

Kenworth Heavy Duty Body Builder Manual 2019



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Kenworth Heavy Duty 2.1m Cab Body Builder Manual



A **PACCAR** COMPANY

Body Builder Manual Contents

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This manual was created to provide body builders with appropriate information and guidelines useful in the body planning and installation process. This information will be helpful when installing bodies or other associated equipment.

This manual contains appropriate dimensional information, guidelines for mounting bodies, guidelines for modifying frames, electrical wiring information, and other information useful in the body installation process. This manual is specific to chassis with 2017 EPA emissions engines.

The Body Builder Manual can be very useful when specifying a vehicle, particularly when the body builder is involved in the vehicle definition and ordering process. Early in the process, professional body builders can often contribute valuable information that reduces the ultimate cost of the body installation.

In the interest of continuing product development, Kenworth reserves the right to change specifications or products at any time without prior notice. It is the responsibility of the user to ensure that he is working with the latest released information. Check Kenworth.com for the latest released version.

If you require additional information or reference materials, please contact your local Kenworth dealer.

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SAFETY SIGNALS

We've put a number of alerting messages in this book. Please read and follow them. They are there for your protection and information. These alerting messages can help you avoid injury to yourself or others and help prevent costly damage to the vehicle.

Key symbols and "signal words" are used to indicate what kind of message is going to follow. Pay special attention to comments prefaced by "WARNING", "CAUTION", and "NOTE." Please don't ignore any of these alerts.

Warnings, cautions, and notes

WARNING



When you see this word and symbol, the message that follows is especially vital. It signals a **potentially hazardous situation** which, if not avoided, could result in death or serious injury. This message will tell you what the hazard is, what can happen if you don't heed the warning, and how to avoid it.

Example:

WARNING! Be sure to use a circuit breaker designed to meet liftgate amperage requirements. An incorrectly specified circuit breaker could result in a electrical overload or fire situation. Follow the liftgate installation instructions and use a circuit breaker with the recommended capacity.

CAUTION



Signals a **potentially hazardous situation** which, if not avoided, could result in minor or moderate injury or damage to the vehicle.

Example:

CAUTION: Never use a torch to make a hole in the rail. Use the appropriate drill bit.

NOTE



Provides general information: for example, the note could warn you on how to avoid damaging your vehicle or how to drive the vehicle more efficiently.

Example:

Note: Be sure to provide maintenance access to the battery box and fuel tank fill neck.

Please take the time to read these messages when you see them, and remember:

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Signals a potentially hazardous situation which, if not avoided, could result in minor or moderate injury or damage to the vehicle.

NOTE

Useful information that is related to the topic being discussed.

FEDERAL MOTOR VEHICLE SAFETY STANDARDS COMPLIANCE

As an Original Equipment Manufacturer (OEM), Kenworth Truck Co. ensures that our products comply with all applicable U.S. or Canadian Federal Motor Vehicle Safety Standards. However, the fact that this vehicle has no fifth wheel and that a Body Builder (Intermediate or Final Stage Manufacturer) will be doing additional modifications means that the vehicle was incomplete when it left the build plant. See next section and Appendix A for additional information.

Incomplete Vehicle Certification

An Incomplete Vehicle Document is shipped with the vehicle, certifying that the vehicle is not complete. [See Figure 2-1.](#) In addition, affixed to the driver's side door frame or edge is an Incomplete Vehicle Certification label. [See Figure 2-2.](#) For further information on Vehicle Certification and Identification, see [APPENDIX A "VEHICLE IDENTIFICATION."](#)

NOTE



These documents list the U.S. or Canadian Federal Motor Vehicle Safety Standard regulations that the vehicle complied with when it left the build plant. You should be aware that if you add, modify or alter any of the components or systems covered by these regulations, it is your responsibility as the Intermediate or Final Stage Manufacturer to ensure that the complete vehicle is in compliance with the particular regulations upon completion of the modifications.



FIGURE 2-1. Incomplete Vehicle Certification Document

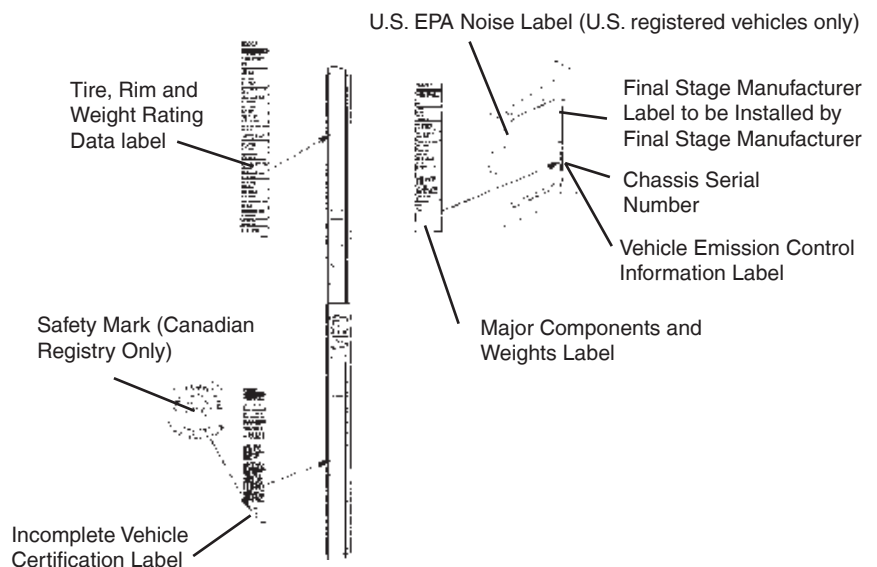


FIGURE 2-2. Locations of Certification Labels - Driver's Door and Frame

As the Intermediate or Final Stage Manufacturer, you should retain the Incomplete Vehicle Document for your records. In addition, you should record and retain the manufacturer and serial number of the tires on the vehicle. Upon completion of the vehicle (installation of the body and any other modifications), you should affix your certification label to the vehicle as required by Federal law. This tag identifies you as the "Intermediate or Final Stage Manufacturer" and certifies that the vehicle complies with Federal Motor Vehicle Safety Standards. (See Figure 2-2.) Be advised that regulations affecting the intermediate and final stage manufacturer may change without notice. Ensure you are referencing the most updated copy of the regulation during the certification and documentation processes.

In part, if the final stage manufacturer can complete and certify the vehicle within the instruction in the incomplete vehicle document (IVD) the certification label would need a statement that reads, "This vehicle has been completed in accordance with the prior manufacturers, IVD where applicable. This vehicle conforms to all applicable Federal Motor Vehicle Safety Standards [and Bumper and Theft Prevention Standards if applicable] in effect in (month, year)."

However, if the vehicle can not be completed and certified with in the guidance provided in the IVD, the final stage manufacturer must ensure the vehicle conforms to all applicable Federal Motor Vehicle Safety Standards (FMVSS). The final stage manufactures certification label would need a statement that reads, "This vehicle conforms to all applicable Federal Motor Vehicle Safety Standards [and Bumper and Theft Prevention Standards if applicable] in effect in (month, year)."

These statements are just part of the changes to the new certification regulation. Please refer to the Feb 15, 2005 final rule for all of the details related to this regulation. You can contact NTEA Technical Services Department at 1-800-441-NTEA for a copy of the final rule (DocID 101760).

For Canadian final stage manufacturers see:

<http://www.gazette.gc.ca/index-eng.html>; and
<http://www.tc.gc.ca/eng/acts-regulations/menu.htm> for the regulations.

Or contact:

Transport Canada
Tower C, Place de Ville, 330 Sparks Street
Ottawa, Ontario K1A 0N5
(613) 990-2309
TTY: 1-888-675-6863

Noise and Emissions Requirements

NOTE



This truck may be equipped with specific emissions control components/systems* in order to meet applicable Federal and California noise and exhaust emissions requirements. Tampering with these emissions control components/systems* is against the rules that are established by the U.S Code of Federal Regulations, Environment Canada Regulations and California Air Resources Board (CARB). These emissions control components/systems* may only be replaced with original equipment parts.

Additionally, most vehicles in North America will be equipped with a Greenhouse Gas (GHG) "Vehicle Emission Control Information" door label indicating its certified configuration. The vehicle components listed on this label are considered emission control devices.

Modifying (i.e. altering, substituting, relocating) any of the emissions control components/systems defined above will affect the noise and emissions performance/certification. Modifications that alter the overall shape and aerodynamic performance of a tractor will also affect the emission certification. If modifications are required, they must first be approved by the manufacturer. Unapproved modifications could negatively affect emissions performance/certification. There is no guarantee that proposed modifications will be approved.

Tires may be substituted provided the new tires possess a Coefficient of rolling resistance (Crr) equal to or lower than Crr of the original tires. Consult with your tire supplier(s) for appropriate replacement tires.

Contact the engine manufacturer for any requirements and restrictions **prior** to any modifications.

- For Cummins Contact 1-800-DIESELS or your local Cummins distributor. Reference AEB 21.102.

It is possible to relocate the DEF tank, however the relocation requirements need to be followed. Any variance from the relocation requirements may cause the emissions control components/systems to operate improperly potentially resulting in engine de-rate. See page 4-3 for relocation requirements.

NOTE



All 2017 engine emissions certified vehicles will be equipped with an On-Board Diagnostics (OBD) system. The OBD system is designed to detect malfunctions of any engine or vehicle component that may increase exhaust emissions or interfere with the proper performance of the OBD system itself.

All diesel engines will be equipped with an On-Board Diagnostics (OBD) system. The OBD system consists of computer program on one or more of the vehicle's Electronic Control Units (ECUs). This program uses information from the control system and from additional sensors to detect malfunctions. When a malfunction is detected, information is stored in the ECU(s) for diagnostic purposes. A Malfunction Indicator Light (MIL) is illuminated in the dash to alert the driver of the need for service of an emission-related component or system.

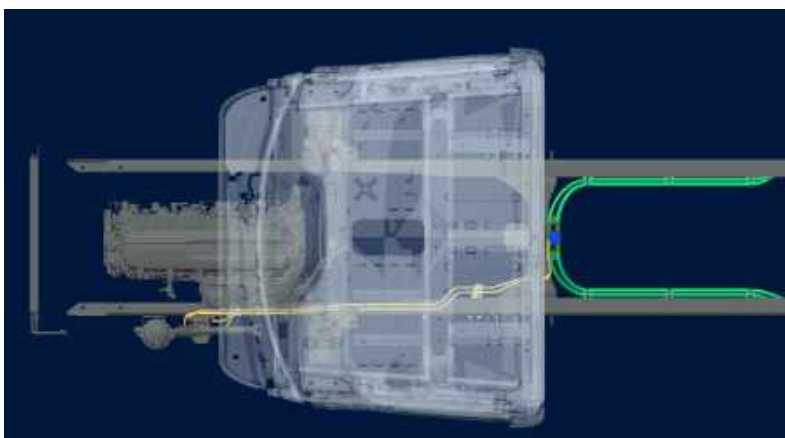
To ensure compliance to emissions regulations, the final configuration of certain features of the completed vehicle must meet specific requirements. This section describes requirements relevant for only the most common or critical modifications done by body builders. For a complete description of acceptable modifications, see the application guidance available from the manufacturer of the engine installed in the chassis.

Fuel System

The following are highlights of some of the more common or critical aspects of this system.

The overall system restriction may not exceed the restriction limitations set forth by the engine manufacturer for both supply and return.

- Ensure that fuel lines are not pinched or can potentially be damaged when installed between body and frame
- Fuel lines must be routed and secured without dips or sags
- There must be easy access to filter(s) and fill cap
- The tank vent may not obstructed
- Added accessories (heaters, generators) cannot introduce air into system
- Fuel tank must be located so that the full level is not above cylinder head
- "Ultra Low Sulfur Fuel Only" labels must be present on the dash and fuel fill
- Modification of the pressure side secondary filter and plumbing is not allowed without engine manufacturer approval
- Body installation of fuel tank or routing of lines must not cause significant increase in fuel temperature
- Fuel hoses shall meet or exceed OEM supplied hose material construction specifications
- Formed nylon fuel lines with quick-connects are installed underneath the cab and hood along the frame rail. Behind the cab from the fuel tee to tanks are wirebraid-reinforced rubber lines. Supply and return fittings are poka-yoked to prevent incorrect assembly.

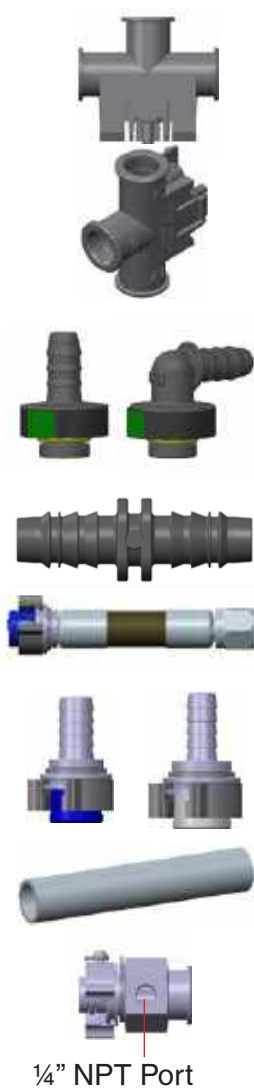


Nylon

Wirebraid-reinforced rubber

PARTS

Replacement nylon fuel line assemblies are available based on individual chassis and fuel system hardware. For other chassis changes, individual parts are listed below.



DESCRIPTION	USE	PART NO.
Supply Tee – All ports open	Dual LH and RH fuel tanks	K38-1057
Supply Tee – RH port closed	Only LH fuel tank(s)	K38-1058
Supply Tee – LH port closed	Only RH fuel tank(s)	K38-1059
Return Tee – All ports open	Dual LH and RH fuel tanks	K38-1060
Return Tee – RH port closed	Only LH fuel tank(s)	K38-1061
Return Tee – LH port closed	Only RH fuel tank(s)	K38-1062
Supply Fitting – Straight	Nylon line assemblies	K38-1069-001
Supply Fitting – 90°	Nylon line assemblies	K38-1069-002
Return Fitting – Straight	Nylon line assemblies	K38-1069-003
Return Fitting – 90°	Nylon line assemblies	K38-1069-004
Supply Union	Short-term repair, 12mm ID	K38-1069-010
Return Union	Short-term repair, 10mm ID	K38-1069-009
Supply Rubber Line Assembly	Fuel tee to fuel tank lines, xxx in inches	V50-14860082111xxx
Return Rubber Line Assembly	Fuel tee to fuel tank lines, xxx in inches	V50-14860063111xxx
Supply Steel Fitting – Straight	Rubber line assemblies, 1/2" barb	K38-1069-007
Return Steel Fitting – Straight	Rubber line assemblies, 3/8" barb	K38-1069-008
Retaining Clip	Collar on steel rubber hose fittings	K38-1069-015
Bulk Supply Nylon Line	Short-term repair, 12mm ID, xxxx in mm	V50-1178-1xxxx
Bulk Return Nylon Line	Short-term repair, 10mm ID, xxxx in mm	V50-1178-2xxxx
Supply APU Fitting	Additional fuel-powered unit, install in-line at tee	K38-1055
Return APU Fitting	Additional fuel-powered unit, install in-line at tee	K38-1056

Compressed Air System

The following are highlights of some of the more common or critical aspects of this system.

- Air system modification must meet applicable FMVSS regulations
- Compressed Air tank may not be modified (exception – addition or removal of fittings or relocation of the tank)
- Added devices or bodywork may not interfere with or rub air lines
- Air supply to the engine doser may not be restricted or disconnected
- Air lines should be routed, protected from heat, and properly secured to prevent damage from other components
- Care should be taken so that air lines do not rub against other components
- Care should be taken to protect the air system from heat sources.

Exhaust and Exhaust After-treatment System

The following are highlights of some of the more common or critical aspects of this system.

- The following after-treatment and exhaust system components may not be modified:
 - DPF assembly
 - SCR Catalyst assembly
 - Exhaust pipes between the engine and after-treatment devices (DPF, SCR Catalyst) and between after-treatment devices
 - NO_x Sensors
 - PM Sensor
- The following modifications may only be done within the guidelines of the “DEF System Relocation Guide.”
 - Modifications to Diesel Exhaust Fluid (DEF) throttle, suction, or pressure lines
 - Modification or relocation of the DEF tank
 - Modification of coolant lines to and from the DEF tank
- All DEF and coolant lines should be routed, protected, and properly secured to prevent damage during vehicle operation or other components
- If relocation of the DCU or ACM is necessary, use existing frame brackets and mount inside of frame flanges where necessary. Do not extend the harnesses
- The DPF, the SCR catalyst, or their mounting may not be modified
- The NO_x sensor may not be relocated or altered in any way; this includes re-clocking the aftertreatment canister or reorienting the sensor(s)
- Exhaust pipes used for tailpipes/stacks must be properly sized, and must prevent water from entering
- Ensure adequate clearance between the exhaust and body panels, hoses, and wire harnesses
- The body in the vicinity of the DPF must be able to withstand temperatures up to 400°C (750°F)
- Do not add thermal insulation to the external surface of the DPF
- The SCR water drain hole may not be blocked
- Allow adequate clearance (25mm (1 inch)) for servicing the DPF sensors, wiring, and clamped joints
- Drainage may not come in contact with the DPF, SCR catalyst, sensors or wiring
- Allow sufficient clearance for removing sensors from DPF. Thermistors require four inches. Other sensors require one inch
- Wiring should be routed, protected from heat, and properly secured to prevent damage from other components
- The exhaust system from an auxiliary power unit (APU) must not be connected to any part of the vehicle after-treatment system or vehicle tail pipe.

Cooling System

The following are highlights of some of the more common or critical aspects of this system.

- Modifications to the design or locations of fill or vent lines, heater or defroster core, and surge tank are not recommended
- Additional accessories plumbed into the engine cooling system are not permitted, at the risk of voiding vehicle warranty
- Coolant level sensor tampering will void warranty

- When installing auxiliary equipment in front of the vehicle, or additional heat exchangers, ensure that adequate air flow is available to the vehicle cooling system. Refer to engine manufacturer application guidelines for further detail
- When installing FEPTO drivelines, the lower radiator anti-recirculation seal must be retained with FEPTO driveline clearance modification only
- Changes made to cooling fan circuit and controls are not allowed, with the exception of AC minimum fan on time parameter
- See owner's manual for appropriate winter front usage

Electrical System

The following are highlights of some of the more common or critical aspects of this system.

- Electrical harnesses providing battery power and electronic control signals to engine and emissions control/vehicle OBD components including datalinks may not be spliced. These emissions control/vehicle OBD components include the following:
 - throttle pedal
 - vehicle speed sensor
 - after-treatment wiring
 - 9-pin OBD Connector
 - CAN Communication / OBD Diagnostic wiring
- If the alternator or battery is substituted, it must meet the requirements of the engine manufacturer's guidelines. This includes alternator ground voltage drop and alternator ground cable effectiveness. See the engine manufacturer's guidelines for recommended test procedure. Additionally the maximum voltage differential and the peak-peak voltage differential between the engine ECM block ground stud and battery negative terminal may not exceed 500 mV under any combination of loads or operating conditions.
- Only an OBD compliant battery disconnect switch may be installed on vehicles equipped EPA 2013 and beyond compliant diesel engines. An OBD compliant switch and harness, even in the off position, supply a small amount of power to the engine controller and enable certain emissions critical functions (e.g. DEF line purge). Any modifications to the electrical system which interrupt this power supply will cause OBD fault codes and illumination of the MIL. In addition, such a modification will render the engine non-compliant with certain emission regulations. As a general rule of thumb, you can remove and replace a battery disconnect switch on a truck equipped with a battery disconnect switch at the factory. However, if a battery disconnect switch was not installed in the factory a significant harness modification is required before a battery disconnect switch can be added.
- Installation of aftermarket transfer-cases must address the vehicle speed sensor position. The standard position of the speed sensor is at the transmission tail shaft. When a transfer-case is added it is best to relocate the sensor to the axle side output shaft of the transfer-case. This is typically accomplished by adding a tone wheel into the driveline yoke assembly.
- Wiring extensions for the after-treatment wiring are available for relocating the DEF tank from your dealer via Paccar Parts. For relocation of DEF tank, refer to the after-treatment section of this manual.
- The emission system requires an accurate Outside Air Temperature (OAT) reading in order to properly run its control algorithms. The OAT sensor is located in the driver's side mirror assembly on Kenworth trucks and is shown in the figures below. If the body builder needs to modify the mirror assembly in any way, it is important the OAT sensor stay positioned on the mirror assembly. Running the vehicle without the OAT sensor connected will cause the MIL lamp to illuminate. If needed, a replacement sensor can be ordered from your Kenworth dealer.

Section 2 Safety & Compliance

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FIGURE 2-3: Aerodynamic Mirror OAT Sensor Location

- Coolant Sensor considerations are given in the Cooling section above
- The OBD/Diagnostic connector port is located below the dash to the left of the steering wheel. This connector and its location may not be changed.
- All vehicles equipped with EPA 2013 compliant diesel and bi-fueled engines must be equipped with a Malfunction Indicator Lamp (MIL) lamp. This lamp is required to be an engine outline symbol as defined by ISO (International Standards Organization). The figure below shows the instrument cluster and MIL lamp position. Note this lamp location is fixed with respect to the controls and its location may not be changed if you are updating the warning lamp cards.

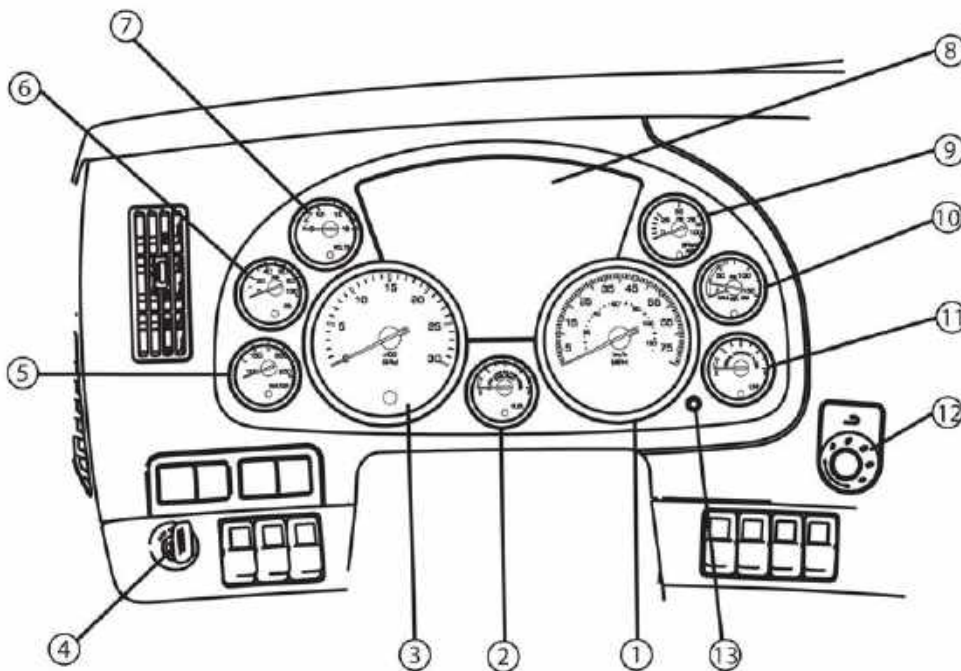


FIGURE 2-4: Instrument Cluster for T680/T880 used with EPA 2013 Emission compliant engines. The Check Engine lamp  and/or the MIL lamp  will appear in the Driver Performance Center (#8). See T680/T880 Operator's Manual for more information.

- In addition to the sensors and lamps above, the emission system also depends on signals from the exhaust DPF (Diesel Particulate Filter), SCR (Selective Catalytic Reduction), and NOx sensor. Wiring between these devices, the Dosing Control Unit (DCU) and engine ECM should not be tampered with or altered in any way.

Air Intake System

The following are highlights of some of the more common or critical aspects of this system.

- The air intake screen may not be blocked, either fully or partially
- Modification to the air intake system may not restrict airflow. For example, pipe diameter may not be reduced
- All sensors must be retained in existing locations
- To retain system seal, proper clamp torque must be used. Refer to service manual for proper clamp torque

Charge Air Cooler System

The following are highlights of some of the more common or critical aspects of this system.

- The Charge Air Cooler may not be modified
- The installation of engine overspeed shutdown devices must not introduce restriction in the intake system
- All plumbing associated with the charge air cooler may not be modified

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DIMENSIONS

This section has been designed to provide enough information to successfully layout chassis in the body planning process. Optional equipment may not be depicted. Please contact your local Kenworth dealer if more dimensional information is desired.

ABBREVIATIONS

Throughout this section, and in other sections as well, abbreviations are used to describe certain characteristics on your vehicle. The chart below lists the abbreviated terms used.

TABLE 3-1. Abbreviations Used

CA	BACK OF CAB TO CENTERLINE OF REAR AXLE OR CENTERLINE OF TANDEM ON TANDEM SUSPENSION
EOF	FRAME RAIL OVERHANG BEHIND REAR AXLE – MEASURED FROM THE CENTERLINE OF TANDEM
FS	FRONT SUSPENSION HEIGHT
RS	REAR SUSPENSION HEIGHT
WB	WHEELBASE
SOC	SIDE OF CAB
BOC	BACK OF CAB

TURNING RADIUS

Approximate turning radius specifications are listed in the following tables as a general guide. It is important to note that optional components may alter the results.

TABLE 3-2. Turning Radius

Model	Steering Gear	Front Axle	Front Wheel	Front Tire	Rear Suspension	Wheel Base (in.)	Turning Radius (ft)
T680/T880	Single Gear HD94 or THP60	Dana Spicer E-1202I 12K or E13221 13.2K	Accuride 50487 or Alcoa 88367 22.5 X 8.25	295/75R22.5	Tandem 52" Axle Spacing	181	26.7
						193	26.9
						201	28.0
						213	29.7
						220	30.6
						232	32.3
						240	33.4
						252	35.0
						260	36.1
						272	37.7
						280	38.8
						291	40.4
						303	42.0
						323	44.7
						331	45.8

TABLE 3-2 CONTINUES ON NEXT PAGE...

Section 3 Dimensions

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TABLE 3-2 CONTINUED

Model	Steering Gear	Front Axle	Front Wheel	Front Tire	Rear Suspension	Wheel Base (in.)	Turning Radius (ft)
T680/T880	Single Gear HD94 or THP60	Meritor MFS12 or MFS13 Dana Spicer E-12021 12K or E-13221 13.2K	Accuride 50487 or Alcoa 88367 22.5 X 8.25	11R22.5	Tandem 52" Axle Spacing	181	26.9
						193	27.4
						201	28.5
						213	30.2
						220	31.2
						232	32.9
						240	34.0
						252	35.7
						260	36.8
						272	38.4
						280	39.6
						291	41.1
						303	42.8
						323	45.6
						331	46.7
T880	Single Gear SD110 or TAS85	Meritor MFS14 Dana Spicer E-14621	Alcoa 89365 22.5 X 9	315/80R22.5	Tandem 52" Axle Spacing	181	26.9
						193	26.9
						201	27.9
						213	29.6
						220	30.5
						232	32.2
						240	33.2
						252	34.0
						260	35.1
						272	36.7
						280	37.8
						291	39.2
						303	40.8
						323	43.4
						331	44.5
T880	Dual Gears HD94 or THP60	Meritor MFS20 Standard Track Dana Spicer D2000 20K Standard Track	Alcoa 89365 22.5 X 9	315/80R22.5	Tandem 52" Axle Spacing	181	28.1
						193	28.6
						201	29.7
						213	31.5
						220	32.5
						232	34.2
						240	35.3
						252	35.2
						260	36.3
						272	38.0
						280	39.1
						291	40.6
						303	42.2
						323	45.0
						331	46.0

TABLE 3-2 CONTINUES ON NEXT PAGE...

Section 3 Dimensions

TABLE 3-2 CONTINUED

Model	Steering Gear	Front Axle	Front Wheel	Front Tire	Rear Suspension	Wheel Base (in.)	Turning Radius (ft)
T880	Dual Gears HD94 or THP60	Meritor MFS20 Standard Track Dana Spicer D2000 20K Standard Track	Alcoa 82362 22.5 X 12.25	385/65R22.5	Tandem 52" Axle Spacing	181	28.1
						193	28.6
						201	29.8
						213	31.5
						220	32.5
						232	34.2
						240	35.4
						252	35.3
						260	36.4
						272	38.0
						280	39.1
						291	40.6
						303	42.2
						323	45.0
						331	46.1
T880	Dual Gears HD94 or THP60	Meritor MFS20 Standard Track Dana Spicer D2000 20K Standard Track	Alcoa 82362 22.5 X 12.25	425/65R22.5	Tandem 52" Axle Spacing	181	28.1
						193	28.6
						201	29.8
						213	31.5
						220	32.5
						232	34.2
						240	35.4
						252	36.7
						260	37.8
						272	39.5
						280	40.7
						291	42.2
						303	43.9
						323	46.8
						331	47.9

Prospector Turn Circle Analysis:

Please see Figure 3-2 as an example of Kenworth's turn circle calculation made in Prospector for your specific chassis. Your local Kenworth dealer can provide this information to you.

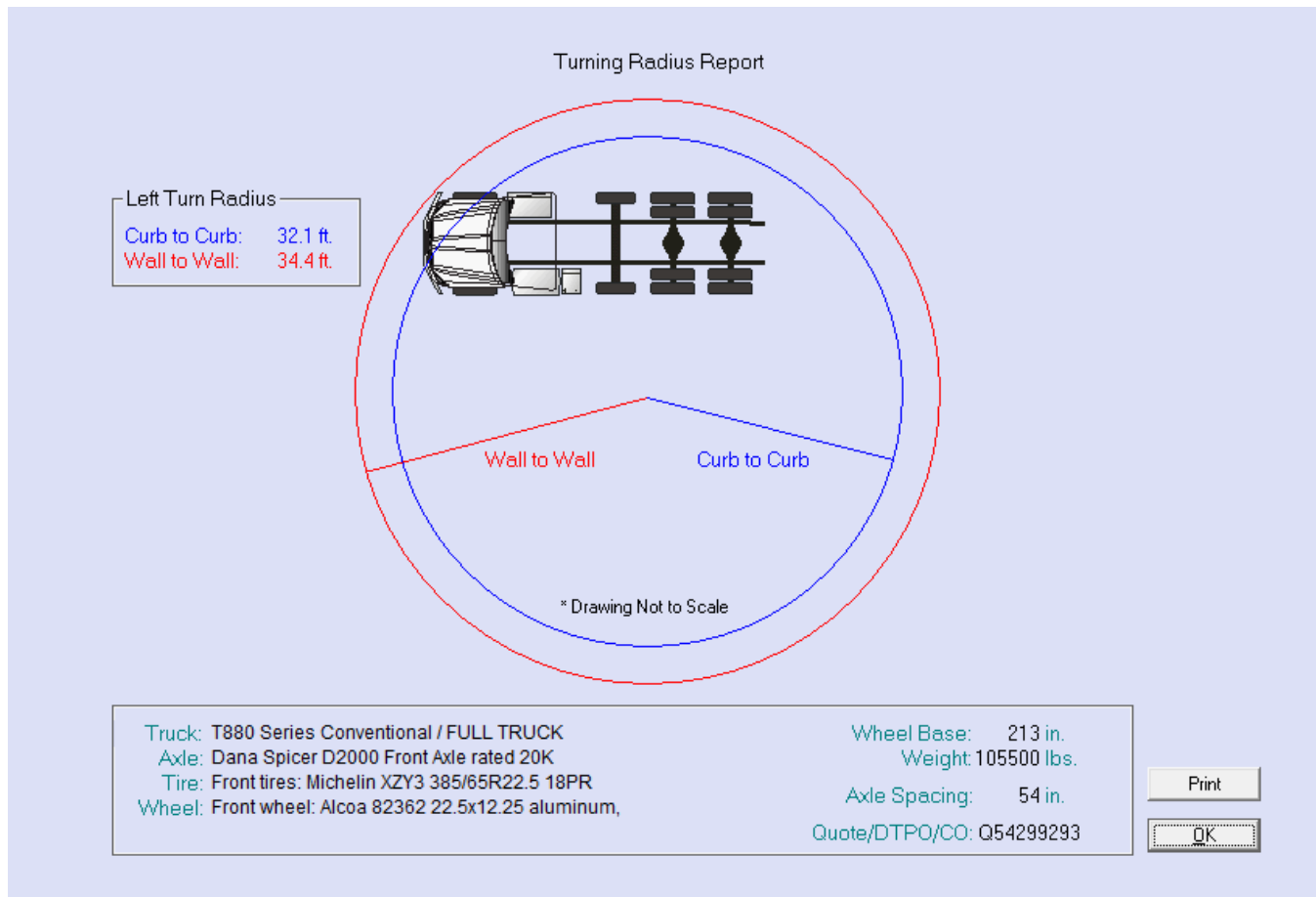


FIGURE 3-1. Prospector Turn Circle Analysis

Please consult your local Kenworth Dealer for this information, as it is chassis specific.

OVERALL DIMENSIONS

This section includes drawings and charts of the following Class 8 models: T680 and T880, including 40", 52", and 76" sleepers

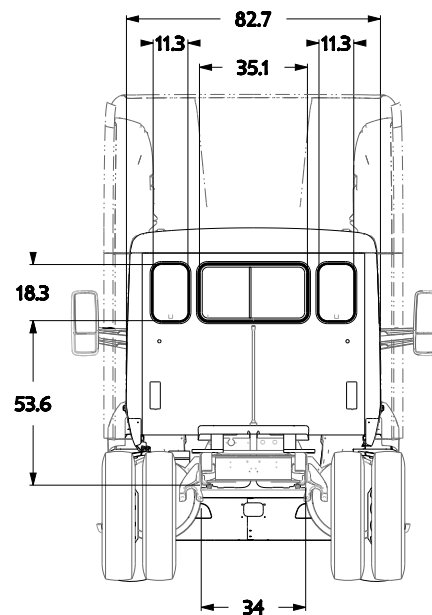
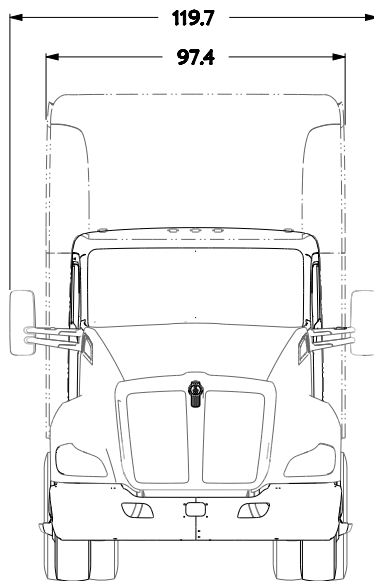
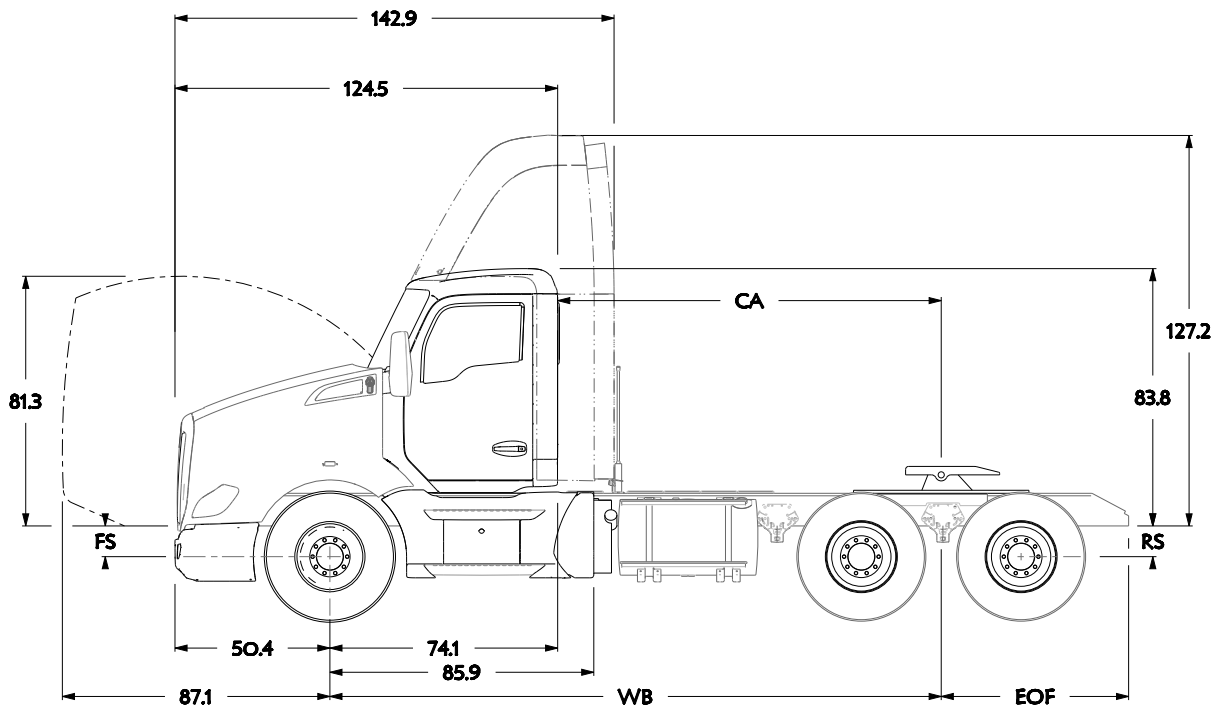
On the pages that follow, detail drawings show particular views of each vehicle, all dimensions are in inches (in). They illustrate important measurements critical to designing bodies of all types. See the "Contents" at the beginning of the manual to locate the drawing that you need.

Note: To determine overall height please locate the chart Table 3-3 on page 3-12 and add that value to the height. All heights are given from the bottom of the frame rail.

Kenworth also offers .dxf files and frame layouts of ordered chassis four weeks prior to build. Please speak with your salesman to request this feature when specifying your chassis.

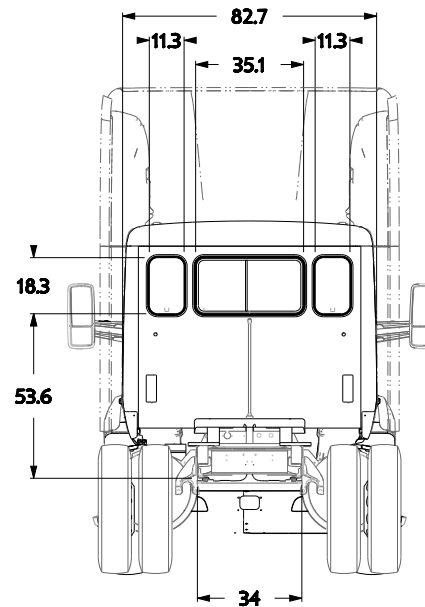
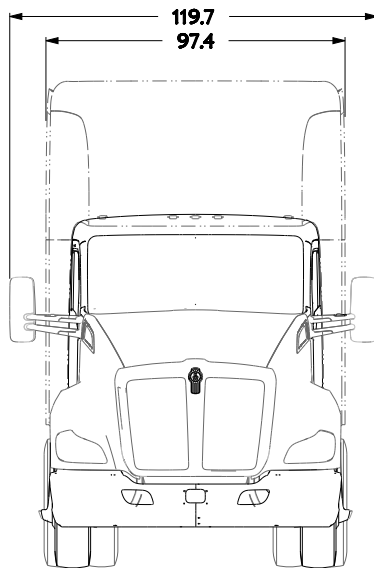
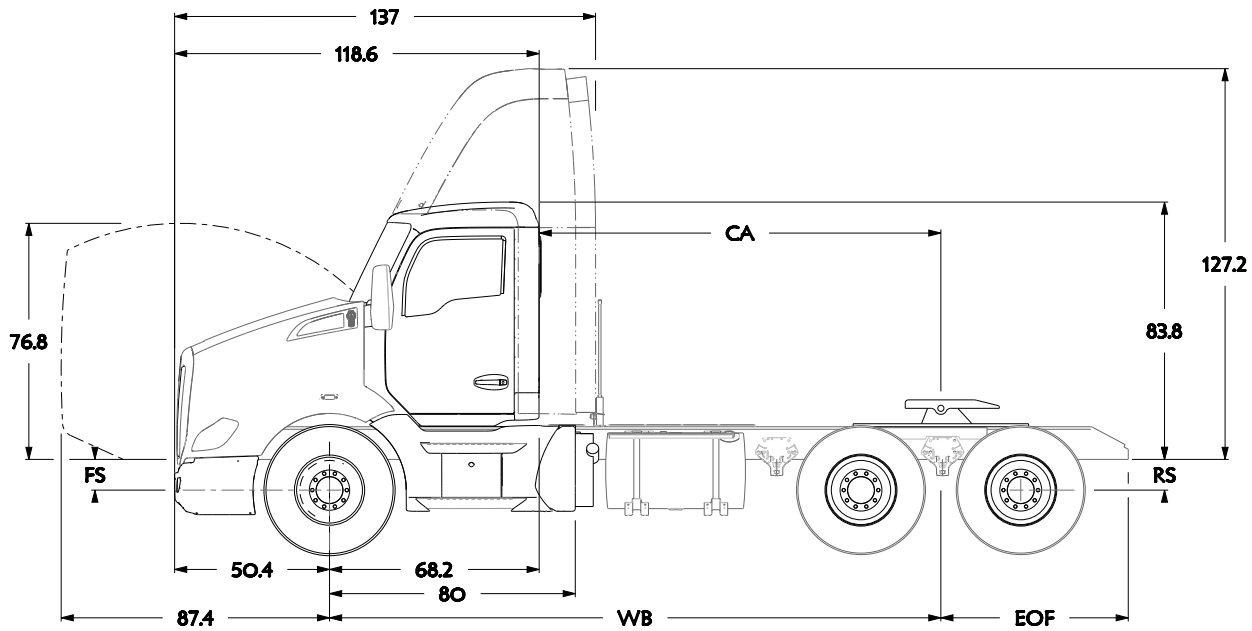
T680 STANDARD HOOD DAYCAB

The following drawings are of a standard T680 Standard Hood Daycab, shown with standard chassis components.



T680 MX (SHORT) HOOD DAYCAB

The following drawings are of a standard T680 MX (Short) Hood Daycab, shown with standard chassis components.

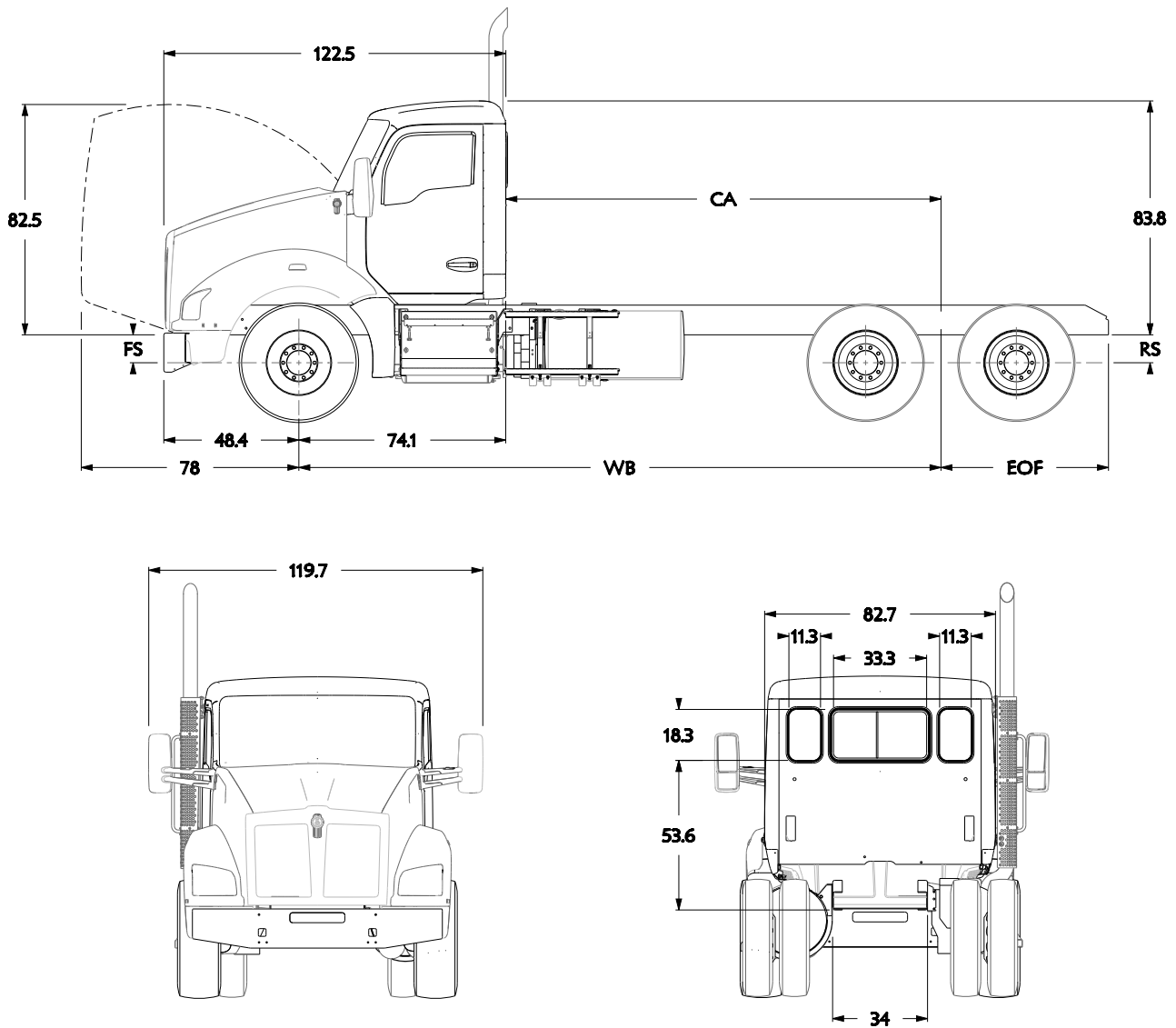


Section 3 Dimensions

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T880 STANDARD HOOD DAYCAB

The following drawings are of a standard T880 Standard Hood Daycab, shown with standard chassis components.

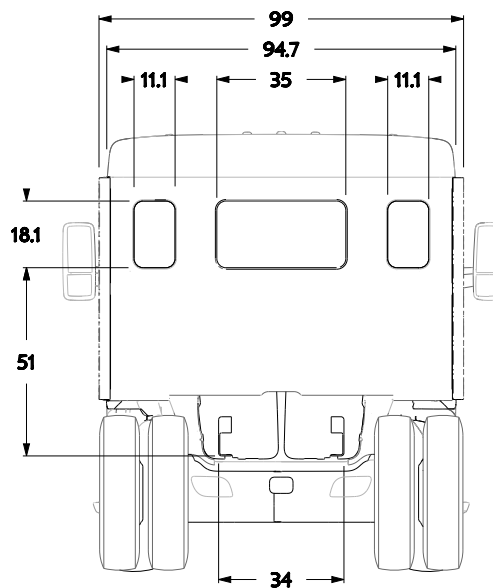
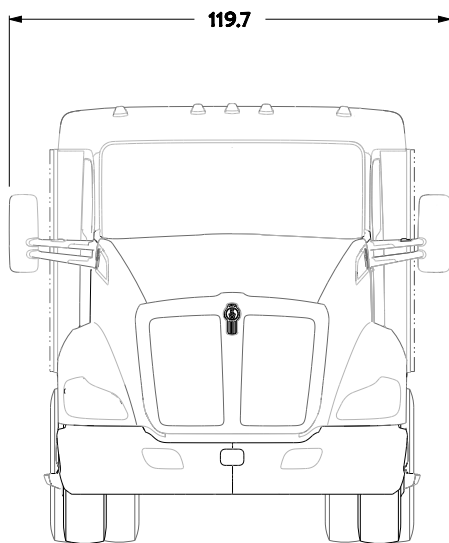
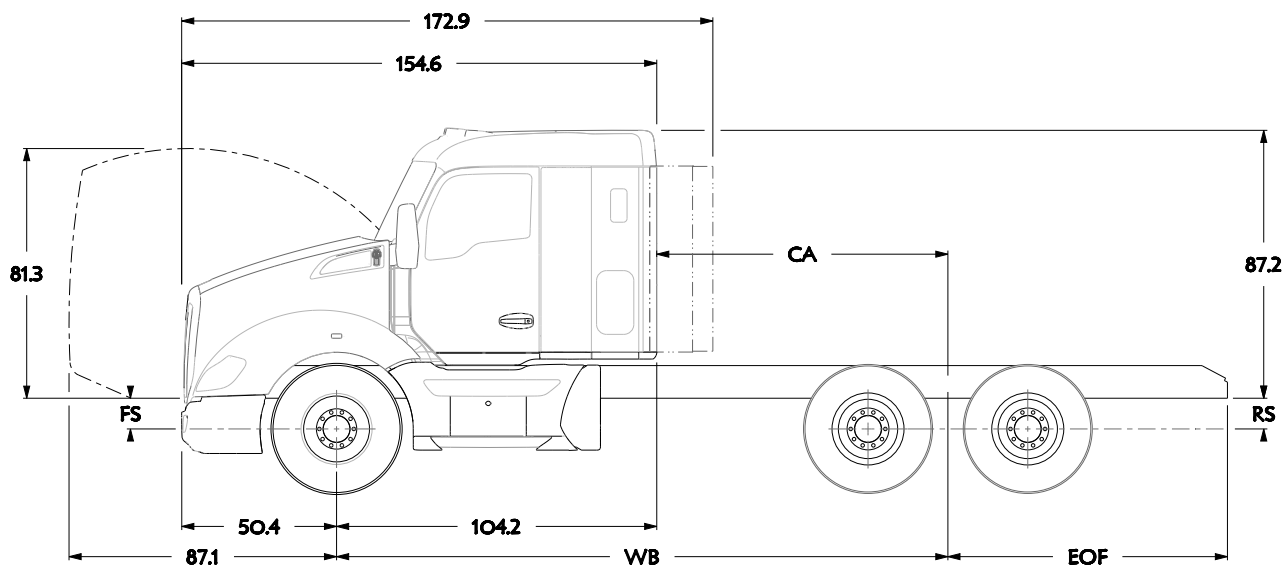


The following drawings are of a standard T880S SFFA (Short) Hood Daycab, shown with standard chassis components.



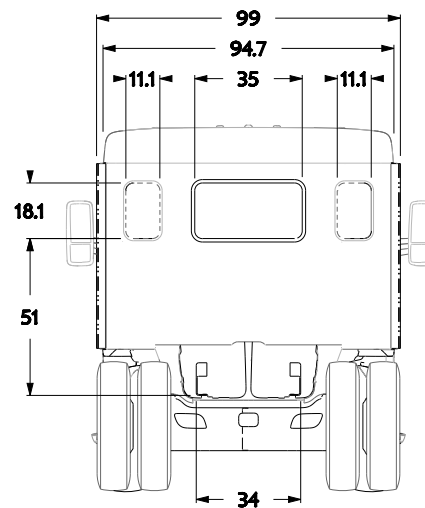
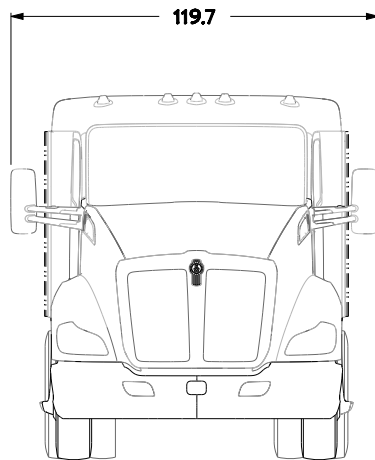
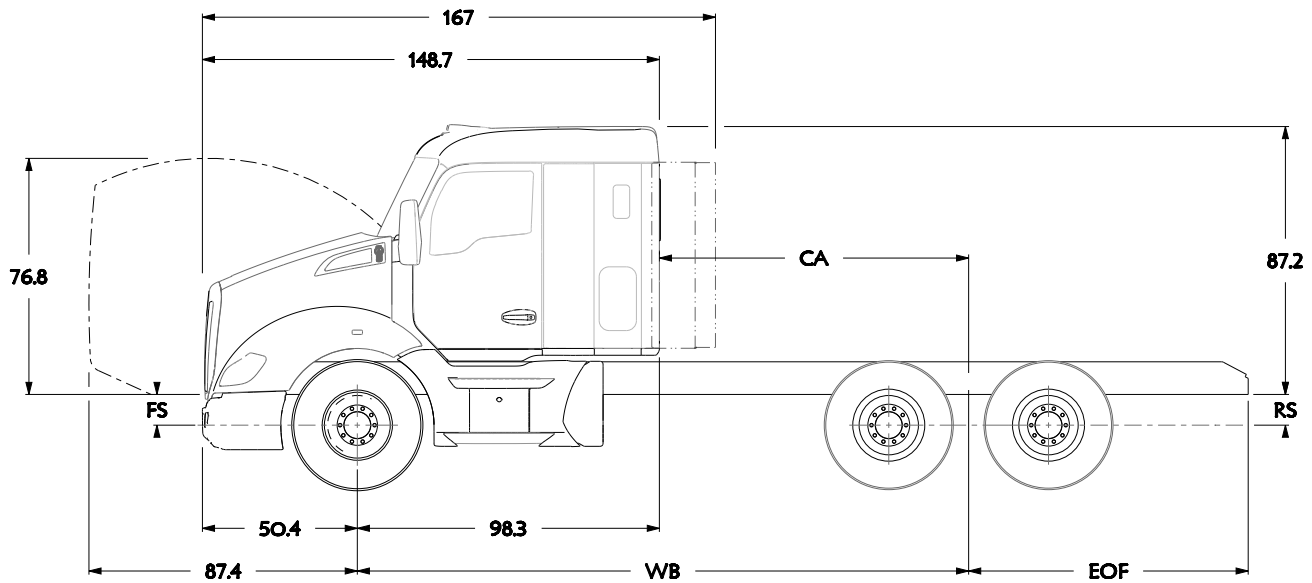
T680 STANDARD HOOD 40" SLEEPER

The following drawings are of a standard T680 Standard Hood 40" Sleeper, shown with standard chassis components.



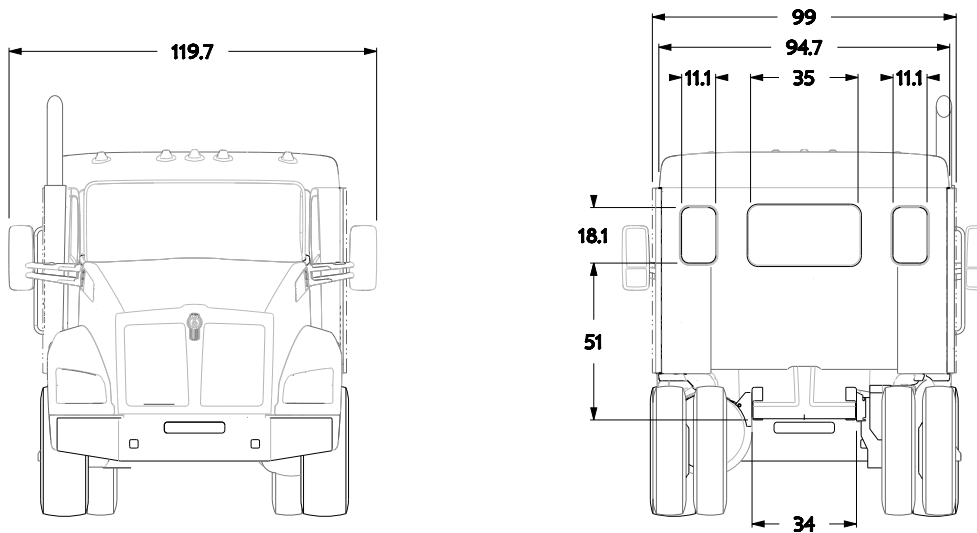
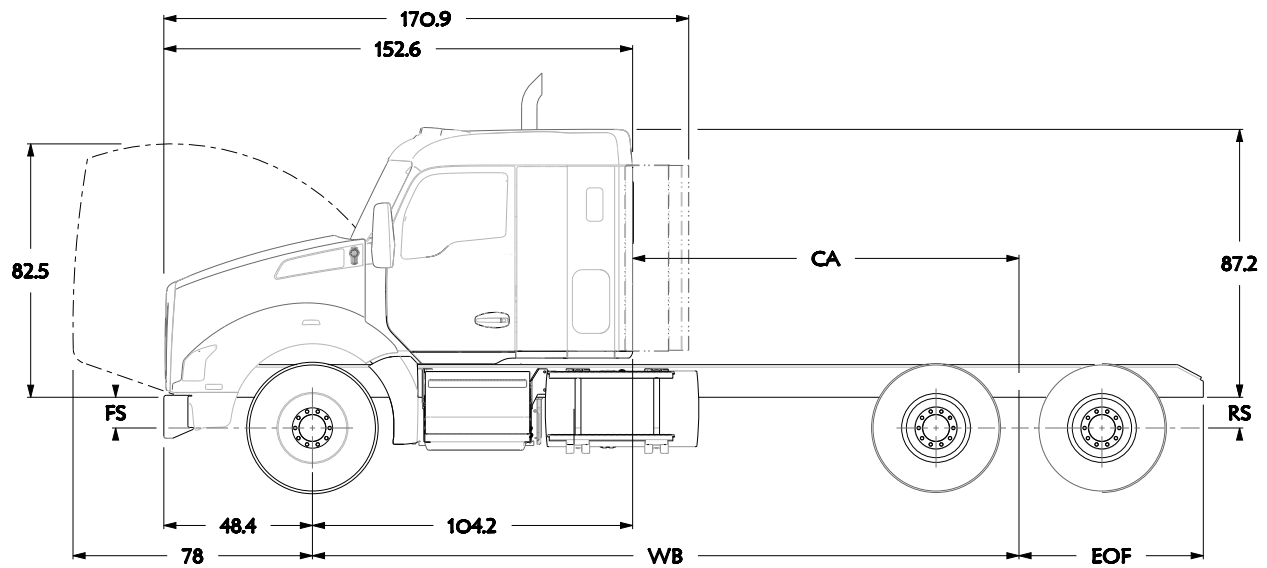
T680 MX (SHORT) HOOD 40" SLEEPER

The following drawings are of a standard T680 MX (Short) Hood 40" Sleeper, shown with standard chassis components.



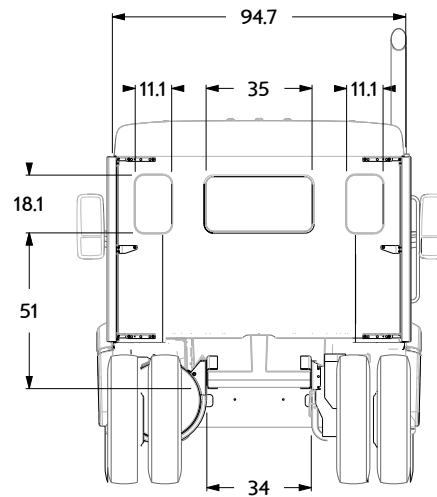
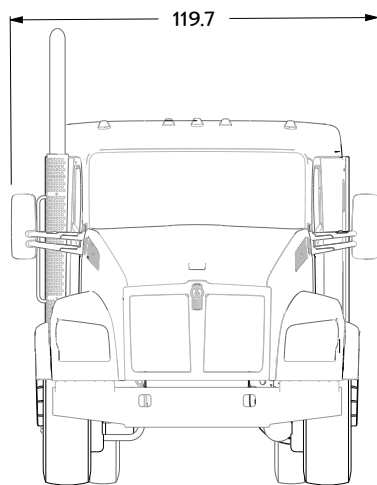
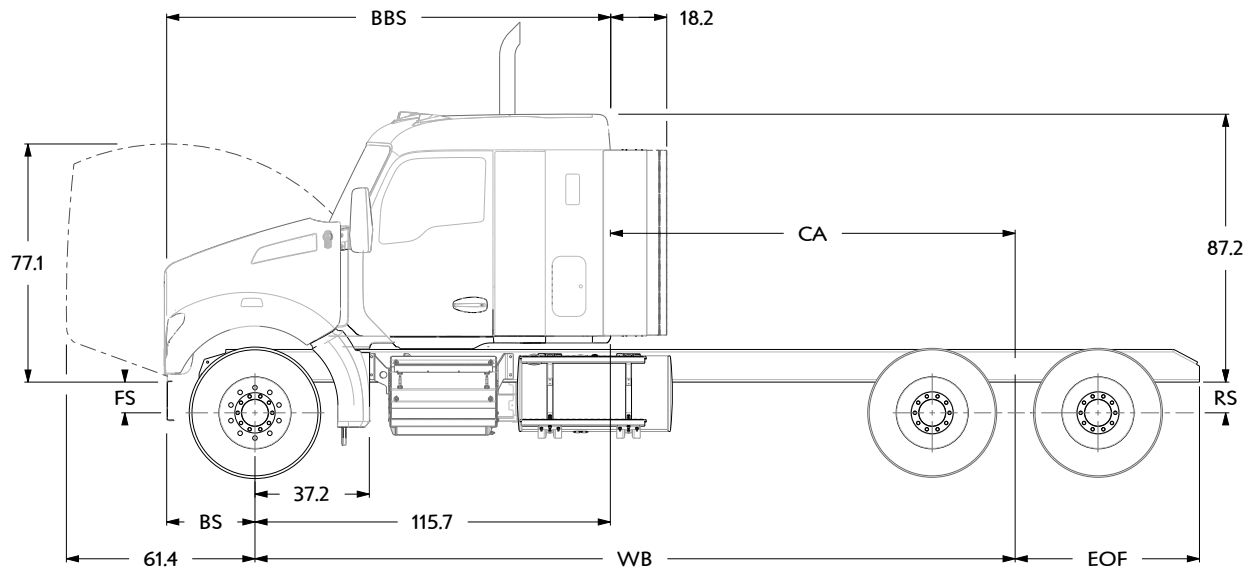
T880 STANDARD HOOD 40" SLEEPER

The following drawings are of a standard T880 Standard Hood 40" Sleeper, shown with standard chassis components.



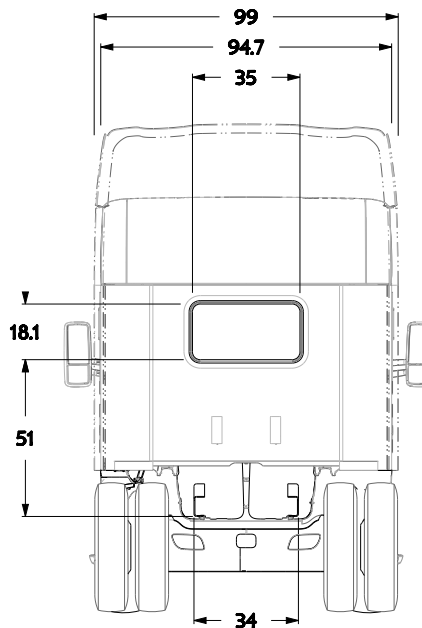
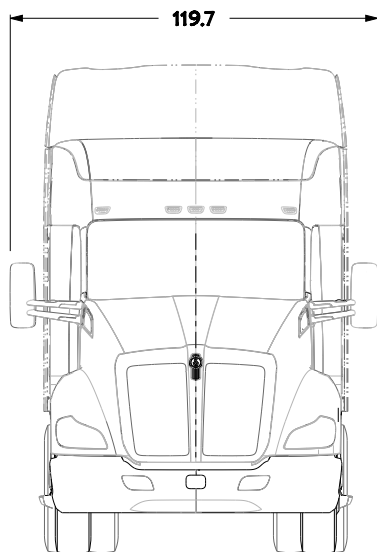
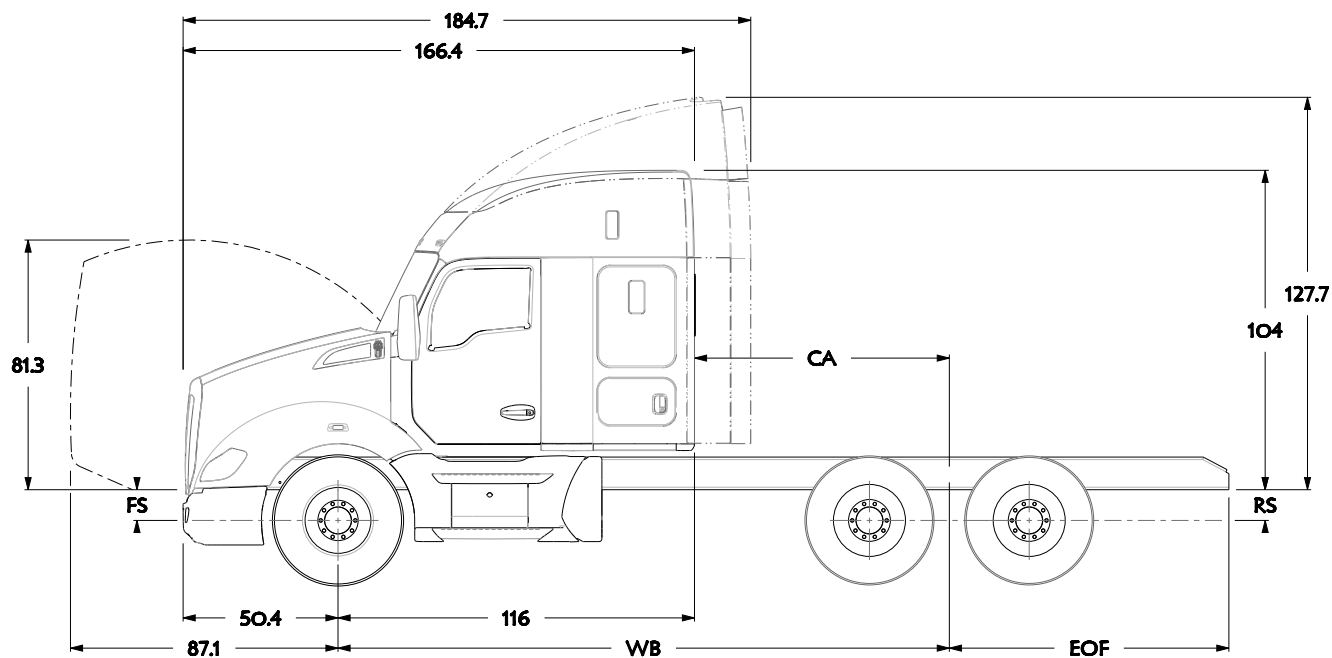
T880S SFFA (SHORT) HOOD 40" SLEEPER

The following drawings are of a standard T880S SFFA (Short) Hood 40" Sleeper, shown with standard chassis components.

