RECREATIONAL VEHICLE CHASSIS WORKSHOP MANUAL

Models: MC
MCL
XC
XCF
XCL
XCM
XCP
XCR
XCS
VCL

STI-354, S21 (10/10P)

Published by
Daimler Trucks North America LLC
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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 *Recreational Vehicle 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** and **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.

Daimler Trucks North America LLC
Service Systems and Documentation (CVI-SSD)
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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.

Workshop/Service Manual

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.

Maintenance Manual

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.

Driver's/Operator's Manual

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.

Service Bulletins

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.

IMPORTANT: Before using a particular service bulletin, check the current service bulletin validity list to be sure the bulletin is valid.

Parts Technical Bulletins

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.

ServicePro

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.

PartsPro

PartsPro® is an electronic parts catalog system, showing the specified vehicle's build record.

EZWiring

EZWiring™ makes Freightliner, Sterling, Western Star, Thomas Built Buses, and Freightliner Custom Chassis Corporation 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

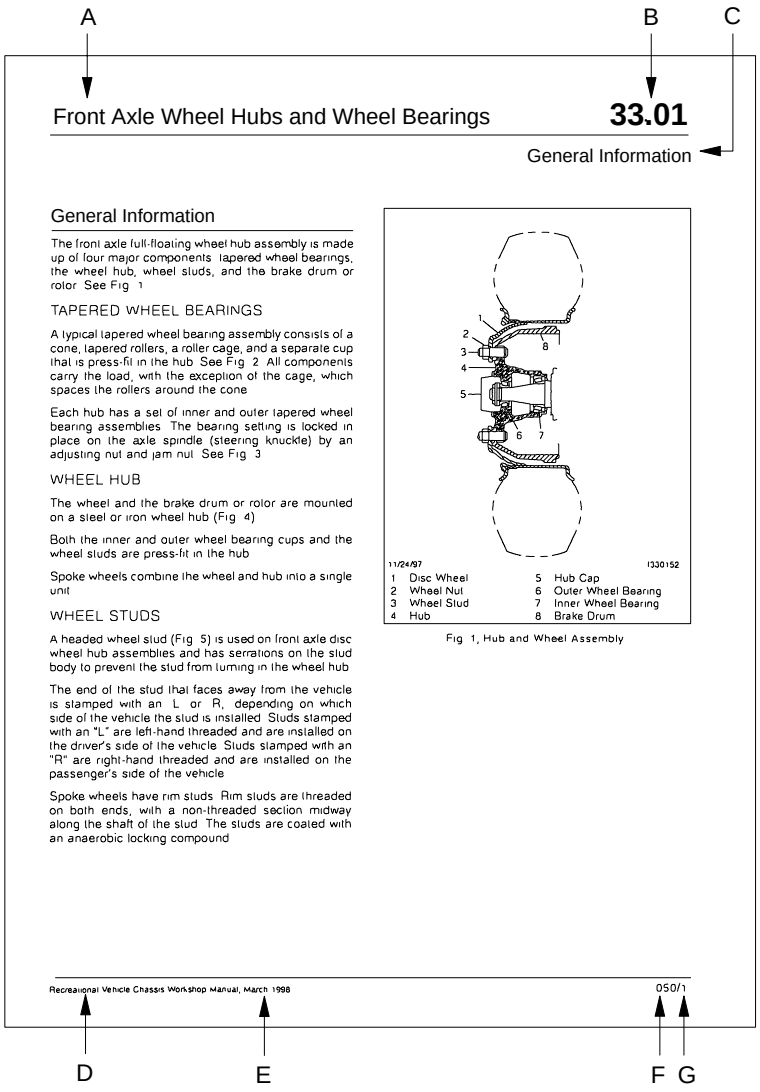
Warranty-related service information available on the AccessFreightliner.com website includes the following documentation.

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 *Recreational Vehicle Chassis Workshop Manual* page, see **Fig. 1**.



A. Section Title
B. Section Number (made up of the Group Number—first two digits, followed by a sequence number—last two digits)
C. Subject Title
D. Manual Title
E. Release (Supplement) Date
F. Subject Number
G. Subject Page Number

Fig. 1, Example of a Recreational Vehicle Chassis Workshop Manual Page

Workshop Manual Contents

Group No.	Group Title
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
83	Heater and Air Conditioner

List of Abbreviations

The following is a list of definitions for abbreviations and symbols used in Freightliner publications.

