is completely flexible, and can plunge in and out. The outer joint is also flexible, but cannot plunge in and out. These drive axles are used to transmit rotational force from the transaxle to the front tire and wheel assemblies.

Seal and Clamp

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

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

The function of the clamps is as follows:

- Provide a leak proof connection at both the housing and the axle shaft for the inboard and outboard joints.
- The thermoplastic material performs well against normal handing, operational wear and conditions. This material however, is not strong enough to withstand abusive handling or damage due to objects such as sharp tools or the sharp edge of any other surrounding component on the vehicle.

Inner Joint

The inner joints are of the tripot design without an over-extension limitation retainer. If equipped with an automatic transmission, the inner joint uses a female spline which is installed over a stub shaft protruding from the transaxle. If equipped with a manual transmission, the inner joint incorporates a male spline which interlocks with the transaxle using snap rings.

Outer Joint

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

Intermediate Drive Shaft

The intermediate drive shaft (IDS) is used with RPO LSJ, to permit the use of equal length wheel drive shafts, and thus eliminate torque steer during heavy acceleration. The IDS incorporates a male spine which mates to the transaxle. The IDS is supported and maintained in position by a sealed bearing mounted within a bracket that is bolted to the engine block. The IDS incorporates a tone wheel which is used by the vehicle speed sensor (VSS).

Vehicle Speed Sensor

On RPO LSJ equipped vehicles, the vehicle speed sensor (VSS) is mounted to a bracket which is in turn mounted to the IDS bracket. The IDS bracket is machined to a precise thickness and the VSS bracket is manufactured to a precise thickness to position the VSS with the correct air-gap to the tone wheel on the IDS. The VSS to tone wheel air-gap is non-adjustable.

Braking System Description and Operation

Hydraulic Brake System Description and Operation

System Component Description

The hydraulic brake system consists of the following:

Hydraulic Brake Master Cylinder Fluid Reservoir

Contains supply of brake fluid for the hydraulic brake system.

Hydraulic Brake Master Cylinder

Converts mechanical input force into hydraulic output pressure.

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

Hydraulic Brake Pressure Balance Control System

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

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

Hydraulic Brake Pipes and Flexible Brake Hoses

Carries brake fluid to and from hydraulic brake system components.

Hydraulic Brake Wheel Apply Components

Converts hydraulic input pressure into mechanical output force.

System Operation

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

Brake Assist System Description and Operation

System Component Description

The brake assist system consists of the following:

Brake Pedal

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

Brake Pedal Pushrod

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

Vacuum Brake Booster

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

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

Vacuum Source

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

Vacuum Source Delivery System

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

System Operation

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

Disc Brake System Description and Operation

System Component Description

The disc brake system consists of the following components:

Disc Brake Pads

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

Disc Brake Rotors

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

Disc Brake Pad Hardware

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

Disc Brake Caliper Hardware

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

System Operation

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

Drum Brake System Description and Operation

System Component Description

The drum brake system consists of the following:

Drum Brake Shoes

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

Brake Drums

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

Drum Brake Hardware

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

Drum Brake Adjusting Hardware

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

System Operation

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

Park Brake System Description and Operation

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 drum brake shoes toward the friction surface of the brake drum.

Threaded park brake actuators/adjusters are also used to control clearance between the drum brake shoes and the friction surface of the brake drum.

Drum Brake Shoes

Applies mechanical output force from park brake actuator/adjuster to friction surface of the brake drum.

System Operation

Park brake apply input force is received by the park brake lever assembly being applied. The input force is multiplied by the lever assembly, transferred, and evenly distributed, through the park brake cables and the park brake cable equalizer, to the left and right park brake apply levers. The park brake apply levers multiply and transfer the apply input force to the park brake actuators/adjusters which expand the drum brake shoes toward the friction surface of the brake drum in order to prevent the rotation of the rear tire and wheel assemblies. The park brake lever assembly releases an applied park brake system when it is returned to the at-rest, lowered, position.

ABS Description and Operation

Antilock Brake System

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

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

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

Engine Description and Operation

Engine Mechanical – 2.0L

General Specifications

Application	Specification	
	Metric	English
General Data		
Engine Type	Inline 4 Cylinder	
Displacement	2.0 L	122 CID
RPO	LSJ	
Liter (VIN)	P	
Bore	85.992-86.008 mm	3.3855-3.3861 in
Compression Ratio	9.5:1	
Balance Shaft		
Bearing Clearance	0.030-0.063 mm	0.0012-0.0025 in
Bearing Diameter - Inside - Carrier	20.050-20.063 mm	0.7894-0.7899 in
Bearing Diameter - Outside - Carrier	41.975-41.995 mm	1.6526-1.6534 in
Bearing Journal Diameter	20.000-20.020 mm	0.7874-0.7882 in
Bushing Clearance	0.033-0.102 mm	0.0013-0.0040 in
Bushing Diameter - Inside	36.776-36.825 mm	1.4479-1.4498 in
Bushing Journal Diameter	36.723-36.743 mm	1.4458-1.4466 in
End Play	0.100-0.300 mm	0.0020-0.0118 in
Block		
Balance Shaft Bearing Bore Diameter - Carrier	42.000-42.016 mm	1.6535-1.6542 in
Balance Shaft Bushing Bore Diameter	40.763-40.776 mm	1.6048-1.6054 in
Crankshaft Main Bearing Bore Diameter	64.068-64.082 mm	2.5224-2.5229 in
Cylinder Bore Diameter	85.992-86.008 mm	3.3855-3.3861 in
Cylinder Bore Out-of-Round - Maximum	0.010 mm	0.0004 in
Cylinder Bore Taper - Maximum	0.010 mm	0.0004 in
Cylinder Head Deck Surface Flatness - Transverse	0.030 mm	0.0012 in
Cylinder Head Deck Surface Flatness - Longitude	0.050 mm	0.002 in
Cylinder Head Deck Surface Flatness - Overall	0.08 mm	0.0031 in
Camshaft		
Camshaft End Play	0.040-0.144 mm	0.0016-0.0057 in
Camshaft Journal Diameter	26.935-26.960 mm	1.0604-1.0614 in
Camshaft Thrust Surface	21.000-21.052 mm	0.8268-0.8252 in
Connecting Rod		
Connecting Rod Bearing Clearance	0.029-0.069 mm	0.0011-0.0027 in
Connecting Rod Bore Diameter - Bearing End	52.118-52.134 mm	2.0519-2.05252 in
Connecting Rod Bore Diameter - Pin End	20.007-20.021 mm	0.7877-0.7882 in
Connecting Rod Side Clearance	0.070-0.370 mm	0.0028-0.0146 in
Connecting Rod Straightness - Bend - Maximum	0.021 mm	0.0083 in
Connecting Rod Straightness - Twist - Maximum	0.04 mm	0.0157 in
Crankshaft		
Connecting Rod Journal Diameter	49.000-49.014 mm	1.9291-1.9297 in
Crankshaft End Play	0.050-0.380 mm	0.0012-0.0150 in
Crankshaft Main Bearing Clearance	0.031-0.067 mm	0.0012-0.0026 in
Crankshaft Main Journal Diameter	55.994-56.008 mm	2.2045-2.2050 in

Application	Specification	
	Metric	English
Cylinder Head		
Surface Flatness - Block Deck - Transverse	0.030 mm	0.0012 in
Surface Flatness - Block Deck - Longitude	0.050 mm	0.002 in
Surface Flatness - Block Deck - Overall	0.1 mm	0.004 in
Valve Guide Bore - Exhaust	6.000-6.012 mm	0.2362-0.2367 in
Valve Guide Bore - Intake	6.000-6.012 mm	0.2362-0.2367 in
Valve Lifter Bore Diameter - Stationary Lash Adjusters	12.013-12.037 mm	0.4730-0.4739 in
Lubrication System		
Oil Pressure - Minimum - [commat]1000 RPM	344.75-551.60 kPa	50-80 psi
Oil Capacity - with or without Filter	5.7L	6.0 quarts
Piston Rings		
Piston Ring End Gap - First Compression Ring	0.20-0.40 mm	0.008-0.016 in
Piston Ring End Gap - Second Compression Ring	0.35-0.55 mm	0.014-0.022 in
Piston Ring End Gap - Oil Control Ring - Rails	0.25-0.76 mm	0.010-0.030 in
Piston Ring to Groove Clearance - First Compression Ring	0.04-0.08 mm	0.0015-0.0031 in
Piston Ring to Groove Clearance - Second Compression Ring	0.030-0.069 mm	0.0012-0.0027 in
Piston Ring to Groove Clearance - Oil Control Ring	0.090-0.106 mm	0.0035-0.0042 in
Piston Ring Thickness - First Compression Ring	1.170-1.190 mm	0.0461-0.0469 in
Piston Ring Thickness - Second Compression Ring	1.471-1.490 mm	0.0579-0.0587 in
Piston Ring Thickness - Oil Control Ring - Rail - Maximum	0.43 mm	0.0169 in
Piston Ring Thickness - Oil Control Ring - Spacer	1.574-1.651 mm	0.0620-0.0650 in
Pistons and Pins		
Piston - Piston Diameter - [commat]14.5 mm up	85.967-85.982 mm	3.3845-3.3851 in
Piston - Piston Pin Bore Diameter	20.002-20.007 mm	0.07875-0.7877 in
Piston - Piston Ring Grove Width - Top	1.23-1.25 mm	0.0484-0.0492 in
Piston - Piston Ring Grove Width - Second	1.52-1.54 mm	0.0598-0.0606 in
Piston - Piston Ring Grove Width - Oil Control	2.52-2.54 mm	0.0992-0.1000 in
Piston - Piston To Bore Clearance	0.010-0.041 mm	0.0004-0.0016 in
Pin - Piston Pin Clearance to Connecting Rod Bore	0.007-0.026 mm	0.0003-0.0010 in
Pin - Piston Pin Clearance to Piston Pin Bore	0.002-0.012 mm	0.0001-0.0005 in
Pin - Piston Pin Diameter	19.995-20.000 mm	0.7872-0.7874 in
Pin - Piston Pin End Play	0.19-1.16 mm	0.0075-0.0461 in
Valve System		
Valves - Valve Face Runout - Maximum	0.04 mm	0.0016 in
Valves - Valve Seat Runout - Maximum	0.05 mm	0.0020 in
Valves - Valve Stem Diameter - Intake	5.955-5.970 mm	0.2344-0.2355 in
Valves - Valve Stem Diameter - Exhaust	5.935-5.950 mm	0.2337-0.2343 in
Valves - Valve Stem to Guide Clearance - Intake	0.030-0.057 mm	0.0012-0.0022 in
Valves - Valve Stem to Guide Clearance - Exhaust	0.050-0.077 mm	0.0020-0.0026 in
Valve Lifters - Valve Lifter Diameter - Stationary Lash Adjuster	11.986-12.000 mm	0.0005-0.0020 in
Valve Lifters - Valve Lifter-to-Bore Clearance - Stationary Lash Adjuster	0.013-0.051 mm	3.2210-3.2299 in
Valve Springs - Valve Spring Load - Closed - [commat]32.5 mm	245.0-271.0 N. - Eng Spec.	
Valve Springs - Valve Spring Load - Open - [commat]32.5 mm	525.0-575.0 N. - Eng Spec.	

Fastener Tightening Specifications

Application	Specification	
	Metric	English
A/C Compressor to Block Bolt	20 N·m	15 lb ft
Accessory Drive Belt Tensioner Bolt	32 N·m	24 lb ft
Balance Shaft Adjustable Chain Guide Bolt	10 N·m	89 lb in
Balance Shaft Bearing Carrier to Block Bolt	10 N·m	89 lb in
Balance Shaft Fixed Chain Guide Bolt	10 N·m	89 lb in
Balance Shaft Sprocket Bolt	50 N·m	37 lb ft
Baro Sensor and Coolant Return Line Assembly	8 N·m	71 lb in
Boost Solenoid Bracket Nut	10 N·m	89 lb in
Cam Cover to Cylinder Head Bolt	8 N·m	71 lb in
Cam Cover to Ground Cable Bolt	10 N·m	89 lb in
Cam Cover to Ground Cable Stud	10 N·m	89 lb in
Cam Sensor Bolt	8 N·m	71 lb in
Camshaft Position Sensor Housing Stud	22 N·m	16 lb ft
Camshaft Bearing Cap Bolt	10 N·m	89 lb in
Camshaft Sprocket Bolt		
First Pass	85 N·m	63 lb ft
Final Pass	30 degrees	
Camshaft Timing Chain Tensioner	75 N·m	55 lb ft
Chain Guide Access Hole Plug	90 N·m	59 lb ft
Connecting Rod Bolts		
First Pass	25 N·m	18 lb ft
Final Pass	100 degrees	
Crankshaft Bearing Lower Crankcase to Block Bolts		
First Pass	20 N·m	15 lb ft
Final Pass	70 degrees	
Crankshaft Position Sensor Bolt	8 N·m	71 lb in
Crankshaft Position Sensor Housing Studs	22 N·m	16 lb ft
Crankshaft Pulley Bolt		
First Pass	100 N·m	74 lb ft
Final Pass	75 degrees	
Cylinder Head Bolt		
First Pass	30 N·m	22 lb ft
Final Pass	155 degrees	
Cylinder Head Front Chaincase Bolt	35 N·m	26 lb ft
Cylinder Head Oil Gallery Plug	35 N·m	26 lb ft
Dipstick Guide to Intake Manifold Bolt	10 N·m	89 lb in
Elek. ICM Cover Bolt	8 N·m	71 lb in
Engine Coolant Temperature Sensor	22 N·m	16 lb ft
Engine Lift Bracket Front Bolt	25 N·m	18 lb ft
Engine Lift Bracket Rear Bolt	25 N·m	18 lb ft
Engine Mount Intermediate Bracket Bolts	100 N·m	74 lb ft
Engine Mount to Intermediate Bracket Bolts	50 N·m	37 lb ft
Engine Mount to Mid-Rail Nuts	100 N·m	74 lb ft
Exhaust Manifold to Cylinder Head Nut	12 N·m	106 lb in
Exhaust Manifold to Cylinder Head Stud	10 N·m	89 lb in
Exhaust Manifold Pipe Flange Stud	16 N·m	12 lb ft
Exhaust Takedown Pipe Nuts	30 N·m	22 lb ft
Flywheel (SMT) Bolt		
First Pass	53 N·m	39 lb ft
Final Pass	25 degrees	

Application	Specification	
	Metric	English
Frame Bolts		
First Pass	100 N·m	74 lb ft
Second Pass	180 degrees	
Front Cover to Block Bolt	25 N·m	18 lb ft
Front Lift Bracket Bolt	25 N·m	18 lb ft
Fuel Feed Line	14 N·m	124 lb in
Fuel Feed Line and Injector Harness Bracket	10 N·m	89 lb in
Fuel Line Bracket Bolt	10 N·m	89 lb in
Fuel Pipe Bracket Bolt	10 N·m	89 lb in
Fuel Rail Bracket Stud	10 N·m	89 lb in
Generator Bracket Bolt	42 N·m	31 lb ft
Generator Connector Nut	20 N·m	15 lb ft
Generator to Block Bolt	20 N·m	15 lb ft
Heat Shield to Exhaust Manifold Bolt	23 N·m	17 lb ft
Idler Pulley	22 N·m	16 lb ft
Ignition Coil Bolt	8 N·m	71 lb in
Intake Camshaft Rear Cap Bolt	25 N·m	18 lb ft
Intake Manifold to Cylinder Head Bolt	22 N·m	16 lb ft
Intake Manifold to Cylinder Head Nut	22 N·m	16 lb ft
Intake Manifold to Cylinder Head Stud	6 N·m	53 lb in
Knock Sensor Bolt	25 N·m	18 lb ft
Lower Crankcase to Block Peripheral Bolts	25 N·m	18 lb ft
Oil Bypass Tube	22 N·m	16 lb ft
Oil Cooler	22 N·m	16 lb ft
Oil Filter Housing Cover	25 N·m	18 lb ft
Oil Gallery Plug	35 N·m	26 lb ft
Oil Gallery Plug - Rear	60 N·m	44 lb ft
Oil Level Indicator Tube Bolt	10 N·m	89 lb in
Oil Pan Drain Plug	25 N·m	18 lb ft
Oil Pan to Block Bolts	25 N·m	18 lb ft
Oil Pressure Sensor	18 N·m	13 lb ft
Oil Pump Gerotor Cover Bolt	6 N·m	53 lb in
Oil Pump Pressure Relief Valve Plug	40 N·m	30 lb ft
Oxygen Sensor	42 N·m	31 lb ft
Power Steering Pump Blockout Plate Bolts	25 N·m	18 lb ft
Rear Lift Bracket Bolt	22 N·m	16 lb ft
Spark Plug	20 N·m	15 lb ft
Starter Motor to Block Bolt	40 N·m	30 lb ft
Starter Terminal Nut	17 N·m	13 lb ft
Supercharger Bolts	25 N·m	18 lb ft
Thermostat Housing to Block Bolts	10 N·m	89 lb in
Throttle Body Bolt	10 N·m	89 lb in
Timing Chain Adjustable Guide Bolt	10 N·m	89 lb in
Timing Chain Fixed Guide Bolt	10 N·m	89 lb in
Timing Chain Oil Nozzle Bolt	10 N·m	89 lb in
Timing Chain Upper Guide Bolt	10 N·m	89 lb in
Torque Converter Bolts	62 N·m	46 lb ft
Transmission to Engine Bolts	75 N·m	55 lb ft
Vent Tube to Cylinder Head	15 N·m	11 lb ft
Water Pipe Support Bracket Bolt	10 N·m	89 lb in
Water Pump Access Cover Bolt	7 N·m	62 lb in

Application	Specification	
	Metric	English
Water Pump/Balance Shaft Chain Tensioner Bolt	10 N·m	89 lb in
Water Pump Bolts	25 N·m	18 lb ft
Water Pump Drain Plug	20 N·m	15 lb ft
Water Pump Sprocket Bolt	10 N·m	89 lb in

Engine Component Description

Cylinder Block

The cylinder block is lost foam cast aluminum with four cylinders arranged in-line. The cylinders have pressed in place iron liners. The block has five crankshaft bearings with the thrust bearing located on the second bearing from the front of the engine. The cylinder block incorporates a bedplate design that forms an upper and lower crankcase. This design promotes cylinder block rigidity and reduced noise and vibration.

Crankshaft

The crankshaft is cast nodular iron with eight counterweights. The number eight counterweight is also the ignition system reluctor wheel. The main bearing journals are cross-drilled, and the upper bearings are grooved. The crankshaft has a slip fit balance shaft drove sprocket. Number two main bearing is the thrust bearing. A harmonic damper is used to control torsional vibration.

Connecting Rod and Piston

The connecting rods are powdered metal. The connecting rod incorporates the floating piston pin. The pistons are cast aluminum. The piston rings are of a low tension type to reduce friction. The top compression ring is ductile iron with a molybdenum facing and phosphate coated sides. The second compression ring is gray iron. The oil ring is a 3-piece spring construction with chromium plating.

Oil Pan

The oil pan is die cast aluminum. The oil pan includes an attachment to the transmission to provide additional structural support.

Balance Shaft Assembly

There are two block mounted balance shafts located on each side of the crankcase at the bottom of the cylinder bores. The balance shafts are driven by a single roller chain that also drives the water pump. The chain is tensioned by a hydraulic tensioner that is supplied pressure by the engine oil pump. This design promotes the maximum effectiveness of the balance shaft system and reduces noise and vibration.

Cylinder Head

The cylinder head is a lost foam aluminum casting. Pressed-in powdered metal valve guides and valve seat insets are used. The fuel injection nozzle is located in the intake port. The cylinder head incorporates camshaft bearing journals and camshaft bearing caps.

Valves

There are two intake and two exhaust valves per cylinder. Rotators are used on all of the intake valves. The rotators are located at the bottom of the valve spring to reduce valve train reciprocating mass. Positive valve stem seals are used on all valves.

Camshaft

Two camshafts are used, one for all intake valves, the other for all exhaust valves. The camshafts are cast iron. The intake camshaft had a pressed-in hex insert. The hex inset is used to drive the direct drive power steering pump.

Valve Lifters

The valve train uses a roller finger follower acted on by a hydraulic element adjuster. The roller finger follower reduces friction and noise.

Camshaft Cover

The camshaft cover is cast aluminum with steel crankcase ventilation baffling incorporated. The camshaft cover has mounting locations for the ignition system.

Camshaft Drive

A single row roller chain is used for camshaft drive. There is a tensioner and active guide used on the slack side of the chain to control chain motion and noise. The chain drive promotes long valve train life and low maintenance.

Intake and Exhaust Manifold

The intake manifold is made of composite plastic. The exhaust manifold is cast iron. The intake manifold incorporates a distribution and control system for PCV gases. The exhaust manifold is a dual plane design that promotes good low end torque and performance.

Supercharger Description and Operation

Description

The Eaton™ M 62 is a fifth generation Roots™-type supercharger. The supercharger is a positive displacement pump that consists of 2 counter-rotating rotors in a housing with an inlet port and an outlet port. The rotors are designed with 3 lobes and a helical 60° twist from front to back. An air bypass valve is built into the housing. The rotors in the supercharger are designed to run at a minimal clearance, not in contact with each other or the housing. The rotors are timed to each other by a pair of precision spur gears which are pressed onto the rotor shafts. The forward end of the rotors are held in position by deep-groove ball bearings. The back end of the rotors are supported by sealed roller bearings.

The gears and ball bearings are lubricated by a synthetic oil. The oil reservoir is self-contained in the supercharger and does not rely on engine oil for lubrication. This oil reservoir is sealed for the life of the unit and is not serviceable.

The cover on the supercharger contains the input shaft which is supported by 2, deep-groove ball bearings and is coupled to the rotor drive gears. The pulley is pressed onto the input shaft and is not serviceable. These bearings are lubricated by the synthetic oil contained in the same reservoir as the gears and rotor bearings.

Operation

The supercharger is designed to pump more air than the engine would normally use. This excess air creates a boost pressure in the intake manifold. Maximum engine boost is 83 kPa (12 psi). Because the supercharger is a positive displacement pump and is directly driven from the engine drive belt system, boost pressure is available at all driving conditions.

When boost is not desired, such as during idle and light throttle cruising, the excess air that the supercharger is producing is routed through the bypass passage between the intake manifold and the supercharger inlet. This bypass circuit is regulated by a bypass valve which is similar to a throttle plate. The bypass valve is controlled by a vacuum actuator which is connected to the vacuum signal between the throttle and the supercharger inlet. Spring force from the actuator holds the valve closed to create boost, and vacuum pulls the valve open when the throttle closes to decrease boost. The open bypass valve reduces pumping loss thereby increasing fuel efficiency.

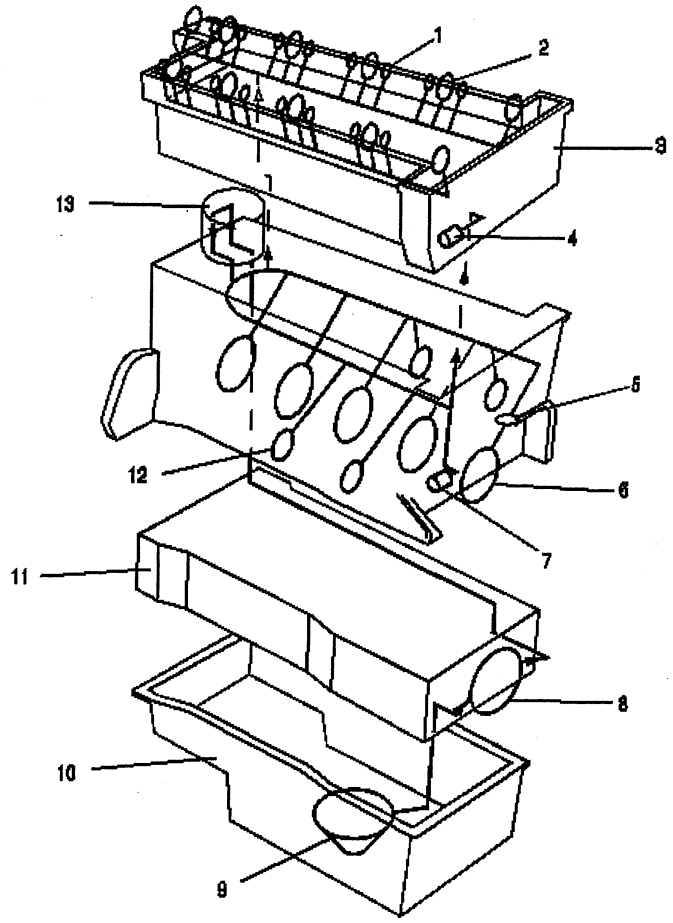
The solenoid valve attached to the bypass actuator is an electronically controlled, 3-way valve. This valve, controlled by the powertrain control module (PCM), determines whether pressure from the manifold is routed to the bypass actuator or closed off. The valve allows pressure from the manifold to open the bypass valve and regulate boost pressure during specific driving conditions.

Intercooler

The supercharger has an integrated intercooler. Cooling the air enhances the effectiveness of the supercharger. The intercooler uses conventional coolant in a separate sealed system from the engine cooling system. The intercooler system has a radiator, a reserve tank/filler neck, a pressure cap,

attaching hoses, and a pump capable of a 26 liters (7 gallons) per minute flow rate. The pump is commanded ON, by the control module, whenever the engine is running.

