



## **SHUTTLE BUS CHASSIS WORKSHOP MANUAL**

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**Models: FB65  
MB45  
MB55  
MBC  
XBP  
XBR  
XBS**

## Foreword

The purpose of this manual is to assist the service technician when the vehicle is serviced. Major drivetrain component service information is not included in this manual, but is located in each manufacturer's service manual.

Instructions and procedures are those recommended by Freightliner Custom Chassis Corporation (FCCC) or the component manufacturer.

Maintenance schedules and additional service information are included in the *Shuttle Bus Chassis Maintenance Manual*.

**IMPORTANT:** Descriptions and specifications in this manual were in effect at the time of printing. Freightliner Custom Chassis Corporation reserves the right to discontinue models at any time, or change specifications and design without notice and without incurring obligation.

Refer to [www.Daimler-TrucksNorthAmerica.com](http://www.Daimler-TrucksNorthAmerica.com) and [www.FreightlinerChassis.com](http://www.FreightlinerChassis.com) for more information, or contact Daimler Trucks North America LLC at the address below.

## Environmental Concerns and Recommendations

Whenever you see instructions in this manual to discard materials, you should attempt to reclaim and recycle them. To preserve our environment, follow appropriate environmental rules and regulations when disposing of materials.

## NOTICE: Parts Replacement Considerations

Do not replace suspension, axle, or steering parts (such as springs, wheels, hubs, and steering gears) with used parts. Used parts may have been subjected to collisions or improper use and have undetected structural damage.

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## Descriptions of Service Publications

Daimler Trucks North America LLC distributes the following major service publications in paper and electronic (via ServicePro®) formats.

<b>Workshop/Service Manual</b>	Workshop/service manuals contain service and repair information for all vehicle systems and components, except for major components such as engines, transmissions, and rear axles. Each workshop/service manual section is divided into subjects that can include general information, principles of operation, removal, disassembly, assembly, installation, specifications, and troubleshooting.
<b>Maintenance Manual</b>	Maintenance manuals contain routine maintenance procedures and intervals for vehicle components and systems. They have information such as lubrication procedures and tables, fluid replacement procedures, fluid capacities, specifications, and procedures for adjustments and for checking the tightness of fasteners. Maintenance manuals do not contain detailed repair or service information.
<b>Driver's/Operator's Manual</b>	Driver's/operator's manuals contain information needed to enhance the driver's understanding of how to operate and care for the vehicle and its components. Each manual contains a chapter that covers pretrip and post-trip inspections, and daily, weekly, and monthly maintenance of vehicle components. Driver's/operator's manuals do not contain detailed repair or service information.
<b>Service Bulletins</b>	Service bulletins provide the latest service tips, field repairs, product improvements, and related information. Some service bulletins are updates to information in the workshop/service manual. These bulletins take precedence over workshop/service manual information, until the latter is updated; at that time, the bulletin is usually canceled. The service bulletins manual is available only to dealers. When doing service work on a vehicle system or part, check for a valid service bulletin for the latest information on the subject.  <b>IMPORTANT:</b> Before using a particular service bulletin, check the current service bulletin validity list to be sure the bulletin is valid.
<b>Parts Technical Bulletins</b>	Parts technical bulletins provide information on parts. These bulletins contain lists of parts and BOMs needed to do replacement and upgrade procedures.
Web-based repair, service, and parts documentation can be accessed using the following applications on the AccessFreightliner.com website.	
<b>ServicePro</b>	ServicePro® provides Web-based access to the most up-to-date versions of the publications listed above. In addition, the Service Solutions feature provides diagnostic assistance with Symptoms Search, by connecting to a large knowledge base gathered from technicians and service personnel. Search results for both documents and service solutions can be narrowed by initially entering vehicle identification data.
<b>PartsPro</b>	PartsPro® is an electronic parts catalog system, showing the specified vehicle's build record.
<b>EZWiring</b>	EZWiring™ makes Freightliner Custom Chassis Corporation, Freightliner, Sterling, Western Star, and Thomas Built Buses products' wiring drawings and floating pin lists available online for viewing and printing. EZWiring can also be accessed from within PartsPro.

## Descriptions of Service Publications

Warranty-related service information available on the AccessFreightliner.com website includes the following documentation.

### **Recall Campaigns**

Recall campaigns cover situations that involve service work or replacement of parts in connection with a recall notice. These campaigns pertain to matters of vehicle safety. All recall campaigns are distributed to dealers; customers receive notices that apply to their vehicles.

### **Field Service Campaigns**

Field service campaigns are concerned with non-safety-related service work or replacement of parts. All field service campaigns are distributed to dealers; customers receive notices that apply to their vehicles.

Page Description

For an example of a *Shuttle Bus Chassis Workshop Manual* page, see **Fig. 1**.

A
B
C

**13.00**

**Air Compressor Removal and Installation**

Cummins Air Compressor

7.3 Remove and support the power steering pump.

8. Remove the air compressor

8.1 Remove the capscrews that attach the air compressor flange to the rear support bracket and engine. See Fig. 2.

8.2 Support the air compressor, and remove the nuts and washers from the front gear cover studs.

8.3 Lift or lower the air compressor out of the engine compartment.

8.4 Remove and discard the air compressor mounting gasket, and clean the mating surfaces.

1. Install the air compressor

1.1 Install a new gasket on the front gear cover.

1.2 Position the air compressor on the front gear cover cover studs while aligning the compressor drive gear.

1.3 Install the washers and nuts to the mounting studs and tighten 57 lbf ft (77 N m).

1.4 Install the compressor rear support bracket and tighten the capscrews 35 lbf ft (47 N m).

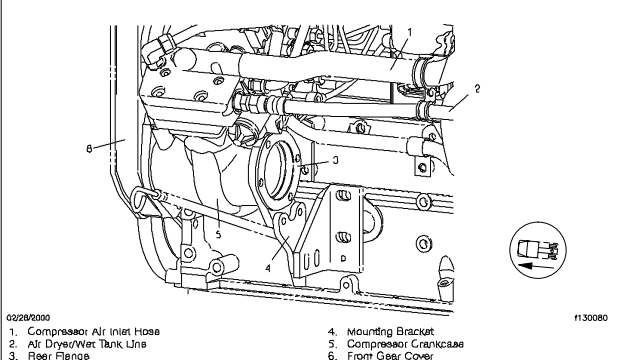
2. Install the power steering pump if equipped with an air compressor mounted steering pump.

