



Business Class M2 Driver's Manual

**Models: M2 100
M2 106
M2 106V
M2 112
M2 112V**

Table of Contents

1. Foreword.....	5
2. Vehicle Identification	9
3. Vehicle Access	23
4. Instruments	41
5. Controls	67
6. Cab Features.....	93
7. Heater, Ventilator and Air Conditioner	111
8. Engines.....	117
9. Drivetrain	145
10. Steering and Brake Systems.....	191
11. Fifth Wheels and Trailer Couplings	201
12. Pretrip and Post-Trip Inspections and Maintenance	221
13. Cab Appearance	251
14. In an Emergency.....	255
15. Headlight Aiming.....	273
16. Hybrid Electric Vehicle	279
17. Natural Gas Vehicle	285
18. Driver Assistance Features	303
19. Telematics Data	315

1.01 Customer Assistance Center.....	6
1.02 Environmental Concerns and Recommendations	6
1.03 Data Logging	6
1.04 Emissions and Fuel Efficiency Compliance.....	6
1.05 Reporting Safety Defects	6

1. Foreword

1.01 Customer Assistance Center

Having trouble finding service? Call the Customer Assistance Center at 1-800-385-4357 or 1-800-FTL-HELP. For dealer referrals and breakdown support, call night or day, weekdays or weekends. For specification requests and all other concerns and inquiries, the Customer Assistance Center is available 5:00 A.M. to 4:00 P.M. PST Monday through Friday. Our people are knowledgeable, professional, and committed to following through to help you keep your truck moving.

1.02 Environmental Concerns and Recommendations

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

1.03 Data Logging

This vehicle is equipped with a control module that performs data logging capabilities.

This vehicle is equipped with one or more devices that record specific vehicle data and may perform some of the same functionality as a regulated Event Data Recorder but the device(s) are not subject to, nor designed pursuant to, 49 C.F.R. Part 563.

The type and amount of data recorded varies depending on how the vehicle is equipped (such as the brand of engine, if an air bag is installed, or if the vehicle features a collision avoidance system, etc.). GPS location data, fault codes, and other technical data may be recorded.

This data may help provide a better understanding of the circumstances of a crash.

Personal data such as name, gender, and age are not recorded. However, other parties such as law enforcement, could combine the data logger's contents with the type of personally identifying data routinely acquired during a crash investigation.

1.04 Emissions and Fuel Efficiency Compliance

This vehicle must be regularly inspected and maintained as indicated in the vehicle *Maintenance Manual*, and in the *Pre- and Post-Trip Inspections and Maintenance* chapter in this manual, in order to continue satisfactory performance and ensure coverage of the vehicle under the manufacturer's warranty.

Many maintenance procedures ensure that the vehicle and engine continue to comply with applicable emissions standards. Maintenance procedures, using components engineered to comply with greenhouse gas emissions and fuel efficiency regulations, may be performed by an authorized Daimler Truck North America dealer, an independent outlet, or the vehicle owner or operator.

The vehicle owner is responsible for determining the suitability of replacement components to maintain compliance with federal and local jurisdictional regulations. Components including, but not limited to, tires, cab/sleeper side extenders, chassis fairings, bumper, hood, vehicle speed limiters, and idle reduction timers are specifically designed and manufactured to exacting standards for regulatory fuel efficiency and greenhouse gas emissions compliance. It is important that these components are always replaced with components that meet or exceed the performance of the originally installed components.

1.05 Reporting Safety Defects

Vehicles domiciled in the USA thought to have a defect that could cause a crash, injury, or death, should immediately be reported to the National Highway Traffic Safety Administration (NHTSA) and Daimler Truck North America LLC.

If the NHTSA receives similar complaints, it may open an investigation; if it finds that a safety defect exists in a group of vehicles, it may order a recall and remedy campaign. However, NHTSA cannot become involved in individual problems between you, your dealer, or Daimler Truck North America LLC.

To contact NHTSA, call the Vehicle Safety Hotline toll-free at 1-888-327-4236 (TTY: 1-800-424-9153).

To e-mail NHTSA, go to <https://www.nhtsa.gov/safertruck> .

You can contact NHTSA by mail at: Administrator, NHTSA Headquarters, 1200 New Jersey Avenue SE, West Building, Washington, DC 20590.

For more information about motor vehicle safety, go to <https://www.nhtsa.gov/safertruck>

To contact Freightliner about a concern about a specific vehicle call the Customer Assistance Center at 1-800-385-4357 or complete a Product Concern Form .

Vehicles domiciled in Canada thought to have a defect that could cause a crash, injury, or death, should immediately be reported to Transport Canada and Daimler Truck North America LLC.

If Transport Canada receives similar complaints, it may open an investigation; if it finds that a safety defect exists in a group of vehicles, it may order a recall and remedy campaign. However, Transport Canada cannot become involved in individual problems between you, your dealer, or Daimler Truck North America LLC.

To contact Freightliner about a concern about a specific vehicle call the Customer Assistance Center at 1-800-385-4357 or complete a Product Concern Form .

To contact Transport Canada, call the Defect Investigations and Recalls Division toll-free in Canada at 1-800-333-0510 or 819-994-3328 in the Gatineau-Ottawa area or internationally.

You can also contact Transport Canada by mail at: Transport Canada, 330 Sparks Street, Ottawa, Ontario, K1A 0N5 Canada.

The following websites contain more information on Canadian recalls:

English: www.tc.gc.ca/recalls.

French: www.tc.gc.ca/rappels.

For additional road safety information, please visit the Road Transportation website:

English: www.tc.gc.ca/en/services/road

French: www.tc.gc.ca/fr/services/routier

- 2.01 Component Information Label 10
- 2.02 Component GWR Label..... 10
- 2.03 Federal Motor Vehicle Safety Standard Label 12
- 2.04 Canada Certification Label 13
- 2.05 Mexico Labeling 14
 - 2.05.01 Mexico Certification Label..... 14
 - 2.05.02 Spanish Weights and Measures Label 16
- 2.06 Emission Labels 16
 - 2.06.01 Aftertreatment System Indicators Label 16
 - 2.06.02 Vehicle Emission Control Information Label 18
 - 2.06.03 Noise Emission Control Labels..... 19
 - 2.06.04 Certified Clean Idle Label 20
- 2.07 Customer Assistance Label..... 21

2. Vehicle Identification

2.01 Component Information Label

NOTE: Labels shown in this chapter are examples only. Actual specifications may vary from vehicle to vehicle.

The component information label lists the vehicle model, identification number, and major component models and serial numbers.

- For vehicles domiciled in Mexico, this label is in Spanish as shown in Fig.
1, [Component Information Label \(Spanish\)](#) Otherwise it is printed in English as shown in Fig.
2, [Component Information Label \(English\)](#).



Fig 1, Component Information Label (Spanish)

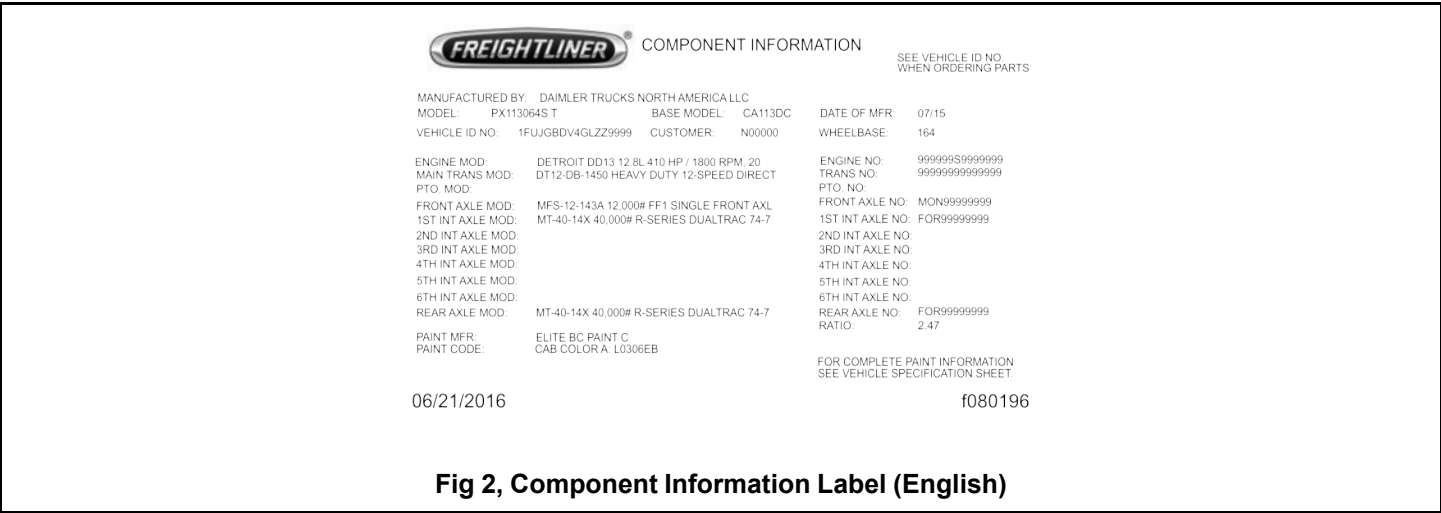


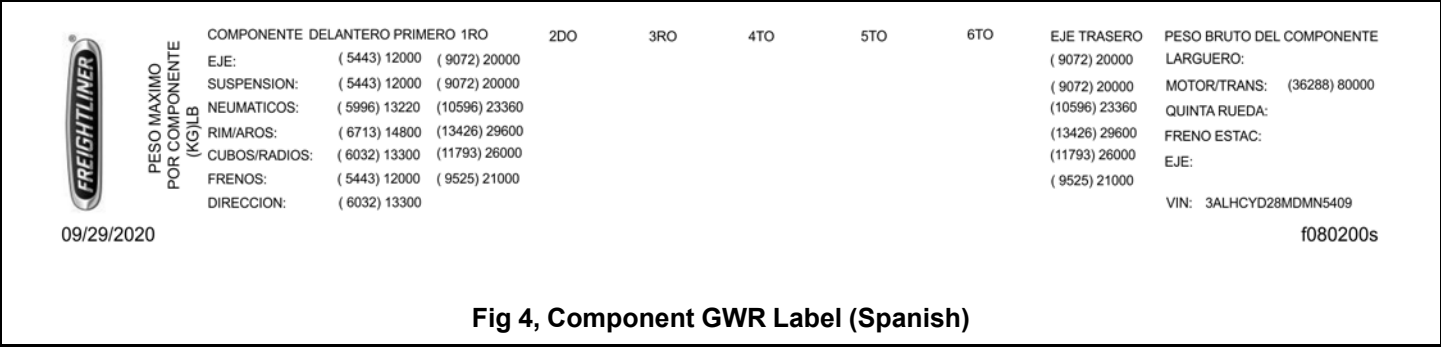
Fig 2, Component Information Label (English)

The component information label is located on the underside of the driver's sun visor.

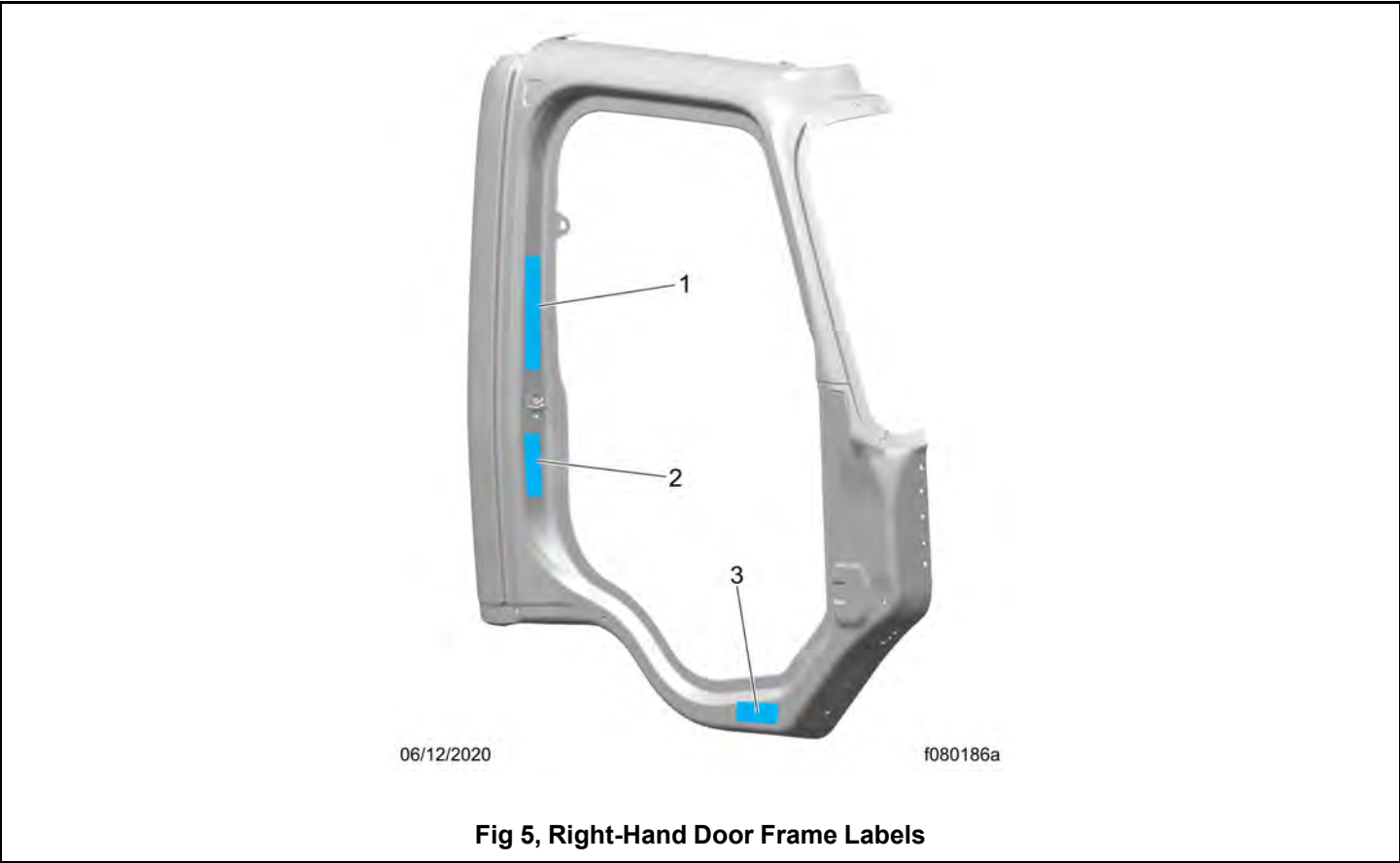
2.02 Component GWR Label

NOTE: Vehicles manufactured for the Canadian market have a Canadian Certification label instead of a component GWR label.

The component GWR label, shown in Fig.3, [Component GWR Label \(English\)](#), provides maximum GWR ratings for each component. For vehicles domiciled in Mexico, this label is in Spanish as shown in Fig.4, [Component GWR Label \(Spanish\)](#).



The component GWR label is located on the right-hand B-pillar as shown in Fig.5, [Right-Hand Door Frame Labels](#).



1. Component GWR Label (United States and Mexico)

- 2. Mexico Certification Label (Mexico)
- 3. Entry/Exit Warning Label

2.03 Federal Motor Vehicle Safety Standard Label

Tractors with or without fifth wheels manufactured for the U.S. are marked as certified by means of a federal motor vehicle safety standard (FMVSS) label, which also lists suitable tire and rim combinations. See Fig. 6,[FMVSS Certification Label \(complete vehicle\)](#).

For vehicles domiciled in the United States, this label is attached to the left-hand side B-pillar as shown in Fig. 7,[Left-Hand B-Pillar Labels, United States](#).

For vehicles manufactured for U.S./Canada operation, this label is applied below the door lock and next to the Canada certification label.

Vehicles domiciled in Mexico are labeled with a Spanish weights and measurement label that lists suitable tire and rim combinations. See Fig.8,[Spanish Weights and Measures Label](#).



08/31/2020

MANUFACTURED BY: DAIMLER TRUCKS N.A. LLC

DATE OF MFR: 07/15

GVWR/PNBV-KG: 23,587

GVWR/PNBV-LBS: 52,000

THIS VEHICLE COMPLIES WITH ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN EFFECT AT THE DATE OF MANUFACTURE SHOWN ABOVE.

VEHICLE ID NO: 1FUJGBDV4GLZZ9999

TYPE: TRUCK/TRACTOR TT/CT

COUNTRY OF ORIGIN: U.S.A.

GAWR/PNBE KGS

GAWR/PNBE LBS

FRONT AXLE: 5,443

1ST INT AXLE: 9,072

2ND INT AXLE:

3RD INT AXLE:

4TH INT AXLE:

5TH INT AXLE:

6TH INT AXLE:

REAR AXLE: 9,072

TIRES

275/80R22.5(G)

445/50R22.5(L)

445/50R22.5(L)

22.5X14.0

RIMS

22.5X8.25

22.5X14.0

22.5X14.0

KPA COLD

758

827

827

PSI COLD

110

120

120

"S"

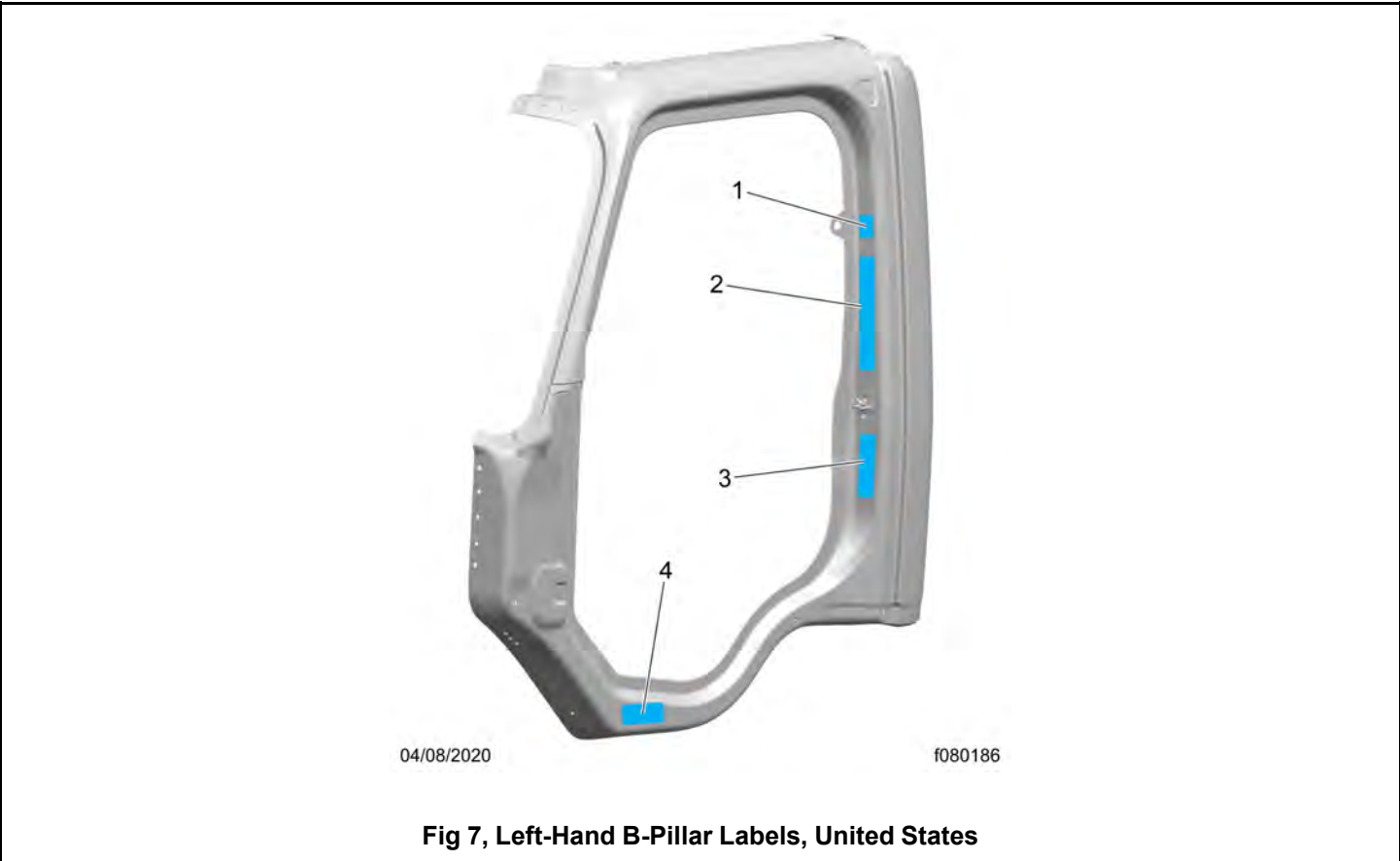
S

S

S

f080199

Fig 6, FMVSS Certification Label (complete vehicle)





FABRICADO POR: DAIMLER VEHICULOS COMERCIALES MEXICO	PV-KGS	PV-LBS	NEUMATICOS	RIM/AROS	KPA	PSI	*S"ENCILLA/ "D"OBLE
FECHA DE FABRICACION: 06/20					FRIQ	FRIQ	
PBV (GVWR)-KG: 23,587	EJE DELANTERO:	5,443	12,000	11R22.5(H)	22.5X8.25	827	120 S
PBV (GVWR)-LBS: 52,000	1RO:	9,072	20,000	11R22.5(G)	22.5X8.25	724	105 D
	2DO:						
	3RO:						
	4TO:						
NO. SERIE VEHICULO: 3ALHCYD28MDMN5409	5TO:						
CHASIS-CABINA	6TO:						
FABRIC. DE MEX.	EJE TRASERO:	9,072	20,000	11R22.5(G)	22.5X8.25	724	105 D

09/29/2020

f080199s

Fig 8, Spanish Weights and Measures Label

The tire and rim combinations listed on these labels are those that can be installed on the vehicle for the given gross axle weight rating. Tires and rims installed on the vehicle at the time of manufacture may have a higher load capacity than that certified by the tire and rim label. If the tires and rims currently on the vehicle have a lower load capacity than that shown on the tire and rim label, then the tires and rims determine the load limitations on each of the axles.

Trucks built without a cargo body that are intended for service in the U.S. have an incomplete FMVSS vehicle certification label. This label will be attached to the incomplete vehicle document included with the vehicle, and certifies that the vehicle conforms to all applicable FMVSS regulations in effect on the date of completion. The final certification label must be attached by the final-stage manufacturer.

2.04 Canada Certification Label

Complete tractors with fifth wheels manufactured for Canada or dual Canada/United States operations, are marked with a Canada certification label, shown in Fig.9, [Canada Certification Label](#), attached to the right-hand B-pillar.



NOTE: Vehicles manufactured for Canada will have a Canada certification label instead of a component GWR label.

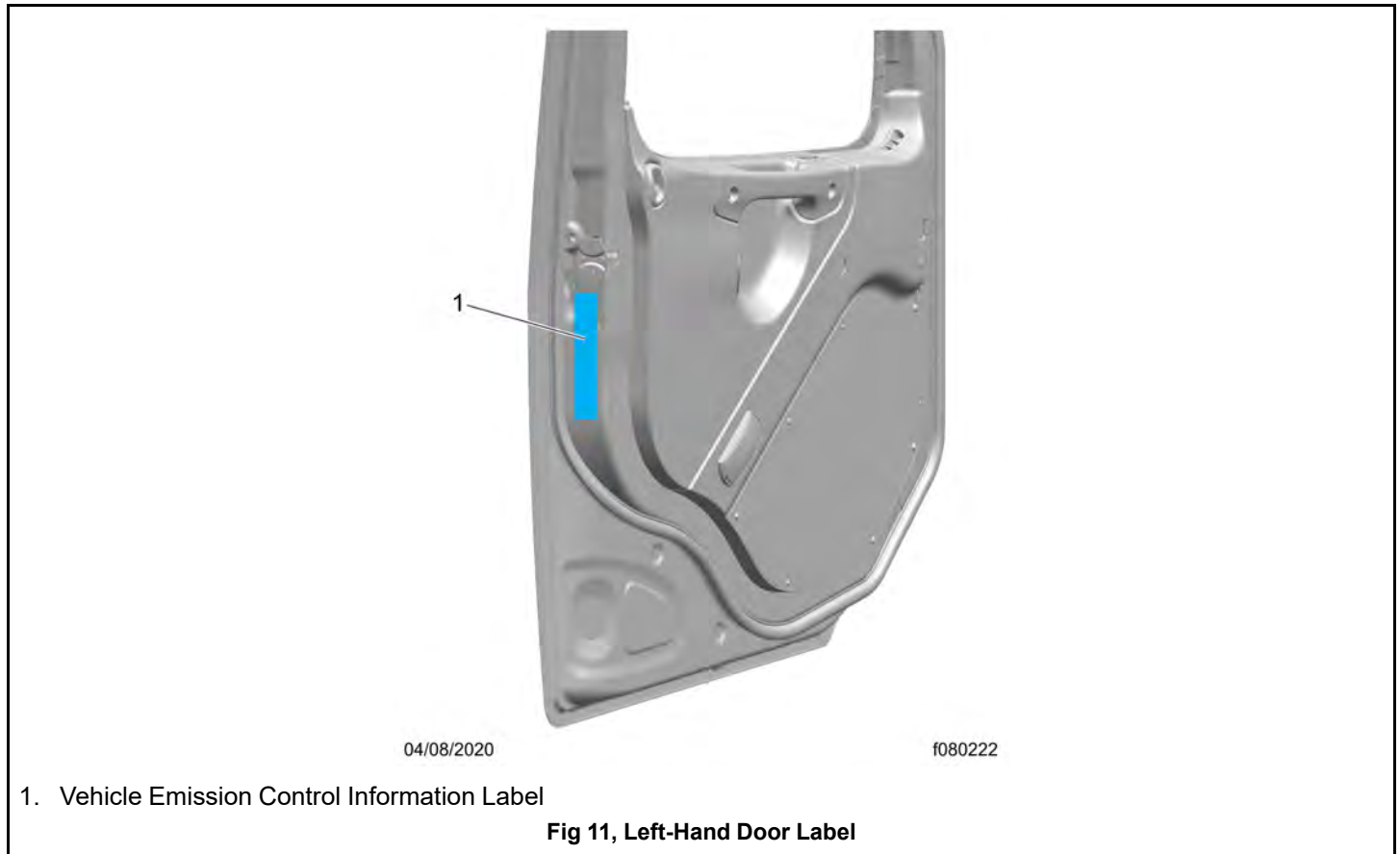
Trucks built without a cargo body and tractors built without a fifth wheel that are intended for service in Canada will have an incomplete Canada certification label attached to the left-hand B-pillar. After completion of the vehicle, a complete Canada certification label must be attached by the final-stage manufacturer to certify that the vehicle conforms to all applicable vehicle safety regulations in effect on the date of completion.

2.05 Mexico Labeling

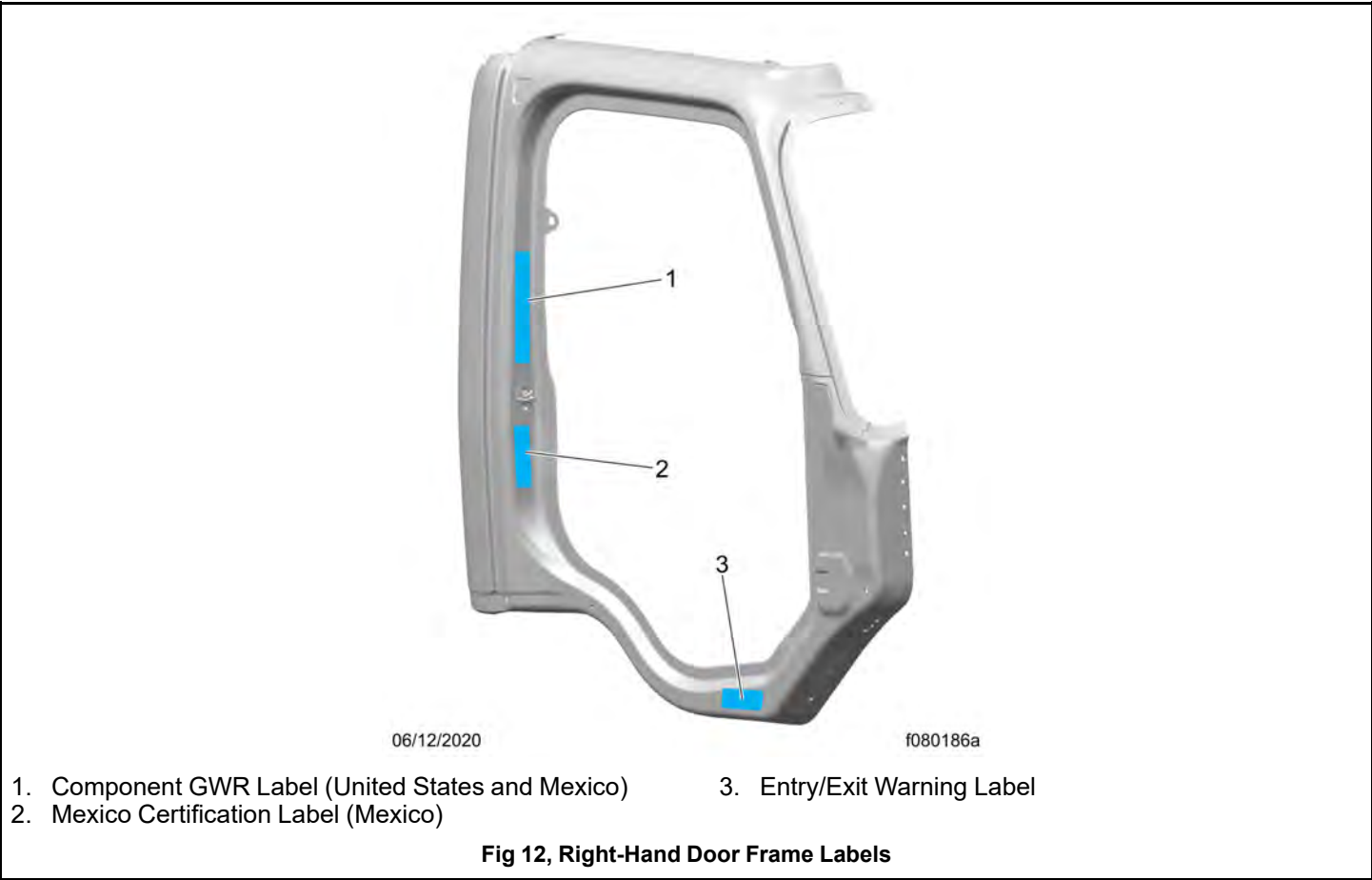
2.05.01 Mexico Certification Label

The Mexico certification label states that the vehicle complies with the Normas Oficiales Mexicanas (NOMs) standards in effect on the date the vehicle was manufactured. See Fig.10,[Mexico Certification Label](#).





Vehicles domiciled in Mexico will have a Mexico certification label applied to the right-hand B-pillar as shown in Fig. 12, [Right-Hand Door Frame Labels](#).



2.05.02 Spanish Weights and Measures Label

Vehicles with a Mexico certification label will also have a Spanish weights and measures label. See Fig. 13,[Spanish Weights and Measures Label](#) for an example.



FABRICADO POR: DAIMLER VEHICULOS COMERCIALES MEXICO		PV-KGS	PV-LBS	NEUMATICOS	RIM/AROS	KPA	PSI	*S"ENCILLA/
FECHA DE FABRICACION: 06/20						FRIIO	FRIIO	"D"OBLE
PBV (GVWR)-KG:	23,587	EJE DELANTERO:	5,443	12,000	11R22.5(H)	22.5X8.25	827	120
PBV (GVWR)-LBS:	52,000	1RO:	9,072	20,000	11R22.5(G)	22.5X8.25	724	105
		2DO:						
		3RO:						
		4TO:						
NO. SERIE VEHICULO: 3ALHCYD28MDMN5409		5TO:						
CHASIS-CABINA		6TO:						
FABRIC. DE MEX.		EJE TRASERO:	9,072	20,000	11R22.5(G)	22.5X8.25	724	105
								D

09/29/2020

f080199s

Fig 13, Spanish Weights and Measures Label

2.06 Emission Labels

2.06.01 Aftertreatment System Indicators Label

Model year 2007 and later diesel engines in vehicles domiciled in the U.S. or Canada are required to meet all EPA exhaust gas emission regulations effective as per the applicable emission model year, and are equipped with an emission aftertreatment system (ATS).

Vehicles domiciled outside of the U.S. and Canada may not have aftertreatment equipment, depending upon local statutory emissions guidelines.

See Table.1, [EPA Regulations](#) and Table.2, [Emission Regulations by Model Year](#) at the end of this chapter for additional information on what EPA and GHG regulations apply to different model years.

EPA Regulations	
Regulation	Emissions Components
EPA07 (Reduction of nitrogen oxides (NOx) emissions to 1.1 g/bhp-hr, and particulate matter emissions to 0.01 g/bhp-hr)	Aftertreatment device (ATD) containing a diesel particulate filter that traps soot and ash. ¹
EPA10 (Reduction of NOx emissions to 0.2 g/bhp-hr)	EPA07-type ATD, with additional selective catalyst reduction (SCR) technology that utilizes diesel exhaust fluid (DEF) to convert NOx to nitrogen and water vapor.
GHG14 (Reduction of greenhouse gas emissions)	Fuel efficiency components including, but not limited to, engines, tires, aerodynamic components, vehicle speed limiters, and idle reduction timers specifically designed to meet regulatory fuel efficiency and greenhouse gas emissions standards.
GHG17	Fuel efficiency components including, but not limited to, engines, tires, aerodynamic components, vehicle speed limiters, and idle reduction timers specifically designed to meet regulatory fuel efficiency and greenhouse gas emissions standards.
GHG21	GHG14/17 components plus additional components including, but not limited to, transmissions, axles, predictive technologies, idle reduction technologies for vocational vehicles, and tire pressure monitoring systems.

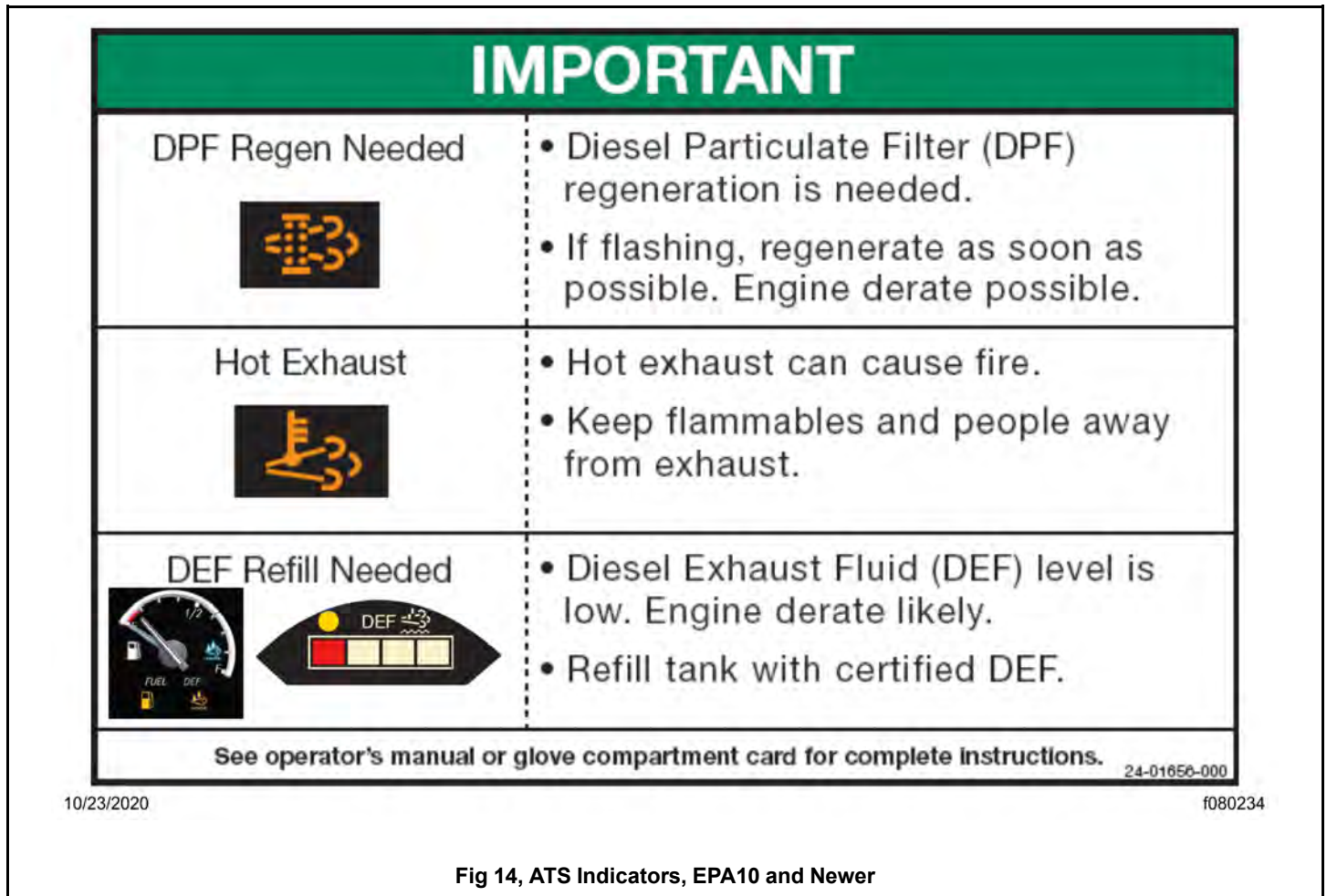
1. Cummins and Detroit ATD's are also equipped with a diesel oxidation catalyst to break down pollutants.

Table 1, EPA Regulations

Emission Regulations by Model Year		
Model Year	Engine Regulation	Vehicle Regulation
2007–2009	EPA07	N/A
2010–2012	EPA10	N/A
2013–2015	EPA10, GHG14	GHG14
2016	EPA10, GHG17	GHG14
2017–2020	EPA10, GHG17	GHG17
2021–and later	EPA10, GHG21	GHG21

Table 2, Emission Regulations by Model Year

See Fig.14, [ATS Indicators, EPA10 and Newer](#) for information on the driver's visor warning label for important warning indicators in the instrument cluster that pertain to the ATS.



It is a violation of U.S. federal law to alter exhaust plumbing, ATS, or other components in any way that would bring the engine/vehicle out of compliance with certification requirements [Ref: 42 U.S.C. S7522(a) (3)]. It is the owner's responsibility to maintain the vehicle so that it conforms to EPA regulations.

2.06.02 Vehicle Emission Control Information Label

Model year 2013 and later vehicles meet requirements as specified by GHG14, GHG17 and GHG21 regulations, respectively. These vehicles are equipped with components that increase fuel efficiency and reduce greenhouse gas (GHG) emissions. Components may include, but are not limited to, low-rolling resistance tires; aerodynamic devices such as hood, cab side extenders, and fuel tank fairings; vehicle speed limiters; and idle shutdown timers.

A vehicle emission control information label is located on the left-hand door. See Fig.16, [Left-Hand Door Label](#). Among other GHG relevant information the label indicates the emission model year of the vehicle. As this label is about meeting United States federal requirements, it is printed in English.

It is the owner's responsibility to maintain the vehicle so that it conforms to U.S. EPA and NHTSA regulations.

VEHICLE EMISSION CONTROL INFORMATION
 Manufactured By: DAIMLER TRUCKS NORTH AMERICA LLC Date of Manufacture: 07/15
 VIN/NIV: 1FUJGBDV4GLZZ9999 REGULATORY CLASS: High-roof day cab tractors above 33,000
 VEH FAMILY CD: GDTN2TRAC13C pounds GVWR.
 GVWR-PNBV-KG: 23,587
 GVWR-PNBV-LBS: 52,000 EMISSION CONTROL IDENTIFIERS: LRRA, ARF, TGR

THIS VEHICLE COMPLIES WITH U.S. EPA AND CALIFORNIA REGULATIONS FOR 2016
 HEAVY DUTY VEHICLES. See owner's manual for proper maintenance of this vehicle.

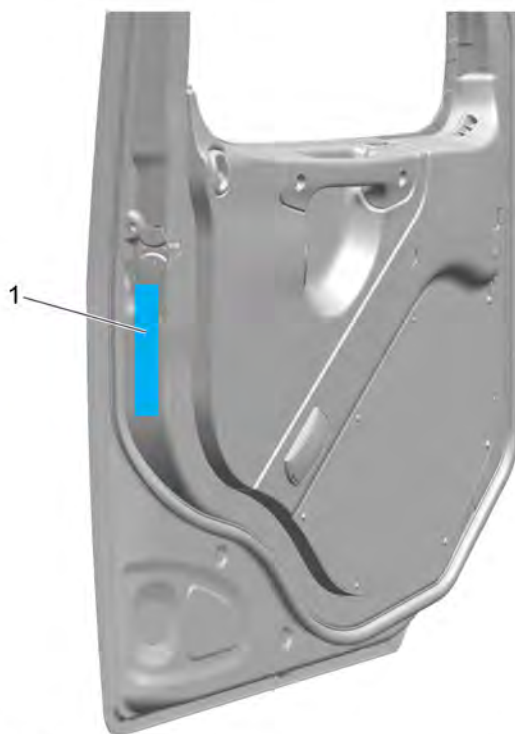


06/21/2016

f080198

1. Vehicle Emission Control Information Label

Fig 15, Vehicle Emission Control Information Label



04/08/2020

f080222

1. Vehicle Emission Control Information Label

Fig 16, Left-Hand Door Label

2.06.03 Noise Emission Control Labels

For vehicles manufactured for operation in the United States, an English language EPA noise emission control label is applied to attest that the vehicle conforms to United States EPA regulations for noise. See Fig.

17, [EPA Vehicle Noise Emission Control Label \(complete vehicle\)](#).

For vehicles manufactured for operation in Mexico, a Spanish language Normas Oficiales Mexicanas (NOM) vehicle noise emission control label attesting that the vehicle conforms to Mexican NOM regulations for noise is applied. See Fig.

18, [NOM Vehicle Noise Emission Control Label \(complete vehicle\)](#).

For vehicles manufactured for dual Mexico/United States operation, both labels are applied.

It is the owner's responsibility to maintain the vehicle so it conforms to all applicable regulations (EPA, NOM).

VEHICLE NOISE EMISSION CONTROL INFORMATION
 DAIMLER TRUCKS NORTH AMERICA LLC DATE OF MANUFACTURE: 07/15
 THIS COMPLETE VEHICLE CONFORMS TO U.S. EPA REGULATIONS FOR NOISE EMISSIONS
 APPLICABLE TO MEDIUM AND HEAVY TRUCKS. THE FOLLOWING ACTS, OR THE CAUSING
 THEREOF BY ANY PERSON ARE PROHIBITED BY THE NOISE CONTROL ACT OF 1972:
 A. THE REMOVAL OR RENDERING INOPERABLE OF OTHER THAN FOR PURPOSES OF
 MAINTENANCE, REPAIR OR REPLACEMENT OF ANY NOISE CONTROL DEVICE OR
 ELEMENT OF DESIGN (LISTED IN THE OWNER'S MANUAL) INCORPORATED INTO THIS
 VEHICLE IN COMPLIANCE WITH THE NOISE CONTROL ACT.
 B. THE USE OF THIS VEHICLE AFTER SUCH DEVICE OR ELEMENT OF DESIGN HAS BEEN
 REMOVED OR RENDERED INOPERABLE.

06/21/2016  f080197

Fig 17, EPA Vehicle Noise Emission Control Label (complete vehicle)

INFORMACION CONTROL DE EMISION DE RUIDO DEL VEHICULO
 DAIMLER VEHICULOS COMERCIALES MEXICO FECHA DE FABRICACION: 06/20
 ESTE VEHICULO CUMPLE CON LA NORMA OFICIAL MEXICANA: NOM-079-ECOL-1994 QUE
 ESTABLECE LIMITES MAXIMOS PERMISIBLES DE LA EMISION DE RUIDO DE LOS VEHICULOS
 AUTOMOTORES NUEVOS EN PLANTA Y SU METODO DE MEDICION PUBLICADA EN EL D.O.F. DEL
 12 DE ENERO DE 1995.

09/29/2020  f080197s

Fig 18, NOM Vehicle Noise Emission Control Label (complete vehicle)

IMPORTANT: Certain Freightliner incomplete vehicles may be produced for the United States market with incomplete noise control hardware. Such vehicles will have an incomplete vehicle noise emission control information label. See Fig. 19, [EPA Vehicle Noise Emission Control Label \(incomplete vehicle\)](#). For such vehicles, it is the final-stage manufacturer's responsibility to complete the vehicle in conformity to the applicable regulations and label it for compliance.

VEHICLE NOISE EMISSION CONTROL INFORMATION
 DAIMLER TRUCKS NORTH AMERICA LLC DATE OF MANUFACTURE: 01/16
 THIS INCOMPLETE VEHICLE AS DELIVERED BY DAIMLER TRUCKS NORTH AMERICA LLC
 CONFORMS TO U.S. EPA REGULATIONS FOR NOISE EMISSIONS APPLICABLE TO MEDIUM
 AND HEAVY TRUCKS. IT IS THE RESPONSIBILITY OF THE FINAL STAGE MANUFACTURER
 TO COMPLETE THIS VEHICLE WHILE MAINTAINING CONFORMANCE TO 40 CFR PART 205,
 INCLUDING LABELING FOR COMPLIANCE (SEC. 205.55-41).

10/17/2016  f080201a

Fig 19, EPA Vehicle Noise Emission Control Label (incomplete vehicle)

2.06.04 Certified Clean Idle Label

The California Air Resources Board (CARB) requires model year 2008 and newer heavy-duty diesel engines to meet CARB's Heavy-Duty Diesel Engine Idling Requirement in order to limit emissions of particulate matter and NOx.

Certified vehicles are equipped with a label, shown in Fig.20, [CARB Clean Idle Label](#), that is placed near the bottom edge of the left-hand door.



Fig 20, CARB Clean Idle Label

2.07 Customer Assistance Label

The customer assistance center telephone number is printed on the customer assistance label. The label also includes a QR code encoded with the vehicle identification number (VIN), readable by dealer apps, to bring up information about the vehicle.

For vehicles domiciled in Mexico this label will be in Spanish as shown in Fig.21, [Customer Assistance Label, Spanish](#). For vehicles domiciled in the United States it will be printed in English as shown in Fig.22, [Customer Assistance Label, English](#).



Fig 21, Customer Assistance Label, Spanish



Fig 22, Customer Assistance Label, English

The customer assistance label is located on the left-hand B-pillar, as shown in Fig. 23, [Left-Hand B-Pillar Labels, United States](#).



Fig 23, Left-Hand B-Pillar Labels, United States

3.01 Cab Door Locks and Handles	24
3.02 Grab Handles and Access Steps	25
3.03 Cab Entry and Exit, Vehicles With Two Steps	26
3.03.01 General Information	26
3.03.02 Entering from the Driver's Side.....	26
3.03.03 Exiting from the Driver's Side	27
3.03.04 Entering from the Passenger's Side.....	28
3.03.05 Exiting from the Passenger's Side	28
3.04 Cab Entry and Exit, Vehicles With One Step.....	30
3.04.01 General Information	30
3.04.02 Entering from the Driver's Side.....	30
3.04.03 Exiting from the Driver's Side	31
3.04.04 Entering from the Passenger's Side.....	32
3.04.05 Exiting from the Passenger's Side	32
3.05 Back-of-Cab Access.....	33
3.05.01 General Information	33
3.05.02 Entering Back-of-Cab	34
3.05.03 Climbing Down from Back-of-Cab	35
3.06 Battery Access.....	35
3.06.01 Battery Compartment	35
3.06.02 Cab (Battery) Isolation Switch	36
3.07 Hood Opening and Closing	36
3.07.01 General Information	36
3.07.02 To Open the Hood.....	36
3.07.03 To Close the Hood	37
3.08 Fuse Identification	37
3.08.01 Main Fuse Box/PDM	37
3.08.02 Trailer and Taillight Fuse Boxes.....	39

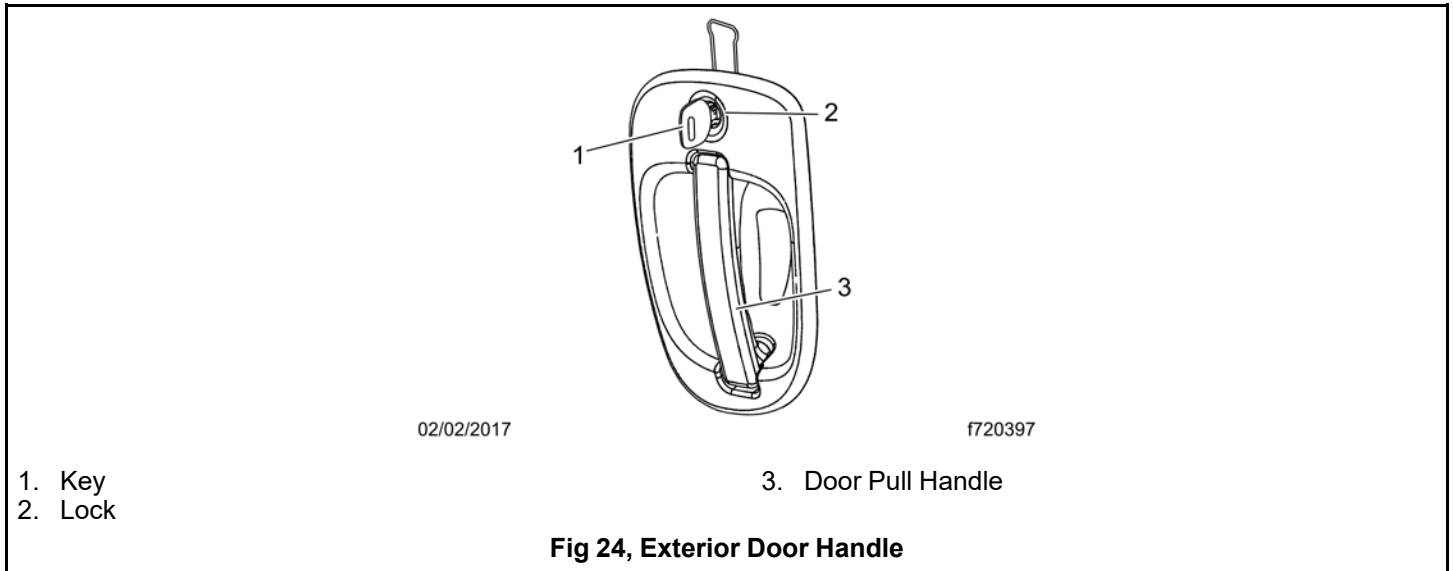
3. Vehicle Access

3.01 Cab Door Locks and Handles

One key operates the ignition switch and all of the door locks.

IMPORTANT: Each key is numbered. Record the number so a duplicate key can be made, if needed.

To unlock the driver's door from outside the cab, insert the key in the lockset and turn it one-quarter turn clockwise (Fig. 24, [Exterior Door Handle](#)). To remove the key, turn it counterclockwise to its original position. Pull out on the door pull handle to open the door.

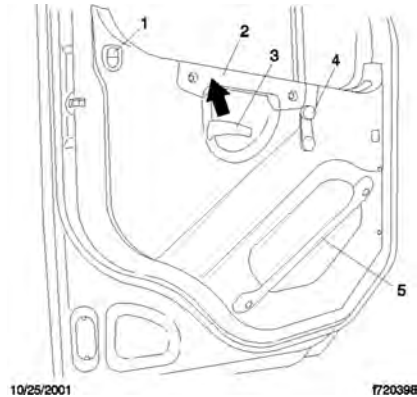


To unlock the passenger's door from outside the cab, insert the key in the lockset and turn it one-quarter turn counterclockwise. Turn the key clockwise to the original position to remove it.

NOTE: The cab door locks can be operated when the doors are open.

To lock a door from outside the cab, do either one of the following:

- Insert the key in the lockset and turn it in the direction opposite to the unlocking direction (counterclockwise for the driver's door, clockwise for the passenger's door). Close the door if it is open.
- Push down the inside lock button (Fig. 25, [Door Interior](#)). Close the door.



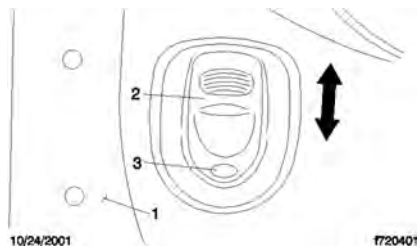
NOTE: To open the door from the inside, lift up on the door lever (arrow).

- | | |
|-------------------|--------------------------------------|
| 1. Lock Button | 4. Window Crank |
| 2. Armrest/Handle | 5. Inner Door Grab Handle (optional) |
| 3. Door Lever | |

Fig 25, Door Interior

To open the door from the inside, lift up on the door lever. This will unlatch the door whether or not it is locked. If it is open, close the door by pulling the inner door grab handle.

To lock either door from inside the cab, slide the lock button downwards (26, [Door Lock Button](#)). To unlock the door without unlatching it, push the lock button upwards. A red dot will show below the lock button when it is unlocked.



NOTE: Move the button down to lock, and up to unlock (arrows). The door is unlocked when the red dot shows.

- | | |
|----------------|------------|
| 1. Door | 3. Red Dot |
| 2. Lock Button | |

Fig 26, Door Lock Button

3.02 Grab Handles and Access Steps

For ease of entry and exit, there are three grab handles, one on the A-pillar, one on the inner B-pillar, and an optional one on the inside of the door. In addition, the steering wheel may be used to provide secure handholds. There are one or two access steps to provide secure footholds.

NOTE: The A-pillar grab handle is not installed on the driver's side.

The grab handles, access steps, and steering wheel are all part of the cab access system. Use these "helping hands" when getting into, or out of, the cab. They will increase your security and comfort.

3.03 Cab Entry and Exit, Vehicles With Two Steps

3.03.01 General Information

**WARNING:**

Wet or dirty shoe soles greatly increase the chance of slipping or falling. If your soles are wet or dirty, be especially careful when climbing onto, or down from, the back-of-cab area.

Always maintain three-point contact with the back-of-cab access supports while entering and exiting the back-of-cab area. Three-point contact means both feet and one hand, or both hands and one foot, on the grab handles, steps, and deck plates. Other areas are not meant to support back-of-cab access, and grabbing or stepping in the wrong place could lead to a fall, and personal injury.

Be careful not to get hands or feet tangled in hoses or other back-of-cab equipment. Carelessness could cause a person to trip and fall, with possible injury.

Use the cab access system (grab handles, access steps, and steering wheel) to enter or exit the cab.

3.03.02 Entering from the Driver's Side

To enter the cab from the driver's side, do the following steps. (Fig.27, [Cab Access System, Driver's Side](#)):



1. Steering Wheel
2. B-Pillar Grab Handle
3. Bottom Step

4. Top Step
5. Inner Door Grab Handle (optional)

Fig 27, Cab Access System, Driver's Side

1. Use the door pull handle to open the driver's door, and place anything that you are carrying in the cab.
2. Grasp the B-pillar grab handle with both hands. Reach up as far as is comfortable.
3. Place your right foot on the bottom step, and pull yourself up.
4. Place your left foot on the top step.
5. Grasp the steering wheel with your left hand, and step up.
6. Step into the cab with your right foot first, and grasp the steering wheel with your right hand.

NOTE: You can also use the inner door grab handle, if available, as a support when getting up or down from the bottom step.

3.03.03 Exiting from the Driver's Side

To exit the cab from the driver's side, do the following steps (Fig.28, Cab Access System, Driver's Side):



- | | |
|-------------------------|--------------------------------------|
| 1. Steering Wheel | 4. Top Step |
| 2. B-Pillar Grab Handle | 5. Inner Door Grab Handle (optional) |
| 3. Bottom Step | |

Fig 28, Cab Access System, Driver's Side

IMPORTANT: Do not attempt to exit the cab while carrying any items in your hands.

1. If you wish to take any items with you, after you exit the cab, place them in an accessible location on the seat or cab floor. Make sure they will not get in your way as you exit.



WARNING:

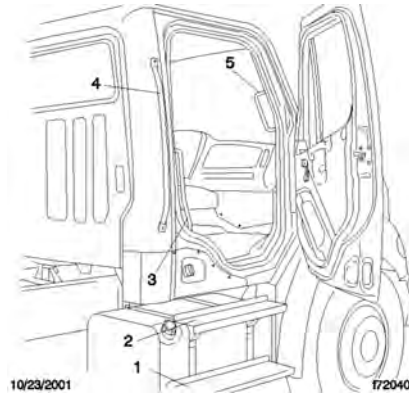
Always face in when exiting the cab. Do not attempt to exit with your back to the cab, as you would going down a flight of stairs. It is easier to slip or lose your balance. If you slip when exiting in this way, there is a greater likelihood of personal injury.

2. Grasp the steering wheel with both hands. Place your left foot on the top step, and stand on the threshold, facing into the cab.
3. Move your right hand to the B-pillar grab handle.
4. Move your right foot to the bottom step.
5. Move your left hand to the B-pillar grab handle.
6. Step to the ground with your left foot first.
7. Retrieve from the cab any items that you wish to take with you.

NOTE: You can also use the inner door grab handle, if available, as a support when getting up or down from the bottom step.

3.03.04 Entering from the Passenger's Side

To enter the cab from the passenger's side, do the following steps (Fig. 29, Cab Access System, Passenger's Side and Back of Cab):



1. Bottom Step
2. Top Step
3. B-Pillar Grab Handle

4. Sidewall Grab Handle (optional)
5. A-Pillar Cover Grab Handle

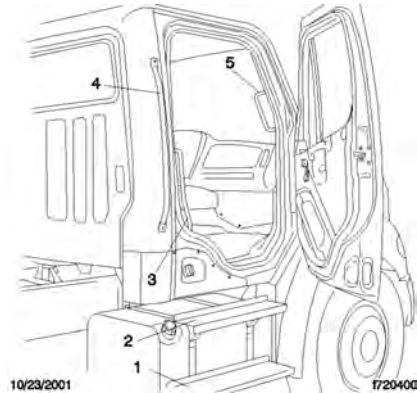
Fig 29, Cab Access System, Passenger's Side and Back of Cab

1. Open the passenger's door, and place anything that you are carrying in the cab.
2. Grasp the B-pillar grab handle on the door with both hands.
3. Place your left foot on the bottom step and step up to the upper step with your right foot.
4. Move your right hand to the A-pillar cover grab handle.
5. Place your left foot on the top step and step up.
6. Move your left hand to the A-pillar cover grab handle.
7. Step into the cab with your left foot first.

NOTE: You can also use the inner door grab handle, if available, as a support when getting up or down from the bottom step.

3.03.05 Exiting from the Passenger's Side

To exit the cab from the passenger's side, do the following steps (Fig.):



1. Bottom Step
2. Top Step
3. B-Pillar Grab Handle
4. Sidewall Grab Handle (optional)
5. A-Pillar Cover Grab Handle

Fig 30, Cab Access System, Passenger's Side and Back of Cab

IMPORTANT: Do not attempt to exit the cab while carrying any items in your hands.

1. If you wish to take any items with you, after you exit the cab, place them in an accessible location on the seat or cab floor. Make sure they will not get in your way as you exit.



WARNING:

Always face in when exiting the cab. Do not attempt to exit with your back to the cab, as you would be going down a flight of stairs. It is easier to slip or lose your balance. If you slip when exiting in this way, there is a greater likelihood of personal injury.

2. Grasp the A-pillar cover grab handle with both hands, then place your right foot on the top step while standing up from the seat facing inward.
3. Place your left foot on the top step.
4. Move your left hand to the B-pillar grab handle.
5. Move your left foot to the bottom step.
6. Move your right hand to the B-pillar grab handle.
7. Step to the ground with your right foot first.
8. Retrieve from the cab any items that you wish to take with you.

NOTE: You can also use the inner door grab handle, if available, as a support when getting up or down from the bottom step.

3.04 Cab Entry and Exit, Vehicles With One Step

3.04.01 General Information

**WARNING:**

Wet or dirty shoe soles greatly increase the chance of slipping or falling. If your soles are wet or dirty, be especially careful when climbing onto, or down from, the back-of-cab area.

Always maintain three-point contact with the back-of-cab access supports while entering and exiting the back-of-cab area. Three-point contact means both feet and one hand, or both hands and one foot, on the grab handles, steps, and deck plates. Other areas are not meant to support back-of-cab access, and grabbing or stepping in the wrong place could lead to a fall, and personal injury.

Be careful not to get hands or feet tangled in hoses or other back-of-cab equipment. Carelessness could cause a person to trip and fall, with possible injury.

Use the cab access system (grab handles, access steps, and steering wheel) to enter or exit the cab.

3.04.02 Entering from the Driver's Side

To enter the cab from the driver's side, do the following steps. (Fig.31, [Cab Access System, Driver's Side](#)):



1. Steering Wheel
2. B-Pillar Grab Handle
3. Bottom Step

4. Top Step
5. Inner Door Grab Handle (optional)

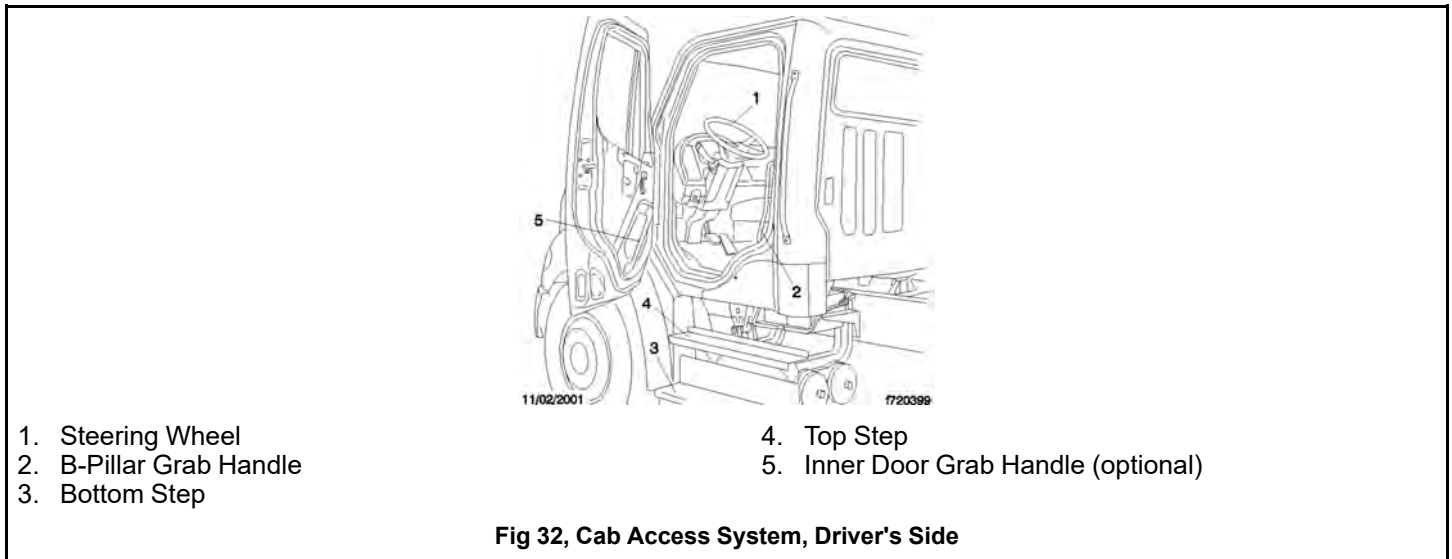
Fig 31, Cab Access System, Driver's Side

1. Use the door pull handle to open the driver's door, and place anything that you are carrying in the cab. Use the door armrest/handle and, if available, the inner door grab handle, as a support if needed.
2. Grasp the B-pillar grab handle with both hands. Reach up as far as is comfortable.
3. Place your right foot on the step, and pull yourself up.
4. Step into the cab with your left foot.
5. Grasp the steering wheel with your left hand.
6. Step into the cab with your right foot, and grasp the steering wheel with your right hand.

NOTE: You can also use the inner door grab handle, if available, as a support when getting up or down from the bottom step.

3.04.03 Exiting from the Driver's Side

To exit the cab from the driver's side, do the following steps (Fig.32, [Cab Access System, Driver's Side](#)):



IMPORTANT: Do not attempt to exit the cab while carrying any items in your hands.

1. If you wish to take any items with you, after you exit the cab, place them in an accessible location on the seat or cab floor. Make sure they will not get in your way as you exit.

**WARNING:**

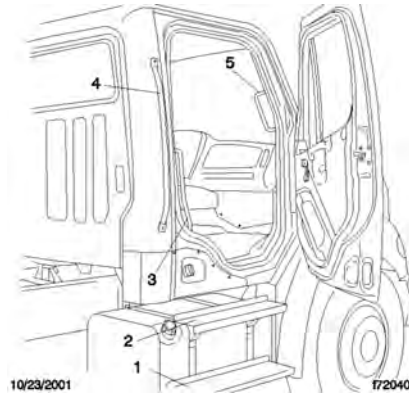
Always face in when exiting the cab. Do not attempt to exit with your back to the cab, as you would going down a flight of stairs. It is easier to slip or lose your balance. If you slip when exiting in this way, there is a greater likelihood of personal injury.

2. Grasp the steering wheel with both hands. Place your left foot on the step, and stand on the threshold, facing into the cab.
3. Move your right hand to the B-pillar grab handle.
4. Move your left hand to the B-pillar grab handle.
5. Move your right foot onto the step.
6. Step to the ground with your left foot first.
7. Retrieve from the cab any items that you wish to take with you.

NOTE: You can also use the inner door grab handle, if available, as a support when getting up or down from the bottom step.

3.04.04 Entering from the Passenger's Side

To enter the cab from the passenger's side, do the following steps (Fig. 33, Cab Access System, Passenger's Side and Back of Cab):



1. Bottom Step
2. Top Step
3. B-Pillar Grab Handle

4. Sidewall Grab Handle (optional)
5. A-Pillar Cover Grab Handle

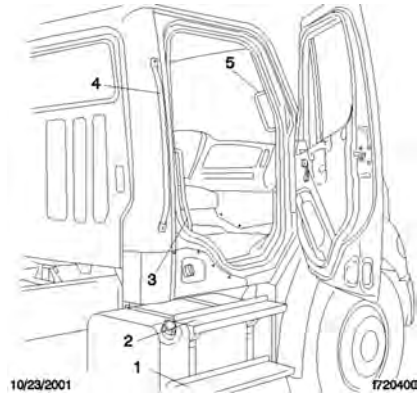
Fig 33, Cab Access System, Passenger's Side and Back of Cab

1. Open the passenger's door, and place anything that you are carrying in the cab.
2. Grasp the B-pillar grab handle with both hands.
3. Place your left foot on the step and step up to the cab with your right foot.
4. Move your right hand to the A-pillar cover grab handle.
5. Move your left hand to the A-pillar cover grab handle.
6. Step into the cab with your left foot.

NOTE: You can also use the inner door grab handle, if available, as a support when getting up or down from the bottom step.

3.04.05 Exiting from the Passenger's Side

To exit the cab from the passenger's side, do the following steps (Fig.):



1. Bottom Step
2. Top Step
3. B-Pillar Grab Handle
4. Sidewall Grab Handle (optional)
5. A-Pillar Cover Grab Handle

Fig 34, Cab Access System, Passenger's Side and Back of Cab

IMPORTANT: Do not attempt to exit the cab while carrying any items in your hands.

1. If you wish to take any items with you, after you exit the cab, place them in an accessible location on the seat or cab floor. Make sure they will not get in your way as you exit.



WARNING:

Always face in when exiting the cab. Do not attempt to exit with your back to the cab, as you would going down a flight of stairs. It is easier to slip or lose your balance. If you slip when exiting in this way, there is a greater likelihood of personal injury.

2. Grasp the A-pillar cover grab handle with both hands, then place your right foot on the step while standing up from the seat facing inward.
3. Place your left foot on the step.
4. Move your left hand to the B-pillar grab handle.
5. Move your right hand to the B-pillar grab handle.
6. Step to the ground with your right foot first.
7. Retrieve from the cab any items that you wish to take with you.

NOTE: You can also use the inner door grab handle, if available, as a support when getting up or down from the bottom step.

3.05 Back-of-Cab Access

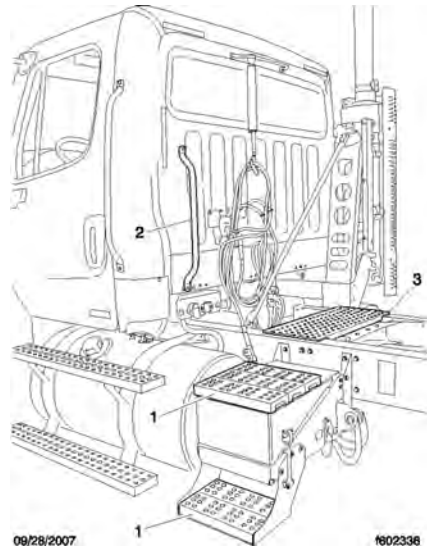
3.05.01 General Information

When trailer air and electrical connections cannot be reached conveniently from the ground, Federal Motor Carrier Safety Regulations require commercial carriers to provide back-of-cab access.

Optional grab handles are mounted on each cab sidewall, or on the left sidewall only. See Fig.

35, [Back-of-Cab Access Supports \(typical\)](#). Steps are mounted either on the fuel tank(s) or on metal brackets. When a deck plate is necessary, it is mounted across the top of the frame rails.

IMPORTANT: Climb onto, and down from, back-of-cab access facing in toward the vehicle, as you would on a ladder. Do not climb up or down facing out away from the vehicle.



- 1. Steps
- 2. Grab Handle

- 3. Deck Plate

Fig 35, Back-of-Cab Access Supports (typical)



WARNING:

Wet or dirty shoe soles greatly increase the chance of slipping or falling. If your soles are wet or dirty, be especially careful when climbing onto, or leaving, the back-of-cab area.

Always maintain three-point contact with the back-of-cab access supports while entering and exiting the back-of-cab area. Three-point contact means both feet and one hand, or both hands and one foot, on the grab handles, steps, and deck plates. Other areas are not meant to support back-of-cab access, and grabbing or stepping in the wrong place could lead to a fall, and personal injury.

Be careful not to get hands or feet tangled in hoses or other back-of-cab equipment. Carelessness could cause a person to trip and fall, with possible injury.

3.05.02 Entering Back-of-Cab

When climbing onto the deck plate, do the following:

1. Grasp the sidewall grab handle with both hands. Reach up as far as is comfortable.
2. Place one foot on the bottom step and pull yourself up.
3. Place your other foot on the top step.
4. Move your lower hand to a higher position on the grab handle.
5. Step onto the deck plate.

3.05.03 Climbing Down from Back-of-Cab

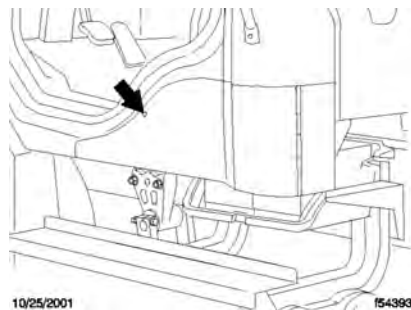
To climb down from the back-of-cab area:

1. Grasp the sidewall grab handle with both hands.
2. Step one foot at a time onto the top step.
3. Move your upper hand to a lower position on the grab handle.
4. Move one foot to the bottom step.
5. Move your upper hand to a lower position on the grab handle.
6. Step to the ground with your upper foot first.

3.06 Battery Access

3.06.01 Battery Compartment

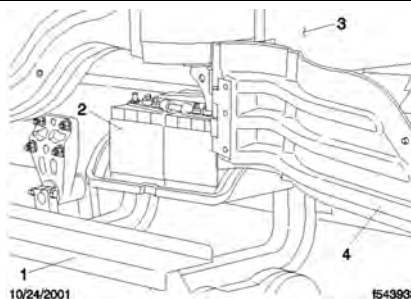
The battery compartment is located in the lower part of the cab beneath and to the rear of the driver's door. It is fastened by a quarter-turn fastener. To open the battery access door, turn the quarter-turn fastener with a small screwdriver. See Fig. 36, [Battery Compartment, Closed](#).



NOTE: Open the battery access door by turning the quarter-turn fastener (arrow) with a small screwdriver.

Fig 36, Battery Compartment, Closed

With the battery access door open (Fig.37, [Battery Compartment, Open](#)), it is easy to get access to the battery terminals for cleaning, charging, or emergency jump starting.



- A. Top Step
B. 2.Battery
C. 3.Cab

- D. 4.Battery Access Door
1.

Fig 37, Battery Compartment, Open

To close the battery access door, do the following steps:

1. Swing the battery access door to line up the quarter-turn fastener with the hole in the cab door frame.
2. Close the battery access door and check to be sure the quarter-turn fastener is engaged with the hole.
3. Turn the fastener one-quarter turn.

3.06.02 Cab (Battery) Isolation Switch

The cab isolation switch (see Fig.38, [Cab \(Battery\) Isolation Switch](#)) is located on the cab floor at the left of the driver's seat, or inside the battery box. The battery isolation switch reduces the power to the cab and engine power wiring. Use it whenever the vehicle is to be put out of service for extended periods.

IMPORTANT: Open the battery access door by turning the quarter-turn fastener (arrow) with a small screwdriver.

NOTE: Open the battery access door by turning the quarter-turn fastener (arrow) with a small screwdriver.

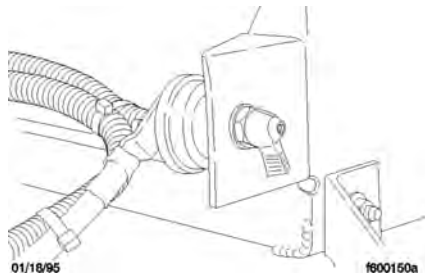


Fig 38, Cab (Battery) Isolation Switch

3.07 Hood Opening and Closing

3.07.01 General Information

The hood can be raised to a full-open position. A torsion bar helps you to raise the hood, and to lower it to the operating position. Hood restraint cables prevent the hood from overtravel. A hood damper limits the closing speed. In the operating position, the hood is secured to the cab-mounted half-fenders by a hold-down latch on each side of the hood.

3.07.02 To Open the Hood

1. Apply the parking brakes.
2. Release both hood hold-down latches by pulling the ends outward. See Fig.39, [Hood Hold-Down Latch](#).

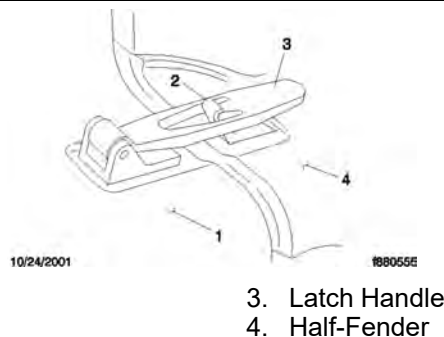


Fig 39, Hood Hold-Down Latch

**CAUTION:**

Do not let the hood free-fall to the full-open position. To do so could cause damage to the hood or hood straps.

3. Standing in front of the hood, raise the rear of the hood upward until it reaches the over-center position (45 degrees from vertical). Then slowly bring it to a stop.

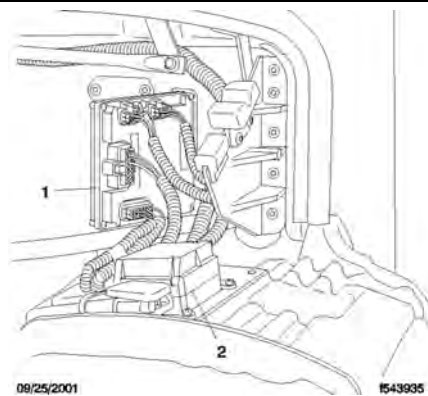
3.07.03 To Close the Hood

1. Push the hood over center.
2. As the hood goes over center, the damper automatically slows its rate of descent. If needed, you can also slow its rate of descent with your hand.
3. Make sure the hood is flush with the cowl, then secure the hood by engaging both hood hold-down latches.

IMPORTANT: Make sure that both hold-down latches are fully engaged before operating the vehicle.

3.08 Fuse Identification**3.08.01 Main Fuse Box/PDM**

The main fuse box, also known as the power distribution module, or PDM, is located under the hood on the left front fender just forward of the bulkhead module. See Fig.40, [Location of the Main Fuse Box](#). To open the fuse box, pull down on the wire clips holding the lid on the fuse box.



1. Bulkhead Module

2. Main Fuse Box

Fig 40, Location of the Main Fuse Box

A sticker inside the lid of the fuse box shows the locations of the fuses and describes the circuit(s) that each fuse protects (see Fig.41, [Main Fuse Box Diagram](#)). See Table.3, [Fuse Identification, Main Fuse Box](#) for descriptions of a typical set of fuses. The fuses in the main fuse box are mini blade-type fuses. Battery power fuses, located near the batteries, are bolt-in megafuses.

Because the electrical system is multiplexed, no relays are needed. The multiplexing module performs the functions normally provided by relays.

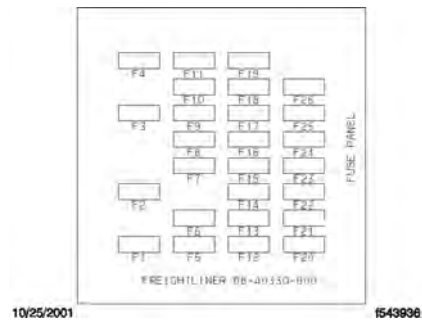


Fig 41, Main Fuse Box Diagram

Fuse Identification, Main Fuse Box			
Pos. No.	Description	Fuse Color	Rating
F1	VCU (MBE900 only)	Red	10 Amp
F2	Blower Motor	Green	30 Amp
F3	Engine ECU	Yellow	20 Amp
F4	Transmission Control Unit	Green	30 Amp
F5	Ignition Switch	Tan	5 Amp
F6	Spare	—	—
F7	Bulkhead Module	Green	30 Amp
F8	ICU	Red	10 Amp
F9	Transmission Control Unit	Yellow	20 Amp
F10	Door Locks (optional)	Red	10 Amp
F11	Mirrors (optional)	Blue	15 Amp
F12	Radio/Diagnostics	Yellow	20 Amp
F13	Chassis Module	Green	30 Amp
F14	L/H Power Windows (optional)	Blue	15 Amp
F15	Bulkhead Module	Green	30 Amp
F16	ABS ECU	Blue	15 Amp
F17	Chassis Module	Green	30 Amp

Table 3, Fuse Identification, Main Fuse Box

F18	Bulkhead Module	Green	30 Amp
F19	Chassis Module	Green	30 Amp
F20	Bulkhead Module	Green	30 Amp
F21	R/H Power Windows (optional)	Blue	15 Amp
F22	Bulkhead Module	Green	30 Amp
F23	Spare	—	—
F24	Spare	—	—
F25	Spare	—	—
F26	Spare	—	—
M1	Battery Power	—	125 Amp
M2	Battery Power	—	125 Amp
M3	Battery Power	—	150 Amp

Table 3, Fuse Identification, Main Fuse Box

3.08.02 Trailer and Taillight Fuse Boxes

The trailer fuse box and the taillight fuse box, on vehicles so equipped, are mounted on a bracket with the chassis module on the left-hand frame rail aft of the cab, or on a crossmember at the end of the frame rail. These may be referred to as the chassis fuse box or chassis PDM. See Fig.42, [Trailer Fuse Box Diagram](#) for trailer fuse and relay information, and Fig. 43, [Taillight Fuse Box Diagram](#) for taillight fuse and relay information.

These fuse boxes contain mini blade-type fuses, 12-volt mini relays, and 12-volt micro relays.

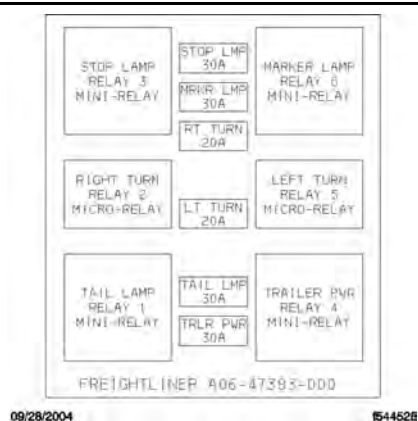
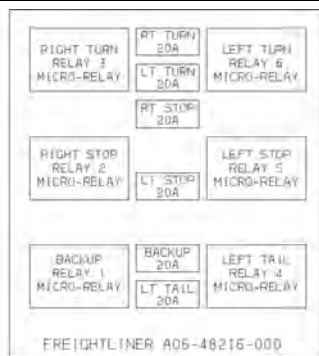


Fig 42, Trailer Fuse Box Diagram



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Fig 43, Taillight Fuse Box Diagram

4.01 Instrumentation Control Unit.....	42
4.01.01 General Information	42
4.01.02 Ignition Sequence	43
4.01.03 Audible Alerts	48
4.02 Warning and Indicator Lights.....	49
4.02.01 General Information	49
4.02.02 Engine Protection System	54
4.03 Driver Message Center.....	55
4.03.01 General Information	55
4.03.02 Driving Screens	55
4.03.03 Parked Screens/Menus	56
4.04 Instruments.....	58
4.04.01 General Information	58
4.04.02 Air Intake Restriction Gauge	58
4.04.03 Ambient Temperature Gauge	59
4.04.04 Coolant Temperature Gauge.....	60
4.04.05 Drive Axle Oil Temperature Gauges.....	60
4.04.06 Engine Oil Pressure Gauge	61
4.04.07 Engine Oil Temperature Gauge	62
4.04.08 Fuel Gauge, Pre-EPA10	62
4.04.09 Fuel/Diesel Exhaust Fluid (DEF) Gauge, EPA10 and Newer.....	63
4.04.10 Primary and Secondary Air Pressure Gauges	63
4.04.11 Speedometer	64
4.04.12 Tachometer	64
4.04.13 Transmission Fluid Temperature Gauge	64
4.04.14 Turbocharger Boost Pressure Gauge	65
4.04.15 Voltmeter.....	65
4.05 Overhead Instrument Panel	65

4. Instruments

4.01 Instrumentation Control Unit

4.01.01 General Information

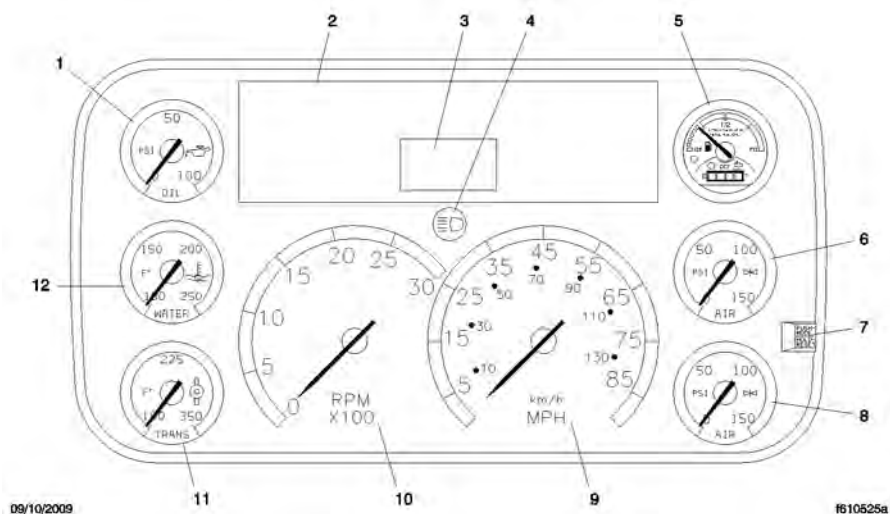
The instrumentation control unit (ICU) provides the driver with engine and vehicle information. It is comprised of standard and optional gauges, an audible warning, a driver message center, and a lightbar containing warning and indicator lamps (also known as telltales). Warning and indicator lamps illuminate in red (danger), amber (caution), green (status advisory), or blue (high-beam headlights active).

The following headings in this chapter provide additional information and operating instructions for ICU components:

- "Warning and Indicator Lights"
- "Instruments"
- "Driver Message Center"

Fig.44, [ICU3 \(EPA10 shown\)](#) shows a typical ICU3 instrument cluster.