Lubrication Description



(1) Hydraulic Lifter
(2) Cam Bearing
(3) Cylinder Head
(4) Timing Chain Tensioner
(5) Cam Drive Chain Oil Nozzle
(6) Crankshaft Bearing
(7) Balance Shaft Chain Tensioner
(8) Oil Pump
(9) Oil Pick Up
(10) Oil Pan
(11) Bedplate
(12) Balance Shaft Bearings
(13) Oil Filter

Oil is applied under pressure to the crankshaft, connecting rods, balance shaft assembly, camshaft bearing surfaces, valve lifters and timing chain hydraulic tensioner. All other moving parts are lubricated by gravity flow or splash. Oil enters the gerotor type oil pump thorough a fixed inlet screen. The oil pump is driven by the crankshaft. The oil pump body is within the engine front cover. The pressurized oil from the pump passes through the oil filter. The oil filter is located on the right (front) side of the engine block. The oil filter is housed in a casting that is integrated with the engine block. The oil filter is a disposable cartridge type. A by-pass valve in the filter cap allows continuous oil flow in case the oil filter should become restricted. Oil then enters the gallery where it is distributed to the balance shafts, crankshaft,

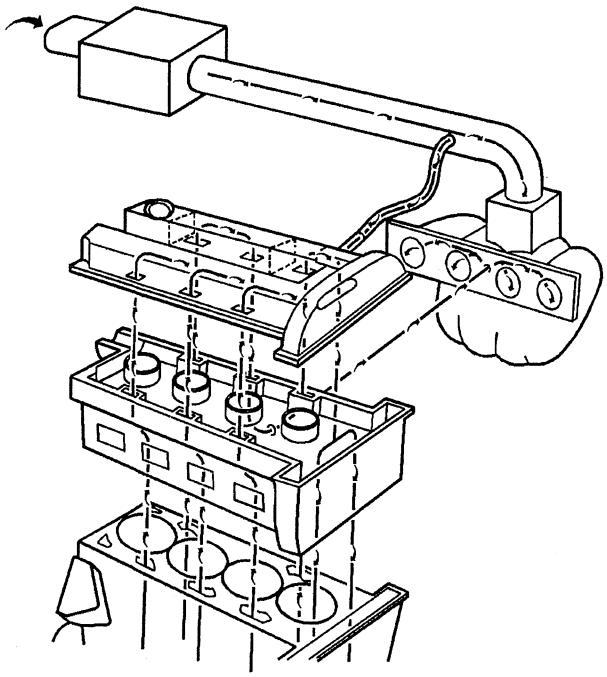
camshafts and camshaft timing chain oiler nozzle. The connecting rod bearings are oiled by constant oil flow passages through the crankshaft connecting the main journals to the rod journals. A groove around each upper main bearing furnishes oil to the drilled crankshaft passages. The pressurized oil passes through the cylinder head restrictor orifice into the cylinder head and then into each camshaft feed gallery. Cast passages feed each hydraulic element adjuster and drilled passages feed each camshaft bearing surface. An engine oil pressure switch or sensor is installed at the end. Oil returns to the oil pan through passages cast into the cylinder head. The timing chain lubrication drains directly into the oil pan.

Crankcase Ventilation System Description

General Description

A crankcase ventilation system is used to consume crankcase vapors in the combustion process instead of venting them to atmosphere. Fresh air from the intake system is supplied to the crankcase, mixed with blow by gases and then passed through a calibrated orifice into the intake manifold.

Operation



The primary control is through the positive crankcase ventilation (PCV) orifice which meters the flow at a rate depending on inlet vacuum. The PCV orifice is an integral part of the camshaft cover. If abnormal operating conditions occur, the system is designed to allow excessive amounts of blow by gases to back flow through the crankcase vent into the intake system to be consumed by normal combustion.

Results of Incorrect Operation

A plugged orifice may cause the following conditions:

- Rough idle
- Stalling or slow idle speed
- Oil leaks
- Sludge in engine

A leaking orifice may cause the following conditions:

- Rough idle
- Stalling
- High idle speed

Engine Mechanical – 2.2L – L61

General Specifications

Application	Specification	
	Metric	English
General Data		
• Engine Type	Inline 4 Cylinder	
• Displacement	2.2 L	134 CID
• RPO	L61	
• Liter (VIN)	F	
• Bore	85.992-86.008 mm	3.3855-3.3861 in
• Stroke	94.6 mm	3.727 in
• Compression Ratio	10:01	
Balance Shaft		
• Bearing Clearance	0.030-0.063 mm	0.0012-0.0025 in
• Bearing Diameter - Inside - Carrier	20.050-20.063 mm	0.7894-0.7899 in
• Bearing Diameter - Outside - Carrier	41.975-41.995 mm	1.6526-1.6534 in
• Bearing Journal Diameter	20.000-20.020 mm	0.7874-0.7882 in
• Bushing Clearance	0.033-0.102 mm	0.0013-0.0040 in
• Bushing Diameter - Inside	36.776-36.825 mm	1.4479-1.4498 in
• Bushing Journal Diameter	36.723-36.743 mm	1.4458-1.4466 in
• End Play	0.100-0.300 mm	0.0020-0.0118 in
Block		
• Balance Shaft Bearing Bore Diameter - Carrier	42.000-42.016 mm	1.6535-1.6542 in
• Balance Shaft Bushing Bore Diameter	40.763-40.776 mm	1.6048-1.6054 in
• Crankshaft Main Bearing Bore Diameter	64.068-64.082 mm	2.5224-2.5229 in
• Cylinder Bore Diameter	85.992-86.008 mm	3.3855-3.3861 in
• Cylinder Bore Out-of-Round - Maximum	0.010 mm	0.0004 in
• Cylinder Bore Taper - Maximum	0.010 mm	0.0004 in
• Cylinder Head Deck Surface Flatness - Transverse	0.030 mm	0.0012 in
• Cylinder Head Deck Surface Flatness - Longitude	0.050 mm	0.002 in
• Cylinder Head Deck Surface Flatness - Overall	0.08 mm	0.0031 in
Camshaft		
• Camshaft End Play	0.040-0.144 mm	0.0016-0.0057 in
• Camshaft Journal Diameter	26.935-26.960 mm	1.0604-1.0614 in
• Camshaft Thrust Surface	21.000-21.052 mm	0.8268-0.8252 in
Connecting Rod		
• Connecting Rod Bearing Clearance	0.029-0.069 mm	0.0011-0.0027 in
• Connecting Rod Bore Diameter - Bearing End	52.118-52.134 mm	2.0519-2.05252 in
• Connecting Rod Bore Diameter - Pin End	20.007-20.021 mm	0.7877-0.7882 in
• Connecting Rod Side Clearance	0.070-0.370 mm	0.0028-0.0146 in
• Connecting Rod Straightness - Bend - Maximum	0.021 mm	0.0083 in
• Connecting Rod Straightness - Twist - Maximum	0.04 mm	0.0157 in
Crankshaft		
• Connecting Rod Journal Diameter	49.000-49.014 mm	1.9291-1.9297 in
• Crankshaft End Play	0.050-0.380 mm	0.0012-0.0150 in
• Crankshaft Main Bearing Clearance	0.031-0.067 mm	0.0012-0.0026 in
• Crankshaft Main Journal Diameter	55.994-56.008 mm	2.2045-2.2050 in

Application	Specification	
	Metric	English
Cylinder Head		
• Surface Flatness - Block Deck - Transverse	0.030 mm	0.0012 in
• Surface Flatness - Block Deck - Longitude	0.050 mm	0.002 in
• Surface Flatness - Block Deck - Overall	0.1 mm	0.004 in
• Valve Guide Bore - Exhaust	6.000-6.012 mm	0.2362-0.2367 in
• Valve Guide Bore - Intake	6.000-6.012 mm	0.2362-0.2367 in
• Valve Lifter Bore Diameter - Stationary Lash Adjusters	12.013-12.037 mm	0.4730-0.4739 in
Lubrication System		
• Oil Pressure - Minimum - [commat]1000 RPM	344.75-551.60 kPa	50-80 psi
• Oil Capacity	4.8L	5.0 quarts
Piston Rings		
• Piston Ring End Gap - First Compression Ring	0.20-0.40 mm	0.008-0.016 in
• Piston Ring End Gap - Second Compression Ring	0.35-0.55 mm	0.014-0.022 in
• Piston Ring End Gap - Oil Control Ring - Rails	0.25-0.76 mm	0.010-0.030 in
• Piston Ring to Groove Clearance - First Compression Ring	0.04-0.08 mm	0.0015-0.0031 in
• Piston Ring to Groove Clearance - Second Compression Ring	0.030-0.069 mm	0.0012-0.0027 in
• Piston Ring to Groove Clearance - Oil Control Ring	0.090-0.106 mm	0.0035-0.0042 in
• Piston Ring Thickness - First Compression Ring	1.170-1.190 mm	0.0461-0.0469 in
• Piston Ring Thickness - Second Compression Ring	1.471-1.490 mm	0.0579-0.0587 in
• Piston Ring Thickness - Oil Control Ring - Rail - Maximum	0.43 mm	0.0169 in
• Piston Ring Thickness - Oil Control Ring - Spacer	1.574-1.651 mm	0.0620-0.0650 in
Pistons and Pins		
• Piston - Piston Diameter - [commat]14.5 mm up	85.967-85.982 mm	3.3845-3.3851 in
• Piston - Piston Pin Bore Diameter	20.002-20.007 mm	0.07875-0.7877 in
• Piston - Piston Ring Grove Width - Top	1.23-1.25 mm	0.0484-0.0492 in
• Piston - Piston Ring Grove Width - Second	1.52-1.54 mm	0.0598-0.0606 in
• Piston - Piston Ring Grove Width - Oil Control	2.52-2.54 mm	0.0992-0.1000 in
• Piston - Piston To Bore Clearance	0.010-0.041 mm	0.0004-0.0016 in
• Pin - Piston Pin Clearance to Connecting Rod Bore	0.007-0.026 mm	0.0003-0.0010 in
• Pin - Piston Pin Clearance to Piston Pin Bore	0.002-0.012 mm	0.0001-0.0005 in
• Pin - Piston Pin Diameter	19.995-20.000 mm	0.7872-0.7874 in
• Pin - Piston Pin End Play	0.19-1.16 mm	0.0075-0.0461 in
Valve System		
• Valves - Valve Face Runout - Maximum	0.04 mm	0.0016 in
• Valves - Valve Seat Runout - Maximum	0.05 mm	0.0020 in
• Valves - Valve Stem Diameter - Intake	5.955-5.970 mm	0.2344-0.2355 in
• Valves - Valve Stem Diameter - Exhaust	5.935-5.950 mm	0.2337-0.2343 in
• Valves - Valve Stem to Guide Clearance - Intake	0.030-0.057 mm	0.0012-0.0022 in
• Valves - Valve Stem to Guide Clearance - Exhaust	0.050-0.077 mm	0.0020-0.0026 in
• Valve Lifters - Valve Lifter Diameter - Stationary Lash Adjuster	11.986-12.000 mm	0.0005-0.0020 in
• Valve Lifters - Valve Lifter-to-Bore Clearance - Stationary Lash Adjuster	0.013-0.051 mm	3.2210-3.2299 in

Application	Specification	
	Metric	English
• Valve Springs - Valve Spring Load - Closed - [commat]22.5 mm	245.0-271.0 N. - Eng Spec.	
• Valve Springs - Valve Spring Load - Open - [commat]32.5 mm	525.0-575.0 N. - Eng Spec.	

Fastener Tightening Specifications

Application	Specification	
	Metric	English
A/C Compressor to Block Bolt	20 N·m	15 lb ft
Balance Shaft Adjustable Chain Guide Bolt	10 N·m	89 lb in
Balance Shaft Bearing Carrier to Block Bolt	10 N·m	89 lb in
Balance Shaft Fixed Chain Guide Bolt	10 N·m	89 lb in
Balance Shaft Sprocket Bolt	50 N·m	37 lb ft
Block Heater Bolt	10 N·m	89 lb in
Cam Cover to Cylinder Head Bolt	10 N·m	89 lb in
Cam Cover to Ground Cable Bolt	10 N·m	89 lb in
Cam Cover to Ground Cable Stud	10 N·m	89 lb in
Camshaft Bearing Cap Bolt	10 N·m	89 lb in
Camshaft Sprocket Bolt		
• First Pass	85 N·m	63 lb ft
• Final Pass	30 degrees	
Camshaft Timing Chain Tensioner	75 N·m	55 lb ft
Chain Guide Plug	90 N·m	59 lb ft
Connecting Rod Bolt		
• First Pass	25 N·m	18 lb ft
• Final Pass	100 degrees	
Crankshaft Bearings - Lower Crankcase to Block		
• First Pass	20 N·m	15 lb ft
• Final Pass	70 degrees	
Crankshaft Pulley Bolt		
• First Pass	100 N·m	74 lb ft
• Final Pass	75 degrees	
Crankshaft Position Sensor Bolt	10 N·m	89 lb in
Cylinder Head Bolt		
• First Pass	30 N·m	22 lb ft
• Final Pass	155 degrees	
Cylinder Head Front Chaincase Bolt	35 N·m	26 lb ft
Cylinder Head Oil Gallery Plug	35 N·m	26 lb ft
Dipstick Guide to Intake Manifold Bolt	10 N·m	89 lb in
Drive Belt Tensioner Bolt	45 N·m	33 lb ft
EGR Cover Bolt	25 N·m	18 lb ft
Elek. ICM Cover Bolt	10 N·m	89 lb in
Engine Coolant Temperature Sensor	22 N·m	16 lb ft
Engine Lift Bracket Front Bolt	25 N·m	18 lb ft
Engine Lift Bracket Rear Bolt	25 N·m	18 lb ft
Exhaust Manifold to Cylinder Head Nut	12 N·m	9 lb ft
Exhaust Manifold to Cylinder Head Stud	10 N·m	89 lb in
Exhaust Manifold Pipe Flange Stud	16 N·m	12 lb ft

Application	Specification	
	Metric	English
Flexplate (AMT) Bolt		
• First Pass	53 N·m	39 lb ft
• Final Pass	25 degrees	
Flywheel (SMT) Bolt		
• First Pass	53 N·m	39 lb ft
• Final Pass	25 degrees	
Front Cover to Block Bolt	25 N·m	18 lb ft
Front Lift Bracket Bolt	25 N·m	18 lb ft
Fuel Pipe Bracket Bolt	10 N·m	89 lb in
Fuel Rail Bracket Stud	10 N·m	89 lb in
Generator to Block Bolt	20 N·m	15 lb ft
Heat Shield to Exhaust Manifold Bolt	23 N·m	17 lb ft
Ignition Coil Bolt	10 N·m	89 lb in
Intake Camshaft Rear Cap Bolt	25 N·m	18 lb ft
Intake Manifold to Cylinder Head Bolt	10 N·m	89 lb in
Intake Manifold to Cylinder Head Nut	10 N·m	89 lb in
Intake Manifold to Cylinder Head Stud	6 N·m	53 lb in
Knock Sensor Bolt	25 N·m	18 lb ft
Lower Crankcase to Block Peripheral Bolt	25 N·m	18 lb ft
Oil Filter Housing Cover	25 N·m	18 lb ft
Oil Gallery Gerotor Cover - Rear Bolt	6 N·m	53 lb in
Oil Gallery Plug	35 N·m	26 lb ft
Oil Gallery Plug -Rear	60 N·m	44 lb ft
Oil Pan Drain Plug	25 N·m	18 lb ft
Oil Pan to Block Bolts	25 N·m	18 lb ft
Oil Pressure Switch	22 N·m	16 lb ft
Oil Pump Cover Bolt	6 N·m	53 lb in
Oil Pump Pressure Relief Valve Plug	40 N·m	30 lb ft
Oxygen Sensor	42 N·m	31 lb ft
Power Steering Pump Bolt	25 N·m	18 lb ft
Spark plug	20 N·m	15 lb ft
Starter Motor to Block Bolt	40 N·m	30 lb ft
Thermostat Housing to Block Bolts	10 N·m	89 lb in
Throttle Body Bolt	10 N·m	89 lb in
Throttle Body Nut	10 N·m	89 lb in
Throttle Body Stud	6 N·m	53 lb in
Timing Adjustable Chain Guide Bolt	10 N·m	89 lb in
Timing Chain Oil Nozzle Bolt	10 N·m	89 lb in
Timing Fixed Chain Guide Bolt	10 N·m	89 lb in
Timing Upper Chain Guide Bolt	10 N·m	89 lb in
Vent Tube to Cylinder Head	15 N·m	11 lb ft
Water Jacket Drain Plug	20 N·m	15 lb ft
Water Pipe Support Bracket Bolt	10 N·m	89 lb in
Water Pump Access Cover Bolt	7 N·m	62 lb in
Water Pump/Balance Shaft Chain Tensioner Bolt	10 N·m	89 lb in
Water Pump Bolts	25 N·m	18 lb ft
Water Pump Sprocket Bolt	10 N·m	89 lb in

Engine Component Description

Cylinder Block

The cylinder block is lost foam cast aluminum with four cylinders arranged in-line. The cylinders have pressed in place iron liners. The block has five crankshaft bearings with the thrust bearing located on the second bearing from the front of the engine. The cylinder block incorporates a bedplate design that forms an upper and lower crankcase. This design promotes cylinder block rigidity and reduced noise and vibration.

Crankshaft

The crankshaft is cast nodular iron with eight counterweights. The number eight counterweight is also the ignition system reluctor wheel. The main bearing journals are cross-drilled, and the upper bearings are grooved. The crankshaft has a slip fit balance shaft drove sprocket. Number two main bearing is the thrust bearing. A harmonic damper is used to control torsional vibration.

Connecting Rod and Piston

The connecting rods are powdered metal. The connecting rod incorporates the floating piston pin. The pistons are cast aluminum. The piston rings are of a low tension type to reduce friction. The top compression ring is ductile iron with a molybdenum facing and phosphate coated sides. The second compression ring is gray iron. The oil ring is a 3-piece spring construction with chromium plating.

Oil Pan

The oil pan is die cast aluminum. The oil pan includes an attachment to the transmission to provide additional structural support.

Balance Shaft Assembly

There are two block mounted balance shafts located on each side of the crankcase at the bottom of the cylinder bores. The balance shafts are driven by a single roller chain that also drives the water pump. The chain is tensioned by a hydraulic tensioner that is supplied pressure by the engine oil pump. This design promotes the maximum effectiveness of the balance shaft system and reduces noise and vibration.

Cylinder Head

The cylinder head is a lost foam aluminum casting. Pressed-in powdered metal valve guides and valve seat insets are used. The fuel injection nozzle is located in the intake port. The cylinder head incorporates camshaft bearing journals and camshaft bearing caps.

Valves

There are two intake and two exhaust valves per cylinder. Rotators are used on all of the intake valves. The rotators are located at the bottom of the valve spring to reduce valve train reciprocating mass. Positive valve stem seals are used on all valves.

Camshaft

Two camshafts are used, one for all intake valves, the other for all exhaust valves. The camshafts are cast iron. The intake camshaft had a pressed-in hex insert. The hex inset is used to drive the direct drive power steering pump.

Valve Lifters

The valve train uses a roller finger follower acted on by a hydraulic element adjuster. The roller finger follower reduces friction and noise.

Camshaft Cover

The camshaft cover is cast aluminum with steel crankcase ventilation baffling incorporated. The camshaft cover has mounting locations for the ignition system.

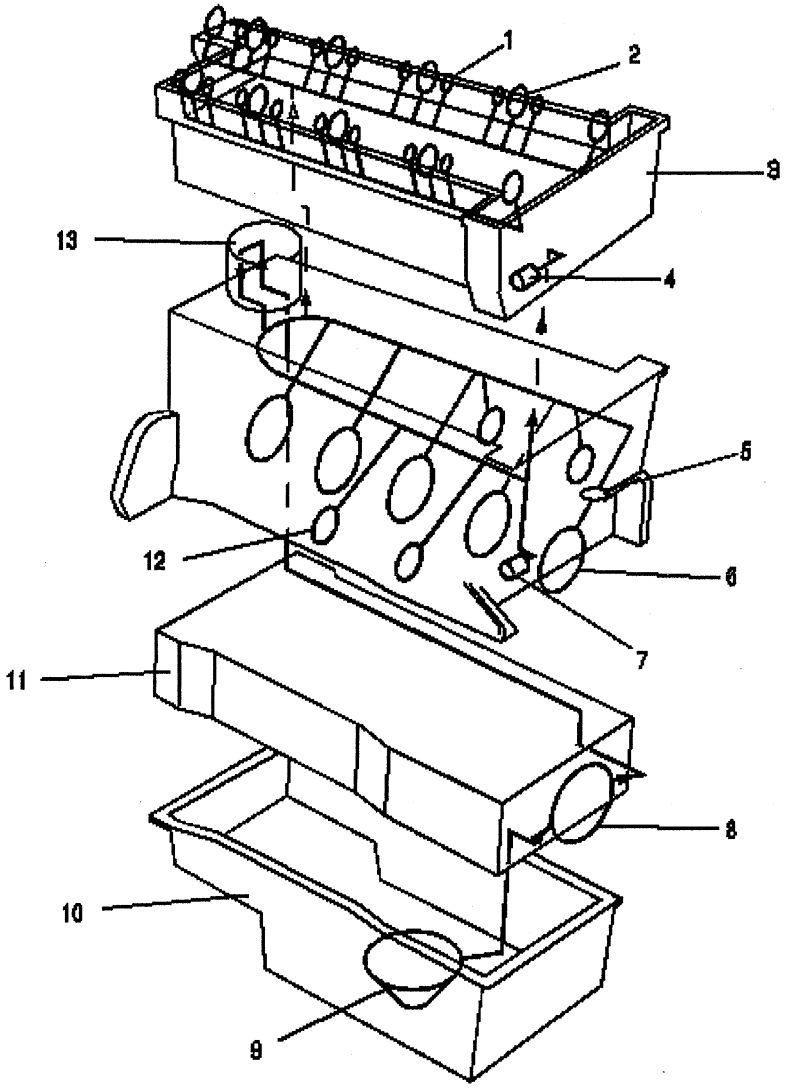
Camshaft Drive

A single row roller chain is used for camshaft drive. There is a tensioner and active guide used on the slack side of the chain to control chain motion and noise. The chain drive promotes long valve train life and low maintenance.

Intake and Exhaust Manifold

The intake manifold is made of composite plastic. The exhaust manifold is cast iron. The intake manifold incorporates a distribution and control system for PCV gases. The exhaust manifold is a dual plane design that promotes good low end torque and performance.

Lubrication Description



(1) Hydraulic Lifter
(2) Cam Bearing
(3) Cylinder Head
(4) Timing Chain Tensioner
(5) Cam Drive Chain Oil Nozzle
(6) Crankshaft Bearing
(7) Balance Shaft Chain Tensioner
(8) Oil Pump

(9) Oil Pick Up
(10) Oil Pan
(11) Bedplate
(12) Balance Shaft Bearings
(13) Oil Filter

Oil is applied under pressure to the crankshaft, connecting rods, balance shaft assembly, camshaft bearing surfaces, valve lifters and timing chain hydraulic tensioner. All other moving parts are lubricated by gravity flow or splash. Oil enters the gerotor type oil pump thorough a fixed inlet screen. The oil pump is driven by the crankshaft. The oil pump body is within the engine front cover. The pressurized oil from the pump passes through the oil filter. The oil filter is located on the right (front) side of the engine block. The oil filter is housed in a casting that is integrated with the engine block. The oil filter is a disposable cartridge type. A by-pass valve in the filter cap allows continuous oil flow in case the oil filter should become restricted. Oil then enters the gallery where it is distributed to the balance shafts, crankshaft, camshafts and camshaft timing chain oiler nozzle. The connecting rod bearings are oiled by constant oil flow passages through the crankshaft connecting the main journals to the rod journals. A groove around each upper main bearing furnishes oil to the drilled crankshaft passages. The pressurized oil passes through the cylinder head restrictor orifice into the cylinder head and then into each camshaft feed gallery. Cast passages feed each hydraulic element adjuster and drilled passages feed each camshaft bearing surface. An engine oil pressure switch or sensor is installed at the end. Oil returns to the oil pan through passages cast into the cylinder head. The timing chain lubrication drains directly into the oil pan.

