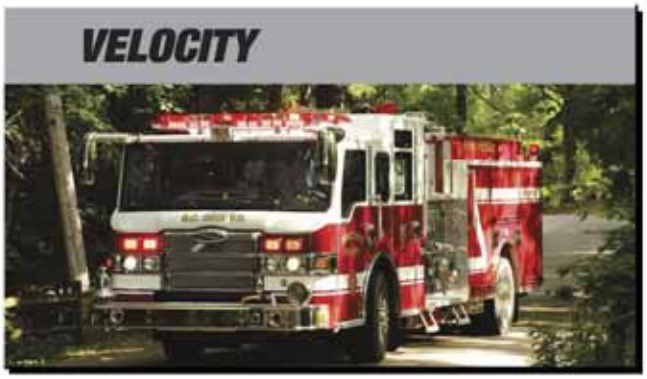
Operator's Manual

Custom Chassis



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SECTION 1 TO THE OWNER

1-1. Who Should Use, Service, and Maintain This Vehicle

This manual explains the operation and maintenance of a Pierce® fire apparatus. The manual reviews basic principles of operation, highlights common safety concerns and procedures, and gives recommendations for using and maintaining the apparatus.

This manual assumes that you:

- Have already been fully trained and certified to operate fire apparatus. Only trained personnel should operate this vehicle or perform maintenance.
- Have had formal education from a technical college or other fire fighter training institution.
- Understand, are proficient in, and meet all of the requirements set forth in NFPA 1002 Standard on Fire Apparatus Driver/Operator Professional Qualifications (latest edition).
- Already understand fire apparatus operation and/or maintenance.

All Pierce vehicles are delivered with a set of manuals for major components that your fire department selected. If you need replacement manuals, or safety warning labels, contact your authorized Pierce selling or servicing dealer.

BEFORE operating the fire apparatus, you, the operator or maintainer, must read, understand, and follow the instructions found in:

- Pierce operator and maintenance manuals.
- Operator and maintenance manuals from the manufacturers of major components used on the apparatus, such as engine, transmission, etc.
- IFSTA Pumping Apparatus Driver/Operator Handbook (latest edition).

Proper tools and service equipment must be used, taking appropriate precautions as required by accepted safety practices, to prevent personal injury and/or equipment damage.

1-2. What To Do If You Lack Knowledge

Fire apparatus control systems require you to understand the function of each switch, gauge, valve, control, etc.

Before your fire department allows you to operate this fire apparatus, you already must be educated and trained in fire apparatus operations.

You also must know the principles of operation, so you can change operation when circumstances change.

Each switch, gauge, valve, and control has an important function. If you are uncertain about the function or don't know something, inform your fire department's training officer.

You are the only person who knows what you don't know. You must speak up about the things you don't know, so you can learn about them before someone is injured or killed because of your lack of knowledge.

You are responsible for learning how to operate the fire apparatus under all conditions without having to read this manual at a fire or other emergency.

1-3. Warnings and Cautions

1-3.1 Warning and Caution Statements

Throughout this manual you will find warnings and cautions:

⚠WARNING

Warnings will point out a procedure that must be taken, or action that must be avoided, to guard against the possibility of serious personal injury or death.

CAUTION

Cautions will advise you that there is a risk of damage to property if certain precautions are not followed.

Study this manual and the component operator manuals found in the service manual carefully and ensure that all operators and other users are fully familiar with their contents. The warnings, cautions, and procedures listed in these manuals must be incorporated into the safety program of the fire department to which the vehicle is assigned.

1-3.2 General Warnings and Cautions

⚠WARNING

Fire helmets shall not be worn by persons riding in enclosed driving and crew areas. Fire helmets are not designed for crash protection and they will interfere with the protection provided by head rests. The use of seat belts is essential to protecting fire fighters during driving. Failure to comply may result in serious injury or death to personnel.

Use extreme caution when walking on the top of the vehicle - hosebed, hosebed cover, top of cab, etc. Use extra caution in wet, icy, snowy, or muddy conditions. Failure to comply may result in slipping or falling - causing injury or death.

Care must always be taken when climbing on and off the vehicle. Always face the vehicle, use steps and grab handles, and maintain three points of contact with the vehicle (two feet/one hand or two hands/one foot). Keep steps, grab handles, and walkways clean. Be extra careful in wet, icy, snowy, or muddy conditions. Failure to comply may result in slipping or falling - causing injury or death.

Fire apparatus are often equipped with Power Take-Off (PTO) operated accessories. Never operate the engine with personnel in the vicinity of any driveshaft as they may engage without warning. Hands, clothes, hair, etc., can get caught on spinning shafts and U-joints. Failure to heed this warning may lead to personal injury or death.

Internal combustion engines give off hazardous fumes and gases while running. Do not operate the engine in an area where exhaust gases can accumulate, or serious injury or death may occur.

1-3.3 Safety Warning Labels

Walk around the fire apparatus. Locate each safety warning label. Read the label. Identify and pay attention to the hazard it describes. Practice all the time to avoid the hazard, so you develop a habit to avoid the hazard.

1-4. Responsibility

Study carefully this manual and the manuals for major components such as engine, transmission, and other allied equipment. Make sure that all operators and other users also completely understand their contents.

The warnings, cautions, and procedures listed in these manuals must be part of the fire department's safety program.

As the operator of this vehicle and pumping equipment, you are responsible for:

- Understanding the function of each component of the fire apparatus.
- Understanding how to adjust each control to obtain the results you want.
- Maintaining control of the fire apparatus at all times.
- Remaining proficient in use, so at a fire you can operate and make successful changes in the operation quickly, without having to read the operator's instructions or safety warning labels.
- Practicing proper manual override and emergency shutdown procedures, so you can respond immediately in an emergency or during the failure of a component. Remember stress is high. Your failure to practice increases the odds you will forget or do it wrong in the heat of the moment.

1-5. Custom Products

Your department developed specifications for this fire apparatus. It purchased a Pierce apparatus that is built to meet those specifications. The information in this manual will be generic at times.

Due to the highly customized nature of each Pierce fire apparatus, the exact location of each component in the pumper system will vary.

This manual describes basic controls. Not every apparatus will have all controls. Some will have extra controls, as determined by each fire department's specification.

Pictures describe typical components or devices. Actual parts might vary from those pictured.

You must learn the location and function of all controls, switches, gauges, valves, inlets, and discharges.

Major inconsistencies between your vehicle and the information contained in this manual should be directed to your Pierce Dealer or Sales Representative.

1-6. Vehicle Handling Characteristics

Safe operation of any vehicle is the responsibility of the driver. Heavy trucks have a significantly higher rollover tendency than other types of vehicles, due to a higher center of gravity. To reduce the risk of rollover, avoid making sharp turns at excessive speeds and other abrupt maneuvers. In the event of a rollover crash, an unbelted person is significantly more likely to become injured or die than a person wearing a seat belt. Unbuckled occupants can also become a hazard to other occupants as they may be thrown around inside the cab in the event of a crash. **ALWAYS BUCKLE UP.**

1-7. Tanker (Mobile Water Supply) Truck Characteristics

1-7.1 Description of Hazard

Mobile water supply vehicles, known as tankers or tenders, are widely used to transport water to areas beyond a water supply system or where the water supply is inadequate. Incidents involving motor vehicles account for approximately 20% of U.S. fire fighter deaths each year; cases involving tankers are the most prevalent of these motor vehicle incidents. During 1977-1999, 73 deaths occurred in 63 crashes involving tankers. Of those deaths, 54 occurred in 49 crashes in which tankers rolled over (no collision), and 8 occurred in 6 crashes in which the tankers left the road (no collision). The other cases involved collision with another vehicle (10 deaths in 7 crashes) and collision with stationary object(s) (1 death) [NFPA 2000].

Tanker drivers may not be fully aware that tanker trucks are more difficult to control than passenger vehicles. A tanker truck requires a much greater distance to stop. Tankers weigh substantially more, and their air brake systems take more time to activate than the hydraulic/mechanical brake systems on smaller passenger cars. The effect is influenced by the amount of water the tanker is hauling and whether the tanker is baffled.

1-7.2 Recommendations for Prevention

To reduce the risk of tanker truck rollovers, the National Institute for Occupational Safety and Health (NIOSH) recommends that fire departments take the following precautions:

- Develop, implement, and enforce standard operating procedures (SOPs) for emergency vehicles - particularly with regard to the use of seat belts.

- Ensure that drivers have necessary driving skills and experience and provide them with periodic refresher training.
- Consider terrain, weather, and bridge and road conditions when purchasing a mobile water supply vehicle.
- Adhere to the requirements of NFPA 1915 for keeping a vehicle on a maintenance schedule and documenting the performance of the maintenance [NFPA 2001].
- Inspect the complete vehicle at least once per year to comply with Federal and State motor vehicle regulations.
- Adhere to the requirements of NFPA 1901 for an approved mobile supply vehicle [NFPA 2001].
- Equip all vehicles with seat belts.
- Ensure that water tank capacity is adequate and has proper tank mounting and sufficient front and rear weight distribution.
- Ensure that the weight of the fully loaded vehicle does not exceed the gross axle weight rating of any axle and the gross vehicle weight rating of the chassis.
- Ensure that the center of gravity of the vehicle does not exceed the chassis manufacturer's specified center of gravity.
- Provide proper baffles to control water movement for all vehicles equipped with water tanks.
- Verify that vehicles are of proper design and have adequate suspension, steering and braking ability.

1-7.2a All Drivers Should Do the Following

- Recognize that they are responsible for the safe and prudent operation of the vehicle under all conditions.
- Wear a seat belt when operating a vehicle.
- Take training to meet the job performance requirements stated in NFPA 1102 before driving and operating the vehicle [NFPA 2001].
- Take refresher driver training at least twice per year.
- Understand the vehicle characteristics, capabilities, and limitations.
- Be aware of the potential for unpredictable driving by the public (excessive speed, failure to yield to emergency vehicles, inattentiveness, etc.).
- Adjust speed when driving on wet or icy roads, in darkness or fog, or under any other conditions that make emergency vehicle operation especially hazardous.

1-8. Vehicle Identification

Figure 1-1: FMVSS Information Decal

1099

The Vehicle Identification Number (VIN) can be found in the upper right hand corner of the yellow Federal Motor Vehicle Safety Standard (FMVSS) information decal found in the driver's side of the cab.

1-9. Safety Defect Reporting

If you believe that your vehicle has a defect that could cause a crash or could cause serious injury or death, it should be reported immediately to the National Highway Traffic Safety Administration (NHTSA) and to Pierce Manufacturing Inc. If NHTSA receives a number of similar complaints, it may open an investigation. If the investigation reveals a latent safety defect, NHTSA may order a recall and remedy campaign. NHTSA will not become involved in individual complaints between customers, dealers, and manufacturers.

To contact NHTSA, call the Auto Safety Hotline at 1-800-424-9393 or write to NHTSA, U.S. Department of Transportation, Washington, D.C. 20590.

1-10. Customer Assistance Information

Your satisfaction with your Pierce apparatus is important to your dealer and Pierce Manufacturing Inc. Normally, any question or concern you may have with your apparatus can be handled by your selling or servicing dealer. Your dealer has the facility, trained technicians, special tools, and up-to-date information to promptly address any issue that may arise. Pierce Manufacturing Inc. has empowered dealers to make decisions and repair vehicles, and they are eager to resolve your issues to your complete satisfaction. Should you encounter an issue with your Pierce apparatus that requires service, take the following steps:

Step 1.) Contact your authorized Pierce selling or servicing dealer. They will make the necessary arrangements to order the necessary parts and make the required repairs.

Step 2.) If they are not able to repair the problem to your satisfaction, discuss your concern with a member of dealer management. Normally, concerns can be quickly resolved at that level. If the matter has already been reviewed with the Sales, Service, or Parts Manager, contact the owner of the dealership or the General Manager.

Step 3.) If, after contacting a member of the dealership management, it appears your question or concern cannot be resolved by the dealership without further help, you may contact Pierce Manufacturing Inc. at 888-Y-PIERCE (888-974-3723).

1-11. Professional, Training, and Standards Organizations

To keep up-to-date on knowledge and new standards that affect all facets of fire fighting, make sure that you check these organizations' catalogues and websites each month:

National Fire Protection Association (for standards and requirements)
One Batterymarch Park
P.O. Box 9101
Quincy, MA 02269-9101
617-770-3000
www.nfpa.org
Make sure you read the latest editions.

Pierce Manufacturing Inc.
Customer Service
2600 American Drive
P.O. Box 2017
Appleton, WI, 54913
888-Y-PIERCE (888-974-3723)
www.piercemfg.com and www.pierceparts.com

International Fire Service Training Association (for textbooks and other training material)
Fire Protection Publications
Oklahoma State University
930 North Willis
Stillwater, OK 74079-8045
800-654-4055
www.ifsta.org

SECTION 2 BEFORE PLACING VEHICLE IN SERVICE

2-1. Axle Weights and Axle Capacity

⚠WARNING

Never exceed the gross axle weight ratings printed on the label inside the cab. Exceeding these ratings could lead to reduced component life, personal injury, or death.

Due to the highly custom nature of fire apparatus, it is very important to consider weight distribution and axle capacity during the specification stage of the procurement procedure. Before shipment, every Pierce fire apparatus is weighed with all loose equipment removed to ensure that the axle, suspension, tire, and wheel capacities provide for the applicable NFPA allowances of men and equipment. As it is impossible to predict the manner in which the vehicle will be loaded after delivery, Pierce assumes that allowances for personnel will be centered over the front axle, while the combined effect of hose load and equipment allowances will be centered over the rear axle.

Before placing the apparatus in service, load all compartments with the intended equipment and manpower, and obtain front and rear axle weights from a certified scale. Compare the results to the axle capacities listed on the Federal Motor Vehicle Safety Standard (FMVSS) information decal located inside the cab. In-service weights must not exceed the axle capacities listed on the tag.

2-2. Tire Pressure

⚠WARNING

Maintain tire pressure at the tire manufacturer's pressure recommendations for the correct tire size, type, load range (ply rating), and measured in-service axle load of the vehicle. Failure to maintain proper tire pressure may result in loss of vehicle control, property damage, personal injury, or death.

When checking air pressure or inflating/deflating tires, always use the following:

- **A clip-on chuck.**
- **An in-line valve with a pressure gauge or a pre-settable regulator.**
- **A sufficient length of hose between the clip-on chuck and in-line valve (if one is used) to allow personnel to stand outside the trajectory area.**

Tire pressure should be checked while the tire is cold. Tires that are heated through use may have a 15 psi (103 kPa) higher rating.

Proper tire inflation is essential to safe vehicle performance and handling. Tire inflation pressure must match the weight on each axle. Before placing the vehicle in service, obtain the axle weights with all equipment loaded and tanks full. Adjust the tire pressure to match the tire loads. See *"Tire Inflation"* on *page 4-37*. Once all of the tires are inflated to the proper air pressure, install on each tire the VECSAFE tire pressure managment system valve caps *(if equipped)* that were shipped loose with your apparatus.

2-3. Brake Balance

All Pierce Custom Chassis are configured to provide properly matched drivetrain components at the maximum axle capacities listed on the tag located inside the cab. Brake operation in fire apparatus service is unique to the trucking industry because of the high horsepower to weight ratios, high acceleration, high speed, and hard braking involved in emergency use. To account for this duty cycle, brakes employed on fire apparatus use more aggressive lining materials than is common in over-the-road cargo haulers. These linings provide the brake performance required, but are more sensitive to under-loaded conditions

Before placing the apparatus in service, load all compartments with the intended equipment and manpower, and obtain front and rear axle weights from a certified scale. Compare the results to the axle capacities listed on the Federal Motor Vehicle Safety Standard (FMVSS) information decal located inside the cab. Refer to the brake power charts to ensure that the brake power will fall within the appropriate guidelines. Brake power is indicated on the chart by the size of the chamber in square inches (24, 30, or 36) followed by the slack adjuster length in inches (5.5 or 6.0).

The proper chart must be referenced based upon the brake type on each axle:

Table 2-1: Brake Power Chart Reference Table

	Front Axle	Rear Axle
Figure 2-1	Cam Brakes	Cam Brakes
Figure 2-2	Disc Brakes	Cam Brakes
Figure 2-3	Disc Brakes	Disc Brakes
Figure 2-4	Disc Brakes	ALL STEER® Cam Brakes

Axle model numbers are listed on the Fluid Capacity Chart located in the cab. Brake chamber size is stamped on the components themselves. Slack adjuster length can be determined directly by measuring between the camshaft center and the large clevis pin. Any modification to the brakes to balance the system by reducing brake power must be accompanied by a revision to the Federal Motor Vehicle Safety Standard (FMVSS) information decal (contact Pierce Customer Service for revised tags).