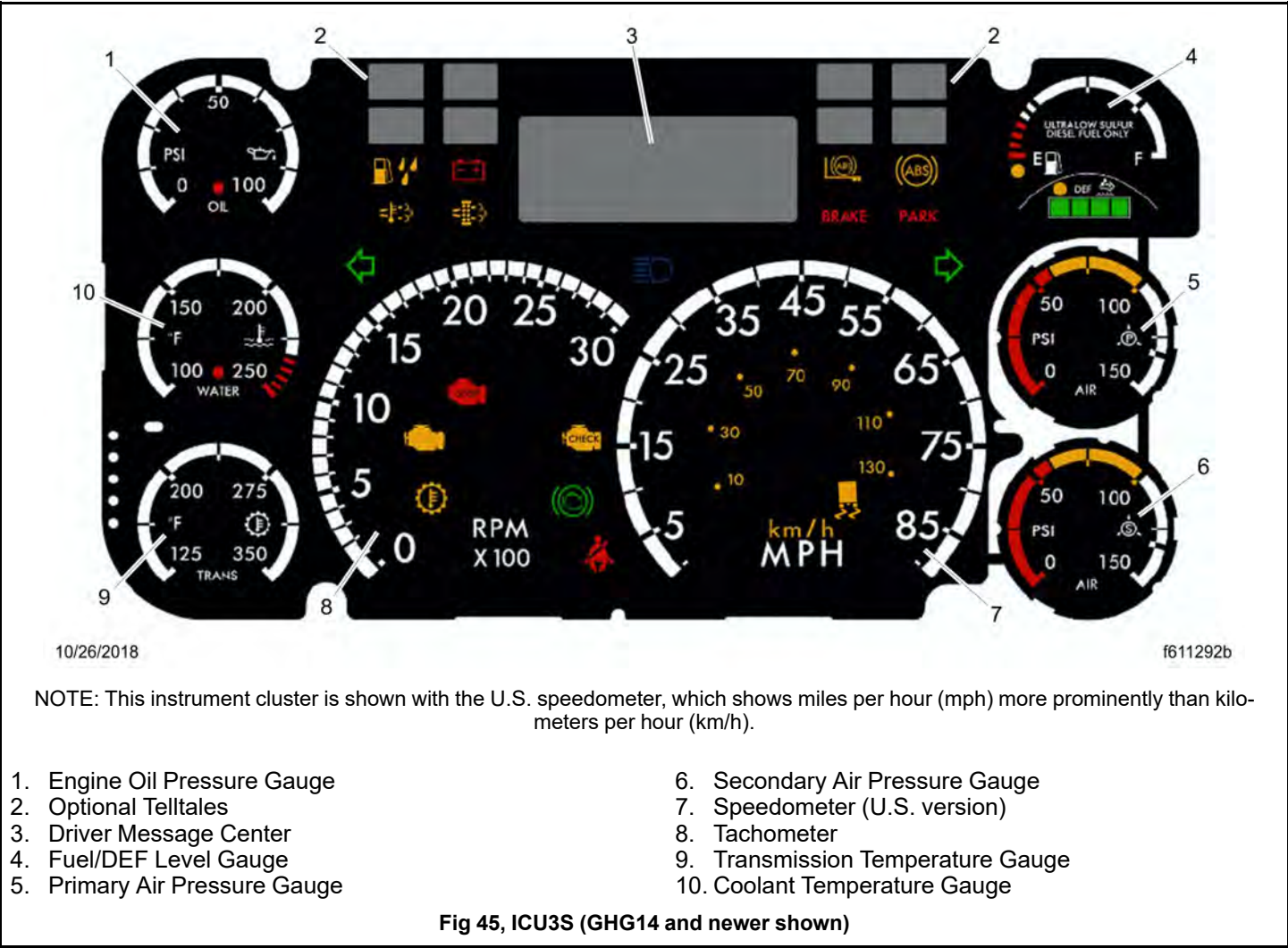
Fig.45, [ICU3S \(GHG14 and newer shown\)](#) shows the ICU3S instrument cluster.



NOTE: This instrument cluster is shown with the U.S. speedometer, which shows miles per hour (mph) more prominently than kilometers per hour (km/h).

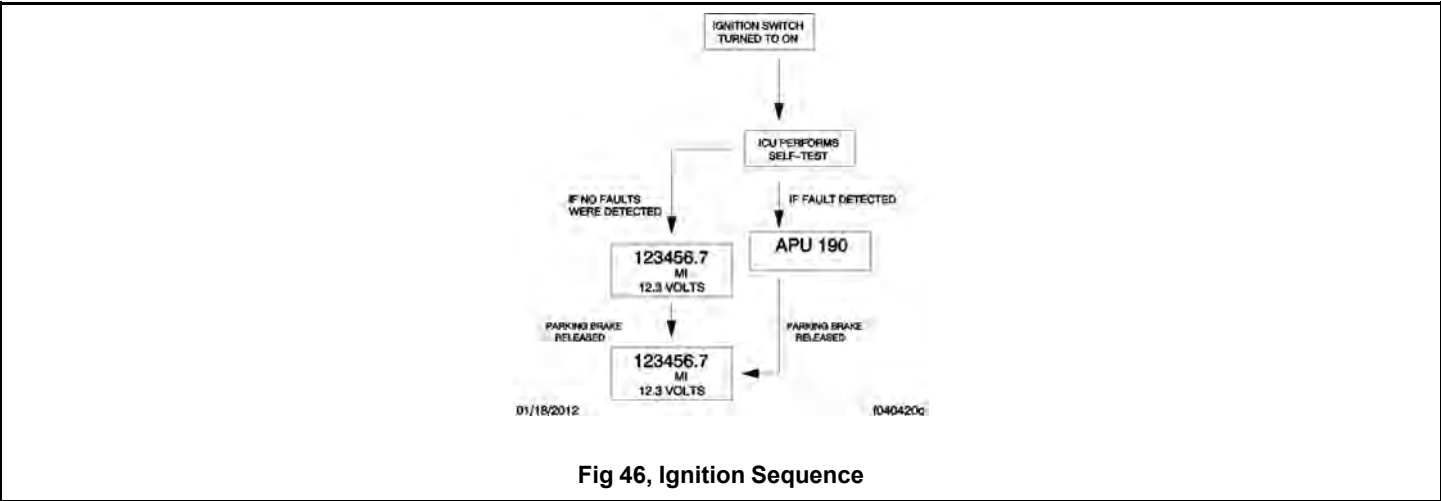
- | | |
|----------------------------------|------------------------------------|
| 1. Engine Oil Pressure Gauge | 7. Mode/Reset Button |
| 2. Lightbar | 8. Secondary Air Pressure Gauge |
| 3. Driver Message Center | 9. Speedometer (U.S. version) |
| 4. Headlight High-Beam Indicator | 10. Tachometer |
| 5. Fuel/DEF Level Gauge | 11. Transmission Temperature Gauge |
| 6. Primary Air Pressure Gauge | 12. Coolant Temperature Gauge |

Fig 44, ICU3 (EPA10 shown)



4.01.02 Ignition Sequence

When the ignition is turned on, the ICU runs a self-check. See Fig.46, [Ignition Sequence](#). Observing the ignition sequence is a good way to ensure the ICU is functioning properly.



IMPORTANT: Do not crank the engine until the ICU self-check is complete.

When the ignition is turned on, the following actions should occur:

- electronic gauges complete a full sweep of their dials
- some warning and indicator lamps illuminate, then are extinguished
- audible alert sounds until sufficient air pressure builds up in the primary and secondary air systems
- DEF level indicator illuminates all segments green, then turns them off one at a time before turning the leftmost segment amber, then red
- software revision level of the ICU is displayed on the driver message center, followed by active faults

NOTE: Air gauges do not complete a sweep of their dials during the ignition sequence.

IMPORTANT: If any red or amber warning and indicator lamps, or telltales, do not illuminate during the ICU self-check, take the vehicle to an authorized Freightliner service facility as soon as possible. If any of the red or amber telltales do not go out after the self-check completes, use Table.4, [Common Warning and Indicator Lamps and ICU Messages](#) to determine if the lamp illuminated indicates a problem requiring service.

If the ICU receives active fault codes, it displays them one after the other until the parking brake is released or the ignition is turned off. Once the parking brake is completely released, the ICU displays the odometer. If there are no active faults, the ICU displays the odometer after the self-check completes.

NOTE: If active faults are present, take the vehicle to an authorized Freightliner service facility as soon as possible.

Common Warning and Indicator Lamps and ICU Messages			
Lamp Description			Color
	STOP Engine ¹	Indicates a serious fault that requires engine shutdown immediately. The engine protection system will reduce the maximum engine torque and speed, and, if the condition does not improve, will shut down the engine within 30 to 60 seconds. Safely bring the vehicle to a stop on the side of the road and shut down the engine as soon as the red light is seen. If the engine shuts down while the vehicle is in a hazardous location, turn the key to the OFF position for a few seconds, then restart the engine and move the vehicle to a safer location.	Red
	High Coolant Temperature	Indicates the coolant temperature is above the maximum allowable temperature.	Red

Table 4, Common Warning and Indicator Lamps and ICU Messages

	Low Air Pressure (EPA07)	Indicates air pressure in the primary or secondary reservoir has dropped below approximately 70 psi (483 kPa).	Red
	Low Air Pressure (EPA10 and Newer)	Indicates air pressure in the primary or secondary reservoir has dropped below approximately 70 psi (483 kPa).	Red
	Low Engine Oil Pressure	Indicates the engine oil pressure is below the minimum allowable pressure.	Red
	Parking Brake (EPA07)	Indicates the parking brake is engaged, or hydraulic brake fluid pressure is low. An audible alert activates when the vehicle is moving over 2 mph (3 km/h) with the parking brake set.	Red
	Parking Brake (EPA10 and Newer)	Indicates the parking brake is engaged.	Red
	Low Battery Voltage	Indicates that battery voltage is 11.9 volts or less.	Red
	Unfastened Seat Belt	Activates with an audible alert when the system detects that the parking brake is off and the driver seat belt is not fastened on some vehicles. On other vehicles, this lamp illuminates for 15 seconds when the ignition is first turned on.	Red
	CHECK Engine ¹	Indicates an engine condition (low oil pressure, low coolant level, high coolant temperature, high DPF soot level, or uncontrolled DPF regeneration) that requires correction. Correct the condition as soon as possible. If the condition worsens, the STOP engine lamp will illuminate.	Amber
	High Exhaust System Temperature (HEST) ¹	Slow (10-second) flashing indicates a regeneration (regen) is in progress. IMPORTANT: When the HEST lamp is illuminated, do not park the vehicle near flammable material. Solid illumination indicates high exhaust temperatures at the outlet of the tail pipe when speed is below 5 mph (8 km/h).	Amber

Table 4, Common Warning and Indicator Lamps and ICU Messages

	Diesel Particulate Filter (DPF) Status	Solid illumination indicates a regen is required. Change to a more challenging duty cycle (such as highway driving) to raise exhaust temperatures for at least twenty minutes, or perform a parked regen. Blinking indicates that a parked regen is required immediately. An engine derate and shut-down will occur.	Amber
	Malfunction Indicator Lamp (MIL)	Indicates an emissions-related fault. See the engine operation manual for details.	Amber
	Vehicle ABS	Momentary illumination indicates the vehicle ABS is engaged. Solid illumination indicates a problem with the vehicle ABS. Repair the ABS immediately to ensure full braking capability.	Amber
	Trailer ABS	Momentary illumination indicates the trailer ABS is engaged. Solid illumination indicates a problem with the trailer ABS. Repair the ABS immediately to ensure full braking capability.	Amber
	No Charge	Indicates the alternator is not properly powering the electrical system.	Amber
	Water in Fuel	Indicates the fuel may contain water. Drain any water collected in the fuel/water separators.	Amber
	Fuel Filter Restriction	Indicates the fuel filter is clogged and requires service.	Amber
	Optimized Idle	Indicates optimized idle is enabled.	Amber
	Check Transmission	Indicates an undesirable transmission condition.	Amber
	Transmission Overheat	Indicates high transmission temperature.	Amber
	Wait To Start (EPA07/EPA10)	Indicates that the system is preventing the starter from cranking. This can occur when the ignition switch is turned to START before the gauge sweep has completed, or if the starter has overheated.	Amber

Table 4, Common Warning and Indicator Lamps and ICU Messages

		Turn the ignition switch back to ON, wait for the lamp to go out, then turn the ignition switch to START again.	
	Start Blocked (GHG14 only)	Indicates that the system is preventing the starter from cranking. This can occur when the ignition switch is turned to START before the gauge sweep has completed, or if the starter has overheated. NOTE: Illumination of the Start Blocked lamp does not indicate a problem with the starter. Turn the ignition switch back to ON, wait for the lamp to go out, then turn the ignition switch to START again.	Amber
	Wheel Spin (pre-EPA16)	Flashing indicates the ATC system is active, or the ATC button has been pressed to allow wheel slip. Solid illumination indicates ATC is shut off or unavailable due to a system fault. In the event of a system fault, repair the ATC system immediately to ensure full braking capability.	Amber
	Stability Event (EPA16 and newer)	Flashing indicates a stability event has been detected, and the ESC system is active. Solid illumination indicates a problem with the stability system. Repair the ESC system immediately to ensure full stability capability.	Amber
	ATC Deactivated (EPA16 and newer)	Flashing indicates the ATC SPIN button has been pressed to allow wheel slip. Solid illumination indicates ATC is shut off or unavailable due to a system fault. In the event of a system fault, repair the ATC system immediately to ensure full braking capability.	Amber
	Roll Stability (pre-EPA16)	Momentary illumination indicates that a stability event has occurred. On vehicles that are also equipped with ATC, flashing indicates the ATC button has been pressed to allow wheel slip.	Amber

Table 4, Common Warning and Indicator Lamps and ICU Messages

		Solid illumination indicates ATC is shut off or unavailable due to a system fault. In the event of a system fault, repair the ATC system immediately to ensure full braking capability.	
	Hill Start Aid (HSA) Override	Indicates the HSA switch has been pressed to override the hill start assist feature.	Amber
	Engine Brake ²	Indicates the engine brake is enabled.	Green
	Left-Turn Signal	Flashing indicates the outside left-turn signal lights are activated.	Green
	Right-Turn Signal	Flashing indicates the outside right-turn signal lights are activated.	Green
	Cruise Control ²	Indicates the cruise control is enabled. NOTE: The ICU4Me does not have a green cruise control telltale.	Green
	High-Beam Headlights	Indicates the high-beam headlights are on.	Blue

1. See Fig.47,, page 48 for an explanation of the aftertreatment system (ATS) warning indicators, and actions required to avoid further engine protection steps.
2. On vehicles equipped with the ICU3S, this information is displayed on the driver message center.

Table 4, Common Warning and Indicator Lamps and ICU Messages

EXHAUST AFTERTREATMENT SYSTEM INFORMATION					
INDICATOR LAMP(S)	 Level 1	 Level 2	 Level 3	 Level 4	
Indicator Lamp Message(s)	Filter Regeneration Recommended.	Filter Regeneration Necessary.	Parked Regeneration Required - Engine Idle.	Service Regeneration Required. Engine Idle Only.	HEST (High Exhaust System Temperature)
Diesel Particulate Filter Condition	Filter is reaching capacity.	Filter is now reaching maximum capacity.	Filter has reached maximum capacity.	Filter has exceeded maximum capacity.	Flashing A regeneration is in progress.
Required Action	Bring vehicle to highway speeds to allow for an Automatic Regeneration or perform a Parked Regeneration.	To avoid engine damage, bring vehicle to highway speeds to allow for an Automatic Regeneration, or perform a Parked Regeneration as soon as possible.	Vehicle must be parked, and a Parked Regeneration must be performed. Engine will begin idle.	Vehicle must be parked, and a Service Regeneration must be performed. Check engine operator's manual for details. Engine will shut down.	Solid Exhaust components and exhaust gas are at high temperature. When stationary, keep away from people and flammable materials or vapors.
For a driver performed Parked Regeneration, vehicle must be equipped with a dash mounted Regeneration Switch:					

02/20/2009

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Fig 47, ATS Warning Lamps

4.01.03 Audible Alerts

An audible alert sounds during the ignition sequence and whenever one of the following conditions exists:

- Engine oil pressure falls below the minimum preset value.

- Coolant temperature rises above the maximum preset value.
- Air pressure falls below about 70 psi (483 kPa).
- Parking brake is set with the vehicle moving faster than two miles per hour.
- System voltage falls below 12 volts.
- Door is open with the headlights on and the parking brake off.
- Driver seat belt is not fastened with the parking brake off (optional).
- Outside temperature falls below 35°F (1.7°C) (optional).

4.02 Warning and Indicator Lights

4.02.01 General Information

There can be up to 28 telltales installed in the ICU. If an optional lamp is not requested, the position is blank.

See Table.5, [Common Warning and Indicator Lamps and ICU Messages](#) for a list of standard and commonly used warning and indicator lamps.

Warning and indicator lamps illuminate in red (danger), amber (caution), green (status advisory), or blue (high-beam headlights active).

IMPORTANT: Depending upon local jurisdictional emissions guidelines, vehicles and/or engines that are domiciled outside of the U.S. and Canada may not be compliant with EPA10 or GHG21 regulations. Noncompliant vehicles may not be equipped with all of the telltales shown in Table.5, [Common Warning and Indicator Lamps and ICU Messages](#).

Common Warning and Indicator Lamps and ICU Messages			
Lamp Description			Color
	STOP Engine ¹	Indicates a serious fault that requires engine shutdown immediately. The engine protection system will reduce the maximum engine torque and speed, and, if the condition does not improve, will shut down the engine within 30 to 60 seconds. Safely bring the vehicle to a stop on the side of the road and shut down the engine as soon as the red light is seen. If the engine shuts down while the vehicle is in a hazardous location, turn the key to the OFF position for a few seconds, then restart the engine and move the vehicle to a safer location.	Red
	High Coolant Temperature	Indicates the coolant temperature is above the maximum allowable temperature.	Red
	Low Air Pressure (EPA07)	Indicates air pressure in the primary or secondary reservoir	Red

Table 5, Common Warning and Indicator Lamps and ICU Messages

		has dropped below approximately 70 psi (483 kPa).	
	Low Air Pressure (EPA10 and Newer)	Indicates air pressure in the primary or secondary reservoir has dropped below approximately 70 psi (483 kPa).	Red
	Low Engine Oil Pressure	Indicates the engine oil pressure is below the minimum allowable pressure.	Red
	Parking Brake (EPA07)	Indicates the parking brake is engaged, or hydraulic brake fluid pressure is low. An audible alert activates when the vehicle is moving over 2 mph (3 km/h) with the parking brake set.	Red
	Parking Brake (EPA10 and Newer)	Indicates the parking brake is engaged.	Red
	Low Battery Voltage	Indicates that battery voltage is 11.9 volts or less.	Red
	Unfastened Seat Belt	Activates with an audible alert when the system detects that the parking brake is off and the driver seat belt is not fastened on some vehicles. On other vehicles, this lamp illuminates for 15 seconds when the ignition is first turned on.	Red
	CHECK Engine ¹	Indicates an engine condition (low oil pressure, low coolant level, high coolant temperature, high DPF soot level, or uncontrolled DPF regeneration) that requires correction. Correct the condition as soon as possible. If the condition worsens, the STOP engine lamp will illuminate.	Amber
	High Exhaust System Temperature (HEST) ¹	Slow (10-second) flashing indicates a regeneration (regen) is in progress. IMPORTANT: When the HEST lamp is illuminated, do not park the vehicle near flammable material. Solid illumination indicates high exhaust temperatures at the outlet of the tail pipe when speed is below 5 mph (8 km/h).	Amber
	Diesel Particulate Filter (DPF) Status	Solid illumination indicates a regen is required. Change to a more challenging duty cycle	Amber

Table 5, Common Warning and Indicator Lamps and ICU Messages

		(such as highway driving) to raise exhaust temperatures for at least twenty minutes, or perform a parked regen. Blinking indicates that a parked regen is required immediately. An engine derate and shut-down will occur.	
	Malfunction Indicator Lamp (MIL)	Indicates an emissions-related fault. See the engine operation manual for details.	Amber
	Vehicle ABS	Momentary illumination indicates the vehicle ABS is engaged. Solid illumination indicates a problem with the vehicle ABS. Repair the ABS immediately to ensure full braking capability.	Amber
	Trailer ABS	Momentary illumination indicates the trailer ABS is engaged. Solid illumination indicates a problem with the trailer ABS. Repair the ABS immediately to ensure full braking capability.	Amber
	No Charge	Indicates the alternator is not properly powering the electrical system.	Amber
	Water in Fuel	Indicates the fuel may contain water. Drain any water collected in the fuel/water separators.	Amber
	Fuel Filter Restriction	Indicates the fuel filter is clogged and requires service.	Amber
	Optimized Idle	Indicates optimized idle is enabled.	Amber
	Check Transmission	Indicates an undesirable transmission condition.	Amber
	Transmission Overheat	Indicates high transmission temperature.	Amber
	Wait To Start (EPA07/EPA10)	Indicates that the system is preventing the starter from cranking. This can occur when the ignition switch is turned to START before the gauge sweep has completed, or if the starter has overheated. Turn the ignition switch back to ON, wait for the lamp to go out,	Amber

Table 5, Common Warning and Indicator Lamps and ICU Messages

		then turn the ignition switch to START again.	
	Start Blocked (GHG14 only)	Indicates that the system is preventing the starter from cranking. This can occur when the ignition switch is turned to START before the gauge sweep has completed, or if the starter has overheated. NOTE: Illumination of the Start Blocked lamp does not indicate a problem with the starter. Turn the ignition switch back to ON, wait for the lamp to go out, then turn the ignition switch to START again.	Amber
	Wheel Spin (pre-EPA16)	Flashing indicates the ATC system is active, or the ATC button has been pressed to allow wheel slip. Solid illumination indicates ATC is shut off or unavailable due to a system fault. In the event of a system fault, repair the ATC system immediately to ensure full braking capability.	Amber
	Stability Event (EPA16 and newer)	Flashing indicates a stability event has been detected, and the ESC system is active. Solid illumination indicates a problem with the stability system. Repair the ESC system immediately to ensure full stability capability.	Amber
	ATC Deactivated (EPA16 and newer)	Flashing indicates the ATC SPIN button has been pressed to allow wheel slip. Solid illumination indicates ATC is shut off or unavailable due to a system fault. In the event of a system fault, repair the ATC system immediately to ensure full braking capability.	Amber
	Roll Stability (pre-EPA16)	Momentary illumination indicates that a stability event has occurred. On vehicles that are also equipped with ATC, flashing indicates the ATC button has been pressed to allow wheel slip. Solid illumination indicates ATC is shut off or unavailable due to	Amber

Table 5, Common Warning and Indicator Lamps and ICU Messages

		a system fault. In the event of a system fault, repair the ATC system immediately to ensure full braking capability.	
	Hill Start Aid (HSA) Override	Indicates the HSA switch has been pressed to override the hill start assist feature.	Amber
	Engine Brake ²	Indicates the engine brake is enabled.	Green
	Left-Turn Signal	Flashing indicates the outside left-turn signal lights are activated.	Green
	Right-Turn Signal	Flashing indicates the outside right-turn signal lights are activated.	Green
	Cruise Control ²	Indicates the cruise control is enabled. NOTE: The ICU4Me does not have a green cruise control telltale.	Green
	High-Beam Headlights	Indicates the high-beam headlights are on.	Blue

1. See Fig.48,, page 53 for an explanation of the aftertreatment system (ATS) warning indicators, and actions required to avoid further engine protection steps.
2. On vehicles equipped with the ICU3S, this information is displayed on the driver message center.

Table 5, Common Warning and Indicator Lamps and ICU Messages

EXHAUST AFTERTREATMENT SYSTEM INFORMATION					
INDICATOR LAMP(S)	 Level 1	 Level 2	 Level 3	 Level 4	 WARNING
Indicator Lamp Message(s)	Filter Regeneration Recommended.	Filter Regeneration Necessary	Parked Regeneration Required - Engine Derate	Service Regeneration Required. Engine Derate To Idle Only.	HEST (High Exhaust System Temperature)
Diesel Particulate Filter Condition	Filter is reaching capacity.	Filter is now reaching maximum capacity.	Filter has reached maximum capacity.	Filter has exceeded maximum capacity.	Flashing A regeneration is in progress.
Required Action	Bring vehicle to highway speeds to allow for an Automatic Regeneration or perform a Parked Regeneration.	To avoid engine derate, bring vehicle to highway speeds to allow for an Automatic Regeneration, or perform a Parked Regeneration as soon as possible.	Vehicle must be parked, and a Parked Regeneration must be performed. Engine will begin derate.	Vehicle must be parked, and a Service Regeneration must be performed. Check engine operator's manual for details. Engine will shut down.	Solid Exhaust components and exhaust gas are at high temperature. When stationary, keep away from people and flammable materials or vapors.
For a driver performed Parked Regeneration, vehicle must be equipped with a dash mounted Regeneration Switch:					

02/20/2009

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Fig 48, ATS Warning Lamps

4.02.02 Engine Protection System

**WARNING:**

When the red STOP engine lamp illuminates, most engines are programmed to shut down automatically within 30 seconds. The driver must immediately move the vehicle to a safe location at the side of the road to prevent causing a hazardous situation that could cause bodily injury, property damage, or severe damage to the engine.

See Fig.49, [ATS Warning Lamps](#) for an explanation of the aftertreatment system (ATS) warning indicators, and actions required to avoid further engine protection steps.

EXHAUST AFTERTREATMENT SYSTEM INFORMATION					
INDICATOR LAMP(S)	 Level 1	 Level 2	 Level 3	 Level 4	
Indicator Lamp Message(s)	Filter Regeneration Recommended.	Filter Regeneration Necessary.	Parked Regeneration Required - Engine Derate.	Service Regeneration Required. Engine Derate To Idle Only.	HEST (High Exhaust System Temperature)
Diesel Particulate Filter Condition	Filter is reaching capacity.	Filter is now reaching maximum capacity.	Filter has reached maximum capacity.	Filter has exceeded maximum capacity.	Flashing A regeneration is in progress.
Required Action	Bring vehicle to highway speeds to allow for an Automatic Regeneration or perform a Parked Regeneration.	To avoid engine derate, bring vehicle to highway speeds to allow for an Automatic Regeneration, or perform a Parked Regeneration as soon as possible.	Vehicle must be parked, and a Parked Regeneration must be performed. Engine will begin derate.	Vehicle must be parked, and a Service Regeneration must be performed. Check engine operator's manual for details. Engine will shut down.	Solid Exhaust components and exhaust gas are at high temperature. When stationary, keep away from people and flammable materials or vapors.
For a driver performed Parked Regeneration, vehicle must be equipped with a dash mounted Regeneration Switch:					

02/20/2009

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Fig 49, ATS Warning Lamps

The STOP engine lamp illuminates when the engine protection system is activated in one of two ways. On some engines, the engine protection system will derate the engine, allowing it to run at lower rpm and slower vehicle speed. Drive the vehicle to a safe location or to a service facility.

IMPORTANT: Safely bring the vehicle to a stop on the side of the road and shut down the engine as soon as the red light is seen. If the engine shuts down while the vehicle is in a hazardous location, turn the key to the OFF position for a few seconds, then restart the engine and move the vehicle to a safer location.

On other engines, the engine protection system will shut down the engine. It will first derate the engine, then shut it down completely 30 to 60 seconds after the indicator illuminates (depending on the critical fault type) if the condition does not improve. Bring the vehicle to a stop on the side of the road before the engine shuts down.

Some vehicles may have a shutdown-override switch, which may be used to momentarily override the shutdown sequence. See [8.01 General Information](#) for detailed information regarding the shutdown process.

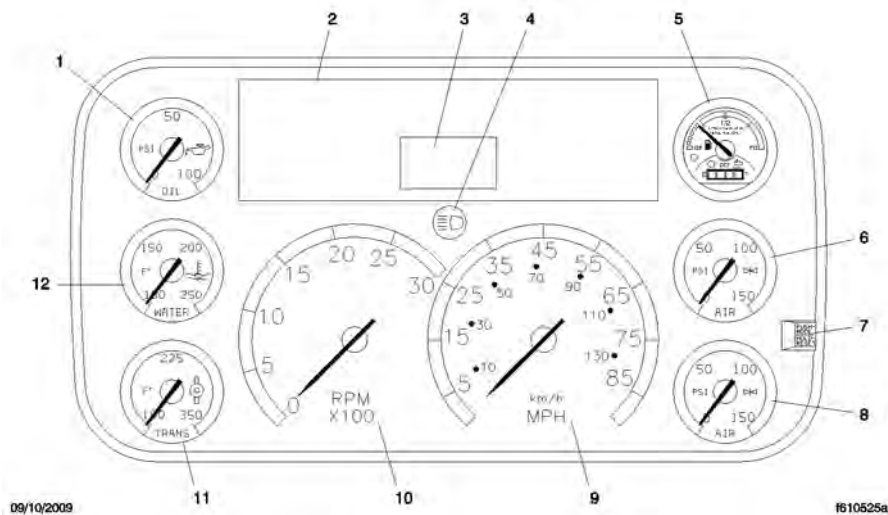
IMPORTANT: Do not attempt to restart the engine while the vehicle is moving. Bring the vehicle to a safe stop, then restart the engine.

To restart the engine, turn the ignition to OFF, leave it there a few seconds, then turn the ignition to START. The engine will run for a short period and shut down again if the condition does not improve.

4.03 Driver Message Center

4.03.01 General Information

The driver message center is controlled using the mode/reset switch, located on the right side of the ICU. See Fig. 50, [ICU3 \(EPA10 shown\)](#). Tap the mode/reset switch to advance one screen; press and hold the switch to select a menu choice or reset the display. When the display resets, an audible chirp sounds.



NOTE: This instrument cluster is shown with the U.S. speedometer, which shows miles per hour (mph) more prominently than kilometers per hour (km/h).

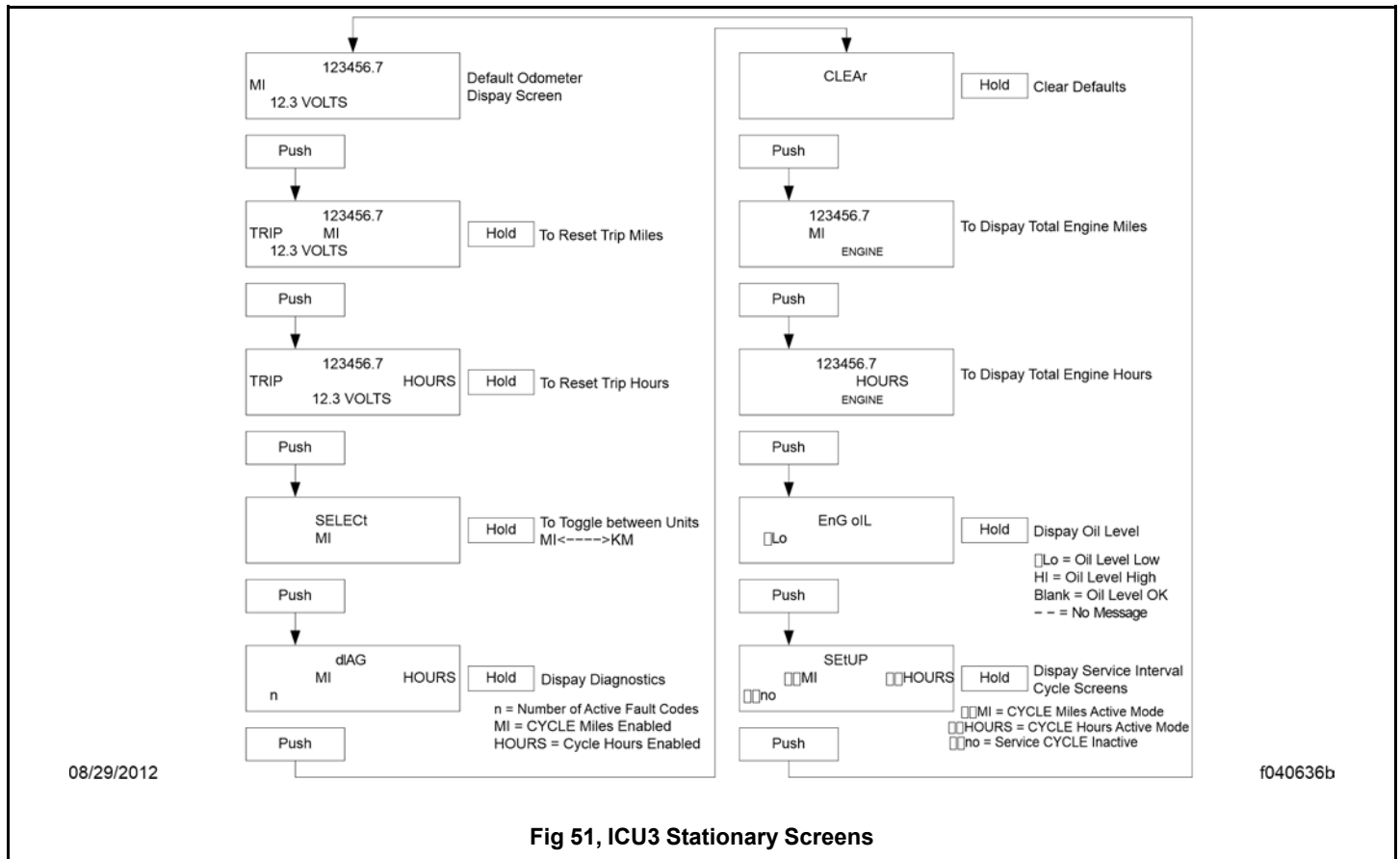
- | | |
|----------------------------------|------------------------------------|
| 1. Engine Oil Pressure Gauge | 7. Mode/Reset Button |
| 2. Lightbar | 8. Secondary Air Pressure Gauge |
| 3. Driver Message Center | 9. Speedometer (U.S. version) |
| 4. Headlight High-Beam Indicator | 10. Tachometer |
| 5. Fuel/DEF Level Gauge | 11. Transmission Temperature Gauge |
| 6. Primary Air Pressure Gauge | 12. Coolant Temperature Gauge |

Fig 50, ICU3 (EPA10 shown)

4.03.02 Driving Screens

The following screens are available when the parking brake is off (when the vehicle is mobile) and no active fault codes are found. Use the mode/reset switch to scroll through the screens. To reset any values, press and hold the mode/reset switch. The driving screens appear in the following order:

- Odometer
- Trip distance
- Trip hours
- Outside temperature

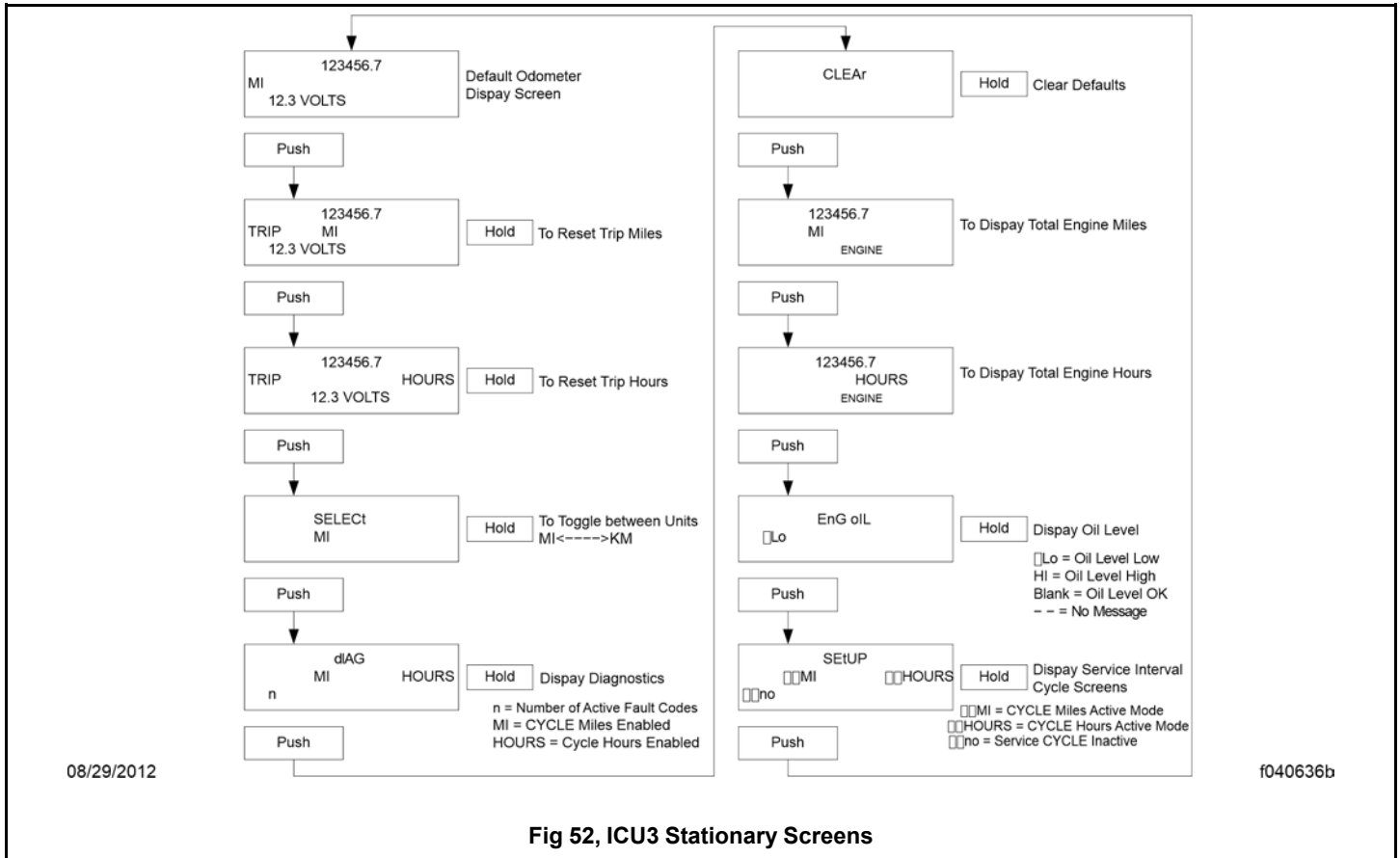


On the ICU3S, the cruise control and engine brake indicators are displayed on the driver message center. On vehicles equipped with an ICU3, these systems are active when the indicator lamp is illuminated.

4.03.03 Parked Screens/Menus

The parked screens and menus are available when the parking brake is on and no active fault codes are found. See Fig. 52, [ICU3 Stationary Screens](#). Use the mode/reset switch to scroll through the parked screens. To reset any values, press and hold the mode/reset switch. The parked screens appear in the following order:

- Odometer
- Trip distance
- Trip hours
- Outside temperature
- Select units
- Temperature alert
- Diagnostics
- Engine miles
- Engine hours
- Setup



If service intervals are enabled and service distance or time has been exceeded, the text SERVICE HOUR/MI (KM) will display at start-up to indicate vehicle service is required.

For each parameter, press and hold the mode/reset switch to navigate to the parameter change screen. In each change screen, tap the mode/reset switch to toggle between options.

The last screen in the setup menu, **RESET EE**, is for resetting certain parameters to the original settings. Press and hold the mode/reset switch to reset the antilock braking system (ABS), SAMs roll call, automated transmission display, transmission heartbeat, sensor fault codes, seat belt switch learning, and engine oil level.

4.04 Instruments

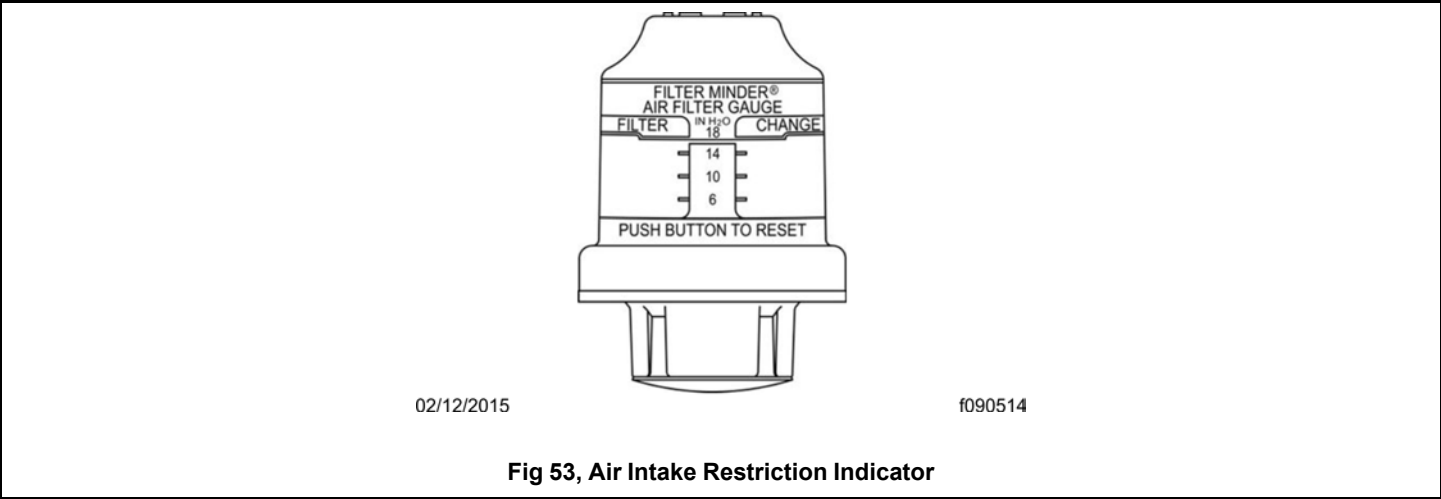
4.04.01 General Information

Standard instruments are present on every vehicle. They are listed here in alphabetical order to make the information easier to find.

Optional instruments, typically located on the auxiliary dash panel or right-hand control panel, are not found on every vehicle. They are listed here in alphabetical order, to make the information easier to find.

4.04.02 Air Intake Restriction Gauge

The air intake restriction gauge indicates the vacuum on the engine side of the air cleaner. On standard installations, it is mounted on the air intake duct in the engine compartment. See Fig.53,[Air Intake Restriction Indicator](#). As an option for easier viewing, the air intake restriction indicator can be mounted on the dash, usually on the right-hand control panel.



NOTE: Rain or snow can wet the filter and cause a temporary high reading.

Air intake restriction vacuum is measured in inches of water (inH₂O). For vehicles equipped with a graduated indicator or a restriction gauge on the dash, check the gauge with the engine off. If the yellow signal stays locked in the red zone once the engine is shut down, or is at or above the values shown in Table.6,[Air Intake Maximum Restriction Values](#), the air cleaner element needs to be replaced.

Air Intake Maximum Restriction Values (in H ₂ O)	
Engine Make	GHG14, GHG17, and GHG21 Engines

Table 6, Air Intake Maximum Restriction Values

Detroit	18
Cummins	25

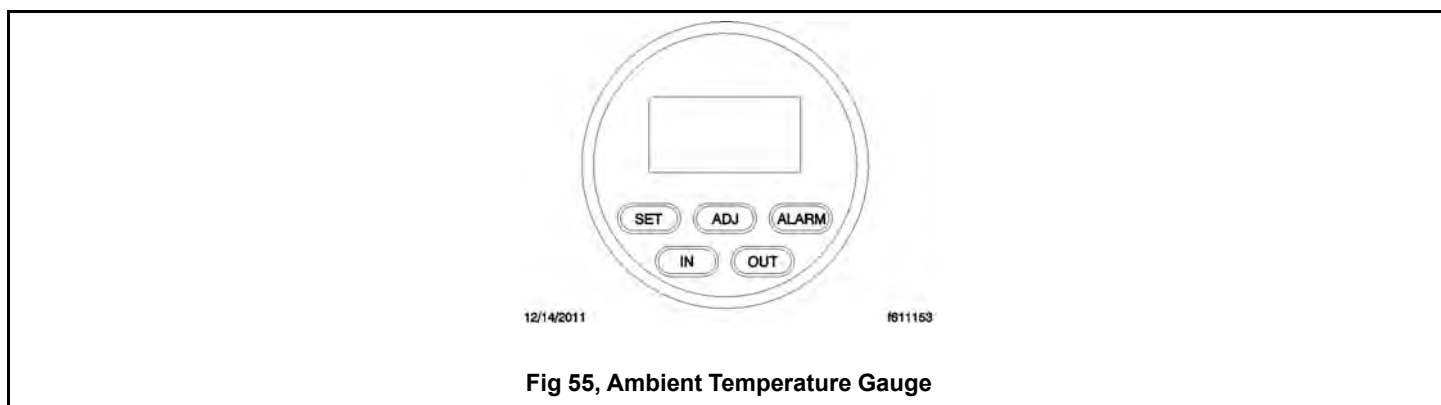
Table 6, Air Intake Maximum Restriction Values

Vehicles may be equipped with a go/no-go restriction indicator without graduations (see Fig. 54, [Manual-Reset Air Restriction Indicator, Go/No-Go](#)) instead of a graduated indicator.



4.04.03 Ambient Temperature Gauge

The ambient temperature gauge, shown in Fig. 55, [Ambient Temperature Gauge](#), displays the in-cab or outside temperature, depending on the settings selected.



When the alarm is enabled, the ambient temperature gauge will sound an audible alert and the amber lamp will illuminate when the outside or inside temperature (depending on the setting selected) reaches the set temperature. Turn the alarm on and off using the steps below.

1. Press the IN button for in-cab temperature, or the OUT button for outside temperature.
2. Press the SET button.
3. Press the ADJ button until the desired temperature is displayed.
4. Press the ALARM button and "AL" will appear on the display.
5. Press the SET button to return to the current temperature display.

NOTE: To turn the alarm off, press the ALARM button again and "AL" will disappear from the display.

4.04.04 Coolant Temperature Gauge



NOTICE:

A sudden increase in coolant temperature may indicate engine or cooling system failure. Bring the vehicle to a safe stop and investigate the cause to prevent further damage. Do not operate the engine until the cause has been determined and corrected.

During normal engine operation, the coolant temperature gauge, as shown in Fig.56, [Coolant Temperature Gauge](#), should read 175 to 195°F (79 to 91°C). If the temperature remains below 160°F (71°C), inspect the cooling system to determine the cause.



If coolant temperature rises above the maximum temperature listed in Table.7, [Maximum Coolant Temperature](#), the CHECK engine lamp will illuminate. If the condition does not improve, the STOP engine lamp will also illuminate and an audible warning will sound. The engine will then derate or shut down, depending on the type of engine protection system installed.

Maximum Coolant Temperature	
Engine Make	Temperature: °F (°C)
Caterpillar	230 (110)
Cummins	225 (107)
Detroit	215 (101)
Mercedes-Benz	222 (105)

Table 7, Maximum Coolant Temperature

4.04.05 Drive Axle Oil Temperature Gauges



NOTICE:

A sudden increase in oil temperature that is not caused by a load increase may indicate mechanical failure. Bring the vehicle to a safe stop and investigate the cause to prevent further damage. Do not operate the vehicle until the cause has been determined and corrected.

During normal operation, the drive axle oil temperature gauges should read as follows:

- 160 to 220°F (71 to 104°C) for Detroit Classic Model 2, 4, and 6 axles.
- 160 to 275°F (71 to 135°C) for Meritor™ drive axles.
- 180 to 200°F (82 to 93°C) for Dana Spicer® drive axles.

Under heavy loads, such as when climbing steep grades, temperatures that exceed the normal oil temperature range for a short period are not unusual. If the temperature returns to normal when the load decreases, there is no problem.



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Fig 57, Drive Axle Oil Temperature Gauge (rear drive axle gauge shown)

4.04.06 Engine Oil Pressure Gauge

A sudden decrease or absence of oil pressure may indicate mechanical failure. Bring the vehicle to a safe stop and investigate the cause to prevent further damage. Do not operate the engine until the cause has been determined and corrected.

The engine oil pressure gauge, as shown in Fig.58, [Engine Oil Pressure Gauge](#), displays the current engine oil pressure. If engine oil pressure falls below the minimum levels shown in Table.8, [Minimum Oil Pressure](#), the CHECK engine lamp will illuminate. If the condition does not improve, the STOP engine lamp will also illuminate and an audible warning will sound. The engine will then derate or shut down, depending on the type of engine protection system installed.



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Fig 58, Engine Oil Pressure Gauge

Minimum Oil Pressure ¹		
Engine Model	At Idle Speed: psi (kPa)	At Rated RPM: psi (kPa)
Caterpillar	10–20 (69–138)	30–45 (207–310)
Cummins	15 (103)	35 (241)
Detroit	14 (97)	55 (350)
Mercedes-Benz	7 (50)	36 (250)

1. Oil pressures are given with the engine at operating temperature. With the engine cold, oil pressure may be higher. Individual engines may vary from the listed pressures; observe and record pressures when the engine is new to create a guide for checking engine condition.

Table 8, Minimum Oil Pressure

4.04.07 Engine Oil Temperature Gauge



NOTICE:

A sudden increase in oil temperature that is not caused by a load increase may indicate mechanical failure. Bring the vehicle to a safe stop and investigate the cause to prevent further damage. Do not operate the engine until the cause has been determined and corrected.

During normal operation, the optional engine oil temperature gauge (Fig.59, [Engine Oil Temperature Gauge](#)) should read in the following temperature ranges:

- 160 to 195°F (71 to 91°C) for Caterpillar engines
- 200 to 260°F (93 to 126°C) for Detroit and Cummins engines
- 177 to 203°F (81 to 95°C) for Mercedes-Benz engines

Under heavy loads, such as when climbing steep grades, temperatures that exceed the normal oil temperature range for a short period are not unusual. If the temperature returns to normal when the load decreases, there is no problem.

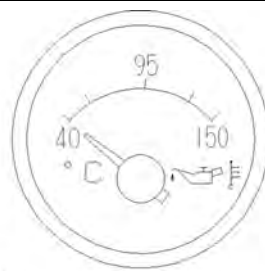
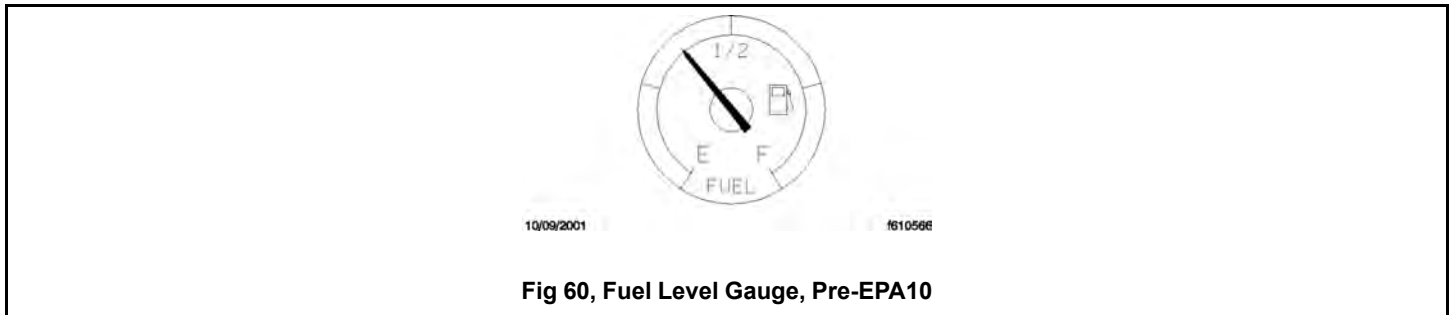


Fig 59, Engine Oil Temperature Gauge

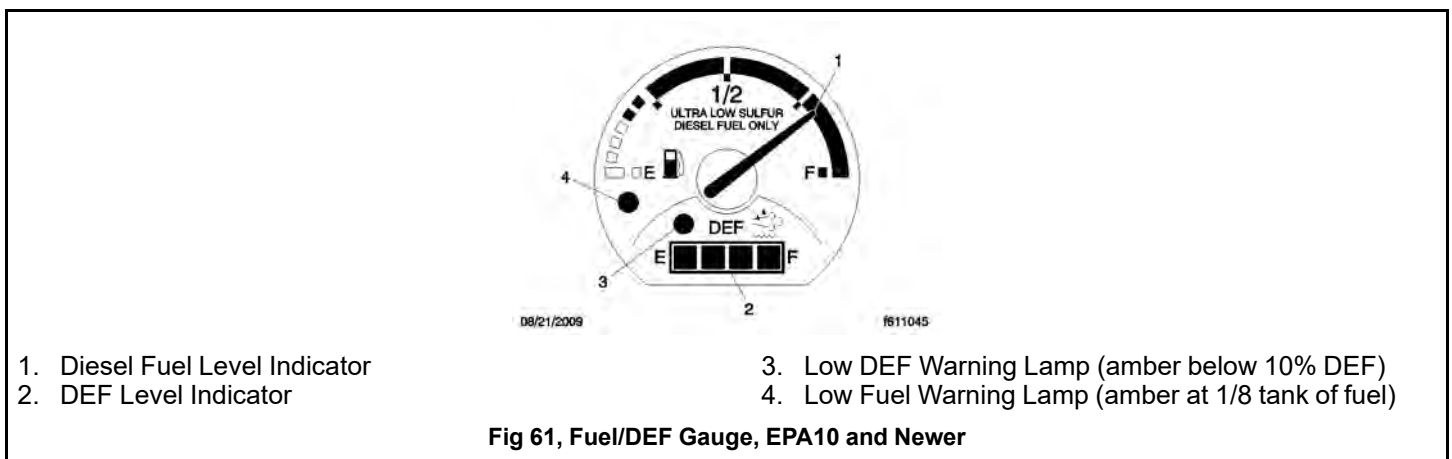
4.04.08 Fuel Gauge, Pre-EPA10

The fuel gauge indicates the level of fuel in the fuel tank(s). A single fuel gauge is standard. If equipped with an optional second fuel tank, each fuel tank level is indicated on a separate gauge. See Fig.60, [Fuel Level Gauge, Pre-EPA10](#).



4.04.09 Fuel/Diesel Exhaust Fluid (DEF) Gauge, EPA10 and Newer

For engines that are EPA10-compliant or newer, the fuel and DEF levels are measured in a dual purpose fuel/DEF level gauge. See Fig.61, [Fuel/DEF Gauge, EPA10 and Newer](#).



The diesel fuel level is indicated at the top of the gauge, with a low-fuel warning lamp that illuminates amber when the diesel fuel level registers 1/8th of capacity.

The DEF level is indicated in the lightbar on the lower portion of the gauge. There is a low DEF level warning lamp that illuminates amber when the DEF level reaches 10% of capacity. See [8.01 General Information](#) for details of the DEF gauge functions.

4.04.10 Primary and Secondary Air Pressure Gauges



WARNING:

If air pressure falls below minimum pressure, the braking ability of the vehicle will be limited. Slow the vehicle down and bring it to a gradual stop. Do not attempt to move the vehicle until air pressure has risen above the minimum level. Moving a vehicle without adequate braking power could cause an accident resulting in property damage, personal injury, or death.

Air pressure gauges, as shown in Fig.62, [Air Pressure Gauge \(reservoir A shown\)](#), register the pressure in the primary and secondary air systems. The gauges are labeled for the A or B reservoir. Normal pressure with the engine running is 100 to 120 psi (689 to 827 kPa) in both systems.



05/14/2001

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Fig 62, Air Pressure Gauge (reservoir A shown)

A low-air-pressure warning light and audible alert, connected to both the primary and secondary systems, activate when air pressure in either system drops below approximately 70 psi (483 kPa).

When the engine is started, the warning light and audible warning remain on until air pressure in both systems exceeds minimum pressure.

4.04.11 Speedometer

Three speedometer options are available. The U.S. version of the speedometer registers speed in both miles per hour (mph) and kilometers per hour (km/h), with mph in larger numbers. The metric version of the speedometer face reverses this arrangement, with km/h in larger numbers. The metric-only version shows km/h exclusively.

4.04.12 Tachometer

The tachometer indicates engine speed in revolutions per minute (rpm) and serves as a guide for shifting the transmission and keeping the engine in the appropriate rpm range. For low idle and rated rpm, see the engine identification plate.

4.04.13 Transmission Fluid Temperature Gauge

The transmission fluid temperature gauge, shown in Fig.63, [Transmission Fluid Temperature Gauge](#), measures the transmission lubricant operating temperature. Temperatures vary by application, but the transmission fluid temperature gauge reading should not exceed 250°F (121°C).



10/30/2001

1610600

Fig 63, Transmission Fluid Temperature Gauge



NOTICE:

A sudden increase in transmission fluid temperature that is not caused by a load increase may indicate mechanical failure. Bring the vehicle to a safe stop and investigate the cause to prevent further damage. Do not operate the vehicle until the cause has been determined and corrected.

Under heavy loads, such as when climbing steep grades, temperatures that exceed the normal oil temperature range for a short period are not unusual. If the temperature returns to normal when the load decreases, there is no problem.

4.04.14 Turbocharger Boost Pressure Gauge

A turbocharger boost pressure gauge indicates the pressure in the intake manifold, in excess of atmospheric pressure, being created by the turbocharger.

4.04.15 Voltmeter

The voltmeter indicates the vehicle charging system voltage when the engine is running and the battery voltage when the engine is off. By monitoring the voltmeter, the driver can stay aware of potential battery charging problems and have them fixed before the batteries discharge enough to create starting difficulties. Cascadia vehicles are equipped with either a voltmeter gauge, or a digital voltmeter readout located on the bottom line of the dash message center.

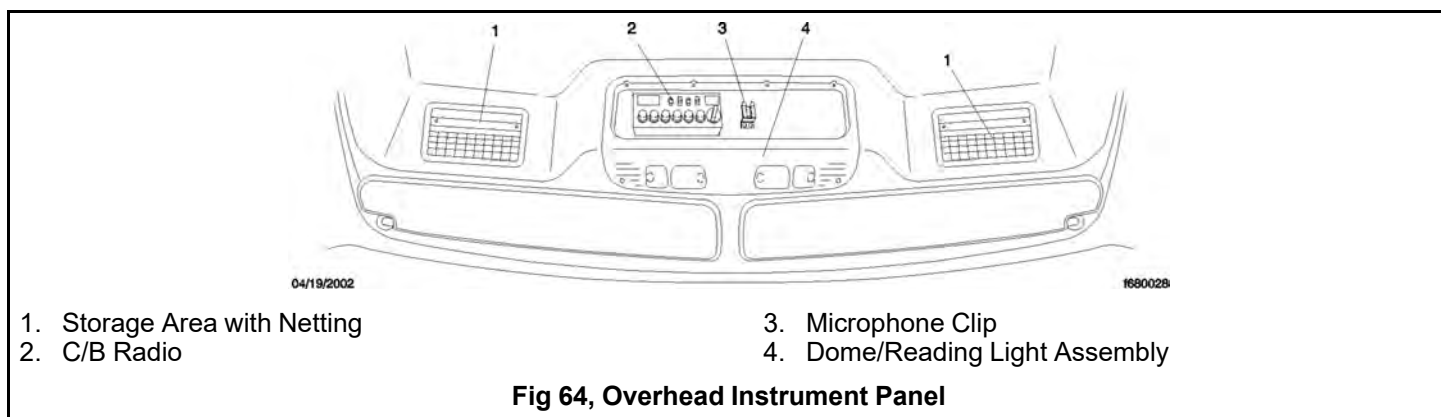
The voltmeter will normally show approximately 13.7 to 14.1 volts when the engine is running. The voltage of a fully charged battery is 12.7 to 12.8 volts when the engine is off. Battery voltage under 12.0 volts is considered a low battery, and a completely discharged battery will produce only about 11.0 volts.

If the voltmeter shows an undercharged or overcharged condition for an extended period, have the charging system and batteries checked at an authorized Freightliner service facility.

On a vehicle equipped with a battery isolator system, the voltmeter measures the average voltage of all the batteries when the engine is running. When the engine is off, the voltmeter shows only the isolated battery voltage and does not indicate the voltage of the engine-starting batteries.

4.05 Overhead Instrument Panel

The optional overhead instrument panel, shown in Fig.64, [Overhead Instrument Panel](#), may hold a citizen's band (C/B) radio, a microphone clip, and any switches that can not be accommodated on the driver's or auxiliary dash panels.



The underside of the overhead console also holds the sun visors and the optional dome/reading light assembly. For more information on the dome/reading light assembly, see [5.01 Ignition Switch and Key](#).

5.01 Ignition Switch and Key	69
5.02 Electrical System	69
5.03 Lighting Controls	70
5.03.01 General Information	70
5.03.02 Control Panels	70
5.03.03 Exterior Light Controls	71
5.03.04 Interior Lights and Light Controls	73
5.04 Multifunction Turn Signal Switch	75
5.04.01 General Information	75
5.04.02 Turn-Signal Controls	76
5.04.03 Windshield Wiper/Washer Controls	76
5.04.04 Headlight High Beams	77
5.04.05 Hazard Warning Flasher	78
5.05 Horn Controls	78
5.05.01 Electric Horn	78
5.05.02 Air Horn, Optional	79
5.06 Powertrain Controls	79
5.06.01 After-Treatment System (ATS) Request/Inhibit Regen Switch	79
5.06.02 Cruise Control Switches	80
5.06.03 Engine Brake Switch, Optional	80
5.06.04 Exhaust Brake Switch, Optional	81
5.06.05 Engine Fan Switch, Optional	82
5.06.06 Transmission Controls	82
5.06.07 Axle Switches	83
5.07 AWD Controls	85
5.07.01 General Information	85
5.07.02 AWD Operation Switch	85
5.07.03 Transfer Case Range Switch	85
5.08 Braking	86
5.08.01 Parking Brake Control Valve	86
5.08.02 Trailer Air Supply Valve	86

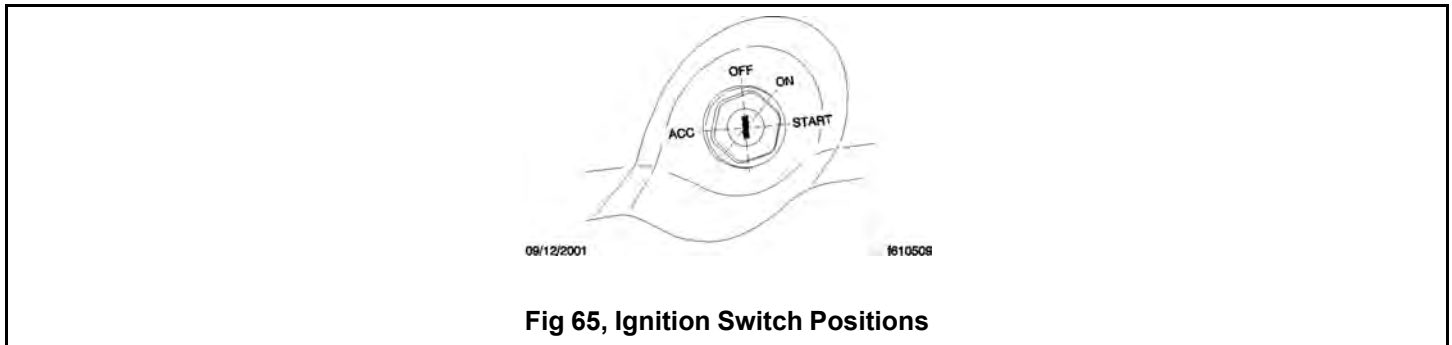
5.08.03 Trailer Brake Lever.....	87
5.08.04 Meritor™ WABCO® Antilock Braking System (ABS).....	87
5.09 Adjustable Steering Column.....	88
5.10 Other Dash-Mounted Controls.....	88
5.11 Heater/Air Conditioner Control Panel	90
5.12 Seat Controls	90
5.12.01 Bench Seat Adjustment Controls.....	90
5.12.02 Suspension Seat Adjustment Controls.....	91

5. Controls

5.01 Ignition Switch and Key

The ignition switch (Fig. 65, [Ignition Switch Positions](#)) has four positions: ACCESSORY, OFF, ON, and START. In addition, the same key locks and unlocks the cab doors.

Fig. 4.1, Ignition Switch Positions



In the OFF position, the key slot is vertical; the key can be inserted and removed only in this position. The following can be operated in the off position (regardless of whether the key is inserted): The low-beam headlights, taillights, brake lights, road lights, dome lights, clearance lights, turn signals, hazard warning lights, horn, CB radio, power windows, cigarette lighter, clock, and electric oil pan heater.

In the ACCESSORY position, the key is turned counterclockwise. The radio, stereo system, mirror heat, air dryer, backup lights, and all of the electrical systems that are operable in the off position are operable in the accessory position.

In the ON position, the key is turned clockwise and all electrical systems are operable. The low air pressure and low oil pressure warning lights (or messages) and buzzer operate until the engine is started and pressure is built up.

5.02 Electrical System

The Business Class® M2 features a new type of electrical system, different from any previous vehicle. Multiple electrical signals are carried along a simplified set of wires, reducing the size of wiring bundles. There are significantly fewer wires overall, meaning less chance of damage, shorts and other problems.

**WARNING:**

Do not attempt to modify, add, splice, or remove electrical wiring on this vehicle without authorization from Freightliner Engineering. Doing so could damage the electrical system and result in a fire that could cause serious personal injury or property damage.

There are two new electrical modules, a main module located near the frontwall (bulkhead module) and a secondary module located between the frame rails (chassis module).

This new wiring system features intelligent controls that blink to show switch activity and error conditions. These controls cannot be distinguished by their appearance, only by their function.

For more information about these controls, see under the headings "Axle Switches" and "Suspension Dump Switch."

5.03 Lighting Controls

5.03.01 General Information

The lighting controls mentioned under this heading generally operate through switches located on the dash.

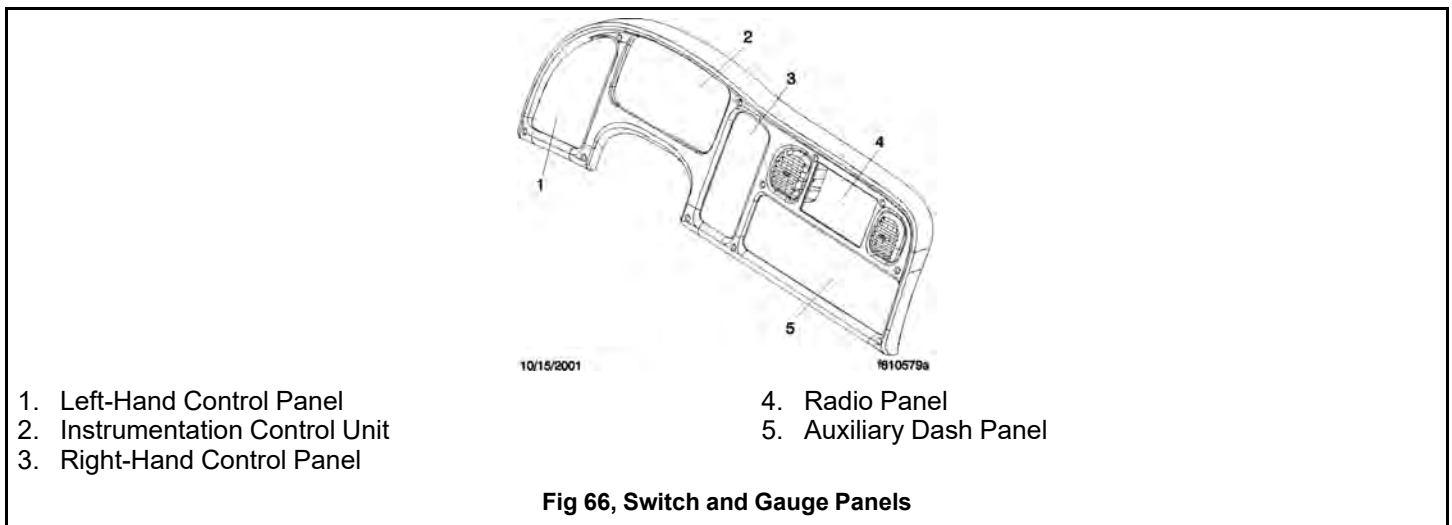
Two types of dash switches are used:

- Paddle switches with a single paddle located in the center of the switch. The paddle can be raised or lowered to perform a function.
- Rocker switches that can be pressed at either the upper or lower end to perform a function. Certain rocker switches are guarded to prevent them from being switched on or off accidentally.

When the panel lights are on, most switch legends are backlit with a colored light, usually green. This allows the driver to find the switch more easily in the dark. When the switch is on, the switch icon is normally backlit with a colored light, usually amber. Some switch icons are dead-fronted (not visible until the switch is turned on). When turned on, some switches are illuminated from within by a red or amber LED (light-emitting diode).

5.03.02 Control Panels

The left-hand control panel (Fig.66, [Switch and Gauge Panels](#)) contains a louvered window outlet for the face vents of the heating, ventilation, and air conditioning system (HVAC), and four switches arranged in a vertical line, usually the headlight, panel light increase/decrease, and the cruise control On/Off and Set/Resume switches.



The instrument cluster (ICU3-M2) is located right behind the steering wheel. No controls are installed on the standard instrument cluster.

The right-hand control panel (Fig.66, [Switch and Gauge Panels](#)) usually contains the transmission push-button shift selector (on vehicles with automatic or automated transmission) and the trailer brake lever (hand control valve). On vehicles with manual transmission, a variety of switches are installed here. If there is a dash-mounted air-restriction indicator, it is often mounted here.

The radio panel contains two louvered dash outlets for the face vents of the HVAC, one on either side of the radio (if installed).

The auxiliary dash panel (Fig.66, [Switch and Gauge Panels](#)) below the radio panel contains the marker interrupt switch, the air brake valve knobs, the cigarette lighter, and a variety of switch options.

The HVAC climate control panel is on a separate panel below the auxiliary dash panel, between the two cupholders.

5.03.03 Exterior Light Controls

Headlight/Parking Light Switch

The headlight/parking light switch (Fig.67,[Headlight/Parking Light Switch](#)) is a paddle switch located on the left-hand control panel above the cruise control switches. When the paddle is lowered, the parking lights illuminate (the front turn signals, the cab marker and identification lights, and the taillights). When the paddle is raised, the low-beam headlights illuminate, along with all the parking lights. To turn off all lights, return the paddle to the center position.



NOTE: Raise the paddle to illuminate the headlights, low beam.

Lower the paddle to illuminate the parking lights.

Fig 67, Headlight/Parking Light Switch

NOTE: The front turn signal is the amber lens in each headlight unit. The low-beam headlight is the top clear lens in each headlight unit.

When the headlights or parking lights are on, the panel lights also illuminate. An amber light in the switch backlights either the top icon (for headlights and parking lights) or the bottom icon (for parking lights only).

Panel Light Increase/Decrease Switch

When the panel lights are on, they can be either brightened or dimmed by using the INCR/DECR rocker switch just below the headlight switch (Fig.68,[Panel Light Increase/Decrease Switch](#)). To brighten the panel lights, press on the upper part of the rocker (at the INCR legend). To dim the panel lights, press on the lower part of the rocker (at the DECR legend).



Fig 68, Panel Light Increase/Decrease Switch

When the panel lights are on, both legends are backlit in green.

Daytime Running Lights

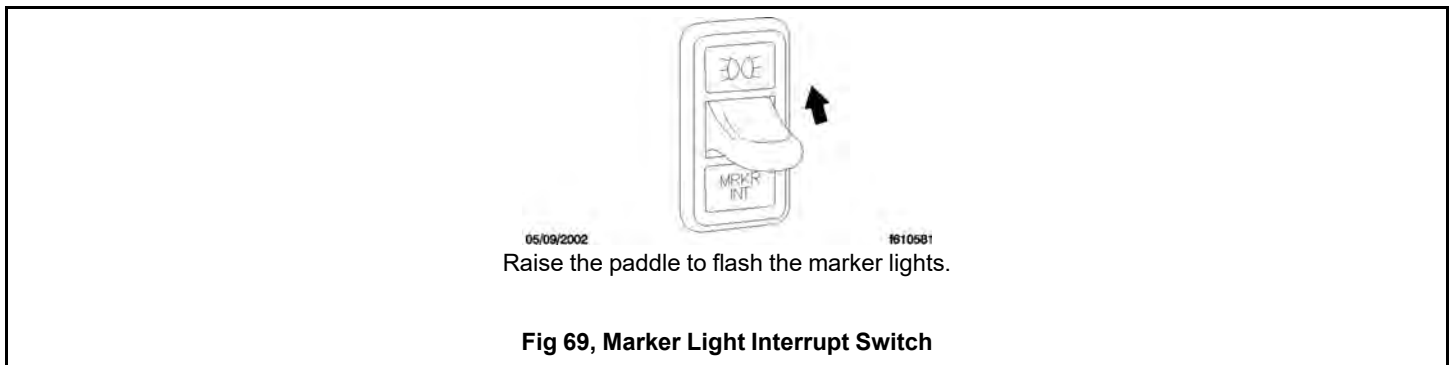
Switching on the ignition and releasing the parking brakes automatically activates the daytime running lights, if equipped. The daytime running lights will operate until the parking brakes are applied or the headlights are turned on.

NOTE: Daytime running lights are standard on all Canadian vehicles.

The daytime running lights illuminate at about two-thirds of normal power.

Marker Light Interrupt Switch

The marker light interrupt (MRKR INT) paddle switch temporarily flashes the marker lights and taillights (Fig. 69, [Marker Light Interrupt Switch](#)). With the vehicle lights on, raise the paddle to briefly turn off the marker lights and taillights. With the vehicle lights off, raise the paddle to briefly turn on the marker lights and taillights.



Raise the paddle to flash the marker lights.

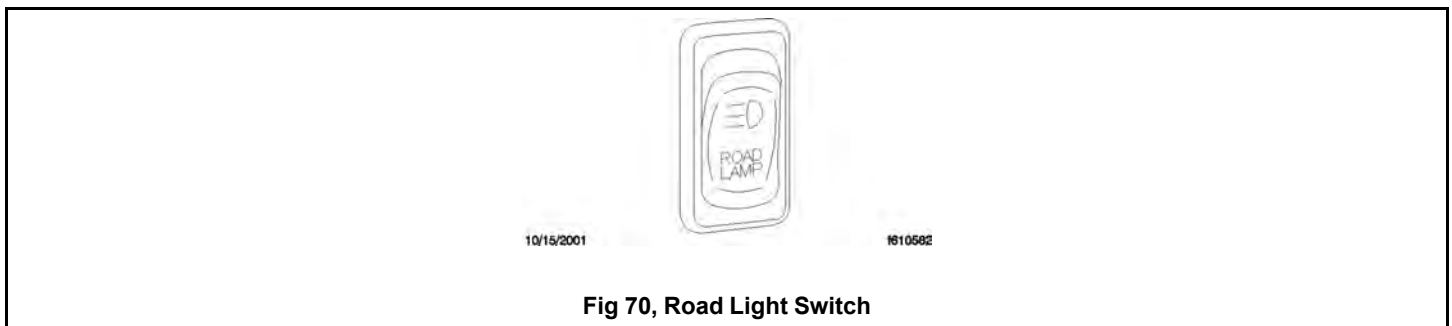
Turning off the vehicle lights automatically turns off the marker lights. When the panel lights are on, the marker light icon and MRKR INT legend are backlit in green.

Road Light Switch, Optional

The road light (ROAD LAMP) rocker switch operates the optional road lights, which are recessed into the front bumper or mounted on the lower edge of a cutout in the center of the front bumper.

The low beam headlights must be turned on before the road lights can be turned on. The road lights will not illuminate if the high beam headlights are already on, and switching from low beams to high beams will switch off the road lights.

To turn the road lights on, press on the upper part of the rocker (at the road light icon). See Fig.70, [Road Light Switch](#). To turn the road lights off, press on the lower part of the rocker (at the ROAD LAMP legend).



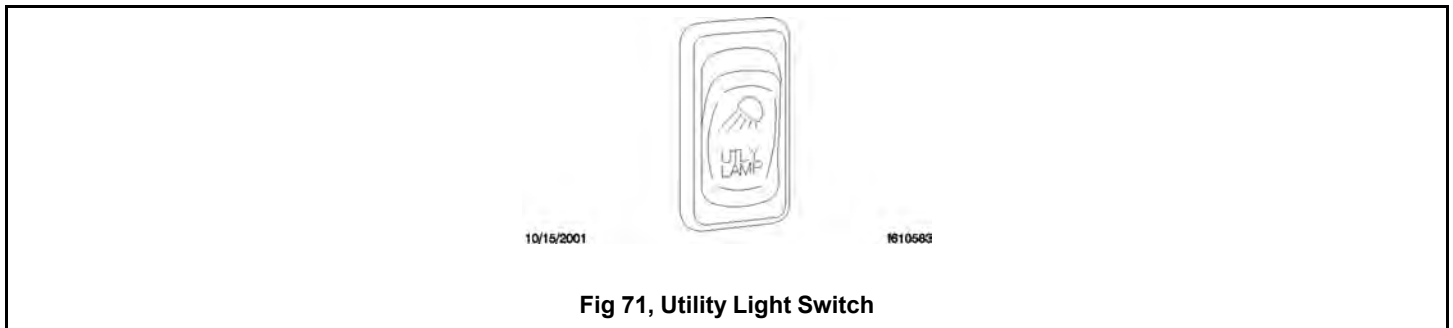
When the road lights are on, the road light icon is backlit in amber. When the panel lights are on, the ROAD LAMP legend is backlit in green.

Utility Light Switch, Optional

The utility light switch operates one of the following lights or sets of lights:

- A single round utility light swivel-mounted in the center of the cab roof;
- Two round utility lights mounted in fixed positions on each side of the cab roof;
- Two flush-mounted utility lights mounted on the back of the cab, one on each side.

To turn the utility light(s) on, press in on the upper part of the utility light (UTLY LAMP) rocker switch (Fig. 71, [Utility Light Switch](#)). To turn the utility light(s) off, press on the lower part of the rocker (at the UTLY LAMP legend).



When the utility lights are on, the diagonal light beam icon is backlit in red. When the panel lights are on, the UTLY LAMP legend is backlit in green.

Spotlight, Optional

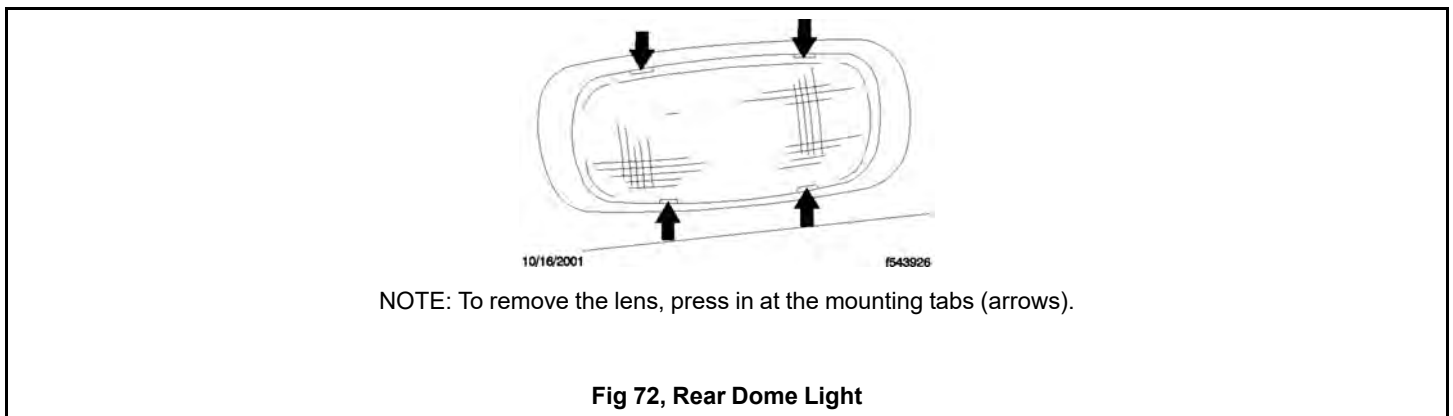
The spotlight switch is located on the pivoting handle of the spotlight. There may be a single spotlight assembly mounted on the driver's door, or one on each door.

5.03.04 Interior Lights and Light Controls

Dome Lights

The interior lights include dome lights, red map lights, and clear reading lights.

Diffuse dome lights are installed on all cabs. The standard dome light has a clear lens and is installed on the back of the cab above the rear window. See Fig.72, [Rear Dome Light](#) for the rear dome light.



On cabs with an overhead console, there is an optional overhead dome light assembly containing a diffuse dome and a clear reading light. See Fig.73, [Overhead Console Dome Lights](#) for the optional dome/reading lights on the overhead console.

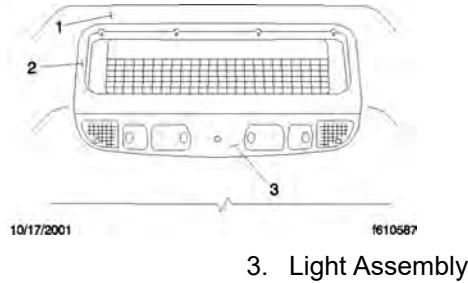


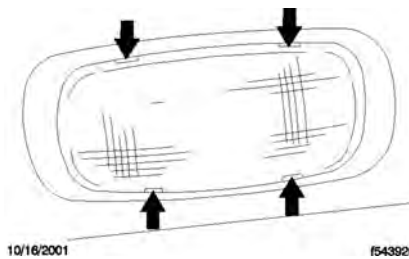
Fig 73, Overhead Console Dome Lights

Light Replacement

Rear Dome Light

To replace the rear dome light (Fig.74,[Rear Dome Light](#)), do the following steps:

1. Press in on the lens at the four mounting tabs (arrows).



NOTE: To remove the lens, press in at the mounting tabs (arrows).

Fig 74, Rear Dome Light

2. Replace the bullet-type bulb and install the lens on the lamp base with the button at the bottom.

Overhead Console Dome/Reading Lights

To replace the overhead console dome/reading lights (Fig.75,[Overhead Console Dome Lights](#)), do the following steps:

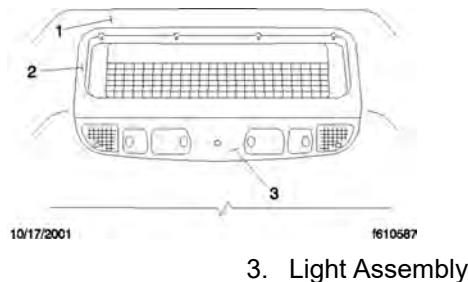


Fig 75, Overhead Console Dome Lights

1. Remove the tapping screws that attach the lamp assembly and trimplate to the overhead console.

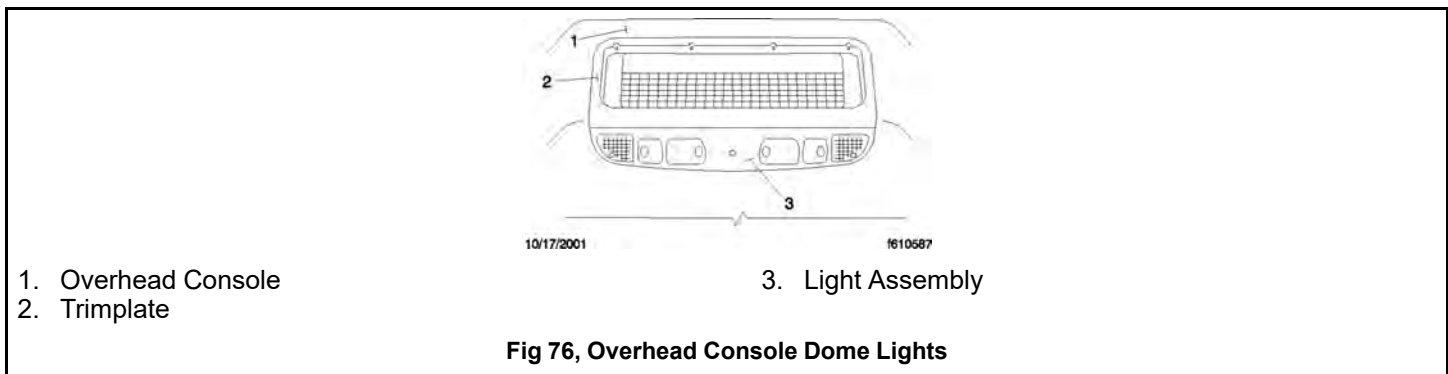
2. Separate the lamp assembly from the trimplate and disconnect the wiring harness.
3. Replace the lamp assembly.
4. Snap the lamp assembly and trimplate together.
5. Connect the lamp assembly to the wiring harness.
6. Insert the tabs on the trimplate into the slots on the overhead console attachment plate.
7. Center the lamp assembly in the headliner cutout and install the center tapping screw.
8. Install the remaining tapping screws.

Dome Light Switches

In the standard cab, there is one dome light switch in the driver's door that turns on the diffuse dome light when the driver's door is opened. In one option, two switches are installed, so that the diffuse dome light turns on when either the driver's or passenger's door is opened.

Clear Reading Lights, Optional

Clear reading lights are available as a option. They are included only in the light assembly installed in the overhead console, located next to the diffuse dome light in the same fixture (Fig.76, [Overhead Console Dome Lights](#)). Like the dome lights, the reading lights are door-activated.



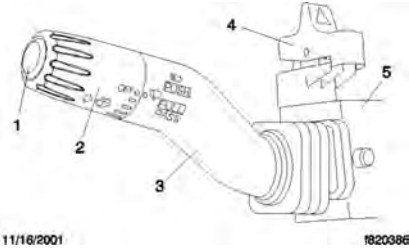
5.04 Multifunction Turn Signal Switch

5.04.01 General Information

The multifunction turn signal switch is attached to the steering column, just below the steering wheel, on the left-hand side. This switch has the following functions:

- The turn signals
- The windshield wipers and washers
- The headlight high beams
- The hazard warning flasher

See Fig.77, [Multifunction Turn Signal Switch](#) for the multifunction switch and its component parts.



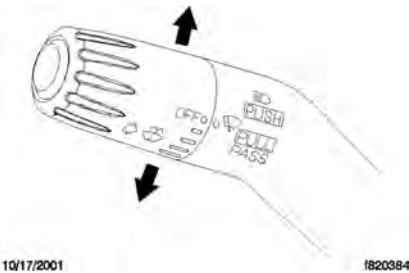
NOTE: Press down on the upper part of the rocker to activate the hazard warning flashers.