Drive Belt System Description

The drive belt system consists of the following components:

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

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

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

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

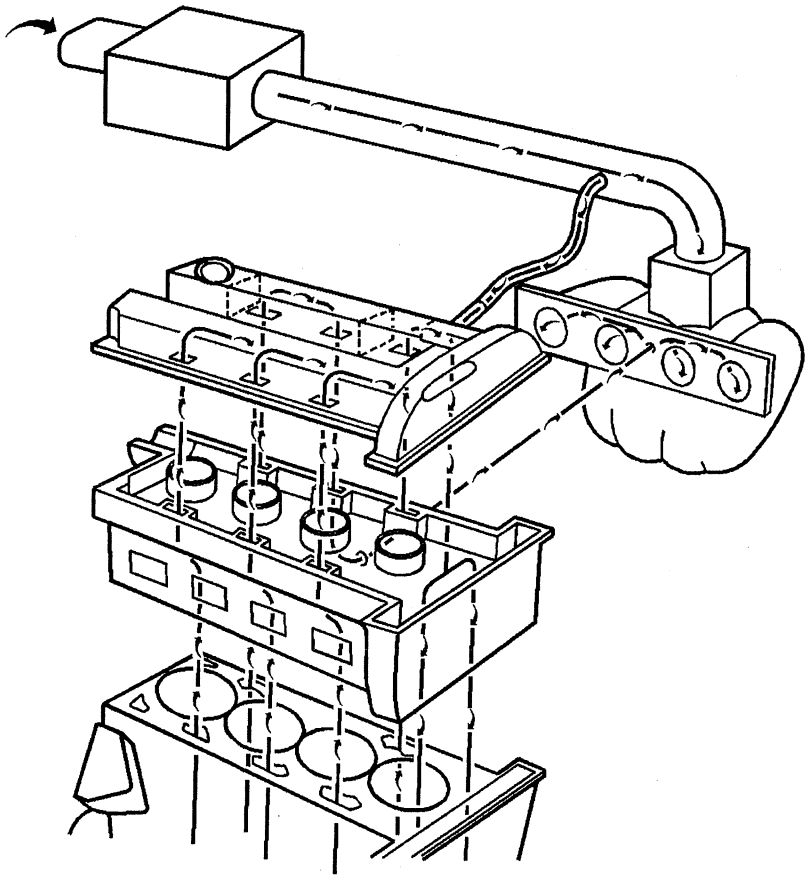
The drive belt system may have an idler pulley, which is used to add wrap to the adjacent pulleys. Some systems use an idler pulley in place of an accessory drive component when the vehicle is not equipped with the accessory.

Crankcase Ventilation System Description

General Description

A crankcase ventilation system is used to consume crankcase vapors in the combustion process instead of venting them to atmosphere. Fresh air from the intake system is supplied to the crankcase, mixed with blow by gases and then passed through a calibrated orifice into the intake manifold.

Operation



The primary control is through the positive crankcase ventilation (PCV) orifice which meters the flow at a rate depending on inlet vacuum. The PCV orifice is an integral part of the camshaft cover. If abnormal operating conditions occur, the system is designed to allow excessive amounts of blow by gases to back flow through the crankcase vent into the intake system to be consumed by normal combustion.

Results of Incorrect Operation

A plugged orifice may cause the following conditions:

- Rough idle
- Stalling or slow idle speed
- Oil leaks
- Sludge in engine

A leaking orifice may cause the following conditions:

- Rough idle
- Stalling
- High idle speed

Engine Mechanical – 2.4L

General Specifications

Application	Specification	
	Metric	English
General Data		
• Engine Type	Inline 4 Cylinder	
• Displacement	2.4 L	146 CID
• RPO	LE5	
• Liter (VIN)	B	
• Bore	87.992-88.008 mm	3.4668-3.4675 in
• Stroke	98 mm	3.861 in
• Compression Ratio	10:01	
Balance Shaft		
• Bearing Clearance	0.030-0.063 mm	0.0012-0.0025 in
• Bearing Diameter - Inside - Carrier	20.050-20.063 mm	0.7894-0.7899 in
• Bearing Diameter - Outside - Carrier	41.975-41.995 mm	1.6526-1.6534 in
• Bearing Journal Diameter	20.000-20.020 mm	0.7874-0.7882 in
• Bushing Clearance	0.033-0.102 mm	0.0013-0.0040 in
• Bushing Diameter - Inside	36.776-36.825 mm	1.4479-1.4498 in
• Bushing Journal Diameter	36.723-36.743 mm	1.4458-1.4466 in
• End Play	0.100-0.300 mm	0.0020-0.0118 in
Block		
• Balance Shaft Bearing Bore Diameter - Carrier	42.000-42.016 mm	1.6535-1.6542 in
• Balance Shaft Bushing Bore Diameter	40.763-40.776 mm	1.6048-1.6054 in
• Crankshaft Main Bearing Bore Diameter	64.068-64.082 mm	2.5224-2.5229 in
• Cylinder Bore Diameter	87.992-88.008 mm	3.4668-3.4675 in
• Cylinder Bore Out-of-Round - Maximum	0.010 mm	0.0004 in
• Cylinder Bore Taper - Maximum	0.010 mm	0.0004 in
• Cylinder Head Deck Surface Flatness - Transverse	0.030 mm	0.0012 in
• Cylinder Head Deck Surface Flatness - Longitude	0.050 mm	0.002 in
• Cylinder Head Deck Surface Flatness - Overall	0.08 mm	0.0031 in
Camshaft		
• Camshaft End Play	0.040-0.144 mm	0.0016-0.0057 in
• Camshaft Journal Diameter	26.935-26.960 mm	1.0604-1.0614 in
• Camshaft Thrust Surface	21.000-21.052 mm	0.8268-0.8252 in
Connecting Rod		
• Connecting Rod Bearing Clearance	0.029-0.069 mm	0.0011-0.0027 in
• Connecting Rod Bore Diameter - Bearing End	52.118-52.134 mm	2.0519-2.05252 in
• Connecting Rod Bore Diameter - Pin End	20.007-20.021 mm	0.7877-0.7882 in
• Connecting Rod Side Clearance	0.070-0.370 mm	0.0028-0.0146 in
• Connecting Rod Straightness - Bend - Maximum	0.021 mm	0.0083 in
• Connecting Rod Straightness - Twist - Maximum	0.04 mm	0.0157 in
Crankshaft		
• Connecting Rod Journal Diameter	49.000-49.014 mm	1.9291-1.9297 in
• Crankshaft End Play	0.050-0.380 mm	0.0012-0.0150 in
• Crankshaft Main Bearing Clearance	0.031-0.067 mm	0.0012-0.0026 in
• Crankshaft Main Journal Diameter	55.994-56.008 mm	2.2045-2.2050 in

Application	Specification	
	Metric	English
Cylinder Head		
• Surface Flatness - Block Deck - Transverse	0.030 mm	0.0012 in
• Surface Flatness - Block Deck - Longitude	0.050 mm	0.002 in
• Surface Flatness - Block Deck - Overall	0.1 mm	0.004 in
• Valve Guide Bore - Exhaust	6.000-6.012 mm	0.2362-0.2367 in
• Valve Guide Bore - Intake	6.000-6.012 mm	0.2362-0.2367 in
• Valve Lifter Bore Diameter - Stationary Lash Adjusters	12.013-12.037 mm	0.4730-0.4739 in
Lubrication System		
• Oil Pressure - Minimum - @1000 RPM	344.75-551.60 kPa	50-80 psi
• Oil Capacity	4.8L	5.0 quarts
Piston Rings		
• Piston Ring End Gap - First Compression Ring	0.20-0.40 mm	0.008-0.016 in
• Piston Ring End Gap - Second Compression Ring	0.35-0.55 mm	0.014-0.022 in
• Piston Ring End Gap - Oil Control Ring - Rails	0.25-0.76 mm	0.010-0.030 in
• Piston Ring to Groove Clearance - First Compression Ring	0.04-0.08 mm	0.0015-0.0031 in
• Piston Ring to Groove Clearance - Second Compression Ring	0.030-0.069 mm	0.0012-0.0027 in
• Piston Ring to Groove Clearance - Oil Control Ring	0.090-0.106 mm	0.0035-0.0042 in
• Piston Ring Thickness - First Compression Ring	1.170-1.190 mm	0.0461-0.0469 in
• Piston Ring Thickness - Second Compression Ring	1.471-1.490 mm	0.0579-0.0587 in
• Piston Ring Thickness - Oil Control Ring - Rail - Maximum	0.43 mm	0.0169 in
• Piston Ring Thickness - Oil Control Ring - Spacer	1.574-1.651 mm	0.0620-0.0650 in
Pistons and Pins		
• Piston - Piston Diameter - @14.5 mm up	85.967-85.982 mm	3.3845-3.3851 in
• Piston - Piston Pin Bore Diameter	20.002-20.007 mm	0.07875-0.7877 in
• Piston - Piston Ring Grove Width - Top	1.23-1.25 mm	0.0484-0.0492 in
• Piston - Piston Ring Grove Width - Second	1.52-1.54 mm	0.0598-0.0606 in
• Piston - Piston Ring Grove Width - Oil Control	2.52-2.54 mm	0.0992-0.1000 in
• Piston - Piston To Bore Clearance	0.010-0.041 mm	0.0004-0.0016 in
• Pin - Piston Pin Clearance to Connecting Rod Bore	0.007-0.026 mm	0.0003-0.0010 in
• Pin - Piston Pin Clearance to Piston Pin Bore	0.002-0.012 mm	0.0001-0.0005 in
• Pin - Piston Pin Diameter	19.995-20.000 mm	0.7872-0.7874 in
• Pin - Piston Pin End Play	0.19-1.16 mm	0.0075-0.0461 in
Valve System		
• Valves - Valve Face Runout - Maximum	0.04 mm	0.0016 in
• Valves - Valve Seat Runout - Maximum	0.05 mm	0.0020 in
• Valves - Valve Stem Diameter - Intake	5.955-5.970 mm	0.2344-0.2355 in
• Valves - Valve Stem Diameter - Exhaust	5.935-5.950 mm	0.2337-0.2343 in
• Valves - Valve Stem to Guide Clearance - Intake	0.030-0.057 mm	0.0012-0.0022 in
• Valves - Valve Stem to Guide Clearance - Exhaust	0.050-0.077 mm	0.0020-0.0026 in
• Valve Lifters - Valve Lifter Diameter - Stationary Lash Adjuster	11.986-12.000 mm	0.0005-0.0020 in
• Valve Lifters - Valve Lifter-to-Bore Clearance - Stationary Lash Adjuster	0.013-0.051 mm	3.2210-3.2299 in

Application	Specification	
	Metric	English
• Valve Springs - Valve Spring Load - Closed - @22.5 mm	525.0-575.0 N. - Eng Spec.	
• Valve Springs - Valve Spring Load - Open - @32.5 mm	245.0-271.0 N. - Eng Spec.	

Fastener Tightening Specifications

Application	Specification	
	Metric	English
A/C Compressor to Block Bolt	20 N·m	15 lb ft
Balance Shaft Adjustable Chain Guide Bolt	15 N·m	11 lb ft
Balance Shaft Bearing Carrier to Block Bolt	10 N·m	89 lb in
Balance Shaft Fixed Chain Guide Bolt	15 N·m	11 lb ft
Balance Shaft Sprocket Bolt	50 N·m	37 lb ft
Block Core Plug	40 N·m	30 lb ft
Block Heater Bolt	10 N·m	89 lb in
Cam Cover to Cylinder Head Bolt	10 N·m	89 lb in
Cam Cover to Ground Cable Bolt	10 N·m	89 lb in
Cam Cover to Ground Cable Stud	10 N·m	89 lb in
Camshaft Cap Bolt	10 N·m	89 lb in
Camshaft Position Actuator Solenoid Valve Bolt	10 N·m	89 lb in
Camshaft Position Sensor Bolt	10 N·m	89 lb in
Camshaft Timing Chain Tensioner	75 N·m	55 lb ft
Chain Guide Plug	90 N·m	59 lb ft
Connecting Rod Bolt		
First Pass	25 N·m	18 lb ft
Final Pass	100 degrees	
Crankshaft Bearings - Lower Crankcase to Block - Bedplate		
First Pass	20 N·m	15 lb ft
Final Pass	70 degrees	
Crankshaft Position Sensor Bolt	10 N·m	89 lb in
Crankshaft Balancer Bolt		
First Pass	100 N·m	74 lb ft
Final Pass	125 degrees	
Cylinder Head Bolt		
First Pass	30 N·m	22 lb ft
Final Pass	155 degrees	
Cylinder Head Front Chaincase Bolt	35 N·m	26 lb ft
Cylinder Head Oil Gallery Plug	35 N·m	26 lb ft
Drive Belt Tensioner Bolt	45 N·m	33 lb ft
EGR Cover Bolt	25 N·m	18 lb ft
Engine Coolant Temperature Sensor	20 N·m	15 lb ft
Engine Lift Bracket Front Bolt	25 N·m	18 lb ft
Engine Lift Bracket Rear Bolt	25 N·m	18 lb ft
EVAP Canister Valve Bolt	22 N·m	16 lb ft
Exhaust Camshaft Position Actuator		
First Pass	30 N·m	22 lb ft
Final Pass	100 degrees	
Exhaust Manifold to Cylinder Head Nut	14 N·m	124 lb in
Exhaust Manifold to Cylinder Head Stud	10 N·m	89 lb in
Exhaust Manifold Pipe Flange Stud	16 N·m	12 lb ft
Flywheel Bolt - Automatic Transmission		
First Pass	53 N·m	39 lb ft
Final Pass	25 degrees	

Application	Specification	
	Metric	English
Flywheel Bolt - Manual Transmission		
First Pass	53 N·m	39 lb ft
Final Pass	25 degrees	
Front Cover to Block Bolt	25 N·m	18 lb ft
Front Lift Bracket Bolt	25 N·m	18 lb ft
Fuel Pipe Bracket Bolt	10 N·m	89 lb in
Fuel Rail Bracket Stud	10 N·m	89 lb in
Generator to Block Bolt	23 N·m	17 lb ft
Heat Shield to Exhaust Manifold Bolt	22 N·m	16 lb ft
Ignition Coil Bolt	10 N·m	89 lb in
Intake Camshaft Position Actuator		
First Pass	30 N·m	22 lb ft
Final Pass	100 degrees	
Intake Camshaft Rear Cap Bolt	25 N·m	18 lb ft
Intake Manifold to Cylinder Head Bolt	10 N·m	89 lb in
Intake Manifold to Cylinder Head Nut	10 N·m	89 lb in
Intake Manifold to Cylinder Head Stud	6 N·m	53 lb in
Knock Sensor Bolt	25 N·m	18 lb ft
Lower Crankcase to Block Perimeter Bolt	25 N·m	18 lb ft
Oil Cooler Bolts	22 N·m	16 lb ft
Oil Filter Housing Cover	22 N·m	16 lb ft
Oil Gallery Gerotor Cover - Rear Bolt	6 N·m	53 lb in
Oil Gallery Plug	35 N·m	26 lb ft
Oil Gallery Plug - Rear	60 N·m	44 lb ft
Oil Level Indicator Tube to Intake Manifold Bolt	10 N·m	89 lb in
Oil Pan Drain Plug	25 N·m	18 lb ft
Oil Pan to Block Bolts	25 N·m	18 lb ft
Oil Pressure Switch	22 N·m	16 lb ft
Oil Pump Cover Bolt	6 N·m	53 lb in
Oil Pump Pressure Relief Valve Plug	40 N·m	30 lb ft
Oxygen Sensor	42 N·m	31 lb ft
Piston Oil Squirter	15 N·m	11 lb ft
Power Steering Pump Bolt	25 N·m	18 lb ft
Spark Plug	20 N·m	15 lb ft
Starter Motor to Block Bolt	53 N·m	39 lb ft
Thermostat Housing to Block Bolts	10 N·m	89 lb in
Throttle Body Bolt	10 N·m	89 lb in
Throttle Body Nut	10 N·m	89 lb in
Throttle Body Stud	6 N·m	53 lb in
Timing Adjustable Chain Guide Bolt	10 N·m	89 lb in
Timing Chain Oil Nozzle Bolt	10 N·m	89 lb in
Timing Fixed Chain Guide Bolt	15 N·m	11 lb ft
Timing Upper Chain Guide Bolt	10 N·m	89 lb in
Vent Tube to Cylinder Head	15 N·m	11 lb ft
Water Jacket Drain Plug	20 N·m	15 lb ft
Water Pipe Support Bracket Bolt	10 N·m	89 lb in
Water Pump Access Cover Bolt	7 N·m	62 lb in
Water Pump/Balance Shaft Chain Tensioner Bolt	10 N·m	89 lb in
Water Pump Bolts	25 N·m	18 lb ft
Water Pump Sprocket Bolt	10 N·m	89 lb in

Engine Component Description

Cylinder Block

The cylinder block is lost foam cast aluminum with four cylinders arranged in-line. The cylinders have pressed in place iron liners. The block has five crankshaft bearings with the thrust bearing located on the second bearing from the front of the engine. The cylinder block incorporates a bedplate design that forms an upper and lower crankcase. This design promotes cylinder block rigidity and reduced noise and vibration.

Crankshaft

The crankshaft is cast nodular iron with eight counterweights. The number eight counterweight is also the ignition system reluctor wheel. The main bearing journals are cross-drilled, and the upper bearings are grooved. The crankshaft has a slip fit balance shaft drove sprocket. Number two main bearing is the thrust bearing. A harmonic damper is used to control torsional vibration.

Connecting Rod and Piston

The connecting rods are powdered metal. The connecting rod incorporates the floating piston pin. The pistons are cast aluminum. The piston rings are of a low tension type to reduce friction. The top compression ring is ductile iron with a molybdenum facing and phosphate coated sides. The second compression ring is gray iron. The oil ring is a 3-piece spring construction with chromium plating.

Oil Pan

The oil pan is die cast aluminum. The oil pan includes an attachment to the transmission to provide additional structural support.

Balance Shaft Assembly

There are two block mounted balance shafts located on each side of the crankcase at the bottom of the cylinder bores. The balance shafts are driven by a single roller chain that also drives the water pump. The chain is tensioned by a hydraulic tensioner that is supplied pressure by the engine oil pump. This design promotes the maximum effectiveness of the balance shaft system and reduces noise and vibration.

Cylinder Head

The cylinder head is a lost foam aluminum casting. Pressed-in powdered metal valve guides and valve seat insets are used. The fuel injection nozzle is located in the intake port. The cylinder head incorporates camshaft journals and camshaft caps.

Valves

There are two intake and two exhaust valves per cylinder. Rotators are used on all of the intake valves. The rotators are located at the bottom of the valve spring to reduce valve train reciprocating mass. Positive valve stem seals are used on all valves.

Camshaft

Two camshafts are used, one for all intake valves, the other for all exhaust valves. The camshafts are cast iron. The intake camshaft had a pressed-in hex insert. The hex inset is used to drive the direct drive power steering pump.

Valve Lifters

The valve train uses a roller finger follower acted on by a hydraulic lash adjuster. The roller finger follower reduces friction and noise.

Camshaft Cover

The camshaft cover has a steel crankcase ventilation baffling incorporated. The camshaft cover has mounting locations for the ignition system.

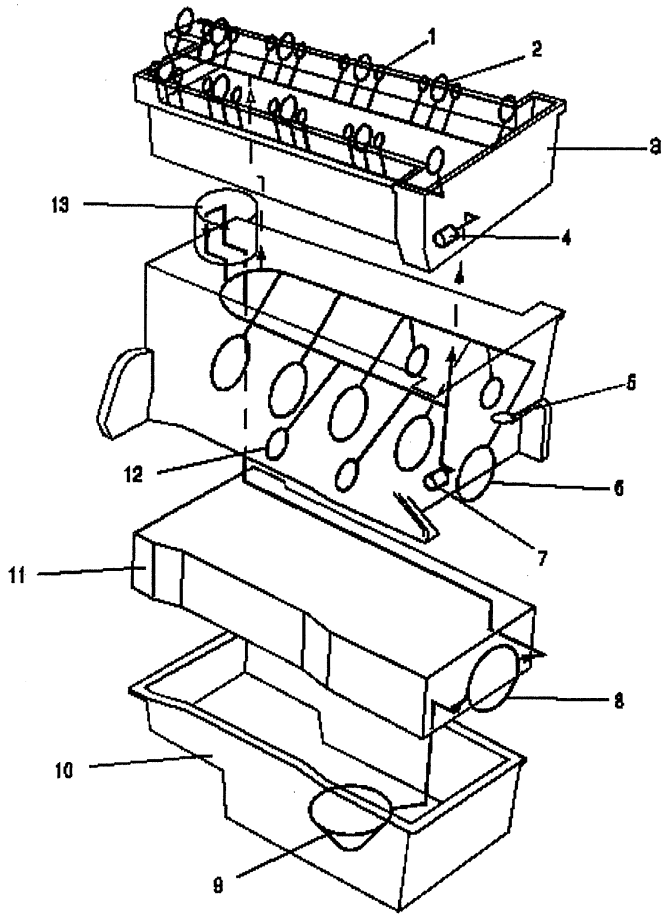
Camshaft Drive

A single row roller chain is used for camshaft drive. There is a tensioner and active guide used on the slack side of the chain to control chain motion and noise. The chain drive promotes long valve train life and low maintenance.

Intake and Exhaust Manifold

The intake manifold is made of composite plastic. The exhaust manifold is cast iron. The intake manifold incorporates a distribution and control system for PCV gases. The exhaust manifold is a dual plane design that promotes good low end torque and performance.

Lubrication Description



(1) Hydraulic Lash Adjuster
(2) Cam Journal
(3) Cylinder Head
(4) Timing Chain Tensioner
(5) Cam Drive Chain Oil Nozzle
(6) Crankshaft Bearing
(7) Balance Shaft Chain Tensioner
(8) Oil Pump
(9) Oil Pick Up
(10) Oil Pan
(11) Bedplate
(12) Balance Shaft Bearings
(13) Oil Filter

Oil is applied under pressure to the crankshaft, connecting rods, balance shaft assembly, camshaft bearing surfaces, valve lifters and timing chain hydraulic tensioner. All other moving parts are lubricated by gravity flow or splash. Oil enters the gerotor type oil pump thorough a fixed inlet screen. The oil pump is driven by the crankshaft. The oil pump body is within the engine front cover. The pressurized oil from the pump passes through the oil filter. The oil filter is located on the right (front) side of the engine block. The oil filter is housed in a casting that is integrated with the engine block. The oil filter is a disposable cartridge type. A by-pass valve in the filter cap allows continuous oil flow in case the oil filter should become restricted. Oil then enters the gallery where it is distributed to the balance shafts, crankshaft, camshafts and camshaft timing chain oiler nozzle. The connecting rod bearings are oiled by constant oil flow passages through the crankshaft connecting the main journals to the rod journals. A groove around each upper main bearing furnishes oil to the drilled crankshaft passages. The pressurized oil passes through the cylinder head restrictor orifice into the cylinder head and then into each camshaft feed gallery. Cast passages feed each hydraulic element adjuster and drilled passages feed each camshaft bearing surface. An engine oil pressure switch or sensor is installed at the end. Oil returns to the oil pan through passages cast into the cylinder head. The timing chain lubrication drains directly into the oil pan.

Engine Cooling

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Air Cleaner Assembly Nut (RPO LE5/L61)	10 N·m	89 lb in
Charged Air Cooler Bolt	10 N·m	89 lb in
Charged Air Cooler Pump Clamp Bolt	10 N·m	89 lb in
Charged Air Cooler Reservoir Bolt	8 N·m	70 lb in
Condenser Bolt	10 N·m	89 lb in
Coolant Heater Bolt	10 N·m	89 lb in
Coolant Heater Cord Clip Nut (RPO LSJ)	10 N·m	89 lb in
Exhaust Shield Stud	22 N·m	16 lb ft
Lower Radiator Mount Bracket Bolt	25 N·m	18 lb ft
Positive Crankcase Ventilation (PCV) Tube/Hose Bolt/Nut (RPO LSJ)	10 N·m	89 lb in
Surge Tank Bolt	6.5 N·m	58 lb in
Thermostat Cover Bolt	10 N·m	89 lb in
Thermostat Housing Bolt	10 N·m	89 lb in
Transmission Oil Cooler Line to Radiator	20 N·m	15 lb ft
Underhood Junction Block Bracket Bolt	25 N·m	18 lb ft
Underhood Junction Block Bracket Nut	10 N·m	89 lb in
Water Pump Access Plate Bolt	10 N·m	89 lb in
Water Pump Bolt	25 N·m	18 lb ft
Water Pump Sprocket Bolt	10 N·m	89 lb in

Cooling System Description and Operation

Coolant Heater

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

Cooling System

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

Cooling Cycle

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

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

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

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

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

Coolant

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

Radiator

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

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

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

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

Pressure Cap

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

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

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

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

Coolant Recovery System

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

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

Air Baffles and Seals

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

Water Pump

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

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

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

Thermostat

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

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

Engine Oil Cooler

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

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

Transmission Oil Cooler

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

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

Engine Electrical

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Battery Cable Ground Nut	20 N·m	15 lb ft
Battery Retainer Bolt	18 N·m	13 lb ft
Engine Harness Ground Nut	17 N·m	13 lb ft
Engine Harness Ground Stud	25 N·m	18 lb ft
Generator Bolt (RPO LSJ)	25 N·m	18 lb ft
Generator Bolt (RPOs L61/LE5)	22 N·m	16 lb ft
Generator Terminal Nut	20 N·m	15 lb ft
Junction Block Nut	17 N·m	13 lb ft
Negative Battery Cable Bolt	17 N·m	13 lb ft
Positive Battery Cable Bolt	17 N·m	13 lb ft
Starter Motor Bolt (RPO LSJ)	50 N·m	37 lb ft
Starter Motor Bolt (RPOs L61/LE5)	40 N·m	30 lb ft
Starter Solenoid Terminal Nut (RPO LSJ)	11 N·m	97 lb in
Starter Solenoid Terminal Nut (RPOs L61/LE5)	17 N·m	13 lb ft
Starter Solenoid S Terminal Nut	3 N·m	27 lb in

Battery Usage

Application	Specification
Cold Cranking Amperage (CCA)	600 A
Reserve Capacity	90 min.
Replacement Model Number	90-6YR

Generator Usage

Application	Specification
2.2L (L61), 2.4L (LE5)	
Generator Model	Denso SC0
Rated Output	115 A
Load Test Output	80 A
2.0L (LSJ)	
Generator Model	Denso SC1
Rated Output	135 A
Load Test Output	94 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.