Figure 2-1: Brake Power Chart (Cam Brakes on Front and Rear Axles)

FRONT

REAR	In-Service Axle Weights (Lb.)		11,000-14,600	14,601-16,540	16,541-18,000	18,001-21,500
		Axle Model	FG941	RF16-145, FL941/FL943		
	14,000-17,000	RS21	Front:24 x 5-1/2 Rear:24 x 5-1/2	Front:24 x 5-1/2 Rear:24 x 5-1/2		
	17,001-21,000	RS21	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2
	21,001-24,000	RS23	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 6
	24,001-27,000	RS25	Front:30 x 5-1/2 Rear:30 x 6	Front:30 x 5-1/2 Rear:30 x 6	Front:30 x 5-1/2 Rear:30 x 6	Front:30 x 5-1/2 Rear:30 x 6
	27,001-31,000	RS30	Front:30 x 5-1/2 Rear:36 x 6	Front:30 x 5-1/2 Rear:36 x 6	Front:30 x 5- 1/2 Rear:36 x 6	Front:30 x 5-1/2 Rear:36 x 6
	34,000-42,000	RT34 RT40	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2
	42,001-48,000	RT44 RT46	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 6
	48,001-54,000	RT52	Front:30 x 5-1/2 Rear:30 x 6	Front:30 x 5-1/2 Rear:30 x 6	Front:30 x 5-1/2 Rear:30 x 6	Front:30 x 5-1/2 Rear:30 x 6
	54,001-58,000	RT58		Front:30 x 5-1/2 Rear:36 x 6	Front:30 x 5-1/2 Rear:36 x 6	Front:30 x 5-1/2 Rear:36 x 6

POM0039

Figure 2-2: Brake Power Chart (Disc Brakes Front, Cam Brakes Rear)

FRONT

REAR	In-Service Axle Weights (Lb.)		11,000-14,600	14,601-16,540	16,541-18,000	18,001-21,500
		Axle Model	FG941	FL941/FL943		
	14,000-17,000	RS21	Front:24 x 5-1/2 Rear:24 x 5-1/2	Front:24 x 5-1/2 Rear:24 x 5-1/2		
	17,001-21,000	RS21	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2
	21,001-24,000	RS23	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 6
	24,001-27,000	RS25	Front:24 x 5-1/2 Rear:30 x 6	Front:24 x 5-1/2 Rear:30 x 6	Front:30 x 5-1/2 Rear:30 x 6	Front:30 x 5-1/2 Rear:30 x 6
	27,001-31,000	RS30	Front:24 x 5-1/2 Rear:36 x 6	Front:24 x 5-1/2 Rear:36 x 6	Front:30 x 5-1/2 Rear:36 x 6	Front:30 x 5-1/2 Rear:36 x 6
	34,000-42,000	RT34 RT40	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2
	42,001-48,000	RT44 RT46	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 6
	48,001-54,000	RT52	Front:24 x 5-1/2 Rear:30 x 6	Front:24 x 5-1/2 Rear:30 x 6	Front:30 x 5-1/2 Rear:30 x 6	Front:30 x 5-1/2 Rear:30 x 6
	54,001-58,000	RT58		Front:24 x 5-1/2 Rear:36 x 6	Front:30 x 5-1/2 Rear:36 x 6	Front:30 x 5-1/2 Rear:36 x 6

POM0040

Figure 2-3: Brake Power Chart (Disc Brakes Front, Disc Brakes Rear)

FRONT

In-Service Axle Weights (Lb.)		11,000-14,600	14,601-16,540	16,541-18,000	18,001-21,500
REAR	Axle Model	FG941	FL941/FL943		
14,600-17,000	RS21	Front:24 x 5-1/2 Rear:24 x 5-1/2	Front:24 x 5-1/2 Rear:24 x 5-1/2		
17,001-22,000	RS21	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2
22,001-24,000	RS23	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2
24,001-27,000	RS25				
27,001-31,000	RS30				
34,000-42,000	RT34 RT40	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2
42,001-48,000	RT44 RT46	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2
48,001-54,000	RT52				

POM0041

Figure 2-4: Brake Power Chart (Disc Brakes Front, ALL STEER® Cam Brakes Rear)

FRONT

In-Service Axle Weights (Lb.)		11,000-14,600	14,601-16,540	16,541-18,000	18,001-18,999	19,000-20,000	20,001-21,500
REAR	Axle Model	FG941	FL941/FL943				
17,000-21,500	AWS21.5	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:24 x 5-1/2 Rear:30 x 5-1/2		
21,501-24,000	AWS24	Front:24 x 5-1/2 Rear:30 x 6	Front:24 x 5-1/2 Rear:30 x 6	Front:24 x 5-1/2 Rear:30 x 6	Front:24 x 5-1/2 Rear:30 x 6		
24,001-26,000	AWS26	Front:24 x 5-1/2 Rear:30 x 6	Front:24 x 5-1/2 Rear:30 x 6	Front:24 x 5-1/2 Rear:30 x 6	Front:24 x 5-1/2 Rear:30 x 6	Front:24 x 5-1/2 Rear:30 x 6	Front:30 x 5-1/2 Rear:30 x 6
34,000-42,000	AWS42	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:24 x 5-1/2 Rear:30 x 5-1/2	Front:30 x 5-1/2 Rear:30 x 5-1/2
42,001-48,000	AWS48	Front:24 x 5-1/2 Rear:30 x 6	Front:24 x 5-1/2 Rear:30 x 6	Front:24 x 5-1/2 Rear:30 x 6	Front:24 x 5-1/2 Rear:30 x 6	Front:24 x 5-1/2 Rear:30 x 6	Front:30 x 5-1/2 Rear:30 x 6
48,001-52,000	AWS52	Front:24 x 5-1/2 Rear:30 x 6	Front:24 x 5-1/2 Rear:30 x 6	Front:24 x 5-1/2 Rear:30 x 6	Front:24 x 5-1/2 Rear:30 x 6	Front:24 x 5-1/2 Rear:30 x 6	Front:30 x 5-1/2 Rear:30 x 6

POM0042

2-4. Brake Burnishing

2-4.1 General Information

IMPORTANT: Brake noise is an inevitable characteristic of heavy-duty truck brakes with aggressive friction materials. Total elimination of all brake noise in heavy truck brakes cannot be expected.

Brakes shoes and pads are most effective after they have been worn-in sufficiently so that the surface of the friction material mates consistently with the drum or rotor surface. The process of wearing-in the friction material is termed “burnishing.” Braking performance and grade holding ability will improve once the brakes are burnished. The following burnish procedure is recommended by the axle and brake manufacturer to optimize brake performance and minimize the possibility of developing brake squeal or vibration.

Pierce recommends a burnishing procedure be done after a new truck has been delivered and has been loaded to it’s in service weight. This same practice should also be done, after new brakes, disc brake pads or drum brake shoes have been installed. This will ensure that they are broken in properly and will give proper performance during stopping and grade holding.

2-4.2 Procedure

⚠CAUTION

Make sure the driving route is in a safe, low traffic area.

Before starting the brake burnish procedure, make sure the brake chamber slack adjuster strokes, both free and applied, are within the brake supplier specifications. For brakes without slack adjusters, ensure that the caliper running clearance is correct. Refer to the axle manufacturer’s maintenance manual (included in the Pierce Service Manual) for maintenance schedules, lubrication recommendations, and inspection procedures.

The brake burnish procedure is called 30/30/30 and 5.

Under safe conditions, make 30 stops from 30 mph with a 30 second interval of time between each stop to allow the brakes to cool slightly. The time it should take to stop from 30 mph to 0 mph is 5 seconds. This will equate to a gentle stop.

During the burnishing procedure for new pads or shoes, it is common to smell the resins coming out of the lining material. This odor may disappear near the end of the burnish or shortly after the truck goes into service.

The brakes may also appear to be smoking. Again, these are the resins and other organic materials getting baked out of the linings. If you suspect one of the brakes is not performing the way it should, measure the brake rotor or drum temperature using an infrared hand held thermometer.

The infrared thermometer readings can vary depending on the location of the infrared beam on the object. Try to get within 12 inches of the drum or rotor and always try to check the same area of the component. Brake temperatures can vary from side to side on an axle as well as axle to axle.

Following this procedure should provide sufficient burnishing of the brakes and allow the truck brakes to perform as intended. Contact Pierce Customer Service if you have any questions or concerns regarding the brake system or performance.

2-5. Customer Installed Equipment and Accessories

Use the following guidelines when installing accessories or permanently mounted equipment:

2-5.1 Dissimilar Metals

Consider the metal types whenever mounting accessories. Dissimilar metals such as aluminum, steel, stainless steel, brass, etc., placed in direct contact with each other and subjected to moisture will form a galvanic reaction that will lead to rapid corrosion and possible failure of the mount, fastener, or base material. Select mounting material and fasteners to avoid dissimilar metals, or coat all mounting surfaces, base material, and fasteners with a commercial grade rust-proofing agent such as those conforming to MIL-C-0083933A specification.

2-5.2 Radio Equipment

Refer to the *"Mobile Radio Installation Guide"* on *page A-1* for information concerning radio installation in a Pierce fire apparatus.

2-5.3 Cab Exterior Equipment

Avoid mounting hose or equipment in a manner that blocks airflow to the grill. Large items blocking air to the grill may degrade cooling performance and cause the engine to over-heat during heavy use and high ambient temperatures. Logos, letters, numbers, or placards should not be attached to the radiator grill. Numbers, letters, flags, etc., that are painted on the grill are acceptable.

When mounting equipment to the bumper deck plate of a tilt cab model, consider the motion of the cab when tilting to avoid interference in the tilted condition.

2-5.4 Cab Interior Equipment

⚠WARNING

Installation of equipment in the deployment path of the air bag can result in improper deployment, serious injury or death in the event of a collision. No part of any equipment may extend within the area shown below, extending 4” outward from all sides of the first officer’s knee air bag.

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When installing equipment in trucks equipped with Frontal Impact Protection, it is critical that equipment not be mounted in the deployment path of the air bags. Additionally, no equipment should be placed in the area between the first officer and the dashboard.

Consider the effect of cab-tilt on equipment storage to avoid damage from items falling forward when the cab is tilted for service or maintenance.

Monitor the weight of items installed in a tilt-cab, or stored in tilt-cab storage areas. Too much weight inside the cab may prevent the cab from being tilted for service or maintenance.

⚠WARNING

Always stow work surface while vehicle is in motion. Never ride in the seat unless the work surface is stowed. Impact with the work surface during a crash will injure or kill.

Refer to NFPA guidelines when mounting equipment inside the cab to avoid unnecessary risk of injury from flying objects during a collision.

Exercise caution if drilling into cab walls and headliners to mount equipment, as there may be wiring, heater hoses, or air conditioning hoses hidden beneath the surface.

2-5.5 Air Pressure Operated Equipment

⚠WARNING

Pressure protection valves are installed in both front and rear brake systems to ensure that no other air pressure requirements of the vehicle are allowed to deplete the vehicle braking system capabilities. Addition of any air pressure equipment added by the end user upstream of these pressure protection valves will negate the conformance of the vehicle to this NFPA recommendation and property damage, personal injury, or death could result.

- Any air-operated equipment must only be added to the air system downstream of a pressure protection valve.
- Consider the airflow requirements of any air-operated accessory that will draw pressure from the vehicle system. The engine air compressor output is but a fraction of its total capacity at engine idle and will not keep up with continuous operation of most shop-type air tools.

2-6. Equipment and Cargo Loading

⚠WARNING

Excessively uneven loading from side to side (greater than 550 lbs) can cause the vehicle to pull to one side during braking and/or produce a reduction in the rollover threshold of the vehicle. Operation of an improperly loaded vehicle could lead to loss of vehicle control causing property damage, serious personal injury, or death.

⚠CAUTION

NFPA Standards specify that "All equipment required to be used during an emergency response shall be securely fastened". Equipment not needed during the response must be secured to 9 Gs. Items not secured can injure or kill during a crash.

Every Pierce custom fire truck is measured prior to leaving the factory to ensure that it sits level. Since the apparatus may be configured with heavier options on one side or the other, it may be equipped with factory-installed shims at the time of delivery. As the compartments are filled with equipment of varying weight, the initial weight distribution will change, which may cause the truck to lean. The amount of lean depends on the spring rate of the suspension. Vehicles with higher capacity suspensions will lean less when subjected to the same variation in weight.

To ensure that a vehicle does not lean objectionably, careful consideration must be given to the weight and location of equipment. The following guidelines will help level a vehicle that has an objectionable lean:

- Check tire pressure and tread condition. Tire pressure and tread wear can affect vehicle height by as much as +/- 0.25 inches. Ensure that all tires are inflated to recommended pressures and that tread wear is reasonably even from side to side.
- Inspect the vehicle on a surface that is both flat and level. Keep in mind that the variations in height are generally measured in fractions of an inch. The tolerance of concrete and asphalt surfaces over the length and width of fire apparatus are rarely within the limits required to provide accurate measurements.
- Transfer load. Balance the spring loading by shifting equipment from the low side to the high side of the vehicle. Relocate heavy equipment closer to the longitudinal center of the vehicle whenever possible.

NFPA 1901 and 1906 specify that the apparatus when placed in service shall have a side-to-side tire load variation of no more than 7% of the total tire load for that axle. This can be calculated as follows:

The projections of total equipment payload and mounting locations are essential for proper engineering of a new fire apparatus. The purchaser of the fire apparatus should maintain the side-to-side loading requirement in (NFPA) 4.13.3.3 as equipment is loaded or installed on the apparatus. The percentage difference in side-to-side tire load should be calculated as shown in the following formula:

$$\frac{(\text{Heavier weight} - \text{Lighter weight})}{\text{Total weight}} \times 100 = \text{Percent difference}$$

After loading the apparatus to its in-service condition, weigh each wheel position independently to ensure that the side-to-side specification is met. If the variation exceeds 7%, shift the load in the compartments until the specification is met.

2-6.1 Front Spring/Suspension Adjustment

Refer to the following paragraphs for front spring/suspension adjustment information (if needed after equipment and cargo has been loaded).

2-6.1a TAK-4™ Independent Front Suspension

Information concerning the ride height adjustment of the TAK-4™ Independent Front Suspension can be found in the Pierce Service Manual, group 0152-P-002, TAK-4™ Independent Front Suspension.

2-6.1b Leaf Spring Suspension

⚠WARNING

Excessive shimming of the front axle can adversely affect steering and braking performance.

- Remove factory installed shims. It is likely that any lean induced by the weight from factory installed options such as ladder racks, high side compartments, and generators was corrected before the vehicle left Pierce by adding shims between the spring pack and the axle pad. This action, although necessary to provide a level product as delivered, may complicate the leveling process once equipment is added. If accurate scale measurements indicated that the unit is equally loaded from side to side and an objectionable lean persists, inspect each spring for the presence of shims. These shims may be removed to reduce the lean if they are located on one of the high side springs.
- Adding shims. If all the above actions have been taken and an objectionable lean still persists, additional shims may be installed on the low side of the vehicle. Shim thickness should not exceed 0.50 inches on the front and 1.00 inches on the rear. Appropriate shim stock may be ordered from the Pierce customer service department. Shims must be installed in a manner that maintains the locating pin function between the axle and the springs. U-bolts should be retightened to the specified torque after 500 miles of road operation. Contact Pierce Customer Service concerning any shimming beyond these guidelines.

2-7. ALL STEER® All-Wheel Steering *(Optional)*

The operation of the ALL STEER® all-wheel steering system is covered in detail in the ALL STEER® Operator's Manual. The use of all-wheel steering significantly changes vehicle handling, particularly on a slippery road surface caused by rain, snow, or icy conditions. Before placing a vehicle equipped with the ALL STEER® option in service, all vehicle operators must be thoroughly trained in accordance with the procedures outlined in the ALL STEER® Operator's Manual.

2-8. Suspension

Truck suspensions are designed to absorb high forces from road irregularities, steering inputs, and variations in load. Certain aspects of suspensions will naturally "wear in" during the first few miles of operation under load. Truck springs will wear off the high spots between the leaves, friction rates will drop off, and the ride height will settle in. In most cases a leaf spring pack will settle by up to 0.50 inches in the first few hundred miles. This settling phenomenon can also cause certain suspension fasteners to require tightening.

2-8.1 Spring Suspensions *(Spring U-Bolts)*

Spring suspension U-bolts must be tightened to the proper torque after approximately 500 miles of initial use. See *"Spring Suspension (Front and Rear)"* on *page 4-34*. Ensure that this procedure has been completed prior to placing the unit in service. Check other suspension related fasteners and torque as required.

