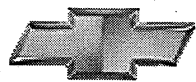


Chevrolet



Venture



2001

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Product Information

2001 Chevrolet Venture: More Versatile, Way More Fun!

DETROIT — Chevrolet Venture is the Minivan that's fun for the whole family! No other minivan offers as many models, seating configurations and kid (and parent) pleasing features (excluding similar GM models). With its constant product improvements such as an available third row stowable seat, an available driver's side power sliding door and the new rear parking aid option, Venture keeps getting better in 2001.

"Chevrolet Venture takes the concept of dependable, versatile family transportation to a whole new level," said Pete Langenhorst, Venture brand manager. "We like to think of it as the minivan that helps families to do more and get the most out of life."

By adding an available power driver's side sliding door, Venture buyers now have the availability of dual power sliding doors to easily access the spacious interior — room enough for up to eight in Chevy Venture extended wheelbase models. The seats feature a new recline lever for 2001 to make adjustments more simple. To make the conversion from people to cargo easier, new flat folding captain's chairs with cupholders are available in the second row, while the third row of seats can be folded flat without having to be removed.

Keeping with the Venture idea of allowing owners to do more, 2001 Venture has OnStar on board. Standard on all Ventures except the Value Van, OnStar provides safety and security benefits such as automatic air bag deployment notification and emergency assistance with remote location. That translates to help where the customer needs it, even if they don't know or can't say where they are.

Other news inside includes a new climate control (HVAC) system, which provides greater interior comfort, an instrument panel mounted cupholder and an optional in-dash six-CD changer/player. While outside, a redesigned front fascia and grille plus a new black exterior color give Chevy Venture a new appearance for 2001.

Also helpful to families is Venture's rear parking aid, new for 2001, which promotes family safety. When in reverse, an audio and video signal will alert the driver of the close proximity of an object or person. Power comes from the standard and highly dependable 3400 V6 engine with a four-speed automatic transmission.

Because Venture is the minivan families have come to trust, Chevrolet has a host of safety and security features to protect "precious cargo" on the road, including: four-wheel anti-lock brakes, driver and front-passenger air bags, standard driver and front passenger side-impact air bags, child security rear door locks and available integrated child safety seats. Daytime Running Lamps with automatic exterior lamp control are also standard to help other drivers see Venture day and night.

Chevrolet Venture Warner Bros. Edition

The Chevrolet Venture Warner Bros. Edition was a blockbuster hit when it premiered last year. This special edition is truly one of a kind. It comes with an integrated video entertainment system for the back seat passengers, and a tri-mode audio system that lets parents catch up on the news, while the kids listen to CDs or watch a video, all at the same time.

Continuing in 2001, Warner Bros. owners receive VentureTainment! — a package of special ownership benefits and privileges that translates to excellent entertainment benefits for the whole family to enjoy.

With its wide model choices and expanded flexibility in 2001, Chevrolet Venture continues to be the most versatile minivan ever.

Brand Identity

The Chevrolet Venture is the most versatile minivan ever. It features flip-and-fold seats, available eight-passenger seating, wide dual sliding doors, an available stowable third-row seat and a rear liftgate that provides six feet of ground clearance when open. Venture's versatility makes it the minivan active, time-challenged families depend on to do more.

New for 2001

Exterior

- New front fascia and grille
- Left-hand power sliding door (mid-2001)
- Black exterior paint
- Rear parking aid (not available on Value and Plus models, optional on extended wheelbase LS and standard for LT and Warner Bros. Edition)

Interior

- Seat enhancements
 - Third-row stowable seat and convenience center
 - Recline lever
 - Fold-flat captain's seats
 - Cup holder on captain's seats (second row)
- Latch child restraint anchorage system
- Warner Bros. Edition entertainment improvements
 - larger viewing screen for video monitor
 - wireless headsets
- Universal garage door opener
- New climate control (HVAC) system
- Instrument panel-mounted cup holder
- In-dash six-disc compact disc changer/player
- OnStar* (all models except Value Van)

* One-year OnStar Safety and Security service contract included as standard on Venture Plus, LS, LT and Warner Bros. Edition models. Call 1-800-ONSTAR-7 for system limitations and details.

Vehicle Overview

Models

- Value
- Plus
- LS
- LT
- Warner Bros. Edition

Customer Profile

The Chevy Venture is a minivan designed with a "family-comes-first" mentality. Buyers are typically active, family-centered and proud of the family image. Venture is perfect for on-the-go families with many different needs for their vehicle. They might need Venture to carry the kids to soccer, haul lumber or transport the family to the local zoo.

Buyer Demographics

Median age:	50 years
Median household income:	\$60,000
Purchaser (male/female):	50%/50%
Married:	89%
Children in household:	At least one
College graduates:	50%

Competition

- Dodge Caravan and Grand Caravan
- Chrysler Voyager and Grand Voyager
- Ford Windstar
- Honda Odyssey
- Toyota Sienna
- Mazda MPV

Color and Trim

Exterior Colors

- Smokey Carmel Metallic
- Carmine Red
- Medium Redfire Metallic
- Sandrift Metallic
- Silvermist Metallic
- Dark Sapphire Metallic
- Bright White
- Dark Teal Metallic
- Black
- Warner Bros. Edition available in Silvermist Metallic, Black and Medium Redfire Metallic. Venture Value model available in Bright White and Dark Sapphire Metallic.

Interior Fabric and Colors

- Medium Gray cloth
- Neutral cloth
- Dark Gray* cloth
- Medium Gray leather

- Neutral leather
- Dark Gray* leather

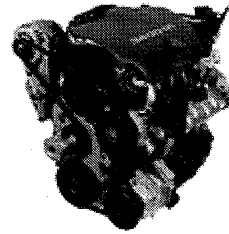
* Warner Bros. Edition only.

Engine

3400 V6 SFI Engine

Technical Features of the 3400 V6 Engine:

- Sequential Fuel Injection
- Forged alloy steel connecting rods
- "Assembled" steel camshaft
- Low coolant and low oil level indicators
- Towing capacity of 3,500 lbs. when equipped with the optional Trailering Provisions Package and proper trailering equipment
- Engine protection mode
- OBD II
- Low-friction roller rocker arms and roller lifters
- 24x ignition system
- Engine acoustic cover
- Extended-Life Service Items Include:
 - Platinum-tip spark plugs
 - Extended-life engine coolant



Transmissions

4T65-E 4-Speed Electronically Controlled Automatic Transmission with Overdrive

Technical Features of the 4T65-E Transmission:

- Temperature sensor
- Cast-aluminum side cover
- Engine protection mode
- Torque-axis mounting system
- Long-life automatic transmission fluid

Suspension

Front Suspension

- Independent MacPherson struts
- Variable-rate coil springs
- L-shaped lower control arms
- Standard front stabilizer bar
- Aluminum steering knuckles
- Maintenance-free ball joints

Rear Suspension

- Semi-independent
- Twist axle/coil spring rear suspension
- Double-acting shocks
- Rear shock absorbers mounted parallel to each other
- Counter-angled rear shock absorbers

Suspension Packages

- Smooth Ride Suspension (standard on all Venture models)

2001 Chevrolet Venture Restoration Kit

- Touring Suspension (optional with LS trim package and Warner Bros. Edition model, and included with LT trim)
- Technical Features of the Touring Suspension:
- Load leveling
- Auxiliary air pump

Steering

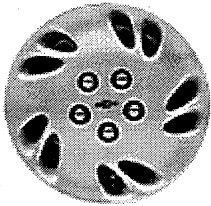
- Power rack-and-pinion
- Intermediate steering shaft with a solid shaft
- Rigid steering column mounted in a stiff magnesium bracket and attached to a cross-vehicle beam

Brakes

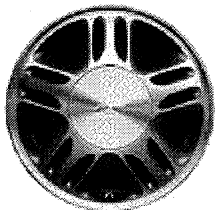
- Front disc/rear drum
- 4-wheel antilock brake system (ABS)
- Brake/transmission shift interlock

Wheels and Tires

Wheels



15-inch x 6-inch steel wheels with 15-inch bolt-on wheel covers – standard



15-inch x 6-inch aluminum wheels are included with LS, LT trim and the Warner Bros. Edition, and available on Plus models (except with PEG 1SA and Value Van model)

Tires

- P215/70R-15 – standard on all models
- P215/70R-15 self-sealing, all-season steel-belted radial Touring tires optional (not available on Value Van or Plus Passenger Van models)
- Compact spare tire

Feature Availability

	Value Van	Plus	LS	LT	Warner Bros. Edition
Interior Features					
Air bags— driver and right front-passenger(1)	S	S	S	S	S
— driver and front-passenger, side-impact(1)	S	S	S	S	S
Air conditioning — front	S	S	S	S	S
Console — center, non-locking	S	S	S	S	NA
Convenience net — cargo (liftgate) (not available with third row convenience center)	NA	NA	S	S	S
Cruise control	NA	S	S	S	S
Cup holders — instrument panel, second-row and third-row	S	S	S	S	S
Defogger— rear-window	O	S	S	S	S
— side-window	S	S	S	S	S
Glass — deep-tinted (extended wheelbase)	NA	S	S	S	S
Lighting — interior roof rail, third-row (extended wheelbase)	NA	S	S	S	S
Locks — child safety sliding door	S	S	S	S	S
— power door/liftgate	S	S	S	S	S
Map pockets — front bucket seatbacks and front doors	S	S	S	S	S
OnStar system(2)	NA	S	S	S	S
Seats— 2 front bucket, 2-passenger 40/60 split-bench and 3-passenger 50/50 split-bench	S	S	S	NA	NA
— 2 front bucket, 2 captain's and 3-passenger stowable rear bench	NA	NA	O	S	NA
— 2 front bucket, 5 rear modular buckets (limited availability)	NA	NA	NA	NA	S
— 2 front bucket, 3 modular buckets, 3-passenger stowable rear bench	NA	NA	O	O	S
— 6-way power driver	NA	O	O	S	S
— leather seating surfaces	NA	NA	NA	O	NA
— leather seating surfaces with cloth inserts	NA	NA	NA	NA	S
Steering column — Tilt-Wheel™	S	S	S	S	S
Video — IP-mounted stereo videocassette player with remote control and overhead/flip-down LCD video monitor	NA	NA	NA	NA	S
Windows — power with driver's Express-Down feature	NA	S	S	S	S
Sound Systems					
NOTE: All sound systems feature an Electronically Tuned Receiver (ETR) and include a digital clock and seek-scan.					
AM/FM stereo	S	NA	NA	NA	NA
AM/FM stereo with TheftLock, cassette player and auto tone control	NA	S	NA	NA	NA
AM/FM stereo with TheftLock, speed-compensated volume, compact disc player, auto tone control and Radio Data System (RDS)	NA	O	S	NA	NA
AM/FM stereo with TheftLock, speed-compensated volume, six-disc compact disc changer/player, auto tone control and Radio Data System (RDS)	NA	NA	O	O	O

AM/FM stereo with TheftLock, speed-compensated volume, cassette and compact disc players, auto tone control and Radio Data System (RDS)	NA	NA	O	S	S
Rear-seat audio controls with headphone jacks	NA	NA	O	S	S
Exterior Features					
Badging — Warner Bros. Family Entertainment	NA	NA	NA	NA	S
Daytime Running Lamps with Automatic Exterior Lamp Control	S	S	S	S	S
Door — dual sliding side	S	S	S	S	S
— power passenger-side sliding	NA	O	O	S	S
Luggage carrier	NA	O	S	S	S
Mirrors — manually operated	S	NA	NA	NA	NA
Mirrors — outside dual power remote, heated	NA	S	S	S	S
Power-driver side sliding door (late availability)	NA	NA	O	O	O
Tires— P215/70R-15 blackwall all-season	S	S	S	S	S
— P215/70R-15 blackwall Touring, self-sealing	NA	NA	O	O	O
Wheels— 15-inch steel with bolt-on wheel cover	S	S	NA	NA	NA
— 15-inch cast-aluminum	NA	O	S	S	S
Wipers — intermittent variable	S	S	S	S	S
Functional Features					
Battery-rundown protection	S	S	S	S	S
Brakes — power front disc/rear drum with 4-wheel antilock	S	S	S	S	S
Engine — 3400 V6 SFI	S	S	S	S	S
Remote Keyless Entry	NA	S	S	S	S
Suspension— Smooth Ride	S	S	S	NA	S
— Touring with load leveling	NA	NA	O	S	O
Traction Control	NA	NA	O	S	O
Transmission — 4-speed electronically controlled automatic	S	S	S	S	S
Safety and Security Features					
Air bags— driver and front-passenger(1)	S	S	S	S	S
— driver and front-passenger, side-impact(1)	S	S	S	S	S
Brakes — power front disc/rear drum with 4-wheel antilock	S	S	S	S	S
Brake/transmission shift interlock	S	S	S	S	S
Daytime Running Lamps with Automatic Exterior Lamp Control	S	S	S	S	S
OnStar system(2)	NA	S	S	S	S
Remote Keyless Entry	NA	S	S	S	S
Traction Control	NA	NA	O	S	O
Reverse Parking Aid System	NA	NA	O	S	S

S – Standard.

O – Optional. (Some options may be available only as part of a Preferred Equipment Group.)

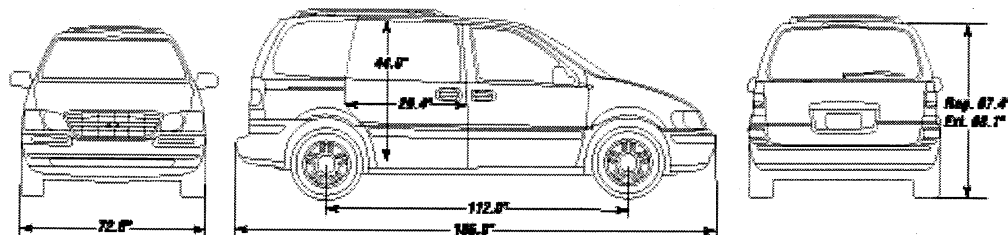
NA – Not available.