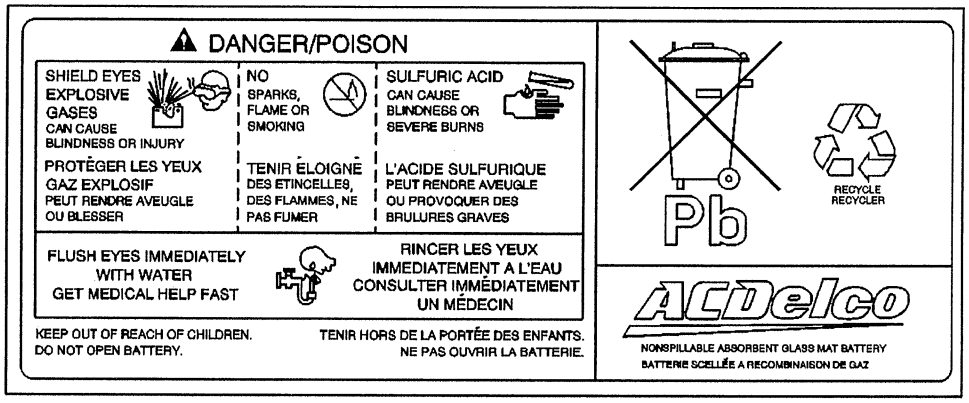
Important

Because of the materials used in the manufacture of automotive lead-acid batteries, dealers and service shops that handle them are subject to various regulations issued by OSHA, EPA, DOT, and various state or local agencies. Other regulations may also apply in other locations. Always know and follow these regulations when handling batteries.

Batteries that are no longer wanted must be disposed of by an approved battery recycler and must never be thrown in the trash or sent to a landfill.

Batteries that are not part of the vehicle itself, not the battery under the hood, must only be transported on public streets for business purposes via approved hazardous material transportation procedures.

Battery storage, charging and testing facilities in repair shops must meet various requirements for ventilation, safety equipment, material segregation, etc.



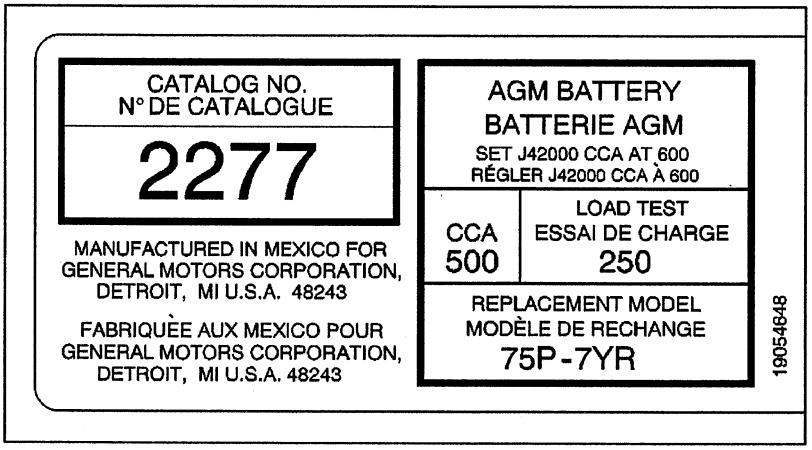
The maintenance free absorbent glass mat (AGM) battery is the standard original equipment battery. The battery is completely sealed except for one vent port in the end of the cover. The vent port allows the small amount of gas that is produced in the battery to escape when pressures exceed 2 psi. The AGM battery is a lead-acid battery that is similar to current batteries. They use glass mats that absorb electrolyte that are pressed between the plates instead of immersing the plates in electrolyte. This allows a smaller, lighter battery with the same amount of power which is less susceptible to heat.

The battery has 3 functions as a major source of energy:

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

The battery specification label (see typical figure) contains information about the following:

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



Battery Ratings

A battery has 2 ratings:

- Reserve capacity (RC)
- Cold cranking amperage (CCA)

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

The reserve capacity (RC) is an indication of the battery's ability to produce a relatively low amount of current over a long period of time. The RC rating is the amount of time in minutes it takes a fully charged battery at 27°C (80°F) to reach a terminal voltage of 10.5 volts when it is being discharged at a constant rate of 25 amps. 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 underhood fuse block and the rear fuse block. The underhood fuse block provides a cable connection for the generator and a cable connection for the starter.

Starting System Description and Operation

The PG starter motors are non-repairable. It has pole pieces that are arranged around the armature. Both solenoid windings are energized. The pull-in winding circuit is completed to the ground through the starter motor. The windings work together magnetically to pull 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. Moving at the same time, the plunger also closes the solenoid switch contacts in the starter solenoid. Full battery voltage is 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 because battery voltage is 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, pinion overrun protects the armature from excessive speed until the switch is opened.

When the ignition switch is released from the START position, the START relay opens and battery voltage is removed from the starter solenoid S terminal. Current flows from the motor contacts through both windings to the ground at the end of the hold-in winding. However, the direction of the current flow through the pull-in winding is now opposite the 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, causes the starter drive assembly to disengage and the solenoid switch contacts to open simultaneously. As soon as the contacts open, the starter circuit is turned off.

Circuit Description

Moving the ignition switch to the START position signals the body control module (BCM) through discrete inputs from the ignition transducer that engine crank has been requested. The BCM verifies that theft is not active and sends a serial data message to the engine control module (ECM)/powertrain control module (PCM) requesting engine start. The ECM/PCM receives a 12-volt signal from the park/neutral

position (PNP) switch or clutch pedal start switch notifying that it is safe to start the engine. There is a splice on this circuit in the fuse block-underhood that supplies power for the starter relay coil. The starter relay coil control circuit is then grounded by the ECM/PCM closing the switch in the starter relay suppling 12 volts to the S-terminal of the starter. Ground is supplied through the engine block.

Charging System Description and Operation with RVC

Electrical Power Management (EPM) Overview

The electrical power management (EPM) system is designed to monitor and control the charging system and send diagnostic messages to alert the driver of possible problems with the battery and generator. This EPM system primarily utilizes existing on-board computer capability to maximize the effectiveness of the generator, to manage the load, improve battery state-of-charge (SOC) and life, and minimize the system's impact on fuel economy. The EPM system performs 3 functions:

- It monitors the battery voltage and estimates the battery condition.
- It takes corrective actions by adjusting the regulated voltage.
- It performs diagnostics and driver notification.

The battery's condition is estimated during key-off and during key-on. During key-off the SOC of the battery is determined by measuring the open-circuit voltage. The SOC is a function of the acid concentration and the internal resistance of the battery, and is estimated by reading the battery open circuit voltage when the battery has been at rest for several hours.

The SOC can be used as a diagnostic tool to tell the customer or the dealer the condition of the battery. Throughout key-on, the algorithm continuously estimates SOC based on adjusted net amp hours, battery capacity, initial SOC, and temperature.

While running, the battery's degree of discharge is primarily determined by a battery current sensor, which is integrated to obtain net amp hours.

In addition, the EPM function is designed to perform regulated voltage control (RVC) to improve battery SOC, battery life, and fuel economy. This is accomplished by using knowledge of the battery's SOC and temperature to set the charging voltage to an optimum battery voltage level for recharging without detriment to battery life.

The Charging System Description and Operation is divided into 3 sections. The first section describes the charging system components and their integration into the electrical power management (EPM). The second section describes charging system operation. The third section describes the instrument panel cluster (IPC) operation of the charge indicator, driver information center (DIC) messages, and voltmeter operation.

Charging System Components

Generator

The generator is a serviceable component. If there is a diagnosed failure of the generator it must be replaced as an assembly. The engine drive belt drives the generator. When the rotor is spun it induces an alternating current (AC) into the stator windings. The AC voltage is then sent through a series of diodes for rectification. The rectified voltage has been converted into a direct current (DC) for use by the vehicles electrical system to maintain electrical loads and the battery charge. The voltage regulator integral to the generator controls the output of the generator. It is not serviceable. The voltage regulator controls the amount of current provided to the rotor. If the generator has field control circuit failure, the generator defaults to an output voltage of 13.8 volts.

Body Control Module (BCM)

The body control module (BCM) is a GM LAN device. It communicates with the engine control module (ECM) and the instrument panel cluster (IPC) for electrical power management (EPM) operation. The BCM determines the output of the generator and sends the information to the ECM for control of the generator field control circuit. It monitors the generator field duty cycle signal circuit information sent from the ECM for control of the generator. It monitors a battery current sensor, the battery positive voltage

circuit, and estimated battery temperature to determine battery state-of-charge (SOC). The BCM performs idle boost and load management operations.

Battery Current Sensor

The battery current sensor is a serviceable component that is connected to the negative battery cable at the battery. The battery current sensor is a 3-wire hall effect current sensor. The battery current sensor monitors the battery current. It directly inputs to the BCM. It creates a 5-volt pulse width modulation (PWM) signal of 128 Hz with a duty cycle of 0-100 percent. Normal duty cycle is between 5-95 percent. Between 0-5 percent and 95-100 percent are for diagnostic purposes.

Engine Control Module (ECM)

The ECM directly controls the generator field control circuit input to the generator. It monitors the generators generator field duty cycle signal circuit and sends the information to the BCM. The ECM will override the BCM control of the generator when one of the following conditions are met:

- The engine cooling fans are on high speed.
- There is a high fuel demand.
- The calculated ambient air temperature is less that 0°C (32°F).

Instrument Panel Cluster (IPC)

The IPC provides a means of customer notification in case of a failure and a voltmeter. There are 2 means of notification, a charge indicator and a driver information center (DIC) message of SERVICE CHARGING SYSTEM and CHARGING SYSTEM FAULT.

Charging System Operation

The purpose of the charging system is to maintain the battery charge and vehicle loads. There are 6 modes of operation and they include:

- Charge Mode
- Fuel Economy Mode
- Voltage Reduction Mode
- Start-up Mode
- Windshield Deice Mode
- Battery Sulfation Mode

The engine control module (ECM) controls the generator through the generator L-terminal control circuit. The signal is a 5-volt pulse width modulation (PWM) signal of 128 Hz with a duty cycle of 0-100 percent. Normal duty cycle is between 5-95 percent. Between 0-5 percent and 95-100 percent are for diagnostic purposes. The following table shows the commanded duty cycle and output voltage of the generator:

Commanded Duty Cycle	Generator Output Voltage
10%	11 V
20%	11.56 V
30%	12.12 V
40%	12.68 V
50%	13.25 V
60%	13.81 V
70%	14.37 V
80%	14.94 V
90%	15.5 V

The generator provides a feedback signal of the generator voltage output through the generator field duty cycle signal circuit to the ECM. This information is sent to the body control module (BCM). The signal is a 12-volt PWM signal of 128 Hz with a duty cycle of 0-100 percent. Normal duty cycle is between 5-99 percent. Between 0-5 percent and 100 percent are for diagnostic purposes.

Charge Mode

The BCM will enter Charge Mode when ever one of the following conditions are met:

- The interpreted fuel rate is greater than 21 g/s and the throttle position is greater than 90 percent.
- The headlamps are ON, low or high beam.
- The wipers are ON for more than 8 seconds.
- The electric cooling fans are on high speed.
- The rear defogger is ON.

Once one of these conditions are met, the generator battery control module will set the targeted generator output voltage to 13.4 volts and then ramp that voltage up to 14.5 volts at a rate of 50 mV per second.

Fuel Economy Mode

The BCM will enter Fuel Economy Mode when the calculated ambient air temperature is above 0°C (32°F), the calculated battery current is less than 15 amps and greater than -8 amps, and the battery state-of-charge (SOC) is greater than 80 percent. Its targeted generator output voltage is 13 volts. The BCM will exit this mode once the criteria are met for Charge Mode.

Voltage Reduction Mode

The BCM will enter Voltage Reduction Mode when the calculated ambient air temperature is above 0°C (32°F); the calculated battery current is less than 2 amps and greater than -7 amps, and the generator field duty cycle is less than 99 percent. Its targeted generator output voltage is 12.9 volts. The BCM will exit this mode once the criteria are met for Charge Mode.

Start-up Mode

After the engine has started, the BCM sets a targeted generator output voltage of 14.5 volts for 20 seconds.

Windshield Deice Mode

After the engine has run for more than 10 seconds, the BCM sets a targeted generator output voltage of 13.8 volts if the calculated ambient air temperature is less that 0°C (32°F). The BCM will stay in this mode until the engine coolant temperature (ECT) reaches 75°C (167°F) for 10 minutes.

Battery Sulfation Mode

The BCM will enter this mode when the interpreted generator output voltage is less than 13.2 volts for 45 minutes. Once in this mode, the BCM will set a targeted output voltage of 13.8 volts for 5 minutes. The BCM will then determine which mode to enter depending on voltage requirements.

Instrument Panel Cluster (IPC) Operation

Charge Indicator Operation

The instrument panel cluster (IPC) illuminates the charge indicator in the message center when the one or more of the following occurs:

- The engine control module (ECM) detects that the generator output is less than 11 volts or greater than 16 volts. The IPC receives a serial data message from the ECM requesting illumination.
- The IPC determines that the system voltage is less than 11 volts or greater than 16 volts for more than 30 seconds. The IPC receives a serial data message from the body control module (BCM) indicating there is a system voltage range concern.
- The IPC performs the displays test at the start of each ignition cycle. The indicator illuminates for approximately 3 seconds.
- The ignition is ON, with the engine OFF.

Charging System Failure

The BCM and the ECM will send a serial data message to the IPC for the CHARGING SYSTEM FAILURE message to be displayed. It is commanded ON when a charging system DTC is a current DTC. The message is turned OFF when the conditions for clearing the DTC have been met.

Battery Voltage

The IPC displays the system voltage as received from the BCM over the serial data circuit. If there is no communication with the BCM, then the display will read all dashes until communication is restored.

Battery Saver Active

The BATTERY SAVER ACTIVE message will display on the driver information center (DIC) when the vehicle enters a load shed 2 event. Refer to for load shed 2 setting criteria.

Charging System Description and Operation without RVC

Generator

The generator features the following major components:

- The dual "Y" stator
- The rectifier bridge
- The rotor with slip rings and brushes
- A decoupler 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 powertrain control module (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.

Charging System Indicator

The instrument panel cluster (IPC) illuminates the charge indicator in the message center when the following occurs:

- The powertrain control module (PCM) detects that the generator output is less than 11 volts or greater than 16 volts. The IPC receives a serial data message from the PCM requesting illumination.
- The IPC determines that the system voltage is less than 11 volts or greater than 16 volts. The IPC receives a serial data message from the body control module (BCM) indicating the system voltage.
- The IPC performs the displays test at the start of each ignition cycle. The indicator illuminates for approximately 3 seconds.
- The ignition is ON, with the engine OFF.

Engine Controls

Fuel System Specifications – All Engines

If your vehicle has the 2.2L or 2.4L L4 engine, use regular unleaded gasoline with a posted octane of 87 or higher. If the octane is less than 87, you may get a heavy knocking noise when you drive. If this occurs, use a gasoline rated at 87 octane or higher as soon as possible. Otherwise, you might damage your engine. A little pinging noise when you accelerate or drive uphill is considered normal. This does not indicate a problem exists or that a higher-octane fuel is necessary. If you are using 87 octane or higher-octane fuel and hear heavy knocking, your engine needs service.

If your vehicle has the 2.0L L4 Supercharged engine, use premium unleaded gasoline with a posted octane of 91 or higher for best performance. You may also use middle grade or regular unleaded gasoline rated at 87 octane or higher, but your vehicle's acceleration may be slightly reduced. If the octane is less than 87, you may get a heavy knocking noise when you drive. If this occurs, use a gasoline rated at 87 octane or higher as soon as possible. Otherwise, you might damage your engine.

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.

Engine Controls - 2.0L

Ignition System Specifications

Application	Specification	
	Metric	English
Ignition Type	Coil-On-Plug	
Firing Order	1-3-4-2	
Spark Plug Type	GM P/N 12787099	
Spark Plug Torque	25-30 N·m	18.4-22.1 lb ft
Spark Plug Gap	1 mm	0.04 in

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accelerator Pedal Position Assembly Bolts	9 N·m	80 lb in
Air Cleaner Assembly Attaching Screws	3 N·m	27 lb in
Air Cleaner Assembly Bolts	10 N·m	89 lb in
Air Cleaner Intake Duct Assembly Bolt	10 N·m	89 lb in
Air Cleaner Intake Duct Clamp	5 N·m	44 lb in
BARO Sensor	10 N·m	89 lb in
Boost Control Solenoid Bolt	10 N·m	89 lb in
Bypass Vavle Actuator Bolt	10 N·m	89 lb in
CKP Sensor Stud	22 N·m	16 lb ft
Coolant Overflow Pipe	8 N·m	71 lb in
Engine Coolant Temperature (ECT) Sensor	22 N·m	16 lb ft
Engine Identification Cover Nuts	10 N·m	89 lb in
EVAP Canister Purge Valve Mounting Bracket Nut	8 N·m	71 lb in
EVAP Canister Retaining Bolt	10 N·m	89 lb in
Fuel Filler Hose Clamp	4.5 N·m	40 lb in
Fuel Filler Pipe Attaching Screw	10 N·m	89 lb in
Fuel Filler Pipe Lower Retaining Bolt	10 N·m	89 lb in
Fuel Filter Retaining Bolt	10 N·m	89 lb in
Fuel Rail Studs	10 N·m	89 lb in
Fuel Supply Line Fitting	14 N·m	10 lb ft
Fuel Tank Strap Bolts	25 N·m	18 lb ft
Heated Oxygen Sensor (HO2S) 1	30 N·m	22 lb ft
Heated Oxygen Sensor (HO2S) 2	41 N·m	30 lb ft
Ignition Coil Cover Screws	8 N·m	71 lb in
Intake Air Temperature (IAT) Sensor Bolt	10 N·m	89 lb in
Knock Sensor (KS) Bolt	25 N·m	18 lb ft
Manifold Absolute Pressure (MAP) Sensor Bolt	10 N·m	89 lb in
Mass Air Flow (MAF) Sensor Screws	2 N·m	18 lb in
Rear Brake Hose Bracket Nut	10 N·m	89 lb in
Spark Plugs	20 N·m	15 lb in
Throttle Body Attaching Bolts	10 N·m	89 lb in

Engine Controls - 2.2L (L61)

Ignition System Specifications

Application	Specification	
	Metric	English
Ignition Type	Waste spark cassette w/compression sense	
Firing Order	1-3-4-2	
Primary Coil Current Output	8.5-9.5 Amps	
Spark Plug Torque	20 N·m	15 lb ft
Spark Plug Gap	1.06 mm	0.042 in
Spark Plug Type	GM P/N 12569190 or 41-981--AC plug type	

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accelerator Cable Bracket Bolts	10 N·m	89 lb in
Accelerator Pedal Retaining Nuts	10 N·m	89 lb in
Air Cleaner Assembly Attaching Nut	10 N·m	89 lb in
Air Cleaner Intake Duct Assembly Bolt	10 N·m	89 lb in
Air Cleaner Intake Duct Clamp	5 N·m	44 lb in
Air Cleaner Outlet Resonator Clamp	5 N·m	44 lb in
Bypass Valve Actuator Bolt	10 N·m	89 lb in
CKP Sensor Bolt	8 N·m	71 lb in
Engine Control Module (ECM) Harness Connector Bolt	4 N·m	35 lb in
Engine Coolant Temperature (ECT) Sensor	10 N·m	89 lb in
EVAP Canister Purge Valve Mounting Bracket Nut	8 N·m	71 lb in
EVAP Canister Retaining Bolt	10 N·m	89 lb in
Fuel Filler Hose Clamp	4.5 N·m	40 lb in
Fuel Filler Pipe Attaching Screw	10 N·m	89 lb in
Fuel Filler Pipe Lower Retaining Bolt	10 N·m	89 lb in
Fuel Filter Retaining Bolt	10 N·m	89 lb in
Fuel Rail Studs	10 N·m	89 lb in
Fuel Supply Line Fitting	10 N·m	89 lb in
Fuel Tank Strap Bolts	25 N·m	18 lb ft
Heated Oxygen Sensor (HO2S) 1	30 N·m	22 lb ft
Heated Oxygen Sensor (HO2S) 2	41 N·m	30 lb ft
Idle Air Control (IAC) Valve Screw	3 N·m	27 lb in
Ignition Coil Housing Retaining Bolts	10 N·m	89 lb in
Ignition Control Module (ICM) Screws	1.5 N·m	13 lb in
Knock Sensor (KS)	25 N·m	18 lb ft
Mass Air Flow Sensor Bolt	10 N·m	89 lb in
Rear Brake Hose Bracket	10 N·m	89 lb in
Spark Plugs	20 N·m	15 lb in
Throttle Body Attaching Bolts	10 N·m	89 lb in
Throttle Position (TP) Sensor Mounting Screw	2 N·m	18 lb in

Engine Controls - 2.4L

Ignition System Specifications

Application	Specification	
	Metric	English
Firing Order	1-3-4-2	
Spark Plug Torque	20 N·m	15 lb ft
Spark Plug Gap	1.06 mm	0.042 in
Spark Plug Type	GM P/N 12569190 or 41-981--AC plug type	

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accelerator Pedal Bolt	10 N·m	89 lb in
Air Cleaner Intake Duct Bolt	10 N·m	89 lb in
Air Cleaner Nut	10 N·m	89 lb in
Air Cleaner Outlet Duct Clamp	5 N·m	44 lb in
Camshaft Position (CMP) Actuator Solenoid Valve Bolt	10 N·m	89 lb in
Camshaft Position (CMP) Sensor Bolt	10 N·m	89 lb in
Crankshaft Position (CKP) Sensor Bolt	10 N·m	89 lb in
Engine Coolant Temperature (ECT) Sensor	10 N·m	89 lb in
Evaporative Emission (EVAP) Canister Purge Valve Bracket Nut	18 N·m	13 lb ft
Evaporative Emission (EVAP) Canister Bolt	10 N·m	89 lb in
Exhaust Manifold Heat Shield Stud	22 N·m	16 lb ft
Fuel Fill Hose Clamp	4.5 N·m	40 lb in
Fuel Fill Pipe Bolt	10 N·m	89 lb in
Fuel Fill Pipe Lower Bolt	10 N·m	89 lb in
Fuel Filter Bracket Bolt	10 N·m	89 lb in
Fuel Rail Bolt	10 N·m	89 lb in
Fuel Tank Strap Bolt	25 N·m	18 lb ft
Heated Oxygen Sensor (HO2S)	42 N·m	31 lb ft
Ignition Coil Bolt	10 N·m	89 lb in
Knock Sensor (KS)	25 N·m	18 lb ft
Mass Air Flow (MAF)/Intake Air Temperature (IAT) Sensor Screw	10 N·m	89 lb in
Rear Brake Hose Bracket Nut	10 N·m	89 lb in
Spark Plug	20 N·m	15 lb in
Throttle Body Bolt	10 N·m	89 lb in

Exhaust System

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Catalytic Converter-to-Exhaust Manifold Nuts	50 N·m	37 lb ft
Catalytic Converter-to-Muffler Pipe Nut	30 N·m	22 lb ft
Exhaust Clamp Nut	45 N·m	33 lb ft
Exhaust Manifold Heat Shield Stud	22 N·m	16 lb ft
Exhaust Manifold Nut	14 N·m	10 lb ft
Heater Oxygen Sensor (HO2S)	42 N·m	31 lb ft
Heat Shield Nut	10 N·m	89 lb in
Positive Crankcase Ventilation (PCV) Vent Tube Bolt/Nut (RPO LSJ)	10 N·m	89 lb in
Secondary Air Injection (AIR) Outlet Hose/Pipe Bracket Bolt (RPO L61)	20 N·m	15 lb ft
Secondary Air Injection (AIR) Outlet Hose/Pipe Bracket Nut (RPO L61)	10 N·m	89 lb in
Wheel Drive Shaft Heat Shield Bolt (to Engine Block)	30 N·m	22 lb ft
Wheel Drive Shaft Heat Shield Bolt (to Transaxle Mount Bracket)	10 N·m	89 lb in

Exhaust System Description

Important

Use of non-OEM parts may cause driveability concerns.

The exhaust system carries exhaust gases, treated by the catalytic converter, through a resonator, if applicable and into the exhaust muffler where exhaust noise is lessened.

In order to secure the exhaust pipe to the exhaust manifold, a flange and seal-joint coupling is utilized. The exhaust system may utilize a slip-joint coupling design with a clamp and a U-bolt or a flange connection with a gasket.

Exhaust hangers and rubber insulators help to support the weight of the exhaust pipe along with insulating any exhaust system vibration, rattle, or noise.

Exhaust hangers also space the exhaust system away from the underbody of the vehicle and allows the exhaust system to expand as the exhaust system warms up.