2-8.2 Air and Rubber Suspensions

Like spring suspensions, road shock and vibration can cause some initial settling of components. Certain suspensions do require a retorquing procedure after the first 500 miles. Refer to the suspension manufacturers service information for any pre-delivery inspection or torquing requirements.

3-1. Pre-Trip Inspection

3-1.1 Reasons for Daily Inspection

To be sure that the vehicle is safe to operate, conduct a pre-trip inspection at the beginning of every work period. Perform a pre-trip inspection before each trip to find problems that could cause a crash or breakdown. Although the inspection can be completed by a single individual, it is most effectively accomplished with two. This way one person can be operating interior controls while the second person is checking for exterior functions such as turn signal lamps, flashers, brake lights, etc. Since the performance of a pre-trip inspection as mandated for holders of a Commercial Driver's license would be impractical in emergency response situations, it is important that these inspections occur as part of the daily firehouse routine.

Safety

Safety is the most important and obvious reason for inspecting regularly. Inspecting your vehicle helps you to know your vehicle is safe.

Legal Requirements

Federal and State laws require inspection by the driver. Federal and State inspectors also inspect commercial vehicles. An unsafe vehicle can be put "out of service" until the driver or owner fixes it.

3-1.2 Beginning the Inspection

Perform a pre-trip inspection the same way each time to reduce the probability that something will be missed.

Records Review

Review last vehicle inspection report. Drivers may have to make a vehicle inspection report in writing each day. The vehicle owner should repair any items in the report that affects safety. You should look at the last report to find out what was the matter, if anything. Inspect the vehicle to find out if problems were fixed.

Approaching the Vehicle

Check that the parking brakes are on and/or wheels chocked.

Notice general condition. Look for damage or the vehicle leaning to one side. Look under the vehicle for fresh oil, coolant, grease, or fuel leaks. Check the area around the vehicle for hazards to vehicle movement (people, other vehicles, objects, low hanging wires or limbs, etc.).

3-1.3 Interior Inspection

Engine Compartment

> **NOTE:** Secure loose items in cab and ensure the vehicle is on a flat and level surface before tilting.

Tilt the cab or open the engine compartment doors and check the following:

- ❑ Engine oil level OK.
- ❑ Automatic transmission fluid level and physical appearance OK. (Refer to *"Transmission Fluid Analysis – Allison Transmissions"* on *page 4-49*, for additional information.)
- ❑ Coolant level in radiator OK.
- ❑ Power steering fluid level OK.
- ❑ Windshield washer fluid level OK.
- ❑ Hoses show no signs of excessive wear, damage, or leaking.

- ❑ Battery box securely mounted to vehicle.
- ❑ Batteries secured against movement.
- ❑ Batteries not broken or leaking.
- ❑ Fluid in batteries at proper level (except maintenance-free type).
- ❑ Cell caps present and securely tightened (except maintenance-free type).
- ❑ Vents in cell caps free of foreign material (except maintenance-free type).
- ❑ Belts are tight and show no sign of excessive wear. With engine off, press belt to test that it is snug.
- ❑ No apparent leaks of fuel, coolant, oil, power steering fluid, hydraulic fluid, or battery fluid.
- ❑ Electrical wiring insulation shows no sign of excessive wear, chafing, or damage from heat.

Cab Interior

Lower cab and ensure that the parking brake is set. Put gearshift in neutral and start the engine. Perform the following checks:

- ❑ No unusual noises.
- ❑ All gauges indicate within normal operating ranges.
- ❑ Oil pressure indicates normal within seconds after engine is started.
- ❑ Voltmeter indicates normal electrical voltage.
- ❑ Coolant temperature begins a gradual rise to normal operating range.
- ❑ Review indicator lights to ensure all bulbs are functional.

Glass

Check mirrors and windshield.

- ❑ Windshield is clear of dirt and ice.
- ❑ Windshield is free from cracks or distortion.
- ❑ Mirrors are clean and properly adjusted.

Safety Equipment

Ensure that the vehicle is equipped with the following safety equipment:

- ❑ Spare electrical fuses (unless vehicle has circuit breakers).
- ❑ Three red reflective triangles.
- ❑ Properly charged and rated fire extinguisher.

Functional Controls

Check all of the following for looseness, sticking, damage, or improper setting. Ensure that all are operational.

- ❑ Steering wheel.
- ❑ Accelerator.
- ❑ Brake controls.
- ❑ Parking brake.
- ❑ Retarder controls (if so equipped).
- ❑ Transmission controls.
- ❑ Interaxle differential lock (if so equipped).
- ❑ Horn(s).
- ❑ Windshield wiper/washer.
- ❑ Lights.
- ❑ Headlights.

- ❑ Dimmer switch.
- ❑ Turn signal.
- ❑ 4-way flashers.
- ❑ Clearance, identification, and marker lights.
- ❑ Tire chains (when winter conditions require them).

3-1.4 Exterior Inspection

Perform a walk-around inspection. Re-enter the cab as required during the inspection to check that exterior features are functioning properly.

Tires

Look for tire problems. It is dangerous to drive with bad tires. Look for problems such as:

- Too much or too little air pressure.
- Bad wear. You need at least 4/32 inch tread depth in every major groove on front wheels. You need 2/32 inch on other wheels. No fabric should show through the tread or sidewall.
- Cuts or other damage.
- Dual tires that come in contact with each other or parts of the vehicle.
- Mismatched sizes.
- Radial and bias-ply tires used together.
- Cut or cracked valve stems.
- Re-grooved, recapped, or retreaded tires on the front wheels.

Wheels and Rims

Bad wheels or rims could cause an accident. A damaged rim can cause the tire to lose pressure or come off. Observe the following warning signs:

- Rust around wheel nuts may mean the nuts are loose – check tightness.
- Missing clamps, spacers, studs, and lugs mean danger.
- Mismatched, bent, or cracked lock rings are dangerous.
- Wheels or rims that have had welding repairs are not safe.
- After a tire has been changed, stop a short while later and recheck tightness of nuts.

Brake Drums or Shoes

Inspect brakes for the following:

- Cracked drums or rotors.
- Shoes or pads contaminated with oil, grease, or brake fluid.
- Shoes or pads worn dangerously thin, missing, or broken.

Steering System

Inspect the steering system for the following:

- Missing nuts, bolts, cotter keys, or other parts.
- Bent, loose, or broken parts, such as steering column, steering gear box, pitman arm, toe links, or steering shafts.
- Check power steering hoses, pump, reservoir, cooler, and fittings for leaks.
- Steering wheel play of more than 10 degrees (approximately 2 inches movement at the rim of a 20-inch steering wheel) can make it hard to steer.

Suspension System

The suspension system holds up the vehicle and its load. It keeps the axles in place. Broken suspension parts can be extremely dangerous. Check for:

- Spring hangers that allow movement of axle from proper position.
- Cracked or broken spring hangers.
- Missing or broken leaves in any leaf spring. If one fourth or more are missing, it will put the vehicle “out of service,” but any defect could be dangerous.
- Broken leaves in a multi-leaf spring or leaves that have shifted so they might hit a tire or other part.
- Leaking shock absorbers.
- Torque rods or arms, U-bolts, spring hangers, or other axle positioning parts that are cracked, damaged, or missing.
- Air suspension systems that are damaged and/or leaking.
- Any loose, cracked, broken, or missing frame members.
- Broken or damaged torsion bars. Cut or torn tape on torsion bars. *(TAK-4™ suspension only. Refer to Pierce Service Manual, group 0152-P-002, TAK-4™ Independent Front Suspension.)*

Exhaust System

A broken exhaust system can let poisonous fumes into the cab. Check for:

- Loose, broken, or missing exhaust pipes, mufflers, tailpipes, or vertical stacks.
- Loose, broken, or missing mounting brackets, clamps, bolts, or nuts.
- Exhaust system parts rubbing against fuel system parts, tires, or other moving parts of vehicle.
- Exhaust system parts that are leaking.
- Missing or damaged insulation or heat shields.
- Exhaust temperature mitigation device damage.

Equipment Loading

- Inspect for cargo overloading and correct balance and securement before each trip. If the cargo contains hazardous materials, inspect for proper papers and placarding.

Left Front Side

- ❑ Driver’s door glass should be clean.
- ❑ Door latches and window regulators work properly.

Left Front Wheel

- ❑ Wheel and rim are in good condition – no missing, bent, or broken studs, clamps, or lugs. Show no signs of misalignment.
- ❑ Condition of tires – properly inflated, valve stem and cap OK, no serious cuts, bulges, or excessive tread wear.
- ❑ Use wrench to test – rust streaked lug nuts, indicating looseness.
- ❑ Hub oil level OK. No leaks apparent.

Left Front Suspension

- ❑ Spring, spring hangers, shackles, U-bolts are in good condition.
- ❑ Shock absorber shows no sign of excess wear or damage.
- ❑ Torsion bar is not damaged and tape is not cut or torn. *(TAK-4™ suspension only. Refer to Pierce Service Manual, group 0152-P-002, TAK-4™ Independent Front Suspension.)*

Left Front Brake

- ❑ Brake drums or rotors are not cracked or worn.
- ❑ Hoses show no signs of excessive wear.

Front

- ❑ Front axle shows no signs of damage or excessive wear.
- ❑ Steering linkages are tight and show no signs of damage. Grasp each steering link and test for looseness.
- ❑ Windshield is clean and shows no sign of cracks or other damage. Perimeter seal is holding windshield glass firmly in place.
- ❑ Windshield wiper arms have proper spring tension.
- ❑ Wiper blades are in good condition.

Front Lights and Reflectors

- ❑ Parking, clearance, and identification lights clean, operating, and proper color (amber at front).
- ❑ Reflectors clean and proper color (amber at front).
- ❑ Turn signal lights clean, operating, and proper color (amber or white on signals facing forward).

Right Front Wheel

- ❑ Wheel and rim are in good condition – no missing, bent, or broken studs, clamps, or lugs. Show no signs of misalignment.
- ❑ Condition of tires – properly inflated, valve stem and cap OK, no serious cuts, bulges, or excessive tread wear.
- ❑ Use wrench to test rust–streaked lug nuts, indicating looseness.
- ❑ Hub oil level OK. No leaks apparent.

Right Front Suspension

- ❑ Spring, spring hangers, shackles, U-bolts are in good condition.
- ❑ Shock absorber shows no sign of excess wear or damage.
- ❑ Torsion bar is not damaged and tape is not cut or torn. *(TAK-4™ suspension only. Refer to Pierce Service Manual, group 0152-P-002, TAK-4™ Independent Front Suspension.)*

Right Front Brake

- ❑ Brake drums or rotors are not cracked or worn.
- ❑ Hoses show no signs of excessive wear.

Right Front

- ❑ Passenger door glass should be clean.
- ❑ Door latches and window regulators work properly.
- ❑ Primary and safety cab locks engaged.
- ❑ Rear of engine – not leaking.
- ❑ Transmission – not leaking.
- ❑ Exhaust system – secure, not leaking, not touching wires, fuel or air lines.
- ❑ Frame and cross members – no bends or cracks.
- ❑ Air lines and electrical wiring – secured against snagging, rubbing, wearing.

Right Rear

- ❑ Wheel and rim are in good condition – no missing, bent, or broken studs, clamps, or lugs. Show no signs of misalignment.
- ❑ Condition of tires – properly inflated, valve stem and cap OK, no serious cuts, bulges, or excessive tread wear.
- ❑ Use wrench to test rust-streaked lug nuts, indicating looseness.
- ❑ Tires are of the same type (not mixed radial and bias type).
- ❑ Tires evenly matched (same sizes).
- ❑ Wheel bearing/seals not leaking.

Right Rear Suspension

- ❑ Spring, spring hangers, shackles, U-bolts are in good condition.
- ❑ Shock absorber shows no sign of excess wear or damage.
- ❑ Powered axle(s) not leaking lube (gear oil).
- ❑ Torque rod arms and bushings show no sign of excessive wear.

Right Rear Brake

- ❑ Brake drums or rotors are not cracked or worn.
- ❑ Hoses show no signs of excessive wear.

Side Lights and Reflectors

- ❑ Side-marker lights clean, operating, and proper color (red at rear, others amber).
- ❑ Side-marker reflectors clean and proper color (red at rear, others amber).

Rear Lights and Reflectors

- ❑ Rear clearance and identification lights clean, operating, and proper color (red at rear).
- ❑ Reflectors clean and proper color (red at rear).
- ❑ Taillights clean, operating, and proper color (red at rear).
- ❑ Rear turn signals operating and proper color (red, yellow, or amber at rear).
- ❑ License plate(s) present, clean, and secured.
- ❑ Splash guards present, not damaged, properly fastened, not dragging on ground or rubbing tires.
- ❑ Rear doors securely closed, latched/locked.

Left Rear

- ❑ Fuel tank is securely mounted, not damaged or leaking.
- ❑ Fuel tank contains enough fuel.
- ❑ Fuel cap is on and secure.
- ❑ Wheel and rim are in good condition – no missing, bent, or broken studs, clamps, or lugs. Show no signs of misalignment.
- ❑ Condition of tires – properly inflated, valve stem and cap OK, no serious cuts, bulges, or excessive tread wear.
- ❑ Use wrench to test rust-streaked lug nuts, indicating looseness.
- ❑ Tires are of the same type (not mixed radial and bias type).
- ❑ Tires evenly matched (same sizes).
- ❑ Wheel bearing/seals not leaking.

Left Rear Suspension

- ❑ Spring, spring hangers, shackles, U-bolts are in good condition.
- ❑ Shock absorber shows no sign of excess wear or damage.
- ❑ Powered axle(s) not leaking lube (gear oil).
- ❑ Torque rod arms and bushings show no sign of excessive wear.

Left Rear Brake

- ❑ Brake drums or rotors are not cracked or worn.
- ❑ Hoses show no signs of excessive wear.

3-1.5 Brake Testing

Secure all loose articles in cab, fasten seat belts, and start the engine. Proceed with functional brake tests as follows:

Test Parking Brake

1. Allow vehicle to move forward slowly.
2. Apply parking brake.

If vehicle does not stop, bring it to a stop using the service brakes and have the problem repaired by a qualified truck service facility.

Test Service Brake Stopping Action

1. Accelerate to about five miles per hour.
2. Push brake pedal firmly.

Excessive pulling to one side or the other, unusual brake pedal “feel,” or delayed stopping action may indicate a problem. Have the problem diagnosed and repaired by a qualified truck service facility.

Test Dual Air Brake System Warning Light and Buzzer

A dual air brake system has two separate air brake systems that use a single set of brake controls. Each system has its own air tank, hoses, lines, etc. One system typically operates the regular brakes on the rear axle or axles. The other system operates the regular brakes on the front axle. The first system is called the “primary” system. The other is called the “secondary” system.

1. Allow time for the air compressor to build up a minimum of 110-psi pressure in both the primary and secondary systems.
2. Shut the engine off when the air pressure rises sufficiently to shut off the low pressure light and buzzer.
3. Shut the ignition switch off and step on and off the brake pedal to reduce air tank pressure.
4. Note the pressure at which the low air pressure warning signal alarm begins. Alarm should signal before the pressure drops to less than 60 psi in the air tank with the lowest air pressure.

If the warning signal doesn’t work, the vehicle could lose air pressure without the knowledge of the operator. This will reduce the effectiveness of the brakes and increase stopping distance. Have the problem diagnosed and repaired by a qualified truck service facility.

Test That the Spring Brakes Come On Automatically

The parking brakes should engage any time brake pressure drops below 40 psi. Test this function as follows:

1. Chock the wheels.
2. Allow air pressure to build sufficiently to release the parking brakes.
3. Step on and off the brake pedal to reduce the air tank pressure. The “parking brake” knob should pop out when the air pressure falls to 40 psi. This will engage the spring brakes and help to prevent the vehicle from moving.

Test the Rate of Air Pressure Buildup

Time the rise in pressure from 85 to 100 psi with the engine at operating rpm. Pressure should build from 85 to 100 psi within 45 seconds. (If the vehicle has larger than minimum air tanks, the buildup time can be longer and still be safe.) If air pressure does not build up fast enough, pressure may drop too low during driving, requiring an emergency stop. Do not drive until the problem has been repaired.

Test Air Leakage Rate

1. Run the engine to fully charge the air system to 125 psi.
2. Turn off the engine and release the service brake.
3. Time the air pressure drop. The loss rate should be less than 2 psi in one minute for single vehicles.
4. Apply 90 psi or more with the brake pedal. After the initial pressure drop, the pressure should not fall more than 3 psi in one minute.