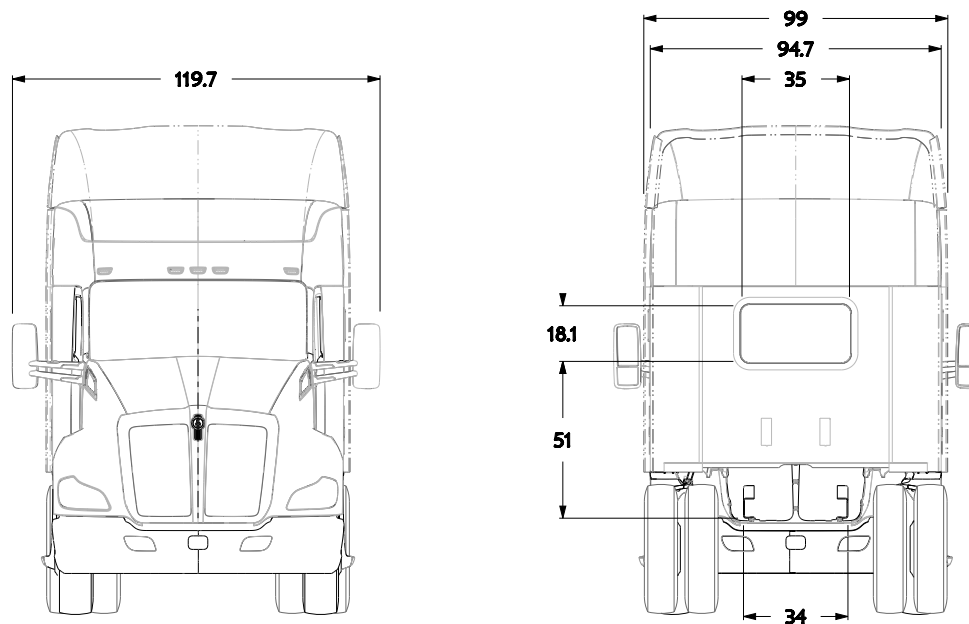


T680 STANDARD HOOD 52" SLEEPER

The following drawings are of a standard T680 Standard Hood 52" Sleeper, shown with standard chassis components.

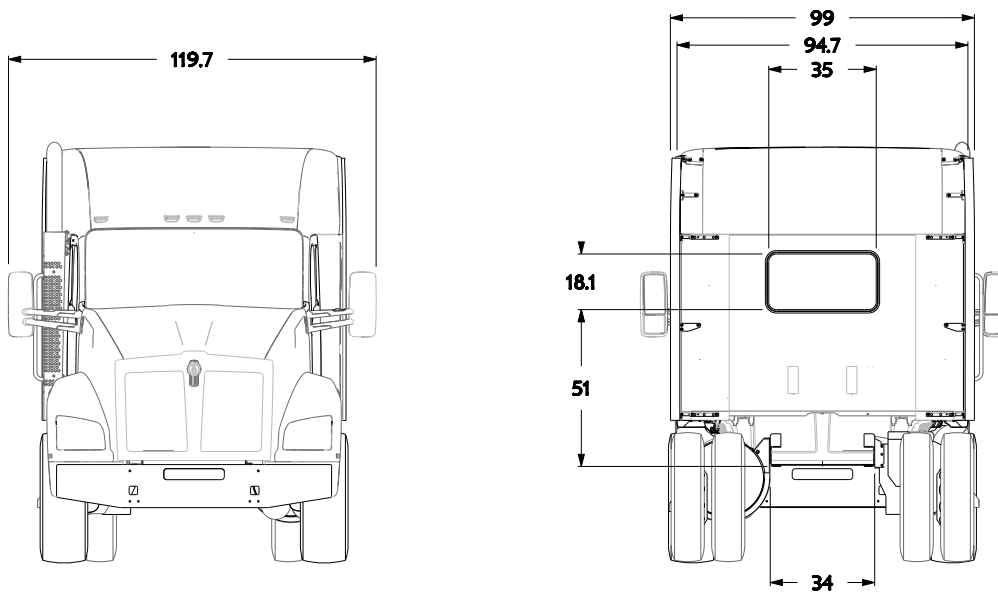
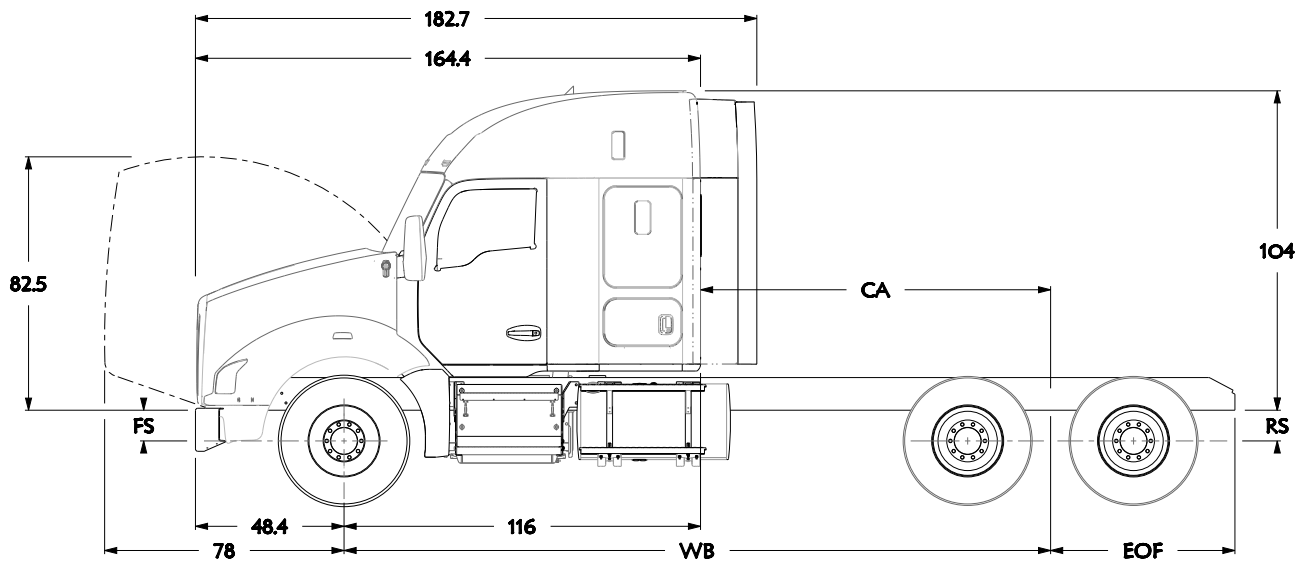


The following drawings are of a standard T880 MX (Short) Hood 52" Sleeper, shown with standard chassis components.

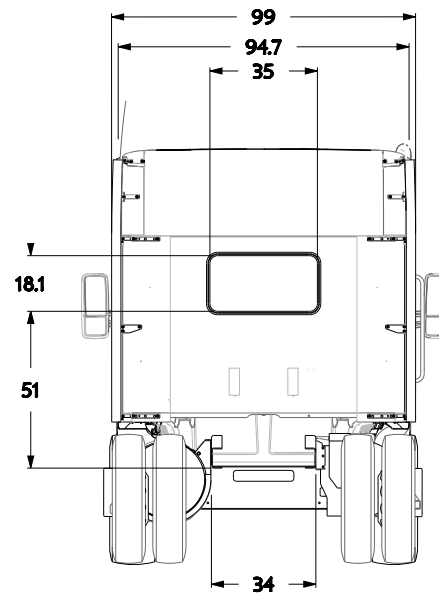
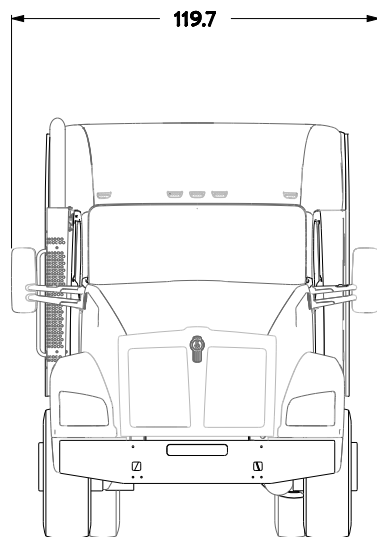
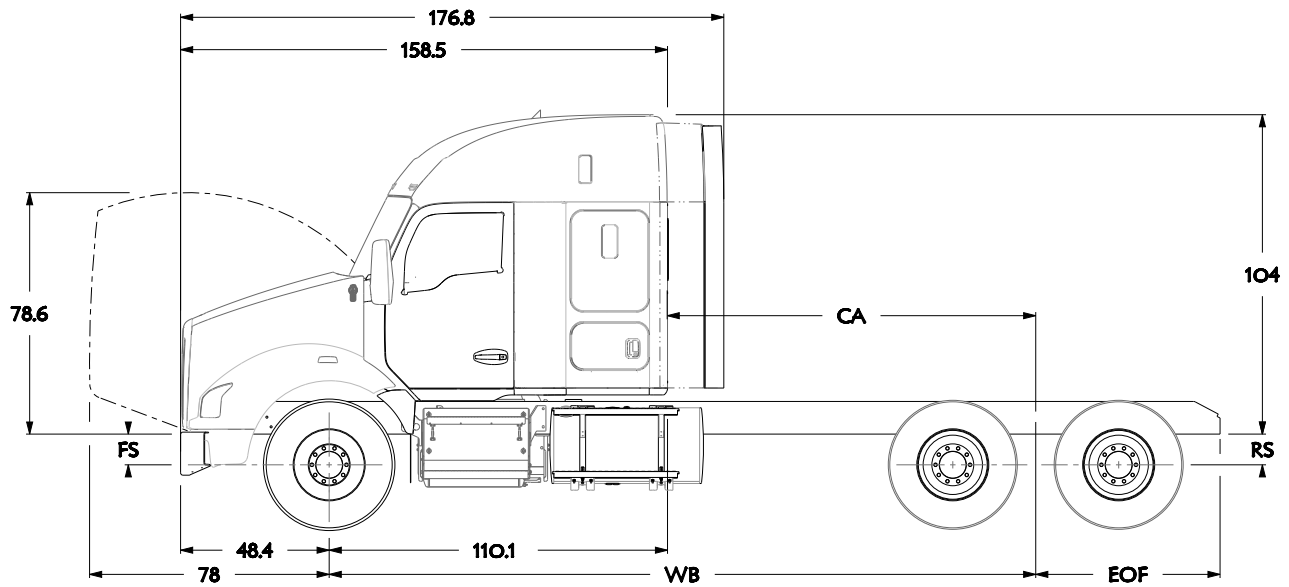


T880 STANDARD HOOD WITH 52" SLEEPER

The following drawings are of a standard T880 Standard Hood with 52" Sleeper, shown with standard chassis components.

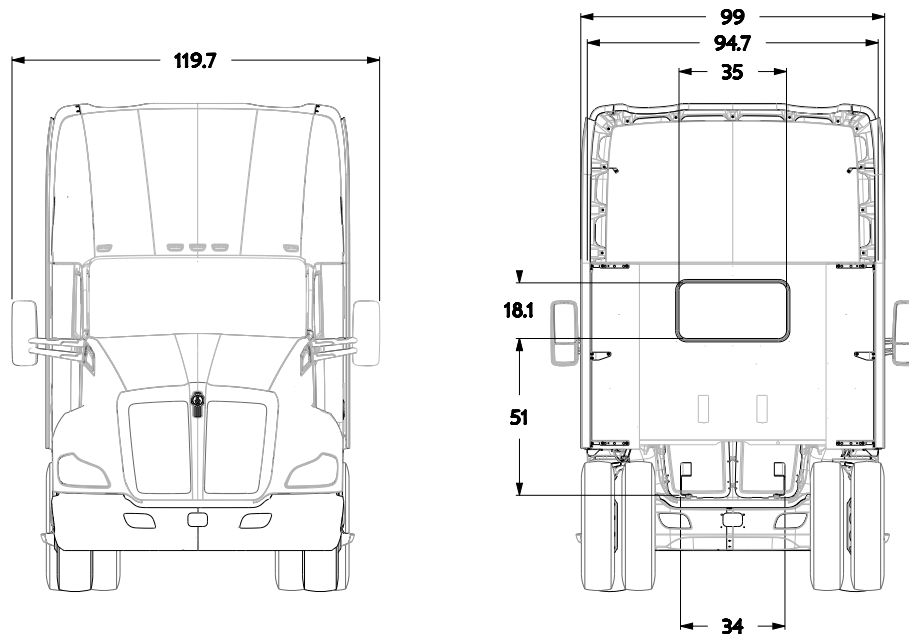
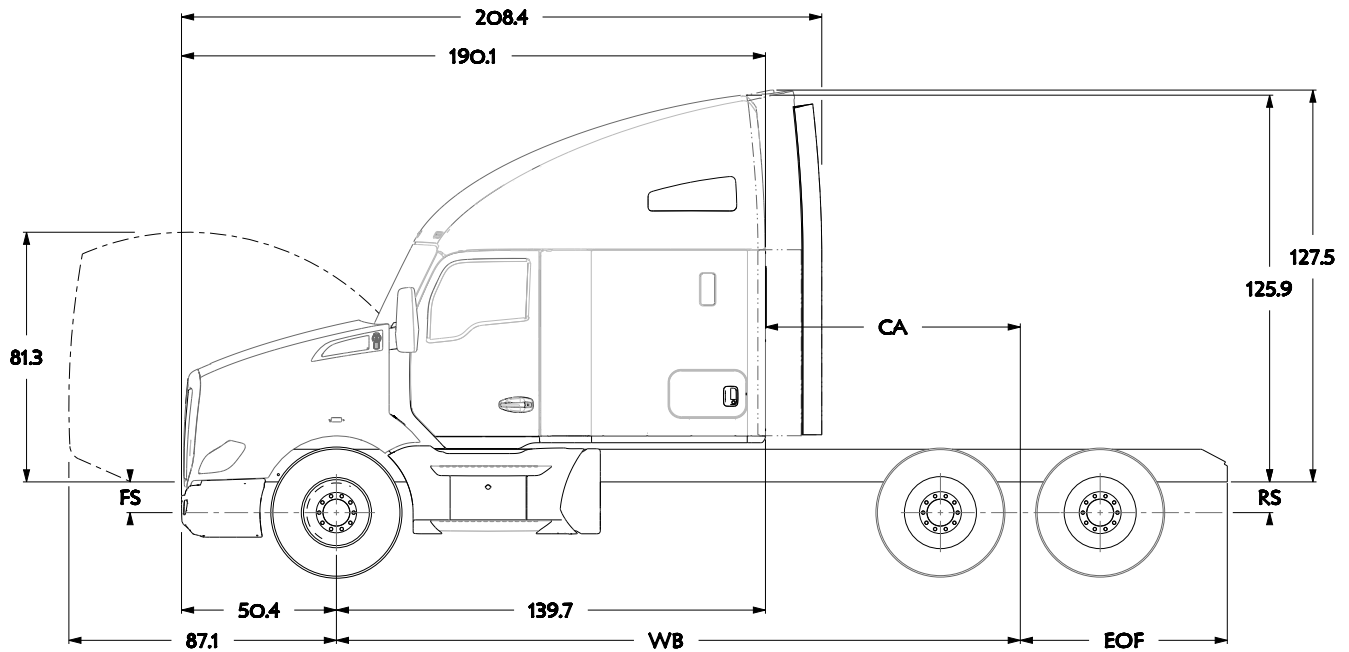


The following drawings are of a standard T880 MX (Short) hood with 52" Sleeper, shown with standard chassis components.



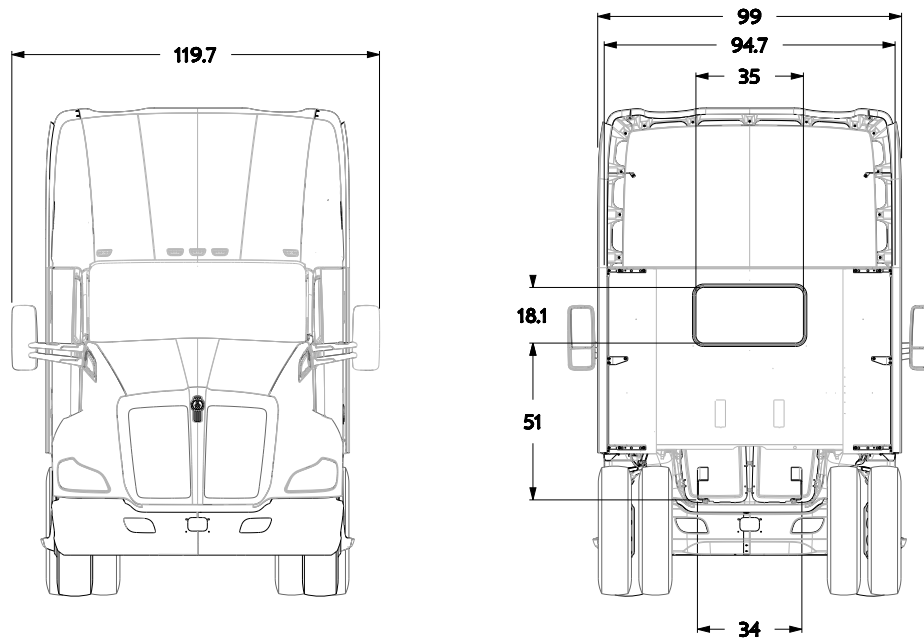
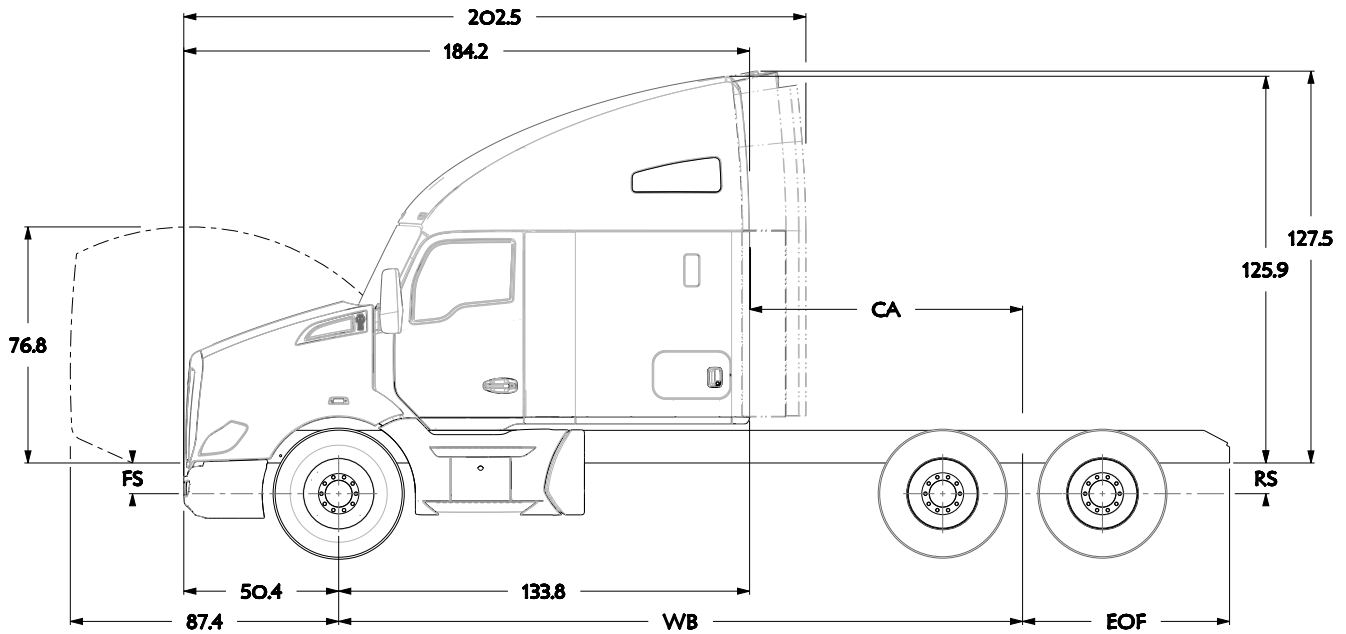
T680 STANDARD HOOD WITH 76" HIGH-ROOF SLEEPER

The following drawings are of a standard T680 Standard Hood with 76" High-Roof Sleeper, shown with standard chassis components.

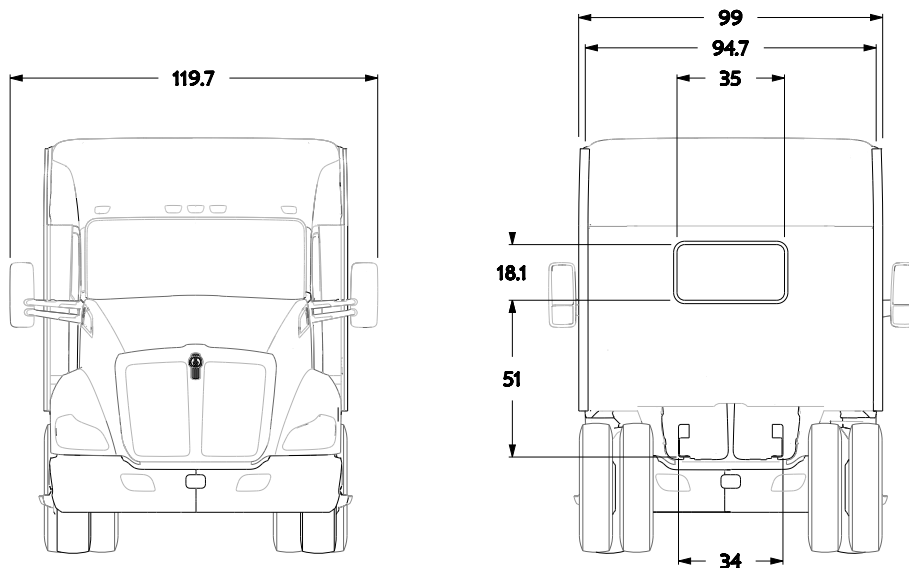


T680 MX (SHORT) HOOD WITH 76" HIGH-ROOF SLEEPER

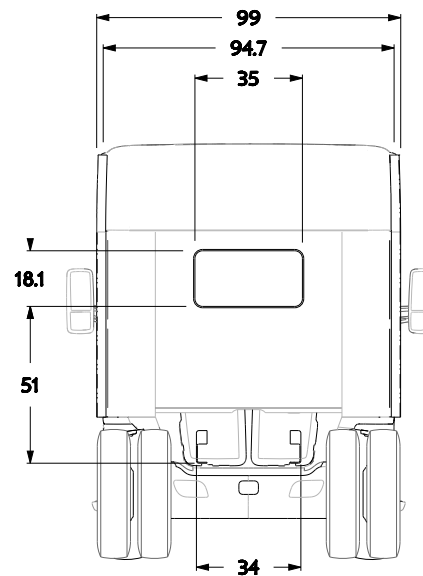
The following drawings are of a standard T680 MX (Short) hood with 76" High-Roof Sleeper, shown with standard chassis components.



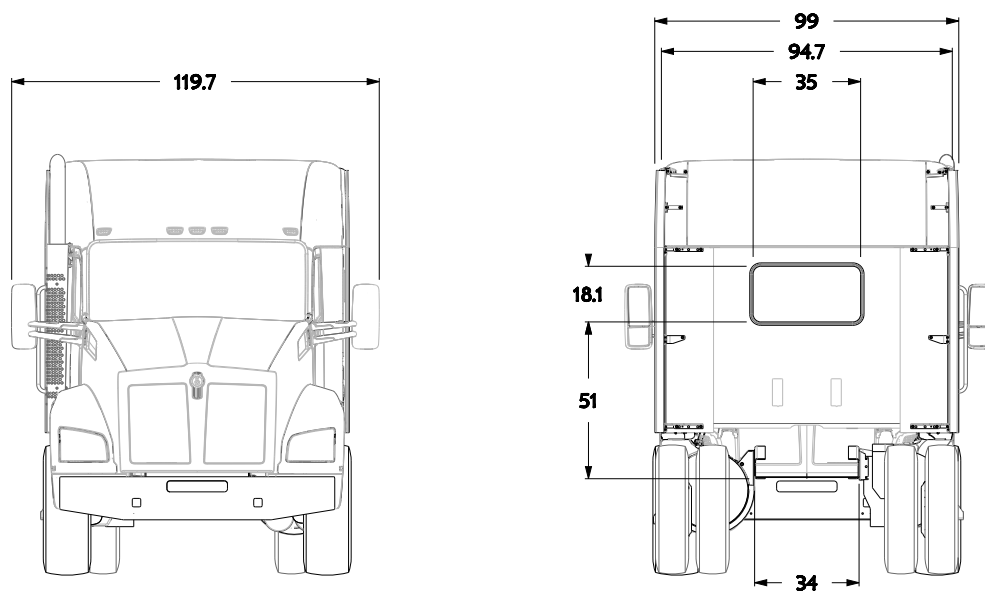
The following drawings are of a standard T680 Standard Hood with 76" Mid-Roof Sleeper, shown with standard chassis components.



The following drawings are of a standard T680 MX (Short) hood with 76" Mid-Roof Sleeper, shown with standard chassis components.



The following drawings are of a standard T880 Standard Hood with 76" Mid-Roof Sleeper, shown with standard chassis components.



The following drawings are of a standard T880 MX (Short) hood with 76" Mid-Roof Sleeper, shown with standard chassis components.



RIDE HEIGHTS

The front (FS) and rear (RS) suspension ride heights are provided as a basic tool to determine the overall height of the cab, height of exhaust components, and frame heights. The heights are all calculated from the centerlines of the axles, please be sure to include the tire radius dimension to determine overall height. Note: the frame rail height itself will not affect the overall height as all components are located from the bottom of the frame rail.

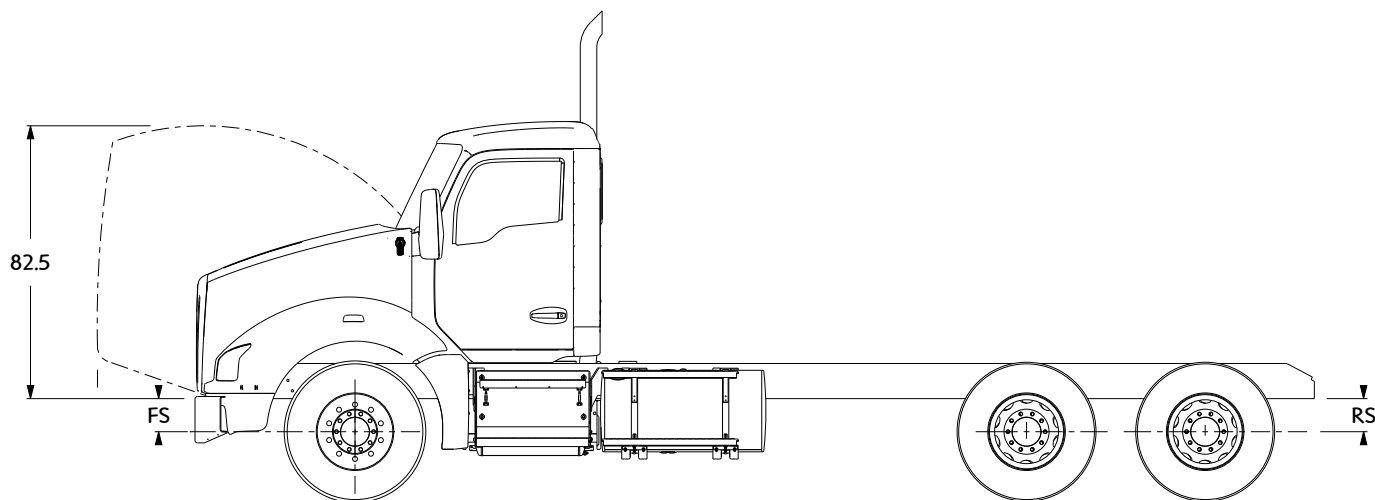


TABLE 3-3. Ride Heights. To calculate the frame height use the following formulas:

Front Frame Height = FS + 1/2 Front Tire Diameter

Rear Frame Height = RS + 1/2 Rear Tire Diameter

Front Suspension (T680/T880)

Front Suspension (FS)	Laden:	Unladen:
12K Taperleaf	10.3"	11.5"
13.2K Taperleaf	10.3"	11.5"
14.6K Taperleaf	10.3"	11.7"
16K Taperleaf	10.6"	12.3"
20K Taperleaf	10.4"	11.9"
22K Multi-stage Taperleaf	10.7"	12.7"

Rear Suspension (All Models). Common Rear Suspensions are shown here, for detailed suspensions please use the Rear suspension layouts on pages 3-18 to 3-33.

Rear Suspension	Laden:	Unladen:
Kenworth AG400L	8.5"	8.5"
Kenworth AG400	9"	9"
Kenworth AG460	10.5"	10.5"
Kenworth AG690 Tridem	10.5"	10.5"
Reyco 79KB 23K Rating	8.3"	10.8"
Reyco 102 38K Rating	9.2"	10.8"
Chalmers 854-40-L-HS 40K Rating	9.6"	11"
Chalmers 854-46-H 46K Rating	10.1"	12.4"
Chalmers 854-50-H-HS 50K Rating	10.8"	12.5"
Chalmers 865-65-XL 65K Rating	13"	15.7"
Hend HMX400 16.5" Saddle	9.5"	10.6"
Hend HMX400 17.5" Saddle	10.5"	11.6"
Hend HMX460 46K 16.5" Saddle	9.5"	10.6"
Hend HMX460 46K 17.5" Saddle	10.5"	11.6"
Hendrickson Primaax EX 46K Rating	10"	10"
Hendrickson RT463 6" Saddle 46K Rating	10"	11.1"
Hendrickson RT463 7.19" Saddle 46K Rating	11.2"	12.5"
Hend RT523 52K 6" Saddle	9.9"	11"
Neway ADZ246 46K Rating	10" or 12"	10" or 12"
Neway ADZ252 52K Rating	10" or 12"	10" or 12"
Neway ADZ369 69K Tridem	10" or 12"	10" or 12"
Neway ADZ378 78K Tridem	10"	10"

REAR SUSPENSION LAYOUTS

The rear suspension layouts are provided as a tool to help layout bodies prior to arrival. The applicable dimensions are shown. Be sure to check the axle spacing that is shown, as alternate spacings may exist and could change some of the dimensions. The dimensions shown below are the most typical installations, in special cases some hole locations will move. If you are planning on using the holes shown for your body installation, please confirm with your local KW dealer that the drawing below will be the installation used on your specific truck. Ensure that proper torque is used to reinstall any suspension components. See Tables 7-1 and 7-2 on page 7-7.

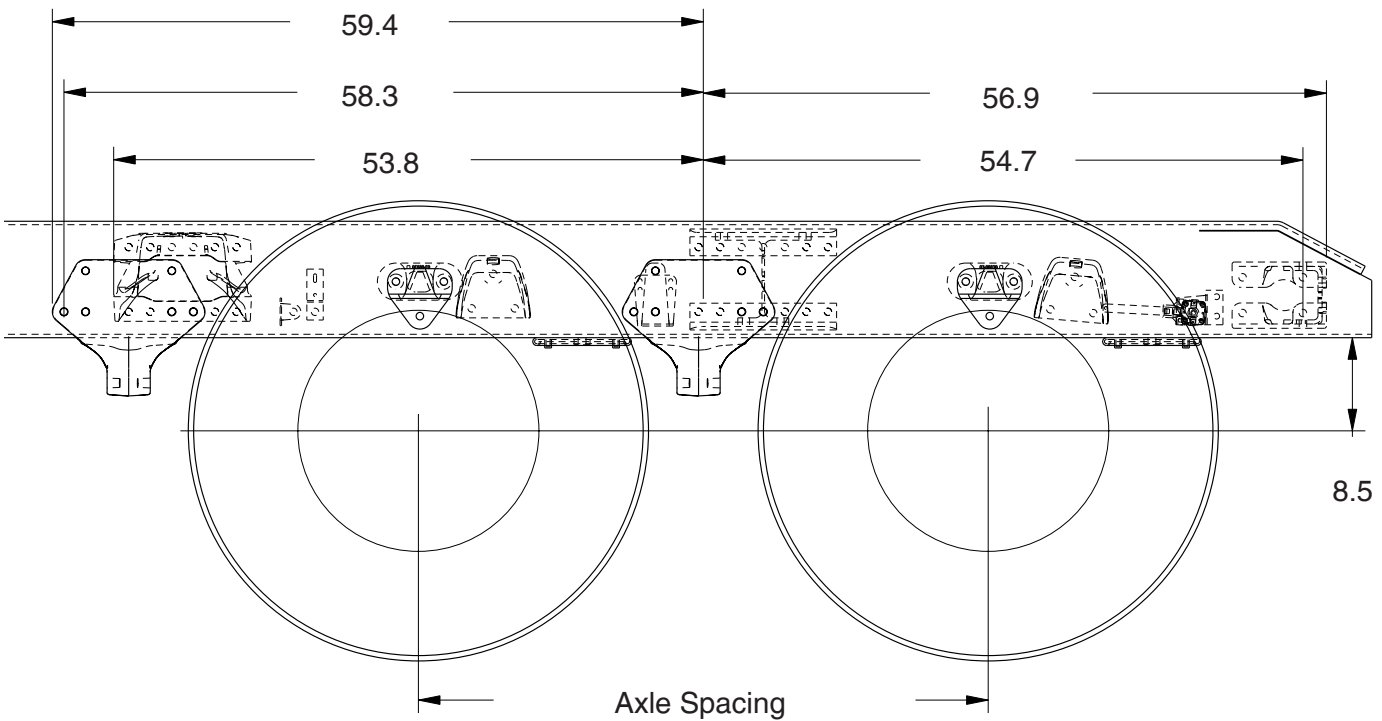
It would be a good idea in this case to order the frame layout of your chassis along with your truck order. This can be done on any Kenworth truck, and will be provided 4 weeks ahead of the build schedule.

If there are hole locations that are not detailed please work with your local Kenworth Dealer to request that information.

Additionally optional axle spacings are shown in the charts, if you would like details on the frame drilling with optional spacings, please contact your local Kenworth dealer.

NOTE: Actual axle spacing can depart from nominal due to axle slant requirements. Final axle spacing can vary by more than an inch from nominal in some cases. If precise axle spacing is critical due to body installation or state/local regulatory requirements please contact Kenworth Applications/technical Support for assistance.

AG400L TANDEM



AG400L Suspensions

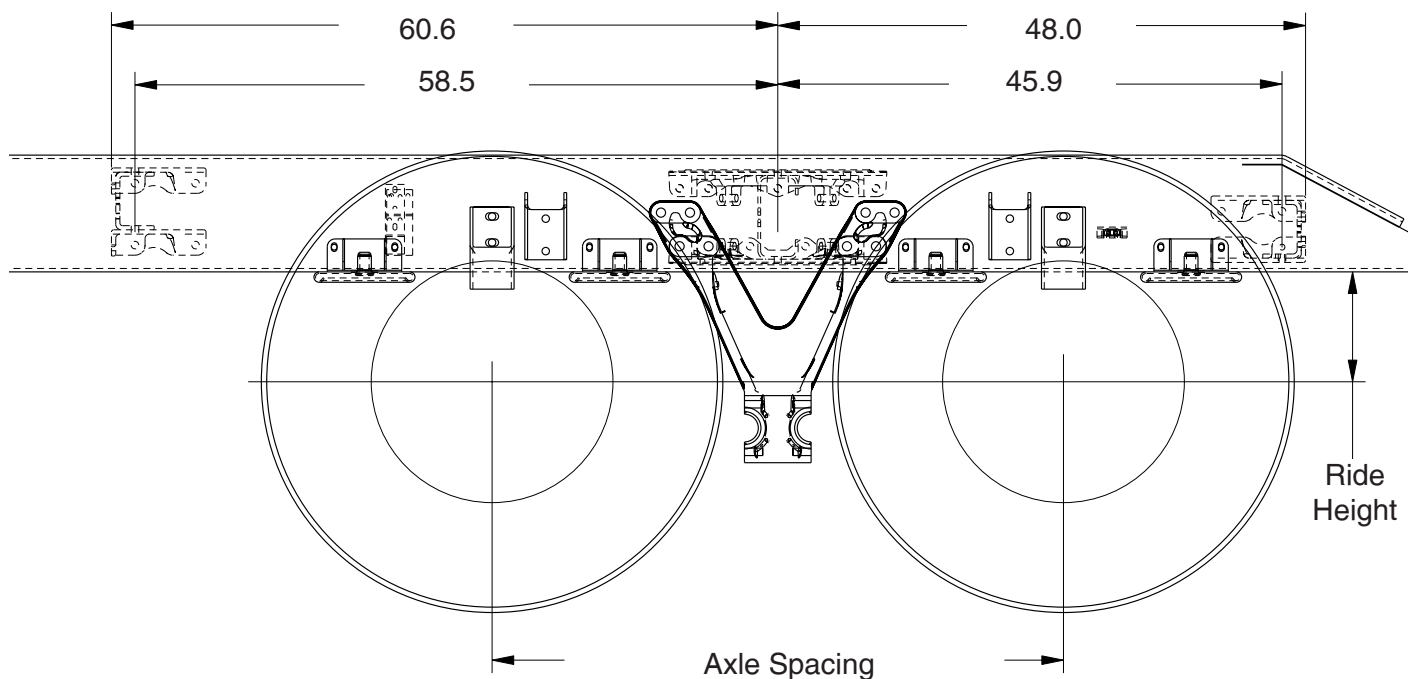
Note: "54" Axle Spacing dimensions shown

TABLE 3-4. Rear Suspension Options

Suspension Type	Rating	Axle Spacing	Laden Ride Height	Unladen Ride Height
AG400L Tandem	40K	52"	8.5"	8.5"
AG400L Tandem	40K	54"	8.5"	8.5"

NOTE: Actual axle spacing can depart from nominal due to axle slant requirements. Final axle spacing can vary by more than an inch from nominal in some cases. If precise axle spacing is critical due to body installation or state/local regulatory requirements please contact Kenworth Applications/technical Support for assistance.

AG400 OR AG460 TANDEM



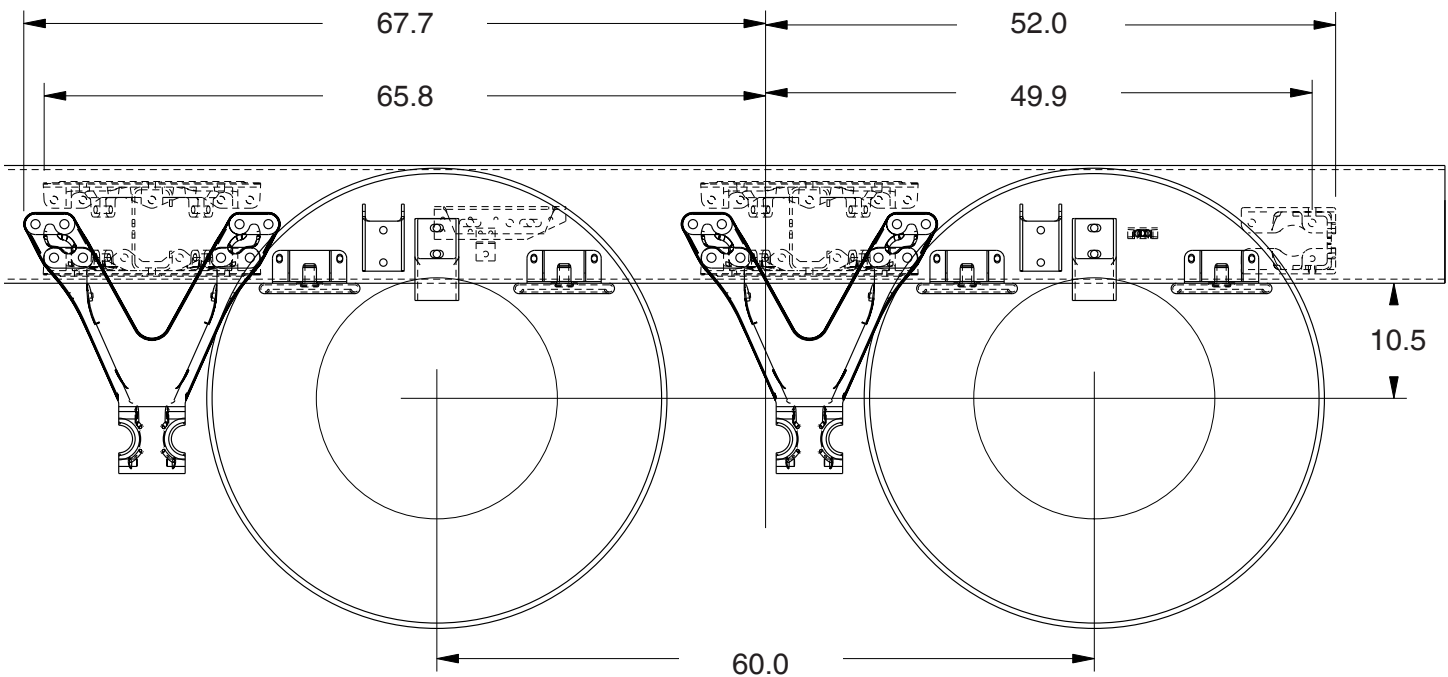
AG400 Suspensions

TABLE 3-5. Rear Suspension Options

Suspension Type	Rating	Axle Spacing	Laden Ride Height	Unladen Ride Height
AG400 Tandem	40K	52"	9"	9"
AG400 Tandem	40K	54"	9"	9"
AG460 Tandem	46K	54"	10.5"	10.5"

NOTE: Actual axle spacing can depart from nominal due to axle slant requirements. Final axle spacing can vary by more than an inch from nominal in some cases. If precise axle spacing is critical due to body installation or state/local regulatory requirements please contact Kenworth Applications/technical Support for assistance.

AG460 TANDEM



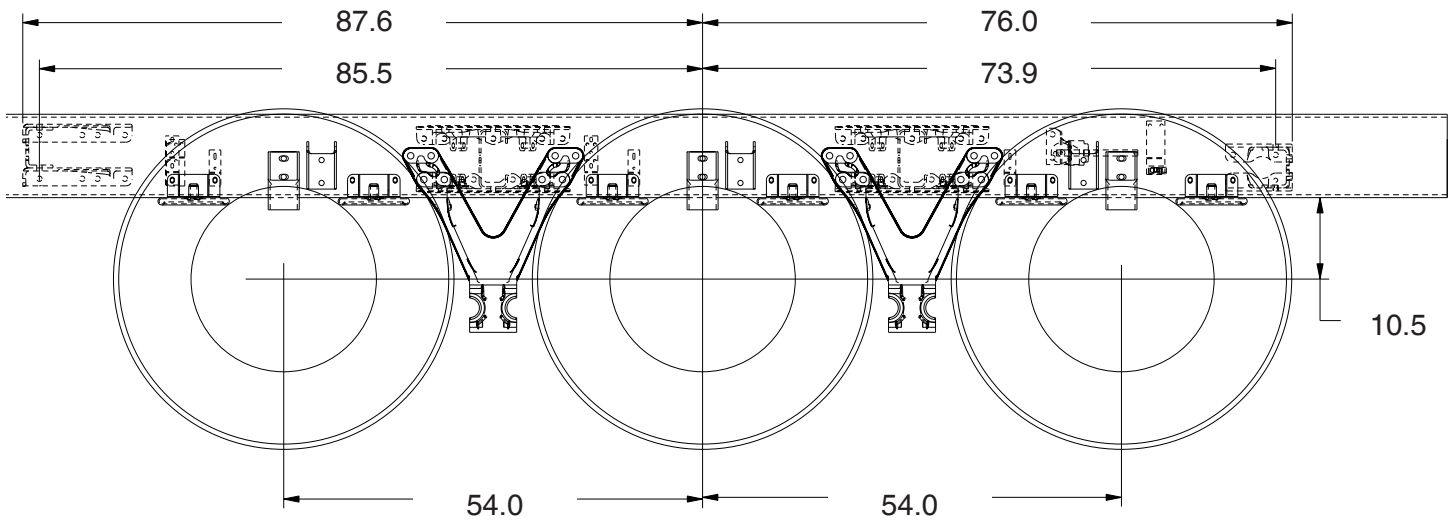
AG460 Suspensions

TABLE 3-6. Rear Suspension Options

Suspension Type	Rating	Axle Spacing	Laden Ride Height	Unladen Ride Height
AG460 Tandem 60" Spacing	46K	60"	10.5"	10.5"

NOTE: Actual axle spacing can depart from nominal due to axle slant requirements. Final axle spacing can vary by more than an inch from nominal in some cases. If precise axle spacing is critical due to body installation or state/local regulatory requirements please contact Kenworth Applications/technical Support for assistance.

AG690 TRIDEM



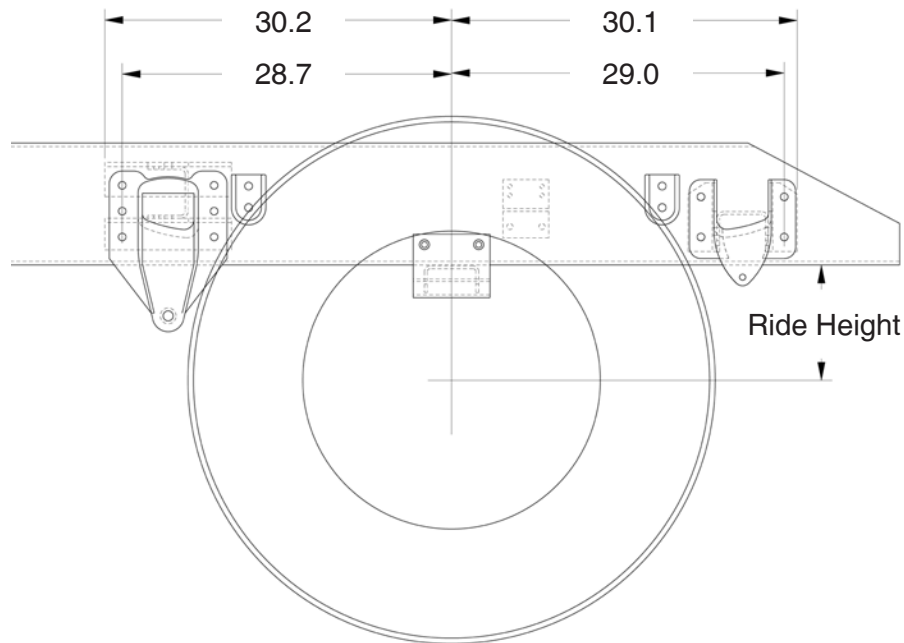
AG690 Tridem Suspension

TABLE 3-7. Rear Suspension Options

Suspension Type	Rating	Axle Spacing	Laden Ride Height	Unladen Ride Height
AG690 Tridem	69K	108" (54" + 54")	10.5"	10.5"

NOTE: Actual axle spacing can depart from nominal due to axle slant requirements. Final axle spacing can vary by more than an inch from nominal in some cases. If precise axle spacing is critical due to body installation or state/local regulatory requirements please contact Kenworth Applications/technical Support for assistance.

REYCO 79KB SINGLE REAR AXLE



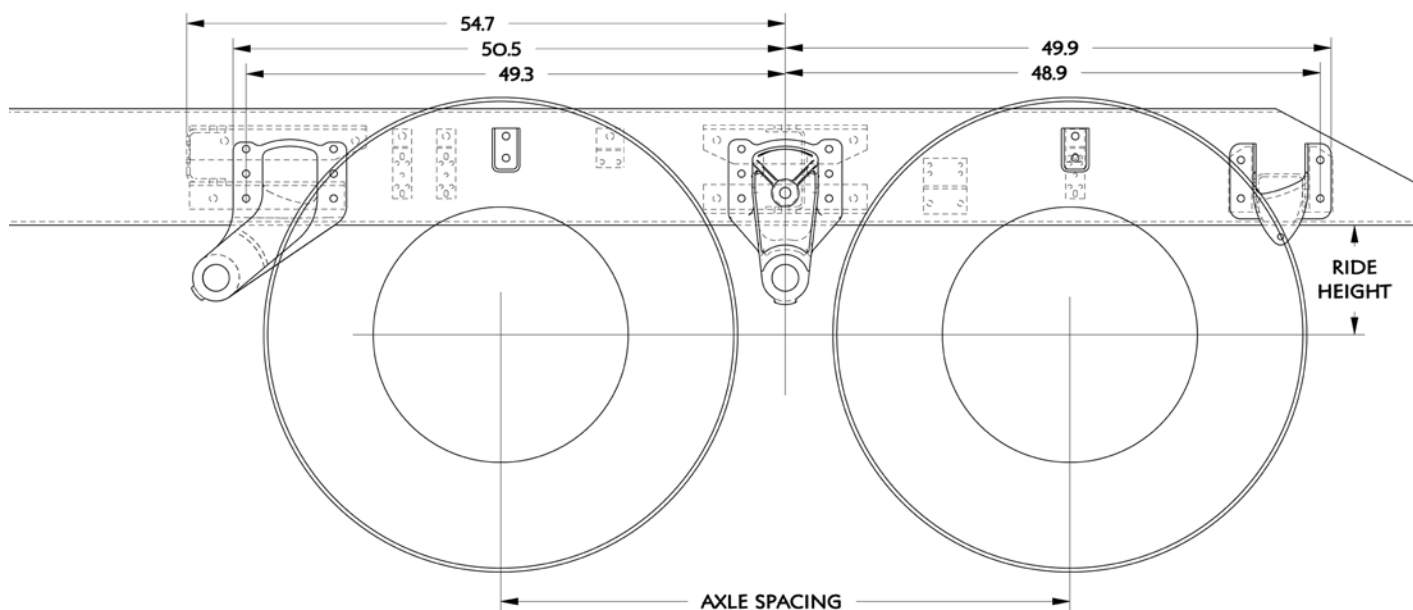
Optional Reyco 79KB Suspensions

TABLE 3-8. Rear Suspension Options

Suspension Type	Rating	Axle Spacing	Laden Ride Height	Unladen Ride Height
Reyco 79KB single	20K	-	8.3"	10.8"
Reyco 79KB single	23K	-	8.3"	10.8"
Reyco 79KB single	26K	-	8.2"	11.3"
Reyco 79KB single	31K	-	9.6"	12.2"

REYCO 102 TANDEM REAR AXLE

Shown with a 52" Axle Spacing



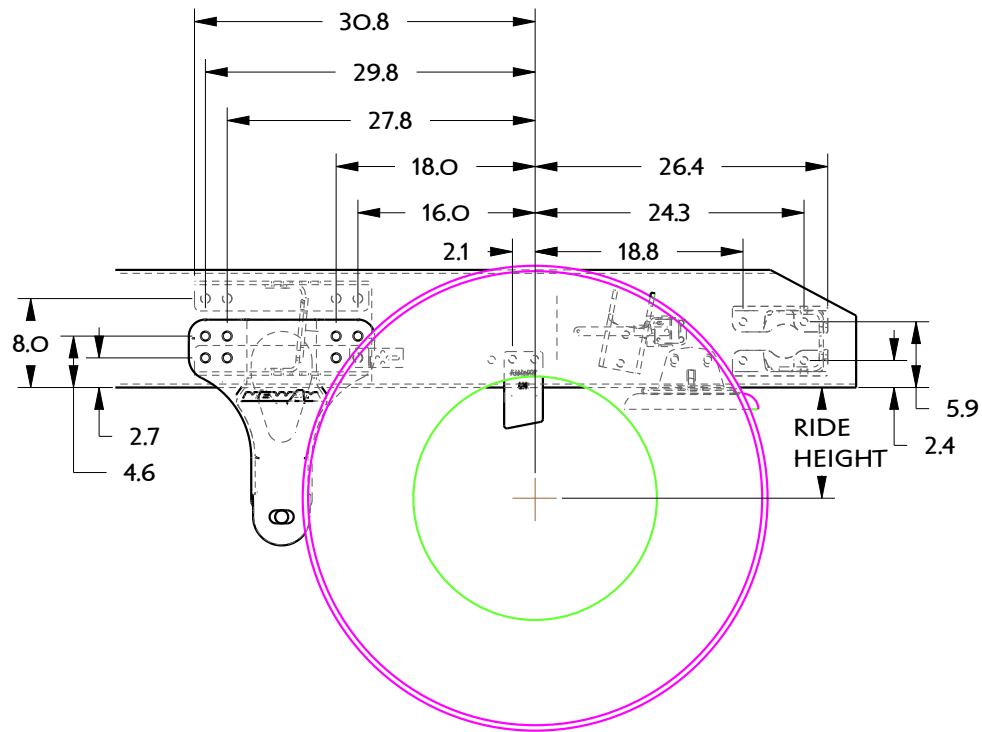
Reyco 102 Suspension Data

TABLE 3-9. Rear Suspension Options

Suspension Type	Rating	Axle Spacing	Laden Ride Height	Unladen Ride Height
Reyco 102 Tandem	38K	52"	9.2"	10.8"

NOTE: Actual axle spacing can depart from nominal due to axle slant requirements. Final axle spacing can vary by more than an inch from nominal in some cases. If precise axle spacing is critical due to body installation or state/local regulatory requirements please contact Kenworth Applications/technical Support for assistance.

NEWAY ADZ 123 SINGLE REAR AXLE



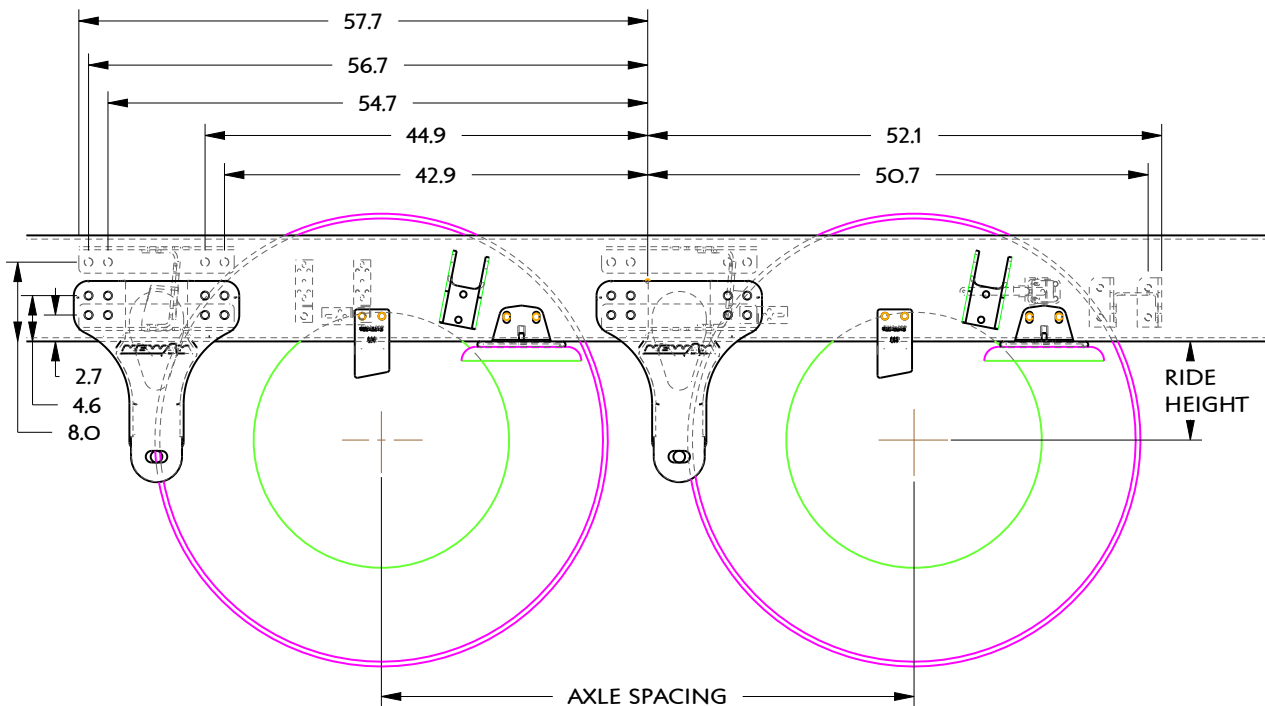
Optional Neway ADZ Single Suspensions

TABLE 3-10. Rear Suspension Options

Suspension Type	Rating	Axle Spacing	Laden Ride Height	Unladen Ride Height
Neway ADZ123 single	23K	-	10"	10"
Neway ADZ126 single	26K	-	10"	10"

NEWAY ADZ 246 TANDEM SUSPENSION

Shown with a 54" Axle Spacing



Optional Neway ADZ Tandem Suspensions

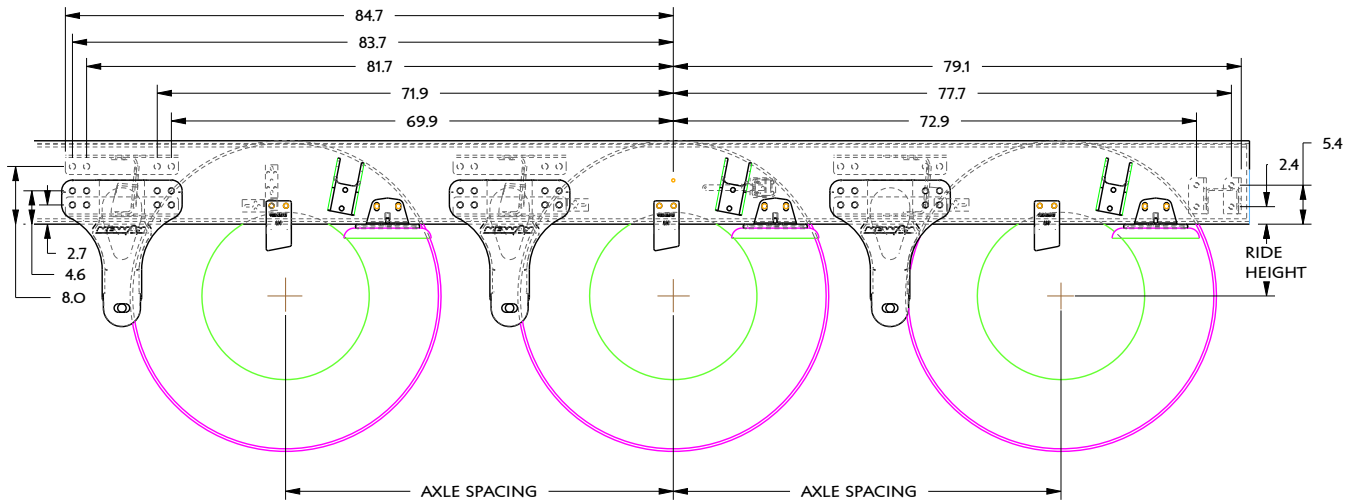
TABLE 3-11. Rear Suspension Options

Suspension Type	Rating	Axle Spacing	Laden Ride Height	Unladen Ride Height
Neway ADZ246 tandem	46K	54"	10"	10"
Neway ADZ246 tandem	46K	60"	10"	10"
Neway ADZ246 tandem	46K	72"	10"	10"
Neway ADZ252 tandem	52K	54"	10"	10"
Neway ADZ252 tandem	52K	54"	12"	12"
Neway ADZ252 tandem	52K	60"	10"	10"
Neway ADZ252 tandem	52K	60"	12"	12"

NOTE: Actual axle spacing can depart from nominal due to axle slant requirements. Final axle spacing can vary by more than an inch from nominal in some cases. If precise axle spacing is critical due to body installation or state/local regulatory requirements please contact Kenworth Applications/technical Support for assistance.

NEWAY ADZ 369 TRIDEM SUSPENSION

Shown with 54" Axle Spacings



Optional Neway ADZ Tridem Suspensions

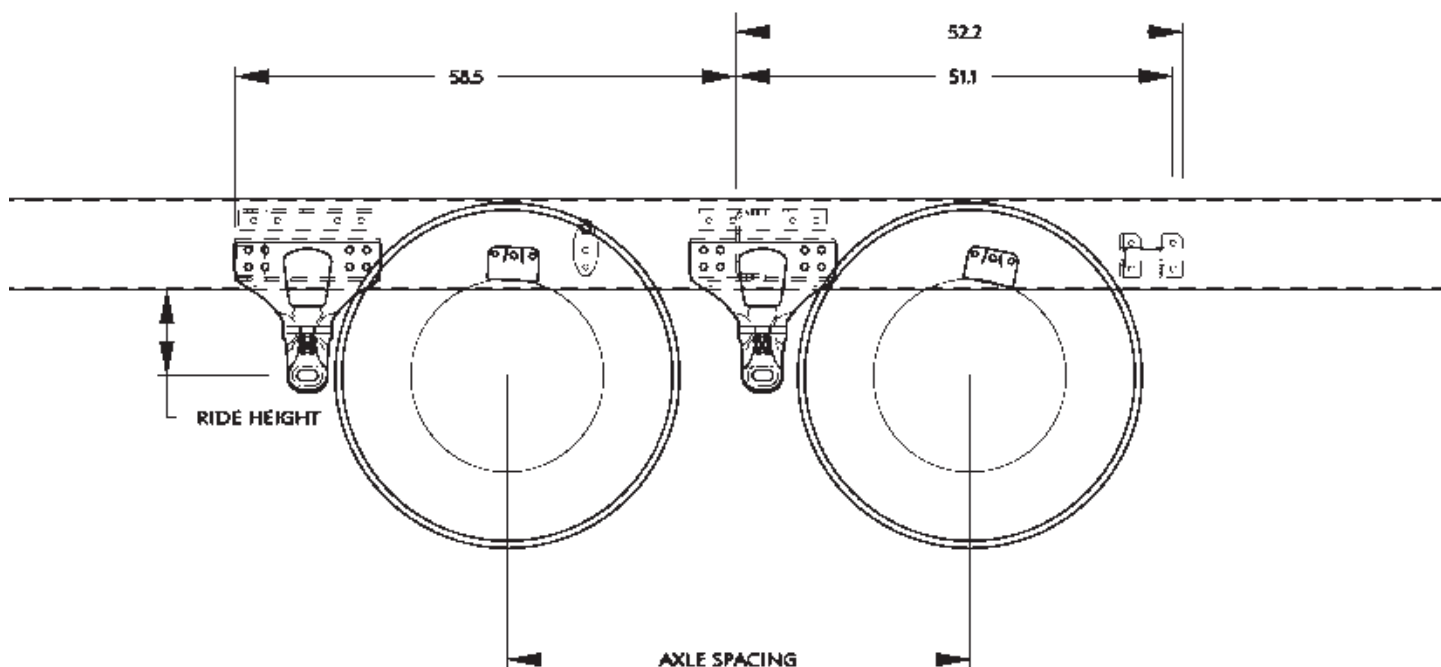
TABLE 3-12. Rear Suspension Options

Suspension Type	Rating	Axle Spacing	Laden Ride Height	Unladen Ride Height
Neway ADZ369 tridem	69K	54"	10"	10"
Neway ADZ369 tridem	69K	54"	12"	12"
Neway ADZ369 tridem	69K	60"	12"	12"
Neway ADZ378 tridem	78K	54"	10"	10"
Neway AD378 tridem	78K	60"	10"	10"

NOTE: Actual axle spacing can depart from nominal due to axle slant requirements. Final axle spacing can vary by more than an inch from nominal in some cases. If precise axle spacing is critical due to body installation or state/local regulatory requirements please contact Kenworth Applications/technical Support for assistance.

HENDRICKSON PRIMAAX EX TANDEM SUSPENSION

Shown with 54" Axle Spacings



Optional Hendrickson Primaax EX Tandem Suspensions

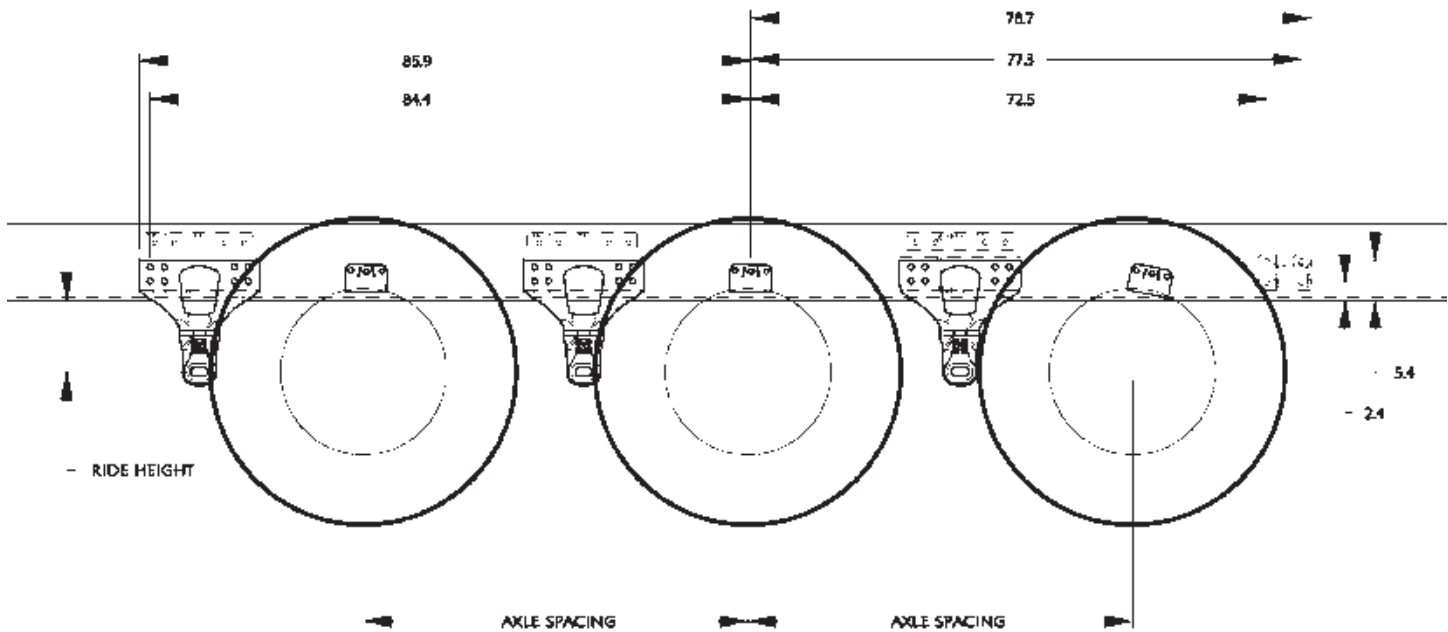
TABLE 3-13. Rear Suspension Options

Suspension Type	Rating	Axle Spacing	Laden Ride Height	Unladen Ride Height
Hendrickson Primaax Tandem	46K	54"	10"	10"
Hendrickson Primaax Tandem	46K	60"	10"	10"
Hendrickson Primaax Tandem	46K	72"	10"	10"

NOTE: Actual axle spacing can depart from nominal due to axle slant requirements. Final axle spacing can vary by more than an inch from nominal in some cases. If precise axle spacing is critical due to body installation or state/local regulatory requirements please contact Kenworth Applications/technical Support for assistance.