2.1 Position the steering pump on the air compressor. Install the mounting capscrews. Tighten the capscrews 36 lbf ft (47 N m).

2.2 Install the power steering hose support brackets.

**Installation**

**IMPORTANT:** Be sure the gasket surfaces are cleaned and not damaged.



02/28/2000  
1. Compressor Air Inlet Hose  
2. Air Dryer/Water Tank Line  
3. Rear Flange  
4. Mounting Bracket  
5. Compressor Crankcase  
6. Front Gear Cover

Fig. 2. Air Compressor Rear Support Bracket

10002 Shuttle Bus Chassis Workshop Manual, Supplement 0, April 2000

DE
F
G

05/17/2000

A. Section Number (made up of the Group Number—first two digits, followed by a sequence number—last two digits)

B. Section Title

C. Subject Title

D. Subject Number

E. Subject Page Number

F. Manual Title

G. Release (Supplement) Date

f020109

**Fig. 1, Example of a Shuttle Bus Chassis Workshop Manual Page**

<b>Group No.</b>	<b>Group Title</b>
00	General Information
01	Engine
09	Air Intake
13	Air Compressor
15	Alternators and Starters
20	Engine Cooling/Radiator
26	Transmission
30	Throttle Control
31	Frame and Frame Components
32	Suspension
33	Front Axle
35	Rear Axle
40	Wheels and Tires
41	Driveline
42	Brakes
46	Steering
47	Fuel
49	Exhaust
54	Electrical, Instruments, and Controls
60	Cab
82	Windshield Wipers and Washer
83	Heater and Air Conditioner
88	Hood, Grille, and Cab Fenders
98	Paint

## General Information

U.S. Customary to Metric			Metric to U.S. Customary		
When You Know	Multiply By	To Get	When You Know	Multiply By	To Get
<b>Length</b>					
inches (in)	25.4	millimeters (mm)	0.03937		inches (in)
inches (in)	2.54	centimeters (cm)	0.3937		inches (in)
feet (ft)	0.3048	meters (m)	3.281		feet (ft)
yards (yd)	0.9144	meters (m)	1.094		yards (yd)
miles (mi)	1.609	kilometers (km)	0.6215		miles (mi)
<b>Area</b>					
square inches (in <sup>2</sup> )	645.16	square millimeters (mm <sup>2</sup> )	0.00155		square inches (in <sup>2</sup> )
square inches (in <sup>2</sup> )	6.452	square centimeters (cm <sup>2</sup> )	0.15		square inches (in <sup>2</sup> )
square feet (ft <sup>2</sup> )	0.0929	square meters (m <sup>2</sup> )	10.764		square feet (ft <sup>2</sup> )
<b>Volume</b>					
cubic inches (in <sup>3</sup> )	16387.0	cubic millimeters (mm <sup>3</sup> )	0.000061		cubic inches (in <sup>3</sup> )
cubic inches (in <sup>3</sup> )	16.387	cubic centimeters (cm <sup>3</sup> )	0.06102		cubic inches (in <sup>3</sup> )
cubic inches (in <sup>3</sup> )	0.01639	liters (L)	61.024		cubic inches (in <sup>3</sup> )
fluid ounces (fl oz)	29.54	milliliters (mL)	0.03381		fluid ounces (fl oz)
pints (pt)	0.47318	liters (L)	2.1134		pints (pt)
quarts (qt)	0.94635	liters (L)	1.0567		quarts (qt)
gallons (gal)	3.7854	liters (L)	0.2642		gallons (gal)
cubic feet (ft <sup>3</sup> )	28.317	liters (L)	0.03531		cubic feet (ft <sup>3</sup> )
cubic feet (ft <sup>3</sup> )	0.02832	cubic meters (m <sup>3</sup> )	35.315		cubic feet (ft <sup>3</sup> )
<b>Weight/Force</b>					
ounces (av) (oz)	28.35	grams (g)	0.03527		ounces (av) (oz)
pounds (av) (lb)	0.454	kilograms (kg)	2.205		pounds (av) (lb)
U.S. tons (t)	907.18	kilograms (kg)	0.001102		U.S. tons (t)
U.S. tons (t)	0.90718	metric tons (t)	1.1023		U.S. tons (t)
<b>Torque/Work Force</b>					
inch-pounds (lbf-in)	11.298	Newton-centimeters (N-cm)	0.08851		inch-pounds (lbf-in)
foot-pounds (lbf-ft)	1.3558	Newton-meters (N-m)	0.7376		foot-pounds (lbf-ft)
<b>Pressure/Vacuum</b>					
inches of mercury (inHg)	3.37685	kilo Pascals (kPa)	0.29613		inches of mercury (inHg)
pounds per square inch (psi)	6.895	kilo Pascals (kPa)	0.14503		pounds per square inch (psi)

When You Know	Subtract	Then Divide By	To Get	When You Know	Multiply By	Then Add	To Get
degrees Fahrenheit (°F)	32	1.8	degrees Celsius (°C)	degrees Celsius (°C)	1.8	32	degrees Fahrenheit (°F)

## VIN for Vehicles Built before May 1, 2000

**IMPORTANT:** See **Subject 060** for the vehicle identification numbering system for vehicles built May 1, 2000, or later.