A ..... amperes
AAVA ..... auxiliary air valve assembly
ABS ..... antilock braking system
ABS ..... acrylonitrile-butadiene-styrene
A/C ..... air conditioner
AC ..... alternating current
acc ..... accessories
ACM ..... aftertreatment control module
ACPU ..... air conditioning protection unit
ADLO ..... auto-disengagement lockout
AGM ..... absorbed glass mat
AGS ..... automated gear shift
AG2 ..... Aluminum Generation 2
a.m. ..... *ante meridiem* (midnight to noon)
AM ..... amplitude modulation
amp(s) ..... ampere(s)
AMT ..... automated mechanical transmission
AMU ..... air management unit
ANSI ..... American National Standards Institute
API ..... American Petroleum Institute
API ..... application programming interface
ARI ..... Air Conditioning and Refrigeration Institute
ASA ..... American Standards Association
ASF ..... American Steel Foundries
ASR ..... automatic spin regulator
assy. ..... assembly
ASTM ..... American Society for Testing and Materials
ATC ..... automatic temperature control
ATC ..... automatic traction control
ATC ..... automatic transmission control
ATD ..... aftertreatment device
ATF ..... automatic transmission fluid
ATS ..... aftertreatment system
attn ..... attention
aux. ..... auxiliary
av ..... *avoirdupois* (British weight system)
AWD ..... all-wheel drive
AWG ..... American wire gauge
AWS ..... American Welding Society
BAT ..... battery
BBC ..... bumper-to-back-of-cab
BHM ..... bulkhead module
BOC ..... back-of-cab
BOM ..... bill of material
BTDC ..... before top dead center
Btu(s) ..... British thermal unit(s)
C ..... common (terminal)
CAC ..... charge air cooler
CAN ..... controller area network
CARB ..... California Air Resources Board
CAT ..... Caterpillar
CB ..... circuit breaker
CB ..... citizens' band
CBE ..... cab behind engine
CCA ..... cold cranking amperes
CCR ..... California Code of Regulations
CD-ROM .. compact-disc/read-only memory
CDTC ..... constant discharge temperature control
CEL ..... check-engine light
CFC ..... chlorofluorocarbons (refrigerant-12)
cfm ..... cubic feet per minute
CFR ..... Code of Federal Regulations
CGI ..... clean gas induction
CGW ..... central gateway
CHM ..... chassis module
CIP ..... cold inflation pressure
CLDS ..... cab load disconnect switch
CLS ..... coolant level sensor
cm ..... centimeters
cm^3 ..... cubic centimeters
CMVSS .... Canadian Motor Vehicle Safety Standard
Co. ..... company
COE ..... cab over engine
Corp. ..... corporation
CPC ..... common powertrain controller
CPU ..... central processing unit
CRT ..... cathode ray tube
cSt ..... centistokes (unit of measurement for describing the viscosity of general liquids)
cu ft ..... cubic feet
cu in ..... cubic inches
CUM ..... Cummins
CVSA ..... Commercial Vehicle Safety Alliance
CWS ..... collision warning system
DC ..... direct current
DCA ..... diesel coolant additive
DCDL ..... driver-controlled differential lock
DDA ..... Detroit Diesel Allison (obs)
DDC ..... Detroit Diesel Corporation
DDDL ..... Detroit Diesel Diagnostic Link
DDE ..... Detroit Diesel Engines
DDEC ..... Detroit Diesel Electronic (engine) Control
DDR ..... diagnostic data reader
DDU ..... driver display unit
def ..... defrost
DEF ..... diesel exhaust fluid
DFI ..... direct fuel injection
DGPS ..... differential global positioning system
DHD ..... dealer help desk
dia. ..... diameter
DIAG ..... diagnosis
DIP ..... dual inline package (switch)
DIU ..... driver interface unit
DLA ..... datalink adaptor
DLM ..... datalink monitor
DLU ..... data logging unit
DMM ..... digital multimeter
DOC ..... diesel oxidation catalyst
DOT ..... Department of Transportation
DPF ..... diesel particulate filter
DRL ..... daytime running lights
DRM ..... dryer reservoir module
DSM ..... district service manager
DTC ..... diagnostic trouble code
DTC ..... discharge temperature control
DTNA ..... Daimler Trucks North America
DVOM ..... digital volt/ohm meter
ea. ..... each
EBS ..... electronic braking system
ECA ..... electric clutch actuator
ECAP ..... electronic control analyzer programmer
ECAS ..... electronically controlled air suspension