- | | |
|-----------------------|---------------------------------------|
| 1. Washer Button | 4. Hazard Flasher (red rocker switch) |
| 2. Wiper Control Dial | 5. Multifunction Switch Module |
| 3. Turn Signal Lever | |

Fig 77, Multifunction Turn Signal Switch

5.04.02 Turn-Signal Controls

The turn signal lever (Fig.78, [Turn Signal Controls](#)) is mounted on the steering column. Moving the lever down turns on the left turn signal lights; moving it up turns on the right turn signal lights.



NOTE: Move the lever down to turn on the left turn signals.

Move the lever up to turn on the right turn signals.

Fig 78, Turn Signal Controls

When one of the turn-signal lights is on, a green indicator arrow flashes at the far left or far right of the warning and indicator light panel.

The lever automatically returns to the neutral position (self-cancels the switch) when the steering wheel returns to the straight ahead position after a turn. To cancel the signal manually, move the lever to the neutral position.

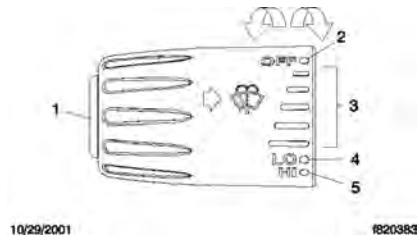
5.04.03 Windshield Wiper/Washer Controls



CAUTION:

Do not move the wiper arms manually. Wiper motor damage will occur if the arms are moved.

The wipers are operated by a rotary switch in the wiper control dial, which is on the end of the turn signal lever. See Fig. 79, [Wiper/Washer Controls](#). There are five delay settings, marked on the dial by lines of increasing length, and two steady speed settings, LO and HI.



NOTE: Rotate the control dial away from you to turn the wipers on, or speed them up.

Rotate the control dial towards you to slow the wipers down, or turn them off.

1. Washer Button
2. OFF Position
3. Delay Positions

4. Wipers On, Low Speed
5. Wipers On, High Speed

Fig 79, Wiper/Washer Controls

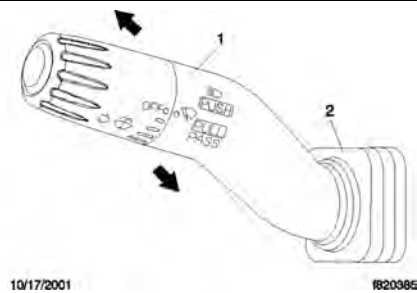
Rotating the control dial forward (in a counterclockwise direction) turns the wipers on. If they are already on, rotating the handle further forward (to a faster speed setting) increases the speed of the wipers through the various delay settings, and to LO and then HI.

Rotating the control dial in the opposite direction (clockwise) causes the wipers to slow down. Rotating the control dial clockwise as far as it will go (to the OFF setting) turns the wipers off.

The washers are operated by a yellow button at the very end of the turn signal lever. To operate the washers, press the button in and hold it in until you want the washers to stop.

5.04.04 Headlight High Beams

Push the turn signal lever forward, towards the windshield, to turn on the high-beam headlights. Pull the turn signal lever back to its original position to turn them off. See Fig.80, [Headlight High Beams](#).



NOTE: Move the lever away from you to turn on the high beams. Move the lever back to its original position to turn them off.

Move the lever towards you to flash the high beams momentarily.

1. Turn Signal Lever

2. Boot

Fig 80, Headlight High Beams

When the high beam headlights are on, a blue light illuminates on the instrument cluster between the tachometer and speedometer. For vehicles built to operate in the United States, switching on the high beams will switch off the road lights.

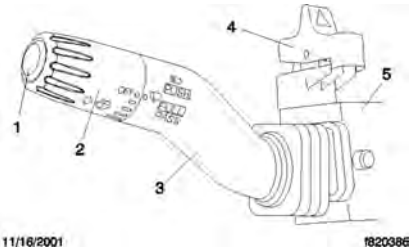
NOTE: The ignition switch must be on for the high beams to work.

With the headlight low beams on, pull the lever backward, towards the steering wheel, to flash the high beams (turn them on momentarily).

The headlight low beams remain on continuously during high beam operation. If the low beam headlights are turned off by use of the headlight switch, the high beams turn off also.

5.04.05 Hazard Warning Flasher

The hazard warning light flasher (Fig.81,[Multifunction Turn Signal Switch](#)) is a red rocker switch located on the top of the multifunction switch module. When the flashers are activated, all of the turn signal lights (front, side, and rear) and the two green indicator arrows on the control panel will blink on and off.



NOTE: Press down on the upper part of the rocker to activate the hazard warning flashers.

- | | |
|-----------------------|---------------------------------------|
| 1. Washer Button | 4. Hazard Flasher (red rocker switch) |
| 2. Wiper Control Dial | 5. Multifunction Switch Module |
| 3. Turn Signal Lever | |

Fig 81, Multifunction Turn Signal Switch

To flash the hazard warning lights, press down on the upper part of the rocker (towards the dash). To stop the hazard warning lights, press down on the lower part of the rocker (towards the steering wheel).

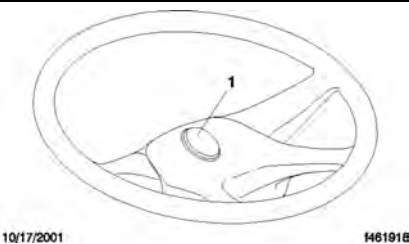
5.05 Horn Controls

5.05.01 Electric Horn

NOTE: It is possible to have both the electric and the air horn installed on one vehicle.

A single electric horn is standard. Dual electric horns are available as an option.

The button for the electric horn is located in the center of the steering wheel. To sound the horn, press down on the button. See Fig.82,[Electric Horn Control](#).



NOTE: To sound the electric horn, press down on the horn button.

1. Horn Button

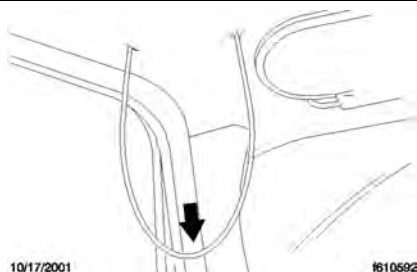
Fig 82, Electric Horn Control

5.05.02 Air Horn, Optional

NOTE: It is possible to have both the electric and the air horn installed on one vehicle.

Single and dual air horns are available as options.

The air horn is controlled by a wire lanyard hanging down just inboard on the driver's door. See Fig.83, [Air Horn Control](#). Pull downward on the lanyard to sound the air horn.



NOTE: To sound the air horn, pull down on the lanyard (arrow).

Fig 83, Air Horn Control

5.06 Powertrain Controls

5.06.01 After-Treatment System (ATS) Request/Inhibit Regen Switch

A parked regen of the ATS can be initiated with the request/inhibit regen switch. It may also be used to inhibit the vehicle from performing an automatic regen. See Fig.84, [Request/Inhibit Regen Switch](#).

The style and function of switch will vary with the engine make and model. See the engine operation manual for operation details.

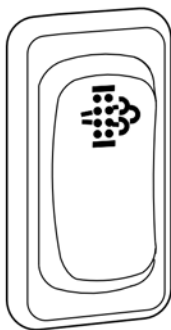


Fig 84, Request/Inhibit Regen Switch

5.06.02 Cruise Control Switches

**CAUTION:**

Do not attempt to shift gears without using the clutch pedal when the cruise control is engaged. Failure to follow this precaution will result in a temporarily uncontrolled increase in engine speed; transmission damage and gear stripping could result.

On standard models, cruise control is activated by two dash switches. See Fig.85, [Cruise Control Switches, Dash-Mounted](#). On some models, cruise control can be activated by a button on the transmission shift knob.

- The On/Off Switch—this two-position rocker switch bears the legend SPD CNTL on the lower half of the switch. When cruise control is on, an amber light illuminates in the top part of the switch.
- The Set/Resume Switch—this three-position paddle switch bears the legend RES/ACC above the paddle and SET/CST below the paddle.



NOTE: To turn cruise control on, press the upper half of the On/Off (rocker) switch. To turn cruise control off, press the lower half of the On/Off (rocker) switch.

1. Cruise Control On/Off (rocker) Switch

2. Cruise Control Set/Resume (paddle) Switch

Fig 85, Cruise Control Switches, Dash-Mounted

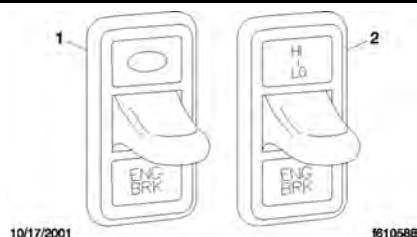
NOTE: For more information about cruise control operation, see [8.01 General Information](#).

5.06.03 Engine Brake Switch, Optional

The engine brake switch controls the degree of engine braking. Normally there are two paddle switches, a two-position On/Off Switch to activate the engine brake, and a two-position HI-LO Switch to control the amount of engine braking.

To turn the two-position On/Off Switch on, raise the paddle. When the two-position switch is on, an amber LED (light-emitting diode) illuminates inside the switch.

To turn the two-position HI-LO Switch on high, raise the paddle (at the HI-LO icon). To turn the two-position HI-LO Switch on low, lower the paddle (at the ENG BRK legend). See Fig.86, [Engine Brake Switches](#).



1. On/Off Switch

2. HI-LO Switch

Fig 86, Engine Brake Switches

A three-position switch is used on MBE900 engines equipped with both the regular engine brake and the constant-throttle (decompression) brake. It works the same as the two-position HI-LO switch, except that there is a third (off) position when the switch is left at its normal position.

The engine brake turns off automatically or when the clutch pedal is pressed. On vehicles without a clutch pedal, the brake pedal can be used to deactivate the engine brake. For more information about engine brake operation, see [8.01 General Information](#).

When the panel lights are on, the HI-LO icon is backlit in amber on the HI-LO switch. On both switches, the ENG BRK legend is backlit in green when the panel lights are on.

5.06.04 Exhaust Brake Switch, Optional

The optional exhaust brake is controlled by a dash-mounted rocker switch to help slow the vehicle when the accelerator is released. See [8.01 General Information](#) under the heading "Exhaust Braking System, Optional" for additional information.

To turn the exhaust brake on, press on the upper part of the rocker (at the light inside the switch). The exhaust brake turns off automatically. See Fig.87, [Exhaust Brake Switch](#) and Fig.88, [Exhaust Brake Switch](#).

**Fig 87, Exhaust Brake Switch****Fig 88, Exhaust Brake Switch**

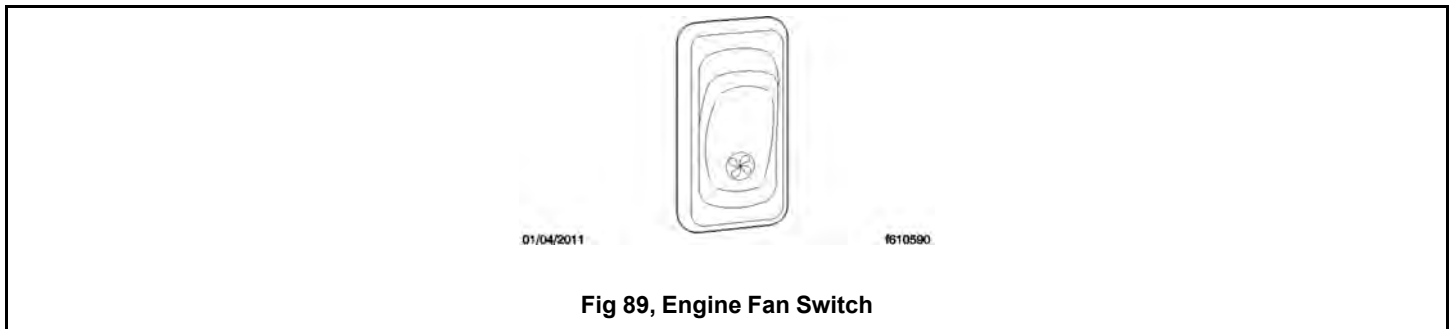
When the exhaust brake switch is on, an amber LED illuminates inside the switch. When the panel lights are on, the EXHST BRK legend is backlit in green.

5.06.05 Engine Fan Switch, Optional

The engine cooling fan can be turned on by the engine fan switch (ENG FAN legend). The fan will continue to operate for a set amount of time and then turn off unless the coolant temperature is high enough to continue the fan operation.

To turn the engine fan on, press on the upper part of the rocker (at the fan icon). See Fig.89, [Engine Fan Switch](#).

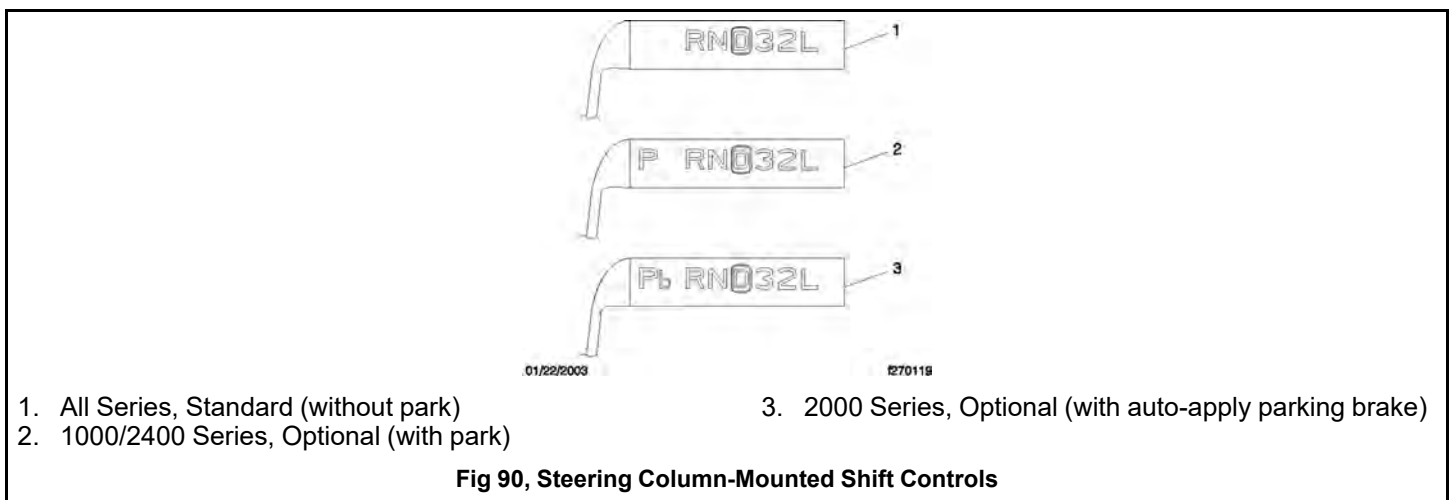
When the engine fan is running, the fan blade icon is backlit in amber. When the panel lights are on, the ENG FAN legend is backlit in green.



5.06.06 Transmission Controls

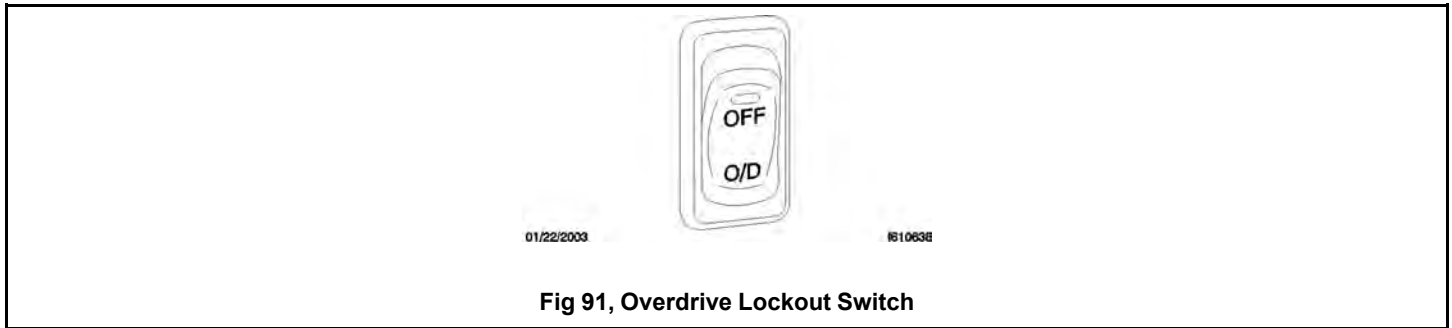
If so equipped, the transmission range control valve and splitter valve are attached to the gearshift knob. Transmission shift pattern labels are located inside the cab. See [9.01.01 Meritor MTC Series](#) for complete transmission operating instructions.

On vehicles with standard Allison On-Highway Series automatic transmission, the shift selector is lever-activated. The display mounted on the steering column provides four forward ranges and one reverse range. See Fig. 90, [Steering Column-Mounted Shift Controls](#).



1. All Series, Standard (without park)
2. 1000/2400 Series, Optional (with park)
3. 2000 Series, Optional (with auto-apply parking brake)

When the transmission is in D (drive), the vehicle will operate in the overdrive (5th) gear. To shift down into the direct drive (4th) gear, use the overdrive lockout switch (O/D legend). See Fig.91, [Overdrive Lockout Switch](#). The transmission will shift into 4th gear and remain in that gear unless a range inhibitor is active, such as engine overspeed. See [9.01.01 Meritor MTC Series](#) for more information about range inhibitors.



To shift to fourth gear, press on the upper part of the rocker (at the LED). The LED will come on and stay illuminated until the bottom part of the rocker switch is pressed.

On vehicles with Allison MD Series automatic transmission or Eaton Autoshift automated transmission, a push-button shift selector provides four, five, or six forward ranges and one reverse range. See [9.01.01 Meritor MTC Series](#) for more information about the push-button shift selector.

5.06.07 Axle Switches

All axle switches contain a red LED (light-emitting diode) that illuminates the switch from within when the switch is turned on (the upper part of the rocker is pressed). The legend under the LED, if any, is not visible until the switch is turned on.

IMPORTANT: A guard is positioned around all axle switches to prevent unintentional activation.

NOTE: For more information on axle switch function, see [9.01.01 Meritor MTC Series](#).

Differential Lock Switch



CAUTION:

Differential lock should only be engaged when the vehicle is stopped or moving slowly at low throttle. This will prevent internal axle damage.

The differential lock switch is a two-position guarded rocker switch. See Fig.92,[Differential Lock Switch](#). It causes the wheels on each axle governed by the switch to rotate together. It is also known as side-to-side wheel lock.



To lock the wheels together, press the upper half of the rocker momentarily (at the LED). To turn off differential lock, press the upper half of the rocker again.

When the panel lights are on, the double-axle icon is backlit in green.

IMPORTANT: The differential lock switch is guarded to prevent unintentional switch activation. If the LED in the switch begins to blink during normal operation, when the switch has not been activated, this indicates an error condition. Bring the vehicle to an authorized Freightliner service facility as soon as possible.

Interaxle Lock Switch

**CAUTION:**

The interaxle lock should not be engaged on a vehicle with obviously spinning wheels. Engagement at high speed or power can damage the axle(s).

The interaxle lock switch is a two-position guarded rocker switch installed on vehicles with dual drive axles. See Fig. 93, [Interaxle Lock Switch](#). It causes both axle shafts to rotate together.



Fig 93, Interaxle Lock Switch

To lock the axles together, press the upper half of the rocker momentarily (at the LED). To turn off interaxle lock, press the upper half of the rocker again.

When the panel lights are on, the double-axle icon is backlit in green.

IMPORTANT: The interaxle lock rocker switch is guarded to prevent unintentional switch activation. This switch does not have a diagnostic blink function when inactive.

Axle Shift Switch

**CAUTION:**

To prevent transmission and axle damage, make sure the automatic transmission is in high range when performing an axle shift with the vehicle moving.

The axle shift switch is a two-position guarded rocker switch installed on vehicles with two-speed axles. See Fig. 94, [Axle Shift Switch](#).



Fig 94, Axle Shift Switch

To shift the axle from low speed to high speed, press the upper half of the rocker momentarily (at the LED). To turn the axle shift off (switch from high speed back to low speed), press the upper half of the rocker again.

NOTE: On vehicles with tandem drive axles, there is an interlock that prevents a 2-speed axle from shifting whenever the interaxle lock is on.

When the panel lights are on, the AXLE SHIFT legend is backlit in green.

IMPORTANT: The axle shift switch is guarded to prevent unintentional switch activation. If the LED in the switch begins to blink during normal operation, when the switch has not been activated, this indicates an error condition. Bring the vehicle to an authorized Freightliner service facility as soon as possible.

5.07 AWD Controls

5.07.01 General Information

The AWD switch allows the driver to direct power to the steer axle. For more information about transfer cases and driven steer axles, see [9.01.01 Meritor MTC Series](#).

5.07.02 AWD Operation Switch

The AWD operation switch (LOCKED AWD) is a two-position rocker switch. See Fig.95, [AWD Operation Switch](#).

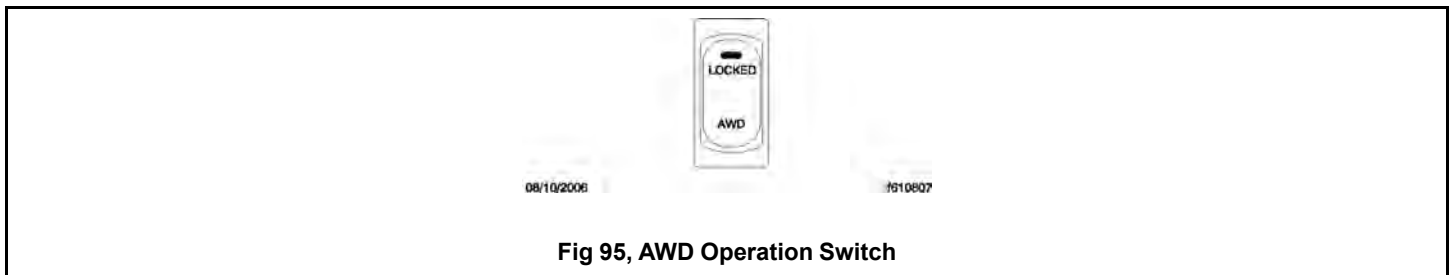


Fig 95, AWD Operation Switch

To engage the steer axle, press the upper half of the rocker switch. To disengage it, press the lower half of the switch.

5.07.03 Transfer Case Range Switch



CAUTION:

Before selecting the neutral (N-TRL) position, stop the vehicle and set the parking brake to prevent the vehicle from rolling and causing damage and/or personal injury.



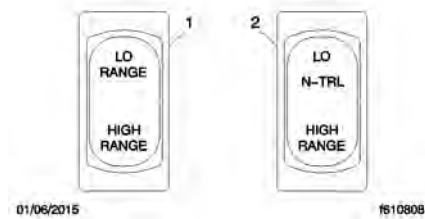
NOTICE:

To prevent damage to the transfer case and the driveline, stop the vehicle and put the transmission in neutral before using the range switch.

IMPORTANT: Use this switch only when the steer axle has been engaged.

There are two transfer case range switches: a two-position rocker switch with LO and HIGH RANGE, and a three-position switch that has a neutral (N-TRL) position in the middle for vehicles with a power take-off (PTO) unit. See Fig. 96, [Transfer Case Range Switches](#).

For operating guidelines for Meritor MTC transfer cases, see [9.01.01 Meritor MTC Series](#).



1. Two-Position Switch

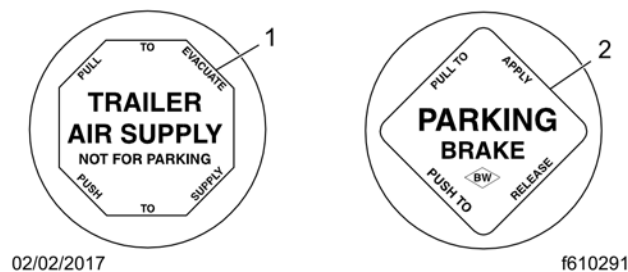
2. Three-Position Switch

Fig 96, Transfer Case Range Switches

5.08 Braking

5.08.01 Parking Brake Control Valve

The yellow diamond-shaped knob (Fig.97, [Brake Valve Control Knobs](#)) on the auxiliary dash panel operates the parking brake control valve (park brake switch). Pulling the yellow knob applies the tractor parking brakes (spring brakes). Pushing in the knob releases the tractor parking brakes. Before the parking brakes can be released, the air pressure in either air brake system must be at least 65 psi (448 kPa).



1. Trailer Air Supply Valve (red knob)

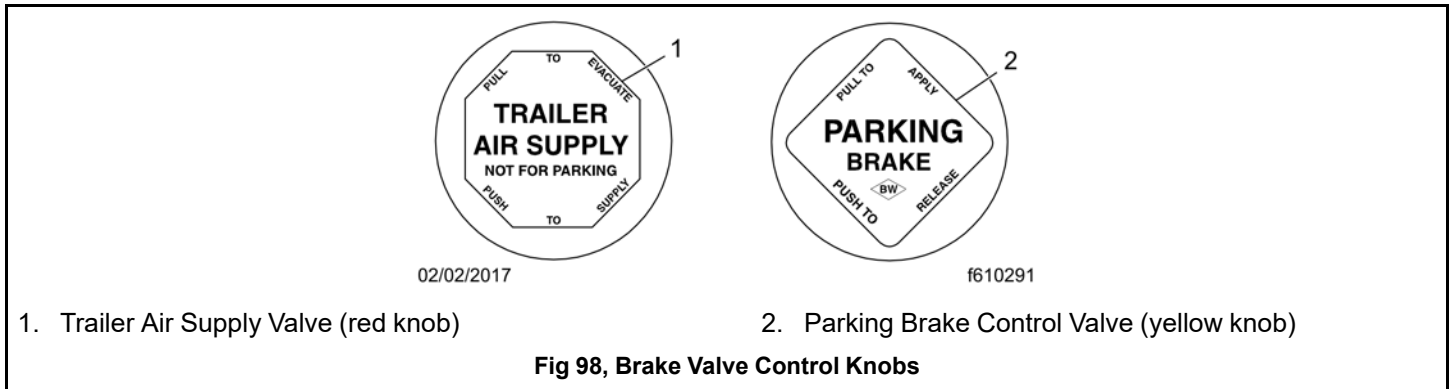
2. Parking Brake Control Valve (yellow knob)

Fig 97, Brake Valve Control Knobs

See [10.01.01 General Information](#) under the heading "Dual Air Brake System" for further information about the parking brake control valve.

5.08.02 Trailer Air Supply Valve

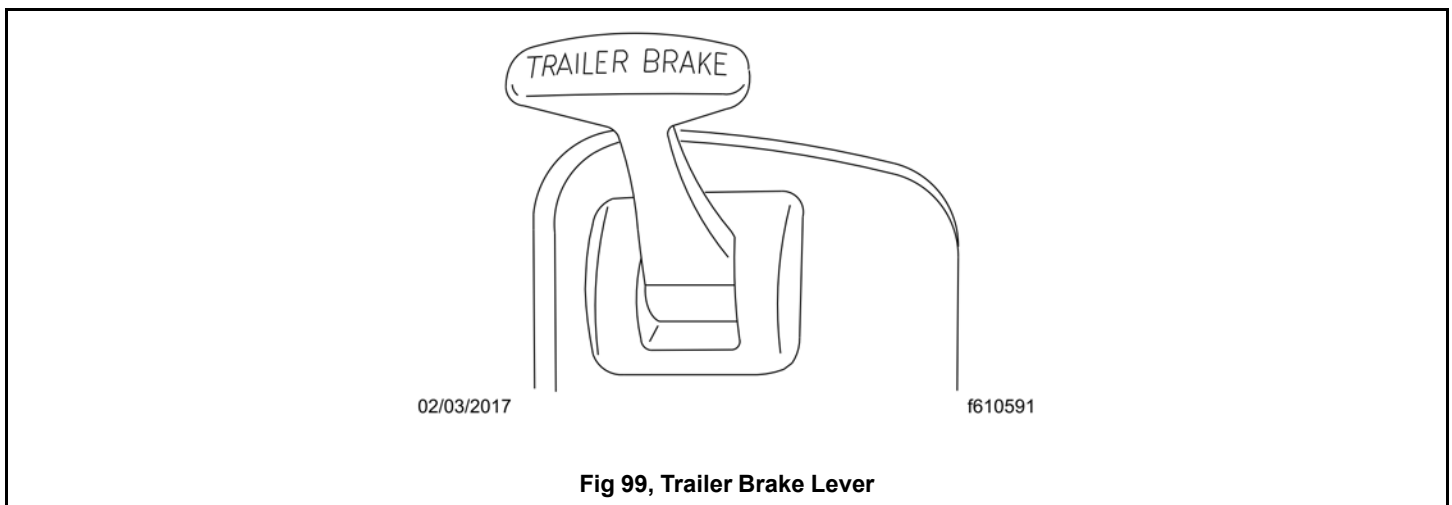
The red octagonal-shaped knob (Fig.98, [Brake Valve Control Knobs](#)) on the auxiliary dash panel operates the trailer air supply valve. After the vehicle and its air hoses are connected to a trailer, and the pressure in the air system is at least 65 psi (448 kPa), the red knob must be pushed in (and should stay in) to charge the trailer air supply system and release the trailer spring parking brakes. Before disconnecting a trailer or when operating a vehicle without a trailer, the red knob must be pulled out.



See [10.01.01 General Information](#) under the heading "Dual Air Brake System" for further information about the trailer air supply valve.

5.08.03 Trailer Brake Lever

The trailer brake lever (hand control valve) is used for applying the trailer brakes without applying the truck or tractor brakes. It is usually mounted on the right-hand control panel. See Fig.99, [Trailer Brake Lever](#). See [10.01.01 General Information](#) under the heading "Dual Air Brake System" for operating instructions.

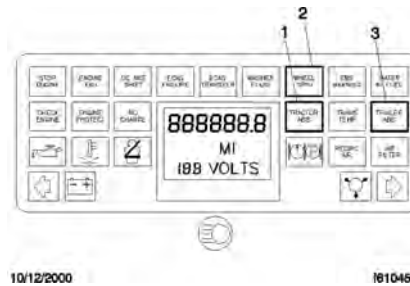


5.08.04 Meritor™ WABCO® Antilock Braking System (ABS)

The Meritor WABCO Antilock Braking System (ABS) has an amber tractor indicator light (TRACTOR ABS legend) and, if equipped with automatic traction control (ATC), an amber wheel spin indicator light (WHEEL SPIN legend). See Fig. 100, [ABS Indicator Lights](#).

On vehicles equipped with a compatible trailer, there is also an amber trailer indicator light (TRAILER ABS legend).

See the brake system operating instructions in [10.01.01 General Information](#) for more information about ABS.



1. Tractor ABS Indicator
2. Wheel Spin Indicator (optional)

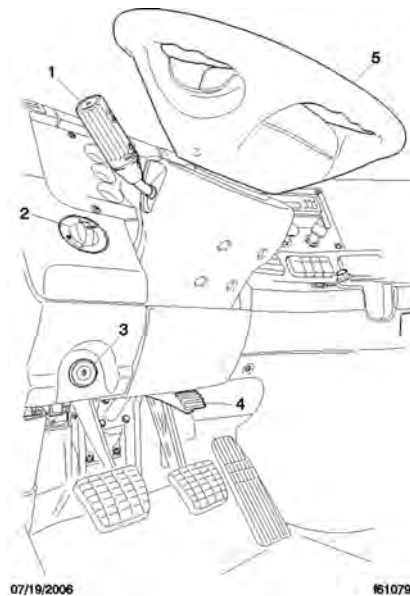
3. Trailer ABS Indicator

Fig 100, ABS Indicator Lights

5.09 Adjustable Steering Column

To tilt the steering column, press down on the foot pedal located below the steering column. Tilt the steering column up or down to the desired position. Release the foot pedal to lock the steering column in place. See Fig. 101, [Adjustable Steering Column](#).

To telescope the steering column, press down on the foot pedal located below the steering column. Pull the steering wheel closer to you or push the steering wheel farther away from you. Release the foot pedal to lock the steering column in place.



1. Multifunction Turn Signal Switch
2. Headlight Switch
3. Ignition Switch

4. Adjustable Steering Column foot Pedal
5. Steering Wheel

Fig 101, Adjustable Steering Column

5.10 Other Dash-Mounted Controls

Windshield-Fan Switches, Optional

Ceiling-mounted defogger fans are operated by LOW/OFF/HIGH toggle switches located in the base of the fan.

Cigarette Lighter

Push in the lighter to heat the element. The lighter will stay in and will automatically pop out when the element is hot.

CB Radio Connections

An antenna connection and positive (+) and negative (–) power connections are provided for a CB radio.

Suspension Dump Switch

**NOTICE:**

Do not operate the vehicle over uneven ground such as ramps, speed bumps, curbs, etc. with the air springs deflated. Doing this may lead to air bag separation from the piston, preventing the suspension air springs from reinflating.

**NOTICE:**

Never exhaust air from the suspension while driving. When the air is exhausted, the suspension will not absorb road shocks, and components may be damaged.

The suspension dump switch is a two-position guarded rocker switch (Fig.102, [Suspension Dump Switch](#)). It allows the air in the vehicle air suspension to be quickly exhausted, lowering the rear of the vehicle. This makes it easier to connect to, or disconnect from, a trailer.



Fig 102, Suspension Dump Switch

To lower the rear of the vehicle quickly, press the upper half of the rocker momentarily (at the LED). To raise the suspension to its normal height, press the upper half of the rocker again.

When the panel lights are on, the tractor icon is backlit in green.

IMPORTANT: The suspension dump switch is guarded to prevent unintentional switch activation. This switch does not have a diagnostic blink function when inactive.

When the suspension dump switch is pressed, three responses are possible: a normal response, a slow response, and an abnormal response.

Normal Response: The LED in the switch blinks while the suspension is deflating or filling. When it is completely deflated, the LED comes on steady and stays illuminated. In normal operation, the suspension may dump or fill so quickly that the blinking of the switch is barely noticeable.

If operation of the switch is not possible for any reason (vehicle is moving faster than 5 mph, ignition is turned off, etc.), the LED will stop blinking and turn off.

Slow Response: If operation of the switch is slowed for any reason (by cold weather, low air pressure, etc.), the switch will continue to blink until the suspension completes a dump or fill. As in the normal response, the LED comes on steady and stays illuminated when the suspension is fully deflated.

Abnormal Response: If the LED blinks for more than 10 seconds, the suspension dump mechanism may not be operating properly. Bring the vehicle to an authorized Freightliner service facility for testing.

If the ignition is turned off while the vehicle is in dump mode, the power to the dump solenoid is cut off to prevent battery drain, and the suspension system will autofill the rear air springs. The suspension will also autofill if the vehicle is operated with the suspension dumped, and the speed is over 5 mph (e.g. – driver forgot to inflate the bags or there was a system failure).

Suspension Autofill Override Valve

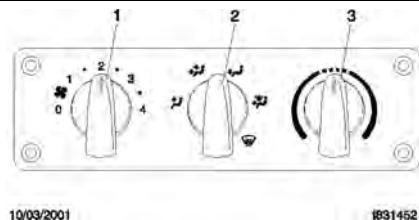
The suspension autofill override option is a dash air valve, that keeps the suspension deflated when the ignition is turned off. To operate it, turn off the ignition then push the override valve knob. See Fig.103, [Suspension Autofill Override Valve](#). When the ignition is turned on, the override valve will release automatically, and the suspension will autofill. The suspension dump switch will then operate normally as described previously.



Fig 103, Suspension Autofill Override Valve

5.11 Heater/Air Conditioner Control Panel

Standard controls (Fig.104, [HVAC Climate Control Panel, Standard](#)) for the heating, ventilation, and air-conditioning system (HVAC) consist of an eight-speed fan switch, an air selection switch, and a temperature control switch. On vehicles with air conditioning, the panel also contains a telltale LED and an air recirculation button. See [7.01.01 General Information](#) for detailed operating instructions for the HVAC.



1. Fan Switch
2. Air Selection Switch

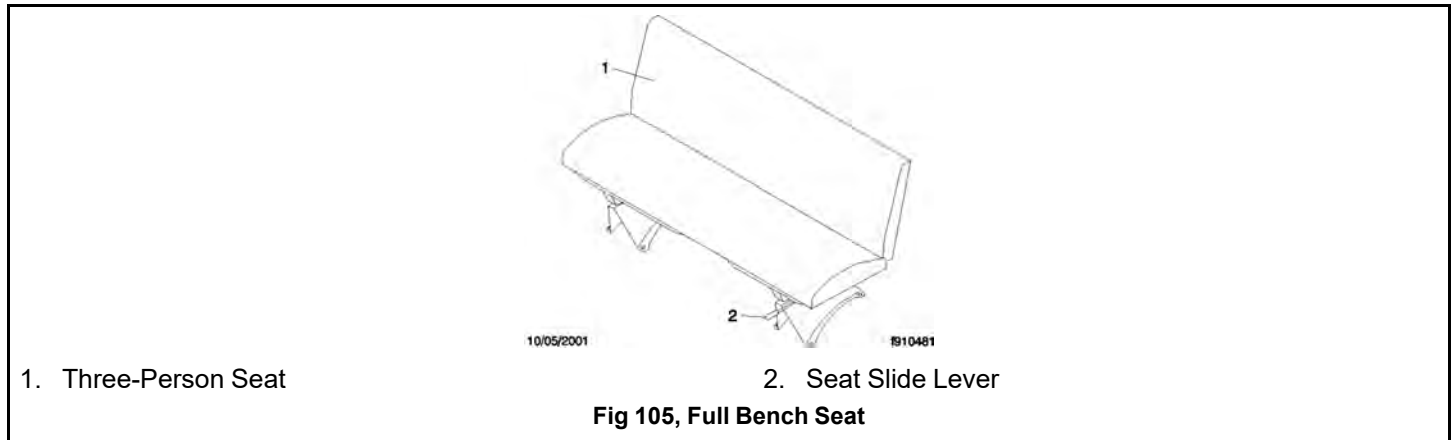
3. Temperature Control Switch

Fig 104, HVAC Climate Control Panel, Standard

5.12 Seat Controls

5.12.01 Bench Seat Adjustment Controls

The standard bench seat has one control: the seat slide lever. See Fig.105, [Full Bench Seat](#). The two-person bench seat and the non-suspended passenger seat have no controls.



5.12.02 Suspension Seat Adjustment Controls

All controls for adjusting air suspension seats are located within easy reach of the occupant.

Due to the maximum adjustability of mid- and high-back air suspension seats, it is possible to combine the seat back recline adjustment and the seat slide adjustment so that the seat back contacts the backwall. It is the responsibility of the driver to adjust the seat to prevent damage to the seat and the cab interior.

All adjustment controls for a suspension seat are located on the seat base. See [6.01 Windows](#) for complete instructions.

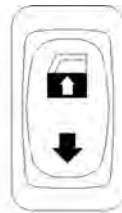
6.01 Windows	94
6.02 Mirrors.....	94
6.02.01 General Information	94
6.02.02 Mirror Heat Switch, Optional	94
6.02.03 Power Mirrors, Optional.....	95
6.02.04 Down View Mirror, Optional.....	95
6.03 Seats	96
6.03.01 General Information	96
6.03.02 Bench Seats.....	98
6.03.03 Freightliner High-Back Seat	98
6.03.04 Bostrom Seat.....	100
6.03.05 National 2000 Series Seat	101
6.03.06 Sears Seat	102
6.04 Seat Belts and Tether Belts	103
6.04.01 General Information	103
6.04.02 Seat Belt Inspection	104
6.04.03 Seat Belt Operation.....	104
6.05 Cab Amenities	107
6.05.01 Cup Holders	107
6.05.02 Cab Storage	107
6.06 Windshield Washer Reservoir	109

6. Cab Features

6.01 Windows

Standard windows operate mechanically using a hand crank.

Power windows are optional, and can be installed on one side or both sides. One power window switch (window icon) will be installed on the dash for each window. See Fig.106, [Power Window Switch](#). If your vehicle is equipped with power windows, press up to raise the window; press down to lower the window. Releasing the switch causes the window to stop.



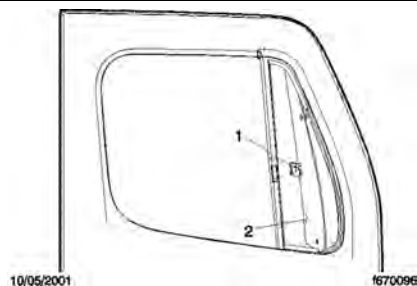
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1610522

NOTE: Press up to raise the window; press down to lower the window. Releasing the switch causes the window to stop.

Fig 106, Power Window Switch

Standard vent (wing) windows do not open. Operating vent windows are optional. To open the operating vent window, turn the latch on the window and push the window open. See Fig.107, [Operating Vent Window \(optional\)](#).



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1. Latch

2. Vent Window

Fig 107, Operating Vent Window (optional)

6.02 Mirrors

6.02.01 General Information

The standard outside mirrors are mounted on the door frame. There is a primary rear view mirror and a convex mirror.

6.02.02 Mirror Heat Switch, Optional

One or both outside door mirrors can be heated to keep them clear of fog, frost, and ice.

To heat the mirrors, press the upper part of the mirror heat switch (MIRR HEAT) on the dash. See Fig. 108, [Mirror Heat Switch](#). When the mirror heat switch is on, an amber indicator light illuminates inside the switch.

The mirror heat switch is a smart switch (fully multiplexed).



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NOTE: To heat the mirrors, press up; press down to turn off the heat.

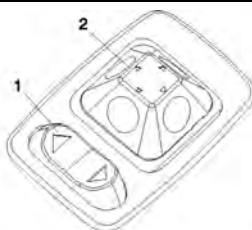
Fig 108, Mirror Heat Switch

6.02.03 Power Mirrors, Optional

The main outside mirrors, if heated, can be equipped with an electrical remote control located on the driver's door. See Fig. 109, [Power Mirror Switch Pad](#).

To select the mirrors on the left-hand side, press the left side of the mirror select switch. To select the mirrors on the right-hand side, press the right side of the mirror select switch.

The keypad has four arrow keys, pointing up, down, left, and right. To adjust the mirror position, press the keypad in the direction you want the mirror to move.



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NOTE: To adjust the mirror position, press the keypad on the door in the direction you want the mirror to move.

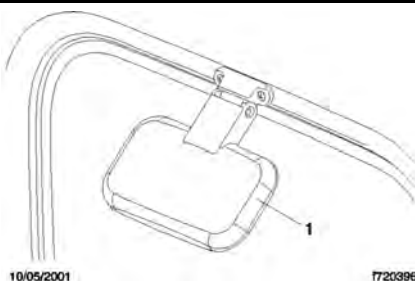
1. Mirror Select Switch

2. Keypad

Fig 109, Power Mirror Switch Pad

6.02.04 Down View Mirror, Optional

A down view mirror can be installed on the top of the passenger door frame to allow the driver a view of the area adjacent to the right side of the cab. See Fig. 110, [Down View Mirror \(optional\)](#).



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1. Mirror

Fig 110, Down View Mirror (optional)

6.03 Seats

6.03.01 General Information

**WARNING:**

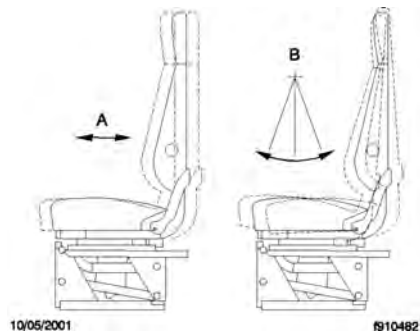
Keep hands, tools, and other objects away from the scissor points under the seats. Failure to do so could cause personal injury.

Unless otherwise noted, all seat adjustments should be made while seated and before the engine is started.

Due to the high degree of adjustability found in high-back air suspension seats, it is possible to set the seat back recline adjustment and the seat slide adjustment in such a combination that the seat back will come into contact with the rear wall of the cab. It is the responsibility of the driver to adjust the seat to prevent damage to the seat and the cab interior.

The following is a description of adjustments that are available on one or more seats. Not all seats have all of the adjustments listed below.

1. Seat Slide (fore-and-aft): When this adjustment is made, the entire seat moves forward or backward on its track (see Fig.111, [Seat Slide Adjustment and Isolator Feature](#)).

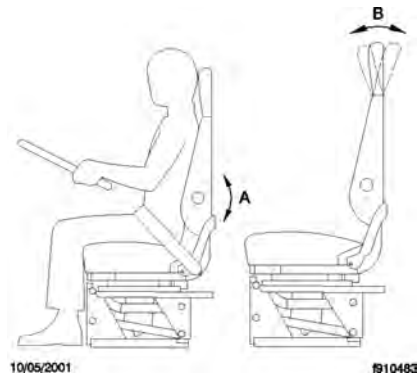


A. Seat Slide (fore-and-aft) Adjustment

B. Isolator Feature

Fig 111, Seat Slide Adjustment and Isolator Feature

2. Isolator: This feature (also referred to as back-slap isolator or Chugger-Snubber®) reduces the amount of road shock by isolating the occupant from the motion of the vehicle, and allowing the upper seat to move in a simple pendulum motion. Whenever the isolator is not desired, it can be locked out (see Fig. 111, [Seat Slide Adjustment and Isolator Feature](#)).
3. Lumbar Support: Lumbar support changes the shape of the seat back to give more or less support to the occupant's lumbar (lower back) area. This adjustment is either mechanical or air controlled, depending on make and model of the seat (see Fig.112, [Lumbar Support and Headrest Adjustment](#)).

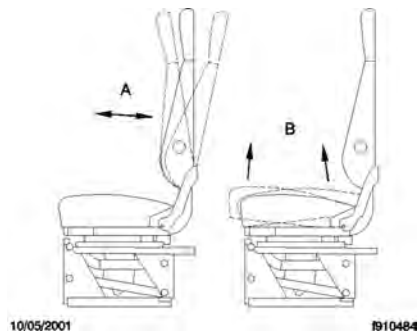


A. Lumbar Support

B. Headrest Adjustment

Fig 112, Lumbar Support and Headrest Adjustment

4. Headrest: When this adjustment is made, the upper part of the backrest (back cushion) changes angle to provide head and upper back support (see Fig.112,[Lumbar Support and Headrest Adjustment](#)).
5. Backrest Tilt: This adjustment pivots the backrest forward or backward (see Fig.113,[Cushion Tilt Adjustments](#)).

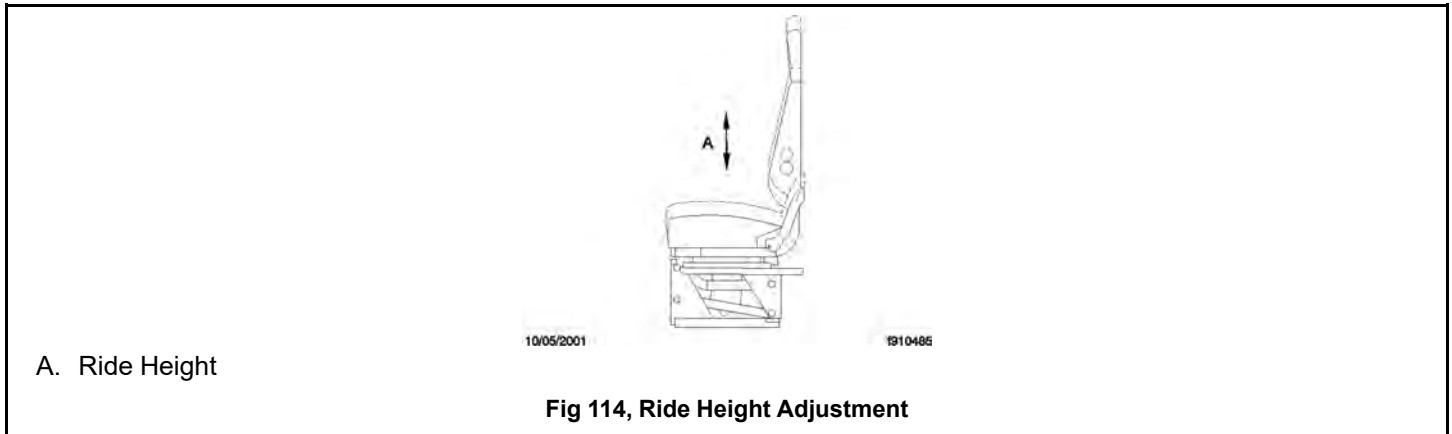


A. Backrest Tilt

B. Seat Cushion Tilt

Fig 113, Cushion Tilt Adjustments

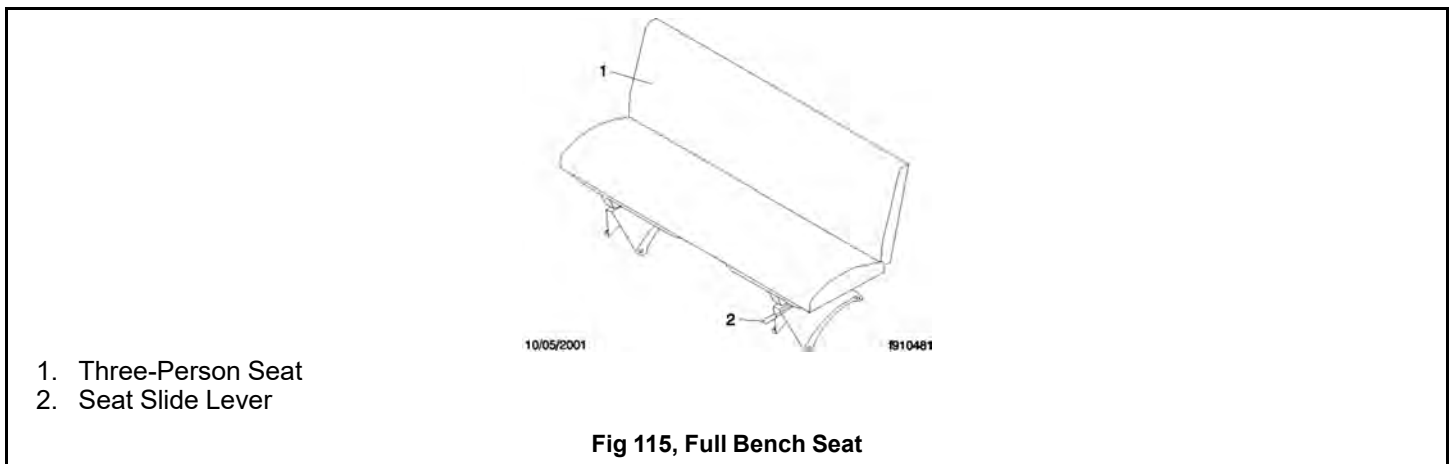
6. Seat Cushion Tilt: This adjustment raises or lowers the front and/or back of the seat (bottom) cushion. This adjustment is easier to perform when all weight is removed from the seat (see Fig.113,[Cushion Tilt Adjustments](#)).
7. Seat Tilt: When this adjustment is made, the seat assembly, both backrest and seat cushion, tilts forward or backward (see Fig.113,[Cushion Tilt Adjustments](#)).
8. Ride Height Adjustment: The entire seat moves up or down when adjusting the ride height. The adjustment is either manual or air controlled, depending on the make and model of the seat (see Fig.114,[Ride Height Adjustment](#)).



9. **Damper:** When you sit on the seat, a leveling valve places you in the center of the ride zone. When the damper is adjusted properly under normal driving conditions, the seat should not top or bottom against the limits of the vertical travel.
10. **Ride Firmness:** A firmer ride gives a better feel for the road but less protection against unevenness in the road surface. A softer ride smooths out the bumps.

6.03.02 Bench Seats

The three-person full bench seat is standard. See Fig.115, [Full Bench Seat](#).



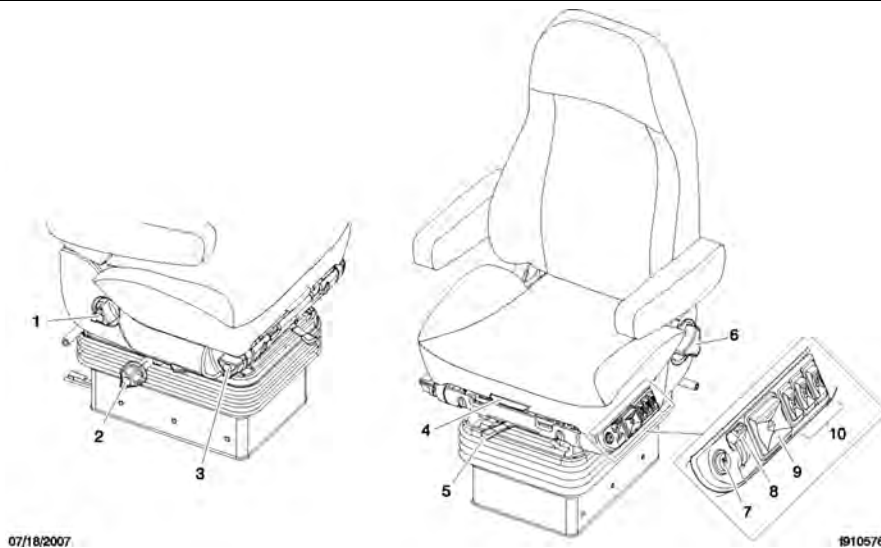
The full bench seat has a seat slide adjustment to allow more or less leg room for the driver and passengers. Release the seat slide lever and push backwards or forwards to move the seat along its track.

High-back air suspension seats are optional for both driver's and passenger's seats. Also available are a non-suspended passenger's seat, and a two-person bench seat with a safe or tool box located under the seat.

No adjustments are possible on the two-person bench seat or the non-suspended passenger seat.

6.03.03 Freightliner High-Back Seat

See Fig.116, [Freightliner High-Back Seat](#) for seat adjustment controls. Not all models of the seat have all the adjustments listed below.



NOTE: Not all models of the seat have all the adjustment controls shown.

- | | |
|---|-----------------------------|
| 1. Rear Cushion Height Adjustment Knob | 6. Backrest Tilt Knob |
| 2. Fore/Aft Isolator | 7. Heater Button |
| 3. Front Cushion Height Adjustment Knob | 8. Shock Absorber Lever |
| 4. Bottom Cushion Extension Handle | 9. Height Adjustment Switch |
| 5. Fore/Aft Seat Slide Lever | 10. Lumbar Support Switches |

Fig 116, Freightliner High-Back Seat

Backrest Tilt

To tilt the backrest, lean forward slightly to remove pressure from the cushion, then turn the knob forward or rearward to achieve the desired position.

Lumbar Support

To adjust the lumbar support, use the lumbar support switches on the side of the seat.

Height Adjustment

To raise or lower the height of the seat, use the height adjustment switch on the side of the seat.

Bottom Cushion Extension

To adjust the fore-and-aft position of the seat cushion, remove your weight from the seat, then lift up and pull forward on the cushion adjustment handle. To return the cushion to the aft position, lift up and push rearward.

Fore/Aft Seat Slide

To adjust the fore-and-aft position of the entire seat, move the fore-and-aft seat adjustment lever to the left and slide the seat forward or backward to the desired position. Move the lever back to its original position to lock the seat in place.

Fore/Aft Isolator

To engage the isolator, turn the isolator knob rearward to the unlocked position. Turn the isolator knob forward to the locked position when the isolator feature is not desired.

Shock Absorber

To adjust the amount of damping the shock absorber provides, move the lever up to increase damping; move the lever down to decrease damping.

Front Cushion Height

To adjust the height of the front of the cushion, remove your weight from the seat, then turn the adjustment knob toward the front of the seat (clockwise) to increase cushion height. To lower the cushion height, turn the adjustment knob toward the rear of the seat (counterclockwise).

Rear Cushion Height

To adjust the height of the rear of the seat cushion, remove your weight from the seat and turn the rear cushion adjustment knob to one of three positions.

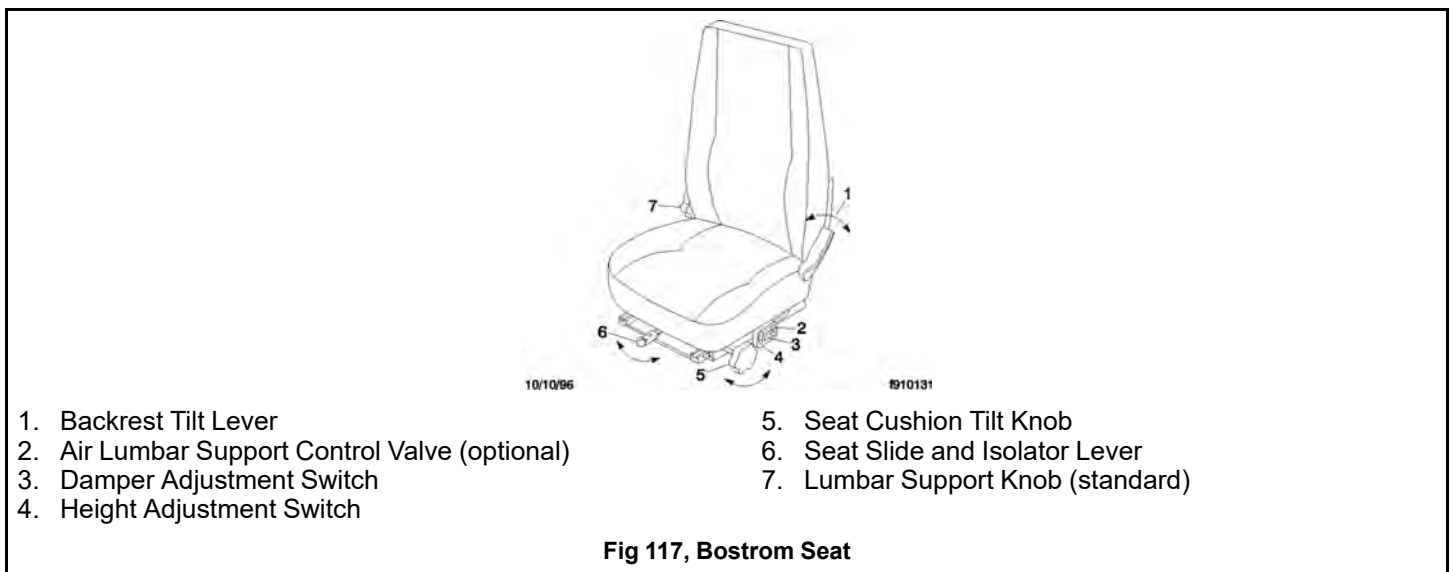
Heater

To turn on the heat option, press the button. To turn off the heat option, press the button again. If the vehicle has Optimized Idle, seat heating will not operate with the key in accessory mode. Optimized Idle may also turn seat heating off to reduce stress on the batteries.

6.03.04 Bostrom Seat

Seat Slide Adjustment

Move the seat slide and isolator lever (see Fig.117, [Bostrom Seat](#)) to the left and hold it there to slide the seat forward or backward to the desired position.



Isolator

To engage the isolator, put the seat slide and isolator lever in the center position. Lock out the isolator by moving the lever to the right.

Lumbar Support

To increase lumbar support, rotate the lumbar support knob forward. To decrease lumbar support, rotate the knob rearward.

On seats equipped with air lumbar support, press the control valve upward to increase lumbar support. Press the control valve downward to decrease lumbar support.

Seat Cushion Tilt

Rotate the seat cushion tilt knob to increase or decrease seat cushion tilt.

Backrest Tilt

To tilt the backrest, lean forward slightly to remove pressure from the cushion and hold the backrest tilt lever rearward. Lean backward slowly to the desired position and release the lever to lock the backrest in place.

Ride Height and Damper Adjustment

To raise the seat, press the upper portion of the height adjustment switch. To lower the seat, press the lower portion of the switch.

Press the damper adjustment switch to adjust the damper.

6.03.05 National 2000 Series Seat

Seat Slide Adjustment

Move the seat slide lever (see Fig.118,[National 2000 Series Seat](#)) to the left and hold it there to slide the seat forward or backward to the desired position. Move the lever back to its original position to lock the seat in place.



Isolator

To use the isolator feature, turn the isolator handle to the horizontal position. Turn the isolator handle down to lock out the isolator.

Lumbar Support

To adjust the lumbar support, use the lumbar support switch on the side of the seat to give more or less support to your lower back.

Backrest Tilt

To tilt the backrest, turn the backrest tilt knob until the desired position is reached.

Seat Cushion Adjustment

To adjust the height of the front of the seat cushion, lift the front cushion height adjustment handle, and pull forward or push back to the desired setting.

To adjust the height of the rear of the seat cushion, remove your weight from the seat and turn the rear cushion adjustment knob to one of three positions.

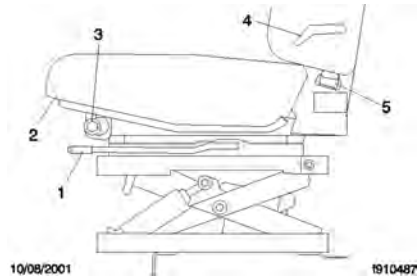
Ride Height and Damper Adjustment

To raise or lower the height of the seat, use the height adjustment switch on the side of the seat.

6.03.06 Sears Seat

Seat Slide Adjustment

Push the seat slide (fore-and-aft adjustment) lever (see Fig. 119, [Sears Low Profile Seat](#)) all the way to the left and slide the seat forward or backward, as desired. Release the lever to lock the seat in the desired position.



- | | |
|---------------------------------|-------------------------|
| 1. Seat Slide Lever | 4. Lumbar Support Lever |
| 2. Seat Cushion Tilt Adjustment | 5. Backrest Lever |
| 3. Ride Height Knob | |

Fig 119, Sears Low Profile Seat

Isolator

To engage the isolator (if installed), move the seat slide and isolator lever (see Fig. 120, [Sears Fleetmaster Seat \(with isolator\)](#)) all the way to the right. To lock out the isolator, move the isolator lever to the center position.



NOTE: Armrests are optional.

- | | |
|---|----------------------------------|
| 1. Lumbar Support Lever | 5. Pin (ride firmness) |
| 2. Backrest Lever | 6. Snap Ring (ride firmness) |
| 3. Ride Height Knob | 7. Seat Slide and Isolator Lever |
| 4. Shock Absorber Bracket (ride firmness) | 8. Seat Cushion Adjustment |

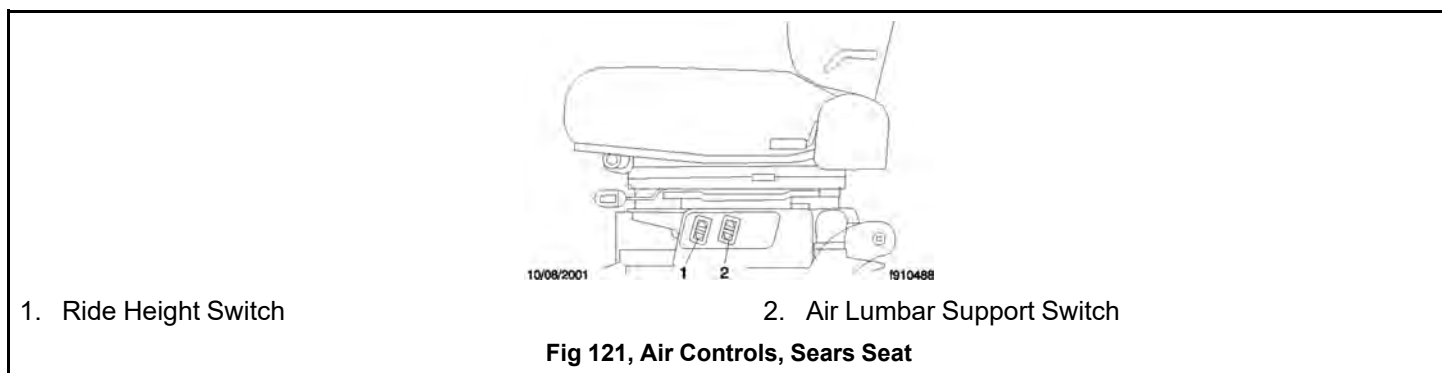
Fig 120, Sears Fleetmaster Seat (with isolator)

Lumbar Support

Move the three-position lumbar support lever upward to increase lumbar support (firmer). Move the lever downward to decrease lumbar support (less firm).

NOTE: This three-position lever (see inset) does not rotate a full 360 degrees.

For seats with air support, use the aft rocker switch on the control panel on the left-hand side of the seat (see Fig. 121, [Air Controls, Sears Seat](#)). Press up to make the seat firmer; press down to make the seat less firm.



Seat Cushion Tilt

To raise the seat cushion, lift upward on the front of the seat cushion, and then push it rearwards. To lower the seat cushion, pull forward on the front of the seat cushion, and then push downwards.

Backrest Adjustment

To adjust the backrest, push downwards on the backrest lever just below the bottom of the backrest cushion. With the lever down, lean forward or backward to the desired position. Release the lever to lock the backrest in place.

Ride Height Adjustment

Push the ride height knob inwards to inflate the air cylinder, raising the height of the seat. Pull the ride height knob outwards to deflate the air cylinder, lowering the height of the seat.

For seats with air support, use the forward rocker switch on the control panel on the left-hand side of the seat (see Fig. 121, [Air Controls, Sears Seat](#)). Press up to raise the seat; press down to lower the seat.

Ride Firmness Adjustment

For a softer ride, remove the snap ring and pin from the shock absorber bracket (see inset). Relocate the pin in the other set of holes in the bracket and secure it with the snap ring.

6.04 Seat Belts and Tether Belts

6.04.01 General Information

Seat belt assemblies are designed to secure persons in the vehicle to help reduce the chance of injury or the amount of injury resulting from accidents or sudden stops. For this reason, Daimler Truck North America LLC urges that the driver and *all* passengers, regardless of age or physical condition, use seat belts when riding in the vehicle.

**WARNING:**

Always use the vehicle's seat belt system when operating the vehicle. Failure to do so can result in severe personal injury or death.

Seat belt assemblies in Daimler Truck North America (DTNA) vehicles meet Federal Motor Vehicle Safety Standard 209, "Type 1" and "Type 2" requirements.

When transporting a child, always use a child restraint system or the vehicle seat belts as appropriate. To determine whether a child restraint system is required, review and comply with applicable state and local laws. Any child restraint used must comply with Federal Motor Vehicle Safety Standard 213, "Child Restraint Systems." When providing a child restraint system, always carefully read and follow all instructions pertaining to installation and usage for the child. Make certain the child remains in the restraint system at all times when the vehicle is in motion.

In addition to seat belt assemblies, tether belts are installed on suspension-type seats. Tether belts help secure the seat to the floor and are intended to restrain the seat and seat belt in case of an accident or sudden stop.

IMPORTANT: Seat belts have a finite life which may be much shorter than the life of the vehicle. Regular inspections and replacement as needed are the only assurance of adequate seat belt security over the life of the vehicle.

6.04.02 Seat Belt Inspection

**WARNING:**

Inspect and maintain seat belts. When any part of a seat belt system needs replacement, the entire seat belt must be replaced, both retractor and buckle side. Any time a vehicle is involved in an accident, and the seat belt system was in use, the entire vehicle seat belt system must be replaced before operating the vehicle. Do not attempt to modify the seat belt system; doing so could change the effectiveness of the system. Failure to replace worn or damaged seat belts, or making any modifications to the system, may result in personal injury or death.

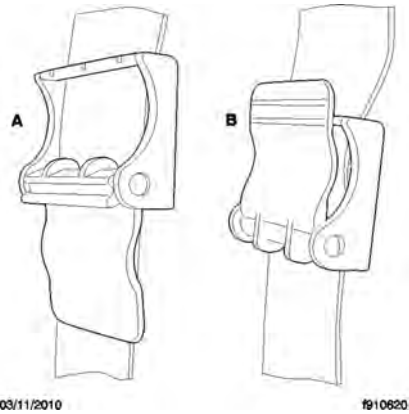
Inspect the seat belts and tether belts (if so equipped).

1. Check the web for fraying, cuts, extreme dirt and dust, or for severe fading from exposure to sunlight, especially near the buckle latch plate and in the D-loop guide area.
2. Check operation of the buckle, latch, comfort clip or Sliding Komfort Latch (if equipped), web retractor, and upper seat belt mount on the door pillar. Check all visible components for wear or damage.
3. Check the seat belt and tether belt connection points and tighten any that are loose.

6.04.03 Seat Belt Operation

Three-Point Seat Belt With Comfort Clip or Sliding Komfort Latch

When engaged and used properly, the comfort clip, (Fig.122,[Comfort Clip](#)) and the Sliding Komfort Latch Fig. 123,[Sliding Komfort Latch](#) introduce a small amount of slack into the seat belt, resulting in a more comfortable ride.

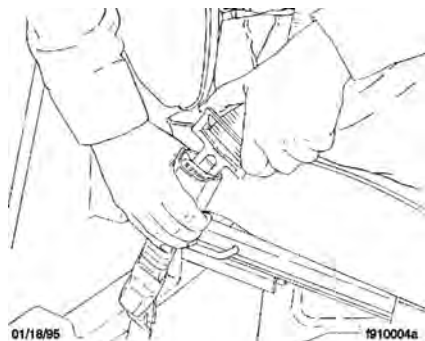


A. Disengaged

B. Engaged

Fig 122, Comfort Clip**Fig 123, Sliding Komfort Latch**

1. Slowly pull the latch end of the three-point seat belt out of the retractor and pull it across your lap (from outboard to inboard) far enough to engage the buckle. If the retractor locks too soon, allow the belt to retract slightly, then slowly pull it out again.
2. Fasten the three-point seat belt by pushing the latch into the buckle. Listen for an audible click. See Fig. 124, [Fastening the Three-Point Belt](#).

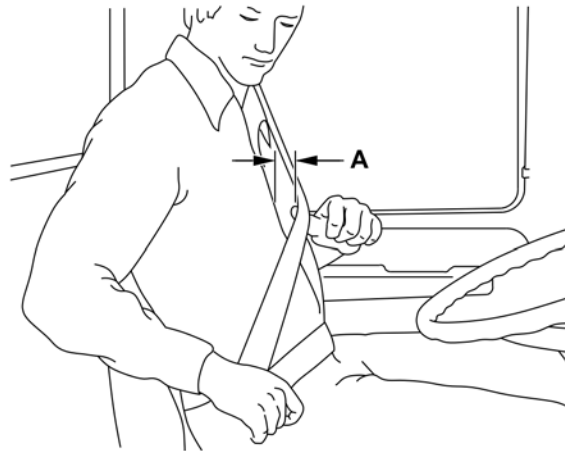
**Fig 124, Fastening the Three-Point Belt**

3. Tug on the seat belt to make sure it is securely fastened. If the buckle unlatches, repeat this step. If the problem continues, replace the three-point seat belt.
4. Snug the seat belt to your waist.
5. Position the shoulder strap diagonally across your chest with the adjustable D-loop bracket (if equipped). If desired, engage the comfort clip or Sliding Komfort Latch as follows.

If equipped with a comfort clip, pull on the shoulder strap to lessen the pressure of the strap on your shoulder and chest. Allow no more than 1 inch (2.5 cm) of slack between your chest and the shoulder harness. More slack can significantly reduce the seat belt effectiveness in an accident or a sudden stop. While holding the belt slack, press the comfort clip lever up, clamping the seat belt webbing as shown in Fig.

125, [Adjusting Shoulder Harness Clearance, Comfort Clip](#) and Fig. 126, [Locking the Comfort Clip](#).

If equipped with a Sliding Komfort Latch, make sure that the shoulder strap is snug against your chest. Without loosening the shoulder strap, push the Sliding Komfort Latch switch to the "ON" position. See Fig. 123, [Sliding Komfort Latch](#). To activate the latch lean forward until you hear a click. This allows for approximately 1 inch (2.5 cm) of slack between your chest and the shoulder harness. Once engaged, the latch allows you to lean forward about 5 inches (13 cm) without having to reset the latch. Leaning forward more than 5 inches (13 cm) disengages the Sliding Komfort Latch, requiring it to be reset.



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A. 1 Inch (2.5 cm) Maximum

Fig 125, Adjusting Shoulder Harness Clearance, Comfort Clip

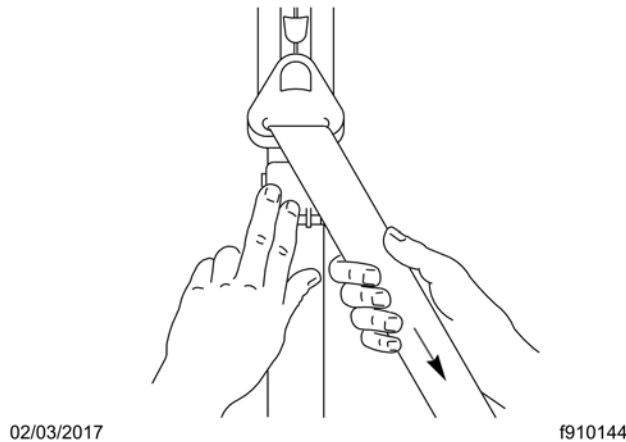


Fig 126, Locking the Comfort Clip

NOTE: Neither the comfort clip nor the Sliding Komfort Latch need to be manually released in an emergency situation. Each releases by itself under rough road or other abnormal conditions. Make sure the three-point seat belt is completely retracted when it is not in use.

6. Unbuckle the three-point seat belt and release the comfort clip or the Sliding Komfort Latch as follows.

If equipped with a comfort clip, unbuckle the seat belt, then release the comfort clip by giving the shoulder belt a quick tug. If you lean forward against the shoulder belt, the comfort clip automatically releases, and needs to be reset.

If equipped with a Sliding Komfort Latch, unbuckle the seat belt, then tug on the shoulder belt to release the Sliding Komfort Latch, or press the Sliding Komfort latch to the "OFF" position, then unbuckle the seat belt.

6.05 Cab Amenities

6.05.01 Cup Holders

There are two cup holders molded into the lower part of the auxiliary dash panel, one on either side of the HVAC control head.

6.05.02 Cab Storage

There are storage bins in the dash and the overhead console. On vehicles with optional individual driver's and passenger seats, there is a center storage console between the seats.

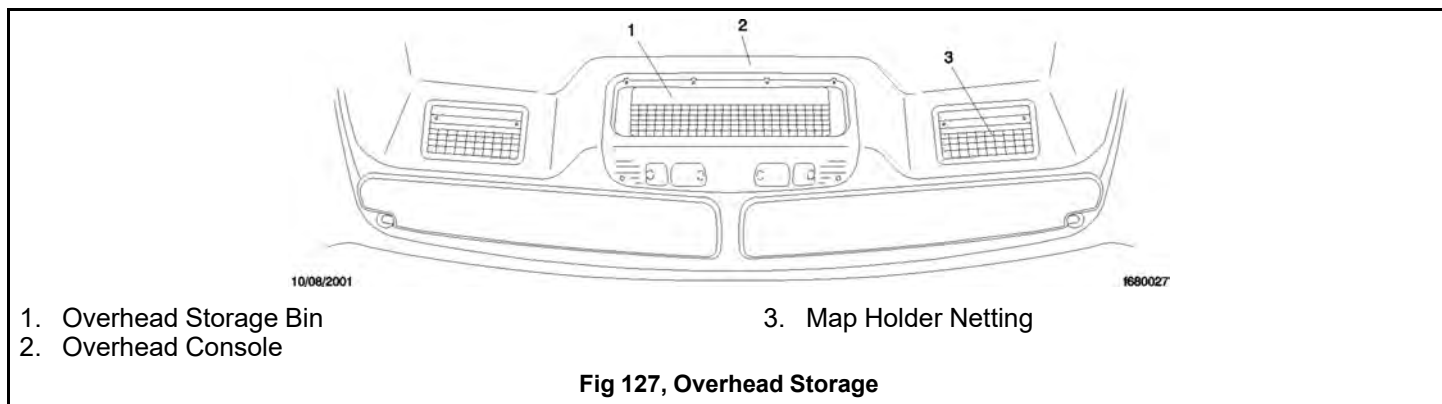
There is a dash storage bin located under the cup holders on the center panel. The bin has a hinged cover and can be used to store sunglasses. There is also a small storage pocket above the radio.

Overhead Storage

Vehicles without an overhead console have two storage bins located above the windshield.

On vehicles equipped with an overhead console, most vehicles have a storage bin located in the overhead console. See Fig.127, [Overhead Storage](#). The overhead storage bin is often removed and replaced with a CB radio.

Two map holders with netted openings are located overhead, one on either side of the overhead console.

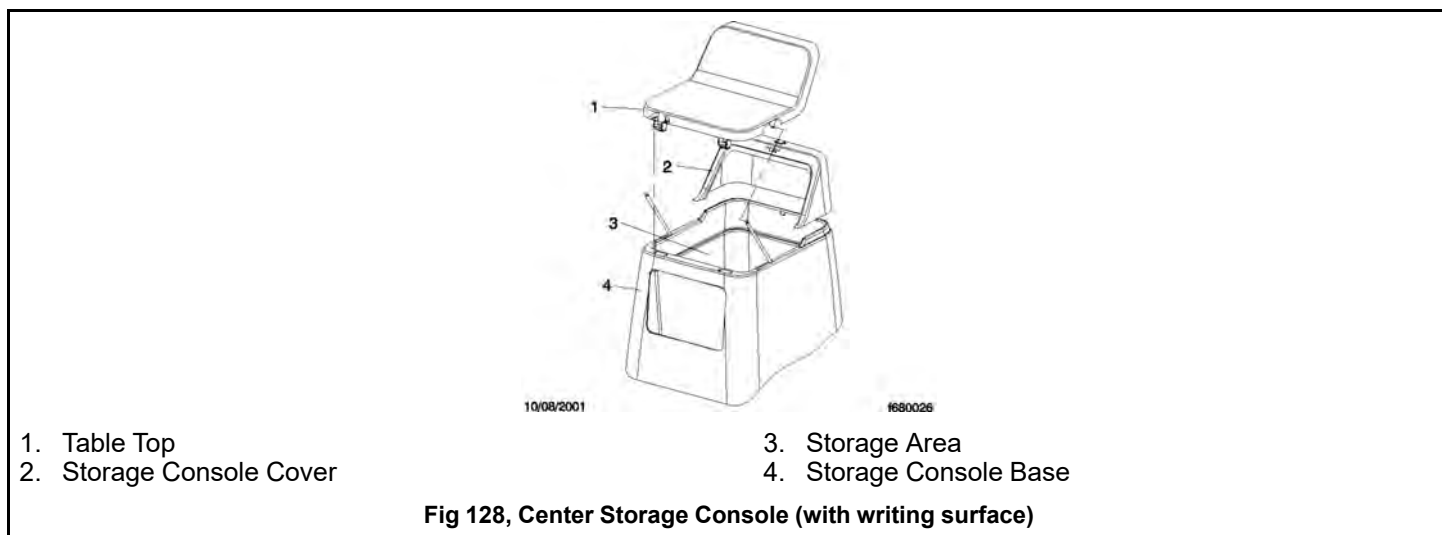


Center Storage Console (optional)

On vehicles with individual driver's and passenger's seats, a center storage console can be installed between the seats.

The center storage console has a table top that can be lifted up to deploy a writing surface. See Fig. 128, [Center Storage Console \(with writing surface\)](#).

In another version, the center storage console has a printer top with a paper slot in it. See Fig. 129, [Center Storage Console \(printer option\)](#).





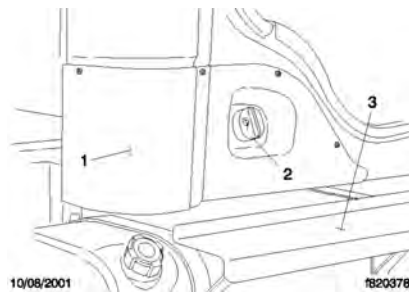
1. Printer Top
2. Printer/Paper Area

3. Storage Console Base

Fig 129, Center Storage Console (printer option)

6.06 Windshield Washer Reservoir

The standard location for the windshield washer reservoir is on the right-hand side of the cab underneath the door, just above the trailing edge of the top cab step. See Fig.130, [Windshield Washer Reservoir](#).



1. Cab
2. Washer Reservoir Fill Cap

3. Top Step

Fig 130, Windshield Washer Reservoir

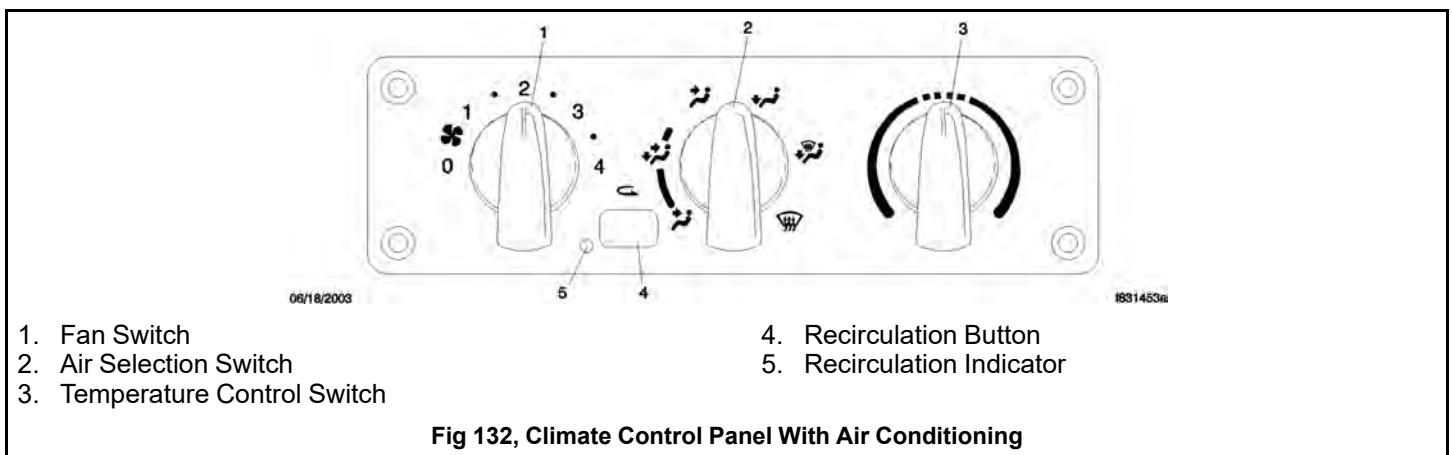
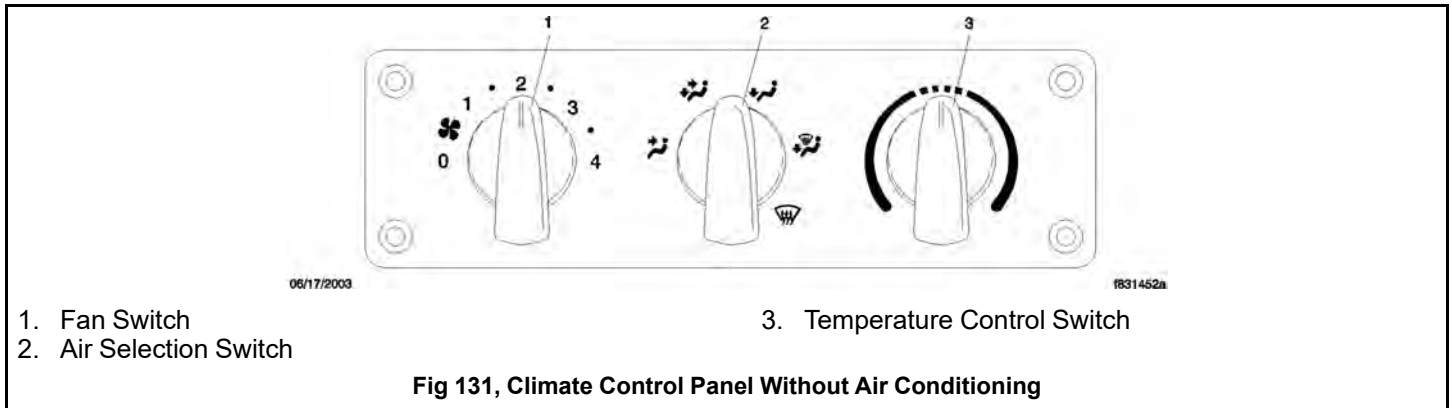
7.01 Climate Control Panel.....	112
7.01.01 General Information	112
7.01.02 Fan Switch	112
7.01.03 Air Selection Switch	112
7.01.04 Temperature Control Switch.....	114
7.01.05 Fresh Air Mode	114
7.01.06 Recirculation Mode	114
7.01.07 Defrosting	115
7.01.08 Air Conditioning, Optional	115
7.01.09 Accessory Heaters.....	115

7. Heater, Ventilator and Air Conditioner

7.01 Climate Control Panel

7.01.01 General Information

The climate control panel allows you to control the heating, ventilating, defrosting, and air conditioning functions. The climate control panel without air conditioning is shown in Fig.131, [Climate Control Panel Without Air Conditioning](#). The climate control panel with air conditioning is shown in Fig.132, [Climate Control Panel With Air Conditioning](#).



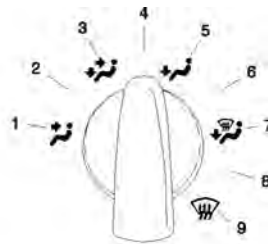
7.01.02 Fan Switch

The fan switch controls the fan speed and forces fresh or recirculated air through the air outlets. The fan switch has eight fan speeds and an off position.

To increase airflow, turn the fan switch to the right or to a higher number. To decrease the airflow, turn the switch to the left or to a lower number.