- (1) Always use safety belts and proper child restraints, even with air bags. Children are safer when properly secured in a rear seat. Front-seat side-impact air bags help reduce the risk of certain injuries to front-seat occupants in side impacts. See the Owner's Manual for more safety information.
- (2) One-year OnStar Safety and Security service contract included as standard on Venture LS, LT and Warner Bros. Edition models. Call 1-800-ONSTAR-7 for system limitations and details.

Specifications

Engine		
	Vortec 3400 V6 SFI	
RPO	LA1	
Displacement (cu. in./liters)	207/3.4	
Bore x stroke (in.)	3.62 x 3.31	
(mm)	92 x 84	
Compression ratio	9.5:1	
Block material	cast-iron	
Cylinder head material	aluminum	
Valvetrain configuration	OHV	
Valves/cylinder	2	
Induction	SFI	
Ignition system	direct	
Lifters	hydraulic roller	
Cam drive	chain	
Coolant capacity (quarts/liters)	11.3/10.7	
Oil capacity (quarts/liters)	4.5/4.3	
Alternator rating (amps)	105	
Battery (SAE rating, cca)	600	
Recommended unleaded fuel	87 octane	
Maximum engine speed (RPM)	6000	
Horsepower/kW @ engine RPM	185/134 @ 5200	
Torque (lb.-ft./N-m @ engine RPM)	210/278 @4000	
Transmission Specifications		
Transmission	4T65-E	
RPO	M15	
First gear	2.92	
Second gear	1.57	
Third gear	1.00	
Fourth gear	0.71	
Reverse	2.39	
Axle ratios	3.29	
Fluid capacity (quarts/liters)	7.4/7.0	
Case material	cast-aluminum	
Steering Specifications		
Ratio	16.8:1	
Turning diameter curb-to-curb (ft./m)		
— Regular Wheelbase models	37.4/11.4	
— Extended Wheelbase models	39.7/12.1	
Brake Specifications		
Front	U.S. Standard	Metric
— rotor size (diam. x thick.)	10.94 x 1.27 in.	278 x 32 mm
— swept area	240.6 sq. in.	1550 sq. cm
Rear	U.S. Standard	Metric
— drum size (diam. x width)	8.86 x 1.77 in.	225 x 45 mm
— swept area	98.6 sq. in.	636 sq. cm

Dimensions



NOTE: All dimensions shown are inches/millimeters unless otherwise noted.

	Reg. Wheelbase	Ext. Wheelbase
Exterior		
Wheelbase	112.0/2845	120.0/3048
Length	186.9/4747	200.9/5103
Height	67.4/1712	68.1/1730
Maximum width	72.0/1829	72.0/1829
Side-door load opening		
— height	44.0/1117	44.0/1117
— width	29.4/746	32.0/812
Rear-door load opening		
— height	40.7/1033	40.7/1033
— width above beltline	43.0/1092	43.0/1092
— width at beltline	51.4/1305	50.5/1282
Ground to rear load floor	24.0/610	25.0/635
Ground clearance		
— front	8.3/211	8.5/216
— rear	10.4/264	11.0/279
Tread width		
— front	61.5/1562	61.5/1562
— rear	63.3/1607	63.3/1607
Interior		
Headroom		
— front	39.9/1014	39.9/1014
— middle	39.3/998	39.3/998
— rear	38.8/986	38.9/988
Legroom		
— front	39.9/1014	39.9/1014
— middle	36.9/937	39.0/991
— rear	34.0/864	36.7/932
Shoulder room		
— front	59.8/1519	59.8/1519
— middle	61.9/1572	61.9/1572
— rear	60.1/1527	59.6/1514
Hip room		
— front	55.5/1410	55.5/1410
— middle	60.4/1534	64.3/1633
— rear	48.3/1227	48.3/1227

	Reg. wheelbase	Ext. wheelbase
Cargo area		
Cargo volume (cu. ft./liters)		
— with front seat	126.6/3584	NA
— with front seat and left-side sliding door	133.0/3766	155.9/4414
— with front/middle seats (max.)	42.8/1211	54.7/1548
— with front/middle/ rear seats (max.)	16.3/461	24.2/685
Width between wheel housings	48.3/1226	48.3/1226
Load floor length		
— with front seat	86.1/2186	100.0/2540
— with front/middle seats (max.)	50.7/1287	62.4/1584
— with front/middle/rear seats (max.)	18.1/467	26.9/683
Interior height	45.8/1163	45.1/1145
Capacities And Weights		
Est. curb weight (std.) (lbs./kg)	3699/1678	3838/1741
Maximum GVWR (lbs./kg)	5357/2430	5357/2430
Base payload (std.) (lbs./kg)	1612/601	1457/661
Max. trailer capacity* (lbs./kg)	3500/1588	3500/1588
Max. cargo capacity (cu. ft./lit)	119.8/3392	140.7/3984
Fuel tank capacity (gal./lit.)	20/75.7	25/94.6

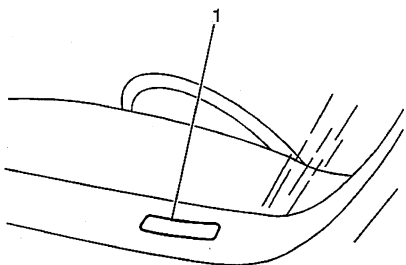
* When properly equipped with optional Trailering Provisions Package.

Trailering⁽¹⁾		
The 2001 Chevy Venture can be equipped to tow up to 3,500 lbs. with the optional trailering provisions.		
Models	All	
Gross trailer weight (lbs./kg, up to)	2000/907	3500/1587
Maximum tongue load (lbs./kg, max.)	200/91	350/159

- (1) Additional equipment required. Properly equipped. Maximum trailer weight is calculated by assuming only the driver is in the tow vehicle. Optional equipment, passengers or cargo will reduce the trailer weight rating. The vehicle owner is responsible for obtaining the hitch ball, a hitch of the proper size, type and capacity, and other appropriate equipment required to safely tow both the trailer and the load that will be towed.

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	World Identifier	1	USA
2	Manufacturer	G	General Motors
3	Nameplate	N M H	Chevrolet Pontiac Oldsmobile
4	GVWR/Brake System	D	GVWR 5001- 6000/Brake System - Hydraulic
5	Line and Chassis Type	U/0 U/1 U/2 V/O V/1 V/2 XO X1 X2 U/0 U/1 U/2 V/O V/1 V/2 XO X1 X2 V/O V/1 V/2 XO X1 X2	CHEV-Venture APV 4x2 CHEV-Venture APV 4X2 Luxury CHEV-Venture APV 4X2 Economy CHEV-Venture APV 4X4 CHEV-Venture APV 4X4 Luxury CHEV-Venture APV 4X4 Economy CHEV-Venture APV 4X2 EXT W/B CHEV-Venture APV 4X2 EXT W/B Luxury EXT W/B CHEV-Venture APV 4X2 EXT W/B Montana APV 4x2 Montana APV 4X2 Luxury Montana APV 4X2 Economy Montana APV 4X4 Montana APV 4X4 Luxury Montana APV 4X4 Economy Montana APV 4X2 EXT W/B Montana APV 4X2 Luxury EXT W/B Montana APV 4X2 Economy EXT W/B Silhoutte APV 4X2 Economy Silhoutte APV 4X4 Silhoutte APV 4X4 Luxury Silhoutte APV 4X4 Economy Silhoutte APV 4X2 EXT W/B Silhoutte APV 4X2 EXT W/B Luxury EXT W/B Silhoutte APV 4X2 EXT W/B

6	Series	0 1 2	Base Luxury Economy
7	Body Type	3	Four-Door All Purpose Vehicle
8	Engine Type	E	RPO LA1, Engine Gas, 3.4L, V6, MFI, HO
9	Check Digit	--	Check Digit
10	Model Year	1	2001
11	Assembly Plant	D	Doraville, GA
12-17	Production Sequence Number	--	100001

VIN Derivative

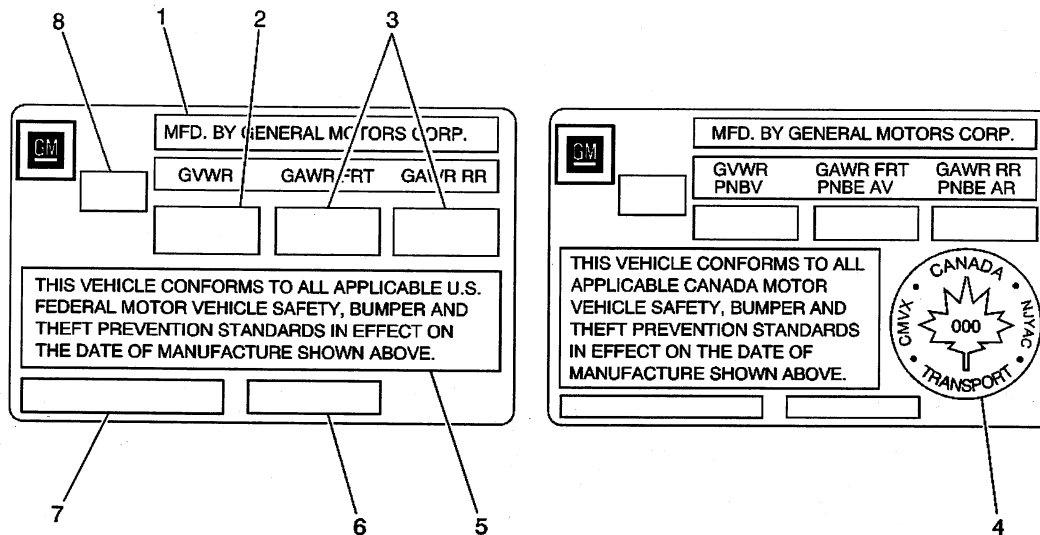
All engines and transmissions are stamped or laser etched with a partial vehicle identification number (VIN), which was derived from the complete VIN. A VIN derivative contains the following nine positions:

VIN Derivative Position	Definition	Character	Description
1	GM Division Identifier	N M H	Chevrolet Pontiac Oldsmobile
2	Model Year	1	2001
3	Assembly Plant	D	Doraville
4-9	Plant Sequence Number	--	Plant Sequence Number

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

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

Vehicle Certification Label



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

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

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

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

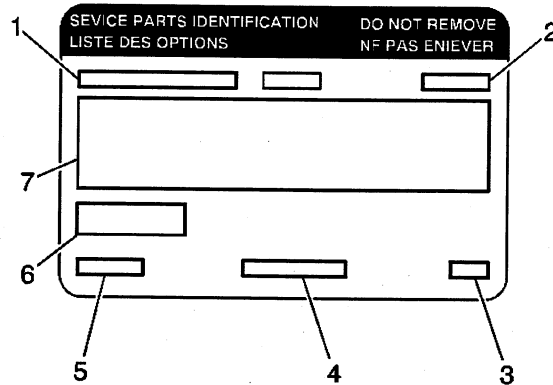
The GVW is the weight of the vehicle and everything the vehicle carries. Include the following items when figuring the GVW:

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

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

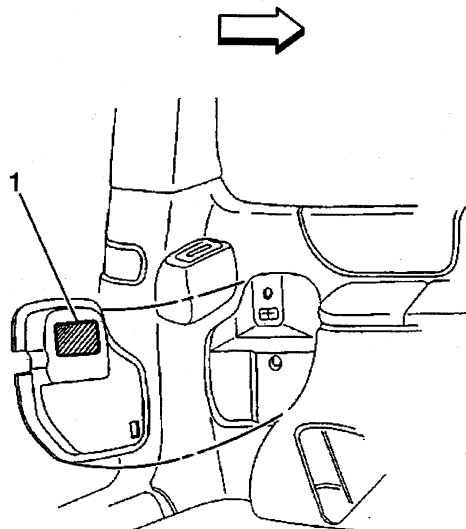
The GAW is the weight exerted on one of the axles (front or rear).

Service Parts Identification Label (SPID)



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

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



The service parts identification label is located on the inside of the left quarter trim access panel (1). Refer to RPO Code List below for a definition of the codes that are printed on the service parts identification label or referred to in this service information.

Tire Placard

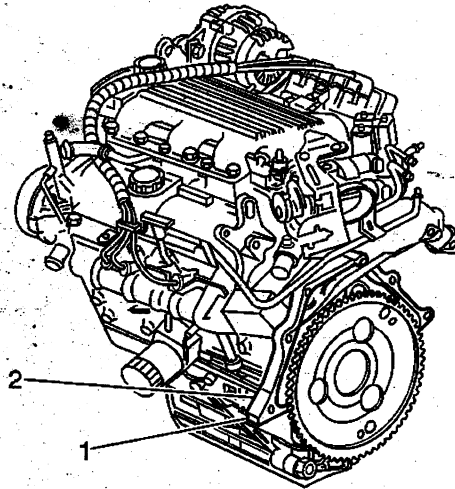
MFD BY GENERAL MOTORS CORP	
GVWR	GAWR FRT GAWR RR
THIS VEHICLE CONFORMS TO ALL APPLICABLE U.S. FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.	
MODEL:	
	TIRE SIZE SPEED RTG RIM COLD TIRE PRESSURE
FRT	
RR	
SPA	
SEE OWNER'S MANUAL FOR ADDITIONAL INFORMATION.	

The tire placard is located on the inside edge of the driver's door. Refer to the tire placard to obtain the following information:

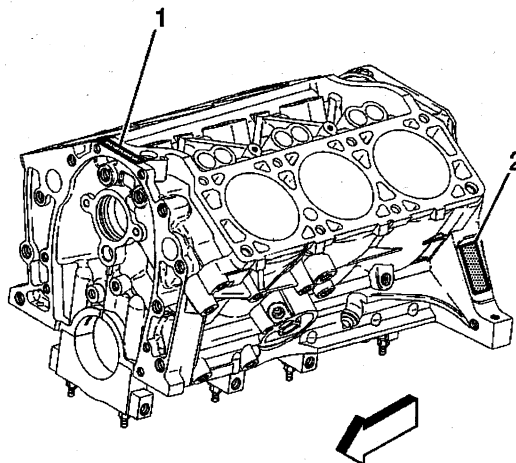
- Maximum vehicle capacity weight
- Cold tire inflation pressures
- Original equipment tire sizes
- Original equipment tire speed ratings

Engine ID and VIN Derivative Location

The eighth character in the Vehicle Identification Number (VIN) identifies the engine. Adhesive-backed labels attached to the engine, laser etching or stampings on the engine block indicate the engine unit number/date code. All engines are stamped with a VIN derivative. For more information on the VIN derivative, refer to VIN Derivative above.