List of Abbreviations

ECI ..... electronically controlled injection
ECL ..... engine coolant level
ECM ..... electronic control module
ECT ..... engine coolant temperature
ECU ..... electronic control unit
EDM ..... electronic data monitor
EEPROM .. electrically erasable programmable read-only memory
EFG ..... electric fuel gauge
EFPA ..... electronic foot pedal assembly
EGR ..... exhaust gas recirculation
ELC ..... extended-life coolant
EMC ..... electromagnetic compatibility
EMI ..... electromagnetic interference
EOA ..... electric over air
EP ..... extreme pressure (describes an antiwear agent added to some lubricants)
EPA ..... Environmental Protection Agency
EPS ..... engine position sensor
ESC ..... electronic stability control
ESC ..... enhanced stability control
ESD ..... electrostatic discharge
ESS ..... engine syncro shift (transmission)
etc. ..... *et cetera* (and so forth)
ETEC ..... electronic truck engine control
EUI ..... electronic unit (fuel) injectors
EVA ..... electronic vibration analyzer
EXM ..... (chassis) expansion module
E85 ..... 85% ethanol fuel
FAS ..... Freightliner air suspension
FCCC ..... Freightliner Custom Chassis Corporation
FCU ..... forward control unit
FET ..... field effect transistor
Fig. ..... figure
fl oz ..... fluid ounces
FLA ..... post-1984 advancements Freightliner COE
FLB ..... enhanced Freightliner FLA COE
FLC ..... steel-cab Freightliner 112 Conventional
FLD ..... post-1984 advancements Freightliner 112/120 aluminum-cab Conventional
FLR ..... forward-looking radar
FM ..... frequency modulation
FMCSA .... Federal Motor Carrier Safety Administration
FMEA ..... failure mode effects analysis
FMI ..... failure mode indicator
FMSI ..... Friction Materials Standards Institute
FMVSS .... Federal Motor Vehicle Safety Standard
FRP ..... fiberglass reinforced plastic
FSA ..... field service authorization
FSM ..... fleet service manager
ft ..... feet
ft^3 ..... cubic feet
ft^3/min ..... cubic feet per minute
FTL ..... Freightliner
F.U.E.L. .... fuel usage efficiency level
g ..... grams
gal ..... gallons
GAWR ..... gross axle weight rating
GHG ..... greenhouse gas
GHG14 .... greenhouse gas and fuel efficiency regulations
GL ..... gear lubricant
GND ..... ground
gpm ..... gallons per minute
GPS ..... global positioning system
GVWR ..... gross vehicle weight rating
HBED ..... hard-braking event data
HCM ..... hybrid control module
HCOE ..... high cab over engine
HCU ..... hydraulic control unit
HD ..... heavy-duty
HDU ..... hybrid drive unit
HEPA ..... high-efficiency particulate air (filter)
HEST ..... high exhaust system temperature
HEV ..... hybrid electric vehicle
HFC ..... hydrogenated fluorocarbons (refrigerant-134a)
hp ..... horsepower
hp ..... high pressure
HRC ..... Rockwell "C" hardness
hr(s) ..... hour(s)
HSA ..... hill start aid
HSD ..... high-side driver
htr. ..... heater
HVAC ..... heating, ventilating, and air conditioning
HVLP ..... high velocity, low pressure
H/W ..... hardware
Hz ..... hertz
IAD ..... interaxle differential
ICS ..... integrated child seat
ICU ..... instrumentation control unit
i.d. ..... inside diameter
ID ..... identification
IFI ..... Industrial Fasteners Institute
IFS ..... independent front suspension
IGN ..... ignition
ILB ..... intelligent lightbar
ILO ..... *in lieu of* (in the place of)
in ..... inches
in^3 ..... cubic inches
Inc. ..... incorporated
inH_2O ..... inches of water
inHg ..... inches of mercury
I/O ..... input/output
IP ..... instrument panel
ISO ..... International Organization for Standardization
IVS ..... idle validation switch
k ..... kilo (1000)
kg ..... kilograms
km ..... kilometers
km/h ..... kilometers per hour
kPa ..... kilopascals
kW ..... kilowatts
L ..... liters
lb ..... pounds
LBCU ..... lightbar control unit
lbf·ft ..... pounds force feet
lbf·in ..... pounds force inches
LCD ..... liquid crystal display
LCOE ..... low cab over engine
LED ..... light-emitting diode
LFL ..... lower flammability limit
LH ..... left-hand
LHD ..... left-hand drive
LH DR ..... left-hand-drive
LHK ..... liters per hundred kilometers
LHS ..... low-hydrogen steel
LIN ..... Local Interconnect Network
LLC ..... limited liability company
L/min ..... liters per minute
LNG ..... liquefied natural gas
LPG ..... liquefied petroleum gas