HENDRICKSON PRIMAAX EX TRIDEM SUSPENSION

Shown with 54" Axle Spacings



Optional Hendrickson Primaax EX Tridem Suspensions

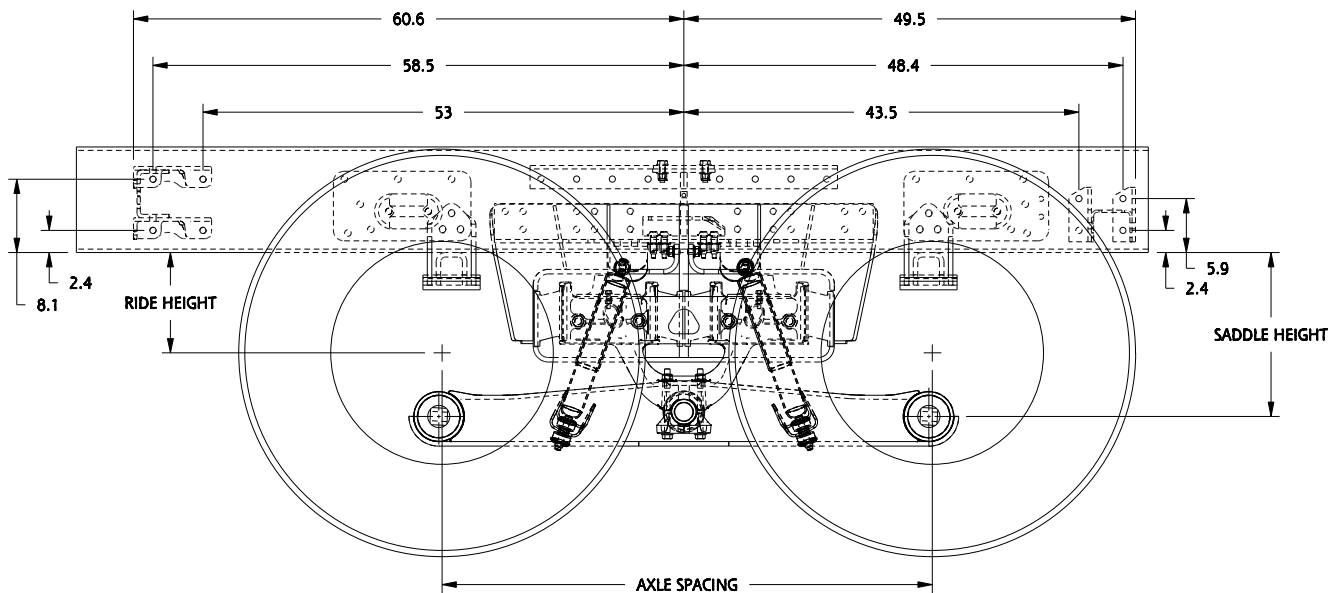
TABLE 3-14. Rear Suspension Options

Suspension Type	Rating	Axle Spacing	Laden Ride Height	Unladen Ride Height
Hendrickson Primaax Tridem	69K	54"	10"	10"
Hendrickson Primaax Tridem	69K	60"	10"	10"

NOTE: Actual axle spacing can depart from nominal due to axle slant requirements. Final axle spacing can vary by more than an inch from nominal in some cases. If precise axle spacing is critical due to body installation or state/local regulatory requirements please contact Kenworth Applications/technical Support for assistance.

HENDRICKSON UMX TANDEM SUSPENSION

Shown with 54" Axle Spacing



Optional Hendrickson HMX Tandem Suspensions

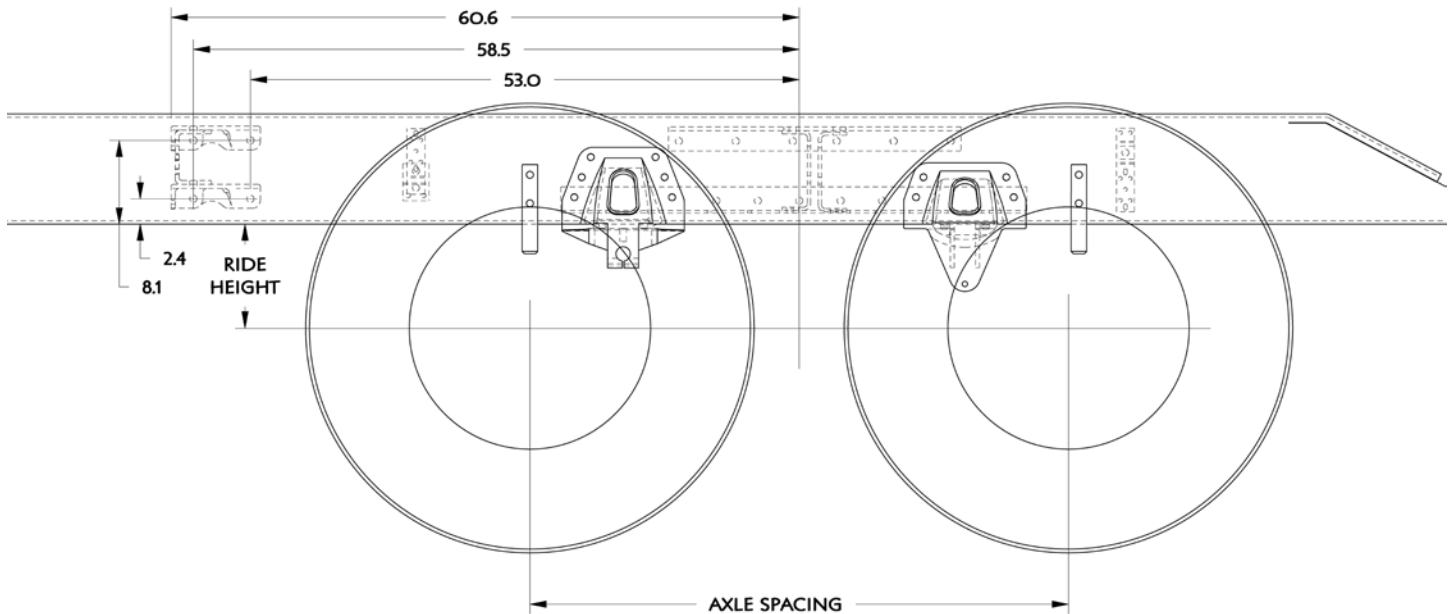
TABLE 3-15. Rear Suspension Options

Suspension Type	Rating	Axle Spacing	Laden Ride Height	Unladen Ride Height
Hendrickson ULTIMAAX 460 17.5" Saddle Height	46K	54"	11"	12.5"
Hendrickson ULTIMAAX 460 18.25" Saddle Height	46K	54"	11"	12.5"
Hendrickson ULTIMAAX 460 17.5" Saddle Height	46K	60"	11"	12.5"
Hendrickson ULTIMAAX 460 18.25" Saddle Height	46K	60"	11"	12.5"
Hendrickson ULTIMAAX 520 17.5" Saddle Height	52K	54"	11"	12.5"
Hendrickson ULTIMAAX 520 18.25" Saddle Height	52K	54"	11"	12.5"
Hendrickson ULTIMAAX 520 17.5" Saddle Height	52K	60"	11"	12.5"
Hendrickson ULTIMAAX 520 18.25" Saddle Height	52K	60"	11"	12.5"

NOTE: Actual axle spacing can depart from nominal due to axle slant requirements. Final axle spacing can vary by more than an inch from nominal in some cases. If precise axle spacing is critical due to body installation or state/local regulatory requirements please contact Kenworth Applications/technical Support for assistance.

HENDRICKSON RT TANDEM SUSPENSION

Shown with a 54" Axle Spacing Without Track Rods



Optional Hendrickson RT Tandem Suspensions

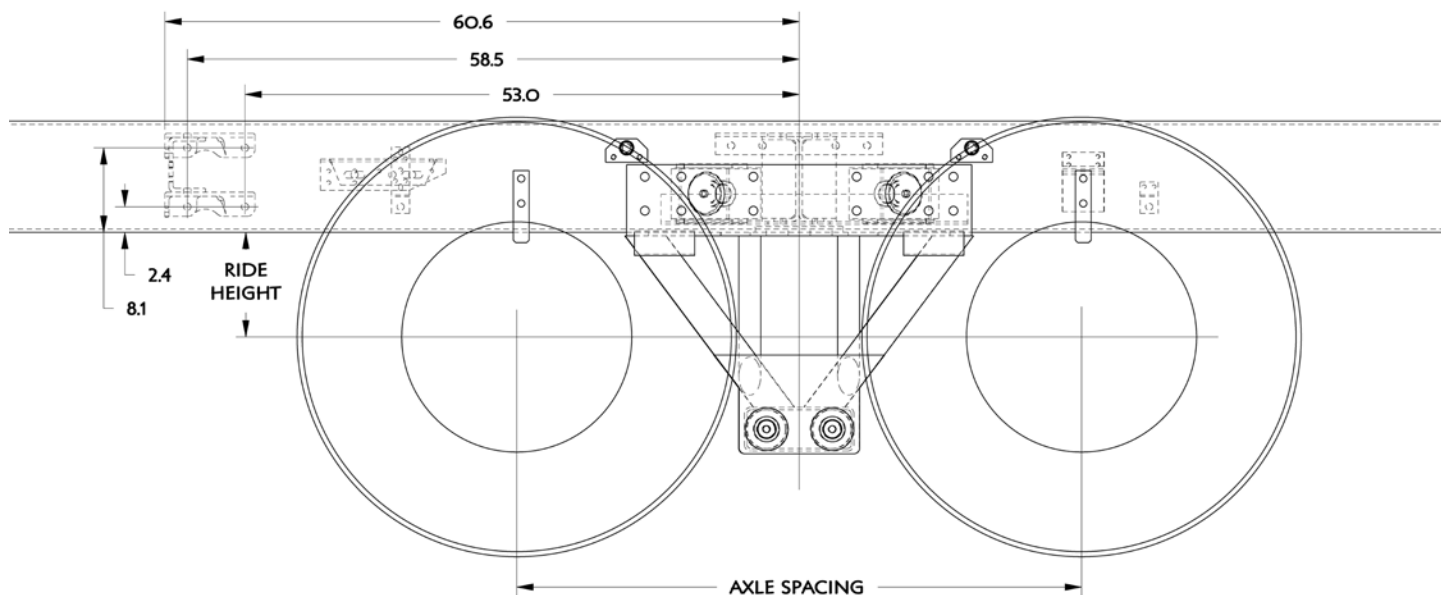
TABLE 3-16. Rear Suspension Options

Suspension Type	Rating	Axle Spacing	Laden Ride Height	Unladen Ride Height
Hendrickson RT463 6" saddle	46K	52"	10.0"	11.1"
Hendrickson RT463 6" saddle	46K	54"	10.0"	11.1"
Hendrickson RT463 7.19" saddle	46K	54"	11.2"	12.5"
Hendrickson RT463 7.94" saddle	46K	54"	11.9"	13.3"
Hendrickson RT463 6" saddle	46K	60"	10.0"	11.1"
Hendrickson RT463 7.94" saddle	46K	60"	11.9"	13.0"
Hendrickson RTE463 7.19" saddle	46K	52"	10.5"	11.6"
Hendrickson RT523 6" saddle	52K	52"	9.9"	11.0"
Hendrickson RT523 6" saddle	52K	54"	9.9"	11.0"
Hendrickson RT523 7.19" saddle	52K	54"	11.1"	12.2"
Hendrickson RT523 11" saddle	52K	54"	14.9"	16.0"
Hendrickson RT523 6" saddle	52K	60"	9.9"	11.0"
Hendrickson RT523 7.19" saddle	52K	60"	11.1"	12.2"

NOTE: Actual axle spacing can depart from nominal due to axle slant requirements. Final axle spacing can vary by more than an inch from nominal in some cases. If precise axle spacing is critical due to body installation or state/local regulatory requirements please contact Kenworth Applications/technical Support for assistance.

CHALMERS 856-46 TANDEM SUSPENSION

Shown with a 54" Axle Spacing



Optional Chalmers Tandem Suspensions

TABLE 3-17. Rear Suspension Options

Suspension Type	Rating	Axle Spacing	Laden Ride Height	Unladen Ride Height
Chalmers 854-40-L	40K	54"	8.9"	11.1"
Chalmers 854-40-L-HS	40K	54"	9.6"	11.1"
Chalmers 854-40-H	40K	54"	10.2"	12.4"
Chalmers 854-40-H-HS	40K	54"	10.9"	12.4"
Chalmers 854-46-L	46K	54"	8.9"	11.3"
Chalmers 854-46-L-HS	46K	54"	9.6"	11.3"
Chalmers 854-46-H	46K	54"	10.1"	12.5"
Chalmers 854-46-H-HS	46K	54"	10.9"	12.5"
Chalmers 854-50-L	50K	54"	8.9"	11.3"
Chalmers 854-50-L-HS	50K	54"	9.6"	11.3"
Chalmers 854-50-H	50K	54"	10.1"	12.5"

TABLE 3-17 CONTINUES ON NEXT PAGE...

TABLE 3-17 CONTINUED

Suspension Type	Rating	Axle Spacing	Laden Ride Height	Unladen Ride Height
Chalmers 854-50-H-HS	50K	54"	10.9"	12.5"
Chalmers 854-52-L-HS	52K	54"	9.6"	11.3"
Chalmers 854-52-H-HS	52K	54"	10.9"	12.5"
Chalmers 860-40-L	40K	60"	8.9"	11.1"
Chalmers 860-46-L	46K	60"	8.9"	11.3"
Chalmers 860-46-L-HS	46K	60"	9.6"	11.3"
Chalmers 860-46-H	46K	60"	10.1"	12.5"
Chalmers 860-46-H-HS	46K	60"	10.9"	12.5"
Chalmers 860-52-H	52K	60"	10.9"	12.5"
Chalmers 872-46-H-HS	46K	72"	11.0"	12.5"

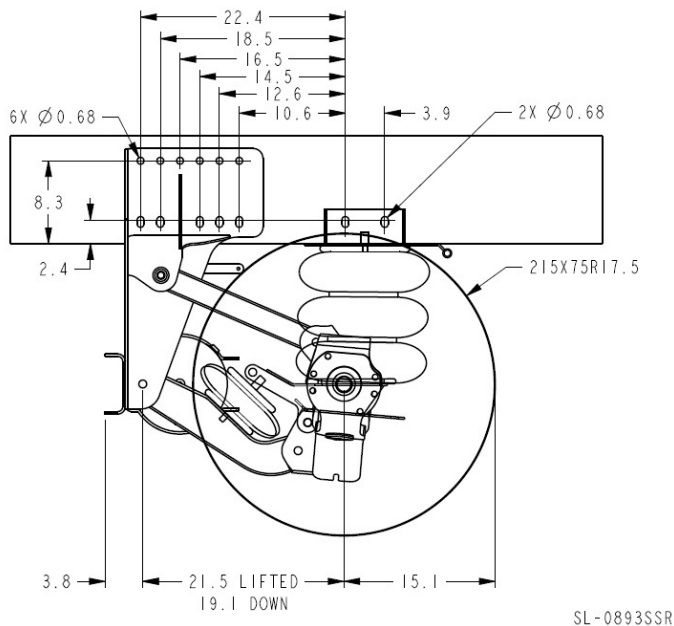
NOTE: Actual axle spacing can depart from nominal due to axle slant requirements. Final axle spacing can vary by more than an inch from nominal in some cases. If precise axle spacing is critical due to body installation or state/local regulatory requirements please contact Kenworth Applications/technical Support for assistance.

LIFT AXLES (PUSHERS AND TAGS)

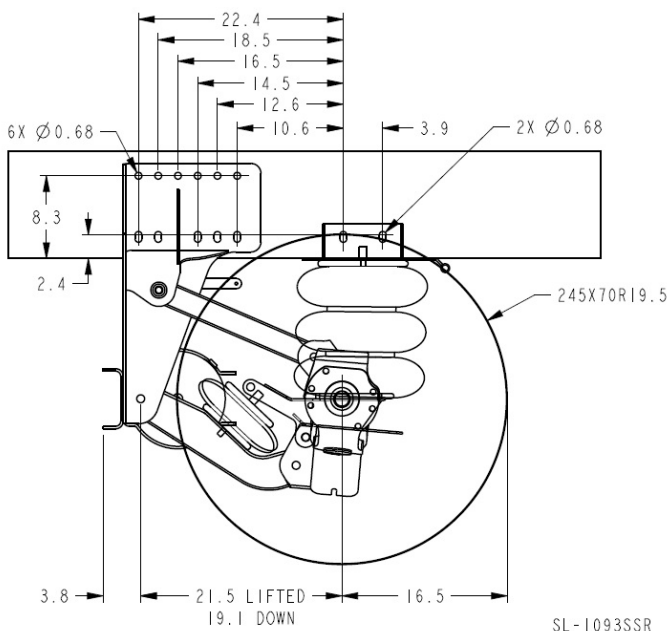
The rear pusher axle layouts are provided as a tool to help layout bodies prior to arrival. The applicable dimensions are shown. When using the pusher layouts to determine available frame space please be aware that clearances required are not shown. For information that may not be detailed in these drawings work with your local Kenworth Dealer to request that information.

Kenworth will automatically install highest lift axle kit as applicable based on chassis frame height and loading conditions. Lift axle available run range it utilized, along with frame height and lift axle tire size to identify applicable kits that can be installed. Installing highest lift axle kit will maximize ground clearance when axle is in lifted state. If needed, kit may be lowered in order to clear driveline when in lifted state.

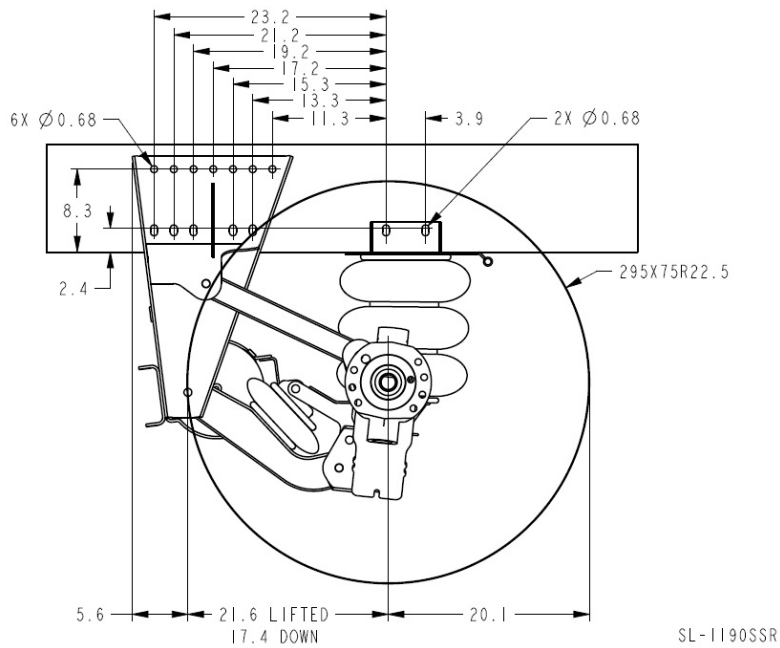
Watson & Chalin 8K Steerable (SL0893SSR)



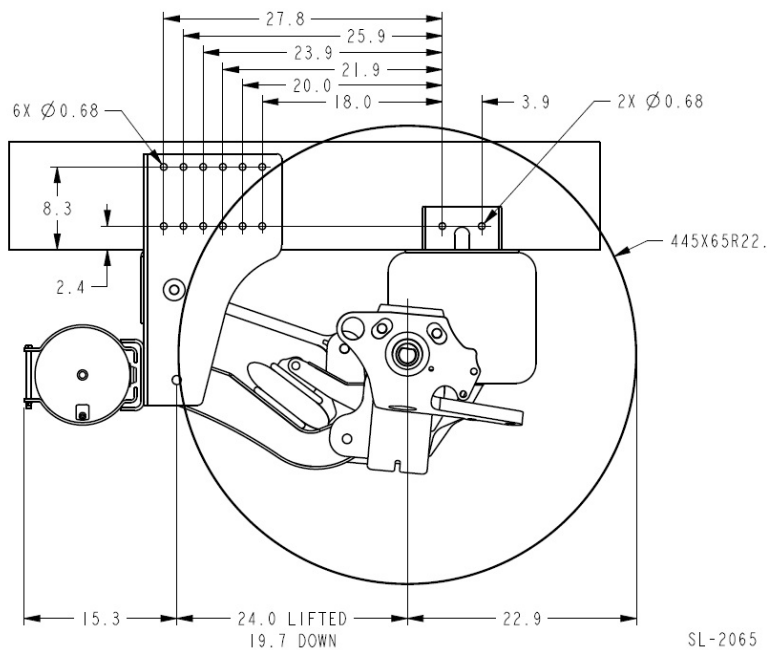
Watson & Chalin 10K Steerable (SL1093SSR)



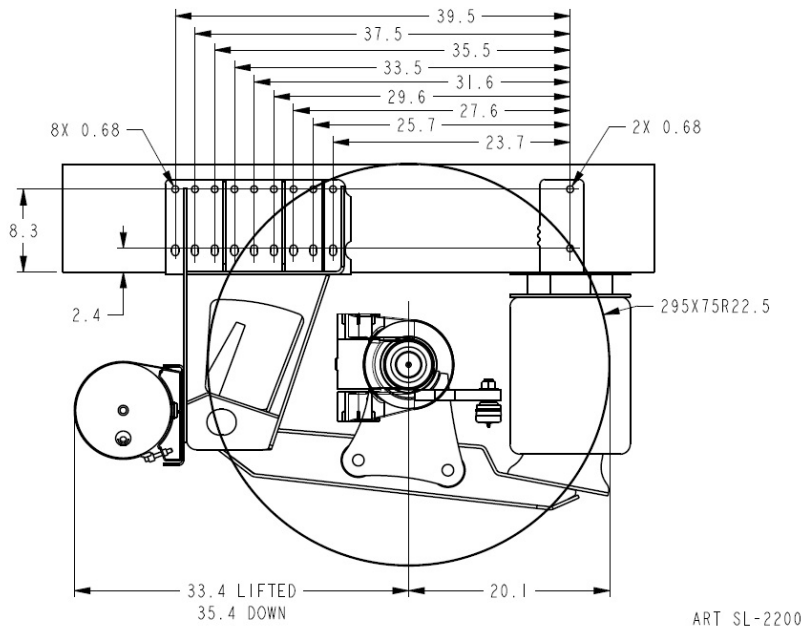
Watson & Chalin Tru Track Alumilite 13.5K Steerable (SL1190SSR)



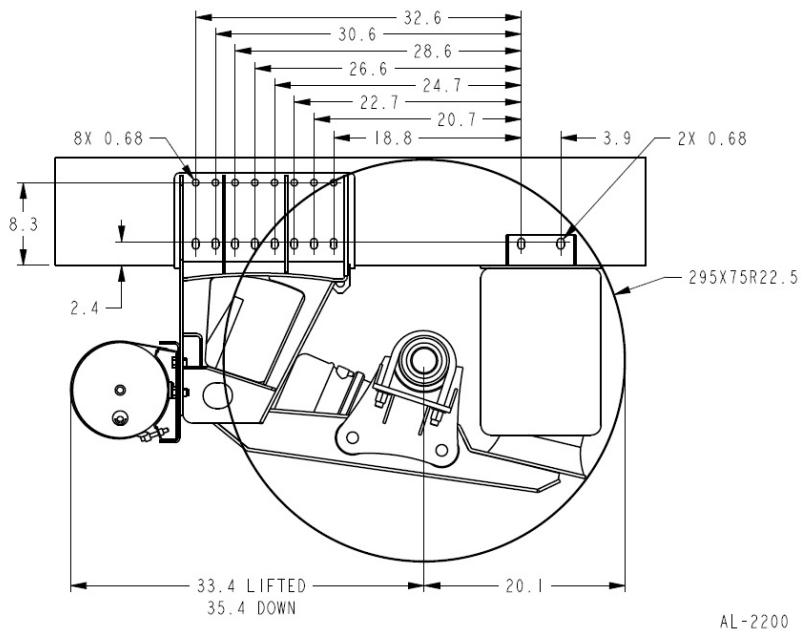
Watson & Chalin Tru Track 20K Steerable (SL2065)



Watson & Chalin 23K Steerable (SL2200) *Use with Duals Only*



Watson & Chalin 23K Non-Steerable (AL2200)



AXLE TRACK AND TIRE WIDTH

The dimensions provided in this section are representative of some typical product combinations. The purpose this section is to demonstrate some of the typical dimensions.

- **Axle Track:** The distance between the dual tire centerlines on a dual tire arrangement or the distance between the tire centerlines on a single tire arrangement.
- **Width:** The distance over the outermost tire sidewall to sidewall.

These dimensions may be significant to the following:

- Appearance relative to other tires and chassis mounted equipment.
- Load carrying capacity. Different wheel disc offset can have a positive or negative impact on the axle carrying capacity of the axle.

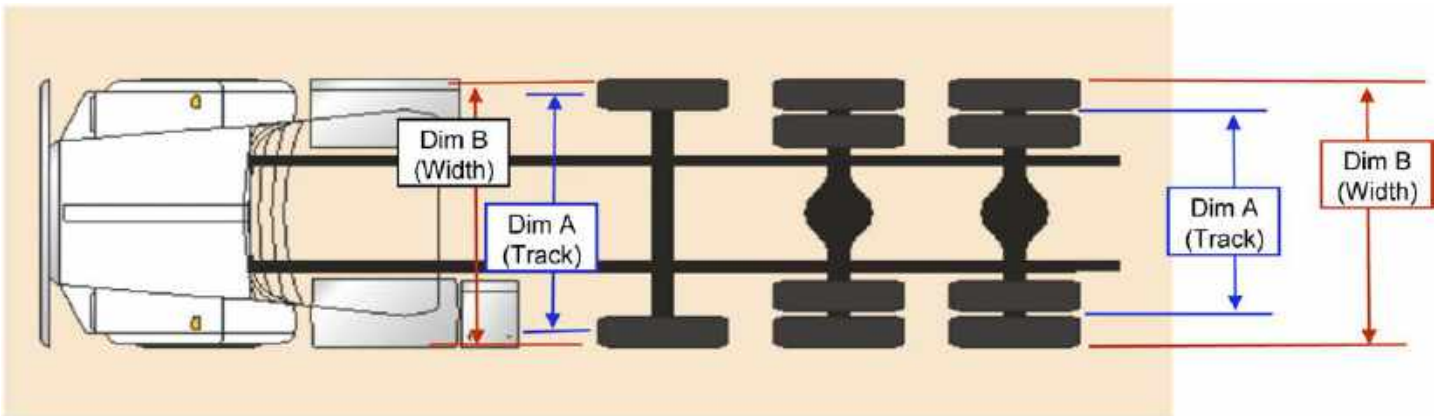


TABLE 3-18. Axle Width Calculation.

Axle - Drive	Wheel	Tire	Configuration	Track Dim "A"	Overall Width Dim "B":
Meritor RT46-160(P)(EH) 46K Dual Dana Spicer D46-170(H)(P) 46K Dual	Alcoa 88367 22.5X8.25	11R22.5	4-4	73.3"	97.8"
Meritor RT46-160(P)(EH) 46K Dual Dana Spicer D46-170(H)(P) 46K Dual	Alcoa 98363 24.5X8.25	11R24.5	4-4	73.6"	98.0"
Meritor RT46-160WT(P)(EH) 46K Dual Wide Track Dana Spicer D46-170W(H)(P) 46K Dual Wide Track	Alcoa 88367 22.5X8.25	11R22.5	4-4	79.2"	103.7"
Meritor RT46-160WT(P)(EH) 46K Dual Wide Track Dana Spicer D46-170W(H)(P) 46K Dual Wide Track	Alcoa 98363 24.5X8.25	11R24.5	4-4	79.5"	103.9"
Dana Spicer D46-170(H)(P) 46K Dual Meritor RT46-160(P)(EH) 46K Dual	Alcoa 82262 22.5X12.25	425/65R22.5	2-4	72.7	88.9"
Meritor RT46-160WT(P)(EH) 46K Dual Wide Track Dana Spicer D46-170W(H)(P) 46K Dual Wide Track	Alcoa 82262 22.5X12.25	425/65R22.5	2-4	78.7"	94.9"

TABLE 3-18 CONTINUES ON NEXT PAGE...

Section 3 Dimensions

<https://truckmanualshub.com/>

TABLE 3-18 CONTINUED

Axle - Steer	Wheel	Tire	Brake Drum Type	Track Dim "A"	Overall Width Dim "B:
Meritor MFS13 Std Track Dana Spicer E-1322I 13.2K	Alcoa 98363 24.5X8.25	11R24.5	CAST	80.2"	91.0"
Meritor MFS13 Wide Track Dana Spicer E-1322W 13.2K	Alcoa 98363 24.5X8.25	11R24.5	CAST	82.2"	93.0"
Meritor MFS20 Std Track Dana Spicer D2000 20K	Alcoa 82362 22.5X12.25	425/65R22.5	CAST	86.5"	102.7"
Meritor MFS20 Std Track Dana Spicer D2000 20K	Alcoa 82462 22.5X12.25	425/65R22.5	CAST	82.6"	98.8"

Lift Axle Model	Wheel	Tire	Wheel Orientation	Track Dim "A"	Overall Width Dim "B"
W&C SL0893SSR 8K Steerable	Alcoa 66480 17.5x6	215/75R17.5	Same as FR	77.3"	85.8"
W&C SL1093SSR Steerable 10K	Alcoa 77349 19.5x7.5	265/70R19.5	Same as FR	78.5"	88.5"
W&C SL1190SSR Steerable 13.5K	Alcoa 88367 22.5x8.25	255/70R22.5	Same as FR	80.4"	90.7"
W&C SL2065 Steerable 20K	Alcoa 82362 22.5x12.25	425/65R22.5	Same as FR	83.6"	99.8"
W&C SL2200 Steerable 23K	Alcoa 88367 22.5x8.25	295/75R22.5	Same as RR, dual	78.2"	102.8"
W&C AL2200-STD Track Non-Steerable 23K	Alcoa 88367 22.5x8.25	11R22.5	Same as RR, dual	72.2"	96.6"
W&C AL2200-STD Track Non-Steerable 23K	Alcoa 82362 22.5x12.25	425/65R22.5	Same as RR, single	78.4"	94.7"
W&C AL2200-Wide Track Non-Steerable 23K	Alcoa 89465 22.5x9	315/80R22.5	Same as FR, single	64.7"	77.3"
W&C AL2200-Wide Track Non-Steerable 23K	Alcoa 84362 22.5x14	445/50R22.5	Same as RR, single	80.6"	97.7"

GROUND CLEARANCE

This information is provided as a reference, not all optional equipment is included. In order to calculate the height on your specific chassis, please use the ride height information provided on page 3-14. For comparison the FS value shown is 11.4" unladen and 10.4" laden.

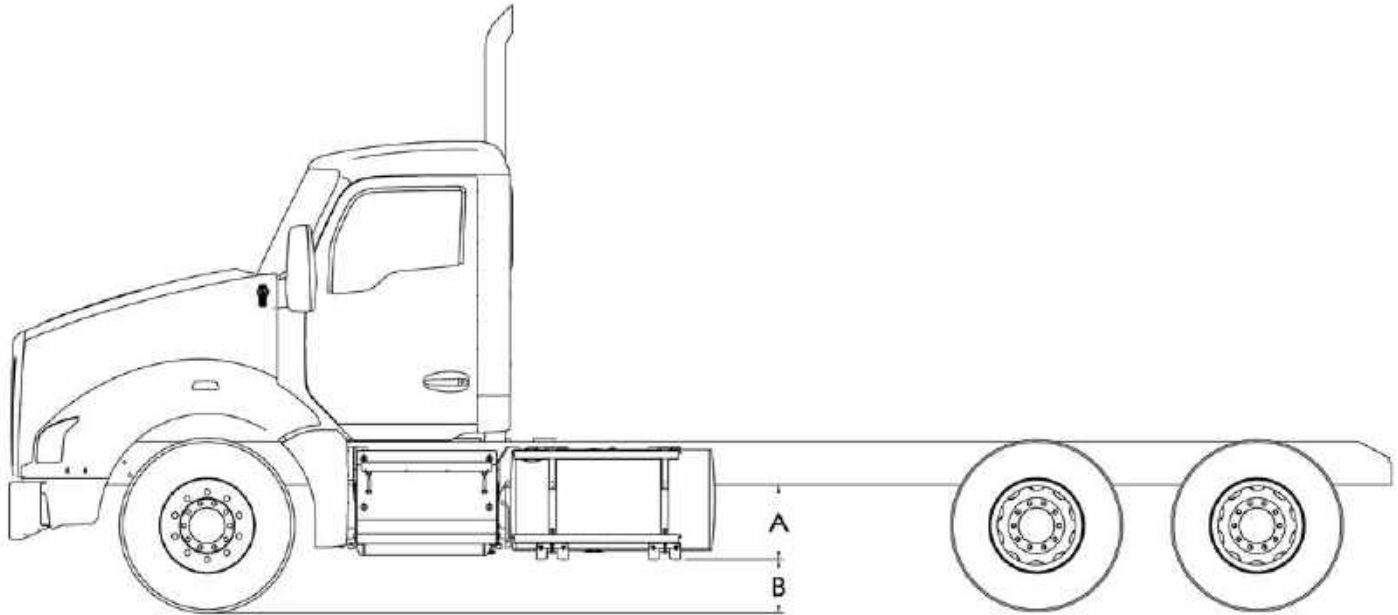


TABLE 3-19. Ground Clearance for Fuel Tanks

Front Suspension	Front Tires	Rear Suspension	Rear Tires	Fuel Tank Size	Component	Dimension "A" Distance from Bottom of Frame Rail (in)	Dimension "B" Ground Clearance (in)	
							Unladen	Laden
20K Taperleaf Spring	425/65R22.5	Hendrickson HMX 460 17.5" Saddle Height	11R24.5	22" Diameter	Fuel Tank	16.3	17.2	14.9
					DEF Tank	15.3	18.2	15.9
				24.5" Diameter	Fuel Tank	18.2	15.3	13
					DEF Tank	15.8	17.7	15.4
				28.5" Diameter	Fuel Tank	21.4	12	9.7
					DEF Tank	17.2	16.2	13.9

Section 3 Dimensions

<https://truckmanualshub.com/>

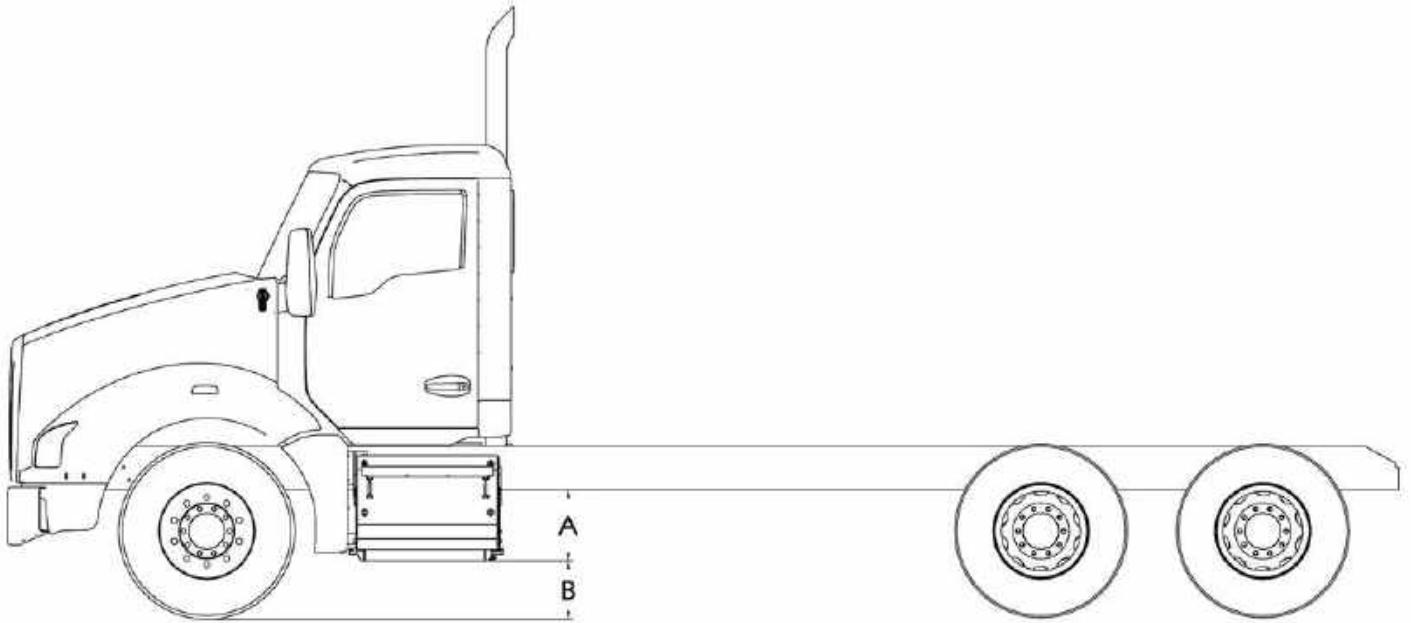


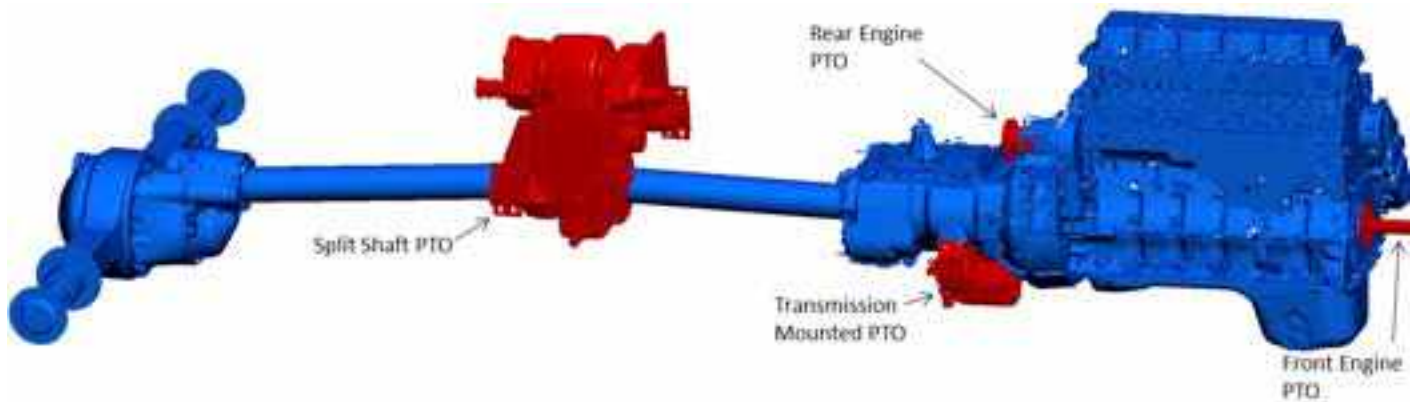
TABLE 3-20. Ground Clearance for Battery Boxes

Front Suspension	Front Tires	Rear Suspension	Rear Tires	Component	Dimension "A" Distance from Bottom of Frame Rail (in)	Dimension "B" Ground Clearance (in)	
						Unladen	Laden
20K Taper-leaf Spring	425/65R22.5 Tires	Hendrickson HMX 460 17.5" Saddle Height	11R24.5	Battery Box with Air Tanks	17.3	16.2	13.9
				Vocational Battery Box with Air Tanks	17.8	15.7	13.4
				DPF ¹ Box	15.6	17.8	15.5

¹ Dimensions shown are for daycabs with high route exhaust. Sleeper ground clearance is reduced by 1.3 inches.

INTRODUCTION

A Power Take Off (PTO) provides a way to divert some or all of the trucks engine power to another component. There are a wide variety of PTO options available.



PTO ACRONYM LIBRARY

Acronym	Definition
ABS	Anti-Lock Braking System
CAN	Controller Area Network
CC	Cruise Control
CECU	Cab Electrical Control Unit
DEF	Diesel Exhaust Fluid
DTC	Diagnostics Trouble Code
ECM	Engine Control Module
ECU	Electrical Control Unit
EIST	Engine Idle Shutdown Timer
EOA	Electric Over Air
EOH	Electric Over Hydraulic
FIC	Fast Idle Control
J-1939	SAE CAN Communication Standard
LIN	Local Interconnect Network
MSB	Master Solenoid Bank
MSM	Master Switch Module
MUX	Multiplex
OBD	On Board Diagnostics
OCM	Optional Control Module
OEM	Original Equipment Manufacture
PCC	Predictive Cruise Control
PDC	Power Distribution Center
PGN	Parameter Group Number

Acronym	Definition
PMC	PTO Mode Control
PSC	PTO Speed Control
PTO	Power Take Off
PVP	PACCAR Vehicle Pro
RP1226	TMS Messaging Standard
SCM	Standard Control Module
SCR	Selective Catalyst Reduction
SPN	Suspect Parameter Number
TCM	Transmission Control Module
TSC1	Torque Speed Control (request)
VECU	Vehicle Electrical Control Unit

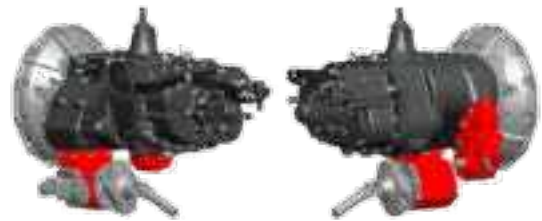
4.1. TRANSMISSION MOUNTED PTO

MANUAL TRANSMISSIONS

This is the most common type of PTO that is used. On a manual transmission there are two locations for PTO's. On medium duty transmissions there are 6 bolt PTO locations on the right and left. On heavy duty manual transmissions there is a 6 bolt PTO on the right and an 8 bolt PTO on the bottom left. There are also some options for a thru shaft or extended countershaft PTO. On a thru shaft PTO, the counter shaft extends out through the back of the transmission which can be used to power a PTO. When using a thru shaft PTO the vehicle must be spec'd with the correct option as not all transmissions will be set up for use with thru shaft PTO's. For more information go to www.roadranger.com and enter "PTO Installation Guide" in the search bar in the upper right corner.



MD Manual Transmission



HD Manual Transmission - RT



HD Manual Transmission – RT Vocational



HD Manual Transmission – RT Performance



HD Manual Transmission – Fuller Advantage



HD Manual Transmission – FR Series



MD Automated



HD Automated – Ultrashift Plus – VCS and VMS

FIGURE 4-1. Manual Transmissions

AUTOMATIC TRANSMISSIONS

On Allison transmissions there are two locations for PTO's. The Allison 4000 series has PTO locations at 1 and 8 o'clock viewed from the back of the transmission. The 4000HS transmissions do not have any PTO locations. The 3000 series Allison transmissions have PTO locations at 4 and 8 o'clock. For more information on using PTO's with an Allison transmission go to www.allisontransmission.com and refer to the "Rugged Duty Series Brochure" and "PTO Request Flyer" which is available in a 1000/2000 version and a 3000/4000 version.

Some PTO configurations will have clearance issues with other components on the truck. With manual transmissions, a 6-bolt PTO on the right will typically clear most components when the DPF and SCR are under the cab. This is also true when 30 and 45 degree adapters are used. The 8-bolt bottom mount PTO will not have any issues unless you are running a driveshaft back to another component and the truck has a crossover style exhaust. In this case, the DPF and SCR would block any routing for the driveshaft. If a wet kit is used in this scenario there is enough room to mount the PTO and the hydraulic pump without interfering with the exhaust. On Allison 4000 series transmissions, most PTO's will fit in the 1 o'clock position without interfering with the cab. If a wet kit is used here, the dipstick housing will most likely need to be modified as it runs over the top of the transmission to the driver side of the vehicle. The PTO in the 8 o'clock position is typically ok. The same issue with crossover exhaust would apply here as well. There are some scenarios where the PTO will be very close to or could interfere with the rear spring shackle on the front suspension. This problem can occur on vehicles with a set-back front axle and the problem is amplified on the short hood models.



FIGURE 4-2. Allison 4000 Series



FIGURE 4-3. Allison 3000 Series

REAR ENGINE PTO

Rear Engine PTO (REPTO) is commonly used in cement mixer and feed lot applications. The REPTO is driven off the rear gear train on the engine. There is a 1350/1410 flange on the bell housing in the 1 o'clock position that can be used to attach a hydraulic pump or driveshaft. The REPTO flange will always be turning when the engine is running and the output rotation is the same as the engine. The Cummins ISL9 and PX-9 REPTO turns at a rate of 1.15:1. The Cummins ISX-12 REPTO turns at a rate of 1.32:1. The Paccar MX-13 REPTO turns at a rate of 1.2:1. The Paccar MX-11 REPTO turns at a rate of 1.3:1.



FIGURE 4-4. REPTO Flywheel Housing

4-2. PTO TELLTALE:

With key switch to "RUN" position, all the telltale icons will turn on briefly. PTO icon below will be illuminated green to the left side of the Driver Performance Center.



FIGURE 4-5. PTO Icon

If the factory did not install the PTO or did not install the PTO pre-wire (T680-T880) you may have to install wiring from the PTO engagement switch to the instrument panel harness to illuminate this icon. To do this:

Your dealer will have access to your truck's Instrumentation diagram. That drawing will have a picture of the cluster and will help identify how to turn on the PTO ICON you saw doing the key switch test above.

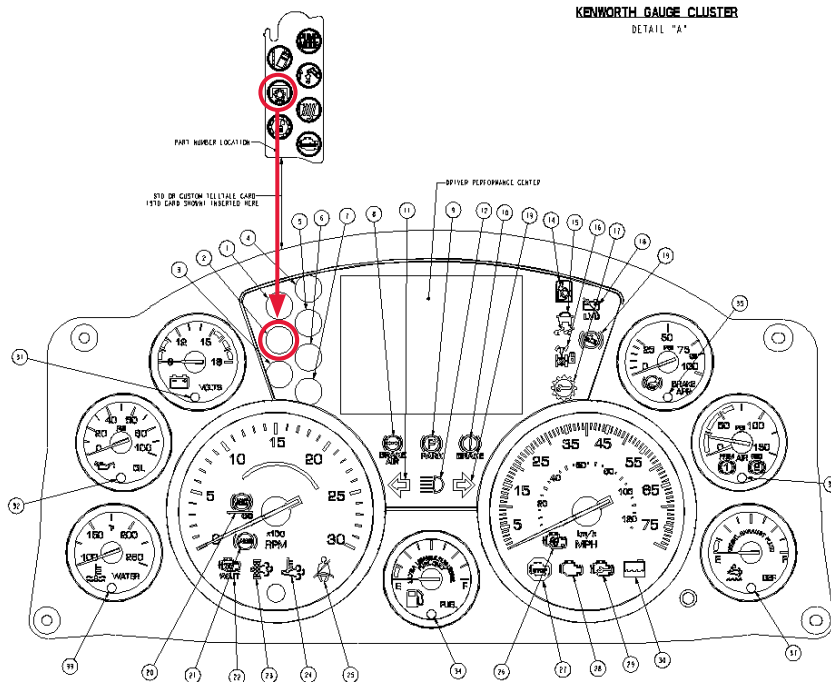


FIGURE 4-6. PTO Telltale Location

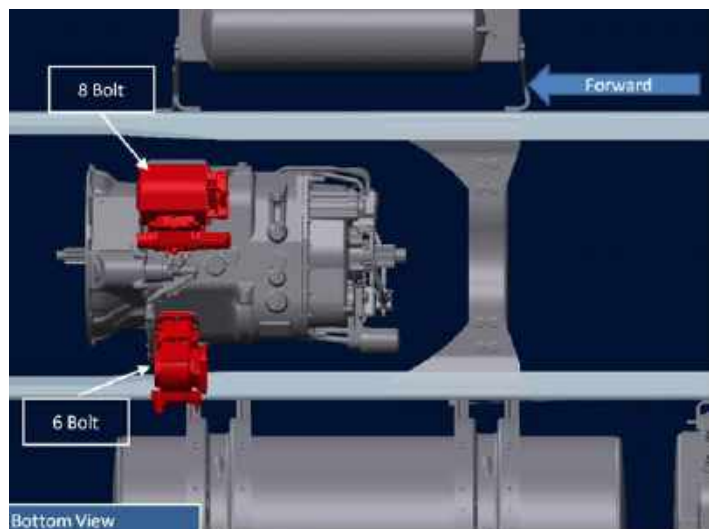
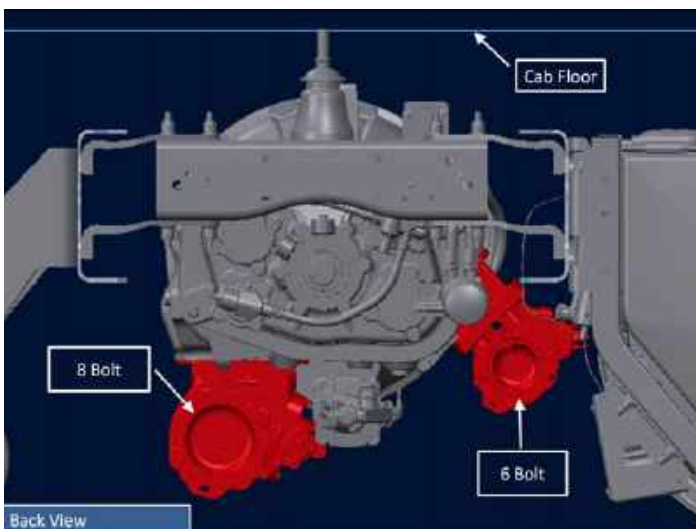
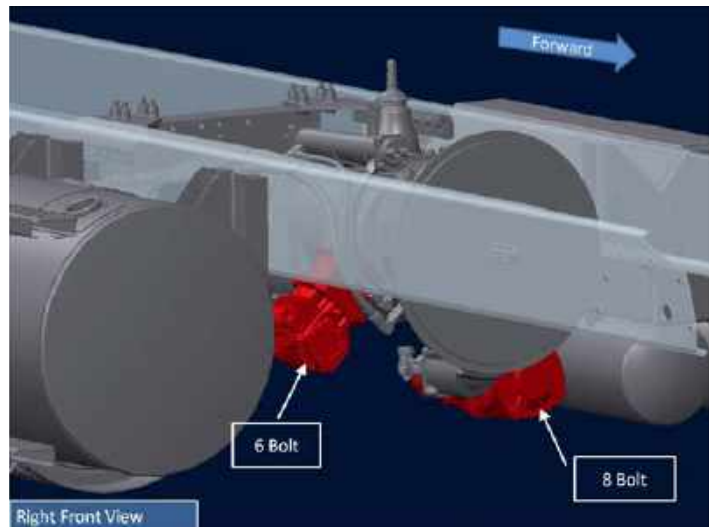
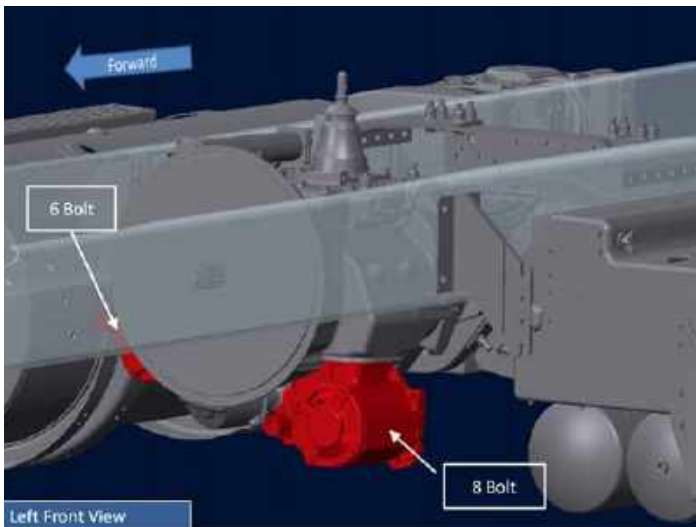
The standard telltale card has a GREEN PTO icon in position #2 (shown above). To activate this icon, locate where (6) RED, GREEN and YELLOW labeled 2-way connectors are taped to the instrument panel harness on the left side of the cup holder. One of these 2-way connectors has a GREEN label with the text "EDITABLE TELLTALE #2 P025". A gray wire goes to pin 2 of this connector. When that gray wire is grounded the PTO icon will turn on. No programming is needed, and it can be easily tested before wiring with a ground wire jumper (reference Section 9: Electrical for new telltale light connector information).

4-3. PTO CLEARANCES

The following visuals are provided to help aid in determining PTO locations and clearances. For specific dimensions please work through your local Kenworth dealer. Note: Installations depict multiple PTOs.

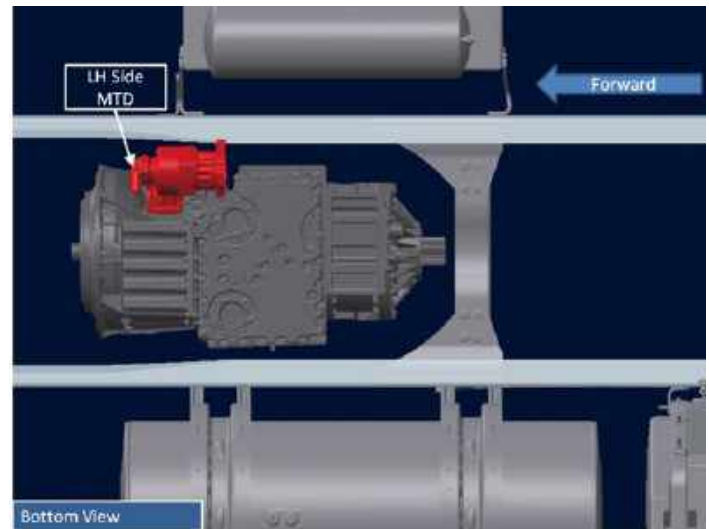
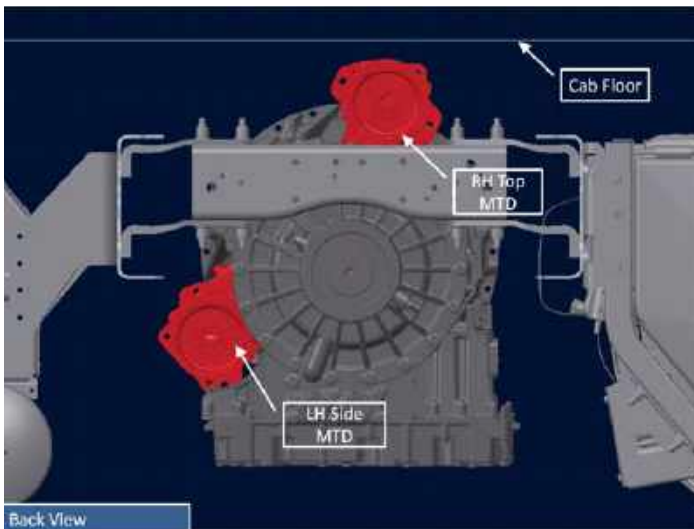
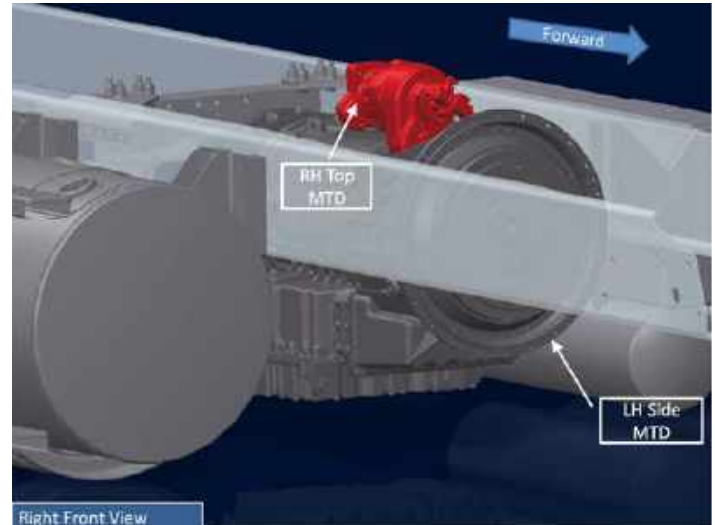
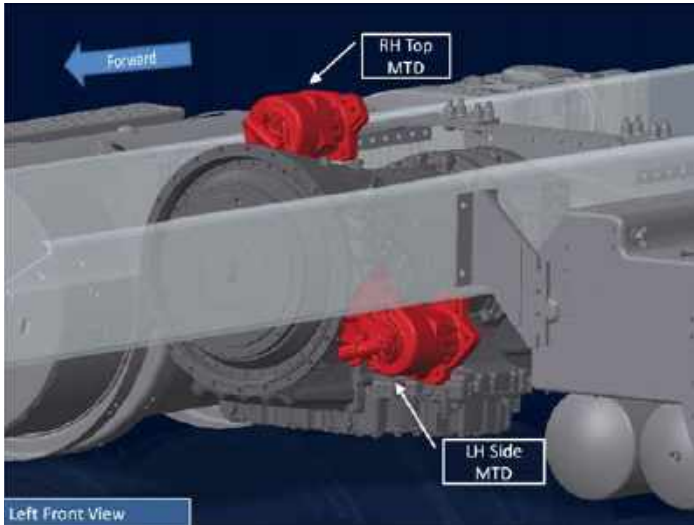
In order to ensure the PTO area remains clear of air equipment, electrical and emissions equipment, Kenworth recommends always ordering PTO controls, even when installing the PTO aftermarket. Kenworth does offer a variety of factory installed PTOs. Contact your local dealer for assistance.

Manual Transmission:



Section 4 PTO Mounting & Programming

Allison Transmission:



4-4. PTO MOUNTING CLEARANCE

This application guide indicates if a PTO has sufficient clearance to truck components in various mounting configurations. A green "ok" indicates that there is sufficient clearance to other truck components. A red "x" indicates that there minimal or no clearance and the application is not recommended. The truck components investigated in this guide include frame rails, Set Back Front Axle (SBFA) rear shackle, SBFA Front Air Suspension (FAS) rear shackle, over-bell frame brace, coolant return manifold, transmission clutch actuator, and exhaust system components.

Usage Notes:

1. This application guide is only applicable to 2.1M trucks.
2. Only the specified PTO configurations have been analyzed.
3. Horizontal crossover exhaust limits access behind PTO's for shaft drives and other PTO attachments.
4. Eaton FR transmissions require the use of a 30° adapter when installing Chelsea or Muncie transmission PTO's in the right hand position.
5. Eaton RT & Ultrashift Plus transmissions require the use of a 49° adapter when installing Chelsea transmission PTO's in the right hand position.
6. Eaton RT & Ultrashift Plus transmissions require the use of a 55° adapter when installing Muncie transmission PTO's in the right hand position.
7. Eaton transmissions require the use of a 6 to 8 Bolt adapter when installing a 6 bolt PTO in the bottom position.

2.1M PTO MOUNTING CLEARANCE CHARTS

TABLE 4-1. 10-Bolt PTO's for Allison Transmissions

10-Bolt PTO's for Allison Transmissions			4000 Series		3000 Series - 1 & 8		3000 Series - 4 & 8	
Brand	PTO	Truck Model	1 o'clock	8 o'clock	1 o'clock	8 o'clock	4 o'clock	8 o'clock
Chelsea	267-M3XX	All	x	x	ok	x	x	x
	267-M5XX	All	ok	ok	ok	x	ok	ok
	277-B5XS	579-123/567-121	ok	ok	ok	x	ok	ok
		579-117/567-115	ok	x	ok	x	ok	ok
	859-B5XS	All	ok	x	x	x	x	x
	870X-B3RS	All	ok	x	ok	x	x	x
	870X-B5RS	All	ok	x	ok	x	x	x
	890-B5XS	All	ok	x	ok	x	x	ok
Muncie	CD05-M3CX	All	ok	ok	ok	ok	ok	ok
	CD10-M1CX, DX	579-123/567-121	ok	x	ok	x	ok	ok
		579-117/567-115	ok	x	ok	x	x	ok
	CD10-M3CX, DX	579-123/567-121	ok	x	ok	x	ok	ok
		579-117/567-115	ok	x	ok	x	x	ok
	CS10-H1CX, EX	All	x	x	x	x	x	x
	CS10-H3CX, EX	All	x	x	x	x	x	x
	CS24-H1KX	All	ok	x	ok	x	x	x
	CS24-H3BX, KX	579-123/567-121	ok	ok	ok	x	ok	ok
		579-117/567-115	ok	ok	ok	x	x	ok
	CS24-X1BX	All	ok	x	ok	x	x	ok
	CS41-H1EX, CX	All	ok	x	x	x	x	x
	CS41-H3CX, EX	All	ok	x	x	x	x	x
	HS24-H1BX, KX	579-123/567-121	ok	x	x	x	ok	x
		579-117/567-115	ok	x	x	x	ok	ok
	HS24-H3BX, KX	All	ok	ok	ok	x	x	ok

Section 4

PTO Mounting & Programming

TABLE 4-2. 6 and 8-Bolt PTO's for Eaton Transmissions

6 & 8 Bolt PTO's for Eaton Transmissions

Brand	Style	PTO	FR		RT		Ultrashift Plus	
			Bottom	Right	Bottom	Right	Bottom	Right
Chevy	6-Bolt	230-V3XD/XK	ok	ok ^{1,2,3}	ok	ok ^{1,2,3}	ok	ok ^{1,2,3}
		236-V3XD/XK	Recommend 238	ok ^{1,2,3}	Recommend 238	ok ^{1,2,3}	Recommend 238	ok ^{1,2,3}
		270-113XD/XK	ok	ok ^{1,2,3}	ok	ok ^{1,2,3}	ok	ok ^{1,2,3}
		340-V3XD	ok	ok ^{1,2,3}	ok	ok ^{1,2,3}	ok	ok ^{1,2,3}
		442-V3XK	Recommend 489	ok ^{1,2,3}	Recommend 489	ok ^{1,2,3}	Recommend 489	ok ^{1,2,3}
		660-V3XK	Recommend 680	ok ^{1,2,3}	Recommend 680	ok ^{1,2,3}	Recommend 680	ok ^{1,2,3}
	8-Bolt	238-V3XD/XK	ok	n/a	ok	n/a	ok	n/a
		489-V3XK	ok	n/a	ok	n/a	ok	n/a
		680-V3XK	ok	n/a	ok	n/a	ok	n/a
		823-V3XS	ok	n/a	ok	n/a	ok	n/a
		880-V3XS/XV ⁴	ok	n/a	ok	n/a	ok	n/a
		885-V3XS ⁴	ok	n/a	ok	n/a	ok	n/a
Muncie	6-Bolt	CS6-P1BX/KX	Recommend CS8	ok ^{1,2,3}	Recommend CS8	ok ^{1,2,3}	x	ok ^{1,2,3}
		SH6-P1BX/KX	Recommend SH8	ok ^{1,2,3}	Recommend SH8	ok ^{1,2,3}	x	ok ^{1,2,3}
		TG6-P1BX/KX	Recommend TG8	ok ^{1,2,3}	Recommend TG8	ok ^{1,2,3}	Recommend TG8	ok ^{1,2,3}
	8-Bolt	828S-U1CX/EG	ok	n/a	ok	n/a	x	n/a
		CS8-P1BX/KX	ok	n/a	ok	n/a	ok	n/a
		SH8-P1BX/KX	ok	n/a	ok	n/a	ok	n/a
		TG8S-P1BX/KX	ok	n/a	ok	n/a	ok	n/a

NOTE



1. Not available with Front Air Leaf Suspension.
2. Not available with Horizontal Crossover or Right Hand behind Fairing Exhaust Systems.
3. Restricted PTO access with RH Cab Step Assembly DPF-SCR exhaust systems with Vertical BOS tailpipes or RH Horizontal Tailpipe below rail.
4. The Optional Hydraulic Clutch Orientation must be used with this PTO.

PTO Mounting & Programming

TABLE 4-3. Dual PTO Compatibility for Eaton Transmissions

Dual PTO Compatibility for Eaton Transmissions

Chelsea										Muncie						
RH (6-Bolt) PTO's																
Model	RT			FR			Ultrashift+		Model	RT		FR		Ultrashift+		
	230/236-V3	340X-A5	442/660-V3	230/236-V3	340X-A5	442/660-V3	340X-A5	442/660-V3		CS/SH6-A1	TG6-A1	CS/SH6-A1	TG6-A1	CS/SH6-A1	TG6-A1	
LH (6 & 8-Bolt) PTO's	230/236-V3	S	S	S	S	S	S	ok	ok	828S-Q1	S	S	S	S	ok	ok
	238-V3	S	S	S	S	S	S	ok	ok	CS/SH8-A1	S	S	S	S	ok	ok
	340X-A5	S	S	S	S	S	S	ok	ok	TG8S-A1	S	S	S	S	ok	ok
	442/660-V3	S	S	S	S	S	S	ok	ok							
	489/680-V3	S	S	S	S	S	S	ok	ok							
	823-V3	S	S	S	S	S	S	ok	ok							
	880-V3	X	X	O	X	O	X	ok	ok							
	885-V3	X	X	O	X	O	X	ok	ok							

Note:
The actuator should not be flipped upside down to achieve PTO clearance.

S = Standard Hydraulic Clutch Actuator Configuration
O = Optional Hydraulic Clutch Actuator Configuration

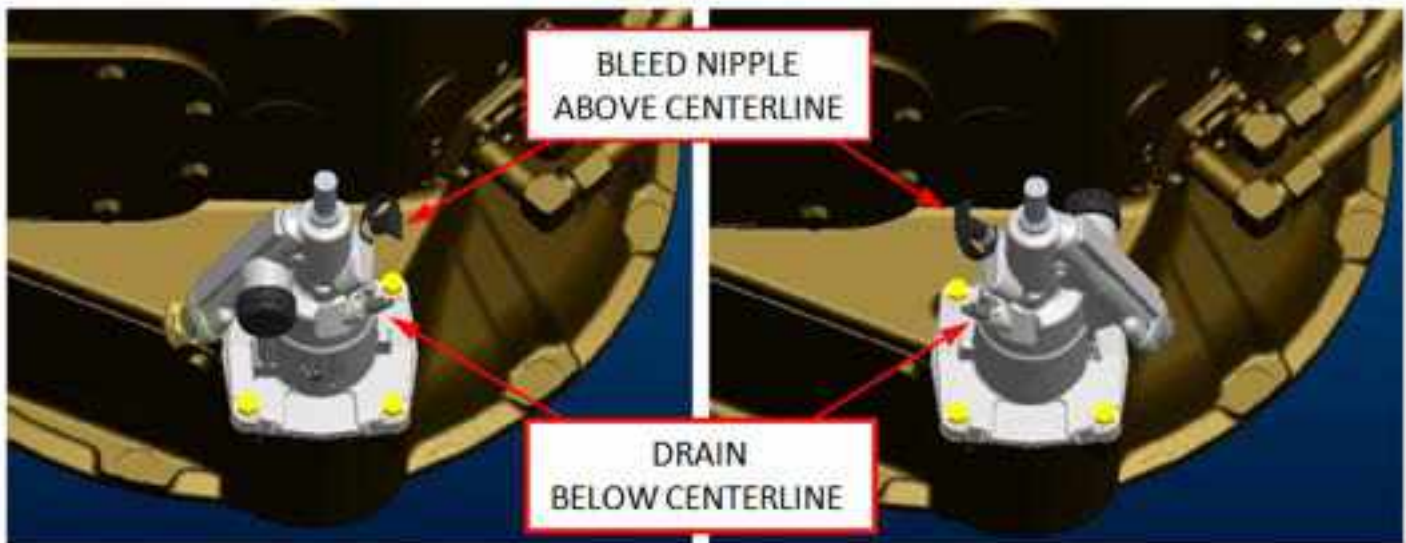
Note:
The actuator should not be flipped upside down to achieve PTO clearance.