Exhaust heat shields are used to protect the body and other components from damage due to the heat from the exhaust system.

The exhaust system may be comprised of the following components:

- Exhaust manifold
- Exhaust pipes
- Catalytic converters
- Exhaust muffler
- Exhaust resonator, if equipped
- Exhaust tail pipe, if equipped
- Exhaust hangers
- Exhaust heat shields

Resonator

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

Catalytic Converter

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

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

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

The catalyst in the converter is not serviceable.

Muffler

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

Transmission/Transaxle Description and Operation

Manual Transmission - Getrag 5-Speed

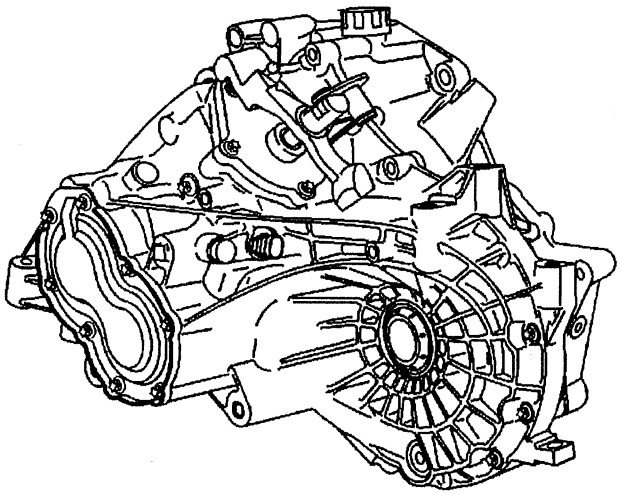
Fastener Tightening Specifications

Application	Specification	
	Metric	English
Drain Plugs	38 N·m	28 lb ft
Front Transmission Mount Bolts	50 N·m	37 lb ft
Front Transmission Mount Through Bolt	100 N·m	74 lb ft
Heat Shield to Engine Block Bolt	30 N·m	22 lb ft
Heat Shield to Transmission Mount Bolt	10 N·m	89 lb in
Intermediate Shaft Bolt	100 N·m	74 lb ft
Rear Cover Bolts	25 N·m	18 lb ft
Rear Transmission Mount Bracket to Transmission Bolts	60 N·m	44 lb ft
Rear Transmission Mount Through Bolt	100 N·m	74 lb ft
Rear Transmission Mount to Frame Bolts	60 N·m	44 lb ft
Reverse Lockout Bolt	6 N·m	53 lb in
Reverse Switch	18 N·m	13 lb ft
Ring Gear	90 N·m	66 lb ft
Side Transmission Mount Bolts	45 N·m	33 lb ft
Side Transmission Mount to Mid-Rail Bolts	34 N·m	25 lb ft
Shaft Bolts	100 N·m	74 lb ft
Shift Cable Attachment Nut	10 N·m	89 lb in
Shift Control Nuts	25 N·m	18 lb ft
Shifter Guide Bolt	25 N·m	18 lb ft
Shifter Retaining Bolts	25 N·m	18 lb ft
Speed Sensor	12 N·m	106 lb in
Transmission Housing Bolts	27 N·m	20 lb ft
UBEC Bracket Bolts	25 N·m	18 lb ft
UBEC Bracket Nuts	10 N·m	89 lb in
UBEC Positive Post	10 N·m	89 lb in

Lubrication Specifications

Application	Specification	
	Metric	English
DEXRON®III	1.7 liters	1.8 quarts

Transmission General Description



The Getrag 5 Speed is a 5 speed manual transmission assembly.

Important

Use only DEXRON®III Automatic Transmission Lubricant for this manual transmission assembly. Other lubricants or additives may affect the shift performance.

The Getrag 5 Speed manual transmission has the following features:

- First and second gear double coned synchronizer
- Third, fourth, and fifth gear single coned synchronizer
- Reverse synchronized
- Three shaft design consisting of an input shaft, output shaft, and intermediate shaft
- Reverse inhibit feature
- One piece clutch actuator - no bleed screw
- Transmission venting system is part of the fill cap
- First gear ratio is 3.58
- Second gear ratio is 2.02
- Third gear ratio is 1.35
- Fourth gear ratio is 0.98
- Fifth gear ratio is 0.69
- Reverse gear ratio is 3.31
- Final drive ratio is 3.94
- Vehicle speed sensor (VSS)

The manual transmission shift cables must be adjusted for proper shifter performance.

Manual Transaxle MU3

Fastener Tightening Specifications

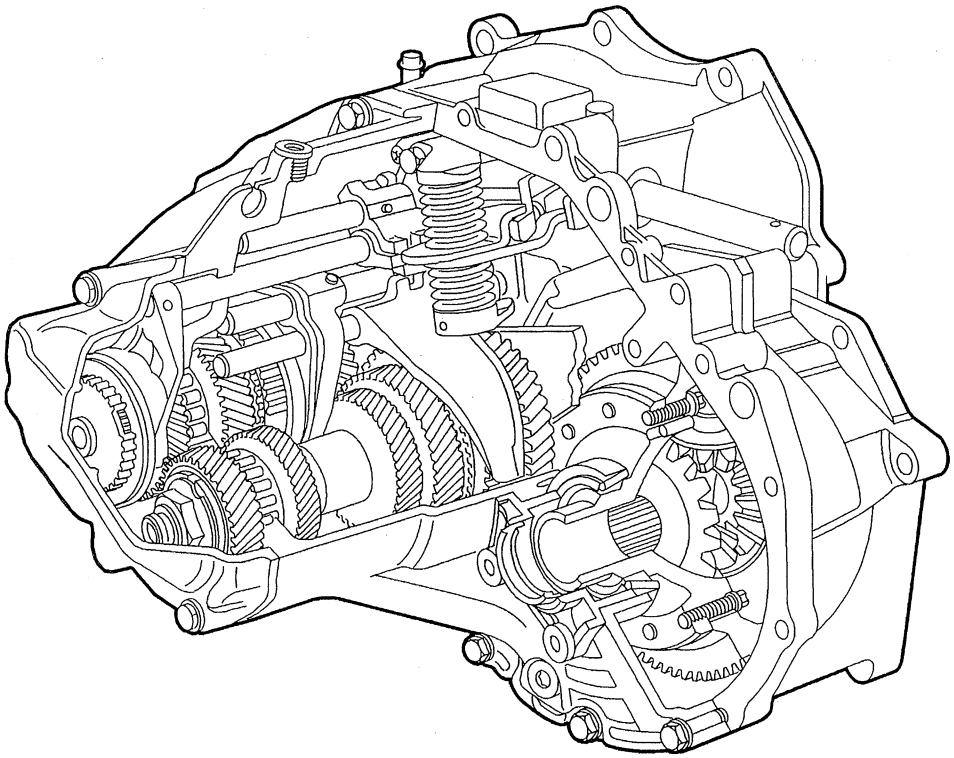
Application	Specification	
	Metric	English
Backup Lamp Switch	24 N·m	18 lb ft
Ball Stud Into Steering Knuckle	100 N·m	75 lb ft
Battery Cable Terminals	17 N·m	13 lb ft
Battery Feed Cable-to-Underhood Fuse Block	16 N·m	12 lb ft
Battery Hold Down Bracket Fasteners	20 N·m	15 lb ft
Battery Tray Fasteners	15 N·m	11 lb ft
Console Front Fasteners	2.5 N·m	22 lb in
Console Rear Fasteners	2.5 N·m	22 lb in
Control Asm Rod-to-Control Lever Asm Pinch Bolt		
First Pass	12 N·m	106 lb in
Final Pass	180 degrees	
Control Asm-to-Floor Pan Bolts	8 N·m	71 lb in
Control Shaft Lever Pivot Pin Bracket-to-Transaxle Bolts	24 N·m	18 lb ft
Differential Bearing Retainer-to-Transaxle Bolts	24 N·m	18 lb ft
Exhaust Manifold Pipe-to-Exhaust Manifold	30 N·m	25 lb ft
Exhaust Manifold Pipe-to-Exhaust Manifold Nuts	50 N·m	37 lb ft
Exhaust Manifold-to-Resonator	20 N·m	15 lb ft
Fluid Level Check and Fill Plug	50 N·m	37 lb ft
Frame-to-Body Bolts		
First Pass	90 N·m	60 lb ft
Second Pass	45 degrees	
Final Pass	60 degrees	
Front Transaxle Mount Through Bolt	55 N·m	41 lb ft
Front Transaxle Mount-to-Transaxle	55 N·m	41 lb ft
Input Shaft Bearing Retainer Bolts	38 N·m	28 lb ft
Left Transaxle Mount Bolts	55 N·m	41 lb ft
Left Transaxle Mount Bracket-to-Transaxle Bolt	55 N·m	41 lb ft
Linkage Installer J 44015-to-Seat Tie Rod Ends	45 N·m	35 lb ft
Lower Control Arm Ball Stud Bolt and Nut-to-Steering Knuckle	100 N·m	75 lb ft
O2 Sensor Clamp-to-Heat Shield	4 N·m	35 lb in
Output Shaft Bearing Retainer Bolts-Inner	45 N·m	33 lb ft
Output Shaft Bearing Retainer Bolts-Outer	24 N·m	18 lb ft
Rear Cover-to-Transaxle Bolts	24 N·m	18 lb ft
Rear Transaxle Mount Through Bolt	90 N·m	66 lb ft
Rear Transaxle Mount-to-Frame Bolts	60 N·m	44 lb ft
Rear Transaxle Mount-to-Transaxle	55 N·m	41 lb ft
Reverse Idler Gear Shaft Bolt	24 N·m	18 lb ft
Reverse Idler Gear Shaft Bracket Bolt	24 N·m	18 lb ft
Reverse Shift Lever Bolts	24 N·m	18 lb ft
Right Front Lower Splash Shield to Frame Assembly	5 N·m	44 lb in
Slave Cylinder Fasteners	10 N·m	89 lb in
Stabilizer Bar Links-to-Strut Assemblies	65 N·m	50 lb ft
Steering Gear-to-Frame		
First Pass	45 N·m	35 lb ft
Final Pass	90 degrees	
Tie Rod End-to-Steering Knuckle	60 N·m	45 lb ft
Transaxle Case-to-Clutch Housing Bolts	24 N·m	18 lb ft
Transaxle Drain Plug	50 N·m	37 lb ft

Application	Specification	
	Metric	English
Transaxle Fill Plug	50 N·m	37 lb ft
Transaxle Level Plug	50 N·m	37 lb ft
Transaxle Shift Control Shaft Block	24 N·m	18 lb ft
Transaxle-to-Engine Bolts	65 N·m	48 lb ft
Underhood Fuse Block Case Bolt	9 N·m	80 lb in
Wheel Bolts, Final Torque	125 N·m	92 lb ft
Wheel Bolts, Initial Torque	63 N·m	46 lb ft

Lubrication Specifications

Service Procedure	Capacities	
	Liters	Quarts
Dry - Lubricant P/N 21018899	1.9	2.0

Transmission System Description and Operation

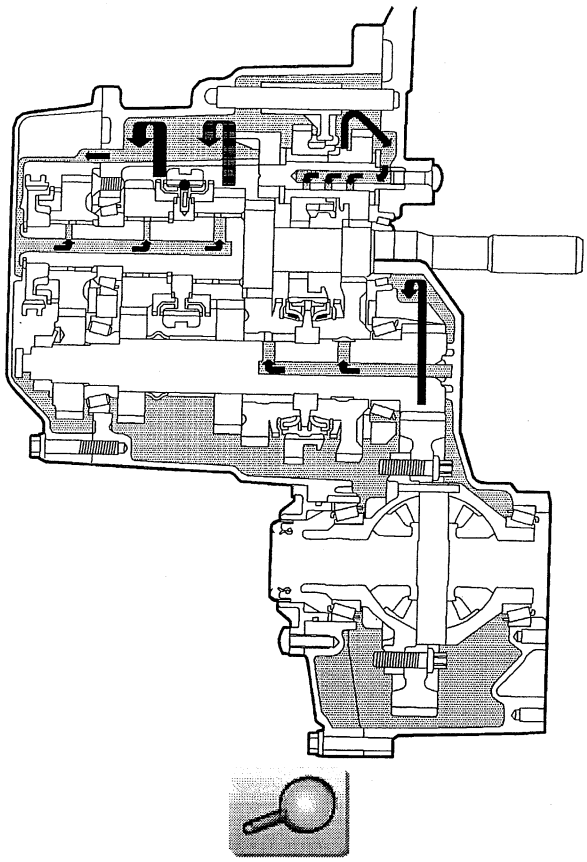


The 5 speed manual transaxle assembly consists of a differential assembly and a constant mesh design transaxle in a single case. All forward gears are in constant mesh. Synchronizers with blocking rings, controlled by shift forks, are used for ease of shifting and selection of desired gear range.

All fundamental components, including the transaxle case, clutch housing, input shaft, output shaft, and differential assembly are supported by tapered roller bearings. Pre-loading of the bearings is required.

The transaxle is filled with transaxle fluid at the factory and requires no routine oil changes.

Lubrication Flow



A common sump supplies oil for the manual transaxle. When the manual transaxle is operating normally, the differential assembly, together with 1st and 2nd gears, splash oil from the sump to oil pockets in the transaxle case. From these pockets, oil travels into channels in the input and output shafts and lubricates all gear bearings. Reverse gear has its own lubrication system. First gear splashes oil into a pocket in the clutch housing. From there, oil travels through the reverse idler gear shaft to lubricate the reverse gear components.

Power Flow

Neutral

In neutral, with the engine running and the clutch engaged, the input shaft will turn. With the 1st/2nd, 3rd/4th, and 5th/Rev synchronizers in a neutral position, power will not flow to the output shaft.

1st Gear

In 1st gear range, the 3rd/4th and 5th/Rev synchronizers are in neutral and the 1st/2nd synchronizer sleeve is moved toward the 1st gear blocking ring and 1st gear on the counter shaft. Because the 1st/2nd synchronizer hub is splined to the counter shaft, torque is transmitted from the input shaft 1st gear through the counter shaft 1st gear, synchronizer sleeve and hub, counter shaft 3rd gear, output shaft 3rd gear, and into the differential (final drive) assembly.

2nd Gear

In 2nd gear range, the 3rd/4th and 5th/Rev synchronizers are in neutral and the 1st/2nd synchronizer sleeve is moved toward the 2nd gear blocking ring and 2nd gear on the counter shaft. Since the 1st/2nd synchronizer hub is splined to the counter shaft, torque is transmitted from the input shaft 2nd gear through the counter shaft 2nd gear, synchronizer sleeve and hub, counter shaft 3rd gear, output shaft 3rd gear, and into the differential (final drive) assembly.

3rd Gear

In 3rd gear range, the 1st/2nd and 5th/Rev synchronizers are in a neutral, and the 3rd/4th synchronizer sleeve is moved toward the 3rd gear blocking ring and 3rd gear on the input shaft. Since the 3rd/4th synchronizer hub is splined to the input shaft, torque is transmitted from the input shaft through the synchronizer hub and sleeve, 3rd drive gear, 3rd driven gear, output shaft, and into the differential (final drive) assembly.

4th Gear

In 4th gear range, the 1st/2nd and 5th/Rev synchronizers are in neutral and the 3rd/4th synchronizer sleeve is moved toward the 4th gear blocking ring and 4th gear on the input shaft. Since the 3rd/4th synchronizer hub is splined to the input shaft, torque is transmitted from the input shaft through the synchronizer hub and sleeve, 4th drive gear, 4th driven gear, output shaft, and into the differential (final drive) assembly.

5th Gear

In 5th gear range, the 1st/2nd and 3rd/4th synchronizers are in a neutral position and the 5th/Rev synchronizer sleeve is moved toward the 5th gear blocking ring and 5th gear on the output shaft. Since the 5th/Rev synchronizer hub is splined to the output shaft, torque is transmitted from the input shaft through the 5th drive gear, 5th driven gear, synchronizer sleeve and hub, output shaft, and into the differential (final drive) assembly.

Reverse

In reverse gear range, the 1st/2nd and 3rd/4th synchronizers are in neutral and the 5th/Rev synchronizer sleeve is moved toward the reverse gear blocking ring and the reverse gear on the output shaft. Since the 5th/Rev synchronizer hub is splined to the output shaft, torque is transmitted from the input shaft through the input shaft 1st drive gear, counter shaft 1st gear, reverse driven gear, synchronizer sleeve and hub, output shaft, and into the differential (final drive) assembly.

Clutch

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Clutch Actuator Bolts	10 N·m	89 lb in
Clutch Cover to Flywheel Bolts	30 N·m	22 lb ft
Clutch Pedal Bracket Nuts	10 N·m	89 lb in
Clutch Pedal Pivot Nut	10 N·m	89 lb in
Coolant Reservoir Attaching Nut	15 N·m	11 lb ft

Hydraulic Clutch Description

Clutch Spin Down Time

Check the clutch spin down time as follows:

1. Apply the parking brake. Block the vehicle wheels.
2. Shift the manual transmission into neutral.
3. Start the engine. Run the engine at idle speed.
4. Engage the clutch.
5. Disengage the clutch. Wait 9 seconds.
6. Shift the transmission into reverse.

Clutch Driving Members

The clutch driving members are two flat surfaces machined to a smooth finish. They are:

1. The rear face of the engine flywheel
2. The front face of the clutch pressure plate

Clutch Driven Members

The driven member is the clutch driven plate. The clutch driven plate has a splined hub. The splined hub slides lengthwise along the splines of the input shaft. The splined hub drives the input shaft through these same splines. The driving and driven members are held together with a spring pressure. This pressure is exerted by a diaphragm spring in the clutch pressure plate.

Hydraulic Clutch Fluid

Notice

Do not use mineral or paraffin-base oil in the clutch hydraulic system. These fluids may damage the rubber parts in the cylinders.

When refilling the system or adding fluid after service, use GM Delco Supreme No. 2 Brake Fluid, or equivalent that meets DOT 3 specifications.

Hydraulic Clutch Operating Members

The clutch system consists of the following components:

- A master cylinder with a reservoir
- A switch
- An concentric slave cylinder connected to hydraulic tubing
- Pressure Plate
- Clutch Cover
- Diaphragm Springs
- Release Bearing
- Clutch Disc
- Torsional Springs

With the depression of the clutch pedal, the clutch master cylinder becomes pressurized from the force of the push rod into the master cylinder. This forces hydraulic fluid into the tubing from the master cylinder to the concentric slave cylinder. The concentric slave cylinder then engages by pushing the releasing bearing into the diaphragm spring and release the clutch. A hole in the cowl panel accommodates the master cylinder. A quick connect coupling helps route the hydraulic tubing. the concentric slave cylinder is inside the transmission and on the input bearing retainer. The hydraulic control system can be replaced without having to gain access to the clutch system internal components , simply engage the quick connect coupling mounted through the transmission housing. No adjustments to the clutch system are necessary. as the clutch wears, the fluid level in the master cylinder reservoir changes to compensates for clear wear. A new system will have fluid in the reservoir. An electrical switch on the push rod has two functions: One function is a clutch interlock, ensuring the engine does not start unless the clutch pedal is engaged (positioned to the floor). The second function is to cut off the cruise-control system (if so equipped) when the clutch pedal is engaged.

Automatic Transaxle - 4T45-E

Transmission General Specifications

Name	Hydra-Matic® 4T45-E
RPO Codes	MN5 - 4T45-E
Production Location	Windsor, Ontario, Canada
Vehicle Platform Engine/Transmission Usage	A
Transmission Drive	Transverse Mounted Front Wheel Drive
Maximum Engine Torque	4T45-E 270 N·m (200 lb ft)
Maximum Shift Speed	1-2 6,500 RPM 2-3 6,500 RPM 3-4 6,500 RPM
1st Gear Ratio	2.960:1
2nd Gear Ratio	1.626:1
3rd Gear Ratio	1.000:1
4th Gear Ratio	0.681:1
Reverse	2.143:1
Torque Converter Size - Diameter of Torque Converter Turbine	245 mm
Pressure Taps	Line Pressure
Transmission Fluid Type	DEXRON® VI
Transmission Fluid Capacity - Approximate	Bottom Pan Removal: 6.5 L (6.9 qts) Complete Overhaul: 9.0 L (9.5 qts) Dry: 12.2 L (12.9 qts)
Transmission Type: 4	Four Forward Gears
Transmission Type: T	Transverse Mount
Transmission Type: 40	Product Series
Transmission Type: E	Electronic Controls
Position Quadrant	P, R, N, Overdrive, 3, 2, 1
Case Material	Die Cast Aluminum
Transmission Weight Dry	74.7 kg (164 lbs)
Transmission Weight Wet	85.0 kg (187 lbs)
Maximum Trailer Towing Capacity	487 kg (1,000 lbs)
Maximum Gross Vehicle Weight (GVW)	1,826 kg (4,100 lbs)

Ratios		
Chain	Final Drive	Effective - Overall
32/38	3.29	3.91
32/38	3.05	3.63

Fastener Tightening Specifications

Description of Usage	Specification	
	Metric	English
Bottom Pan to Case	14 N·m	124 lb in
Channel Plate to Case	14 N·m	124 lb in
Channel Plate to Case	12 N·m	106 lb in
Channel Plate to Driven Sprocket Support	14 N·m	124 lb in
Detent Spring Assembly to Channel Plate	12 N·m	106 lb in
Drive Sprocket Support Assembly to Case	12 N·m	106 lb in
Input Speed Sensor to Case	12 N·m	106 lb in
Intermediate 4th Servo Cover to Case	12 N·m	106 lb in
Line Pressure Plug to Case	12 N·m	106 lb in
Lo/Reverse Servo Cover to Case	12 N·m	106 lb in
Oil Level Control Plug to Case	12 N·m	106 lb in
Oil Tube Assembly To Case	12 N·m	106 lb in
Oil Tube Assembly to Forward Clutch	12 N·m	106 lb in
Oil Tube Assembly to Lo/Reverse Servo Cover	12 N·m	106 lb in
Output Shaft Speed Sensor to Case	12 N·m	106 lb in
Pump to Case	12 N·m	106 lb in
Pump to Channel Plate	12 N·m	106 lb in
Pump to Channel Plate	12 N·m	106 lb in
Side Cover to Case	28 N·m	22 lb ft
Side Cover to Case (Stud)	28 N·m	22 lb ft
Spacer to Driven Sprocket Support	14 N·m	124 lb in
TFP Switch Assembly to Case	14 N·m	124 lb in
TFP Switch to Channel Plate	14 N·m	124 lb in
TFP Switch to Channel Plate	14 N·m	124 lb in
Valve Body to Case	14 N·m	124 lb in
Valve Body to Case	14 N·m	124 lb in
Valve Body to Channel Plate	14 N·m	124 lb in
Wiring Harness Clip to Case	12 N·m	106 lb in

Fluid Capacity Specifications - Approximate

Application	Specification	
	Metric	English
Bottom Pan Removal	6.5 liters	6.9 quarts
Complete Overhaul	9.0 liters	9.5 quarts
Dry	12.2 liters	12.9 quarts

Transmission General Description

The 4T45-E is a fully automatic front wheel drive electronically controlled transmission. The 4T45-E provides four forward ranges including overdrive and one reverse gear range. The PCM controls shift points by means of two shift solenoids. A vane type pump supplies the oil pressure. The PCM regulates oil pressure by means of the Pressure Control Solenoid (PCS).

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

- P -- Park position prevents the vehicle from rolling either forward or backward. For safety reasons, use the parking brake in addition to the park position.
- R -- Reverse allows the vehicle to be operated in a rearward direction.
- N -- Neutral allows the engine to be started and operated while driving the vehicle. If necessary, you may select this position in order to restart the engine with the vehicle moving.
- D -- Overdrive is used for all normal driving conditions. Overdrive provides four gear ratios plus a converter clutch operation. Depress the accelerator in order to downshift for safe passing.

- 3 -- Drive position is used for city traffic, hilly terrain, and trailer towing. Drive provides three gear ranges and prevents the transmission from operating in fourth gear. Depress the accelerator in order to downshift.
- 2 -- Manual Second provides two gear ratios under most operating conditions. Manual Second provides acceleration and engine braking. You may select this range at any vehicle speed, but you cannot downshift the transmission into Second gear until the vehicle speed drops below approximately 100 km/h (62 mph).
- 1 -- Manual Lo provides maximum engine braking. You may select this range at any vehicle speed, but you cannot downshift the transmission into First gear until the vehicle speed drops below approximately 60 km/h (37 mph).