The primary (1) and optional (2) location of the VIN derivative for the 3400 LA1 engine is on the lower left front transaxle mounting surface.

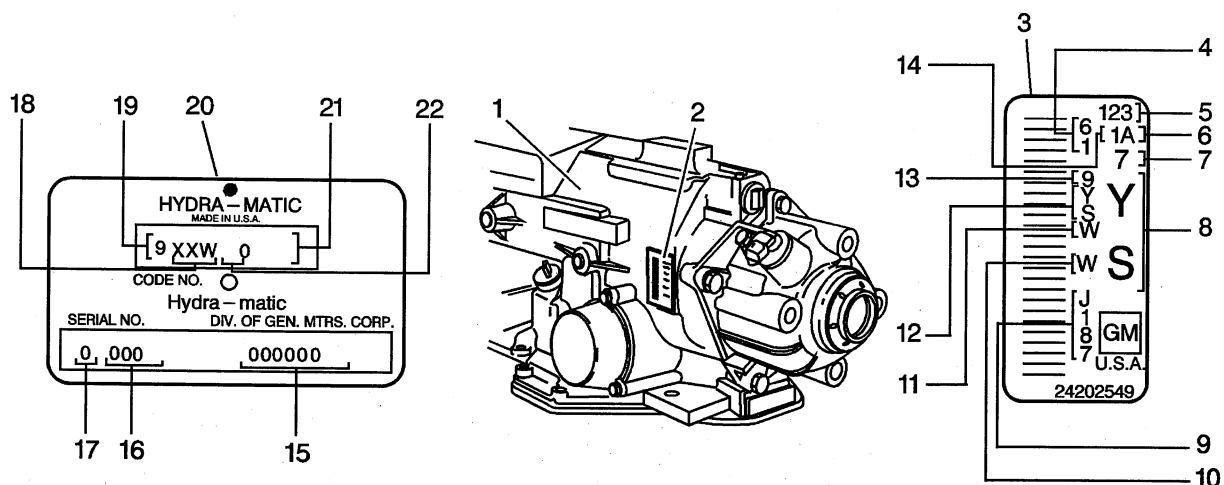


The eighth digit of the Vehicle Identification Number (VIN) identifies the engine. The adhesive-backed labels attached to the engine, laser etching or stampings on the engine block indicate the engine unit number/date code. All engines are stamped with a VIN derivative.

The primary location (1) of the Engine ID for the 3400 (LA1) engine on top of the RH rocker arm cover or front of RH oil pan rail. The secondary location (2) of the VIN derivative for the 3400 (LA1) engine is above the starter motor on the engine block. For additional information, refer to VIN Derivative above.

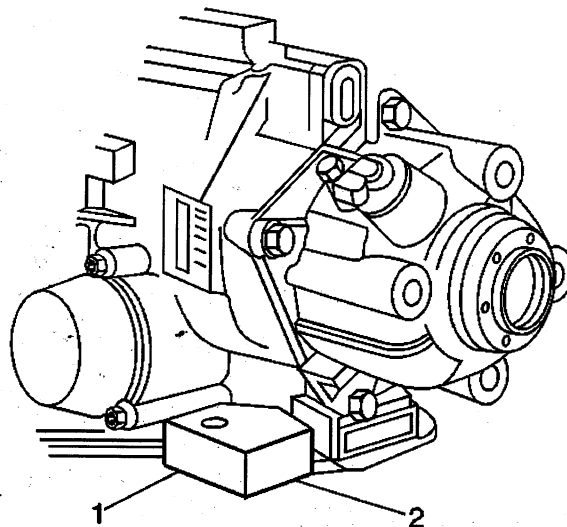
Transmission ID and VIN Derivative Location

Transmission ID and VIN Derivative Location 4T60-E/4T65-E(c)



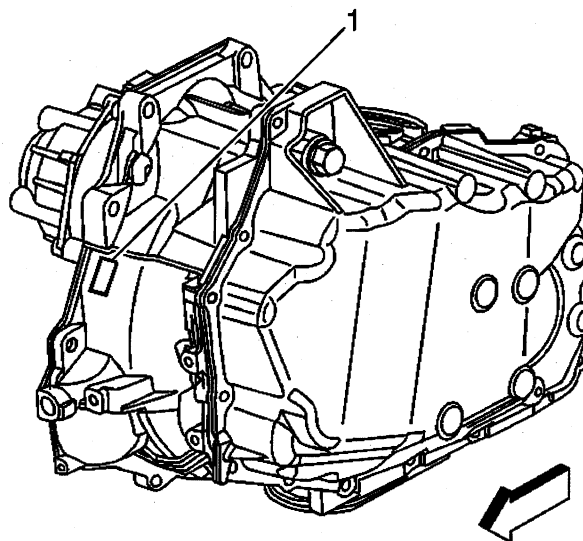
- (1) Goodwrench® Tag Location
 - (2) Year
 - (3) Not Used
 - (4) Remanufacturing Site Code
 - (5) Serial Number
 - (6) Julian Date
 - (7) Year Remanufactured
 - (8) Model
 - (9) Transmission Identification Plate Location
 - (10) Model Year
 - (11) Line Build
 - (12) GM Production Code
 - (13) Julian Date
 - (14) Shift
 - (15) Model
 - (16) Serial Number in Base Code 31
 - (17) W = Warren Assembly Plant
 - (18) 4T65-E
 - (19) Model
 - (20) Vehicle Identification Number (VIN) Derivative Stamping Location
- All automatic transmissions have a metal identification (ID) nameplate (9) attached to the case exterior.

Transmission VIN Location 4T65-E, M15/MN3/MN7(c)



The primary (1) and secondary (2) Manual Tooling VIN Derivative Locations are on the casting of the transmission housing.

Transaxle VIN Derivative Stamping(c)



The location for the Semi-Automatic VIN derivative (1) is on the transmission housing.

Labeling - Anti-Theft

Notice

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

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

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

RPO Code List

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

RPO	Description
ABA	Seat Configuration #1 (Req. 7 Pass. ZP7); Row 1: Front Buckets - 2; Row 2: 40/60 Bench - 2 (RPO AT5); Row 3: 50/50 Bench - 3 (RPO AM9)
ABB	Seat Configuration #2 (Req. 7 Pass. ZP7); Row 1: Front Buckets - 2; Row 2/3: Rear Buckets - 3/2 (RPO AL4)
ABC	Seat Configuration #3 (Req. 7 Pass. ZP7); Row 1: Front Buckets - 2; Row 2: Captain Seats; Row 3 Passenger Fold Stowable (RPO AJ2)
ABD	Seat Configuration #4 (Req. 7 Pass ZP7); Row 1: Front Buckets - 2; Row 2: Captain Seats - 2 (RPO AQ4); Row 3: 50/50 Bench - 3 (RPO AM9)
ABE	Seat Configuration #5 (Req. 7 Pass ZP7); Row 1: Front Buckets - 2; Row 2: Bucket Seats - 2 (RPO AQ4); Row 3: 50/50 Bench - 3 (RPO AL4)
ABF	Seat Configuration #6 (Req. 7 Pass ZP7); Row 1: Front Buckets - 2; Row 2: Bucket Seats - 2 (RPO AQ4); Row 3: Passenger Fold Stowable - 3 (RPO AJ2)
ABG	Seat Configuration #7 (Req. 7 Pass ZP7); Row 1: Front Buckets - 2; Row 2: Captain Seats - 2 (RPO AQ4); Row 3: Captain Seats - 3 (RPO AQ4)
ABH	Seat Configuration #8 (Req. 7 Pass ZP7); Row 1: Front Buckets - 2; (RPO: AV5); Row 2: Solid Bench - 2 (RPO AQ3); Row 3: Solid Bench - 3 (RPO AM9)
AB3	Seating Arrangement 6 Pass
AB7	Window Tinted, Deep, Liftgate
ACG	Filler Opaque Glass, Side RR Window
AG1	Adjuster Front Seat Power 6-Way Driver
AG2	Adjuster, Front Passenger Seat Power 6-Way
AJ1	Window Tinted Deep, All Except Windshield and Doors (FRT) (Solar Privacy Glass)
AJ2	Seat, Rear Folding Jumpseat
AJ7	Restraint System FRT Seat, Inflatable, Dr/Pass, Front and Side
AK5	Restraint System FRT Seat, Inflatable, Dr/Pass
AL4	Seat RR Bucket w/Reclin, HDREST (2nd/3rd Rows)
AM7	Seat RR Folding (3-Pass Bench) (3rd Row)
AM9	Seat Rr Split Back, Folding (50/50 Split Bench 3-Pass) (3rd Row)
AN2	Seat Child Integral Single RH 2nd Row
AN5	Seat Child Integral - Dual LH/RH 2nd Row
AP9	Restraint Cargo
AQ4	Seat RR
AR9	Seat Frt Bucket, Deluxe
AT5	Seat Rr Center, Folding 2-Pass 40/60 Bench, (2nd Row)
AU0	Lock Control Remote Entry (RFA) (Int Lights - On/Fade Off)
AV5	Seat, Front Bucket, Highback
AX4	Restraint Conversion Seat, Man, European
A20	Window, Rear Quarter Vent Swing-Out - Power-Operated
A26	Window European Glazing, All
A31	Window Power-Operated Side; Domestic Inc.: Express Down; GME Inc. Auto Down/Auto Up/Anti-jam
BA8	Compartment Stowage, Front Seat, Passenger
BG9	Covering Floor Rubber
BS1	Insulation Acoustical Package
B18	Ornamentation Interior, Deluxe
B37	Covering Floor Mat, FRT & RR, AUX
B4U	Performance Package Sport

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B57	Ornamentation Exterior, Deluxe
CJ3	HVAC system Air conditioner Front, Manual Temperature Control, Auxilliary Temperature Control
CKD	Vehicle Completely Knocked Down (CKD)
C25	Wiper System RR Window, Intermittent
C3L	GVW Rating 5357 Lbs.
C34	HVAC System Air Conditioner Heater Combination (FRT/RR w/Rear Controls)
C49	Defogger RR Window, Electric
C60	HVAC System Air Conditioner Front Manual Controls
C69	Rear A/C
C79	Lamp Interior, Roof Rail, Courtesy & Single Reading (Rows 2/3 - SSD -- Row 3 - DDS)
DD9	Mirror O/S LH & RH, Remote Control, Electric, Breakaway Color
DH6	Mirror, I/S Sunshade ILLUM and Map HLDR - LH/R)
DK6	Console, Interior Roof (Ext. - Inc. DIC)
DK7	Consolette, Overhead Base
DL5	Decal Roadside Service Information (N/A Can/Exp)
DOE	Plant Code Doraville, GA, USA
DR1	Mirror O/S LH & RH, Manual Control, Color
DR5	Mirror O/S LH & RH, Remote Control, Electric, Heated Manual Folding, Color
D55	Console FRT Compt, Floor
D84	Paint, Custom Two-Tone
E28	Assist Grips, B-Pillar-Mounted
E58	Door, Electric Sliding Side
E59	LH Power Sliding Door
E88	Pocket Stowage (Cargo Net Storage - RH Sidewall)
FE1	Suspension System Soft Ride
FE2	Suspension System Ride, Handling
FE3	Suspension System Sport
FE4	Suspension System Special Ride and Handling
FR9	Ratio Transaxle Final Drive 3.29
GQ1	Axle Rear Standard Ratio
G50	Spring, Rear Heavy Duty, VAR 1
G67	Level Control Auto, Air
JL9	Brake System Power, FRT and RR Disc, Antilock, FRT and RR Wheel
JM4	Brake System Power, FRT Disc, RR Drum, Cast Iron, Antilock, FRT/RR Wheel
KA1	Heater Seat, FRT
KC4	Cooling System Engine Oil
KG7	Generator 125 AMP
KG9	Generator 140 AMP
KNB	Air Cleaner, Dry
K05	Engine Block Heater
K12	Filter, Air, Pollutant
K29	Module Powertrain Control
K34	Cruise Control Automatic Electronic
K39	Cruise Control Automatic - Delete
K45	Air Cleaner, Heavy Duty
K68	Generator, 105 AMP
LA1	Engine, Gas, 6 Cyl. 3.4L, MFI, HO
MX0	Merchandises TRANS AUTO Provisions, O/D
M15	Trans, Auto 4-Spd, HMD, (4T65-E) Enhanced Electronic
NC8	Emission System California, ULEV
NF2	Emission System Federal, Tier 1
NF4	Emission System Clean Fuel Fleet
NF7	Emission System Federal, NLEV