7.01.03 Air Selection Switch

The air selection switch allows you to control the flow of air through the face outlets, the floor outlets, the defrost (windshield) outlets, or a combination of these outlets to give you nine air selection modes on a system without air conditioning. See Fig. 133, [Air Selection Switch Without Air Conditioning](#). A system with air conditioning has 11 air selection modes, four of which are air conditioning modes. See Fig.134, [Air Selection Switch With Air Conditioning](#).



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- | | |
|---|--|
| 1. Face Mode | 6. Selection Between Floor Mode and Floor/Defrost Mode |
| 2. Selection Between Face Mode and Bi-Level Mode | 7. Floor/Defrost Mode |
| 3. Bi-Level Mode | 8. Selection Between Floor/Defrost Mode and Defrost Mode |
| 4. Selection Between Bi-Level Mode and Floor Mode | 9. Defrost Mode |
| 5. Floor Mode | |

Fig 133, Air Selection Switch Without Air Conditioning



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- | | |
|--|---|
| A. Air Conditioning Modes | 6. Selection Between Face Mode and Floor Mode |
| 1. Air Conditioning Face Mode | 7. Floor Mode |
| 2. Selection Between Air Conditioning Face Mode and Air Conditioning Bi-Level Mode | 8. Selection between Floor Mode and Floor/Defrost Mode |
| 3. Air Conditioning Bi-Level Mode | 9. Floor/Defrost Mode |
| 4. Selection Between Air Conditioning Bi-Level Mode and Face Mode | 10. Selection between Floor/Defrost Mode and Defrost Mode |
| 5. Face Mode | 11. Defrost Mode |

Fig 134, Air Selection Switch With Air Conditioning

Air Selection Switch Without Air Conditioning

1. **Face Mode:** Directs all airflow through the face or instrument panel outlets.
2. **Selection between Face Mode and Bi-Level Mode:** Directs 75 percent of the airflow through the face outlets and 25 percent through the floor outlets.
3. **Bi-Level Mode:** Directs the airflow equally to the face outlets and the floor outlets.
4. **Selection between Bi-Level Mode and Floor Mode:** Directs 25 percent of the airflow through the face outlets and 75 percent through the floor outlets.
5. **Floor Mode:** Directs all airflow through the floor outlets.
6. **Selection between Floor Mode and Floor/Defrost Mode:** Directs 75 percent of the airflow through the floor outlets and 25 percent through the defrost outlets.
7. **Floor/Defrost Mode:** Directs the airflow equally to the floor outlets and the defrost outlets.
8. **Selection between Floor/Defrost Mode and Defrost Mode:** Directs 75 percent of the airflow through the defrost outlets and 25 percent through the floor outlets.
9. **Defrost Mode:** Directs all airflow through the defrost outlets.

Air Selection Switch With Air Conditioning

1. **Air Conditioning Face Mode:** Directs all airflow through the face or instrument panel outlets.
2. **Selection between the Air Conditioning Face Mode and the Air Conditioning Bi-Level Mode:** Directs 75 percent of the airflow to the face outlets and 25 percent to the floor outlets.
3. **Air Conditioning Bi-Level Mode:** Directs the airflow equally to the face outlets and the floor outlets.
4. **Selection between the Air Conditioning Bi-Level Mode and the Face Mode:** Directs 25 percent of the airflow to the face outlets and 75 percent to the floor outlets.
5. **Face Mode:** Directs all airflow through the face outlets.
6. **Selection between Face Mode and Floor Mode:** Directs the airflow equally through the face outlets and the floor outlets.
7. **Floor Mode:** Directs all airflow through the floor outlets.
8. **Selection between Floor Mode and Floor/Defrost Mode:** Directs 75 percent of the airflow through the floor outlets and 25 percent through the defrost outlets.
9. **Floor/Defrost Mode:** Directs the airflow equally to the floor outlets and the defrost outlets. The recirculation button will not work in this mode.
10. **Selection between Floor/Defrost Mode and Defrost Mode:** Directs 75 percent of the airflow through the defrost outlets and 25 percent through the floor outlets. The recirculation button will not work in this mode.
11. **Defrost Mode:** Directs all airflow through the defrost outlets. The recirculation button will not work in this mode.

7.01.04 Temperature Control Switch

The temperature control switch is used to select the desired temperature. Turn the switch to the left (counterclockwise) for cool air, or to the right (clockwise) for hot air. There are 21 positions on the temperature control switch ranging from full cool air to full hot air.

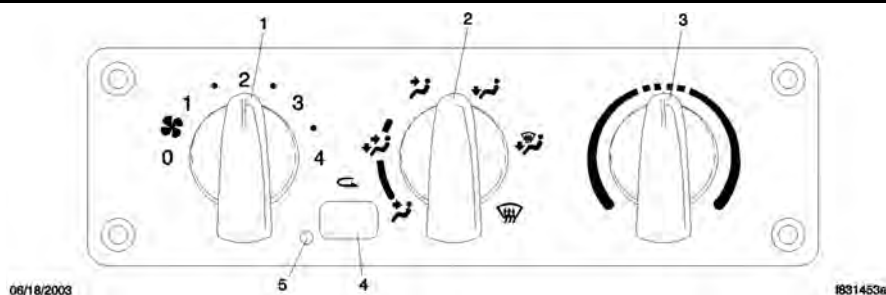
7.01.05 Fresh Air Mode

Fresh air, or outside air, is circulated through the heating and air conditioning system unless the recirculation mode, if equipped, is turned on.

7.01.06 Recirculation Mode

The recirculation mode is only available on vehicles with air conditioning.

The recirculation mode limits the amount of outside air entering the cab. Press the recirculation button to prevent dusty or smoky air from entering the cab. The recirculation mode can also be used to decrease the time required to cool or heat the cab interior during extreme outside temperature conditions. When the recirculation mode is on, the recirculation indicator will be on. See Fig.135, [Climate Control Panel With Air Conditioning](#).



- | | |
|-------------------------------|----------------------------|
| 1. Fan Switch | 4. Recirculation Button |
| 2. Air Selection Switch | 5. Recirculation Indicator |
| 3. Temperature Control Switch | |

Fig 135, Climate Control Panel With Air Conditioning

The recirculation mode is not available when the air selection switch is in one of the following modes:

- floor/defrost mode
- selection between floor/defrost mode and defrost mode
- defrost mode

When the recirculation mode is turned on, it will stay on for 20 minutes, or until the recirculation button is pressed again, or the air selection switch is turned to a defrost mode.

IMPORTANT: On vehicles built before May 2, 2003, the recirculation mode turns off after twenty minutes and can be turned back on when the recirculation button is pressed again. On vehicles built from May 2, 2003, the system enters a partial recirculation mode for five minutes after being in full recirculation mode for 20 minutes. This cycle repeats as long as the system is in recirculation mode.

NOTE: To prevent the buildup of fumes or odors inside the cab on a vehicle built before May 2, 2003, do not use the recirculation mode for more than 20 minutes. It is recommended that the recirculation mode remains off for five minutes before it is turned back on.

7.01.07 Defrosting

Before using any of the defrost modes, clear the screen at the base of the windshield if snow or ice is present.

7.01.08 Air Conditioning, Optional

There are four air conditioning modes on the air selection switch. The air conditioning settings on the air selection switch are blue, in addition to the selection between the air conditioning bi-level mode and the face mode.

IMPORTANT: Operate the air conditioner at least five minutes each month, even during cool weather. This helps prevent drying and cracking of the refrigerant compressor seals and reduces the chance of refrigerant leaks in the system.

NOTE: The heating and air conditioning system has a brushless blower motor with a protection or shutdown mode to prevent damage due to overheating and overcurrent conditions. If the brushless blower motor goes into a protection mode, the motor will operate at a slower speed. If the overheating or overcurrent condition continues, the motor will shut down and stop completely.

The motor will resume proper operation after the motor has cooled or the overcurrent condition has been resolved. It will be necessary to cycle the fan switch off, and then on, to reset the motor. If the problem appears repeatedly, take the vehicle to an Freightliner dealer or authorized service outlet for repairs.

7.01.09 Accessory Heaters

Optional accessory heaters are available from the factory in several configurations. Familiarize yourself with the equipment on your specific vehicle, and follow the manufacturer's operating and maintenance instructions.

**WARNING:**

Do not operate fuel-operated heaters in an area where flammable vapors, including gasoline or diesel fumes, are present, such as at filling stations and tank farms. Turn off a fuel-operated heater and allow it shut down completely before entering an area where flammable gases or liquids are present. Heaters continue to operate for up to three minutes after being turned off.

Failure to observe these precautions could cause an explosion or fire, resulting in serious property damage, and personal injury or death.

8.01 General Information.....	119
8.02 Greenhouse Gas Emissions and Fuel Consumption Standards	119
8.03 Regeneration	120
8.04 Regen Switches	121
8.05 ATS Warning Lamps.....	122
8.06 Maintenance	124
8.07 Diesel Exhaust Fluid and Tank, EPA10 and Newer Engines.....	125
8.07.01 Diesel Exhaust Fluid	125
8.07.02 DEF Tank	125
8.07.03 Fuel/DEF Gauge.....	126
8.07.04 DEF Warnings and Engine Limits	126
8.08 Engine Starting	128
8.09 Cold-Weather Starting	130
8.10 Starting After Extended Shutdown or Oil Change.....	130
8.11 Engine Break-In	131
8.12 Engine Operation	131
8.12.01 Safety and Environmental Considerations.....	131
8.12.02 Normal Operation	132
8.13 Cold-Weather Operation	132
8.14 High-Altitude Operation	133
8.15 Engine Shutdown Procedure.....	133
8.15.01 Engine Protection—Warning and Shutdown.....	134
8.16 Cruise Control.....	136
8.16.01 Dash-Mounted Switches.....	136
8.16.02 Shift Knob Controls, Optional	138
8.17 Power Takeoff (PTO) Governor	138
8.18 Engine Braking	139
8.18.01 Engine Brake Operation	140
8.19 Exhaust Braking Systems	141
8.19.01 Exhaust Brake Switch	141
8.19.02 Mercedes-Benz Exhaust Brake.....	142

8.19.03 Pacbrake® Exhaust Brake..... 143

8.19.04 Pacbrake Operation (Caterpillar)..... 143

8.19.05 Allison World Transmission..... 144

8. Engines

8.01 General Information

IMPORTANT: Depending upon local jurisdictional emissions guidelines, vehicles that are domiciled outside of the U.S. and Canada may not have engines and/or emissions aftertreatment systems that are compliant with current emissions regulations.



NOTICE:

Follow these guidelines for engines that comply with EPA07 or newer regulations, or damage may occur to the after-treatment device (ATD) and the warranty may be compromised.

- Use ultralow-sulfur diesel with 15 ppm sulfur content or less.
- Do not use fuel blended with used engine lube oil or kerosene.
- Use only approved engine lube oil. For lists of engine oils approved for Detroit Diesel engines, refer to the Engine Operator Manual, accessible on Lubricants, Fuels & Coolants on the DTNA Portal. For third party engines, please refer to the engine manual.

IMPORTANT: Using non-specification fuels or oils can lead to shortened diesel particulate filter (DPF) cleaning or replacement intervals.

IMPORTANT: See the engine manufacturer's operation manual for complete details and operation of the ATS.

8.02 Greenhouse Gas Emissions and Fuel Consumption Standards

Model year 2007 and later vehicles and/or engines domiciled in the U.S. or Canada are designed to meet Emission and Fuel Efficiency Standards of the U.S. (Federal) Environmental Protection Agency (EPA), the National Highway Traffic Safety Administration (NHTSA), Emission Regulations under the Canada Motor Vehicle Safety Act in Canada, and the California Air Resources Board (CARB) effective as per the applicable emission model year. To determine an engine's or vehicle's emission model year, refer to the respective EPA/CARB certification label.

EPA Regulations	
Regulation	Emissions Components
EPA07 (Reduction of nitrogen oxides (NOx) emissions to 1.1 g/ bhp-hr, and particulate matter emissions to 0.01 g/bhp-hr)	Aftertreatment device (ATD) containing a diesel particulate filter that traps soot and ash.*
EPA10 (Reduction of NOx emissions to 0.2 g/bhp-hr)	EPA07-type ATD, with additional selective catalyst reduction (SCR) technology that utilizes diesel exhaust fluid (DEF) to convert NOx to nitrogen and water vapor.
GHG14 (Reduction of greenhouse gas emissions)	Fuel efficiency components including, but not limited to, engines, tires, aerodynamic components, vehicle speed limiters, and idle reduction timers specifically designed to meet regulatory fuel efficiency and greenhouse gas emissions standards.

Table 9, EPA Regulations

GHG17	Fuel efficiency components including, but not limited to, engines, tires, aerodynamic components, vehicle speed limiters, and idle reduction timers specifically designed to meet regulatory fuel efficiency and greenhouse gas emissions standards.
GHG21	GHG14/17 components plus additional components including, but not limited to, transmissions, axles, predictive technologies, idle reduction technologies for vocational vehicles, tire pressure monitoring systems.

* Cummins and Detroit ATD's are also equipped with a diesel oxidation catalyst to break down pollutants.

Emission Regulations by Model Year		
Model Year	Engine Regulation	GHG Regulation
2007–2009	EPA07	N/A
2010–2012	EPA10	N/A
2013–2015	EPA10, GHG14	GHG14
2016	EPA10, GHG17	GHG14
2017–2020	EPA10, GHG17	GHG17
2021–and later	EPA10, GHG21	GHG21

8.03 Regeneration

The harder an engine works, the better it disposes of soot. If the exhaust temperature is high enough, a process called **passive regeneration** (regen) occurs as the vehicle is driven normally. However, if the engine isn't running hot enough, the electronic controls may initiate an **active regen**, whereby extra fuel is injected into the exhaust stream to superheat and reduce the soot trapped in the DPF to ash. Active regen happens only when the vehicle is moving above a certain speed, determined by the engine manufacturer. See your engine operation manual for complete details. Both active and passive regen happen automatically, without driver input.



WARNING:

Active regeneration can occur automatically anytime the vehicle is moving. The exhaust gas temperature could reach 1500°F (800°C), which is hot enough to cause a fire, heat damage to objects or materials, or personal injury to persons near the exhaust outlet. The exhaust temperature can remain high even after the vehicle has stopped. When stopping the vehicle shortly after an automatic regen, ensure the exhaust outlets are directed away from structures, vegetation, flammable materials, and anything else that may be harmed by exposure to high heat.

See Regen Switches , below, for instructions on preventing automatic regen if necessary.

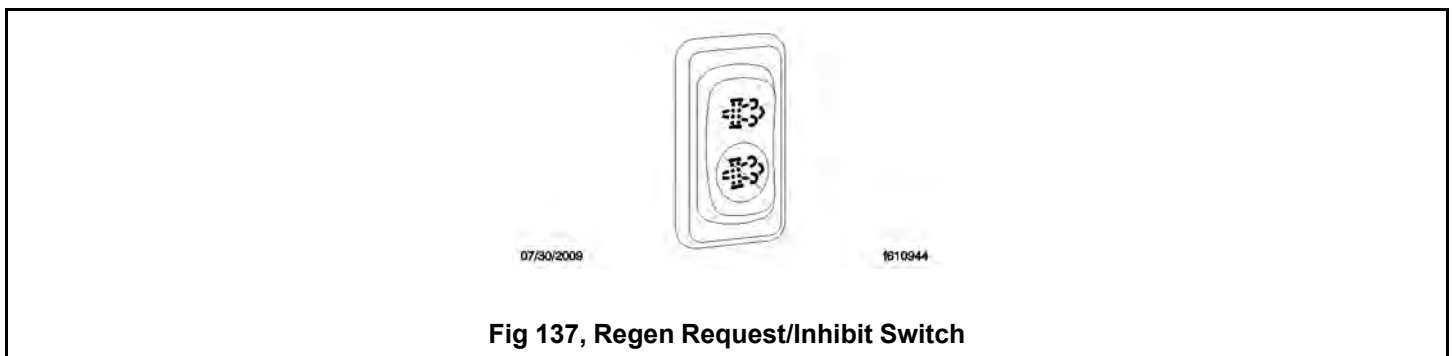
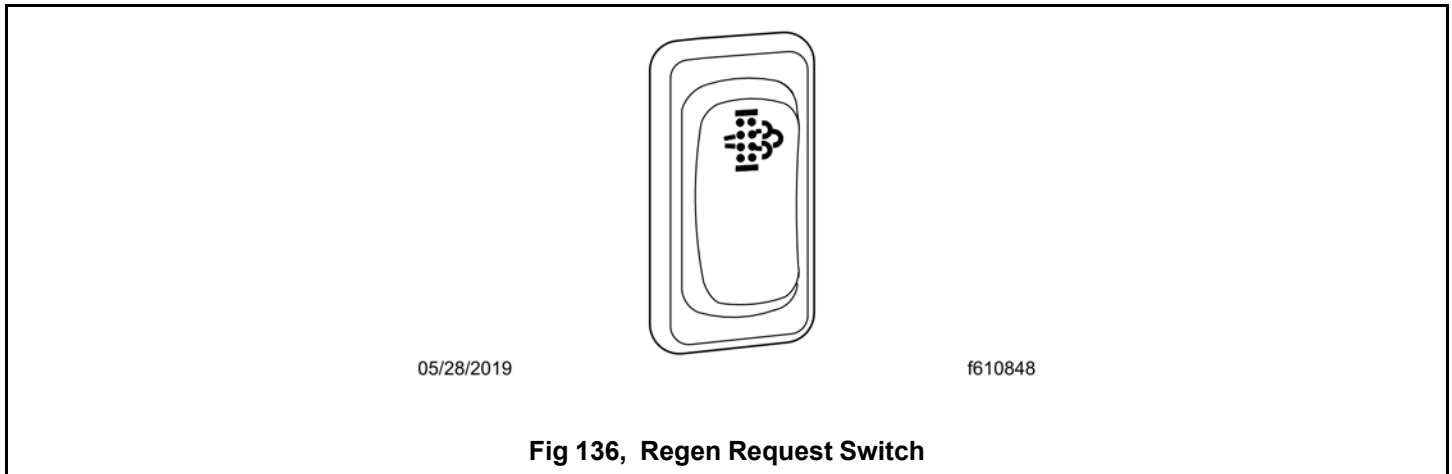
When operating conditions do not allow for ATD filter cleaning by active or passive regen, the vehicle may require a driver-activated **parked regen**. When this occurs, the DPF lamp illuminates, indicating that a regen is required. The driver must either bring the vehicle up to highway speed to increase the load (thus starting an active regen), or park the vehicle and initiate a parked regen. See *Regen Switches* , below, for instructions on initiating a parked regen.

8.04 Regen Switches

The regen request switch, located on the dash, is used to initiate a parked regen. See Fig. 136, [Regen Request Switch](#). The function of the switch varies by the engine make and model in the vehicle. See the engine operation manual for switch operation details.

Some vehicles may be equipped with a regen request/inhibit switch. See Fig. 137, [Regen Request/Inhibit Switch](#). To stop a regen in progress or prevent the start of a regen, press the lower half of the switch. Regen is then delayed until the switch is no longer active.

NOTE: The regen switch can initiate a parked regen only when the DPF lamp is illuminated.

**WARNING:**

During parked regen, exhaust temperatures are very high and could cause a fire, heat damage to objects or materials, or personal injury to persons near the exhaust outlet.

Before initiating a parked regeneration, make certain the exhaust outlets are directed away from structures, vegetation, flammable materials, and anything else that may be harmed by prolonged exposure to high heat.

To initiate a parked regen, perform the following steps.

1. Park the vehicle away from all flammable materials, set the parking brake, and put the transmission in neutral.
2. Start and warm the engine until the coolant temperature is at least 150°F (66°C).
3. Lift the regen request switch guard and press and hold the yellow button for five seconds. As the regen process is initiated, engine rpm increases and the HEST lamp illuminates to indicate extremely high exhaust temperatures.

IMPORTANT: The driver is responsible for ensuring, during the entire regen cycle, that anything that could be injured or damaged by exposure to high heat does not come in contact with the exhaust gases flowing from the outlets.

4. The regen cycle will finish after 20 to 60 minutes, at which time engine idle speed drops to normal and the vehicle can be driven normally. The HEST lamp is extinguished when vehicle speed exceeds 5 mph (8 km/h) or the system has cooled to normal operating temperature.
5. To stop a parked regen at any time during the process:
 - depress the clutch pedal, brake pedal, or accelerator pedal;
 - press and hold the regen inhibit switch until idle returns to normal;
 - shut down the engine.

8.05 ATS Warning Lamps

There are three warning lamps that alert the driver of the need to perform a regen, high exhaust temperature, or a need to refill the diesel exhaust (DEF) fluid tank. A label attached to the driver's sun visor explains these indicators. See Fig. 138, [ATS Indicators, EPA10 and Newer](#).

See Fig. 139, [ATS Warning Lamps](#), for an explanation of common ATS warnings and actions required to avoid engine protection sequences.

Malfunction Indicator Lamp (MIL)

A steadily illuminated yellow malfunction indicator lamp (MIL) indicates an engine fault that affects emissions. See Fig. 140, [Malfunction Indicator Lamp \(MIL\)](#).

DPF Status Lamp

When soot accumulates in the DPF and the DPF status lamp illuminates, see Fig. 141, [DPF Status Lamp](#), perform a parked regen or bring the vehicle up to highway speed to increase the load (thus starting an active regen).

IMPORTANT	
DPF Regen Needed 	• Diesel Particulate Filter (DPF) regeneration is needed. • If flashing, regenerate as soon as possible. Engine derate possible.
Hot Exhaust 	• Hot exhaust can cause fire. • Keep flammables and people away from exhaust.
DEF Refill Needed 	• Diesel Exhaust Fluid (DEF) level is low. Engine derate likely. • Refill tank with certified DEF.
See operator's manual or glove compartment card for complete instructions.	

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Fig 138, ATS Indicators, EPA10 and Newer

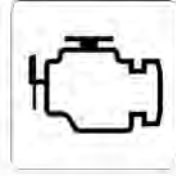
EXHAUST AFTERTREATMENT SYSTEM INFORMATION				
INDICATOR LAMP(S)	 Level 1	 Level 2	 Level 3	 Level 4
Indicator Lamp Message(s)	Filter Regeneration Recommended	Filter Regeneration Necessary	Parked Regeneration Required - Engine Derate	Parked Regeneration Required - Engine Shut Down
Diesel Particulate Filter Condition	Filter is reaching capacity.	Filter is now reaching maximum capacity.	Filter has reached maximum capacity.	Filter has exceeded maximum capacity.
Required Action	Bring vehicle to highway speeds to allow for an Automatic Regeneration or perform a Parked Regeneration.	To avoid engine derate bring vehicle to highway speeds to allow for an Automatic Regeneration or perform a Parked Regeneration as soon as possible.	Vehicle must be parked and a Parked Regeneration must be performed - engine will begin derate.	Vehicle must be parked and a Parked Regeneration or Service Regeneration must be performed. Check engine operator's manual for details - engine will shut down.
For a driver performed Parked Regeneration, vehicle must be equipped with a dash mounted Regeneration Switch.				
See Engine Operator's Manual for complete Regeneration Instructions.				

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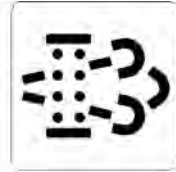
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Fig 139, ATS Warning Lamps



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Fig 140, Malfunction Indicator Lamp (MIL)

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Fig 141, DPF Status Lamp

If the DPF status lamp blinks while the CHECK engine lamp is illuminated, initiate a parked regen immediately in order to prevent an engine derate.

If the red STOP engine lamp illuminates with the blinking DPF lamp and the CHECK engine lamp, begin a parked regen in order to prevent an engine shutdown. Park the vehicle and perform a parked regen.

High Exhaust System Temperature (HEST) Lamp

Slow (10-second) flashing of the high exhaust system temperature (HEST) lamp indicates that a parked regen is in progress, and the engine's high idle speed is being controlled by the engine software, not the vehicle driver.

Steady illumination of the HEST lamp alerts the driver of high exhaust temperature during the regen process if the vehicle speed is below 5 mph (8 km/h), or during a parked regen. See Fig. 142, [HEST Lamp](#).



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Fig 142, HEST Lamp

8.06 Maintenance

Authorized service facilities must perform any DPF service. For warranty purposes, maintain a record that includes:

- date of cleaning or replacement;
- vehicle mileage;
- particulate filter part number and serial number.

8.07 Diesel Exhaust Fluid and Tank, EPA10 and Newer Engines

8.07.01 Diesel Exhaust Fluid

Diesel exhaust fluid (DEF) is used in the ATS to lower NOx in the exhaust stream. DEF is colorless and close to odorless (it may have a slightly pungent odor similar to ammonia). It is nontoxic, nonflammable, and biodegradable. It is mildly corrosive to aluminum, but does not affect the strength or structure of the aluminum.

White crystals may be noticeable around components that come into contact with DEF. The crystals are easily removed with water.

DEF consumption varies depending on ambient conditions and vehicle application.

Freezing Conditions

DEF freezes to slush at around 12°F (-11°C). It is not damaged or destroyed if frozen, and is fully usable when thawed. The DEF in the tank is allowed to freeze while a vehicle is non-operational. At start-up, normal operation of the vehicle is not inhibited if the DEF is frozen; an immersion heater with engine coolant flowing through it warms the DEF once the engine is running, allowing the SCR system to operate.

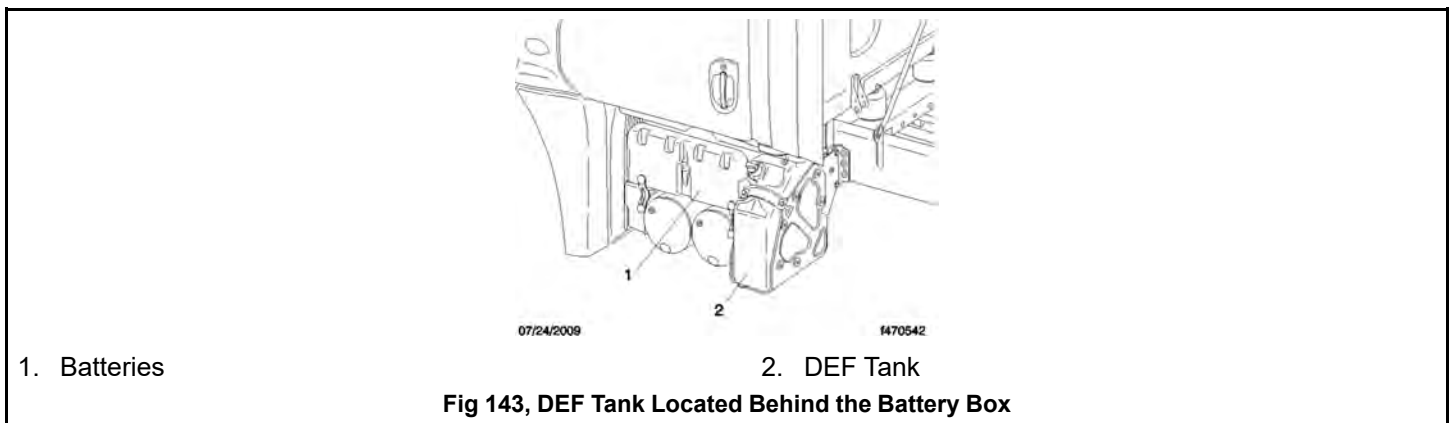
Pre-2013 DEF supply lines are electrically-heated and are purged when the engine is shut down; complete purging of the DEF lines requires approximately five minutes after the engine is shut down.

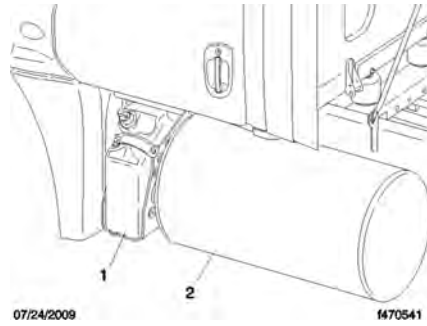
DEF supply lines with engine model year 2013 and newer are designed to survive freezing conditions while containing DEF, so purging is not required.

8.07.02 DEF Tank

Engines that are compliant with EPA10 and newer regulations are equipped with a DEF tank located on the driver's side of the vehicle behind the battery box or forward of the fuel tank. See Fig.

143, [DEF Tank Located Behind the Battery Box](#) and see Fig. 144, [DEF Tank Located Forward of the Fuel Tank](#). The DEF tank has a 19 mm filler neck inlet that prevents the hose from a diesel outlet from being inserted, and has a blue cap for easy identification.





1. DEF Tank

2. Fuel Tank

Fig 144, DEF Tank Located Forward of the Fuel Tank

8.07.03 Fuel/DEF Gauge

The diesel fuel and DEF levels are measured in a dual-purpose gauge. See Fig.145, [Fuel/DEF Gauge](#).

Fuel level is indicated at the top of the gauge. Below the fuel level, a low fuel warning lamp illuminates amber when the fuel level drops below 1/8th of the capacity.



A. Green bars—DEF level indicators

B. One bar illuminated amber—DEF very low, refill DEF

C. One bar flashing red—DEF empty, refill DEF

1. Low Fuel Warning Lamp

2. DEF Warning Lamp

Fig 145, Fuel/DEF Gauge

The lower portion of the gauge has a DEF warning lamp that illuminates amber when the DEF tank is near empty, and a lightbar that indicates the level of DEF in the tank. The DEF light bar illuminates as follows:

- Four bars illuminated green—Between 75% and 100% full
- Three bars illuminated green—Between 50% and 75% full
- Two bars illuminated green—Between 25% and 50% full
- One bar illuminated green—Between approximately 10% and 25% full
- One bar illuminated amber—DEF very low, refill DEF
- One bar flashing red—DEF empty, refill DEF

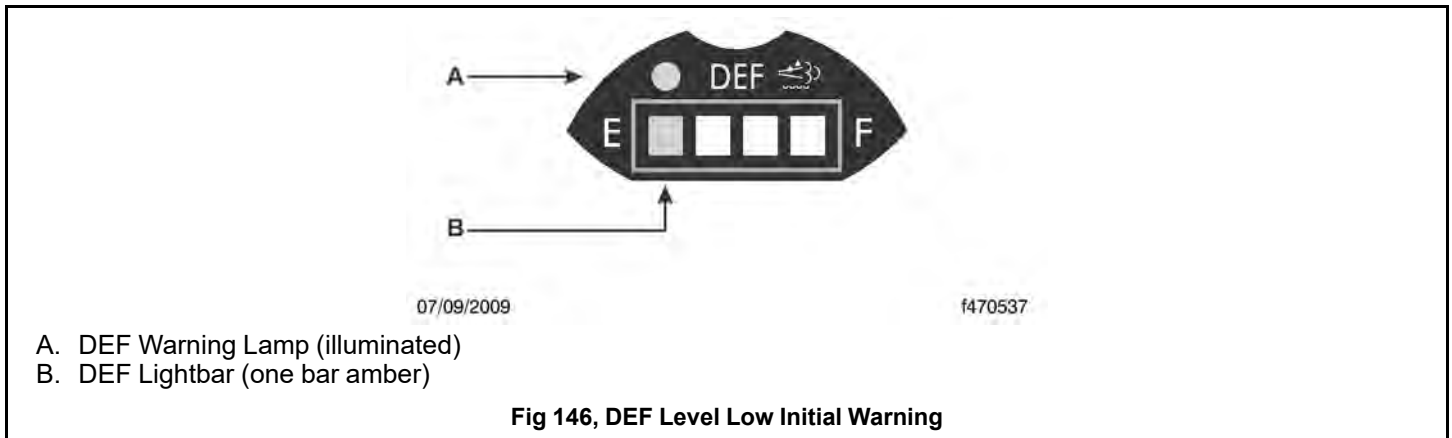
8.07.04 DEF Warnings and Engine Limits

IMPORTANT: Ignoring the DEF warning lights results in limited engine power, with the application of a 5 mph (8 km/h) speed limit after the engine is shut down and started again.

DEF Level Low—Initial Warning

When the DEF level is low, the following lamps notify the driver. See Fig.146, [DEF Level Low Initial Warning](#). Refill the DEF tank in order to cancel the warning sequence.

- One bar of the DEF level indicator illuminates amber—DEF very low, refill DEF
- The DEF warning lamp illuminates solid amber



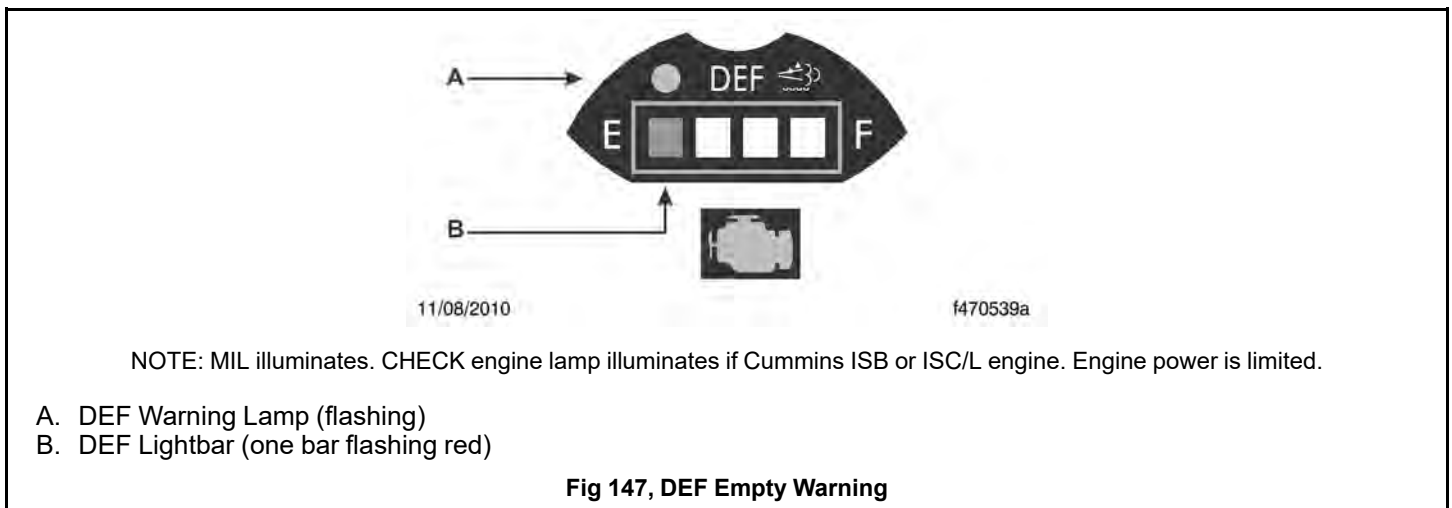
DEF Empty

When the DEF level reads empty, the following lamps notify the drive. See Fig.147, [DEF Empty Warning](#).

- One bar of the DEF level indicator flashes red—DEF empty, refill DEF
- The DEF warning lamp flashes amber
- The MIL lamp illuminates

Detroit engines: Power is limited, with a 55 mph (90 km/h) speed limit.

Cummins engines: Power is limited with progressively harsher engine power limits applied.

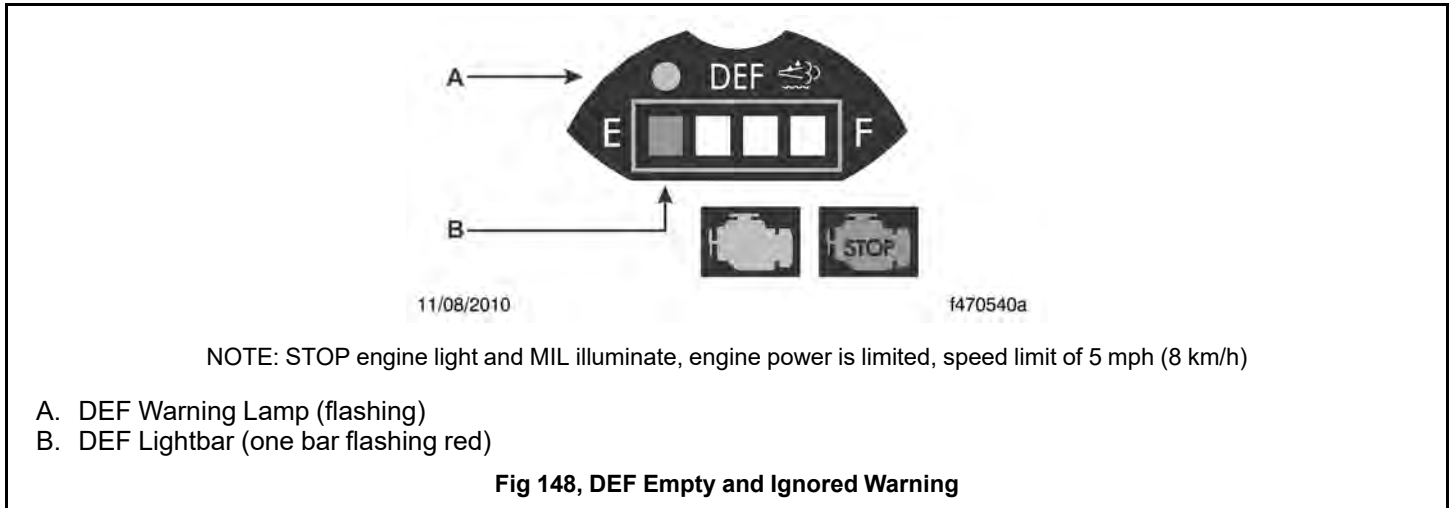


DEF Tank Empty and Ignored

If the empty warning is ignored and the DEF tank is not refilled, the red STOP engine lamp illuminates in addition to the MIL lamp and CHECK engine lamp (on vehicles with a Cummins ISB or ISC/L engine.) See Fig.

148, [DEF Empty and Ignored Warning](#).

If the DEF is not refilled, a 5 mph (8 km/h) speed limit is applied after the next engine shutdown or if a fuel refill is detected.



DEF Contamination or SCR Tampering



NOTICE:

Once contaminated DEF or tampering has been detected, the vehicle must be taken to an authorized service facility to check the SCR system for damage and to deactivate the warning lights and engine limits.

If contaminated DEF or tampering with the ATS is detected, the DEF warning light flashes and the MIL lamp illuminates to warn the driver. The CHECK engine lamp also illuminates on vehicles with a Cummins ISB or ISC/L engine. See Fig. 148, DEF Empty and Ignored Warning.

- Detroit engines: Engine power is limited with progressively harsher limits applied. If the fault is not corrected, the STOP engine light illuminates and a 5 mph (8 km/h) speed limit is applied after the next engine shutdown or if a fuel refill is detected.
- Cummins engines: Engine power is limited with progressively harsher limits applied. If the fault is not corrected, the STOP engine light illuminates and a 5 mph (8 km/h) speed limit is applied after the next engine shutdown, or while parked and idling.

8.08 Engine Starting

For cold-weather starting, refer to "Cold Weather Starting" later in this chapter.

This engine chapter is to serve as a guide for best practices only. Each make and model engine may have operating characteristics that are unique to that particular engine, and will be documented in the engine manufacturer's literature. Always refer to specific instructions and recommendations from the engine manufacturer.

NOTE: Before starting the engine, read [4.01.01 General Information](#) for detailed information on how to read the instruments and see [5.01 Ignition Switch and Key](#) for detailed information on how to operate the controls. Read the operating instructions in the manufacturer's engine operation manual before starting the engine.

**WARNING:**

Never pour fuel or other flammable liquid into the air inlet opening in the air intake in an attempt to start the vehicle. This could result in a flash fire causing serious personal injury or property damage.

1. Before engine start-up, complete the pretrip inspections and maintenance procedures in [12.01.01 General information](#).
2. Set the parking brake.
3. For manual transmissions, place the transmission in neutral and fully depress the clutch pedal. Do not depress the accelerator pedal.

For automatic transmissions, put the transmission in neutral. Do depress the accelerator pedal.

NOTE: Depending on local jurisdictional emissions regulations, vehicles and/or engines that are domiciled outside of the U.S. and Canada may not be equipped with the WAIT TO START or START BLOCKED lamp.

4. Turn the ignition switch to ON. See Fig.149, [Ignition Switch](#). The following actions should occur:
 - electronic gauges complete a full sweep of their dials
 - warning and indicator lamps illuminate, then are extinguished
 - DEF level indicator illuminates all segments green, then turns them off one at a time before turning the leftmost segment amber and then red
 - During cold conditions, the WAIT TO START lamp may illuminate.

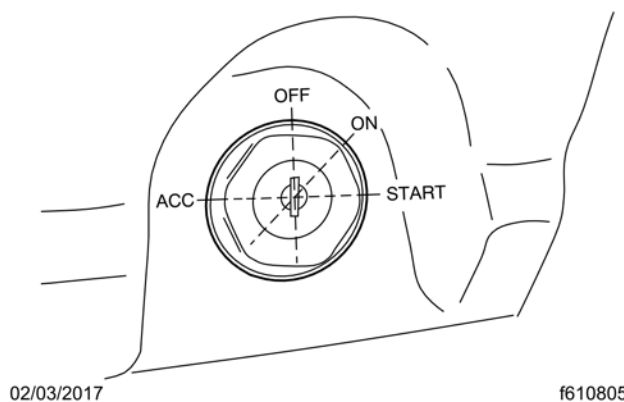


Fig 149, Ignition Switch

NOTE: The length of time the WAIT TO START lamp remains illuminated depends on the ambient temperature. The lower the ambient temperature, the longer the lamp will be illuminated.

NOTE: If the ignition switch is turned to START before the gauge sweep has completed or if the starter has overheated, the START BLOCKED lamp may illuminate. Turn the ignition switch back to ON, wait for the lamp to go out, then turn the ignition switch to START again.

5. Once the gauge sweep has completed, turn the ignition key to the START position. Release the key the moment the engine starts.

**NOTICE:**

Do not rev the engine if the oil pressure gauge indicates no oil pressure. Shut down the engine if oil pressure does not build within approximately ten seconds. Check to determine the cause of the problem. Operating the engine with no oil pressure will damage the engine.

6. It is not necessary to idle the engine before engaging or starting the operation, but load should be applied gradually during the warm-up period until the oil temperature reaches 140°F (60°C).
7. Apply load gradually during the warm-up period.

**NOTICE:**

If the oil pressure gauge indicates no oil pressure, shut down the engine within approximately ten seconds to avoid engine damage.

8. Check the oil pressure gauge for any drop in lubricating oil pressure or mechanical malfunction in the lubricating oil system. Minimum oil pressure at idle is 7 psi (50 kPa).

8.09 Cold-Weather Starting

Electronic engines do not normally require special starting aids.

See the engine manufacturer's operation manual for starting aids that are approved for specific engines.

8.10 Starting After Extended Shutdown or Oil Change

Before engine start-up, complete the engine pretrip and post-trip inspections and maintenance procedures in [12.01.01 General information](#).

**NOTICE:**

Failure to eliminate water-diluted lubricating oil may lead to serious engine damage at startup.

An engine in storage for an extended period of time (over winter, for example) may accumulate water in the oil pan through normal condensation of moisture on the internal surfaces of the engine. Oil diluted by water cannot provide adequate bearing protection at start-up. For this reason, change the engine oil and filters after extended storage.

8.11 Engine Break-In

Each engine must pass a full-load operating test on a dynamometer before shipment, thereby eliminating the need for a break-in. Before running the engine for the first time, follow the instructions in the engine manufacturer's operation manual specific to your engine.

8.12 Engine Operation

8.12.01 Safety and Environmental Considerations

All Freightliner diesel engines comply with the requirements of the Federal (U.S.) Clean Air Act. Once an engine is placed in service, the responsibility for meeting local jurisdictional regulations is with the owner/operator.

IMPORTANT: Depending upon local jurisdictional emissions guidelines, vehicles and/or engines that are domiciled outside of the U.S. and Canada may not be compliant with current emissions regulations.

**NOTICE:**

It is extremely important that the following guidelines be followed for vehicles with EPA07 or newer engines, or damage may occur to the aftertreatment device, and the warranty may be compromised.

- Use ultralow-sulfur diesel with 15 ppm sulfur content or less.
- Do not use fuel blended with used engine lube oil or kerosene.
- Use only approved engine lube oil. For lists of engine oils approved for Detroit Diesel engines, refer to the Engine Operator Manual, accessible on Lubricants, Fuels & Coolants on the DTNA Portal. For third party engines, please refer to the engine manual.

A Top Tier™ compliant fuel is recommended. Look for the symbol that denotes a Top Tier compliant fuel; see Fig. 150, [Top Tier Fuel Symbol](#).



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Fig 150, Top Tier Fuel Symbol

Adequate maintenance of the engine and the diesel particulate filter (DPF) are the responsibility of the owner/operator, and are essential to keep the emission levels low. Good operating practices, regular maintenance, and correct adjustments are factors that will help keep emissions within the regulations.

8.12.02 Normal Operation

**WARNING:**

Do not operate the engine in an area where flammable vapors such as gasoline or diesel fumes are present. Shut off the engine when in an area where flammable liquids or gases are being handled. Failure to observe these precautions could result in serious injury or death.

Every engine has an operating range in which it performs most efficiently. The operating range extends from maximum torque rpm at the low end, to engine rated speed at the high end. Most engines deliver best fuel economy when operated in the low- and mid-speed segments of the efficiency range and produce maximum horsepower at rated speed, which is also the recommended maximum speed of the engine. For further engine-specific information, refer to the engine manufacturer's operation manual.

Prolonged idling of engines is not recommended, and is illegal in some states. Idling produces sulfuric acid, that is absorbed by the lubricating oil, and eats into bearings, rings, valve stems, and engine surfaces. If you must idle the engine for cab heat or cooling, use the high idle function of the cruise control switches. An idle speed of 900 rpm should be enough to provide cab heat in above freezing ambient temperatures.

If the engine is programmed with the idle shutdown timer, ninety seconds before the preset shutdown time, the CHECK ENGINE light will begin to flash at a rapid rate. If the position of the clutch pedal or service brake changes during this final ninety seconds the idle shutdown timer will be disabled until reset.

8.13 Cold-Weather Operation

Satisfactory performance of a diesel engine operating in low ambient temperatures requires modification of the engine, surrounding equipment, operating practices, and maintenance procedures. The lower the temperature, the greater the amount of modification required. For service products approved for use in cold weather for your engine, see the engine manufacturer's engine operation manual, supplied in the vehicle documentation package.

If satisfactory engine temperature is not maintained, maintenance costs will increase due to greater engine wear. If the engine coolant temperature becomes too low, raw fuel will wash the lubricating oil off the cylinder walls and dilute the crank-case oil, causing all moving parts of the engine to suffer from poor lubrication.

If the engine is in good mechanical condition and the precautions necessary for cold-weather operation are taken, ordinary cold weather will not cause difficulty in starting or loss of efficiency.

The following points are important to observe when operating in cold weather:

- Check for cracks in the batteries, for corrosion of the terminals, and for tightness of the cable clamps at the terminals.
- Charge the batteries to full capacity. Replace any battery that is damaged.
- If equipped, turn off the load disconnect switch after the engine is shut down, to prevent battery discharge.
- Have the alternator output checked at an authorized service provider.
- Check the condition and tension of the drive belts.
- Refer to the engine manufacturer's engine operation manual for recommended heaters, low-viscosity lubricating oils, wintergrade fuels, and approved coolants.

**NOTICE:**

For Detroit engines (EPA07 and newer), use of a winterfront is not recommended, as it can cause false fault codes with the engine and aftertreatment system, and possible emission component failures.

If using a winterfront, leave at least 25% of the grille opening exposed in sectioned stripes that run perpendicular to the charge-air-cooler tube-flow direction. This assures even cooling across each tube, and reduces header-to-tube stress, and possible chance of component failure. For engine-specific guidelines, see below:

Cummins and Mercedes-Benz engines: A winterfront may be used to improve cab heating while idling, and only when the ambient temperature remains below 10°F (-12°C).

Detroit engines (EPA07 and newer): Use of a winterfront is not recommended. Using a winterfront can cause excessive fan run time, increased fuel consumption, and failure of the DEF system heaters to operate correctly, resulting in fault codes, poor performance, and power reduction. A winterfront should only be used temporarily in the following situations:

- to improve cab heating while idling in an extremely cold ambient temperature;
- when the ambient temperature remains below -22°F (-30°C) and the engine is unable to maintain a running coolant temperature of 175°F (80°C) during normal over-the-road operation.

8.14 High-Altitude Operation

Engines lose horsepower when operated at high altitude because the air is too thin to burn as much fuel as at sea level. This loss is about three percent for each 1000 feet (300 m) altitude above sea level for a naturally aspirated engine.

All Business Class M2 engines are altitude-compensated by the use of a turbocharger. This reduces smoky exhaust at high altitudes, requires less downshifting, and allows the engine to make better use of its fuel. Nevertheless, shift gears as needed to avoid excessive exhaust smoke.

8.15 Engine Shutdown Procedure

1. With the vehicle stopped, apply the parking brake, and place the transmission in neutral.

**NOTICE:**

Idle the engine one to two minutes before shutting it down. After hard operation, shutting down the engine without idling may cause damage to the turbocharger.

2. Allow the engine to idle one to two minutes before shutting it down. This allows the lubricating oil and the coolant to carry heat away from the combustion chambers, bearings, shafts, and seals. The extreme heat may cause bearings to seize or oil seals to leak.

IMPORTANT: Bearings and seals in the turbocharger are subjected to the high heat of combustion exhaust gases. While the engine is running, this heat is carried away by oil circulation, but if the engine is stopped suddenly, the turbocharger temperature may rise as much as 115°F (46°C).

**NOTICE:**

Except in an emergency, do not shut down the engine when the coolant temperature is above 194°F (90°C). To do so could damage the engine.

3. Turn off the ignition switch and shut down the engine.

8.15.01 Engine Protection—Warning and Shutdown

The driver should be familiar with the vehicle warning system in order to bring the vehicle to a safe stop if necessary. If the driver doesn't understand how the warning system works, the driver may not be able to utilize the advantage of the advance warning system to pull over appropriately.

The engine will begin a warning and derate and/or shutdown process if the engine coolant temperature, coolant level, engine oil pressure, or exhaust aftertreatment system (ATS) reach preset levels. On some engines, the warning process will begin when the engine oil temperature, engine coolant temperature, or the intake air temperature reach preset levels. Detroit™ engines may also begin the warning and shutdown process if water is detected in the fuel.

IMPORTANT: See the engine manufacturer's operation manual for complete details and operation of the ATS.

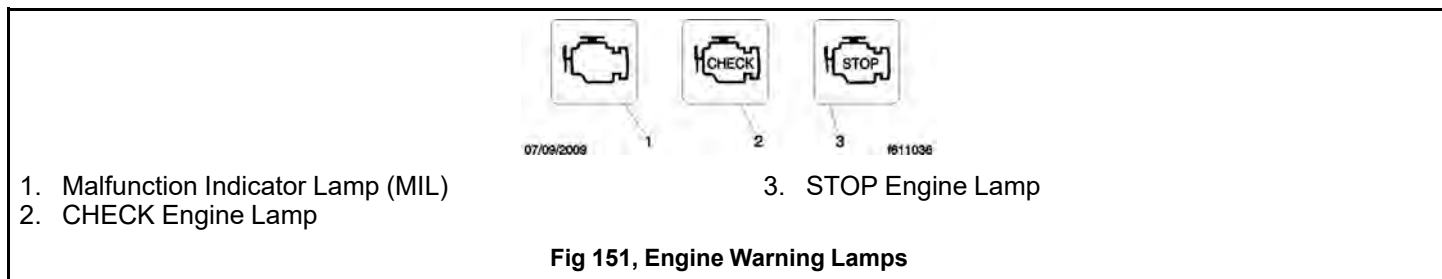
Electronic engine protection can be specified as either SHUTDOWN or WARNING and DERATE.

**WARNING:**

When the STOP engine lamp illuminates, most engines are programmed to shut down automatically within 30 seconds. The driver must immediately move the vehicle to a safe location at the side of the road to prevent causing a hazardous situation that could cause bodily injury, property damage, or severe damage to the engine.

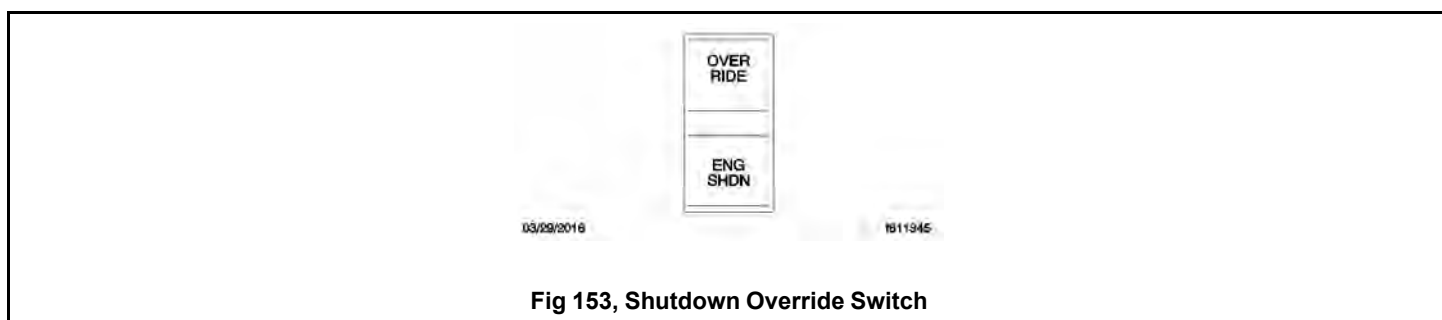
In SHUTDOWN mode, the red STOP engine lamp will illuminate when the problem is serious enough to reduce power or speed. See Fig.151, [Engine Warning Lamps](#). Engine power will ramp down, then the engine will shut down if the problem continues while in derate mode. The driver has 30 or 60 seconds (depending on the critical fault type) after the STOP engine lamp illuminates to move the vehicle safely off the road. If the vehicle cannot be moved to a safe location within that time, turn the ignition switch to OFF for at least five seconds, then restart the engine. Repeat this action until the vehicle is safely off the road.

NOTE: In addition to the warning lamp, the driver display screen will present a warning message when the engine is in SHUTDOWN mode. See Fig.152, [Shutdown Alert](#). For vehicles with Detroit engines only, the time remaining before shutdown is displayed.



IMPORTANT: Do not operate the vehicle further until the problem causing the shutdown has been corrected.

Some vehicles may have a shutdown override switch, which can be used to momentarily override the shutdown sequence. This switch resets the shutdown timer, restoring power to the level before the derate. The switch must be pressed again after five seconds to obtain a subsequent override. See Fig.153, [Shutdown Override Switch](#).



**NOTICE:**

When the derate process begins, immediately get the vehicle serviced in order to prevent severe damage to the engine.

Detroit engines may begin a warning and derate process if water is detected in the fuel, or for high engine coolant temperature. In WARNING and DERATE mode, the CHECK engine, STOP engine, or MIL lamp will illuminate to indicate an engine problem that requires service and the engine controls will begin a derate of engine output.

**CAUTION:**

Continuing to run the engine while it is in derate mode could cause severe damage to the engine.

8.16 Cruise Control

8.16.01 Dash-Mounted Switches

**WARNING:**

Do not use the cruise control system when driving conditions do not permit maintaining a constant speed, such as in heavy traffic or on roads that are winding, icy, snow-covered, slippery, or roads with a loose driving surface. Failure to follow this precaution could cause a collision or loss of vehicle control, possibly resulting in personal injury or property damage.

**NOTICE:**

When the cruise control is engaged, do not attempt to shift gears without using the clutch pedal. Failure to follow this precaution will result in a temporarily uncontrolled increase in engine speed. Transmission damage and gear stripping could result.

Cruise control is activated by two dash-mounted switches (see Fig.154, [Cruise Control Switches](#)).

- On/Off Switch—this two-position rocker is labeled SPD CNTL on the lower half of the switch. When cruise control is on, an amber light illuminates the top part of the switch.
- Set/Resume Switch—this three-position paddle switch is labeled RES/ACC above the paddle and SET/CST below the paddle.



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NOTE: To turn cruise control on, press the upper half of the On/Off switch. To turn cruise control off, press the lower half of the On/Off switch.

To increase cruise speed, raise and hold the paddle of the Set/Resume switch to RES/ACC until the vehicle accelerates to the desired speed. To decrease cruise speed, lower and the paddle of the Set/Resume switch to SET/CST until the vehicle decelerates to the desired speed.

1. Cruise Control On/Off Switch
2. Cruise Control Set/Resume Switch

Fig 154, Cruise Control Switches

1. To cruise at a particular speed:
 - 1.a Press the upper half of the On/Off switch.
 - 1.b Depress the accelerator pedal until the speedometer reaches the desired speed.
 - 1.c Momentarily lower the paddle of the Set/Resume switch to set the desired speed.

NOTE: The speed memory is lost whenever the ignition switch is turned to OFF, or cruise control is turned off.

2. To disengage the cruise control, do one of the following:
 - Press the lower half of the on/off switch button.
 - Depress the brake pedal.
 - Depress the clutch pedal (on a manual transmission only).
3. To resume a preselected cruise speed:
 - 3.a Ensure the cruise control is on.
 - 3.b Momentarily raise the paddle of the Set/Resume switch. Cruise will return to the last speed selected.

NOTE: If vehicle speed drops below the minimum cruise control speed, cruise control will disengage. To resume to the preselected cruise speed, increase vehicle speed to above minimum cruise control speed and press the ACC/RES button.

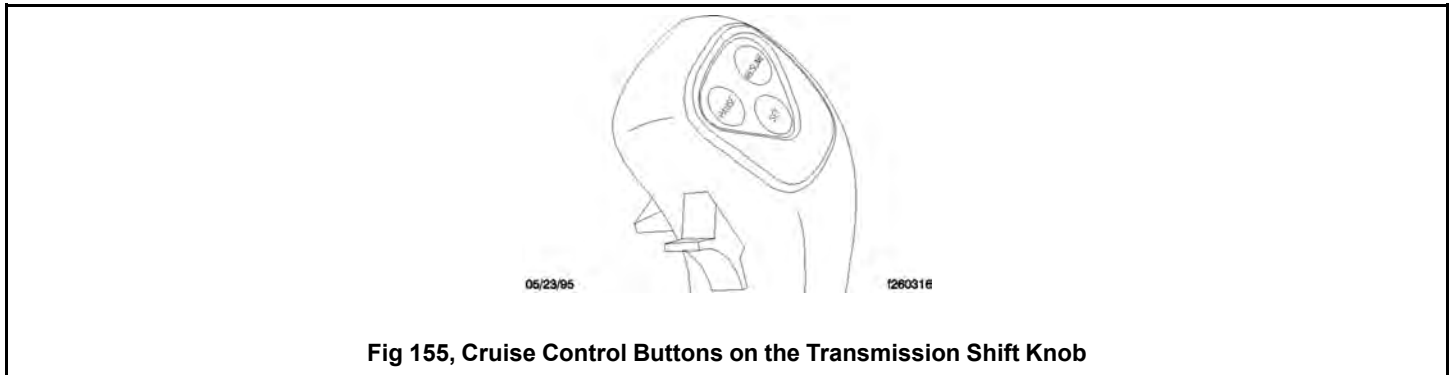
NOTE: The speed memory is lost whenever the ignition is turned off or the cruise control switch is toggled to Off.

4. To increase cruise speed, raise and hold the paddle of the Set/Resume switch until the vehicle accelerates to the desired speed.

5. To decrease cruise speed, lower and the paddle of the Set/Resume switch until the vehicle decelerates to the desired speed.

8.16.02 Shift Knob Controls, Optional

Cruise control can also be activated by the optional PAUSE, RESUME, and SET buttons on the transmission shift knob (see Fig.155, [Cruise Control Buttons on the Transmission Shift Knob](#)).



1. To cruise at a particular speed, do these steps:
 - 1.a Hold the accelerator pedal down until the speedometer reaches the desired speed.
 - 1.b Push the SET button on the transmission shift knob.
2. To disengage the cruise control, do these steps:
 - 2.a Press down the brake pedal (on automatic and manual transmission) *or* Press down the clutch pedal (on manual transmission only)
 - 2.b Push the PAUSE button on the transmission shift knob.
3. To resume a preselected cruise speed, push the RESUME button on the transmission shift knob. Cruise will return to the last speed selected.
4. To adjust cruise speed up, push the SET button and hold it in until the vehicle accelerates to the desired speed.
5. To adjust cruise speed down, push the RESUME button and hold it in until the vehicle decelerates to the desired speed.

8.17 Power Takeoff (PTO) Governor

Engine power takeoffs (PTO) are devices used to tap into engine power to run auxiliary devices, such as hydraulic pumps that power additional equipment. The following instructions are general guidelines for operating a PTO.

1. Set the parking brake and put the transmission in neutral.
2. Press the dash-mounted PTO switch. Release the switch when the amber light behind the switch begins to blink.
When the light is steadily illuminated, the PTO is engaged and ready to operate. In stationary mode, the vehicle must remain in neutral with the parking brake set.
3. To activate the mobile mode, shift from neutral to reverse, 1st, or 2nd gear. The clutch will open and the PTO will disengage for a moment.
4. Touch the throttle pedal to close the clutch and engage the PTO in mobile mode. The PTO may be operated with the transmission in reverse, neutral, 1st, or 2nd gears only.

NOTE: Do not attempt to change gears while the vehicle is moving. The transmission will ignore the request.

5. To end the mobile mode, bring the vehicle to a stop. The clutch will open and shut down power to the PTO.
6. To resume stationary mode, shift to neutral. The PTO will engage.
7. To end stationary mode, press the dash switch. When the light in the switch goes out, power to the PTO is shut off.

8.18 Engine Braking

Each engine manufacturer uses a specific engine brake for their engine. Regardless of the manufacturer, the engine brake is operated with the principles outlined in this chapter. Refer to the engine manufacturer's operation manual for details of their particular engine brake product.



WARNING:

To avoid injury from loss of vehicle control, do not activate the engine brake system under the following conditions:

- on wet or slippery pavement, unless the vehicle is equipped with antilock braking system (ABS) and you have had prior experience driving under these conditions;
- when driving without a trailer or pulling an empty trailer;
- if the tractor drive wheels begin to lock, or there is fishtail motion after the engine brake is activated.

Whenever vehicle braking is required on good road conditions, the engine brake may be used in conjunction with the service brakes. There is no time limit for operation of the engine brake. However, an engine brake does not provide the precise control of, and is not a substitute for, service brakes.



WARNING:

Usage of the engine brake as the primary braking system can cause unpredictable stopping distances, that could result in personal injury or property damage. Service brakes are the primary vehicle braking system.

Two dash-mounted switches control the engine brake:

- The On/Off switch (ENG BRK), is used to turn the engine brake on and off. See Fig.156, [Engine Brake Switches](#). When the engine brake is on, an amber light will illuminate behind the switch.
- The engine brake intensity switch (HI/MED/LO or, in some cases, HI/LO) controls the amount of engine braking. When the panel lights are on, the ENG BRK legend is backlit in green.



1. Engine Brake On/Off
2. Engine Brake Intensity Switch

Fig 156, Engine Brake Switches

Since the engine brake is most effective at rated engine speed, gear selection is very important. Gearing down the vehicle within the limits of the rated engine speed makes the engine brake more effective. Recommended engine braking speed is above 1800 rpm and below the rated speed.

**WARNING:**

The engine brake must be disengaged when shifting gears using the clutch pedal. If the engine brake is engaged when the transmission is in neutral, the braking power of the engine brake can stall the engine, which could result in loss of vehicle control, possibly causing personal injury and property damage.

"Control speed" is the speed at which the engine brake performs 100 percent of the required downhill braking, resulting in a constant speed of descent. The control speed varies, depending on vehicle weight and the downhill grade.

For faster descent, select a higher gear than that used for control speed. Service brakes must then be used intermittently to prevent engine overspeed and to maintain desired vehicle speed.

For slower descent, select a lower gear, being careful not to overspeed the engine. Occasional deactivation of the engine brake may be necessary to maintain the designated road speed under these conditions.

If the engine is equipped with both cruise control and an engine brake, the engine brake can operate automatically while in cruise control mode. If the cruise control/engine brake function is turned on in the DDEC VI system programming, the engine brake will come on low when the set road speed increases a few mph (km/h) above the cruise set speed. The maximum amount of braking is selected with the dash switches. When the vehicle returns to the set cruise speed, the engine brake will turn off.

The engine brake will only operate when the accelerator pedal is fully released. Depressing the clutch will also prevent the engine brake from operating.

Vehicles equipped with ABS have the ability to turn the engine brake off if wheel slip is detected. The engine brake will automatically turn back on once wheel slip is no longer detected.

The DDEC VI system will deactivate the engine brake when the engine speed falls below 1000 rpm or when the vehicle slows down to a preset speed, depending on DDEC programming. This prevents stalling the engine.

8.18.01 Engine Brake Operation

Depending on the brake type, the engine brake may be disabled when engine temperature falls below a set level.

**NOTICE:**

Do not allow the engine to exceed 2500 rpm. Serious engine damage could result.

To activate the engine brake after the engine is warmed up and the vehicle is in motion:

1. Remove your feet from both the clutch and throttle pedals.
2. Press the On/Off switch to toggle the engine brake on. See Fig.157, [Engine Brake Switches](#). The engine brake will engage at the rate last set on the brake intensity switch.
3. Move the intensity switch to the desired intensity.

On vehicles with a HI/MED/LO intensity switch, LO will provide 1/3 of the full braking capacity of the engine, MED will provide 2/3 of the full braking capacity, and HI will provide maximum engine braking. On vehicles with a HI/LO intensity switch, LO will provide ½ of the full braking capacity of the engine; HI will provide maximum engine braking.



1. Engine Brake On/Off
2. Engine Brake Intensity Switch

Fig 157, Engine Brake Switches

4. Use the intensity switch set at the LO position when driving on flat, open stretches of road. If the service brakes are still required to slow down on a grade, switch to a higher setting on the dash switch until there is no need for the service brakes. Grade descent speed should be such that the service brakes are used infrequently and remain cool, thus retaining their effectiveness.
5. For maximum retarding, maintain the top governed speed of the engine through the appropriate selection of gears. When shifting gears, the engine brake will disengage when the clutch pedal is depressed, then engage when the clutch pedal is released.
6. To cancel the engine brake application, toggle the On/Off to off.

8.19 Exhaust Braking Systems

8.19.01 Exhaust Brake Switch

The optional exhaust brake is controlled by a dash-mounted rocker switch to help slow the vehicle when the accelerator is released.

To turn the exhaust brake on, press on the upper part of the rocker (at the light inside the switch). The exhaust brake turns off automatically. See Fig.158, [Exhaust Brake Switch](#) or Fig.159, [Exhaust Brake Switch](#).



Fig 158, Exhaust Brake Switch



Fig 159, Exhaust Brake Switch

8.19.02 Mercedes-Benz Exhaust Brake

An exhaust brake is an optional auxiliary braking system that assists but does not replace the service brake system. The exhaust brake can be used alone or together with the constant-throttle valves for steep or long grades. The exhaust brake switch located on the control panel, in combination with the accelerator and clutch pedals, allows the driver to make maximum use of the exhaust brake in off-highway and mountain driving as well as in traffic or high-speed highway driving.

When only the exhaust brake is installed, a two-position switch on the dash controls the engine braking system. The exhaust brake is only active when the engine speed is between 1100 and 2700 rpm. Depressing the accelerator or clutch pedal deactivates the exhaust brake. The ABS system, when active, also deactivates the exhaust brake.

The exhaust brake is a butterfly valve mounted in the exhaust pipe. When the driver's foot is not on the accelerator pedal and the upper half of the exhaust brake switch is pressed in, with the amber light on the switch illuminated, an air cylinder shuts the butterfly valve, which restricts the flow of exhaust gases and retards the engine. This retarding action is carried through the engine and drivetrain, slowing the vehicle and reducing the need for frequent service brake applications.

Exhaust brakes are not intended for use as the primary braking system during vehicle operation.

Operating Characteristics

**WARNING:**

Do not use the exhaust brake when driving on slippery or low-traction road surfaces. Failure to follow this precaution could result in a loss of vehicle control and possible personal injury or property damage.

Before starting the engine, make sure that the lower half of the exhaust brake switch is pressed in and the amber light is not illuminated. Do not turn the exhaust brake on until the engine has reached normal operating temperatures.

When you remove your feet from both the accelerator and clutch pedals and the upper half of the exhaust brake switch is pressed in with the amber light illuminated, the exhaust brake is applied. The following conditions should exist if the brake is operating properly:

- A slight change in the sound of the engine may be noticed when the exhaust brake is applied.
- Exhaust smoke should appear normal.
- Engine temperature should remain in the normal operating range.
- Road speed usually decreases when the exhaust brake is applied during a descent. When the vehicle is carrying a heavy load or the grade is extremely steep, you may need to apply the service brakes occasionally.
- Do not expect a retarding effect similar to sudden hard application of the service brakes. The exhaust brake retards the vehicle with a smooth braking effect.
- During a descent, the tachometer usually shows a drop in rpm, depending on the grade and the vehicle load.
- Depending on the grade and vehicle load, you may or may not feel the retarding force acting against your body when the brake is applied. The retarding force of the brake may not always be noticed, but it is actually preventing the vehicle from going much faster.

Make sure the exhaust brake is turned off before shutting down the engine.

Driving Downhill

While approaching a steep grade, make sure that the upper half of the exhaust brake switch is pressed in, with the amber light illuminated. The exhaust brake comes on as soon as you remove your foot from the accelerator pedal. While going down the grade, use a low enough gear to safely descend with a minimum application of the service brakes. As a general guideline, use the same gear as you would to ascend the hill.

**NOTICE:**

Do not allow the engine to exceed its governed speed, or serious engine damage could result.

Apply the service brakes to reduce the engine rpm or make a slower descent by using a lower gear.

8.19.03 Pacbrake® Exhaust Brake

The Pacbrake exhaust brake is intended as a supplement to the service brakes and will *not* bring the vehicle to a complete stop. The Pacbrake will assist in the control or reduction of road speed in conjunction with, or independent of, the service brakes. The amount of retarding or braking force is controlled by the driver.

8.19.04 Pacbrake Operation (Caterpillar)

The Pacbrake is controlled by the exhaust brake switch and the throttle pedal. All applications are additionally affected, controlled, or governed by engine speed through transmission gear selection. The Allison MD3060 transmission has automatic downshifting when the exhaust brake is requested. See the information on the "Allison World Transmission" later in this chapter.

On some applications, when the Pacbrake is in use, it may be necessary to check that the cruise control is not set and that the throttle is in the idle position.

On some applications, the engine, transmission, cruise control, and the Pacbrake exhaust brake may electronically interact with each other, which automatically operates their functions. Following are some examples of the programmed options that may be available with the cruise control in the on position:

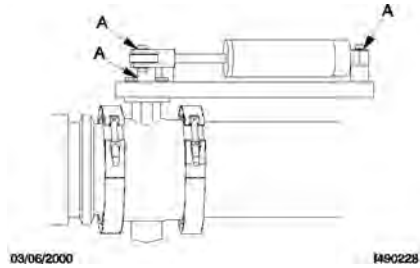
- The coast mode engages the Pacbrake when the service brake is applied and disengages when the service brake is released.
- The latch mode engages the Pacbrake when the service brake is applied and the Pacbrake remains on after the service brake is released. The Pacbrake is disengaged when another input (depressing the throttle or clutch, engine speed drops below 800 rpm, or the exhaust brake switch is turned off) is supplied.
- The manual mode does not require the cruise control switch to be on, and operates the Pacbrake manually at the driver's discretion.

The amount of braking power the engine will develop is related to the speed (rpm) of the engine. The higher the engine rpm, the greater the retarding power.

Certain conditions may require that the transmission be downshifted in order to generate adequate rpm for the amount of retarding power required. Pacbrake exhaust brakes are designed and approved for safe use at 300 rpm above the engine's maximum governed rpm. Refer to individual engine manufacturer's specifications.

The Pacbrake will function best if it is used all of the time. However, if the vehicle is used inconsistently or seasonally, it may be necessary to perform a preventive maintenance procedure.

1. With the engine shut down, use any oil-free or nonpetroleum-based high-heat lubricant, and spray or coat a sufficient amount on the restrictor valve shaft and the attaching locations at each end of the actuation cylinder. See Fig. 160, [Pacbrake Exhaust Brake and Air Cylinder](#).



A. Lubrication Point

Fig 160, Pacbrake Exhaust Brake and Air Cylinder

NOTE: Starting the engine and idling for short periods of time is not recommended. During a cold engine start-up, enough moisture is developed within the engine and the exhaust system to create a corrosion hazard that could affect the future operation of the Pacbrake. The brake housing may trap water in the valve shaft bore causing corrosion in an improperly functioning or nonfunctioning brake. If it is necessary to periodically start the engine, it is recommended that normal operating temperatures be attained before shutting down the engine.

2. With your hands or a pair of pliers, motion the valve several times to distribute the lubricant down the shaft and the attaching locations.

8.19.05 Allison World Transmission

Pacbrake exhaust brakes used with the Allison World Transmission MD series, are interfaced with the transmission electronic control module (ECM). An exhaust-brake-enabled transmission ECM will usually provide converter lockup in gears two through six. Effective exhaust braking begins when the transmission automatically downshifts into fifth gear (62 mph or less). Once on, the Pacbrake exhaust brake will control road speed and/or slow the vehicle sufficiently that the transmission will automatically downshift, if necessary, to Allison's preselect mode.

The preselect mode is normally assigned to second gear; however, the transmission can be reprogrammed by an Allison Transmission Distributor to third or fourth gear, should the operator desire. If additional retarding power is required before the automatic downshifting occurs, you can select a lower transmission gear on the Allison shift selector.

9.01 Transfer Cases	147
9.01.01 Meritor MTC Series	147
9.02 Clutches	148
9.02.01 Clutch Operation	148
9.02.02 Clutch Wear	150
9.02.03 Clutch Adjustments	150
9.02.04 Clutch Lubrication	150
9.02.05 Sachs Hydraulic Clutch	151
9.03 Allison On-Highway Transmissions	151
9.03.01 Safety Precautions	151
9.03.02 Range Inhibit Indicator, 2000 and 2400 Series	152
9.03.03 Operating Instructions, On-Highway Transmissions	153
9.04 Allison MD Series	155
9.04.01 Safety Precautions	155
9.04.02 Operating Instructions, MD Series	156
9.05 Eaton® Fuller® Straight-Shift Transmissions	159
9.05.01 General Information, Straight-Shift	159
9.05.02 Operation, Straight-Shift	160
9.06 Eaton Fuller Range-Shift Transmissions	161
9.06.01 General Information, Range-Shift	161
9.06.02 Operation, Range-Shift	163
9.06.03 Operation, Deep-Reduction Models	164
9.07 Eaton Fuller AutoShift™ Automated Transmissions	165
9.07.01 General Information	165
9.07.02 Push-Button Shift Selector	166
9.07.03 Automatic Mode	167
9.07.04 Manual Mode	167
9.07.05 Selecting Gears	167
9.08 Freightliner SmartShift Shift Control	168
9.09 Eaton Fuller UltraShift PLUS Automated Transmissions	170
9.09.01 Power Up	170

9.09.02 Power Down	171
9.09.03 Reverse (R).....	171
9.09.04 Automatic Mode (AUTO)	171
9.09.05 Manual Mode (MAN)	172
9.09.06 Low (L).....	172
9.09.07 Clutch Abuse Protection	173
9.09.08 Creep Mode	173
9.09.09 Hill Start Aid	173
9.09.10 Engine Overspeed Protection	174
9.09.11 Shuttle Shifting.....	174
9.09.12 Auto Start Gear Selection and Override	174
9.09.13 Skip Shifting	174
9.09.14 Auto Neutral	174
9.09.15 Automatic Traction Control	174
9.09.16 Load-Based Shifting.....	175
9.09.17 Coasting	175
9.09.18 Ultrashift Diagnostics	175
9.10 Mercedes-Benz Manual Transmissions.....	175
9.11 Mercedes-Benz Automated Transmissions.....	176
9.11.01 General Information, AGS.....	176
9.11.02 Operation, AGS	177
9.11.03 AGS Diagnostics.....	183
9.12 Meritor™ Drive Axles.....	184
9.12.01 Drive Axles With Differential Lock.....	184
9.12.02 Tandem Drive Axles With Interaxle Lock	186
9.12.03 Axle Shift.....	188

9. Drivetrain

9.01 Transfer Cases

9.01.01 Meritor MTC Series

Some vehicles are equipped with a Meritor MTC Series transfer case for part-time 4x4, 6x6, or 8x8 operation. Meritor MTC Series transfer cases have two gear sets: HIGH RANGE and LO RANGE.



WARNING:

Do not engage a Meritor MTC Series transfer case when driving on normal highway conditions. Severe personal injury and/or damage to components can result when the transfer case is misused.

IMPORTANT: Steer axle engagement is limited to 20% or less of annual vehicle mileage.

Follow the operating guidelines in Table.11, [Operating Guidelines, Meritor MTC Transfer Cases](#) when driving a vehicle equipped with a Meritor MTC transfer case.

Engaging and Disengaging the Steer Axle

Dash-mounted switches control the transfer case functions; see [5.01 Ignition Switch and Key](#) for more information.

IMPORTANT: The wheels must not slip during engagement of the steer axle driveline.

To engage the steer axle driveline, drive the vehicle at a constant speed below 10 mph (16 km/h) and press the AWD switch. An audible engagement may be heard.

To disengage the steer axle, drive the vehicle at a constant speed below 10 mph (16 km/h) and press the AWD switch. An audible disengagement may be heard. If the steer axle driveline does not disengage, the steer axle driveline coupling may be in a bind. Turn the steering wheel back and forth while driving, or briefly drive the vehicle in reverse.

	Disengaged Steer Axle		Engaged Steer Axle	
Range	Traction Conditions	Applicable Vehicle Speeds	Traction Conditions	Applicable Vehicle Speeds
HIGH RANGE	Most normal driving conditions (such as dry or wet pavement or mixed road surfaces) when moderate to high vehicle speeds are appropriate.	0 mph (0 km/h) to maximum vehicle speed	When more traction is needed at moderate to low vehicle speeds on dirt or gravel surface with shallow to moderate grades (8% maximum), icy or snow-covered roads, or hard-packed sand.	20 mph (32 km/h) or less

Table 11, Operating Guidelines, Meritor MTC Transfer Cases

LO RANGE	Not applicable. Do not use LO RANGE unless the steer axle is engaged.	When maximum power and maximum traction is needed on steeper grades (15% maximum), deeply rutted tracks, deep mud or snow, extremely rocky surfaces, or soft, loamy sand.	15 mph (24 km/h) or less
IMPORTANT: Engaging the steer axle will increase the turning radius of the vehicle.			

Table 9, Operating Guidelines, Meritor MTC Transfer Cases

Shifting Between HIGH RANGE and LO RANGE

MTC Series transfer cases use an air cylinder to shift between HIGH RANGE and LO RANGE. A dash-mounted switch operates the shift mechanism (see [5.01 Ignition Switch and Key](#) for more information).

Shift between HIGH RANGE and LO RANGE, as follows:

1. Stop the vehicle.
2. Shift the transmission to NEUTRAL.
3. Apply the parking brake.
4. Move the dash-mounted switch to the HIGH or LO RANGE position to pressurize the shift mechanism in the transfer case. An audible engagement may be heard (which is normal).
5. Shift the transmission to FIRST gear and apply light torque to test the engagement.

If the shifter does not engage when shifting from HIGH RANGE to LO RANGE, shift the transmission into REVERSE, then NEUTRAL, and apply light torque to engage the LO RANGE.

Engaging PTO

Some vehicles are equipped with a PTO mounted to a Meritor MTC transfer case. For these vehicles, engage the PTO only when the transfer case is in neutral, the transmission is in neutral/park, and the parking brake is applied. To begin using the PTO, select the drive gear based on the PTO system operators manual.

9.02 Clutches

9.02.01 Clutch Operation

Applying the Clutch Brake

The purpose of the clutch brake is to stop the transmission gears from rotating in order to engage the transmission gears quickly in making an initial start. To apply the clutch brake, put the transmission in neutral and press the clutch pedal to the floor.

**NOTICE:**

Never apply the clutch brake while the vehicle is moving. The clutch pedal should never be pressed down fully before putting the transmission in neutral. Considerable heat will be generated, which will be detrimental to the friction discs, release bearings, and transmission front bearings.

Applying the clutch brake with the transmission still in gear puts a reverse load on the gear. At the same time, it will have the effect of trying to stop or decelerate the vehicle with the clutch brake. Rapid wear of friction discs will take place necessitating frequent replacement.

Vehicle Overload, or Overloading the Clutch

NOTICE

**NOTICE:**

Overloading will not only result in damage to the clutch, but also to the entire powertrain.

Clutches are designed for specific vehicle applications and loads. These limitations should not be exceeded.

Riding the Clutch Pedal

Riding the clutch pedal is destructive to the clutch. Partial clutch engagement permits slippage, and generates excessive heat. Riding the clutch pedal will also put a constant thrust load on the release bearing, which can thin out the lubricant. Release bearing failures can be attributed to this type of misuse.

Holding the Vehicle on an Incline With a Slipping Clutch

A slipping clutch accumulates heat faster than it can be dissipated, resulting in early clutch failures. Never use the clutch to hold a vehicle on a hill.

Coasting With the Clutch Released (pedal down) and the Transmission in Gear

If the transmission remains in a low gear and the vehicle gains speed, as may occur on a downgrade, the input shaft and clutch driven disc will turn at speeds that are higher than normal. This occurs because the rear wheels and the driveline become the input for the transmission, and a higher-than-normal speed for a given transmission gear translates to a higher rpm value for the clutch driven disc.

Clutch driven discs are designed to allow for some amount of excess rotational speed, but the facing has a limited burst strength. If the clutch driven disc rpm increases too much, the clutch facing can be thrown off the disc(s).

Engaging the Clutch While Coasting

Engaging the clutch while coasting can result in tremendous shock loads and possible damage to the clutch as well as to the entire drivetrain.

Report Erratic Clutch Operation Promptly

Reporting erratic clutch operation as soon as possible will give maintenance personnel a chance to inspect the clutch components.

**NOTICE:**

Operating the vehicle with incorrect clutch pedal free-travel could result in clutch damage. See General Description of the **Business Class® M2 Workshop Manual** for free-pedal adjustment procedures and specifications.

On mechanical clutch linkages, free-pedal travel should be included and commented on daily in the driver's report, since clutch free-pedal travel is the best guide to the condition of the clutch and the release mechanism.

9.02.02 Clutch Wear

The major reason clutches wear out too soon is excessive heat. Clutches are designed to absorb and dissipate more heat than encountered in typical operation. The temperatures developed in typical operation will not break down the clutch friction surfaces. However, if a clutch is slipped excessively or required to do the job of a fluid coupling, high temperatures develop quickly and destroy the clutch. Temperatures generated between the flywheel, driven discs, and pressure plates can be high enough to cause the metal to flow and the friction facing material to char and burn.

**NOTICE:**

Do not allow sustained slippage of the clutch; this could severely damage the clutch disc, pressure plate, or flywheel. Damage caused by clutch slippage due to improper break-in is not warrantable.

Slipping and excessive heat are practically nonexistent when a clutch is fully engaged. But during the moment of engagement, when the clutch is picking up the load, it generates considerable heat. An incorrectly adjusted or slipping clutch will rapidly generate sufficient heat to destroy itself.

The most important items that a driver should be aware of to ensure long service life of the clutch include: starting in the right gear, recognizing clutch malfunctions, and knowing when to adjust a clutch.

9.02.03 Clutch Adjustments

Some clutches have an internal adjustment. See the applicable section in [General Description](#) of the **Business Class® M2 Workshop Manual** for clutch adjustment procedures and specifications.

**NOTICE:**

Operating the vehicle with the clutch incorrectly adjusted could result in clutch or clutch brake failure.

9.02.04 Clutch Lubrication

The release bearing should be lubricated at frequent intervals. See **Group 25** of the **Business Class® M2 Maintenance Manual** for intervals and procedures.

**NOTICE:**

Failure to lubricate the release bearing as recommended could result in release bearing damage and damage to the clutch.

NOTE: The Sachs hydraulic clutch does not require lubrication of the release bearing.

9.02.05 Sachs Hydraulic Clutch

The Sachs hydraulic clutch is a 14.5-inch (365 mm) push-type clutch that is used with the Mercedes-Benz medium-duty transmissions, models MBT520 and MBT660.

NOTE: All Mercedes-Benz transmission models require a hydraulic clutch system. For more information on the Mercedes-Benz transmissions, see under the heading "Mercedes-Benz Manual Transmissions."

The clutch hydraulic system consists of three main components:

- A pedal unit, including the pedal, main cylinder and fluid reservoir,
- A Secondary cylinder at the clutch,
- A hydraulic hose that connects the main and secondary cylinders.

Keep the clutch fluid reservoir full to the MAX mark. If fluid level falls below the MIN mark, have the hydraulic system checked for leaks at an authorized Freightliner service facility. Use only DOT 4 brake fluid to fill the reservoir.

The hydraulic clutch provides smooth, quiet, and reliable clutch actuation with a minimum of maintenance.

Pressure builds up in the main cylinder when the clutch pedal is pressed. This pressure is transmitted through the brake fluid in the hose to the secondary cylinder, where it acts directly on the clutch release fork.