1. Bleed nipple should always be above centerline.
2. Drain should always be below centerline.

HYDRAULIC CLUTCH ACTUATOR CONFIGURATIONS

(Only used with 2.1M models with Eaton FR or RT transmissions)

FIGURE 4-7.



Standard Configuration
Air assist connection faces driver's side
Used with all but Chelsea 880 and 885 PTOs

Bottom Mount PTO Provisions
Air assist connection faces passenger's side
Used with Chelsea 880 and 885 PTOs

4.5. MX PTO MODE CONTROL (PMC)

MX PTO Mode Control (PMC) includes features, limits, and protections that are active in PTO Mode. It also includes PTO Speed Control (PSC) functionality that includes a variety of useful ways to control engine speed during PTO operation.

Reference the VECU Programming Guide for detailed information on PTO Mode Control configuration, functionality and usage.

MX PTO MODE ACTIVATION

There are three ways to activate PTO Mode. PMC parameter(s) must be enabled on the vehicle in order for PTO Mode to activate.

- Active feedback of physical PTO engagement
 - Trucks with factory installed PTOs or that are coded for Customer Installed PTOs will come prewired to receive the PTO engaged signal.
- Active PTO Mode Switch
 - The PTO Mode Switch can be configured at the time of order or in the aftermarket. The PTO Mode switch can be used to activate PTO Mode independent of PTO engagement and may be useful for trucks with FEPTOs or REPTOs that need the ability to use PMC features.
- PTO Mode Request over the CAN bus



PTO Mode Switch

MX PTO MODE CONTROL LOCATION

Vehicles can be configured to control PTO functionality from a cab location and/or a remote location (outside the cab). Most PTO Mode Features and Interlocks have a cab station option and a remote station option. This allows a vehicle to be configured for two unique jobs. For example a vehicle could be configured for mobile cab station operation with one set of limits and stationary remote station operation with a different set of limits.

If a vehicle is configured for both cab and remote PTO control, a PMC Location Switch must be installed on the dash. This switch will determine which set of PTO Mode Features to apply and which control location to use.



PMC Location Switch

MX PTO MODE FEATURES

The following features and configurations are available when PTO Mode is active.

- Cab Accelerator Configurations
 - Disable in PTO Mode
 - Torque Control (Automotive Style)
 - Speed Control
 - Enable in Remote PTO Mode
- Log Time and Fuel in PTO Mode
- Disable Engine Idle Shutdown Timer (EIST) in PTO Mode
- PTO Mode Specific Engine Idle Shutdown Timer (EIST)
- Fan On in PTO Mode
- Adjustable PTO Engine Speed Governor Responsiveness (for light or heavy varying loads)

MX PTO MODE PROTECTIONS AND LIMITS

The following protections and limits are available when PTO Mode is active. Protections and limits are active when PTO Mode is active and will continue to be active until PTO Mode is no longer active.

- Max Vehicle Speed
- Max Engine Torque
- Max Engine Speed – Accelerator Controlled
- Max Engine Speed – Switch Controlled
- Min Engine Speed
- Max Rate of Engine Speed Change

MX PTO SPEED CONTROL (PSC) FEATURES

PTO Mode must be active prior to using PTO Speed Control (PSC) to control engine speed. PSC is available from both the cab station and remote station (see PTO Mode Control Location Section above). In the cab location, cruise control switches and PSC specific switches are used to control engine speed. Equivalent remote station inputs are available (Reference Remote PMC Connections section below).

- Set / Res
 - Bump RPM Up / Down (Short Press)
 - Ramp RPM Up / Down (Long Press)



Steering Wheel Buttons

- + / -
 - Configurable to either command one unique preset when "+" is pressed and a second unique preset when "-" is pressed OR toggle through up to 6 presets.



Dash Switches

- Preset 1, 2 & 3
 - 3 Dedicated Presets with the following configuration options.
 - Latch: Hold Preset Speed When Switch is Released
 - Cancel: Cancel PSC When Switch is Released
 - The Remote PTO Inputs for Presets 1, 2 & 3 can be configured to function when Cab PTO Mode is active
 - In some applications, it may be useful to connect the Remote PTO Inputs for Presets 1, 2 & 3 to something other than a hand-operated switch. For example, the inputs can be configured to activate based off PTO engagement, hydraulic pressure or equipment movement.



Dedicated Preset Switches

MX PTO SPEED CONTROL INTERLOCKS

PTO Speed Control Interlocks cancel PSC when active. There is an option to disable the accelerator when a PSC interlock is active. When a PSC interlock is active the engine speed will return to the Minimum Engine Speed in PTO Mode or the engine speed commanded by the accelerator if applicable. An active PSC interlock does not disable PMC protections and limits.

The configurable PSC interlocks are listed below.

- Clutch Pressed
- Park Brake NOT Set
- Transmission NOT in Neutral
- Service Brake (Configurable for Pressed or NOT Pressed)
- Custom Hardwired Interlock (Configurable Polarity)

A custom hardwired interlock input is available that will allow a body builder to create a customized interlock for their specific application. This interlock functions for both Cab and Remote Station PSC. Many types of switches such as hand-operated switches, hydraulic pressure switches, equipment position switches, or pressure plate switches can activate the interlock. The switch polarity is configurable which allows the body builder to choose the interlock state if the circuit fails.

PTO SPEED CONTROL ICONS

During PSC operation there will be icons on the driver information display that indicate:

- PSC Enabled (white icon) or Active (green icon)
- PSC Control Location (designed by “Cab” or “Remote”)
- PSC target engine speed when active



FIGURE 4-8. PSC Icons

Remote PMC Connections

There are options to control PTO functionality from the following locations.

- Engine Bay – Hardwired option only
- RP1226 Connection in the Cab – CAN bus connection only
- BOC/BOS – Hardwired and CAN bus connections
- EOF – Hardwired and CAN bus connections

There are options available for the body builder to specify controller speeds of 250 kbps or 500 kbps.

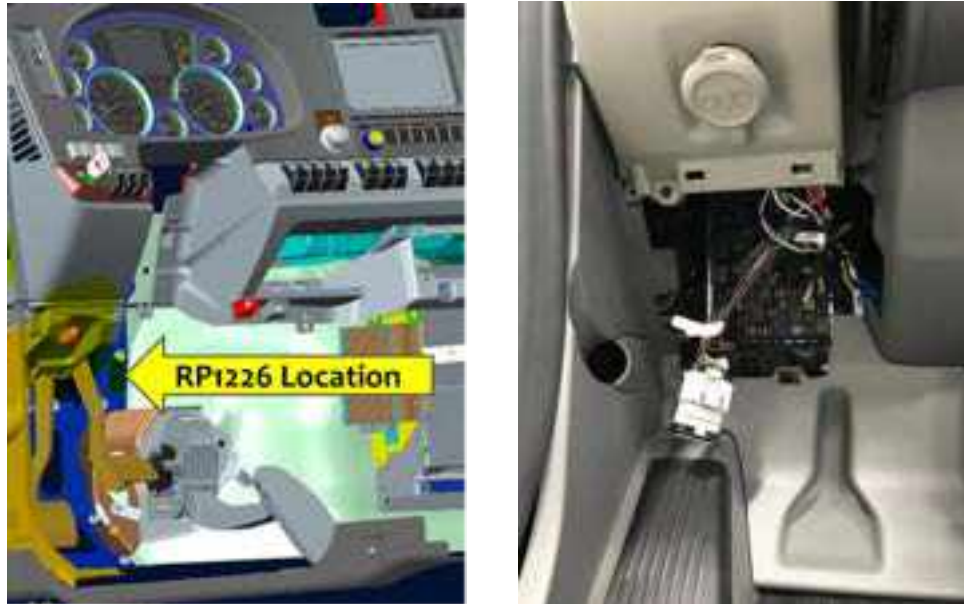


FIGURE 4-9.

MX PTO CAN functionality may be accessed in the cab through the RP1226 connector and remotely through the body connectors K-CAN (E-3375-021) and B-CAN (DTM06-2S-EP10) Connectors.

MX PTO hardwired functionality may be accessed in the engine bay or on the frame through optional 12-Way and 8-Way connectors



12-Way Deutsch Connector

8-Way Deutsch Connector

RP1226 Delphi Connector

FIGURE 4-10.

Pin-out information for the PTO connectors can be found in the Electrical Section

PTO MODE CONTROL FLOW CHARTS

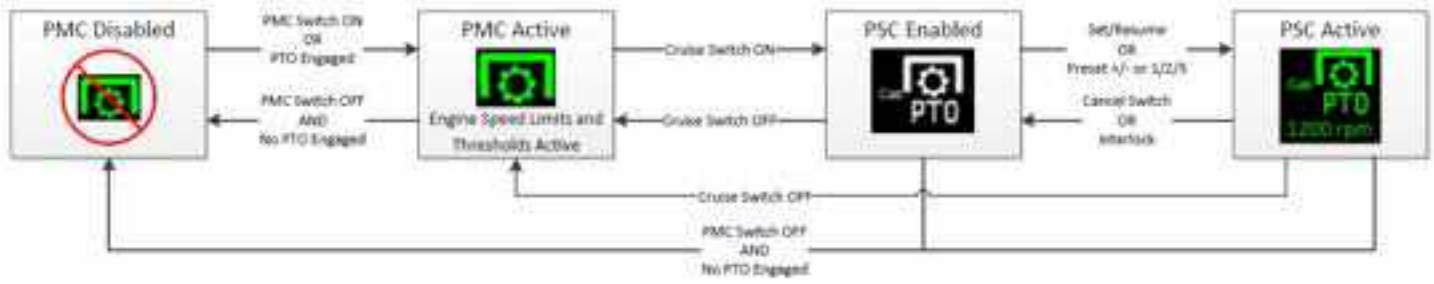


FIGURE 4-11. Cab Controls

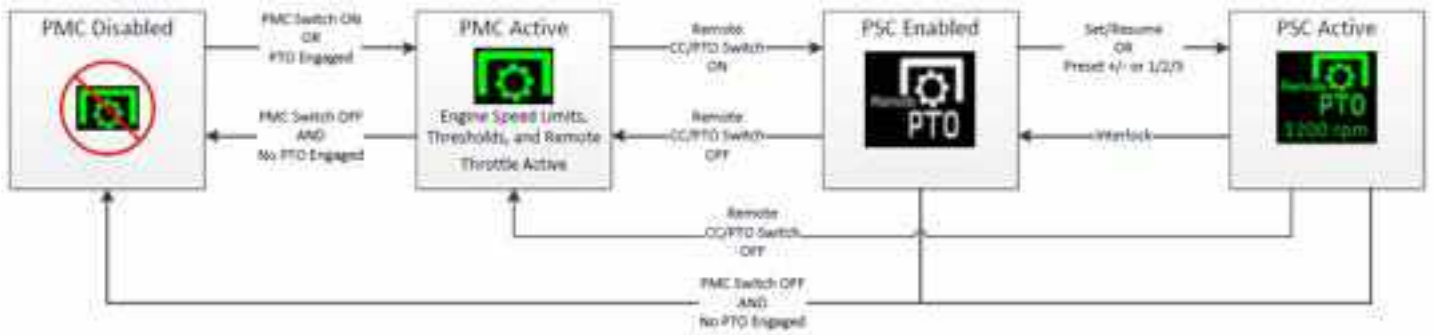


FIGURE 4-12. Remote Hardwire Controls

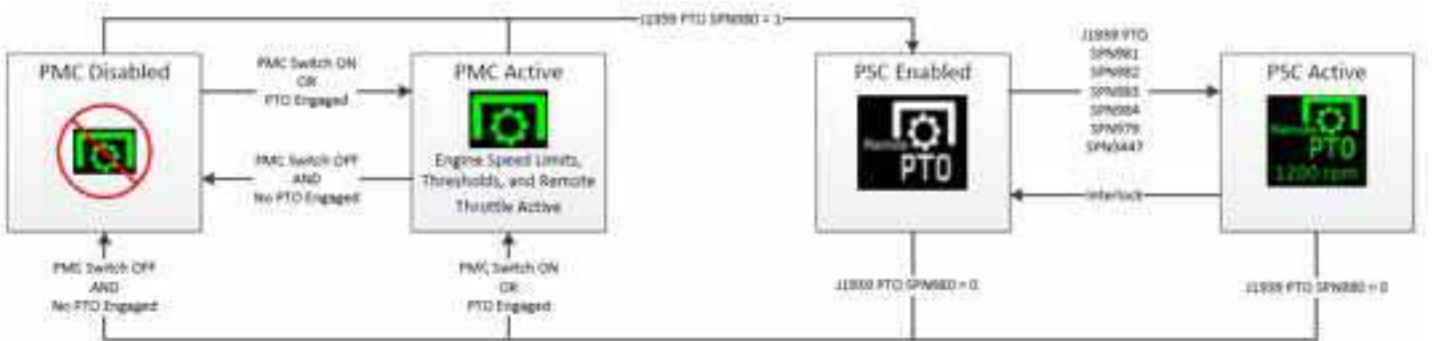


FIGURE 4-13. Remote CAN Controls



FIGURE 4-14. Remote TSC1 CAN Controls

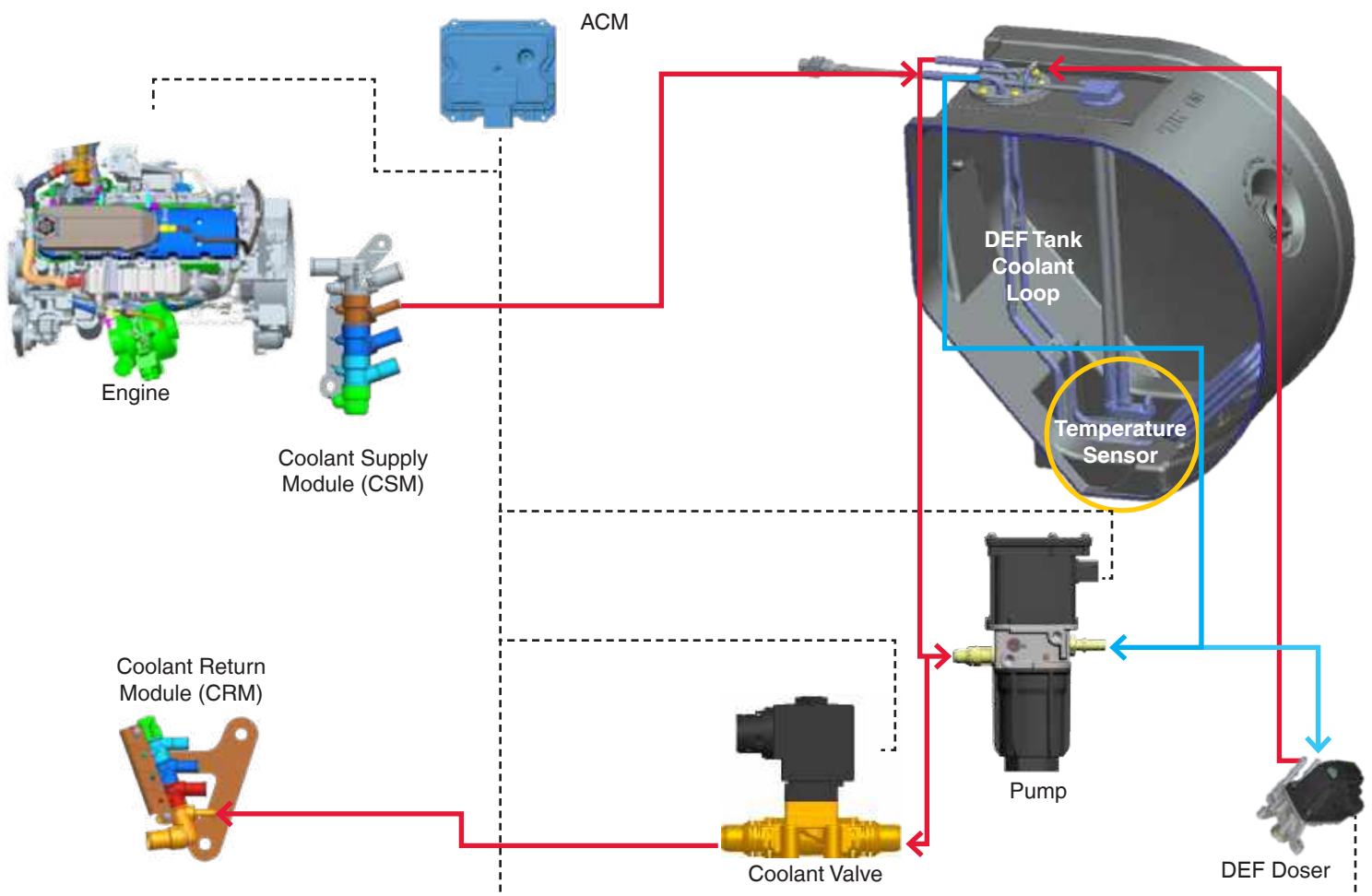
EXHAUST AND AFTER-TREATMENT INFORMATION

The following section is designed to give you information regarding the exhaust and after-treatment systems on Kenworth chassis.

All Kenworth's equipped with 2017 emission level engines will utilize Selective Catalyst Reduction (SCR). SCR is a process in which Diesel Exhaust Fluid (DEF) is injected into the exhaust downstream of the engine. DEF is converted to ammonia by the heat of the exhaust system. Inside of the SCR canister a catalyst causes a chemical reaction to occur between the ammonia and NOx, turning it into water and nitrogen. For more information on the specific details of how SCR works, please contact your local Kenworth dealer.

DEF System Schematic:

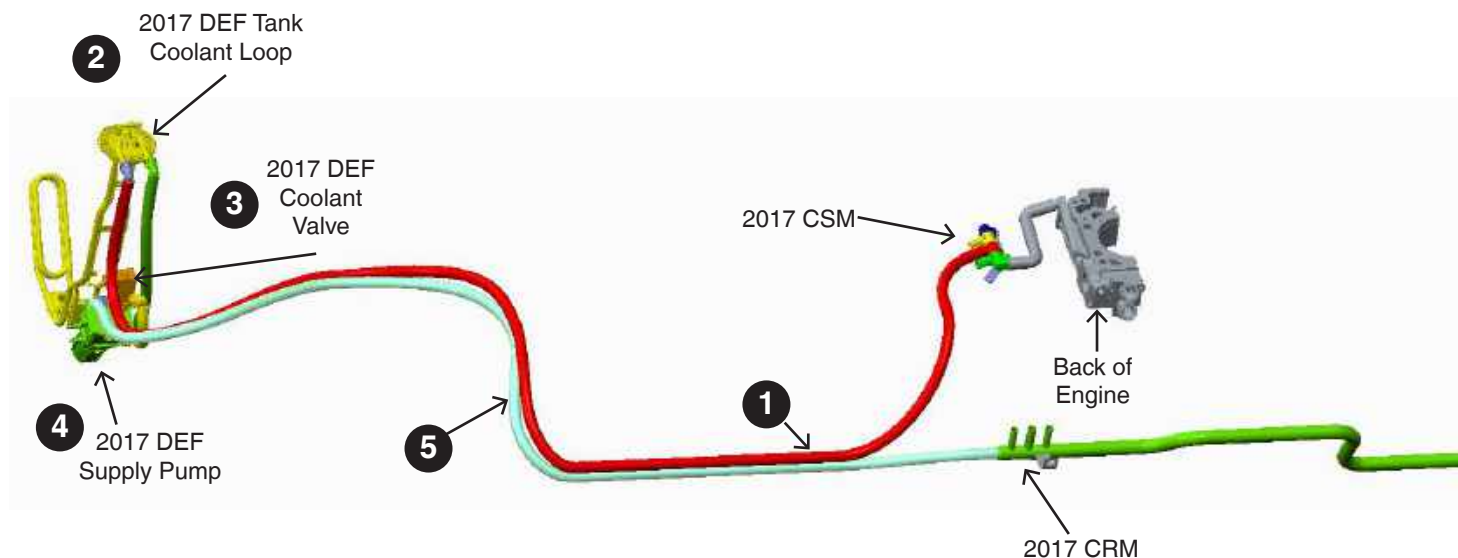
On most Kenworth chassis the DEF Supply Module (or pump) is integrated into the DEF tank. Kenworth does not allow relocation of this pump. The following schematic details how the DEF lines route to the after-treatment system.



Section 5 Exhaust & Aftertreatment

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DEF will freeze at approximately 11° F. In order to keep DEF from freezing all tanks will be heated with engine coolant. The following schematic shows the routing of these lines. It is critical that the system is not compromised in any manner. Below, numbers denote the order of the component in the flow.



GENERAL GUIDELINES FOR DEF SYSTEM

The installation of the DEF tank is a critical component of the aftertreatment system. While Kenworth does not recommend relocating the DEF tank, there are applications and body installations that will require it. The guidelines below must be strictly followed by any entity relocating the tank. Failure to follow the guidelines completely and accurately may result in engine shut-down situations.

PACCAR-approved DEF hoses are required when retrofitting for system to function properly. The use of unapproved hoses for DEF lines will void warranty and may cause engine shut-down situations. The DEF pump (or Supply Module) cannot be relocated from the DEF tank.

Kenworth offers a variety of DEF tank sizes to meet every application. The DEF tank volume is regulated by the E.P.A. Kenworth advises against modifying the tank volume after the truck has been delivered from the factory. These are estimated nominal (published) maximum fuel capacities for various DEF tanks, engines, and fill ratios. Dosing rates for these calculations are also shown.

TABLE 5-1.

DEF Tank	FUEL VOLUME ALLOWED (USABLE GALLONS)											
	Standard DEF-Fuel Ratio (2:1)				Minimum Recommended DEF-Fuel Ratio (1:1), No Derates				Minimum Required DEF-Fuel Ratio (1:1), First Derate Allowed			
	PX-7/ ISX15	ISX12	MX-11/ MX-13	PX-9	PX-7/ ISX15	ISX12	MX-11/ MX-13	PX-9	PX-7/ ISX15	ISX12	MX-11/ MX-13	PX-9
SMALL	153	162	113	189	193	204	152	238	245	260	191	303
MEDIUM	286	303	212	353	387	409	286	477	458	484	339	565
LARGE	431	455	318	531	581	614	430	717	689	728	510	850
MEDIUM AERO	291	307	215	358	393	416	308	485	464	491	361	573
LARGE AERO	368	389	272	454	538	569	419	664	585	618	453	721
Rectangular	103	109	76	128	148	157	110	183	176	186	130	217

Engine	Nominal DEF Dosing Rate (as a percentage of fuel volume)
PX7/ISX15	3.7%
ISX12	3.5%
MX-11/MX-13	5.0%
PX9	3.0%

INSTALLATION REQUIREMENTS AND DIMENSIONS FOR DEF SYSTEM

When relocating any DEF system components, the locations must meet the guidelines below. Failure to comply may result in non-conformance to EPA standards and engine shutdown.

With all relocating procedures, general clearances and routing guidelines must be followed. See section 9 of this manual for general routing guidelines.

When relocating the components the maximum pressure DEF hose length, from Supply module to Dosing Module, is 5.5 meters (216.5").

Maintain a minimum of 3" clearance to shielded exhaust components when routing DEF lines to prevent possible melting.

If the DEF tank is relocated the coolant lines will need to be modified. During this process if the tank is moved forward on the chassis (ie closer to the engine) it is necessary to remove excess coolant lines and maintain the original routing path. If the tank is moved rearward on the chassis the additional length of cooling line required to complete the installation must be installed in a straight section of the existing coolant routing lines. This process minimizes the change in coolant flow by mitigating changes in restrictions. Changes in restriction are added with excessive line length and bends. Work with your local Kenworth dealer if you are unsure about the coolant line modifications.

Routing to the Dosing Module (Injector)

A DEF pressure line “trap” is no longer required after EPA 2013 emissions level engine. The dosing module (injector) no longer needs to be purged and relative heights of components is no longer critical.. See Figure 5-7 below for typical routing with RHUC exhaust and LH DEF tank shown. Also shown in this figure is the coolant line routing for T680 and T880 models.

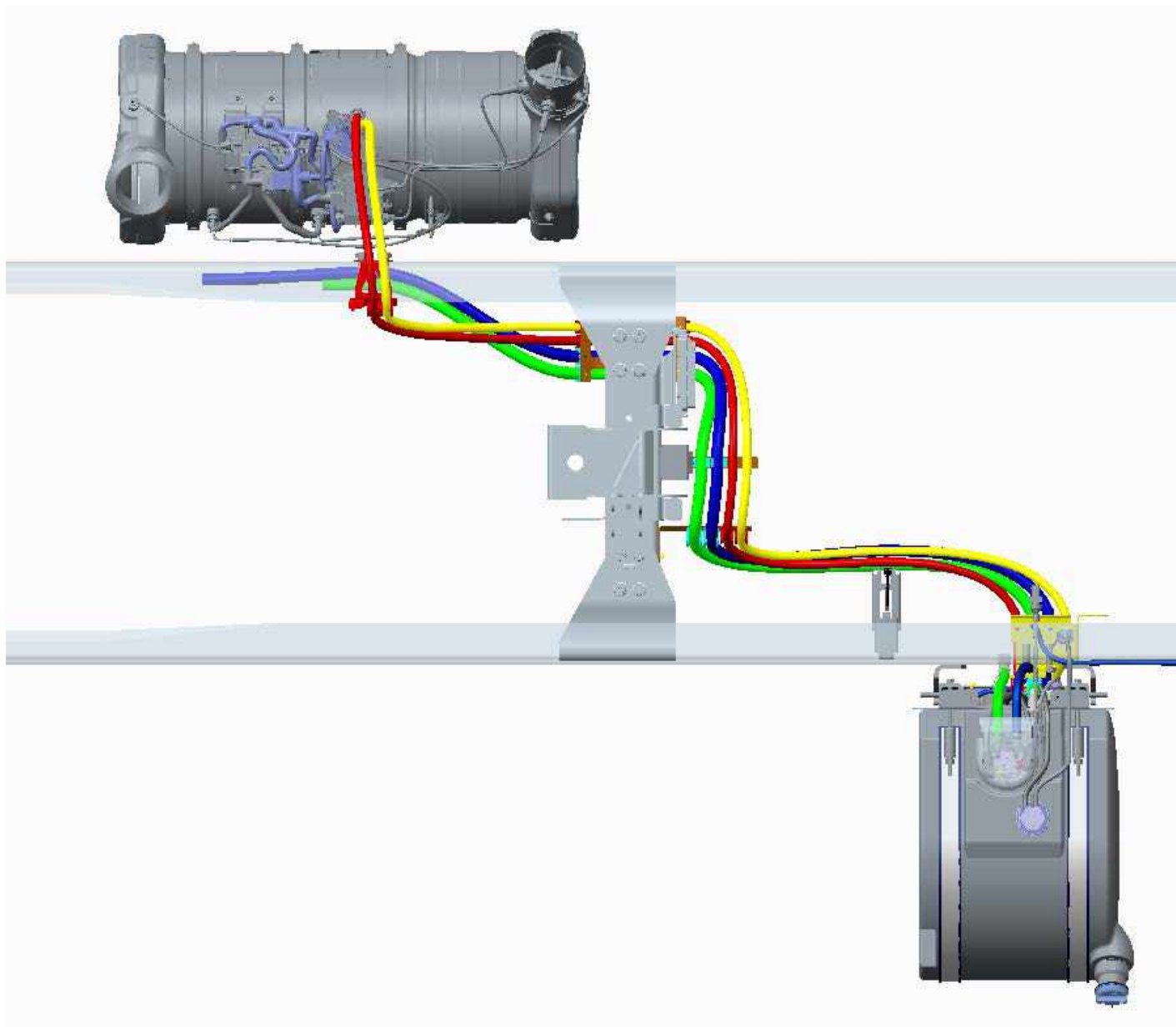


FIGURE 5-1. Routing DEF and Coolant Lines

DEF Supply Module Mounting Requirements

The Supply Module (or Pump) standard mounting location is on the DEF tank assembly. Body builders may need to relocate this component, and should follow the location and length restrictions above. Additionally the mounting and the orientation of the Supply Module must not exceed 45° from vertical in any direction.

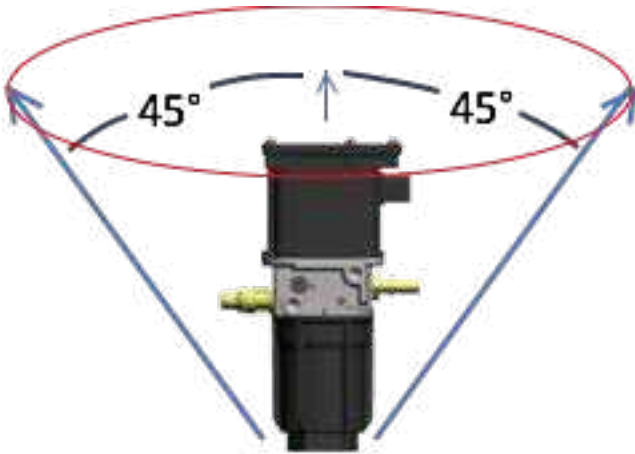
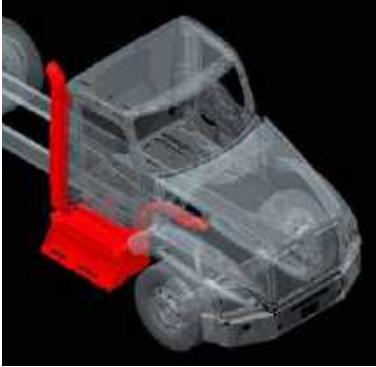


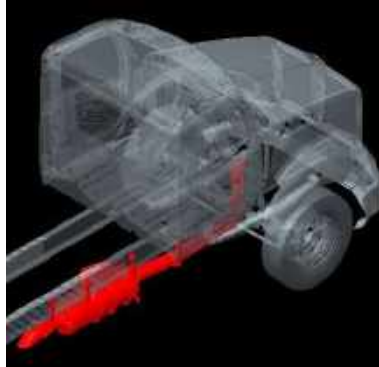
FIGURE 5-2. Supply Module Allowed Clocking Angle Limit Scribes a 90° Inverted Cone.

GENERAL EXHAUST INFORMATION

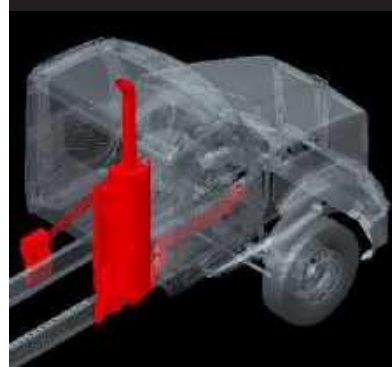
Kenworth will offer three main DPF and SCR exhaust systems on heavy duty chassis in 2017. A Right Hand Under DPF and SCR system, in which both canisters are located underneath the cab access step. A horizontal system with both the DPF and SCR located horizontally with a cross over pipe in the frame, and an Independent DPF and SCR located vertically back of cab on stanchion brackets.



RH Under DPF and SCR



Horizontal DPF and SCR



Independent Back of Cab

The following images depict the typical exhaust routings for each system, and can be used to determine exhaust routing paths for systems you choose. Dimensional information can be found in Section 5 of this manual.

Body Builders must not modify (including altering, substituting, and relocating) the DPF and SCR canisters. The exhaust piping after it exits the SCR canister may be modified, however using smaller diameter piping or piping with numerous bends is not recommend as the backpressure requirements of the system may be exceeded.

Right Hand Under DPF/SCR on DayCav with Single Side of Cab Tailpipe

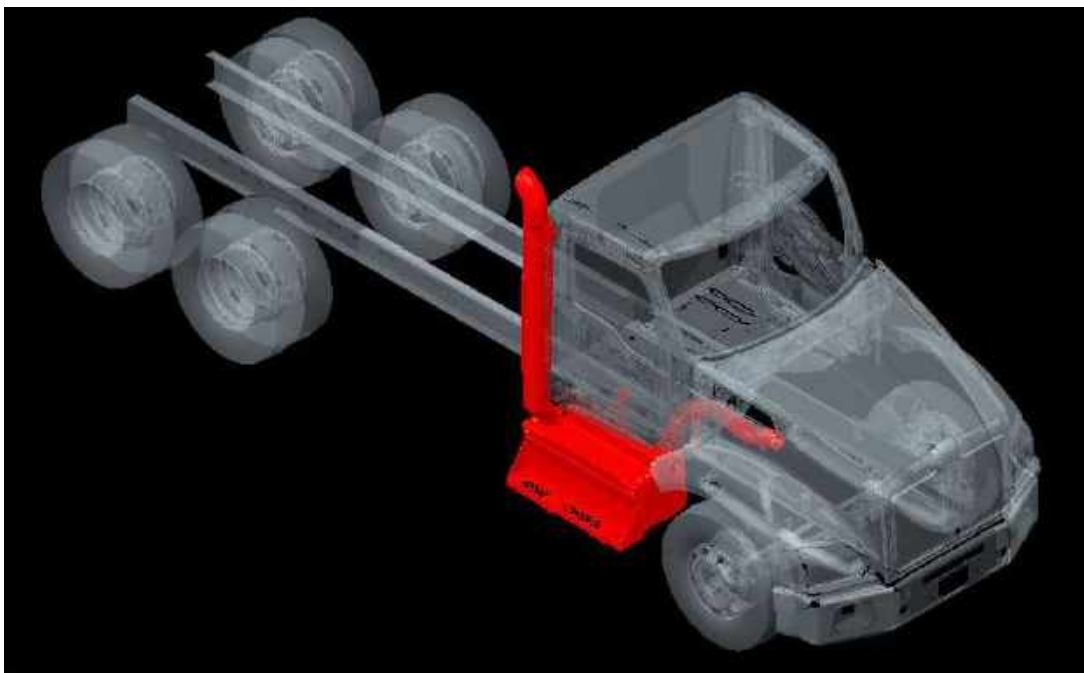


FIGURE 5-3. Isometric view of Right Hand Under DPF/SCR with Single Side of Cab Tailpipe

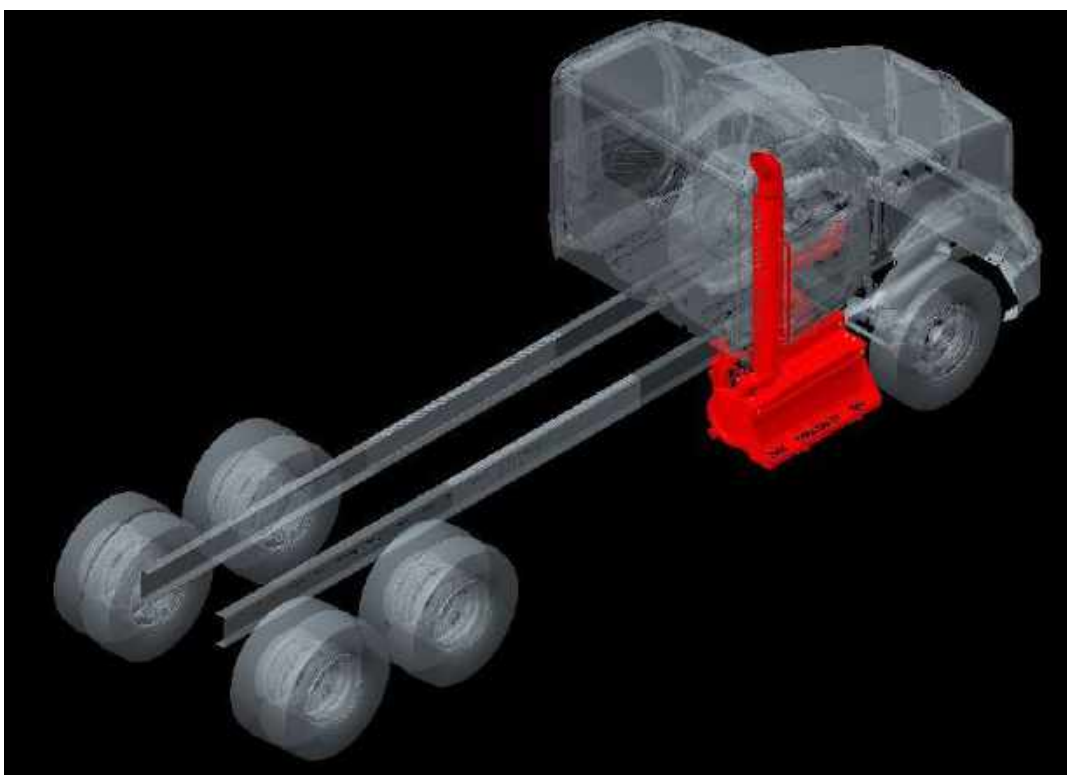


FIGURE 5-4. Isometric view of Right Hand Under DPF/SCR with Single Side of Cab Tailpipe

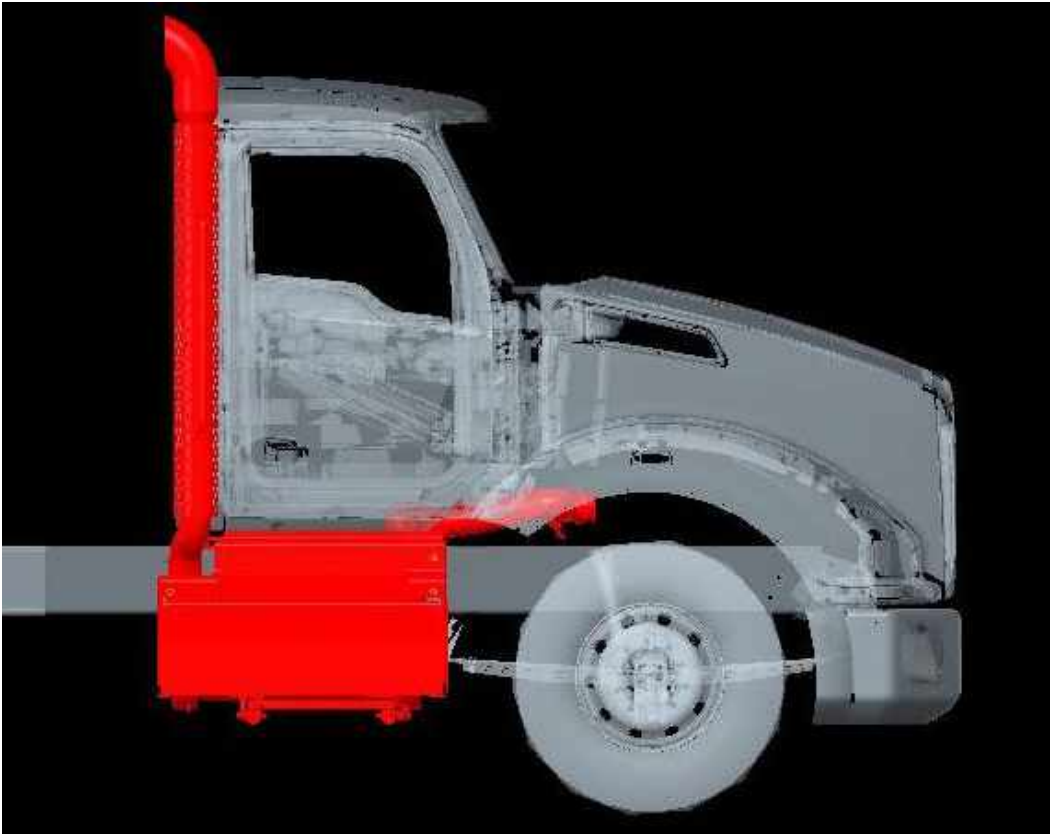


FIGURE 5-5. Right view of Right Hand Under DPF/SCR with Single Side of Cab Tailpipe

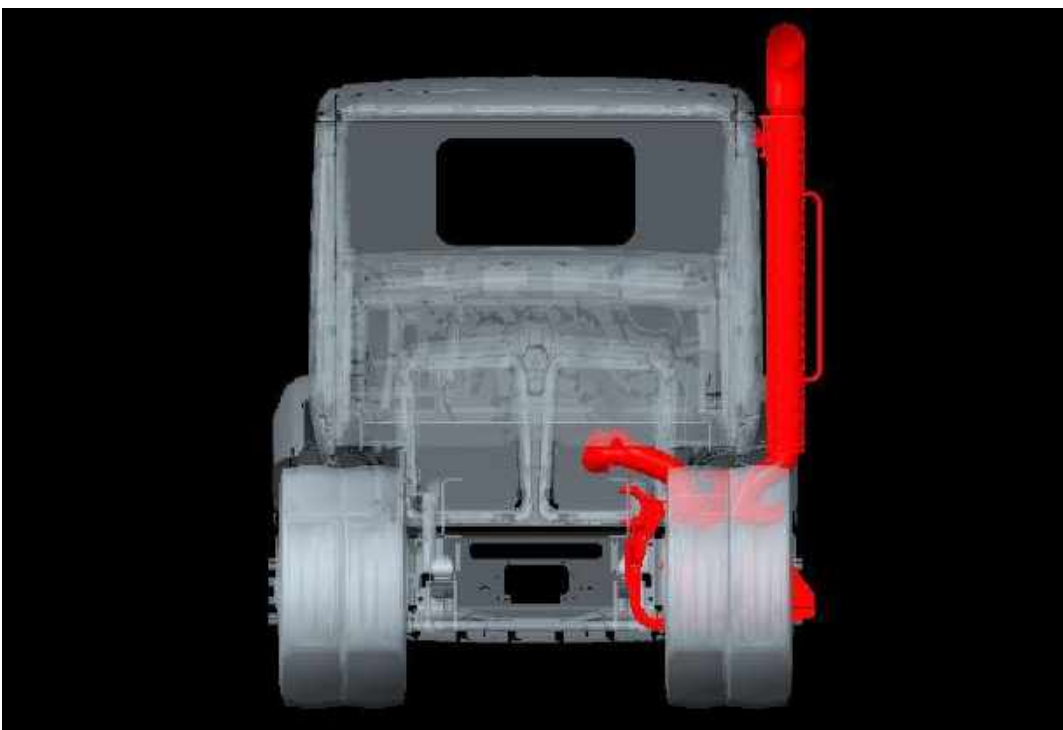


FIGURE 5-6. Back view of Right Hand Under DPF/SCR with Single Side of Cab Tailpipe

Right Hand Under DPF/SCR on DayCab with Dual Side of Cab Tailpipes

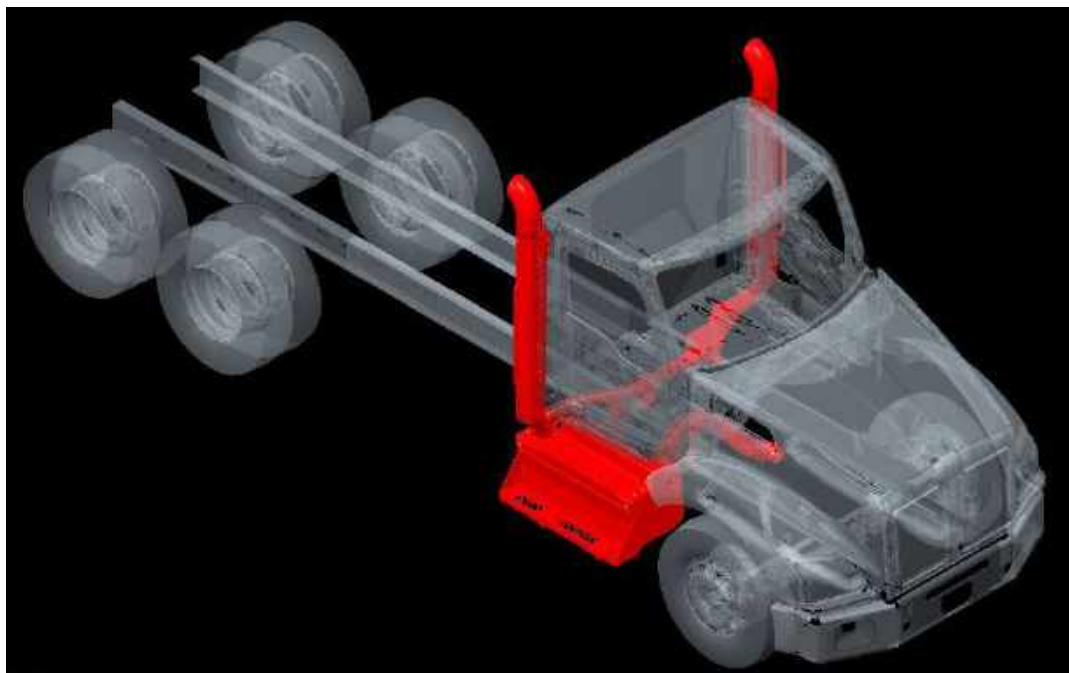


FIGURE 5-7. Isometric view of Right Hand Under DPF/SCR with Dual Side of Cab Tailpipe

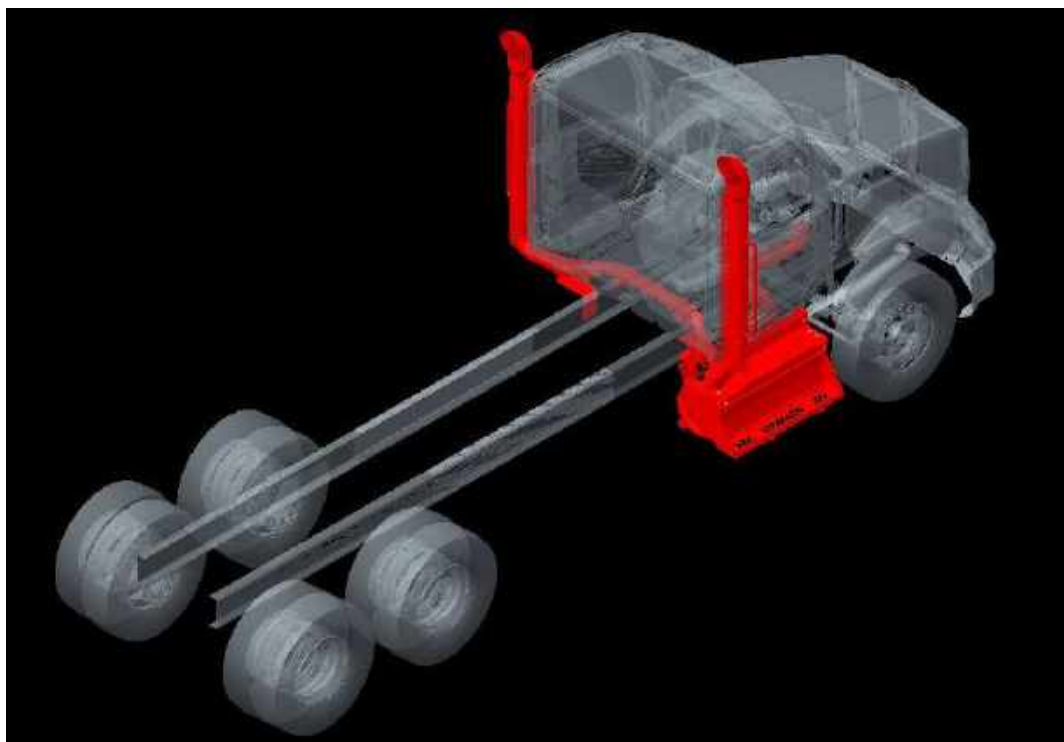


FIGURE 5-8. Isometric view of Right Hand Under DPF/SCR with Dual Side of Cab Tailpipe

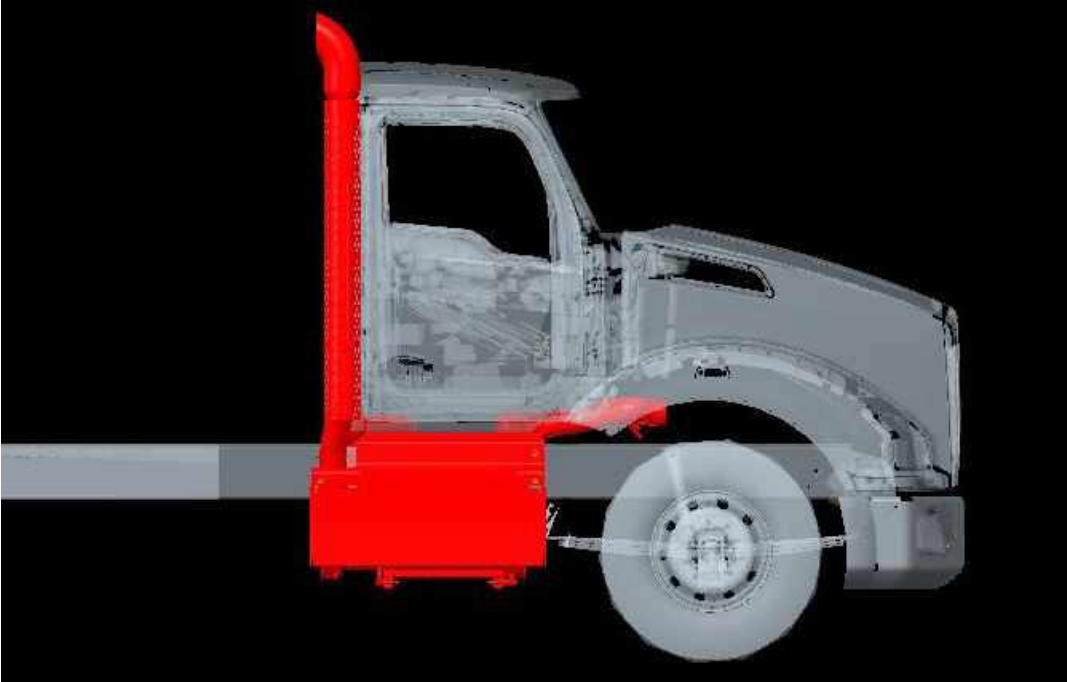


FIGURE 5-9. Right View of Right Hand Under DPF/SCR with Dual Side of Cab Tailpipe

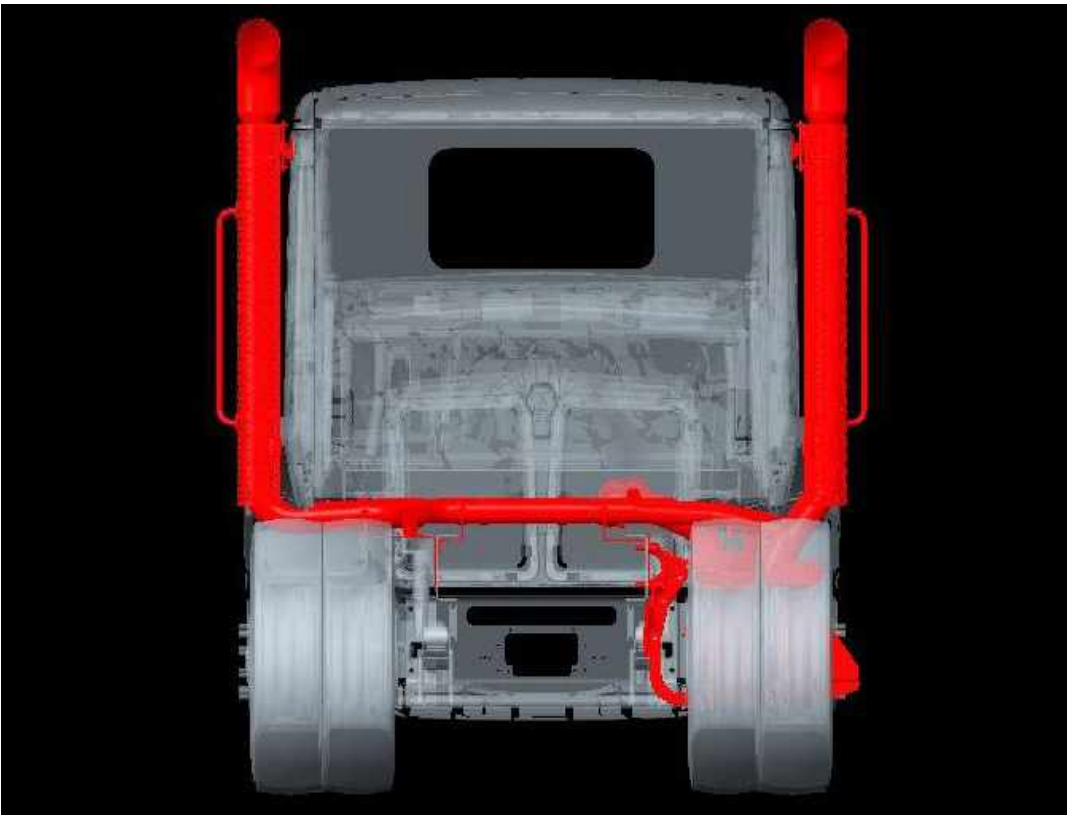


FIGURE 5-10. Back View of Right Hand Under DPF/SCR with Dual Side of Cab Tailpipe

Right Hand Under DPF/SCR on DayCab with Single Back of Cab Tailpipe

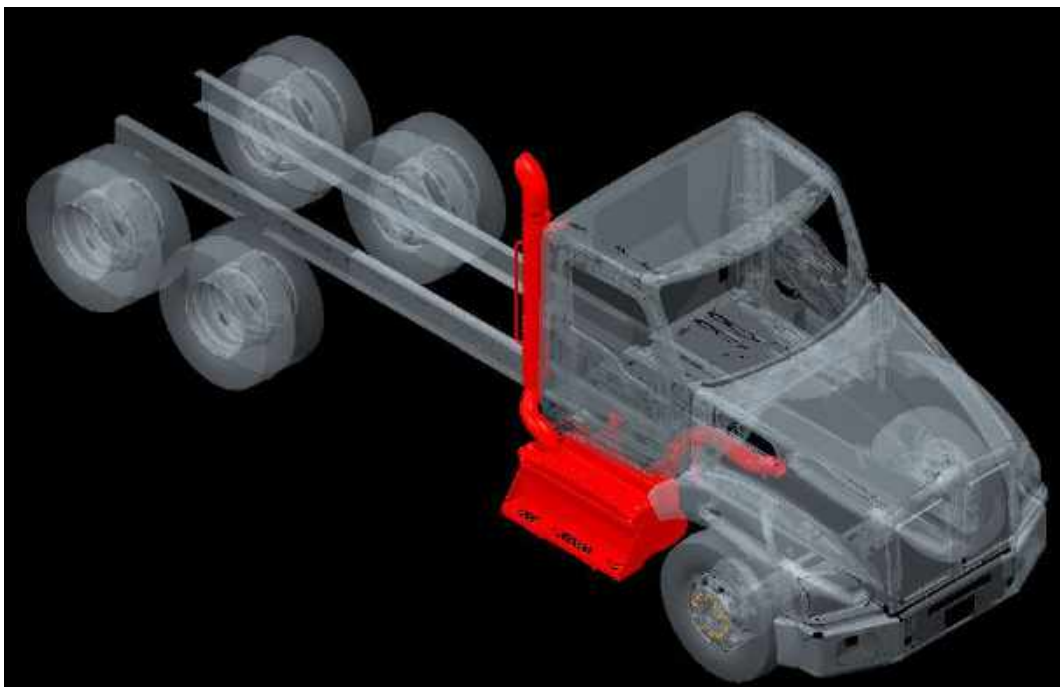


FIGURE 5-11. Isometric View of Right Hand Under DPF/SCR with Single Back of Cab Tailpipe

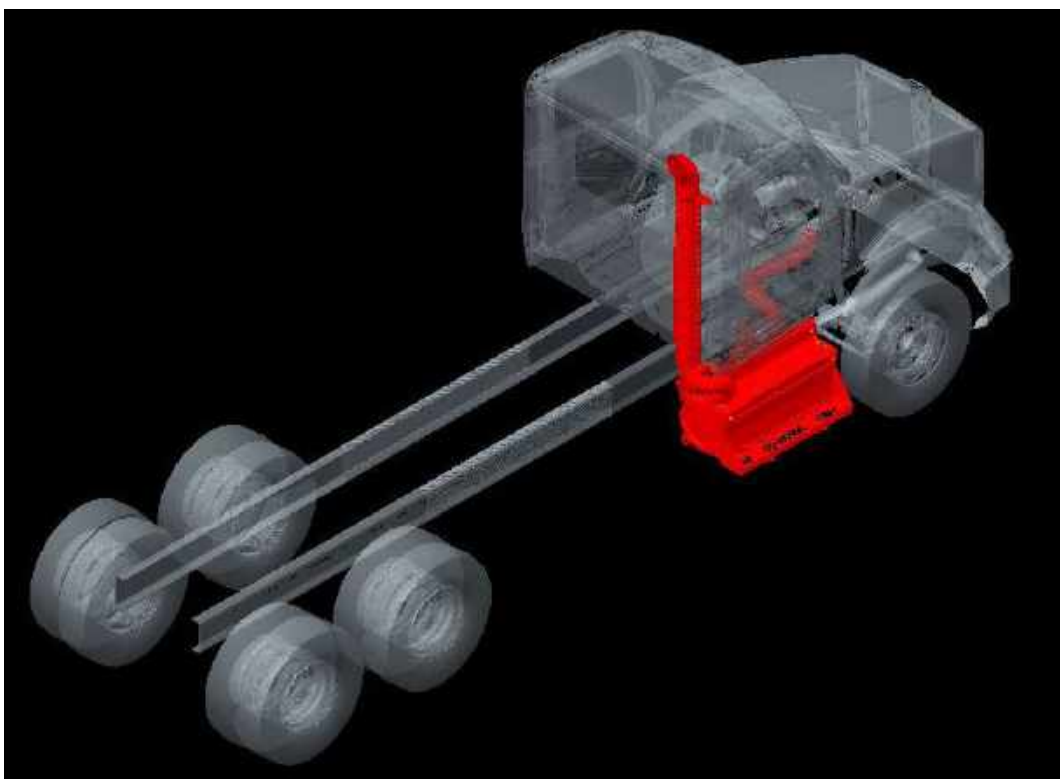


FIGURE 5-12. Isometric View of Right Hand Under DPF/SCR with Single Back of Cab Tailpipe



FIGURE 5-13. Right View of Right Hand Under DPF/SCR with Single Back of Cab Tailpipe

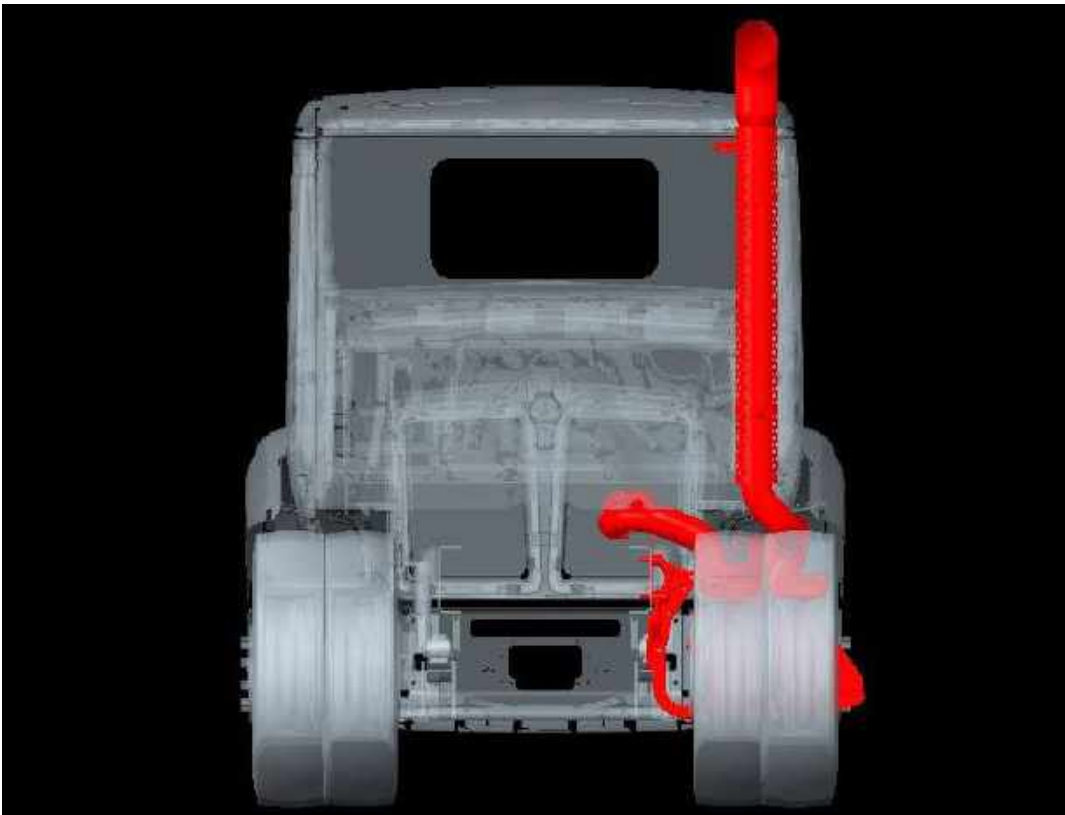


FIGURE 5-14. Back View of Right Hand Under DPF/SCR with Single Back of Cab Tailpipe

Right Hand Under DPF/SCR on DayCab with Ground-Dump Tailpipe

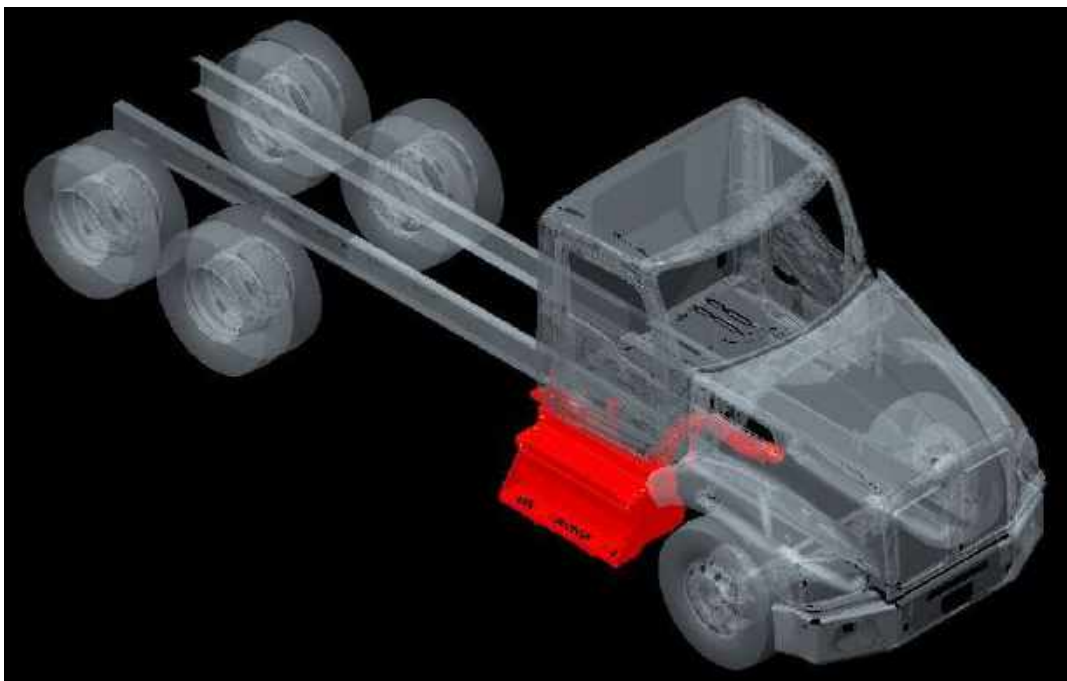


FIGURE 5-15. Isometric View of Right Hand Under DPF/SCR with Ground-Dump Tailpipe

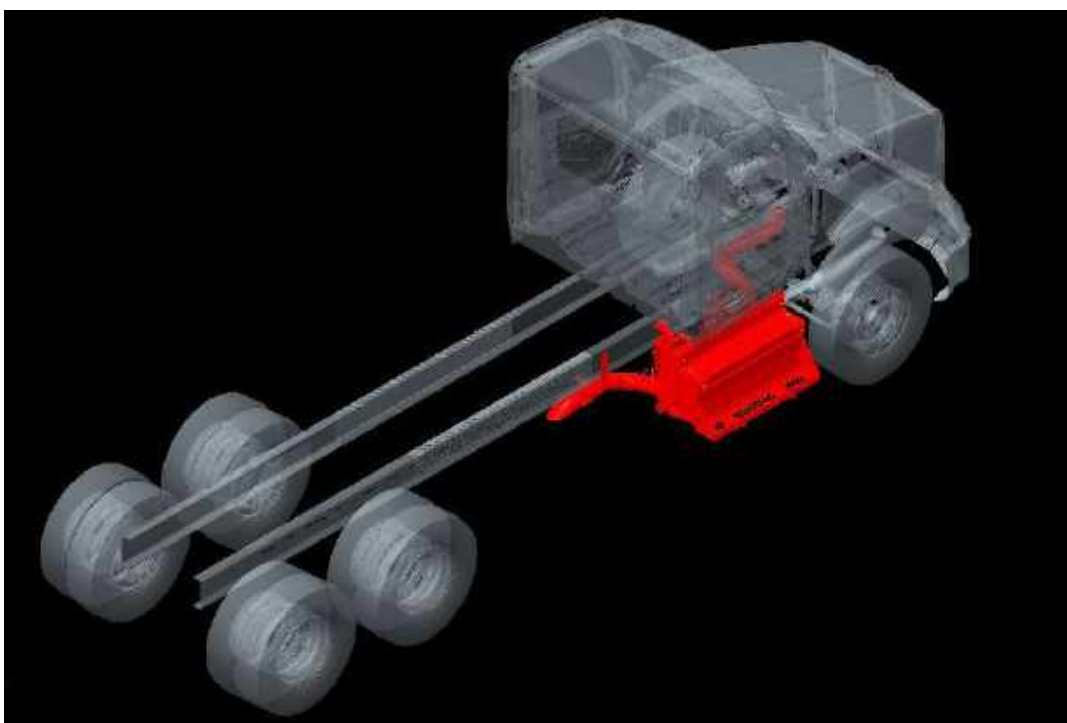


FIGURE 5-16. Isometric View of Right Hand Under DPF/SCR with Ground-Dump Tailpipe