Federal Motor Vehicle Safety Standard 115 specifies that all vehicles sold in the U.S. be assigned a 17-character Vehicle Identification Number (VIN). Using a combination of letters and numerals, the VIN defines the manufacturer, model, and major characteristics of the vehicle. See **Table 1** for the character positions of a typical Freightliner Custom Chassis Corporation (FCCC) VIN, 4UZ33FAD3VC345678.

The VIN is stamped on a metal plate permanently attached to the vehicle, and the last six digits (designating the chassis serial number) are stamped into the metal frame.

**IMPORTANT:** A new VIN-code structure will be used for all vehicles built after April 30, 2000.

Character positions 1 through 4 and 9 through 17 are nearly the same in both versions, but positions 5 through 8 have been assigned slightly different parameters. As a result, the build date of a vehicle must be determined before the VIN can be decoded.

For all vehicles, a check digit (9th character) is determined by assignment of weighted values to the other 16 characters. These weighted values are processed through a series of equations designed to check validity of the VIN and to detect VIN alteration.

**NOTE:** Always specify the VIN when ordering parts.

Seventeen-Character Vehicle Identification Number (VIN)									
Typical VIN	4 U Z	3	3	F A	D	3	V	C	3 4 5 6 7 8
Character Position	1, 2, 3	4	5	6, 7	8	9	10	11	12 thru 17
Decoding Table *	Table 2	Table 3	Table 4	Table 5	Table 6	—	Table 7	Table 8	—
<b>Code Description</b>									
Manufacturer, Make, Vehicle Type									
Chassis, Front Axle Position, Brakes									
Vehicle Model Series, Cab									
Engine Model, Horsepower Range									
Gross Vehicle Weight Rating (GVWR)									
Check Digit									
Vehicle Model Year									
Plant of Manufacture									
Production Number									

\* For corresponding decoding information, see the applicable tables in this subject.

**Table 1, Seventeen-Character Vehicle Identification Number (VIN)**

VIN Positions 1, 2, and 3 (World Manufacturer Identification)			
Code	Vehicle Manufacturer	Vehicle Make	Vehicle Type
4UZ	Freightliner Custom Chassis Corporation, USA	Freightliner	Incomplete Vehicle

**Table 2, VIN Positions 1, 2, and 3 (World Manufacturer Identification)**



## VIN for Vehicles Built before May 1, 2000

VIN Position 4 (Chassis, Front Axle Position, Brakes)			
Code	Chassis	Front Axle Position	Brakes
A	4 x 2 Truck	Forward	Hydraulic
H	4 x 2 Truck	Forward	Air
1	4 x 2 Truck	Forward	Air/Hydraulic
3	4 x 2 Truck	Setback	Hydraulic
6	4 x 2 Truck	Setback	Air
9	4 x 2 Truck	Setback	Air/Hydraulic

**Table 3, VIN Position 4 (Chassis, Front Axle Position, Brakes)**

VIN Position 5 (Vehicle Model Series, Cab)	
Code	Freightliner Custom Chassis Corporation
B	MB Chassis (Shuttle Bus, front engine)

VIN Position 5 (Vehicle Model Series, Cab)	
Code	Freightliner Custom Chassis Corporation
C	FS65 Chassis (School Bus, front engine)
F	Sbfd Chassis (School Bus, front engine)
L	VCL Chassis (RV, luxury, rear engine)
M	MC Chassis (RV, front engine)
R	SBRD Chassis (School Bus, rear engine)
V	VC Chassis (RV, hiline, rear engine)
X	XC Chassis (RV, midline, rear engine)
2	XB Chassis (Shuttle Bus, rear engine)
3	MT35 Chassis (Walk-In Van, front engine)
4	MT45 Chassis (Walk-In Van, front engine)
5	MT55 Chassis (Walk-In Van, front engine)

**Table 4, VIN Position 5 (Vehicle Model Series, Cab)**

VIN Positions 6 and 7 (Engine Manufacturer, Model, Horsepower Range)			
Code	Engine Manufacturer	Engine Model	HP Range
EB	Caterpillar	C10 / 3176J	225–275
EC	Caterpillar	C10 / 3176J	276–335
ED	Caterpillar	C10 / 3176J	336–407
FA	Cummins	6BT 5.9 (diesel) / ISB	185–224
FB	Cummins	6BT 5.9 (diesel) / ISB	225–275
FF	Cummins	6BT 5.9/ ISB	153–184
FH	Cummins	6BT 5.9–195G (natural gas)	185–224
FV	Cummins	6BT 5.9–195G (natural gas)	126–152
HB	Detroit Diesel	S–50	225–275
HC	Detroit Diesel	S–50	276–335
JA	Caterpillar	CFE / 3126 (diesel)	185–224
JB	Caterpillar	CFE / 3126 (diesel)	225–275
JC	Caterpillar	CFE / 3126 (diesel)	276–335
JF	Caterpillar	CFE / 3126 (diesel)	153–184
KY	Cummins	L10	225–275
LA	Cummins	6C 8.3 (diesel) / ISC	185–224
LB	Cummins	6C 8.3 (diesel) / ISC	225–275
LC	Cummins	6C 8.3 (diesel) / ISC	276–335
LD	Cummins	L10	336–407
LE	Cummins	ISC	336–407
LY	Cummins	L10	276–330