9.03 Allison On-Highway Transmissions

9.03.01 Safety Precautions

The Allison on-highway transmissions are fully automatic and include the 1000 Series™, 2000 Series™, and 2400 Series™. Refer to the Allison website for additional information, [\[Missing cross reference text\]](#).

**WARNING:**

Do not leave the vehicle unattended with the engine running. If you leave the vehicle and the engine is running, the vehicle can move suddenly, which could result in personal injury or property damage.

1000 Series

On vehicles with Allison 1000 series transmissions, do the following steps if you have to leave the cab with the engine running (for example, when checking the transmission fluid):

Without Park Position

1. Bring the vehicle to a complete stop using the service brake.

2. Ensure that the engine is at low idle rpm.
3. Put the transmission in neutral.
4. Apply the parking brake, and make sure it is properly engaged.
5. Chock the rear tires and take any other steps necessary to keep the vehicle from moving.

With Park Position

1. Bring the vehicle to a complete stop using the service brake.
2. Ensure that the engine is at low idle rpm.
3. Put the transmission in P (park).
4. Apply the parking brake (if equipped), and make sure it is properly engaged.
5. Engage the park range by slowly releasing the service brake.
6. Chock the rear tires and take any other steps necessary to keep the vehicle from moving.

2000 Series

On vehicles with Allison 2000 series transmissions, do the following steps if you have to leave the cab with the engine running (for example, when checking the transmission fluid):

Without Auto-Apply Parking Brake

Follow the instructions for vehicles with 1000 series transmissions, under the heading "Without Park Position."

With Auto-Apply Parking Brake

1. Bring the vehicle to a complete stop using the service brake.
2. Ensure that the engine is at low idle rpm.
3. Put the transmission in PB (auto-apply parking brake).
4. Apply the parking brake (if equipped), and make sure it is properly engaged.
5. Chock the rear tires and take any other steps necessary to keep the vehicle from moving.

2400 Series

On vehicles with 2400 series transmissions, follow the instructions for vehicles with 1000 series transmissions.

9.03.02 Range Inhibit Indicator, 2000 and 2400 Series

A RANGE INHIBIT indicator is a standard feature of the 2000 series and 2400 series transmissions. The RANGE INHIBIT indicator comes on to alert the driver that transmission operation is being inhibited and that the range shifts being requested by the driver may not occur. When certain operating conditions are detected by the TCM (transmission control module), the controls will lock the transmission in the current operating range.

Shift inhibits occur under the following conditions:

- Shifts from neutral to reverse or from neutral to a forward range are not permitted when the engine is above idle (greater than 900 rpm).
- Forward/reverse directional shifts are typically not permitted if appreciable output shaft speed is detected.
- When some types of unusual transmission operating conditions are detected by the TCM, the TCM temporarily limits transmission operation until the vehicle can be driven to a service location. When this type of situation is detected, the TCM will lock the transmission in a safe gear range.
- The TCM will prevent shifts from park or neutral to range when auxiliary equipment, such as a power takeoff unit (PTO), is in operation.

9.03.03 Operating Instructions, On-Highway Transmissions

Allison automatic transmissions are electronically controlled. The shift selector provides five or six forward ranges and one reverse range.

P (Park, optional on 1000 and 2400 Series)

Use park when turning the engine on or off, to check vehicle accessories, to operate the engine in idle for longer than 5 minutes, and for stationary operation of the power takeoff, if equipped. This position places the transmission in neutral and engages the park pawl of the transmission.

NOTE: This does not apply the parking brake.

PB (Auto-Apply Parking Brake, optional on 2000 Series)

**WARNING:**

Before selecting PB on the shift lever, make sure the ignition switch is not in the OFF position. Selecting PB with the ignition switch in the OFF position places the transmission in neutral, but does not apply the parking brake automatically. The vehicle could roll unexpectedly, possibly causing property damage or personal injury.

The auto-apply parking brake places the transmission in neutral and applies the parking brake.

NOTE: Selecting PB on the shift lever does not engage the park pawl of the transmission.

R (Reverse)

Reverse is used to back the vehicle. When the selector is in reverse, the reverse warning signal will sound. Always bring the vehicle to a complete stop before shifting from a forward range to reverse, or from reverse to a forward range.

**NOTICE:**

Extended idling in reverse may cause transmission overheating and damage.

Do not idle in reverse for more than 5 minutes. Select P (park), PB (auto-apply parking brake), or N (neutral) when time at idle exceeds 5 minutes.

NOTE: The shift into reverse may not succeed if a range inhibitor is active. Check for illumination of the RANGE INHIBIT indicator.

N (Neutral)

The neutral position places the transmission in neutral. This position is used when starting the engine and for stationary operation.

**WARNING:**

Failure to apply the vehicle parking brakes when the transmission is in neutral may allow the vehicle to move unexpectedly, possibly causing property damage or personal injury.

When neutral is selected, the vehicle service brakes, parking brake, or emergency brake must be applied. Selecting neutral does not apply vehicle brakes unless an auxiliary system to apply the parking brake is installed.

**WARNING:**

Do not coast in neutral. Coasting in neutral can cause an accident, possibly resulting in severe personal injury or death.

Do not let the vehicle coast in neutral. If the vehicle is allowed to coast in neutral, the engine brake will not work and you could lose control of the vehicle.

**NOTICE:**

Coasting in neutral can cause severe transmission damage.

D (Drive)

**WARNING:**

When going downhill, use a combination of downshifting, braking, and other retarding devices to control vehicle speed and the engine's rated governed speed. Failure to do so could reduce vehicle braking, possibly causing loss of vehicle control and resulting in personal injury or property damage.

In the drive position, the transmission will initially go into first range when drive is selected. As vehicle speed increases, the transmission will upshift automatically through each available range up to fourth range or fifth range. As the vehicle slows, the transmission will downshift automatically.

When going downhill, downshift to a lower transmission range to increase engine braking and to help maintain control. The transmission has a feature to prevent automatic upshifting above the lower range selected. However, during downhill operation, the transmission may upshift to the next higher range, if the engine is exceeding its governed speed in the lower range.

**NOTICE:**

Do not idle in drive for more than 5 minutes. Extended idling in drive may cause transmission overheating and damage. Always select PB (auto-apply parking brake) or P (park) if time at idle is longer than 5 minutes.

NOTE: The shift into drive may not succeed if a range inhibitor is active. Check for illumination of the RANGE INHIBIT indicator.

4 and 3 (Fourth and Third Ranges, optional)

Use the fourth or third range for city traffic and for braking on steep downgrades.

3 and 2 (Third and Second Ranges, standard)

Use the third or second range for heavy city traffic and for braking on steeper downgrades.

1 (First Range)

Use first range when pulling through mud or deep snow, when maneuvering in tight spaces, or when driving up or down very steep grades. First range provides the vehicle with its maximum driving torque and maximum engine braking effect.

NOTE: To have the transmission select these ranges automatically, leave the selector lever in D (drive).

9.04 Allison MD Series

9.04.01 Safety Precautions

Refer to the Allison website for additional information, [\[Missing cross reference text\]](#).

**WARNING:**

Do not leave the vehicle unattended with the engine running. If you leave the vehicle and the engine is running, the vehicle can move suddenly, which could result in personal injury or property damage.

On vehicles with MD series transmissions, do the following steps if you have to leave the cab with the engine running (for example, when checking the transmission fluid):

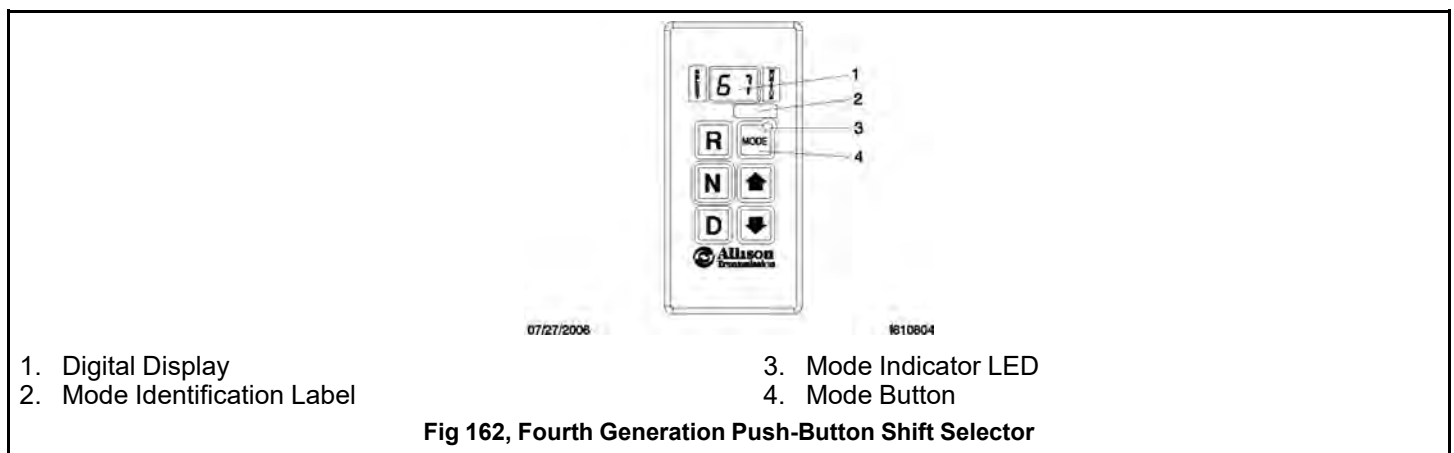
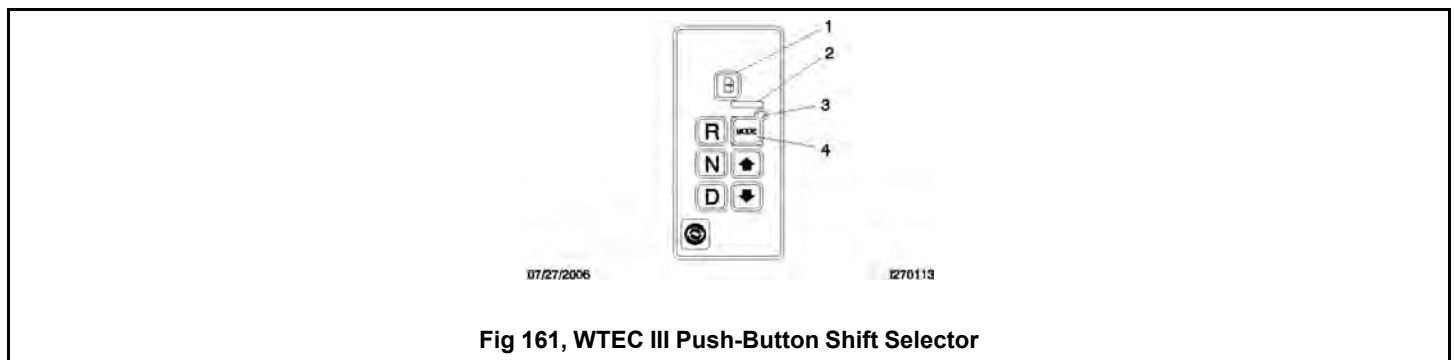
1. Bring the vehicle to a complete stop using the service brake.
2. Put the transmission in N (neutral).

3. Ensure that the engine is at low idle (500 to 800 rpm).
4. Apply the parking brake and emergency brakes, and make sure they are properly engaged.
5. Chock the rear tires and take any other steps necessary to keep the vehicle from moving.

9.04.02 Operating Instructions, MD Series

The Allison MD transmission is electronically controlled and comes with a push-button shift control that provides five or six forward ranges and one reverse range. The push-button shift selector has an R (reverse), an N (neutral), a D (drive), an up arrow, a down arrow, a mode button, and a digital display.

New shift controls — known as "fourth generation" — were introduced in mid-2006. They replaced the previous units that are commonly referred to as "WTEC III". See Fig. 161, [WTEC III Push-Button Shift Selector](#) and Fig. 162, [Fourth Generation Push-Button Shift Selector](#).



R (Reverse)

Press the R button to select reverse. The digital display will show R when reverse is selected. Always bring the vehicle to a complete stop and let the engine return to idle before shifting from a forward range to reverse, or from reverse to a forward range.

**NOTICE:**

Extended idling in reverse may cause transmission overheating and damage.

Do not idle in reverse for more than 5 minutes. Select neutral when time at idle exceeds 5 minutes.

NOTE: The shift into reverse may not succeed if a range inhibitor is active. When reverse is selected, always be sure that R is not flashing.

N (Neutral)

**WARNING:**

When starting the engine, make sure that the service brakes are applied. Failure to apply the service brakes may result in unexpected vehicle movement, which could cause severe personal injury or death. Failure to apply the vehicle parking brakes when the transmission is in neutral may allow the vehicle to move unexpectedly, possibly causing property damage or personal injury.

Press the N button to select neutral. The digital display will display N when neutral is selected. It is not necessary to press neutral before starting the vehicle. The ECU (electronic control unit) or TCM (transmission control module) automatically places the transmission in neutral at start-up.

**WARNING:**

Failure to apply the vehicle parking brakes when the transmission is in neutral may allow the vehicle to move unexpectedly, possibly causing property damage or personal injury.

When neutral is selected, the vehicle service brakes, parking brake, or emergency brake must be applied. Selecting neutral does not apply vehicle brakes unless an auxiliary system to apply the parking brake is installed.

**WARNING:**

Do not coast in neutral. Coasting in neutral can cause an accident, possibly resulting in severe personal injury or death.

Do not let the vehicle coast in neutral. If the vehicle is allowed to coast in neutral, the engine brake will not work and you could lose control of the vehicle.

Always select neutral before turning off the engine. Neutral is also used during stationary operation of the power takeoff if your vehicle is equipped with a PTO.

D (Drive)

When the D button is pushed, the highest forward range will appear in the display. The transmission will normally go into first range when drive is selected (except for those units programmed to start in second range). As vehicle speed increases, the transmission will upshift automatically through each range. As the vehicle slows, the transmission will downshift automatically.

**NOTICE:**

Do not idle in drive for more than 5 minutes. Extended idling in drive may cause transmission overheating and damage. Always select neutral if time at idle is longer than 5 minutes.

NOTE: The shift into drive may not succeed if a range inhibitor is active. When drive is selected, always be sure that D is not flashing.

5, 4, 3, and 2 (Fifth, Fourth, Third, and Second Ranges)

Occasionally, road conditions, load, or traffic conditions will make it desirable to restrict automatic shifting to a lower range. Lower ranges provide greater braking for going down grades. The lower the range, the greater the braking effect.

Push the up or down arrows on the push-button shift selector to select individual forward ranges. The digital display will display your choice of range. When a lower range is selected, the transmission may not downshift until the vehicle speed or engine RPM (engine governed speed) is reduced.

**WARNING:**

When going downhill, use a combination of downshifting, braking, and other retarding devices to control vehicle speed and the engine's rated governed speed. Failure to do so could reduce vehicle braking, possibly causing loss of vehicle control and resulting in personal injury or property damage.

When going downhill, downshift to a lower transmission range to increase engine braking and to help maintain control. The transmission has a feature to prevent automatic upshifting above the lower range selected. However, during downhill operation, if the engine governed speed is exceeded in the lower range, the transmission may upshift to the next higher range.

1 (First Range)

Use the first range when pulling through mud or deep snow, when maneuvering in tight spaces, or when driving up or down steep grades. First range provides the vehicle with its maximum driving torque and maximum engine braking effect. Push the down arrow until the first range appears on the display.

Up and Down Arrows

When a lower range is desired, after D has been pressed, press the down arrow until the desired range is shown on the display. Pressing the down arrow continuously causes the range position to continue to go down until the button is released or the lowest range is attained.

When the transmission is in drive and the down arrow has the transmission in a lower range position, press the up arrow to shift to a higher selector position. Pressing the up arrow continuously causes the range position to continue to rise until the button is released or the highest available position is attained.

Pressing the up or down arrows does not override the transmission automatic shifting operation. If a higher or lower position is selected, the transmission continues shifting through the ranges according to the vehicle operating characteristics until the highest or lowest selected position is reached.

Mode Button

The MODE button starts a specialized input or output function that has been previously programmed into the ECU or TCM. Pressing the MODE button changes transmission operation for a specific function.

Mode Indicator LED

When the MODE button is pressed, the mode indicator LED illuminates. A mode identification label, located above the MODE button, identifies the function associated with a mode change.

Digital Display

The dual digital display shows both the selected range (SELECT) and actual range attained (MONITOR). The single digital display shows the selected range.

Oil Level Sensor

Allison MD Series transmissions have an electronic oil level sensor to read fluid level information. The fluid level diagnostic will display whether the oil level is OK, too low, or too high. It will also display a default code and indicate if the preconditions (of receiving the fluid level information) are not met.

IMPORTANT: Maintain the proper fluid level at all times. If the fluid level is too low, the converter and clutch do not receive an adequate supply of fluid. If the level is too high, the transmission may shift erratically or overheat.

To access the oil level display mode, park the vehicle on a level surface, shift to N (Neutral), apply the parking brake, and idle the engine. Then simultaneously press both the up and down arrows once. The oil level will display at the end of a two-minute countdown.

Diagnostic Codes

Diagnostic codes are numerical indications relating to a malfunction in transmission operation. These codes are logged in the TCM/ECU memory. The most severe or most recent code is listed first. A maximum of five codes (numbered d1-d5) may be listed in memory at one time. If the mode indicator LED is illuminated, the displayed code is active. If it is not illuminated, the displayed code is not active.

NOTE: During normal operation, an illuminated mode indicator LED signifies the specialized mode operation is in use.

To enter diagnostics mode, first park the vehicle and apply the parking brake. Then simultaneously press both the up and down arrows twice.

9.05 Eaton® Fuller® Straight-Shift Transmissions

9.05.01 General Information, Straight-Shift

Refer to the Eaton website for additional information, [\[Missing cross reference text\]](#).

Eaton Fuller 5-speed FS models are fully synchronized. They have five forward speeds and one reverse. See Fig. 163, [Shift Pattern, 5-Speed FS Models](#) for the shift pattern.

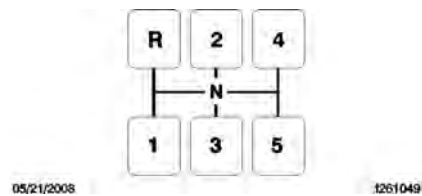


Fig 163, Shift Pattern, 5-Speed FS Models

Eaton Fuller 6-speed FS and FSO models are fully synchronized. They have six forward speeds and one reverse. See Fig. 164, [Shift Pattern, 6-Speed FS and FSO Models](#) for the shift pattern.

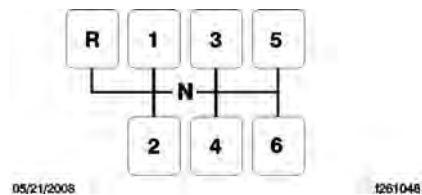


Fig 164, Shift Pattern, 6-Speed FS and FSO Models

Eaton Fuller 7-speed T models are not synchronized. They have seven forward speeds and one reverse. See Fig. 165, [Shift Pattern, 7-Speed T Models](#) for the shift pattern.

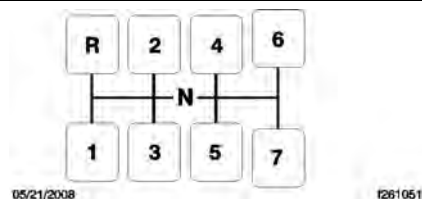


Fig 165, Shift Pattern, 7-Speed T Models

These transmissions are designed for use with on-highway, fuel economy engines where a minimum of shifting is desired and less gear reduction is acceptable.

9.05.02 Operation, Straight-Shift

1. Always use first gear when starting to move the vehicle forward.

IMPORTANT: Do not rest your foot on the clutch pedal while driving. This causes partial clutch disengagement which could cause premature clutch wear.

2. On synchronized models, press the clutch pedal to the floor when shifting gears. Double-clutching is unnecessary. On unsynchronized models, press the clutch pedal to the floor to contact the clutch brake only when engaging the first or reverse gears.

NOTE: If the vehicle is moving when shifting, press the clutch pedal just far enough to disengage the clutch. Pressing it to the floor will engage the clutch brake, if so equipped, causing premature clutch brake wear.

3. To upshift, do the following steps:
 - 3.a Accelerate to engine governed speed.
 - 3.b On synchronized models, disengage the clutch and move the shift lever to second gear.
On unsynchronized models, disengage the clutch and move the shift lever to neutral. Engage the clutch again. With the shift lever in neutral, disengage the clutch and move the shift lever to second gear.
 - 3.c Engage the clutch and note the drop in engine rpm before accelerating up to engine governed speed again.
 - 3.d Continue upshifting using the same sequence described in the previous step. Follow the pattern on the shift lever.
4. To downshift, do the following steps:
 - 4.a Wait until the engine speed drops to the rpm noted immediately after the upshift.
 - 4.b On synchronized models, disengage the clutch and move the shift lever to the next lower gear.
On unsynchronized models, disengage the clutch and move the shift lever to neutral. Engage the clutch again. With the shift lever in neutral, disengage the clutch and move the shift lever to the next lowest gear.
 - 4.c Engage the clutch smoothly.
 - 4.d Use the sequence described above to shift progressively down through each successive lower gear, as driving conditions require.

9.06 Eaton Fuller Range-Shift Transmissions

9.06.01 General Information, Range-Shift

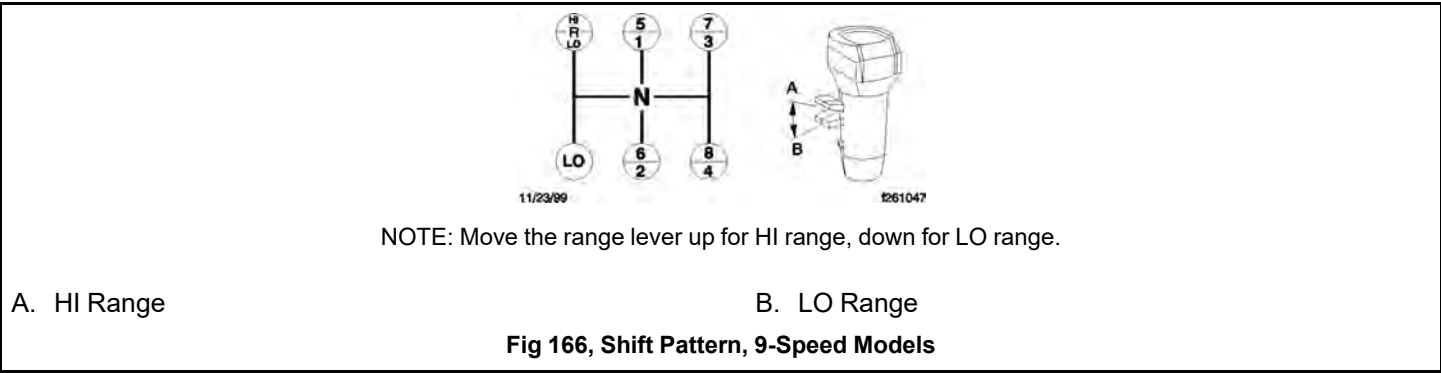
Eaton Fuller 9-Speed Models

Refer to the Eaton website for additional information, www.roadranger.com.

Eaton Fuller 9-speed range-shift models are not synchronized. They have nine forward speeds and two reverse speeds. The shift lever controls five forward gears and one reverse gear in the transmission front section, and the range lever controls a LO and HI range in the two-speed auxiliary section. The first position in the front section is used only as a starting gear. The other four ratios are used once in LO range and once again in HI range. See Fig. 166, [Shift Pattern, 9-Speed Models](#) for the shift patterns.

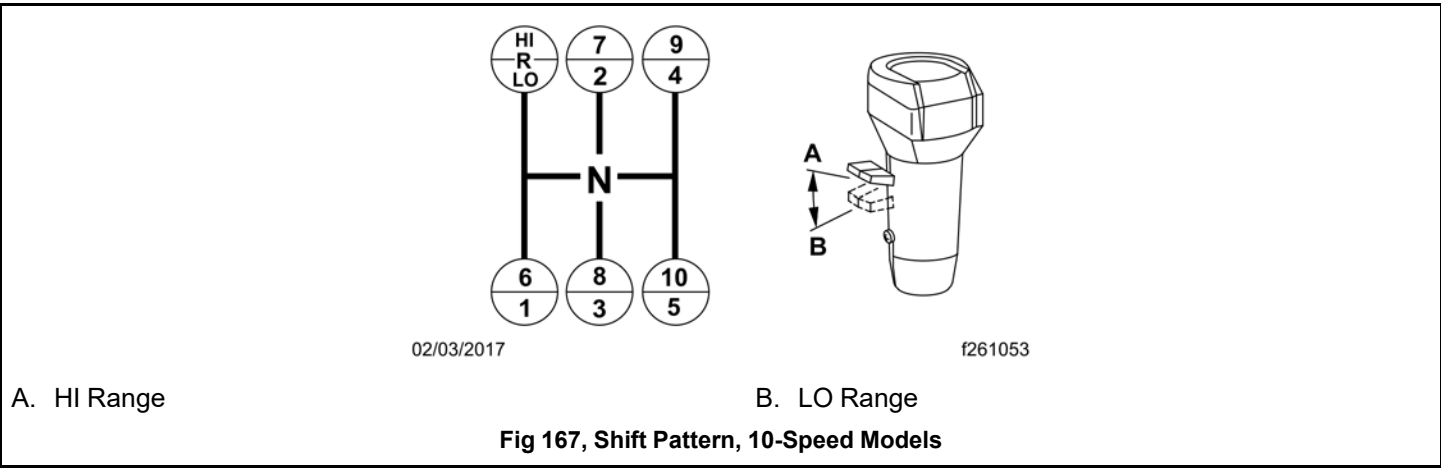
After shifting out of the first gear position, use the Roadranger® "repeat H" shift pattern. Select both LO range and HI range with the range lever (range knob). It is used once during the upshift sequence and once during the downshift sequence.

Always preselect the range shift. After preselection, the transmission will automatically make the synchronizer range shift as the shift lever passes through neutral.



Eaton Fuller 10-Speed Models

Eaton Fuller 10-speed range-shift models are not synchronized. They have ten forward speeds and two reverse speeds. The shift lever controls five forward gears and one reverse gear in the transmission front section, and the range lever controls a LO and HI range in the two-speed auxiliary section. The five forward gears selected in LO range are used again in HI range to provide the 10 progressive forward gears. See Fig.167, [Shift Pattern, 10-Speed Models](#) for the shift patterns. See Table.12, [Eaton Fuller Shift Progressions](#) for the shift progressions.



Once the highest shift lever position (fifth gear) is reached in LO range, the driver preselects the range shift lever for HI range. The range shift occurs automatically as the shift lever is moved from fifth gear position to the sixth gear position.

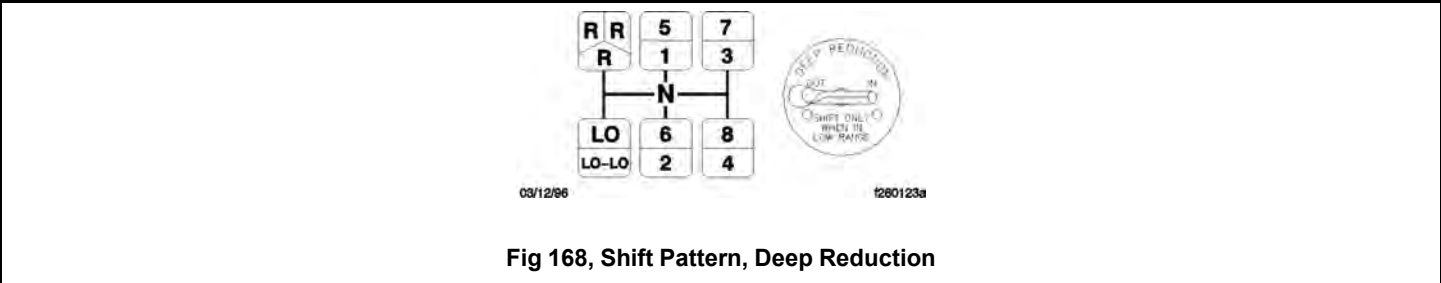
Eaton Fuller Shift Progressions			
Model	LO Range		HI Range
	Off-Highway	On-Highway	
-Speed Direct or Overdrive			
10-Speed Direct or Overdrive			

Table 10, Eaton Fuller Shift Progressions

When downshifting, the driver preselects the range lever for LO range and the range shift occurs automatically during the shift lever movement to the next gear position.

Eaton Fuller Deep-Reduction Models

Eaton Fuller deep-reduction models are not synchronized. They have a five-speed front section and a two-speed auxiliary section which has an extra deep reduction gear. The LO gear in the front section is used only as a starting gear. The other four ratios are used once in LOW RANGE and once in HIGH RANGE giving eight highway ratios. LO-LO is selected by the DEEP REDUCTION lever on the dashboard. See Fig.168,Shift Pattern, Deep Reduction for the shift pattern.



9.06.02 Operation, Range-Shift

Upshifting

- When operating off-highway or under adverse conditions, always use low gear when starting to move the vehicle.
When operating on-highway, with no load or under ideal conditions, use first gear when starting to move the vehicle.
For all conditions, use the highest gear that is still low enough to start the vehicle moving with the engine idling and without excessively slipping the clutch.
- Use the clutch brake to stop gear rotation when shifting into low (or first) or reverse when the vehicle is stationary. The clutch brake is applied by pressing the clutch pedal all the way to the floor.
For normal upshifts and downshifts, only a partial disengagement of the clutch is necessary to break engine torque.
- Do not make range shifts with the vehicle moving in reverse gear.
- Never attempt to move the range preselection lever with the gear shift lever in neutral while the vehicle is moving. Pre-selection with the range preselection lever must be made prior to moving the shift lever out of gear into neutral.

5. Do not shift from high range to low range at high vehicle speeds.
6. Use double-clutching between all upshifts and downshifts.
7. After your shifting ability improves, you may want to skip some of the ratios. This may be done only when operating conditions such as load, grade, and road speed permit.
8. Position the gear shift lever in neutral. Start the engine and bring the air system pressure up to 100 to 120 psi (689 to 827 kPa).
9. Position the range preselection lever down into low range.
10. Press the clutch pedal to the floor. Shift into low or first gear, then engage the clutch with the engine at or near idle speed to start the vehicle moving. Accelerate to 80 percent of engine governed speed.
11. Shift progressively up from low or 1st gear to the top gear in low range, double-clutching between shifts and accelerating to 80 percent of engine governed speed.
12. While in the top gear of the low-range shift pattern and ready for the next upshift, flip the range preselection lever up into high range. Double-clutch through neutral and shift into the bottom gear in high range. As the shift lever passes through neutral, the transmission will automatically shift from low range to high range.
13. With the transmission in high range, shift progressively up through each of the high range gears, double-clutching between shifts.

Downshifting

1. With the transmission in high range, shift progressively down to the bottom gear in high range, double-clutching between shifts.
2. When in the bottom gear of the high-range shift pattern and ready for the next downshift, push the range preselection lever down into low range. Double-clutch through neutral and shift into the top gear of the low-range shift pattern. As the shift lever passes through neutral, the transmission will automatically shift from high range to low range.
3. With the transmission in low range, downshift through the low range gears as conditions require.

Never use the clutch brake when downshifting or as a brake to slow the vehicle.

9.06.03 Operation, Deep-Reduction Models

Upshifting

1. Position the gear shift lever in neutral. See Fig. 169, [Shift Pattern, Deep Reduction](#) for the shift pattern. Start the engine, and bring the air system pressure up to 95 to 125 psi (655 to 862 kPa).

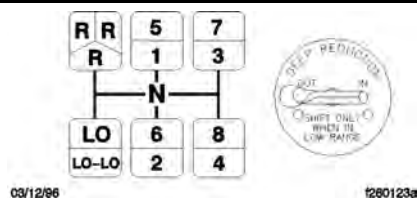


Fig 169, Shift Pattern, Deep Reduction

NOTE: If conditions are difficult, start out in LO-LO. Move the DEEP REDUCTION lever on the dashboard to the IN position. Otherwise start out in LO with the DEEP REDUCTION lever in the OUT position.

2. Position the range preselection lever down, into low range.

3. Depress the clutch pedal to the floor. Shift into LO gear; then, engage the clutch, with the engine at or near idle rpm to start the vehicle moving. The vehicle will start in LO or LO-LO depending on the DEEP REDUCTION lever position.
4. To upshift if in LO-LO, move the DEEP REDUCTION lever to the OUT position and *immediately* release the accelerator, depress the clutch pedal once to break torque, and reengage the clutch. The auxiliary section will shift from LO-LO to LO when the gears reach the same speed.
5. Shift progressively upward from LO through 1st, 2nd, 3rd, and 4th gears while the range preselection lever is in LO. Always double-clutch between gears.
6. When in 4th gear and ready for the next upshift, pull up the range preselection lever and move the shift lever, double-clutching, to the 5th gear position. As the shift lever passes through neutral, the auxiliary section will automatically shift from low to high range.

**NOTICE:**

Never move the shift lever into the LO gear position after high range preselection or anytime the auxiliary section is in high range. Transmission damage could result.

7. Continue upshifting from 5th gear through 8th gear, always double-clutching between gears.

Downshifting

1. While in high range, move the gear shift lever from 8th gear through 5th gear as conditions require, always double-clutching between gears.
2. When in 5th gear and ready for the next downshift, push down the range preselection lever and move the shift lever to the 4th gear position, being sure to double-clutch. As the shift lever passes through neutral, the auxiliary section will automatically shift from high to low range.
3. While in the low range, continue downshifting from 4th through LO as conditions require, always double-clutching between gears.
4. *Do not* downshift into LO-LO from LO unless operating conditions make it necessary. If it is necessary, make sure that the shift lever is in the LO gear position and the auxiliary section is in the low range. Then, move the DEEP REDUCTION lever on the dashboard to the IN position. *Immediately* release the accelerator, depress the clutch pedal once to break torque, engage the clutch, and accelerate. The auxiliary section will automatically shift from LO to LO-LO when the gears reach the same speed.

**NOTICE:**

Never use the clutch brake when downshifting, or as a brake to slow the vehicle. This will cause premature clutch brake wear.

9.07 Eaton Fuller AutoShift™ Automated Transmissions**9.07.01 General Information**

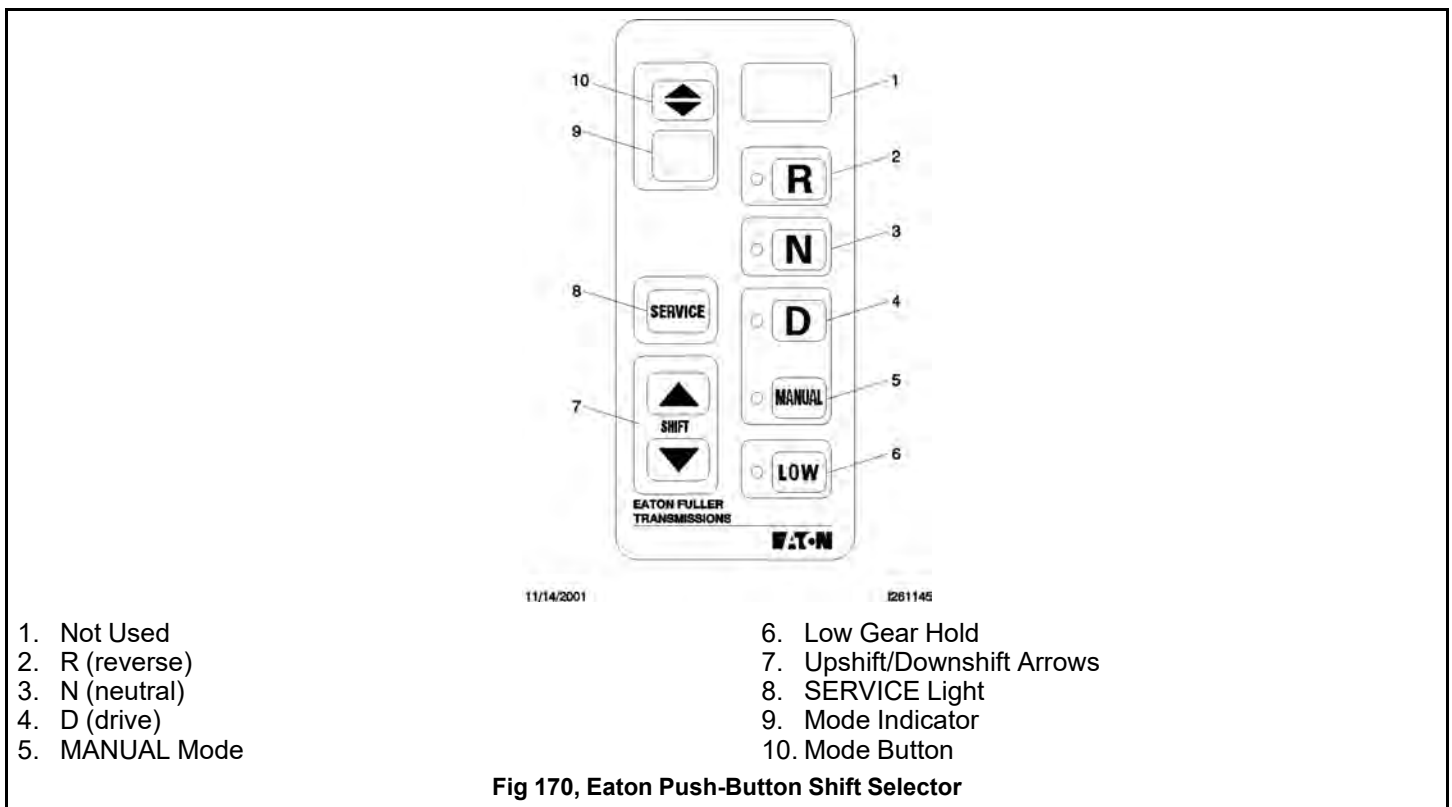
Refer to the Eaton website for additional information, www.roadranger.com.

IMPORTANT: Before starting the vehicle, always do the following:

- Be seated in the driver's seat.
- Place the transmission in neutral.
- Set the parking brakes.
- Press the clutch pedal (if equipped) down to the floor.

The AutoShift ASW is an automated 6-speed Eaton Fuller transmission. No clutch is necessary to operate the vehicle.

The AutoShift AS2 is a partially automated 10-speed Eaton Fuller transmission. The driver must use the clutch and put the transmission in neutral to start and stop the vehicle. A push-button shift selector (see Fig. 170, [Eaton Push-Button Shift Selector](#)) is used with AutoShift AS2 and ASW transmissions.



IMPORTANT: If you have to leave the cab with the engine running:

- Place the transmission in neutral.
- Set the parking brakes.
- Chock the tires.

9.07.02 Push-Button Shift Selector

Gear information is presented to the driver on the push-button shift selector, usually mounted on the right-hand control panel. On this display, the information is presented as follows:

- To select neutral, press the N button. When neutral is engaged, the telltale LED will light up next to the N button.
- To select reverse, press the R button. When reverse is engaged, the telltale LED will light up next to the R button.
- To select drive, press the D button. When drive is engaged, the telltale LED will light up next to the D button.
- To select low gear, press the LOW button. When low is engaged, the telltale LED will light up next to the LOW button.

- To change gears manually, press the MANUAL button. When the manual mode is engaged, the telltale LED will light up next to the MANUAL button.
- Use the shift buttons (upshift/downshift) to change the current starting gear selection in R, D, and LOW. In MANUAL, the shift buttons can be used to select gears.
- In automatic mode, the number of the forward gear currently engaged appears continually on the mode indicator when in drive. In MANUAL, the last gear selected appears on the mode indicator.
- If the SERVICE indicator illuminates, take the vehicle as soon as possible to an authorized Freightliner service facility.
- The mode button is reserved for future use.

IMPORTANT: To prevent engine overspeed, the transmission software will override both MANUAL and LOW if necessary. The system will not respond to gear selection requests that will either overspeed or excessively lug the engine.

9.07.03 Automatic Mode

The AutoShift AS2 transmission is normally operated in an automatic mode. To select MANUAL mode, press the MANUAL button on the push-button shift selector.

When the transmission is in automatic mode, the transmission automatically selects and engages the gears, although the transmission will respond to upshift and downshift requests as though in manual mode. See the instructions for shifting under heading "Manual Mode" below.

9.07.04 Manual Mode

When the transmission is in manual mode, the driver must select the appropriate gear, using the shift buttons on the push-button shift selector.

To upshift in MANUAL, press the upshift button (up arrow), and release. The number of the gear will appear on the mode indicator. If the requested gear is available, the transmission will shift up.

**NOTICE:**

Do not attempt to upshift until the vehicle has reached a sufficient speed. The clutch absorbs the speed difference by generating heat, which causes the clutch to wear out too soon.

Many drivers upshift into the next gear or even skip-shift into a higher gear before the vehicle has reached the correct speed. This type of shifting is almost as bad as starting off in a gear that is too high. When the engine speed (rpm) and the vehicle speed (mph or km/h) are too far apart, the clutch must absorb the difference in speed by generating heat.

To downshift in MANUAL, press the downshift button (down arrow), and release. The number of the gear will appear on the mode indicator. If the requested gear is available, the transmission will shift down.

If any requested gear is not available, an audible warning will sound and the digital display will indicate that the gear is not available.

9.07.05 Selecting Gears

R (Reverse)

Reverse (R) is used to back the vehicle. Make sure the vehicle comes to a full stop and the clutch pedal has been pressed before shifting into reverse.

To select reverse, press the clutch pedal to the floor. Then press the R button.

N (Neutral)

Neutral (N) is used for starting, parking, or any stationary operation. No gear is selected. The transmission must be in neutral to start the engine.

IMPORTANT: If the vehicle starts up in any gear but neutral, bring the vehicle to an authorized Freightliner service facility as soon as possible.

To select neutral, press the clutch pedal to the floor. Then press the N button. Set the parking brakes and slowly release the clutch pedal.

NOTE: Neutral is always available during vehicle operation. When in neutral, requests to upshift or to downshift are ignored.

D (Drive)

Drive (D) is used for normal highway driving. In drive, the transmission shifts into the proper gear for starting, and then automatically selects additional gears as needed, in a range between the starting gear and the highest gear.

To select drive, press the clutch pedal to the floor. Then press the D button. Slowly release the clutch pedal and drive the vehicle.

To start up in a gear other than the normal starting gear, push the upshift arrow with D selected, and while the vehicle is stopped.

IMPORTANT: AutoShift will not start up in any gear higher than third gear.

The number of the gear selected will flash on the auxiliary display until the driver presses the clutch pedal. This gear will be stored in memory as the default starting gear until a different starting gear is selected by the driver, or until the engine is shut down.

NOTE: The transmission may be programmed so that it is not possible to select a starting gear other than the preprogrammed starting gear.

L (Low)

LOW is used to hold the transmission in low gear when descending steep hills. If LOW is selected when the vehicle is stopped, the transmission remains in low gear until drive is selected. If LOW is selected while the vehicle is moving, the transmission downshifts at a higher engine speed than normal, in order to maximize the engine braking effect.

To select LOW, press the clutch pedal to the floor. Then press the LOW button. Slowly release the clutch pedal and drive the vehicle.

IMPORTANT: Before parking the vehicle, always do the following:

- Place the transmission in neutral.
- Set the parking brakes.
- Chock the tires, if parking on an incline.

9.08 Freightliner SmartShift Shift Control

General Information, SmartShift

The SmartShift transmission control is an electronic transmission control device. It is installed with the following transmissions:

- Eaton Fuller UltraShift PLUS

- Mercedes-Benz Automated Gear Shift (AGS)

It replaces the typical floor-mounted shift lever or dash-mounted push button control.

SmartShift accepts driver requests for transmission functions and transmits them through hard wiring to the transmission control unit (TCU). SmartShift is a true shift-by-wire system.

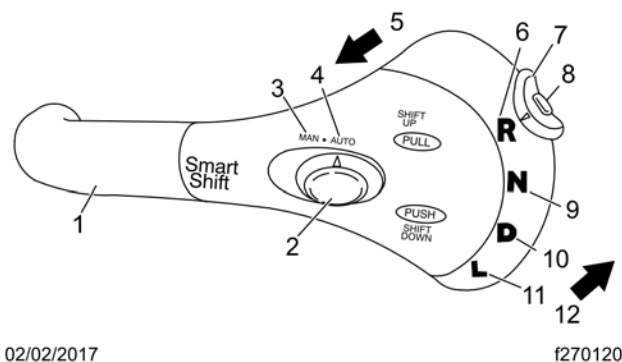
SmartShift offers two main advantages over conventional transmission control devices. Without a floor-mounted shift control, usable cab space is increased. The SmartShift control mounts to the right-hand side of the steering column and is operated by the fingers of the driver's right hand, allowing both hands to remain on the steering wheel.

A two-position slide switch (Fig. 171, [SmartShift Control \(with Eaton Fuller UltraShift PLUS\)](#)) is mounted on the body of the control lever just before the paddle widens out. The slide switch allows the driver to choose automatic (AUTO) or manual (MAN) mode.

In AUTO mode, gears shift automatically, without driver interaction. Manual gearshifts are accomplished by a momentary pull or push on the control in the plane perpendicular to the steering wheel. Pull upward (toward you) on the control to upshift and push downward (away from you) to downshift. The control is spring-loaded and returns to mid-position when released after an upshift or downshift.

For Eaton Fuller UltraShift PLUS, and AutoShift transmissions (Fig. 171, [SmartShift Control \(with Eaton Fuller UltraShift PLUS\)](#)), a four-position (R, N, D, L) selector switch is located at the end of the lever.

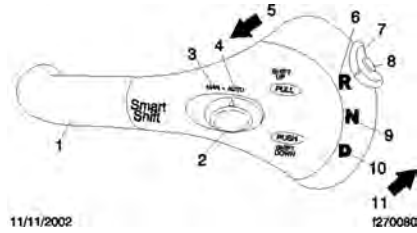
For Eaton Fuller UltraShift PLUS (Fig. 171, [SmartShift Control \(with Eaton Fuller UltraShift PLUS\)](#)), a four-position R, N, D, L selector switch is located at the end of the lever. For the Mercedes-Benz AGS (Fig. 172, [SmartShift Control \(with Mercedes-Benz AGS\)](#)), a three-position R, N, D selector switch is located at the end of the lever.



NOTE: To upshift manually, pull the lever up (towards you). To downshift manually, push the lever down (away from you).

- | | |
|---|--|
| 1. SmartShift Control Lever | 7. Selector Switch |
| 2. Slide Switch (forward driving mode switch) | 8. Neutral Lock Button |
| 3. MAN Mode (of slide switch) | 9. Neutral Position (of selector switch) |
| 4. AUTO Mode (of slide switch) | 10. Drive Position (of selector switch) |
| 5. Upshift Direction | 11. Low Position (of selector switch) |
| 6. Reverse Position (of selector switch) | 12. Downshift Direction |

Fig 171, SmartShift Control (with Eaton Fuller UltraShift PLUS)



NOTE: To upshift manually, pull the lever up (towards you). To downshift manually, push the lever down (away from you).

- | | |
|--|--|
| 1. SmartShift Control Lever | 7. Selector Switch |
| 2. Slide Switch | 8. Neutral Lock Button |
| 3. MAN Mode (of slide switch) | 9. Neutral Position (of selector switch) |
| 4. AUTO Mode (of slide switch) | 10. Drive Position (of selector switch) |
| 5. Upshift Direction | 11. Downshift Direction |
| 6. Reverse Position (of selector switch) | |

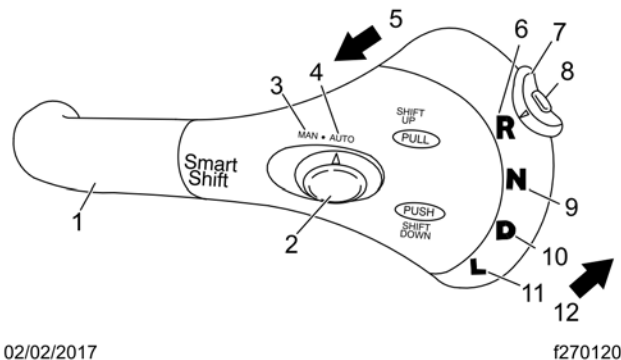
Fig 172, SmartShift Control (with Mercedes-Benz AGS)

Embedded in the selector switch is a small neutral lock button to prevent accidental shifts into gear from neutral. Any time you shift through N, press down on the neutral lock button to move the switch from neutral (N) to another gear, such as drive (D), low (L), or reverse (R). When shifting to N, it is not necessary to press the neutral lock button.

9.09 Eaton Fuller UltraShift PLUS Automated Transmissions

9.09.01 Power Up

Eaton Fuller UltraShift PLUS automated transmissions use shift selection software and electric clutch actuation; a clutch pedal is not needed to operate the vehicle. These transmissions use the four-position SmartShift control (Fig. 173, [SmartShift Control \(with Eaton Fuller UltraShift PLUS\)](#)) on the steering column to select mode, direction, neutral, low, and to make manual shifts. To know what gear the transmission is in, see the current gear indicator on the dash. Forward shifts can be made either manually or automatically.



NOTE: To upshift manually, pull the lever up (towards you). To downshift manually, push the lever down (away from you).

- | | |
|---|--|
| 1. SmartShift Control Lever | 7. Selector Switch |
| 2. Slide Switch (forward driving mode switch) | 8. Neutral Lock Button |
| 3. MAN Mode (of slide switch) | 9. Neutral Position (of selector switch) |
| 4. AUTO Mode (of slide switch) | 10. Drive Position (of selector switch) |
| 5. Upshift Direction | 11. Low Position (of selector switch) |
| 6. Reverse Position (of selector switch) | 12. Downshift Direction |

Fig 173, SmartShift Control (with Eaton Fuller UltraShift PLUS)

NOTE: Engine cranking is delayed until the transmission power-up is complete and the gear display shows a solid "N".

1. With the parking brake set, turn the ignition switch to the ON position.
2. Start the engine.
3. Apply the service brake.

NOTE: If the service brake is not applied while selecting a starting gear, the initial start gear will not be found and the driver will need to select Neutral and press the service brake while selecting the desired mode.

4. Select the desired mode and starting gear. (Inappropriate start gear selections are ignored to avoid damaging the transmission.)
5. Release the parking brake.
6. Release the service brake and apply the accelerator.

9.09.02 Power Down

1. Select Neutral on the shift control

NOTE: If the gear display does not show a solid "N", neutral has not yet been obtained. Neutral should always be reached before powering down an UltraShift PLUS, except in cases of emergency.

2. Set the parking brake.
3. Turn off the ignition, and shut down the engine.

9.09.03 Reverse (R)

NOTE: If attempting to select a non-Neutral mode without applying the service brakes, the transmission will not shift into gear. To shift into gear, select Neutral, apply the service brakes, and select the desired mode again. Also, the vehicle will not engage reverse above 2 mph (3 km/h).

Reverse (R) is at the upper end of the four-position selector switch located at the end of the SmartShift control. To select R, press in the neutral lock button and move the selector switch to the position above neutral. The default Reverse gear is engaged.

**NOTICE:**

Avoid launching the vehicle in high range. Launching the vehicle in high range increases the likelihood of clutch abuse and could be detrimental to clutch life.

9.09.04 Automatic Mode (AUTO)

In automatic drive mode (AUTO), upshifts and downshifts are made by the UltraShift PLUS without driver intervention. Press in the neutral lock button, move the selector switch to Drive (D), and press down on the throttle pedal. The transmission will shift automatically.

NOTE: If attempting to select a non-Neutral mode without applying the service brakes, the transmission will not shift into gear. To shift into gear, select Neutral, apply the service brakes, and select the desired mode again.

In Drive, the start gear is automatically selected. The selected start gear can vary depending on several vehicle inputs such as load, grade, and axle/transmission ratio. The start gear can be changed using the SmartShift control, provided the selected gear would allow the vehicle to launch without damaging the transmission. If the start gear is changed using the SmartShift control, it will be the default until the vehicle is powered down or the selection is changed again manually.

IMPORTANT: Prior to ascending a steep grade, either reduce the default start gear by one (using the SmartShift control) or apply full throttle for the duration of the grade so the vehicle maintains the proper engine and vehicle speed during the entire grade.

In Drive, the transmission automatically performs upshifts and downshifts. However, when the transmission is near the shift point, the shift can be forced using the upshift or downshift function of the SmartShift control.

NOTE: The transmission may deny a shift while ascending or descending a grade if the load of the vehicle and grade of the terrain in combination with the drivetrain ratio and engine torque fall outside of the acceptable range to perform a shift. If the shift is denied, a tone will sound.

9.09.05 Manual Mode (MAN)

In manual mode (MAN), the driver selects upshifts and downshifts instead of letting the UltraShift PLUS select them automatically. Manual shifting may be helpful when traversing a work site, railroad tracks, or steep grades, for example. To drive forward, press in the neutral lock button, move the selector switch to Drive (D), and press down on the throttle pedal. To shift up, pull the lever up (towards you); to shift down, push the lever down (away from you). The system holds the current gear unless a shift is requested or if the system initiates a manual mode override.

NOTE: The transmission may deny a shift while ascending or descending a grade if the load of the vehicle and grade of the terrain in combination with the drivetrain ratio and engine torque fall outside of the acceptable range to perform a shift. If the shift is denied, a tone will sound.

NOTE: If attempting to select a non-Neutral mode without applying the service brakes, the transmission will not shift into gear. To shift into gear, select Neutral, apply the service brakes, and select the desired mode again.

Manual Mode Override

The system is equipped with a manual mode override function. If the vehicle is being "back driven" (for example, descending a grade and vehicle speed exceeds engine speed) and the engine speed is excessively high, the system will upshift automatically. Also, if the start gear is changed and it causes the engine to lug at takeoff, the system will override the current position and select the best available gear.

9.09.06 Low (L)

Low (L) is at the lower end of the four-position selector switch located at the end of the SmartShift control. Use Low when wanting to maximize engine braking and minimize the use of the brake pedal—for example, when driving down long grades or when coming to a stop. To select Low, press in the neutral lock button and move the selector switch to the L position. The lowest available start gear will be selected (the starting gear cannot be changed in Low).

If Low is selected while moving, the transmission will not upshift (unless the system initiates a Low override). The system will downshift at the earliest opportunity to provide maximum engine braking.

NOTE: If attempting to select a non-Neutral mode without applying the service brakes, the transmission will not shift into gear. To shift into gear, select Neutral, apply the service brakes, and select the desired mode again.

Low Override

The system is equipped with a Low override function. If the vehicle is being "back driven" (for example, descending a grade and vehicle speed exceeds engine speed) and the engine speed is excessively high, the system will upshift automatically.

Also, if the start gear is changed and it causes the engine to lug at takeoff, the system will override the current position and upshift.

9.09.07 Clutch Abuse Protection

Although a vehicle equipped with an UltraShift PLUS uses an automated clutch, the clutch can still overheat and slip with improper use. The clutch abuse protection feature helps protect the clutch if the automated clutch starts to overheat. When the clutch abuse protection feature initiates and sounds a warning tone, full clutch actuation must be completed quickly. If it is not completed quickly enough, the system will either open the clutch (if the throttle pedal is not being pressed) or close the clutch (if the throttle pedal is being pressed). If the abuse continues, the system will open the clutch and take away throttle control briefly to allow the clutch to cool down.

To protect the clutch:

- Select the lowest possible start gear for the application.
- Use Creep Mode when appropriate.
- Use the service brakes and the Hill Start Aid when launching on a grade.
- Minimize the time it takes to engage the clutch from rest.
- Do not use the throttle to hold the vehicle on a grade; use the service brakes.
- Do not use the throttle to stop roll back on an incline after Hill Start Aid disengages; use the service brakes, and then relaunch.
- Do not continually start and stop, especially when loaded; use a lower gear or Creep Mode.

9.09.08 Creep Mode

The Creep Mode function allows the vehicle to maintain a constant speed at engine idle without the driver holding the throttle pedal position. This mode is useful for very low-speed maneuvering and applications where steady vehicle speed is required. The vehicle speed is determined by the selected gear ratio operating at governed low engine idle speed. Any available gear may be selected, though the transmission will downshift or exit Creep Mode to prevent stalling if the engine lugs due to load conditions.

By default, Creep Mode can be activated while in Manual Mode or Low. Eaton's ServiceRanger diagnostic software can be used to enable Creep Mode in Automatic Mode and/or Reverse.

Engaging Creep Mode

To engage Creep Mode:

1. Select Low or Manual Mode and the desired gear (while stopped or moving).
2. Apply the throttle pedal to accelerate the vehicle until the clutch is closed (engaged).
3. Release the throttle pedal. The vehicle will continue moving at governed low engine idle speed.

Exiting Creep Mode

To exit Creep Mode, apply the throttle pedal to accelerate temporarily, or select a higher gear in Manual Mode. (Creep Mode can be resumed in the selected gear by releasing the throttle pedal.)

NOTE: The transmission will exit Creep Mode if the engine lugs 150 rpm below the governed low engine idle speed. In this case, a lower gear should be selected if available.

9.09.09 Hill Start Aid

UltraShift PLUS transmissions are equipped with a Hill Start Aid (HSA) feature to prevent the vehicle from rolling while on grades steeper than 3% and allow for a controlled launch. A grade sensor is used to determine when to engage the feature.

HSA is "on" by default. It can be turned off by pressing and releasing the override switch on the dash. HSA will turn back on after the first successful launch.

When the vehicle is stopped on a grade greater than 3% and in a forward mode or reverse, depress the service brakes then release them. The vehicle will begin to move after 3 seconds, and the clutch will perform partial engagements to slow the vehicle motion. Either step on the brake or apply the throttle to continue negotiating the grade.

9.09.10 Engine Overspeed Protection

The system will upshift if necessary to prevent engine overspeed in Drive, Manual, and Low.

9.09.11 Shuttle Shifting

Shuttle shifting from reverse to any forward mode is only allowed if the vehicle speed is approximately zero.

9.09.12 Auto Start Gear Selection and Override

The UltraShift PLUS system uses various inputs to automatically select the best start gear in Drive and Manual. This selection can be changed using the SmartShift control; however, if the selection requested could cause damage or engine lugging, the request will be denied and a tone will sound.

9.09.13 Skip Shifting

When appropriate, the UltraShift PLUS system may skip shift in Drive. When prevailing conditions like load and grade allow, skip shifts can be performed in Manual mode using the SmartShift control.

9.09.14 Auto Neutral

The UltraShift PLUS system will automatically shift to neutral if the vehicle is left in Drive and the parking brake is set. "AN" will show on the gear display. To re-engage the transmission, select Neutral and then either Drive or Reverse on the shift control (it will re-engage regardless of whether the parking brake is released).

9.09.15 Automatic Traction Control

The UltraShift PLUS system requires the Automatic Traction Control (ATC) option to be enabled when driving in soft soil/sand to prevent wheel slippage and shifting issues. The ATC system has two modes: "normal" (for sand and loose road surface) and a mud/snow setting.

ATC Normal Mode

In normal mode, the system will engage the brakes on the wheel or side that the wheel slip is occurring to help the vehicle gain traction. The point at which the traction control will actuate the braking system increases with throttle: low throttle allows the system to brake the wheels earlier; heavy/full throttle raises the point of the acceptable wheel slip.

Adhere to the following points when driving in ATC normal mode:

- If using Automatic mode in soft soil and/or sand, maintain the engine speed between 1000 and 1300 rpm to prevent unnecessary upshifting.
- If using Manual mode in soft soil and/or sand, do not attempt an upshift and try to maintain the current gear.
- If the vehicle comes to a stop in the sand it may be necessary to back up prior to attempting forward movement.

ATC Mud/Snow Mode

To select the mud/snow mode, depress the ATC switch. This mode raises the wheel slip speed that is allowed before the traction control activates. The point at which the traction control will actuate the braking system increases with throttle: low throttle allows the system to brake the wheels earlier; heavy/full throttle raises the point of the acceptable wheel slip.

9.09.16 Load-Based Shifting

The UltraShift PLUS system is adaptive and will change the shift points based on grade, engine RPM, throttle position, and vehicle load. After changing loads or powering up, the system needs to relearn these inputs for the first few shifts to make the proper adjustments.

9.09.17 Coasting

When coasting to a stop on level terrain, the UltraShift PLUS system may not downshift into the lower gears. It will select a gear after the throttle is applied.

9.09.18 Ultrashift Diagnostics

System Problem

In the event of a problem, do the following steps.

1. Note the driving conditions at the time the problem occurred.
2. Record the status of the transmission at the time of the problem (AUTO or MAN mode, gear setting R, N, D, or L, current gear, engine speed, etc.)
3. Reset the system, using the procedure below.

Reset Procedure

Transmission operation can sometimes be restored by doing the following reset procedure:

1. Stop the vehicle when it is safe to do so. Set the parking brake.
2. Place the selector switch in neutral and turn off the ignition.
3. Check all harness connectors as described in .
4. Wait at least two minutes with the engine shut down.
5. Restart the engine.

If the problem continues, contact an authorized Freightliner or Eaton service facility.

9.10 Mercedes-Benz Manual Transmissions



NOTICE:

Operating a manual transmission with the fluid level higher or lower than recommended can result in transmission damage.

Mercedes-Benz transmissions use a simple 6-speed gear pattern as shown in Fig.174, [Shift Pattern, M-B Transmissions](#).

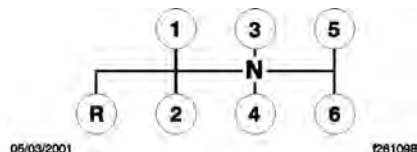


Fig 174, Shift Pattern, M-B Transmissions

Always use first gear when starting to move the vehicle forward.

IMPORTANT: Do not rest your foot on the clutch pedal while driving. This causes partial clutch disengagement which could cause premature clutch wear.

While traveling, check the tachometer regularly to be sure the engine speed is within the most economical range (1400 to 2000 rpm).

On level roads, drive in the highest usable gear, keeping engine speed down.

**NOTICE:**

Do not rest your hand on the gear shift lever while driving. This can cause synchronizer damage.

When approaching an uphill grade, shift down ahead of time to prevent loss of engine rpm. When approaching a downhill grade, shift down ahead of time to prevent runaway speed. For information about shift points and "progressive shifting," see [8.01 General Information](#).

Change gears only when absolutely necessary. Skip gears if needed.

When shifting, always press the clutch pedal all the way down. Do not force the gear lever.

Before shifting into reverse, be sure the engine is idling and the vehicle is not moving.

**NOTICE:**

If the transmission locks up while driving, making further shifting impossible, continue driving in the gear already selected to reach service assistance, as circumstances allow. Or, safely park the vehicle off the roadway and contact your nearest Freightliner dealer or other qualified service provider for roadside assistance. To prevent further transmission damage, do not move the vehicle from a standing start unless this can be accomplished safely, taking into account the gear that is engaged and the load on the vehicle.

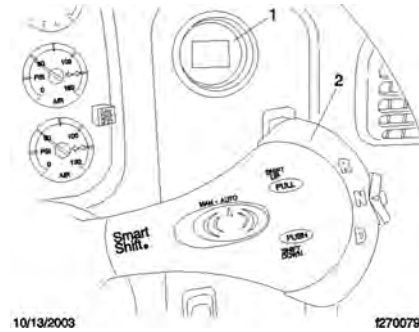
9.11 Mercedes-Benz Automated Transmissions

9.11.01 General Information, AGS

The AGS Automated Gear Shift is a fully automated 6-speed medium-duty transmission. The clutch is activated by a hydraulic system that is integral to the transmission. No clutch pedal is needed to operate the vehicle.

AGS transmissions use the SmartShift control lever on the steering column to select gears. A manual shift is possible at any time by moving the SmartShift lever up or down as needed.

The transmission control unit (TCU) can direct all forward shifts in response to driving conditions and the driver's pressure on the brake and throttle pedals. To know which gear the transmission is in, look at the round current gear indicator on the right-hand control panel as shown in Fig.175, [Shift Controls and Indicators](#).



NOTE: To know what gear the transmission is in, look at the current gear indicator.

1. Gear Indicator

2. SmartShift Control

Fig 175, Shift Controls and Indicators

The TCU always selects first gear to start the vehicle in motion. It is possible, in manual mode, to start an unloaded or lightly loaded vehicle in second gear. In most cases, second gear is acceptable for downhill starts. In other situations, for best results always start moving in first gear. Loaded vehicles, or vehicles on substantial grades, must start moving only in first gear.



NOTICE:

At the first sign of a transmission malfunction, take the vehicle out of service immediately. Depending on the type of problem, further shifting may not be possible, and driveline torque may be interrupted.

9.11.02 Operation, AGS

Power Up

1. With the parking brake set and/or the brake pedal pressed down, select neutral (N) by moving the selector switch to the center position.
2. With the transmission in neutral, turn on the ignition switch. The "CHECK TRANS" and "TRANS TEMP" telltale lights come on and go out again (bulb check). See Fig.176, [Telltale Lights](#).

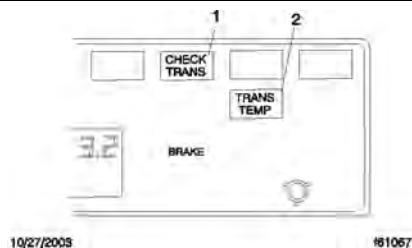


Fig 176, Telltale Lights

3. On power up, the current gear indicator shows the dot display, arranged in a square pattern. All dots in the pattern should light up, without gaps or spaces. See Fig.177, [Power-Up Dot Display](#).

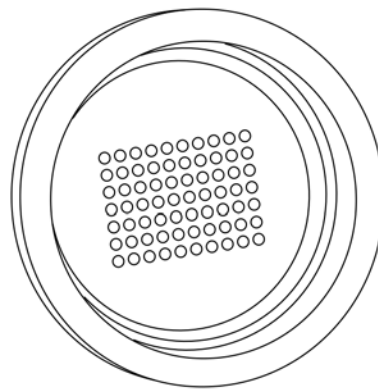


Fig 177, Power-Up Dot Display

4. When the current gear indicator shows "N," start the engine.

NOTE: No matter what the circumstances, do not start the engine unless the current gear indicator shows "N."
See 14.01, page 256 for jump starting information.

5. Select drive (D) by pressing in the neutral lock button and moving the selector switch downward to the position below neutral. Release the parking brake and/or service brake pedal. The gear is displayed on the current gear indicator.

NOTE: When D is selected, the transmission starts up in first gear. To start up in second gear (downhill start, vehicle unloaded or lightly loaded), pull up on the SmartShift lever when the current gear indicator displays "1."

6. On a level grade, press down on the throttle pedal to allow the vehicle to move forward. The vehicle will not move until the pedal is depressed.

**WARNING:**

Prevent the vehicle from rolling backwards when stopped on a hill or grade, or when the vehicle is starting from a stop on a hill or grade.

7. Prevent the vehicle from rolling backwards when stopped on a hill or grade, or when the vehicle is starting from a stop on a hill or grade.

- 7.a *To start from a full stop on a hill or grade* , quickly move your foot from the brake pedal and press firmly on the throttle pedal.

On steep hills, set the parking brake and release it only when there is enough engine power to prevent rollback.

- 7.a *To stop on a hill or grade* , press and hold the brake pedal to keep the vehicle from moving.

On steep hills, set the parking brake. Never hold a hill with the throttle pedal. This will cause the clutch to overheat.

Power Down

1. Bring the vehicle to a complete stop.
2. Set the parking brake.
3. Move the selector switch to N. Wait until "N" appears on the current gear indicator.

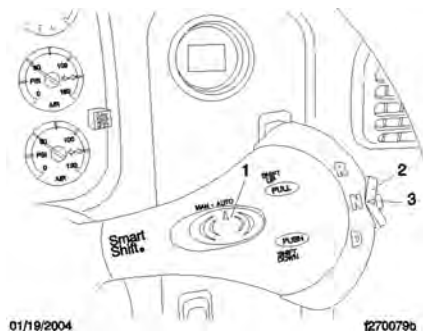
**WARNING:**

Always apply the parking brake before shutting down the engine. AGS will shift into neutral after shutdown, regardless of the position of the shift lever. If you do not set the parking brake, the vehicle could roll and cause an accident resulting in death, serious personal injury, or property damage.

4. Turn the ignition switch off and shut down the engine.
5. If the current gear indicator flashes "PB" when the engine is shut down, set the parking brake and move the selector switch to "N."

Automatic and Manual Modes

The SmartShift control has a slide switch located on the body of the lever just before the paddle widens out. See Fig. 178, [Switches, AGS Transmissions](#). The slide switch controls the forward driving mode, automatic or manual.



1. Slide Switch (controls forward driving mode)
2. Selector Switch (controls gear selection)

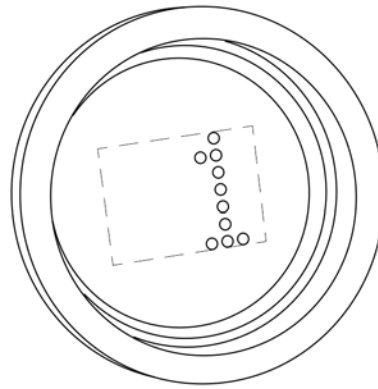
3. Neutral Lock Button (prevents accidental shift into gear)

Fig 178, Switches, AGS Transmissions

To change mode at any time, move the slide switch in the desired direction. This allows the driver to respond to a wide range of driving conditions, such as blind corners, tight curves, and steep hills.

IMPORTANT: Whatever the mode, it is always possible to shift manually by moving the lever up or down as needed.

In either mode, the gear indicator displays the current gear. See Fig. 179, [Current Gear Display](#).



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NOTE: The gear indicator displays the current gear. In this example, it displays first gear.

Fig 179, Current Gear Display

Automatic Mode (AUTO)

Automatic drive mode (AUTO) is recommended for most driving conditions. For the best fuel economy, always use AUTO mode.

In AUTO mode, upshifts and downshifts are made by the transmission without driver intervention. Press in the neutral lock button, move the selector switch to drive (D), and press down on the throttle pedal. The transmission will shift automatically through the forward gears.

If driving conditions require, it is still possible to request a manual shift. The transmission will make the shift unless the selected gear would cause engine overspeed.

If the driver presses down on the throttle pedal after a manual downshift in automatic mode, the transmission will upshift again if the TCU requires it.

On downgrades, the transmission holds the current gear until the driver requests a shift, or presses the throttle pedal.



WARNING:

While driving off-road or with locked differential in AUTO mode, use extra caution. Shifts of the AGS could interrupt power to the drive wheels, causing a rollback accident while climbing steep grades at low speeds. A rollback accident could cause death, serious personal injury, or property damage.

Manual Mode (MAN)

Manual mode may be required under certain conditions, such as:

- In difficult or slippery conditions
- On hills, steep grades, or other situations where driveline torque interruption is not desirable
- During off-road driving or driving with a locked differential
- In downhill driving where control of engine braking is needed
- If necessary to hold a specific gear on a downgrade

In manual drive mode (MAN), upshifts and downshifts are made by the driver:

- To shift up, pull the lever up (towards you).

- To shift down, push the lever down (away from you).

The system will hold the current gear until the driver requests a shift. In downhill situations in particular, the driver must be alert to vehicle speed and maintain vehicle control by downshifting and/or using the service brakes as needed.

When braking or slowing in MAN, downshift as necessary to prevent lugging the engine when speed is resumed. If the vehicle comes to a complete stop, the TCU resets the transmission to neutral.

NOTE: A downshift request will be refused if the selected gear would cause engine overspeed.

Cruise Control

Cruise control is fully functional with AGS transmission in either AUTO or MAN mode.

In AUTO, the TCU will adjust the gear selections to maintain the speed settings as desired. No driver action is necessary.

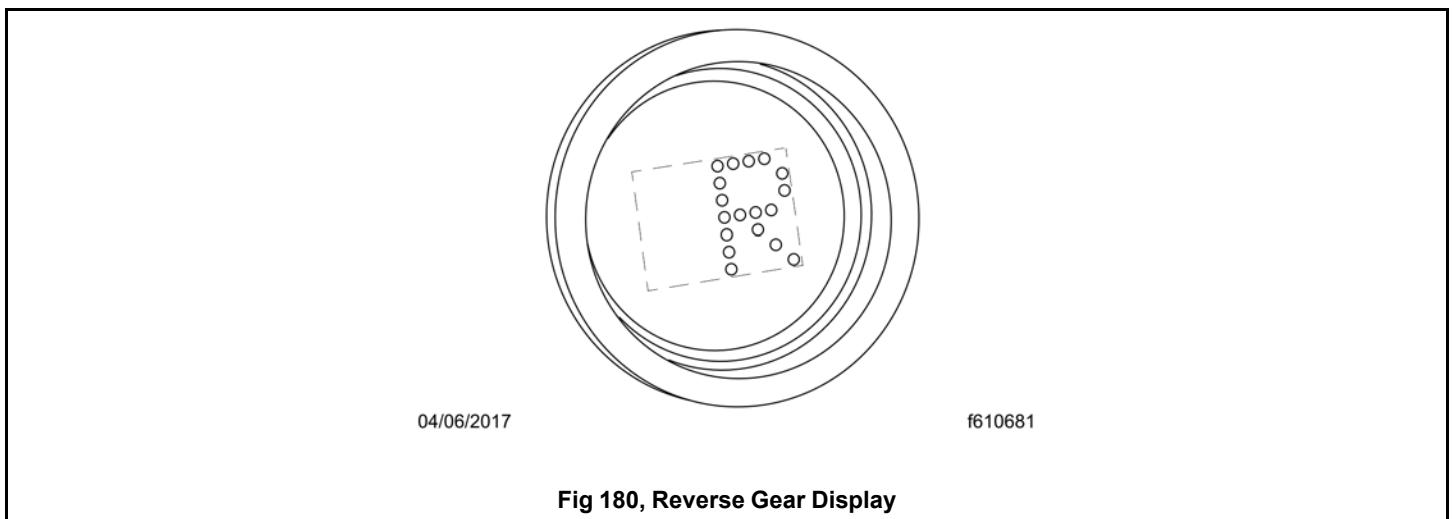
In MAN, the vehicle speed settings must be within the engine speed range for the gear selected. If the engine cannot maintain set speed due to changes in road grade, the driver must downshift or upshift as necessary.

For vehicles equipped with a power take-off (PTO) unit, two modes of operation are possible, stationary and mobile. For PTO operation, see [8.01 General Information](#).

Selecting Gears

Reverse

Reverse (R) is at the upper end of the three-position selector switch located at the end of the SmartShift control lever. To select reverse (R), press in the neutral lock button and move the selector switch upward to the position above neutral. When reverse is selected, the letter "R" displays on the gear indicator. See Fig.180, [Reverse Gear Display](#).

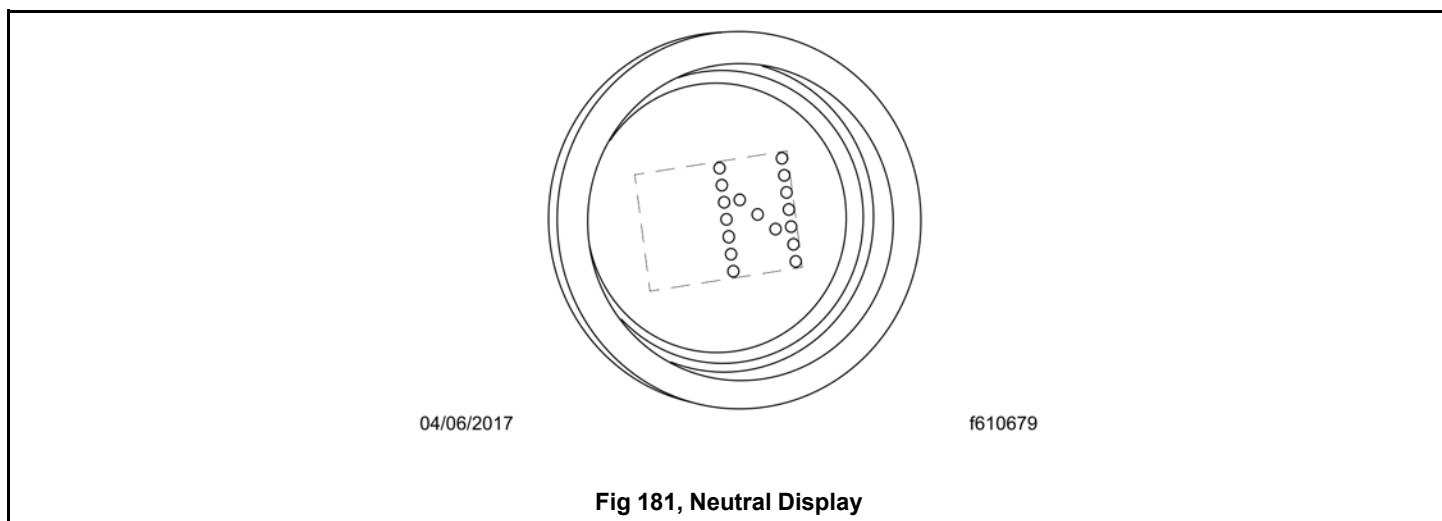


IMPORTANT: The vehicle must come to a complete stop before selecting reverse. If reverse is selected with the vehicle moving forward, an audible alert will sound and continue sounding at three-second intervals until the selector switch is returned to N or D.

Once the vehicle has come to a complete stop, reverse can be engaged.

Neutral

Neutral (N) is in the center of the three-position selector switch located at the end of the SmartShift control lever. Always start the engine in neutral. To select neutral, move the selector switch to the center position. When neutral is selected, the letter "N" displays on the gear indicator. See Fig.181, [Neutral Display](#).

**WARNING:**

Do not coast in neutral. Coasting in neutral can cause an accident, possibly resulting in severe personal injury or death.

Neutral is always available during operation, whatever the vehicle speed. When in neutral, requests to upshift or downshift are ignored. If the selector switch is moved from neutral to drive while the vehicle is moving, the transmission will shift into a gear within the operating torque range of the engine.

**WARNING:**

Always apply the parking brake before shutting down the engine. AGS will shift into neutral after shutdown, regardless of the position of the shift lever. If you do not set the parking brake, the vehicle could roll and cause an accident resulting in death, serious personal injury, or property damage.

Before shutting down the engine, return the selector switch to "N." When the ignition is turned off, the transmission will reset to neutral during power down.

Drive

IMPORTANT: The vehicle must come to a complete stop before selecting drive. If drive is selected with the vehicle moving in reverse, an audible alert will sound and continue sounding at three-second intervals until the selector switch is returned to N or R.

Drive (D) is at the lower end of the three-position selector switch located at the end of the SmartShift control lever. To select drive, press in the neutral lock button and move the selector switch to the position below neutral. When drive is selected, the number of the currently selected forward gear (1, 2, 3, 4, 5, or 6) displays on the gear indicator.

Upshifting

NOTE: The driver can manually upshift at any time, even when the slide switch is set to AUTO mode.

To request an upshift with the transmission in drive, pull the control lever up (towards you). If the gear is available, the transmission upshifts and the new gear displays on the gear indicator.

As in a manual transmission, upshifting too early causes engine lugging and uneven operation.

To achieve smooth operation in MAN mode, upshift when the engine speed reaches approximately 2000 revolutions per minute (rpm). Heavy loads or steep grades require higher rpm; lighter loads require lower rpm.

An unavailable request to upshift is not stored in memory. The upshift must be requested again.

Downshifting

NOTE: The driver can manually downshift at any time, even when the slide switch is set to AUTO mode.

To request a downshift with the transmission in drive, push the control lever down (away from you). If the gear is available, the transmission downshifts and the new gear displays on the gear indicator.

Downshifts are not available if the engine speed after the shift would exceed 2700 rpm. If the gear requested is unavailable, an audible alert will sound. An unavailable request to downshift is not stored in memory. The downshift must be requested again.

To achieve smooth operation in MAN mode, downshift when the engine speed reaches approximately 1200 rpm.

Before starting down a hill, slow down. Downshift to a speed that you can control without hard pressure on the service brakes.

Before entering a curve, slow down to a safe speed. Downshift if necessary. This lets you use some power through the curve to help the vehicle be more stable when turning. It also allows you to regain speed faster as you come out of the curve.

9.11.03 AGS Diagnostics

**NOTICE:**

At the first sign of a transmission malfunction, take the vehicle out of service immediately. Depending on the type of problem, further shifting may not be possible, and driveline torque may be interrupted.

System Malfunction

If the "CHECK TRANS" telltale light comes on while driving, the audible alert sounds, and the current gear indicator begins to flash between the current gear and "SM" (system malfunction), there is a problem which may or may not be apparent to the driver. Bring the vehicle at once to a safe stopping place and call an authorized Freightliner service facility for assistance.

Clutch Overload

If the "TRANS TEMP" telltale light comes on while driving and the current gear indicator begins to flash between the current gear and "CO" (clutch overload), the clutch has begun to overheat.

The clutch overload may have been caused by improper driving practices such as frequent and rapid start/stop driving, or hillholding with the throttle pedal. In this case, allow the clutch to cool, and continue on, but cease the improper driving practices.

If the clutch overload message returns or continues, the clutch is worn or damaged. Bring the vehicle at once to a safe stopping place and call an authorized Freightliner service facility for assistance.

Low Hydraulic Fluid Level

IMPORTANT: The only hydraulic fluid permitted in this system is Pentosin CHF 11S. No other fluid can be substituted.

If the "CHECK TRANS" telltale light comes on while driving and the current gear indicator begins to flash between the current gear and "FL" (fluid level), there has been an unusual loss of hydraulic fluid. Bring the vehicle at once to a safe stopping place and call an authorized Freightliner service facility for assistance. The hydraulic reservoir holds about 1.05 quarts (one liter) of Pentosin CHF 11S.

NOTE: After hydraulic fluid loss, a special procedure is required to fill the hydraulic reservoir. This procedure must be carried out by an authorized Freightliner service facility.

9.12 Meritor™ Drive Axles

9.12.01 Drive Axles With Differential Lock

Refer to the Meritor website for additional information, www.meritor.com.

The Meritor driver-controlled differential lock feature (side-to-side wheel lock, traction control, or traction equalizer) is available on single-drive or dual-drive rear axles. It is available on both axles of a dual-drive vehicle, or on one only. It is only available on drive axles. Differential lock must only be used under adverse road conditions where greater traction is needed. With differential lock on, the turning radius is increased and vehicle handling is affected. The differential lock switch (see Fig. 182, [Differential Lock Switch](#)) allows the driver to lock the wheels on the same axle together. The red differential lock warning light illuminates on the dash message center when differential lock is engaged.



Differential lock provides maximum traction under slippery conditions. When the differential lock is engaged, the clutch collar completely locks the differential case, gearing, and axle shafts together, maximizing the traction of both wheels and protecting against spinout.

Under normal traction conditions, do not use the differential lock feature.

Differential Lock Switch

**NOTICE:**

Differential lock should only be engaged when the vehicle is stopped or moving slowly at low throttle. This will prevent internal axle damage.

Normally, when differential lock is available on dual-drive vehicles, one switch activates the lock on both rear drive axles. As an option, it is possible to have two differential lock switches, one for the forward rear and one for the rearmost drive axle. It is also possible for some vehicles to have differential lock on only one of the drive axles.

A two-position guarded rocker switch (Fig. 182, [Differential Lock Switch](#)) controls differential lock, causing the wheels on each axle governed by the switch to rotate together. To lock the wheels together, press the upper half of the rocker momentarily (at the red LED). To unlock the wheels, press the upper half of the rocker again.

IMPORTANT: The differential lock rocker switch is guarded to prevent unintentional switch activation. If the LED in the switch begins to blink during normal operation, when the switch has not been activated, this indicates an error condition. Bring the vehicle to an authorized Freightliner service facility as soon as possible.

When the differential lock switch is pressed, three responses are possible: a normal response, a slow response, and an abnormal response.

Normal Response: The LED in the switch blinks until the axle has responded to the request to lock the wheels. At this point, the LED comes on steady and stays illuminated. In normal operation, the wheels may lock so quickly that the blinking of the switch is barely noticeable.

If operation of the switch is not possible for any reason (ignition is turned off, vehicle is moving faster than 25 mph, etc.), the LED will stop blinking and turn off.

Slow Response: If operation of the switch is slowed for any reason (vehicle moving too fast, low air pressure, etc.), the switch will continue to blink until the wheels are able to lock. As in the normal response, the LED comes on steady and stays illuminated once the wheels have locked.

NOTE: If the vehicle is moving too fast, let up slightly on the accelerator. As the vehicle slows, the wheels will lock.

Abnormal Response: If the LED blinks for more than 30 seconds, the lock mechanism may not be fully engaged/disengaged. Bring the vehicle to an authorized Freightliner service facility for testing.

Differential Lock Operation

**WARNING:**

Locking the wheels when the vehicle is traveling down steep grades or when the wheels are slipping could damage the differential and/or lead to loss of vehicle control, causing personal injury and property damage.

Lock the wheels only when the vehicle is standing still or moving at very low speed, less than 5 mph (8 km/h). Never lock the wheels when the vehicle is traveling down steep grades or when the wheels are slipping.