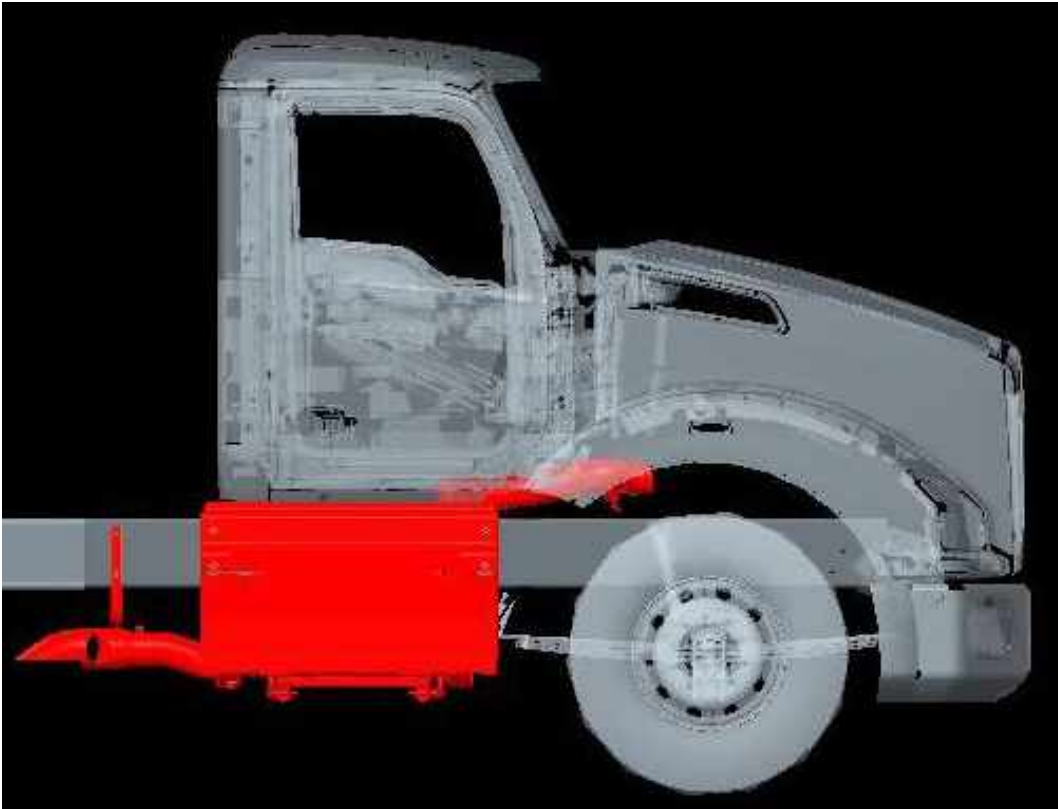


FIGURE 5-17. Right View of Right Hand Under DPF/SCR with Ground-Dump Tailpipe

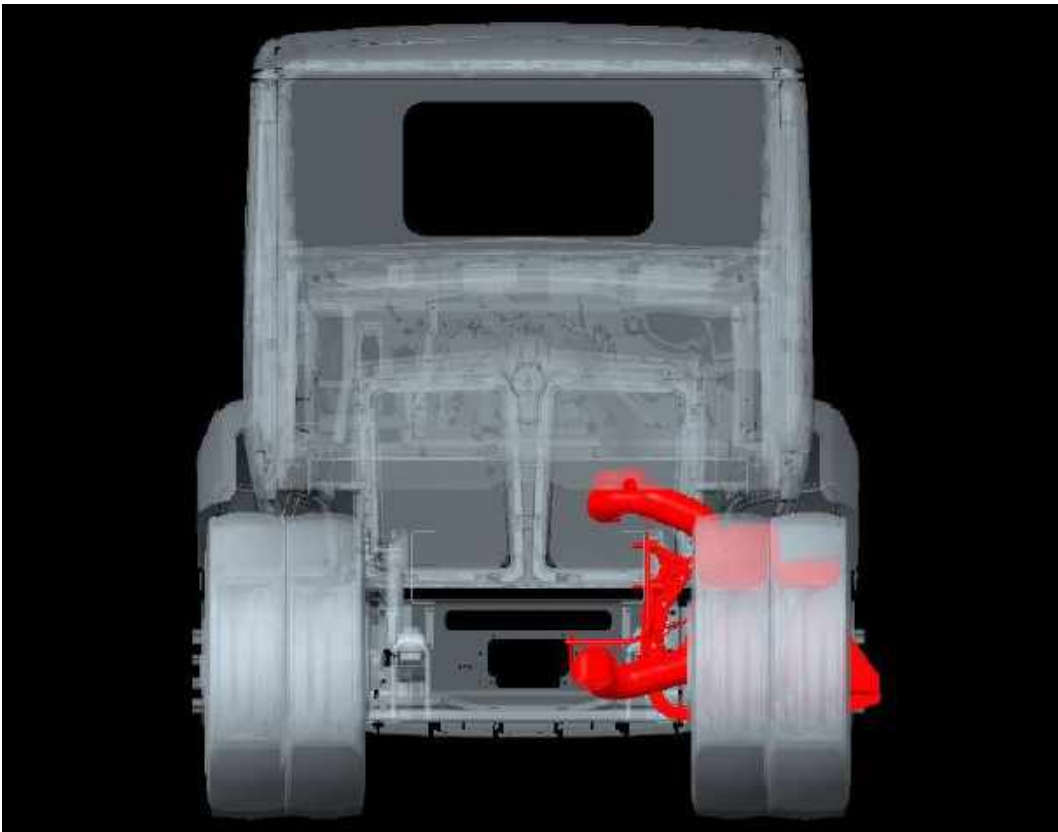


FIGURE 5-18. Back View of Right Hand Under DPF/SCR with Ground-Dump Tailpipe

Independent Back of Cab DPF/SCR on DayCab with Back of Cab Tailpipe

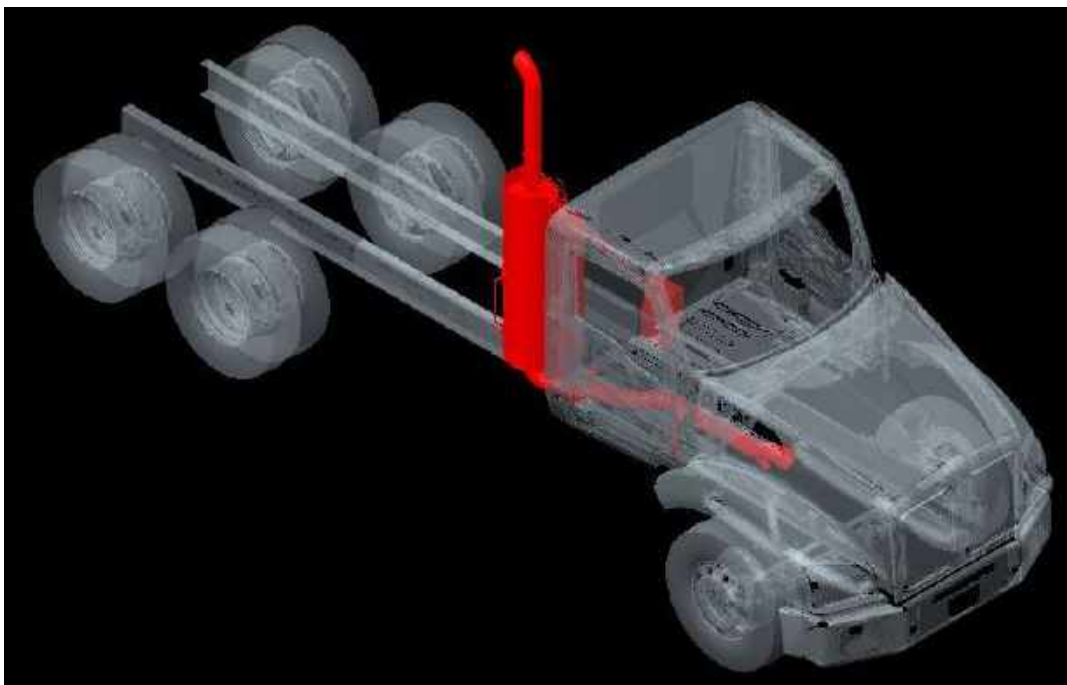


FIGURE 5-19. Isometric View of Independent Back of Cab DPF/SCR with Back of Cab Tailpipe

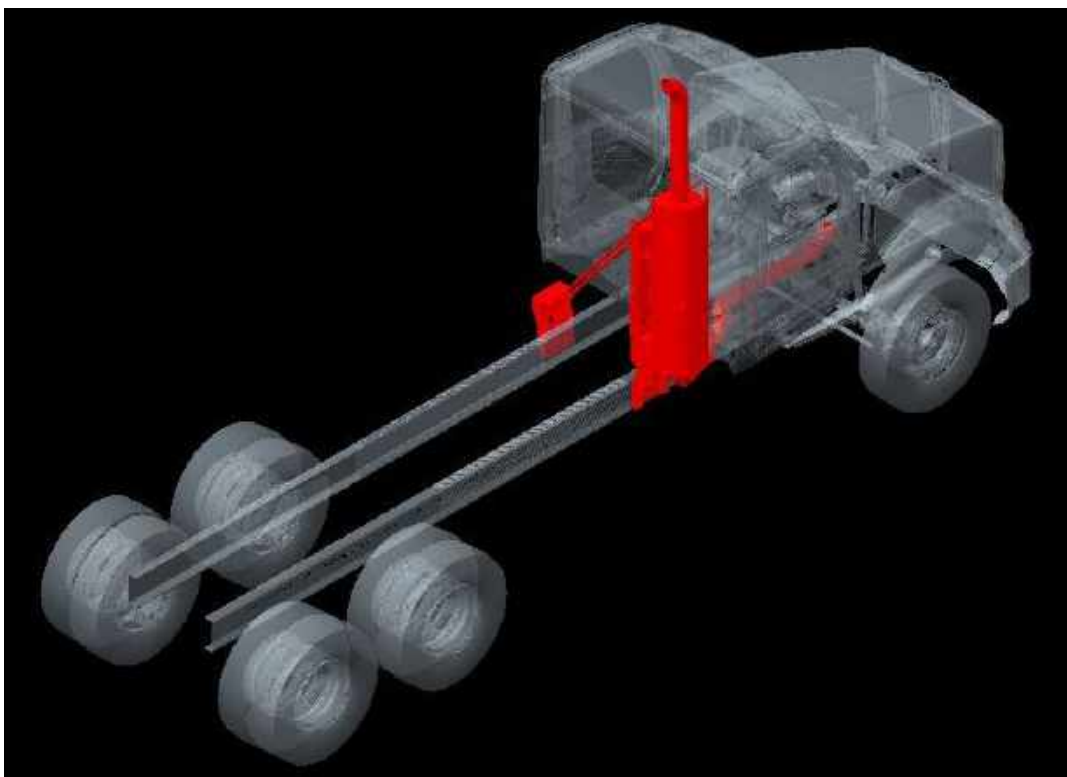


FIGURE 5-20. Isometric View of Independent Back of Cab DPF/SCR with Back of Cab Tailpipe

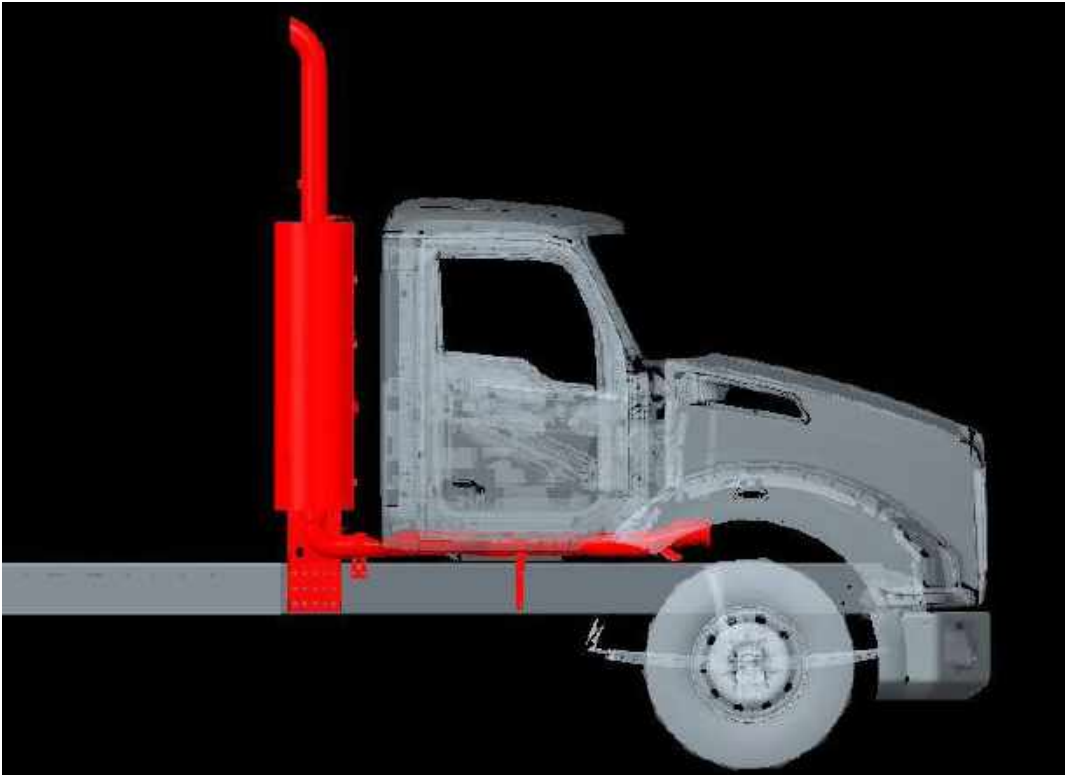


FIGURE 5-21. Right View of Independent Back of Cab DPF/SCR with Back of Cab Tailpipe

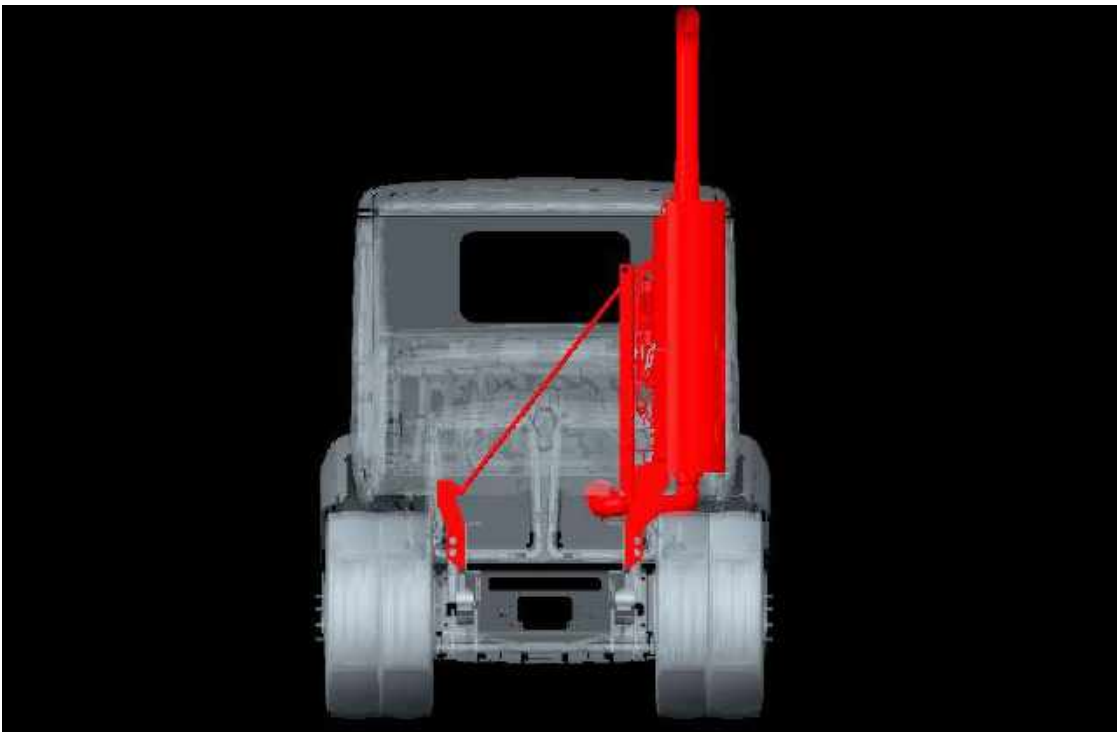


FIGURE 5-22. Back View of Independent Back of Cab DPF/SCR with Back of Cab Tailpipe

Horizontal DPF/SCR on DayCab with Ground-Dump Tailpipe

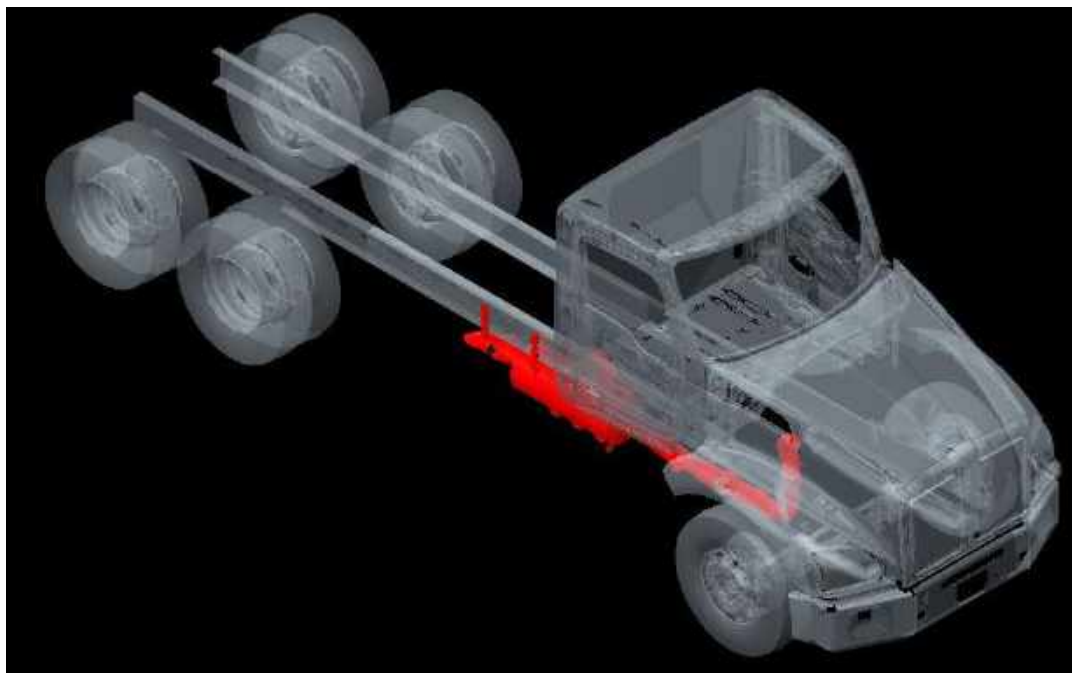


FIGURE 5-23. Isometric View of Horizontal DPF/SCR with Ground-Dump Tailpipe

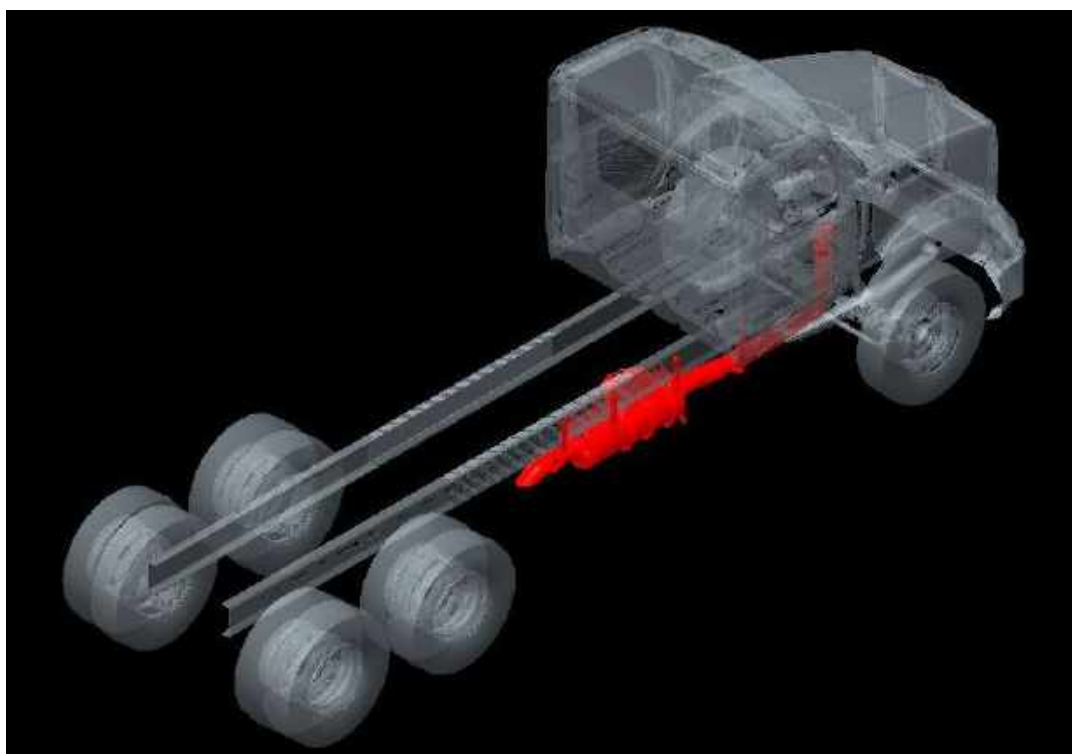


FIGURE 5-24. Isometric View of Horizontal DPF/SCR with Ground-Dump Tailpipe

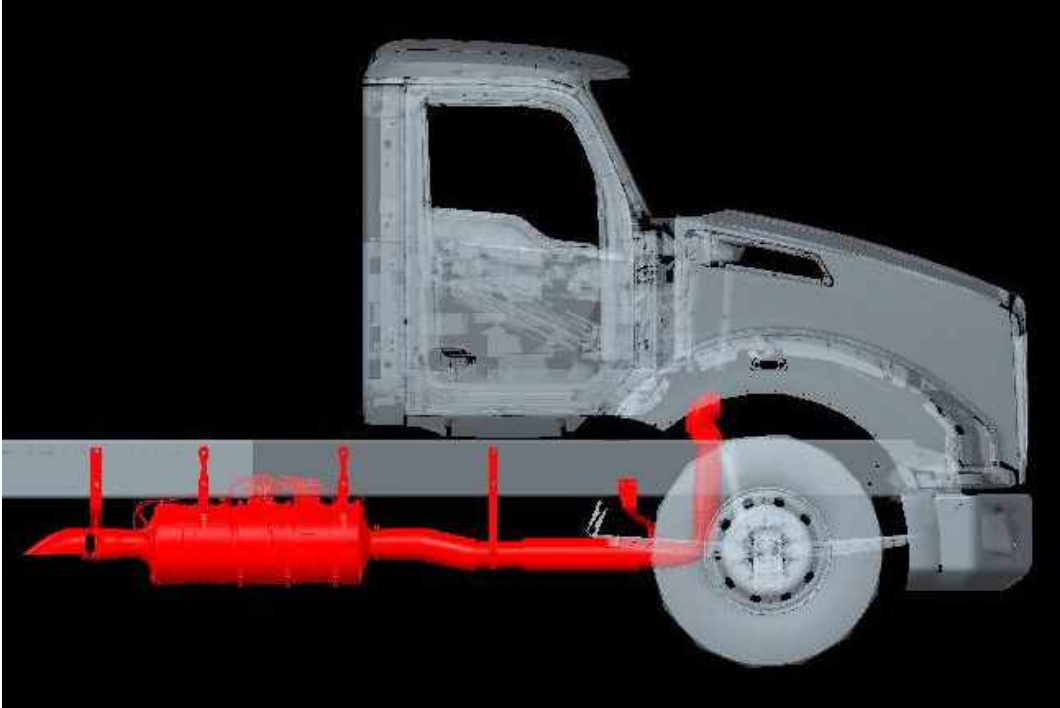


FIGURE 5-25. Right View of Horizontal DPF/SCR with Ground-Dump Tailpipe

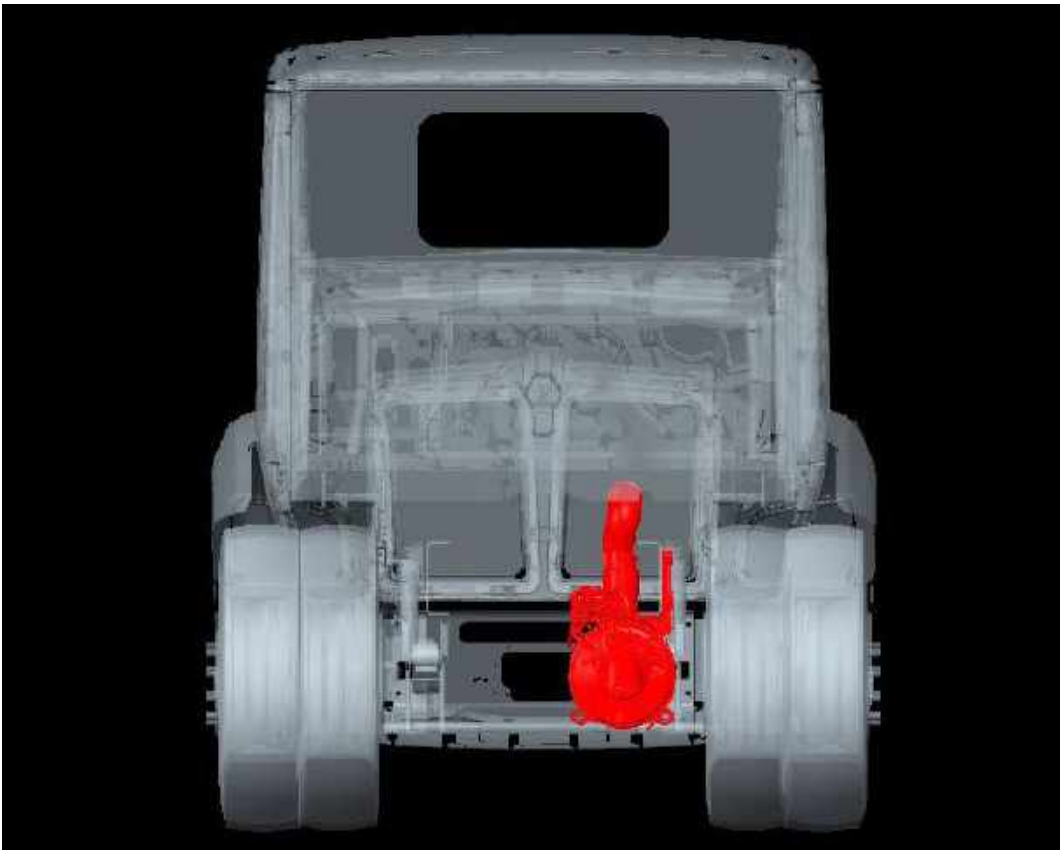


FIGURE 5-26. Back View of Horizontal DPF/SCR with Ground-Dump Tailpipe

Section 5 Exhaust & Aftertreatment

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EXHAUST INFORMATION

This section includes information on how to calculate tailpipe heights.

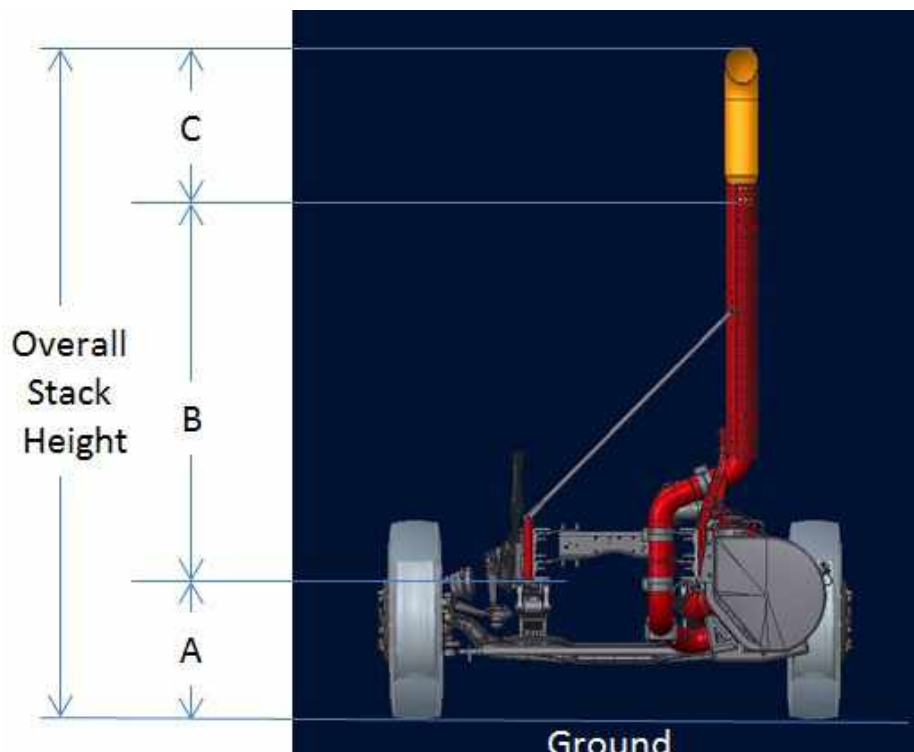


FIGURE 5-27.

Dimension B		Min. Tailpipe Length Dimension "C" (DayCab)	Min. Tailpipe Length Dimension "C" (40" Sleeper)	Min. Tailpipe Length Dimension "C" (52" Sleeper)
Diesel	Tailpipes Side of Cab (RHUC DPF/SCR)	69.2"	24"	N/A
	Tailpipes Side of Sleeper (RHUC DPF/SCR)	69.2"	N/A	36"
	Tailpipes Back of Cab (RHUC DPF/SCR)	70.3"	24"	N/A
	Tailpipes Back of Sleeper (RHUC DPF/SCR or Horizontal Crossover DPF/SCR)	86"	N/A	24"
	Tailpipes Back of Cab (Independent DPF/SCR Back of Cab)	77.5"	24"	24"
Natural Gas	Tailpipes Side of Cab (RHUC Catalyst)	69.2"	24"	36"
	Tailpipe Back of Cab (Independent Catalyst Back of Cab)	74"	24"	N/A

TABLE 5-2.

Utilize Prospector frame heights (or calculated knowing tire size and suspension height) to accurately calculate Dimension "A" from ground to bottom of frame rail.

Section 5

Exhaust & Aftertreatment

When utilizing Prospector, remember that heights shown are calculated to top of frame rail, and frame section height needs to be subtracted from Prospector height to get overall frame height from ground to bottom of frame flange (Dimension A).

Model: T680 Series Conventional
Quote/DTPO/CO No. Q20899436

The listed heights should be considered approximations due to variations which may occur in component manufacturing processes, spring set, and the way in which the vehicle is loaded.

Component	Code	Name	Laden	Unladen
Frame:	6056400	Frame Rails: 10-3/4 x 3-1/2 x 3/8in. Steel 285in.	10.8	10.8
Front Spring:	2864012	Front Springs: Taperleaf 13.2K w/ shock absorbers	10.3	11.5
FX drop-3.5:	2502326	Dana Spicer E-1322W Front Axle rated 13.2K	0	0
Height adj:	0000000	No Adjustment	0.0	0.0
Front Tires:	4077484	Front tires: Bridgestone R283ECOPIA 295/75R22.5	18.8	19.9
Front Frame Height:			39.9	42.2
Frame:	6056400	Frame Rails: 10-3/4 x 3-1/2 x 3/8in. Steel 285in.	10.8	10.8
Suspension:	3730028	Rear suspension: Tandem Kenworth Airglide 400L	8.5	8.8
Rear Tires:	4277484	Rear tires: Bridgestone R283ECOPIA 295/75R22.5	18.8	19.9
Rear Frame Height:			38.1	39.5
Frame Rake:			-1.8	-2.7
Frame Rake Slope (%):			-0.8	-1.1

These characteristics are considered to be out of the standard range:
Laden rake more than 1% of wheelbase from level (positive or negative).

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FIGURE 5-28. Dimension A = Top of Rail Frame Height from Prospector – Frame Depth.

For approximate unladen stack height (12,000 pound springs) use the following frame heights:

Tire Size	Top of Rail
11R24.5	43.5"
11R22.5	42.5"
285/75R24.5	42"
295/75R22.5	41.5"

*Use Prospector frame heights for more accurate results.

Sample: Tailpipe height 13'6" = Desired overall stack height = 162.0"
 (–) Prospector frame height (–) 43.5"
 (+) Frame rail depth (+) 10.6"
 (–) Dimension 'B' from chart (–) 68.6"
 = Tail pipe length = 60.5"

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Exhaust & Aftertreatment

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FRAME LAYOUTS

The dimensions in the frame layout section are intended to aid in layout of the chassis, and to help determine the best possible combination of fuel tanks, battery boxes, the diesel particulate filter (DPF), SCR canister, and Diesel Exhaust Fluid (DEF) tank. For your application, the layouts focus on the under cab area, with appropriate dimensional information included for pertinent back of cab components. Not all optional equipment is included in this section. Additional components may be placed on the rail behind components shown. The Back of Cab components are shown primarily for reference. For more specific requirements please work with your local Kenworth Dealer. Please read the instructions carefully.

The following dimensions are consistent across the entire section to aid in the comparison of one layout option versus another.

TABLE 6-1.

B = Battery box
D = DEF tank
E = Exhaust
F1 = Fuel Tank RHS
F2 = Fuel Tank LHS
T = Tool Box

The layouts are organized by type, specifically the arrangement of under cab components. The visual index that follows will give you a quick overview of the layouts that are included. Using the index locate the layout that you are interested in, then turn to the specified pages. The charts that follow are then model specific. It is important that the correct chart is used for accurate dimensional information.

Visual Index

Symbol	Description
	RHUC DPF/SCR
	Horizontal DPF/SCR
	Parallel Battery Box, Standard Length
	In Cab Battery Box

Symbol	Description
	Cantilever Battery Box
	Tool Box
	DEF Tank
	Fuel Tank

COMMON OPTIONAL COMPONENTS

The frame layouts that follow contain the minimum frame requirements to be operational (fuel tanks, battery box, and after-treatment components). All layouts are shown with standard length battery boxes unless otherwise noted. Dimensions for these components have been provided below to help complete the frame layout for chassis with more fuel tanks, additional tool boxes, etc.

TABLE 6-2. Fuel Tank Overall Length (in)

Fuel Tank Overall Length (in)			
	Fuel Tank Diameter		
Gallons	22"	24.5"	28.5"
45	N/A	23.0	N/A
56	35.6	N/A	N/A
60	38.0	30.6	N/A
75	47.3	38.5	28.7
90	N/A	45.5	34.3
100	62.2	50.0	N/A
105	N/A	N/A	38.8
110	N/A	55.0	N/A
120	74.3	60.6	45.8
135	N/A	67.2	50.9
150	N/A	74.5	56.2
177	N/A	N/A	66.1

TABLE 6-3. Battery Box Centerframe Lengths (in)

Battery Box Centerframe Lengths (in)		
	T680	T880
Parallel Short	34.8	34.8
Parallel Extended	42.0	42.0
Parallel BOC	34.8	34.8
Cantilever (Standard)	17.8	17.8
Cantilever (Vocational)	15.2	15.2

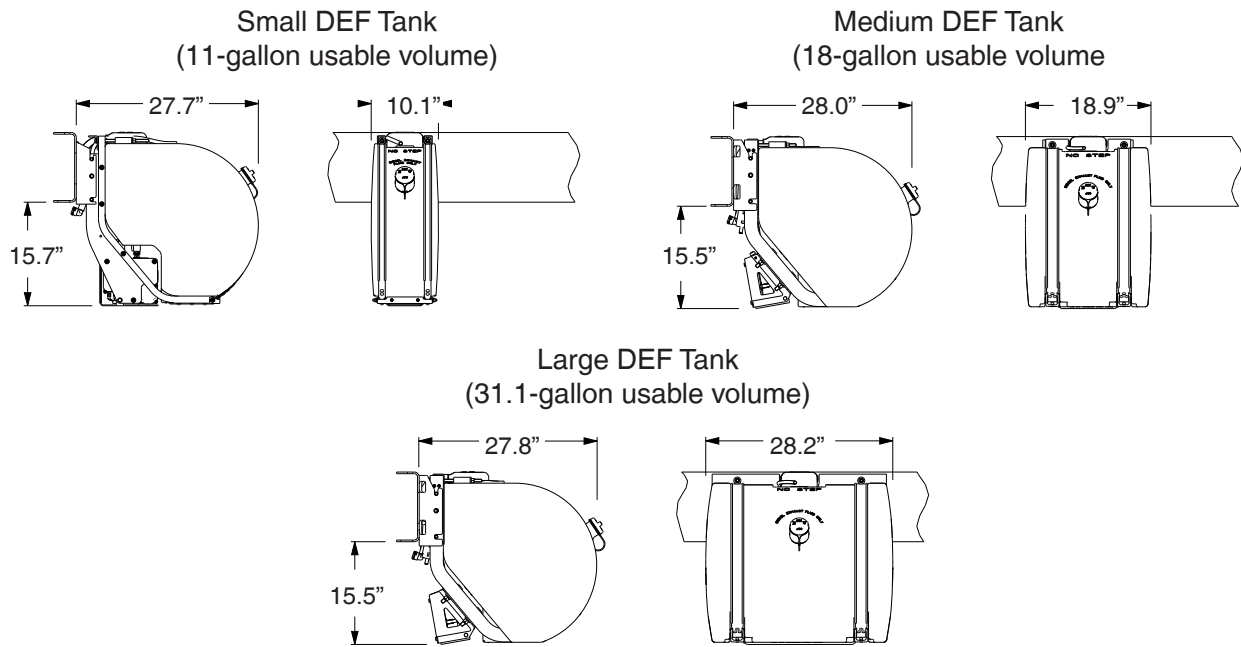


FIGURE 6-1. DEF Tank Dimensions.

Acronyms Index

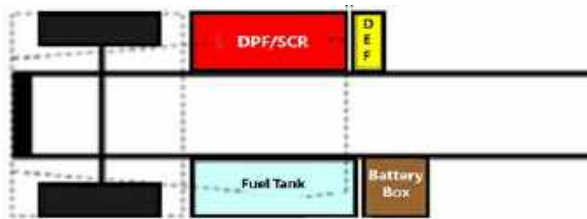
Throughout the Frame Layout section you will see these acronyms. They are defined here to help you decode the layouts.

BOC	Back Of Cab
BOS	Back Of Sleeper
CBOC	Clear Back Of Cab
DEF	Diesel Exhaust Fluid
DSOAC	Dual Side Of AeroCab

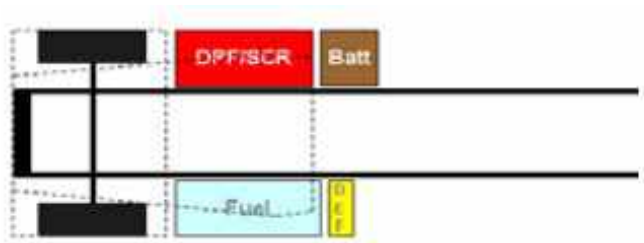
DSOC	Dual Side Of Cab
LHUC	Left Hand Under Cab
RHUC	Right Hand Under Cab
SOAC	Side Of AeroCab
SOC	Side Of Cab

FRAME LAYOUT INDEX

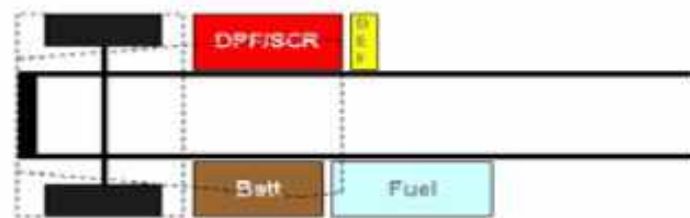
Day Cab Chassis Layout Options



D1 is used with RHUC DPF/SCR, LHUC fuel tank, RH BOC DEF tank, and LH BOC cantilever battery box. Charts located on pages 6-6 through 6-8.



D2 is used with RHUC DPF/SCR, LHUC fuel tank, RH BOC cantilever battery box, and LH BOC DEF tank. Charts located on pages 6-9 through 6-11.



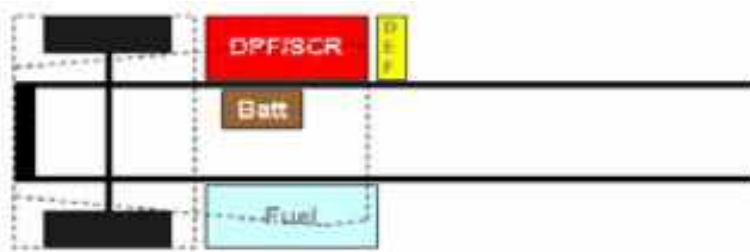
D3 is used with RHUC DPF/SCR, LHUC battery box, RH BOC DEF tank, and LH BOC fuel tank. Charts located on pages 6-12 through 6-14.



D4 is used with RHUC DPF/SCR, LHUC battery box, LH BOC DEF tank, and RH BOC fuel tank. Charts located on pages 6-15 through 6-17.

Section 6

Frame Layouts

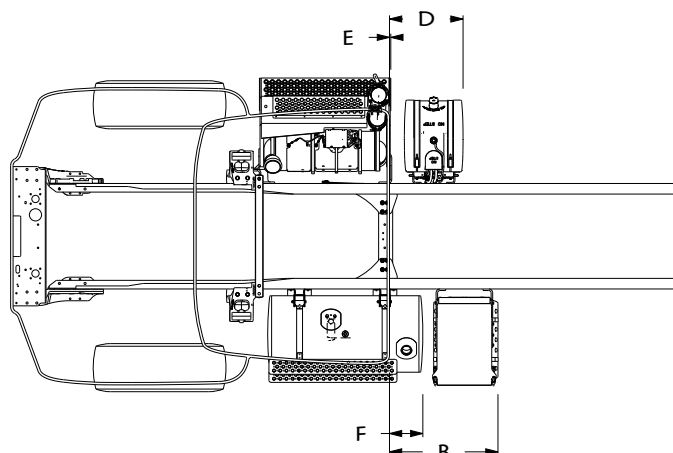


D5 is used with RHUC DPF/SCR, LHUC fuel tank, RH BOC DEF tank, and in cab battery box. Charts located on pages 6-18 through 6-20.

Section 6 Frame Layouts

<https://truckmanualshub.com/>

D1—Use with the following models: T880 (Standard Hood)



Dimension E (BOC to DPF/SCR) = 2.7in

TABLE 6-5.

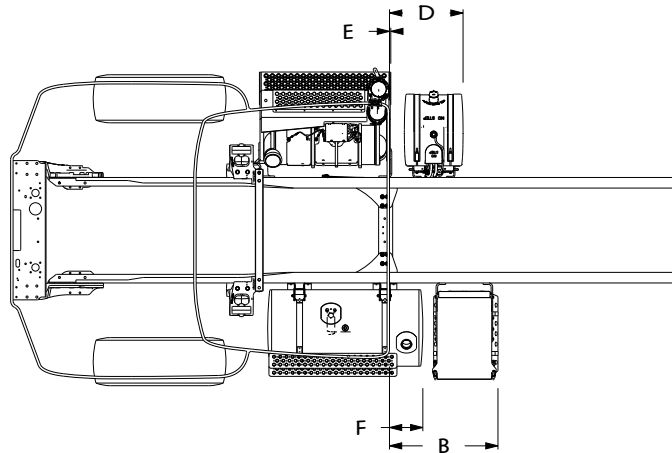
T880 (SBFA) Standard Hood Daycab							
Fuel Tank Size			Dimension F BOC to Fuel Tank Daycab (in)	Dimension B BOC to Battery Box* (in)	Dimension D (in) BOC to DEF Tank (in)		
Diameter	Gallons	Length (in)			Small	Medium	Large
22" Diameter Tank	56	35.6	-2.1	19.5	22.3	29.6	39.8
	60	38.0	0.4	21.4			
	75	47.3	9.6	31.3			
	100	62.2	24.5	47.0			
	120	74.3	36.6	58.8			
24.5" Diameter Tank	60	30.6	-6.5	15.5			
	75	38.5	0.6	23.4			
	90	45.5	7.7	31.3			
	100	50.0	12.2	23.0			
	110	55.0	17.2	41.1			
	120	60.6	22.8	45.1			
	135	67.2	29.4	52.9			
	150	74.5	36.7	58.8			
28.5" Diameter Tank	75	28.7	-8.8*	13.9			
	90	34.3	-3.3*	19.5			
	105	38.8	-0.4*	23.4			
	110	42.4	4.0*	25.4			
	120	45.8	7.4*	29.3			
	135	50.9	12.5*	35.2			
	150	56.2	17.8*	41.1			
	177	66.1	27.7*	51.0			

NOTE: DIMENSION "B" IS CALCULATED USING A CANTILEVER SIZED BATTERY BOX. OPTIONAL BOXES WILL AFFECT THIS DIMENSION.
* N/A W/ DUAL SIDE OF CAB OR BACK OF CAB EXHAUST

Section 6

Frame Layouts

D1—Use with the following models: T880 (Short Hood)



Dimension E (BOC to DPF/SCR) = 2.7in

TABLE 6-6.

T880 (SBFA) Short Hood Daycab							
Fuel Tank Size			Dimension F BOC to Fuel Tank Daycab (in)	Dimension B BOC to Battery Box* (in)	Dimension D (in) BOC to DEF Tank (in)		
Diameter	Gallons	Length (in)			Small	Medium	Large
22" Diameter Tank	56	35.6	-2.1	19.5	22.3	29.6	39.8
	60	38.0	0.4	21.4			
	75	47.3	9.6	31.3			
	100	62.2	24.5	47.0			
	120	74.3	36.6	58.8			
24.5" Diameter Tank	60	30.6	-6.5	15.5			
	75	38.5	0.6	23.4			
	90	45.5	7.7	31.3			
	100	50.0	12.2	23.0			
	110	55.0	17.2	41.1			
	120	60.6	22.8	45.1			
	135	67.2	29.4	52.9			
	150	74.5	36.7	58.8			
28.5" Diameter Tank	75	28.7	-8.8*	13.9			
	90	34.3	-3.3*	19.5			
	105	38.8	-0.4*	23.4			
	110	42.4	4.0*	25.4			
	120	45.8	7.4*	29.3			
	135	50.9	12.5*	35.2			
	150	56.2	17.8*	41.1			
	177	66.1	27.7*	51.0			

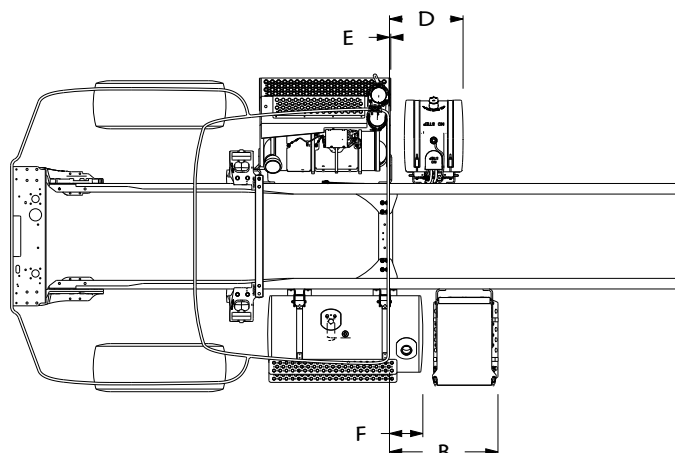
NOTE: DIMENSION "B" IS CALCULATED USING A CANTILEVER SIZED BATTERY BOX. OPTIONAL BOXES WILL AFFECT THIS DIMENSION.

* N/A W/ DUAL SIDE OF CAB EXHAUST

Section 6 Frame Layouts

<https://truckmanualshub.com/>

D1—Use with the following models: T880S (SFFA)



Dimension E (BOC to DPF/SCR) = 2.7in

TABLE 6-7.

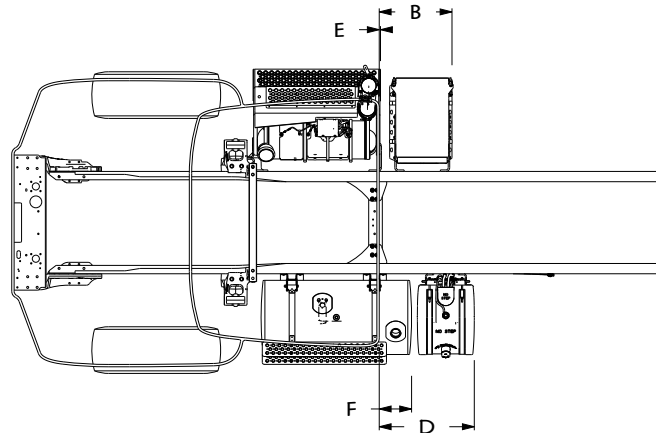
T880S (SFFA) Daycab with Short Hood							
Fuel Tank Size			Dimension F BOC to Fuel Tank Daycab (in)	Dimension B BOC to Battery Box* (in)	Dimension D (in) BOC to DEF Tank (in)		
Diameter	Gallons	Length (in)			Small	Medium	Large
22" Diameter Tank	56	35.6	-8.2	13.6	18.4	33.6	42.2
	60	38.0	-5.2	17.5			
	75	47.3	0.0	21.4			
	100	62.2	14.9	37.2			
	120	74.3	27.0	49.9			
24.5" Diameter Tank	60	30.6	-7.4	15.5			
	75	38.5	-4.4	17.5			
	90	45.5	-1.3	21.4			
	100	50.0	3.2	25.4			
	110	55.0	8.1	31.3			
	120	60.6	13.7	37.2			
	135	67.2	22.4	45.1			
	150	74.5	27.7	51.0			

NOTE: DIMENSION "B" IS CALCULATED USING A CANTILEVER SIZED BATTERY BOX. OPTIONAL BOXES WILL AFFECT THIS DIMENSION.

Section 6

Frame Layouts

D2—Use with the following models: T880 (Standard Hood)



Dimension B (BOC to Cantilever Battery Box) = 25.4in

Dimension E (BOC to DPF/SCR) = 2.7in

TABLE 6-8.

T880 (SBFA) Standard Hood Daycab						
Fuel Tank Size			Dimension F BOC to Fuel Tank Daycab (in)	Dimension D (in) BOC to DEF Tank (in)		
Diameter	Gallons	Length (in)		Small	Medium	Large
22" Diameter Tank	56	35.6	-2.1	11.4	19.8	28.3
	60	38.0	0.4	12.4	21.7	30.3
	75	47.3	9.6	21.8	31.6	40.2
	100	62.2	24.5	36.0	45.4	56
	120	74.3	36.6	49.8	57.2	67.8
24.5" Diameter Tank	60	30.6	-7.1	6.5	13.9	24.4
	75	38.5	0.7	14.4	21.7	32.3
	90	45.5	7.7	20.3	29.6	38.2
	100	50.0	12.2	25.7	33.6	44.2
	110	55.0	17.2	30.1	39.5	48
	120	60.6	22.8	36.0	45.4	53.9
	135	67.2	29.4	41.9	51.3	59.8
	150	74.5	36.7	49.8	59.1	67.8
28.5" Diameter Tank	90	34.3	-3.3*	8.5	17.8	26.4
	105	38.8	-1.3*	14.4	21.7	32.3
	120	45.8	8.3*	20.3	29.6	38.2
	135	50.9	13.3*	26.2	35.5	44.2
	150	56.2	18.7*	32.1	39.5	50.1
	177	66.1	28.6*	41.9	49.3	59.8

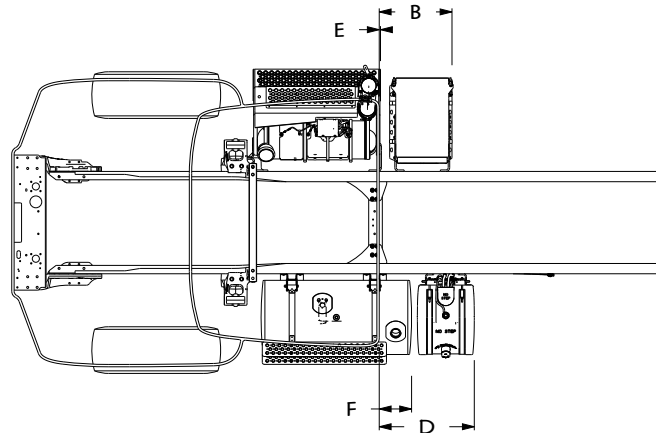
NOTE: DIMENSION "B" IS CALCULATED USING A CANTILEVER SIZED BATTERY BOX. OPTIONAL BOXES WILL AFFECT THIS DIMENSION.

* N/A w/ Back of Cab or Dual Side of Cab Exhaust

Section 6 Frame Layouts

<https://truckmanualshub.com/>

D2—Use with the following models: T880 (Short Hood)



Dimension B (BOC to Cantilever Battery Box) = 25.4in

Dimension E (BOC to DPF/SCR) = 2.7in

TABLE 6-9.

T880 (SBFA) Short Hood Daycab						
Fuel Tank Size			Dimension F BOC to Fuel Tank Daycab (in)	Dimension D (in) BOC to DEF Tank (in)		
Diameter	Gallons	Length (in)		Small	Medium	Large
22" Diameter Tank	56	35.6	-2.1	10.4	19.8	28.3
	60	38.0	0.0	12.4	21.2	30.3
	75	47.3	8.7	22.2	29.6	40.2
	100	62.2	23.5	36.0	45.4	53.9
	120	74.3	35.6	47.8	57.2	65.7
24.5" Diameter Tank	60	30.6	-6.2	6.5**	15.9**	24.5**
	75	38.5	0.0	12.4	21.7	30.3
	90	45.5	6.6	20.3	27.6	38.2
	100	50.0	11.7	24.2	33.6	42.1
	110	55.0	16.7	28.1	37.5	48.0
	120	60.6	22.2	34.0	43.4	51.0
	135	67.2	28.3	41.9	49.3	59.8
	150	74.5	35.6	47.8	57.2	65.7
28.5" Diameter Tank	75	28.7	-8.4*	10.4	17.8	26.4
	90	34.3	-2.7*	10.4	17.8	28.3
	105	38.8	0.2*	14.4	21.3	32.3
	110	42.4	4.0*	18.3	25.7	36.2
	120	45.8	6.4*	20.3	27.6	37.3
	135	50.9	11.5*	24.2	33.6	42.1
	150	56.2	16.8*	30.1	39.5	48.0
	177	66.1	26.7*	39.9	49.3	57.8

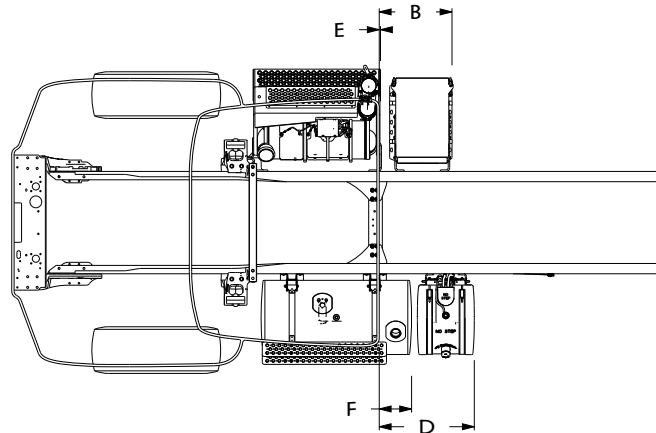
NOTE: DIMENSION "B" IS CALCULATED USING A CANTILEVER SIZED BATTERY BOX. OPTIONAL BOXES WILL AFFECT THIS DIMENSION.

* N/A W/ BACK OF CAB OR DUAL SIDE OF CAB EXHAUST

** ADD 2 INCHES FOR DUAL SIDE OF CAB EXHAUST

Section 6 Frame Layouts

D2—Use with the following models: T880S (SFFA)



Dimension B (BOC to Cantilever Battery Box) = 23.4in

Dimension E (BOC to DPF/SCR) = 0.2in

TABLE 6-10.

T880S (SFFA) Daycab with Short Hood						
Fuel Tank Size			Dimension F BOC to Fuel Tank Daycab (in)	Dimension D (in) BOC to DEF Tank (in)		
Diameter	Gallons	Length (in)		Small	Medium	Large
22" Diameter Tank	56	35.6	-8.2	4.6***	11.5***	22.5***
	60	38.0	-5.2	6.5**	13.4**	22.4**
	75	47.3	0.0	12.4	21.7	30.3
	100	62.2	14.9	28.1	36.5	46.1
	120	74.3	27.0	39.9	47.3	55.9
24.5" Diameter Tank	60	30.6	-3.6	6.5**	13.4**	22.4**
	75	38.5	0.9	8.5	17.8	28.3
	90	45.5	-1.3	10.4	19.8	28.3
	100	50.0	3.2	15.8	25.1	34.2
	110	55.0	8.1	20.3	29.6	38.2
	120	60.6	13.7	26.2	35.5	44.1
	135	67.2	22.4	32.2	41.6	52
	150	74.5	27.7	39.9	49.3	57.9

NOTE: DIMENSION "B" IS CALCULATED USING A CANTILEVER SIZED BATTERY BOX. OPTIONAL BOXES WILL AFFECT THIS DIMENSION.

* N/A W/ BACK OF CAB OR DUAL SIDE OF CAB EXHAUST

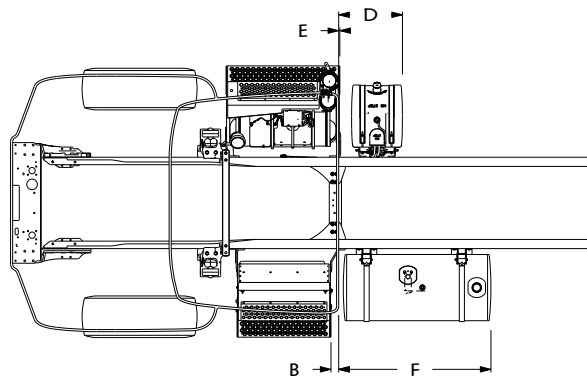
** ADD 2 INCHES FOR DUAL SIDE OF CAB EXHAUST

*** ADD 3.9 INCHES FOR DUAL SIDE OF CAB EXHAUST

Section 6 Frame Layouts

<https://truckmanualshub.com/>

D3—Use with the following models: T880 (Standard Hood)



Dimension B (BOC to 34" Short Battery Box) = -2.5in

Dimension B (BOC to 40" Long Battery Box) = 3.5in

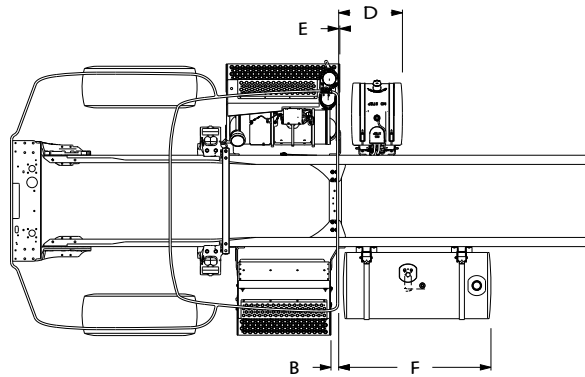
Dimension E (BOC to DPF/SCR) = 2.7in

TABLE 6-11.

T880 (SBFA) Standard Hood Daycab						
Fuel Tank Size			Dimension F BOC to Fuel Tank Daycab (in)	Dimension D (in) BOC to DEF Tank (in)		
Diameter	Gallons	Length (in)		Small	Medium	Large
22" Diameter Tank	56	35.6	39.7	20.4*	29.6*	40.2*
	60	38.0	42			
	75	47.3	51			
	100	62.2	66			
	120	74.3	78			
24.5" Diameter Tank	60	30.6	35			
	75	38.5	43			
	90	45.5	50			
	100	50.0	54.5			
	110	55.0	59.5			
	120	60.6	65			
	135	67.2	71.7			
	150	74.5	78.8			
28.5" Diameter Tank	75	28.7	32.6			
	90	34.3	38.2			
	105	38.8	42.7			
	110	42.4	46.3			
	120	45.8	49.7			
	135	50.9	54.8			
	150	56.2	60.1			
	177	66.1	70			

NOTE: DIMENSIONS "B" AND "F" ARE CALCULATED USING A 34" SHORT BATTERY BOX. OPTIONAL BOXES WILL AFFECT THESE DIMENSIONS.
* ADD 6.0 INCHES FOR 40" LONG BATTERY BOX

D3—Use with the following models: T880 (Short Hood)



Dimension B (BOC to 34" Short Battery Box) = -2.5in

Dimension B (BOC to 40" Long Battery Box) = 3.5in

Dimension E (BOC to DPF/SCR) = 2.7in

TABLE 6-12.

T880 (SBFA) Short Hood Daycab						
Fuel Tank Size			Dimension F BOC to Fuel Tank Daycab (in)	Dimension D (in) BOC to DEF Tank (in)		
Diameter	Gallons	Length (in)		Small	Medium	Large
22" Diameter Tank	56	35.6	39.7	20.4*	29.6*	40.2*
	60	38.0	42			
	75	47.3	51			
	85	53.2	56.9			
	100	62.2	66			
	120	74.3	78			
24.5" Diameter Tank	60	30.6	35			
	75	38.5	43			
	90	45.5	50			
	100	50.0	54.5			
	110	55.0	59.5			
	120	60.6	65			
	135	67.2	71.7			
	150	74.5	78.8			
28.5" Diameter Tank	75	28.7	32.6			
	90	34.3	38.2			
	105	38.8	42.7			
	110	42.4	46.3			
	120	45.8	49.7			
	135	50.9	54.8			
	150	56.2	60.1			
	177	66.1	70			

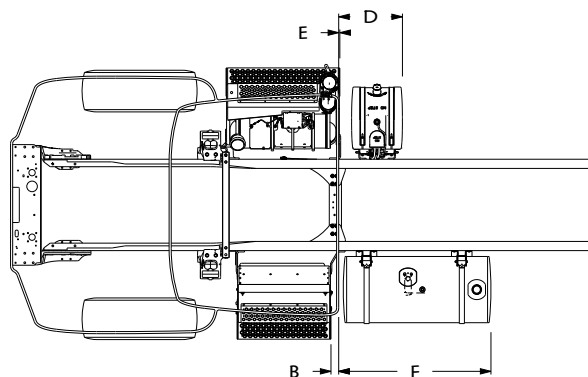
NOTE: DIMENSIONS "B" AND "F" ARE CALCULATED USING A 34" SHORT BATTERY BOX. OPTIONAL BOXES WILL AFFECT THESE DIMENSIONS.

* ADD 6.0 INCHES FOR 40" LONG BATTERY BOX** Add 3.9 inches for Back of Cab Exhaust

Section 6 Frame Layouts

<https://truckmanualshub.com/>

D3—Use with the following models: T880S (SFFA)



Dimension B (BOC to 34" Short Battery Box) = -6.5in

Dimension B (BOC to 40" Long Battery Box) = -4.0in

Dimension E (BOC to DPF/SCR) = 0.2in

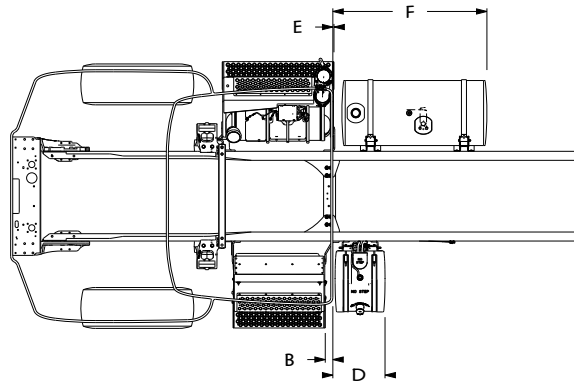
TABLE 6-13.

T880S (SFFA) Daycab with Short Hood						
Fuel Tank Size			Dimension F BOC to Fuel Tank Daycab (in)	Dimension D (in) BOC to DEF Tank (in)		
Diameter	Gallons	Length (in)		Small	Medium	Large
22" Diameter Tank	56	35.6	36.3	17.4*	27.6*	38.2*
	60	38.0	38.7			
	75	47.3	48			
	100	62.2	62.9			
	120	74.3	74.9			
24.5" Diameter Tank	60	30.6	31.9			
	75	38.5	39.7			
	90	45.5	46.7			
	100	50.0	51.2			
	110	55.0	56.2			
	120	60.6	61.8			
	135	67.2	68.5			
	150	74.5	75.7			
28.5" Diameter Tank	75	28.7	29.4			
	90	34.3	35			
	105	38.8	39.5			
	110	42.4	43.1			
	120	45.8	46.5			
	135	50.9	51.6			
	150	56.2	56.9			
	177	66.1	66.9			

NOTE: DIMENSIONS "B" AND "F" ARE CALCULATED USING A 34" SHORT BATTERY BOX. OPTIONAL BOXES WILL AFFECT THESE DIMENSIONS.

* ADD 6.0 INCHES FOR 40" LONG BATTERY BOX

D4—Use with the following models: T880 (Standard Hood)



Dimension B (BOC to 34" Short Battery Box) = -2.5in

Dimension B (BOC to 40" Long Battery Box) = 3.5in

Dimension E (BOC to DPF/SCR) = 2.7in

TABLE 6-14.

T880 (SBFA) Standard Hood Daycab						
Fuel Tank Size			Dimension F BOC to Fuel Tank Daycab (in)	Dimension D (in) BOC to DEF Tank (in)		
Diameter	Gallons	Length (in)		Small	Medium	Large
22" Diameter Tank	56	35.6	40.9	13.4*	26.2*	34.8*
	60	38.0	43.3			
	75	47.3	52.4			
	100	62.2	67.2			
	120	74.3	79.2			
24.5" Diameter Tank	60	30.6	36.1			
	75	38.5	44.1			
	90	45.5	51.1			
	100	50.0	55.5			
	110	55.0	60.5			
	120	60.6	66.1			
	135	67.2	72.8			
	150	74.5	80.1			
28.5" Diameter Tank	75	28.7	33.8			
	90	34.3	39.3			
	105	38.8	43.9			
	110	42.4	47.5			
	120	45.8	50.9			
	135	50.9	55.9			
	150	56.2	61.3			
	177	66.1	71.2			

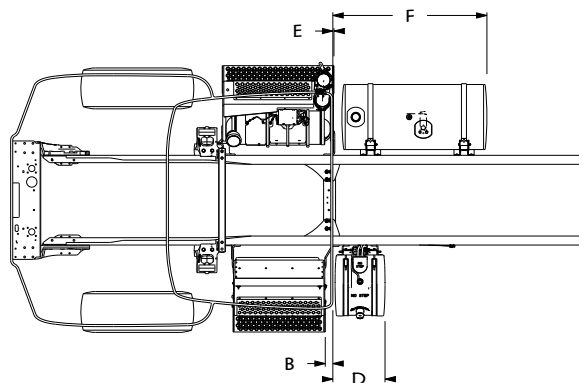
NOTE: DIMENSIONS "B" AND "F" ARE CALCULATED USING A 34" SHORT BATTERY BOX. OPTIONAL BOXES WILL AFFECT THESE DIMENSIONS.

* ADD 6.0 INCHES FOR 40" LONG BATTERY BOX

Section 6 Frame Layouts

<https://truckmanualshub.com/>

D4—Use with the following models: T880 (Short Hood)



Dimension B (BOC to 34" Short Battery Box) = -2.5in

Dimension B (BOC to 40" Long Battery Box) = 3.5in

Dimension E (BOC to DPF/SCR) = 2.7in

TABLE 6-15.