VIN for Vehicles Built before May 1, 2000

VIN Positions 6 and 7 (Engine Manufacturer, Model, Horsepower Range)			
Code	Engine Manufacturer	Engine Model	HP Range
MC	Cummins	M11 / ISM	276–335
MD	Cummins	M11 / ISM	336–407
NT	Cummins	4B 3.9–130 hp (diesel)	126–152
RY	Caterpillar	3406	270–330
SY	Caterpillar	3406	233–407
TY	Caterpillar	3408	383–467
UY	Caterpillar	3306	225–275
VY	Caterpillar	3406	225–269
WD	Caterpillar	C12 / 3176L	336–407
WE	Caterpillar	C12 / 3176L	408–495
WY	Caterpillar	3306	276–335
XY	Caterpillar	3406	408–495
XZ	Caterpillar	3406	496–605
OY	No Engine	—	—

Table 5, VIN Positions 6 and 7 (Engine Manufacturer, Model, Horsepower Range)

VIN Position 8 (Gross Vehicle Weight Rating)		
Code	lb	kg
A	26,001–33,000	11 794–14 968
B	33,001 or over	14 969 or over
C	19,501–26,000	8846–11 793
D	16,001–19,500	7258–8845
2	6001–10,000	2722–4536
3	10,001–14,000	4537–6350
4	14,001–16,000	6351–7257

Table 6, VIN Position 8 (Gross Vehicle Weight Rating)

VIN Position 10 (Vehicle Model Year)	
Code	Model Year
N	1992
P	1993
R	1994
S	1995
T	1996
V	1997
W	1998

VIN Position 10 (Vehicle Model Year)	
Code	Model Year
X	1999
Y	2000

Table 7, VIN Position 10 (Vehicle Model Year)

VIN Position 11 (Plant of Manufacture)	
Code	Plant of Manufacture
C	Gaffney, South Carolina

# 00.02

## Vehicle Identification Numbering System

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### VIN for Vehicles Built before May 1, 2000

VIN Position 11 (Plant of Manufacture)	
Code	Plant of Manufacture
D	Mercedes-Benz, Mexico, Santiago
M	Mercedes-Benz, Mexico, Monterrey

**Table 8, VIN Position 11 (Plant of Manufacture)**

## VIN for Vehicles Built from May 1, 2000

**IMPORTANT:** See **Subject 050** for the vehicle identification numbering system for vehicles built before May 1, 2000.

Federal Motor Vehicle Safety Standard 115 specifies that all vehicles sold in the U.S. be assigned a 17-character Vehicle Identification Number (VIN). Using a combination of letters and numerals, the VIN defines the manufacturer, model, and major characteristics of the vehicle. See **Table 1** for the character positions of a typical Freightliner Custom Chassis Corporation (FCCC) VIN, 4UZAAA211CA12345.

The VIN is stamped on a metal plate permanently attached to the vehicle, and the last six digits (designating the chassis serial number) are stamped into the metal frame.

**IMPORTANT:** A revised VIN-code structure will be used for all vehicles built after April 30, 2000. As a result, the build date of a vehicle must be determined before the VIN can be decoded.

Character positions 1 through 4 and 9 through 17 are nearly the same in both versions, but positions 5 through 8 have been assigned slightly different parameters.

Another new feature is that each product line has its own model list; that is, positions 5 and 6 are product-specific. For example, the code AB in positions 5 and 6 for a FCCC vehicle indicates an MB45 chassis. Code AB in the same position for a Freightliner vehicle represents an FLD112 conventional truck or trailer.

For all vehicles, a check digit (9th character) is determined by assignment of weighted values to the other 16 characters. These weighted values are processed through a series of equations designed to check validity of the VIN and to detect VIN alteration.

**NOTE:** Always specify the VIN when ordering parts.

Seventeen-Character Vehicle Identification Number (VIN)								
Typical VIN	4 U Z	A	A A	A 2	1	1	C	A 1 2 3 4 5
Character Position	1, 2, 3	4	5, 6	7, 8	9	10	11	12–17
Code Description	World Manufacturer Identification	Chassis Configuration	Model, Cab, GVWR	Engine, Brakes	Check Digit Calculation	Model Year	Build Location	Production Serial Number
Decoding Table*	<b>Table 2</b>	<b>Table 3</b>	<b>Table 4</b>	<b>Table 5</b>	—	<b>Table 6</b>	<b>Table 7</b>	—

\* For corresponding decoding information, see the applicable tables in this subject.

**Table 1, Seventeen-Character Vehicle Identification Number (VIN)**

VIN Positions 1, 2, and 3 (World Manufacturer Identification)			
Code	Vehicle Manufacturer	Vehicle Make	Vehicle Type
4UZ	Freightliner Custom Chassis Corporation, USA	Freightliner	Incomplete Vehicle

**Table 2, VIN Positions 1, 2, and 3 (World Manufacturer Identification)**

VIN Position 4 (Chassis Configuration)	
Code	Chassis
A	4 x 2 Truck
F	6 x 2 Truck
X	Glider