2001 Chevrolet Venture Restoration Kit

NK4	Steering Wheel, Sport Leather
NM8	Leaded Fuel System Compatible
NP7	Steering Column EEG Approved
NV6	Steering Power, Reduced Effort
NW9	Traction Control Electronic
NY8	Shield Exhaust
N05	Lock Control Fuel Filler Cap
N30	Steering Wheel, Deluxe (Urethane)
PB4	Lock, Wheel
PG1	Wheels 15 x 6, Steel
PH3	Wheels 15 x 6, Aluminum Cast 115 mm Bolt Circle
PH6	Wheels 15 x 6, Aluminum
PY0	Wheels 16 x 6.5, Aluminum
PY1	Wheels 16 x 6.5, Aluminum Chrome
P42	Tires Self Sealing
TL4	Grille Painted
TT5	Headlamps Halogen, 2
TU8	Lamp INTR, Stop, High Level
T2H	Ornamentation EXTR, Export Unique Requirement
T2J	Ornamentation INTR, Export Unique Requirement
T62	Lamps System Daytime Running, Export
T65	Lamps System Daytime Running, Export
T84	Headlamps RH Rule of the Road, E Mark
T89	Lamps Tail and Stop. Export
T90	Lamps Signaling and Marker, Export
UA6	Theft Deterrent System
UC6	Radio AM/FM Stereo, Seek/Scan, RDS, Multiple Compact Disc, Auto Tone Control, Clock, ETR
UD4	Alarm Vehicle Speed, 120 K/H
UD7	Rear Parking Aid
UE1	Communication System Vehicle, G.P.S. 1
UG1	Garage Door Opener, Universal
UH8	Cluster Instrument, Coolant Temperature, Trip Odometer, Tachometer
UK3	Electronic System Steering Wheel Accessory Controls
UK6	Radio Control, RR Seat, and Earphone Jacks
UL0	Radio AM/FM Stereo, Seek/Scan, Auto Reverse Music Search Cassette, Auto Tone, Clock, ETR
UL2	Frequencies, European Radio
UL5	Radio Delete
UL8	Frequencies, Saudi Arabian
UM7	Radio AM/FM Stereo, Seek/Scan, Clock, ETR
UN0	Radio AM/FM Stereo, Seek/Scan, Compact Disc, Auto Tone, Clock, ETR
UP0	Radio AM/FM Stereo, Seek/Scan, Compact Disc, Equalizer, Clock, ETR
UX6	Speaker System Front, Dual
UZ4	Speaker System, Four Dual Front Door Extended Range, Dual Rear Liftgate Extended Range
UZ5	Speaker System, Four Dual Front Door Coaxial, Dual Rear Liftgate Coaxial
U1N	Radio AM/FM Stereo, Seek/Scan, Auto Rev Music Search Cass, Clock, Eqlzr, RDS, ETR
U1P	Radio AM/FM Stereo, Seek/Scan, CD, Clock, EQLZR, RDS ETR
U1Q	Radio AM/FM Stereo, Seek/Scan, Auto Rev Music Search Cass, CD, Clock, EQLZR, RDS, ETR
U18	Speedometer-Instrument Kilo/Miles
U19	Speedometer-Instrument Kilo/Miles; Kilo Odometer
U2E	Cluster Instrument, Coolant Temperature, Trip Odometer

2001 Chevrolet Venture Restoration Kit

U29	Lamp INTR, I/P Courtesy
U42	Entertainment System, Rear Seat
U68	Display Driver Info Center
U76	Antenna, Windshield Radio
VA5	Language Label English
VG9	Protector Wax, Exterior Body
VH5	Plate Vehicle Identification
VH7	Bumper Custom
VH9	Envelope Owner Information Manual
VZ2	Calibration Speedometer A
V08	Cooling System Heavy Duty
V41	Kit Accessory
V54	Luggage Carrier Roof, Painted
V76	Hook Tow
V92	Trailer Provisions
XCK	Tire Frt P215/70R15-97S WOL PE ST TL AL2
XNA	Tire Frt 205/65R15-94H BW R/PE ST TL HWY
XXN	Tire P225/60R16 AL2 (Only Olds & Thunder, Req. FE4)
XPA	Tire P215/70R15-97S WOL PE/ ST TL AL2 (Rear YPA) (Req. B4U/P42)
XPB	Tire Frt P215/70R15-97S BW R/PE ST TL ALS
XPU	Tire Frt P215/70R15 BW R/PE ST TL AL2 97S (Olds Req. FE3)
YCK	Tire Rear P215/70R15 WOL PE ST TL AL2 97S Self Sealing
YNA	Tire Rear 205/65R15 BW R/PE ST TL HWY 94H
YXX	Tire Rear P225/60R16-97S BL R/PE ST TL AL2
YPA	Tire Rear P215/70R15 WOL PE ST TL AL2 97S
YPB	Tire Rear P215/70R15 BW R/PE ST TL ALS 97S
YPU	Tire Rear P215/70R15 BW R/PE ST TL AL2 97S
Y91	Merchandised PKG Luxury Edition
Y92	Merchandised PKG Special Edition
ZP7	Seating Arrangement 7 Pass
ZP8	Seating Arrangement 8 Pass
ZX2	Seating Arrangement Driver and Passenger Highback
ZX9	Spare Tire with Wheel - Delete
Z10	Merchandised Package Cargo Van

Technical Information

Maintenance and Lubrication

Capacities - Approximate Fluid

Application	Specification	
	Metric	English
Automatic Transmission		
• Bottom Pan Removal	7.0 Liters	7.4 Quarts
• Complete Overhaul	9.5 Liters	10.0 Quarts
• Dry	12.7 Liters	13.4 Quarts
Engine Cooling System		
• Front HVAC System Only (C60) Without Heavy Duty Cooling (V08)	9.1 Liters	9.6 Quarts
• Front and Rear HVAC System (C34) Without Heavy Duty Cooling (V08)	11.1 Liters	11.9 Quarts
• Front HVAC System Only (C60) With Heavy Duty Cooling (V08)	10.1 Liters	10.5 Quarts
• Front and Rear HVAC System (C34) With Heavy Duty Cooling (V08)	12.6 Liters	13.2 Quarts
Engine Oil	4.2 Liters	4.5 Quarts
Fuel Tank		
• Standard/Regular	75.0 Liters	19.8 Gallons
• Optional/Extended	96.5 Liters	25.5 Gallons
Windshield Washer Fluid	0.37 Liters	1.0 Quarts

Maintenance Items

Item	Type/Part Number
Battery Replacement	CCA=600
Engine Air Cleaner Filter	AC Type A-1208C
Engine Oil Filter	AC Type PF-47
Fuel Filter	AC Type GF-819
Passenger Compartment Air Filter	(2) GM P/N 52482929
Radiator Cap	RC27
Spark Plugs	AC Type 41-940 Gap: 1.5 mm (0.060 in)
Windshield Wiper Blades	
• Back Glass Wiper Blade	GM P/N 22143295--Hook Type 40.6 mm (16 in)
• Left Wiper Blade	GM P/N 10293948--Hook Type 60.0 mm (24 in)
• Right Wiper Blade	GM P/N 10293947--Hook Type 60.0 mm (24 in)

Tire Inflation Pressure Specifications

Application	Specification	
	Metric	English
Compact Spare	414 kPa	60 psi
Front and Rear Tires	241 kPa	35 psi
Front and Rear Tires (w/ Entertainment Center U42)	220 kPa	32 psi

Fluid and Lubricant Recommendations

Usage	Fluid/Lubricant
Automatic Transmission	DEXRON®-III, Automatic Transmission Fluid
Engine Coolant	50/50 mixture of clean, drinkable water and use only GM Goodwrench® DEX-COOL® or Havoline® DEX-COOL® Coolant
Engine Oil	Engine oil with the American Petroleum Institute Certified For Gasoline Engines Starburst symbol of the proper viscosity
Hood and Door Hinges	Multi-Purpose Lubricant, Superlube® (GM P/N 12346241 or equivalent)
Hood Latch Assembly, Secondary Latch, Pivots, Spring Anchor and Release Pawl	Lubriplate® Lubricant Aerosol (GM P/N 12346293 or equivalent) or lubricant meeting requirements of NLGI # 2, Category LB or GC-LB
Hydraulic Brake System	Delco Supreme 11® Brake Fluid (GM P/N 12377967 or equivalent DOT-3 Brake Fluid)
Key Lock Cylinders	Multi-Purpose Lubricant, Superlube® (GM P/N 12346241 or equivalent)
Parking Brake Cable Guides	Chassis Lubricant (GM P/N 12377985 or equivalent) or Lubricant meeting requirements of NLGI # 2, Category LB or GC-LB
Power Steering System	GM Power Steering Fluid (GM P/N 1052884 - 1 pint, 1050017 - 1 quart, or equivalent)
Rear Folding Seat, Fuel Door Hinge, Liftgate Hinges, Power Sliding Door Cable	Multi-Purpose Lubricant, Superlube® (GM P/N 12346241 or equivalent)
Sliding Door Track	Lubriplate® Lubricant Aerosol (GM P/N 12346293 or equivalent) or lubricant meeting requirements of NLGI # 2, Category LB or GC-LB
Weatherstrips	Dielectric Silicone Grease (GM P/N 12345579 or equivalent)
Windshield Washer Solvent	GM Optikleen® Washer Solvent (GM P/N 1051515) or equivalent

Descriptions and Operations

Power Steering System Description

Power Steering Pump Description

The power steering pump is a vane-type pump which provides hydraulic pressure for the system. The power steering system consists of the following components:

- The driveshaft
- The pump housing
- The pump ring
- The pressure plate
- The thrust plate
- The flow control valve
- The rotor
- The vanes

The opening at the rear of the pump housing contains the following components:

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

The small opening on the side of the housing contains the following components:

- The pressure line fitting
- The flow control valve
- The spring

The flow control orifice is a component of the pressure line fitting. A pressure relief valve inside the flow control valve limits the pump pressure.

Power Steering Gear Description

The movement of the steering wheel has the following results:

1. The movement of the steering wheel transfers to the pinion.
2. The movement of the pinion transfers through the pinion teeth.
3. The pinion teeth mesh with the teeth on the rack.
4. This action causes the rack to move.

The power rack and pinion steering system has a rotary control valve. The rotary control valve directs the hydraulic fluid that flows from the hydraulic pump to either side of the rack piston.

The integral pick piston attaches to the rack.

The integral rack piston has the following effects:

1. The rack piston converts hydraulic pressure to linear force.
2. The linear force moves the rack left or right.
3. The linear force transmits to the inner and outer tie rods to the steering knuckles.
4. The steering knuckles turn the wheels.

The system will require more steering effort if hydraulic assist is not available. If hydraulic assist is not available, the system will maintain manual control.

Steering Wheel and Column Description and Operation

The steering wheel and column has 4 primary functions:

- Vehicle steering
- Vehicle security
- Driver convenience
- Driver safety

Vehicle Steering

The steering wheel is the first link between the driver and the vehicle. The steering wheel is fastened to a steering shaft within the column. At the lower end of the column, the intermediate shaft connects the column to the steering gear.

Vehicle Security

Theft deterrent components are mounted and designed into the steering column. The following components allow the column to be locked in order to minimize theft:

- The ignition switch
- The steering column lock
- The ignition cylinder

Driver Convenience

The steering wheel and column may also have driver controls attached for convenience and comfort. The following controls may be mounted on or near the steering wheel or column.

- The turn signal switch
- The hazard switch
- The headlamp dimmer switch
- The wiper/washer switch
- The horn pad/cruise control switch
- The redundant radio/entertainment system controls
- The tilt or tilt/telescoping functions
- The HVAC controls

Driver Safety

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

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 allows each wheel to compensate for changes in the road surface without affecting the opposite wheel. Each wheel independently connects to the frame with a steering knuckle, ball joint assemblies, and upper and lower control arms.

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The control specifically allow the steering knuckles to move in a three-dimensional arc. Two tie rods connect to steering arms on the knuckles and an intermediate rod. These operate the front wheels.

The rear wheel drive vehicles have coil chassis springs. These springs are mounted between the spring housings on the frame and the lower control arms. Shock absorbers are mounted inside the coil springs. The coil springs attach to the lower control arms with bolts and nuts.

The upper part of each shock absorber extends through the upper control arm frame bracket, and the shock absorber secures with two grommets, two retainers, and a nut.

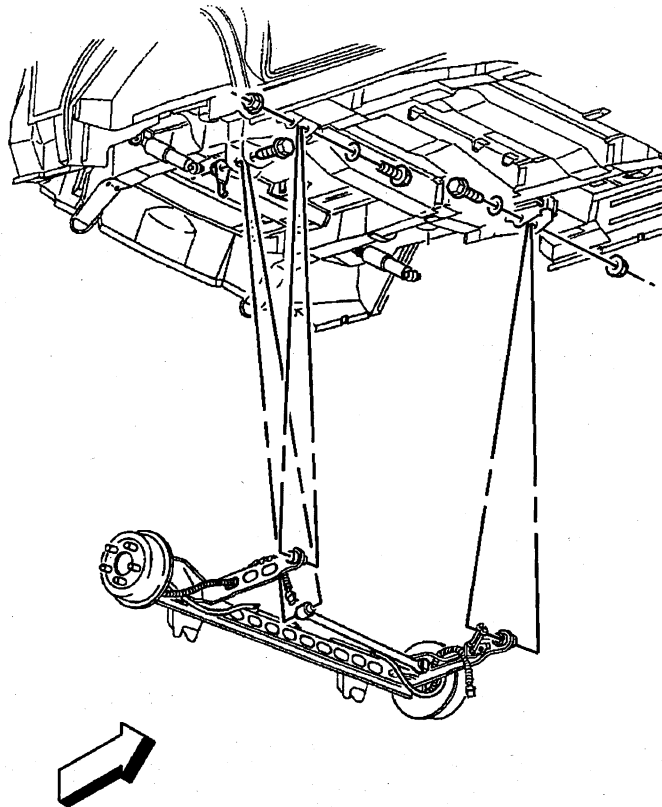
A spring stabilizer shaft controls the side roll of the front suspension. This shaft is mounted in rubber insulators that are held by brackets to the frame side rails. The ends of the stabilizer shaft connect to the lower control arms with link bolts. Rubber insulators isolate these link bolts.

A ball joint assembly is riveted and bolted to the outer end of the upper control arm. A castellated nut and a cotter pin join the steering knuckle to the upper ball joint.

The inner ends of the lower control arm have pressed-in bushings. The bolts pass through the bushings and join the arm to the frame. The lower ball joint assembly is a press fit in the lower control arm and attaches to the steering knuckle with a castellated nut and a cotter pin.

Ball socket assemblies have rubber grease seals. These seals prevent entry of moisture and dirt, and these seals prevent damage to the bearing surfaces.

Rear Suspension



The rear suspension system on this vehicle is the trailing-arm axle type. Two control arms (trailing arms) mount the axle to the vehicle body. The rear suspension system performs the following functions:

- Maintains the relationship of the rear axle to the body
- Opposes the torque reaction on acceleration and braking

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

- The rear axle
- Two coil springs
- Two shock absorbers
- The rear axle tie rod

The rear axle contains a stabilizer shaft which is an integral part of the rear axle. A wheel bearing/hub is secured at each end of the rear axle. The wheel bearing/hub also contains an integral wheel speed sensor.

The rear coil springs are retained between the spring seat in the underbody and the spring seat on the top of the rear axle. Rubber insulators isolate the coil spring at the top and at the bottom.