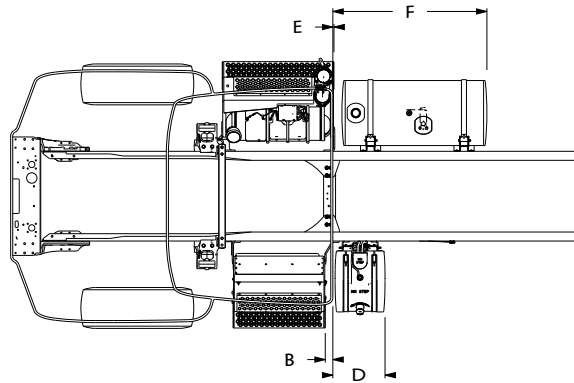
T880 (SBFA) Short Hood Daycab						
Fuel Tank Size			Dimension F BOC to Fuel Tank Daycab (in)	Dimension D (in) BOC to DEF Tank (in)		
Diameter	Gallons	Length (in)		Small	Medium	Large
22" Diameter Tank	56	35.6	40.9	13.4*	26.2*	34.8*
	60	38.0	43.3			
	75	47.3	52.4			
	85	53.2	58.3			
	100	62.2	67.2			
	120	74.3	79.2			
24.5" Diameter Tank	60	30.6	36.1			
	75	38.5	44.1			
	90	45.5	51.1			
	100	50.0	55.5			
	110	55.0	60.5			
	120	60.6	66.1			
	135	67.2	72.8			
	150	74.5	80.1			
28.5" Diameter Tank	75	28.7	33.8			
	90	34.3	39.3			
	105	38.8	43.9			
	110	42.4	47.5			
	120	45.8	50.9			
	135	50.9	55.9			
	150	56.2	61.3			
	177	66.1	71.2			

NOTE: DIMENSIONS "B" AND "F" ARE CALCULATED USING A 34" SHORT BATTERY BOX. OPTIONAL BOXES WILL AFFECT THESE DIMENSIONS.

* ADD 6.0 INCHES FOR 40" LONG BATTERY BOX

Section 6 Frame Layouts

D4—Use with the following models: T880S (SFFA)



Dimension B (BOC to 34" Short Battery Box) = -6.5in

Dimension B (BOC to 40" Long Battery Box) = -4.0in

Dimension E (BOC to DPF/SCR) = 0.2in

TABLE 6-16.

T880S (SFFA) Daycab with Short Hood						
Fuel Tank Size			Dimension F BOC to Fuel Tank Daycab (in)	Dimension D (in) BOC to DEF Tank (in)		
Diameter	Gallons	Length (in)		Small	Medium	Large
22" Diameter Tank	56	35.6	38.8	9.9*	17.8*	28.3*
	60	38.0	41.2			
	75	47.3	50.4			
	100	62.2	65.3			
	120	74.3	77.3			
24.5" Diameter Tank	60	30.6	34.1			
	75	38.5	42.1			
	90	45.5	49.1			
	100	50.0	53.5			
	110	55.0	58.5			
	120	60.6	64.1			
	135	67.2	70.8			
	150	74.5	78.1			
28.5" Diameter Tank	75	28.7	31.8			
	90	34.3	37.3			
	105	38.8	41.9			
	110	42.4	45.5			
	120	45.8	48.9			
	135	50.9	53.9			
	150	56.2	59.3			
	177	66.1	69.2			

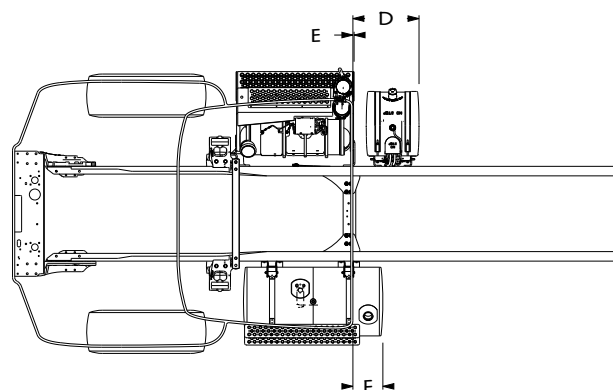
NOTE: DIMENSIONS "B" AND "F" ARE CALCULATED USING A 34" SHORT BATTERY BOX. OPTIONAL BOXES WILL AFFECT THESE DIMENSIONS.

* ADD 6.0 INCHES FOR 40" LONG BATTERY BOX

Section 6 Frame Layouts

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D5—Use with the following models: T880 (Standard Hood)



Dimension E (BOC to DPF/SCR) = 2.7in

TABLE 6-17.

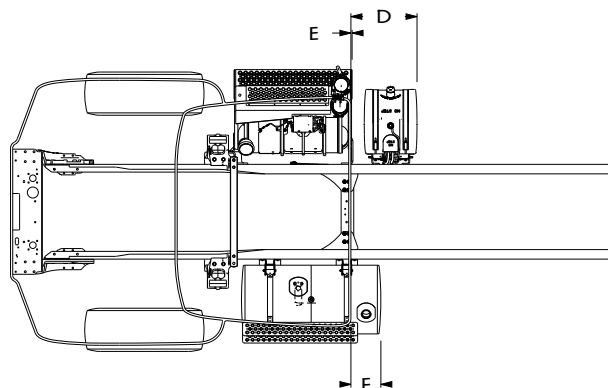
T880 (SBFA) Standard Hood Daycab						
Fuel Tank Size			Dimension F BOC to Fuel Tank Daycab (in)	Dimension D (in) BOC to DEF Tank (in)		
Diameter	Gallons	Length (in)		Small	Medium	Large
22" Diameter Tank	56	35.6	-2.1	22.3	29.6	39.8
	60	38.0	0.4			
	75	47.3	9.6			
	100	62.2	24.5			
	120	74.3	36.6			
24.5" Diameter Tank	60	30.6	-6.5			
	75	38.5	0.6			
	90	45.5	7.7			
	100	50.0	12.2			
	110	55.0	17.2			
	120	60.6	22.8			
	135	67.2	29.4			
	150	74.5	36.7			
28.5" Diameter Tank	75	28.7	-8.8*			
	90	34.3	-3.3*			
	105	38.8	-0.4*			
	110	42.4	4.0*			
	120	45.8	7.4*			
	135	50.9	12.5*			
	150	56.2	17.8*			
	177	66.1	27.7*			

* N/A W/ DUAL SIDE OF CAB OR BACK OF CAB EXHAUST

Section 6

Frame Layouts

D5—Use with the following models: T880 (Short Hood)



Dimension E (BOC to DPF/SCR) = 2.7in

TABLE 6-18.

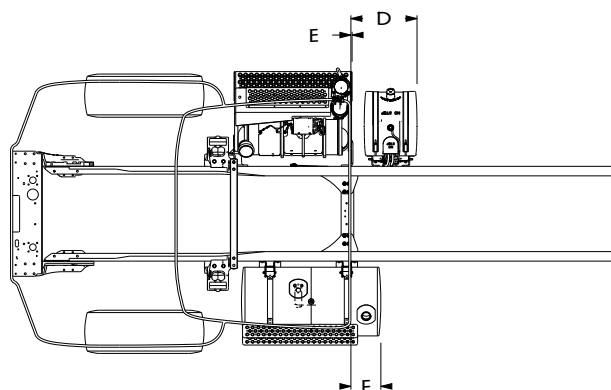
T880 (SBFA) Short Hood Daycab						
Fuel Tank Size			Dimension F BOC to Fuel Tank Daycab (in)	Dimension D (in) BOC to DEF Tank (in)		
Diameter	Gallons	Length (in)		Small	Medium	Large
22" Diameter Tank	56	35.6	-2.1	21.8	29.2	39.3
	60	38.0	0.0			
	75	47.3	8.7			
	100	62.2	23.5			
	120	74.3	35.6			
24.5" Diameter Tank	60	30.6	-6.2			
	75	38.5	0.0			
	90	45.5	6.6			
	100	50.0	11.7			
	110	55.0	16.7			
	120	60.6	22.2			
	135	67.2	28.3			
	150	74.5	35.6			
28.5" Diameter Tank	75	28.7	-8.4*			
	90	34.3	-2.7*			
	105	38.8	0.2*			
	110	42.4	4.0*			
	120	45.8	6.4*			
	135	50.9	11.5*			
	150	56.2	16.8*			
	177	66.1	26.7*			

* N/A W/ DUAL SIDE OF CAB OR BACK OF CAB EXHAUST **D5**—USE WITH THE FOLLOWING MODELS: T680/T880 (SHORT HOOD)

Section 6 Frame Layouts

<https://truckmanualshub.com/>

D5—Use with the following models: T880S (SFFA)



Dimension E (BOC to DPF/SCR) = 0.2 in

TABLE 6-19.

T880S (SFFA) Daycab with Short Hood						
Fuel Tank Size			Dimension F BOC to Fuel Tank Daycab (in)	Dimension D (in) BOC to DEF Tank (in)		
Diameter	Gallons	Length (in)		Small	Medium	Large
22" Diameter Tank	56	35.6	-8.2	18.4	33.6	42.2
	60	38.0	-5.2			
	75	47.3	0.0			
	100	62.2	14.9			
	120	74.3	27.0			
24.5" Diameter Tank	60	30.6	-7.4			
	75	38.5	-4.4			
	90	45.5	-1.3			
	100	50.0	3.2			
	110	55.0	8.1			
	120	60.6	13.7			
	135	67.2	22.4			
	150	74.5	27.7			

FRAME INFORMATION

Frame information provided is per rail, some specifications are written for RBM requirements per pair of rails. Make sure to know the requirement before deciding on the frame rail.

TABLE 7-1. Single Steel Rails

Rail Height		Flange Width		Web Thickness	Section Modulus (in ³)	RBM (in lbs)	Weight (lbs/in)
H		W		T	S	R	W
10 - 5/8"	x	3 - 1/2"	x	5/16"	14.80	1,776,000	2.90
10 - 3/4"	x	3 - 1/2"	x	3/8"	17.80	2,132,000	3.46
10 - 11/16"	x	3 - 1/2"	x	1/2"	22.35	2,683,000	4.53
11- 5/8"	x	3 - 7/8"	x	3/8"	21.43	2,572,000	3.80

TABLE 7-2. Inserted Steel Rails

Rail Height	Insert Material	Section Modulus	RBM (in lbs)	Weight (lbs/in)
10 - 5/8"	Single 9-7/8"x 2-7/8" x 1/4"	24.37	2,925,000	4.96
10 - 3/4"	Single 9-7/8"x 2-7/8" x 1/4"	27.33	3,280,000	5.53
11- 5/8"	Single 10-3/4" x 3-1/2" x 1/4"	39.20	4,704,000	7.28
11- 5/8"	Double (one 10-3/4" x 3-1/2" x 1/4" and one 9-7/8"x 2-7/8" x 1/4")	48.77	5,853,000	9.33

CRITICAL CLEARANCES

Rear Wheels and Cab

CAUTION:



Insufficient clearance between rear tires and body structure could cause damage to the body during suspension movement. Allow at least 8 inches clearance (See Figure 6–5.)

Normal suspension movement could cause contact between the tires and the body. To prevent this, mount the body so that the minimum clearance between the top of the tire and the bottom of the body is 8 inches (203 mm). This should be measured with the body empty. See Figure 6–1.

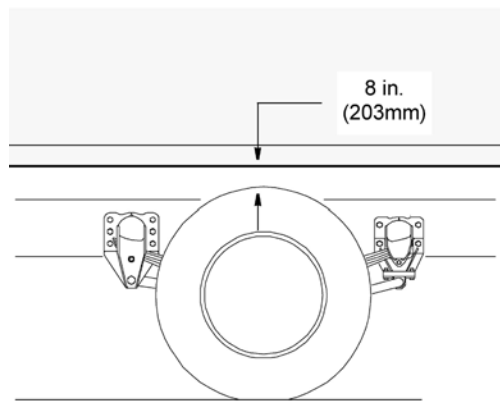


FIGURE 7-1. Minimum Clearance Between Top Of Rear Tires And Body Structure Overhang.

CAUTION:



Maintain adequate clearance between back of cab and the front (leading edge) of mounted body. See Figure 6–2.

Note:



Be sure to provide maintenance access to battery box and fuel tank fill neck.

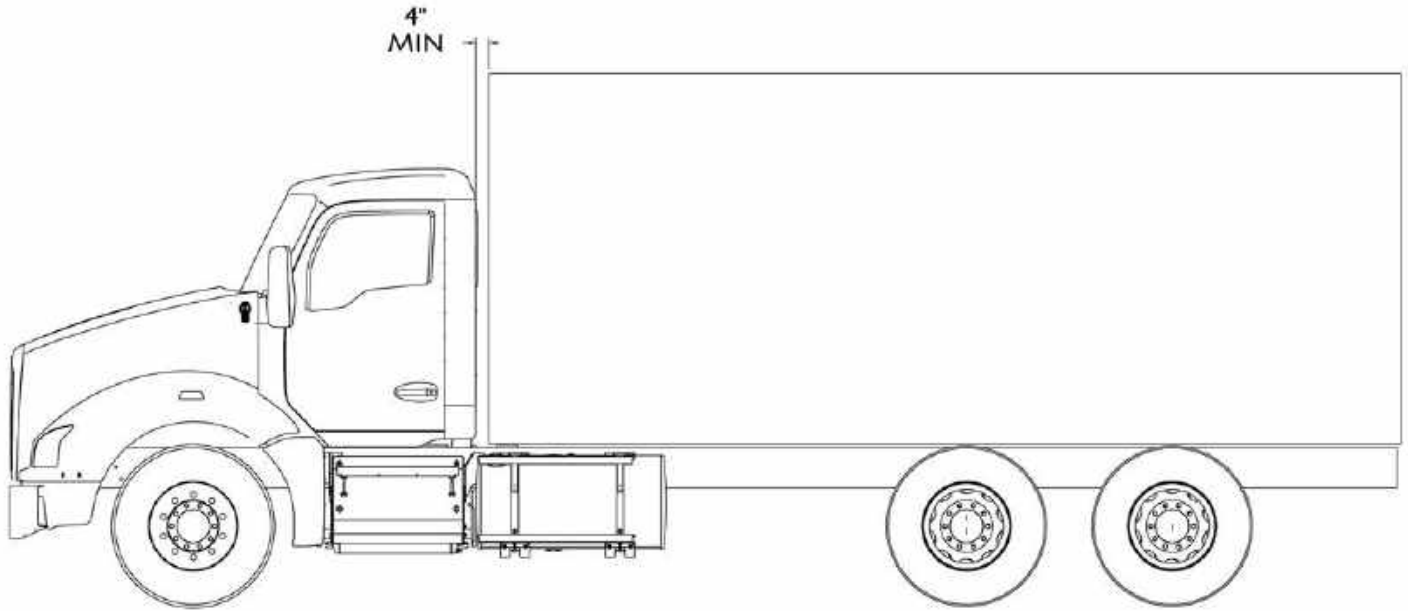


FIGURE 7-2. Minimum Back of Cab Clearance

WARNING:



If the frame rail flanges are modified or damaged, the rail could fail prematurely and cause an accident. When mounting a body to the chassis, **DO NOT** drill holes in the upper or lower flange of the frame rail. Mount the body using body mounting brackets or U-bolts.

BODY MOUNTING USING BRACKETS

CAUTION:



Always install a spacer between the body subframe and the top flange of the frame rail. Failure to do so could result in corrosion due to dissimilar materials.

Installation of a spacer between the body subframe and the top flange of the frame rail will help prevent premature wear of the components due to chafing or corrosion.

Frame Sill

If the body is mounted to the frame with brackets, we recommend that the frame sill spacer be made from a strip of rubber or plastic (delrin or nylon). These materials will not undergo large dimensional changes during periods of high or low humidity. The strip will be less likely to fall out during extreme relative motion between body and chassis. See Figure 6–3.

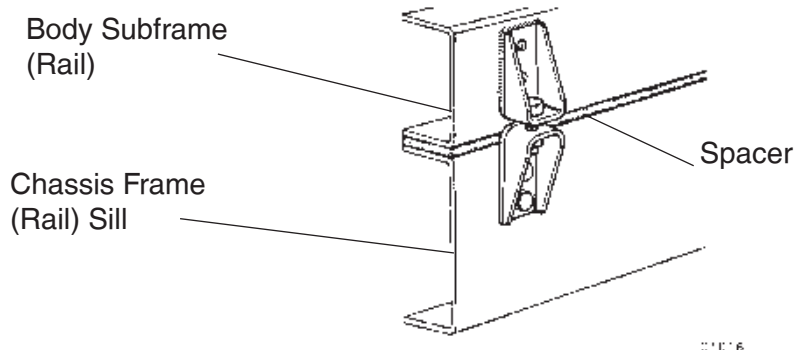


FIGURE 7-3. Spacer Between Frame Sill and Body Rail - Rubber or Plastic

Brackets

When mounting a body to the chassis with brackets, we recommend designs that offer limited amount of relative movement, bolted securely but not too rigid. Brackets should allow for slight movement between the body and the chassis. For instance, Figure 6–4 shows a high compression spring between the bolt and the bracket.

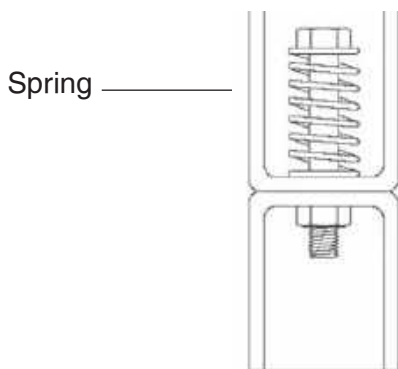


FIGURE 7-4. High Compression Spring Between the Mounting Bolt and Upper Bracket

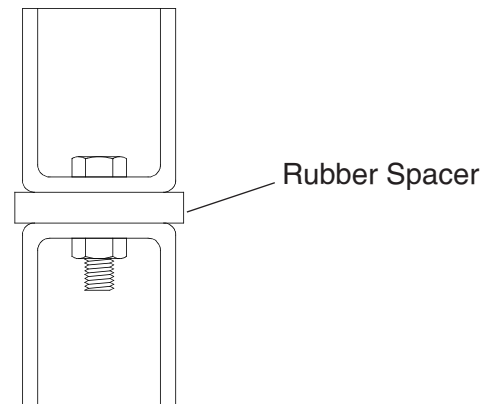


FIGURE 7-5. Rubber Spacer Between Brackets

Another possibility is mounting a rubber spacer between the brackets. See Figure 6–5.

These designs will allow relative movement between the body and the chassis during extreme frame racking situations. Extreme frame racking, and mountings that are too rigid, could cause damage to the body. This is particularly true with tanker installations.

MOUNTING HOLES

When installing the lower bracket on frame rails the mounting holes in the chassis frame bracket and frame rail must comply with the general spacing and location guidelines illustrated in Figure 6–6. The hole diameter should not exceed the bolt diameter by more than .060 inches (1.5 mm).

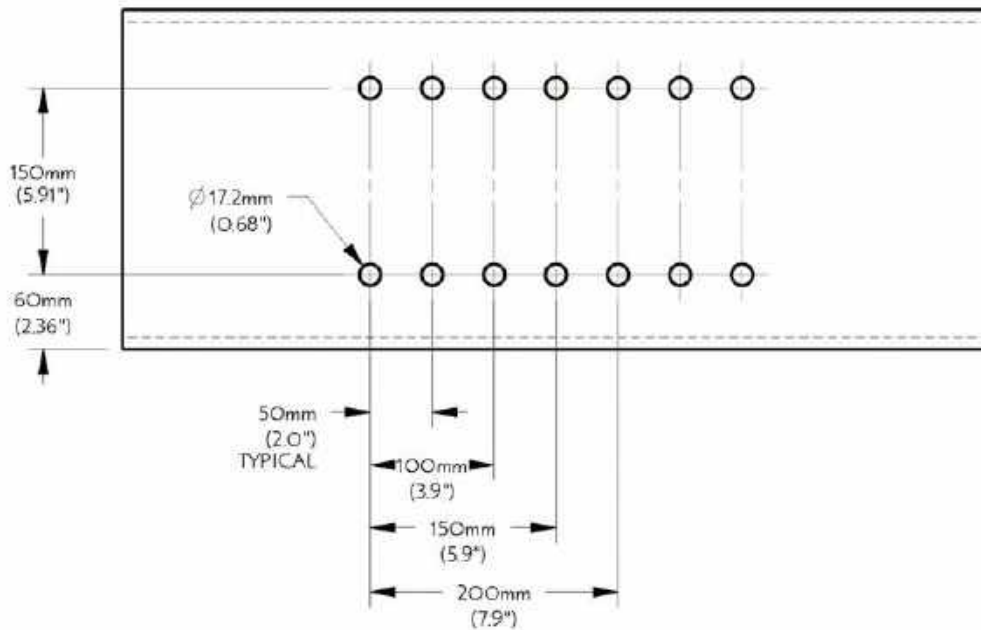


FIGURE 7-6. Crossmember-Gusset Hole Pattern Requirements. [inch (mm)]

Frame Drilling

WARNING:



When mounting a body to the chassis, **DO NOT** drill holes in the upper or lower flange of the frame rail. If the frame rail flanges are modified or damaged, the rail could fail prematurely and cause an accident. Mount the body using body mounting brackets or U-bolts.



CAUTION:



Use care when drilling the frame web so the wires and air lines routed inside the rail are not damaged. Failure to do so could cause an inoperable electrical or air system circuit.

WARNING:



Do not drill closely spaced holes in the frame rail. Hole centers of two adjacent holes should be spaced no less than twice the diameter of the largest hole. Closer spacing could induce a failure between the holes.

BODY MOUNTING USING U-BOLTS

Spacers

If the body is mounted to the frame with U-bolts, use a hardwood sill (minimum 1/2 inch (12 mm) thick) between the frame rail and body frame to protect the top surface of the rail flange.

WARNING:



Do not allow the frame rails or flanges to deform when tightening the U-bolts. It will weaken the frame and could cause an accident. Use suitable spacers made of steel or hardwood on the inside of the frame rail to prevent collapse of the frame flanges.

Use a hardwood spacer between the bottom flange and the U-bolt to prevent the U-bolt from notching the frame flange. See Figure 6-7.

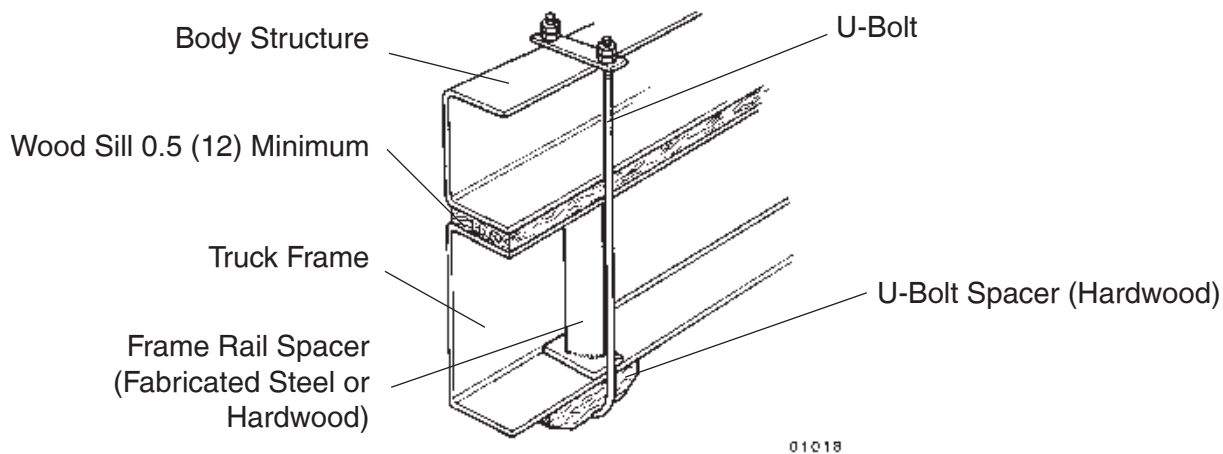


FIGURE 7-7. Acceptable U-Bolt Mounting with Wood and Fabricated Spacers [inch (mm)]

WARNING:



Do not allow spacers and other body mounting parts to interfere with brake lines, fuel lines, or wiring harnesses routed inside the frame rail. Crimped or damaged brake lines, fuel lines, or wiring could result in loss of braking, fuel leaks, electrical overload or a fire. Carefully inspect the installation to ensure adequate clearances for air brake lines, fuel lines, and wiring. See Figure 6-8.

CAUTION:



Mount U-bolts so they do not chafe on frame rail. Failure to do so could result in premature wear of the U-bolt or frame rail.

Section 7 Body Mounting

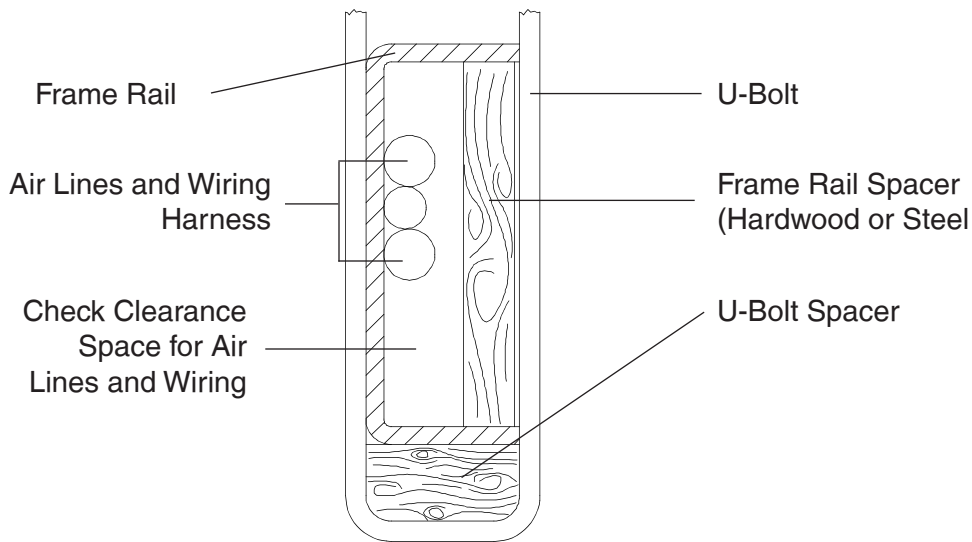
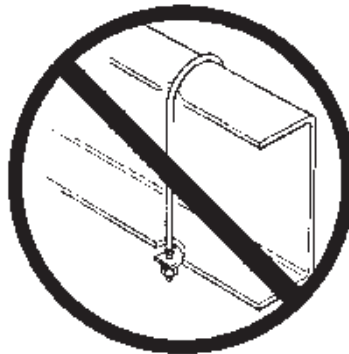


FIGURE 7-8. Clearance Space for Air Lines and Cables

WARNING:



Do not notch frame rail flanges to force a U-bolt fit. Notched or damaged frame flanges could result in premature frame failure. Use a larger size U-bolt. Use a hardwood spacer as shown in Figure 7-7.



Rear Body Mount

When U-bolts are used to mount a body we recommend that the last body attachment be made with a “fishplate” bracket. See Figure 6–9. This provides a firm attaching point and helps prevent any relative fore or aft movement between the body and frame.

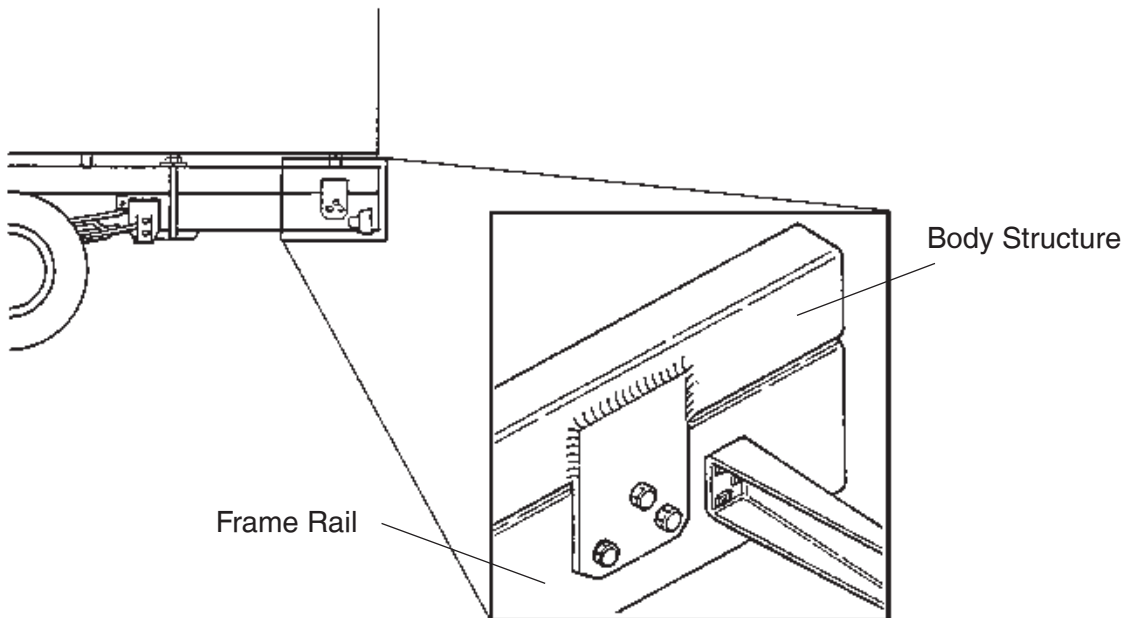


FIGURE 7-9. Example of Fishplate Bracket at Rear End of Body, used with U-Bolts

FRAME MODIFICATIONS

Introduction

Kenworth offers customer specified wheelbases. So, in most cases frame modifications to produce a certain wheelbase should not be necessary.

However, some installations may require slight modifications, while other installations will require extensive modifications. Sometimes an existing dealer stock chassis may need to have the wheelbase changed to better fit a customer's application. The modifications may be as simple as shortening or lengthening the frame cutoff, or they may be as complex as changing the wheelbase.

DRILLING RAILS

Location and Hole Pattern

If holes need to be drilled to attach anything to the rail, see SECTION 6 "BODY MOUNTING" for more information. Follow the general spacing and hole location guidelines on Page 6-5, Figure 6-6.

WARNING!



When mounting a body to the chassis, **DO NOT** drill holes in the upper or lower flange of the frame rail. If the frame rail flanges are modified or damaged, the rail could fail prematurely and cause an accident. Mount the body using body mounting brackets or U-bolts.



WARNING!



Do not drill closely spaced holes in the web of the frame. Hole centers of two adjacent holes should be spaced no less than twice the diameter of the largest hole. Closer spacing could induce a failure between the holes.

CAUTION:



An appropriately sized bolt and nut must be installed and torqued properly in all unused frame holes. Failure to do so could result in frame crack initiation around the hole.

CAUTION:



Use care when drilling the frame web so the wires and air lines routed inside the rail are not damaged. Failure to do so could cause an inoperable electrical or air system circuit.

CAUTION:



Never use a torch to make holes in the rail. Use the appropriate diameter drill bit. Heat from a torch will affect the material properties of the frame rail and could result in frame rail cracks.

CAUTION:



Hole diameter should not exceed the bolt diameter by more than .060 inches (1.5 mm). Oversized holes could result in excessive frame wear around the hole.

MODIFYING FRAME LENGTH

The frame cutoff after the rear axle can be shortened to match a particular body length. Using a torch is acceptable; however, heat from a torch will affect the material characteristics of the frame rail. The affected material will normally be confined to within 1 to 2 inches (25 to 50 mm) of the flame cut and may not adversely affect the strength of the chassis or body installation.

The frame cutoff can be lengthened by adding frame extenders.

When extending 10.5" frame rails, the additional sections can be welded to the existing rails. The joint should be welded and reinforced as illustrated in Figure 7-1.

Note:

See page 8-6 for more information on welding frames.



Frame Insert

A frame insert must be added after welding a frame rail extension to compensate for lost strength. The insert should be of the same material as the frame member, or of steel, and at least equal to the frame rail in thickness. Attachment of the insert to the frame should be made with Ream-Fit heat-treated bolts, 5/8 in. (16 mm) dia. or the next larger size. Both the reinforcement and frame holes should be reamed to provide a fit of from .001 in. to .003 in. (.025 to .076 mm) clearance. Do not weld reinforcing members. The insert should span a distance of at least 24 in. (610 mm) on either side of the joint to insure an even distribution of stresses. Cut the ends of the insert at 45° as shown in Figure 7-2 unless the insert extends to the end of the frame.

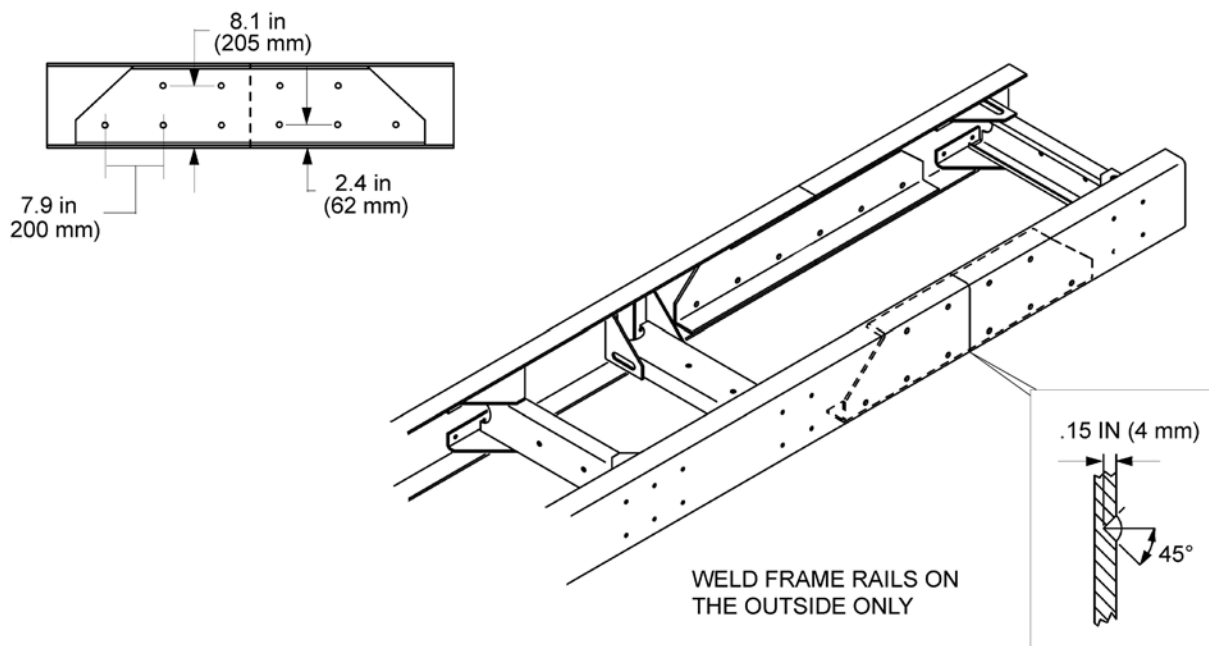


FIGURE 8-1. Detail of Frame Extension and Joint Welding

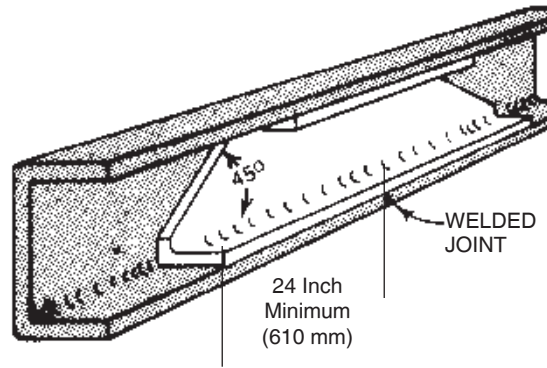


FIGURE 8-2. Frame Insert

Where possible, use existing bolt holes to attach the insert to the frame. Bolt holes must not be located closer to the frame flanges than the present bolt pattern.

If the insert is placed in a section of the main frame where few bolts are located, additional bolts are required. Use the following guideline for locating additional bolt holes.

CHANGING WHEELBASE

We do not recommend modifying the wheelbase. Occasionally, however, a chassis wheelbase will need to be reduced or lengthened. When this needs to be done there are a few guidelines that should be considered.

WARNING!



When changing the wheelbase, be sure to follow the driveline manufacturer's recommendations for driveline length or angle changes. Incorrectly modified drivelines can fail prematurely due to excessive vibration.

Before changing the wheelbase the driveline angles of the proposed wheelbase need to be examined to ensure that no harmful vibrations are created. Consult the driveline manufacturer for appropriate recommendations.

WARNING!



When changing the wheelbase, a continuous blank frame insert/outsert must be added in the area of the new rear suspension mounting bolts. All new mounting holes must pass through the original rail and the insert/outsert. Failure to do so could cause excessive stress in the original rail due to additional holes.

Before the rear suspension is relocated, check the new location of the spring hanger brackets. The new holes for the spring hanger brackets must not overlap existing holes and should not come any closer than 2 inches (50 mm) to existing holes in the frame.

WARNING!



When relocating a suspension bracket, do not mount it on the extended (added) section of a frame rail. The suspension loading could result in premature failure of the added section splice. This could cause an accident. Use care when planning the wheelbase so that the rear suspension bracket is always mounted on the original rail section. See Figure 7-3.

Section 8 Frame Modifications

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When reducing the wheelbase, we recommend that the suspension be moved forward and relocated on the original rail. The rail behind the suspension can then be cut to achieve the desired frame cutoff. See Figure 7–3.

WARNING!



Do not drill new holes any closer than 2 inches (50 mm) to existing holes. Frame drilling affects the strength of the rails.

Before the rear suspension is relocated, check the new location of the spring hanger brackets. The new holes for the spring hanger brackets must not overlap existing holes and should not come any closer than 2 inches (50 mm) to existing holes.

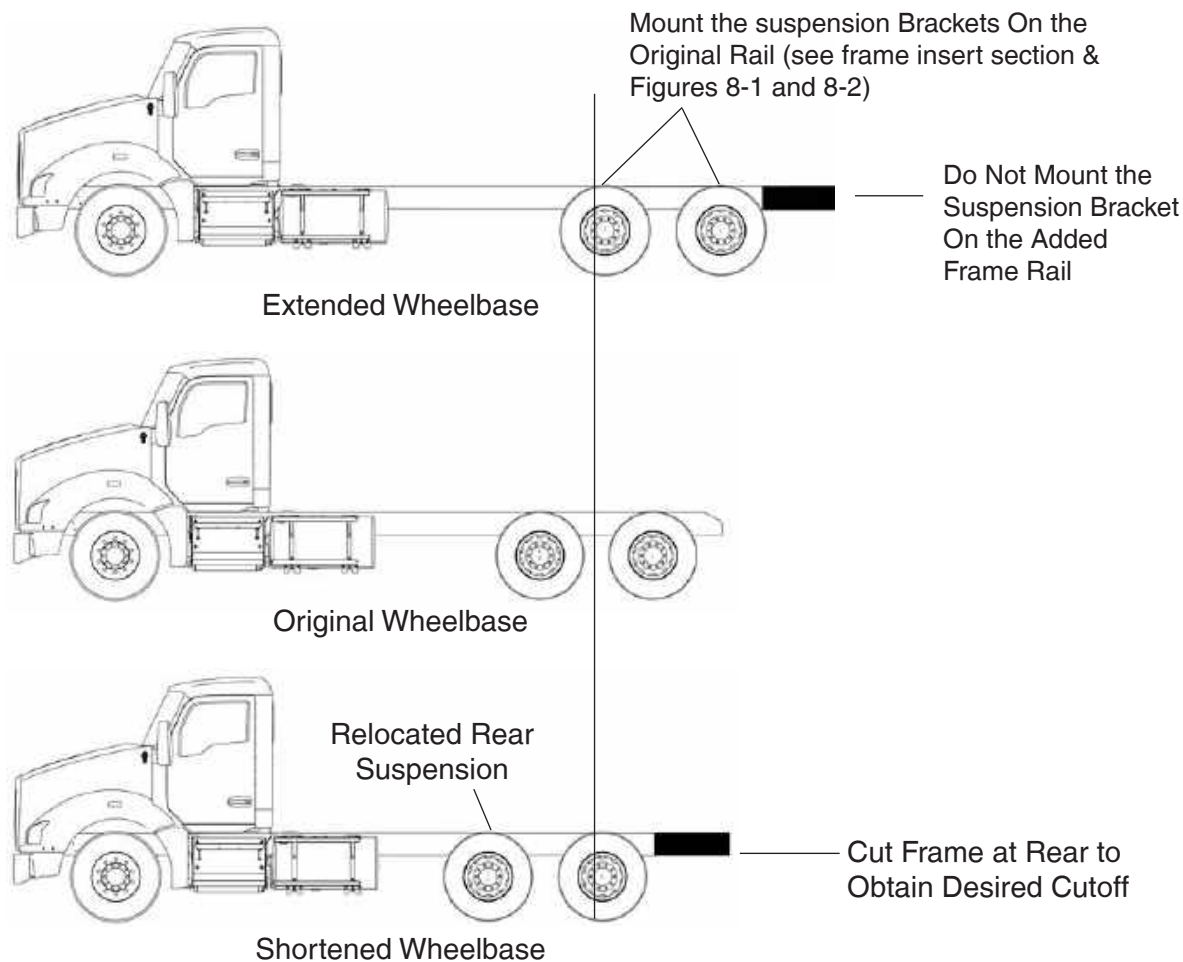


FIGURE 8-3. Comparison of Original, Shortened, and Extended Wheelbases.

CROSSMEMBERS

After changing a wheelbase, an additional crossmember may be required to maintain the original frame strength. The maximum allowable distance between adjacent crossmembers is 60 inches (1524 mm). If the distance between adjacent crossmembers exceeds this dimension, add a crossmember between them. See Figure 7-4.

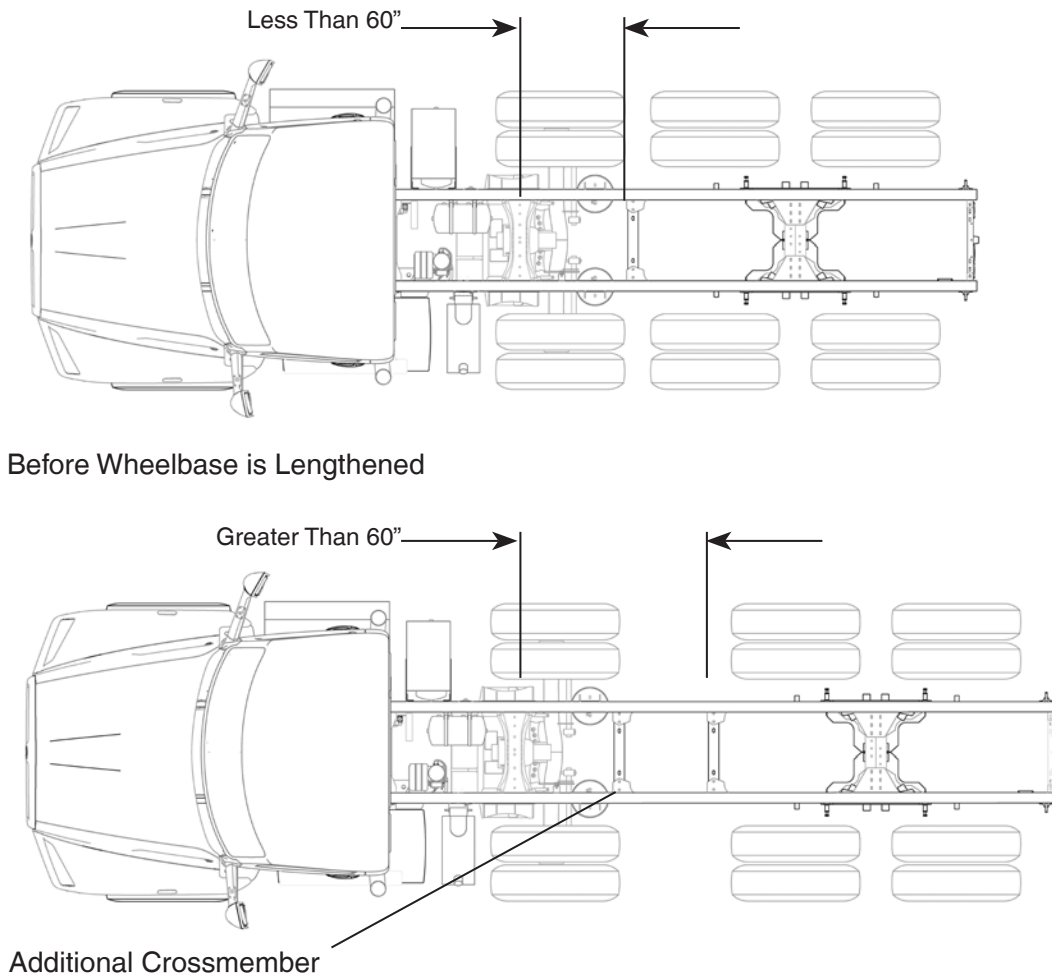


FIGURE 8-4. Crossmember Added When Distance Exceeds 60 Inches (1524 mm)

WELDING

Kenworth DOES NOT recommend frame welding. The high heat of welding nullifies the special heat treatment of the rails, greatly reducing the tensile strength of the frame rail. If a frame member becomes cracked from overloading, fatigue, surface damage or a collision, the only permanent repair is to replace the damaged frame member with a new part.

The following information is provided (for temporary emergency repair). Prior to welding a cracked frame rail, the area should be beveled (V'd out) to allow for a better weld. To prevent spreading of the crack, a 7 to 9 mm (1/4 in. to 3/8 in.) dia. hole should be drilled at the end of the crack. Widen the crack along its full length by using two hack saw blades together. When welding steel frames use the shielded arc method. When welding aluminum frames use either the tungsten inert gas (TIG) or consumable electrode method. Be sure to obtain full weld penetration along the entire length of the crack.

Precautions

CAUTION: Before welding, disconnect the negative terminal battery cable.



CAUTION: Before welding, disconnect the alternator terminals. Failure to do so could result in damage to the voltage regulator and/or alternator.



CAUTION: To prevent damage to electrical equipment, disconnect battery cables before arc-welding on a truck, and be sure that the welding ground lead is connected to the frame. Bearings and other parts will be damaged if current must pass through them in order to complete the circuit.



Welding Precautions: All Electronic Engines

Before welding on vehicles with electronic engines, the following precautions should be observed.

1. Disconnect all electrical connections to the vehicle batteries.
2. Disconnect all ECM connectors.
3. Do not use the ECM or engine ground stud for the ground of the welding probe.
4. Ensure that the ground connection for the welder is as close to the weld point as possible. This ensures maximum weld current and minimum risk to damage electrical components on the vehicle.
5. Turn off key.

Note: Bosch ABS and Wabco ABS: Disconnect ECU.



TORQUE REQUIREMENTS

TABLE 8-1. Customary Grade 8 UNF or UNC.

Fastener	Torque	
	Nm	Lb.-Ft
5/16	22–30	16–22
3/8	41–54	30–40
7/16	75–88	55–65
1/2	109–122	80–90
9/16	156–190	115–140
5/8	224–265	165–195
3/4	394–462	290–340
7/8	517–626	380–460
1	952–1129	800–830
1-1/8	1346–1591	990–1170
1-1/4	1877–2217	1380–1630

Torque values apply to fasteners with clean threads, lightly lubricated, with hardened steel washers, and nylon-insert nuts.

TABLE 8-2. U.S. Customary – Grade 8. Metric Class 10.9

Fastener	Torque	
	Nm	Lb-Ft
M6	9–15	7–11
M8	23–31	17–23
M10	33–43	24–32
M12	75–101	55–75
M14	134–164	99–121
M16	163–217	120–160
M20	352–460	260–340

Section 8

Frame Modifications

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INTRODUCTION

Controller Area Network (CAN) is a serial network technology that was originally designed for the automotive industry but has also become popular in the commercial trucking industrial. The CAN bus is primarily used in embedded systems and is a network technology that provides fast communication among controllers up to real-time requirements, eliminating the need for the much more expensive and complex technology.

CAN is a two-wire high-speed network system, that is far superior to conventional hardwired technologies to functionality and reliability. CAN is designed for real-time requirements and can easily beat hardwire connections when it comes to short reaction times, timely error detection, quick error recovery and error repair.

Characteristics of Controller Area Network

- Is a serial networking technology for embedded solutions
- Needs only two wires to communicate messages
- Operates at data rates of 250K and 500K
- Supports a maximum of 8 bytes per message frame
- One Bus can support multiple message IDs
- Supports message priority, i.e. the lower the message ID the higher its priority

SAE J1939

The Society of Automotive Engineers (SAE) Truck and Bus Control and Communications Subcommittee have developed a family of standards concerning the design and use of devices that transmit electronic signals and control information among vehicle components. SAE J1939 and its companion documents are the accepted industry standard and the vehicle network of choice for commercial truck applications. SAE J1939 is used in the commercial vehicle area for communication in the embedded systems of the commercial vehicle.

SAE J1939 uses CAN as physical layer. The J1939 standards are a set of recommended practices that define which and how the data is communicated between the Electronic Control Units within a vehicle network. Typical controllers are the Engine, Brake, Transmission, etc. The messages exchanged between these units can be data such as vehicle road speed, torque control message from the transmission to the engine, oil temperature, and many more.

Characteristics of J1939

- Extended CAN identifier (29 bit)
- Peer-to-peer and broadcast communication
- Network management
- Definition of parameter groups for commercial vehicles and others
- Manufacturer specific parameter groups are supported
- Diagnostics features
- Is a standard developed by the Society of Automotive Engineers
- Defines communication for vehicle networks
- Is a Higher-Layer Protocol using CAN as the physical layer
- Uses shielded twisted pair wire
- Applies a maximum network length of 120 ft.
- Applies a standard baud rate of 250 Kbit/sec
- Supports peer-to-peer and broadcast communication
- Supports message lengths up to 1785 bytes
- Defines a set of Parameter Group Numbers
- Supports network management

PARAMETER GROUP NUMBER

Parameter Groups contain information on parameter assignments within the 8-byte CAN data field of each message as well as repetition rate and priority. Parameters groups are, for instance, engine temperature, which includes coolant temperature, fuel temperature, oil temperature, etc. Parameter Groups and their numbers are listed in SAE J1939 and defined in SAE J1939/71, a document containing parameter group definitions plus suspect parameter numbers.

SUSPECT PARAMETER NUMBER

A Suspect Parameter Number is a number assigned by the SAE to a specific parameter within a parameter group. It describes the parameter in detail by providing the following information:

Data Length in bytes

Data Type

Resolution

Offset

Range

Reference Tag (Label)

SPNs that share common characteristics are grouped into Parameter Groups and they will be transmitted throughout the network using the Parameter Group Number.

CAN MESSAGES AVAILABLE ON BODY CONNECTIONS

SPN	CAN Signal Description	PGN	CAN BUS
5400	SCR Thermal Management Active	61443, EEC2	SCAN, KCAN, BCAN
91	Accelerator Pedal Position 1	61443, EEC2	SCAN, KCAN, BCAN
92	Engine Percent Load At Current Speed	61443, EEC2	SCAN, KCAN, BCAN
5399	DPF Thermal Management Active	61443, EEC2	SCAN, KCAN, BCAN
559	Accelerator Pedal Kickdown Switch	61443, EEC2	SCAN, KCAN, BCAN
2979	Vehicle Acceleration Rate Limit Status	61443, EEC2	SCAN, KCAN, BCAN
1437	Road Speed Limit Status	61443, EEC2	SCAN, KCAN, BCAN
558	Accelerator Pedal1 Low Idle Switch	61443, EEC2	SCAN, KCAN, BCAN
3357	Actual Max Available Engine Torque	61443, EEC2	SCAN, KCAN, BCAN
5398	Estimated Pumping-Percent Torque	61443, EEC2	SCAN, KCAN, BCAN
513	Actual Engine-Percent Torque	61444, EEC1	SCAN, KCAN, BCAN
512	Driver's Demand Engine-Percent Torque	61444, EEC1	SCAN, KCAN, BCAN
2432	Engine Demand-Percent Torque	61444, EEC1	SCAN, KCAN, BCAN
190	Engine Speed	61444, EEC1	SCAN, KCAN, BCAN
899	Engine Torque Mode	61444, EEC1	SCAN, KCAN, BCAN
1483	Source Address of Controlling Device for Engine Control	61444, EEC1	SCAN, KCAN, BCAN
1675	Engine Starter Mode	61444, EEC1	SCAN, KCAN, BCAN
4154	Actual Engine - Percent Torque (Fractional)	61444, EEC1	SCAN, KCAN, BCAN
3697	Diesel Particulate Filter Lamp Command	64892, DPFC1	SCAN, KCAN, BCAN
3700	Aftertreatment Particulate Filter Active Regen Status	64892, DPFC1	SCAN, KCAN, BCAN
3703	Particulate Filter Active Regen Inhibited Due to Inhibit Switch	64892, DPFC1	SCAN, KCAN, BCAN
3701	Aftertreatment Diesel Particulate Filter Status	64892, DPFC1	SCAN, KCAN, BCAN
3702	Filter Active Regen Inhibited Status	64892, DPFC1	SCAN, KCAN, BCAN
3704	Filter Active Regen Inhibited Due to Clutch Disengaged	64892, DPFC1	SCAN, KCAN, BCAN
3705	Filter Active Regen Inhibited Due to Service Brake Active	64892, DPFC1	SCAN, KCAN, BCAN
3706	Filter Active Regen Inhibited Due to PTO Active	64892, DPFC1	SCAN, KCAN, BCAN
3707	Filter Active Regen Inhibited Due to Accelerator Pedal Off Idle	64892, DPFC1	SCAN, KCAN, BCAN
3708	Filter Active Regen Inhibited Due to Out of Neutral	64892, DPFC1	SCAN, KCAN, BCAN
3709	Filter Active Regen Inhib Due to Vehicle spd Above Allowed Spd	64892, DPFC1	SCAN, KCAN, BCAN
3710	Filter Active Regen Inhibited Due to Parking Brake Not Set	64892, DPFC1	SCAN, KCAN, BCAN
3711	Filter Active Regen Inhibited Due to Low Exhaust Temperature	64892, DPFC1	SCAN, KCAN, BCAN
3712	Filter Active Regen Inhibited Due to System Fault Active	64892, DPFC1	SCAN, KCAN, BCAN
3713	Filter Active Regen Inhibited Due to System Timeout	64892, DPFC1	SCAN, KCAN, BCAN
3716	Filter Active Regen Inhibited Due to Engine Not Warmed Up	64892, DPFC1	SCAN, KCAN, BCAN
3717	Filter Active Regen Inhib Due to Vehicle spd Below Allowed Spd	64892, DPFC1	SCAN, KCAN, BCAN
3718	Filter Automatic Active Regen Initiation Configuration	64892, DPFC1	SCAN, KCAN, BCAN
3698	Exhaust System High Temperature Lamp Command	64892, DPFC1	SCAN, KCAN, BCAN
4175	Particulate Filter Active Regen Forced Status	64892, DPFC1	SCAN, KCAN, BCAN
1761	Aftertreatment 1 Exhaust Fluid Tank Volume	65110, AT1T1I1	SCAN, KCAN, BCAN
3031	Aftertreatment 1 Exhaust Fluid Tank Temperature	65110, AT1T1I1	SCAN, KCAN, BCAN

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CAN Communications

SPN	CAN Signal Description	PGN	CAN BUS
3363	Aftertreatment 1 Exhaust Fluid Tank Heater	65110, AT1T1I	SCAN, KCAN, BCAN
5246	Aftertreatment SCR Operator Inducement Severity	65110, AT1T1I	SCAN, KCAN, BCAN
5245	Aftertreatment Exhaust Fluid Tank Low Level Indicator	65110, AT1T1I	SCAN, KCAN, BCAN
1639	Fan speed	65213, FD1	SCAN, KCAN, BCAN
975	Engine Fan1 Estimated Percent Speed	65213, FD1	SCAN, KCAN, BCAN
977	Fan Drive State	65213, FD1	SCAN, KCAN, BCAN
247	Engine Total Hours of Operation	65253, HOURS	SCAN, KCAN, BCAN
249	Engine Total Revolutions	65253, HOURS	SCAN, KCAN, BCAN
250	Engine Total Fuel Used	65257, LFC1	SCAN, KCAN, BCAN
182	Engine Trip Fuel	65257, LFC1	SCAN, KCAN, BCAN
110	Engine Coolant Temperature	65262, ET1	SCAN, KCAN, BCAN
174	Engine Fuel Temperature 1	65262, ET1	SCAN, KCAN, BCAN
52	Engine Intercooler Temperature	65262, ET1	SCAN, KCAN, BCAN
175	Engine Oil Temperature 1	65262, ET1	SCAN, KCAN, BCAN
111	Engine Coolant Level 1	65263, EFLP1	SCAN, KCAN, BCAN
94	Engine fuel Delivery Pressure	65263, EFLP1	SCAN, KCAN, BCAN
100	Engine Oil Pressure	65263, EFLP1	SCAN, KCAN, BCAN
101	Engine Crankcase Pressure	65263, EFLP1	SCAN, KCAN, BCAN
98	Engine Oil Level	65263, EFLP1	SCAN, KCAN, BCAN
185	Engine Average Fuel Economy	65266, LFE1	SCAN, KCAN, BCAN
184	Engine Instantaneous Fuel Economy	65266, LFE1	SCAN, KCAN, BCAN
183	Engine Fuel Rate	65266, LFE1	SCAN, KCAN, BCAN
51	Engine Throttle Valve1 Postion1	65266, LFE1	SCAN, KCAN, BCAN
171	Ambient Air Temperature	65269, AMB	SCAN, KCAN, BCAN
108	Barometric Pressure	65269, AMB	SCAN, KCAN, BCAN
173	Engine Exhaust Temperature	65270, IC1	SCAN, KCAN, BCAN
105	Engine Intake Manifold 1 Temperature	65270, IC1	SCAN, KCAN, BCAN
81	Aftertreatment 1 Particulate Filter Intake Pressure	65270, IC1	SCAN, KCAN, BCAN
106	Engine Intake Air Pressure	65270, IC1	SCAN, KCAN, BCAN
102	Engine Intake Manifold #1 Pressure	65270, IC1	SCAN, KCAN, BCAN
191	Transmission Output Shaft Speed	61442, ETC1	SCAN, KCAN, BCAN
574	Transmission Shift in Process	61442, ETC1	SCAN, KCAN, BCAN
4816	Transmission Torque Converter Lockup Transition in Process	61442, ETC1	SCAN, KCAN, BCAN
573	Transmission Torque Converter Lockup Engaged	61442, ETC1	SCAN, KCAN, BCAN
560	Transmission Driveline Engaged	61442, ETC1	SCAN, KCAN, BCAN
606	Engine Momentary Overspeed Enable	61442, ETC1	SCAN, KCAN, BCAN
607	Progressive Shift Disable	61442, ETC1	SCAN, KCAN, BCAN
161	Transmission Input Shaft Speed	61442, ETC1	SCAN, KCAN, BCAN
1482	Source Address of Controlling Device for Transmission Control	61442, ETC1	SCAN, KCAN, BCAN
526	Transmission Actual Gear Ratio	61445, ETC2	SCAN, KCAN, BCAN
523	Transmission Current Gear	61445, ETC2	SCAN, KCAN, BCAN
524	Transmission Selected Gear	61445, ETC2	SCAN, KCAN, BCAN

Section 9

CAN Communications

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SPN	CAN Signal Description	PGN	CAN BUS
163	Transmission Current Gear	61445, ETC2	SCAN, KCAN, BCAN
162	Transmission Requested Range	61445, ETC2	SCAN, KCAN, BCAN
177	Transmission Oil Temperature1	65272, TRF1	SCAN, KCAN, BCAN
3027	Transmission Oil Level1 High/Low	65272, TRF1	SCAN, KCAN, BCAN
3026	Transmission Oil Level 1 Measurement Status	65272, TRF1	SCAN, KCAN, BCAN
3028	Transmission Oil Level 1 Countdown Timer	65272, TRF1	SCAN, KCAN, BCAN
597	Brake Switch	65265, CCVS1	SCAN, KCAN, BCAN
598	Clutch Switch	65265, CCVS1	SCAN, KCAN, BCAN
595	Cruise Control Active	65265, CCVS1	SCAN, KCAN, BCAN
976	PTO Governor State	65265, CCVS1	SCAN, KCAN, BCAN
527	Cruise Control States	65265, CCVS1	SCAN, KCAN, BCAN
70	Parking Brake Switch	65265, CCVS1	SCAN, KCAN, BCAN
596	Cruise Control Enable Switch	65265, CCVS1	SCAN, KCAN, BCAN
599	Cruise Control Set Switch	65265, CCVS1	SCAN, KCAN, BCAN
600	Cruise Control Coast (Decelerate) Switch	65265, CCVS1	SCAN, KCAN, BCAN
601	Cruise Control Resume Switch	65265, CCVS1	SCAN, KCAN, BCAN
602	Cruise Control Accelerate Switch	65265, CCVS1	SCAN, KCAN, BCAN
86	Cruise Control Set Speed	65265, CCVS1	SCAN, KCAN, BCAN
69	Two Speed Axle Switch	65265, CCVS1	SCAN, KCAN, BCAN
84	Wheel-Based Vehicle Speed	65265, CCVS1	SCAN, KCAN, BCAN
244	Trip Distance	65248, VD	SCAN, KCAN, BCAN
245	Total Vehicle Distance	65248, VD	SCAN, KCAN, BCAN
979	Engine Remote PTO Governor Preprogrammed spd Control Switch	65264, PTO	SCAN, KCAN, BCAN
3447	Remote PTO Governor Preprogrammed spd Control Switch 2	65264, PTO	SCAN, KCAN, BCAN
974	Remote Accelerator Pedal Position	61443, EEC2	SCAN, KCAN, BCAN
980	Engine PTO Governor Enable Switch	65264, PTO	SCAN, KCAN, BCAN
982	Engine PTO Governor Resume Switch	65264, PTO	SCAN, KCAN, BCAN
984	Engine PTO Governor Set Switch	65264, PTO	SCAN, KCAN, BCAN
90	PTO Oil Temperature	65264, PTO	SCAN, KCAN, BCAN
695	Engine Override Control Mode	0,TSC1	SCAN, KCAN, BCAN
696	Engine Requested Speed Control Conditions	0,TSC1	SCAN, KCAN, BCAN
897	Override Control Mode Priority	0,TSC1	SCAN, KCAN, BCAN
898	Engine Requested Speed/Speed Limit	0,TSC1	SCAN, KCAN, BCAN
518	Engine Requested Torque/Torque Limit	0,TSC1	SCAN, KCAN, BCAN
3349	TSC1 Transmission Rate	0,TSC1	SCAN, KCAN, BCAN
3350	TSC1 Control Putpose	0,TSC1	SCAN, KCAN, BCAN
4191	Engine Requested Torque - High Resolution	0,TSC1	SCAN, KCAN, BCAN
4206	Message Counter	0,TSC1	SCAN, KCAN, BCAN
4207	Message Checksum	0,TSC1	SCAN, KCAN, BCAN
187	Power Take Off Set Speed	65264,PTO	SCAN, KCAN, BCAN
3696	Force Regen	57344,CM1	SCAN, KCAN, BCAN
3695	Inhibit Regen	57344,CM1	SCAN, KCAN, BCAN

INTRODUCTION

This section is written to provide information to the body builder when installing equipment into vehicles built with Multiplexed instrumentation. The new technology presented by VECU level instrumentation integrates J-1939 CAN data communications between equipment on the vehicle. This book is intended to address how to work in aftermarket equipment while still maintaining full functionality of the OEM vehicle.

These topics apply to 2.1M chassis built with VECU architecture. The electrical architecture for these trucks will be named VECU01 which replaces NAMUX4. This system integrates a parallel control unit to manage outbound messages via a faster baud rate 500kbps and FCAN signals for the chassis module(s). All other CAN busses (except the K-CAN) are managed in parallel with the existing CECU3 unit. Since the F-CAN has moved to the VECU, the VCAN on CECU3 is now divided into a 1 (250 kbps) and 2 (500 kbps). The second CAN is dedicated to OBD communication.

The most important advancement of electrical instrumentation is the implementation of the VECU controller. While it is still possible to wire completely outside of the VECU system, utilizing the VECU functions will make a cleaner installation and will maintain OEM functionality. VECU expands controls to air operated devices by receiving input from dash switches, remote (aftermarket) switches, sensors mounted to the aftermarket equipment and other vehicle parameters (engine speed, transmission status etc.) With the proper programming, the VECU will then process the inputs and will create a J-1939 Data instruction which is communicated to another controller outside the cab called the Chassis Module. This chassis module receives the instruction and connects 12V power to an air solenoid. 12V power will open the solenoid and supply air pressure to that air circuit.

ELECTRICAL ACRONYM LIBRARY

Acronym	Definition
CAN	Controller Area Network
CECU	Cab Electrical Control Unit
DTC	Diagnostics Trouble Code
ECM	Engine Control Module
ECU	Electrical Control Unit
EOA	Electric Over Air
EOH	Electric Over Hydraulic
J-1939	SAE CAN Communication Standard
LIN	Local Interconnect Network
MSB	Master Solenoid Bank
MSM	Master Switch Module
MUX	Multiplex Switch
OBD	On Board Diagnostics
OEM	Original Equipment Manufacture
PCC	Predictive Cruise Control
PDC	Power Distribution Center
PGN	Parameter Group Number
PTO	Power Take Off
RP1226	TMS Messaging Standard
SPN	Suspect Parameter Number
TCM	Transmission Control Module
VECU	Vehicle Electrical Control Unit

ELECTRICAL WIRING CIRCUIT CODES

Kenworth will continue to use the wiring scheme that was employed on legacy trucks. The wire system uses 10 different colors and only one striped wire color. Each wire has a minimum of seven characters, with the first three characters as the wire color. The remaining four characters are related to the wire services. The colors determine the circuits function as follows:

Table 10-1. Electrical Wire Circuit Code Table

PACCAR Electrical Circuit Code		
Insulation Color	Color Code	Electrical Function
Red w/white stripe	R/WXXXX	Direct battery power
Red	REDXXXX	Protected battery power
Orange	ORNXXXX	Ignition, Accessory, Low Voltage Disconnect, StartPower
Yellow	YELXXXX	Activated Power
White	WHTXXXX	Ground
Black	BLKXXXX	Load Return
Gray	GRAXXXX	Control
Brown	BRNXXXX	Indicator Illumination Backlit Illumination
Violet	VIOXXXX	Reference Voltage or +5VDC or Sensor Power
Light Blue	BLUXXXX	Sensor Signal
Light Green	GRNXXXX	Sensor common or Sensor Ground

MULTIPLEX SYSTEM

The VECU electrical architecture uses a multiplexing system. Multiplexing can be defined as the process of sending multiple digital signals on the same shared medium at the same time. These signals are introduced into the multiplexing system through data connection points which are defined by J1939 backbone.