**Table 3, VIN Position 4 (Chassis Configuration)**

# 00.02

## Vehicle Identification Numbering System

### VIN for Vehicles Built from May 1, 2000

VIN Positions 5 and 6 (Model, Cab, Class/GVWR)			
Code	Model	Cab	Class (GVWR)
AA	MB45 Chassis	None	Class 4*
AB	MB45 Chassis	None	Class 5†
AC	MB55 Chassis	None	Class 6‡
AD	MB55 Chassis	None	Class 7§
AE	MC45 Chassis	None	Class 5
AF	MC45 Chassis	None	Class 6
AG	XC Chassis	None	Class 6
AH	XC Chassis	None	Class 7
AJ	XCS Chassis	None	Class 6
AK	VCL Chassis	None	Class 8¶
AM	MT35 Chassis	None	Class H**
AN	MT45 Chassis	None	Class 4
AP	MT45 Chassis	None	Class 5
AR	MT55 Chassis	None	Class 6
AS	MT55 Chassis	None	Class 7
AT	XB Chassis	None	Class 6
AU	XB Chassis	None	Class 7
AV	FS65 Chassis	None	Class 5
AW	FS65 Chassis	None	Class 6
AX	FS65 Chassis	None	Class 7
AY	FS65 Chassis	None	Class 8
AZ	FB65 Chassis	None	Class 6
A1	MBO Chassis	None	Class 7
A2	MBO Chassis	None	Class 8
A3	OMC Chassis	None	Class 7
A4	OMC Chassis	None	Class 8
A5	MT55 Chassis	None	Class 4
A6	XCA Chassis	None	Class 7
A7	XCA Chassis	None	Class 8
A8	FB65 Chassis	None	Class 7
A0	EF Front-Engine Bus Chassis	None	Class 6
BA	EF Front-Engine Bus Chassis	None	Class 7
BB	EF Front-Engine Bus Chassis	None	Class 8

## VIN for Vehicles Built from May 1, 2000

VIN Positions 5 and 6 (Model, Cab, Class/GVWR)			
Code	Model	Cab	Class (GVWR)
BC	ER Rear-Engine Bus Chassis	None	Class 6
BD	ER Rear-Engine Bus Chassis	None	Class 7
BE	ER Rear-Engine Bus Chassis	None	Class 8
BF	XC Chassis	None	Class 8
BG	MT55 Chassis	None	Class 5
BH	MT35 Chassis	None	Class 3††
BJ	MT45 Chassis	None	Class 3
BK	FB65 Chassis	None	Class 5
BL	MB55 Chassis	None	Class 5
BM	MT45 Chassis	None	Class 6
BN	B2 Bus Chassis	None	Class 5
BP	B2 Bus Chassis	None	Class 6
BR	B2 Bus Chassis	None	Class 7
BT	B2 Bus Chassis	None	Class 8
BU	XC Straight-Rail Rear-Engine Motor Home Chassis	None	Class 6
BV	XC Straight-Rail Rear-Engine Motor Home Chassis	None	Class 7
BW	XC Formed-Rail Rear-Engine Motor Home Chassis	None	Class 6
BX	XC Formed-Rail Rear-Engine Motor Home Chassis	None	Class 7
BY	XC Modular-Rail Rear-Engine Motor Home Chassis	None	Class 6
BZ	XC Modular-Rail Rear-Engine Motor Home Chassis	None	Class 7
B1	XC Raised-Rail Rear-Engine Motor Home Chassis	None	Class 6
B2	XC Raised-Rail Rear-Engine Motor Home Chassis	None	Class 7
B3	XC Raised-Rail (Lowered-Engine) Rear-Engine Motor Home Chassis	None	Class 6
B4	XC Raised-Rail (Lowered-Engine) Rear-Engine Motor Home Chassis	None	Class 7
B5	FBX 106 Shuttle Bus Chassis	None	Class 5
B6	FBX 106 Shuttle Bus Chassis	None	Class 6
B7	FBX 106 Shuttle Bus Chassis	None	Class 7
B8	FBX 106 Shuttle Bus Chassis	None	Class 8
B9	XB Straight-Rail Rear-Engine Shuttle Bus Chassis	None	Class 6
B0	XB Straight-Rail Rear-Engine Shuttle Bus Chassis	None	Class 7
CA	XB Raised-Rail Rear-Engine Shuttle Bus Chassis	None	Class 6
CB	XB Raised-Rail Rear-Engine Shuttle Bus Chassis	None	Class 7
CC	MT45 HEV Chassis	None	Class 4
CD	MT45 HEV Chassis	None	Class 5
CE	XCS Straight-Rail Rear-Engine Motor Home Chassis	None	Class 8