List of Abbreviations

LPG ..... liquid propane gas
LPI ..... liquid propane injection
LPR ..... low pressure reservoir
LRR ..... low-rolling resistance
LSD ..... low-side driver
LVD ..... low-voltage disconnect
m ..... meters
max. ..... maximum
M-B ..... Mercedes-Benz
MCM ..... motor control module
MESA ..... Mining Enforcement Safety Act
mfr. ..... manufacturer
mi ..... miles
MID ..... message identifier
MIL ..... malfunction indicator lamp (light)
MIL ..... military specification
min. ..... minutes
min. ..... minimum
misc. ..... miscellaneous
mL ..... milliliters
mm ..... millimeters
mod. ..... module
mpg ..... miles per gallon
mph ..... miles per hour
MSF ..... modular switch field
MMT ..... methylcyclopentadienyl manganese tricarbonyl
MSHA ..... Mining Safety and Health Administration
MVDA ..... Motor Vehicle Dealers Association
n ..... negative (front axle wheel alignment specification)
N ..... nitrogen
N/A ..... not applicable
N·cm ..... Newton-centimeters
NC ..... normally closed (terminal or switch)
NCG ..... noncondensable gases
NHTSA ..... National Highway Traffic Safety Administration
NIOSH ..... National Institute for Occupational Safety and Health
NITE ..... no idle thermal environment
NLA ..... no longer available
NLGI ..... National Lubricating Grease Institute
N·m ..... Newton-meters
NO ..... normally open (terminal or switch)
NOAT ..... Nitrited Organic Acid Technology
NOx ..... nitrogen oxides
no. ..... number
NPT ..... national pipe thread
NPTF ..... national pipe thread fitting
NT ..... nylon tube or nylon tubing
NTSB ..... National Transportation Safety Board
OAT ..... Organic Acid Technology
OBD(s) ..... on-board diagnostic(s)
obs ..... obsolete
OC ..... open circuit
OCV ..... open circuit voltage
o.d. ..... outside diameter
O.D. ..... overdrive
OEM ..... original equipment manufacturer
OPD ..... overfill protection device
OSHA ..... Occupational Safety and Health Administration
oz ..... ounces
ozf·in ..... ounces force inches
p ..... positive (front axle wheel alignment specification)
PACE ..... programmable electronically controlled engine
PAG ..... polyalkylene glycol (oil)
parm ..... parameter
PAS ..... passenger advisory system
PC ..... personal computer
PCB ..... printed circuit board
PDC(s) ..... parts distribution center(s)
PDI ..... pre-delivery inspection
PDM ..... power distribution module
PEC ..... power electronics carrier
PEEC ..... programmable electronic engine control
PID ..... parameter identifier
PKP ..... Purple-K powder
PLC ..... power line carrier
PLD ..... *Pumpe-Linie-Düse* (pump-line-nozzle)
PNDB ..... power-net distribution box
PM ..... particulate matter
p.m. ..... *post meridiem* (noon to midnight)
p/n ..... part number
PO ..... purchase order
POE ..... polyol ester
PRD ..... pressure relief device
PRD ..... product requirements document
PSA ..... pressure-sensitive adhesive
PSG ..... pressure sensor governor
psi ..... pounds per square inch
psia ..... pounds per square inch, atmosphere
psig ..... pounds per square inch, gauge
pt ..... pints
PTCM ..... pressure time control module
PTO ..... power takeoff
PTP ..... powertrain protection
PTPDM ..... powertrain power distribution module
pvc ..... polyvinyl chloride
PWM ..... pulse width modulation
pwr ..... power
qt ..... quarts
qty. ..... quantity
R & O ..... rust inhibitors and oxidants
R–12 ..... refrigerant-12 (CFC)
R–134a ..... refrigerant-134a (HFC)
RAM ..... random access memory
RC ..... reserve capacity
recirc. ..... recirculation
Ref(s). ..... reference(s)
regen ..... regeneration
RELS ..... reduced engine load at stop
RFI ..... radio frequency interference
RH ..... right-hand
RHD ..... right-hand drive
RH DR ..... right-hand-drive
R/I ..... removal and installation
RMA ..... return material authorization
ROM ..... read-only memory
rpm ..... revolutions per minute
R/R ..... removal and replacement
RSA ..... roll-stability advisor
RSG ..... road speed governor
RSM ..... regional service manager
RTS ..... ready-to-spray
RTV ..... room temperature vulcanizing
RV ..... recreational vehicle
SA ..... source address
S-ABA ..... self-setting automatic brake adjusters