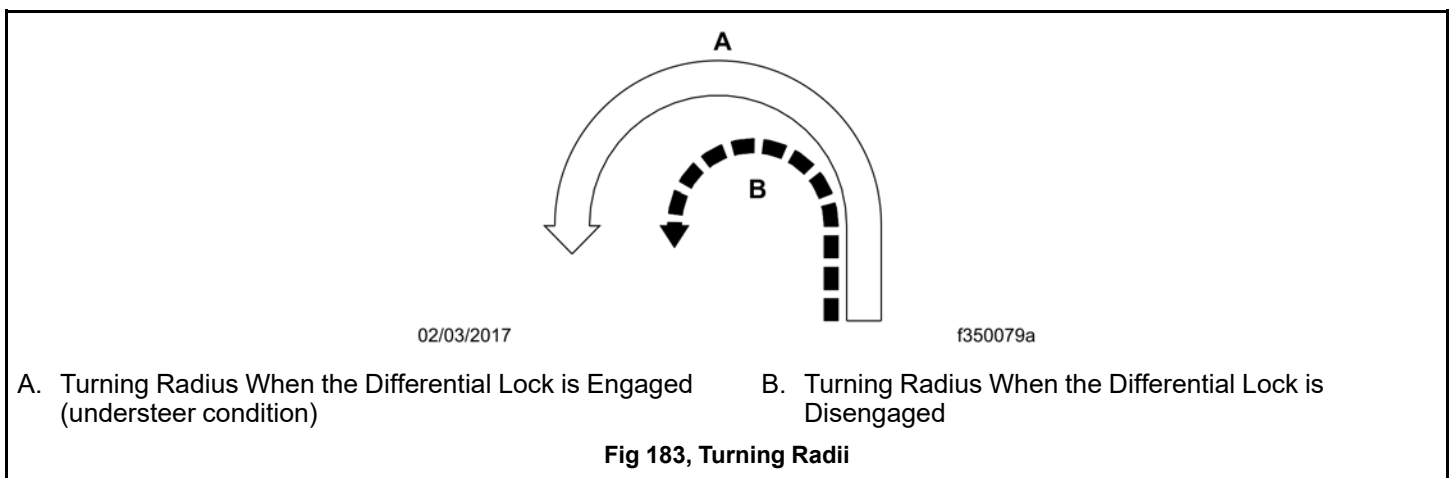
NOTE: On some vehicles, the differential lock system is connected through the low speed range of the transmission. If this system is used, the transmission must be in the low speed range for the wheels to fully lock.

**WARNING:**

A vehicle with locked wheels can still slip sideways, causing possible loss of vehicle control, personal injury, and property damage.

Be especially careful when driving under slippery conditions with the wheels locked. Though forward traction is improved, the vehicle can still slip sideways.

If the vehicle is moving, maintain a constant vehicle speed when the differential lock is turned on. Briefly let up on the accelerator to relieve torque on the gearing, allowing the wheels to lock completely. When the wheels are fully locked, the turning radius will increase because the vehicle understeers. See Fig. 183, [Turning Radii](#). Drive cautiously and do not exceed 25 mph (40 km/h).



To disengage differential lock after leaving poor road conditions, operate the differential lock switch as discussed above while maintaining vehicle speed. Let up momentarily on the accelerator to allow the wheels to fully unlock, then resume driving at normal speed.

NOTE: If the differential lock system is connected with the transmission in its low speed range, shifting out of the low speed range will also disengage the differential lock function. The switch will blink until the wheels unlock, and then go out.

9.12.02 Tandem Drive Axles With Interaxle Lock

**NOTICE:**

The interaxle lock should not be engaged on a vehicle with obviously spinning wheels. Engagement at high speed or power can damage the axle(s).

Meritor has an interaxle lock (axle lock, interaxle differential lockout) feature that is standard on all dual-drive (tandem-drive) vehicles. Interaxle lock is recommended for use under adverse road conditions where greater traction is needed. See the axle manufacturer's manual provided with the vehicle for more information.

The interaxle lock switch (Fig. 184, [Interaxle Lock Switch](#)) allows the driver to lock both rear axles together. The red interaxle warning light illuminates on the dash message center when interaxle lock is engaged.



When the interaxle lock is not engaged, there is differential action between the two axles. The differential compensates for different wheel speeds and variations in tire size. Keep the interaxle lock disengaged when driving on roads where traction is good.

When the interaxle lock is engaged, the differential action between the two axles is locked. Both drive axles now share the power. Both axles, and both sets of wheels, turn together at the same speed. The interaxle lock should be used when the vehicle encounters poor traction conditions; however, it also increases drivetrain and tire wear and should be used only when improved traction is required.

Interaxle Lock Switch

A two-position guarded rocker switch (Fig.184, [Interaxle Lock Switch](#)) controls interaxle lock, causing both axle shafts to rotate together. To lock the axles together, press the upper half of the rocker momentarily (at the red LED). To turn off interaxle lock, press the lower half of the rocker (at the double-axle icon).

IMPORTANT: The interaxle lock rocker switch is guarded to prevent unintentional switch activation. This switch does not have a diagnostic blink function when inactive.

When the interaxle lock switch is pressed, three responses are possible: a normal response, a slow response, and an abnormal response.

Normal Response: The LED in the switch blinks until the interaxle lock is engaged. At this point, the LED comes on steady and stays illuminated. In normal operation, the interaxle may lock so quickly that the blinking of the switch is barely noticeable.

If operation of the switch is not possible for any reason (ignition is turned off, vehicle is moving too fast, etc.), the LED will stop blinking and turn off.

Slow Response: If operation of the switch is slowed for any reason (by cold weather, low air pressure, etc.), the switch will continue to blink until the axles lock together, or for a maximum of 10 seconds. As in the normal response, the LED comes on steady and stays illuminated.

Abnormal Response: If the LED blinks for more than 30 seconds, the lock mechanism may not be fully engaged/disengaged. Bring the vehicle to an authorized Freightliner service facility for testing.

Interaxle Lock Operation

To engage interaxle lock and achieve maximum pulling power in slippery or hazardous road conditions, operate the interaxle lock switch as discussed above, while maintaining vehicle speed. Let up momentarily on the accelerator until the axle lock engages. Proceed over poor road conditions with caution. Do not wait until traction is lost and the tires are spinning before engaging the interaxle lock.

**NOTICE:**

Do not turn on the interaxle lock switch when the tires are slipping. Do not continuously operate the vehicle with the interaxle lock engaged during good road conditions. To do so could result in damage to the axle gearing and excessive tire wear.

To disengage the interaxle lock after leaving poor road conditions, operate the interaxle lock switch as discussed above while maintaining vehicle speed. Let up momentarily on the accelerator to allow the axles to fully unlock, then resume driving at normal speed.

9.12.03 Axle Shift

**NOTICE:**

To prevent transmission and axle damage, make sure the automatic transmission is in high range when performing an axle shift with the vehicle moving.

Axle shift is a function installed on vehicles with two-speed axles to allow the use of the low speed range when greater traction and maximum pulling power is needed at low engine speed (rpm).

Under normal operating conditions, the vehicle is operated using the high-speed gear ratios of the axle. Under extreme weather or off-road conditions, at low speed and rpm and/or to pull heavy loads, the vehicle must be operated using the low-speed, or reduction, gear ratios of the axle.

Axle Shift Switch

The axle shift switch is a two-position guarded rocker switch (Fig. 185, [Axle Shift Switch](#)) installed on vehicles with two-speed axles.



Fig 185, Axle Shift Switch

To shift the axle from low speed to high speed, press the upper half of the rocker momentarily (at the LED). To turn the axle shift off (switch from high speed back to low speed), press the upper half of the rocker again. When the axle has shifted speed, the LED turns off.

When the panel lights are on, the AXLE SHIFT legend is backlit in green.

IMPORTANT: The axle shift rocker switch is guarded to prevent unintentional switch activation. If the LED in the switch begins to blink during normal operation, when the switch has not been activated, this indicates an error condition. Bring the vehicle to an authorized Freightliner service facility as soon as possible.

When the axle shift switch is pressed, three responses are possible: a normal response, a slow response, and an abnormal response.

Normal Response: The LED in the switch blinks until the axle shifts speed. At this point, the LED comes on steady and stays illuminated. In normal operation, the axle may shift so quickly that the blinking of the switch is barely noticeable.

If operation of the switch is not possible for any reason (interaxle lock is on, ignition is turned off, etc.), the LED will stop blinking and turn off.

Slow Response: If operation of the switch is slowed for any reason (by cold weather, low air pressure, etc.), the switch will continue to blink until the axle shifts. As in the normal response, the LED comes on steady and stays illuminated.

Abnormal Response: If the LED blinks for more than 30 seconds, the axle shift function/mechanism may not be operating correctly. Bring the vehicle to an authorized Freightliner service facility for testing.

Axle Switch Interlock

NOTE: On vehicles with tandem drive axles, there is an interlock that prevents an axle from shifting speed whenever the interaxle lock is on.

If the axle shift switch is pressed when the interaxle lock is on, the axle shift will not be completed. The LED does the following:

- If the LED is off, the LED comes on briefly and turns off again.
- If the LED is on, it stays on.

To complete the axle shift, turn off the interaxle lock and press the axle shift switch again. If still needed, the interaxle lock can then be reactivated.

10.01 Steering System.....	192
10.01.01 General Information	192
10.01.02 Steering Wheel Adjustment.....	192
10.02 Air Brake System.....	193
10.02.01 Air Brake System, General Information	193
10.02.02 Air Brake System Operation.....	194
10.02.03 Automatic Slack Adjusters	196
10.03 Hydraulic Brake System.....	196
10.03.01 Hydraulic Brake System, General Information	196
10.03.02 Hydraulic Brake System Operation	197
10.04 Meritor WABCO® Antilock Braking System	198
10.04.01 Trailer ABS Compatibility	198
10.04.02 Automatic Traction Control.....	199
10.05 Enhanced Stability Control	199

10. Steering and Brake Systems

10.01 Steering System

10.01.01 General Information

The power steering system includes the power steering gear, hydraulic hoses, power steering pump, reservoir, steering wheel and column, and other components. Some models are also equipped with a separate hydraulic power cylinder on the right side of the front axle, or a right-hand secondary gear.

The power steering pump, driven by the engine, provides the power assist for the steering system. If the engine is not running, there is no power assist.

If the power-assist feature does not work due to hydraulic fluid loss, steering pump damage, or another cause, bring the vehicle to a safe stop. Do not drive the vehicle until the cause of the problem has been corrected.

**WARNING:**

Driving the vehicle without the power-assist feature of the steering system requires much greater effort, especially in sharp turns or at low speeds, which could result in an accident and possible injury.

**NOTICE:**

Never steam clean or high-pressure wash the steering gear. Internal damage to gear seals, and ultimately the steering gear, can result.

Drivers should carefully use the power available with a power steering system. If the front tires become lodged in a deep hole or rut, drive the vehicle out instead of using the steering system to lift the tires out of the hole.

**NOTICE:**

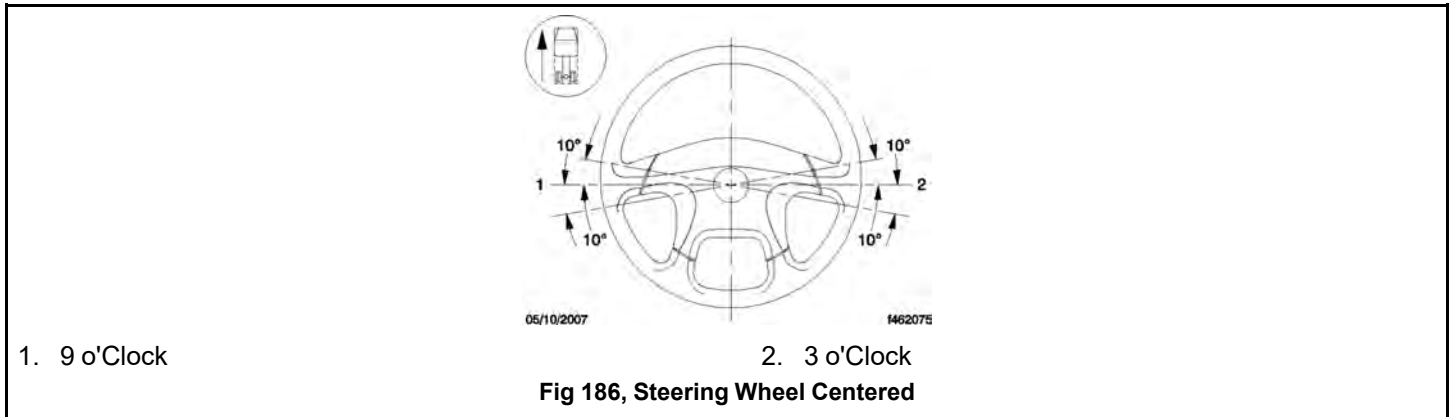
Avoid turning the tires when they are against a curb, as this places a heavy load on steering components and could damage them.

10.01.02 Steering Wheel Adjustment

Two steering wheels are available: a standard 18-inch (450-mm) steering wheel and an optional 20-inch (500-mm) steering wheel.

When there is no load on the vehicle and the front tires are pointed straight ahead, the standard steering wheel spokes should be at the 3 o'clock and 9 o'clock positions or within 10 degrees of these positions. See Fig.

186, [Steering Wheel Centered](#).



On the optional 20-inch (500-mm) wheel, the steering wheel spokes should be at the 4 o'clock and 8 o'clock positions or within 10 degrees of these positions. For steering wheel adjustment procedures, see [Replacement of the Steering Driveline, TRW](#) of the *Business Class® M2 Workshop Manual*.

10.02 Air Brake System

A dual air brake system consists of two independent air systems that use a single set of brake controls. Each system has its own reservoirs, plumbing, and brake chambers. The primary system operates the service brakes on the rear axle; the secondary system operates the service brakes on the front axle. Service brake signals from both systems are sent to the trailer.



WARNING:

Do not operate the vehicle with the front brakes backed off or disconnected. Backing off or disconnecting the front brakes will not improve vehicle handling and may lead to loss of vehicle control, resulting in property damage or personal injury.

10.02.01 Air Brake System, General Information

The warning light and buzzer come on if air pressure drops below 64 to 76 psi (441 to 524 kPa) in either system. If this happens, check the dual system air pressure gauge to determine which system has low air pressure. Although the vehicle's speed can be reduced using the brake pedal, either the front or rear service brakes will not be operating at full capacity, causing a longer stopping distance. Bring the vehicle to a safe stop and have the air system repaired before continuing.

IMPORTANT: In the event of a total loss of service brakes with full system air pressure, use the parking brake control valve (yellow knob) to bring the vehicle to a complete stop in the safest location possible.

Before a vehicle with insufficient system air pressure can be moved, the spring parking brakes must be released by applying an external air source at the gladhands, or by manually caging the parking brake springs.



WARNING:

Do not release the spring parking brakes and then drive the vehicle. There would be no means of stopping the vehicle, which could result in serious personal injury or vehicle damage. Before releasing the spring parking brakes, make the connection to a towing vehicle or chock the tires.

After correcting the brake system problem, uncage the spring parking brakes before resuming normal vehicle operation.

Primary Air Brake System

Loss of air pressure in the primary air system causes the rear service brakes to become inoperative. The secondary air system will continue to operate the front brakes and the trailer brakes (if equipped).

Secondary Air System

Loss of air pressure in the secondary air system causes the front axle brakes to become inoperative. The primary air system will continue to operate the rear service brakes and the trailer brakes (if equipped).

10.02.02 Air Brake System Operation

Before driving your vehicle, allow time for the air compressor to build up a minimum of 100 psi (689 kPa) pressure in both the primary and secondary systems. Monitor the air pressure system by observing the dual system air pressure gauge and the low-air-pressure warning light and buzzer. The warning light and buzzer shut off when air pressure in both systems reaches 64 to 76 psi (441 to 524 kPa).

IMPORTANT: Before driving the vehicle, secure all loose items in the cab so that they will not fly forward during a full brake application. Make sure all passengers are wearing seat belts.

During normal brake stops, depress the brake pedal until braking action slows down the vehicle. Increase or decrease the pressure on the pedal so that the vehicle comes to a smooth, safe stop. Apply the parking brake if the vehicle is to be parked.

IMPORTANT: An air brake proportioning system may be used in tractor air brake systems when the vehicle is not equipped with antilock braking system (ABS). When operating in bobtail mode, the rear brake chambers (on which the axle load has been greatly reduced) receive reduced (proportional) air pressure, while the front axle brake chambers receive full (normal) air pressure. This results in a different brake pedal "feel," as the pedal seems to require more travel and/or effort to slow or stop the vehicle. However, the air brake proportioning system actually improves vehicle control when the tractor is in bobtail mode. When the tractor is towing a trailer, the rear brake chambers will receive full (normal) application air pressure.

When parking a vehicle attached to a trailer that does not have spring parking brakes, apply the tractor parking brake. Chock the trailer tires before disconnecting the vehicle from the trailer.



WARNING:

If a trailer or combination vehicle is not equipped with spring parking brakes, do not park it by pulling out only the trailer air supply valve knob. This would apply only the trailer service brakes. If air were to bleed from the trailer brake system, the trailer brakes would release, possibly causing an unattended runaway vehicle.



NOTICE:

Never apply the service and spring parking brakes simultaneously. To do so transmits excessive input force to the brake components, which could damage or cause eventual failure of brake actuating components.

Brake Controls

The trailer brake lever (hand control valve) is used for applying the trailer brakes without applying the truck or tractor service brakes. It is usually mounted on the right-hand control panel. See Fig.187, [Trailer Brake Lever](#). The valve can be partially or fully applied, but in any partially applied position, it will be overridden by a full application of the brake pedal. Moving the lever down applies the trailer brakes, while moving it up releases the trailer brakes. The lever will automatically return to the up position when it is released.

**WARNING:**

Do not use the trailer service brakes for parking; they are not designed for this purpose. If air bleeds out of the trailer air tank during parking, the vehicle could roll, causing serious personal injury or property damage.

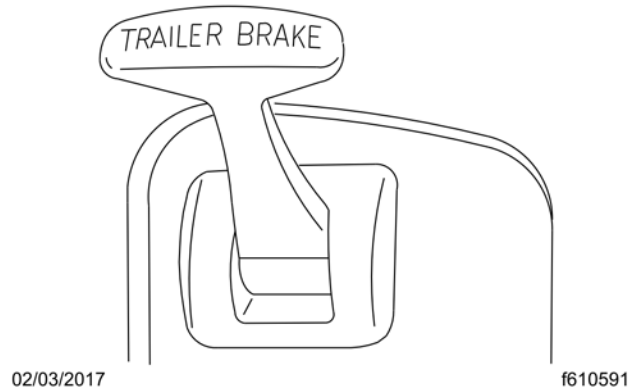
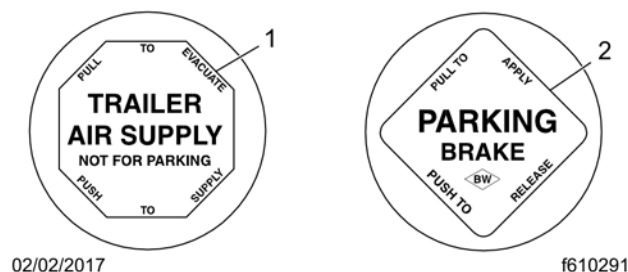


Fig 187, Trailer Brake Lever

The red octagonal-shaped knob in the control panel actuates the trailer air supply valve. See Fig.188, [Brake Valve Knobs](#). After the vehicle's air hoses are connected to a trailer and the pressure in both air systems is at least 65 psi (448 kPa), the trailer air supply valve must be pushed in. It should stay in to charge the trailer air supply system and to release the trailer spring parking brakes.

Pull the trailer air supply valve out before disconnecting a trailer or when operating a vehicle without a trailer.

If pressure in both air systems drops to 20 to 45 psi (138 to 310 kPa), the red trailer air supply valve and yellow parking brake valve automatically pop out, applying both the tractor and trailer spring parking brakes. If the trailer is not equipped with spring parking brakes, the trailer service brakes are applied.



1. Trailer Air-Supply-Valve Knob
2. Parking-Brake-Valve Knob

Fig 188, Brake Valve Knobs

The yellow diamond-shaped knob in the control panel actuates the parking brake valve. See Fig.188, [Brake Valve Knobs](#). Pulling out the parking brake valve applies both the tractor and trailer spring parking brakes and automatically causes the trailer air supply valve to pop out. Pushing in the parking brake valve releases the tractor parking brakes.

**NOTICE:**

Do not use the spring parking brakes if the service brakes are hot, such as after descending a steep grade. To do so could damage the brakes. Allow hot brakes to cool before using the spring parking brakes.

Do not use the spring parking brakes during freezing temperatures if the service brakes are wet. To do so could cause them to freeze. If the brakes are wet, drive the vehicle in low gear and lightly apply the brakes to heat and dry them.

If the trailer is not equipped with spring parking brakes, pulling out the parking brake valve applies the tractor parking brake and the trailer service brakes. When the tractor and trailer parking brakes (or trailer service brakes) are both applied, the trailer brakes are released by pushing in the trailer air supply valve, leaving the tractor parking brake applied. Air pressure in the primary or secondary reservoir must be at least 65 psi (448 kPa) before the tractor spring parking brakes, or the trailer service or spring parking brakes, can be released.

10.02.03 Automatic Slack Adjusters

Automatic slack adjusters should never be manually adjusted except during routine maintenance of the foundation brakes (e.g., replacing shoes), during slack adjuster installation, or in an emergency situation.

When the brake pushrod stroke exceeds the legal brake adjustment limit on a vehicle, there is likely a mechanical problem with the foundation brake components or the adjuster is improperly installed.

Visit a repair facility as soon as possible when brakes equipped with automatic slack adjusters are determined to be out of adjustment.

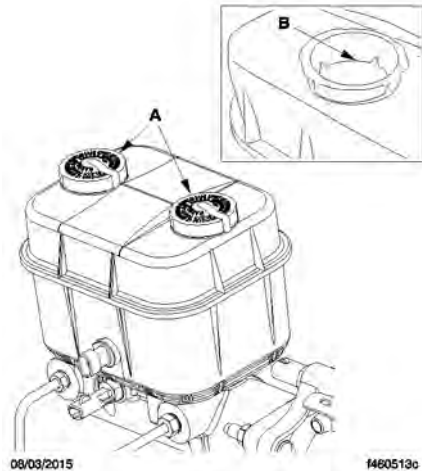
**WARNING:**

Manually adjusting an automatic slack adjuster to bring the pushrod stroke within legal limits is likely masking a mechanical problem. Adjustment is not repairing. Before adjusting an automatic slack adjuster, troubleshoot the foundation brake system and inspect it for worn or damaged components. Improperly maintaining the vehicle braking system may lead to brake failure, resulting in property damage, personal injury, or death.

10.03 Hydraulic Brake System

10.03.01 Hydraulic Brake System, General Information

The hydraulic brake system includes a power booster, main cylinder, reservoir, hydraulic lines, a brake rotor on each wheel hub, and a brake caliper and pad assembly at each rotor.



- A. Open caps and check fluid level.
- B. Fill to this level.

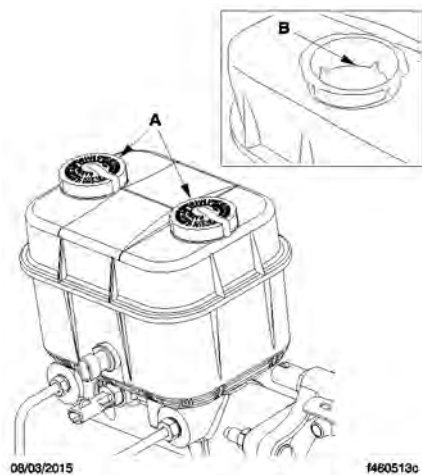
Fig 189, Hydraulic Brake Fluid Reservoir (Bosch reservoir shown, Bendix reservoir similar)

The main cylinder controls braking power to the front and rear brakes. The Bendix Hydro-Max® power booster is attached to the rear of the main cylinder and is connected to the power steering system (which provides pressurized power steering fluid). An electrical backup pump operates if there is inadequate fluid flow from the power steering pump to the power booster.

The brake system warning light illuminates if there is a problem within the system. Bring the vehicle to a safe stop and correct the problem before continuing operation of the vehicle. See [Safety Precautions](#) of the *Business Class® M2 Workshop Manual* for hydraulic brake system troubleshooting and adjustment procedures.

10.03.02 Hydraulic Brake System Operation

IMPORTANT: Make sure that the fluid level in the main cylinder reservoirs is at the bottom of the fill-neck. See Fig. 190, [Hydraulic Brake Fluid Reservoir \(Bosch reservoir shown, Bendix reservoir similar\)](#). Use only heavy-duty brake fluid, DOT 3, in the hydraulic brake system.



- A. Open caps and check fluid level.
- B. Fill to this level.

Fig 190, Hydraulic Brake Fluid Reservoir (Bosch reservoir shown, Bendix reservoir similar)

IMPORTANT: Before driving the vehicle, secure all loose items in the cab so that they will not fly forward during a full brake application. Make sure all passengers are wearing seat belts.

During normal brake stops, depress the brake pedal until braking action slows down the vehicle. Increase or decrease the pressure on the pedal so that the vehicle comes to a smooth, safe stop. Apply the parking brake if the vehicle is to be parked.

When parking a vehicle attached to a trailer, apply the tractor parking brake. Chock the trailer tires before disconnecting the vehicle from the trailer.

10.04 Meritor WABCO® Antilock Braking System

The Meritor WABCO Antilock Braking System (ABS) is an electronic wheel speed monitoring and control system that works with the brake system. ABS passively monitors vehicle wheel speed at all times, and controls wheel speed during emergency stops or wheel lock situations.

NOTE: An accumulation of road salt, dirt, or debris on the ABS tone wheels and sensors can cause the ABS warning light to come on. If the ABS light does come on, the tone rings and sensors should be inspected for corrosion and serviced if necessary. The service should include cleaning of the tone rings and sensors. If any tone ring on a vehicle shows severe corrosion, all tone rings on that vehicle should be replaced. During winter months in areas where corrosive materials are used on the highways, periodically clean the underside of the vehicle, including the tone rings and sensors, to ensure proper ABS function and to protect the components from corrosion. Clean more frequently when unusually corrosive chemicals are being used.

IMPORTANT: For proper ABS system operation, do not change tire sizes. The sizes of the tires installed during production are programmed into the electronic control unit (ECU). Installing different-sized tires could result in a reduced braking force, leading to longer stopping distances.

The ABS includes signal-generating tone wheels and sensors located in the wheel hubs of each sensed wheel. The sensors transmit vehicle wheel speed information to an electronic control unit ECU located behind the center dash. The ECU's main circuit interprets the speed sensor signals and calculates wheel speed, wheel retardation, and a vehicle reference speed. If the calculations indicate wheel lockup, the main circuit signals the appropriate modulator valve to reduce braking pressure. During emergency braking, the modulator valve alternately reduces, increases, or maintains air pressure supply in the brake chamber to prevent front and rear wheel lockup.

The Meritor WABCO ABS combines one front-axle control channel with one rear-axle control channel to form one control circuit. For example, the sensor and modulator valve on the left-front axle form a control circuit with the sensor and modulator valve on the right-rear axle.

The ECU has a safety circuit that constantly monitors the wheel sensors, traction control valve (if equipped), modulator valves, and the electrical circuitry. If the safety circuit senses a failure in any part of the ABS, the tractor warning lamp (TRACTOR ABS) illuminates and the control circuit where the failure occurred is switched to normal braking action. The remaining control circuit will retain the ABS effect. Even if the ABS is completely inoperative, normal braking ability is maintained.

The ABS indicator lamp illuminates after the ignition is switched on and will go out within three seconds if the system is functioning correctly. If the ABS indicator lamp does not illuminate, or does not go out after three seconds, have the vehicle serviced before operation.

During emergency or reduced-traction stops, fully depress the brake pedal until the vehicle comes to a safe stop. *Do not pump the brake pedal*. With the brake pedal fully depressed, the ABS will control all wheels to provide steering control and a reduced braking distance.

Although the ABS improves vehicle control during emergency braking situations, the driver still has the responsibility to change driving styles depending on existing traffic and road conditions. For example, the ABS cannot prevent an accident if the driver is speeding or following too closely.

10.04.01 Trailer ABS Compatibility

The Meritor WABCO ABS is designed to communicate with a trailer ABS, if they are compatible. Compatibility will result in the illumination of the TRAILER ABS lamp during vehicle start-up and fault detection.

The TRAILER ABS lamp will not illuminate unless a compatible trailer is connected to the tractor. The dash-mounted lamp will operate as follows when a compatible trailer is properly connected to the tractor:

- When the ignition key is turned to the ON position, the TRAILER ABS lamp will illuminate momentarily, then turn off.
- If the lamp illuminates momentarily during vehicle operation, then shuts off, a fault was detected and corrected.
- If the lamp illuminates and stays on during vehicle operation, there is a fault with the trailer ABS. Repair the trailer ABS system immediately to ensure full antilock braking capability.

IMPORTANT: If a compatible trailer is connected, and the lamp is not illuminating momentarily when the ignition key is turned to the ON position, it is possible that the lamp is burnt out.

10.04.02 Automatic Traction Control

Vehicles with electronic engines and ABS may have Automatic Traction Control (ATC). On these vehicles, the ATC system automatically limits wheel spin during reduced-traction situations. In normal braking applications, the standard air brake system is in effect.

An additional solenoid valve is installed. During reduced-traction situations, the ATC solenoid valve controls air pressure to the modulator valves and they in turn increase, hold, or reduce pressure to the appropriate brake chambers to provide better traction whenever wheel spin occurs.

When the ATC system is in the NORMAL mode, it will apply gentle braking to the spinning wheel, to feed power to the wheel(s) with better traction. If both wheels are spinning, the system will signal the engine to reduce power.

ATC includes a deep snow and mud option to increase available traction on extra soft surfaces like snow, mud, or gravel. A momentary contact rocker switch labeled ATC will be located on the dash. Pressing the switch will temporarily allow more wheel spin. The activation of the deep snow and mud option is indicated by a flashing WHEEL SPIN lamp. Pressing the switch again will cycle the system back to normal operation.

**NOTICE:**

The deep snow and mud option is intended to be used under specific slippery conditions that require momentary increased wheel spin. Using this option for an extended period of time may damage the vehicle brake system.

After the ignition switch is turned on, the TRACTOR ABS lamp and the WHEEL SPIN indicator lamp illuminate for about three seconds. After three seconds, the warning lights go out if all of the tractor's ABS components are working.

IMPORTANT: If any of the ABS warning lights do not work as described above, or illuminate while driving, repair the ABS immediately to ensure full antilock braking capability.

10.05 Enhanced Stability Control

**WARNING:**

Enhanced Stability Control (ESC) is intended only as an aid for a conscientious and alert driver. Carefully read the information in this manual to understand this system and its limitations. ESC is not a substitute for safe driving procedures. Failure to drive safely, and use the system properly, could result in personal injury and/or death and property damage.

ESC automatically reduces engine power, applies the engine brake, and/or applies the tractor and trailer brakes when the acceleration sensor detects that the vehicle is at risk of rolling over. In addition, ESC offers the added capability of complete directional stability (yaw control) in oversteer and understeer conditions to reduce the likelihood of drift-out or jackknife. The system determines where the driver is attempting to steer the vehicle and how much brake demand is required in order to more precisely control the vehicle in an emergency situation.

ESC works by constantly comparing the driver's intention with the vehicle's actual behavior. The system does this by monitoring systems such as wheel speed, steering angle, yaw rate, lateral acceleration, throttle position, and brake application. A central microcomputer analyzes the collected data and triggers a response to keep the vehicle on course when an unstable condition is detected.

The roll stability control system automatically reduces engine power, applies the engine brake, and/or applies the tractor and trailer brakes when the acceleration sensor detects that the vehicle is at risk of rolling over. The control can intervene even before an advisory message is displayed.

When the system detects that the vehicle is at risk of oversteering or understeering, it applies individual tractor wheel end brakes and trailer brakes, activates the engine brake (if equipped), and/or cuts engine power, depending on the severity. As a result, the driver has full control over the vehicle until the system detects a potential risk and intervenes accordingly. ESC operates automatically; the driver does not monitor or activate the system.

11.01 Fifth Wheels, General Information	202
11.01.01 Air-Suspension Dump Valve.....	202
11.01.02 Fifth Wheel Lubrication	202
11.02 Fifth Wheel Coupling.....	203
11.02.01 Fontaine and Holland Fifth Wheels Coupling	203
11.02.02 Jost Fifth Wheel Coupling	207
11.03 Fifth Wheel Uncoupling	210
11.03.01 Manual Uncoupling.....	210
11.03.02 Air-Actuated Uncoupling	213
11.04 Fifth Wheel Slide	214
11.04.01 General Description, Fifth Wheel Slide	214
11.04.02 Operation of Manual Slide.....	215
11.04.03 Operation of the Air Slide	217

11. Fifth Wheels and Trailer Couplings

11.01 Fifth Wheels, General Information

11.01.01 Air-Suspension Dump Valve

**WARNING:**

Do not use any fifth wheel that fails to operate properly. Doing so may cause loss of vehicle control, possibly resulting in severe personal injury or death.

The air-suspension dump valve may be used to adjust the tractor height to aid with coupling to or uncoupling from a trailer. See Fig.191, [Air-Suspension Dump Valve](#). When the switch is set to LOWER, the air-suspension dump valve deflates the air springs to lower the rear of the vehicle. In the AUTO position, the automatic ride-control valves operate for normal driving.

**WARNING:**

Never exhaust air from the suspension while driving. The suspension will not absorb road shocks, possibly damaging components, and vehicle handling may be compromised. This could result in loss of vehicle control, possibly resulting in severe personal injury or death.

**NOTICE:**

Do not operate the vehicle over uneven ground such as ramps, speed bumps, curbs, etc. with the air springs deflated. Doing this may lead to air bag separation from the piston, preventing the suspension air springs from inflating.



Fig 191, Air-Suspension Dump Valve

11.01.02 Fifth Wheel Lubrication

**WARNING:**

A standard fifth wheel plate must be kept lubricated to prevent binding between the tractor and trailer. A binding fifth wheel could cause erratic steering and loss of vehicle control, possibly resulting in personal injury or death.

The standard fifth wheel plate must be kept well lubricated with chassis grease to prevent friction and binding between the tractor fifth wheel plate and the trailer.

For a low-lube fifth wheel plate, inspect the condition of the low-lube pads. There should be no damaged or missing pieces. Slight puckering at the outside edges is normal.

For lubrication instructions, see **Group 31** of the *Business Class M2 Maintenance Manual*.

11.02 Fifth Wheel Coupling

11.02.01 Fontaine and Holland Fifth Wheels Coupling

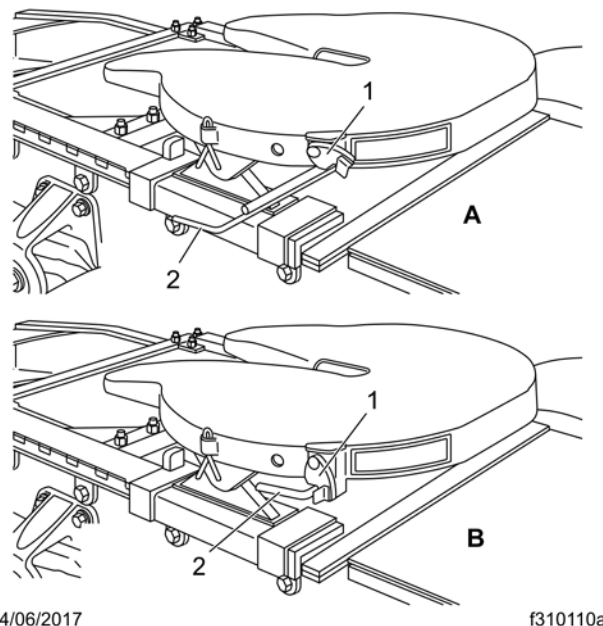
Fifth wheel coupling is activated with the lock control handle located on either the right side or left side of the fifth wheel. Coupling has successfully occurred when the kingpin has been forced into the jaws and the lock control handle has moved to the locked position.



NOTICE:

Some fifth wheels may be mounted on sliding rails. Before attempting to couple a trailer to a sliding fifth wheel, the slide feature must be locked to prevent the top plate from sliding rapidly forward or rearward, causing damage to the fifth wheel or kingpin.

1. Chock the front and rear of the trailer tires to prevent the trailer from moving.
2. Ensure the fifth wheel jaw is fully open and the operating rod is in the unlocked position. See Fig. 192, [Fontaine Locking Mechanism](#) or Fig. 193, [Holland Simplex SE Locking Mechanism](#).



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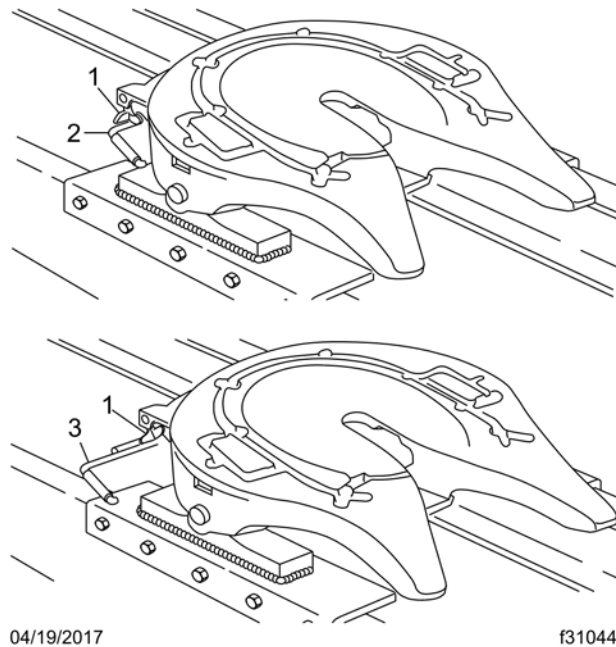
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NOTE: Make sure the safety latch is down when the control handle is locked.

A. Unlocked
B. Locked

1. Safety Latch
2. Lock Control Handle

Fig 192, Fontaine Locking Mechanism



1. Safety Latch
2. Operating Rod (locked)

3. Operating Rod (unlocked)

Fig 193, Holland Simplex SE Locking Mechanism

3. Make sure the fifth wheel top plate is tilted so the ramps are as low as possible.
4. Position the tractor so that the center of the fifth wheel is in line with the trailer kingpin. The kingpin should be in a position to enter the throat of the locking mechanism.



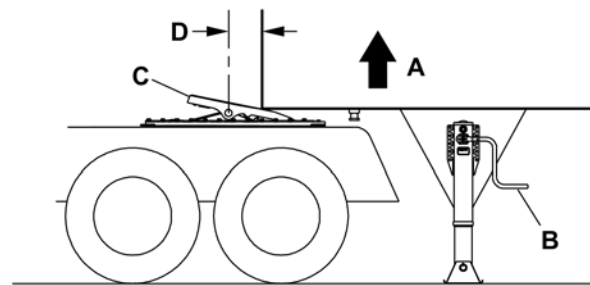
NOTICE:

Attempting to couple at the wrong height may cause improper coupling, which could result in damage to the fifth wheel or kingpin.

5. Adjust the trailer height if required.

For a standard fifth wheel plate, the trailer should contact the fifth wheel approximately 4 to 8 inches (10 to 20 cm) behind the fifth wheel pivot. See Fig.194, [Trailer Connection Point, Standard Fifth Wheel](#).

For a low-lube fifth wheel plate, the fifth wheel must slide freely under the trailer, and the trailer should contact the fifth wheel at the pivot. See Fig.195, [Trailer Connection Point, Low-Lube Fifth Wheel](#).



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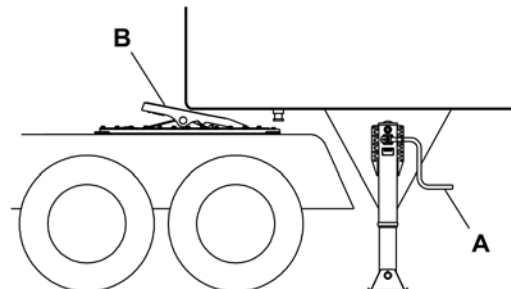
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A proper connection for a standard fifth wheel trailer is ensured by ALL of the following:

- A. The fifth wheel is lifting the trailer.
- B. The trailer height is adjusted with the crank.
- C. The ramps are tilted down.
- D. The trailer is connected 4 to 8 inches behind the fifth wheel pivot.

Fig 194, Trailer Connection Point, Standard Fifth Wheel

A proper connection for a standard fifth wheel trailer is ensured by ALL of the following:



04/28/2017

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A proper connection for a low-lube fifth wheel trailer is ensured by both of the following:

- A. The trailer height is adjusted with the crank.
- B. The ramps are tilted down.

Fig 195, Trailer Connection Point, Low-Lube Fifth Wheel

A proper connection for a low-lube fifth wheel trailer is ensured by both of the following:

6. With the fifth wheel lock opening aligned with the trailer kingpin, back the tractor slowly toward the trailer. After sliding under the trailer, STOP to prevent from hitting the kingpin too hard, then resume backing slowly until the fifth wheel locks.

On a standard fifth wheel, the fifth wheel must lift the trailer.

On a low-lube fifth wheel, do not lift the trailer as this may damage the fifth wheel plate.

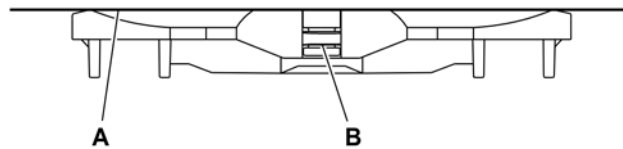
7. Apply the tractor parking brakes.

**WARNING:**

A visual inspection is required by law. Some improper couplings can pass a pull test. Sound is not reliable. Get out of the cab and look. Incorrect coupling could cause the trailer to disconnect, possibly resulting in serious personal injury or death.

8. Perform a coupling inspection, checking that there is no gap between the bottom of the trailer and the fifth wheel, and that the kingpin is securely locked. See Fig.196, [Coupling Inspection](#).

When lockup has occurred, the fifth wheel control handle moves to the locked position. Make sure that the safety latch is down over the lock control handle to hold the control handle in the locked position. (The safety latch will only rotate down if the operating rod is fully retracted in the locked position.) See Fig.192, [Fontaine Locking Mechanism](#) for Fontaine fifth wheels. See Fig.193, [Holland Simplex SE Locking Mechanism](#) for Holland fifth wheels.



04/28/2017

f311126

A successful inspection of the trailer coupling requires both of the following:

- A. There is no gap between the trailer and fifth wheel. B. The kingpin is securely locked.

Fig 196, Coupling Inspection

A successful inspection of the trailer coupling requires both of the following:

9. Release the tractor parking brakes. Test for kingpin lockup slowly inching the tractor forward, pulling on the trailer against the chocks.
10. After lockup is completed, connect the tractor-to-trailer air system lines and the electrical cable to the trailer. Take care to prevent dirt or foreign material from entering the air system lines.

**NOTICE:**

Always make sure the connection hanger keeps the trailer air hoses and electrical cables positioned so that they do not rub on anything. Rubbing may wear through hoses or cables, resulting in air leaks, or exposed or broken wires, potentially affecting trailer brake or electrical systems.

11. Charge the air brake system with air, checking that the air connections do not leak.

**WARNING:**

Incorrect fifth wheel lock adjustment could cause the trailer to disconnect, possibly resulting in serious personal injury or death.

12. With the trailer wheels chocked and the brakes set, check for clearance between the kingpin and the fifth wheel jaws by moving the tractor forward and backward against the locked kingpin. If slack is present, uncouple the trailer and have the fifth wheel inspected and adjusted by a certified technician.

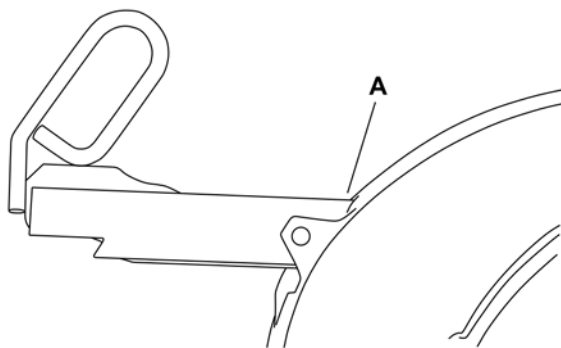
11.02.02 Jost Fifth Wheel Coupling

Fifth wheel coupling is activated with the lock control handle located on either the right side or left side of the fifth wheel. Coupling has successfully occurred when the kingpin has been forced into the jaws and the lock control handle has moved to the locked position.

**NOTICE:**

Some fifth wheels may be mounted on sliding rails. Before attempting to couple a trailer to a sliding fifth wheel, the slide feature must be locked to prevent the top plate from sliding rapidly forward or rearward, causing damage to the fifth wheel or kingpin.

1. Tilt the ramp down.
2. Open the kingpin locks. See Fig.197, [Jost Release Handle Unlocked](#).



- A. When the kingpin locks are opened, they will be held open by the catch mechanism.

Fig 197, Jost Release Handle Unlocked

3. Back the vehicle close to the trailer, centering the kingpin on the fifth wheel.
4. Chock the trailer wheels.
5. Connect the air lines and electrical cable.
6. Ensure that the red trailer air supply valve (trailer brake) is pulled out, and that the trailer parking brakes are set. See in this manual for operation of the dash-mounted brake controls.

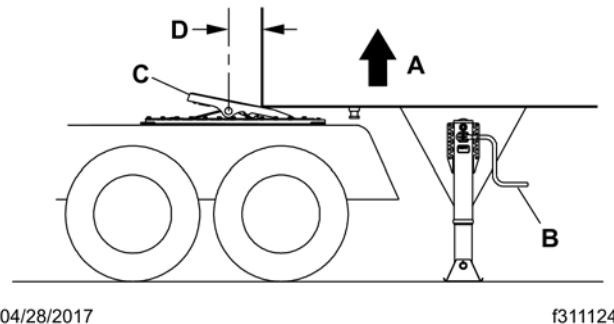
**NOTICE:**

Attempting to couple at the wrong height may cause improper coupling, which could result in damage to the fifth wheel or kingpin.

7. Adjust the trailer height (if required).

For a standard fifth wheel plate, the trailer should contact the fifth wheel approximately 4 to 8 inches (10 to 20 cm) behind the pivot. See Fig.198, [Trailer Connection Point, Standard Fifth Wheel](#).

For a low-lube fifth wheel plate, the fifth wheel must slide freely under the trailer, and the trailer should contact the fifth wheel at the pivot. See Fig.199, [Trailer Connection Point, Low-Lube Fifth Wheel](#).

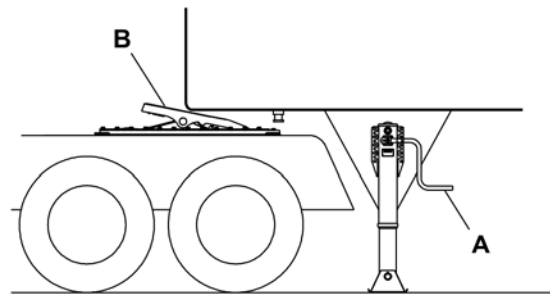


A proper connection for a standard fifth wheel trailer is ensured by all of the following:

- | | |
|---|---|
| A. The fifth wheel is lifting the trailer. | D. The trailer is connected 4 to 8 inches behind the fifth wheel pivot. |
| B. The trailer height is adjusted with the crank. | |
| C. The ramps are tilted down. | |

Fig 198, Trailer Connection Point, Standard Fifth Wheel

A proper connection for a standard fifth wheel trailer is ensured by all of the following:



04/28/2017

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A proper connection for a low-lube fifth wheel trailer is ensured by both of the following:

- A. The trailer height is adjusted with the crank. B. The ramps are tilted down.

Fig 199, Trailer Connection Point, Low-Lube Fifth Wheel

A proper connection for a low-lube fifth wheel trailer is ensured by both of the following:

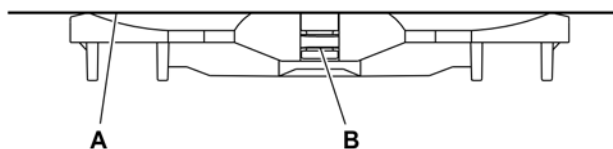
8. Back the tractor under the trailer.
On a standard fifth wheel, the fifth wheel must lift the trailer.
On a low-lube fifth wheel, do not lift the trailer as this may damage the fifth wheel plate.
9. After sliding under the trailer, STOP to prevent from hitting the kingpin too hard, then resume backing slowly until the fifth wheel locks.



WARNING:

A visual inspection is required by law. Some improper couplings can pass a pull test. Sound is not reliable. Get out of the cab and look. Incorrect coupling could cause the trailer to disconnect, possibly resulting in serious personal injury or death.

10. Apply the tractor parking brake, then perform a physical check for positive kingpin lockup, and that there is no gap between the trailer and the fifth wheel. See Fig.200, [Coupling Inspection](#).



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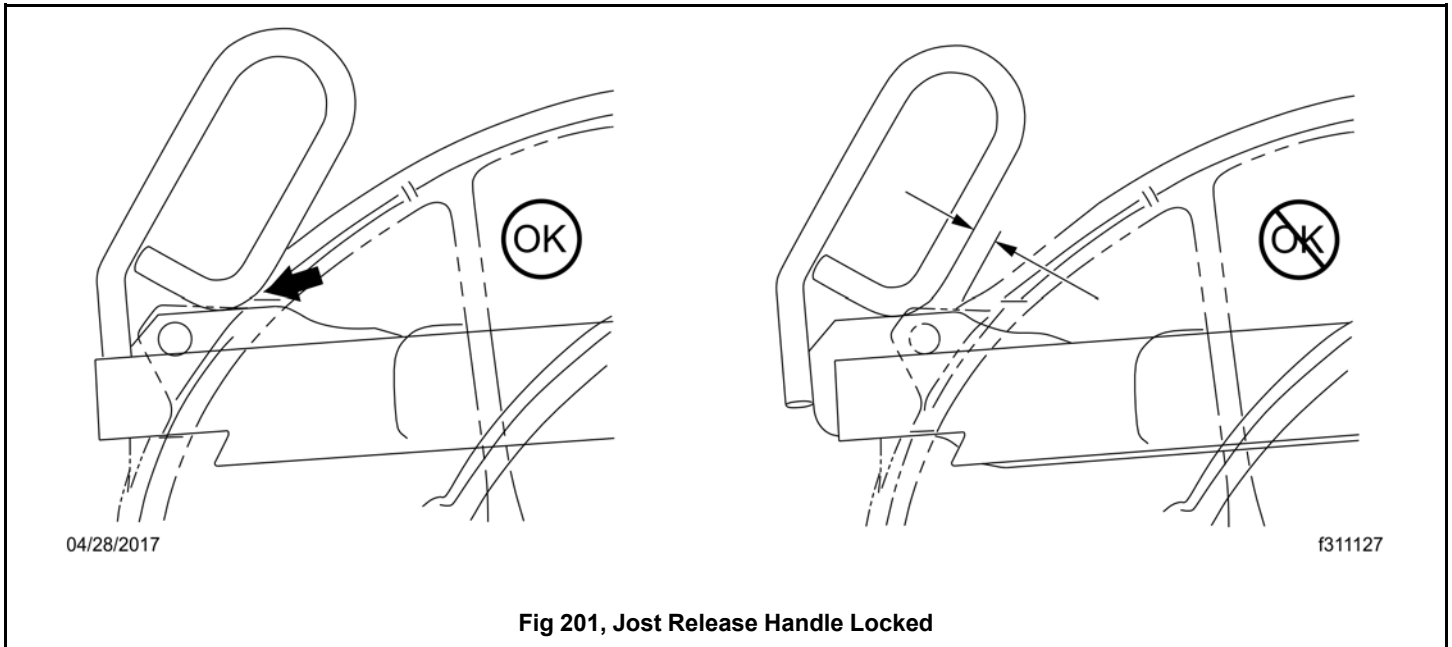
A successful inspection of the trailer coupling requires both of the following:

- A. There is no gap between the trailer and fifth wheel. B. The kingpin is securely locked.

Fig 200, Coupling Inspection

A successful inspection of the trailer coupling requires both of the following:

11. Ensure that the release handle is in the locked position adjacent to the casting. See Fig. 201, [Jost Release Handle Locked](#).

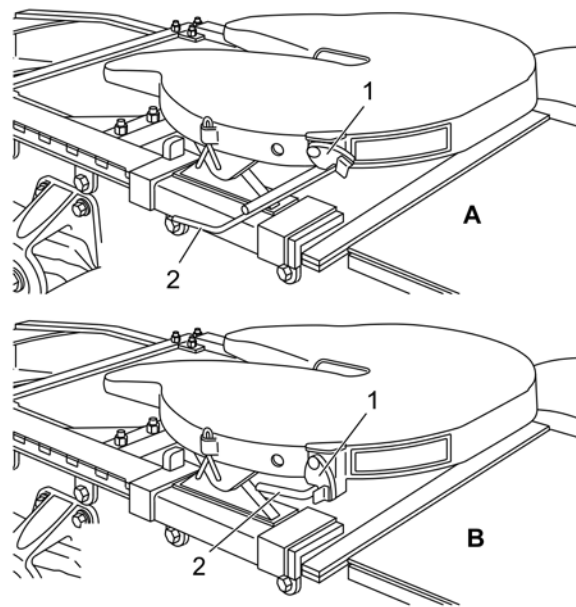


12. Release the tractor parking brakes and test for kingpin lockup by slowly moving the tractor forward, pulling on the trailer against the chocks.

11.03 Fifth Wheel Uncoupling

11.03.01 Manual Uncoupling

1. Apply the tractor and trailer parking brakes.
2. Chock the trailer rear wheels.
3. Lower the trailer landing gear until the weight is removed from the fifth wheel.
4. Disconnect the tractor-to-trailer air system lines and electrical cable. Plug the air lines to prevent dirt or foreign material from entering the lines.
5. Verify that both the yellow parking-brake and red trailer-air-supply knobs are out, the tractor and trailer parking brakes are set, and that the trailer is prepared for uncoupling.
6. Release the kingpin locking mechanism following the instructions for each manufacturer below.
 - 6.a **Fontaine:** Lift the safety latch and pull the lock control handle to the unlocked position. See Fig. 202, [Fontaine Locking Mechanism](#).



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NOTE: Make sure the safety latch is down when the control handle is locked.

A. Unlocked
B. Locked

1. Safety Latch
2. Lock Control Handle

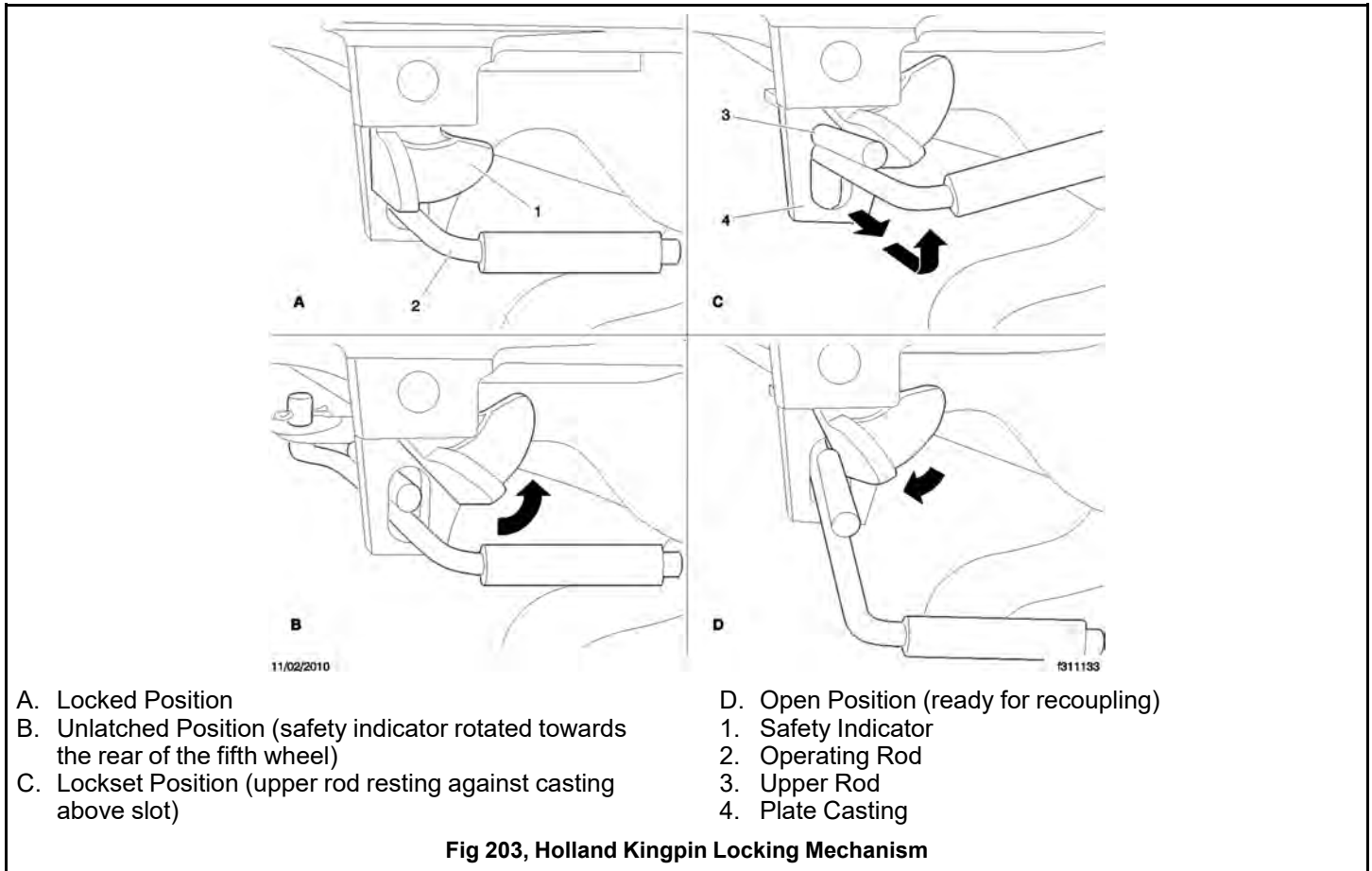
Fig 202, Fontaine Locking Mechanism

- 6.b **Holland:** In the locked position the safety indicator swings freely over the operating rod. See Fig. 203, [Holland Kingpin Locking Mechanism](#), View A.

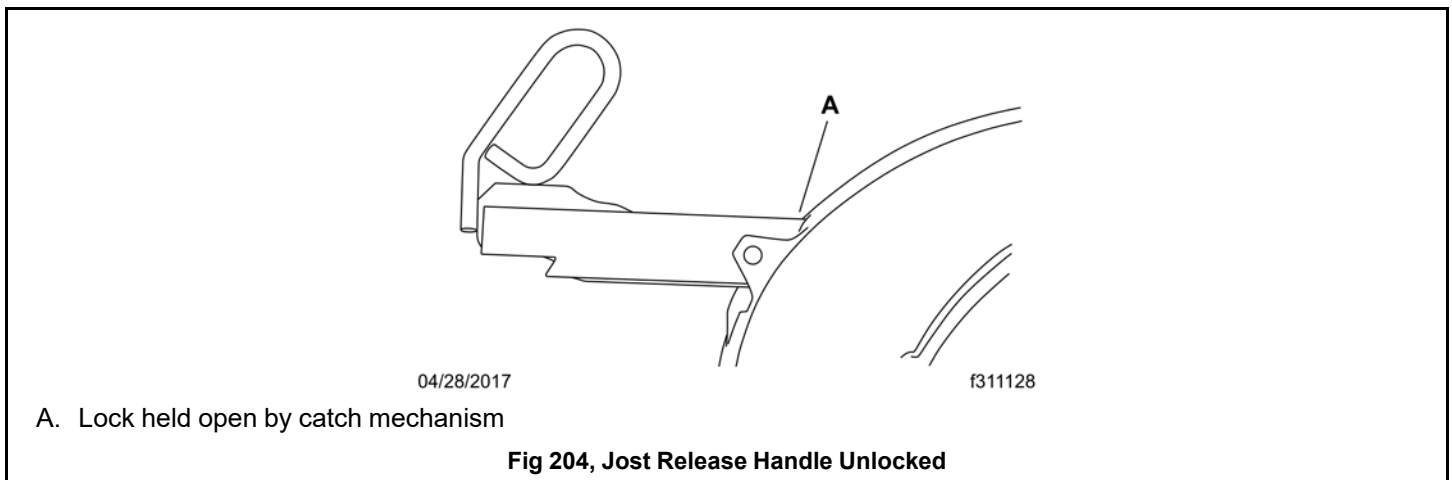
To unlock the mechanism, manually rotate the safety indicator toward the rear of the fifth wheel. See Fig. 203, [Holland Kingpin Locking Mechanism](#), View B.

Pull the operating rod out. When the upper operating rod shoulder is outside the slot, raise the handle and place the shoulder of the upper rod against the plate casting, above the slot. See Fig. 203, [Holland Kingpin Locking Mechanism](#), View C.

The fifth wheel is now in the lockset position and is ready for uncoupling. As the tractor pulls away from the trailer the kingpin forces the jaw to rotate, contacting the lock. Continued rotation of the jaw forces the lock to move outward, and drops the upper rod back into the slot. See Fig. 203, [Holland Kingpin Locking Mechanism](#) View D. The wheel is now ready for coupling.



6.c **Jost:** Pull the retractable handle out, then secure it in the open position with the catch.



7. Release the tractor parking brake then drive out slowly, allowing the trailer to slide down the fifth wheel and pick-up ramps.

11.03.02 Air-Actuated Uncoupling

General Description

A dash-mounted kingpin release switch (if equipped) may be used to uncouple the trailer. See Fig. 205, [Air-Actuated Kingpin Release Valve](#).



NOTE: In the event of an air system failure, air-actuated kingpins can be manually released following the instructions for manual unlocking.

**WARNING:**

Once the kingpin release switch has been pushed, the kingpin lock is released. The vehicle **MUST NOT** be driven with the trailer until the trailer has been uncoupled and coupled again. Failure to do so may result in separation of the trailer from the tractor, possibly causing serious personal injury or death.

Preparing the Trailer for Uncoupling

Before using the air valve to unlock a fifth wheel kingpin, prepare the trailer as follows.

1. Apply the tractor and trailer parking brakes.
2. Chock the trailer rear wheels.
3. Lower the trailer landing gear until the weight is removed from the fifth wheel.
4. Disconnect the tractor-to-trailer air lines and electrical cable. Plug the air lines to prevent dirt or foreign material from entering the lines.

Fontaine and Holland Fifth Wheels Air-Activated Kingpin Unlock

1. Verify that both the yellow parking-brake and red trailer-air supply knobs are out, the tractor and trailer parking brakes are set, and that the trailer is prepared for uncoupling.

NOTE: On Fontaine and Holland fifth wheels, if the tractor parking brake is not set, the air-actuated kingpin-release valve will not activate.

2. Pull and hold the kingpin release valve (see Fig.206, [Air-Actuated Kingpin Release Valve](#)) until the kingpin lock mechanism opens and locks in place.
3. Release the pull valve.

4. Release the tractor parking brake.
5. Drive out from under the trailer.



Fig 206, Air-Actuated Kingpin Release Valve

Jost Fifth Wheels Air-Activated Kingpin Unlock

1. Verify that both the yellow parking-brake and red trailer-air-supply knobs are out, the tractor and trailer parking brakes are set, and that the trailer is prepared for uncoupling.

NOTE: With Jost fifth wheels, if the trailer parking brake is not set the air-actuated valve will not activate.

2. Release the tractor parking brake.
3. Pull and hold the kingpin release valve, then drive forward slowly.
4. After the trailer has slid down the fifth wheel and pick-up ramps, release the pull valve.

11.04 Fifth Wheel Slide

11.04.01 General Description, Fifth Wheel Slide



WARNING:

Adjust the fifth wheel slide correctly, and do not overload any tractor axle by incorrectly loading the trailer. Incorrect slide adjustment or improper axle loading could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

On sliding fifth wheel assemblies, the fifth-wheel plate is attached to rails that allow forward and rearward movement of the fifth wheel to optimally distribute the load across the axles. Slots are evenly spaced along the slide rails, and retractable wedges are positioned through the slots to hold the fifth wheel in the desired position.

The amount of load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle. Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

The maximum axle weight ratings are shown on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety Standard (CMVSS) label attached to the left rear door post of the tractor. The desired load on the axle is no less than 80 percent of the maximum axle weight rating, but in no instances should the axle load exceed the maximum axle weight rating given on the FMVSS or CMVSS label.

11.04.02 Operation of Manual Slide

The manual slide feature is operated from the fifth wheel plate with a manual release handle using the following procedure. See Fig.207, [Manual Release Sliding Fifth Wheel \(Fontaine shown\)](#).

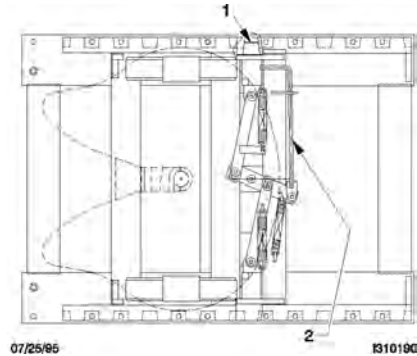


Fig 207, Manual Release Sliding Fifth Wheel (Fontaine shown)

1. Locking Wedge
2. Slide Release Pull Handle
 1. Stop the tractor and trailer in a straight line on level ground. Pull the red trailer air supply knob to apply the trailer parking brakes.
 2. Apply the tractor parking brake, then release the sliding mechanism using the appropriate method for the fifth wheel manufacturer.
 - 2.a **Fontaine:** Lift the slide release pull handle to disengage it from the guide plate. Then, pull out the handle until it is in the unlocked position and can be positioned against the guide plate to hold it out. The handle will stay in the unlocked position until it is manually disengaged from the guide plate. See Fig. 208, [Releasing the Sliding Fifth Wheel, \(Fontaine\)](#).

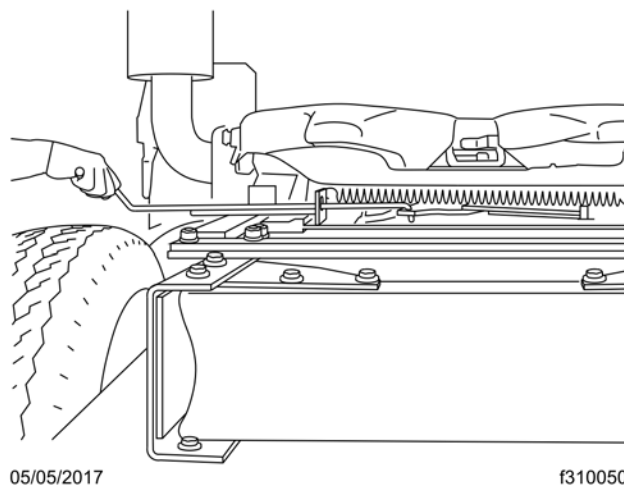
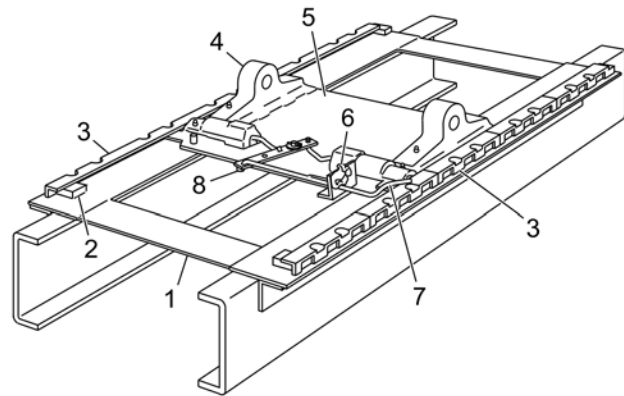


Fig 208, Releasing the Sliding Fifth Wheel, (Fontaine)

- 2.b **Holland:** Pull the operating rod out. Make sure both side plungers have released. See Fig. 209, [Sliding Fifth Wheel Manual Release, \(Holland Simplex\)](#).



- 1. Baseplate
- 2. Bolted Stop
- 3. Baseplate Rail
- 4. Fifth Wheel Mount

- 5. Slider Saddle Plate
- 6. Safety Latch
- 7. Operating Rod
- 8. Operating Lever

Fig 209, Sliding Fifth Wheel Manual Release, (Holland Simplex)

- 3. Lower the trailer landing gear just enough to remove the weight from the tractor.
- 4. Chock the front and rear of the trailer tires to prevent the trailer from moving.
- 5. Release the tractor parking brakes, then slowly move the tractor forward or backward until the fifth wheel is in the desired location.

**WARNING:**

Check that the locking wedges have seated in the slots. Failure to achieve complete lockup may allow disengagement of the tractor from the trailer, possibly resulting in serious personal injury or death.

**NOTICE:**

When moving the fifth wheel to the desired position, be sure the trailer landing gear will not at any time come in contact with the tractor frame or other components. Make sure that the front of the trailer will not come in contact with the rear of the cab or with other components if they extend beyond the rear of the cab.

6. Apply the tractor parking brakes, then lock the sliding member in position using one of the following methods:
 - 6.a **Fontaine:** Disengage the slide release pull handle from the guide plate. The slide release pull handle is spring-loaded in the locked position and will seek the locked position when disengaged from the guide plate. After the slide release pull handle returns to the fully locked position, visually and physically check the locking wedges to make sure they are fully inserted into the slots in the slide rails. Make sure the handle is locked in position against the guide plate.
 - 6.b **Holland:** Raise the operating rod so that it is free to move inward. Make sure that the lock pins have seated in the base plate rail holes and the operating rod moves into the locked position.

NOTE: The fifth wheel may need to be moved slightly to enable the locking wedges to enter the fully locked position.

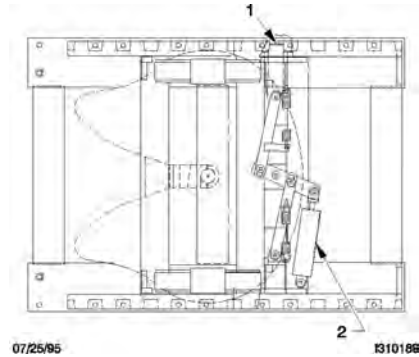
11.04.03 Operation of the Air Slide

The slide feature may be operated with an air switch mounted in the dash, that operates an air cylinder that locks and unlocks the slide. See Fig.210, [Air-Slide Switch](#).



Fig 210, Air-Slide Switch

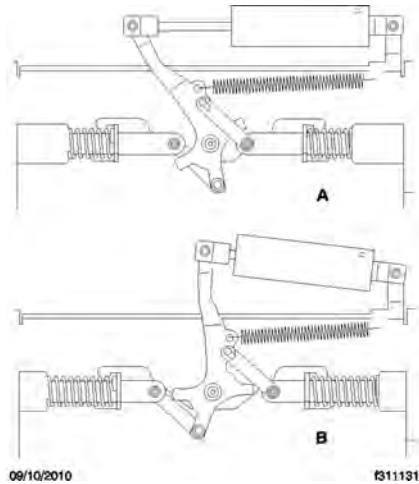
1. Set the air-slide switch (see Fig.210, [Air-Slide Switch](#)) to SLIDE.
Ensure the locking plungers have released. See Fig.211, [Air-Operated Sliding Fifth Wheel \(Fontaine shown\)](#).
For Jost fifth wheels, the mechanism activates as shown in Fig.212, [Jost Sliding Fifth Wheel](#).



1. Locking Wedge

2. Air Cylinder

Fig 211, Air-Operated Sliding Fifth Wheel (Fontaine shown)



A. Unlocked

B. Locked

Fig 212, Jost Sliding Fifth Wheel

2. Lower the trailer landing gear just enough to remove the weight from the tractor.
3. Pull the red trailer-air-supply knob to set the trailer-parking brakes.
4. Slowly move the tractor forward or backward until the fifth wheel is in the desired location.



NOTICE:

Ensure the trailer landing gear does not come in contact with the tractor frame or other components, and that the front of the trailer will not come in contact with the rear of the cab or other components if they extend beyond the rear of the cab.

5. Apply the tractor parking brakes.

**WARNING:**

Check that the locking wedges have seated in the slots. Failure to achieve complete lockup may allow disengagement of the tractor from the trailer, possibly resulting in serious personal injury or death.

6. Set the air-slide switch to LOCK. Visually inspect the locking wedges or plungers to make sure that they are fully inserted in the slide rail slots. Verify that the plungers have engaged by tugging the tractor forward while the trailer brakes are locked and the wheels are chocked.

NOTE: The fifth wheel may need to be moved slightly to enable the locking wedges to fully lock.

12.01 Pre- and Post-Trip Inspection Checklists	222
12.01.01 General information.....	222
12.01.02 Checklists.....	222
12.01.03 Fluids Added	225
12.02 Safety Precautions	226
12.03 Daily Pretrip Inspection and Maintenance.....	226
12.03.01 General Information	226
12.03.02 Suspension and Slack Adjuster Inspection	226
12.03.03 Inspection of the Wheel and Tire	228
12.03.04 Inspection of the Saddle Tank Areas	231
12.03.05 Inspection of the Engine Compartment	232
12.03.06 Inspection of the Cab.....	233
12.03.07 Inspection of the Natural Gas Fuel System, If Equipped	238
12.04 Weekly Post-Trip Inspection and Maintenance.....	240
12.04.01 Inspection of the Engine Compartment	240
12.05 Monthly Post-Trip Inspection and Maintenance.....	244
12.05.01 Inspection of the Brake Component.....	244
12.05.02 Inspection of the Saddle Tank Areas.....	245
12.05.03 Inspection and Adjustments of the Engine Compartment.....	246
12.05.04 Inspection of the Natural Gas Fuel System, If Equipped	248

12. Pretrip and Post-Trip Inspections and Maintenance**12.01 Pre- and Post-Trip Inspection Checklists****12.01.01 General information**

Regulations in Canada and the U.S. clearly indicate that it is the driver's responsibility to perform an inspection, and ensure the complete road-worthiness of a vehicle, before placing it into service. Commercial vehicles may be subject to inspection by authorized inspectors, and an unsafe vehicle can be taken out of service until the driver or owner repairs it.

Use the following checklists to ensure that vehicle components are in good working condition before each trip. Careful inspections eliminate stops later to fix overlooked or forgotten items.

The checklists in this chapter can be copied and kept as a record that the procedures have been completed. For details on how to inspect each item on the checklists, see the corresponding procedure (step number) in this chapter.

NOTE: Checklists in this chapter correspond with the procedures and steps later in this chapter. Your vehicle may not be equipped with all components listed below.

12.01.02 Checklists**Daily Pretrip Inspection Checklists**

See the following tables for a list of procedures that should be performed daily, before the first trip. Place a check mark in the complete (**Comp.**) column to indicate a procedure has been performed.

Inspector		Date

Suspension and Slack Adjusters		Comp.
1	Suspension components	
2	Slack adjusters	

Wheels and Tires		Comp.
1	Wheel covers	
2	Tire condition	
3	Tire inflation	
4	Rims and wheel components	
5	Wheel bearing oil seals and lubrication levels	
6	Mud Flaps	

Saddle Tank Areas		Comp.
1	Drain air reservoirs (without automatic drain valves)	

2	Fuel tank(s) secure	
3	Frame rails and crossmembers	
4	Visible exhaust components	

Engine Compartment		Comp.
1	Leakage under engine	
2	Air intake system	
3	Engine oil level	
4	Power steering reservoir level	
5	Engine coolant level	
6	Visible engine wiring	
7	Frame rails	

Cab		Comp.
1	Reset dash-mounted air intake restriction indicator	
2	Air-pressure warning system	
3	Air governor cut-in and cut-out pressures	
4	Air pressure build-up time	
5	Air system leakage	
6	Air pressure reserve	
8	Mirrors, windows, windshield	
9	Horn, windshield wipers, windshield washers	
10	Heater and defroster	
11	Interior lights	
12	Exterior lights	
13	Seat belts and tether belts	
14	Fuel level	
15	Mirror adjustment	
16	Service brakes	

Natural Gas Fuel System Inspection		Comp.
1	Fuel tanks	
2	Required decals	
3	Vent caps	
4	Plumbing components, fuel fill fitting, fuel lines	
5	Fuel gauge components, fuel level sender cable, LNG fuel tank pressure	
6	Coolant hoses	
7	LNG fuel tank pressure	
8	LNG vaporizer	

Weekly Post-Trip Inspection Checklist

See the following table for procedures that should be performed weekly, post-trip. Place a check mark in the complete (**Comp.**) column to indicate a procedure has been performed.

Inspector	Date

Engine Compartment		Comp.
1	Windshield washer reservoir level	
2	Air intake restriction indicator	
3	Automatic transmission fluid level	
4	Water in fuel/water separator	
5	Steering components	
6	Serpentine drive belts	

Monthly Post-Trip Inspection Checklists

See the following tables for procedures that should be performed monthly, post-trip. Place a check mark in the complete (**Comp.**) column to indicate a procedure has been performed.

Inspector	Date

Brake Components		Comp.
1	Brake system components	

2	Brake chambers	
3	Air brake lines	
4	Flex air hoses	
5	Brake linings and brake drums	
6	Brake lining thickness	

Saddle Tank Areas		Comp.
1	Drain air reservoirs (with automatic drain valves)	
2	Batteries	
3	Aerodynamic components	

Engine Compartment		Comp.
1	Hood and bumper	
2	Hydraulic clutch reservoir	
3	Hydraulic brake reservoir	
4	Radiator and heater hoses	
5	Steering wheel play	

Natural Gas Fuel System		Comp.
1	System leak test	
2	Drain CNG high-pressure fuel filter housing	

12.01.03 Fluids Added

Use the following table to note any fluids that were added during the inspection and maintenance procedures.

Fluids Added During Inspection	
Fluid	Amount Added
Wheel Bearing Oil Seal Lubricant	
Engine Oil	
Power Steering Fluid	
Engine Coolant	

Windshield Washer Fluid	
Automatic Transmission Fluid	
Hydraulic Clutch Fluid, DOT3	

12.02 Safety Precautions



DANGER:

When working on the vehicle, shut down the engine, set the parking brake, and chock the tires. Before working under the vehicle, always place jack stands under the frame rails to ensure the vehicle can not drop. Failure to follow these steps could result in serious personal injury or death.

12.03 Daily Pretrip Inspection and Maintenance

12.03.01 General Information

Complete the following inspection and maintenance procedures to ensure that vehicle components are in good working condition before each trip. A driver who is familiar with the vehicle and drives it regularly can perform the daily inspections, then add the weekly and monthly post-trip inspections as scheduled.

If the driver does not operate the vehicle on a consistent basis, all daily, weekly, and monthly inspection and maintenance procedures should be performed before the trip.

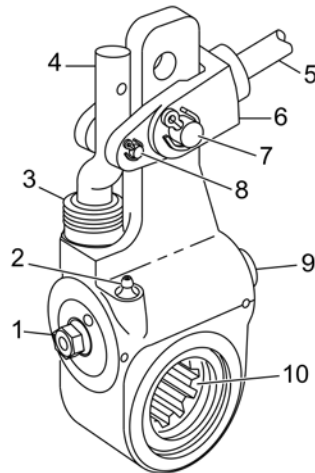
IMPORTANT: The pre- and post-trip checklists, inspections, and maintenance procedures detailed in this chapter are **not all-inclusive**. Refer to other component and body manufacturers' instructions for specific inspection and maintenance instructions, as well as local, state, and federal guidelines.

NOTE: If any system or component does not pass this inspection, it must be corrected before operating the vehicle. Whenever equipment requires adjustment, replacement, and/or repair, see the **Business Class M2 Workshop Manual** for procedures and specifications.

12.03.02 Suspension and Slack Adjuster Inspection

Walk around the vehicle and visually inspect suspension and slack adjuster components.

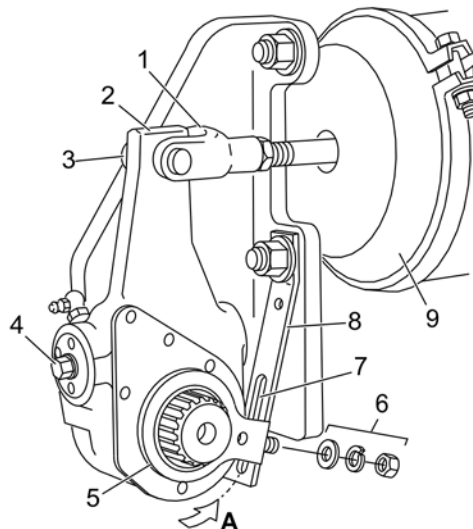
- Inspect the following suspension components for signs of structural damage, cracks, or wear.
 - springs
 - spring hangers
 - shocks
 - suspension arms
 - suspension brackets
 - axle seats
 - bushings
- Inspect slack adjusters for signs of damage. See Fig.213, [Gunit Automatic Slack Adjuster](#), see Fig. 214, [Haldex Automatic Slack Adjuster](#), or see Fig.215, [Meritor Automatic Slack Adjuster](#).



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- | | |
|-----------------------------|---------------------------|
| 1. 7/16-inch Adjusting Nut | 6. Clevis |
| 2. Grease Fitting | 7. 1/2-inch Clevis Pin |
| 3. Boot | 8. 1/4-inch Clevis Pin |
| 4. Link | 9. Grease Relief Opening |
| 5. Brake Chamber Piston Rod | 10. Slack Adjuster Spline |

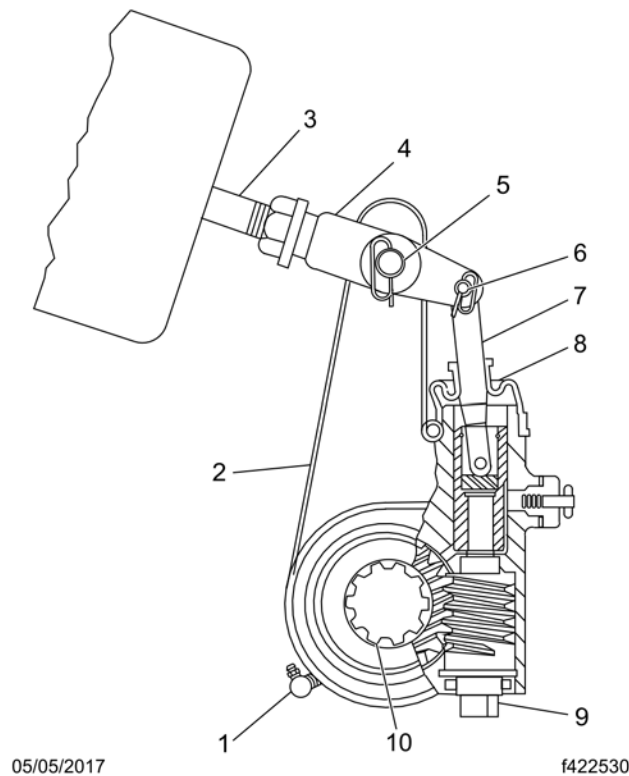
Fig 213, Gunit Automatic Slack Adjuster

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- | | |
|--|--------------------------------|
| A. Rotate the control arm toward the brake chamber until you can feel it contacting the internal stop. | 5. Control Arm |
| 1. Clevis | 6. Control-Arm Washers and Nut |
| 2. Slack Adjuster | 7. Anchor Strap Slot |
| 3. Clevis Pin | 8. Anchor Strap |
| 4. Manual Adjusting Nut | 9. Brake Chamber |

Fig 214, Haldex Automatic Slack Adjuster



- | | |
|---------------------------------|-------------------------|
| 1. Grease Fitting (if equipped) | 6. Clevis Pin (small) |
| 2. Slack Adjuster Housing | 7. Actuator Rod |
| 3. Brake Chamber Pushrod | 8. Boot |
| 4. Clevis | 9. Manual Adjusting Nut |
| 5. Clevis Pin (large) | 10. Camshaft Splines |

Fig 215, Meritor Automatic Slack Adjuster

- Inspect slack adjuster boots, if equipped, for cuts or tears.
- Inspect anchor straps, if equipped, for damage.
- Look for worn clevis pins on brake chamber pushrods.
- Look for missing or damaged cotter pins on the clevis pins.
- Ensure chamber piston rods are in line with the slack adjusters.

12.03.03 Inspection of the Wheel and Tire

Walk around the vehicle and visually inspect each wheel and tire assembly.

IMPORTANT: Wheel covers decrease drag force as a vehicle moves, thereby improving fuel efficiency. If replacement of a wheel cover is necessary, the replacement cover must meet or exceed the drag reduction performance of the originally installed cover in order to maintain compliance with greenhouse gas and fuel efficiency regulations.

1. If the vehicle was originally equipped with wheel covers, ensure all wheel covers are present. Inspect wheel covers for damage or wear. Remove wheel covers from rear drive wheels, if equipped, prior to inspecting the tires and wheel components.

NOTE: During wheel cover installation, ensure the V-notch in the liner inner retaining ring is centered on the valve stem. The inner and outer retaining rings should be uniformly aligned to each other and to the wheel rim. The outer retaining ring of the liner is equipped with two canvas flaps. When installing the face cover, make sure the cover retaining ring is inserted between the two canvas flaps on the liner outer retaining ring so that the Velcro strips line up between the face cover and the liner. Make certain the detachable view cover is centered on the face cover, and the Velcro strips are pressed firmly in place.