If the leakage rate is greater than 3 psi per minute, check for air leaks and fix before driving the vehicle.

Test Air Compressor Governor Cut-In and Cut-Out Pressures

Pumping by the air compressor should start at about 100 psi and stop at about 125 psi.

1. Operate the engine at a fast idle and monitor the pressure at the gauge.
2. Listen for the air pressure governor to cut out (indicated by a pressure discharge from the air dryer and a halt to the rise of the gauge needle). The air governor should cut out the air compressor at about 125 psi.
3. Operate the engine at idle.
4. Apply and release the brake pedal to reduce the air tank pressure. The compressor should cut in at about 110 psi (indicated by a rise in the pressure at the gauge).

3-2. Vehicle Entry and Exit

⚠WARNING

Failure to exercise due care when entering and exiting vehicles can result in personal injury. Entry and exit should be made slowly, deliberately, and carefully.

A three-point stance should be used (three out of four extremities should be in contact with the vehicle at all times). Face inward toward steps and handholds when entering and exiting. Always keep steps and handholds in continuous good repair. Make sure all attaching bolts and hardware are tight, thus eliminating any movement of steps and handholds. Keep steps, grab handles, and shoes free of grease, mud, dirt, fuel, ice and snow. Use extra care during inclement weather.

Do not step or climb upon any vehicle surface unless it is slip resistant and handholds are provided.

Certain steps may be of a pivoting or folding design. Be certain that such steps are firmly engaged in the weight bearing position before placing full weight on the step. Make sure steps are deployed in the down position before exiting cab. Failure to deploy steps properly can lead to falls and possible injury.

Automatic deploying side entry steps fold out and down to provide easy access to the cab. When properly adjusted, these steps will retract into the cab on either the first or second catch of the door. Other steps may also be of a folding or pivoting design.

3-2.1 Keyless Entry *(Optional)*

3-2.1a To Unlock Officer's Door

- Enter access code
- Listen for double beep
- Within three seconds, press the (1/2) button

3-2.1b To Unlock All Doors

- Enter access code
- Listen for double beep
- Within three seconds, press the (3/4) button

3-2.1c Locking the Doors with Keypad

Press and hold down the (1/2) button for 1-2 seconds.

3-2.1d Additional Information

The dome light is activated for a timed duration (20 seconds) whenever the system is unlocked from keypad or fob transmitter.

After repeated attempts to enter incorrect codes (20 button presses without enabling), the keypad enters an inactive mode that disables button for 1 minute. This helps prevent undesired access by entering random codes. No beep will sound with button press while the system is disabled.

See the Pierce Service Manual, group 0810-V-001, TriMark e-ASK Keyless-entry System, for additional information on the keyless entry system (programming fob transmitters, changing authority and access codes, etc.).

3-3. Safety Restraints and Devices

3-3.1 Seat Belts

⚠WARNING

Never ride in or on this vehicle unless properly restrained in a seating position with a seat belt.
Before fastening seat belts, adjust the seat to a position that maintains adequate head clearance (see suspension style seats) to reduce the risk of head or spinal injury when driving over severe dips or bumps in the pavement.
Always ride with your seat back upright and the lap belt snug and low about your hips to reduce the risk of serious injury to the abdomen or neck that could be caused by sliding under the safety belts in a collision.
Fasten seat belt low and snug on the hips, and the shoulder belt snug against the chest.
Never use a single belt for more than one person or across more than one seating position.
Use the shoulder belt on the outside shoulder only. Never wear the shoulder belt under the arm or swing it around the neck over the inside shoulder.
The effectiveness of an air bag may be reduced on vehicles equipped with an extended front bumper. Always wear seat belts.
Fire helmets shall not be worn by persons riding in enclosed driving and crew areas. Fire helmets are not designed for crash protection and they will interfere with the protection provided by head rests. The use of seat belts is essential to protecting fire fighters during driving. Failure to comply may result in serious injury or death to personnel.

The use of seat belts help to restrain you and your passengers in case of a collision. In most states, the law requires their use.

Safety belts provide the best restraint when:

- The seat back is upright.
- The occupant is sitting upright (not slouched).
- The lap belt is snug and low on the hips.
- The shoulder belt is snug against the chest.
- The knees are straight forward.

⚠CAUTION

Failure to use care in closing the door can cause seat belt damage if the seat belt is caught in the door latch and striker.

In certain apparatus configurations, the seat belt retractor may not retract the belt quickly or completely enough to prevent it being caught in the door. In these instances it is necessary for the belt to be placed manually inside the door before it is closed.

3-3.2 Seat Belt Monitoring System

Most Pierce apparatus are equipped with a Seat Belt Monitoring System (SBMS). The SBMS is capable of monitoring up to ten (10) sensors indicating the status of each seating position in the cab with green and red LED indicators as follows:

- Green - Seat occupied and seat belt buckled
- Red - Seat occupied and seat belt unbuckled
- Red - No occupant in seat and seat belt buckled
- Not Illuminated - No occupant in seat and seat belt unbuckled

The SBMS will include an audible alarm that will be activated when a red illumination condition exists and the parking brake is released, or a red illumination condition exists and the transmission is not in park.

3-3.3 Side Roll Protection System *(Optional)*

3-3.3a General Description

IMPORTANT: The Side Roll Protection System is only designed to activate during a vehicle side roll accident or whenever the front air bags are deployed. It will not activate during:

- **Side impacts;**
- **Rear impacts;**
- **End-over-end accidents;**
- **Other accidents not involving a side roll.**

The Side Roll Protection System is a Supplemental Restraint System (SRS) consisting of pyrotechnically actuated advanced protective devices, working in conjunction with the seats and seat belts of the vehicle, to provide the occupant a lower probability for injury during a side roll (up to 90 from vertical). A roll sensor located in the cab headliner of the vehicle triggers the system. The roll sensor analyzes the vehicle roll angle and rate of roll to determine when the Side Roll Protection System will activate.

3-3.3b General Warnings and Cautions

⚠WARNING

The Side Roll Protection System will only enhance safety if the seat belt is worn! ALWAYS WEAR YOUR SEAT BELT. The seat belt will pretension and restrain the occupant during a vehicle side roll accident. If the seat belt is not worn, the occupant will move out of position and become unprotected. The driver's seat pull down system and side air bags are ineffective unless the occupant wears the seat belt.

Children 12 years old and under should be seat belted in a back seat. Never install a child seat in the front seat. Pregnant women should consult their doctor concerning the proper use and positioning of seat belts. Death or serious injury can occur.

Occupants 5 feet ¼ inch tall or less, weighing less than 107.5 lbs, or having a sitting height of 31.3 inches or less, must ride in the crew cab seating area. Death or serious injury can occur.

The Side Roll Protection System is a dynamic system that contains pyrotechnic devices that can be dangerous if modified or removed. When activated in a side roll accident, they will exhaust harmless blue smoke. Never service, attempt to salvage, or reuse Side Roll Protection System components. Never weld or apply heat on or near Side Roll Protection System components. Never grind, puncture, or drill on Side Roll Protection System components.

The Side Roll Protection System will decrease the occupant's probability for injury when used properly. In the event of a vehicle side roll accident, the system will activate and there will be rapidly moving components. Keep hands and other objects away from air bags, seat belt buckles, and suspension seat components.

Information on all component caution and warning labels must be complied with. Labels are placed in visible locations on each component of the Side Roll Protection System. If labels have been removed or are not visible, please contact your Pierce Dealer for the proper replacement labels.

CAUTION

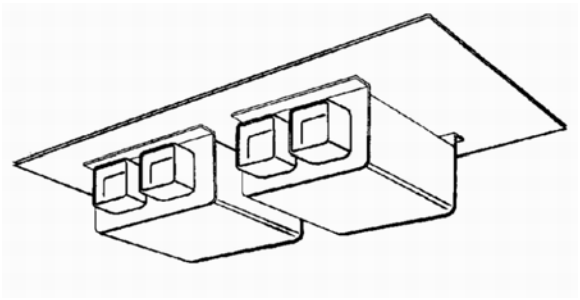
Keep hands and other objects out of deployment path of side air bags, suspension seat, and seat belt buckles. Such objects could prevent the air bag from inflating properly or cause injury or death to the occupant when the devices activate.

3-3.3c Side Roll Protection System Components

The system is composed of the following major components: Roll Sensor, Suspension Seat Safety System (S4S), Inflatable Tubular Structure Side Air Bag (ITS), Integrated Gas Pretensioner (IGP) or Integrated Belt Pretensioner (IBP), and Inflatable Head Cushion (IHC) or Supplemental Restraint Air Bag (SRA) *(optional)*.

Roll Sensor

Figure 3-1: Roll Sensor



POM0099

WARNING

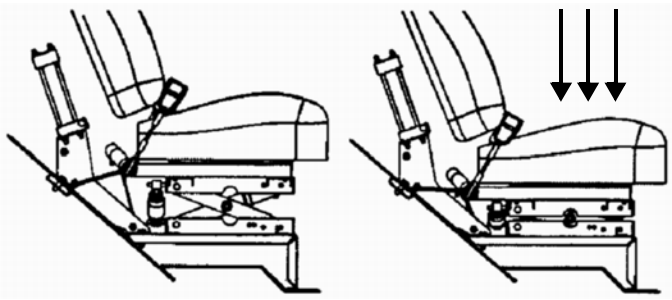
The roll sensor triggers air bags and seat restraints. Accidental deployment can cause serious injury.

- Service the roll sensor(s) only if you are an authorized technician.
- Never remove the roll sensor. Removing the roll sensor will turn OFF and/or trigger deployment of the air bags and seat restraints.
- BEFORE welding, disconnect the roll sensor and refer to *"Welding Instructions"* on *page 4-50*, for additional welding information.
- BEFORE disconnecting the roll sensor, remove the electric power.

The roll sensor monitors the vehicle's angle and rate of roll. Cabs may be equipped with a single roll sensor or two roll sensors – a master and a slave. In the event of a side roll accident, the roll sensor sends a signal to deploy the advanced occupant protection devices. The roll sensor stores in memory a ten-second stream of roll angle and rate data that can be retrieved in the event of an incident.

Suspension Seat Safety System (S4S)

Figure 3-2: Suspension Seat Safety System (S4S)



POM0100

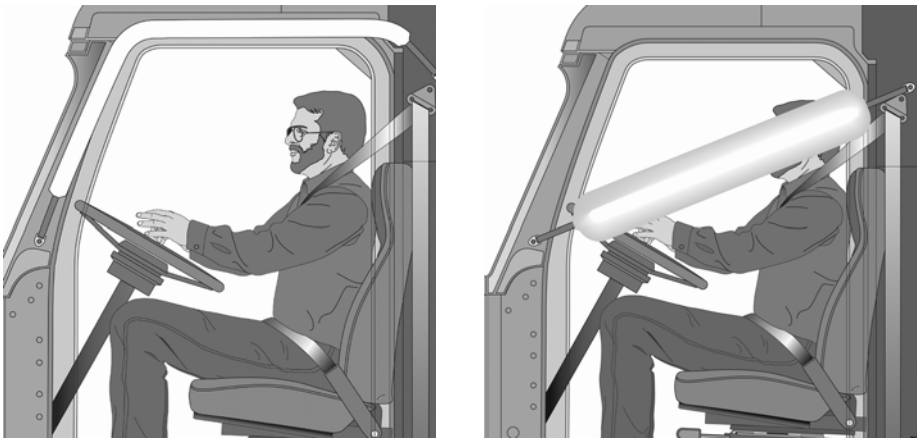
⚠WARNING

Keep hands and other objects clear of the deployment path of seat, seat belt, and suspension components.

The S4S actuator is located immediately behind the driver's suspension seat. In the event of a side roll accident the S4S unit deploys, pretensioning the seat belt and pulling the seat to its lowest position. The S4S is only effective when you wear your seat belt. **ALWAYS WEAR YOUR SEAT BELT.**

Inflatable Tubular Structure Side Airbag (ITS)

Figure 3-3: Inflatable Tubular Structure Side Airbag (ITS)



Pre-Deployment Post-Deployment

POM0101, POM0102

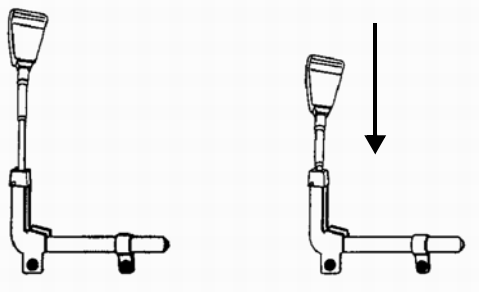
⚠WARNING

Do not sit or lean unnecessarily close to the air bag. Do not place or mount any object over the air bag or between the air bag and the occupants.

ITS is an inflatable air bag that inflates next to the occupant's head and provides a cushion in case of a side roll accident. Two air bag inflators are located, one each side, in the sidewalls behind the driver and first officer area. During normal vehicle operation the ITS airbag is stowed around the door frame, inside a protective plastic cover. In the event of a side roll accident, the roll sensor detects the impending roll and signals the ITS system to activate. The ITS air bag then inflates and assumes a position between the occupant's head and the side window. The ITS is only effective when used with a seat belt. **ALWAYS WEAR YOUR SEAT BELT.**

Integrated Gas Pretensioner (IGP) / Integrated Belt Pretensioner (IBP)

Figure 3-4: Integrated Gas Pretensioner (IGP) / Integrated Belt Pretensioner (IBP)



Pre-Deployment Post-Deployment

POM0119

CAUTION

Keep hands and other objects clear of the retraction path of the seat belt buckle.

Seat belt pretensioner actuators are located at the base of the seat belt buckle cable in the first officer and crew cab seating positions. In the event of a side roll accident, the IGP/IBP deploys at each non-suspension seat location. The cable pretensioner retracts the cable and buckle assembly, removing up to five inches (120 mm) of slack from the belt. The buckle pretensioner is only effective when you wear your seat belt. **ALWAYS WEAR YOUR SEAT BELT.**

Inflatable Head Curtain (IHC)/Supplemental Restraint Air Bag (SRA)

Figure 3-5: Inflatable Head Curtain (IHC)/Supplemental Restraint Air Bag (SRA)

Mounted to seat back

Integral to seat bolster

POM0122/1109

WARNING

Do not sit or lean unnecessarily close to the air curtain. Do not place or mount any object over the air curtain or between the air curtain and the occupants.

Inflatable Head Curtains (IHC) / Supplemental Restraint Airbags (SRA) are mounted on the seat backs of the outboard rear seats or integral to the outboard seat bolster on PS6™ seats. In the event of a side roll accident, the IHC/SRA inflates the curtain air bag to protect the head and neck from contact with the cab structure. The IHC/SRA is designed to work in conjunction with your seat belts. **ALWAYS WEAR YOUR SEAT BELT.**

3-3.3d What to Expect During the Deployment of the Side Roll Protection System

During a side roll accident, the roll sensor will send a signal to deploy the advanced occupant protection devices to restrain and protect the occupants. Below is a list of what to expect at each seating position during deployment.

Driver Position

The driver position is equipped with a Suspension Seat Safety System (S4S) and Inflatable Tubular Structure Side Airbag (ITS). The S4S device will quickly activate and pull the seat belt tightly around the occupant. The ITS side air bag will deploy and position itself next to the driver's head. Simultaneously, the seat will be pulled toward the floor and tightly held down until after the vehicle has rolled and stopped. All this will occur in a fraction of a second.

First Officer Position

The first officer position is equipped with Integrated Gas Pretensioner (IGP) / Integrated Belt Pretensioner (IBP) and Inflatable Tubular Structure Side Airbag (ITS). The IGP will activate and pull the belt snugly around the occupant. The ITS side air bag will deploy and position itself next to the occupant's head. All this will occur in a fraction of a second. The buckle pretensioner will expel some **blue smoke** during deployment. The smoke will have an acrid smell, but will not be harmful.

Rear Occupants

The rear occupant positions are equipped with Integrated Gas Pretensioners (IGP) / Integrated Belt Pretensioners (IBP) and optional Inflatable Head Cushions (IHC) or Supplemental Restraint Airbags (SRA) located outboard of the outside seating positions. The IGP/IBP will activate and pull the belt snugly around the occupant. All this will occur in a fraction of a second. The buckle pretensioner will expel some **blue smoke** during deployment. The smoke will have an acrid smell, but will not be harmful. The IHC/SRA will inflate to protect the head and neck from contact with the cab structure.