The shock absorbers mount at the bottom with a bolt and nut to brackets which are welded to the axle housing and at the top with a bolt and nut beneath the body.

The rear tie rod attaches to the axle and to the underbody. The rear axle tie rod controls the lateral movement of the rear axle in relation to the vehicle body. The rear axle tie rod bushings are an integral part of the rear axle tie rod.

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.

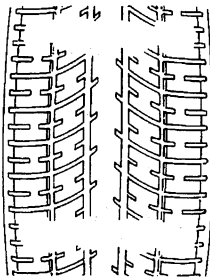
The following factors have an important influence on tire life:

- 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:

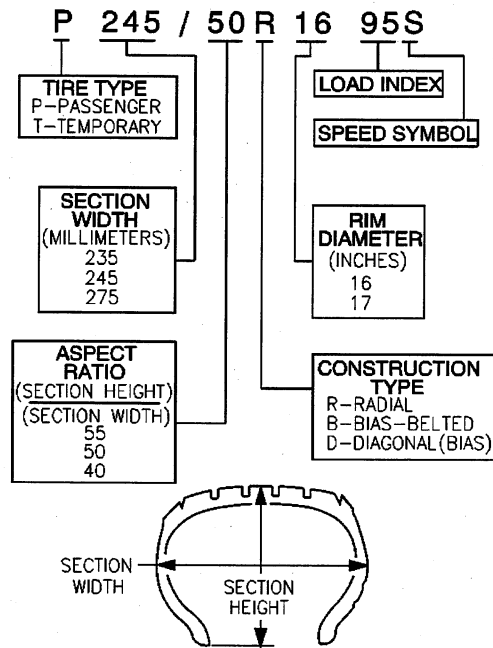
- A tire squeal on turns
- Hard steering
- Rapid wear and uneven wear on the edge of the tread
- Tire rim bruises and tire rim rupture
- Tire cord breakage
- High tire temperatures

- 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

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.

Automatic Level Control General Description

The function of the Automatic Level Control (ALC) system is maintaining a constant trim height at the rear suspension when the vehicle is loaded beyond a predetermined amount. The ALC system is active ONLY when the vehicle ignition is ON. The system consists of the following components:

- An automatic level control sensor
- Air shocks
- Air lines
- An automatic level control air compressor assembly, consisting of the following components:
 - Automatic level control air compressor motor and head
 - Automatic level control air compressor air compressor bracket
 - Air drier
 - Exhaust solenoid

- Automatic level control relay
- Automatic level control air compressor filter

An inflator system is included as part of the overall ALC system. The function of the inflator system is to provide air under pressure up to 482 kPa (70 psi) to an inflator solenoid fill valve for the purpose of inflating items other than the vehicle air shocks, such as sports balls, bicycle tires, automobile tires, etc. The inflator solenoid fill valve and the inflator on/off switch are located behind an access door in the rear left-hand side of the passenger compartment. The inflator system is active **ONLY** when the vehicle ignition is ON.

- An inflator solenoid fill valve
- An inflator solenoid
- An inflator switch
- An inflation timer relay
- An accessory kit

Driveline System Description and Operation

Wheel Drive Shafts

Front wheel drive axles are flexible assemblies.

Front wheel drive axles consist of the following components:

- A front wheel drive shaft tri-pot joint (inner joint)
- A front wheel drive shaft constant velocity joint (outer joint)
- A front wheel drive shaft The front wheel drive shaft connects the front wheel drive shaft tri-pot joint and the front wheel drive shaft constant velocity joint.

The front wheel drive shaft tri-pot joint is completely flexible. The front wheel drive shaft tri-pot joint can move in and out.

The front wheel drive shaft constant velocity joint is flexible, but the front wheel drive shaft constant velocity joint cannot move in and out.

Boots (Seals) And Clamps

The front wheel drive shaft constant velocity joint and the front wheel drive shaft tri-pot joint boots (seals) in the front wheel drive axle are made of a thermoplastic material.

The clamps in front wheel drive axle are made of stainless steel.

The boot (seal) provides the following functions:

- Protection of the internal parts of the front wheel drive shaft constant velocity joint and the front wheel drive shaft tri-pot joint. The boot (seal) protects the grease from the following sources of damage:
 - Harmful atmospheric conditions (such as extreme temperatures or ozone gas)
 - Foreign material (such as dirt or water)
- Allows angular movement and the axial movement of the front wheel drive shaft tri-pot joint.
- Allows angular movement of the front wheel drive shaft constant velocity joint.

Important

Protect the boots (seals) from sharp tools and from the sharp edges of the surrounding components.

Any damage to the boots (seals) or the clamps will result in leakage. Leakage will allow water to leak into the front wheel drive shaft tri-pot joint and the front wheel drive shaft constant velocity joints. Leakage will also allow grease to leak out of the front wheel drive shaft tri-pot joints and the front wheel drive shaft constant velocity joints.

Leakage may cause noisy front wheel drive axle operation and eventual failure of the internal components.

The clamps provide a leak proof connection for the front wheel drive shaft tri-pot joint and the front wheel drive shaft constant velocity joint at the following locations:

- The housing
- The front wheel drive shaft

The thermoplastic material performs well under normal conditions and normal operation. However, the material is not strong enough to withstand the following conditions:

- Abusive handling
- Damage from sharp objects (such as sharp tools or any sharp edges of the surrounding components in the vehicle).

Front Wheel Drive Shaft Tri-pot Joint (Inner Joint)

The front wheel drive shaft tri-pot joint is made with the tri-pot design without an over-extension limitation retainer.

The joint is constructed as follows for vehicles that are equipped with an automatic transmission:

- The left front wheel drive axle has a female spline. The female spline installs over a stub shaft that protrudes from the transaxle.
- The right front wheel drive axle has a male spline. The right front wheel drive axle uses barrel type snap rings in order to interlock with the transaxle gears.

Front Wheel Drive Shaft Constant Velocity Joint (Outer Joint)

The front wheel drive shaft constant velocity joint is made with the Rzeppa joint design.

The shaft end (which mates with the knuckle/hub) has a helical spline. The helical spline ensures a tight, press-type fit.

This design prevents end play between the hub bearing and the front wheel drive axle.

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.

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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 – 3.4L

Mechanical Specifications

Application	Specification	
	Metric	English
General Data		
• Engine Type	60° V-6	
• Displacement	3.4L	204 cu in
• RPO (VIN Code)	LA1 (E)	
• Bore	92 mm	3.62 in
• Stroke	84 mm	3.31 in
• Compression Ratio	9.6:1	
• Firing Order	1-2-3-4-5-6	
• Oil Pressure - Warm	103 kPa	15 psi @ 1100 RPM
Cylinder Bore		
• Diameter	92.019-92.037 mm	3.6228-3.6235 in
• Out Of Round Maximum	0.007 mm	0.0003 in
• Taper -- Thrust Side Maximum	0.010 mm	0.0004 in
Piston		
• Diameter-Gaged on the skirt 13 mm (0.51 in) below the centerline of the piston pin bore	91.970-91.988 mm	3.6209-3.6216 in
• Clearance	0.032-0.068 mm	0.0013-0.0027 in
• Pin Bore	23.006-23.013 mm	0.9057-0.9060 in
Piston Ring		
• Top Groove Side Clearance	0.04-0.075 mm	0.002-0.0033 in
• Second Groove Side Clearance	0.04-0.09 mm	0.002-0.0035 in
• Top Ring Gap	0.15-0.36 mm	0.006-0.014 in
• Second Ring Gap	0.48-0.74 mm	0.0197-0.0280 in
• Oil Ring Groove Clearance	0.48-0.20 mm	0.008 in
• Gap with segment at 92.0 mm (3.62 in)	0.25-0.75 mm	0.0098-0.05 in
Piston Pin		
• Diameter	22.9915-22.9964 mm	0.9052-0.9054 in
• Clearance In Piston	0.0096-0.0215 mm	0.0004-0.0008 in
• Fit In Rod	(-)0.0469-(-)0.017 mm press fit	0.0006-0.0018 in
Crankshaft		
• Main Journal Diameter	67.239-67.257 mm	2.6473-2.6483 in
• Main Journal Taper	0.005 mm	0.0002 in
• Out Of Round - Max	0.005 mm	0.0002 in
• Flange Runout - Max	0.04 mm	0.0016 in
• Cylinder Block Main Bearing Bore Diameter	72.155-72.168 mm	2.8407-2.8412 in
• Crankshaft Main Bearing Inside Diameter	67.289-67.316 mm	2.6492-2.6502 in
• Main Bearing Clearance	0.019-0.064 mm	0.0008-0.0025 in
• Main Thrust Bearing Clearance	0.032-0.077 mm	0.0012-0.0030 in
• Crankshaft End Play	0.060-0.210 mm	0.0024-0.0083 in
• Crankshaft Flange Runout - Max	0.04 mm	0.0016 in

Connecting Rod		
• Rod Bearing Journal Diameter	50.768-50.784 mm	1.9987-1.9994 in
• Rod Bearing Journal Taper - Max	0.005 mm	0.0002 in
• Rod Bearing Journal Out Of Round - Max	0.005 mm	0.0002 in
• Rod Bearing Bore Diameter	53.962-53.984 mm	2.124-2.125 in
• Rod Inside Bearing Diameter	50.812-50.850 mm	2.000-2.002 in
• Rod Bearing Journal Clearance	0.018-0.062 mm	0.0007-0.0024 in
• Rod Side Clearance	0.18-0.44 mm	0.007-0.017 in
Camshaft		
• Lobe Lift (Intake and Exhaust)	6.9263 mm	0.2727 in
• Journal Diameter	47.45-47.48 mm	1.868-1.869 in
• Camshaft Bearing Bore Diameter-Front and Rear	51.03-51.08 mm	2.009-2.011 in
• Camshaft Bearing Bore Diameter-Middle #2 and #3	50.77-50.82 mm	1.999-2.001 in
• Camshaft Bearing Inside Diameter	47.523-47.549 mm	1.871-1.872 in
• Journal Clearance	0.026-0.101 mm	0.001-0.0039 in
• Journal Runout - Max	0.025 mm	0.001 in
Valve System		
• Roller Lifter	Hydraulic	
• Rocker Arm Ratio	1.60:1	
• Valve Face Angle	45°	
• Seat Angle	46°	
• Valve Seat Runout	0.050 mm	0.002 in
• Seat Width-Intake	1.55-1.80 mm	0.061-0.071 in
• Seat Width-Exhaust	1.70-2.0 mm	0.067-0.079 in
• Valve Margin - Minimum Intake	2.10 mm	0.083 in
• Valve Margin - Minimum Exhaust	2.70 mm	0.106 in
• Valve Stem Clearance	0.026-0.068 mm	0.0010-0.0027 in
Valve Spring		
• Valve Springs Free Length	48.5 mm	1.89 in
• Valve Springs Load (Closed)	320 N @ 43.2 mm	75 lb @ 1.701 in
• Valve Springs Load (Open)	1036 N @ 32 mm	230 lb @ 1.260 in
• Installed Height Intake-Exhaust	43.2 mm	1.701 in
• Approx. # or coils	6.55	
Oil Pump		
• Gear Lash	0.094-0.195 mm	0.0037-0.0077 in
• Gear Pocket Depth	30.52-30.58 mm	1.202-1.204 in
• Gear Pocket Diameter	38.176-38.226 mm	1.503-1.505 in
Oil Pump Gear		
• Length	30.45-30.48 mm	1.199-1.200 in
• Diameter	38.05-38.10 mm	1.498-1.500 in
• Side Clearance	0.038-0.088 mm	0.001-0.003 in
• End Clearance	0.040-0.125 mm	0.002-0.005 in
• Valve to Bore Clearance	0.038-0.089 mm	0.0015-0.0035 in

Fastener Tightening Specifications

Application	Specifications	
	Metric	English
Accelerator Control Cable Bracket Bolt/Nut	10 N·m	89 lb in
Camshaft Position Sensor Bolt	10 N·m	89 lb in
Camshaft Sprocket Bolt	140 N·m	103 lb ft
Camshaft Thrust Plate Screw	10 N·m	89 lb in
Connecting Rod Bearing Bolt		
• First Pass	25 N·m	18 lb ft
• Final Pass	100 degrees	
Coolant Drain Plug	19 N·m	14 lb ft
Coolant Temperature Sensor	23 N·m	17 lb ft
Crankshaft Balancer Bolt	103 N·m	76 lb ft
Crankshaft Main Bearing Cap Bolt/Stud		
• First Pass	50 N·m	37 lb ft
• Final Pass	77 degrees	
Crankshaft Oil Deflector Nut	25 N·m	18 lb ft
Crankshaft Position Sensor Bolt - Front Cover	10 N·m	89 lb in
Crankshaft Position Sensor Bolt - Side of Engine Block	11 N·m	98 lb in
Crankshaft Position Sensor Wiring Bracket Bolt	50 N·m	37 lb ft
Crankshaft Position Sensor Shield Bolt	11 N·m	98 lb in
Cylinder Head Bolt		
• First Pass	60 N·m	44 lb ft
• Final Pass	95 degrees	
Drive Belt Idler Pulley Bolt	50 N·m	37 lb ft
Drive Belt Shield Bolt	10 N·m	89 lb in
Drive Belt Tensioner Bolt	50 N·m	37 lb ft
EGR Valve to EGR Valve Pipe Bolt	30 N·m	22 lb ft
EGR Valve Adapter Pipe to Exhaust Manifold Nut	25 N·m	18 lb ft
Engine Flywheel Bolt	71 N·m	52 lb ft
Engine Front Cover Bolt - Large	55 N·m	41 lb ft
Engine Front Cover Bolt - Medium	55 N·m	41 lb ft
Engine Front Cover Bolt - Small	27 N·m	20 lb ft
Engine Mount Bracket Bolt	58 N·m	43 lb ft
Engine Mount Lower Nut	43 N·m	32 lb ft
Engine Mount Strut and Lift Bracket Bolt - Engine Left Rear	70 N·m	52 lb ft
Engine Mount Strut Bolt/Nut	48 N·m	35 lb ft
Engine Mount Strut Bracket Bolt - Upper Radiator Support	28 N·m	21 lb ft
Engine Mount Strut Bracket Bolt - Vehicle Right Side	50 N·m	37 lb ft
Engine Mount Upper Nut	47 N·m	35 lb ft
Engine Oil Pressure Indicator Switch	16 N·m	12 lb ft
Engine Wiring Harness Bracket Bolt	13 N·m	115 lb in
Exhaust Crossover Pipe Heat Shield Bolt	10 N·m	89 lb in
Exhaust Crossover Pipe Nut/Stud	25 N·m	18 lb ft
Exhaust Manifold Heat Shield Bolt	10 N·m	89 lb in
Exhaust Manifold Nut	16 N·m	12 lb ft
Exhaust Manifold Stud	18 N·m	13 lb ft
Fuel Feed Pipe to Fuel Injector Rail Nut	17 N·m	13 lb ft
Fuel Injector Rail Bolt	10 N·m	89 lb in
Fuel Pipe Bracket Bolt/Stud	50 N·m	37 lb ft
Fuel Pipe Clip Bolt	8 N·m	71 lb in
Fuel Return Pipe to Fuel Injector Rail Nut	17 N·m	13 lb ft
Generator Bracket and Front Engine Lift Hook Bolt	50 N·m	37 lb ft