# 00.02

## Vehicle Identification Numbering System

### VIN for Vehicles Built from May 1, 2000

VIN Positions 5 and 6 (Model, Cab, Class/GVWR)			
Code	Model	Cab	Class (GVWR)
CF	XCF Formed-Rail Rear-Engine Motor Home Chassis	None	Class 8
CG	XCM Modular-Rail Rear-Engine Motor Home Chassis	None	Class 8
CH	XCR Raised-Rail Rear-Engine Motor Home Chassis	None	Class 8
CJ	XCS Straight-Rail Rear-Engine Motor Home Chassis	None	Class 7
CK	XCF Formed-Rail Rear-Engine Motor Home Chassis	None	Class 7
CL	MC Front-Engine Motor Home Chassis	None	Class 6
CM	MC Front-Engine Motor Home Chassis	None	Class 7
CN	S2 106 Bus Chassis	None	Class 5
CP	S2 106 Bus Chassis	None	Class 6
CR	S2 106 Bus Chassis	None	Class 7
CS	XB Raised-Rail Rear-Engine Shuttle Bus Chassis	None	Class 8
CT	XCP Powerliner Raised-Rail Rear-Engine Motor Home Chassis	None	Class 8
CU	XCL Lowered Rail Rear-Engine Motor Home Chassis	None	Class 8
CV	XCL Lowered Rail Rear-Engine Motor Home Chassis	None	Class 7
CW	XCM Modular-Rail Rear-Engine Motor Home Chassis	None	Class 7
CX	MT55 Hybrid Electric Vehicle (HEV) Chassis	None	Class 5
CY	MT55 Hybrid Electric Vehicle (HEV) Chassis	None	Class 6
CZ	MT55 Hybrid Electric Vehicle (HEV) Chassis	None	Class 7
C1	MT45G Front-Engine Gasoline Walk-In Van Chassis	None	Class 4
C2	MT45G Front-Engine Gasoline Walk-In Van Chassis	None	Class 5
C3	MT55G Front-Engine Gasoline Walk-In Van Chassis	None	Class 6
C4	MCG Front-Engine Gasoline Motor Home Chassis	None	Class 6
C5	MCG Front-Engine Gasoline Motor Home Chassis	None	Class 7
C6	MC Front-Engine Hybrid Electric Vehicle (HEV) Motor Home Chassis	None	Class 6
C7	MC Front-Engine Hybrid Electric Vehicle (HEV) Motor Home Chassis	None	Class 7
C8	B2 106 Hybrid Electric Vehicle (HEV) Bus Chassis	None	Class 5
C9	B2 106 Hybrid Electric Vehicle (HEV) Bus Chassis	None	Class 6
DA	B2 106 Hybrid Electric Vehicle (HEV) Bus Chassis	None	Class 7
DB	B2 106 Hybrid Electric Vehicle (HEV) Bus Chassis	None	Class 8
DC	MBC Front-Engine Commercial Bus Chassis	None	Class 4
DD	MBC Front-Engine Commercial Bus Chassis	None	Class 5
DE	MBC Front-Engine Commercial Bus Chassis	None	Class 6
DF	MBC Front-Engine Commercial Bus Chassis	None	Class 7
DG	XBP Rear-Engine Commercial Bus Chassis	None	Class 8

## VIN for Vehicles Built from May 1, 2000

VIN Positions 5 and 6 (Model, Cab, Class/GVWR)			
Code	Model	Cab	Class (GVWR)
DH	MCL Front-Engine Motor Home Chassis	None	Class 6
DJ	MCL Front-Engine Motor Home Chassis	None	Class 7
DK	MCL Front-Engine Motor Home Chassis	None	Class 5
DL	MT55 HHV Chassis (Hydraulic Hybrid Chassis)	None	Class 5
DM	MT55 HHV Chassis (Hydraulic Hybrid Chassis)	None	Class 6
DN	MT55 HHV Chassis (Hydraulic Hybrid Chassis)	None	Class 7
DP	S2C 106 Conventional Cab and Chassis	Conventional	Class 5
DR	S2C 106 Conventional Cab and Chassis	Conventional	Class 6
DS	S2C 106 Conventional Cab and Chassis	Conventional	Class 7
DT	S2RV 106 Conventional Cab and Chassis	Conventional	Class 5
DU	S2RV 106 Conventional Cab and Chassis	Conventional	Class 6
DV	S2RV 106 Conventional Cab and Chassis	Conventional	Class 7
DW	S2 106 Bus Chassis	None	Class 8
DX	MT45EV (Electric Vehicle)	None	Class 4
DY	MT45EV (Electric Vehicle)	None	Class 5
DZ	XC Rear Engine Motor Home Chassis Glider	None	Glider
EA	EFX Front Engine Bus Chassis	None	Class 6
EB	EFX Front Engine Bus Chassis	None	Class 7
EC	EFX Front Engine Bus Chassis	None	Class 8
EF	S2G Conventional Full Cab and Chassis	Conventional	Class 8

\* Class 4 GVWR is 14,001–16,000 lb.

† Class 5 GVWR is 16,001–19,500 lb.

‡ Class 6 GVWR is 19,501–26,000 lb.

§ Class 7 GVWR is 26,001–33,000 lb.

¶ Class 8 GVWR is 33,001 lb. and over.

\*\* Class H GVWR is 9001–10,000 lb.

†† Class 3 GVWR is 10,001–14,000 lb.

**Table 4, VIN Positions 5 and 6 (Model, Cab, Class/GVWR)**

VIN Positions 7 and 8 (Engine, Brakes)					
Code	Engine	Fuel	Displacement: Liter	Configuration	Brakes
AA	Caterpillar 3176	Diesel	10.3	I-6	Air
AB	Caterpillar 3176	Diesel	10.3	I-6	Hydraulic
AC	Caterpillar 3176	Diesel	10.3	I-6	Air/Hydraulic