3-3.3e What to Do After a Deployment

Vehicle Accident Response Information

⚠WARNING

The roll sensor is located in the vehicle headliner. Disturbing this area, changing the position of the vehicle, or the position of the roll sensor within the vehicle, may cause the protective devices to fire. ALWAYS deactivate the side roll protection system when performing an extrication if unfired protective devices are present.

Protective device actuators have cylinders containing high-pressure gases and/or pyrotechnics. Hot, pressurized gases are present in cylinders even after they have fired. These cylinders should not be cut or punctured under any circumstances.

In case it is necessary to perform the extrication of an occupant of this vehicle, performing any one of the following will disable the roll sensor and any unfired protective devices:

- Deactivating the battery switch, **OR**
- Deactivating the ignition switch, **OR**
- Disconnecting the batteries, **OR**
- Cutting the wires to the protective device actuators.

Fired protective devices pose no toxic threat to rescue personnel. After a side roll accident, the seat belts on all the occupants will be tight, but have specially designed buckles that can be released under belt tension. Use extreme care when releasing seat belt buckles and exiting a damaged vehicle. The ITS side air bag will be deployed and across the doorframe opening on the driver and first officer sides. The ITS may be cut loose with a knife or scissors to facilitate egress of the occupants. It is recommended to cut the black tethers to remove the side airbags. The bags will be filled with warm inert gases. The gases will be nearly invisible, but will have an acrid smell. The gases pose no harm to occupants or rescue personnel.

Pierce Customer Service must be notified whenever the Side Roll Protection System has been activated. DO NOT remove or tamper with any Side Roll Protection System components, except to extricate the occupants.

Returning to Service

⚠WARNING

Do not attempt to remove any Side Roll Protection System components. Any component that did not completely deploy requires special precautions. Contact Pierce Manufacturing for disposal instructions for system components.

After the system is activated, the major components of the Side Roll Protection System will be deployed and cannot be reused. The Suspension Seat Safety System (S4S), Inflatable Tubular Structure Side Airbags (ITS), roll sensor(s), Integrated Gas Pretensioners (IGP) / Integrated Belt Pretensioners (IBP), and Inflatable Head Curtains (IHC) / Supplemental Restraint Airbags (SRA) must be replaced. In addition, the wiring harnesses will require inspection and possible replacement. After all system components are inspected and/or replaced, the integrity of the system must be checked by a Pierce authorized technician. **This service must be performed by Pierce Manufacturing or a Pierce authorized service facility.**

3-3.4 Frontal Impact Protection *(Optional)*

The cab may be equipped with a frontal impact protection system consisting of an air bag in front of the driver, a knee bolster air bag in front of the first officer seating position, and suspension seat safety system (S4S) for suspension seats or belt pretensioners for fixed seats in the driver or forward first officer positions.

The driver side air bag is mounted in the steering wheel and is designed to protect the head and upper torso of the occupant, when used in combination with the seat belt, in the event of a frontal or oblique impact.

The first officer side knee bolster is mounted in the modesty panel below the dash panel and is designed to protect the legs of the occupant, when used in combination with the seat belt, in the event of a frontal or oblique impact.

⚠WARNING

The knee bolster air bag deploys with great force in the event of a crash. Do not place people or objects in the path of the bag. Objects flying from the bag deployment can injure or kill.

In the event of a frontal impact, the system will deploy the driver air bag and first officer knee bolster and activate the following components that are integrated into the driver and first officer cab seats:

- Suspension safety seat system (S4S) will retract the suspension seat to its lowest travel position;
- Belt pretensioners will pretension the seat belts to firmly hold the occupants in place;
- Side Roll Protection air bags (if the truck has this option.)

3-3.5 SCBA Brackets Mounted in Seat Backs

⚠WARNING

Avoid storing SCBA bottles in seat backs of seats that will not be occupied while the vehicle is in motion. SCBA bottles not secured properly in unoccupied seats could cause serious injury or death during a collision. *(Does not pertain to inertia-activated hands-free SCBA holders.)*

Always verify that the seat belt buckle and SCBA harness buckle are in their respective proper receptacle. Interchange between the SCBA harness and seat belt buckles will negate the benefit of the seat belt and death or serious injury may result.

Self Contained Breathing Apparatus (SCBA) bottle brackets are designed to hold the SCBA bottle in position while the firefighter is riding to the fire scene. Bottles mounted in seats without occupants must be fastened using the SCBA mounting bracket manufacturer's restraining device. *(Does not pertain to inertia-activated hands-free SCBA holders.)*

SCBA harnesses are often manufactured using nylon straps and buckles similar in construction to seat belt buckles. Care must be taken to ensure that the occupant does not mistake the SCBA harness buckle for the seat belt buckle. We strongly recommend that fire companies check all SCBA harnesses to ensure that they are not interchangeable with the seat belt buckles and that all firefighters are trained to become aware of this danger.

⚠WARNING

Never operate the vehicle with passengers occupying seats equipped with SCBA brackets without either the SCBA bottles in place or approved back inserts installed to reduce the risk of back injury caused by contact with protruding parts of the SCBA bracket during a collision.

Movable headrests must be placed in the closed position while the vehicle is in motion to reduce the risk of head injury during a collision.

Always leave the SCBA harness loose when riding in the seat. Tight SCBA straps will add the weight of the occupant to the bottle and will pull the bottle out of the holder in the event of a crash. The bottle restraining devices are designed for the weight of the bottle only. SCBA bottles that are not secured properly can injure or kill in the event of a crash.

Seats equipped with SCBA brackets may be used by occupants without SCBA bottles by installing the seat back inserts.

Many SCBA bracket equipped seats include movable headrests that allow the SCBA bottle to be removed without interference with the headrest.

Refer to the SCBA manufacturer's operation manual for proper use instructions.

3-3.6 Seat Adjustment

WARNING

Certain suspension style seats must be adjusted individually for each occupant to maintain adequate head clearance while the vehicle is in motion, or death or serious injury may result.

Do not adjust driver's seat while vehicle is moving. The seat could suddenly or unexpectedly move causing the driver to lose control of the vehicle.

Operating this vehicle over rough roads or surfaces can result in personal injury. Use caution and reduce speed. Properly adjusted seats and seating systems may not compensate completely for severe road conditions.

Several suspension style seat options are offered for the front seating positions of Pierce fire apparatus. Suspension seats improve comfort by absorbing road deflections and vibrations. The motion of the seat suspension reduces the available head clearance.

For suspension type seat adjustment, refer to the seat operator's manual or to the decal attached to seat frame as supplied by the seat manufacturer.

3-3.7 Adjustable Foot Pedals *(Optional)*

After adjusting the seat, use the pedal adjustment switch to move the throttle and brake pedals to a comfortable position. The pedals offer three inches of adjustment.

3-4. Axles

3-4.1 Meritor Driver Controlled Differential Lock (DCDL) *(Optional)*

CAUTION

When DCDL is engaged, an "understeer" condition can occur when making turns, so operate the vehicle carefully. When you disengage DCDL, normal steering resumes.

If the vehicle is equipped with DCDL:

- Engage DCDL only under poor road conditions.
- Do not engage during downhill operation.
- Do not engage DCDL or operate the vehicle at speeds above 25 mph.

3-4.2 Dana Drive Axle Wheel Differential Lock *(Optional)*

⚠CAUTION

Engage Wheel Differential Lock ONLY when vehicle is stationary, or moving without wheel slippage.

To engage:

1. Flip the control lever to the LOCK position, either while the vehicle is stationary, or while moving at a steady speed under 25 mph without the wheels slipping (spin out).
2. Let up momentarily on the accelerator pedal to relieve torque on the gearing and fully engage the clutch.
3. When the differential lock is engaged, the indicator light will be ON, or an audible signal will sound.
4. When the differential lock is engaged, the vehicle will understeer, requiring a longer turning radius for a given turn.

To disengage:

1. To disengage the Wheel Differential Lock, flip the control lever to UNLOCK.
2. Let up momentarily on the accelerator pedal to relieve torque and allow the clutch to disengage.
3. When the differential lock is disengaged, the indicator light and/or audible signal will go out.

3-4.3 Inter Axle Differential (IAD) Lock (Tandem Axles)

CAUTION

Lock the Inter Axle Differential only when stopped or moving at a slow speed. Never attempt to lock the Inter Axle Differential while the rear wheels are spinning as this may cause shock damage to the axle components and result in costly repairs.

Never shift a two-speed tandem axle from one range to another with the IAD in the LOCKED position. This may cause shock damage to axle components and result in costly repairs.

The inter-axle differential provides for necessary differential action between the axles of a tandem drive unit. This allows the wheels of either axle to revolve faster or slower than the wheels of the other axle in order to compensate for cornering, uneven road surfaces, and slightly different tire sizes. When encountering soft or slippery road conditions, the IAD can be locked out, eliminating any differential action between the axles.

Lock the inter-axle differential and achieve maximum pulling power when approaching slippery or poor road conditions.

After engaging the IAD Lock switch and proceeding at a slow, even speed, let up momentarily on the accelerator pedal to allow the lock to engage. Proceed over the poor road conditions cautiously.

Once road conditions have improved, move the IAD Lock switch to the UNLOCK position while maintaining vehicle speed. Let up momentarily on the accelerator to allow the lock to disengage. Resume driving at normal speed.

3-4.4 Two-Speed Rear Axle

The two-speed rear axle switch permits selection of either the high or low axle ratio.

Downshift	Move selector switch to low. Release and depress the accelerator quickly.
Upshift	Move the selector switch to the high range with the accelerator depressed. Release the accelerator and pause until the shift is complete.

3-5. Brakes

⚠WARNING

Brakes and brake systems must be maintained and adjusted properly. Failure to properly maintain or adjust the brakes can lead to reduced brake performance, property damage, or personal injury.

3-5.1 Downhill Operation or Heavy Braking

Always rely on the braking effect of the engine, engine brake, exhaust brake, or retarder when descending a grade or when anticipating frequent heavy deceleration. If service brakes alone are used to control vehicle speed, excess heat may be developed causing brake fade. Brake fade occurs when the brake drums become hot and expand away from the brake shoes and the stroke of the slack adjusters become less effective. If service brakes are required to supplement retardation, apply the brakes in short durations of 5 to 10 seconds rather than a continuous application. This will minimize heat buildup and reduce the possibility of brake fade.

The brake lining material used on Pierce Custom Chassis has been selected in conjunction with the axle manufacturers to provide the best balance of stopping distance performance, grade holding capacity, and lining life. Brake lining life is dependent on the type of service to which the vehicle is subjected and is heavily influenced by driving habits.

3-5.2 Air Pressure Gauge, Indicator Light, and Audible Alarm

⚠WARNING

The quick buildup feature allows the vehicle to be driven even though the front brake section may not have sufficient air pressure to enable sustained or full force braking. Use extreme caution when operating the vehicle with either air brake section charged to less than 60 psi, or property damage or personal injury could result.

The air pressure gauges indicate the amount of pressure in each section of the split air brake system. The indicator light will light and the alarm will sound any time the ignition switch is set to the run position and the pressure in either section is less than approximately 60 psi.

The quick buildup feature allows the pressure to be built up in the rear brake section first to enable release of the parking brakes before the pressure in the front section is adequately charged. This is a feature unique to the fire apparatus industry and is part of the NFPA recommendations. This feature is meant to allow the vehicle to be driven as soon as possible in the event of an emergency response.

3-5.3 Antilock Braking System (ABS)

⚠WARNING

ABS cannot provide more braking performance than the road conditions will permit. Reduce speed during slippery conditions, or serious injury or death may result.

The antilock braking system automatically applies and releases the brakes during low traction or panic brake applications to minimize the stopping distance and improve steering control. ABS will prevent wheel lock-up at all times. Push the pedal steadily (do not pump brakes) until the vehicle speed has been reduced to the desired level.

3-5.4 Traction Control *(Optional)*

Automatic Traction Control (ATC) is an optional feature of the ABS system. ATC operates in two ways:

It applies the service brake to a spinning wheel so that the torque can be transferred through the differential to the wheel that has the traction. It reduces engine torque when both wheels are spinning to improve traction. The ATC light located in the cab will light when the ATC feature is active.

A traction control switch is provided with the ATC option. This function increases available traction on extra soft surfaces like snow, mud, or gravel by slightly increasing the permissible wheel spin. When this feature is selected, the ATC indicator light will blink continuously.

3-5.5 Parking Brakes

⚠WARNING

When parking on a grade, always block wheels and turn the front wheels completely in the direction of the curb. Failure to follow these procedures may lead to loss of vehicle control, property damage, personal injury, or death.

Never attempt to disassemble a spring brake chamber as the release of a powerful spring could result in severe personal injury or death.

All Pierce Custom Chassis are equipped with spring brakes on the rear axles for parking. The spring brakes are applied by operation of the yellow parking brake valve. These brakes are intended to hold the vehicle in a parked position or to assist in bringing it to an emergency stop and should not be used for normal driving.

If air pressure is lost in the rear service brake section, the spring brakes will be modulated by pressure from the front brake section allowing a few brake applications before the spring brakes are automatically applied. If air pressure is reduced to approximately 40 psi in both systems, the spring brake valve will automatically apply.

3-5.6 Manual Parking Brake Release

⚠WARNING

To avoid the loss of vehicle control resulting in property damage or personal injury, block the wheels of the vehicle to prevent motion before attempting to manually release spring brake chambers.

Spring brake chambers require air pressure to release. If sufficient pressure is not available and the vehicle must be towed, the spring brakes can be manually released or “caged.”

To manually release the spring brake chambers, use the caging stud supplied with the spring brake chamber. Insert the stud into the chamber and turn to engage the stud in the slots. Tighten the nut on the caging stud with a wrench to compress the spring and release the brake. After the need for caging the brakes has past, charge the spring brake chambers with air pressure and remove the caging stud.

3-5.7 Emergency Parking Brake Release *(Optional)*

⚠WARNING

The emergency parking brake release feature allows the vehicle to be driven even though service brakes may not have sufficient air pressure to enable sustained or full force braking. Never exceed 2 mph with the emergency parking brake release engaged and use extreme caution when operating the vehicle with either air brake section charged to less than 60 psi, or property damage or personal injury could result.

The emergency parking brake release option allows the operator to override the parking brake safety feature that prevents the spring brakes from being released until minimum pressure has been built up in the air brake system. Air pressure for the spring brake release is supplied by a dedicated air tank.

3-5.8 Auxiliary Front Wheel Lock *(Optional)*

⚠WARNING

The auxiliary front wheel lock feature uses air brake system pressure to keep the front brakes applied. It should be used only with the engine running and a qualified attendant present at all times. It is a supplemental brake only, which does not meet the FMVSS parking brake criteria and must be used in conjunction with the yellow parking brake valve when parking the vehicle. Failure to follow these precautions could lead to loss of vehicle control causing property damage, serious personal injury, or death.

The auxiliary front wheel lock feature allows the operator to engage the service brakes on the front axle to gain additional grade holding capability, or to improve stability when the aerial device outriggers raise the rear wheels off the ground. The parking brake must be engaged before the auxiliary front wheel lock will function.

3-5.9 Air Reservoir Moisture Draining

Collection of moisture in the air reservoirs due to condensation is normal even though the vehicle is equipped with an air dryer. Open the petcocks on each air tank to drain the condensate.

3-5.10 Air Dryer

Every Pierce Custom Chassis is equipped with an air dryer that removes moisture and contaminants from the pressurized air before it reaches the air reservoirs. Moisture is collected on the surface of desiccant pellets and is discharged out the bottom of the air dryer each time the governor unloads.

3-5.11 Grade Holding and Brake Burnishing

WARNING

The capability of the vehicle to hold on a specific grade may decrease temporarily whenever new friction material is installed. Use wheel chocks when parking on a grade to avoid loss of vehicle control resulting in possible property damage, personal injury, or death.

The ability of the vehicle to park downhill or uphill is affected by the conformity of the friction material to the brake drum or rotor. This conformity improves through the natural burnishing action of brake applications during the early life of the vehicle. The ability of the vehicle to hold on a specific grade is determined after the brakes have been fully burnished. See *"Brake Burnishing"* on *page 2-5* for additional information.

3-6. Auxiliary Braking System

WARNING

The use of any compression brake or exhaust brake systems during slippery road conditions or inclement weather may cause rear wheel lock-up and loss of vehicle control, resulting in property damage, personal injury, or death.

An Auxiliary Brake System provides braking torque through the driveline to the rear wheels. The use of an auxiliary brake reduces brake wear, reduces brake heat buildup, and can help to minimize the occurrence of brake fade during heavy or frequent braking.