Heated Oxygen Sensor	42 N·m	31 lb ft
Heater Inlet Pipe Nut	25 N·m	18 lb ft
Ignition Coil Bracket Bolt/Nut/Stud	25 N·m	18 lb ft
Intake Manifold Coolant Pipe Bolt	10 N·m	89 lb in
Knock Sensor	19 N·m	14 lb ft
Lower Intake Manifold Bolt		
• First Pass	7 N·m	62 lb in
• Final Pass - 4 Middle Bolts	13 N·m	115 lb in
• Final Pass - 4 Outside Bolts	25 N·m	18 lb ft
MAP Sensor Bolt	5 N·m	44 lb in
MAP Sensor Bracket Bolt	25 N·m	18 lb ft
Oil Cooler Pipe Bracket Bolt	10 N·m	89 lb in
Oil Filter	13 N·m	115 lb in
Oil Filter Bypass Hole Plug	19 N·m	14 lb ft
Oil Filter Fitting	39 N·m	29 lb ft
Oil Gallery Plug - 1/4 inch	19 N·m	14 lb ft
Oil Gallery Plug - 3/8 inch	33 N·m	24 lb ft
Oil Level Indicator Tube Stud	25 N·m	18 lb ft
Oil Level Sensor Bolt	10 N·m	89 lb in
Oil Pan Bolt	25 N·m	18 lb ft
Oil Pan Drain Plug	25 N·m	18 lb ft
Oil Pan Side Bolt	50 N·m	37 lb ft
Oil Pump Drive Clamp Bolt	36 N·m	27 lb ft
Oil Pump Mounting Bolt	41 N·m	30 lb ft
Spark Plug	27 N·m	20 lb ft
Thermostat Bypass Pipe to Cylinder Head Nut	25 N·m	18 lb ft
Thermostat Bypass Pipe to Engine Front Cover Bolt	12 N·m	106 lb in
Thermostat Bypass Pipe to Throttle Body Nut	25 N·m	18 lb ft
Throttle Body Bolt/Stud	25 N·m	18 lb ft
Timing Chain Dampener Bolt	21 N·m	15 lb ft
Upper Intake Manifold Bolt/Stud	25 N·m	18 lb ft
Valve Lifter Guide Bolt	10 N·m	89 lb in
Valve Rocker Arm Bolt		
• First Pass	19 N·m	14 lb ft
• Final Pass	30 degrees	
Valve Rocker Arm Cover Bolt	10 N·m	89 lb in
Water Outlet Bolt	25 N·m	18 lb ft
Water Pump Bolt	10 N·m	89 lb in
Water Pump Pulley Bolt	25 N·m	18 lb ft

Engine Component Description

The cylinder block is made of cast alloy iron. The cylinder block has 6 cylinders that are arranged in a V shape. There are 3 cylinders in each bank. The cylinder banks are set at a 60 degree angle from each other.

Starting from the front of the engine, the left bank cylinders are 1, 3, 5. The right bank cylinders are 2, 4, 6.

Four main bearings support the crankshaft. The crankshaft is retained by the bearing caps. The bearing caps are machined with the block for proper alignment and clearances. The main bearing caps are drilled and tapped for the structural oil pan side bolts.

The aluminum cylinder heads have individual intake and exhaust ports for each cylinder. The valve guides are pressed in. The roller rocker arms are located on a pedestal in a slot in the cylinder head. The roller rocker arms are retained on individual threaded bolts.

The crankshaft is cast nodular iron with deep rolled fillets on all 6 crankpins and all 4 main journals. Four steel-backed aluminum bearings are used. The #3 bearing is the end-thrust bearing.

The camshaft is made from a new metal composite design. The camshaft profile is a hydraulic roller design. The camshaft is supported by 4 journals. The camshaft includes an oil pump drive gear.

The pistons are cast aluminum using 2 compression rings and 1 oil control ring. The piston pin is offset 0.8 mm (0.031 in) towards the major thrust side. This placement allows for a gradual change in thrust pressure against the cylinder wall as the piston travels its path. The pins are chromium steel. The pins have a floating fit in the pistons. The pins are retained in the connecting rods by a press fit.

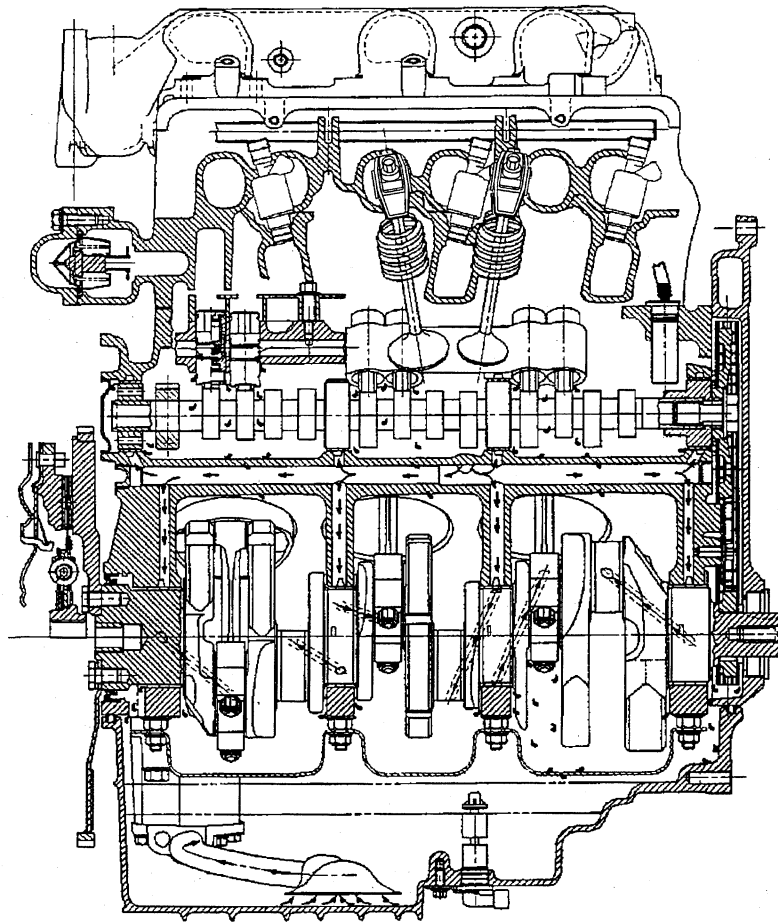
The connecting rods are made of forged steel. Full pressure lubrication is directed to the connecting rods by drilled oil passages from the adjacent main bearing journal.

A roller rocker type valve train is used. Motion is transmitted from the camshaft through the hydraulic roller lifter and from the pushrod to the roller rocker arm. The rocker arm pivots on the needle roller bearings. The rocker arm transmits the camshaft motion to the valve. The rocker arm pedestal is located in a slot in the cylinder head. The rocker arm is retained in the cylinder head by a bolt. The pushrod is located by the rocker arm.

The intake manifold is a 2-piece cast aluminum unit. The intake manifold centrally supports a fuel rail with 6 fuel injectors.

The exhaust manifolds are cast nodular iron.

Lubrication



Full pressure lubrication, through a full flow oil filter, is furnished by a gear type oil pump. The oil is drawn up through the pickup screen and the tube. The oil passes through the pump to the oil filter.

The oil filter is a full flow paper element unit. An oil filter bypass is used in order to ensure oil supply during the following conditions:

- On a cold start
- If the filter is plugged
- If the filter develops excessive pressure drop

The bypass is designed to open at 69-83 kPa (10-12 psi).

A new priority oil delivery system supplies oil first to the crankshaft journals. The oil from the crankshaft main bearings is supplied to the connecting rod bearings by intersecting the passages drilled in the crankshaft. The passages supply the oil to the crankshaft main bearings and the camshaft bearings through the intersecting vertical drilled holes. The oil passages from the camshaft journals supply oil to the hydraulic lifters.

The hydraulic lifters pump oil up through the pushrods to the rocker arms. The cast dams in the crankcase casting direct the oil that drains back from the rocker arms in order to supply the camshaft lobes. The camshaft chain drive is lubricated by indirect oil splash.

Drive Belt System Description

The drive belt system consists of the following components:

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

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

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

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

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

Engine Cooling

Engine Cooling System Specifications

Application	Specification	
	Metric	English
Antifreeze	GM Goodwrench DEX-COOL® or HAVOLINE® DEX-COOL®	
Antifreeze to Water Ratio	56% GM Goodwrench DEX-COOL® or HAVOLINE® DEX-COOL® to 44% Water	
Coolant Freeze Point Protection	-35°C (-32°F) to -45°C (-48°F)	
Cooling System Capacities (Approximate)		
• Front HVAC System Only (C60) without Heavy Duty Cooling (V08)	9.1 liters	9.5 quarts
• Front and Rear HVAC System (C34) without Heavy Duty Cooling (V08)	11.6 liters	12.1 quarts
• Front HVAC System Only (C60) with Heavy Duty Cooling (V08)	10.1 liters	10.5 quarts
• Front and Rear HVAC System (C34) with Heavy Duty Cooling (V08)	12.6 liters	13.2 quarts
• Coolant Recovery Reservoir	0.99 liters	1 quart
Cooling Fans		
• Blade Diameter	360 mm	14.1 in
• Motor Type	Generation II Low Profile Permanent Magnet	

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Coolant Heater Bolt/Screw	2 N·m	18 lb in
Cooling Fan Nut	6 N·m	53 lb in
Cooling Fan Motor Screws	6 N·m	53 lb in
Cooling Fan Shroud Bolts	6 N·m	53 lb in
Radiator Bracket Bolts	24 N·m	18 lb ft
Radiator Lower Air Deflector Bolts	20 N·m	15 lb ft
Thermostat Bypass Pipe Bolt	11 N·m	98 lb in
Thermostat Bypass Pipe Nut	25 N·m	18 lb ft
Thermostat Housing Bolts	25 N·m	18 lb ft
Water Pump Bolts	10 N·m	89 lb in
Water Pump Pulley Bolts	25 N·m	18 lb ft

Cooling System Description and Operation

Coolant Heater

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

Cooling System

The cooling system's function is to maintain an efficient engine operating temperature during all engine speeds and operating conditions. The cooling system is designed to remove approximately one-third of

the heat produced by the burning of the air-fuel mixture. When the engine is cold, the coolant does not flow to the radiator until the thermostat opens. This allows the engine to warm quickly.

Cooling Cycle

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

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

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

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

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

Coolant

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

Radiator

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

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

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

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

Pressure Cap

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

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

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

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

Coolant Recovery System

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

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

Air Baffles and Seals

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

Water Pump

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

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

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

Thermostat

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

When the coolant temperature is below the rated thermostat opening temperature, the thermostat valve remains closed. This prevents circulation of the coolant to the radiator and allows the engine to warm up. After the coolant temperature reaches the rated thermostat opening temperature, the thermostat valve will open. The coolant is then allowed to circulate through the thermostat to the radiator where the engine heat is dissipated to the atmosphere. The thermostat also provides a restriction in the cooling system,

after it has opened. This restriction creates a pressure difference which prevents cavitation at the water pump and forces coolant to circulate through the engine block.

Engine Oil Cooler

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

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

Transmission Oil Cooler

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

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

Engine Electrical

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Battery Hold Down Bolt	18 N·m	13 lb ft
Battery Negative Terminal Bolt	15 N·m	11 lb ft
Battery Negative Cable Bolt to Frame Rail	8 N·m	71 lb in
Battery (Positive) Cable Junction Block Lead Nut	15 N·m	11 lb ft
Battery Positive Terminal Bolt	15 N·m	11 lb ft
Battery Tray Bolts	5 N·m	44 lb in
Generator Pulley Shaft Nut	100 N·m	74 lb ft
Starter Bolt(s)	43 N·m	32 lb ft
Starter Solenoid BAT Terminal Nut	9.5 N·m	89 lb in
Starter Solenoid S Terminal Nut	2.3 N·m	20.5 lb in
Underhood Accessory Wiring Junction Block Nuts	2 N·m	18 lb in
Transaxle Stud Nut	25 N·m	18 lb ft
Generator Bolt (Long)	50 N·m	37 lb ft
Generator Bolt (Short)	50 N·m	37 lb ft
Generator Output BAT Terminal Nut	20 N·m	15 lb ft
Generator Pivot Bolt	50 N·m	37 lb ft
Generator Rear Brace Nut	25 N·m	18 lb ft

Battery Usage

Application	Specification
3.4L LA1	
GM Part Number	19001810
Test Load	300 A
Cold Cranking Amperes	600 A
Reserve Capacity Rating	115 min
Replacement Battery Number	78-6YR

Battery Temperature vs Minimum Voltage

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

Starter Motor Usage

Application	Model
LA1	PG260 D

Generator Usage

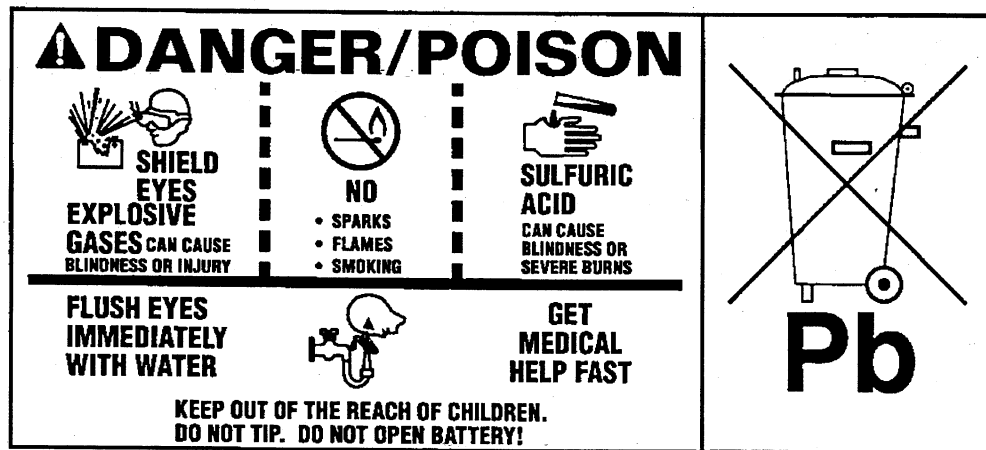
RPO K68	
Application	Specification
Generator Model	Bosch KCB3
Rated Output	105 A
Load Test Output	70 A
RPO KG9	
Application	Specification
Generator Model	Bosch NCB1
Rated Output	125 A
Load Test Output	87.5 A

Battery Description and Operation

Caution

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

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



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

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

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

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

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

CATALOG NO.