Transmission Component and System Description

The mechanical components of this unit are as follows:

- A torque converter with a torque converter clutch (TCC)
- A drive link assembly
- Intermediate/4th and Lo/Reverse friction band assemblies
- Forward, Coast, 2nd, Reverse, and Direct multiple disc clutch assemblies
- Two planetary gear sets: Input and Reaction
- Two roller clutches - Lo and 2nd
- One sprag clutch
- One vane type oil pump
- One control valve assembly
- A final drive and differential assembly

The electrical components of this unit are as follows:

- Two shift solenoid valves, 1-2 and 2-3
- A torque converter clutch pulse width modulated (TCC PWM) solenoid valve
- A transmission pressure control (PC) solenoid valve
- An automatic transmission fluid temperature (TFT) sensor
- Two speed sensors: input and output speed sensor
- An automatic transmission fluid pressure (TFP) manual valve position switch assembly
- An automatic transmission wiring harness assembly
- A park/neutral position switch

Adapt Function

Transmission Adapt Function

The 4T45-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 and Operation

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

- The automatic transmission shift lock control solenoid
- The body control module (BCM)
- The powertrain control module (PCM)

With the ignition in the ON position, battery positive voltage is supplied to the automatic transmission shift lock control solenoid. The automatic transmission shift lock control solenoid receives a ground from the BCM. When the automatic transmission shift lock control solenoid is energized, the shift lever mechanically locked in the PARK position. When the driver presses the brake pedal the PCM sends a class 2 serial data message to the BCM. The BCM turns OFF the ground control circuit and this de-energizes the automatic transmission shift lock control solenoid. When the automatic transmission shift lock control solenoid is de-energized, the shift lever may be moved out of the PARK position. The BCM determines transaxle shift lever position through a class 2 serial data message from the PCM. The PCM receives inputs from the park/neutral position switch and determines shift lever position. When the BCM receives this information and determines that the shift lever is out of the PARK position, the automatic transmission shift lock control solenoid ground is opened.

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

This page intentionally left blank.

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

This page intentionally left blank.

Fasteners

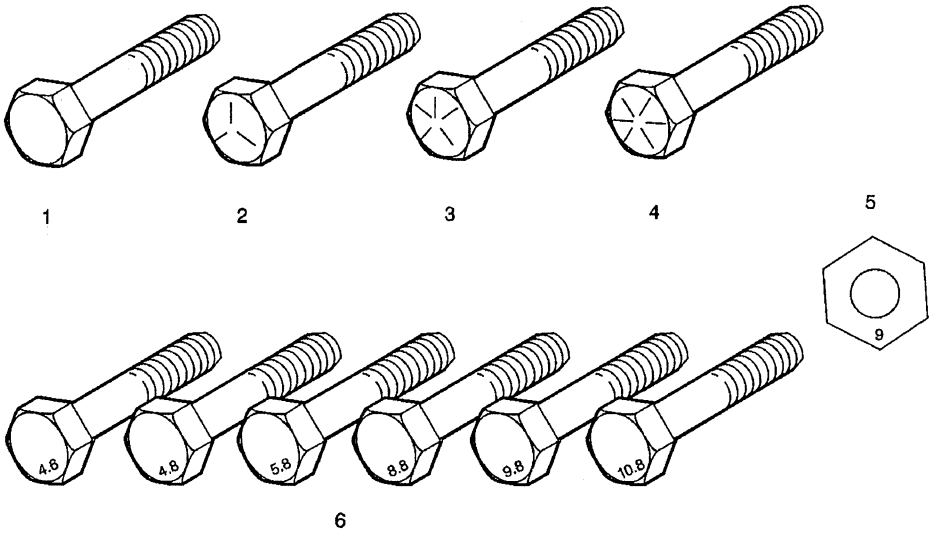
Metric Fasteners

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

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

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

Fastener Strength Identification



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

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

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

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

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

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

Prevailing Torque Fasteners

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

All Metal Prevailing Torque Fasteners

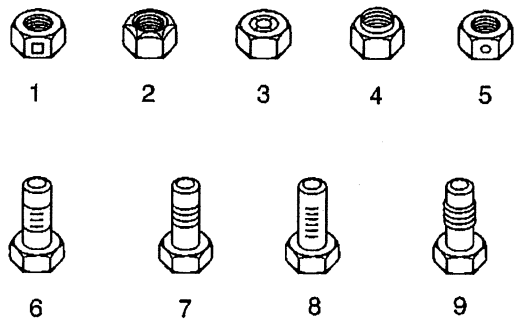
These fasteners accomplish the thread interface by a designed distortion or deformation in the fastener.

Nylon Interface Prevailing Torque Fasteners

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

Adhesive Coated Fasteners

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



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

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

A prevailing torque fastener may be reused ONLY if:

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

Metric Prevailing Torque Fastener Minimum Torque Development

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

English Prevailing Torque Fastener Minimum Torque Development

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

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

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

Free Flow RPO Code	Ref. Only RPO Code	Description	LS Coupe 1AK37	LS Sedan 1AK69	LT Coupe 1AL37		LT Sedan 1AL69		LTZ Sedan 1AZ69
			1LS	1LS	1LT	2LT	1LT	2LT	1LZ
	AK5	**Air bags,** dual-stage, frontal, driver and right front passenger, includes automatic occupant sensing **1 - Always used safety belts and proper child restraints, even with air bags. Children are safer when properly secured in a rear seat. See the Owner's Manual for more safety information.**	S[1]	S[1]	S[1]	S[1]	S[1]	S[1]	S[1]
	C67	**Air conditioning,** front manual, includes air filtration system	S	S	S	S	S	S	S
AP9		**Cargo convenience net,** trunk	A	A	S	S	S	S	S
		Console, floor, includes 2 power outlets	S	S	S	S	S	S	S
		Console, between front seats, includes adjustable armrest, storage compartment and 2 power outlets **1 - Included and only available with (MX0) Transmission, 4-speed automatic.**	--	--	A[1]	A[1]	A[1]	A[1]	S
K34		**Cruise control**, electronic with set and resume speed, steering wheel mounted	A	A	S	S	S	S	S
		Cupholders, dual front and dual rear	S	S	S	S	S	S	S
		Defogger, rear-window, electric	S	S	S	S	S	S	S
		Defogger, side windows	S	S	S	S	S	S	S
		Door locks, child security, rear	--	S	--	--	S	S	S
AU3		**Door locks,** power, includes Remote Keyless Entry, lockout protection and content theft security	A	A	S	S	S	S	S
B34		**Floormats,** carpeted, front, includes (B35) Floormats, rear	A	A	S	S	S	S	S
		Instrumentation, includes speedometer, fuel gauge, tachometer and Driver Information Center with outside temperature, warning messages and programmable menu features	S	S	S	--	S	--	S
		LATCH system, (Lower Anchors and Top tethers for CHildren), for child safety seats	S	S	S	S	S	S	S
		Lighting, interior, trunk and single dome	S	S	--	--	--	--	--
		Lighting, interior, trunk and dual reading	--	--	S	S	S	S	S
		Safety belts, 3-point, all positions	S	--	S	S	--	--	--
		Safety belts, 3-point, all positions, front height adjustable	--	S	--	--	S	S	S

Free Flow RPO Code	Ref. Only RPO Code	Description	LS Coupe 1AK37	LS Sedan 1AK69	LT Coupe 1AL37		LT Sedan 1AL69		LTZ Sedan 1AZ69
			1LS	1LS	1LT	2LT	1LT	2LT	1LZ
		Seat, driver, height adjuster, 4-way manual	S	S	S	S	S	S	S
		Seat, easy entry, front passenger	S	--	S	S	--	--	--
		Seats, front Cloth buckets, include manual recliners, adjustable head restraints and 60/40 split-bench rear with trunk pass-through	S	S	--	--	--	--	--
		Seats, front Sport Cloth buckets, include manual recliners, driver-side manual lumbar adjuster, adjustable head restraints, passenger side seatback map pocket and 60/40 split-bench rear with trunk pass-through	--	--	S	S	S	S	--
**2		**Seats,** front Leather appointed buckets, include heated seat cushions, manual recliners, driver-side manual lumbar adjuster, adjustable head restraints, passenger side seatback map pocket and 60/40 split-bench rear with trunk pass-through **1 - Requires (UQ3) Sound system feature, 7-speakers.**	--	--	A[1]	A[1]	A[1]	A[1]	S
		Shift lever, leather-wrapped **1 - Included and only available with (**2) Leather interior.**	--	--	A[1]	■	A[1]	■	S[1]
	UN0	**Sound system,** ETR AM/FM stereo with CD player, includes Radio Data System, seek-and-scan, digital clock, auto-tone control, automatic volume and TheftLock	S	S	S	S	S	S	S
	UQ4	**Sound system feature,** 4-speakers	S	S	S	S	S	S	--
UQ3		**Sound system feature,** 7-speakers, Pioneer premium amplified system with tweeters and rear subwoofer speaker **1 - Required with (**2) Seats, front Leather appointed buckets.**	--	--	A[1]	A[1]	A[1]	A[1]	S
		Steering column, tilt	S	S	S	S	S	S	S
		Steering wheel, urethane	S	S	S	--	S	--	--
UK3		**Steering wheel,** leather-wrapped with mounted audio and cruise controls	--	--	A	■	A	■	S
		Theft-deterrent system, PASSkey 3+	S	S	S	S	S	S	S
		Trunk release, remote	S	S	S	S	S	S	S
		Visors, vanity mirror, front passenger, includes driver map pocket	S	S	--	--	--	--	--
		Visors, vanity mirrors, covered, driver and front passenger, includes driver map pocket	--	--	S	S	S	S	S
		Windows, power, includes driver express-down and passenger lockout	--	--	S	S	S	S	S

Free Flow RPO Code	Ref. Only RPO Code	Description	LS Coupe 1AK37	LS Sedan 1AK69	LT Coupe 1AL37		LT Sedan 1AL69		LTZ Sedan 1AZ69
			1LS	1LS	1LT	2LT	1LT	2LT	1LZ
		Daytime running lamps	S	S	S	S	S	S	S
		Door handles, body-color	S	S	S	S	S	S	--
		Door handles, chrome	--	--	--	--	--	--	S
		Fascias, front and rear, includes body-color grille	S	S	--	--	--	--	--
		Fascias, front and rear, body-color, includes Black grille	--	--	S	S	S	S	--
		Fascias, front and rear, body-color, includes chrome grille and halogen fog lamps	--	--	--	--	--	--	S
		Glass, Solar-Ray light tinted	S	S	S	S	S	S	S
		Headlamps, halogen, includes automatic exterior lamp control	S	S	S	S	S	S	S
		Mirrors, outside rearview, manual, Black	S	S	--	--	--	--	--
		Mirrors, outside rearview, power, body-color	--	--	S	S	S	S	S
B84		**Moldings,** bodyside, body-color	A	A	S	S	S	S	--
		Moldings, bodyside, chrome	--	--	--	--	--	--	S
	QTU	**Tires,** P195/60R15, touring, blackwall	S	S	S	--	S	--	--
	QMF	**Tires,** P205/55R16, touring, blackwall	--	--	--	■	--	■	S
	PG1	**Wheels,** 15" (38.1 cm) steel, includes full bolt-on wheel covers	S	S	--	--	--	--	--
	PF7	**Wheels,** 15" (38.1 cm) aluminum	--	--	S	--	S	--	--
	PFD	**Wheels,** 16" (40.6 cm) aluminum, machine-faced	--	--	--	■	--	■	S
		Wipers, intermittent, front, speed-sensitive	S	S	S	S	S	S	S
		Battery, maintenance free, includes rundown protection, trunk-mounted	S	S	S	S	S	S	S
	J41	**Brakes,** front disc/rear drum	S	S	--	--	--	--	--
JM4		**Brakes,** 4-wheel antilock, front disc/rear drum	A	A	S	S	S	S	S
	L61	**Engine,** ECOTEC 2.2L DOHC, 16-valve, 4-cylinder, SFI (145 HP [108.1 kW] @ 5600 rpm, 155 lb.-ft. [209.3 N-m] @ 4000 rpm)	S	S	S	S	S	S	S
		Exhaust, stainless-steel	S	S	S	--	S	--	--
		Exhaust, stainless-steel, includes chrome tip	--	--	--	■	--	■	S
		Steering, electric power (EPS)	S	S	S	S	S	S	S
	FE1	**Suspension,** Premium Ride	S	S	S	S	S	S	S

Free Flow RPO Code	Ref. Only RPO Code	Description	LS Coupe 1AK37	LS Sedan 1AK69	LT Coupe 1AL37		LT Sedan 1AL69		LTZ Sedan 1AZ69
			1LS	1LS	1LT	2LT	1LT	2LT	1LZ
	NW7	**Traction Control,** all-speed **1 - Included and only available with (JM4) Brakes, 4-wheel antilock and (MX0) Transmission, 4-speed automatic.** **2 - Included and only available with (MX0) Transmission, 4-speed automatic.**	A[1]	A[1]	A[2]	A[2]	A[2]	A[2]	S
	MM5	**Transmission,** 5-speed manual, includes 3.84 axle ratio	S	S	S	S	S	S	--
MX0		**Transmission,** 4-speed automatic, electronically controlled with overdrive, includes 3.63 axle ratio	A	A	A	A	A	A	S

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

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

Free Flow RPO Code	Ref. Only RPO Code	Description	SS Coupe 1AM37	SS Sedan 1AM69	SS Supercharged Coupe 1AP37
			1SS	1SS	2SS
	AK5	**Air bags,** dual-stage, frontal, driver and right front passenger, includes automatic occupant sensing **1 - Always used safety belts and proper child restraints, even with air bags. Children are safer when properly secured in a rear seat. See the Owner's Manual for more safety information.** **2 - Automatic occupant sensing is not included on 1AP37 models. Always used safety belts and proper child restraints, even with air bags. Children are safer when properly secured in a rear seat. See the Owner's Manual for more safety information.**	S[1]	S[1]	S[2]
	C67	**Air conditioning,** front manual, includes air filtration system	S	S	S
	AP9	**Cargo convenience net,** trunk	S	S	S
		Console, floor, includes 2 power outlets	S	S	S
	K34	**Cruise control**, electronic with set and resume speed, steering wheel mounted	S	S	S
		Cupholders, dual front and dual rear	S	S	S
		Defogger, rear-window, electric	S	S	S
		Defogger, side windows	S	S	S
		Door locks, child security, rear	--	S	--
	AU3	**Door locks,** power, includes Remote Keyless Entry, lockout protection and content theft security	S	S	S
		Floormats, carpeted, front and rear	S	S	S
		Instrumentation, white-faced sport gauges, includes speedometer, fuel gauge, tachometer and Driver Information Center with outside temperature, warning messages and programmable menu features	S	S	--
		Instrumentation, titanium-faced sport gauges, includes speedometer, fuel gauge, tachometer, A-pillar mounted boost gauge and Driver Information Center with outside temperature, warning messages and programmable menu features	--	--	S
		LATCH system, (Lower Anchors and Top tethers for CHildren), for child safety seats	S	S	S
		Lighting, interior, trunk and dual reading	S	S	S
		Safety belts, 3-point, all positions	S	--	S
		Safety belts, 3-point, all positions, front height adjustable	--	S	--
		Seat, driver, height adjuster, 4-way manual	S	S	S
		Seat, easy entry, front passenger	S	--	S

Free Flow RPO Code	Ref. Only RPO Code	Description	SS Coupe 1AM37	SS Sedan 1AM69	SS Supercharged Coupe 1AP37
			1SS	1SS	2SS
		Seats, front Sport Cloth buckets, include manual recliners, driver-side manual lumbar adjuster, adjustable head restraints, passenger side seatback map pocket and 60/40 split-bench rear with trunk pass-through	S	S	--
	19*	**Seats,** front Leather appointed buckets with color-keyed perforated inserts, include manual recliners, driver-side manual lumbar adjuster, adjustable head restraints, passenger side seatback map pocket and 60/40 split-bench rear with trunk pass-through	--	--	S
		Shift lever, leather-wrapped	S	S	S
	UN0	**Sound system,** ETR AM/FM stereo with CD player, includes Radio Data System, seek-and-scan, digital clock, auto-tone control, automatic volume and TheftLock	S	S	--
US8		**Sound system,** ETR AM/FM stereo with CD player and MP3 playback, includes Radio Data System, seek-and-scan, digital clock, auto-tone control, automatic volume and TheftLock	A	A	S
	UQ4	**Sound system feature,** 4-speakers	S	S	--
UQ3		**Sound system feature,** 7-speakers, Pioneer premium amplified system with tweeters and rear subwoofer speaker **1 - Required with (**2) Seats, front Leather appointed buckets.**	A[1]	A[1]	S
		Steering column, tilt	S	S	S
	UK3	**Steering wheel,** leather-wrapped with mounted audio and cruise controls	S	S	S
		Theft-deterrent system, PASSkey 3+	S	S	S
		Trunk release, remote	S	S	S
		Visors, vanity mirrors, covered, driver and front passenger, includes driver map pocket	S	S	S
		Windows, power, includes driver express-down and passenger lockout	S	S	S
		Daytime running lamps	S	S	S
		Door handles, body-color	S	S	S
		Fascias, sport, front and rear, body-color, includes front halogen fog lamps	S	S	--
		Fascias, sport, front and rear, body-color, includes front halogen fog lamps and extensions	--	--	S
		Glass, Solar-Ray light tinted	S	S	S
		Headlamps, halogen, includes automatic exterior lamp control	S	S	S
		Mirrors, outside rearview, power, body-color	S	S	S
		Moldings, lower rocker, body-color	S	S	S
	T43	**Spoiler,** rear, deck-lid, body-color	S	S	--
		Spoiler, rear, high-mount, body-color	--	--	S

Free Flow RPO Code	Ref. Only RPO Code	Description	SS Coupe 1AM37	SS Sedan 1AM69	SS Supercharged Coupe 1AP37
			1SS	1SS	2SS
	QBU	**Tires**, P205/50R17, blackwall	S	S	--
	QTJ	**Tires,** P215/45R18, performance, blackwall	--	--	S
	PFE	**Wheels**, 17" (43.2 cm) aluminum, polished	S	S	--
	NW5	**Wheels,** 18" (45.7 cm) aluminum, painted	--	--	S
		Wipers, intermittent, front, speed-sensitive	S	S	S
		Battery, maintenance free, includes rundown protection, trunk-mounted	S	S	S
	JL9	**Brakes,** 4-wheel antilock, 4-wheel disc	S	S	S
	LE5	**Engine**, ECOTEC 2.4L DOHC, 4-cylinder, SFI, (171 HP [127.5 kW] @ 6200 rpm, 163 lb-ft [220.1 N-m] @ 5000 rpm)	S	S	--
	LSJ	**Engine,** ECOTEC 2.0L DOHC, 4-cylinder, SFI, Supercharged (205 HP [153 kW] @ 5600 rpm, 200 lb-ft [272 N-m] @ 4400 rpm)	--	--	S
		Exhaust, stainless-steel, includes chrome tip	S	S	S
		Steering, electric power (EPS)	S	S	S
	FE3	**Suspension**, Sport	S	S	--
	FE5	**Suspension,** Performance Handling	--	--	S
	MM5	**Transmission,** 5-speed manual, includes 3.91 axle ratio	S	S	--
	MM5	**Transmission,** 5-speed manual, includes 4.05 axle ratio and short throw shifter	--	--	S

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

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

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

Free Flow RPO Code	Ref. Only RPO Code	Description	LS Coupe 1AK37	LS Sedan 1AK69	LT Coupe 1AL37		LT Sedan 1AL69		LTZ Sedan 1AZ69
			1LS	1LS	1LT	2LT	1LT	2LT	1LZ
		Instrumentation, white-faced sport gauges, includes speedometer, fuel gauge, tachometer and Driver Information Center with outside temperature, warning messages and programmable menu features	--	--	--	■	--	■	--
		Shift lever, leather-wrapped **1 - Included and only available with (**2) Leather interior.**	--	--	A[1]	■	A[1]	■	S[1]
UK3		**Steering wheel,** leather-wrapped with mounted audio and cruise controls	--	--	A	■	A	■	S
T43		**Spoiler,** rear, deck-lid, body-color **1 - Included with (TV5) Sport Appearance Package.**	A	A	A	■[1]	A	■[1]	A
	TV5	**Sport Package**, includes (T43) Spoiler, rear, (PFD) Wheels, 16" (40.6 cm) aluminum, machine-faced, (QMF) Tires, P205/55R16, touring, blackwall, Fascias, front and rear, body-color, includes Exhaust, chrome tip, white faced gauges, leather-wrapped steering wheel and shifter lever	--	--	--	■	--	■	--
	QMF	**Tires,** P205/55R16, touring, blackwall	--	--	--	■	--	■	S
	PFD	**Wheels,** 16" (40.6 cm) aluminum, machine-faced	--	--	--	■	--	■	S
		Exhaust, stainless-steel, includes chrome tip	--	--	--	■	--	■	S

EQUIPMENT GROUPS - SS and SS Supercharged

S = Standard Equipment A = Available -- (dashes) = Not Available

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

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

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

Free Flow RPO Code	Ref. Only RPO Code	Description	SS Coupe 1AM37	SS Sedan 1AM69	SS Supercharged Coupe 1AP37
			1SS	1SS	2SS
		Standard Equipment	■	■	■

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

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

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

Free Flow RPO Code	Ref. Only RPO Code	Description	LS Coupe 1AK37	LS Sedan 1AK69	LT Coupe 1AL37		LT Sedan 1AL69		LTZ Sedan 1AZ69
			1LS	1LS	1LT	2LT	1LT	2LT	1LZ
		Instrumentation, white-faced sport gauges, includes speedometer, fuel gauge, tachometer and Driver Information Center with outside temperature, warning messages and programmable menu features	--	--	--	■	--	■	--
		Shift lever, leather-wrapped **1 - Included and only available with (**2) Leather interior.**	--	--	A[1]	■	A[1]	■	S[1]
UK3		**Steering wheel,** leather-wrapped with mounted audio and cruise controls	--	--	A	■	A	■	S
T43		**Spoiler,** rear, deck-lid, body-color **1 - Included with (TV5) Sport Appearance Package.**	A	A	A	■[1]	A	■[1]	A
	TV5	**Sport Package**, includes (T43) Spoiler, rear, (PFD) Wheels, 16" (40.6 cm) aluminum, machine-faced, (QMF) Tires, P205/55R16, touring, blackwall, Fascias, front and rear, body-color, includes Exhaust, chrome tip, white faced gauges, leather-wrapped steering wheel and shifter lever	--	--	--	■	--	■	--
	QMF	**Tires,** P205/55R16, touring, blackwall	--	--	--	■	--	■	S
	PFD	**Wheels,** 16" (40.6 cm) aluminum, machine-faced	--	--	--	■	--	■	S
		Exhaust, stainless-steel, includes chrome tip	--	--	--	■	--	■	S

ADDITIONAL OPTIONS									
Free Flow RPO Code	Ref. Only RPO Code	Description	LS Coupe 1AK37	LS Sedan 1AK69	LT Coupe 1AL37		LT Sedan 1AL69		LTZ Sedan 1AZ69
			1LS	1LS	1LT	2LT	1LT	2LT	1LZ
ASF		**Air bags,** dual-stage, frontal, driver and right front passenger, and side head curtain, includes automatic occupant sensing **1 - Requires (JM4) Brakes, 4-wheel antilock. Always use safety belts and proper child restraints, even with air bags. Children are safer when properly secured in a rear seat. See the Owner's Manual for more safety information.** **2 - Required when (UE1) OnStar is ordered. Always use safety belts and proper child restraints, even with air bags. Children are safer when properly secured in a rear seat. See the Owner's Manual for more safety information.**	A[1]	A[1]	A[2]	A[2]	A[2]	A[2]	A[2]
DT4		**Ashtray and lighter**	A	A	A	A	A	A	A
AP9		**Cargo convenience net,** trunk	A	A	S	S	S	S	S
K34		**Cruise control**, electronic with set and resume speed, steering wheel mounted	A	A	S	S	S	S	S
AU3		**Door locks,** power, includes Remote Keyless Entry, lockout protection and content theft security	A	A	S	S	S	S	S
B34		**Floormats,** carpeted, front, includes (B35) Floormats, rear	A	A	S	S	S	S	S
UE1		**OnStar**, 1-year Safe and Sound Service, includes automatic notification of air bag deployment, stolen vehicle tracking, emergency services, roadside assistance, remote door unlock, remote horn and lights, GM Goodwrench remote diagnostics, AccidentAssist and online concierge. Drivers can also obtain the available voice-activated, hands-free personal calling service and virtual advisor that provides location-based traffic and weather reports and other personalized information. **1 - Requires (ASF) Air bags, dual-stage, frontal, driver and right front passenger, and side head curtain. Visit onstar.com for system information and details. Not available with a ship-to of Puerto Rico or the Virgin Islands.**	--	--	A[1]	A[1]	A[1]	A[1]	A[1]