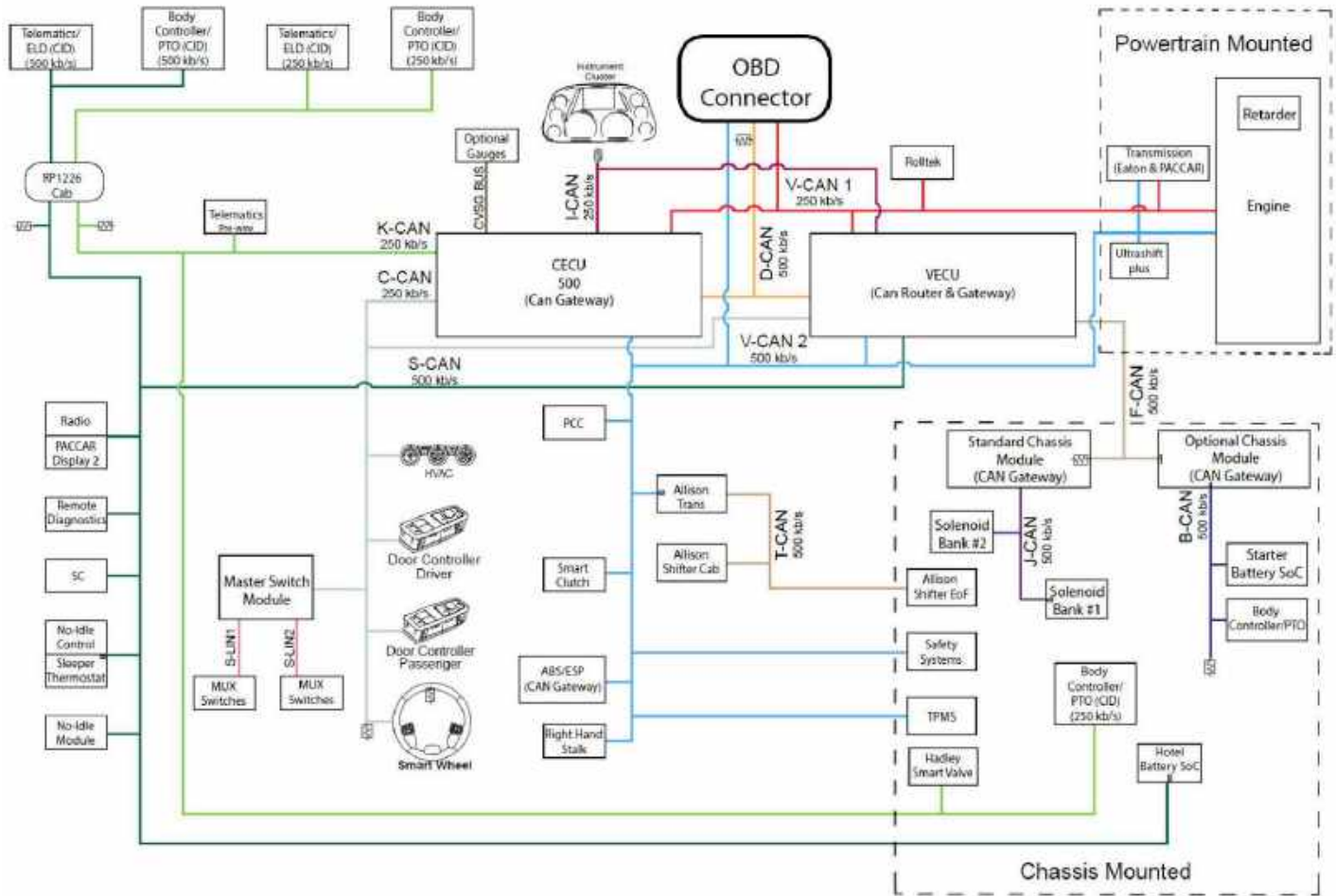


FIGURE 10-1. Can Bus System Overview

CAN BUS SPEEDS AND CIRCUIT DESIGNATION

J1939-14 (500KBPS):

B-CAN – 0813 Body Builder
D-CAN – 0822 Diagnostics
F-CAN – 0819 Frame
G-CAN – 0825 Bendix ACB Antenna
J-CAN – 0826 Solenoid Bank
T-CAN – 0828 Transmission
V-CAN2 – 0823 Vehicle
S-CAN – 0827 Sleeper

J1939-15 (250KBPS):

I-CAN – 0825 Instrumentation
C-CAN – 0821 Cab
K-CAN – 0829 Telematics and Remote PTO

ELECTRICAL COMPONENT OVERVIEW

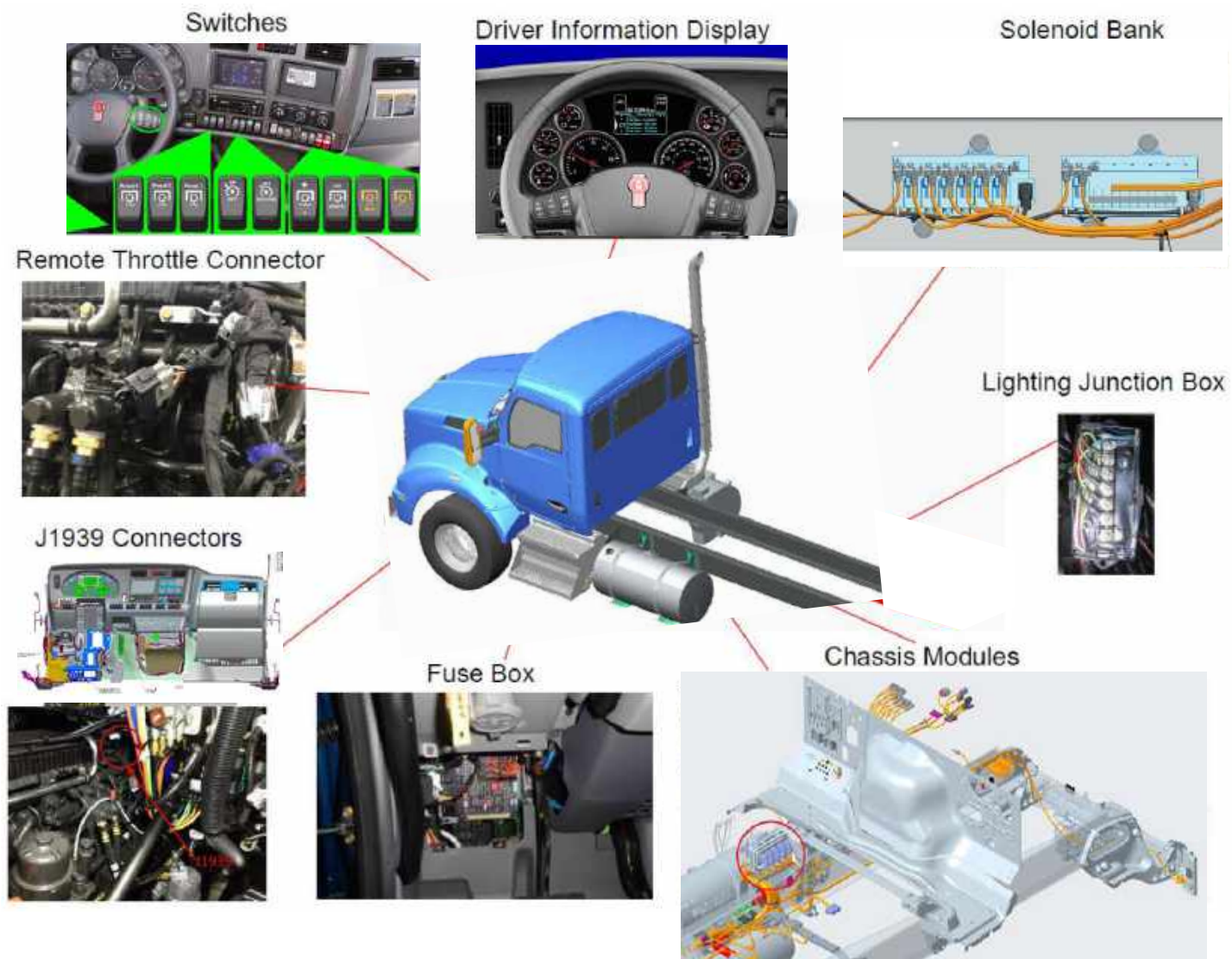


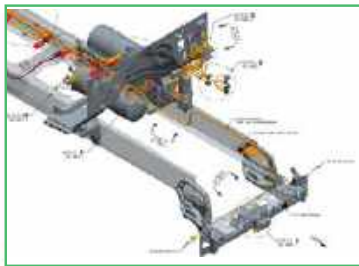
Figure 10-2. Overview Diagram of Electrical Component Locations

Section 10 Electrical



MAIN CHASSIS HARNESS

- 1) Connections to Firewall Bulkhead
- 2) Connections to Rear Chassis Harness
- 3) Connections to Chassis Module
- 4) Connection to Solenoid Bank
- 5) Connections to Rear Chassis Harness
- 6) Connections to Hood Harness



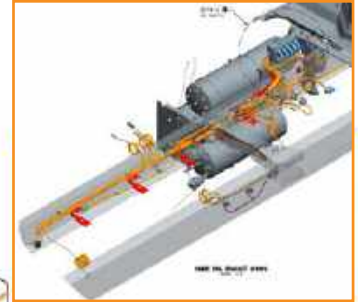
ENGINE HARNESS

- 1) Connections to Main Chassis Harness
- 2) Connections to Firewall Bulkhead
- 3) Connections to Starter
- 4) Connections to Aftertreatment Harness
- 5) Connection to Engine ECU



HOOD CHASSIS HARNESS

- 1) Connections to Main Chassis Harness
- 2) Connections to Head Lights
- 3) Connections to Turn Signal Lamps



REAR CHASSIS HARNESS

- 1) Connections to Chassis Harness
- 2) Connections to Tail Light



CAB ROOF HARNESS

- 1) Connections to Main Cab IP Harness
- 2) Connections to Antennas
- 3) Connections to Roof Lighting



MAIN CAB IP HARNESS

- 1) Connections to Firewall Bulkhead
- 2) Connections to VECU and CECU
- 3) Connections to Power Distribution Center
- 4) Connections to Instrument Panels
- 5) Connection to Allison TCM
- 6) Connections to Cab Roof Harness

Figure 10-3. Electrical Harness Overview

IN CAB CAN BASED MESSAGING CONNECTOR

RP1226 CONNECTOR

The RP1226 connector is located on the left hand side of the steering wheel behind the dash near the OBD connector. The RP1226 connector can be used for aftermarket telematics, ELD, body controls, and PTO controls. There will be multiple bus speeds available K-CAN for 250kbps and S-CAN for 500 kbps. The RP1226 provides defined messages and major telematics supplier data for customer use.



FIGURE 10-4.

BODY CONNECTION POINTS

LOCATION DIAGRAMS FOR VARIOUS BODY CONNECTORS ON THE MAIN CHASSIS HARNESS

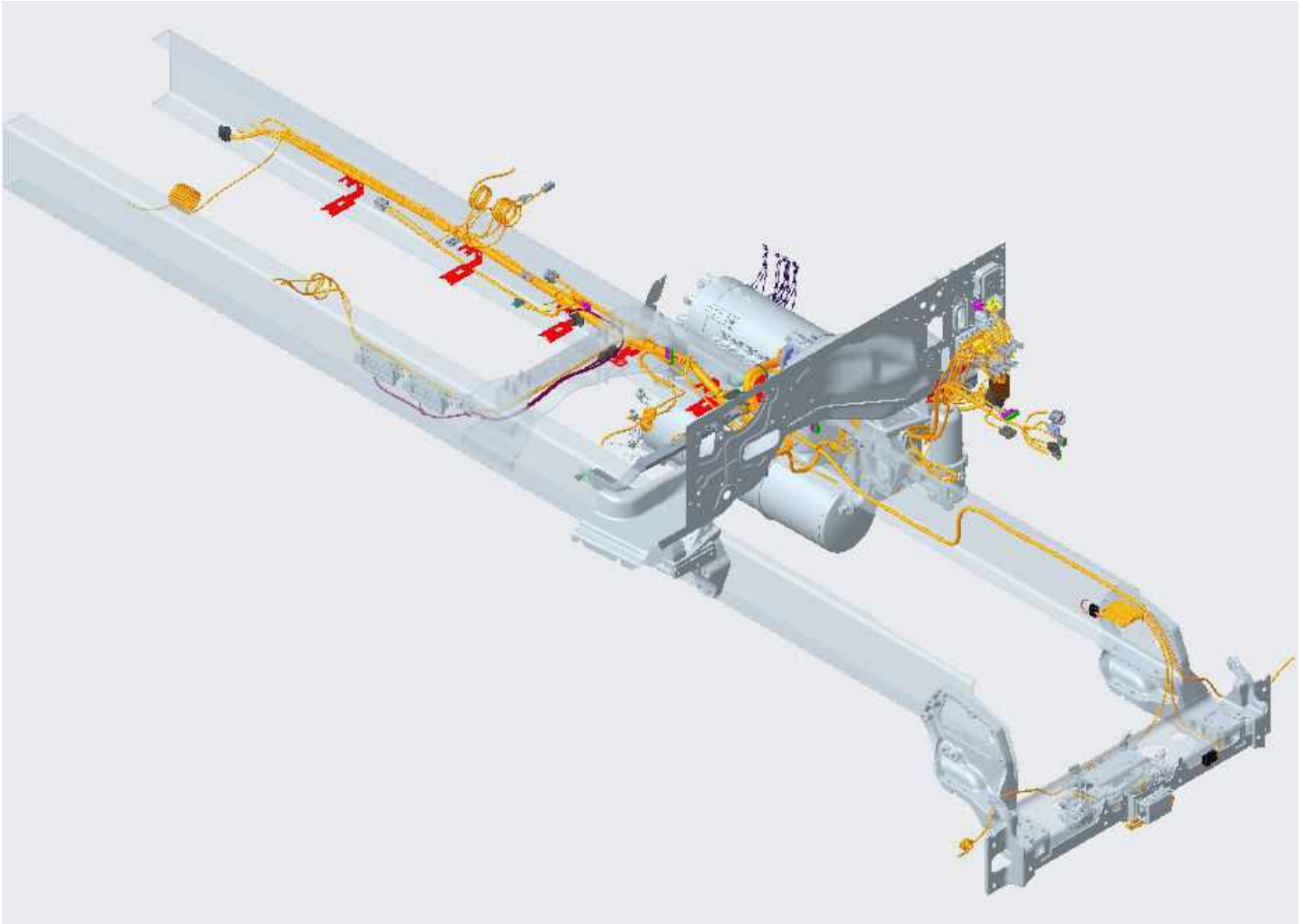


FIGURE 10-5. Isometric View

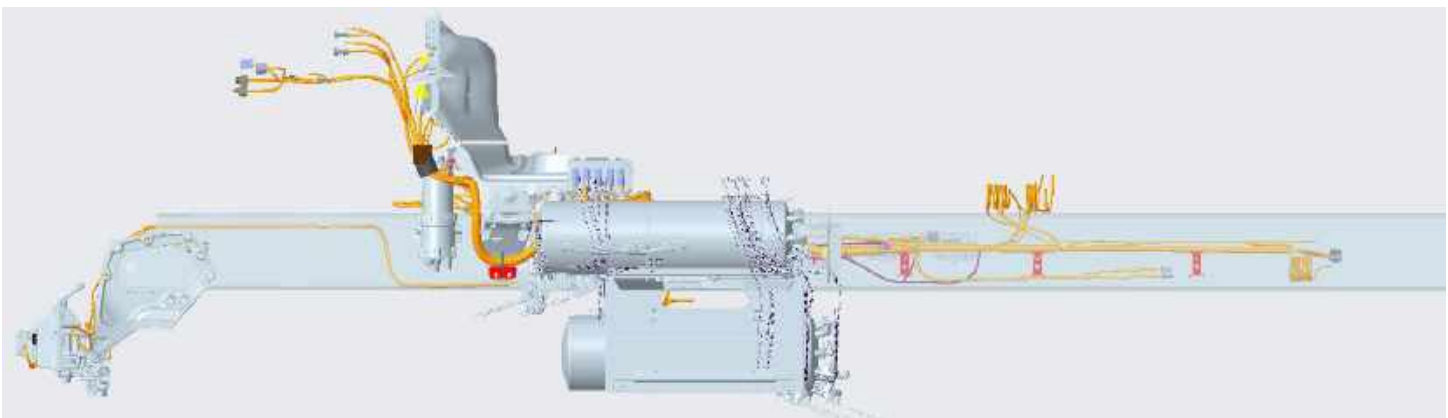


FIGURE 10-6. Side View

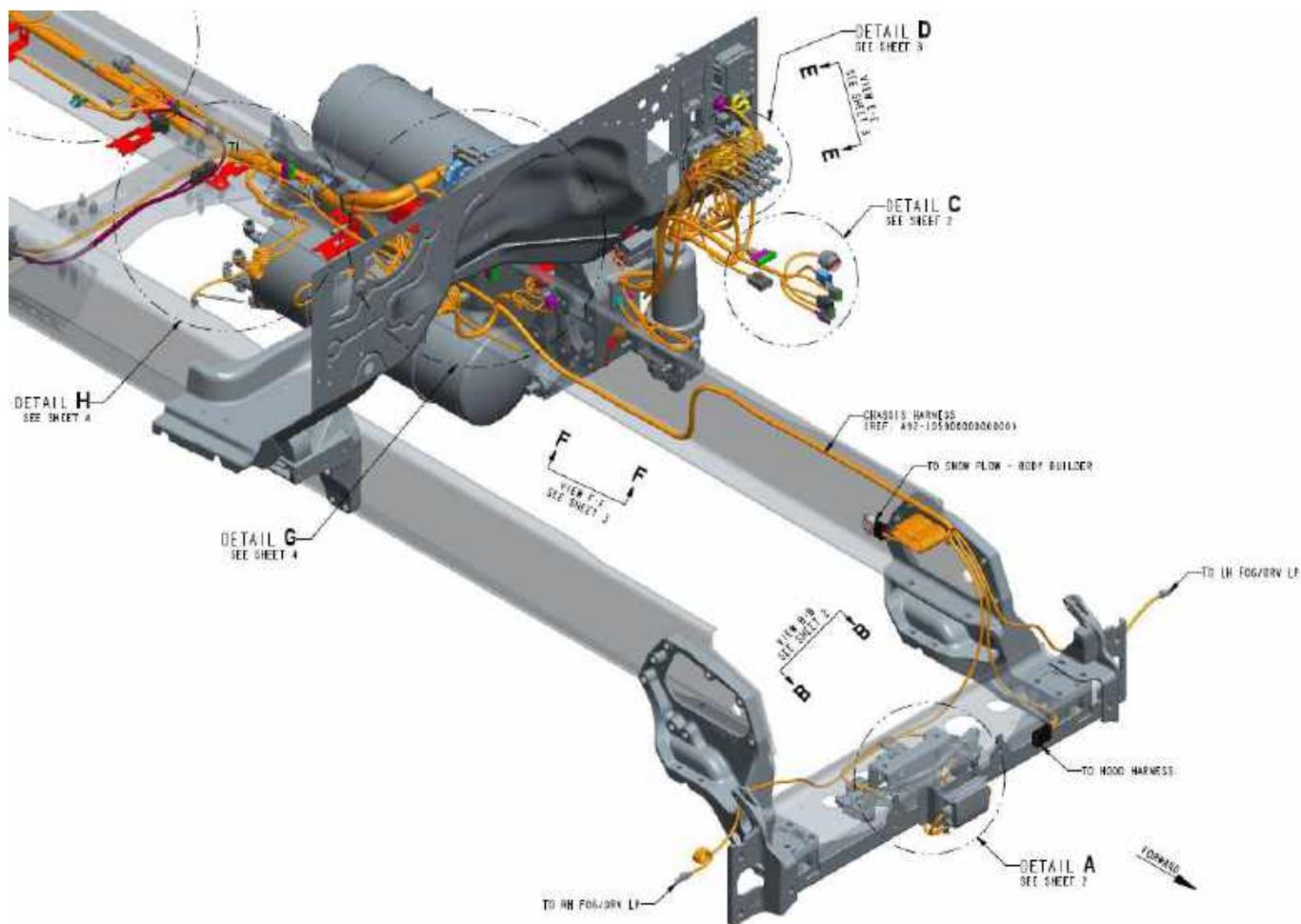


FIGURE 10-7. Front Portion View

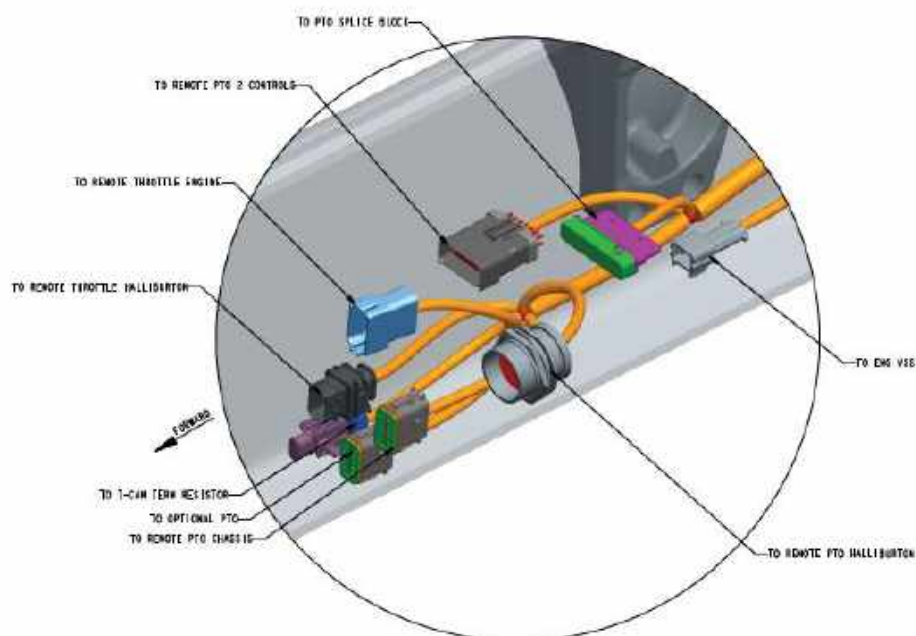


FIGURE 10-8. Detail View Of Engine Compartment Body Connectors

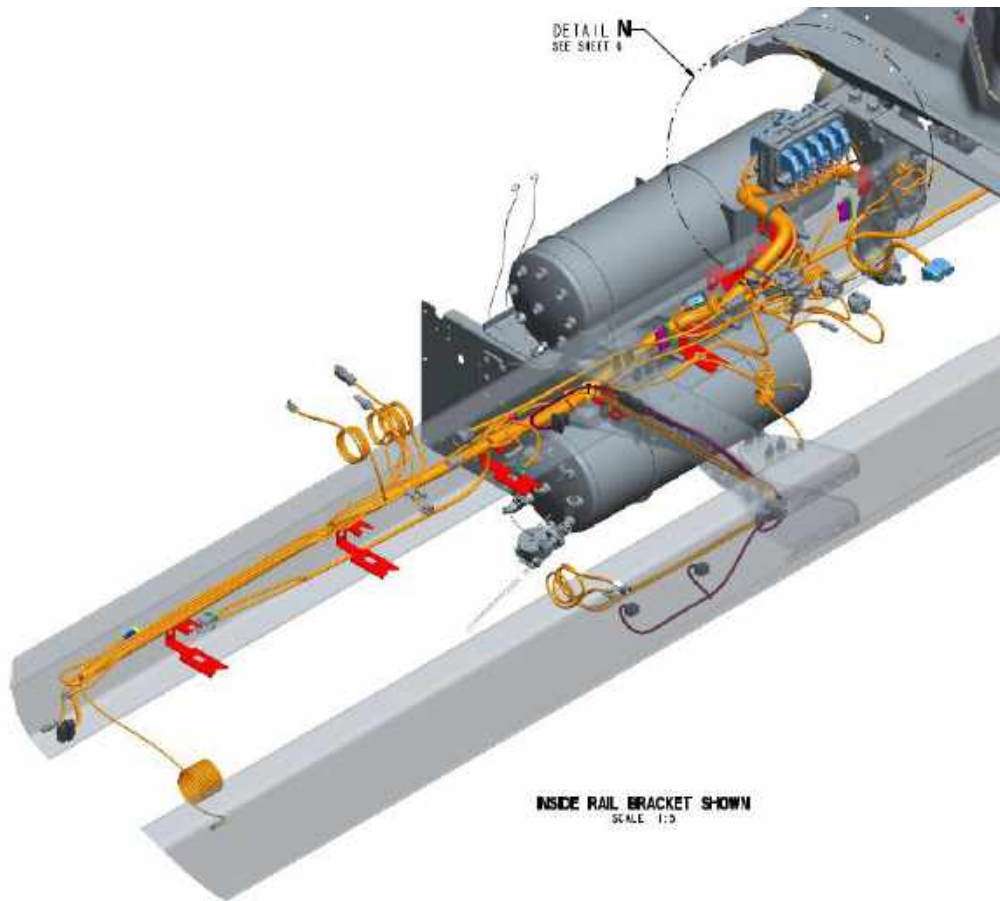


FIGURE 10-9. Rear Portion View

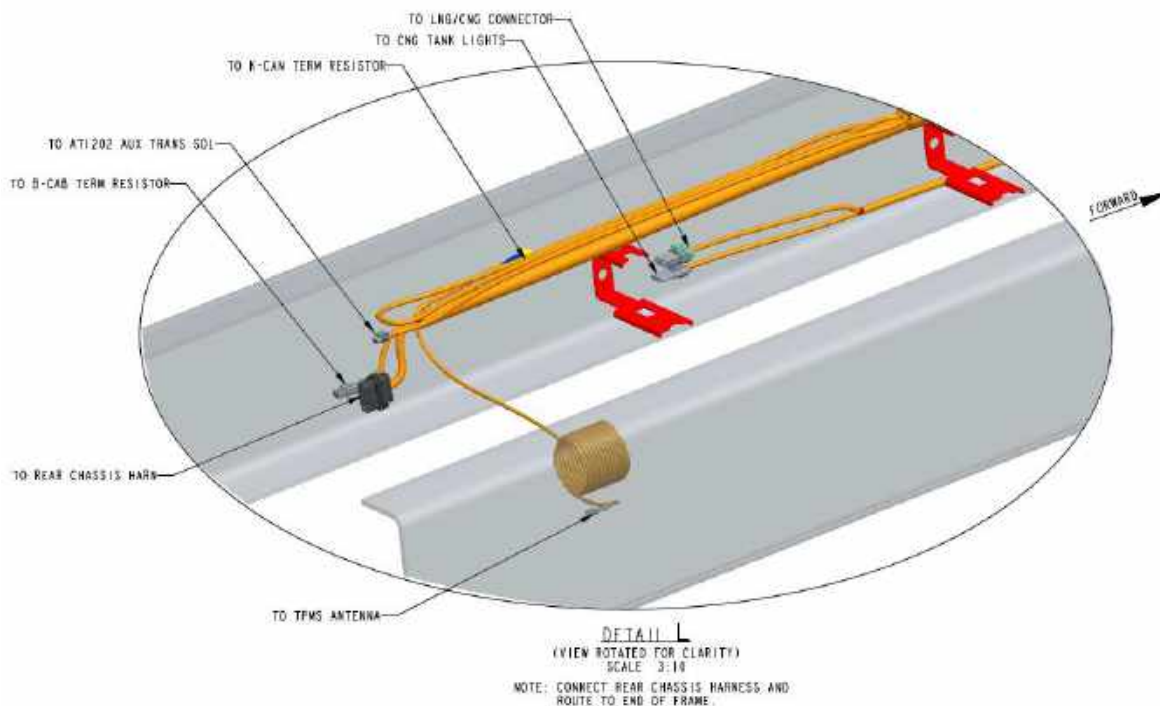
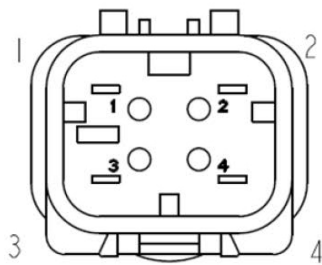


FIGURE 10-10. Detail View Of Boc/Bos And Eof Body Connectors
10-9

ELECTRIC ENGAGED EQUIPMENT

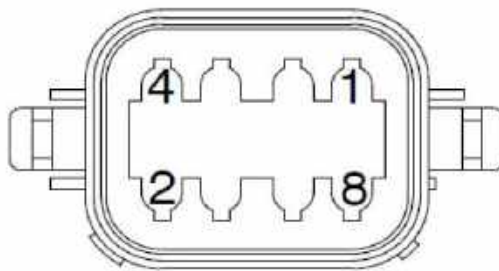
At the left hand forward cab mount, P198 is available for PTO controls that are electrically engaged via ground.



Pin	Function
1	VEHICLE GROUND
2	#1 PTO ON/OFF
3	PTO PUMP MODE SIGNAL
4	#2 PTO ON/OFF

FIGURE 10-11.

OPTIONAL 8 PIN PTO INPUT CONNECTOR



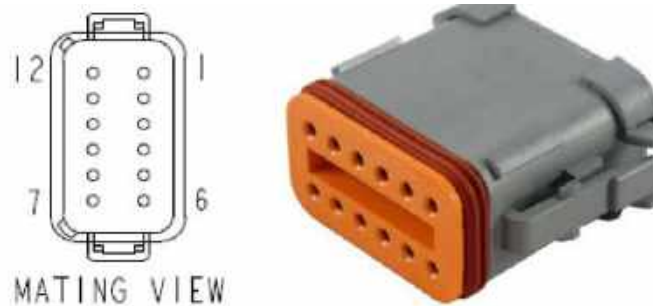
Pin	Function
1	12V IGNITION SIGNAL
2	PTO INTERLOCK INPUT (Active Low)
3	REMOTE PTO PRESET 3 (Active High)
4	REMOTE PTO PRESET 2 (Active High)
5	REMOTE PTO PRESET 1 (Active High)
6	REMOTE PTO PRESET INCREMENT + (Active High)
7	REMOTE PTO PRESET DECREMENT - (Active High)
8	VEHICLE GROUND

FIGURE 10-12. Chassis Harness (P197N)

REMOTE THROTTLE AND REMOTE PTO CONTROLS

PACCAR MX ENGINES

Chassis must be ordered with the appropriate option to have a 12 pin connector on the chassis harness. All signals will feed into the Chassis Modules, which will have Active Low inputs. Connect pins 3 and 5 for simple PTO ON/OFF signal. For Remote throttle bump, you must connect pins 3 & 6. Then momentarily connect pins 2 and 3 for SET, and pins 1 and 3 for Resume. Engine speed will depend on how engine ECM is programmed. Unless otherwise specified, engine is set by default



Pin	Description
1	INPUT FOR REMOTE PTO RESUME (Active Low)
2	INPUT FOR REMOTE PTO SET (Active Low)
3	INPUT FOR NAMUX ANALOG RETURN (TWISTED TRIPLE)
4	INPUT FOR REMOTE THROTTLE SENSOR CIRCUIT (TWISTED TRIPLE)
5	PTO ENGAGED SIGNAL (LOW = ENGAGED)
6	CRUISE ON/OFF (Active Low)
7	+12V 10A BODY IGN FUSE C_A6
8	VEHICLE GROUND
9	NOT USED
10	INPUT FOR NAMUX PWR SUPPLY +5V(TWISTED TRIPLE)
11	+12V 20A ENG PWR (MX) FUSE C_A6
12	NOT USED

FIGURE 10-13.

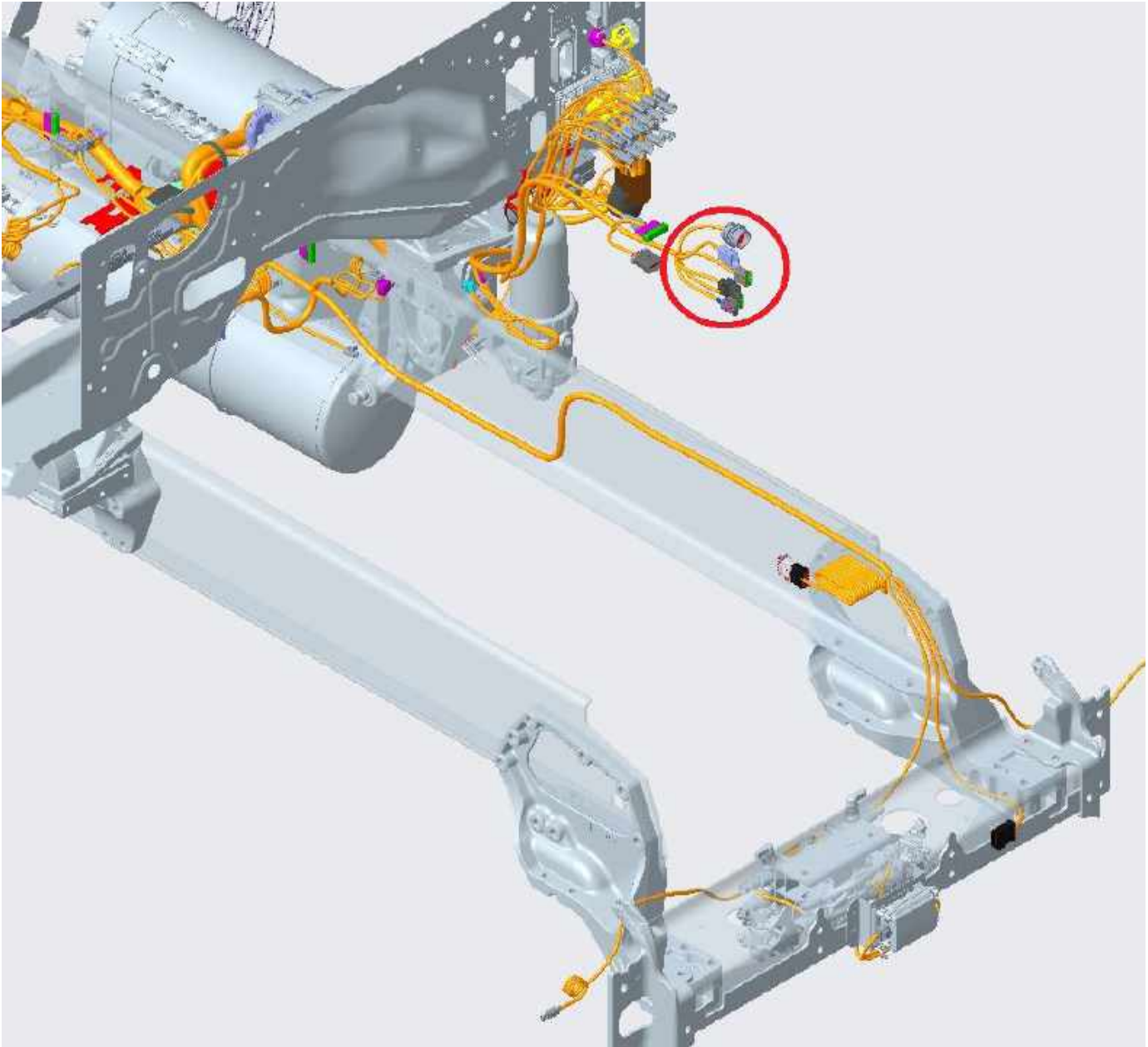
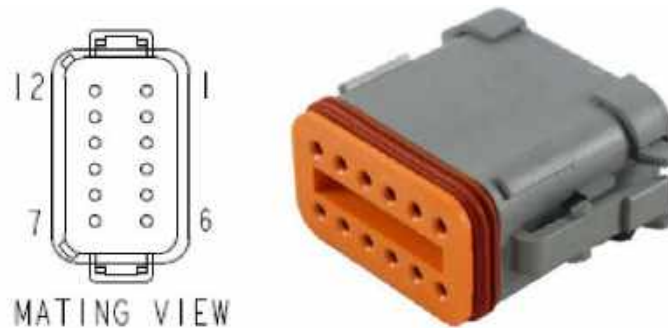


FIGURE 10-14. MX-11 and MX-13 Connector Location.

Chassis must be ordered with the appropriate option to have a 12 pin connector on the engine harness. The Body IGN signal was moved off the engine harness connector, so for Cummins, the Chassis Harness will include the PTO layer to insert the Body IGN signal back into the 12-way connector. Signals that feed directly to the engine ECM typically will be active low signals. Connect pins 3 and 5 for simple PTO ON/OFF signal. For Remote throttle bump, you must connect pins 3 & 6. Having a momentary switch to signal ground on pins 2 and 1 will then increase/decrease engine speed. Engine speed will depend on how engine is programmed. Unless otherwise specified, engine is set by default for incremental speed increase. Full remote throttle control can be achieved with a twisted triple to pin 4, 10, and 11.



Pin	Description
1	INPUT FOR REMOTE PTO RESUME (Active Low)
2	INPUT FOR REMOTE PTO SET (Active Low)
3	INPUT FOR NAMUX ANALOG RETURN (TWISTED TRIPLE)
4	INPUT FOR REMOTE THROTTLE SENSOR CIRCUIT (TWISTED TRIPLE)
5	PTO ENGAGED SIGNAL (LOW = ENGAGED)
6	CRUISE ON/OFF (Active Low)
7	+12V 10A BODY IGN FUSE C_A6
8	VEHICLEGROUND
9	NOT USED
10	INPUT FOR NAMUX PWR SUPPLY +5V(TWISTED TRIPLE)
11	+12V 20A ENG PWR (MX) FUSE C_A6
12	NOT USED

FIGURE 10-15. Cummins Engines 12 Pin Connector

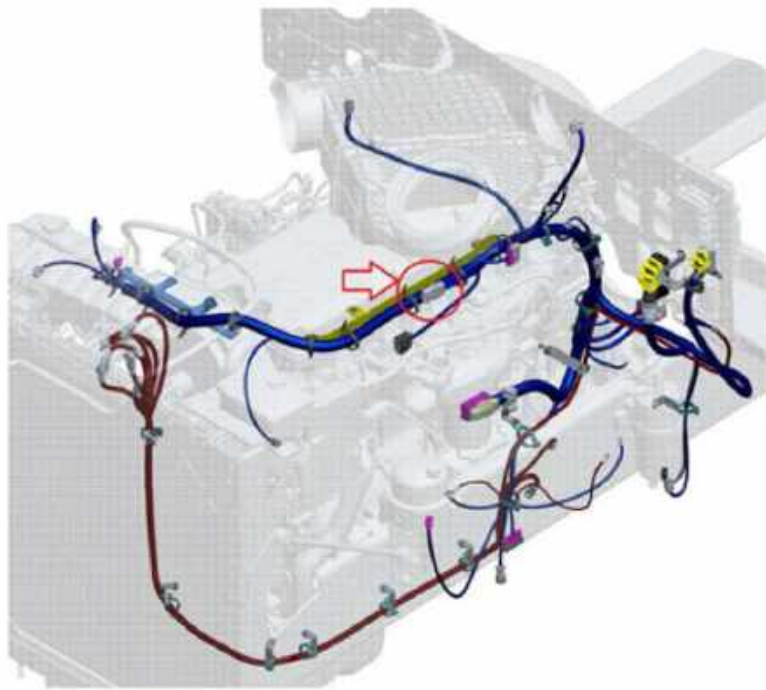


FIGURE 10-16. X15 Connection location

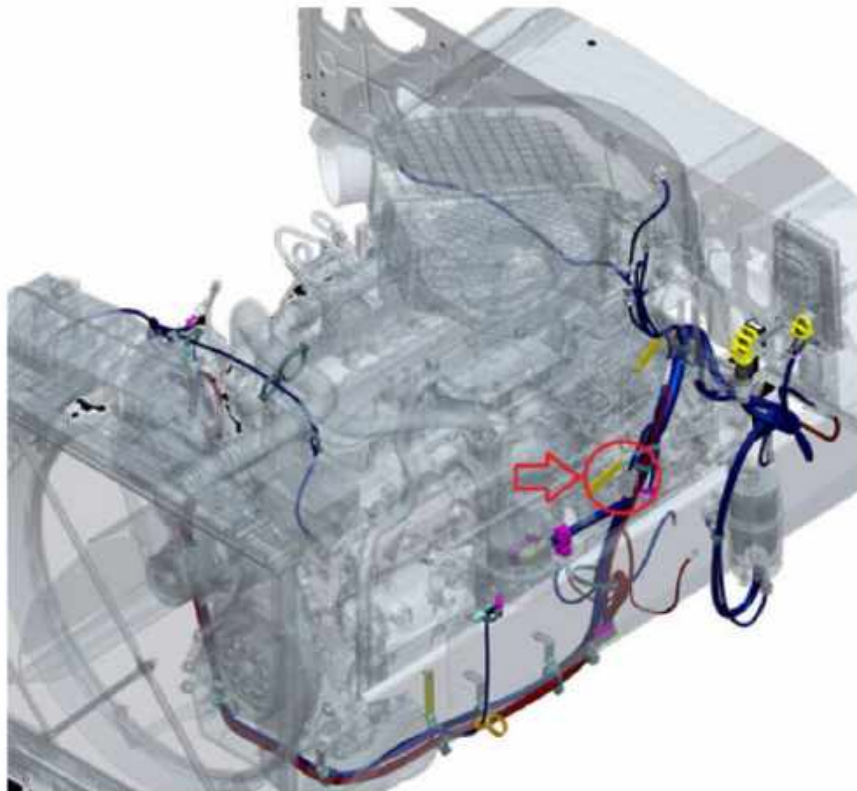


FIGURE 10-17. ISX12 Connection location

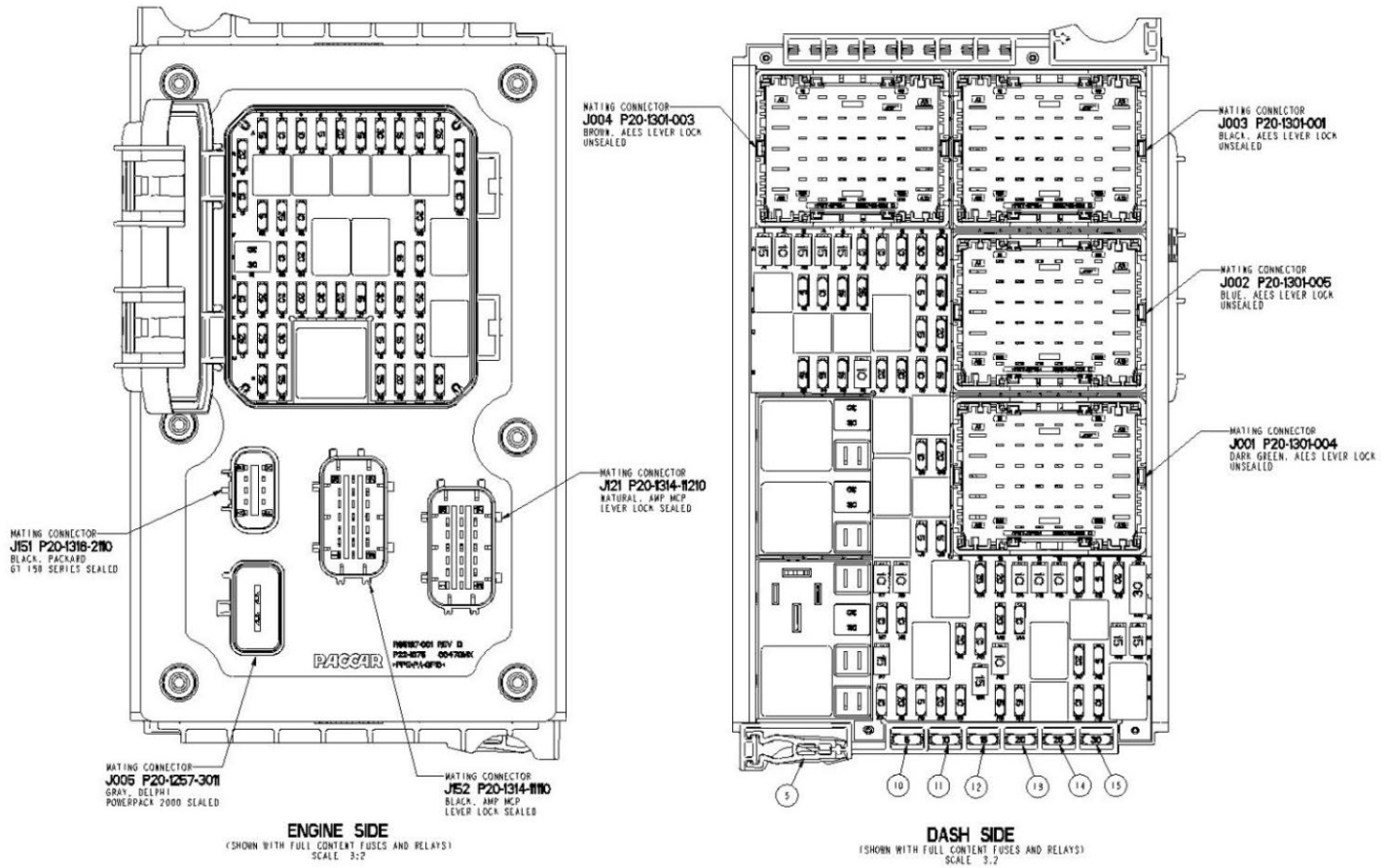
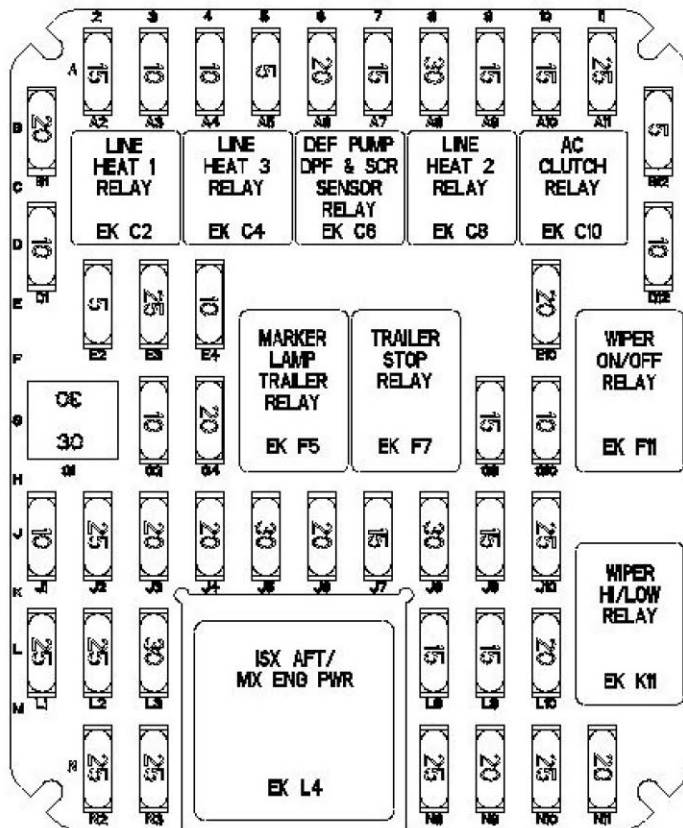


FIGURE 10-18. Power Distribution Center

Section 10 Electrical

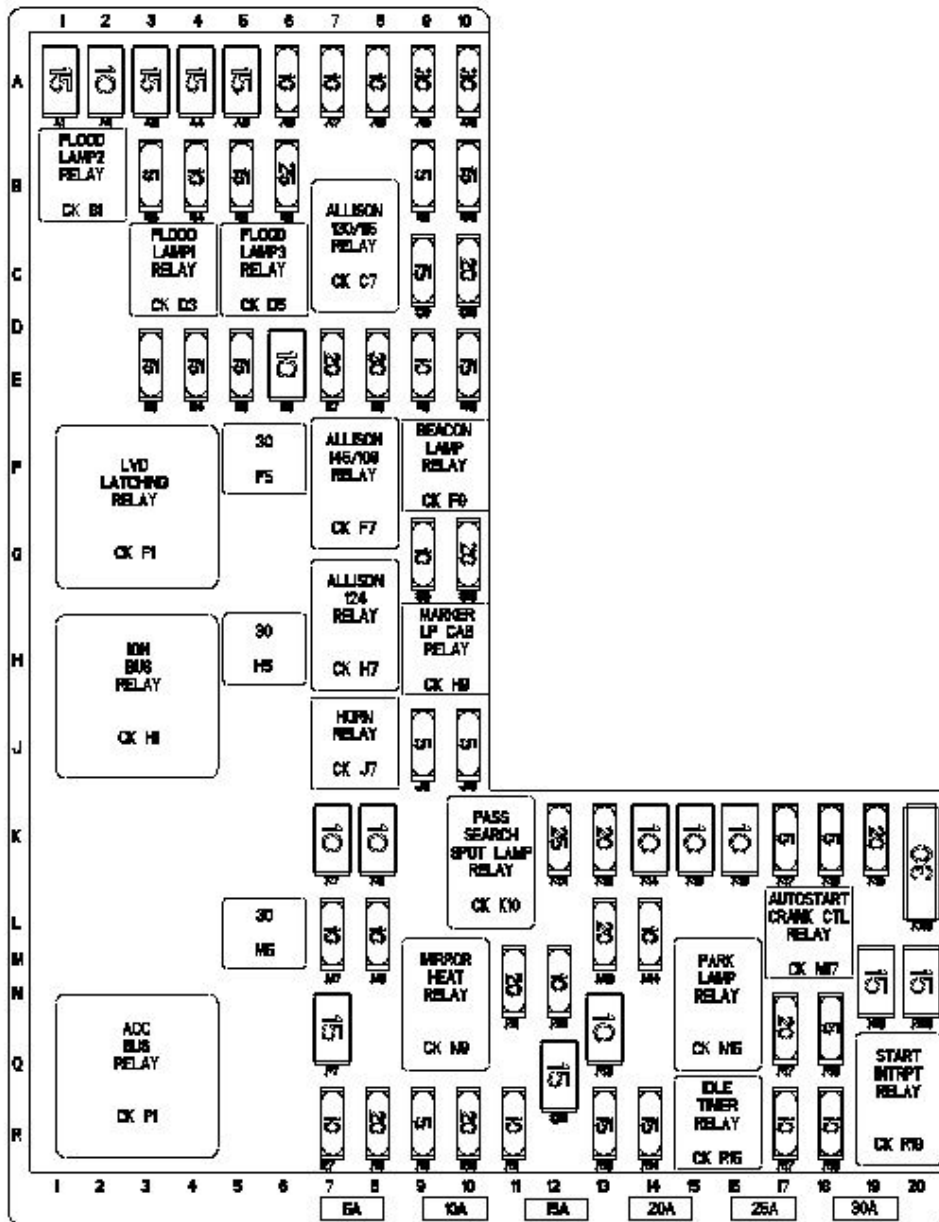
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FUSE ID	AMP	DESCRIPTION
A2	15A	LINE HEAT 1 (PRESSURE) -PWR
A3	10A	ALLISON/AUTO/ULTRASHIFT
A4	10A	CHASSIS MODULE
A5	5A	LINE HEAT 3
A6	20A	SCM F1-HDLP LH HI/RH RR TURN/BRK
A7	15A	DEF PUMP / DPF*** SENSORS PWR
A8	30A	CAB ABS
A9	15A	LINE HEAT 2 (BACKFLOW) -PWR
A10	15A	AUX TRANS AIR TO OIL COOLER
A11	25A	WIPER MOTOR
B1	20A	EXT REGEN / SPARE IGN
B12	5A	HVAC HEAD PWR
D1	10A	ACC RADAR/TPMS
D12	10A	AC CLUTCH RELAY - PWR
E2	5A	ECU WAKEUP (ENG SIDE)
E3	25A	OCM F6
E4	10A	MUX SOL BANK 2
E10	20A	SPARE BATT 2
G1	30A JCASE	HVAC BLDC MOTOR
G3	10A	MUX SOL BNK 1
G4	20A	OCM F4
G9	15A	ISX AFT / MX ENGINE PWR
G10	10A	VECU BATT PWR 1
J1	10A	CAB ABS PWR -10A IGN
J2	25A	SCM F3-HDLP RH LO/FRNT PARK/RH DRL/TURN
J3	20A	SCM F2-HDLP LH LO/FRNT PARK/LH DRL/TURN
J4	20A	SCM F7
J5	30A	TRLR MARKER RELAY-PWR
J6	20A	OCM F5
J7	15A	BACKUP LAMP
J8	30A	TRAILER STOP RELAY-PWR
J9	15A	VTG
J10	25A	WIPER ON CTL
L1	25A	QUALCOMM TRLR TRACKS
L2	25A	SCM F4-HDLP RH HI/FRNT FOG/PB DRL
L3	30A	AUTO TRANS
L8	15A	MX AFT/ CUM AFT PWR (CNG/LNG)
L9	15A	MX ENG ACC PWR
L10	20A	DCU PWR/LPC(MX)/ISX SM/DEF HT CTL
N2	25A	SCM F5
N3	25A	SCM F6
N8	25A	FRAME FUEL HEATER
N9	20A	MX ENGINE PWR 1
N10	25A	MX ECM
N11	20A	CUM ECM/ MX ACM PWR 1&2

FIGURE 10-19. Engine Side Fuse Box Full Content Population

Section 10 Electrical



FUSE ID	AMP	DESCRIPTION
A1	15A	FLOOD LAMP 2
A2	10A	SPOT LAMP
A3	15A	FLOOD LAMP 1
A4	15A	FLOOD LAMP 3
A5	15A	FLOOD BEACON PWR
A6	10A	BODY IGN
A7	10A	RP1226 IGN
A8	10A	RP1226 BATT
A9	30A	SLEEPER PDC 1
A10	30A	SLEEPER PDC 2
B3	5A	DOOR AJAR SENSOR
B4	10A	VECU BATT PWR 2
B5	15A	CECU BATT PWR 2
B6	25A	PACCAR AMT/SPARE BATT
B9	5A	MASTER SWITCH MODULE
B10	15A	CECU BATT PWR 1
C9	15A	CB/RADIO POWER
C10	20A	OCN F1
E9	15A	SPARE LVD 2
E4	15A	POWER PORT 1
E5	15A	POWER PORT 2
E6	10A	CAB DONE LP
E7	20A	SPARE LVD 1
E8	30A	RADIO AMPLIFIER
E9	10A	QUALCOMM-BATT
E10	15A	OCN F2
F5	30A JCASE	RH DOOR MOD
G9	10A	EQAS
G10	20A	TELEMATICS
H5	30A JCASE	LH DOOR MOD
J9	5A	DIAGNOSTIC POWER
J10	5A	CECU LVD V SENSE
K7	10A	HORN RELAY - PWR
K8	10A	CAB MARKER PWR 1
K12	25A	MX ON ENG FULL HT
K13	20A	SPARE IGN 1
K14	10A	LTRAC VALVE
K15	10A	VECU STOP LAMP SW
K16	10A	PARK LAMP CAB PWR 1
K17	5A	CECU/VECU IGN PWR
K18	5A	RH STALK SWITCH
K19	20A	OCN F3
K20	30A	TRAILER HOT LINE
M5	30A JCASE	SLEEPER PDC 3
M7	10A	SPLICE FEED IGN
M8	10A	RH HEATED SLAT
N13	20A	SPARE IGN 2
N14	10A	SIGN LAMP SW
N11	20A	SPARE ACC 2
N12	10A	LH HEATED SLAT
N19	15A	LH MIRROR HEAT
N20	15A	PARK LAMP TRLR PWR
P7	15A	AIR DRYER
P13	10A	GAUGE CLUSTER
P17	20A	SPARE ACC 3
P18	5A	HVAC HEAD ACC
Q12	15A	RH MIRROR HEAT
R7	10A	SPARE ACC 6
R8	20A	SPARE ACC 1
R9	5A	VECU/CECU ACC PWR
R10	20A	SPARE ACC 1
R11	10A	REMOTE DIAG
R13	15A	SPARE ACC SW 3.485
R14	15A	SPARE ACC SW 1.82
R17	10A	SPARE ACC 4
R18	10A	RADIO WAKE UP

FIGURE 10-20. Dash Side Fuse Box Full Content Population

CHASSIS MODULE

The standard chassis modules are replacing the legacy NAMUX4 chassis node. The standard chassis modules are a slave I/O driver controlled by the VECU. The standard chassis modules have an expanded functionality and option platform growth in comparison to the chassis node. There is hardware and software based protections to prevent damage. The standard chassis modules will generate and store faults to free up space for the VECU. The standard chassis module can be diagnosed through DAVIE service tool.

There will be two standard chassis modules with one a primary chassis module on all trucks and a secondary for optional content. The primary chassis module will be mounted as a primary chassis module under the cab on the left hand side of the over-bell mounting bracket. The secondary optional chassis module will be located above the rail on the left hand side on the back of cab cross-member.

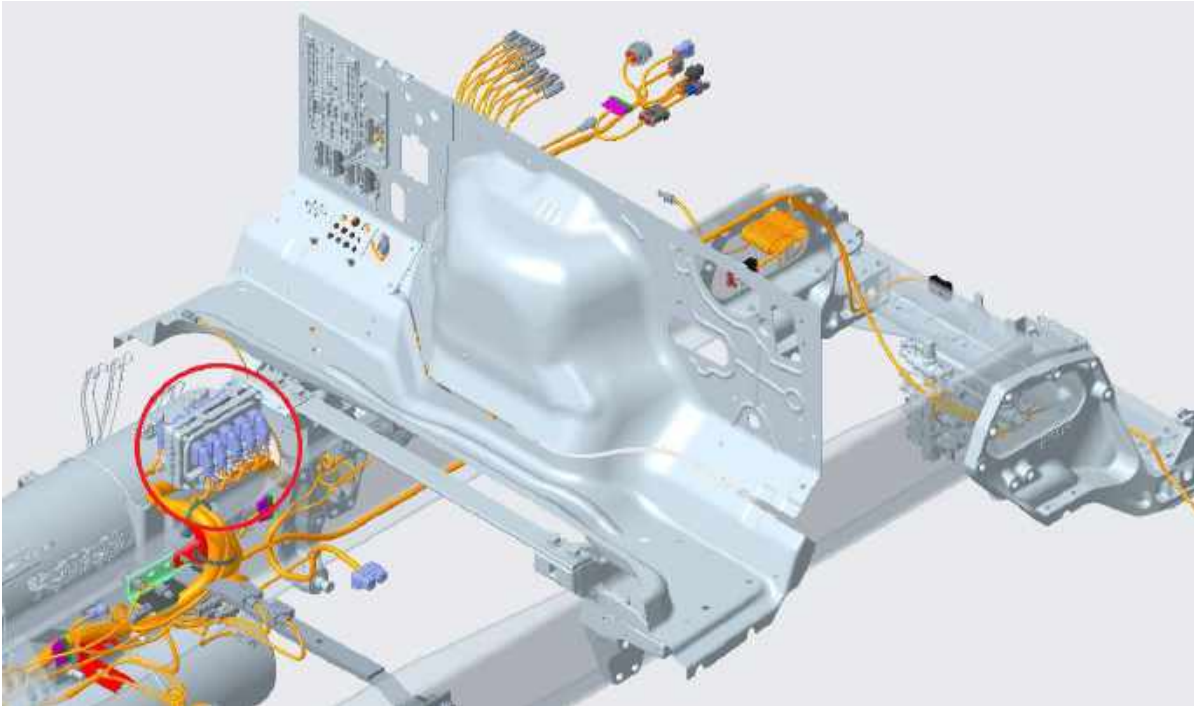


FIGURE 10-21. Chassis Module Locations

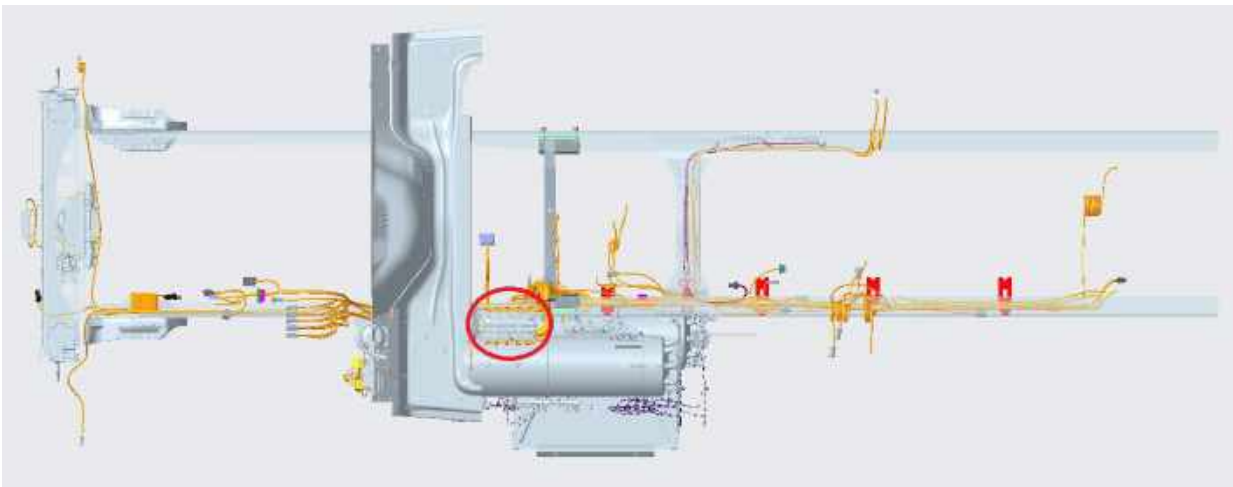


FIGURE 10-22. Plan view of Chassis Module Locations

CHASSIS MODULE FUNCTION DESIGNATION

PRIMARY CHASSIS MODULE

- Exterior Lighting: Headlamps, Park/Tail, Turn, Brake, DRL, Reverse etc.
- Axle Temperature Sensor Inputs Front Rear and Rear
- Ammeter Sensor Input
- Secondary Kingpin Release Solenoid Control
- Primary/Secondary Fuel Level Sensors
- Lift Axle Air Solenoid Controls 1st, 2nd
- Primary Transmission Neutral Position Switch
- Remote PTO/Throttle Control Inputs
- J-CAN Multiplexed EOA Solenoid Bank Control
- Fuel Filter Gauges
- Main Transmission Oil Temp

SECONDARY CHASSIS MODULE

- External Notification of DPF Regeneration
- AT1202 Aux Trans Neutral Switch
- Axle Temperature Gauges Center Rear
- Lift Axle Air Solenoid Controls 3rd , Tag (Rocker Panel Controls)
- NAMCO/FABCO Splitshaft PTO/Transfer Case Sensors
- Aux Transmission Temperature Sensor
- Split Shaft PTO Temperature Sensor
- Fuel Temp Sensor (Auto Start)
- Chicken/Panel Lamps, Snow Plow Lamp
- ISO 3731 Spare Outputs
- B-CAN
- Auto Start/Stop Hood Tilt Switch
- City Horn

ELECTRIC OVER AIR SOLENOIDS

Air solenoids are the devices that translate the electrical signal into physical change that controls the air pressure in various circuits. The air solenoids are mounted to a bracket outside the cab. The solenoids are designed to stack on each other so that they share a common air supply rail which reduces the amount of air lines on the vehicle.

The aftermarket installer/final vehicle manufacturer needs to decide what type of valve to install and ensure that the documentation to the operator provides them with enough understanding of how the customized switches work.