# 00.02

## Vehicle Identification Numbering System

### VIN for Vehicles Built from May 1, 2000

VIN Positions 7 and 8 (Engine, Brakes)					
Code	Engine	Fuel	Displacement: Liter	Configuration	Brakes
AK	Caterpillar 3126/CFE	Diesel	7.2	I-6	Air
AL	Caterpillar 3126/CFE	Diesel	7.2	I-6	Hydraulic
AM	Caterpillar 3126/CFE	Diesel	7.2	I-6	Air/Hydraulic
AN	Caterpillar C10	Diesel	10.3	I-6	Air
AP	Caterpillar C10	Diesel	10.3	I-6	Hydraulic
AR	Caterpillar C10	Diesel	10.3	I-6	Air/Hydraulic
A2	Cummins L10	Diesel	10.8	I-6	Air
A3	Cummins L10	Diesel	10.8	I-6	Hydraulic
A4	Cummins L10	Diesel	10.8	I-6	Air/Hydraulic
A5	Cummins M11	Diesel	10.8	I-6	Air
A6	Cummins M11	Diesel	10.8	I-6	Hydraulic
A7	Cummins M11	Diesel	10.8	I-6	Air/Hydraulic
A8	Cummins ISM	Diesel	10.8	I-6	Air
A9	Cummins ISM	Diesel	10.8	I-6	Hydraulic
A0	Cummins ISM	Diesel	10.8	I-6	Air/Hydraulic
BK	Cummins C8.3	Diesel	8.3	I-6	Air
BL	Cummins C8.3	Diesel	8.3	I-6	Hydraulic
BM	Cummins C8.3	Diesel	8.3	I-6	Air/Hydraulic
BN	Cummins B5.9	Diesel	5.9	I-6	Air
BP	Cummins B5.9	Diesel	5.9	I-6	Hydraulic
BR	Cummins B5.9	Diesel	5.9	I-6	Air/Hydraulic
BS	Cummins ISC	Diesel	8.3	I-6	Air
BT	Cummins ISC	Diesel	8.3	I-6	Hydraulic
BU	Cummins ISC	Diesel	8.3	I-6	Air/Hydraulic
BV	Cummins ISB	Diesel	5.9	I-6	Air
BW	Cummins ISB	Diesel	5.9	I-6	Hydraulic
BX	Cummins ISB	Diesel	5.9	I-6	Air/Hydraulic
BY	Cummins B5.9	Propane	5.9	I-6	Air
BZ	Cummins B5.9	Propane	5.9	I-6	Hydraulic
B1	Cummins B5.9	Propane	5.9	I-6	Air/Hydraulic
B2	Cummins B5.9	Natural Gas	5.9	I-6	Air
B3	Cummins B5.9	Natural Gas	5.9	I-6	Hydraulic
B4	Cummins B5.9	Natural Gas	5.9	I-6	Air/Hydraulic

## VIN for Vehicles Built from May 1, 2000

VIN Positions 7 and 8 (Engine, Brakes)					
Code	Engine	Fuel	Displacement: Liter	Configuration	Brakes
B5	Cummins B8.3	Natural Gas	8.3	I-6	Air
B6	Cummins B8.3	Natural Gas	8.3	I-6	Hydraulic
B7	Cummins B8.3	Natural Gas	8.3	I-6	Air/Hydraulic
B8	Detroit Series 50	Diesel	8.5	I-4	Air
B9	Detroit Series 50	Diesel	8.5	I-4	Hydraulic
B0	Detroit Series 50	Diesel	8.5	I-4	Air/Hydraulic
CN	Mercedes-Benz MBE900	Diesel	4.3	I-4	Air
CP	Mercedes-Benz MBE900	Diesel	4.3	I-4	Hydraulic
CR	Mercedes-Benz MBE900	Diesel	4.3	I-4	Air/Hydraulic
CS	Mercedes-Benz MBE900	Diesel	6.4	I-6	Air
CT	Mercedes-Benz MBE900	Diesel	6.4	I-6	Hydraulic
CU	Mercedes-Benz MBE900	Diesel	6.4	I-6	Air/Hydraulic
CV	Mercedes-Benz MBE4000	Diesel	12.0	I-6	Air
CW	Mercedes-Benz MBE4000	Diesel	12.0	I-6	Hydraulic
CX	Mercedes-Benz MBE4000	Diesel	12.0	I-6	Air/Hydraulic
CY	Cummins ISL	Diesel	8.9	I-6	Air
CZ	Cummins ISL	Diesel	8.9	I-6	Hydraulic
C1	Cummins ISL	Diesel	8.9	I-6	Air/Hydraulic
C2	Cummins B3.9	Diesel	3.9	I-4	Air
C3	Cummins B3.9	Diesel	3.9	I-4	Hydraulic
C4	Cummins B3.9	Diesel	3.9	I-4	Air/Hydraulic
C5	Cummins ISB 3.9	Diesel	3.9	I-4	Air
C6	Cummins ISB 3.9	Diesel	3.9	I-4	Hydraulic
C7	Cummins ISB 3.9	Diesel	3.9	I-4	Air/Hydraulic
C8	John Deere 6081H	CNG	8.1	I-6	Air
C9	John Deere 6081H	CNG	8.1	I-6	Hydraulic
DC	CAT C7	Diesel	7.2	I-6	Air
DD	CAT C7	Diesel	7.2	I-6	Hydraulic
DG	Mercedes-Benz MBE900	Diesel	4.8	I-4	Air
DH	Mercedes-Benz MBE900	Diesel	4.8	I-4	Hydraulic
DJ	Mercedes-Benz MBE900	Diesel	7.2	I-6	Air
DK	Mercedes-Benz MBE900	Diesel	7.2	I-6	Hydraulic
DL	CAT C11	Diesel	11.1	I-6	Air
DM	CAT C11	Diesel	11.1	I-6	Hydraulic

# 00.02

## Vehicle Identification Numbering System

### VIN for Vehicles Built from May 1, 2000

VIN Positions 7 and 8 (Engine, Brakes)					
Code	Engine	Fuel	Displacement: Liter	Configuration	Brakes
DT	Cummins ISB	Diesel	6.7	I-6	Air
DU	Cummins ISB	Diesel	6.7	I-6	Hydraulic
DV	GM 307 HP	Gasoline	6.0	V-8	Hydraulic
DX	Enova 120 KW	Electric	—	—	Hydraulic
E1	Fiat 4P10	Diesel	3.0	I-4	Hydraulic
E2	Powertrain Integration LPG	Propane	8.0	V-8	Hydraulic
E3	Powertrain Integration LPG	Propane	8.0	V-8	Air
00	No Engine	—	—	—	—

Table 5, VIN Positions 7 and 8 (Engine, Brakes)

VIN Position 10 (Model Year)	
Code	Model Year
Y	2000
1	2001
2	2002
3	2003
4	2004
5	2005
6	2006
7	2007
8	2008
9	2009
A	2010
B	2011
C	2012
D	2013
E	2014

Table 6, VIN Position 10 (Model Year)

VIN Position 11 (Build Location)	
Code	Plant of Manufacture
C	Gaffney, South Carolina
D	Santiago, Tianguistenco, Mexico
H	Mt. Holly, North Carolina

Table 7, VIN Position 11 (Build Location)

# Threaded Fasteners

# 00.03

## General Information

### Threaded Fastener Types

The majority of threaded fasteners used throughout the vehicle have U.S. customary threads (diameter and pitch are measured in inches). See Fig. 1. However, the engine may use metric fasteners (diameter and pitch are measured in millimeters).