ADDITIONAL OPTIONS									
Free Flow RPO Code	Ref. Only RPO Code	Description	LS Coupe 1AK37	LS Sedan 1AK69	LT Coupe 1AL37		LT Sedan 1AL69		LTZ Sedan 1AZ69
			1LS	1LS	1LT	2LT	1LT	2LT	1LZ
**2		**Seats,** front Leather appointed buckets, include heated seat cushions, manual recliners, driver-side manual lumbar adjuster, adjustable head restraints, passenger side seatback map pocket and 60/40 split-bench rear with trunk pass-through **1 - Requires (UQ3) Sound system feature, 7-speakers.**	--	--	A[1]	A[1]	A[1]	A[1]	S
US8		**Sound system,** ETR AM/FM stereo with CD player and MP3 playback, includes Radio Data System, seek-and-scan, digital clock, auto-tone control, automatic volume and TheftLock	--	--	A	A	A	A	A
U2K		**Sound system feature,** XM Satellite Radio features 67 channels of 100% commercial-free music included in its over 150 channels of the best in music, news, sports, talk, comedy, XM Instant Traffic and Weather, and more. Digital quality sound with coast-to-coast signal coverage. Three trial months - no obligation. **1 - Subscription fees apply. Available only in the 48 contiguous U.S.**	A[1]	--	A[1]	A[1]	A[1]	A[1]	A[1]
UQ3		**Sound system feature,** 7-speakers, Pioneer premium amplified system with tweeters and rear subwoofer speaker **1 - Required with (**2) Seats, front Leather appointed buckets.**	--	--	A[1]	A[1]	A[1]	A[1]	S
UK3		**Steering wheel,** leather-wrapped with mounted audio and cruise controls	--	--	A	■	A	■	S
CF5		**Sunroof,** power, tilt-sliding, includes mirror map lights	--	--	A	A	A	A	A
T37		**Fog lamps,** front	--	--	A	A	A	A	--
VK3		**License plate front mounting package** **1 - Required on all Military order types.**	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]
B84		**Moldings,** bodyside, body-color	A	A	S	S	S	S	--
T43		**Spoiler,** rear, deck-lid, body-color **1 - Included with (TV5) Sport Appearance Package.**	A	A	A	■[1]	A	■[1]	A
JM4		**Brakes,** 4-wheel antilock, front disc/rear drum	A	A	S	S	S	S	S
FE9		**Emissions,** Federal requirements	A	A	A	A	A	A	A
NE1		**Emissions,** Maine, Massachusetts, New York or Vermont state requirements	A	A	A	A	A	A	A

ADDITIONAL OPTIONS									
Free Flow RPO Code	Ref. Only RPO Code	Description	LS Coupe 1AK37	LS Sedan 1AK69	LT Coupe 1AL37		LT Sedan 1AL69		LTZ Sedan 1AZ69
			1LS	1LS	1LT	2LT	1LT	2LT	1LZ
YF5		**Emissions,** California state requirements	A	A	A	A	A	A	A
NB8		**Emissions override**, California, Massachusetts or New York (for vehicles ordered by dealers in states of California, Massachusetts or New York with Federal emissions) **1 - Requires (FE9) Emissions, Federal requirements.**	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]
NC7		**Emissions override,** Federal (for vehicles ordered by dealers in Federal emission states with California, New York, Vermont, Massachusetts or Maine emissions; may also be used by dealers in states of California, New York, Vermont, Massachusetts or Maine to order different state-specific emissions) **1 - Requires (YF5) Emissions, California state requirements or (NE1) Emissions, New York, Vermont, Massachusetts or Maine state requirements.**	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]
VCL		**Emissions Certification,** CFF (Clean Fuel Fleet) LEV (Low Emission Vehicle). Option (VCL) should ONLY be ordered to receive the CFF LEV certification. If (VCL) is not ordered, the vehicle will be produced with your normally selected emission system and may not be CFF LEV certified. Products ordered with the (VCL) option may not be certified to California emission requirements. Therefore, they may not be legal for registration in California, New York, Maine, Massachusetts and Vermont. Option (YF5) should be ordered for all vehicles ordered in California. Option (NE1) should be ordered for all vehicles ordered in Maine or Vermont. **1 - Requires (NB8) Emissions override, California, Massachusetts or New York. Not available in Vermont or Maine.**	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]
K05		**Engine block heater**	A	A	A	A	A	A	A
MX0		**Transmission,** 4-speed automatic, electronically controlled with overdrive, includes 3.63 axle ratio	A	A	A	A	A	A	S

S = Standard Equipment A = Available -- (dashes) = Not Available

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

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

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

Free Flow RPO Code	Ref. Only RPO Code	Description	SS Coupe 1AM37	SS Sedan 1AM69	SS Supercharged Coupe 1AP37
			1SS	1SS	2SS
		Standard Equipment	■	■	■
		ADDITIONAL OPTIONS			
Free Flow RPO Code	Ref. Only RPO Code	Description	SS Coupe 1AM37	SS Sedan 1AM69	SS Supercharged Coupe 1AP37
			1SS	1SS	2SS
ASF		**Air bags,** dual-stage, frontal, driver and right front passenger, and side head curtain, includes automatic occupant sensing **1 - Required when (UE1) OnStar is ordered. Always use safety belts and proper child restraints, even with air bags. Children are safer when properly secured in a rear seat. See the Owner's Manual for more safety information.** **2 - Required when (UE1) OnStar is ordered. Automatic occupant sensing is not included on 1AP37 models. Always use safety belts and proper child restraints, even with air bags. Children are safer when properly secured in a rear seat. See the Owner's Manual for more safety information.**	A[1]	A[1]	A[2]
DT4		**Ashtray and lighter**	A	A	A
UE1		**OnStar**, 1-year Safe and Sound Service, includes automatic notification of air bag deployment, stolen vehicle tracking, emergency services, roadside assistance, remote door unlock, remote horn and lights, GM Goodwrench remote diagnostics, AccidentAssist and online concierge. Drivers can also obtain the available voice-activated, hands-free personal calling service and virtual advisor that provides location-based traffic and weather reports and other personalized information. **1 - Requires (ASF) Air bags, dual-stage, frontal, driver and right front passenger, and side head curtain. Visit onstar.com for system information and details. Not available with a ship-to of Puerto Rico or the Virgin Islands.**	A[1]	A[1]	A[1]
**2		**Seats,** front Leather appointed buckets, include heated seat cushions, manual recliners, driver-side manual lumbar adjuster, adjustable head restraints, passenger side seatback map pocket and 60/40 split-bench rear with trunk pass-through **1 - Requires (UQ3) Sound system feature, 7-speakers.**	A[1]	A[1]	--
US8		**Sound system,** ETR AM/FM stereo with CD player and MP3 playback, includes Radio Data System, seek-and-scan, digital clock, auto-tone control, automatic volume and TheftLock	A	A	S

ADDITIONAL OPTIONS					
Free Flow RPO Code	Ref. Only RPO Code	Description	SS Coupe 1AM37	SS Sedan 1AM69	SS Supercharged Coupe 1AP37
			1SS	1SS	2SS
U2K		**Sound system feature,** XM Satellite Radio features 67 channels of 100% commercial-free music included in its over 150 channels of the best in music, news, sports, talk, comedy, XM Instant Traffic and Weather, and more. Digital quality sound with coast-to-coast signal coverage. Three trial months - no obligation. **1 - Subscription fees apply. Available only in the 48 contiguous U.S.**	A[1]	A[1]	A[1]
UQ3		**Sound system feature,** 7-speakers, Pioneer premium amplified system with tweeters and rear subwoofer speaker **1 - Required with (**2) Seats, front Leather appointed buckets.**	A[1]	A[1]	S
CF5		**Sunroof,** power, tilt-sliding, includes mirror map lights	A	A	A
VK3		**License plate front mounting package** **1 - Required on all Military order types.**	A[1]	A[1]	A[1]
FE9		**Emissions,** Federal requirements	A	A	A
NE1		**Emissions,** Maine, Massachusetts, New York or Vermont state requirements	A	A	A
YF5		**Emissions,** California state requirements	A	A	A
NB8		**Emissions override**, California, Massachusetts or New York (for vehicles ordered by dealers in states of California, Massachusetts or New York with Federal emissions) **1 - Requires (FE9) Emissions, Federal requirements.**	A[1]	A[1]	A[1]
NC7		**Emissions override,** Federal (for vehicles ordered by dealers in Federal emission states with California, New York, Vermont, Massachusetts or Maine emissions; may also be used by dealers in states of California, New York, Vermont, Massachusetts or Maine to order different state-specific emissions) **1 - Requires (YF5) Emissions, California state requirements or (NE1) Emissions, New York, Vermont, Massachusetts or Maine state requirements.**	A[1]	A[1]	A[1]
K05		**Engine block heater**	A	A	--
G85		**Performance Package**, includes (G85) Differential, limited-slip and driver and front passenger leather-accented RECARO bucket seats **1 - Requires (194) Ebony with Ebony inserts interior trim.**	--	--	A[1]
MX0		**Transmission,** 4-speed automatic, electronically controlled with overdrive, includes 3.63 axle ratio	A	A	--

S = Standard Equipment A = Available -- (dashes) = Not Available

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

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

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

Free Flow RPO Code	Ref. Only RPO Code	Description	LS Coupe 1AK37	LS Sedan 1AK69	LT Coupe 1AL37		LT Sedan 1AL69		LTZ Sedan 1AZ69
			1LS	1LS	1LT	2LT	1LT	2LT	1LZ
		Exhaust, stainless-steel				■		■	
		Instrumentation				■		■	
		Shift lever, leather-wrapped				■		■	
T43		**Spoiler,** rear				■		■	
	TV5	**Sport Package**				■		■	
UK3		**Steering wheel,** leather-wrapped				■		■	
	QMF	**Tires,** P205/55R16				■		■	
	PFD	**Wheels,** 16" (40.6 cm) aluminum				■		■	

S = Standard Equipment A = Available -- (dashes) = Not Available

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

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

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

Free Flow RPO Code	Ref. Only RPO Code	Description	SS Coupe 1AM37	SS Sedan 1AM69	SS Supercharged Coupe 1AP37
			1SS	1SS	2SS
		Standard Equipment	■	■	■

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

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

Free Flow RPO Code	Ref. Only RPO Code	Description	LS Coupe 1AK37	LS Sedan 1AK69	LT Coupe 1AL37		LT Sedan 1AL69		LTZ Sedan 1AZ69
			1LS	1LS	1LT	2LT	1LT	2LT	1LZ
	AK5	**Air bags,** dual-stage, frontal, driver and right front passenger, includes automatic occupant sensing **1 - Always used safety belts and proper child restraints, even with air bags. Children are safer when properly secured in a rear seat. See the Owner's Manual for more safety information.**	S[1]	S[1]	S[1]	S[1]	S[1]	S[1]	S[1]
ASF		**Air bags,** dual-stage, frontal, driver and right front passenger, and side head curtain, includes automatic occupant sensing **1 - Requires (JM4) Brakes, 4-wheel antilock. Always use safety belts and proper child restraints, even with air bags. Children are safer when properly secured in a rear seat. See the Owner's Manual for more safety information.** **2 - Required when (UE1) OnStar is ordered. Always use safety belts and proper child restraints, even with air bags. Children are safer when properly secured in a rear seat. See the Owner's Manual for more safety information.**	A[1]	A[1]	A[2]	A[2]	A[2]	A[2]	A[2]
	C67	**Air conditioning,** front manual, includes air filtration system	S	S	S	S	S	S	S
DT4		**Ashtray and lighter**	A	A	A	A	A	A	A
AP9		**Cargo convenience net,** trunk	A	A	S	S	S	S	S
		Console, floor, includes 2 power outlets	S	S	S	S	S	S	S
		Console, between front seats, includes adjustable armrest, storage compartment and 2 power outlets **1 - Included and only available with (MX0) Transmission, 4-speed automatic.**	--	--	A[1]	A[1]	A[1]	A[1]	S
K34		**Cruise control**, electronic with set and resume speed, steering wheel mounted	A	A	S	S	S	S	S
		Cupholders, dual front and dual rear	S	S	S	S	S	S	S
		Defogger, rear-window, electric	S	S	S	S	S	S	S
		Defogger, side windows	S	S	S	S	S	S	S
		Door locks, child security, rear	--	S	--	--	S	S	S
AU3		**Door locks,** power, includes Remote Keyless Entry, lockout protection and content theft security	A	A	S	S	S	S	S
B34		**Floormats,** carpeted, front, includes (B35) Floormats, rear	A	A	S	S	S	S	S

Free Flow RPO Code	Ref. Only RPO Code	Description	LS Coupe 1AK37	LS Sedan 1AK69	LT Coupe 1AL37		LT Sedan 1AL69		LTZ Sedan 1AZ69
			1LS	1LS	1LT	2LT	1LT	2LT	1LZ
		Instrumentation, includes speedometer, fuel gauge, tachometer and Driver Information Center with outside temperature, warning messages and programmable menu features	S	S	S	--	S	--	S
		Instrumentation, white-faced sport gauges, includes speedometer, fuel gauge, tachometer and Driver Information Center with outside temperature, warning messages and programmable menu features	--	--	--	■	--	■	--
		LATCH system, (Lower Anchors and Top tethers for CHildren), for child safety seats	S	S	S	S	S	S	S
		Lighting, interior, trunk and single dome	S	S	--	--	--	--	--
		Lighting, interior, trunk and dual reading	--	--	S	S	S	S	S
UE1		**OnStar**, 1-year Safe and Sound Service, includes automatic notification of air bag deployment, stolen vehicle tracking, emergency services, roadside assistance, remote door unlock, remote horn and lights, GM Goodwrench remote diagnostics, AccidentAssist and online concierge. Drivers can also obtain the available voice-activated, hands-free personal calling service and virtual advisor that provides location-based traffic and weather reports and other personalized information. **1 - Requires (ASF) Air bags, dual-stage, frontal, driver and right front passenger, and side head curtain. Visit onstar.com for system information and details. Not available with a ship-to of Puerto Rico or the Virgin Islands.**	--	--	A[1]	A[1]	A[1]	A[1]	A[1]
		Safety belts, 3-point, all positions	S	--	S	S	--	--	--
		Safety belts, 3-point, all positions, front height adjustable	--	S	--	--	S	S	S
		Seat, driver, height adjuster, 4-way manual	S	S	S	S	S	S	S
		Seat, easy entry, front passenger	S	--	S	S	--	--	--
		Seats, front Cloth buckets, include manual recliners, adjustable head restraints and 60/40 split-bench rear with trunk pass-through	S	S	--	--	--	--	--
		Seats, front Sport Cloth buckets, include manual recliners, driver-side manual lumbar adjuster, adjustable head restraints, passenger side seatback map pocket and 60/40 split-bench rear with trunk pass-through	--	--	S	S	S	S	--

Free Flow RPO Code	Ref. Only RPO Code	Description	LS Coupe 1AK37	LS Sedan 1AK69	LT Coupe 1AL37		LT Sedan 1AL69		LTZ Sedan 1AZ69
			1LS	1LS	1LT	2LT	1LT	2LT	1LZ
**2		**Seats,** front Leather appointed buckets, include heated seat cushions, manual recliners, driver-side manual lumbar adjuster, adjustable head restraints, passenger side seatback map pocket and 60/40 split-bench rear with trunk pass-through **1 - Requires (UQ3) Sound system feature, 7-speakers.**	--	--	A[1]	A[1]	A[1]	A[1]	S
		Shift lever, leather-wrapped **1 - Included and only available with (**2) Leather interior.**	--	--	A[1]	■	A[1]	■	S[1]
	UN0	**Sound system,** ETR AM/FM stereo with CD player, includes Radio Data System, seek-and-scan, digital clock, auto-tone control, automatic volume and TheftLock	S	S	S	S	S	S	S
US8		**Sound system,** ETR AM/FM stereo with CD player and MP3 playback, includes Radio Data System, seek-and-scan, digital clock, auto-tone control, automatic volume and TheftLock	--	--	A	A	A	A	A
U2K		**Sound system feature,** XM Satellite Radio features 67 channels of 100% commercial-free music included in its over 150 channels of the best in music, news, sports, talk, comedy, XM Instant Traffic and Weather, and more. Digital quality sound with coast-to-coast signal coverage. Three trial months - no obligation. **1 - Subscription fees apply. Available only in the 48 contiguous U.S.**	A[1]	--	A[1]	A[1]	A[1]	A[1]	A[1]
	UQ4	**Sound system feature,** 4-speakers	S	S	S	S	S	S	--
UQ3		**Sound system feature,** 7-speakers, Pioneer premium amplified system with tweeters and rear subwoofer speaker **1 - Required with (**2) Seats, front Leather appointed buckets.**	--	--	A[1]	A[1]	A[1]	A[1]	S
		Steering column, tilt	S	S	S	S	S	S	S
		Steering wheel, urethane	S	S	S	--	S	--	--
UK3		**Steering wheel,** leather-wrapped with mounted audio and cruise controls	--	--	A	■	A	■	S
CF5		**Sunroof,** power, tilt-sliding, includes mirror map lights	--	--	A	A	A	A	A
		Theft-deterrent system, PASSkey 3+	S	S	S	S	S	S	S
		Trunk release, remote	S	S	S	S	S	S	S

Free Flow RPO Code	Ref. Only RPO Code	Description	LS Coupe 1AK37	LS Sedan 1AK69	LT Coupe 1AL37		LT Sedan 1AL69		LTZ Sedan 1AZ69
			1LS	1LS	1LT	2LT	1LT	2LT	1LZ
		Visors, vanity mirror, front passenger, includes driver map pocket	S	S	--	--	--	--	--
		Visors, vanity mirrors, covered, driver and front passenger, includes driver map pocket	--	--	S	S	S	S	S
		Windows, power, includes driver express-down and passenger lockout	--	--	S	S	S	S	S

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

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

Free Flow RPO Code	Ref. Only RPO Code	Description	SS Coupe 1AM37	SS Sedan 1AM69	SS Supercharged Coupe 1AP37
			1SS	1SS	2SS
	AK5	**Air bags,** dual-stage, frontal, driver and right front passenger, includes automatic occupant sensing **1 - Always used safety belts and proper child restraints, even with air bags. Children are safer when properly secured in a rear seat. See the Owner's Manual for more safety information.** **2 - Automatic occupant sensing is not included on 1AP37 models. Always used safety belts and proper child restraints, even with air bags. Children are safer when properly secured in a rear seat. See the Owner's Manual for more safety information.**	S[1]	S[1]	S[2]
ASF		**Air bags,** dual-stage, frontal, driver and right front passenger, and side head curtain, includes automatic occupant sensing **1 - Required when (UE1) OnStar is ordered. Always use safety belts and proper child restraints, even with air bags. Children are safer when properly secured in a rear seat. See the Owner's Manual for more safety information.** **2 - Required when (UE1) OnStar is ordered. Automatic occupant sensing is not included on 1AP37 models. Always use safety belts and proper child restraints, even with air bags. Children are safer when properly secured in a rear seat. See the Owner's Manual for more safety information.**	A[1]	A[1]	A[2]
	C67	**Air conditioning,** front manual, includes air filtration system	S	S	S
DT4		**Ashtray and lighter**	A	A	A
	AP9	**Cargo convenience net,** trunk	S	S	S
		Console, floor, includes 2 power outlets	S	S	S
		Console, between front seats, includes adjustable armrest, storage compartment and 2 power outlets **1 - Included and only available with (MX0) Transmission, 4-speed automatic.**	A[1]	A[1]	--
	K34	**Cruise control**, electronic with set and resume speed, steering wheel mounted	S	S	S
		Cupholders, dual front and dual rear	S	S	S
		Defogger, rear-window, electric	S	S	S
		Defogger, side windows	S	S	S
		Door locks, child security, rear	--	S	--
	AU3	**Door locks,** power, includes Remote Keyless Entry, lockout protection and content theft security	S	S	S
		Floormats, carpeted, front and rear	S	S	S
		Instrumentation, white-faced sport gauges, includes speedometer, fuel gauge, tachometer and Driver Information Center with outside temperature, warning messages and programmable menu features	S	S	--

Free Flow RPO Code	Ref. Only RPO Code	Description	SS Coupe 1AM37	SS Sedan 1AM69	SS Supercharged Coupe 1AP37
			1SS	1SS	2SS
		Instrumentation, titanium-faced sport gauges, includes speedometer, fuel gauge, tachometer, A-pillar mounted boost gauge and Driver Information Center with outside temperature, warning messages and programmable menu features	--	--	S
		LATCH system, (Lower Anchors and Top tethers for CHildren), for child safety seats	S	S	S
		Lighting, interior, trunk and dual reading	S	S	S
UE1		**OnStar**, 1-year Safe and Sound Service, includes automatic notification of air bag deployment, stolen vehicle tracking, emergency services, roadside assistance, remote door unlock, remote horn and lights, GM Goodwrench remote diagnostics, AccidentAssist and online concierge. Drivers can also obtain the available voice-activated, hands-free personal calling service and virtual advisor that provides location-based traffic and weather reports and other personalized information. **1 - Requires (ASF) Air bags, dual-stage, frontal, driver and right front passenger, and side head curtain. Visit onstar.com for system information and details. Not available with a ship-to of Puerto Rico or the Virgin Islands.**	A[1]	A[1]	A[1]
		Safety belts, 3-point, all positions	S	--	S
		Safety belts, 3-point, all positions, front height adjustable	--	S	--
		Seat, driver, height adjuster, 4-way manual	S	S	S
		Seat, easy entry, front passenger	S	--	S
		Seats, front Sport Cloth buckets, include manual recliners, driver-side manual lumbar adjuster, adjustable head restraints, passenger side seatback map pocket and 60/40 split-bench rear with trunk pass-through	S	S	--
**2		**Seats,** front Leather appointed buckets, include heated seat cushions, manual recliners, driver-side manual lumbar adjuster, adjustable head restraints, passenger side seatback map pocket and 60/40 split-bench rear with trunk pass-through **1 - Requires (UQ3) Sound system feature, 7-speakers.**	A[1]	A[1]	--
	19*	**Seats,** front Leather appointed buckets with color-keyed perforated inserts, include manual recliners, driver-side manual lumbar adjuster, adjustable head restraints, passenger side seatback map pocket and 60/40 split-bench rear with trunk pass-through	--	--	S
		Seats, front Leather-accented RECARO driver and front passenger buckets **1 - Included and only available with (G85) Performance Package.**	--	--	A[1]
		Shift lever, leather-wrapped	S	S	S
	UN0	**Sound system,** ETR AM/FM stereo with CD player, includes Radio Data System, seek-and-scan, digital clock, auto-tone control, automatic volume and TheftLock	S	S	--

Free Flow RPO Code	Ref. Only RPO Code	Description	SS Coupe 1AM37	SS Sedan 1AM69	SS Supercharged Coupe 1AP37
			1SS	1SS	2SS
US8		**Sound system,** ETR AM/FM stereo with CD player and MP3 playback, includes Radio Data System, seek-and-scan, digital clock, auto-tone control, automatic volume and TheftLock	A	A	S
U2K		**Sound system feature,** XM Satellite Radio features 67 channels of 100% commercial-free music included in its over 150 channels of the best in music, news, sports, talk, comedy, XM Instant Traffic and Weather, and more. Digital quality sound with coast-to-coast signal coverage. Three trial months - no obligation. **1 - Subscription fees apply. Available only in the 48 contiguous U.S.**	A[1]	A[1]	A[1]
	UQ4	**Sound system feature,** 4-speakers	S	S	--
UQ3		**Sound system feature,** 7-speakers, Pioneer premium amplified system with tweeters and rear subwoofer speaker **1 - Required with (**2) Seats, front Leather appointed buckets.**	A[1]	A[1]	S
		Steering column, tilt	S	S	S
	UK3	**Steering wheel,** leather-wrapped with mounted audio and cruise controls	S	S	S
CF5		**Sunroof,** power, tilt-sliding, includes mirror map lights	A	A	A
		Theft-deterrent system, PASSkey 3+	S	S	S
		Trunk release, remote	S	S	S
		Visors, vanity mirrors, covered, driver and front passenger, includes driver map pocket	S	S	S
		Windows, power, includes driver express-down and passenger lockout	S	S	S

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

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

Free Flow RPO Code	Ref. Only RPO Code	Description	LS Coupe 1AK37	LS Sedan 1AK69	LT Coupe 1AL37		LT Sedan 1AL69		LTZ Sedan 1AZ69
			1LS	1LS	1LT	2LT	1LT	2LT	1LZ
		Daytime running lamps	S	S	S	S	S	S	S
		Door handles, body-color	S	S	S	S	S	S	--
		Door handles, chrome	--	--	--	--	--	--	S
		Fascias, front and rear, includes body-color grille	S	S	--	--	--	--	--
		Fascias, front and rear, body-color, includes Black grille	--	--	S	S	S	S	--
		Fascias, front and rear, body-color, includes chrome grille and halogen fog lamps	--	--	--	--	--	--	S
T37		**Fog lamps,** front	--	--	A	A	A	A	--
		Glass, Solar-Ray light tinted	S	S	S	S	S	S	S
		Headlamps, halogen, includes automatic exterior lamp control	S	S	S	S	S	S	S
VK3		**License plate front mounting package** **1 - Required on all Military order types.**	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]
		Mirrors, outside rearview, manual, Black	S	S	--	--	--	--	--
		Mirrors, outside rearview, power, body-color	--	--	S	S	S	S	S
B84		**Moldings,** bodyside, body-color	A	A	S	S	S	S	--
		Moldings, bodyside, chrome	--	--	--	--	--	--	S
T43		**Spoiler,** rear, deck-lid, body-color **1 - Included with (TV5) Sport Appearance Package.**	A	A	A	■[1]	A	■[1]	A
	TV5	**Sport Package**, includes (T43) Spoiler, rear, (PFD) Wheels, 16" (40.6 cm) aluminum, machine-faced, (QMF) Tires, P205/55R16, touring, blackwall, Fascias, front and rear, body-color, includes Exhaust, chrome tip, white faced gauges, leather-wrapped steering wheel and shifter lever	--	--	--	■	--	■	--
	QTU	**Tires,** P195/60R15, touring, blackwall	S	S	S	--	S	--	--
	QMF	**Tires,** P205/55R16, touring, blackwall	--	--	--	■	--	■	S
	PG1	**Wheels,** 15" (38.1 cm) steel, includes full bolt-on wheel covers	S	S	--	--	--	--	--
	PF7	**Wheels,** 15" (38.1 cm) aluminum	--	--	S	--	S	--	--
	PFD	**Wheels,** 16" (40.6 cm) aluminum, machine-faced	--	--	--	■	--	■	S