2. Inspect each tire for the following:

- valve stem caps on every tire, screwed on finger-tight
- bulges, cracks, cuts, and penetrations
- oil contamination (petroleum derivatives will soften the rubber and destroy the tire)
- tread depth—if tread is less than $\frac{4}{32}$ inch (3 mm) on any front tire, or less than $\frac{2}{32}$ inch (1.5 mm) on any rear tire, replace the tire
- debris lodged between dual tire sets

IMPORTANT: Low-rolling resistance (LRR) tires minimize wasted energy as a tire rolls, thereby decreasing rolling effort and improving fuel efficiency. If tire replacement is necessary, replacement tires must meet or have less rolling resistance than the originally installed tires in order to maintain compliance with greenhouse gas and fuel efficiency regulations. Contact your tire manufacturer/supplier to determine the rolling resistance of the originally installed tires. Visit www.epa.gov/smartway for additional information and resources.

3. Check tire inflation.

For inflation pressures and maximum loads, see the tire manufacturer's guidelines. Inflate the tires to the applicable pressures if needed.

If a tire has been run flat or under-inflated, check the wheel and tire for damage before adding air.

Keep compressed air reservoirs and lines dry during tire inflation. Use well-maintained inline moisture traps and service them regularly.

**WARNING:**

Do not operate the vehicle with underinflated or overinflated tires. Incorrect inflation can stress the tires and make the tires and rims more susceptible to damage, possibly leading to rim or tire failure and loss of vehicle control, resulting in serious personal injury or death.

IMPORTANT: The load and cold inflation pressure must not exceed the rim or wheel manufacturer's recommendations, even though the tire may be approved for a higher load inflation. Consult the rim or wheel manufacturer for the correct tire inflation pressure for the vehicle load.

**NOTICE:**

A weekly pressure loss of 4 psi (28 kPa) or more in a tire may indicate damage. The tire should be inspected and, if necessary, repaired or replaced by a qualified tire service facility.

4. Examine each rim and wheel component. Check the wheel nuts or rim nuts for indications of looseness.
 - 4.a Remove all dirt and debris from the assembly. Rust streaks or metal build-up around stud holes, or out-of-round or worn stud holes, may be caused by loose wheel nuts.

**WARNING:**

Have any worn or damaged wheel components replaced by a qualified person using the wheel manufacturer's instructions and the wheel industry's standard safety precautions and equipment. Otherwise a vehicle or workshop accident could occur, possibly resulting in serious personal injury or death.

- 4.b Inspect for broken, cracked, badly worn, bent, rusty, or sprung rings and rims.

**NOTICE:**

Use the recommended torque values and follow the proper tightening sequence. Insufficient wheel nut torque can cause wheel shimmy, resulting in wheel damage, stud breakage, and extreme tire tread wear. Excessive wheel nut torque can break studs, damage threads, and crack discs in the stud hole area.

- 4.c Make sure all wheel nuts are tightened. If tightening is necessary, use the tightening pattern in see Fig. 216, [Tightening Pattern, 10-Hole Wheels](#) or Fig. 217, [Tightening Pattern, 8-Hole Wheels](#).

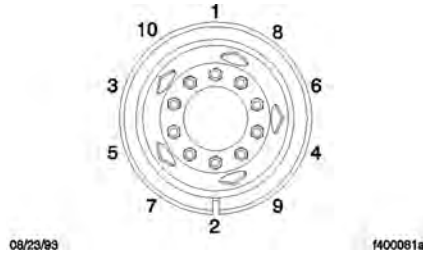


Fig 216, Tightening Pattern, 10-Hole Wheels

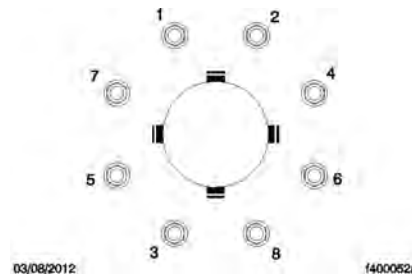


Fig 217, Tightening Pattern, 8-Hole Wheels

5. Inspect the outboard side of all wheel hubs and the hub oil seal area on the inboard side of each wheel for signs of oil leakage. If any oil is found on wheel and tire or brake components, remove the vehicle from service until the leak has been fixed.

If needed, fill the hubs to the level indicated on the hub cap. See **Group 35** of the **Business Class M2 Maintenance Manual** for recommended lubricants.

6. Check that mud flaps are undamaged and hang 10 inches (25.4 cm) or less from the ground.

12.03.04 Inspection of the Saddle Tank Areas



WARNING:

When draining the air reservoir, do not look into the air jets or direct them toward anyone. Dirt or sludge particles may be in the airstream and could cause injury.



NOTICE:

If the water drained from the air reservoirs is cloudy or oily, it may indicate a problem with the compressor. If oil is allowed to contaminate the air dryer, it will not remove the water from the air brake system, which could adversely affect braking.

1. Drain the brake system air reservoirs (reservoirs without automatic drain valves only).

**WARNING:**

Never operate the engine with the fuel tank shutoff valves partially closed. This could damage the fuel pump, causing sudden loss of engine power, possibly resulting in serious personal injury due to reduced vehicle control.

2. Ensure fuel tanks are secured to their mounting brackets and that the mounting brackets are secured to the frame.
3. Inspect visible frame rails for missing bolts, shiny areas, or rust streaks. Check all visible crossmembers for damage or signs of looseness.
4. Inspect visible components of the exhaust system to ensure connections are tight.

Inspect upstream of the aftertreatment device (ATD) for cracking or signs of leaks, such as soot trails. Inspect downstream of the ATD for signs of exhaust leaks, such as blistering or warping of nearby components.

12.03.05 Inspection of the Engine Compartment

1. Check the ground underneath the engine for fuel, oil, or coolant leaks.
2. Inspect the air intake system for leaks or damage.

**NOTICE:**

Failure to maintain a sealed air intake system could allow the entry of dirt and contaminants into the engine. This could adversely affect engine performance and result in engine damage.

- 2.a Push the reset button on the air intake restriction indicator located on the air cleaner, if equipped.
- 2.b Check the air intake duct from the air cleaner to the engine intake. Make sure the duct components are secure and airtight.
- 2.c Check the vacuator (spitter) valve(s) for damage, and make sure the lips of the valve are pliable and free of debris.
3. Check the engine oil level.

**NOTICE:**

Operating the engine with the oil level below the minimum fill (or "add") mark or above the maximum fill (or "full") mark could result in engine damage.

- 3.a Check the oil level with the vehicle parked on a level surface. See the engine manufacturer's guidelines for engine shutdown time requirements prior to checking the oil level.

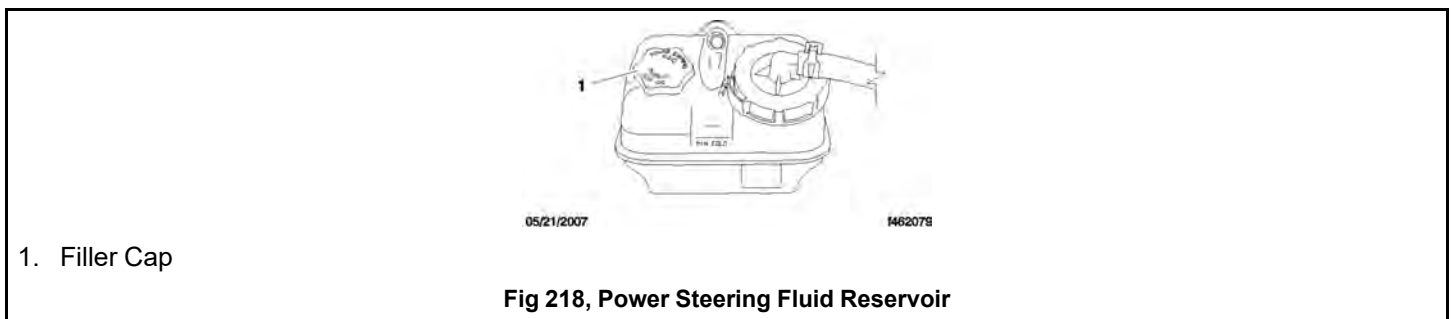
IMPORTANT: Use only approved engine lube oil. For lists of engine oils approved for Detroit Diesel engines, refer to the Engine Operator Manual, accessible on Lubricants, Fuels & Coolants on the DTNA Portal. For third party engines, please refer to the engine manual.

- 3.b If the oil level is at or below the minimum fill (or "add") mark on the dipstick, add enough oil to maintain the level between the minimum and maximum fill marks. See the engine operation manual for recommended lubricants.

For natural gas vehicles, use only Exxon Busgard® Geo 15W-40 natural gas engine oil.

4. Check the power steering reservoir fluid level.

The power steering fluid level should be between the MIN COLD mark and the middle mark just above it. See Fig. 218, [Power Steering Fluid Reservoir](#). If needed, fill the reservoir with automatic transmission fluid that meets Dexron III or TES-389 specifications.



IMPORTANT: The surge tank must be cool to check the coolant level.



NOTICE:

Low coolant could result in engine overheating, which could cause engine damage.

5. Check the engine coolant level in the radiator surge tank.
 - 5.a If the coolant is low, fill the surge tank to the MAX line with a 50/50 mixture of water and the type of antifreeze currently installed in your vehicle.

For natural gas vehicles, use only Fleetguard ES Compleat™ EG Premix 50/50 engine coolant.
 - 5.b If the surge tank was empty, start the engine after refilling and check the level again when the engine is at operating temperature.
6. Inspect visible engine wiring for damage or looseness.
7. Inspect visible frame rails for missing bolts, shiny areas, or rust streaks.

12.03.06 Inspection of the Cab

1. Push the reset button on the dash-mounted air intake restriction indicator, if equipped.
2. With the ignition switch in the OFF position, check the air-pressure warning system.

- 2.a If not previously drained, drain the air reservoirs using moderate brake applications until pressure in both reservoirs is less than 70 psi (483 kPa).
- 2.b Turn the ignition to the ON position. The ICU will complete a full gauge sweep and bulb check, and the warning buzzer will sound. Ensure the BRAKE AIR lamp remains illuminated and the warning buzzer continues to sound after the gauge sweep is complete.
3. Check air governor cut-in and cut-out pressures.
 - 3.a Start the engine and ensure the BRAKE AIR lamp goes out and the buzzer silences when pressure reaches approximately 70 psi (483 kPa) in both air reservoirs.
 The air governor should cut out at approximately 120 psi (827 kPa). For vehicles with an optional dryer reservoir module (DRM), the cut-out pressure is approximately 130 psi (896 kPa).
 - 3.b With the engine idling, apply the brake pedal several times. The air governor should cut in when pressure in the primary air reservoir (top air gauge) reaches approximately 100 psi (689 kPa).
4. Check air pressure build-up time.
 - 4.a With the air system fully charged, make one full brake application and note the air pressure reading on the primary air gauge.
 - 4.b Further reduce air pressure using moderate brake applications, then run the engine at governed rpm.
 - 4.c Note the time that the pressure reaches the previously noted reading on the primary air gauge, then note the time that the air pressure reaches cut-out pressure.
 - 4.d If it takes longer than 30 seconds to reach cut-out pressure after the primary air gauge passes the previously noted pressure (noted after one full brake application), eliminate any leaks or replace the air compressor before operating the vehicle.
5. Check air leakage in the system.
 - 5.a With the parking brake applied, the transmission out of gear, and the air system fully charged, release the service brakes and shut down the engine.
 - 5.b Wait one minute and note the air pressure drop in psi (kPa) per minute from the primary air reservoir.
 If the pressure drop exceeds the limits shown in Table 13, [Maximum Allowable Air Leakage](#), eliminate any leaks before operating the vehicle.
6. Check the air pressure reserve.

With the engine still off, make one full brake application and observe the pressure drop on the primary air gauge. If pressure drops more than 25 psi (172 kPa), eliminate any leaks before operating the vehicle.

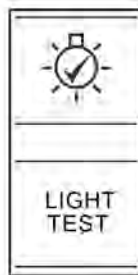
Maximum Allowable Air Leakage		
Description	Pressure Drop: psi (kPa) Per Minute	
	Released	Applied
Truck or Tractor Only	2 (14)	3 (21)
Truck or Tractor w/Single Trailer	3 (21)	4 (28)

Table 11, Maximum Allowable Air Leakage

**WARNING:**

When cleaning windshields and windows, always stand on the ground or on a secure ladder or platform. Use a long-handled window cleaner. Do not use the cab steps, tires, fenders, fuel tanks, engine, or under-hood components to access the windshield or windows. Doing so could cause a fall and result in an injury.

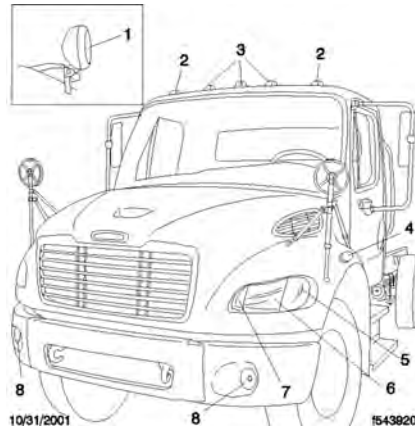
7. Inspect the mirrors, window glass, and windshield for cracks or other damage.
8. Ensure that the horn, windshield wipers, and windshield washers are operating properly. These devices must be in good working order for safe vehicle operation.
9. Ensure the heater and defroster are operating properly.
10. Check the operation of all interior lights.
 - 10.a Turn on the headlights and leave them on. If equipped, ensure all gauge bulbs illuminate. If equipped, ensure ICU screens illuminate.
 - 10.b Ensure all equipped driver control switches illuminate and verify the interior cab lights controlled by some of these switches illuminate.
 - 10.c Ensure both turn signal indicators illuminate when the turn signal switch is activated.
11. Check the operation of all exterior lamps manually or, if equipped, by using the LIGHT TEST switch on the dash. See Fig.219,[Pretrip Light Test Switch](#)



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Fig 219, Pretrip Light Test Switch



NOTE: The parking lamps, front clearance lamps, and tail lamps all function as turn signals.

- | | |
|-------------------------|-----------------------|
| 1. Utility Lamp | 5. Headlamp Low Beam |
| 2. Marker Lamps | 6. Headlamp High Beam |
| 3. Identification Lamps | 7. Parking Lamp |
| 4. Front Clearance Lamp | 8. Road Lamps |

Fig 220, Exterior Lamps

12. To check exterior lamps manually:
 - 12.a Turn the ignition switch to the ACC or ON position.
 - 12.b Make certain the parking brake is set.
 - 12.c Activate the high-beam headlamps and hazard warning lamps.
 - 12.d Exit the cab and check that all exterior lamps and reflectors are clean and intact.
 - 12.e Check that the brake lamps, tail lamps, headlamps, turn signals, marker lamps, identification lamps, and clearance lamps are working properly.
13. To check the exterior lamps using the dash LIGHT TEST switch:
 - 13.a Make sure the parking brake is set.

NOTE: Factory settings have groups of lamps activate sequentially up to 100 times or until manually stopped.

- 13.b Press the LIGHT TEST switch to begin the pretrip light inspection. If equipped, groups of lamps will cycle on and off in the following sequence:
 - Group 1: Always ON: marker lamps, clearance lamps, tail lamps, licence plate lamp
 - Group 2: Low beam headlamps
 - Group 3: High beam headlamps and stop lamps
 - Group 4: Backup lamps and daytime running lamps
 - Group 5: Front and rear fog lamps
 - Group 6: Turn signals and utility lamps

NOTE: LED accent lighting turns off when the high beam headlamps turn on.

- 13.c Walk around the truck and check that the lamps are working properly.

- 13.d Verify that all exterior lights and reflectors are clean and intact.
- 13.e The pretrip light inspection can be stopped by:
 - releasing the parking brake;
 - Pressing either the LIGHT TEST switch on the dash or the Lamp Check button on the key fob.
- 14. Inspect the seat belts and tether belts.

**WARNING:**

Inspect and maintain seat belts. When any part of a seat belt system needs replacement, the entire seat belt must be replaced, both retractor and buckle side. Any time a vehicle is involved in an accident, and the seat belt system was in use, the entire vehicle seat belt system must be replaced before operating the vehicle. Do not attempt to modify the seat belt system; doing so could change the effectiveness of the system. Failure to replace worn or damaged seat belts, or making any modifications to the system, may result in personal injury or death.

- 14.a Check the web for fraying, cuts, extreme dirt and dust, or for severe fading from exposure to sunlight, especially near the buckle latch plate and in the D-loop guide area.
- 14.b Check operation of the buckle, latch, Komfort Latch or Sliding Komfort Latch (if equipped), web retractor, and upper seat belt mount on the door pillar. Check all visible components for wear or damage.
- 14.c Check the seat belt and tether belt connection points and tighten any that are loose.

**WARNING:**

Never fill fuel tanks to more than 95 percent of their liquid capacity. This could make them more likely to rupture from impact, possibly causing fire and resulting in serious personal injury or death by burning.

Do not mix gasoline or alcohol with diesel fuel. This mixture could cause an explosion, possibly resulting in serious personal injury or death. Do not fill the fuel tanks in the presence of sparks, open flames, or intense heat. These could ignite the fuel, possibly causing severe burns.

IMPORTANT: Use ultralow-sulfur diesel (ULSD) with 15 ppm sulfur content or less. Failure to use ULSD fuel may void the warranty on emission components.

- 15. Check the fuel level in the fuel tank(s). To keep condensation to a minimum, fuel tanks should be filled at the end of each day.
- 16. Adjust the rearview and down view mirrors as necessary.
- 17. Test the service brakes.
 - 17.a With the engine running and air system fully charged, set the parking brake.
 - 17.b Put the vehicle in the lowest gear and gently attempt to move it forward. The vehicle should not move.

If the vehicle moves, the parking brakes are not operating correctly and must be repaired before the vehicle is operated.

12.03.07 Inspection of the Natural Gas Fuel System, If Equipped

1. Inspect fuel tanks for dents, scratches, gouges, or other signs of damage. Inspect the fuel lines and connections for leaks.

Check that the fuel tanks are securely mounted. Look for signs of abrasion between components.

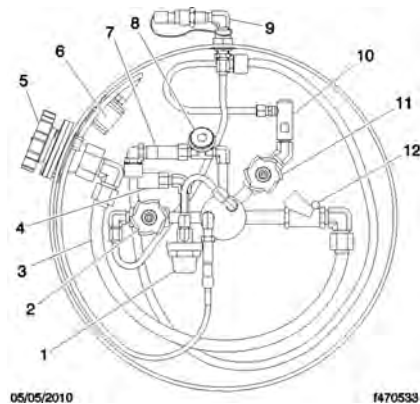
Compressed Natural Gas (CNG) Fuel System : Ensure that the CNG fuel cylinder storage box is secured to the frame. Inspect for signs of looseness.

Liquefied Natural Gas (LNG) Fuel System : Ensure that the LNG fuel tank is secured to the mounting brackets and that the mounting brackets are secured to the frame. Ensure all rubber isolator straps are secure around the LNG fuel tank.

2. Check for the presence of all required decals present in the following locations:
 - Gas detection system overhead console;
 - Above the door handle on both doors;
 - Left front bumper;
 - End-of-frame crossmember;
 - LNG fuel tank fill port (maximum psi), if equipped.
3. Check for the presence of vent caps on pressure relief valves and devices. If any caps are missing, have the fuel system inspected by a qualified technician.

CNG Fuel System : Each fuel cylinder should have two caps (one on each end), which are visible on the back of the CNG fuel cylinder storage box. One additional cap is located on the pressure relief valve on the inboard side of the CNG fuel box, next to the fuel outlet line.

LNG Fuel System : A red cap should be present on the secondary relief valve (Fig. 221, [LNG Tank Plumbing Components](#)).



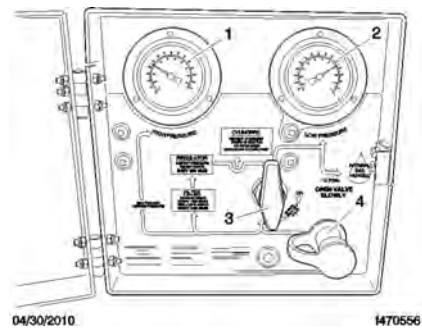
- | | |
|-------------------------------------|---------------------------------|
| 1. Pressure Control Regulator | 7. Primary Relief Valve |
| 2. Vapor Shutoff Valve | 8. Tank Pressure Gauge |
| 3. Fuel Fill Hose | 9. Fill Vent Fitting |
| 4. Secondary Relief Valve (red cap) | 10. Excess Flow Valve |
| 5. Fuel Fill Fitting | 11. Fuel Shutoff Valve (liquid) |
| 6. Fuel Level Sender Box | 12. Fill Check Valve |

Fig 221, LNG Tank Plumbing Components

4. Inspect all plumbing components, including the fuel shutoff valve(s), primary and secondary relief valves, and the LNG vapor shutoff and excess flow valves, if equipped, for signs of damage or leaks. See Fig. 221, [LNG Tank Plumbing Components](#) or Fig. 222, [CNG Fuel Panel](#).

Inspect the fuel fill fitting for signs of damage or leaks.

Inspect all lines for signs of leaks or damage, and check all threaded connections.

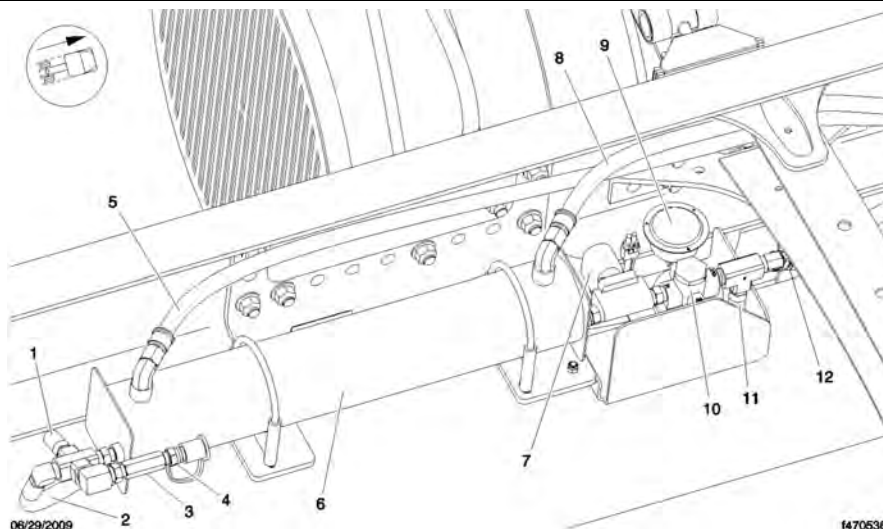


1. High Pressure Gauge
2. Low Pressure Gauge

3. Manual Fuel Shutoff Valve
4. Fuel Fill Port

Fig 222, CNG Fuel Panel

5. Inspect all fuel gauge components for signs of leaks or damage. Inspect the fuel level sender cable and wiring.
6. Inspect all coolant hoses for signs of chafing, kinks, or leaks. The LNG fuel system utilizes coolant hoses between the engine and the vaporizer; the CNG fuel system utilizes coolant hoses between the engine and the pressure regulator inside the fuel panel.
7. If equipped with an LNG fuel system, check the fuel tank pressure gauge to ensure that pressure is within the normal range of 120 to 150 psi (827 to 1034 kPa). If tank pressure exceeds 230 psi (1586 kPa) and the pressure relief valve does not open automatically, vent the tank immediately.
8. Inspect the LNG vaporizer for signs of damage or leaks. See Fig.223, [LNG Vaporizer Assembly](#). Inspect the vaporizer mounting brackets for signs of looseness.



1. Pressure Relief Device
2. Fuel Inlet Line
3. Check Valve
4. CNG Quick-Connect Port
5. Coolant Inlet Line
6. Vaporizer

7. Fuel Shutoff Solenoid Valve
8. Coolant Outlet Line
9. Pressure Gauge
10. Overpressure Regulator
11. Pressure Relief Valve
12. Fuel Outlet Line

Fig 223, LNG Vaporizer Assembly

12.04 Weekly Post-Trip Inspection and Maintenance

12.04.01 Inspection of the Engine Compartment

**WARNING:**

Washer fluids may be flammable and poisonous. Do not expose washer fluid to an open flame or any burning material, such as a cigarette. Always comply with the washer fluid manufacturer's recommended safety precautions.

1. Check the windshield washer reservoir fluid level. The reservoir is usually located near the right-hand frame rail.
2. After resetting the air intake restriction indicator during the daily pretrip inspection, check the indicator again with the engine off.
 - 2.a Check an indicator with graduations to see if air restriction exceeds the value shown in Table 14, [Air Intake Maximum Restriction Values](#).

Check a go/no-go indicator without graduations to see if the colored bar shows through the clear window.

Air Intake Maximum Restriction Values (in H ₂ O)	
Engine Make	GHG14, GHG17, and GHG21 Engines
Detroit	18
Cummins	25

Table 12, Air Intake Maximum Restriction Values

- 2.b If air restriction exceeds the maximum allowable value, operate the vehicle for one more day, making sure not to run the engine over rated rpm. Refer to the engine operation manual for more information on rated rpm for your engine.
 - 2.c If air restriction exceeds the maximum value again, replace the air cleaner. For instructions, see of the *Business Class M2 Workshop Manual*.
3. If the vehicle is equipped with an Allison automatic transmission, check the automatic transmission fluid level.
4. Check for water in the fuel/water separator, if equipped.

IMPORTANT: When draining fluid from a fuel/water separator, drain the fluid into an appropriate container and dispose of it properly. Many jurisdictions now issue fines for draining fuel/water separators onto the ground.

- 4.a Place a suitable container under the fuel/water separator.

NOTE: A hose may be used to direct water into the container. On older DAVCO models, the drain valve has a 1/2-inch (12.7-mm) pipe with threads. Use a hose with a 1/2-inch pipe thread to fit correctly and open the drain valve by turning it one-quarter revolution. On new DAVCO models, the drain valve has a 3/4-inch (19-mm) slip-on hose connection; pipe threads are no longer used. Open the drain valve by turning it one to one-and-a-half revolutions.

- 4.b If the engine is equipped with a built-in water separator, loosen the drain valve, and allow the water to run out. Close the drain valve, taking care not to overtighten it.

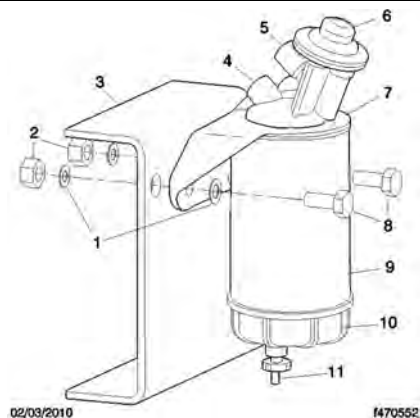
- 4.c *Alliance/Racor Models* : Turn the drain plug counterclockwise to open it. See Fig. 224, [Alliance Fuel/Water Separator Assembly and Installation](#).

DAVCO Models : Remove the vent cap and open the drain. See Fig. 225, [DAVCO Fuel Pro 482](#) and Fig. 226, [DAVCO Fuel Pro 487](#).

- 4.d Stop draining fluid when fuel begins to drain out.

Alliance/Racor Models : turn the drain plug clockwise to close it.

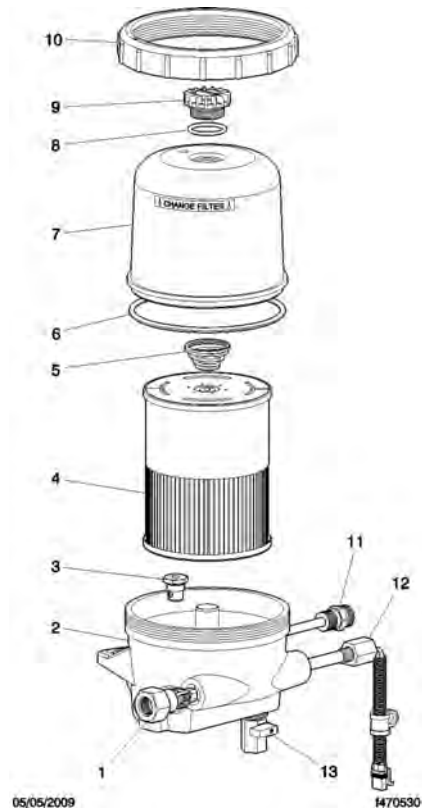
DAVCO Models : close the drain valve. Install and hand-tighten the vent cap.



1. Washers (qty 2)
2. Nuts (qty 2)
3. Frame Rail
4. Fuel Outlet Port
5. Fuel Inlet Port
6. Priming Pump

7. Mounting Head
8. Mounting Bolts (qty 2)
9. Filter Element
10. Sight Bowl
11. Drain Plug

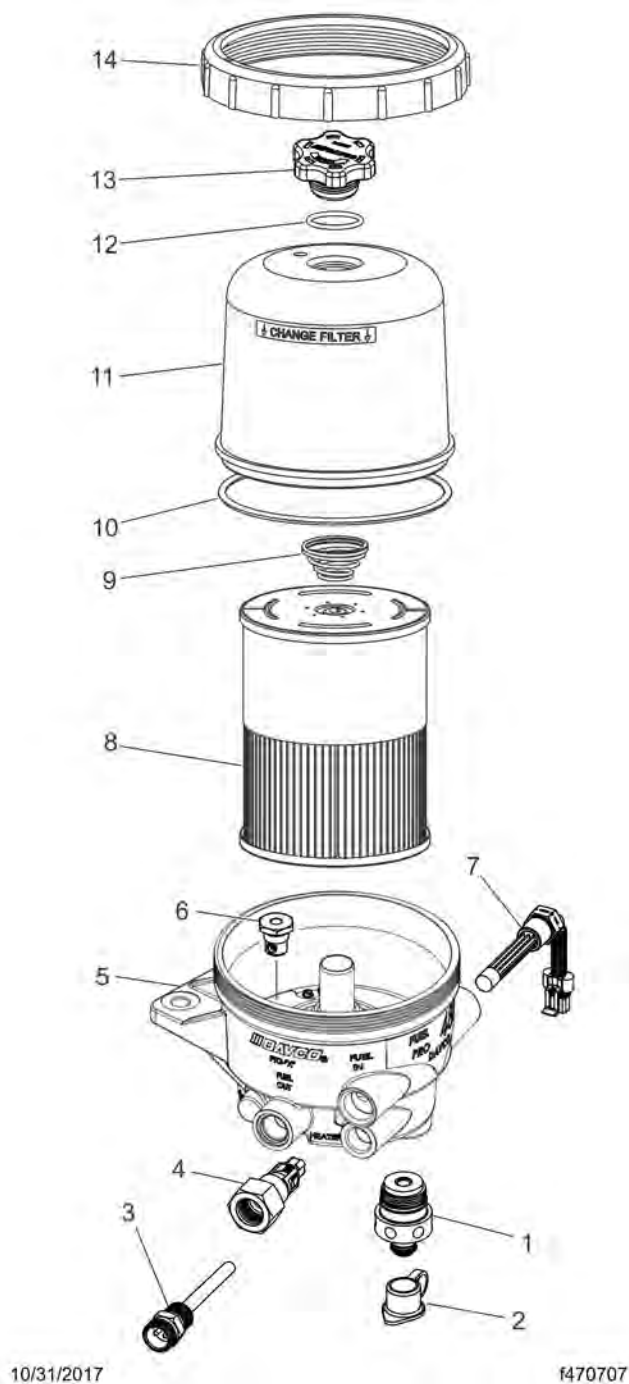
Fig 224, Alliance Fuel/Water Separator Assembly and Installation



1. Inlet Port/Check Valve
2. Lower Housing
3. Bypass Valve
4. Filter Element
5. Spring
6. Cover O-Ring
7. Clear Cover

8. Vent Cap O-Ring
9. Vent Cap
10. Collar
11. 120VAC Pre-Heater
12. 12VDC Pre-Heater
13. Drain Valve

Fig 225, DAVCO Fuel Pro 482

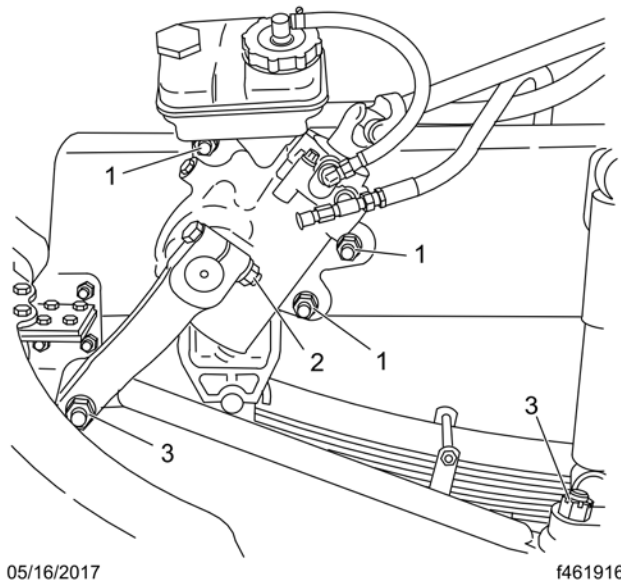


1. Drain Valve
2. Drain Valve Cap
3. 120VAC Pre-Heater
4. Inlet Port/Check Valve
5. Lower Housing
6. Bypass Valve
7. 12VDC Pre-Heater

8. Filter Element
9. Spring
10. Cover O-Ring
11. Clear Cover
12. Vent Cap O-Ring
13. Vent Cap
14. Collar

Fig 226, DAVCO Fuel Pro 487

5. Inspect the steering components. See Fig.226,[DAVCO Fuel Pro 487](#).



- 1. Steering Gear Mounting Bolt
- 2. Pitman Arm Pinch Bolt Nut

- 3. Drag Link Nut

Fig 227, Steering Gear Fasteners

- 5.a Inspect tie rods, steering arms, and the drag link for signs of looseness (i.e., shiny spots or rust tracks).
- 5.b Check the steering gear mounting bolts and pitman arm nut for signs of looseness.
- 5.c Check the drag link nuts for missing cotter pins.
- 5.d Inspect the steering intermediate shaft and end yokes for excessive looseness or other damage.



NOTICE:

Do not drive with a drive belt that is visibly worn or damaged. If it fails, the lack of coolant flow could rapidly cause damage to engine components.

- 6. Inspect the serpentine drive belts for signs of glazing, frayed edges, breaks, cracks, or oil contamination.

12.05 Monthly Post-Trip Inspection and Maintenance

12.05.01 Inspection of the Brake Component

Walk around the vehicle and visually the brake system components for visible damage.

- 1. Inspect all visible brake system components for missing fasteners or signs of looseness, such as rust tracks.

**NOTICE:**

If the external breather tube or breather cap is missing or incorrectly installed, road dirt and debris can adversely affect the operation of the brake chamber. Once inside of the chamber, dirt and debris can cause the internal parts of the chamber to deteriorate faster.

2. Inspect the exterior surfaces of brake chambers for damage. Make sure that breather holes are open and free of debris.

NOTE: Do not route air brake lines on top of anything likely to be stepped on.

3. Inspect air brake lines for dents, swelling, kinks, twisting, abrasion, and damage, especially near moving parts.
4. Inspect flex air lines for deterioration or signs of abrasion.
5. Inspect for cracked, worn, or oil-contaminated brake linings and brake drums (or rotors).
6. Check the thickness of the brake linings. Replace brake linings on all brake assemblies on the axle if any brake linings are worn to less than approximately 1/4 inch (6.4 mm) at the thinnest point.

12.05.02 Inspection of the Saddle Tank Areas

**WARNING:**

When draining the air reservoir, do not look into the air jets or direct them toward anyone. Dirt or sludge particles may be in the airstream and could cause injury.

**NOTICE:**

If the water drained from the air reservoirs is cloudy or oily, it may indicate a problem with the compressor. If oil is allowed to contaminate the air dryer, it will not remove the water from the air brake system, which could adversely affect braking.

1. Drain the brake system air reservoirs (reservoirs with automatic drain valves only).

NOTE: Battery locations vary between vehicles.

2. Inspect the batteries.



WARNING:

Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. To prevent possible personal injury, always wash your hands after handling battery parts and related accessories.

- 2.a Remove the battery box cover and inspect all visible battery cables for loose wiring or damage.
- 2.b Check that the battery hold-down is secure.

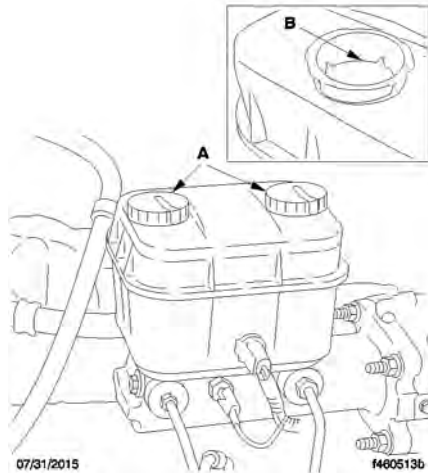
IMPORTANT: Aerodynamic components decrease drag force as a vehicle moves, thereby improving fuel efficiency. If replacement of an aerodynamic component is necessary, replacement components must meet or exceed the drag reduction performance of the originally installed component in order to maintain compliance with greenhouse gas and fuel efficiency regulations.

3. Inspect the following aerodynamic components, if equipped, for structural damage, cracks, or wear.
 - Chassis fairings
 - Roof fairing/deflector
 - Side skirts
 - Cab/sleeper extenders
 - Battery access cover

12.05.03 Inspection and Adjustments of the Engine Compartment

IMPORTANT: If replacement of the hood or bumper is necessary, the replacement component must meet or exceed the drag reduction performance of the originally installed item in order to maintain compliance with greenhouse gas and fuel efficiency regulations.

1. Inspect the bumper and hood for structural damage, cracks, or wear.
2. Check the hydraulic clutch reservoir, if equipped. If necessary, add DOT 4 brake fluid.
3. Check the hydraulic brake reservoir, if equipped. If necessary, add DOT 3 brake fluid. See Fig. 228, [Hydraulic Brake Reservoir](#).



A. Open caps and check fluid level.

B. Fill to this level.

Fig 228, Hydraulic Brake Reservoir

4. Inspect the radiator and heater hoses, including the clamps and support brackets.
 - 4.a Inspect the radiator and charge air cooler for damage and accumulated debris. Straighten bent or damaged fins to permit airflow across all areas of the cores.

NOTE: When traveling through areas of high insect concentration, it may be necessary to clean the exterior of the radiator or the charge air cooler core as often as every 200 miles (320 km).

- 4.b Make sure the radiator inlet and outlet hoses are pliable and are not cracking or ballooning.
 - 4.c Make sure the heater hoses are pliable and are not cracking or ballooning.
 - 4.d Tighten hose clamps as necessary.

IMPORTANT: Do not overtighten hose clamps, as hose life can be adversely affected.

- 4.e Ensure hose support brackets are securely fastened. Make sure hoses are not located near sources of wear, abrasion, or high heat.

IMPORTANT: When replacing hoses, install service-type knitted or braided yarn-reinforced neoprene hose. Extended-service-life silicone hoses may also be used. See the Alliance Parts Catalog at www.alliancebrandparts.com or contact your Freightliner Dealer.

5. Check the steering wheel for excessive play.
 - 5.a Start the engine. With the front tires straight ahead, turn the steering wheel until motion is observed at the front wheels.
 - 5.b Align a reference mark on the steering wheel to a rule, then slowly turn the steering wheel in the opposite direction until motion is again detected at the wheels.
 - 5.c Measure the lash (free play) at the rim of the steering wheel. Excessive lash exists if steering wheel movement exceeds 2-1/4 inches (57 mm) with an 18-inch (450-mm) steering wheel.
 - 5.d If there is excessive lash, check the steering system for wear or incorrect adjustment before operating the vehicle.

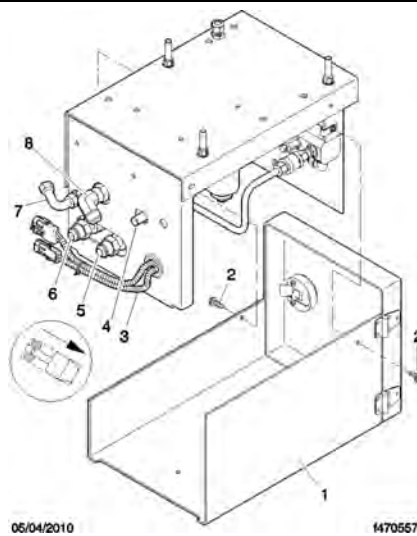
12.05.04 Inspection of the Natural Gas Fuel System, If Equipped

1. Leak test all fuel system components, joints, and fittings using a methane detector. A bubble solution can be used to pinpoint the exact location of leaks.

Replace any leaking or damaged fuel tanks and fuel lines; repair or replace leaking or damaged fittings.

2. Drain the CNG high-pressure fuel filter housing, if equipped.
 - 2.a Purge the CNG fuel lines by closing the CNG fuel cylinder shutoff valves. Start the engine and let it idle until the fuel lines are empty and the engine stops.

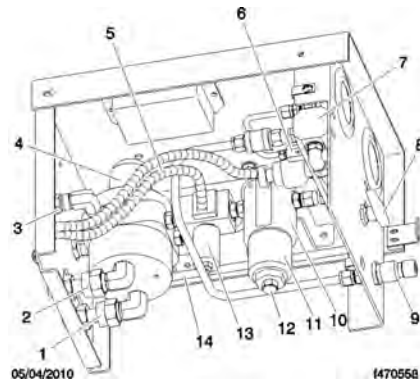
Gauges on the fuel panel should now read at or near 0 psi (0 kPa).
 - 2.b Close the manual fuel shutoff valve on the fuel panel.
 - 2.c Remove the two capscrews that secure the access cover to the fuel panel, then remove the access cover. See Fig.229, [CNG Fuel Panel Assembly](#). Save the capscrews for installation.



- | | |
|----------------------------------|--|
| 1. Fuel Panel Access Cover | 5. Coolant Outlet Line |
| 2. Capscrews (qty 2) | 6. Coolant Inlet Line |
| 3. Wiring Harness | 7. Fuel Inlet Line (to fuel cylinders) |
| 4. Pressure Relief Valve and Cap | 8. Fuel Outlet Line (to engine) |

Fig 229, CNG Fuel Panel Assembly

- 2.d Slowly open the bleed valve on the manifold to relieve remaining fuel pressure within the system. See Fig. 230, [CNG Fuel Panel Components](#).



- | | |
|--------------------------|------------------------------|
| 1. Coolant Inlet Port | 8. Manual Fuel Shutoff Valve |
| 2. Coolant Outlet Port | 9. Fuel Fill Port |
| 3. Pressure Relief Valve | 10. High-Pressure Filter |
| 4. Pressure Regulator | 11. Filter Bowl |
| 5. Wiring Harness | 12. Filter Drain Plug |
| 6. Manifold Bleed Valve | 13. Solenoid Valve |
| 7. Manifold | 14. Fuel Line To Cylinders |

Fig 230, CNG Fuel Panel Components

- 2.e Put a clean receptacle under the filter assembly.

IMPORTANT: Some pressure may remain in the fuel system between the solenoid valve and the engine. Use caution when loosening fittings, as a small amount of gas may leak out.

- 2.f Using an 11/16-inch wrench, remove the drain plug from the filter bowl.

When all liquid has drained, install and tighten the drain plug on the filter bowl.

- 2.g Close the bleed valve on the manifold and open the manual fuel shutoff valve on the fuel panel.

Open the fuel cylinder shutoff valves.

- 2.h Use a methane detector to leak test all fuel system components between the fuel cylinders and the solenoid valve. A bubble solution can be used to pinpoint the exact location of leaks.

Repair or replace any leaking components.

- 2.i Install the access cover on the fuel panel.

13.01 Cab Washing and Polishing.....	252
13.02 Care of Fiberglass Parts	252
13.03 Care of Chrome Parts	252
13.04 Care of Exterior Lights	253
13.05 Dashboard Care.....	253
13.06 Vinyl Upholstery Cleaning	253
13.07 Velour Upholstery Cleaning.....	254

13. Cab Appearance

13.01 Cab Washing and Polishing

**CAUTION:**

When pressure washing the vehicle or leaving the hood open when parked outdoors and subject to rain, cover the air cleaner inlet with a plastic bag to prevent water from entering the air intake system and possibly damaging the engine.

To protect the finish of your new vehicle, follow these guidelines carefully:

- During the first 30 days, rinse your vehicle frequently with water. If the vehicle is dirty, use a mild liquid soap. Do not use detergent.
- During the first 30 days, do not use anything abrasive on your vehicle. Brushes, chemicals, and cleaners may scratch the finish.
- During the first 120 days, do not wax your vehicle.

To extend the life of your vehicle's finish, follow these guidelines:

- Avoid washing your vehicle in the hot sun. Always use water. After the cab is completely washed, dry it with a towel or chamois.
- Do not dust painted surfaces with a dry cloth, as this will scratch the paint.
- Do not remove ice or snow from a painted surface with a scraper of any sort.
- To prevent damage to the finish, wax it regularly. If the finish has become dull, before waxing, remove oxidized paint using a cleaner specifically designed for this purpose. Remove all road tar and tree sap before waxing. Freightliner recommends that a quality brand of cleaner or cleaner-polish and polishing wax be used.
- Do not let diesel fuel or antifreeze stand on a painted surface. If either should occur, rinse the surface off with water.
- To prevent corrosion, have any nicks or other damage on the finish touched up as soon as possible.
- Park your vehicle in a sheltered area whenever possible.

To prevent delamination and deterioration of labels and stickers on the cab, follow these guidelines carefully:

- Do not pressure wash the label or sticker or surfaces near it.
- Do not use strong alkaline soaps on or near the label or sticker.

13.02 Care of Fiberglass Parts

Wash unpainted fiberglass air fairings and shields monthly with a mild detergent, such as dishwashing liquid. Avoid strong alkaline cleansers.

Apply a wax specifically designed for fiberglass.

13.03 Care of Chrome Parts

To prevent rust, keep chrome parts clean and protected at all times. This is especially important during winter driving and in coastal areas where there is exposure to salt air.

When cleaning chrome parts, use clean water and a soft cloth or sponge. A mild detergent may also be used.

Sponge gently, then rinse. If necessary, use a nonabrasive chrome cleaner to remove stubborn rust or other material. Do not use steel wool.

To help protect the chrome after cleaning, apply a coat of polishing wax to the surface. Never use wax on parts that are exposed to high heat, such as exhaust pipes.

13.04 Care of Exterior Lights

Clean the headlight lenses by hand only, using a flannel cloth with mild, non-caustic soap or detergent, and water.

**CAUTION:**

Do not use a power buffer, paper towels, chemical solvents, or abrasive cleaners on the headlight lens, all of which can remove the UV coating from the surface, and result in yellowing of the lens.

13.05 Dashboard Care

**NOTICE:**

When cleaning the dashboard, instrument panel, or gauge lens covers, do not use Armor-All Protectant®, STP Son-of-a-Gun®, window cleaner, or other equivalent treatments. These cleaners contain vinyl plasticizers which can cause stress crazing in the interior plastic panels and can result in cracking of the panels. Some cleaners can also have an adverse effect on the clear plastic of instrument panels and gauge lens covers, resulting in a foggy or cloudy appearance. This type of damage is not covered by vehicle warranty.

To clean the dashboard, instrument panel, and gauge lens covers, use a cloth dampened with warm soapy water. Make certain to wring the cloth out well before cleaning, as excess water will damage the electrical components.

13.06 Vinyl Upholstery Cleaning

To prevent soiling, frequent vacuuming or light brushing to remove dust and dirt is recommended. Harsh cleaning agents can cause permanent damage to vinyl upholstery. To preserve the upholstery and prevent damage, carefully review the following sections for recommended cleaning procedures. Waxing or refinishing improves soil resistance and cleanability for all vinyls. Any hard wax, such as that used on automobiles, may be used.

Ordinary Dirt

Wash the upholstery with warm water and mild soap, such as saddle or oil soap. Apply soapy water to a large area and allow to soak for a few minutes, then rub briskly with a cloth to remove the dirt. This can be repeated several times as necessary.

If dirt is deeply imbedded, use a soft bristle brush after applying the soap.

If dirt is extremely difficult to remove, wall-washing preparations normally found around the home can be used. Powdered cleaners, such as those used for sinks and tiles, are abrasive and must be used with caution as they can scratch the vinyl or give it a permanent dull appearance.

Chewing Gum

Harden the gum with an ice cube wrapped in a plastic bag, then scrape it off with a dull knife. Any remaining traces of gum can be removed with an all-purpose light oil (peanut butter will also work) and wiped off.

Tars, Asphalts, and Creosote

Tars, asphalts, and creosote stain vinyl after prolonged contact. They should be wiped off immediately and the area carefully cleaned, using a cloth dampened with naphtha.

Paint, Shoe Heel Marks

Paint should be removed immediately. Do not use paint remover or liquid-type brush cleaner on vinyl. An unprinted cloth, dampened with naphtha or turpentine may be used. Use care to prevent contact with parts of the upholstery that are not vinyl.

Sulfide Stains

Sulfide compounds, such as those found in eggs and some canned goods, can stain after prolonged contact with vinyl. These stains can be removed by placing a clean, unprinted piece of cloth over the spotted area and pouring a liberal amount of 6 percent hydrogen peroxide onto the cloth. Allow the saturated cloth to remain on the spot for 30 to 60 minutes. For stubborn spots, allow the hydrogen-peroxide saturated cloth to remain on the area overnight. Use caution to prevent the solution from seeping into the seams or it will weaken the cotton thread.

Nail Polish and Nail Polish Remover

Prolonged contact with these substances causes permanent damage to vinyl. Careful blotting immediately after contact minimizes damage. Do not spread the liquid during removal.

Shoe Polish

Most shoe polishes contain dyes which penetrate vinyl and stain it permanently. Shoe polish should be wiped off as quickly as possible using naphtha or lighter fluid. If staining occurs, try the procedure used for sulfide stains.

Ball Point Ink

Ball point ink can sometimes be removed if rubbed immediately with a damp cloth, using water or rubbing alcohol. If this does not work, try the procedure used for sulfide stains.

Miscellaneous

If stains do not respond to any of the treatments described above, it is sometimes helpful to expose the vinyl to direct sunlight for up to 30 hours. Mustard, ball point ink, certain shoe polishes, and dyes often bleach out in direct sunlight leaving the vinyl undamaged.

13.07 Velour Upholstery Cleaning

To prevent soiling, frequent vacuuming or light brushing to remove dust and dirt is recommended. Spot clean with a mild solvent or an upholstery shampoo, or the foam from a mild detergent. When using a solvent or a dry-cleaning product, follow the instructions carefully and clean only in a well-ventilated area. Avoid any product that contains carbon tetrachloride or other toxic materials. With either method, pretest a small area before proceeding. Use a professional upholstery cleaning service when extensive cleaning is needed.

Grease and Oil-Based Stains

Dampen a small absorbent cloth with dry-cleaning solvent or spot remover. Apply the cloth carefully to the spot from the outer edge to the center. Pat and blot the spot with a clean, dry cloth. Repeat several times, as necessary, turning the cloths so that the stain does not redeposit on the fabric.

Sugar and Water-Based Stains

Apply water-based detergent or cleaner, working in circular motions. Pat and blot as dry as possible. Repeat if necessary before drying thoroughly.

Chewing Gum or Wax

Harden the gum or wax with an ice cube wrapped in a plastic bag, then scrape it off with a dull knife. Excess wax can be absorbed by placing a thick white blotter over the wax and heating with a warm (not hot) iron. Remove the remainder by using the procedure for grease and oil-based stains.

Mildew

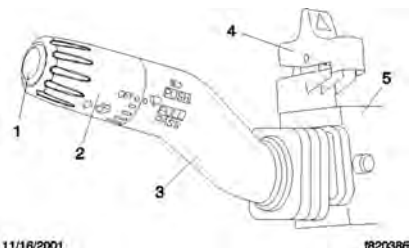
Brush the dry fabric with a soft brush. Sponge with detergent, and blot. If the fabric is colorfast, dilute a teaspoon of bleach in one quart (one liter) of cool water. Apply with a swab, directly on the mildew stain. Dab repeatedly with clear, cool water, and blot dry.

14.01 Hazard Warning Lights	256
14.02 Fire Extinguisher	256
14.03 Fire in the Cab	256
14.04 Emergency Kit, Optional	256
14.05 Emergency Filter Replacement, Davco	257
14.06 Emergency Starting With Jumper Cables	259
14.07 Raising and Lowering a Vehicle	261
14.07.01 Raising a Vehicle with Air Suspension	261
14.07.02 Lowering a Vehicle with Air Suspension	262
14.07.03 Raising a Vehicle without Air Suspension	263
14.07.04 Lowering a Vehicle without Air Suspension	263
14.08 Front Towing Hookup With Removable Tow Hooks	264

14. In an Emergency

14.01 Hazard Warning Lights

The hazard warning light flasher (Fig.231, [Hazard Warning Flashers](#)) is part of the multifunction turn signal switch. It is a red rocker switch located on the top of the multifunction switch module.



NOTE: Press down on the upper part of the rocker to activate the flashers.

- | | |
|-----------------------|--------------------------------|
| 1. Washer Button | 4. Hazard Flasher (red) |
| 2. Wiper Control Dial | 5. Multifunction Switch Module |
| 3. Turn Signal Lever | |

Fig 231, Hazard Warning Flashers

To flash the hazard warning lights, press down on the upper part of the rocker (towards the dash). To stop the hazard warning lights, press down on the lower part of the rocker (towards the steering wheel).

14.02 Fire Extinguisher

A fire extinguisher is located in the cab by the driver's door.

14.03 Fire in the Cab

The incidence of fire in heavy and medium-duty trucks is rare, according to data from the National Highway Traffic Safety Administration. Federal Motor Vehicle Safety Standard #302 limits the flammability of specified materials used inside the cab but, despite this, most materials can burn.



WARNING:

Do not allow flames, sparks, or any other heat sources (such as cigarettes or light bulbs) to contact materials in the cab. Any materials in the cab in contact with such heat sources could cause serious personal injury as well as damage to the vehicle.

In Case of a Cab Fire

As quickly as possible, bring the vehicle to a safe stop, apply the parking brake, turn off the ignition, and get out of the vehicle.

14.04 Emergency Kit, Optional

An optional emergency kit is located in the cab. The kit includes one or more of the following: a first aid kit, a reflective vest, a triangular reflector, a flare kit, and (on vehicles with a Davco fuel/water separator) a spin-on fuel filter element.

If there is an emergency while driving, cautiously pull off the road. Turn on the hazard warning lights. Place the flares and reflector along the side of the road to alert other drivers that an emergency situation exists.

**WARNING:**

Use extreme care when placing flares in emergency situations that involve exposure to flammable substances such as fuel. An explosion or fire could occur causing serious personal injury.

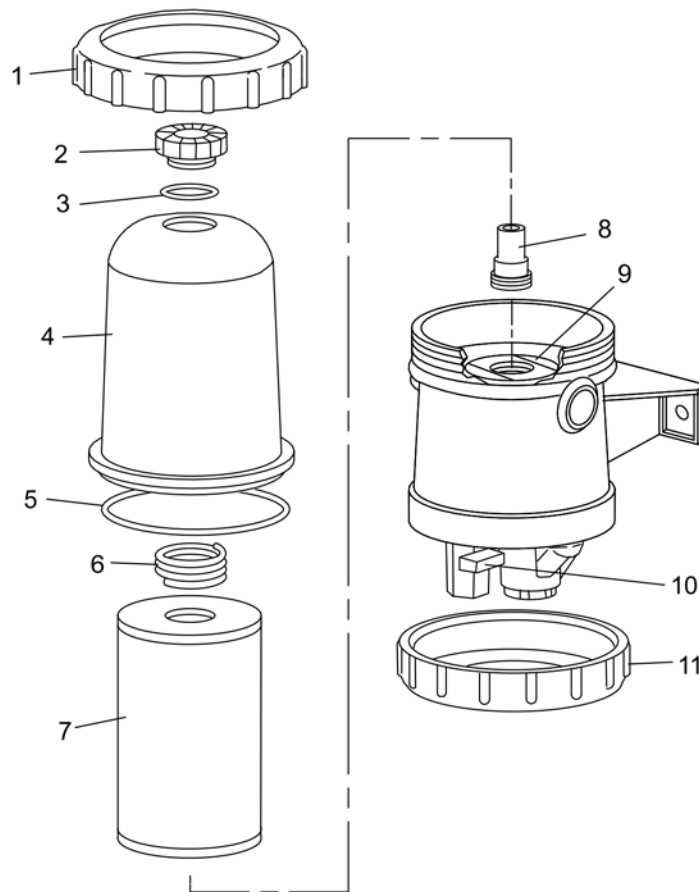
14.05 Emergency Filter Replacement, Davco

If the filter cover on the Davco fuel/water separator is broken, it will not be possible to operate the vehicle. A standard spin-on filter will correct this problem.

Refer to the Davco web site for additional information, www.davco.com.

To replace the filter on all Davco fuel/water separators, follow these procedures:

1. Drain the fuel until it is below the level of the collar. See Fig.232, [Davco Model 382 Fuel/Water Separator](#) for the model 382 fuel/water separator.



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1. Filter Collar
2. Filter Vent
3. Filter Vent Seal
4. Filter Cover
5. Filter Cover Seal
6. Spring

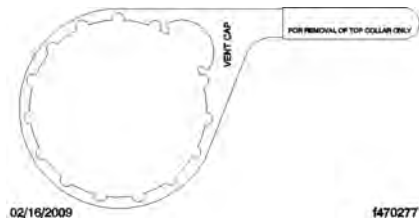
7. Filter Element
8. Threaded Stud
9. Fuel Port
10. Drain
11. Bottom Plate Collar

Fig 232, Davco Model 382 Fuel/Water Separator

2. Remove the filter vent and vent seal.

NOTE: The filter vent and vent seal are not needed in the emergency replacement. They should be retained for later installation at the time when the filter cover is replaced.

3. Using a DAVCO collar wrench, shown in Fig.233, **DAVCO Collar Wrench**, remove the clear cover and collar.

**Fig 233, DAVCO Collar Wrench**

NOTE: Broken vent cap and collar warranty claims will not be accepted if any tool other than a DAVCO collar wrench, p/n 380134 or 382002, is used for removal. During installation, the vent cap is to be **hand-tightened only**, not tightened with a wrench.

4. Remove the filter cover, filter cover seal and spring. Retain them for later assembly.
5. Remove the filter element and dispose of it properly.

NOTE: Remove the rubber grommet from the stud.

6. Install the standard engine spin-on filter (included in the emergency kit) on the threaded stud.
7. Install the filter cover, filter cover seal, and spring, as removed.
8. Install the filter collar over the filter cover. Simultaneously apply downward pressure to the top of the clear cover until it is seated on the body of the lower housing and hand tighten the collar until it no longer spins freely. Using the collar wrench, tighten the cover 18 lbf·ft (24 N·m). This is equivalent to rotating the collar clockwise two or three additional ribs, depending on the specific filter model.
9. Start the engine and run it at increased rpm for one minute to purge air from the fuel lines.

14.06 Emergency Starting With Jumper Cables

When using jumper cables, follow the instructions below.



WARNING:

Batteries release explosive gas. Do not smoke when working around batteries. Put out all flames and remove all sources of sparks or intense heat in the vicinity of the battery. Do not allow the vehicles to touch each other. Do not lean over the batteries when making connections, and keep all other persons away from the batteries. Failure to follow these precautions could lead to severe personal injury as a result of an explosion or acid burns.



NOTICE:

Make sure both starting systems have the same voltage outputs, and avoid making sparks. Otherwise the vehicle charging systems could be severely damaged. Also, do not attempt to charge isolated, deep-cycle batteries with jumper cables. Follow the battery manufacturer's instructions when charging deep-cycle batteries.

NOTE: On vehicles equipped with an optional jump-start post, attach the positive cable clamp to that post instead of to the battery.

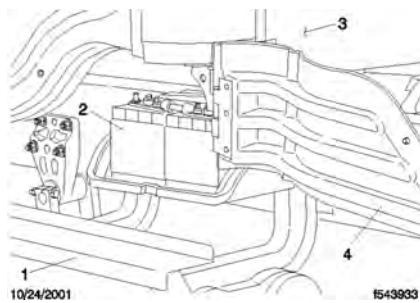
1. Apply the parking brakes and turn off the lights and all other electrical devices.
2. To gain access to the batteries, open the battery compartment. See Fig.234, [Battery Compartment, Open](#). For detailed instructions, see [3.01 Cab Door Locks and Handles](#).



NOTICE:

Always connect the battery, jumper cables, and charger correctly (positive-to-positive and negative-to-negative). Connecting a charging device backwards (positive-to-negative) will blow fuses that power the bulkhead module (BHM) and chassis module (CHM), and the devices they control will not work.

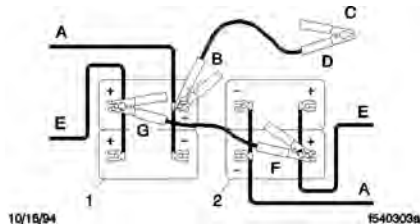
3. Connect an end of one jumper cable to the positive terminal of the booster battery (or jump-start post if equipped), and connect the other end of the cable to the positive terminal of the discharged battery (or jump-start post if equipped). See Fig.235, [Jumper Connections](#).



1. Top Step
2. Battery

3. Cab
4. Battery Access Door

Fig 234, Battery Compartment, Open



- A. To Ground
- B. 3rd
- C. To Frame (ground)
- D. 4th
- E. To Starter

- F. 2nd
 - G. 1st
1. Booster Battery
 2. Discharged Battery

Fig 235, Jumper Connections

**WARNING:**

Do the next step exactly as instructed and do not allow the clamps of one cable to touch the clamps of the other cable. Otherwise, a spark could occur near a battery, possibly resulting in severe personal injury from explosion or acid burns.

4. Connect one end of the second jumper cable to the negative terminal of the booster battery, and connect the other end of the cable to a ground at least 12 inches (300 mm) away from the batteries of the vehicle needing the start. The vehicle frame is usually a good ground. Do *not* connect the cable to or near the discharged batteries.

**WARNING:**

On vehicles with Mercedes-Benz AGS transmissions, make sure the current gear indicator displays "N" before starting the vehicle. If the transmission starts in gear, it could cause an accident resulting in death, serious personal injury, or property damage.

5. Start the engine of the vehicle with the booster batteries, and let the engine run a few minutes to charge the batteries of the other vehicle.
6. Attempt to start the engine of the vehicle with the batteries receiving the charge. Do not operate the starter longer than 30 seconds, and wait at least two minutes between starting attempts to allow the starter to cool.
7. When the engine starts, let it idle a few minutes.

**WARNING:**

Do the next step exactly as instructed and do not allow the clamps of one cable to touch the clamps of the other cable. Otherwise, a spark could occur near a battery, possibly resulting in severe personal injury from explosion or acid burns.

8. Disconnect the grounded cable from the frame or other non-battery location, then disconnect the other end of the cable.
9. Disconnect the remaining cable from the newly charged battery (or jump-start post if equipped) first, then disconnect the other end.
10. Close the battery compartment. For detailed instructions, see [3.01 Cab Door Locks and Handles](#).

14.07 Raising and Lowering a Vehicle

14.07.01 Raising a Vehicle with Air Suspension

1. Park the vehicle on a level surface, set the parking brakes, and shut down the engine. Chock the tires.

**WARNING:**

Remove the air from the suspension. Failure to remove the air from the suspension may cause the vehicle to move or shift on the jack stands as air pressure drains from the system; this could cause the vehicle to fall, resulting in damage to the vehicle, serious injury, or death.

2. Exhaust all air from the air suspension.

**WARNING:**

Do not use bottle jacks to raise the vehicle. Always use floor jacks. Bottle jacks can slip, allowing the vehicle to fall, which could result in damage to the vehicle, serious injury, or death.

IMPORTANT: Only lift unloaded vehicles and vehicles disconnected from trailers. Unload vehicles with bodies (drilling rigs, mixers) as much as possible.

3. Place a floor jack under the axle housing, the clamp group, or the frame rail.

**NOTICE:**

Do not place jack stands under any of the suspension components; doing so could cause suspension component damage. Jack stands can be placed at any point below the axle, including the differential area.

4. Raise the vehicle. Add additional jack stands, as needed, under the axles to support the vehicle.

14.07.02 Lowering a Vehicle with Air Suspension

**WARNING:**

Do not use bottle jacks to raise the vehicle. Always use floor jacks. Bottle jacks can slip, allowing the vehicle to fall, which could result in damage to the vehicle, serious injury, or death.

**NOTICE:**

Do not place jack stands under any of the suspension components; doing so could cause suspension component damage. Jack stands can be placed at any point below the axle, including the differential area.

1. Using the floor jack, raise the vehicle to remove any jack stands used to support the vehicle.
2. Slowly lower the vehicle to the ground.
3. Inflate the air suspension, and check for proper operation. Refer to [General Information, Front Suspension](#) in the *Business Class M2 Workshop Manual* for instructions.

14.07.03 Raising a Vehicle without Air Suspension

1. Park the vehicle on a level surface, set the parking brakes, and shut down the engine. Chock the tires.

**WARNING:**

Do not use bottle jacks to raise the vehicle. Always use floor jacks. Bottle jacks can slip, allowing the vehicle to fall, which could result in damage to the vehicle, serious injury, or death.

IMPORTANT: Only lift unloaded vehicles and vehicles disconnected from trailers. Unload vehicles with bodies (drilling rigs, mixers) as much as possible.

2. Place a floor jack under the axle housing, the clamp group, or the frame rail.

**NOTICE:**

Do not place jack stands under any of the suspension components; doing so could cause suspension component damage. Jack stands can be placed at any point below the axle, including the differential area.

3. Raise the vehicle. Add additional jack stands, as needed, to support the vehicle.

14.07.04 Lowering a Vehicle without Air Suspension**WARNING:**

Do not use bottle jacks to raise the vehicle. Always use floor jacks. Bottle jacks can slip, allowing the vehicle to fall, which could result in damage to the vehicle, serious injury, or death.

**NOTICE:**

Do not place jack stands under any of the suspension components; doing so could cause suspension component damage. Jack stands can be placed at any point below the axle, including the differential area.

1. Using the floor jack, raise the vehicle to remove any jack stands used to support the vehicle.
2. Slowly lower the vehicle to the ground.

14.08 Front Towing Hookup With Removable Tow Hooks

**NOTICE:**

Towing the truck from the front and removing all of the drivelines is the approved method for towing DTNA products. Towing any other way is not preferred.

**DANGER:**

When working on the vehicle, shut down the engine, set the parking brake, and chock the tires. Before working under the vehicle, always place jack stands under the frame rails to ensure the vehicle can not drop. Failure to follow these steps could result in serious personal injury or death.

**WARNING:**

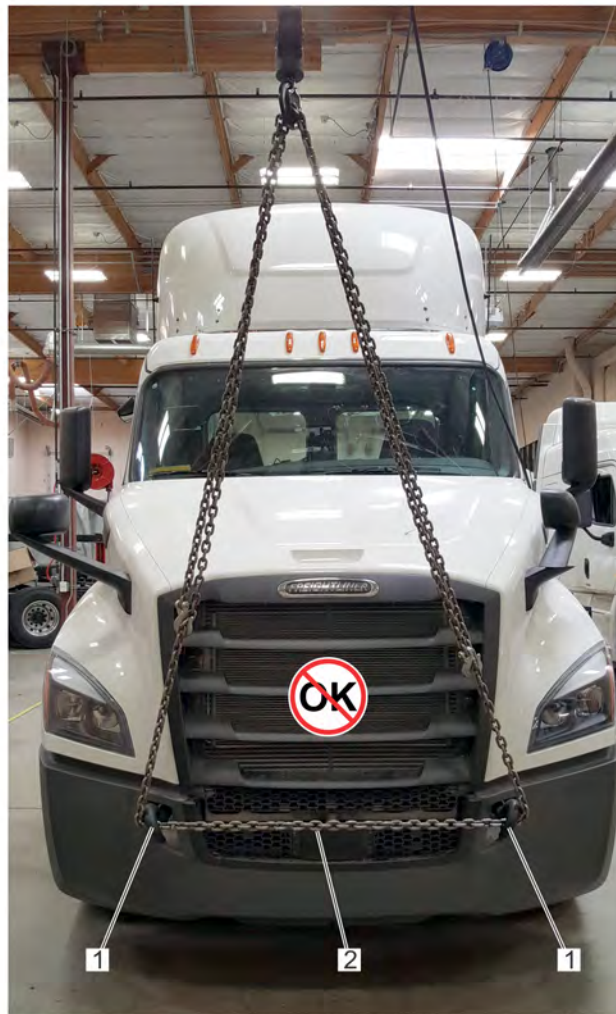
Do not tow an unbraked vehicle if the combined weight of both vehicles is more than the sum of the gross axle weight ratings (GAWR) of the towing vehicle. Otherwise brake capacity will be inadequate, which could result in personal injury or death.

Use of Tow Hooks

Tow hooks are not designed for on-road towing of the vehicle, but to recover and move the vehicle to a position where it can be hooked up properly for front towing.

**NOTICE:**

When using tow hooks to move the vehicle, do not pass a sling (for example, a rope or chain) from one hook to another. Known as reeving, this practice is **not permissible in most industrial applications of towing and hoisting. Reeving can overload the hooks and result in damage to the vehicle.** See Fig. 236,, page 265 .



09/21/2017

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IMPORTANT: Do not reeve when towing.

1. Tow Hook

2. Chain

Fig 236, Reeving

1. Disconnect the battery ground cables.



NOTICE:

Failure to protect the frame rails from the chains could cause damage, leading to eventual frame failure.

2. On dual drive axles, if the vehicle is to be lifted and towed, chain the forward rear-axle assembly to the vehicle frame. Use protection to keep the chains from damaging the frame.
3. Open the hood. Remove the tow hooks, located behind the driver's-side bumper. See Fig. 237, [Tow Hooks](#). Close and latch the hood.

**Fig 237, Tow Hooks****NOTICE:**

New or ungreased tow hooks may be hard to install. Tow hooks that are not properly installed may be damaged or break.

4. Install the tow hooks onto the tow hook receivers through the tow hook holes in the bumper, rotating the hooks so the hook opening faces down. See Fig. 238, [Tow Hooks Installed, Facing Down](#). Pull the tow hooks to ensure they are securely engaged in the tow hook receivers.

**Fig 238, Tow Hooks Installed, Facing Down**

5. Lower the stinger assembly so that it is level and approximately 1 inch (0.3 cm) off the ground. Back the tow truck so that the crossbar with lift adaptors is within 6 inches (15 cm) of the Aero bumper. See Fig. 239, [Positioning the Stinger Assembly](#).



Fig 239, Positioning the Stinger Assembly



NOTICE:

When using tow hooks to move the vehicle, do not pass a sling (for example, a rope or chain) from one hook to another. Known as reeving, this practice is **not permissible in most industrial applications of towing and hoisting**. Reeving can overload the hooks and result in damage to the vehicle.

6. Pull the tow cables out of the tow truck and connect the tow cable lifting hooks onto the tow hooks, then extend the recovery boom within 4 to 6 inches (10 to 15 cm) of being vertical of the tow hooks. See Fig. 240, [Tow Cables Connected to the Tow Hooks](#).



Fig 240, Tow Cables Connected to the Tow Hooks

7. Lift the front of the truck until there is enough clearance for the stinger and crossbar to pass under the bumper. See Fig. 241, [Moving the Stinger and Crossbar Under the Bumper](#).



06/14/2017

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Fig 241, Moving the Stinger and Crossbar Under the Bumper

If enough clearance cannot be gained with a single lift, jack stands or other means capable of supporting the weight on the front axle must be used while the cables are shortened to allow a second lift.

**WARNING:**

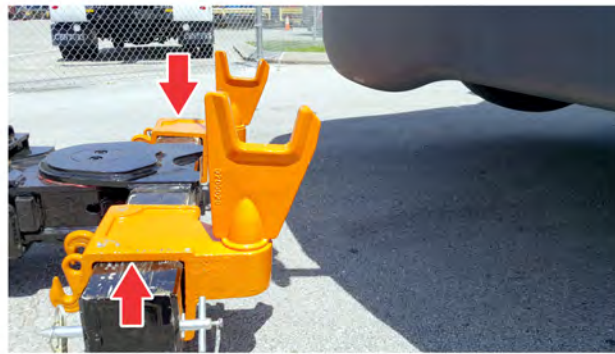
Failure to chock the tires or connect the tow truck's air brake system before releasing the spring parking brakes could allow the disabled vehicle to suddenly roll. This could cause property damage or personal injury.

8. Chock the rear tires.

**NOTICE:**

Reference the applicable axle manufacturer's information to avoid damaging the axle when towing the truck.

9. Use mid-rise or high-rise forks, or lift adaptors (part number 0200020) on the crossbar to provide clearance for the aerodynamic bumper. See Fig. 242, [Lift Adaptors Installed on the Crossbar](#) and Fig. 243, [Backing the Tow Truck with Lift Adaptors on the Crossbar](#).



06/14/2017

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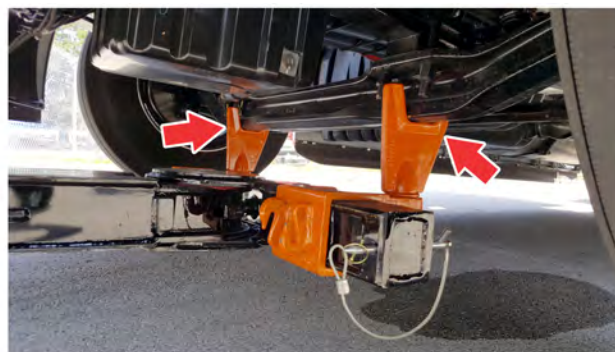
Fig 242, Lift Adaptors Installed on the Crossbar

06/14/2017

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Fig 243, Backing the Tow Truck with Lift Adaptors on the Crossbar

10. Extend the stinger and place the lift adaptors under the axle. Make certain the lift adaptors are under the front suspension springs between the U-bolts. See Fig. 244, [Positioning the Stinger with Lift Adaptors Under the Axle](#) and Fig. 245, [Stinger with Lift Adaptors Under the Axle \(tow truck shown\)](#).



06/14/2017

f130154

Fig 244, Positioning the Stinger with Lift Adaptors Under the Axle



Fig 245, Stinger with Lift Adaptors Under the Axle (tow truck shown)

11. Secure the axle to the crossbar with a chain or ratchet strap.



NOTICE:

Failure to remove the driveline(s) or the drive axle shafts when towing the vehicle with the rear wheels on the ground could result in damage to the transmission and other parts.

12. Use a paint pen to mark the drivelines in as built condition, and then remove the driveline, the interaxle driveline (if equipped), for each axle that may touch the ground during the towing process. Store the drivelines and U-joints in a secure location so they will not come off during transport.
13. Remove the tow cables from the tow hooks and retract the recovery boom. See Fig. 246, [Retracting the Recovery Boom](#).



Fig 246, Retracting the Recovery Boom

14. Remove the tow hooks from the bumper.

IMPORTANT: On trucks equipped with a front air suspension, either air pressure must be supplied to the secondary air system or the front suspension must be blocked to operating height with wooden spacers and the axle chained to the frame to prevent damage to the truck.

15. Connect the air and electrical supply lines from the tow truck to the truck being towed.
16. Connect the clearance lights, taillights, and signal lights. Connect any special towing lights required by local regulations.
17. Release the park brake and remove the chocks from the rear tires.
18. Use the stinger to pull the truck close to the back of the tow truck for final towing position. See Fig. 247, [Final Towing Position](#).



Fig 247, Final Towing Position

19. Connect the safety chains. See Fig. 248, [Safety Chains Connected on the Towed Vehicle](#).



Fig 248, Safety Chains Connected on the Towed Vehicle

15.01 Preliminary Checks	274
15.02 Checking Headlight Aim.....	274
15.03 Adjusting Headlight Aim	276

15. Headlight Aiming

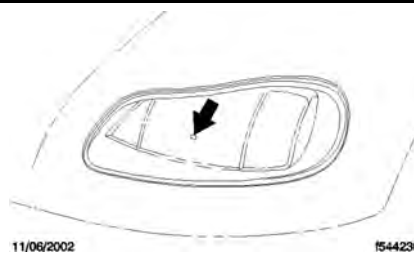
15.01 Preliminary Checks

Before checking or adjusting the headlight aim, do the following:

- Check that the hood is closed and latched.
- Check the suspension for proper functioning of the leveling mechanism. On cabs with air suspensions, make sure that the height is properly adjusted.
- Remove any large amounts of mud or ice from the underside of the fenders.
- Check the springs for sagging or broken leaves.
- Check for damage to the hood and hinge assembly. Repair as necessary.
- With the vehicle unloaded, check that the tires are inflated to the recommended air pressure.
- Clean the headlight lenses. Use a soft cloth with mild, non-caustic soap or detergent, and water.

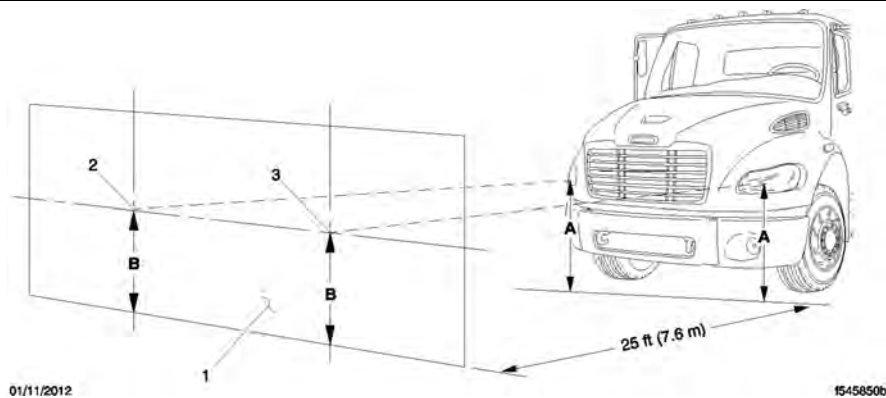
15.02 Checking Headlight Aim

1. Park the vehicle on a level surface, 25 ft (7.6 m) away from, and perpendicular to, a vertical screen or wall. Shut down the engine and set the parking brake. Chock the tires.
2. Each headlight has a height adjusting dot. See Fig.249,[Headlight Beam Height Adjusting Dot](#). Measure the distance from the ground to the height adjusting dot on each headlight. Note those distances. See Fig. 250,[Headlight Aiming Screen/Wall](#), Ref. A.



NOTE: Measure beam height from the ground to the small dot roughly in the center of the headlight lens.

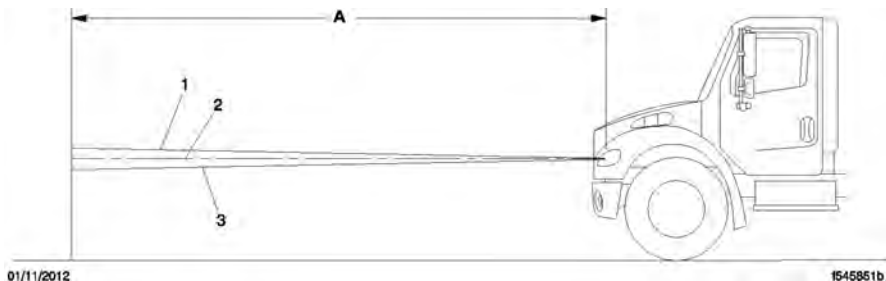
Fig 249, Headlight Beam Height Adjusting Dot



- | | |
|--|---|
| <p>A. Measure the distance from the ground to the center of each headlight bulb.</p> <p>B. Mark where the center of each headlight projection should appear.</p> | <p>1. Screen or Wall</p> <p>2. Center of Right-Hand Headlight Projection</p> <p>3. Center of Left-Hand Headlight Projection</p> |
|--|---|

Fig 250, Headlight Aiming Screen/Wall

3. Mark the vertical distances found in step 2 on the screen or wall, directly in front of the headlights. These marks represent the desired locations of each headlight bulb center in the following steps. See Fig. 250, [Headlight Aiming Screen/Wall](#), Items 2 and 3.
4. Turn on the low-beam headlights.
5. Identify the center of each beam projection by marking the area of brightest intensity on the wall. The area of brightest intensity should fall on or very near the marks made during step 3. See Fig. 251, [Vertical Low-Beam Headlight Variation Limits](#).



- | | |
|--|--------------------------------------|
| <p>1. Low-Beam Angle Upper Limit</p> <p>2. Ideal Low-Beam Projection</p> | <p>3. Low-Beam Angle Lower Limit</p> |
|--|--------------------------------------|

Fig 251, Vertical Low-Beam Headlight Variation Limits

6. Use Table.15, [Vertical Low-Beam Headlight Variation Limits](#) to determine the maximum vertical distance allowable between the marks made in step 3 and the marks made in step 5. If the vertical distance between the marks made in steps 3 and 5 is greater than the maximum distance given in Table.15, [Vertical Low-Beam Headlight Variation Limits](#), adjust the vertical positioning of that headlight.

Vertical Low-Beam Headlight Variation Limits			
Distance Between Ground and Headlight: in (mm)	Desired Variation (Fig. 251, Vertical Low-Beam Headlight Variation Limits, Item 2): in (mm)	Upper Limit (Fig. 251, Vertical Low-Beam Headlight Variation Limits, Item 1): in (mm) up	Lower Limit (Fig. 251, Vertical Low-Beam Headlight Variation Limits, Item 3): in (mm) down
22–36 (560–900)	0	3.9 (100)	3.9 (100)
36–48 (900–1200)	2 (50) down	2 (50)	6 (150)
48–54 (1200–1400)	4 (101.6) down	1.6 (40)	6.5 (165)

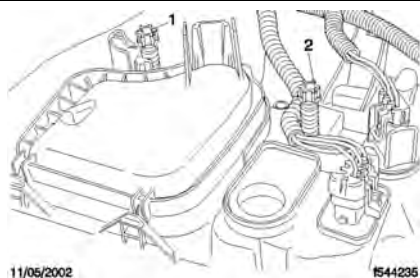
15.03 Adjusting Headlight Aim


NOTICE:

Do not use power tools to adjust headlight aim. Doing so will strip or break the adjusting screw.

NOTE: Freightliner vehicles are offered with various headlight assembly options. Because of the various options, the location of adjustment screws on the vehicle's headlight assembly may vary from what is shown here.

1. Lift the flap over the rear end of the headlight bucket to expose the two plastic adjusting knobs on each headlight. See Fig. 252, [Headlight Adjusting Knobs](#).



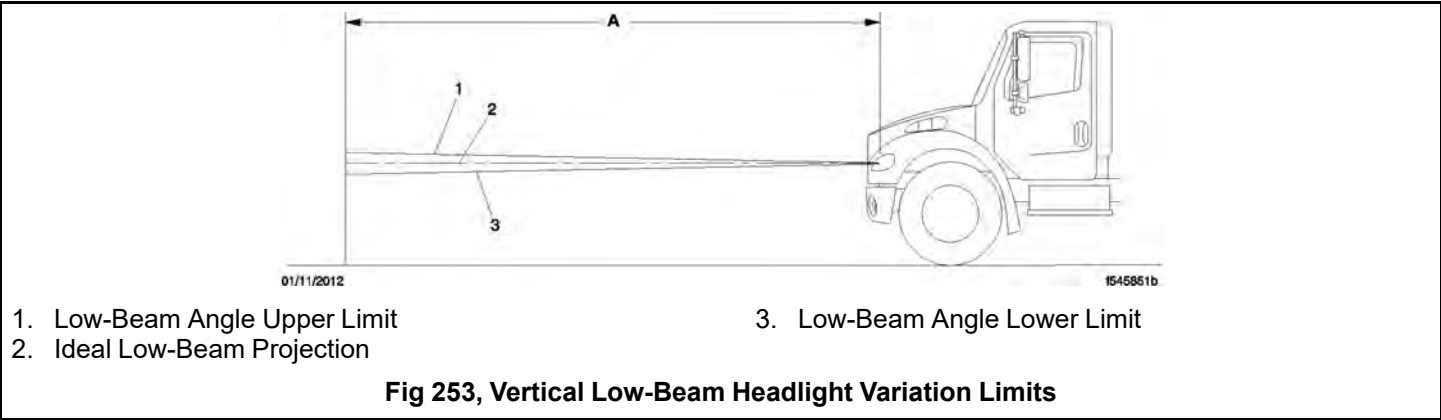
NOTE: The right-hand side headlight bucket is shown. The left-hand side is opposite.

1. Horizontal (inboard) Adjusting Knob
2. Vertical (outboard) Adjusting Knob

Fig 252, Headlight Adjusting Knobs

2. If necessary, adjust the horizontal positioning of the headlights so that each projection points directly forward.
3. Turn the vertical adjustment knob to adjust the headlight beam to meet the desired height. See Table.16, [Vertical Low-Beam Headlight Variation Limits](#). Turn the knob clockwise to raise the beam; turn the knob counterclockwise to lower it.
4. Adjust the other headlight.