1819

CCA 770	LOAD TEST 380
REPLACEMENT MODEL 100-6YR	

A battery has 2 ratings:

- Reserve capacity
- Cold cranking amperage

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

Reserve Capacity

Reserve capacity is the amount of time in minutes it takes a fully charged battery, being discharged at a constant rate of 25 amperes and a constant temperature of 27°C (80°F) to reach a terminal voltage of 10.5 V. Refer to Battery Usage for the reserve capacity rating of the original equipment battery.

Cold Cranking Amperage

The cold cranking amperage is an indication of the ability of the battery to crank the engine at cold temperatures. The cold cranking amperage rating is the minimum amperage the battery must maintain for 30 seconds at -18°C (0°F) while maintaining at least 7.2 volts. Refer to Battery Usage for the cold cranking amperage rating for this vehicle.

Circuit Description

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

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

Starting System Description and Operation

The [PG] starter motors are [non-]repairable starter motors. They have pole pieces that are arranged around the armature within the starter housing. When the solenoid windings are energized, the pull-in winding circuit is completed to ground through the starter motor. The hold-in winding circuit is completed to ground through the solenoid. The windings work together magnetically to pull in and hold in the plunger. The plunger moves the shift lever. This action causes the starter drive assembly to rotate on the armature shaft spline as it engages with the flywheel ring gear on the engine. At the same time, the

plunger closes the solenoid switch contacts in the starter solenoid. Full battery voltage is then applied directly to the starter motor and it cranks the engine.

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

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

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

Charging System Description and Operation

A Bosch KCB2, 105 Amperes generator is standard equipment on this vehicle. A Bosch NCB1 125 ampere generator is used for vehicles equipped with rear air conditioning (RPO C34), and/or heavy duty cooling (RPO V08).

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

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

Engine Controls

Engine Controls – 3.4L

Ignition System Specifications

Application	Specification	
	Metric	English
Firing Order	1-2-3-4-5-6	
Spark Plug Wire Resistance	9868ohms per meter (3000ohms per ft)	
Spark Plug Torque	11N·m	15 lb ft
Spark Plug Gap	1.52 mm	.060 in
Spark Plug Type	41-940	

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accelerator Cable Bracket Retaining Bolts	13 N·m	115 lb in
Accelerator Cable Bracket Retaining Nut	10 N·m	89 lb in
Accelerator Pedal Bolt	5 N·m	44 lb in
Air Cleaner Duct Clamps	2 N·m	18 lb in
Air Cleaner Housing Bolts	10 N·m	89 lb in
(AIR) Shut-Off Valve Pipe Adapter Fasteners	30 N·m	22 lb ft
Camshaft Position (CMP) Sensor Retaining Bolt	8 N·m	71 lb in
Crankshaft Position 7X (CKP) Sensor Bolts	11 N·m	97 lb in
Crankshaft Position 24X (CKP) Sensor Bolts	10 N·m	89 lb in
Engine Coolant Temperature (ECT) Sensor	20 N·m	15 lb ft
(EVAP) Canister Bracket Retaining Nut	9 N·m	80 lb in
EVAP Canister Purge Valve Bracket	10 N·m	89 lb in
Exhaust Gas Recirculation EGR Gasket Nut	25 N·m	18 lb ft
Exhaust Gas Recirculation Pipe Assembly to EGR Valve Bolt	25 N·m	18 lb ft
Exhaust Gas Recirculation Valve to Throttle Body Adapter Bolts	30 N·m	22 lb ft
Fuel Filler Pipe Attaching Nut	10 N·m	89 lb in
Fuel Filler Pipe Attaching Screw	25 N·m	18 lb ft
Fuel Filter Mounting Bracket Nut	10 N·m	89 lb ft
Fuel Pressure and Return Pipes	17 N·m	13 lb ft
Fuel Pressure Regulator Attaching Bolt	8.5 N·m	76 lb in
Fuel Rail Attaching Nuts or Bolts	10 N·m	89 lb in
Fuel Tank Filler Pipe Hose Clamp	2.5 N·m	22 lb in
Fuel Tank Retaining Strap Bolts	47.5 N·m	35 lb ft
Heated Oxygen Sensors HO2S	41 N·m	30 lb ft
Idle Air Control IAC Valve Attaching Screws	3 N·m	27 lb in
Ignition Coil to Ignition Control Module ICM Screws	4.5 N·m	40 lb in
Knock Sensor KS	19 N·m	14 lb in
Manifold Absolute Pressure (MAP) Sensor Retaining Bolt	3 N·m	27 lb in
Secondary AIR Injection Check Valve Bracket Nut	10 N·m	89 lb in
Secondary AIR Injection Check Valve Mounting Bolt	20 N·m	15 lb ft
Secondary AIR Injection Crossover Pipe Fastener	9 N·m	80 lb in
Secondary AIR Injection Pipe Nut	10 N·m	89 lb in
Secondary AIR Injection Pipe Adapter	30 N·m	22 lb ft
Secondary AIR Injection Pump Bracket Bolt	50 N·m	37 lb ft
Secondary AIR Injection Vacuum Bleed Valve Bracket Nut	10 N·m	89 lb in
Spark Plugs	15 N·m	11 lb ft
Throttle Body Retaining Nuts or Bolts	28 N·m	21 lb ft
Throttle Position TP Sensor Screws	2 N·m	18 lb in

Fuel System Specifications

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

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

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

Notice

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

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

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

Exhaust System

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Catalytic Converter Nut	34 N·m	25 lb ft
Exhaust Manifold Pipe Nut	35 N·m	26 lb ft

Exhaust System Description

Important

Use of non-OEM parts may cause driveability concerns.

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

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

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

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

Resonator

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

Catalytic Converter

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

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

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

The catalyst in the converter is not serviceable.

Muffler

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

Transmission/Transaxle Description and Operation

Automatic Transmission – 4T65E

Fastener Tightening Specifications

Description of Usage	Specification	
	Metric	English
2-1 Servo to Case	25 N·m	18 lb ft
Accumulator Cover to Case	12 N·m	106 lb in
Case Cover to Case	12 N·m	106 lb in
Case Cover to Case	12 N·m	106 lb in
Case Cover to Driven Sprocket Support	25 N·m	18 lb ft
Case Cover to Driven Sprocket Support (Torx)	12 N·m	106 lb in
Case to Drive Sprocket Support	25 N·m	18 lb ft
Case Extension to Case	36 N·m	26 lb ft
Case Side Cover to Case	25 N·m	18 lb ft
Case Side Cover to Case (Stud)	25 N·m	18 lb ft
Case Side Cover to Case (Torx Special)	25 N·m	18 lb ft
Detent Spring to Case Cover	12 N·m	106 lb in
Fluid Filler Tube Bolt	13 N·m	115 lb in
Fluid Filler Tube Nut	13 N·m	115 lb in
Flywheel to Torque Converter Bolts	63 N·m	47 lb ft
Forward Band Servo Cover to Case	12 N·m	106 lb in
Manual Shaft/Detent Nut	32 N·m	23 lb ft
Oil Cooler Hose Clip Bolt	25 N·m	17 lb ft
Oil Cooler Pipe Fitting at Radiator	45 N·m	33 lb ft
Oil Cooler Quick Connector	38 N·m	28 lb ft
Oil Cooler Quick Connector with Checkball	38 N·m	28 lb ft
Oil Pan to Case	14 N·m	10 lb ft
Oil Pressure Test Hole Plug	12 N·m	106 lb in
PNP Switch Bolts	25 N·m	18 lb ft
Pump Body to Case	16 N·m	11 lb ft
Pump Cover to Case Cover	12 N·m	106 lb in
Pump Cover to Pump Body	8 N·m	70 lb in
Speed Sensor to Case	12 N·m	106 lb in
Torque Converter Cover Bolts	10 N·m	89 lb in
Transaxle Brace Bolts	43 N·m	32 lb ft
Transaxle Mount Bracket Bolts	95	70 lb ft
Transaxle Mount Lower Nuts	47	35 lb ft
Transaxle Mount Upper Nuts	47	35 lb ft
Transaxle Range Selector Cable Bracket Bolts	25	18 lb ft
Transaxle to Engine Bolts	75	55 lb ft
Transaxle to Engine Stud	75	55 lb ft
TFP Switch to Case	16 N·m	11 lb ft
TFP Switch to Case Cover	12 N·m	106 lb in
TFP Switch to Valve Body	8 N·m	70 lb in
Valve Body to Case	12 N·m	106 lb in
Valve Body to Case	12 N·m	106 lb in
Valve Body to Case Cover	12 N·m	106 lb in
Valve Body to Case Cover	12 N·m	106 lb in
Valve Body to Case Cover (Torx)	12 N·m	106 lb in
Valve Body to Driven Sprocket Support	25 N·m	18 lb ft

Transmission General Specifications

Name	Hydra-matic 4T65-E
RPO Codes	M15 / M76
Production Location	Warren, MI
Vehicle Platform (Engine/Transmission) Usage	U
Transaxle Drive	Transverse Mounted Front Wheel Drive
1st Gear Ratio	2.921:1
2nd Gear Ratio	1.568:1
3rd Gear Ratio	1.000:1
4th Gear Ratio	0.705:1
Reverse	2.385:1
Torque Converter Size (Diameter of Torque Converter Turbine)	245 mm (M15)
Pressure Taps	Line Pressure
Transaxle Fluid Type	DEXRON® III
Transaxle Fluid Capacity (Approximate)	Bottom Pan Removal: 7.0 L (7.4 qts) Complete Overhaul: 9.5 L (10.0 qts) Dry: 12.7 L (13.4 qts)
Transaxle Type: 4	Four Forward Gears
Transaxle Type: T	Transverse Mount
Transaxle Type: 65	Product Series
Transaxle Type: E	Electronic Controls
Chain Ratios (Designates Number of Teeth on the Drive/Driven Sprockets)	35/35
Final Drive Ratios	3.29
Overall Final Drive Ratios	3.29
Position Quadrant	P, R, N, D, 3, 2, 1
Case Material	Die Cast Aluminum
Transaxle Weight Dry	87.9 kg (194.2 lbs)
Transaxle Weight Wet	97.0 kg (214.4 lbs)
Maximum Trailer Towing Capacity	907 kg (2000 lbs)
Maximum Gross Vehicle Weight (GVW)	2903 kg (6,400 lbs)

Fluid Capacity Specifications

Application	Specification	
	Metric	English
Bottom Pan Removal	7.0 liters	7.4 quarts
Complete Overhaul	9.5 liters	10.0 quarts
Dry	12.7 liters	13.4 quarts

Transmission Component and System Description

Transmission General Description

The 4T65-E is a fully automatic front wheel drive electronically controlled transmission. The 4T65-E provides four forward ranges including overdrive. The PCM controls shift points by means of two shift solenoids. A vane-type oil pump supplies the oil pressure. The PCM regulates oil pressure by means of a pressure control solenoid valve.

All vehicles equipped with a 4T65-E transmission have an electronically controlled capacity clutch (ECCC) system. In the ECCC system, the pressure plate does not fully lock to the torque converter cover. It is instead, precisely controlled to maintain a small amount of slippage between the engine and the turbine, reducing driveline torsional disturbances.

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 and hilly terrain. Drive provides three gear ranges and drive range 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. Select this range at any vehicle speed, but the transmission will not downshift into Second gear until the vehicle speed drops below approximately 100 km/h (62 mph)
- 1 -- Manual Lo provides maximum engine braking. You may also select this range at any vehicle speed, but the transmission will not downshift into First gear until the vehicle speed drops below approximately 60 km/h (37 mph).

Mechanical Components

The mechanical components of this unit are as follows:

- A torque converter with an Electronically Controlled Capacity Clutch (ECCC)
- A drive link assembly
- 4 multiple disk clutch assemblies: Input, Second, Third and Fourth
- 3 friction bands: Forward band, 2/1 band and Reverse band
- 2 planetary gear sets: Input and Reaction
- 3 one-way clutches: a roller clutch (1-2 support) and 2 sprag clutches (Third and Input)
- A final drive and differential assembly
- A control valve assembly
- A vane type oil pump

The electrical components of this unit are as follows:

- 2 shift solenoid valves
- A torque converter clutch pulse width modulation (TCC PWM) solenoid valve
- A pressure control (PC) solenoid valve
- An automatic transmission fluid temperature (TFT) sensor
- 2 speed sensors: input shaft and vehicle speed sensors
- An automatic transmission fluid pressure (TFP) manual valve position switch
- Either an Internal Mode Switch or an exterior-mounted Transmission Range Switch.
- An automatic transmission (A/T) wiring harness assembly

Adapt Function

The 4T65-E transmission uses a line pressure control system, that has the ability to adapt line pressure to compensate for normal wear of the following parts:

- The clutch fiber plates
- The springs and seals
- The apply bands

The PCM maintains information for the following transmission adaptive systems:

Upshift Adapts (1-2, 2-3 and 3-4)

The PCM monitors the automatic transmission input shaft speed (AT ISS) sensor and the vehicle speed sensor (VSS) in order to determine when an upshift has started and completed. The PCM measures the time for the upshift. If the upshift time is longer than a calibrated value, then the PCM will adjust the current to the pressure control (PC) solenoid valve to increase the line pressure for the next shift in the same torque range. If the upshift time is shorter than the calibrated value, then the PCM will decrease the line pressure for the next shift in the same torque range.