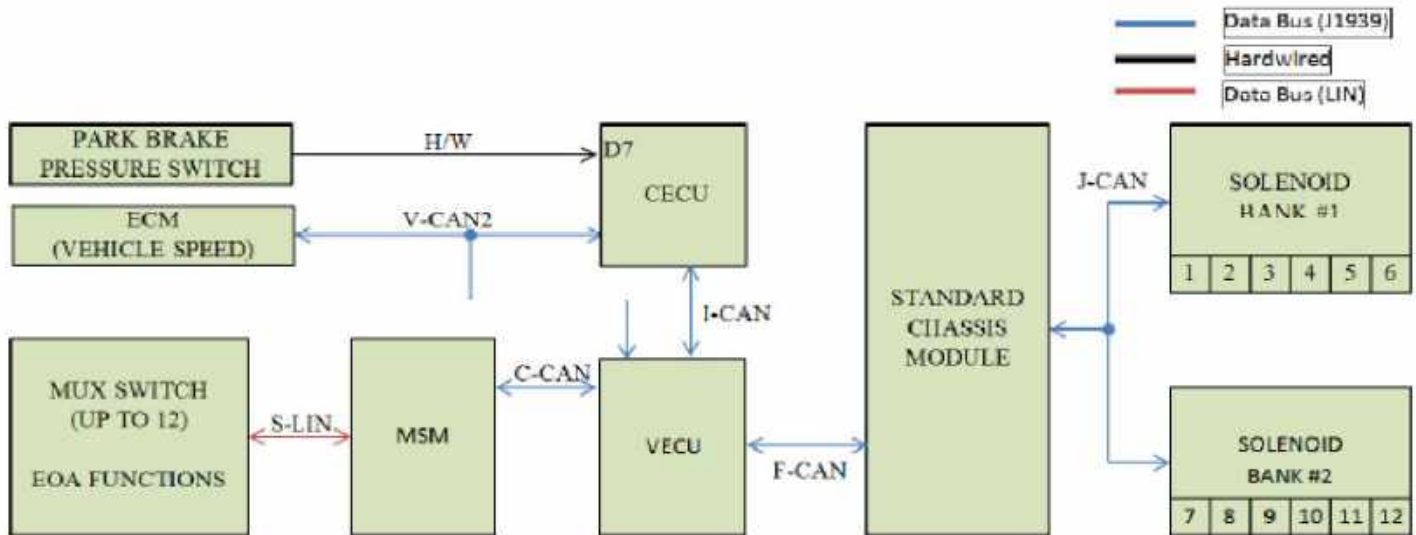


FIGURE 10-23. Solenoid Bank Diagram

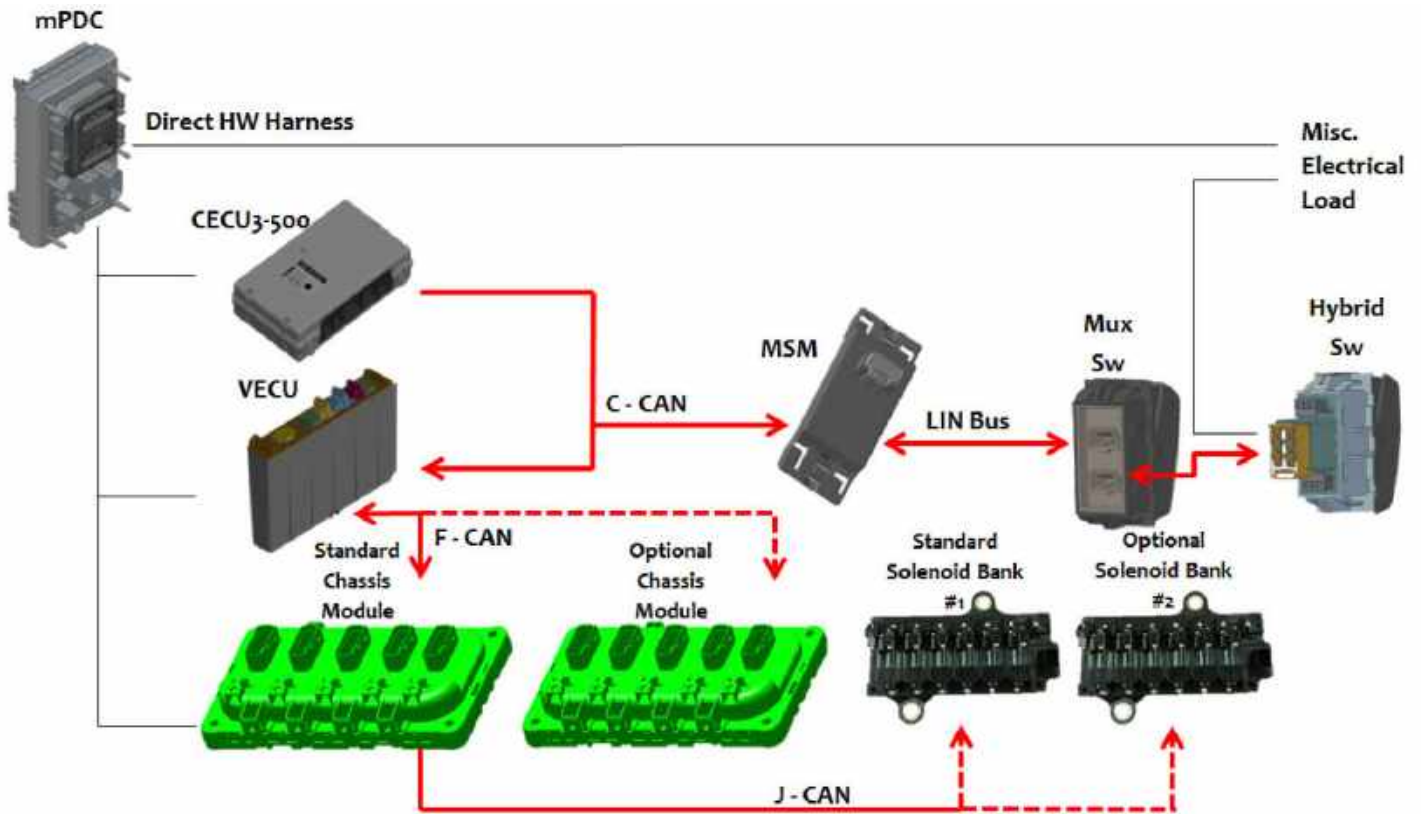


FIGURE 10-24. Overview Layout

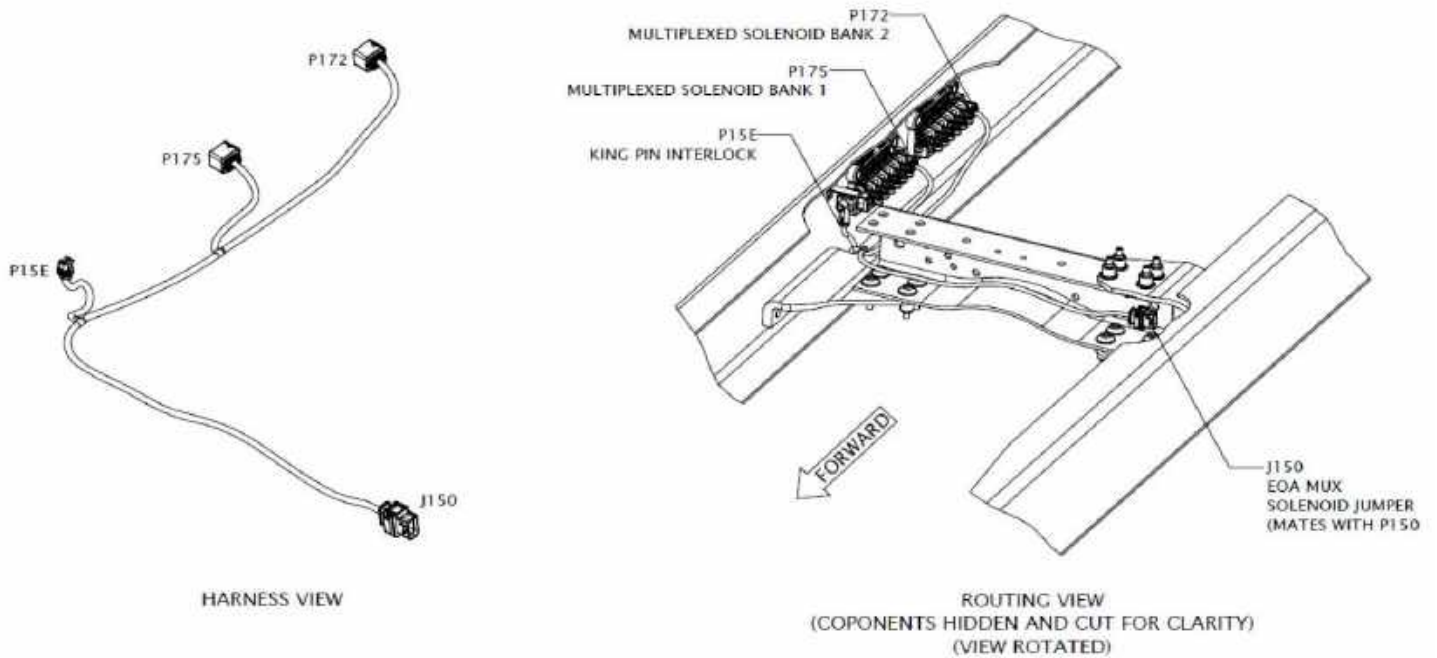


FIGURE 10-25.

SWITCHES

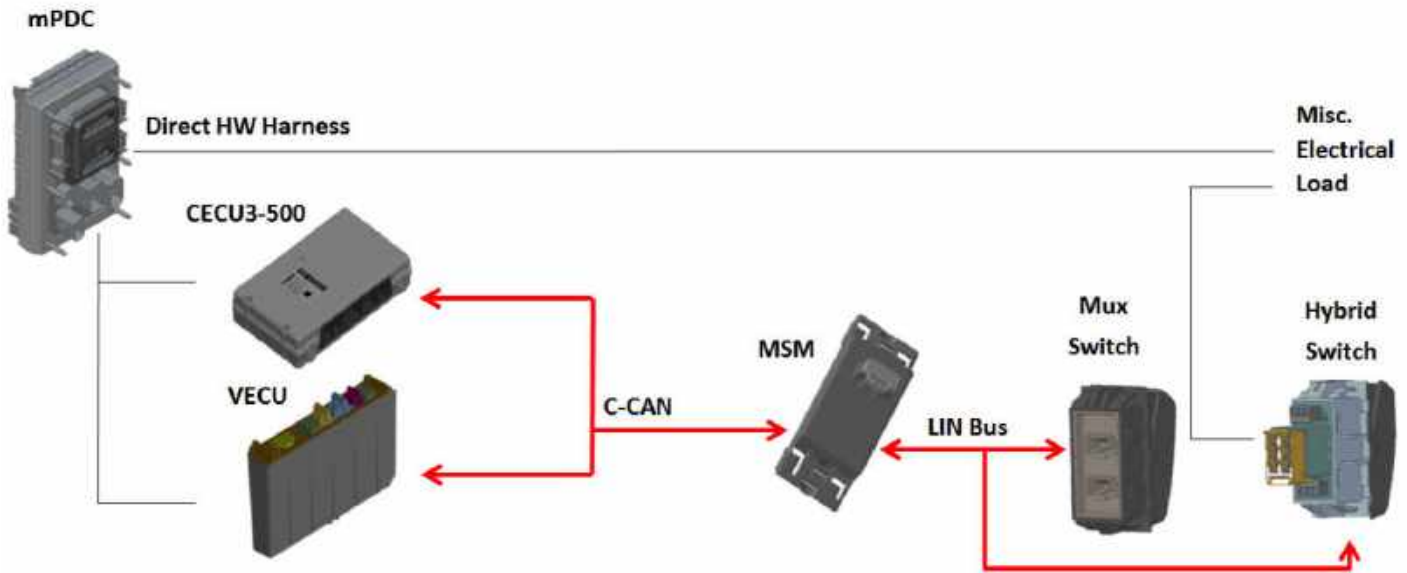


FIGURE 10-26. Overview Layout

Multiplexing = shorter wire bundles, improved diagnostics, & greater driver feedback. Safety critical switches use hybrid switch with hardwire for redundancy. Less expensive switches with fewer wires behind dash and on chassis. Self-diagnosable to improve troubleshooting with DAVIE.

Master Switch Module (MSM)

CAN Communication to/from VECU

LIN Communication to/from Switches

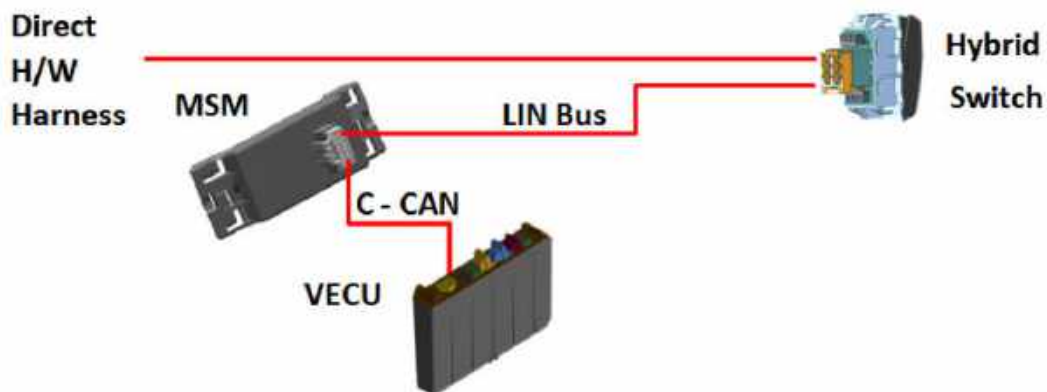


FIGURE 10-27. Spare Switches

Spare switches offer customers and body builders a convenient way to control power and air to various sources, like a body or trailer. They should be flexible and easily configurable to meet the vast and unique needs of body builders. Kenworth shall offer up to five (5) spare dash switches to control spare electrical outputs within the cabin

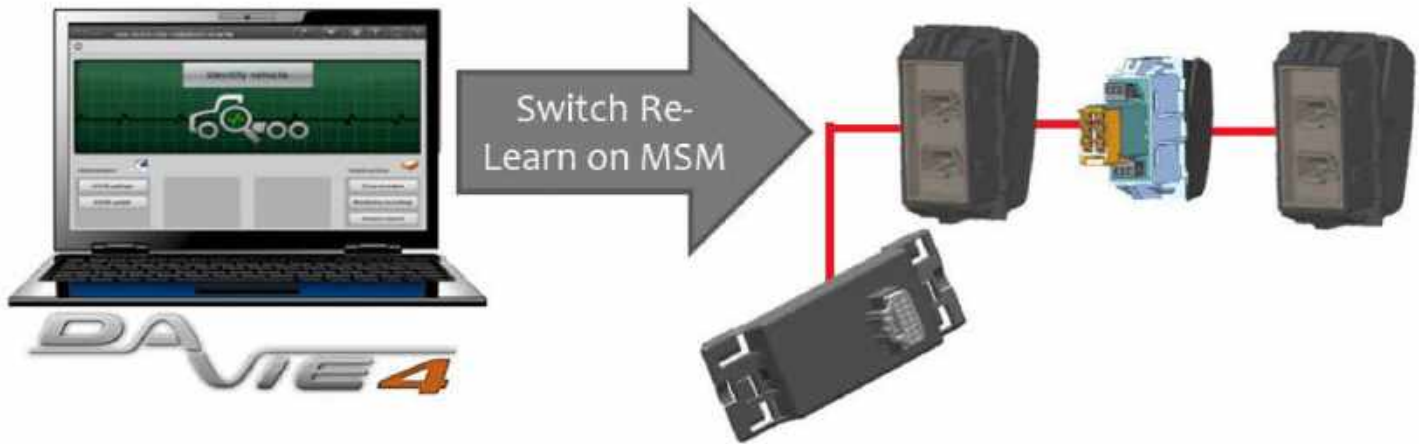


FIGURE 10-28. Switch Relearn Process

Switch replacement installation instructions:

1. Turn off the engine and all switches
2. Remove dash panel
3. Unplug LIN jumpers from the original existing switch
4. Remove original switch
5. Replace the old switch with the new switch
6. Reconnect LIN jumpers into the replacement switch
7. Reinstall the dash panel
8. Open DAVIE application
9. Select the "Repair Support" tab.
10. Select the "Learn Dash Switches"
11. When prompted by DAVIE Cycle the key on and then off
12. Run "Quick Check"
13. Clear Inactive DTCs (Diagnostics trouble code) from MSM
14. Finished

New switch installation instructions:

1. Turn off the engine and put all switches into the off position
2. Remove the dash panels
3. Remove the switch blank
4. Add the new switch into the dash panel
5. Connect the LIN jumper between the last open switch to the newly installed switch
 - a. Part Number S92-1127-0125
6. Reinstall the dash panel
7. Open DAVIE application
8. Select the "Repair Support" tab.
9. Select the "Learn Dash Switches"
10. Cycle the key on and then off
11. Run "Quick Check"
12. Clear Inactive DTCs (Diagnostics trouble code) on the MSM
13. Finished

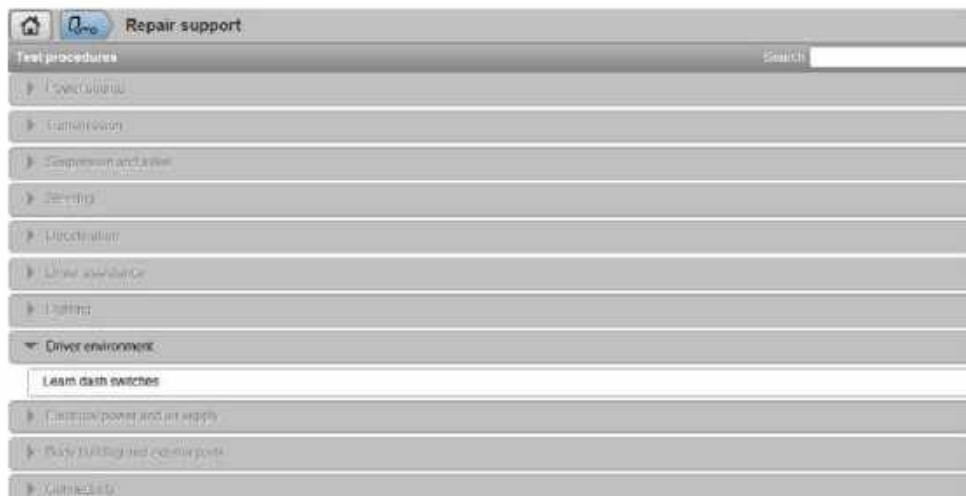


FIGURE 10-29. DAVIE Switch Relearn Screen View

SWITCH LOCATION

Switch on the same LIN bus can be reordered in any configuration without needing a relearn with DAVIE tool. Switches that are swapped across LI busses will need to be relearned with DAVIE. LIN bus 1 consisted of all the switches on the A panel. LIN bus 2 consist of all the switches on B and C panels.



FIGURE 10-30. Dash Layout

GROUNDING

Grounding any post-OEM component/device/apparatus/etc. to the metal cab structure or frame is not acceptable. Failure to properly ground add-on components can result in vehicle damage and possibly bodily injury.

Ground all post-OEM component/device/apparatus/etc. with combined current draw of less than 30A to the firewall ground buss bar with appropriately sized wire/cable for the load required.

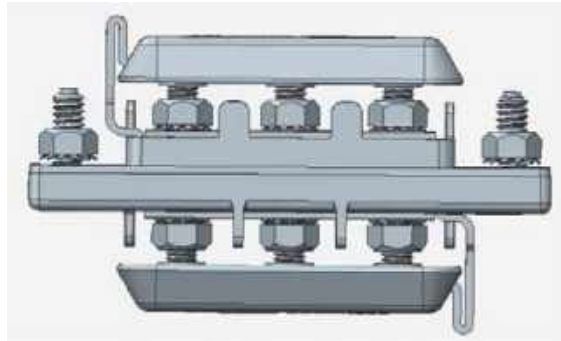


FIGURE 10-31. Grounding Buss Bar Design

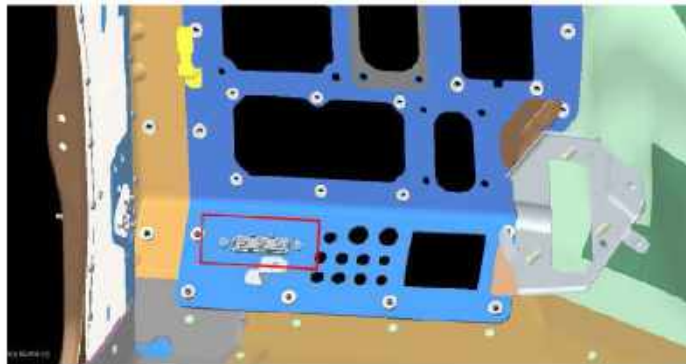


FIGURE 10-32. Grounding Point - Cab Interior Behind Driver's Side Kick Panel

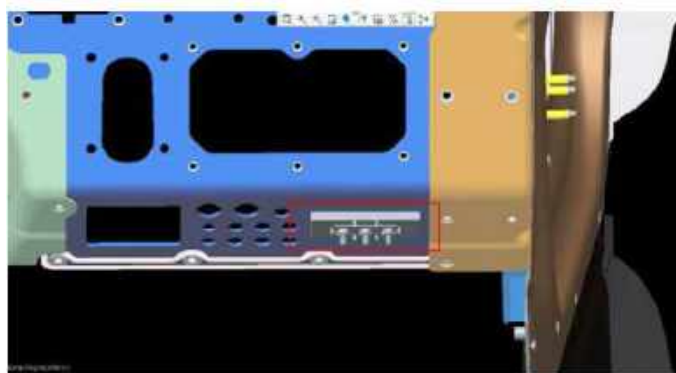
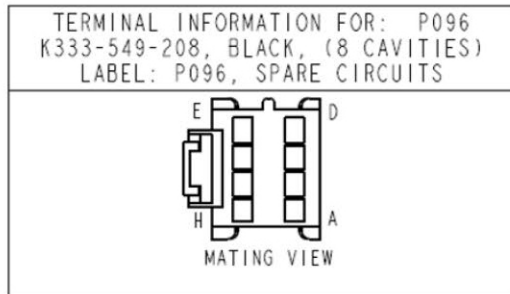


FIGURE 10-33. Grounding Point - Cab Exterior LH Side of Firewall

Post OEM components/devices/apparatus/etc. with combined current draw in excess of 30A, ground must be attained from vehicle batteries directly with appropriately sized wire/cable for the load required.

SPARE POWER

Spare power connector P096 is located on lower left side of dash behind key switch or kick panel. The mating harness is available from PACCAR parts with pre-labeled pigtails, P92-8916-000000001. Any spare power requiring more than 20 amps must go directly to the battery box, not this spare circuit.



Pin	Spare Circuit No.	Designation	Fuse Location and Max Rating
F	ORN0731-001	Spare Ignition #2	Cab Side M13 - 20A
C	ORN0752-001	Spare Accessory #1	Cab Side R10 - 20A
E	ORN0731-002	Spare Ignition #1	Cab Side K13 - 20A
B	RED0712-002	Spare Battery #1	Cab Side G10 - 20A
G	ORN0791-001	Spare LVD #1	Cab Side E7 - 20A
A	RED0711-001	Spare Battery #2	Engine Side E10 - 20A (Not available with Chassis built after 12/1/14)
H	BRN2620-001	Spare Backlight	Not Applicable
D	WHT1515-001	Spare Ground	Not Applicable

FIGURE 10-34. Spare Circuit Connector and Pinout Details

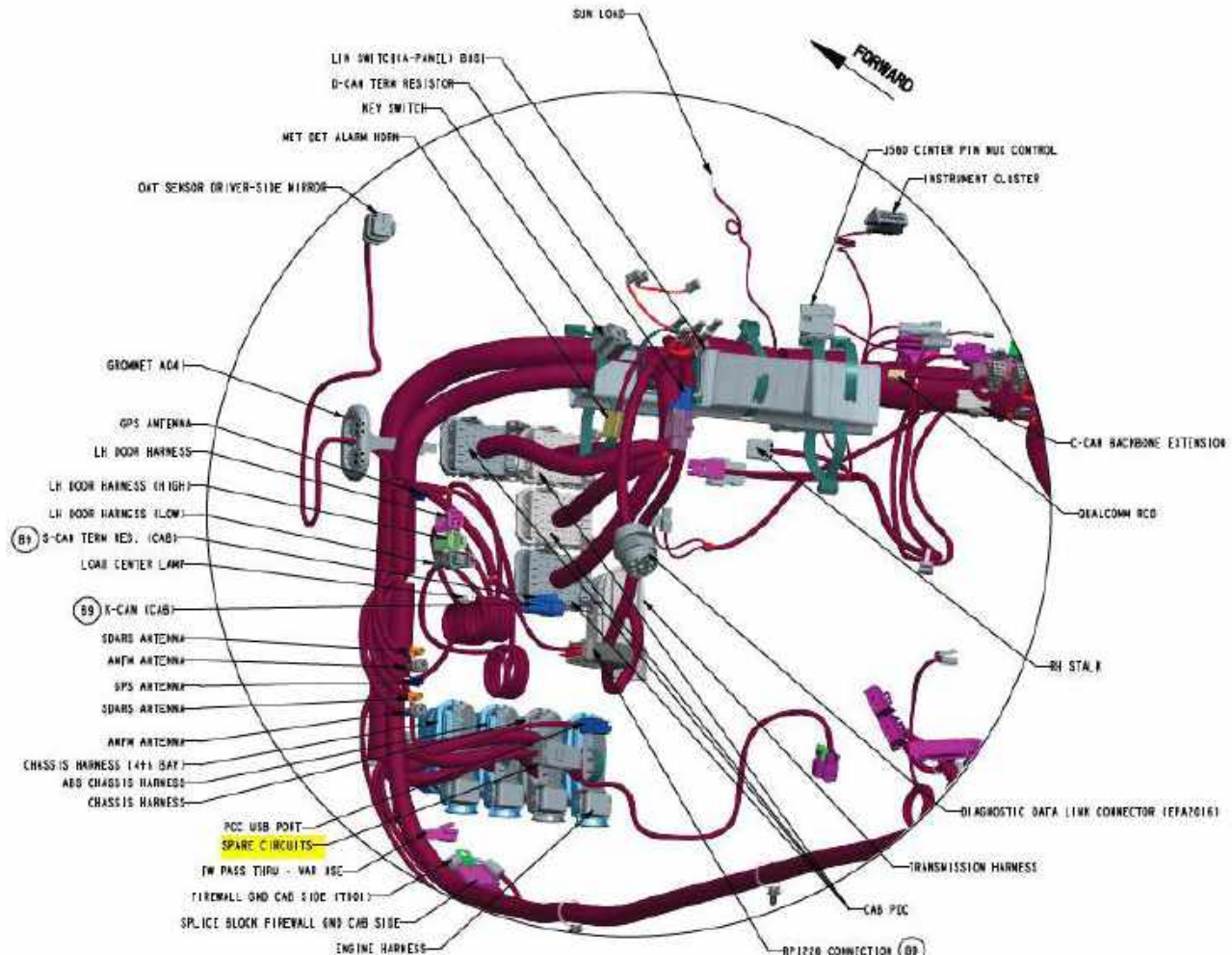


FIGURE 10-35. Spare circuit location under-dash P096

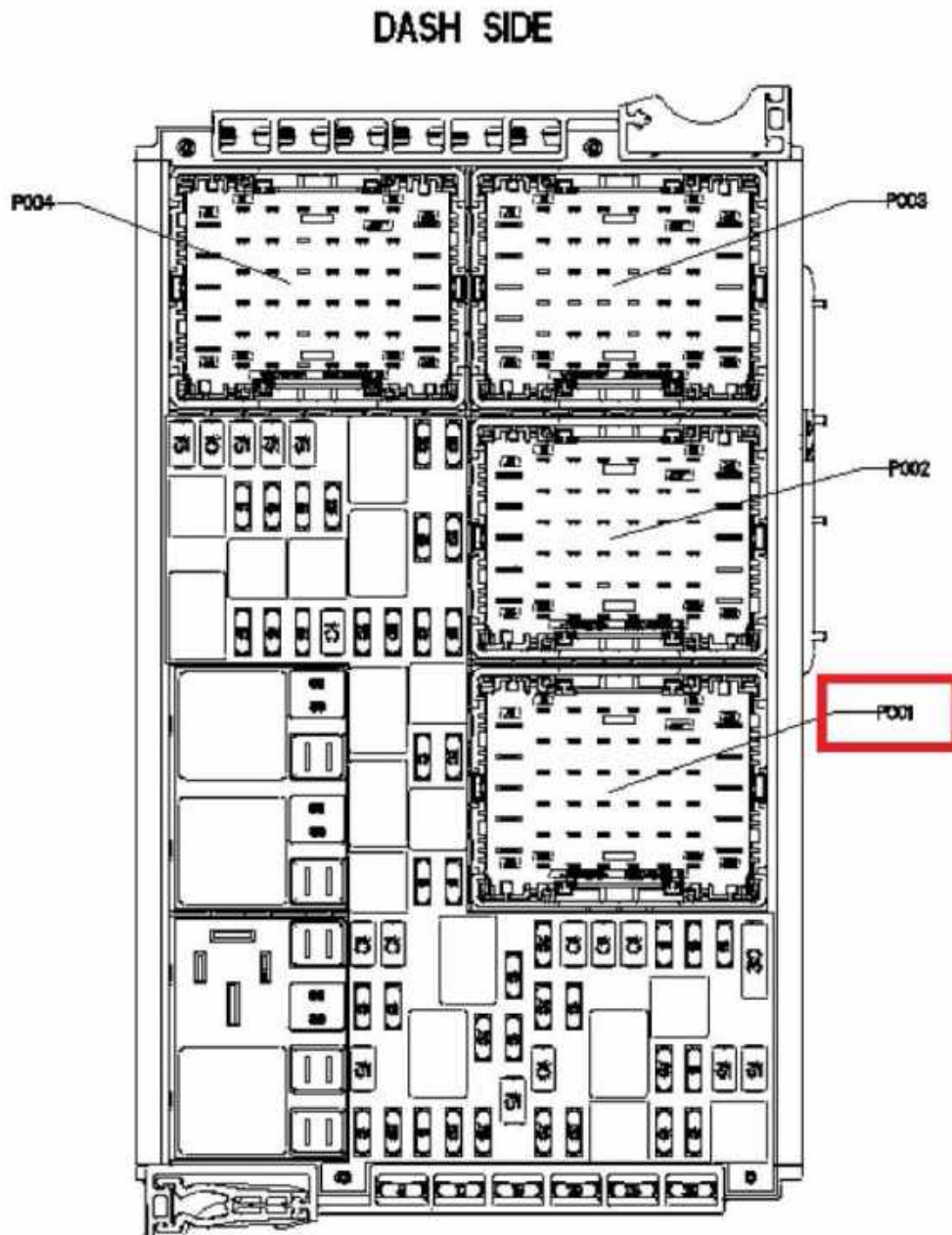


FIGURE 10-36. Spare circuit location on Power Distribution Center (Dash-Side, P001)

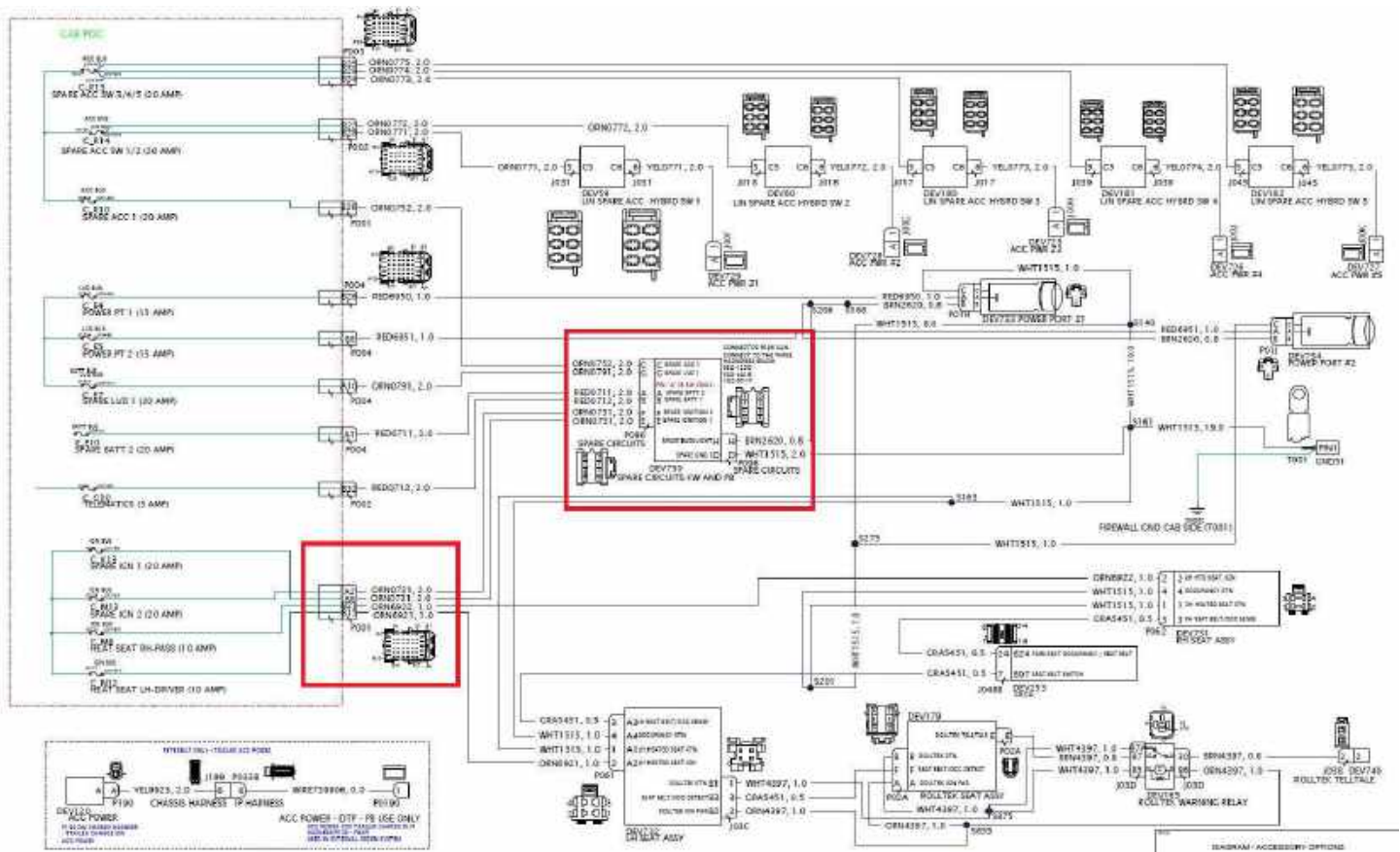


FIGURE 10-37. Spare circuit diagram (P001 and P096)

JUNCTION BOX

The junction box provides access to lighting signals.

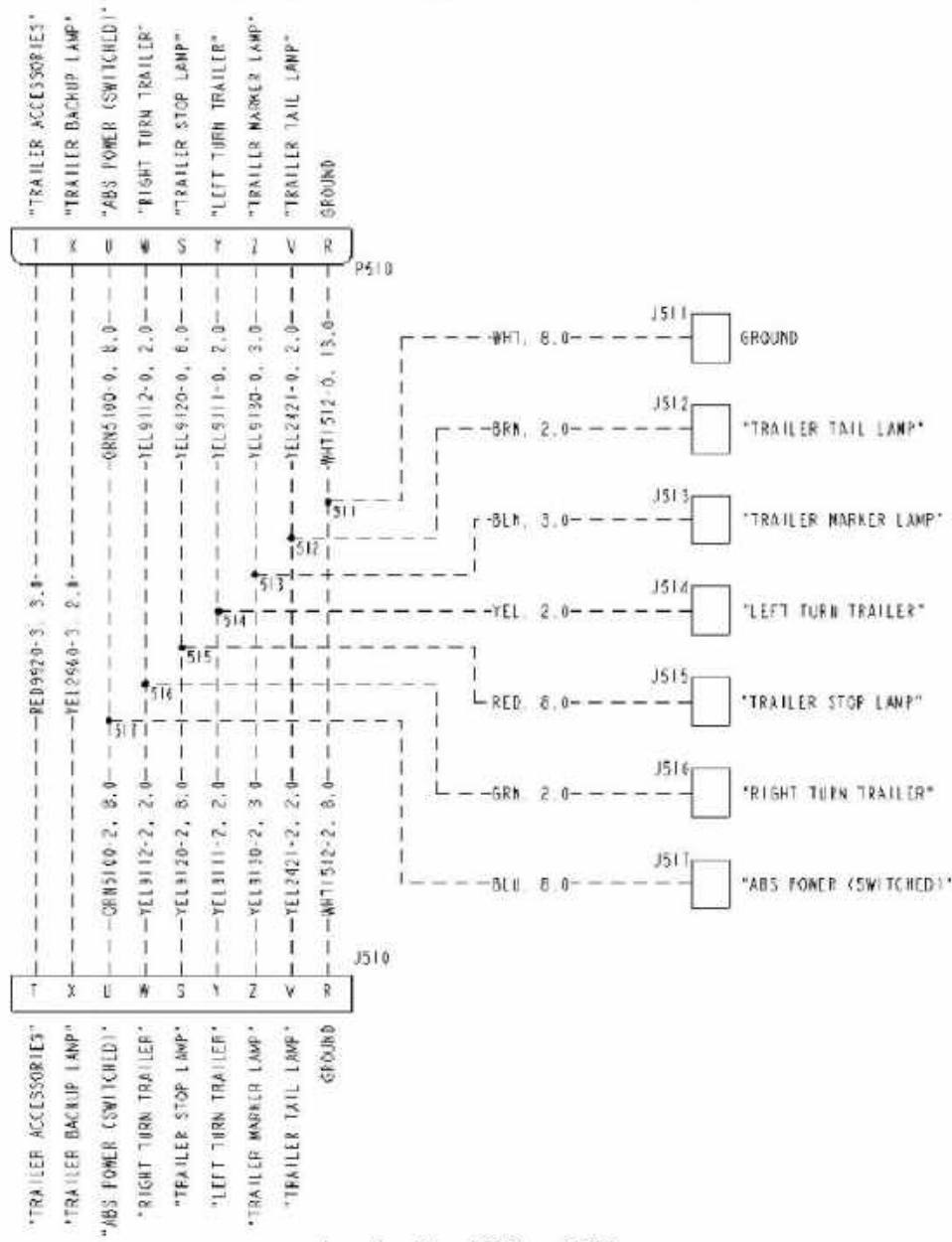


FIGURE 10-38. Junction Box BOC or EOF

TRANSMISSION BACK UP SIGNALS

The back-up signal can be accessed from pin D of the 6-way tail light connector located at the end of frame. The tail light connector is a 6-way connector located in the chassis harness at the end of frame. It will either be connected to a tail light, a jumper harness, or tied up in the rail if no tail lights are provided.

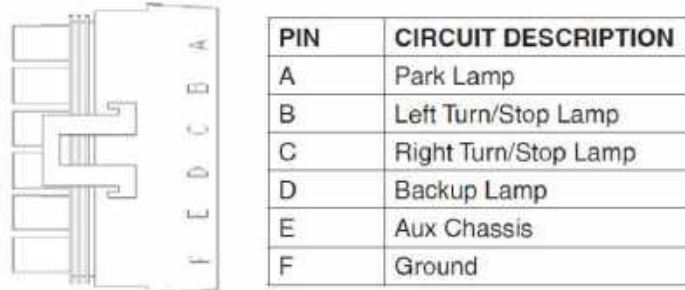


FIGURE 10-39. Mating Connector: Packard PN 12020786

SNOW PLOW LIGHTING

When the optional switch and wiring for snow plow lights are ordered, the truck will include a switch on the dash to control the snow plow lights and a body builder connection at the front of the chassis.

The body builder connection will provide electrical support for:

- LH TURN/FRONT DAYTIME RUNNING LIGHT
- RH TURN/FRONT DAYTIME RUNNING LIGHT
- LH SIDE TURN LIGHT
- RH SIDE TURN LIGHT
- CAB PARK LAMP
- LH LOW BEAM
- RH LOW BEAM
- LH HIGH BEAM
- RH HIGH BEAM
- GROUND

TELLTALE ICONS INSTALLATION

Removing the first panel will allow the panel covering the instrument cluster to be removed. Removing the cluster is necessary to install telltale symbols or access other connectors to complete the installation.

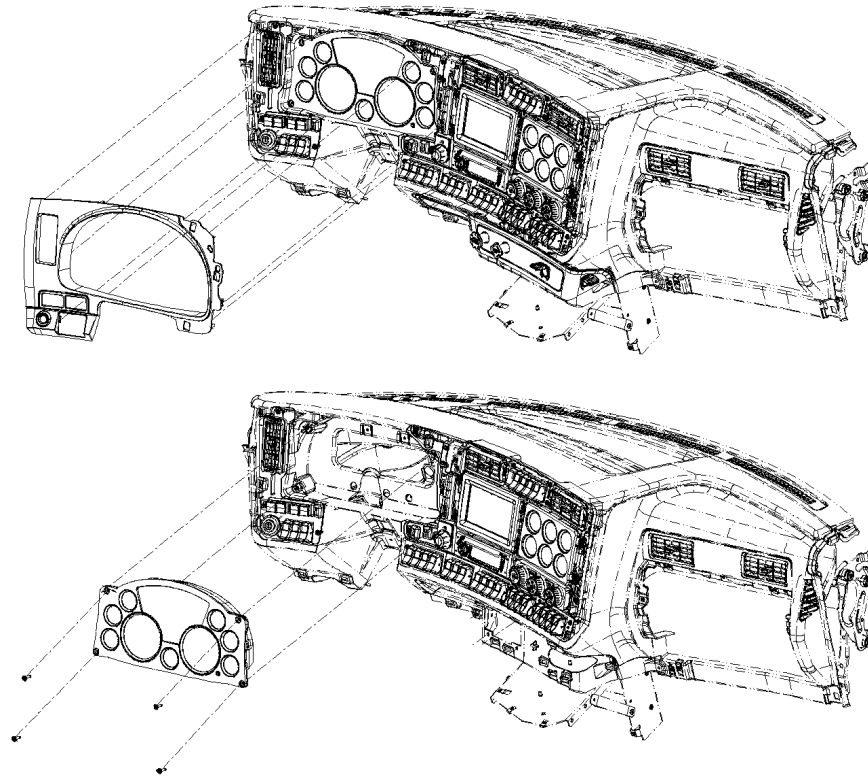


FIGURE 10-40. Cluster Removal

To install new telltales into the instrument cluster, the cluster will need to be removed from the dash. The instrument panel trim is removed after removing the panel immediately to the right of the instrument cluster. Then 4 fasteners hold the instrument cluster to the dash structure.

KENWORTH GAUGE CLUSTER
DETAIL "A"

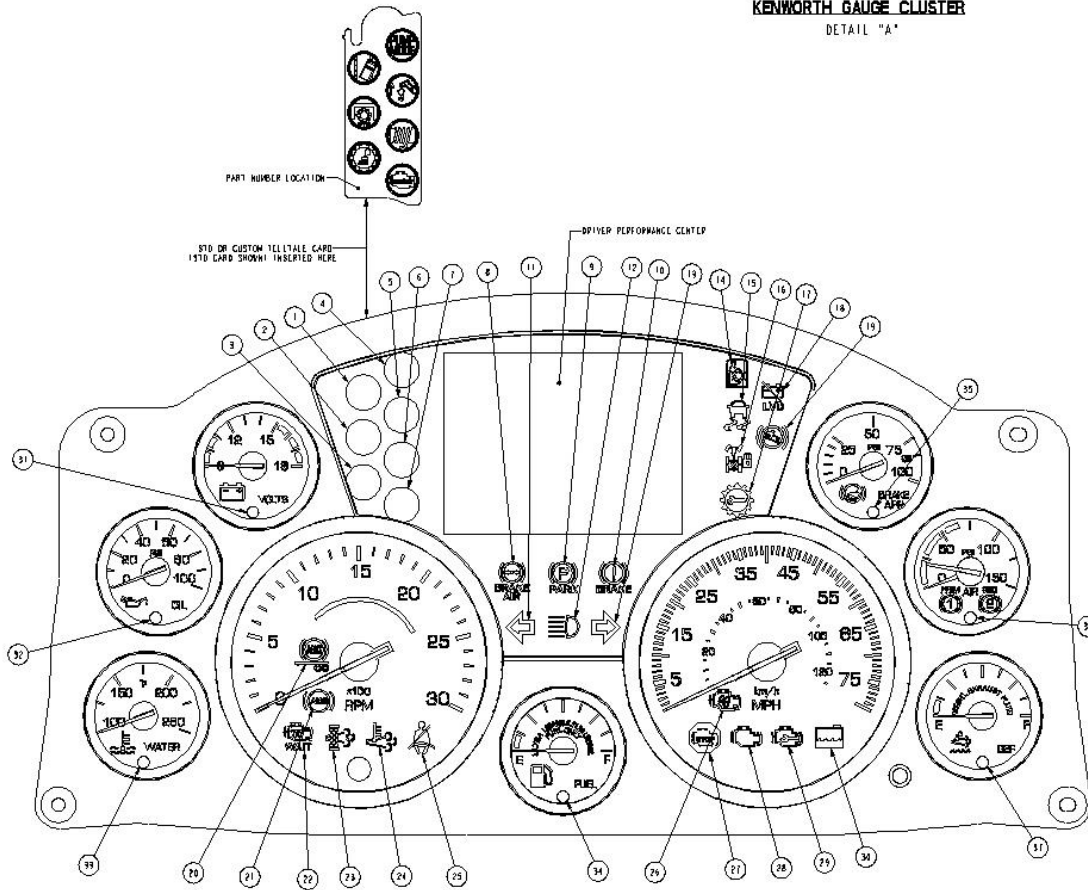


FIGURE 10-41. Telltale Installation Diagnostics & Service Tool Connection

LIFT AXLES

All truck lift axles (pushers and tag), are direct wire Electric-Only from the switch to the axle mounted solenoid. This is not from the EoA Solenoid Bank. There are a total of four lift axle controls available; 3 pushers and 1 tag axle. These are controlled with separate switches by default. The customer can order the following configurations; steerable, non-steerable, with auto-reverse, and with park brake interlock. A lift axle comes with a control switch (single or separate), a gauge, and a regulator valve.

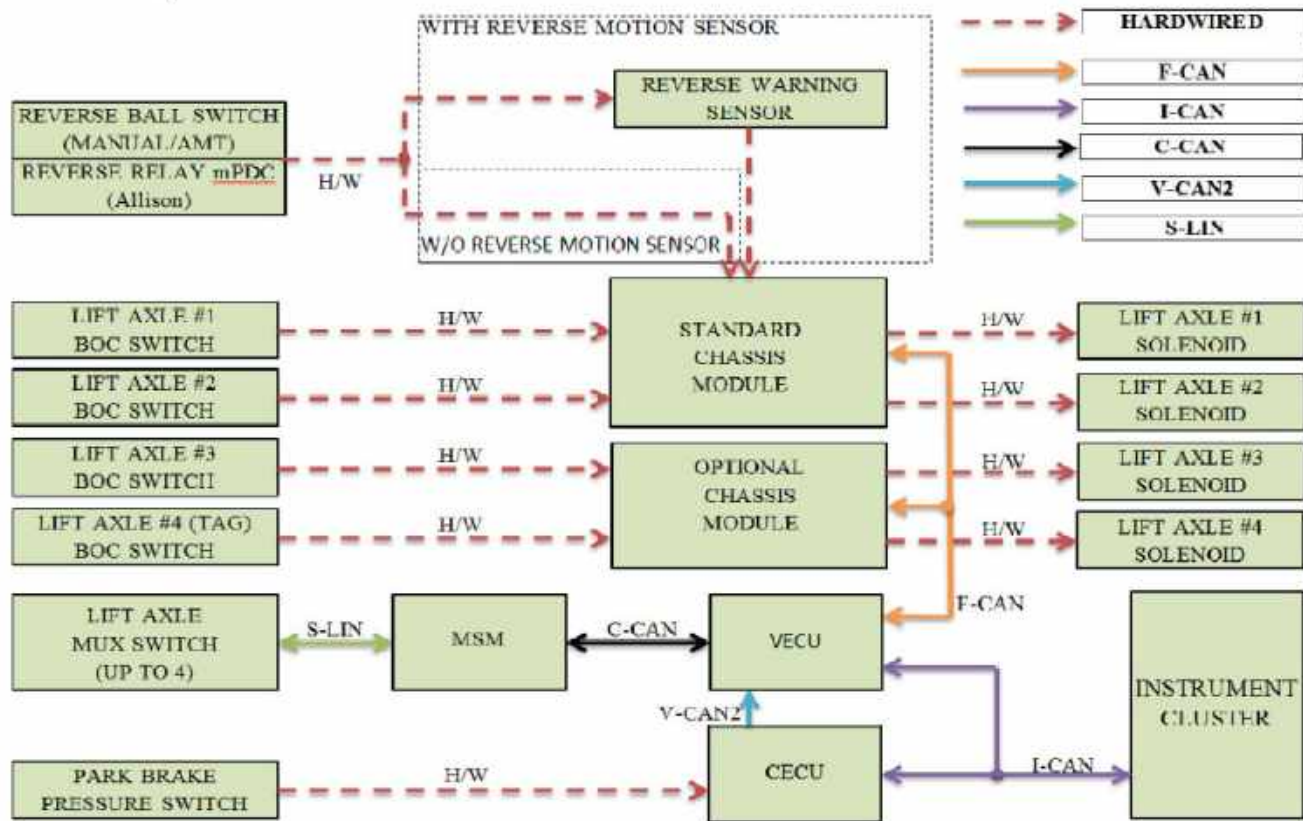


FIGURE 10-42. Lift Axle Diagram

TABLE 10-2. Truck Lift Axle Logic

Lift Axle Type	Raise Condition Logic	Lower Condition Logic
Steerable Lift Axle w/o Auto-Reverse	- Lift Switch is Inactive OR - Park Brake Active OR - Trans in Reverse	- Lift Switch is Active AND - Park Brake Inactive AND - Trans Not is Reverse
Steerable Lift Axle with Auto-Reverse OR Non-Steerable Lift Axle w/o Park Brake	- Lift Switch is Inactive OR - Park Brake Active	- Lift Switch is Active AND - Park Brake Inactive AND
Non-Steerable Lift Axle with Park Brake	- Lift Switch is Inactive AND - Park Brake Inactive	- Lift Switch is Active OR - Park Brake Active

TRAILER LIFT AXLE

Trailer lift axles can be either EoA or Electric-Only type. There are a total of two available EoA trailer lift axle controls using latching solenoids. If one axle is ordered, the customer will receive a switch labeled "Trailer Lift Axle". If two axles are ordered the customer can have a single switch that controls both axles or two switches. If two switches are present they are labeled "Forward Trailer Lift Axle" and "Rear Trailer Lift Axle".

GAUGES

Gauges and switches are fastened directly to the panel. Once the panel is free, the gauge or switch can be installed. Gauges are held by a screwed on collar while switches have a plastic tab.

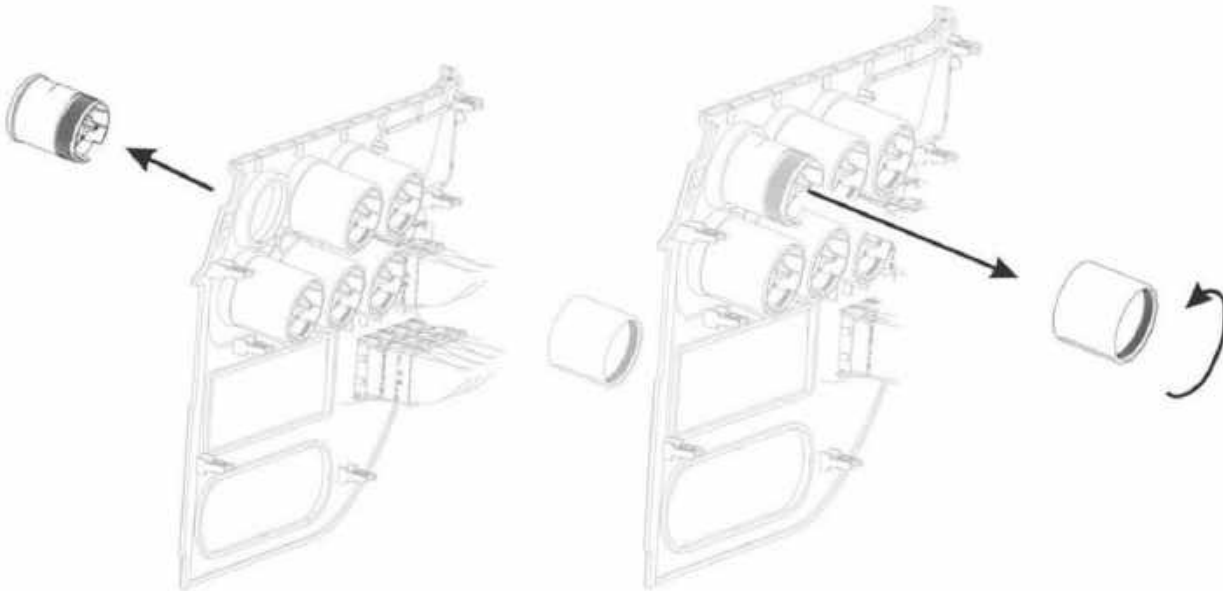


FIGURE 10-43. Optional gauges may be installed and connected to the CECU via a jumper harness. See the Dash section below for additional information.

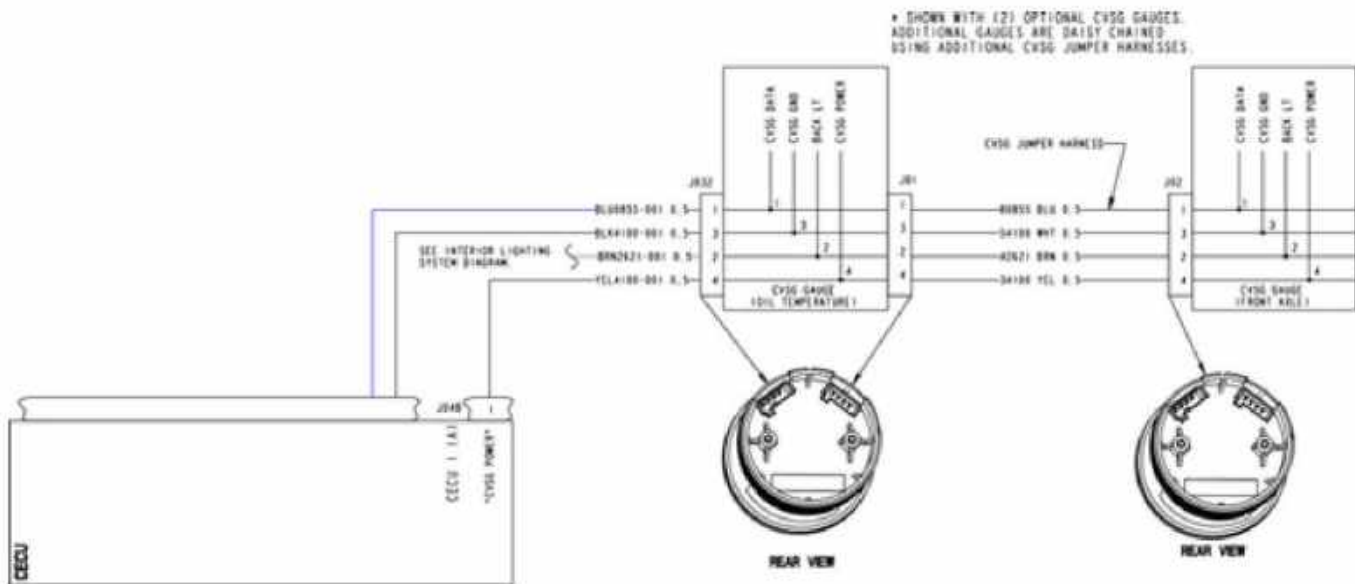


FIGURE 10-44. Installing Additional Gauges on the Dash

ROUTING

Introduction

This section specifies the general requirements for securing hoses and electrical wires to present an orderly appearance, facilitate inspection and maintenance, and prevent potential damage to these lines.

Definitions

Bundle: Two or more air, electrical, fuel, or other lines tied together to form a unitized assembly.

Clamp: A cushioned rigid or semi-rigid, anti-chafing device for containing the bundle and securing it to the frame or other structural support. Standard clamps have a black elastomer lining. High temperature clamps (e.g., those used with compressor discharge hose) have a white or red elastomer lining (most applications for these are called out in the bills of material). An assembly of two clamps fastened together to separate components is referred to as a “butterfly” clamp. Note: the metal portion of clamps shall be stainless steel or otherwise made capable, through plating or other means, of passing a 200 hour salt spray test per ASTM B117 without rusting.



FIGURE 11-1. Clamp and Butterfly Clamp

Butterfly Tie: A tough plastic (nylon or equivalent) locking dual clamp tie strap used to separate bundles or single lines, hoses, etc. These straps must be UV stable. (Tyton DCT11)

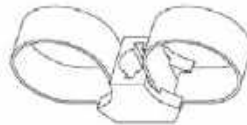


FIGURE 11-2. Butterfly Tie

Tie Strap: A tough plastic (nylon, or equivalent) locking strap used to tie the lines in a bundle together between clamps or to otherwise secure hoses and wires as noted below. These straps must be UV stable.

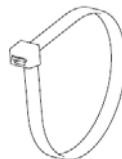


FIGURE 11-3. Tie Strap

Heavy Duty (HD) Mount: A black rigid device used for securing a tie strap to the frame or other structural support. Mounts are made of impact modified, heat stabilized UV resistant nylon capable of continuous operation between temperatures 220°F (150°) and -40°F (-40°).



Note:

Heavy duty tie straps 0.50in (12.7mm) wide (Tyton T255ROHIR or similar) shall be used whenever HD mounts are specified, although 0.25in (6.4mm) tie straps may be used in some specified applications.



FIGURE 11-4. Heavy Duty (HD) Mount.

Excess of material: More than 3 inches of slack for every 14 inch section of hose routing, except for air conditioner hoses. See section 4.1.3 for air conditioner hose requirements.

Shortness of material: Less than 1 inch of slack on a 14 inch section of hose routing.

ROUTING REQUIREMENTS

Wiring

Electrical ground wire terminals must be securely attached and the complete terminal surface must contact a clean bare metal surface. See R414-558 for grounding wire connection practice. Apply electrical contact corrosion inhibitor Nyogel 759G grease (made by William F. Nye, Inc., New Bedford, MA) per R414-558.

Don't bend wires or use tie straps within 3 inches (75 mm) of (connected) wire connectors or plugs.

Wires in Bundles

Electrical wires (other than the exceptions covered below) running parallel with air or coolant hose bundles, may be included in the bundle if they are isolated from the hoses with a covering of convoluted plastic tubing.

EXCEPTIONS:

Battery cables (including jump start cables) may be bundled with or tied to the charging wire harness. They shall **not** be bundled with or tied directly to any other components, including hoses, wires, or bundles. They shall be separated from other routed components using butterfly ties at intervals not exceeding 14 inches (356 mm). Battery strap (W84-1000) tie down shall be used without exception to secure battery cables to frame mounted or other major component (e.g. engine, tmsn, etc.) mounted standoffs at intervals not exceeding 14 inches (356 mm). The (positive) battery cable shall be covered with convoluted plastic tubing from terminal to terminal.

110/220 volt wires for engine heaters, oil pan heaters, transmission oil heaters and battery pad warmers, shall **not** be included in any hose/wire bundle with a fuel hose. Individual heater wires not in a bundle shall be separated from other components by using butterfly clamps or butterfly ties at intervals not exceeding 14 inches (356 mm). Heater wires with a secondary covering shall be covered with convoluted tubing whether they are in bundles or not.

Wires Crossing other Components

Electrical wires crossing over other components, such as lines, bolt heads, fittings, engine components lifting eyes, engine block, cylinder head, etc., close enough to rub shall be isolated with a covering of convoluted tubing **and** separated from the component by using butterfly clamps, butterfly ties, or plastic sheathing. 110/220 volt engine heater wiring shall be installed with butterfly ties or butterfly clamps

Piping

Use no street elbows in air brake, water, fuel, or hydraulic systems unless specified on the piping diagram and the build instructions.

Use no elbows in the air brake system unless specified on the air piping diagram and the build instructions.

Hoses Crossing Components

Hoses crossing over other components close enough to rub shall be protected with a secured covering of convoluted plastic tubing (KW part number K344-813), another section of hose, or plastic sheathing (KW part number K213-1312). The usage of butterfly ties, or butterfly clamps are also recommended.

Air Compressor Discharge Hoses

Wires or hoses shall not be tied to the high temperature air compressor discharge hose. Hoses and wires may be routed across the air compressor discharge hose at a distance of 18 inches (457 mm) or greater from the compressor discharge port. In this case the crossing hoses and wires shall be “butterfly” clamped to the air compressor discharge hose and covered with convoluted tubing at the clamp point (use high temperature clamps on the compressor hose).

Bundles

HD mount and tie strap, or clamp shall be located at intervals not to exceed 14 inches (356 mm) along the bundle.

Regular tie straps shall be located at intervals not to exceed 7 inches (178 mm) between HD mount or clamps. Extra tie straps may be used as needed to contain the hoses and wires in the bundle.

Routing of Wires and Hoses near Moving Components

Wires and Hoses shall be routed away from moving components, such as fans, shackle links, drivelines, steering linkages, etc. so that there is at least 0.5 inches (12.7 mm) clearance when the component is operating at its **maximum** travel limits.

A minimum clearance of 1.0 inches (25.4) shall be maintained between steering axle tires (and associated rotating parts) in all positions and routed components, such as hoses, oil lines, wires, pipes, etc.

Routing of Wires and Hoses near Exhaust System

TABLE 11-1. Exhaust – System Clearance

Description	Shielded	Unshielded
Coolant hoses, HVAC hoses and tubing, and electrical wires within 15" of the turbo and/or over 15" from the turbo	2" minimum	3" minimum
Fuel hoses within 15" of the turbo over 15" from the turbo	n/a 2" minimum	4" minimum 3" minimum
Fuel tanks and hydraulic tanks crossing tank parallel to tank end of tank aluminum/ceramic-coated exhaust pipe crossing tank	n/a n/a n/a n/a	2" minimum 2" minimum 1" minimum 1.5" minimum
Air hose nylon wire braid	3" minimum 2" minimum	8" minimum 3" minimum

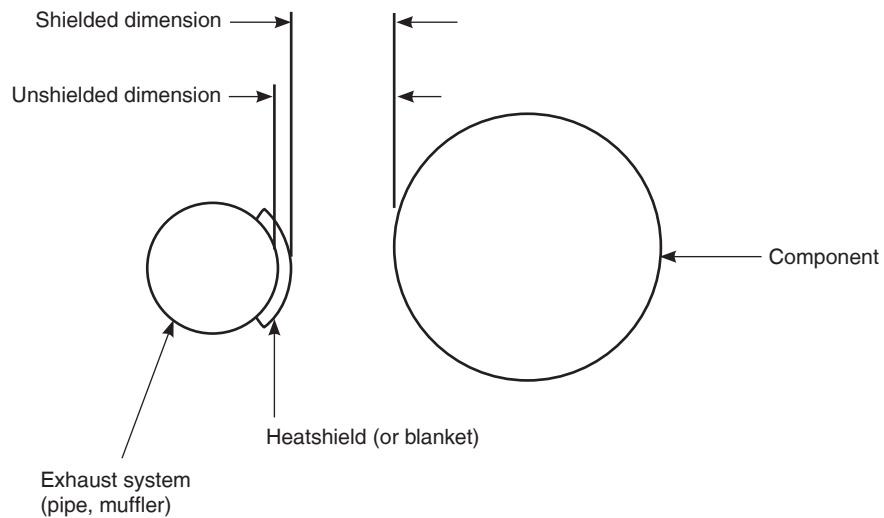
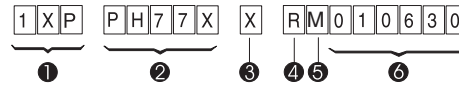


FIGURE 11-5. Definition of measurements.

VEHICLE IDENTIFICATION NUMBER

A 17-character number (numeral and letter combination) forms the Vehicle Identification Number (VIN) which includes the Chassis Number. It contains among other information, the model year (4), assembly plant (5), and vehicle serial number (6). See Figure A-1.

SAMPLE VIN



- ① Manufacturer Identifier
- ② Vehicle Attributes
- ③ Check Digit
- ④ Model Year
- ⑤ Assembly Plant
- ⑥ Serial Number — Chassis Number

FIGURE A-1. Vehicle Identification Number (VIN).

The model year (4) is designated by an alphanumeric code in the tenth character position in the VIN. See Table A-1 and Figure A-1.

Code	Year	Code	Year
5	2005	A	2010
6	2006	B	2011
7	2007	C	2012
8	2008	D	2013
9	2009	E	2014
		F	2015
		G	2016
		H	2017
		J	2018

TABLE A-1. Model Year (Code) Designations.

VIN Location

The VIN is marked on the Incomplete Vehicle Certification Label (on trucks). It is located either on the driver's door edge or door frame. See Figure A-2.

Chassis Number Locations

The Chassis Number comprises the last six characters of the VIN, and is shown in multiple locations on the vehicle.

- Left side of cab, back wall of cab: stmped plate. (DayCab)
- Left side of cab, back wall of sleeper: stamped plate. (Sleeper)
- Tire, Rim, and Weight Rating Data label.
- Major Components and Weights label.
- Noise Emission label.
- Paint Identification label.

VEHICLE IDENTIFICATION LABELS

Vehicle Identification Labels are located on the driver's side door edge or on either the driver's or passenger's side door frames. See Figure A-2. Labels include Vehicle Certification, Components and Weights, Tire/Rim and Weight Rating Data, Noise Emissions, and Paint Identification. Quantity and location of labels may differ based on Complete/Incomplete vehicle, and Single/Dual certification.

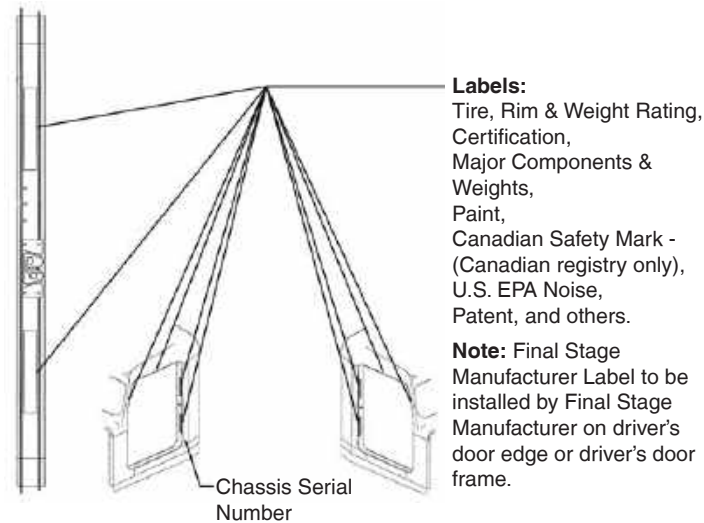


FIGURE A-2. Drivers Door and Door Frame Labels

Tire/Rim and Weight Rating Data Label

The Tire/Rim and Weight Rating Data Label is used in conjunction with the Incomplete Vehicle Certification Label on Incomplete Vehicles. It contains chassis serial number and the following information:

- GVWR — Gross Vehicle Weight Rating
- GAWR FRONT and REAR — Gross Axle Weight Ratings for Front and Rear Axle
- TIRE/RIM SIZES AND INFLATION PRESSURES — Tire/Rim Sizes and Cold Pressure Minimums



Note: GVWR is the **TOTAL WEIGHT** the vehicle is designed to carry. This includes the weight of the empty vehicle, loading platform, occupants, fuel, and any load.

Incomplete Vehicle Certification Label

The Incomplete Vehicle Certification Label contains the chassis VIN, date of manufacture, and listing of applicable motor vehicle safety standards.

Components and Weights Label

The Major Components and Weights Label includes chassis weight and gross weight information, as well as model and serial numbers for the vehicle, engine, transmission, and axles.

Noise Emission Label

The Noise Emission Label contains the chassis serial number, date of manufacture, and information regarding US noise emission regulations. This label is not provided on Canadian registered vehicles.

Paint Identification Label

The Paint Identification Label contains the paint colors used by the factory to paint the truck. It lists frame, wheels, cab interior and exterior colors. This label is located either underneath the dash to the left of the steering column support, inside the glovebox, or on the passenger's door frame.

COMPONENT IDENTIFICATION

Each of the following components has their own identification label.

Engine Identification

The engine serial number is stamped on a plate located on the left front of the engine. For further information, please refer to the Engine Operation and Maintenance Manual (included in the glove compartment of each vehicle).

Transmission Identification

The transmission identification number is stamped on a tag affixed to the right forward side of the transmission case. It includes among other specifications the transmission model, serial, and part number.

Front Axle Identification

The front axle has a identification tag located on the front axle beam. It includes the axle model, part number and serial number.

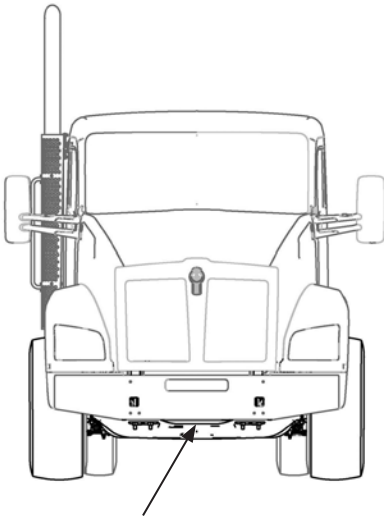


FIGURE A-3. Front Axle Identification

Rear Axle Identification

The rear axle identification numbering system includes two labels or stamps.

1. Axle Housing Number Tag, located on the left forward side of the housing arm. This tag identifies the axle housing.
2. Axle Differential Carrier Identification, located on the top side of the differential carrier. The following information is either stamped, or marked with a metal tag: Model No., Carrier Production Assembly No., Carrier Assembly Serial No., Gear Ratio, Axle Specifications Number and OEM part number and country of origin.

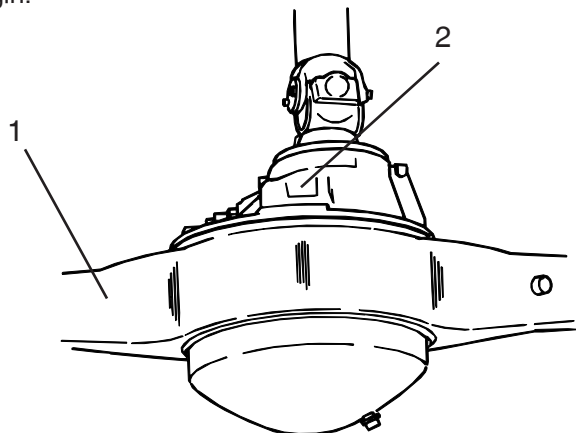


FIGURE A-4. Rear Axle Identification

Note:



Illustrated identification tag locations are typical. Actual locations may vary by axle manufacturer and with single versus tandem axles.

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