Most threaded fasteners used on the chassis that are 1/2-inch diameter or larger are plain hex-type fasteners (non-flanged); *all* metric fasteners are non-flanged. Special hardened flatwashers are used under the bolt head, and between the part being attached and the hexnut, to distribute the load, and to prevent localized overstressing of the parts. The washers are cadmium- or zinc-plated, and have a hardness rating of 38 to 45 HRC.

Some fasteners smaller than 1/2-inch diameter are flanged fasteners, which have integral flanges that fit against the parts being fastened. The flanges eliminate the need for washers.

### Fastener Grades and Classes

Fasteners with U.S. customary threads are divided into grades established by the Society of Automotive Engineers (S.A.E.) or the International Fastener Institute (I.F.I.). The fastener grades indicate the relative strength of the fastener; the higher the number (or letter), the stronger the fastener. Bolt (capscrew) grades can be identified by the number and pattern of radial lines forged on the bolt head. See Fig. 2. Hexnut (and locknut) grades can be identified by the number and pattern of lines and dots on various surfaces of the nut. See Fig. 3. Nearly all of the bolts used on the vehicle are grades 5, 8, and 8.2. Matching grades of hexnuts are always used: grade 5 or grade B hexnuts are used with grade 5 bolts; grade 8, grade C, or grade G (flanged) hexnuts are used with grade 8 or 8.2 bolts.

Fasteners with metric threads are divided into classes adopted by the American National Standards Institute (ANSI). The higher the class number, the stronger the fastener. Bolt classes can be identified by the numbers forged on the head of the bolt. See Fig. 4. Hexnut (and locknut) classes can be identified by the marks or numbers on various surfaces of the nut. See Fig. 5. Class 8 hexnuts are always used with class 8.8 bolts; class 10 hexnuts with class 10.9 bolts.

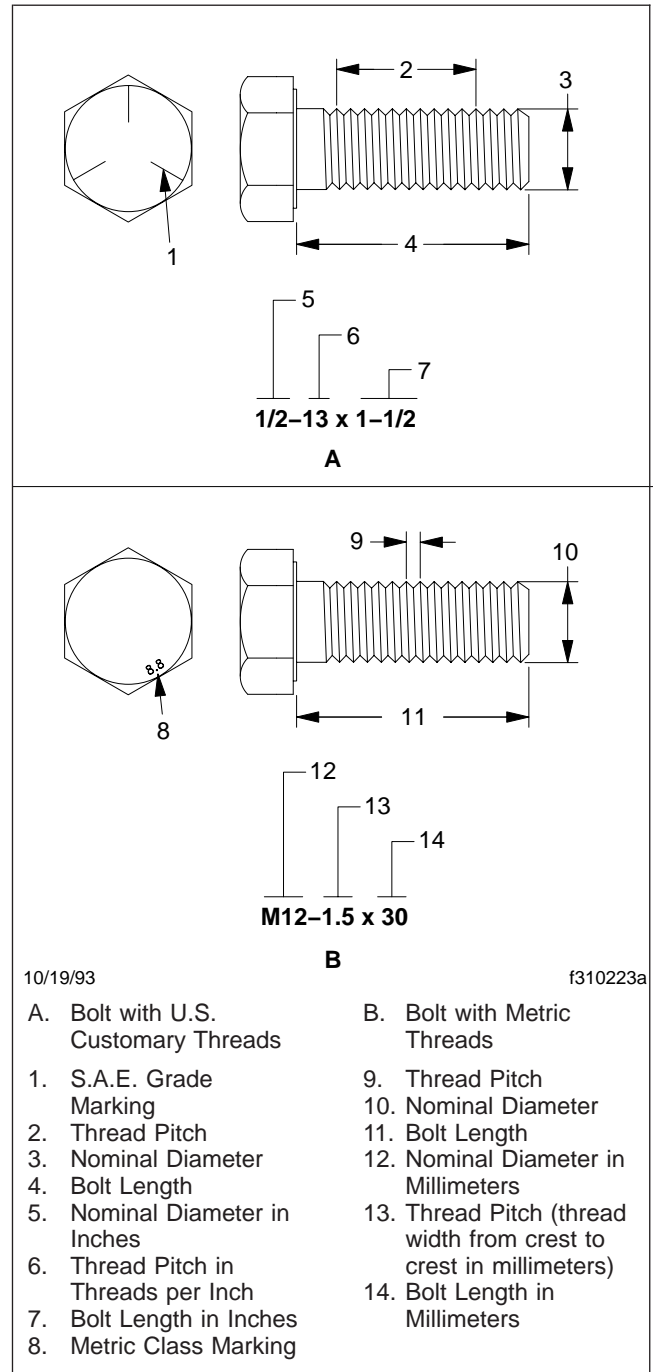


Fig. 1, Fastener Size and Thread Identification