Steady State Adapts

The PCM monitors the AT ISS sensor and the VSS after an upshift in order to determine the amount of clutch slippage. If excessive slippage is detected, then the PCM will adjust the current to the PC solenoid valve in order to increase the line pressure to maintain the proper gear ratio for the commanded gear.

The TAP information is divided into 13 units, called cells. The cells are numbered 4 through 16. Each cell represents a given torque range. TAP cell 4 is the lowest adaptable torque range and TAP cell 16 is the highest adaptable torque range. It is normal for TAP cell values to display zero or negative numbers. This indicates that the PCM has adjusted line pressure at or below the calibrated base pressure.

Automatic Transmission Shift Lock Control Description

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 consist of the following components:

- The automatic transmission shift lock control solenoid.
- The automatic transmission shift lock control switch.
- 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 switch. The circuit continues through the normally-closed switch to the automatic transmission shift lock control solenoid. The body control module (BCM) provides a ground for the automatic transmission shift lock control solenoid when the transmission is in the PARK position. The body control module (BCM) receives the transmission gear position information via class2 serial data from the powertrain control module (PCM). This causes the automatic transmission shift lock control solenoid to energize and lock the shift lever in the PARK position. When the driver presses the brake pedal, the contacts in the automatic transmission shift lock control switch open. This causes the automatic transmission shift lock control solenoid to release. This allows the shift lever to move from the PARK position. The body control module (BCM) turns off the automatic transmission shift lock control solenoid ground circuit when the transmission is out of the PARK position.

Abbreviations and Meanings

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

BHP	Brake Horsepower
BLK	Black
BLU	Blue
BP	Back Pressure
BPCM	Battery Pack Control Module
BPMV	Brake Pressure Modulator Valve
BPP	Brake Pedal Position
BRN	Brown
BTDC	Before Top Dead Center
BTM	Battery Thermal Module
BTSI	Brake Transmission Shift Interlock
Btu	British Thermal Units
C	
°C	Degrees Celsius
CAC	Charge Air Cooler
CAFE	Corporate Average Fuel Economy
Cal	Calibration
Cam	Camshaft
CARB	California Air Resources Board
CC	Coast Clutch
cm ³	Cubic Centimeters
CCM	Convenience Charge Module, Chassis Control Module
CCOT	Cycling Clutch Orifice Tube
CCP	Climate Control Panel
CD	Compact Disc
CE	Commutator End
CEAB	Cold Engine Air Bleed
CEMF	Counter Electromotive Force
CEX	Cabin Exchanger
cfm	Cubic Feet per Minute
cg	Center of Gravity
CID	Cubic Inch Displacement
CKP	Crankshaft Position
CKT	Circuit
C/Ltr	Cigar Lighter
CL	Closed Loop
CLS	Coolant Level Switch
CMC	Compressor Motor Controller
CMP	Camshaft Position
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO2	Carbon Dioxide

Coax	Coaxial
COMM	Communication
Conn	Connector
CPA	Connector Position Assurance
CPP	Clutch Pedal Position
CPS	Central Power Supply
CPU	Central Processing Unit
CRT	Cathode Ray Tube
CRTC	Cathode Ray Tube Controller
CS	Charging System
CSFI	Central Sequential Fuel Injection
CTP	Closed Throttle Position
cu ft	Cubic Foot/Feet
cu in	Cubic Inch/Inches
CV	Constant Velocity Joint
CVRSS	Continuously Variable Road Sensing Suspension
Cyl	Cylinder(s)
D	
DAB	Delayed Accessory Bus
dB	Decibels
dBA	Decibels on A-weighted Scale
DC	Direct Current, Duty Cycle
DCM	Door Control Module
DE	Drive End
DEC	Digital Electronic Controller
DERM	Diagnostic Energy Reserve Module
DI	Distributor Ignition
dia	Diameter
DIC	Driver Information Center
Diff	Differential
DIM	Dash Integration Module
DK	Dark
DLC	Data Link Connector
DMCM	Drive Motor Control Module
DMM	Digital Multimeter
DMSDS	Drive Motor Speed and Direction Sensor
DMU	Drive Motor Unit
DOHC	Dual Overhead Camshafts
DR, Drvr	Driver
DRL	Daytime Running Lamps
DTC	Diagnostic Trouble Code

E	
EBCM	Electronic Brake Control Module
EBTCM	Electronic Brake and Traction Control Module
EC	Electrical Center, Engine Control
ECC	Electronic Climate Control
ECI	Extended Compressor at Idle
ECL	Engine Coolant Level
ECM	Engine Control Module, Electronic Control Module
ECS	Emission Control System
ECT	Engine Coolant Temperature
EEPROM	Electrically Erasable Programmable Read Only Memory
EEVIR	Evaporator Equalized Values in Receiver
EFE	Early Fuel Evaporation
EGR	Exhaust Gas Recirculation
EGR TVV	Exhaust Gas Recirculation Thermal Vacuum Valve
EHPS	Electro-Hydraulic Power Steering
EI	Electronic Ignition
ELAP	Elapsed
ELC	Electronic Level Control
E/M	English/Metric
EMF	Electromotive Force
EMI	Electromagnetic Interference
Eng	Engine
EOP	Engine Oil Pressure
EOT	Engine Oil Temperature
EPA	Environmental Protection Agency
EPR	Exhaust Pressure Regulator
EPROM	Erasable Programmable Read Only Memory
ESB	Expansion Spring Brake
ESC	Electronic Suspension Control
ESD	Electrostatic Discharge
ESN	Electronic Serial Number
ETC	Electronic Throttle Control, Electronic Temperature Control, Electronic Timing Control
ETCC	Electronic Touch Climate Control
ETR	Electronically Tuned Receiver
ETS	Enhanced Traction System
EVAP	Evaporative Emission
EVO	Electronic Variable Orifice
Exh	Exhaust

F	
°F	Degrees Fahrenheit
FC	Fan Control
FDC	Fuel Data Center
FED	Federal All United States except California
FEDS	Fuel Enable Data Stream
FEX	Front Exchanger
FF	Flexible Fuel
FFH	Fuel-Fired Heater
FI	Fuel Injection
FMVSS	Federal U.S. Motor Vehicle Safety Standards
FP	Fuel Pump
ft	Foot/Feet
FT	Fuel Trim
F4WD	Full Time Four-Wheel Drive
4WAL	Four-Wheel Antilock
4WD	Four-Wheel Drive
FW	Flat Wire
FWD	Front Wheel Drive, Forward
G	
g	Grams, Gravitational Acceleration
GA	Gage, Gauge
gal	Gallon
gas	Gasoline
GCW	Gross Combination Weight
Gen	Generator
GL	Gear Lubricant
GM	General Motors
GM SPO	General Motors Service Parts Operations
gnd	Ground
gpm	Gallons per Minute
GRN	Green
GRY	Gray
GVWR	Gross Vehicle Weight Rating
H	
H	Hydrogen
H ₂ O	Water
Harn	Harness
HC	Hydrocarbons
H/CMPR	High Compression
HD	Heavy Duty

HDC	Heavy Duty Cooling
hex	Hexagon, Hexadecimal
Hg	Mercury
Hi Alt	High Altitude
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
SO ₂	Sulfur Dioxide
SP	Splice Pack
S/P	Series/Parallel
SPO	Service Parts Operations
SPS	Service Programming System, Speed Signal
sq ft, ft ²	Square Foot/Feet
sq in, in ²	Square Inch/Inches
SRC	Service Ride Control
SRI	Service Reminder Indicator
SRS	Supplemental Restraint System
SS	Shift Solenoid
ST	Scan Tool
STID	Station Identification Station ID
S4WD	Selectable Four-Wheel Drive
Sw	Switch
SWPS	Steering Wheel Position Sensor
syn	Synchronizer
T	
TAC	Throttle Actuator Control
Tach	Tachometer
TAP	Transmission Adaptive Pressure, Throttle Adaptive Pressure
TBI	Throttle Body Fuel Injection
TC	Turbocharger, Transmission Control
TCC	Torque Converter Clutch
TCS	Traction Control System
TDC	Top Dead Center
TEMP	Temperature
Term	Terminal
TFP	Transmission Fluid Pressure
TFT	Transmission Fluid Temperature
THM	Turbo Hydro-Matic
TIM	Tire Inflation Monitoring, Tire Inflation Module
TOC	Transmission Oil Cooler
TP	Throttle Position
TPA	Terminal Positive Assurance
TPM	Tire Pressure Monitoring, Tire Pressure Monitor
TR	Transmission Range

TRANS	Transmission/Transaxle
TT	Tell Tail Warning Lamp
TV	Throttle Valve
TVRS	Television and Radio Suppression
TVV	Thermal Vacuum Valve
TWC	Three Way Converter Catalytic
TWC+OC	Three Way + Oxidation Converter Catalytic
TXV	Thermal Expansion Valve
U	
UART	Universal Asynchronous Receiver Transmitter
U/H	Underhood
U/HEC	Underhood Electrical Center
U-joint	Universal Joint
UTD	Universal Theft Deterrent
UV	Ultraviolet
V	
V	Volt(s), Voltage
V6	Six-Cylinder Engine, V-Type
V8	Eight-Cylinder Engine, V-Type
Vac	Vacuum
VAC	Vehicle Access Code
VATS	Vehicle Anti-Theft System
VCIM	Vehicle Communication Interface Mode
VCM	Vehicle Control Module
V dif	Voltage Difference
VDOT	Variable Displacement Orifice Tube
VDV	Vacuum Delay Valve
vel	Velocity
VES	Variable Effort Steering
VF	Vacuum Fluorescent
VIO	Violet
VIN	Vehicle Identification Number
VLR	Voltage Loop Reserve
VMV	Vacuum Modulator Valve
VR	Voltage Regulator
V ref	Voltage Reference
VSES	Vehicle Stability Enhancement System
VSS	Vehicle Speed Sensor

W	
w/	With
W/B	Wheel Base
WHL	Wheel
WHT	White
w/o	Without
WOT	Wide Open Throttle
W/P	Water Pump
W/S	Windshield
WSS	Wheel Speed Sensor
WU-OC	Warm Up Oxidation Converter Catalytic
WU-TWC	Warm Up Three-Way Converter Catalytic
X	
X-valve	Expansion Valve
Y	
yd	Yard(s)
YEL	Yellow

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Conversion - English/Metric

English	Multiply/ Divide by	Metric
In order to calculate English measurement, divide by the number in the center column.		
In order to calculate metric measurement, multiply by the number in the center column.		
Length		
in	25.4	mm
ft	0.3048	m
yd	0.9144	
mi	1.609	km
Area		
sq in	645.2	sq mm
	6.45	sq cm
sq ft	0.0929	sq m
sq yd	0.8361	
Volume		
cu in	16,387.00	cu mm
	16.387	cu cm
	0.0164	L
qt	0.9464	
gal	3.7854	
cu yd	0.764	cu m
Mass		
lb	0.4536	kg
ton	907.18	
	0.907	tonne (t)
Force		
Kg F	9.807	newtons (N)
oz F	0.278	
lb F	4.448	
Acceleration		
ft/s²	0.3048	m/s²
ln/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

Fraction (in)	Decimal (in)	Metric (mm)
5/8	0.625	15.875
41/64	0.640625	16.27187
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

Fasteners

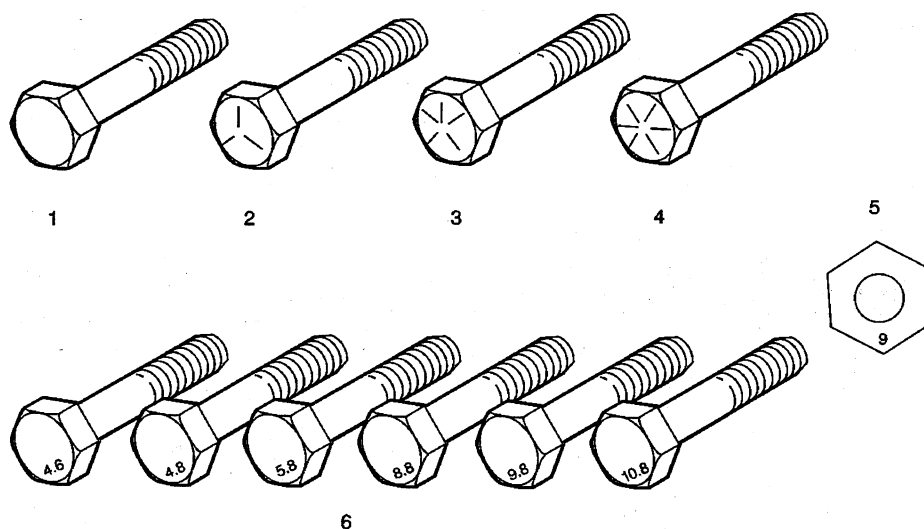
Metric Fasteners

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

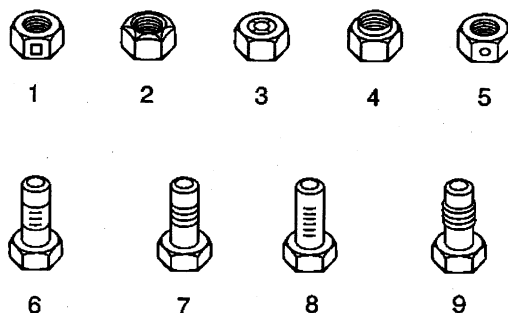
These fasteners accomplish the thread interface by a designed distortion or deformation in the fastener.

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