List of Abbreviations

SAE ..... Society of Automotive Engineers
SB ..... service bulletin
SBT ..... seat back thickness
SBW ..... shift-by-wire
SCA(s) .... Supplemental Coolant Additive(s)
SCR ..... selective catalytic reduction
SCU ..... system control unit (speedometer)
SD ..... severe-duty
SDU ..... step deployment unit
SEL ..... shutdown engine light
SEM ..... switch expansion module
SEO ..... stop engine override
SHM ..... switch hub module
SI ..... service information
SI ..... *Système International*
SID ..... subsystem identifier
SM ..... system malfunction
SMC ..... sheet molded compound
S/N ..... serial number
SOC ..... state-of-charge
SPACE .... seat pretensioner activation for crash survival enhancement
SPG ..... special purpose grease
SPN ..... suspect parameter number
sq in ..... square inches
SRP ..... seating reference point
SRS ..... supplemental restraint system
SRS ..... synchronous reference sensor
SRT ..... standard repair time
SSD ..... side sensor display
SSID ..... smart switch identification
SST ..... stainless steel
std. ..... standard
S/W ..... software
SW ..... switch
TAM ..... thermocouple amplifier module
TBB ..... Thomas Built Buses
TBS ..... turbo boost sensor
TCM ..... transmission control module
TCU ..... transmission control unit
TDC ..... top dead center
TDR ..... technician diagnostic routine
TEM ..... truck equipment manufacturer
temp ..... temperature
TIG ..... tungsten inert gas
TIR ..... total indicator reading
TMC ..... Technology and Maintenance Council
TPMS ..... tire pressure monitoring system
TPS ..... thermal protection switch
TPS ..... throttle position sensor
TRS ..... timing reference sensor
TSO ..... truck specification order
TSU ..... transmission shift unit
TXV ..... thermal expansion valve
U.D. ..... underdrive
ULSD ..... ultralow-sulfur diesel
UNC ..... unified national coarse
UNF ..... unified national fine
U.S. ..... United States
U.S.A. ..... United States of America
USC ..... United States customary (measures)
V ..... volts
VCU ..... vehicle control unit
VDC ..... vehicle data computer
Vdc ..... volts, direct current
VIMS ..... vehicle information management system
VIN ..... vehicle identification number
VIP ..... vehicle instrumentation and protection (Kysor)
VIW ..... vehicle interface wiring (connector)
VOC ..... volatile organic compounds
VOM ..... volt-ohmmeter
VRS ..... variable resistance sensor
VSG ..... variable speed governor
VSS ..... vehicle speed sensor
VSU ..... vehicle security unit
WB ..... wire braid
WI ..... work instructions
WIF ..... water-in-fuel
WOT ..... wide open throttle
– ..... minus or negative
+ ..... plus or positive
± ..... plus-or-minus
> ..... greater than
< ..... less than
x ..... by (used in fastener size descriptions)
" ..... inches
° ..... degrees (of an angle)
°C ..... degrees Celsius (centigrade)
°F ..... degrees Fahrenheit
..... number
% ..... percent
& ..... and
© ..... copyright
™ ..... trademark
® ..... registered trademark

U.S. Customary to Metric			Metric to U.S. Customary		
When You Know	**Multiply By**	**To Get**	**When You Know**	**Multiply By**	**To Get**
Length					
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)
Area					
square inches (in^2)	645.16	square millimeters (mm^2)	0.00155		square inches (in^2)
square inches (in^2)	6.452	square centimeters (cm^2)	0.15		square inches (in^2)
square feet (ft^2)	0.0929	square meters (m^2)	10.764		square feet (ft^2)
Volume					
cubic inches (in^3)	16387.0	cubic millimeters (mm^3)	0.000061		cubic inches (in^3)
cubic inches (in^3)	16.387	cubic centimeters (cm^3)	0.06102		cubic inches (in^3)
cubic inches (in^3)	0.01639	liters (L)	61.024		cubic inches (in^3)
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^3)	28.317	liters (L)	0.03531		cubic feet (ft^3)
cubic feet (ft^3)	0.02832	cubic meters (m^3)	35.315		cubic feet (ft^3)
Weight/Force					
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)
Torque/Work Force					
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)
Pressure/Vacuum					
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)		1.8	32	degrees Fahrenheit (°F)

VIN for Vehicles Built through April 30, 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**	**—**
Code Description									
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 through April 30, 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 through April 30, 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
0Y	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

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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, 4UZAAAA211CA12345.

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*	**Table 2**	**Table 3**	**Table 4**	**Table 5**	—	**Table 6**	**Table 7**	—

* 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)

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

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