An Electronic Control Unit (ECU) in the Antilock Braking System (ABS) monitors the wheels and turns off the auxiliary brake if it senses that the wheels are not spinning at the same speed. The ABS ECU does not know to turn off the auxiliary brake until an ABS event has already occurred. In the split second between the ABS sensing the skid and the time it takes for the auxiliary brake to shut off, there may be a skid initiated. For this reason, Pierce Manufacturing recommends turning off the Auxiliary Brake System during slippery conditions.

3-6.1 Compression Brake

The compression brake (Jake Brake® or equivalent) is an electronically actuated mechanical system added to the engine valve train. When activated, the compression brake alters the operation of the engine's exhaust valves so that the engine works as a power-absorbing air compressor.

3-6.2 Exhaust Brake

The exhaust brake (Extarder®, Blue-Ox®, or equivalent) consists of a flapper valve installed in the exhaust pipe between the engine and the muffler. When activated, the flapper restricts the passage of the exhaust gases and increases the back pressure in the cylinders during the exhaust stroke. This increases the natural retardation effect of the engine. Braking torque at the wheels will vary depending on the transmission range selected.

3-6.3 Electromagnetic Retarder

The electromagnetic retarder (Telma® or equivalent) may be mounted in the driveline or attached directly to the rear axle. When activated, electrical power is supplied to a series of coils in the retarder that create an electromagnetic field. This field inhibits the rotation of the rotor and creates a braking torque at the rear wheels. Various options allow the retarder to be applied in stages either manually or by combinations of brake and accelerator pedal settings. Heat generated by the retardation effect is dissipated by cooling fins on the retarder.

3-6.4 Hydraulic Retarder

CAUTION

Observe the following cautions when driving a vehicle equipped with a hydraulic retarder.
Apply and operate the retarder only when the engine is at closed throttle.
Observe transmission and engine temperature limits at all times. Select the lowest possible transmission range to increase the cooling system capacity and total retardation available.
In the event of overheating, decrease the use of the retarder; use service brakes.
Observe the retarder "over-temp" light to ensure that the vehicle control system is functioning properly.
Refer to the Allison Transmission operator's manual for additional cautions.

The hydraulic retarder (Allison® Transmission Retarder or equivalent) uses the viscous property of transmission fluid to retard the driveline. When activated, transmission fluid is introduced into the retarder housing and energy is absorbed into the fluid through the opposing action of spinning vanes. This retards the vehicle through the rear wheels and adds heat to the transmission fluid. This heat is dissipated through the transmission cooler and radiator.

Retarder Brake Capacity

The maximum braking capacity of Allison retarders is determined by the transmission Electronic Control Unit (ECU) calibration. This capacity is specified at the time of purchase to provide the low, medium, or high capacity setting. This capacity setting indicates the maximum retardation force with the system fully applied. Low settings will provide auxiliary braking force with moderate cooling system heat loads. High settings will provide aggressive auxiliary braking, but may limit the amount of time that the retarder can be applied before exceeding the cooling capacity of the vehicle.

Control Systems

The control system may be specified in many versions. The most popular control systems are described below.

Throttle 100%	The retarder applies fully whenever the throttle pedal is released.
Throttle 50% - Brake 50%	The retarder is applied to half its capacity when the throttle pedal is released, and applied to its full capacity when the brake pedal is depressed.
Throttle 33% - Brake 67%	The retarder is applied to one third its capacity when the throttle pedal is released, and applied to its full capacity when the brake pedal is depressed.
Hand Lever Control	The retarder is applied when the throttle pedal is released. The percent of application is controlled by a six-position hand lever.
Foot Pedal	The retarder is applied when a dedicated foot pedal is depressed. Retardation force increases proportionally as the pedal is depressed farther.

Overheat Warnings

Because the retardation force is created by the churning action of transmission fluid within the retarder housing, a significant amount of waste heat is generated. This heat is transferred to the radiator coolant via a shell and tube heat exchanger. The radiator is thus ultimately required to dissipate heat generated both during vehicle acceleration (engine and transmission heat load) and during braking (retarder heat load). During heavy use and high ambient temperatures, the extra heat load created by the retarder may exceed the rate at which the cooling system can dissipate the transmission fluid heat load (at the shell and tube cooler) or the total heat load (at the radiator). **The vehicle operator must observe the transmission temperature gauge & warning lights and reduce retarder use if the transmission fluid temperature climbs too high.**

When the cooling system capacity is exceeded, the transmission ECU will begin to cut back on the retardation output to limit the degree of overheating, but not before the system temperatures have peaked beyond the normal operating range. The warning light in the center of the instrument panel will illuminate and an alarm will sound when the transmission output temperature exceeds 330°F, or if the transmission sump temperature exceeds 250°F. A warning light adjacent to the transmission temperature gauge will illuminate and an alarm will sound if the gauge reading exceeds 335°F. This provides a redundant warning to the operator that the critical temperatures have been exceeded.

If the transmission high temperature warning light is illuminated, the transmission ECU will change the shift sequence to hold the transmission in gear longer, effectively increasing the rpm of the engine. This increases the speed of the cooling fan and water pump, which will increase the heat transfer rate of the cooling system and thereby hasten the return of the transmission sump temperature to within the normal operating range.

Operation in High Ambient Temperature Conditions

The influence of retarder use on the cooling system temperatures will vary with the retarder capacity and the control system options. The higher capacity settings produce higher amounts of heat. Control systems that apply 50 to 100 percent of the retarder as the throttle pedal is released produce the heaviest heat load. Frequent cycling on and off the throttle pedal builds up heat rapidly even though the situation may not require braking effort. If constant use of the retarder produces frequent overheat situations, consult your Pierce Dealer regarding a change to the control system or capacity setting that will better suit your duty cycle and environmental conditions.

3-7. Cab Occupant Capacity

⚠WARNING

All occupants must be seated and belted when the apparatus is in motion or serious injury or death may result.

Do not ride on the rear step or any other area outside the cab while the vehicle is in motion or death or serious injury may result.

Never transport more people than the seating capacity of the vehicle. Carrying additional personnel may result in death or serious injury.

The number of occupants that can be safely carried is listed on the Federal Motor Vehicle Safety Standard (FMVSS) information decal located inside the cab. Only those seating positions equipped with factory installed seat belts are to be occupied while the vehicle is in motion. Any seat, bench, or stool not equipped with a factory installed seat belt is to be used by emergency personnel only while the vehicle is stationary with the parking brakes properly applied.

3-8. Cab Step Operation - *Quantum*®

3-8.1 Air Pressure Requirements

⚠WARNING

Steps when deployed protrude beyond the legal width of the vehicle. Operation of the vehicle with the steps in the down position may result in damage to the steps or pose a hazard to nearby objects or pedestrians.

The fold-down steps operate with air pressure stored in the wet tank of the air brake system. A pressure protection valve allows the steps to be operated as long as the wet tank pressure remains above 85 psi. This pressure protection feature ensures that the brake system will always have priority in the event that the main air system pressure drops below 85 psi. With the engine running, the main air compressor will regenerate the system sufficiently to allow continuous operation of the steps. With the engine shut down, the wet tank charged to 110 psi, and no auxiliary air supply connected, the steps will operate for approximately 10 cycles before depleting the reserve volume.

In the event that normal leakage or maintenance functions have left the vehicle air tanks totally depleted of pressure, the air system must be recharged before operating the vehicle. The spring brake chambers on the rear axle cannot be released until the main system pressure reaches 60 psi. At full governed engine rpm this will occur within approximately 30 seconds, at which time the parking brake control valve can be released and the vehicle allowed to move. The steps, however, will not have pressure to raise to their stowed position until the main system pressure reaches 85 psi. The door-ajar light located in the overhead console will continue to flash until all steps have returned to their stowed position.

To avoid delay in responding to fire calls, keep the vehicle connected to an external air pressure source whenever parked in the fire station. If an external air source is unavailable, the optional 120-volt on-board compressor or optional 12-volt on-board compressor can be used in its place. If so equipped, the vehicle should be supplied with a shoreline to operate the 120-volt compressor, or a battery charger to supply the 12-volt compressor. The compressor is located above the first officer side cab fender liner and can be accessed for service by removing the center section of the liner.

3-8.2 Speed of Operation

The speed at which the steps extend and retract is governed in part by the setting of the pressure regulation valve located above the fender liner on the first officer side of the cab. This pressure has been preset at the factory to provide quick and smooth operation while minimizing objectionable noise. The speed of operation will vary slightly with changes in temperature, valve adjustment, and lubrication.

3-8.3 Step Actuation

The air valves that control the extension and retraction of each step are located below the cab floor. These brackets are designed to flex as the doors are closed. Each step should retract as soon as the cab door is closed to the first catch of the latch.

3-9. Cab Tilt Operation

⚠WARNING

Remove all loose items from the cab compartment before tilting as contents may shift or drop causing property damage or personal injury.

Never work around or under a tilted cab unless the stay arm or mechanical support is secured in the support position. Hydraulic cylinders can leak or drift and cannot be relied upon to support the cab on their own. Failure to ensure that the stay arm is securely in its support position could cause severe personal injury or death.

CAUTION

Check front bumper extension to ensure that covers are shut and plumbing swivels are rotated forward before tilting cab to avoid possible interference and subsequent property damage when cab is fully tilted.

Always ensure that the vehicle is on a flat and level surface before tilting the cab. Tilting the cab on an inclined or non-flat surface may produce interference between components as the cab is lowered causing damage to the air intake seal and engine tunnel.

If the cab fails to lower after following the proper instructions, do not attempt to force it. Have the system checked by a qualified mechanic, refer to *"Cab Tilt System"* on *page 4-6* in the Maintenance section of this manual, and the Cab section of the Service manual.

The air conditioning system should be shut down prior to tilting the cab. Failure to do so will result in water condensation build-up in the evaporator cover. This water will drip out through the openings in the cover and can pour out as the cab is tilted down after service.

Pierce Custom Chassis may be equipped with one of three types of cab tilt systems.

- The **Type I** system includes a lever-operated hydraulic valve to change the direction of the fluid flow to the lift cylinders in conjunction with a two-position toggle switch (ON-OFF) to operate the electric pump.
- The **Type II** system has two momentary switches (Lock Release & Activate) with a Raise/Lower switch.
- The **Type III** system has a momentary handheld switch, on a coiled tether, with a Raise/Lower switch.

Every tilt cab has a mechanical means of supporting the cab once it has been tilted. Some models employ a stay arm that must be positioned manually. Other models incorporate a locking channel as part of one of the lift cylinders.

3-9.1 Cab Lift System - *Saber*®

WARNING

Always check for people working on or around the cab before raising or lowering the cab. Failure to ensure that everyone is clear of the cab could cause severe personal injury or death.

To Raise Cab

1. Before tilting the cab, ensure that the vehicle is on a flat and level surface, parking brakes are set, loose items in cab are secure, and there are no obstructions in the tilt path.
2. Ensure that the battery and ignition switches are “ON.”
3. Locate the cab lift controls (location varies depending on chassis model).
4. Rotate the control lever on the valve to the RAISE position (valve not present on some models).
5. Activate the lift pump toggle switch and hold until the cab is fully tilted.
6. Release the stay arm from its stowed position and secure the stay arm in its support position.
7. Rotate the control lever on the valve to the lower position and allow the cab to settle onto the stay arm support.
8. Return the control lever to the raise position to hydraulically lock the cylinders in place.

To Lower Cab

1. Rotate the control lever on the valve to the RAISE position.
2. Operate the toggle switch to raise the cab and relieve pressure on the stay arm.
3. Return the stay arm to the stowed position.
4. Rotate the control lever on the valve to the LOWER position.
5. Leave the control lever in the LOWER position for road operation. Cab locks will engage automatically.
6. Check to ensure the cab is fully seated and latched before operating vehicle.

3-9.2 Cab Lift System - *Arrow XT™/Quantum*®

WARNING

Always check for people working on or around the cab before raising or lowering the cab. Failure to ensure that everyone is clear of the cab could cause severe personal injury or death.

To Raise Cab

1. Turn on the battery and ignition switches. Set parking brake.
2. Turn the control switch to RAISE position.
3. Press the activate switch until the cab is fully tilted and the stay arm is engaged.

To Lower Cab

1. Turn on the battery and ignition switches. Set parking brake.
2. Turn control switch to the RAISE position and momentarily activate the lift pump to ensure the stay arm will clear the cylinder.
3. Set the control switch to the LOWER position.
4. Press and hold the lock release switch and press the activate button.
5. Hold the activate switch for at least 5 seconds after the cab comes to rest.

6. Check to ensure the cab is fully seated before operating vehicle.

3-9.3 Cab Lift System - *Velocity™/Impel™*

⚠WARNING

Always check for people working on or around the cab before raising or lowering the cab. Failure to ensure that everyone is clear of the cab could cause severe personal injury or death.

To Raise Cab

1. Before tilting the cab, ensure that the vehicle is on a flat and level surface, engine is off, transmission is in neutral, and the parking brakes are set.
2. Turn on the battery and ignition switches. Set the parking brake.
3. Turn the control switch to RAISE position.
4. Depress the tether switch until the cab is fully tilted.
5. Remove the stay arm from its stowed position and raise it into the stay arm pocket on the engine tunnel.
6. Turn the control switch to the LOWER position and depress the tether switch until the top of the stay arm is inside the stay arm pocket and the cab is lightly resting on the stay arm.

To Lower Cab

1. Turn on the battery and ignition switches. Set the parking brake.
2. Turn the control switch to the RAISE position and momentarily activate the tether switch until the cab is fully tilted and the stay arm can be lowered.
3. Lower the stay arm and lock it in the stowed position.
4. Set the control switch to the LOWER position.
5. Depress and hold the tether switch to lower the cab.
6. Continue to depress the tether switch for at least 5 seconds after the cab comes to rest.
7. Check to ensure the cab is fully seated before operating the vehicle.

3-9.4 Manual Pump Operation *(Optional)*

If the chassis is equipped with a manual pump option, the tilt pump can be operated by hand in the event that power is lost on the vehicle. Locate the pump handle and insert it in the tube at the pump pivot. Use the same procedures as listed above but with the following exceptions:

Saber®:

Operate the hand pump to supply hydraulic pressure in place of activating the toggle switch.

Quantum®/Arrow XT™/Velocity™/Impel™:

CAUTION

Do not overtighten the flow control valve. Overtightening could cause the valve not to function properly, and cause the cab not to tilt or lower as desired.

Operate the hand pump in place of moving the toggle switch to the RAISE position. Operate the hand pump rapidly for the first few strokes so that the fluid flows rapidly enough to close the internal system bypass valve.

Locate the small push button at the end of the descent valve solenoid on the hydraulic power unit. Turn this button counterclockwise and pull out in place of moving the toggle switch to the LOWER position. To raise the cab, this button must be pushed in and rotated clockwise.

3-10. Cooling System

⚠WARNING

Always allow the engine to cool before opening the pressure cap. Wrap a thick, heavy cloth around the cap. Push down, and turn the cap to the first notch position. Pause before opening completely to allow any remaining pressure to escape. Follow this procedure to avoid burns from hot steam or coolant.

Do not operate the engine if the cooling fan is worn, notched, bent, damaged in any manner, or comes in contact with any other chassis component while spinning, or personal injury or death may result.

CAUTION

The optional emergency radiator refill feature allows the engine cooling system to be replenished with water supplied by the fire pump and tank. This option should be used only in a true emergency. Use of this option could lead to cooling system contamination, clogging, water pump damage, or other problems. If this option is used, the cooling system should be flushed and refilled with properly conditioned, clean coolant as soon as possible.

If the coolant is extremely low and the engine is very hot, allow the engine to cool for at least 15 minutes before adding coolant to avoid thermal shock to the engine block resulting in serious engine damage or reduced component life.

Adequate coolant must be maintained in the cooling system to prevent engine overheat. Check the coolant level by observing the sight glass, coolant expansion tank*, or by checking the low coolant warning indicator on the instrument panel electronic display *(if equipped)*. Refer to the engine manufacturer operator's manual for proper coolant selection, inhibitor levels, and mixing procedures.

Pierce Custom Chassis are configured to engage the fan during pumping operations. All 2007 EPA & 2010 EPA engines are configured to engage the fan clutch when the parking brake is applied, pump is engaged, and the transmission is in 4th gear lockup. This is done to prevent water pressure fluctuations (that may occur when the fan engages and disengages), help cool the steering system, improve air conditioning performance, and cool exhaust components, particularly when trucks are operating at elevated high idles for extended periods of time.

** Arrow XT™/Velocity™/Impel™ only.*

3-11. Electrical

3-11.1 Alternator

CAUTION

Always observe proper polarity when making connections to the electrical system. Improper connection of batteries, jumper cables, and charging systems can cause damage to the electrical system or to the alternator.