Vertical Low-Beam Headlight Variation Limits			
Distance Between Ground and Headlight: in (mm)	Desired Variation (Fig. 253, Vertical Low-Beam Headlight Variation Limits , Item 2): in (mm)	Upper Limit (Fig. 253, Vertical Low-Beam Headlight Variation Limits , Item 1): in (mm) up	Lower Limit (Fig. 253, Vertical Low-Beam Headlight Variation Limits , Item 3): in (mm) down
22–36 (560–900)	0	3.9 (100)	3.9 (100)
36–48 (900–1200)	2 (50) down	2 (50)	6 (150)
48–54 (1200–1400)	4 (101.6) down	1.6 (40)	6.5 (165)



16.01 Hybrid Electric Vehicle (HEV) Overview	280
16.01.01 General Information	280
16.01.02 Regenerative Braking	280
16.01.03 High-Voltage Safety Features	280
16.01.04 Cooling System.....	280
16.01.05 Electric Power Take-Off (ePTO)	281
16.02 Safety Precautions (HEV)	281
16.03 Starting, and Engine Shutdown (HEV)	281
16.03.01 The Cranking System	281
16.03.02 Starting	281
16.03.03 Engine Shutdown.....	282
16.04 Hybrid System Fault Lamps (HEV).....	282
16.05 Emergencies (HEV).....	282
16.05.01 Emergency Shutdown	282
16.05.02 In Case of an Accident or Fire	282
16.06 Jumpstarting (HEV)	283
16.07 Towing (HEV).....	283

16. Hybrid Electric Vehicle

16.01 Hybrid Electric Vehicle (HEV) Overview

16.01.01 General Information

A hybrid electric vehicle (HEV) has both a diesel engine and an electric motor. Engine torque is augmented with electrical torque. The electric motor is powered by batteries, which are charged by regenerative braking and, on vehicles equipped with the ePTO option, the diesel engine.

The batteries cannot move the vehicle for long distances at highway speeds. In the event of a diesel engine failure, drive the vehicle to a safe location as quickly as possible.

Eaton Corporation developed and supplies the hybrid electric system for Freightliner Trucks. The primary system components are the hybrid drive unit (or "HDU", which includes the electric generator/motor and automated transmission), power electronics carrier (PEC), and the motor inverter/controller. Electric power take-off (ePTO) and auxiliary power generator (APG) components are optional on the HEV system.

Freightliner Trucks designed the stand-alone liquid cooling system required to support the operation of Eaton's HEV system. Its primary system components are the electric water pump, reservoir/expansion tank, radiator, electric radiator fan, and coolant plumbing.

Body builders will develop the components for the PTO, the PTO plumbing, and a safety switch to prevent the diesel engine from starting when the hood is open.

16.01.02 Regenerative Braking

Regenerative braking reduces vehicle speed by converting some of the vehicle's kinetic energy into electric energy to charge the hybrid system's batteries. When the accelerator pedal is at idle while coasting, or the service brake is depressed to slow the vehicle, the hybrid system charges the batteries.

The regeneration will feel as if the brake is being lightly applied when you remove your foot from the accelerator pedal. The full power of the service brake is always available to the driver, and regenerative braking is automatically shut off during an ABS (antilock brake) event.

The Eaton Hybrid Control Unit will automatically shut off regenerative braking when the batteries are fully charged.

16.01.03 High-Voltage Safety Features

The HEV has high-voltage cables and a service switch on the PEC.

High-voltage cables are covered in orange insulation and conduit. Each high-voltage component is tagged with a warning or danger label.

IMPORTANT: The service switch on the PEC should only be used for an emergency shutdown, or when the service manual or troubleshooting guide calls for work on the high-voltage system. The service manual and troubleshooting guide for the hybrid electric system are available from www.roadranger.com.

The red service switch is located next to the high-voltage cable connections at one end of the PEC. Pushing in the red service switch will shut down the engine. The hybrid system will be disabled, and the high-voltage batteries in the PEC, though still live, are isolated in the PEC.

NOTE: The PEC may be mounted in an area with limited access.

For information on emergency shutdowns, see "Emergencies" in this chapter.

16.01.04 Cooling System

The HEV requires a liquid cooling system for the HDU, inverter, DC/DC Converter (if ePTO equipped), and APG (if equipped). The HEV's cooling system is separate from the engine cooling system.

For coolant, use a mixture of 50 percent ethylene glycol and 50 percent water.

16.01.05 Electric Power Take-Off (ePTO)

The Electric Power Take-Off (ePTO) option provides standard hydraulic functions without continuous diesel engine operation. The PTO drive power is provided by the hybrid motor and hybrid batteries. When the hybrid batteries deplete, the diesel engine automatically starts to recharge them and provide PTO drive power. Once the batteries are fully charged, the engine shuts down automatically. Vehicles with the ePTO option are designed with a safety switch to ensure the diesel engine does not start when the hood is open.

A DC/DC converter is required for ePTO applications to convert high-voltage DC to 12-volt DC.

NOTE: To maintain a power supply from the vehicle's low-voltage batteries, the alternator charges them when the vehicle is being driven.

16.02 Safety Precautions (HEV)

The HEV has high-voltage components, including 340-volt DC batteries and a 500-volt AC motor. Never cut high-voltage cables or connectors. Do not paint high-voltage cables.

Avoid direct pressure wash on high-voltage connections (PEC, DC/DC Converter) and the air intake and exhaust on the PEC.

16.03 Starting, and Engine Shutdown (HEV)

16.03.01 The Cranking System

The primary engine starter is the electric motor in the HDU, which cranks the engine very quickly. The back-up cranking system is the standard 12-volt starter on the engine. If the hybrid system is offline or the hybrid batteries are insufficiently charged, the vehicle will automatically use the 12-volt cranking system to start the engine.

16.03.02 Starting

1. Set the parking brake.
2. Place the key in the ignition, and turn it clockwise to the ON position to initiate power to the hybrid system.

Wait for the gauges on the instrument panel to complete two sweeps (one from left to right, and one from right to left) and return to their normal ranges.

3. Ensure the transmission is in neutral. The gear display should display a solid "N".

**WARNING:**

Never start the engine unless the transmission is in neutral and the brake is applied. Accidental movement of the vehicle could result in property damage, personal injury, or death.

4. Turn the key clockwise to the START position. The engine will crank after a brief delay. As soon as the engine starts, release the key, allowing it to return to the ON position. The engine will continue to run with the key in the ON position.
5. Apply the service brake, then release the parking brake.
6. With the service brake applied, press the desired mode on the shift control to put the vehicle into gear.
7. Slowly release the service brake.

NOTE: The vehicle may be powered by the electric motor or the diesel engine, depending on battery charge and the demand for driveline torque. If the electric motor alone is powering the driveline, the diesel engine will stay at idle.

16.03.03 Engine Shutdown

1. Place the transmission in neutral by selecting N on the shift control.

IMPORTANT: The transmission must be in neutral for proper shutdown.

2. Set the parking brake.
3. Turn the key counterclockwise to the OFF position.

NOTE: Intermittent noises such as clicking and transmission shifting may be audible from the transmission while it completes a self-test and shutdown.

16.04 Hybrid System Fault Lamps (HEV)

There are two lamps on the dashboard that indicate a hybrid system fault is active — the red STOP HYBRID lamp and the amber CHECK HYBRID lamp. See Fig.254, [Hybrid System Fault Lamps](#). When the red STOP HYBRID lamp is illuminated, do not drive the vehicle; have it towed to a Freightliner dealer or an authorized service center for repairs. When the amber CHECK HYBRID lamp is illuminated, the vehicle can still be driven, though it may operate without the assistance of the hybrid electrical system.



Fig 254, Hybrid System Fault Lamps

16.05 Emergencies (HEV)

16.05.01 Emergency Shutdown

**WARNING:**

After disabling the vehicle, power is maintained in the high-voltage electrical system for up to five minutes. Unprotected contact with any "live" high voltage components can cause serious injury or even death.

There are two options for performing an emergency shutdown. The preferred method is to turn off the ignition key. The other option is to disconnect the low-voltage (12-volt) vehicle batteries. In either case, the engine will shut down, dash lights will shut down, the hybrid electrical system will shut down, and the high-voltage batteries in the Power Electronics Carrier (PEC) will remain "live" but isolated in the PEC.

NOTE: If the service switch on the PEC is accessible, it may be pushed in to shut down the hybrid electrical system and isolate the "live" HEV batteries in the PEC.

16.05.02 In Case of an Accident or Fire

If the HEV becomes involved in an accident or fire, be aware of the following:

- Use CO2 or dry chemical extinguishers. The batteries in the PEC are lithium ion.
- Do not cut into high-voltage cables. The high-voltage wiring is covered in orange insulation or convoluted tubing.

- Do not cut into or open the PEC.
- Do not cut into or open the DC/DC converter.
- Do not cut into or open the inverter.

If it is necessary to remove occupants using cutting equipment, avoid high-voltage cables and the PEC.

16.06 Jumpstarting (HEV)

Jumpstarting vehicles equipped with the Eaton® Hybrid System is identical to Non-Hybrid vehicles, which use the vehicle 12-volt battery system.

16.07 Towing (HEV)

When towing the vehicle, the output shaft of the transmission must not be allowed to spin or turn. If the vehicle is towed with the drive wheels still in contact with the road surface, the vehicle axle shafts or driveline must be removed or disconnected. See "Towing" in [14.01 Hazard Warning Lights](#).

17.01 Natural Gas Vehicles, General Information	286
17.02 Natural Gas Vehicles, Safety Precautions	286
17.02.01 In Case of Emergency	287
17.03 Natural Gas Fuel Tank Filling Procedures.....	287
17.03.01 CNG Vehicle Fueling	287
17.03.02 LNG Vehicle Fueling.....	290
17.04 Natural Gas Detection System.....	292
17.04.01 General Information	292
17.04.02 Alarm Procedure.....	293
17.04.03 Sensors.....	294
17.04.04 Fireboy Control Module and Alarm Panel	295
17.04.05 AMGaDS III Plus Control Module and Alarm Panel	298
17.04.06 Testing	300
17.05 Natural Gas Engine Starting	301
17.06 Major Repair and Replacement of Natural Gas Components	302

17. Natural Gas Vehicle

17.01 Natural Gas Vehicles, General Information

The vehicle can be equipped with a compressed natural gas (CNG) fuel system, or a liquefied natural gas (LNG) fuel system. CNG is made by compressing natural gas to less than 1% of its volume at standard atmospheric pressure. LNG is created by condensing natural gas into a liquid by cooling it to approximately -259°F (-162°C). CNG often contains an odor-producing chemical, while LNG does not have any odor.

When vaporized at ambient temperatures, natural gas is less dense than air, and it rises and disperses. However, LNG is initially heavier than air due to its cryogenic temperature. When released in large amounts, it may drop or pool on the ground before its temperature rises enough to vaporize. Cold atmospheric conditions may prevent natural gas from dispersing quickly when released in large amounts.

Natural gas is nontoxic, but it can cause asphyxiation if present in very large concentrations.

For natural gas to burn, it must first vaporize, then mix with air in the proper proportions (flammable range is 5 to 15% by volume in air), and then be ignited.

A typical natural gas fuel system consists of:

- Fuel supply cylinders that store compressed gas at high pressure (CNG), or a tank that stores liquefied gas at an extremely low temperature (LNG).
- A vaporizer or heat exchanging device that changes LNG to gaseous form (LNG fuel systems only).
- Pressure relief and manual fuel shutoff valves.
- A filling connection with a check valve that prevents the gas from flowing back out of the fuel filling line.
- High-pressure and low-pressure fuel filters.
- A pressure control regulator that reduces the high fuel tank or cylinder pressure to the lower pressure needed for the engine.
- A fuel contents gauge that indicates the fuel supply in the tank or cylinders.

17.02 Natural Gas Vehicles, Safety Precautions

**DANGER:**

Natural gas is highly flammable. Failure to observe the following safety precautions could lead to the ignition of the natural gas, which could cause serious bodily injury or death.

Follow these safety precautions when operating or repairing a natural gas vehicle.

- Do not start the engine if a natural gas leak is detected.
- Do not transfer CNG from one vehicle to another, as a buildup of static electricity could cause a spark and ignite the fuel.
- Do not attempt to cut any fuel supply piping components.
- Avoid open flames or sparks near a natural gas vehicle.
- Cover eyes and exposed skin when working on a natural gas fuel system or fueling a natural gas vehicle.
- Permit no smoking or other ignition sources within thirty feet of a natural gas vehicle.
- Have CO₂ fire extinguishers (ABC minimum) located in a highly visible and easily accessible location.
- Use Purple-K powder (PKP) or a similar dry powder to extinguish an LNG fire. Do not attempt use water around an LNG fire.

- Always purge the fuel lines before performing maintenance or repairs on a natural gas fuel system. To purge the lines, close the manual fuel shutoff valve, and start the engine. Let the vehicle idle until the fuel lines are empty and the engine stops.
- Always use a natural gas detector to test the system for leaks, whether an odor is present or not. Routinely inspect the fuel filtering and regulating mechanisms, and the fuel lines. A bubble solution can be used to pinpoint the exact location of leaks.
- Always tighten fasteners and fuel connections to the required torque specification. Overtightening or undertightening could cause leaks.
- Close the fuel shutoff valve(s) before performing maintenance and repairs.
- Do not store a natural gas vehicle indoors for any extended period of time. Do not bring a natural gas vehicle indoors unless the workshop is equipped with a methane detection and ventilation system.

17.02.01 In Case of Emergency

If a vehicle has sustained damage or a leak has been discovered:

1. Turn the ignition switch off, set the parking brake, and disconnect the battery.
2. Remove all ignition sources from the area surrounding the vehicle.
3. If it is safe to do so, close all fuel shutoff valves.
4. Open the vehicle doors to introduce fresh air.
5. Use a natural gas detector to identify leaks in the fuel system.

17.03 Natural Gas Fuel Tank Filling Procedures

17.03.01 CNG Vehicle Fueling

CNG is moved from the fuel station storage tanks to the vehicle cylinders through a metered dispenser. During fueling, as pressure inside of the vehicle cylinders increases, so does the temperature. The dispenser shuts off when it determines the CNG cylinders are full.

CNG fuel cylinders cannot be filled to their full capacity of 3600 psi (24 800 kPa) in cooler weather. Since temperature change causes gas to expand and contract, less pressure in the cylinders on a cold day is equal to the same amount of gas at a higher pressure on a warm day. The fuel station dispenser has a temperature-pressure compensating device, which accounts for ambient temperature during fueling. See Table 17, [CNG Temperature/Pressure Compensation Values](#) for approximate full cylinder pressures at various temperatures.

CNG Temperature/Pressure Compensation Values		
Temperature: °F (°C)	Fill Station Pressure Set Point	
	3000 psi (20 684 kPa) Set Point	3600 psi (24 821 kPa) Set Point
100 (37.8)	3415 (23 546)	4086 (28 172)
90 (32.2)	3276 (22 587)	3909 (26 952)
80 (26.7)	3138 (21 636)	3754 (25 883)
70 (21.1)	3000 (20 684)	3600 (24 821)
60 (15.6)	2861 (19 726)	3445 (23 752)

Table 17, CNG Temperature/Pressure Compensation Values

50 (10)	2723 (18 774)	3288 (22 670)
40 (4.4)	2584 (17 816)	3131 (21 587)
30 (-1.1)	2446 (16 865)	2973 (20 498)
20 (-6.7)	2307 (15 906)	2814 (19 402)
10 (-12.2)	2169 (14 955)	2655 (18 306)
0 (-17.8)	2031 (14 003)	2495 (17 202)
-10 (-23.3)	1893 (13 052)	2336 (16 106)
-20 (-28.9)	1755 (12 100)	2180 (15 031)
-30 (34.4)	1616 (11 142)	2024 (13 955)
-40 (-40)	1477 (10 184)	1868 (12 879)

Table 13, CNG Temperature/Pressure Compensation Values

Use the following steps to fuel a CNG vehicle.

1. Shut down the engine and apply the parking brake.

**WARNING:**

Natural gas fuel tanks, lines, and valves are always pressurized. Always observe safety precautions. Failure to do so could lead to loss of control over a filling hose or to ignition of the natural gas, which could cause serious bodily injury, death, or severe property damage.

IMPORTANT: Close all windows and doors during the fueling process. Keeping windows and doors closed allows for easier leak detection inside the cab after fueling.

2. Ensure all fuel cylinder shutoff valves are open. See Fig. 255, [CNG Fuel Cylinder Storage Box \(5-cylinder system shown\)](#).

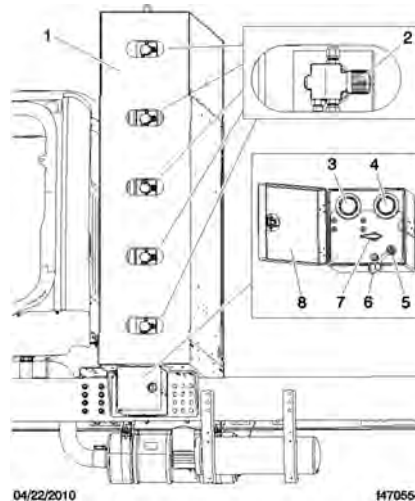


Fig 255, CNG Fuel Cylinder Storage Box (5-cylinder system shown)

3. Ensure the vehicle fuel system main shutoff valve is open.
4. Open the CNG fuel panel access door and remove the dust cap from the vehicle fuel fill port.
5. Ensure the O-ring is present inside the fuel fill port. If the O-ring has been dislodged or is missing, the station dispensing nozzle will not connect securely to the fill port.
6. Turn the selector knob on the service pump to the VENT position, if equipped.
7. Connect the quick coupling on the dispensing nozzle securely to the vehicle fuel fill port.
8. Turn the selector knob on the service pump to the FILL position, if equipped.

IMPORTANT: If at any time the service pump or vehicle begins to vent CNG uncontrollably, notify a station attendant or activate the service station emergency shut-off switch to cease the flow of CNG.

9. Switch on the service pump. A slight hissing noise may be heard as the fuel cylinders fill.
10. Watch the pressure gauge on the service pump. When the gauge reads approximately 3600 psi (24 800 kPa), or when the fill pressure stops climbing, the CNG cylinders are full. The service pump will shut itself down automatically. See Table.17, [CNG Temperature/Pressure Compensation Values](#) for pressure compensation values based on ambient temperatures.
11. Move the selector knob on the service pump to the VENT position, if equipped. A short hiss will be heard as a small amount of natural gas is vented into the hose.

**WARNING:**

Do not attempt to remove the fill station nozzle from the tank fill fitting until venting of pressure is noted. If no venting occurs, ask for assistance from the station attendant. Removing an unvented coupling could result in an uncontrolled hose, which could lead to property damage or personal injury.

12. Remove the station dispensing nozzle from the vehicle fill port.
13. Install the dust cap on the vehicle fuel fill port and close the fuel panel access door.

17.03.02 LNG Vehicle Fueling

The LNG fuel tank is designed to be filled from any LNG fuel source that has a 100 micron or finer fuel filter and a fuel delivery pressure between 120 and 225 psi (827 and 1551 kPa).

The LNG fuel tank is designed to be top-filled through a single hose with no vent return. As cold LNG is sprayed into the vapor space of the tank, the cold liquid condenses the vapor and creates space for itself inside the tank, eliminating any need to vent during the filling process.

The LNG tank is equipped with a small internal ullage tank for vapor space, which allows for fuel expansion and increases vehicle standby time. When an LNG tank is full, fuel can continue to flow into the ullage tank. However, if the ullage tank is completely filled during fueling, standby time will be reduced to zero and the primary relief valve will open almost immediately after fueling, allowing excess LNG vapor to escape. If fueling is stopped when the ullage tank is empty (i.e., the fuel tank has sufficient vapor space to accommodate fuel expansion due to temperature increase), the vehicle will have approximately one week of standby time before venting will occur.

Use the following steps to fuel an LNG vehicle.

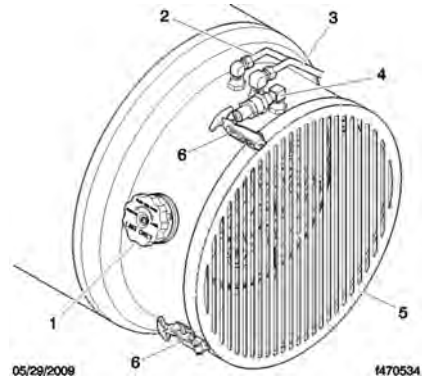
1. Shut down the engine and apply the parking brake.

**WARNING:**

Liquefied natural gas is a cryogenic liquid stored at approximately -259°F (-162°C). Cryogenic burns can be caused by coming into contact with the pressurized liquid stream, or by coming into contact with fuel system components that have been cooled to cryogenic temperatures. Always wear gloves and a face shield, and cover exposed skin when fueling.

IMPORTANT: Close all windows and doors during the fueling process. Keeping windows and doors closed allows for easier leak detection inside the cab after fueling.

2. Remove the fuel fill fitting dust cap. See Fig.256, [LNG Fuel Tank](#).



1. Fuel Fill Fitting
2. Fuel Outlet Line
3. Primary Relief Vent Line

4. Fill Vent Fitting
5. Shroud Cover
6. Shroud Cover Latches

Fig 256, LNG Fuel Tank

3. Using compressed air, remove any dirt, debris, or water that may have collected in the fuel fill fitting and the station dispensing nozzle. Contaminants in the fuel system can cause drivability problems.



WARNING:

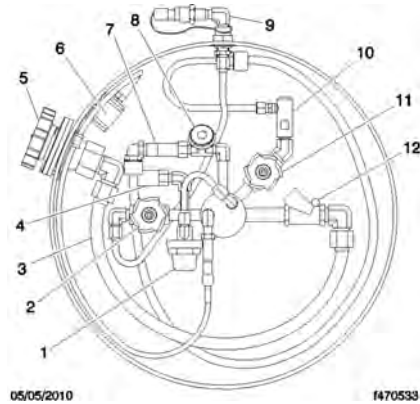
Natural gas fuel tanks, lines, and valves are always pressurized. Always observe safety precautions. Failure to do so could lead to loss of control over a filling hose or to ignition of the natural gas, which could cause serious bodily injury, death, or severe property damage.

4. Connect the station fueling nozzle to the tank fuel fill fitting.
5. Connect an electrical ground clamp and cable to the fuel tank.

IMPORTANT: An LNG tank which is first installed, or is on a vehicle that has not been operated in approximately ten days, is considered to be a hot tank. When fueling a hot tank, LNG entering the tank will immediately vaporize, causing tank pressure to spike above 250 psi (1724 kPa) and automatically shutting down the station fuel pump. To prevent the pump from shutting down, connect a vent line to the fill vent fitting on the LNG tank to capture escaping vapor, then open the shroud cover and open the vapor shutoff valve (see Fig.257, [LNG Fuel Tank Plumbing Components](#) , Item 2).

IMPORTANT: When fueling a hot tank, initially put 5 to 10 gallons (19 to 37 liters) of LNG in the tank and manually stop the fueling process. Drive the vehicle for 15 to 20 minutes to cool the tank and reduce tank pressure, then continue fueling the tank to full.

6. Open the station's fill valve, if equipped, and start fueling. Monitor the flow or line pressure as filling progresses. When filling begins, line pressure will spike quickly until the vehicle tank cools down. The flow and pressure will then remain stable during the remainder of the filling procedure.



1. Pressure Control Regulator
2. Vapor Shutoff Valve
3. Fuel Fill Hose
4. Secondary Relief Valve (red cap)
5. Fuel Fill Fitting
6. Fuel Level Sender Box
7. Primary Relief Valve
8. Tank Pressure Gauge
9. Fill Vent Fitting
10. Excess Flow Valve
11. Fuel Shutoff Valve (liquid)
12. Fill Check Valve

Fig 257, LNG Fuel Tank Plumbing Components

7. When the tank is full, the line pressure will rapidly spike and the flow rate will fall. When a pressure rise or flow rate drop is observed, close the station's fill valve, if equipped.

NOTE: Do not over-fill an LNG tank. If the ullage tank is completely filled during fueling, tank standby time will be reduced to zero and the primary relief valve will open almost immediately after fueling.

8. Disconnect the station hose from the tank fuel fill fitting.
9. Disconnect the electrical ground clamp and cable from the fuel tank.
10. Install the dust cap on the tank fuel fill fitting.

17.04 Natural Gas Detection System

17.04.01 General Information

A gas detection system is standard equipment in all Daimler Truck natural-gas-fueled vehicles. This system has a sensor in the engine compartment and one in the cab, both situated in high areas to detect natural gas buildup as a result of leaks. This device is meant to serve as a supplemental warning only. It is not intended to replace standard safety practices that should be conducted around flammable gases.

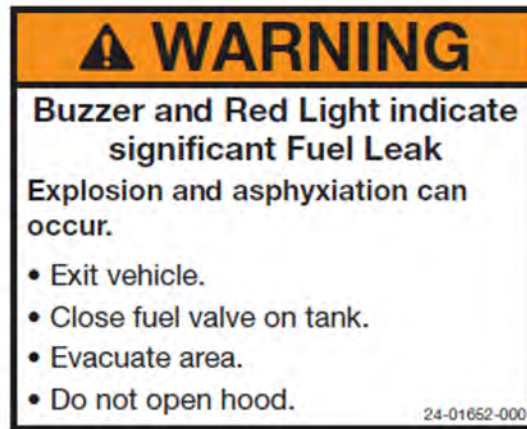
There are two brands of gas detection systems used on DTNA vehicles; Fireboy, and AMGaDS III Plus. Both systems operate the same way. Only the driver interface is different. The Fireboy system control panel is located on the center dash panel, while the AMGaDS III Plus control panel is located on the overhead panel.

IMPORTANT: To function properly, the gas detection system must be powered at all times. The gas detection system is directly powered by the batteries, and can only be powered off by disconnecting the batteries. When servicing a natural-gas-fueled vehicle, disconnect the batteries only when necessary, and do not leave the batteries disconnected for extended periods of time.

The lower flammability limit (LFL) is the smallest amount of the gas that supports a flame when mixed with oxygen and ignited. Zero percent (0%) LFL indicates a gas-free atmosphere. One hundred percent (100%) LFL indicates that gas concentration has reached its lower flammability limit (5% gas in air by volume). The red warning light and audible alarm located in the overhead console activate when a sensor detects gas fumes in concentrations above 50% LFL, and should allow ample time to utilize safety procedures. However, individuals with special needs should review the system with a professional safety engineer.

17.04.02 Alarm Procedure

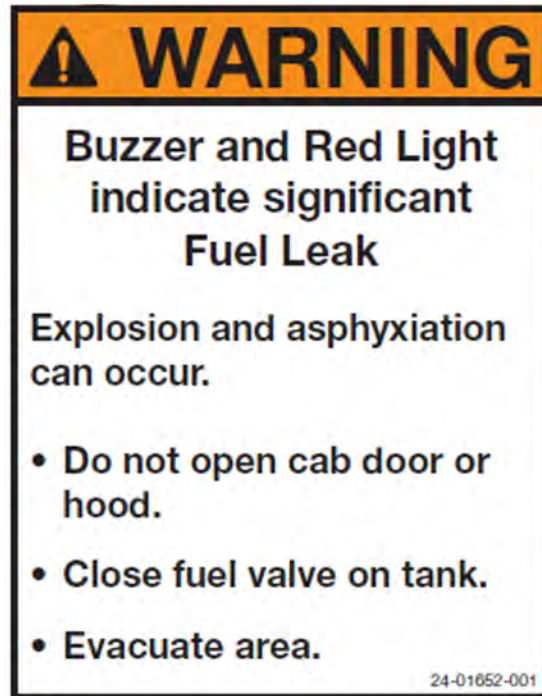
Before operating the vehicle, the driver must be familiar with the procedures as shown on the interior sticker on the overhead panel (see Fig.258, [Interior Warning Sticker](#)) and the exterior sticker on the door (see Fig. 259, [Exterior Warning Sticker](#)).



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Fig 258, Interior Warning Sticker



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Fig 259, Exterior Warning Sticker

IMPORTANT: If an audible alarm activates, do not operate any electrical switch, including lights. Avoid causing sparks and stay away from arcing switches and equipment. Do not use a telephone, including cellular phones or any types of portable communication or electronic devices that have a battery.

If the vehicle is in motion when the audible alarm activates, bring it to a safe stop, shut down the engine, and exit the vehicle. *Do not open the hood.*

If outside the vehicle when the audible alarm activates, *do not open the cab door or hood.*

In the event of an audible alarm, immediately follow these procedures, as allowed by conditions:

- Immediately shut off all engines. Extinguish any cigarettes, pilot lights, flames, or other sources of ignition in the area and adjacent areas.
- Manually close all fuel shutoff valves, including those on the LNG tank or CNG cylinders.
- If the vehicle is indoors (as in a service shop), immediately open windows and doors to provide extra ventilation to the area. Do not start the engine or any other type of equipment until the gas leak is corrected and the area cleared of natural gas.
- Evacuate the area.
- Check the fuel lines, LNG tank/CNG cylinders, and fittings to locate the leak. After the area is cleared of natural gas and the alarm is no longer active, have the vehicle inspected by a qualified technician.

IMPORTANT: Do not consider the area clear until all alarm indicators are off, and the alarm panel light returns to green.

17.04.03 Sensors

Gas detection sensors are located on the cab overhead console and in the engine compartment on the frontwall. The sensors are located in high areas, where rising gas vapors will pass by or accumulate.

If the system detects that one of the sensors has been disconnected or has malfunctioned, the sensor fault light for that zone will illuminate. A failed sensor may trigger and lock on an alarm. If a fault condition or locked alarm is triggered, have the vehicle serviced before operating.

The sensors are sensitive to all hydrocarbon vapors. An alarm may be triggered by the use of chemicals such as cleaners, paint, polish, lacquer, gasoline, silicone, silicone spray, or other harsh chemicals. The sensors will also detect hydrogen fumes from an overcharged battery. If a sensor sends an alarm, but no gas fumes are present, check for recent use of chemicals or a battery charger.

**NOTICE:**

Silicone-based chemicals and cleaners will permanently disable the sensors. When cleaning the vehicle, cover the sensors with a plastic covering. Keep the sensors covered until the area has been cleared of any cleaning fumes.

Harsh chemicals and extremely high temperatures may damage the sensor.

Puncture of or damage to the seal located inside the sensor housing will significantly shorten the sensor life.

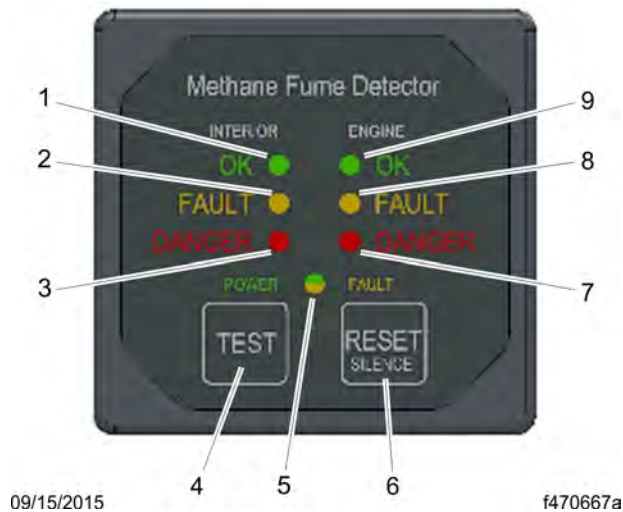
Frequent exposure to high concentrations of gas will accelerate sensor deterioration.

17.04.04 Fireboy Control Module and Alarm Panel

The Fireboy gas detection system control module is located on the center dash panel. See Fig.260, [Fireboy Control Module](#). The alarm panel is located on the overhead consol. It has a green light, a red light, a buzzer, and a sensor. See Fig. 261, [Fireboy Alarm Panel \(overhead consol\)](#). It is located within view from outside of the vehicle. The large green light is continuously illuminated during normal operating conditions. There is also an optional forward-facing alarm panel located at the top center of the windshield for easy viewing from the front of the vehicle. This panel only has the green and red lights. See Fig.262, [Fireboy Alarm Panel \(upper windshield\)](#).

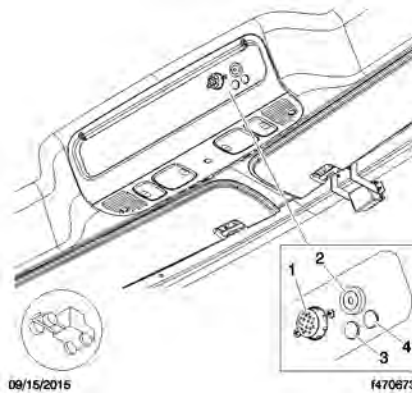
Before entering the vehicle, always verify that the green light is illuminated. If the green light is not illuminated, do not enter the vehicle. Complete the alarm procedure previously outlined.

The control module and the alarm panels meet the California Highway Patrol Title 13-2008 and NFPA 52 2010 requirements. All drivers and technicians using it should be trained regarding the red and green lights, and the audible warning.



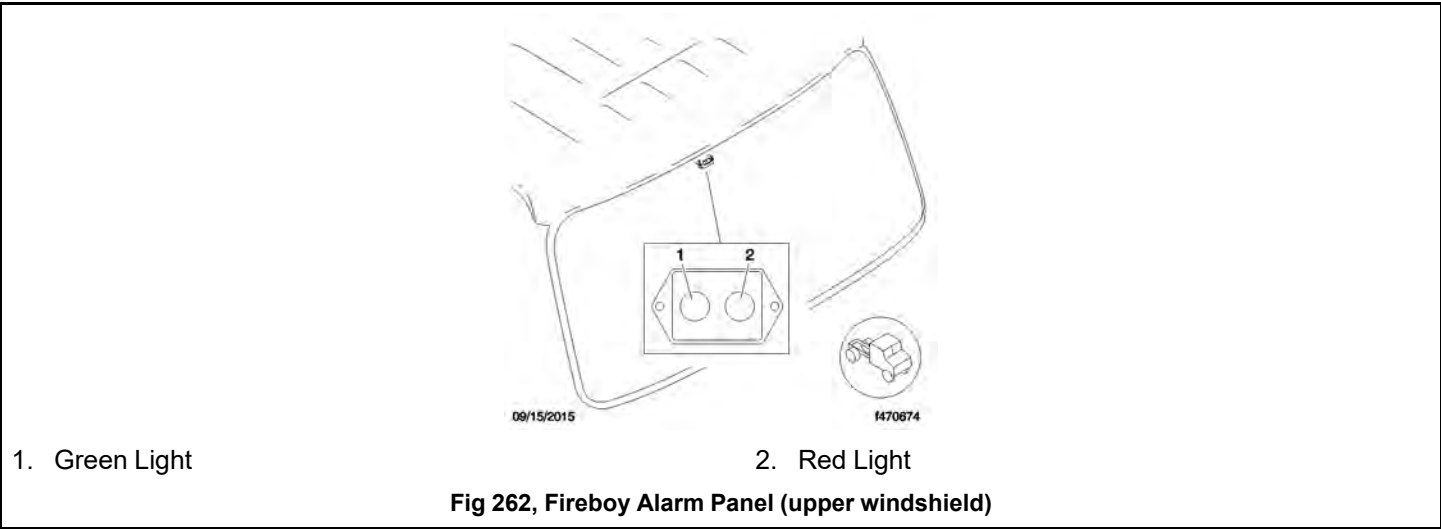
1. Interior OK LED (green)
2. Interior Fault LED (yellow)
3. Interior Danger LED (red)
4. Test Button
5. Power/Fault LED (green/yellow)
6. Reset/Silence
7. Engine Danger LED (red)
8. Engine Fault LED (yellow)
9. Engine OK LED (green)

Fig 260, Fireboy Control Module



1. Sensor
2. Buzzer
3. Green Light
4. Red Light

Fig 261, Fireboy Alarm Panel (overhead consol)



The control module, located on the center dash panel, contains the status lights and control buttons for the system. The areas that the sensors monitor are defined as Zone 1 (cab) and Zone 2 (engine compartment). The control module has lights assigned to each zone that will illuminate if a sensor detects a trace level leak (between 20% and 50% LFL), Or a dangerous leak (above 50% LFL), or if a sensor is disconnected or malfunctioning.

- Green: System is functioning properly.
- Amber: If the system detects that either of the sensors has been disconnected or has malfunctioned, an amber light next to the "FAULT" indicator for that zone will illuminate.
- Red: If either sensor detects gas fumes at a concentration greater than 20% (2.5% gas in air by volume), the small red light next to the "DANGER" indicator for that zone will flash. After approximately 15 seconds, the large green light on the alarm panel will switch off, the red light will illuminate, and the buzzer will sound. All alarm indicators will remain on as long as fumes are detected.

The control module also has buttons used to test or reset the control module and silence the buzzer after an alarm.

- TEST: Press the "TEST" button to test the LED and output operation.
- Reset/Silence: If an alarm has been activated, the "RESET/SILENCE" button will silence the buzzer.

See Table.18,[Fireboy Control Module Functions](#) for the functions of all lights and buttons on the control module.

Fireboy Control Module Functions			
Item	Display	Function	Action Required
Interior OK LED (green)	Illuminated	Interior sensor is detected, signal is OK, and system power is on.	None required.
Interior Fault LED (yellow)	Illuminated	Interior sensor is not detected, or there is a signal malfunction.	Have the system checked immediately.
Interior Danger LED (red)	Illuminated	Interior sensor is reading an amount of gas greater than 20% LFL.	Suspend vehicle operation immediately and follow alarm procedures.

Table 18, Fireboy Control Module Functions

Test Button	—	Cycles the LEDs and triggers the relay temporarily.	Press and hold for one minute to activate a test of all control module components.
Engine OK LED (green)	Illuminated	Engine sensor is detected, signal is OK, and system power is on.	None required.
Engine Fault LED (yellow)	Illuminated	Engine sensor is not detected, or there is a signal malfunction.	Have the system checked immediately.
Engine Danger LED (red)	Illuminated	The engine sensor is reading an amount of gas greater than 20% LFL.	Suspend vehicle operation immediately and follow alarm procedures.
Reset/Silence	—	Turns the relay off when in alarm mode.	Press the button.
Power/Fault LED (green/yellow)	Illuminated (green)	System is on.	None required.
	Illuminated (yellow)	Not used.	Not used.
Buzzer	Sounding	Gas is detected at a level above 50% LFL in the specified zone.	Suspend vehicle operation immediately and follow alarm procedures.

Table 14, Fireboy Control Module Functions

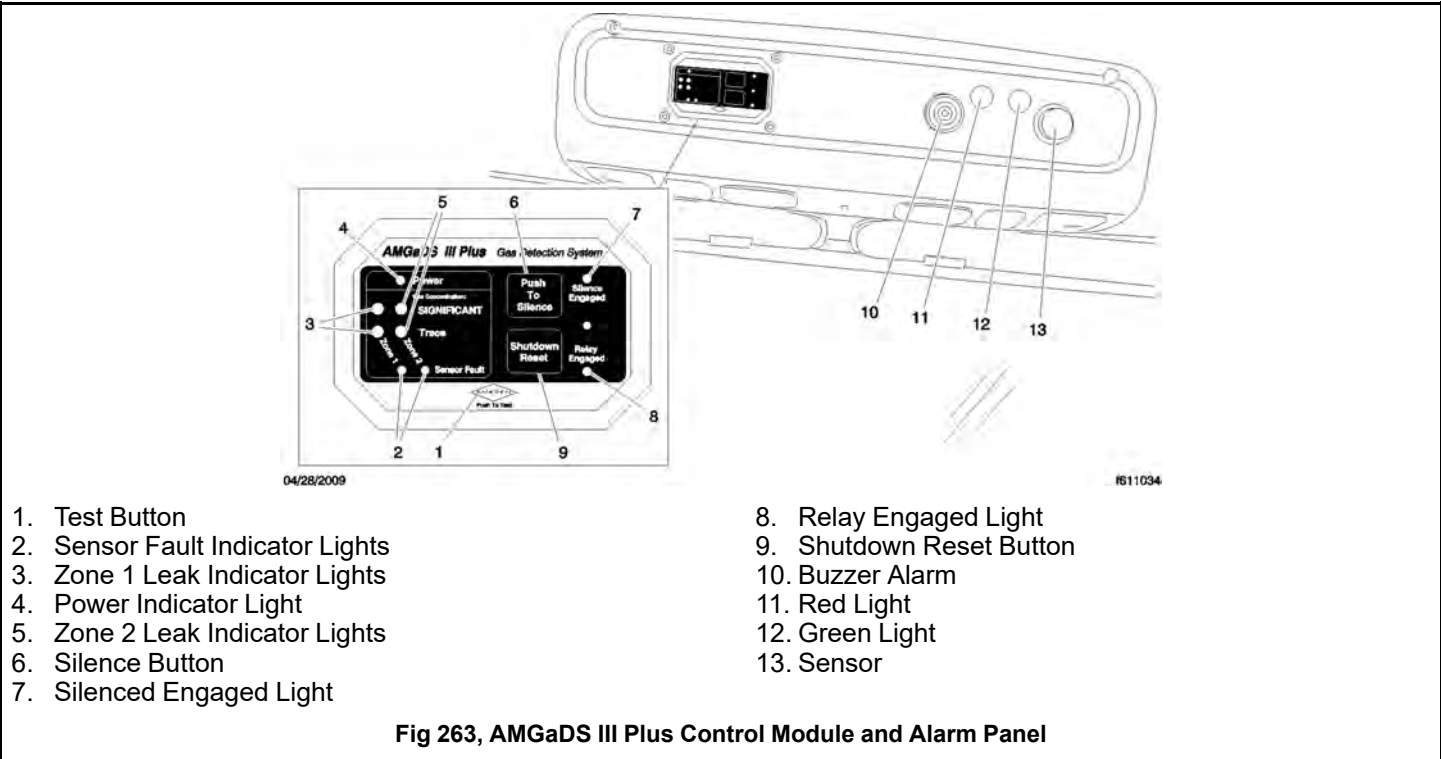
17.04.05 AMGaDS III Plus Control Module and Alarm Panel

The AMGaDS III Plus gas detection system driver interface is located on the overhead console, and consists of an alarm panel on the right side and the control module on the left side.

The alarm panel has a green light, a red light, a buzzer, and a sensor. See Fig. 263, [AMGaDS III Plus Control Module and Alarm Panel](#). It is located within view from outside of the vehicle. The large green light is continuously illuminated during normal operating conditions.

Before entering the vehicle, always verify that the green light is illuminated. If the green light is not illuminated, do not enter the vehicle. Complete the alarm procedure previously outlined.

The alarm panel meets the California Highway Patrol Title 13-2008 and NFPA 52 2010 requirements. All drivers and technicians using it should be trained regarding the red and green lights, and the audible warning.



The control module, located on the left side of the overhead console, contains the status lights and control buttons for the system. The areas that the sensors monitor are defined as Zone 1 (cab) and Zone 2 (engine compartment). The control module has lights assigned to each zone that will illuminate if a sensor detects a trace level leak (between 20% and 30% LFL), a significant level leak (above 50% LFL), or if a sensor is disconnected or malfunctioning.

- Trace Level: If either sensor detects gas fumes at a concentration greater than 20% to 30% LFL (1% gas in air by volume), the amber light next to the "Trace" indicator for that zone will flash. There is no buzzer alarm for a trace level detection, and the large green light on the alarm panel will remain illuminated.
- Significant Level: If either sensor detects gas fumes at a concentration greater than 50% to 60% LFL (2.5% gas in air by volume), the small red light next to the "SIGNIFICANT" indicator for that zone will flash. After approximately 15 seconds, the large green light on the alarm panel will switch off, the red light will illuminate, and the buzzer will sound. All alarm indicators will remain on as long as fumes are detected.
- Sensor Fault: If the system detects that either of the sensors has been disconnected or has malfunctioned, an amber light next to the "Sensor Fault" indicator for that zone will illuminate.

The control module also has buttons used to test or reset the control module after an alarm. Red lights next to each button indicate when they are engaged.

- Shutdown Reset: If an alarm has been activated and the "Relay Engaged" light is illuminated, the "Shutdown Reset" button will reset the internal relay. Press the "Shutdown Reset" button only after the gas has cleared, the buzzer has turned off, and the alarm panel light has returned to green.
- Push To Silence: If an alarm has been activated, the "Push To Silence" button will silence the buzzer.

See Table.19, [AMGADS III Plus Control Module Functions](#) for the functions of all lights and buttons on the overhead console.

AMGADS III Plus Control Module Functions			
Item	Display	Function	Action Required

Table 19, AMGADS III Plus Control Module Functions

Green Power Light	Illuminated	System is on.	None required.
	Unlit	Detection system is not functioning.	Ensure the batteries are connected and replace any blown fuses. If the gas detection system is still not functioning, replace the system immediately.
SIGNIFICANT Gas Concentration Lights	Red (illuminated)	Dangerous gas concentration detected.	Suspend vehicle operation immediately and follow alarm procedures.
Trace Gas Concentration Lights	Amber (flashing)	Minor gas concentration detected.	Use caution and monitor the system.
Sensor Fault Lights	Off	Sensor is functioning properly.	None required.
	On	Sensor has malfunctioned.	Replace the sensor immediately.
Shutdown Reset Button	—	Resets the system after an alarm activation.	Press to reset the system only after the gas has cleared, the buzzer has turned off, and the alarm panel light has returned to green.
Relay Engaged Light	On	Relay is engaged and test or alarm is being cleared.	Press the <i>Shutdown Reset</i> button.
	Off	Normal condition.	None required.
Test Button	—	Tests the control module operation and circuitry.	Press and hold for one minute to activate a test of all control module components.
Silence Button	—	Silences the alarm buzzer.	Press to silence the alarm buzzer.
Silence Engaged Light	On	Indicates the buzzer is active but silenced.	Suspend vehicle operation immediately and follow alarm procedures.
	Off	Normal condition.	None required.

Table 15, AMGaDS III Plus Control Module Functions

17.04.06 Testing

Daimler Truck North America strongly recommends that all operators follow California Code of Regulations (CCR) inspection requirements, regardless of where the vehicle is operated. Per Title 13 CCR § 935 (2), gas detection systems should be tested three times per calendar year at equal intervals. The testing procedure should simulate the same operating environment in which the vehicle is used, with the same gaseous fuel.

Test results validating the performance of the gas detection system within the parameters established by the component manufacturer and NFPA 52 2010 should be maintained as a permanent part of the vehicle service records. Use of alcohol, propane, and other harsh liquids or gases are not acceptable methods for testing.

Always test the system and sensors after any component has been replaced, or if the vehicle has been involved in an accident or fire. Ensure that the gas detection system is wired directly to the battery.

It is recommended that the highest level of safety validation be utilized if there are multiple validation requirements in the state or locality where the vehicle is operated or domiciled.

Control Module Console Test

Press and hold the *Push To Test* button for one minute. The system will proceed with a self-diagnostic test that will include illumination of the *Trace* and *SIGNIFICANT* gas concentration lights, and the sensor fault lights. Verify the large red light and buzzer activate, and that all lights illuminate or flash to ensure that all bulbs are operational.

Sensor Test

The gas detection system sensors must be tested regularly by a trained technician, using certified test equipment that satisfies CCR § 935 (2) or NFPA 52 regulations.

17.05 Natural Gas Engine Starting

Before starting the engine, read [4.01.01 General Information](#) for detailed information on how to read the instruments and [5.01 Ignition Switch and Key](#) for detailed information on how to operate the controls. Read the operating instructions in the engine manufacturer's operation manual before starting the engine.

1. Before engine start-up, complete the engine pretrip and post-trip inspections and maintenance procedures in [12.01.01 General information](#).
2. Ensure the fuel shutoff valve is open.
3. Set the parking brake.
4. Ensure that the transmission shift control is in Neutral (N), Park (P), or the Park Brake (PB) position.
5. Without starting the engine, turn the ignition switch to the ON position (see Fig.264, [Ignition Switch Positions](#)). The electronic gauges on the instrumentation control unit (ICU) will complete a full sweep of their dials, the warning and indicator lights will illuminate, and the buzzer will sound for three seconds.

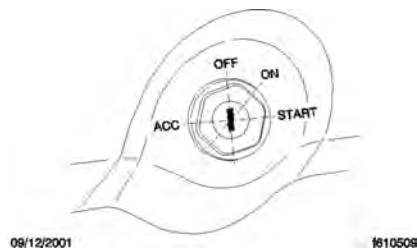


Fig 264, Ignition Switch Positions

6. Turn the ignition switch to the START position.
Press down on the clutch pedal, if equipped, but do not press down on the accelerator pedal.
Release the key the moment the engine starts.
7. Bring the engine up to operating speed gradually as it warms up and develops stable oil pressure. If the vehicle has not been operated previously in a 24-hour period, allow the vehicle to idle for five minutes.

**NOTICE:**

Do not rev the engine if the oil pressure gauge indicates no oil pressure. Shut down the engine within approximately ten seconds to avoid engine damage.

8. Check the oil pressure gauge for any drop in lubricating oil pressure or mechanical malfunction in the lubricating oil system.

17.06 Major Repair and Replacement of Natural Gas Components

If a natural-gas-fueled vehicle is involved in an accident, remove the fuel tank or cylinders from service and have them inspected by a qualified technician. Replace any leaking or damaged fuel tanks/cylinders and fuel lines; repair or replace leaking or damaged fittings. Install parts and components in accordance with the manufacturer's instructions.

18.01 OnGuard Collision Safety System.....	304
18.01.01 General Description	304
18.01.02 System Limitations	304
18.01.03 OnGuardACTIVE Display Unit	304
18.01.04 Collision Mitigation System (CMS).....	305
18.01.05 Adaptive Cruise Control (ACC).....	307
18.01.06 Error Screens	308
18.01.07 Additional Features	308
18.02 OnLane™ Lane Departure Warning	310
18.02.01 General Description	310
18.02.02 System Startup	310
18.02.03 Intentional Lane Changes	310
18.02.04 Unintentional Lane Departure	310
18.02.05 Driver Alertness Warning	310
18.02.06 Temporarily Disabling the System.....	310
18.03 AutoVue® Lane Departure Warning System	311
18.03.01 Overview	311
18.03.02 System Startup	311
18.03.03 Intentional Lane Changes	312
18.03.04 Unintentional Lane Departure	313
18.03.05 Alert Warnings	313
18.03.06 SafetyDirect.....	313
18.03.07 Cleaning the Windshield in the Area of the Camera	313
18.03.08 Temporarily Disabling the System.....	313

18. Driver Assistance Features

18.01 OnGuard Collision Safety System

18.01.01 General Description

The OnGuardACTIVE™ Collision Mitigation System (CMS) is a forward-looking radar-based safety system. The system includes forward collision warning, adaptive cruise control (ACC), and collision mitigation.

OnGuard equipped vehicles have antilock brakes (ABS) and automatic traction control (ATC), and either roll stability control (RSC) or electronic stability control (ESC). These systems work together to enhance control of the vehicle. Depending on the situation, any of these features may apply throttle control, engine brakes, and/or service brakes, as needed.

The front-looking antenna assembly transmits radar signals to, and receives them back from, objects ahead of the vehicle. To be detected, vehicles must be within the radar field of view and provide a surface area that can reflect the radar. The distance, speed, and angle of the vehicle ahead is calculated, and the driver is warned of potentially dangerous situations. The system also warns of stationary objects to alert the driver of potential obstructions ahead in their lane.

**WARNING:**

OnGuard CMS is intended solely as an aid for an alert and conscientious professional driver. It is not intended to be relied upon to operate a vehicle. Use the system in conjunction with rearview mirrors and other instruments to safely operate the vehicle. Operate a vehicle equipped with the OnGuard in the same safe manner as if the CMS were not present.

OnGuard CMS is not a substitute for safe, normal driving procedures, nor will it compensate for any driver impairment such as drugs, alcohol, or fatigue.

Failure to drive safely and use the system properly could result in personal injury and/or death and severe property damage.

18.01.02 System Limitations

The OnGuard CMS may provide little or no warning of hazards such as pedestrians, animals, oncoming vehicles, or cross traffic.

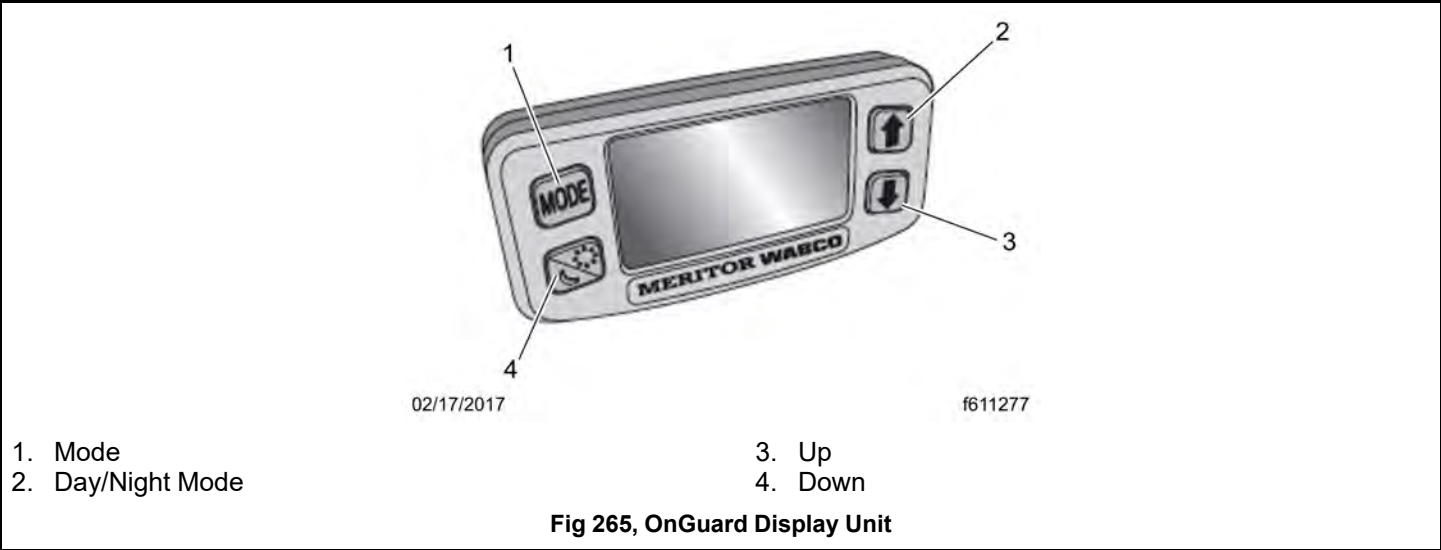
OnGuard CMS only brakes for lead vehicles located directly in front of your vehicle, and does not operate when vehicle speed is less than 15 mph (25 km/h).

Due to these limitations, the system:

- will not react and alert the operator to objects crossing in front of the vehicle or oncoming traffic;
- should not be relied on to track lead vehicles when traveling through a severe curve in the road. Because of this, ACC is not recommended for use on winding roads;
- will alert, but not actively brake, on stationary objects;
- should not be relied upon to track smaller objects like motorcycles, mopeds, bicycles, or pedestrians;
- should not be relied on to alert drivers to vehicles in an adjacent lane.

18.01.03 OnGuardACTIVE Display Unit

The OnGuard system controls are located in the display unit. The display provides visual and audible warnings and messages, as well as verification of correct system operation and faults. Menu selections are made by pressing the up and down arrows, and the MODE button. See Fig.265, [OnGuard Display Unit](#).



The display includes:

- an internal speaker
- a graphic display
- buttons to scroll and select options
- day/night display mode

18.01.04 Collision Mitigation System (CMS)

The CMS provides the driver with audible and visual alerts when the vehicle's following distance could result in a rear-end collision. The OnGuard display unit shows a graphic of the condition, enhanced by a screen color relevant to the intensity of the situation. See Table.20, [OnGuard Display Screen Background Colors](#). If a potential rear-end collision is imminent, On-Guard's active braking automatically applies the engine and service brakes to slow the vehicle. The active braking application is intended only to provide early braking; the driver is still required to recognize and react to all driving situations.

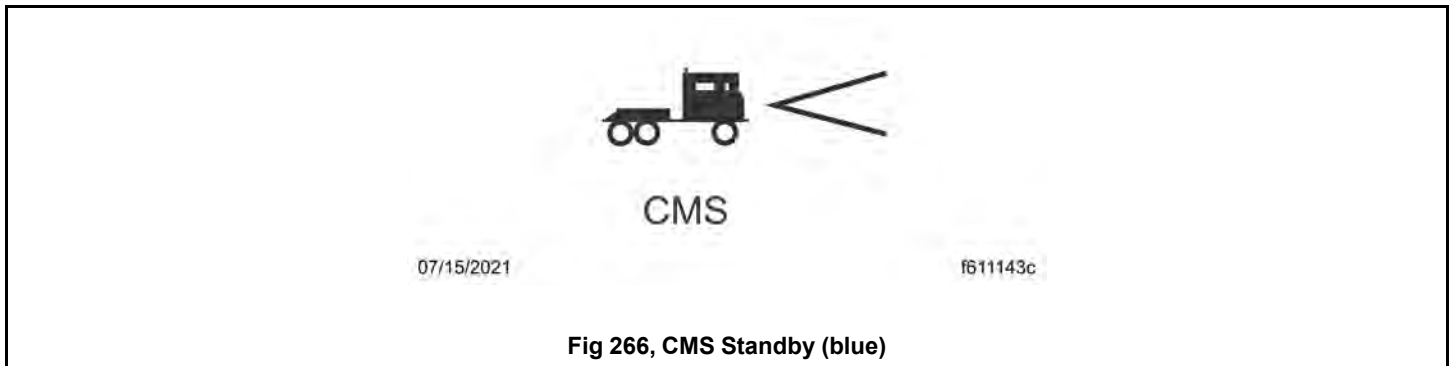
IMPORTANT: CMS and active braking are not operational at vehicle speeds below 15 mph (25 km/h).

OnGuard Display Screen Background Colors	
Screen Color	Description
Blue	General operation; no lead vehicles detected.
Green	Lead vehicle detected.
Yellow	Following distance alert, accompanied by an audible alert.
Red	Collision warning, stationary object warning. Accompanied with audible alert.
Amber	Data Error

Table 16, OnGuard Display Screen Background Colors

Standby

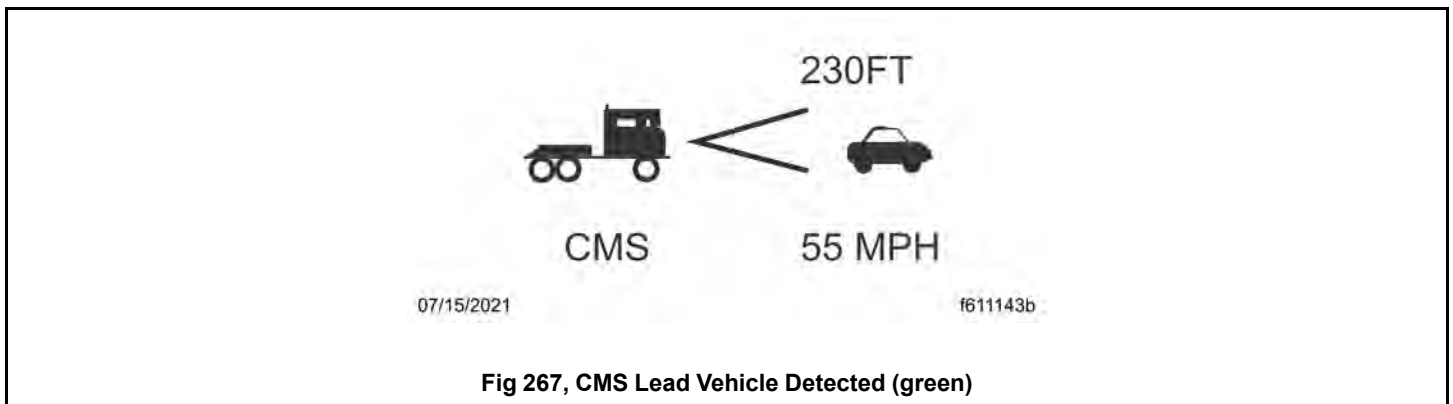
When no lead vehicle is detected, the display shows that the CMS is on and the radar is searching. See Fig. 266, [CMS Standby \(blue\)](#).



A Vehicle is Detected

When a lead vehicle is detected in the lane ahead, the display shows that the CMS is on and the radar is tracking a lead vehicle at the speed shown. See Fig. 267, [CMS Lead Vehicle Detected \(green\)](#).

If the following distance between the vehicle and the lead vehicle is too close, the CMS will emit an audible alert and the display background will turn yellow. The alert will end when the vehicle speed drops below the lead vehicle speed and the following distance is increased.



Collision Warning

When a lead vehicle is detected traveling slower than your vehicle, or the gap between them becomes too close, the CMS warns of an impending collision by emitting an urgent audible alert and displaying the collision warning symbol with a red background. See Fig. 268, [CMS Collision Warning \(red\)](#).

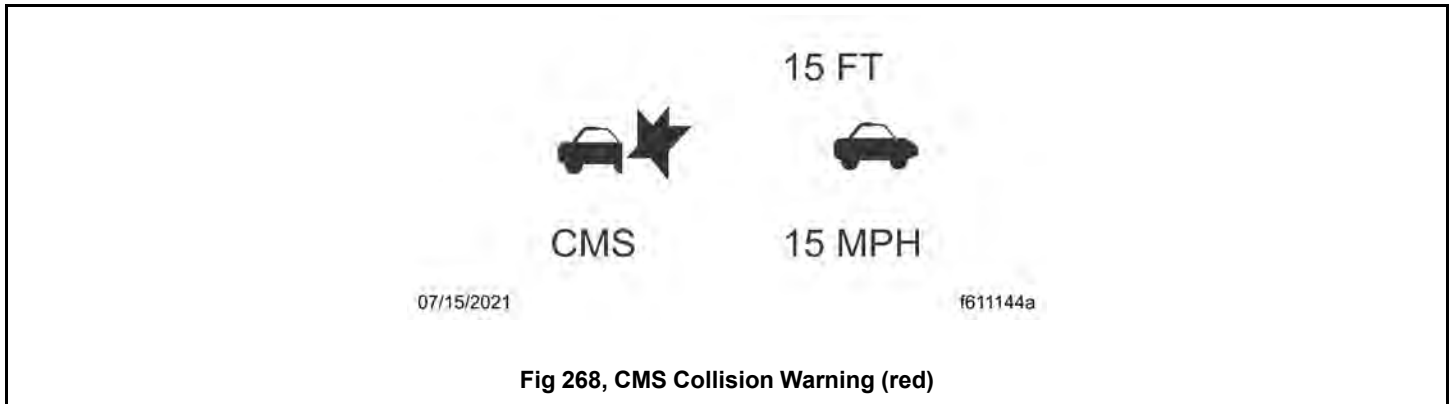


Fig 268, CMS Collision Warning (red)

18.01.05 Adaptive Cruise Control (ACC)

ACC works in conjunction with conventional cruise control to maintain a minimum following distance when a lead vehicle is being tracked. The minimum following distance is maintained by automatically decelerating the vehicle using throttle, engine, and service brakes without driver intervention. When the lead vehicle is no longer being tracked, the set cruise control speed resumes automatically.

Standby

When no lead vehicle is detected, OnGuard ACC operates similarly to conventional cruise control. The cruise control set speed is shown on the OnGuard display unit. See Fig.269, [ACC Standby \(blue\)](#).

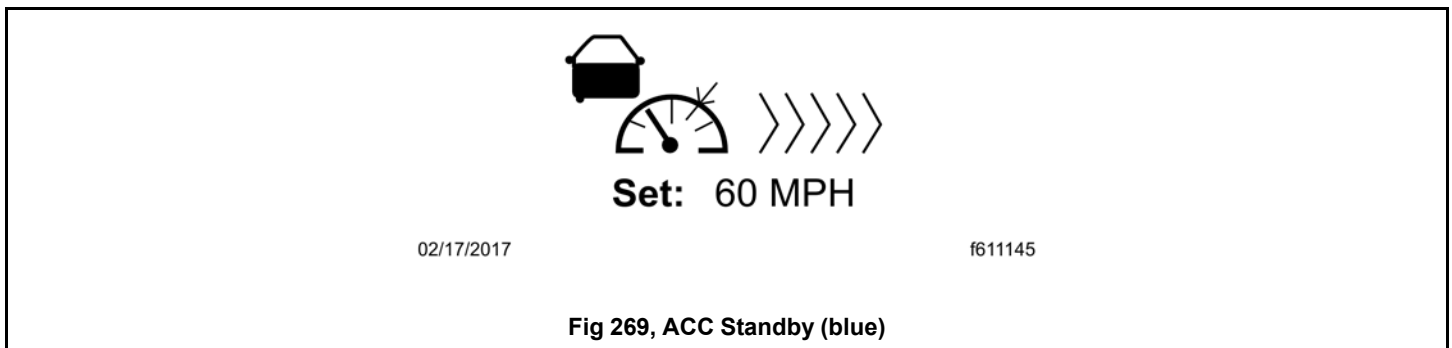


Fig 269, ACC Standby (blue)

Lead Vehicle Detected

When a lead vehicle is detected in the lane ahead, the display shows that ACC is on and the radar is tracking it. See Fig. 270, [ACC Lead Vehicle Detected \(green\)](#).

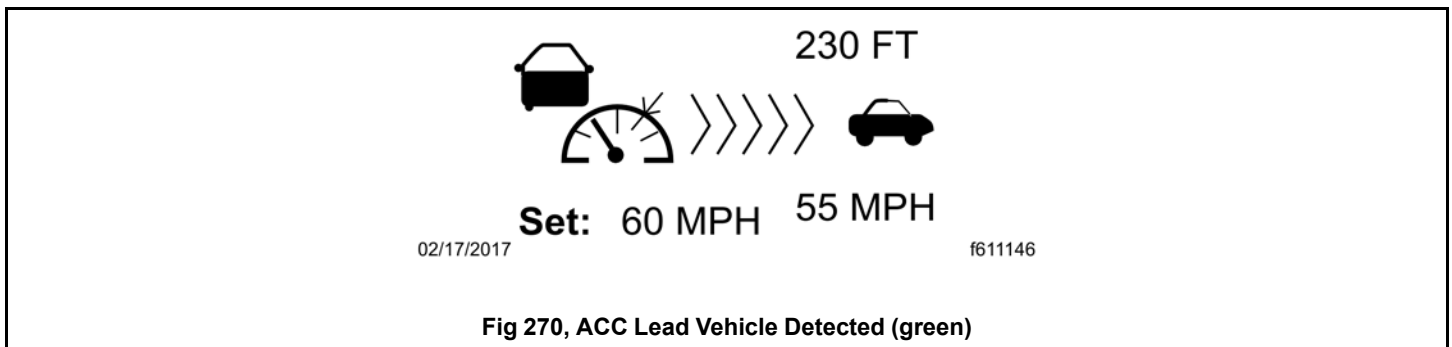


Fig 270, ACC Lead Vehicle Detected (green)

If the driver uses the accelerator pedal to override the cruise control and approach a vehicle too closely, the ACC will emit an audible alert and the display background will turn yellow. The alert will end when vehicle speed drops below the lead vehicle's speed and the following distance is increased.

NOTE: The following distance alert does not operate at speeds below 15 mph (25 km/h).

Collision Warning

If the lead vehicle is traveling slower than the driver's vehicle, the CMS warns of an impending collision by emitting an urgent audible alert and displaying the collision warning symbol with a red background. See Fig.271, [ACC Collision Warning \(red\)](#).

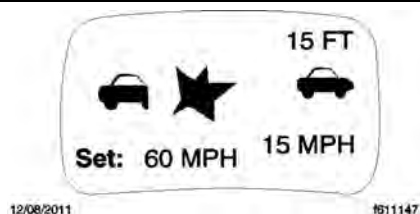


Fig 271, ACC Collision Warning (red)

The braking control will activate and slow the vehicle. The driver must also initiate braking.

18.01.06 Error Screens

IMPORTANT: The OnGuard collision safety system is not operational when an error screen is displayed. If a fault occurs or OnGuard fails to properly track a vehicle, take the vehicle in for service as soon as possible. Standard cruise control will not function with an active OnGuard system fault.

If a system fault is detected, the OnGuard display unit will immediately display an error screen as shown in Fig. 272, [OnGuard Error Screen \(amber\)](#). The first error code transmitted will be displayed first; additional faults (if any) can be viewed using the up or down buttons. The display does not show stored fault codes.

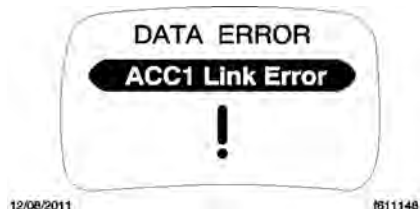


Fig 272, OnGuard Error Screen (amber)

Refer to the OnGuard Collision Safety System Maintenance Manual MM-0951 for a full list of faults (www.meritorwabco.com).

18.01.07 Additional Features

Press the MODE button to access the OnGuard display unit additional features from the CMS or ACC main operating screen. Press the up and down arrows to scroll through each menu, then press the MODE button to select the value to be changed. In edit mode, press the up or down arrows to change a value setting, then press the MODE button to save the setting. Pressing MODE in each feature screen advances the display to the next feature.

The Display Control menu allows adjustment of the alarm volume, LCD brightness, LCD contrast, and U.S./metric unit conversion. See Fig.273, [Display Control Menu](#).

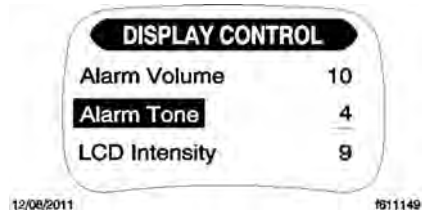


Fig 273, Display Control Menu

The component test menu provides verification of system component operation and acts as a valuable OnGuard system diagnostic tool. The header will display either **COMPONENT TEST** or **ACC FUNCTION**, depending on the software release version of the OnGuard system. The component test screen shown in Fig.274, [Component Test Menu](#) provides access to the following components (press the up or down arrows to scroll through the menu):

brake pedal position

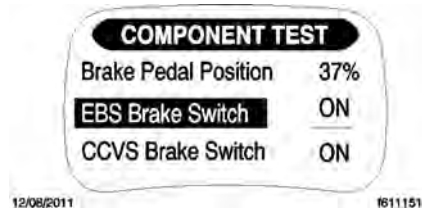


Fig 274, Component Test Menu

- EBS brake switch
- CCVS brake switch
- clutch switch
- park brake switch
- accelerator pedal position
- driveline engaged
- cruise control enable
- cruise control set speed switch
- cruise control coast switch
- cruise control resume switch
- cruise control accelerate switch
- cruise control pause switch

18.02 OnLane™ Lane Departure Warning

18.02.01 General Description

**WARNING:**

OnLane lane departure warning is intended only as an aid for a conscientious and alert driver. The system may not indicate lane departures under certain conditions. Read the information in this manual to understand the circumstances under which this system may not provide adequate lane departure warnings. Do not rely solely on the system to safely operate the vehicle. The system does not warn of all possible hazards. For example, the system cannot prevent an accident if the driver is impaired or not driving safely.

The lane departure warning system is not a substitute for safe driving procedures.

Failure to drive safely and use the system properly could result in personal injury and/or death and severe property damage.

OnLane is a camera-based warning system that helps the driver avoid unintentional lane drifting.

The system utilizes a camera mounted near the top center of the vehicle windshield, which calculates vehicle position within the lane. When the vehicle crosses lane markings without the turn signal being activated, OnLane sounds an audible warning.

The Driver Alertness Warning (DAW) system provides a warning when weaving or erratic driving is detected within the driving lane.

18.02.02 System Startup

OnLane is activated when the vehicle ignition is turned on. Lane departure warnings are active only when the vehicle is traveling at 42 mph (68 kph) or above.

18.02.03 Intentional Lane Changes

The system identifies intentional lane changes by monitoring the turn signal, the brake switch, and vehicle speed. When a lane change is intentional, the assistance warnings are disabled. The following conditions will disable/enable the warnings:

- If brake lights are ON, all warnings are disabled
- If the Left Turn Signal is ON, left departure warnings are disabled
- If the Right Turn Signal is ON, right departure warnings are disabled
- If the vehicle's speed is under 42 mph (68 kph), all warnings are disabled
- If the hazard lights are ON, all warnings are enabled

18.02.04 Unintentional Lane Departure

The system constantly monitors and calculates the vehicle's position within the lane. In the event of an unintentional lane change, the system provides an audible warning (rumble strip noise). The audible warning will terminate once the vehicle is guided back into the lane.

18.02.05 Driver Alertness Warning

The system detects erratic driving based on weaving behavior within the driving lane. OnLane computes a "Driver Alertness Index" based on driving performance, and alerts the driver when it falls below a certain threshold. DAW warns the driver by providing an intermittent warning tone when it detects erratic driving or weaving within the driving lane. The alert terminates when driving performance improves, or when the key is cycled.

18.02.06 Temporarily Disabling the System

The system can be temporarily disabled by pressing the OnLane switch. This disables warnings for 15 minutes. Warnings can be enabled by pressing the OnLane switch again.

18.03 AutoVue® Lane Departure Warning System

18.03.01 Overview

NOTE: The Bendix AutoVue LDW system option became available in 2021.

AutoVue is a camera-based warning system that helps a driver avoid unintentional lane departure.

A camera mounted near the top center of the vehicle windshield tracks visible lane markings to monitor the vehicle's position within the lane. When the vehicle crosses lane markings without the turn signal being activated, AutoVue gives an audible warning.

NOTE: The AutoVue Lane Departure Warning (LDW) system is intended only as an aid for a conscientious and alert driver. It may not warn of unintended lane departures under certain conditions. It does not warn of all possible hazards. Do not rely solely on the system to safely operate the vehicle. The system cannot help prevent an accident if the driver is impaired or not driving safely. Ultimate responsibility for the safe operation of the vehicle remains with the driver at all times.

18.03.02 System Startup

AutoVue activates when the ignition is turned on. Lane departure warnings are active only when the vehicle is traveling at or above 37 mph (60 kph).

At start-up the system performs a self-test. It then plays a brief clip of the "rumble strip" alert sound, first through the left speaker, then the right. The green 'enabled' lamp on the 'LANE ALERT' switch and the 'LANE SRCHNG' dash indicator then illuminate. See Fig.275, [AutoVue Lane Alert Switch](#) and Fig.276, [AutoVue Lane Searching Dash Indicator](#).



The green 'enabled' lamp on the switch will go OFF under the following conditions:

- the driver temporarily disables the system;

- an active diagnostic trouble code (DTC) is present.

The lane searching dash indicator will remain ON under the following conditions:

- vehicle speed is below 37 mph (60 kph);
- an active diagnostic trouble code (DTC) is present.

**WARNING:**

If the system cannot discover right or left lane markings, the AutoVue Lane Departure Warning system may not deliver expected alerts or erroneous alerts may occur.

Missed and false alerts may occur in the following situations:

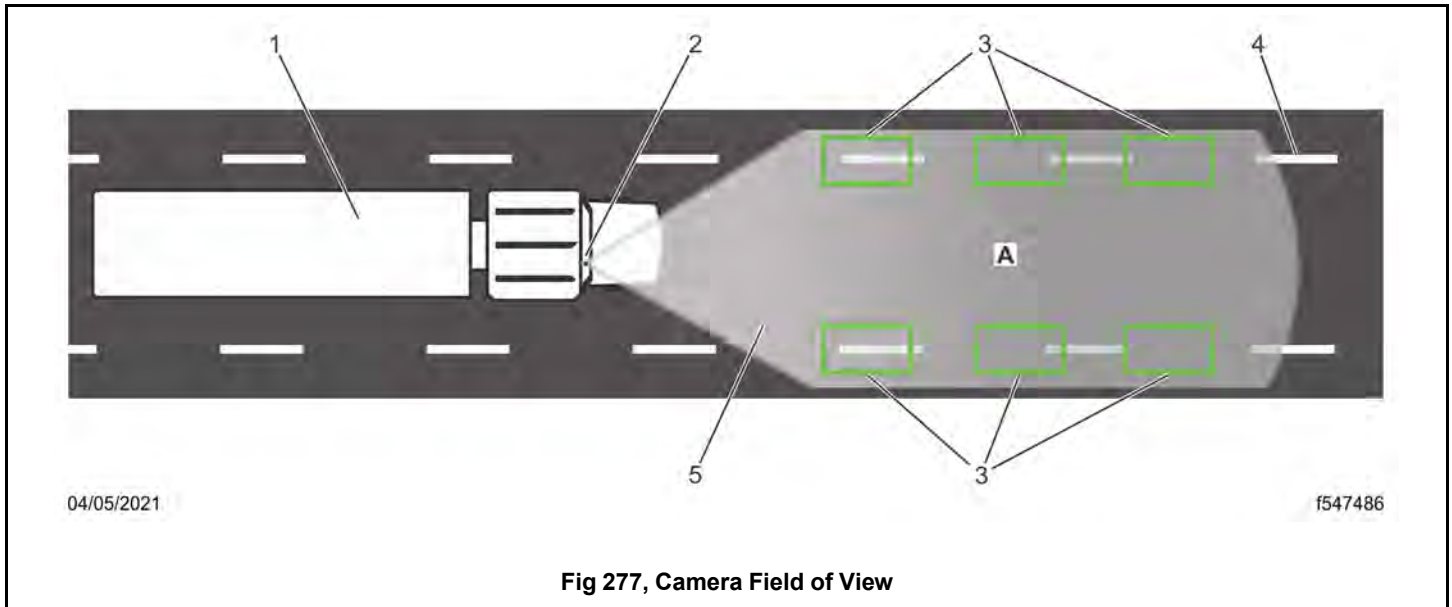
- Lane markings are difficult to distinguish due to standing water, snow, ice, mud, sand, dirt, or other debris on the road.
- Lane markings are hidden or obscured by heavy rain, fog, falling snow or sleet, or blowing smoke.
- Lane markings are missing or faded.
- Sun glare or other light sources blind the camera, obscuring lane markings or making other road markings (e.g. tar strips) look like lane markings.
- The camera's view through the windshield glass is blocked or obscured by dirt, chips, cracks, or some other distortion.
- The camera is mis-installed.
- Headlights are not operating or are mis-aligned.

It is always the responsibility of the driver to remain vigilant and change driving practices to suit traffic and road conditions.

18.03.03 Intentional Lane Changes

At or above 37 mph (60 kph), the AutoVue LDW system tracks both solid and dashed shoulder lines, center lines, and the lines between lanes. For an representation of the camera's field of view, see Fig.277, [Camera Field of View](#)

The system identifies intentional lane changes by monitoring the turn signal. When a lane change is made with the turn signal on, no warnings are made.



18.03.04 Unintentional Lane Departure

When a lane change takes place without the turn signal being activated, the system alerts the driver to make a correction. The alert will come from the side of the vehicle crossing the lane markings.

18.03.05 Alert Warnings

The AutoVue LDW system uses speakers that emit a distinctive "rumble strip" sound on the appropriate side of the cab to alert a driver of an unintentional lane departure. Audible alert volume levels are set at the factory and cannot be adjusted.

18.03.06 SafetyDirect

When triggered by a truck safety event, the AutoVue LDW system records ten seconds of video and transmits it to the SafetyDirect portal. Fleet managers can use the video along with vehicle sensor information to enhance driver training and road safety.

18.03.07 Cleaning the Windshield in the Area of the Camera

Make sure that the windshield is always kept clean and unobstructed in the area of the camera.

The driver should switch on the windshield wiper to clean the windshield and remove snow and ice to avoid incorrect lane detection.

If this area of the windshield is damaged, the AutoVue LDW system may not work as intended. If this happens, the windshield must be replaced.

18.03.08 Temporarily Disabling the System

The system can be temporarily disabled by pressing the Lane Alert switch; when the system is disabled, the green 'enabled' lamp will go off. See Fig.278, [AutoVue Lane Alert Switch](#). The system will re-enable itself after 15 minutes. Warnings can be enabled sooner by pressing the switch again.



19.01 Terms of Use..... 316

19. Telematics Data

19.01 Terms of Use

Your vehicle ("Vehicle") may be equipped with one or more devices that gather information described below regarding the Vehicle and the environment in which it may be operating ("Telematics Information"). The devices may periodically send Telematics Information to Daimler Truck North America LLC ("DTNA"). Additionally, DTNA and its dealers may manually retrieve Telematics Information from the devices for the purposes described below.

Telematics Information We Collect and Why We Collect It

The Telematics Information we collect may include, but is not limited to, information regarding the performance, operation, location, speed, trips, travel history, stop and idle times, fuel consumption, fault codes and diagnostic information, steering and braking performance, air bag deployment and seatbelt use, decelerations, and other information relating to the performance, operation, health and safety of your Vehicle. DTNA gathers this information in order to improve the performance, operation, health and safety of your Vehicle and other DTNA vehicles and products, in the following ways, among others:

- **To enable your subscription services.** DTNA and other third party service providers have developed a variety of applications and services that are now available to you to optimize the performance, use, reliability and safe operation of your Vehicle. These services are enabled by the Telematics Information we receive from your Vehicle and will likely be made more effective in the future by the use of that Telematics Information and similar information we receive from other DTNA vehicles.
- **To make your Vehicle safer and to improve its performance.** Depending on the type of device installed on your Vehicle, DTNA may periodically update your Vehicle's on-board software to improve the performance and safe use of the Vehicle. We may need to obtain certain Telematics Information to ensure the effectiveness of these updates.
- **To monitor and manage the health and efficiency of your Vehicle.** Telematics Information from your Vehicle may be used by DTNA and its affiliates, dealers and service providers to diagnose and resolve problems with your Vehicle more effectively and to help you maintain it.
- **To improve your customer service experience.** Telematics Information may be used by DTNA and its affiliates, dealers and service providers to provide you a more efficient and effective customer service experience in conjunction with Vehicle service, maintenance, field service campaigns and recalls.
- **For product development and product improvement.** Telematics Information may be analyzed and used to identify and resolve performance and safety issues and to develop improvements to our products that will benefit you and our future customers.
- **To develop more meaningful product marketing.** Telematics Information may be used to provide more customized and meaningful information to our customers regarding products and services that best satisfy their operational requirements and improve the performance of their businesses.
- **To help match our customers with the right products.** Telematics Information may be used to develop future products and services that best satisfy the operational requirements of our customers.

What We Do with Telematics Information and Who We Share It With

DTNA may use Telematics Information for any purpose allowed by law, including but not limited to using the information for any of the purposes described in this chapter. DTNA may share Telematics Information with its service providers, affiliates, subsidiaries, dealers and distributors, but only for lawful business purposes. This may include third parties who process information on behalf of DTNA, third parties who you authorize directly to receive information from us, and law enforcement agencies pursuant to applicable law.

DTNA may also combine Telematics Information it obtains from your Vehicle with data from others, anonymize and de-identify that aggregated data ("Aggregated Data"), and use and disclose that Aggregated Data and derivatives of it indefinitely and for any purpose whatsoever, including sharing it with third parties for any purpose without restriction. You will not have any rights in any Aggregated Data or any derivatives or proceeds of it. DTNA will be the exclusive owner of all rights, title and interests in and to all Aggregated Data. DTNA shall not have any obligation to provide any Aggregated Data to you or to compensate you for any use or disclosure of any Aggregated Data.

Collection Method

The Telematics Information may be transmitted automatically or manually from the devices on your Vehicle to DTNA or Detroit Diesel Corporation (DDC) through diagnostic tools, including but not limited to DDC DiagnosticLink.

Safeguards

DTNA will use reasonable data security systems and procedures in an effort to protect Telematics Information from unauthorized use, access, disclosure, distribution, loss or alteration. We do this through physical, electronic and procedural safeguards that are designed to protect the confidentiality, integrity and availability of Telematics Information. However, no security system is perfect. DTNA cannot guarantee that Telematics Information will not be hacked, deleted, intercepted or altered. DTNA will also require other parties to whom Telematics Information is disclosed to take reasonable steps to protect the Telematics Information from unauthorized use, access, disclosure, distribution, loss or alteration.

Your Consent

By continuing to provide to us, or allowing us to receive or retrieve, Telematics Information through the devices on your Vehicle, you consent to its collection and use as described in this chapter. Although some information may be transferred to and processed in countries without laws providing the same level of data protection as your country, our use and disclosure of your information is subject to these terms of use regardless of where your information is transferred. **If you have subscribed to a subscription service such as Virtual Technician or Detroit Analytics, the Telematics Terms and Conditions for that service will apply to DTNA's collection, storage, use and sharing of the data covered by those Terms and Conditions.**

Your Rights

You may ask DTNA to discontinue receiving and retrieving Telematics Information from the devices on your Vehicle. If you do so, you will be unable to receive telematics subscription services relating to your Vehicle and unable to remotely receive important Vehicle software updates, among other things. If you are interested in that option, please contact DTNA at: **DetroitConnect@Daimler.com**.

Privacy Statement Changes

DTNA reserves the right to amend these terms of use from time to time. Changes will be reflected in the online version of this document found at: <https://dtnacontent-dtna.prd.freightliner.com/content/public/dtna-servicelit/TechLit-Homepage.html?make=freightliner>. **By continuing to provide to us, or allowing us to receive or retrieve, Telematics Information through the devices on your Vehicle, you consent to and accept those changes.**

NOTE: These terms of use do not apply to aftermarket telematics devices that may be provided by others or configured to send information to someone other than DTNA or its affiliates, dealers or service providers.



CONTACT INFORMATION

For questions, please create a Service Technical Request using the DTTS Application on the DTNA Portal.