Free Flow RPO Code	Ref. Only RPO Code	Description	LS Coupe 1AK37	LS Sedan 1AK69	LT Coupe 1AL37		LT Sedan 1AL69		LTZ Sedan 1AZ69
			1LS	1LS	1LT	2LT	1LT	2LT	1LZ
		Wipers, intermittent, front, speed-sensitive	S	S	S	S	S	S	S

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

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

Free Flow RPO Code	Ref. Only RPO Code	Description	SS Coupe 1AM37	SS Sedan 1AM69	SS Supercharged Coupe 1AP37
			1SS	1SS	2SS
		Daytime running lamps	S	S	S
		Door handles, body-color	S	S	S
		Fascias, sport, front and rear, body-color, includes front halogen fog lamps	S	S	--
		Fascias, sport, front and rear, body-color, includes front halogen fog lamps and extensions	--	--	S
		Glass, Solar-Ray light tinted	S	S	S
		Headlamps, halogen, includes automatic exterior lamp control	S	S	S
VK3		**License plate front mounting package** **1 - Required on all Military order types.**	A[1]	A[1]	A[1]
		Mirrors, outside rearview, power, body-color	S	S	S
		Moldings, lower rocker, body-color	S	S	S
	T43	**Spoiler,** rear, deck-lid, body-color	S	S	--
		Spoiler, rear, high-mount, body-color	--	--	S
	QBU	**Tires,** P205/50R17, blackwall	S	S	--
	QTJ	**Tires,** P215/45R18, performance, blackwall	--	--	S
	PFE	**Wheels,** 17" (43.2 cm) aluminum, polished	S	S	--
	NW5	**Wheels,** 18" (45.7 cm) aluminum, painted	--	--	S
		Wipers, intermittent, front, speed-sensitive	S	S	S

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

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

Free Flow RPO Code	Ref. Only RPO Code	Description	LS Coupe 1AK37	LS Sedan 1AK69	LT Coupe 1AL37		LT Sedan 1AL69		LTZ Sedan 1AZ69
			1LS	1LS	1LT	2LT	1LT	2LT	1LZ
		Battery, maintenance free, includes rundown protection, trunk-mounted	S	S	S	S	S	S	S
	J41	**Brakes,** front disc/rear drum	S	S	--	--	--	--	--
JM4		**Brakes,** 4-wheel antilock, front disc/rear drum	A	A	S	S	S	S	S
FE9		**Emissions,** Federal requirements	A	A	A	A	A	A	A
NE1		**Emissions,** Maine, Massachusetts, New York or Vermont state requirements	A	A	A	A	A	A	A
YF5		**Emissions,** California state requirements	A	A	A	A	A	A	A
NB8		**Emissions override**, California, Massachusetts or New York (for vehicles ordered by dealers in states of California, Massachusetts or New York with Federal emissions) **1 - Requires (FE9) Emissions, Federal requirements.**	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]
NC7		**Emissions override,** Federal (for vehicles ordered by dealers in Federal emission states with California, New York, Vermont, Massachusetts or Maine emissions; may also be used by dealers in states of California, New York, Vermont, Massachusetts or Maine to order different state-specific emissions) **1 - Requires (YF5) Emissions, California state requirements or (NE1) Emissions, New York, Vermont, Massachusetts or Maine state requirements.**	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]

Free Flow RPO Code	Ref. Only RPO Code	Description	LS Coupe 1AK37	LS Sedan 1AK69	LT Coupe 1AL37		LT Sedan 1AL69		LTZ Sedan 1AZ69
			1LS	1LS	1LT	2LT	1LT	2LT	1LZ
VCL		**Emissions Certification,** CFF (Clean Fuel Fleet) LEV (Low Emission Vehicle). Option (VCL) should ONLY be ordered to receive the CFF LEV certification. If (VCL) is not ordered, the vehicle will be produced with your normally selected emission system and may not be CFF LEV certified. Products ordered with the (VCL) option may not be certified to California emission requirements. Therefore, they may not be legal for registration in California, New York, Maine, Massachusetts and Vermont. Option (YF5) should be ordered for all vehicles ordered in California. Option (NE1) should be ordered for all vehicles ordered in Maine or Vermont. **1 - Requires (NB8) Emissions override, California, Massachusetts or New York. Not available in Vermont or Maine.**	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]
	L61	**Engine,** ECOTEC 2.2L DOHC, 16-valve, 4-cylinder, SFI (145 HP [108.1 kW] @ 5600 rpm, 155 lb.-ft. [209.3 N-m] @ 4000 rpm)	S	S	S	S	S	S	S
K05		**Engine block heater**	A	A	A	A	A	A	A
		Exhaust, stainless-steel	S	S	S	--	S	--	--
		Exhaust, stainless-steel, includes chrome tip	--	--	--	■	--	■	S
		Steering, electric power (EPS)	S	S	S	S	S	S	S
	FE1	**Suspension,** Premium Ride	S	S	S	S	S	S	S
	NW7	**Traction Control,** all-speed **1 - Included and only available with (JM4) Brakes, 4-wheel antilock and (MX0) Transmission, 4-speed automatic.** **2 - Included and only available with (MX0) Transmission, 4-speed automatic.**	A[1]	A[1]	A[2]	A[2]	A[2]	A[2]	S
	MM5	**Transmission,** 5-speed manual, includes 3.84 axle ratio	S	S	S	S	S	S	--
MX0		**Transmission,** 4-speed automatic, electronically controlled with overdrive, includes 3.63 axle ratio	A	A	A	A	A	A	S

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

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

Free Flow RPO Code	Ref. Only RPO Code	Description	SS Coupe 1AM37	SS Sedan 1AM69	SS Supercharged Coupe 1AP37
			1SS	1SS	2SS
		Battery, maintenance free, includes rundown protection, trunk-mounted	S	S	S
	JL9	**Brakes,** 4-wheel antilock, 4-wheel disc	S	S	S
FE9		**Emissions,** Federal requirements	A	A	A
NE1		**Emissions,** Maine, Massachusetts, New York or Vermont state requirements	A	A	A
YF5		**Emissions,** California state requirements	A	A	A
NB8		**Emissions override**, California, Massachusetts or New York (for vehicles ordered by dealers in states of California, Massachusetts or New York with Federal emissions) **1 - Requires (FE9) Emissions, Federal requirements.**	A[1]	A[1]	A[1]
NC7		**Emissions override,** Federal (for vehicles ordered by dealers in Federal emission states with California, New York, Vermont, Massachusetts or Maine emissions; may also be used by dealers in states of California, New York, Vermont, Massachusetts or Maine to order different state-specific emissions) **1 - Requires (YF5) Emissions, California state requirements or (NE1) Emissions, New York, Vermont, Massachusetts or Maine state requirements.**	A[1]	A[1]	A[1]
	LE5	**Engine**, ECOTEC 2.4L DOHC, 4-cylinder, SFI, (171 HP [127.5 kW] @ 6200 rpm, 163 lb-ft [220.1 N-m] @ 5000 rpm)	S	S	--
	LSJ	**Engine,** ECOTEC 2.0L DOHC, 4-cylinder, SFI, Supercharged (205 HP [153 kW] @ 5600 rpm, 200 lb-ft [272 N-m] @ 4400 rpm)	--	--	S
K05		**Engine block heater**	A	A	--
		Exhaust, stainless-steel, includes chrome tip	S	S	S
G85		**Performance Package**, includes (G85) Differential, limited-slip and driver and front passenger leather-accented RECARO bucket seats **1 - Requires (194) Ebony with Ebony inserts interior trim.**	--	--	A[1]
		Steering, electric power (EPS)	S	S	S
	FE3	**Suspension**, Sport	S	S	--
	FE5	**Suspension,** Performance Handling	--	--	S
	NW7	**Traction Control,** all-speed **1 - Included and only available with (MX0) Transmission, 4-speed automatic.**	A[1]	A[1]	--
	MM5	**Transmission,** 5-speed manual, includes 3.91 axle ratio	S	S	--
	MM5	**Transmission,** 5-speed manual, includes 4.05 axle ratio and short throw shifter	--	--	S

Free Flow RPO Code	Ref. Only RPO Code	Description	SS Coupe 1AM37	SS Sedan 1AM69	SS Supercharged Coupe 1AP37
			1SS	1SS	2SS
MX0		**Transmission,** 4-speed automatic, electronically controlled with overdrive, includes 3.63 axle ratio	A	A	--

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

Model	Seat Type	Seat Code	Seat Trim	Interior	
				Gray	Neutral
LS Coupe	Front bucket	AR9	Cloth	14B	--
LS Sedan	Front bucket	AR9	Cloth	14B	52B

Exterior Solid Paint	Color Code	Touch Up Paint Number	Interior	
			Gray	Neutral
Sandstone Metallic[1]	15U	WA-929L	--	A
NEW! Laser Blue Metallic[2]	21U	WA-218M	A	A
Rally Yellow[3]	34U	WA-9414	A	--
Black	41U	WA-8555	A	A
Blue Granite Metallic	46U	WA-928L	A	A
Summit White	50U	WA-8624	A	A
Sunburst Orange Metallic[3]	56U	WA-913L	A	--
Victory Red	74U	WA-9260	A	A
NEW! Majestic Amethyst Metallic	84U	WA-111B	A	A
Arrival Blue Metallic[4]	91U	WA-815K	A	A
Ultra Silver Metallic	95U	WA-8867	A	A

1 - Not available on LS Coupe.
2 - Available beginning winter 2005/2006.
3 - Not available on LS Sedan.
4 - Available through fall 2005.

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

Model	Seat Type	Seat Code	Seat Trim	Interior		
				Ebony[2]	Gray	Neutral[1]
LTZ Sedan	Front bucket	AR9	Leather	--	142	522
SS	Front bucket	AR9	Sport Cloth	19C[6]	14C[7]	--
SS	Front bucket	AR9	Leather	192[6]	142[7]	--

Exterior Solid Paint	Color Code	Touch Up Paint Number	Interior		
			Ebony[2]	Gray	Neutral[1]
Sandstone Metallic[1]	15U	WA-929L	--	--	A
NEW! Laser Blue Metallic[3]	21U	WA-218M	A	A	A
Rally Yellow[4]	34U	WA-9414	A	A	--
Black	41U	WA-8555	A	A	A
Blue Granite Metallic[1]	46U	WA-928L	--	A	A
Summit White	50U	WA-8624	A	A	A
Sunburst Orange Metallic[2]	56U	WA-913L	A	A	--
Victory Red	74U	WA-9260	A	A	A
NEW! Majestic Amethyst Metallic	84U	WA-111B	A	A	A
Arrival Blue Metallic[5]	91U	WA-815K	A	A	A
Ultra Silver Metallic	95U	WA-8867	A	A	A

1 - Not available with SS Coupe or SS Sedan.
2 - Not available with LTZ Sedan.
3 - Available beginning winter 2005/2006.
4 - Not available with LTZ Sedan or SS Sedan.
5 - Available through fall 2005.
6 - Not available on SS Sedan.
7 - Not available on SS Coupe.

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

Model	Seat Type	Seat Code	Seat Trim	Interior		
				Ebony	Gray	Neutral
LT Coupe	Front bucket	AR9	Sport Cloth	19C	14C[1]	--
LT Sedan	Front bucket	AR9	Sport Cloth	--	14C	52C[2]
LT Coupe	Front bucket	AR9	Leather	192	142[1]	--
LT Sedan	Front bucket	AR9	Leather	--	142	522[2]

Exterior Solid Paint	Color Code	Touch Up Paint Number	Interior		
			Ebony	Gray	Neutral
Sandstone Metallic[2]	15U	WA-929L	--	--	A
NEW! Laser Blue Metallic[3]	21U	WA-218M	A	A	A
Rally Yellow[4]	34U	WA-9414	A	A	--
Black	41U	WA-8555	A	A	A
Blue Granite Metallic	46U	WA-928L	A	A	A
Summit White	50U	WA-8624	A	A	A
Sunburst Orange Metallic	56U	WA-913L	A	A	--
Victory Red	74U	WA-9260	A	A	A
NEW! Majestic Amethyst Metallic	84U	WA-111B	A	A	A
Arrival Blue Metallic[5]	91U	WA-815K	A	A	A
Ultra Silver Metallic	95U	WA-8867	A	A	A

1 - Only available on LT Coupe with 1LT.
2 - Only available on LT Sedan with 1LT.
3 - Available beginning winter 2005/2006.
4 - Not available on LT Sedan.
5 - Available through fall 2005.

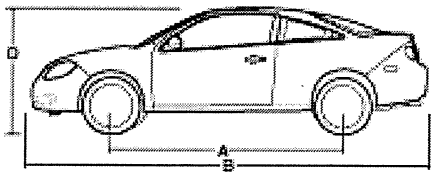
S = Standard Equipment A = Available -- (dashes) = Not Available
■ = Included in Equipment Group □ = Included in Equipment Group but upgradeable

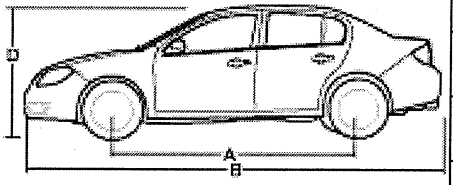
Model	Seat Type	Seat Code	Seat Trim	Interior			
				Ebony with Red Inserts	Ebony with Ebony Inserts	Ebony with Blue Inserts	Ebony with Yellow Inserts
SS Supercharged Coupe	Front bucket	AR9	Leather Seating Surfaces[1]	193	--	--	--
SS Supercharged Coupe	Front bucket	AR9	Leather Seating Surfaces[1]	--	194	--	--
SS Supercharged Coupe	Front bucket	AR9	Leather Seating Surfaces[1]	--	--	195	--
SS Supercharged Coupe	Front bucket	AR9	Leather Seating Surfaces[1]	--	--	--	196
SS Supercharged Coupe	RECARO front bucket	W2E[2]	Leather Seating Surfaces[1]	--	194	--	--

Exterior Solid Paint	Color Code	Touch Up Paint Number	Interior			
			Ebony with Red Inserts	Ebony with Ebony Inserts	Ebony with Blue Inserts	Ebony with Yellow Inserts
NEW! Laser Blue Metallic[3]	21U	WA-218M	--	A	A	--
Rally Yellow	34U	WA-9414	--	A	--	A
Black	41U	WA-8555	A	A	A	A
Sunburst Orange Metallic	56U	WA-913L	--	A	--	--
Victory Red	74U	WA-9260	A	A	--	--
Arrival Blue Metallic[4]	91U	WA-815K	--	A	A	--
Ultra Silver Metallic	95U	WA-8867	A	A	A	A

1 - Color-keyed perforated inserts on front seats.
2 - Included in (G85) Performance Package.
3 - Available beginning winter 2005/2006.
4 - Available through fall 2005.

All dimensions in inches (mm) unless otherwise stated.

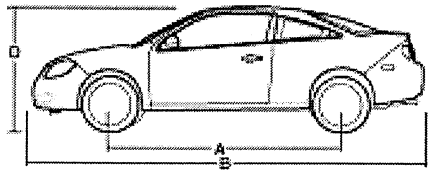


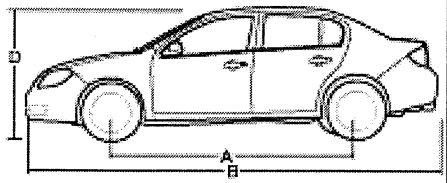


	Specifications	1AK37 LS Coupe	1AK69 LS Sedan	1AL37 LT Coupe	1AL69 LT Sedan	1AZ69 LTZ Sedan
A	**Wheelbase**	103.30 (2624)	103.30 (2624)	103.30 (2624)	103.30 (2624)	103.30 (2624)
B	**Overall length**	180.50 (4585)	180.30 (4580)	180.50 (4585)	180.30 (4580)	180.30 (4580)
C	**Body width**	67.90 (1725)	67.90 (1725)	67.90 (1725)	67.90 (1725)	67.90 (1725)
D	**Overall height**	55.50 (1410)	57.10 (1450)	55.50 (1410)	57.10 (1450)	57.10 (1450)
	Front track width	58.70 (1491)	58.70 (1491)	58.70 (1491)	58.70 (1491)	58.70 (1491)
	Rear track width	58.10 (1476)	58.10 (1476)	58.10 (1476)	58.10 (1476)	58.10 (1476)
	Head room, front	38.70 (983)	38.50 (978)	38.70 (983)	38.50 (978)	38.50 (978)
	Head room, rear	35.70 (907)	37.70 (958)	35.70 (907)	37.70 (958)	37.70 (958)
	Shoulder room, front	53.00 (1346)	53.00 (1346)	53.00 (1346)	53.00 (1346)	53.00 (1346)
	Shoulder room, rear	49.00 (1245)	51.40 (1306)	49.00 (1245)	51.40 (1306)	51.40 (1306)
	Hip room, front	49.50 (1257)	49.60 (1260)	49.50 (1257)	49.60 (1260)	49.60 (1260)
	Hip room, rear	46.10 (1171)	46.40 (1179)	46.10 (1171)	46.40 (1179)	46.40 (1179)
	Leg room, front	42.00 (1067)	41.80 (1062)	42.00 (1067)	41.80 (1062)	41.80 (1062)
	Leg room, rear	32.20 (818)	33.70 (856)	32.20 (818)	33.70 (856)	33.70 (856)

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

All dimensions in inches (mm) unless otherwise stated.



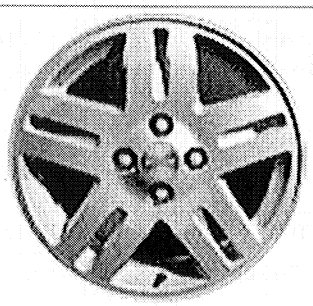
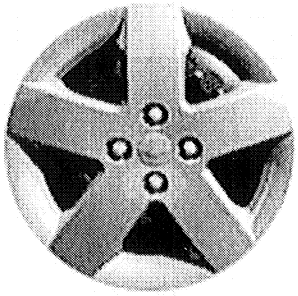
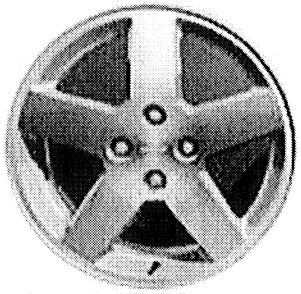
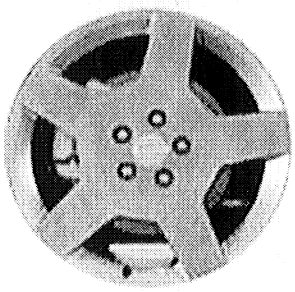


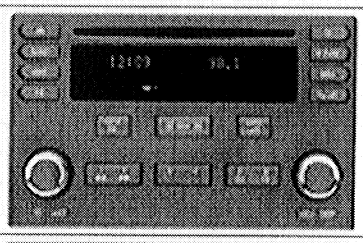
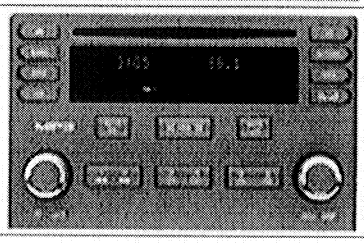
	Specifications	1AM37 SS Coupe	1AM69 SS Sedan	1AP37 SS Supercharged Coupe
A	**Wheelbase**	103.30 (2624)	103.30 (2624)	103.30 (2624)
B	**Overall length**	180.50 (4585)	180.30 (4580)	180.50 (4585)
C	**Body width**	67.90 (1725)	67.90 (1725)	67.90 (1725)
D	**Overall height**	55.50 (1410)	57.10 (1450)	55.50 (1410)
	Front track width	58.70 (1491)	58.70 (1491)	58.70 (1491)
	Rear track width	58.10 (1476)	58.10 (1476)	58.10 (1476)
	Head room, front	38.70 (983)	38.50 (978)	38.70 (983)
	Head room, rear	35.70 (907)	37.70 (958)	35.70 (907)
	Shoulder room, front	53.00 (1346)	53.00 (1346)	53.00 (1346)
	Shoulder room, rear	49.00 (1245)	51.40 (1306)	49.00 (1245)
	Hip room, front	49.50 (1257)	49.60 (1260)	49.50 (1257)
	Hip room, rear	46.10 (1171)	46.40 (1179)	46.10 (1171)
	Leg room, front	42.00 (1067)	41.80 (1062)	42.00 (1067)
	Leg room, rear	32.20 (818)	33.70 (856)	32.20 (818)

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

	1AK37 LS Coupe	1AK69 LS Sedan	1AL37 LT Coupe	1AL69 LT Sedan	1AZ69 LTZ Sedan
Specifications					
Turning diameter, curb-to-curb, ft. (m)	33.5 (10.2)	33.5 (10.2)	33.5 (10.2)	33.5 (10.2)	33.5 (10.2)
Capacities					
Curb weight, lbs. (kg)	2991 (1357)	3216 (1459)	2991 (1357)	3216 (1459)	3216 (1459)
Cargo volume, cu. ft. (liters)	13.9 (393.6)	13.9 (393.6)	13.9 (393.6)	13.9 (393.6)	13.9 (393.6)
Fuel capacity, approximate, gallon (liters)	13 (49)	13 (49)	13 (49)	13 (49)	13 (49)
Seating capacity (front/rear)	2/3	2/3	2/3	2/3	2/3

	1AM37 SS Coupe	1AM69 SS Sedan	1AP37 SS Supercharged Coupe
Specifications			
Turning diameter, curb-to-curb, ft. (m)	33.5 (10.2)	33.5 (10.2)	33.5 (10.2)
Capacities			
Curb weight, lbs. (kg)	TBD	TBD	2991 (1357)
Cargo volume, cu. ft. (liters)	13.9 (393.6)	13.9 (393.6)	13.9 (393.6)
Fuel capacity, approximate, gallon (liters)	13 (49)	13 (49)	13 (49)
Seating capacity (front/rear)	2/3	2/3	2/3

	PF7 **Wheels,** 15" (38.1 cm) aluminum
	PG1 **Wheels,** 15" (38.1 cm) steel, includes full bolt-on wheel covers
	PFD **Wheels,** 16" (40.6 cm) aluminum, machine-faced
	NW5 **Wheels,** 18" (45.7 cm) aluminum, painted
Image to come	PFE **Wheels,** 17" (43.2 cm) aluminum, polished

	UN0 **Sound system,** ETR AM/FM stereo with CD player, includes Radio Data System, seek-and-scan, digital clock, auto-tone control, automatic volume and TheftLock
	US8 **Sound system,** ETR AM/FM stereo with CD player and MP3 playback, includes Radio Data System, seek-and-scan, digital clock, auto-tone control, automatic volume and TheftLock

Option Code	Description
**2	Seats, front
19*	Seats, front
AK5	Air bags, dual-stage, frontal
AP9	Cargo convenience net, trunk
ASF	Air bags, dual-stage
AU3	Door locks, power
B34	Floormats, carpeted
B84	Moldings, bodyside, body-color
C67	Air conditioning, front manual
CF5	Sunroof, power
DT4	Ashtray and lighter
FE1	Suspension, Premium Ride
FE3	Suspension, Sport
FE5	Suspension, Performance Handling
FE9	Emissions, Federal requirements
G85	Performance Package
J41	Brakes, front disc/rear drum
JL9	Brakes, 4-wheel antilock, 4-wheel disc
JM4	Brakes, 4-wheel antilock, front disc/rear drum
K05	Engine block heater
K34	Cruise control
L61	Engine, ECOTEC 2.2L DOHC,
LE5	Engine, ECOTEC 2.4L DOHC, 4-cylinder, SFI
LSJ	Engine, ECOTEC 2.0L DOHC
MM5	Transmission, 5-speed manual
MM5	Transmission, 5-speed manual
MM5	Transmission, 5-speed manual
MX0	Transmission, 4-speed automatic
NB8	Emissions override
NC7	Emissions override, Federal
NE1	Emissions, Maine, Massachusetts, New York or Vermont state requirements
NW5	Wheels, 18" (45.7 cm) aluminum
NW7	Traction Control, all-speed
PF7	Wheels, 15" (38.1 cm) aluminum
PFD	Wheels, 16" (40.6 cm) aluminum
PFE	Wheels, 17" (43.2 cm) aluminum, polished
PG1	Wheels, 15" (38.1 cm) steel
QBU	Tires, P205/50R17
QMF	Tires, P205/55R16
QTJ	Tires, P215/45R18
QTU	Tires, P195/60R15
T37	Fog lamps, front
T43	Spoiler, rear
TV5	Sport Package
U2K	Sound system feature, XM Satellite Radio
UE1	OnStar
UK3	Steering wheel, leather-wrapped
UN0	Sound system, ETR AM/FM stereo with CD player
UQ3	Sound system feature, 7-speakers

Option Code	Description
UQ4	Sound system feature, 4-speakers
US8	Sound system, ETR AM/FM stereo with CD player and MP3 playback
VCL	Emissions Certification, CFF (Clean Fuel Fleet) LEV (Low Emission Vehicle).
VK3	License plate front mounting package
YF5	Emissions, California state requirements