All alternators in Pierce Custom Chassis are of the self-energizing type. Start-up of the alternator is delayed until the engine oil pressure reaches operating levels. This design avoids the situation where the alternator attempts to make up for the heavy battery drain caused by starter operation. This reduces the cranking torque required and protects the voltage regulator from overload. It is therefore normal for the voltmeter to register a lower value for several seconds during and following the starting procedure until the engine oil pressure rises sufficiently to activate the alternator.

3-11.2 Ammeter *(Optional)*

The ammeter displays the amount of current being supplied to the battery by the alternator or the rate of discharge from the battery with the engine running. A slight charge to the battery will be indicated even with the batteries fully charged.

3-11.3 Battery

WARNING

Batteries give off hydrogen gas that is highly explosive. Keep all sources of ignition away when working around batteries. Sparks caused by connection of battery terminals, jumper cables, or charging systems can be a source of ignition. Always wear safety goggles and protective clothing when working on or around batteries.

Inhaling of hydrogen gas produced by the normal operation of the battery could result in partial or permanent damage to the respiratory system.

Battery posts, terminals, and related accessories contain lead and lead compounds – chemicals known to cause cancer and reproductive harm. Wash hands after handling.

Whenever disconnecting battery terminals, always disconnect the ground terminal first. When reconnecting, always connect the ground terminal last.

Do not attempt to jump-start a vehicle having a frozen battery, because the battery may rupture or explode. If a frozen battery is suspected, examine all fill vents on the battery. If ice can be seen, do not attempt to start with jumper cables as long as the battery remains frozen. Thaw out battery and recharge.

Do not check battery condition by shorting across terminals.

Failure to observe these instructions could result in property damage, personal injury, or death.

The standard battery offerings supplied with Pierce Custom Chassis are of a maintenance-free design. To ensure a proper electrical supply, battery terminals must be clean and tight. Use hot water and baking soda for removing corrosion and for cleaning the top of the batteries. Polish the contact surface of the terminals with steel wool and apply a light coat of dielectric lubricant before installing terminals. Ensure that the battery terminals are clamped tightly.

3-11.4 Battery Charging Precautions

- Always disconnect battery leads while charging batteries.
- A fast charger should never be used as a booster for starting the engine.
- Always connect battery charger leads to vehicle battery leads of the same polarity.
- Check ground or return circuit polarity visually (or with a voltmeter) before connecting batteries or other voltage-producing components into the system.

3-11.5 Battery Switch

CAUTION

Never turn the battery switch off while the engine is running or damage to the alternator may result.

The battery switch is used to disconnect electrical power to the vehicle to prevent discharge while the vehicle is not in use.

3-11.6 Voltmeter

The voltmeter measures the voltage across the battery terminals and gives an indication of the electrical condition of the battery. Operating voltage while the alternator is charging may vary between vehicles depending on the regulator setting.

3-11.7 Circuit Breakers and Fuses

⚠WARNING

Wire gauge is designed to meet the fuse/circuit breaker ratings or transistor trip amperages. Do not increase the circuit breaker or fuse size. Improper fuse or circuit breaker sizing can cause wires to overheat and burn, which could cause personal injury or death.

Electrical circuits are protected either by circuit breakers or fuses. Vehicles equipped with Command Zone™ also utilize transistors (solid state logic).

3-11.8 Hourmeter

The hourmeter records the number of hours that the engine has run.

3-11.9 Pyrometer *(Optional)*

The pyrometer gauge indicates the exhaust gas temperature.

3-11.10 Speedometer and Odometer

The speedometer indicates the vehicle speed. Speed sensing is provided by a signal from the transmission Electronic Control Unit (ECU) and will be affected by changes in rear axle ratio or tire size.

3-11.11 Low Fuel Warning Light

Saber®/Contender®: Normally, the light blinks when the level in the fuel tank has dropped to the 1/8th mark, and burns steady when the level in the fuel tank has dropped to 1/16th tank. The light can be adjusted to activate at other fluid levels, depending on customer preference.

Quantum®: A caution indicator, chime alarm, and low fuel text message occurs at 1/8th tank, and the warning light, steady tone alarm, and text message with 1/32nd tank.

Velocity™/Impel™/Arrow XT™ with Command Zone™:

When the level in the fuel tank has dropped to the 1/8th tank mark:

- Light in fuel gauge comes on steady,
- Amber caution light in indicator bank comes on steady,
- LCD display CAUTION text will flash with LOW FUEL LEVEL message.

When the level in the fuel tank has dropped to the 1/32th tank mark:

- Red warning light in indicator bank comes on steady,
- LCD display WARNING text will flash with VERY LOW FUEL LEVEL message,
- Caution alarm will chime.

3-11.12 Tachometer

The tachometer indicates engine speed in revolutions per minute (rpm).

3-11.13 Turn Signal Switch

The turn signal switch located on the left side of the steering column is self-canceling. In addition to operating the turn signals, this switch also operates the high beam headlights, windshield wipers* and washers*:

- Turn signals – raise or depress the lever to operate the turn signal lights.
- High beam – low beam switching is accomplished by pulling on the lever until it clicks.
- Headlight flash to pass – pull on the switch lever to flash the headlights with the headlight switch turned off. Pull on the lever gently so that it does not travel to the click position to flash the high beams when the headlights are switched off.
- Windshield wipers – rotate the knob at the end of the lever to activate the wipers (high/low/intermittent)*.
- Windshield washers – depending on the model, press the knob at the end of the lever, or grasp the collar near the end of the stalk and press inward to activate the washers*.

** Velocity™/Impel™/Arrow XT™ with Command Zone™.*

3-11.14 Warning Lights

Warning lights are provided to alert the operator that fluid levels, pressures, or temperatures are outside the normal operating range. These lights may be located together, or next to each corresponding gauge, depending on chassis model. The following warning lights are standard on Pierce Custom Chassis:

- Engine oil pressure
- Transmission oil temperature
- Coolant level
- Air brake pressure – front and rear
- Engine coolant temperature
- Engine air intake restriction
- Voltage level
- Fuel level low

<u>The following apply to Velocity™/Impel™/Arrow XT™ with Command Zone™ only:</u>

- Amber engine warning light (AWL) - check engine
- Red engine stop light (RSL)
- Engine high exhaust temperature (HET)
- Check transmission
- Water in fuel filter
- Auxiliary brake overheat
- Engine diesel particulate filter (DPF) regeneration light
- Engine emissions system malfunction (MIL)
- Air restriction
- Ladder rack down

Vehicles equipped with Command Zone™: On multiplexed vehicles, this warning light information is also monitored by the Command Zone™ system. The Command Zone™ system operates some dash indicators and all alarms. Text messages related to most abnormal conditions are displayed on the Command Zone™ Information Center (CZIC) and on the 4-line LCD display on the instrument panel*.

** Velocity™/Impel™/Arrow XT™ with Command Zone™ only.*

3-11.15 Hazard Flashers

A switch located on the lower left side of the steering column actuates the hazard flashers. The hazard flashers will operate with the battery master switch and ignition switch in the ON position.

3-11.16 Starter and Ignition Switches

Pierce Custom Chassis are equipped with an ignition switch and a starter switch. The ignition switch engages operational power to the chassis. The starter switches engage the starter motor for cranking.

3-11.17 Radio Installation

CAUTION

Failure to follow the installation guidelines, even though the equipment may appear to operate satisfactorily, may lead to low voltage problems, radio frequency interference, or poor radio performance.

Vehicles equipped with Command Zone™: **Failure to follow the installation guidelines may lead to radio frequency interference, which can affect the operation of multiplex components.**

Disconnect all solid-state devices before welding on the vehicle, or equipment damage may result.

Any radio or other electronic equipment should be installed with the utmost care and craftsmanship by qualified personnel only. Refer to the *"Mobile Radio Installation Guide"* on *page A-1* before installing radio equipment.

3-12. Engine

3-12.1 Starting the Engine

Diesel engine starting motors require a significant amount of current during the starting process. Keep all unnecessary electronic loads turned OFF while starting the engine. Use the following steps for starting the engine:

1. Verify that the parking brake is engaged.
2. Place transmission shifter in **N**eutral.
3. Turn battery master switch to the ON position.
4. Move ignition switch to ON position.
5. *Vehicles with Command Zone™:* Wait until prove out completes (approximately four seconds). If this is not done, it may cause intermittent alarms to occur.
6. *Vehicles equipped with Side Roll Protection System:* The Side Roll Protection System fault light should illuminate (bulb check). If the fault light does not illuminate, or remains lit after 30 seconds, contact your Pierce Dealer. The vehicle may be driven, but should only be done so with the knowledge that the Side Roll Protection System may be partially or completely inoperative. The cause of the fault indication must be corrected as soon as possible. See *"Side Roll Protection System (Optional)" on page 4-33* for additional information.

CAUTION

If the engine does not start within 15 seconds, release the starter buttons and allow the starter motor to cool for 60 seconds before attempting to start the engine again.

7. Push the starter button.
8. When engine starts, release the starter button.

3-12.2 Running the Engine

⚠WARNING

Internal combustion engines give off hazardous fumes and gases while running. Do not operate the engine in an area where exhaust gases can accumulate, or serious injury or death may occur.

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

The exhaust system can get extremely hot without warning. Keep away from exhaust gas and do not park vehicle near flammable material. Do not touch exhaust pipes or parts. Hot metal and exhaust gas will burn skin.

3-12.3 Engine-Specific Operation Instructions

IMPORTANT: Refer to the engine operator's manual for additional information, troubleshooting, and safety instructions.

3-12.4 Stopping the Engine

CAUTION

Never stop the engine by turning off the battery switch, or alternator damage may result.

Running the engine at idle allows the lubricating oil and coolant to carry heat away from the combustion chamber, bearings, shafts, etc. This is especially important with turbocharged engines. The turbocharger contains bearings and seals that are subject to the high heat of combustion exhaust gases. While the engine is running, this heat is carried away by normal oil circulation. If the engine is stopped suddenly, the turbocharger temperature may rise as much as 100°F (56°C). This may result in seized bearings or loose oil seals. Failure to idle the engine for the proper length of time before shutdown can lead to reduced engine life or engine component failure.

1. Bring the truck to a complete stop using the service brakes.
2. Shift transmission into **N**eutral.
3. Set parking brake.
4. Idle engine for 3 to 5 minutes.
5. Turn ignition switch to OFF position.
6. Turn battery selector switch to OFF position.

3-12.5 After Treatment Device (ATD) Regeneration - *Detroit Diesel Series 60 - 2007 EPA*

WARNING

Parked Regeneration causes high exhaust gas temperatures at zero vehicle speed. Keep personnel away from exhaust outlet to avoid serious burns and injury.

CAUTION

Do not perform parked regeneration while connected to an exhaust extraction system. Damage to the exhaust extraction system may result.

3-12.5a Basic Operation of the After Treatment Device

2007 EPA engines are required to use an After Treatment Device (ATD) for controlling emissions. This means a special canister has replaced the typical muffler. This canister contains a Diesel Oxidation Catalyst (DOC) and a Diesel Particulate Filter (DPF). The DPF will trap particulate matter while the engine is running. Over time, soot and ash will build up in the filter and must be removed. Soot build-up is removed by heating the filter until the soot oxidizes and turns into carbon dioxide gas. This process is commonly known as regeneration. Ash build-up is removed from the filter by periodic cleaning in a special machine.

The typical ATD is equipped with two pressure transducers and three temperature transducers. These sensors allow the engine to monitor soot build-up and identify cleaning requirements. Engine instrument panel light functionality is explained in *"Instrument Panel Indicator Lights - Detroit Diesel Engines"* on *page 3-68*.

3-12.5b Passive Regeneration

The passive regeneration process allows cleaning of the DPF under normal engine operation and does not require operator interaction. The operator will see no difference in vehicle performance or vehicle control. When the engine has an adequate amount of exhaust heat, the DPF can go through a passive regeneration process. This occurs when the exhaust temperatures leaving the turbo are high enough to remove the soot caught in the DPF. No extra fuel will need to be burned in order for this event to occur.

Passive regeneration is possible while in pump mode operations. The heat being generated by a loaded engine while pumping water may be high enough to allow passive regeneration. The operator will not experience any change in engine performance or engine control during passive regeneration.

3-12.5c Active Regeneration

Active regeneration can occur in two manners, in automatic mode or in parked mode. Automatic regeneration occurs when the engine load, exhaust temperature, and engine speed are within an acceptable range. When the conditions are met, the engine will begin dosing fuel into the exhaust stream to clean the DPF in a regeneration mode. The automatic regeneration cycle does not require an operator to initiate. No change of engine control or engine speed is experienced during the automatic regeneration event. Automatic regeneration may occur during pumping operations.

Active regeneration can also occur when the truck is parked. Parked regeneration allows the cleaning of the DPF in stationary truck operations and requires operator involvement to initiate. The operator will be notified of the need for a parked regeneration by illumination of the DPF light located in the cab. Parked regeneration cannot be initiated during pumping operations.

The sequence of indicator light(s) is as follows:

1. After usage of the engine for a period of time, the DPF light may be illuminated. Once this light is lit, an active regeneration should be initiated within a reasonable amount of time, generally 8 to 10 hours, depending on the duty cycle.
2. If no regeneration occurs after the DPF light illuminates, the DPF light will begin blinking and an active regeneration should be initiated as soon as possible.
3. If the flashing DPF light is ignored, the Check Engine light will illuminate. A parked regeneration must be performed to clean the DPF before further operation. The engine will not de-rate or shut down in this situation.
4. Continuous usage of the vehicle past the previous levels of warning without regeneration will force the need for a thorough cleaning of the DPF. The extreme level of soot build up will be identified by the following instrument panel lights: blinking DPF Regeneration light, solid Check Engine light, and solid Stop Engine light.

Operation of the engine as described in Item 4 may result in excessive soot accumulation. In this case, contact a Detroit Diesel service representative for assistance.

3-12.5d Parked Regeneration

To initiate a parked regeneration, the following must occur:

1. Move the truck to a safe location that prevents the high exhaust heat from causing damage to the road surface or the ground.
2. The driver MUST stay with the vehicle throughout the regeneration process. The procedure will take 20 to 40 minutes.
3. Locate the regeneration switch located in the cab within reach of the driver. This is a momentary style switch.
4. Cycle the parking brake OFF to ON - once an ignition cycle (Parking Brake must be ON).
5. Engine speed should be at idle.
6. Cycle the transmission from Drive to Neutral. The transmission must be in neutral (confirmed by looking at the Allison Transmission Shift Selector and seeing current gear and selected gear are neutral "N").
7. Vehicle speed must be 0 mph.
8. Hold the regeneration switch to the ON position for five seconds and release.

When the request is accepted, the DPF light will illuminate for one second and then go off for the rest of the parked regeneration. The engine speed will increase to 1600 rpm during a parked regeneration. The HEST light will not illuminate until exhaust temperatures exceed the temperature threshold. Breaking any of the required conditions will stop the parked regeneration and engine speed will return to idle.

Upon completion of parked regeneration, the following should occur:

1. The HEST light will remain illuminated until the exhaust outlet temperature is below the temperature threshold or the vehicle speed exceeds 5 mph.
2. The DPF light will turn off, along with all other associated warning lights. If the Check Engine light, Stop Engine light or MIL are still illuminated, a fault condition exists that should be diagnosed by a Detroit Diesel service representative.

To cancel the parked regeneration, the driver can toggle the regeneration switch to ON for five seconds. The DPF light will flash on for one second to show acceptance of the cancellation request and then return to idle. If a parked regeneration is interrupted, the DPF light will illuminate, indicating the need for further regeneration. The DPF light will remain illuminated until the regeneration is completed through either automatic regeneration (by driving or pumping) or by resuming a parked regeneration.

Parked regeneration is not allowed when the DPF light is not illuminated.

3-12.6 After Treatment Device (ATD) Regeneration - *Detroit Diesel DD13 - 2010 EPA*

WARNING

Parked Regeneration causes high exhaust gas temperatures at zero vehicle speed. Keep personnel away from exhaust outlet to avoid serious burns and injury.

CAUTION

Do not perform parked regeneration while connected to an exhaust extraction system. Damage to the exhaust extraction system may result.

3-12.6a Basic Operation of the After Treatment Device

2010 EPA engines are required to use an After Treatment Device (ATD) and a Selective Catalytic Reduction (SCR) for controlling emissions. These two canisters have replaced the typical muffler.

The first canister in the exhaust stream is the ATD which contains the Diesel Oxidation Catalyst (DOC) and the Diesel Particulate Filter (DPF). The DPF will trap particulate matter while the engine is running. Over time, soot and ash build up in the filter and must be removed. Soot build-up is removed by heating the filter until the soot oxidizes and turns into carbon dioxide gas. This process is commonly known as regeneration. Ash build-up is removed from the filter by periodic cleaning in a special cleaning machine.

The typical ATD is equipped with two pressure transducers and three temperature transducers. These sensors allow the engine to monitor soot build up for cleaning requirements. Engine and ATD status is displayed by instrument panel lights. Light functionality is explained in *"Instrument Panel Indicator Lights - Detroit Diesel Engines"* on *page 3-68*.

The second canister in the exhaust system contains the SCR device. This device will reduce nitrogen oxide (NOx) emissions created during the combustion process. The SCR is a catalytic converter that uses vaporized diesel exhaust fluid (DEF). DEF consists of purified water and urea, an organic nitrogen compound that becomes ammonia when heated. The combination of ammonia and nitrogen oxide in a heated environment creates a chemical reaction. The reaction results in the release of nitrogen gas and water vapor, both of which are found naturally in the atmosphere.

3-12.6b Passive Regeneration

The passive regeneration process allows cleaning of the DPF under normal engine operation and does not require operator interaction. The operator will see no difference in vehicle performance or vehicle control. When the engine has an adequate amount of exhaust heat, the DPF can go through a passive regeneration process. This occurs when the exhaust temperatures leaving the turbo are high enough to remove the soot caught in the DPF. No extra fuel will need to be burned in order for this event to occur.

Passive regeneration is possible while in pump mode operations. The heat being generated by a loaded engine while pumping water may be high enough to allow passive regeneration. The operator will not experience any change in engine performance or engine control during passive regeneration.

3-12.6c Active Regeneration

Active regeneration can occur in two manners, in automatic mode or in parked mode. Automatic regeneration occurs when the engine load, exhaust temperature, and engine speed are within an acceptable range. When the conditions are met, the engine will begin dosing fuel into the exhaust stream to clean the DPF in a regeneration mode. The automatic regeneration cycle does not require an operator to initiate. No change of engine control or engine speed is experienced during the automatic regeneration event. Automatic regeneration may occur during pumping operations.

Active regeneration can also occur when the truck is parked. Parked regeneration allows the cleaning of the DPF in stationary truck operations and requires operator involvement to initiate. The operator will be notified of the need for a parked regeneration by illumination of the DPF light located in the cab. Parked regeneration cannot be initiated during pumping operations.

The sequence of indicator light(s) is as follows:

1. After usage of the engine for a period of time, the DPF light may be illuminated. Once this light is lit, an active regeneration should be initiated within a reasonable amount of time, generally 8 to 10 hours, depending on the duty cycle.
2. If no regeneration occurs after the DPF light illuminates, the DPF light will begin blinking and an active regeneration should be initiated as soon as possible.
3. If the flashing DPF light is ignored, the Check Engine light will illuminate. A parked regeneration must be performed to clean the DPF before further operation. The engine will not de-rate or shut down in this situation.
4. Continuous usage of the vehicle past the previous levels of warning without regeneration will force the need for a thorough cleaning of the DPF. The extreme level of soot build up will be identified by the following instrument panel lights: blinking DPF Regeneration light, solid Check Engine light, and solid Stop Engine light.

Operation of the engine as described in Item 4 may result in excessive soot accumulation. In this case, contact a Detroit Diesel service representative for assistance.

3-12.6d Parked Regeneration

To initiate a parked regeneration, the following must occur:

1. Move the truck to a safe location that prevents the high exhaust heat from causing damage to the road surface or the ground.
2. The driver MUST stay with the vehicle throughout the regeneration process. The procedure will take 20 to 40 minutes.
3. Locate the regeneration switch located in the cab. This is a momentary style switch.
   - — Quantum® - located next to the engine diagnostic connector and diagnostic switch below the dash panel.
   - — Velocity™/Impel™ - located next to the engine diagnostic connector and diagnostic switch below the dash panel.
   - — Arrow XT™ with Hardwired Electrical Systems - located on the switch panel right of the dash panel.
   - — Arrow XT™ with Multiplexed Electrical Systems - located next to the engine diagnostic connector and diagnostic switch below the dash panel.
4. Cycle the parking brake OFF to ON - once an ignition cycle (Parking Brake must be ON).
5. Engine speed should be at idle.
6. Cycle the transmission from Drive to Neutral. The transmission must be in neutral (confirmed by looking at the Allison Transmission Shift Selector and seeing current gear and selected gear are neutral “N”).
7. Vehicle speed must be 0 mph.
8. Hold the regeneration switch to the ON position for five seconds and release.

When the request is accepted, the DPF light will illuminate for one second and then go off for the rest of the parked regeneration. The engine speed will increase to 1100 rpm during a parked regeneration. The HEST light will not illuminate until exhaust temperatures exceed the temperature threshold. Breaking any of the required conditions will stop the parked regeneration and engine speed will return to idle.

Operators may notice a slight increase in vehicle vibration during regeneration. The DD13 engine will fire three cylinders during regeneration and operate the other three in engine brake mode. This increases engine load during regeneration and increases exhaust temperatures.

Upon completion of parked regeneration, the following should occur:

1. The HEST light will remain illuminated until the exhaust outlet temperature is below the temperature threshold or the vehicle speed exceeds 5 mph.
2. The DPF light will turn off, along with all other associated warning lights. If the Check Engine light, Stop Engine light or MIL are still illuminated, a fault condition exists that should be diagnosed by a Detroit Diesel service representative.

To cancel the parked regeneration, the driver can toggle the regeneration switch to ON for five seconds. The DPF light will flash on for one second to show acceptance of the cancellation request and then return to idle. If a parked regeneration is interrupted, the DPF light will illuminate, indicating the need for further regeneration. The DPF light will remain illuminated until the regeneration is completed through either automatic regeneration (by driving or pumping) or by resuming a parked regeneration.

Parked regeneration is not allowed when the DPF light is not illuminated.

3-12.6e Selective Catalytic Reduction (SCR) Operation

The operation of the SCR device does not require any driver involvement. The driver is responsible for filling the diesel exhaust fluid (DEF) reservoir to maintain the proper amounts of DEF fluid required by the engine. The DEF reservoir on Pierce custom fire apparatus is 4 1/2 gallons. The fluid level sensor transmits the fluid level directly to the Aftertreatment Control Module (ACM). The ACM is programmed with specific operational parameters which will trigger the instrument panel DEF indicator light as well as induce vehicle performance derates.

As the fluid level drops in the DEF reservoir, the following reactions will occur.

- DEF level between full and 1/4 full: DEF Fluid Low light will remain off.
- DEF level between 1/4 full and 1/8 full: DEF Fluid Low light will illuminate solid.
- DEF level below 1/8 full: DEF Fluid Low light will flash.
- DEF level below 1/4 gallon: DEF Fluid Low light flashing and Check Engine illuminated. The engine will induce a 55 MPH speed limit and 25% engine torque derate.
- DEF Tank Empty: DEF Low light flashing, Check Engine light and Malfunction Indicator Lamp (MIL) illuminated. The engine will induce a 55 MPH speed limit and 25% engine torque derate.
- DEF Tank Empty and Ignored (fuel tank refilled by more than 30% or engine start after the consumption of more than 350 gallons of diesel fuel): DEF Low light flashing; Check Engine light, Stop Engine light, and MIL illuminated. The engine will induce a 5 MPH speed limit and a 25% engine torque derate.

Refilling the DEF tank will deactivate any torque derates, speed limits, and warning lights.

3-12.7 After Treatment Device (ATD) Regeneration - *Cummins ISL Engines - 2007 EPA*

WARNING

Parked Regeneration causes high exhaust gas temperatures at zero vehicle speed. Keep personnel away from exhaust outlet to avoid serious burns and injury.

CAUTION

Do not perform parked regeneration while connected to an exhaust extraction system. Damage to the exhaust extraction system may result.

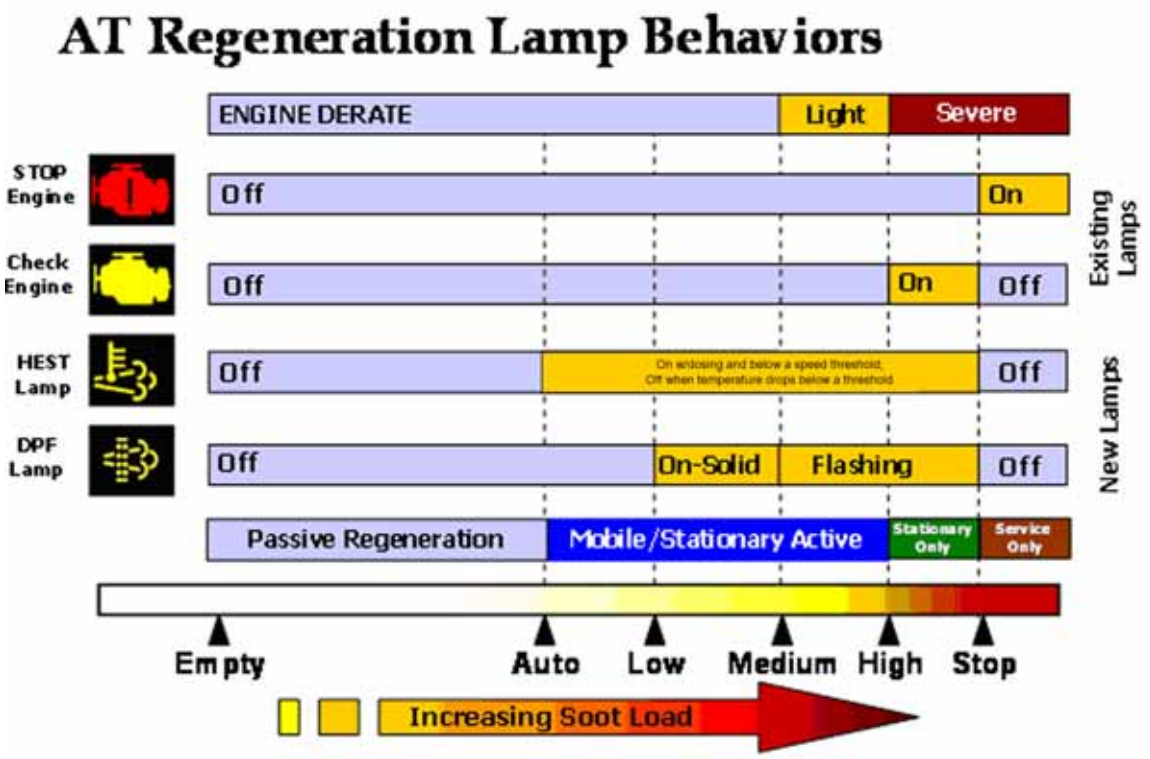
3-12.7a Basic Operation of the After Treatment Device

2007 EPA engines are required to use an After Treatment Device (ATD) for controlling emissions. This means a special canister assembly has replaced the typical muffler. This assembly contains a Diesel Oxidation Catalyst (DOC) and a Diesel Particulate Filter (DPF). The DPF is a ceramic filter that captures soot and ash from the exhaust. Over time, soot and ash build up in the filter and must be removed. Soot build-up is removed by heating the filter until the soot oxidizes and turns into carbon dioxide gas. This process is commonly known as regeneration. Ash build-up is removed from the filter by periodic cleaning in a special cleaning machine.

The Cummins DPF assembly is equipped with a differential pressure transducer and three temperature transducers. These sensors allow the engine to monitor soot build up and identify cleaning requirements. Engine instrument panel light functionality is explained in *"Instrument Panel Indicator Lights - Cummins Engines"* on *page 3-69*.

Exhaust temperatures during a normal regeneration event can get up to 1112°F (600°C).

Figure 3-6: Cummins AT Regeneration Light Behaviors



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3-12.7b Passive Regeneration

The passive regeneration process removes collected soot in the DPF under normal truck operations and does not require operator interaction. The operator will see no difference in vehicle performance during the passive regeneration process. When the engine is operating at higher speeds and loads, there is enough energy in the exhaust to remove the collected soot in the filter. This happens naturally and does not require any action by the engine control system or the operator. No extra fuel will be used, nor will excessive exhaust temperatures occur during passive regeneration. Operators may see the DPF light illuminate and turn off while operating the vehicle. This indicates that the soot level in the DPF temporarily reached a moderately high level, but because the engine operating conditions were right, the passive regeneration process reduced the soot load.

3-12.7c Active Regeneration

The active regeneration process removes collected soot in the DPF through the addition of hydrocarbons (unburned fuel) to the exhaust stream. When the hydrocarbons enter the DPF assembly, the temperature is elevated to a point where removal of the collected soot can occur. This can happen while the truck is being driven, when in stationary truck operations, or during pumping operations. The operator will be notified of the need for regeneration by illumination of the DPF light located in the cab. When the DPF light goes on, the operator can provide assistance by either changing the duty cycle or initiating a stationary regeneration using the regeneration switch, which is located in the cab within reach of the driver.

Active Regeneration During Stationary Operations

The following vehicle conditions must be satisfied before a stationary regeneration can be started using the regeneration switch.

1. Zero vehicle speed
2. Accelerator pedal/remote accelerator at idle

3. Service brake released (brake pedal not depressed)
4. The transmission must be in neutral (confirmed by looking at the Allison Transmission Shift Selector and seeing current gear and selected gear are neutral "N").
5. Engine control mode from accelerator pedal (not PTO, remote PTO, cruise control, etc.)

When a stationary regeneration event is initiated, the DPF light will go off. As the engine adds hydrocarbons to the exhaust stream, the exhaust system temperature goes up. When the exhaust temperature goes above 977°F (525°C), the HEST light will illuminate. Engine speeds will be increased and the sound coming from the turbocharger will change during the stationary active regeneration process, ISM engines will increase speed to 1400 rpm and ISL/ISC engines will increase speed to 1000 rpm. The procedure will take 20 to 40 minutes (depending on the amount of soot accumulated in the filter). Breaking any of the required conditions will stop the regeneration process, and engine operation will return to normal. If excessive soot build up remains in the DPF, the DPF light will return to the appropriate indication stage until an adequate regeneration occurs.

After completion of regeneration, the HEST light will remain illuminated until the exhaust outlet temperature is below 977°F (525°C) or the vehicle speed exceeds 5 mph.

Automatic Active Regeneration During Driving or Pumping Conditions

The following vehicle conditions must be satisfied before the engine will initiate an automatic active regeneration:

1. Accumulation of soot in the filter to the point where the engine control system looks for opportunities to actively regenerate the DPF.
2. Sufficient exhaust flow and temperature conditions (typical pumping or driving conditions should be adequate).
3. Speedometer showing 5 mph or higher vehicle speed.

When the engine determines that it is appropriate to initiate an active regeneration, it adds hydrocarbons to the exhaust stream. When the exhaust system temperature goes above 977°F (525°C), the HEST light will illuminate. Breaking any of the required conditions will stop the regeneration process. If excessive soot build up remains in the DPF, the DPF light will return to the appropriate indication stage until an adequate regeneration occurs. No engine speed or load changes will occur during regeneration in pumping or driving modes.

3-12.7d DPF Build Up Without Regeneration

If the soot load in the DPF builds up and the necessary conditions for regeneration cannot be achieved, the engine lights will indicate a more serious condition. If this occurs, operators should be mindful of the potential for gradual power de-rates due to higher soot loading. If the DPF light begins to flash along with a solid check engine light, the operator may need to take action. This action could be: removing the truck from a mission that requires very high load operation, changing the duty cycle to allow a regeneration to occur, or initiating a stationary regeneration. When the soot load is reduced through effective regeneration, the engine will return to full torque output.

3-12.7e Maintenance

As the soot in the filter is removed in the regeneration process, a small amount of ash is left behind in the filter. Over time, this ash will build up to the point where it must be removed. The engine control system can differentiate between soot build-up and ash build-up. The ash is removed by disassembling the DPF, and cleaning the filter in a special machine. The target for regular maintenance is a 200,000 - 400,000 mile interval, which is dependent on duty cycle, type of oil used, and oil consumption rate. Using CES20081/API CJ-4 oil will maximize the DPF maintenance interval. When the engine senses a build-up of ash, it will light the check engine light and activate a fault code. The ash removal service event is expected to take less than 30 minutes, not including removal and installation.

3-12.8 After Treatment Device (ATD) Regeneration - *Cummins ISL & ISX Engines - 2010 EPA*

WARNING

Parked Regeneration causes high exhaust gas temperatures at zero vehicle speed. Keep personnel away from exhaust outlet to avoid serious burns and injury.

CAUTION

Do not perform parked regeneration while connected to an exhaust extraction system. Damage to the exhaust extraction system may result.

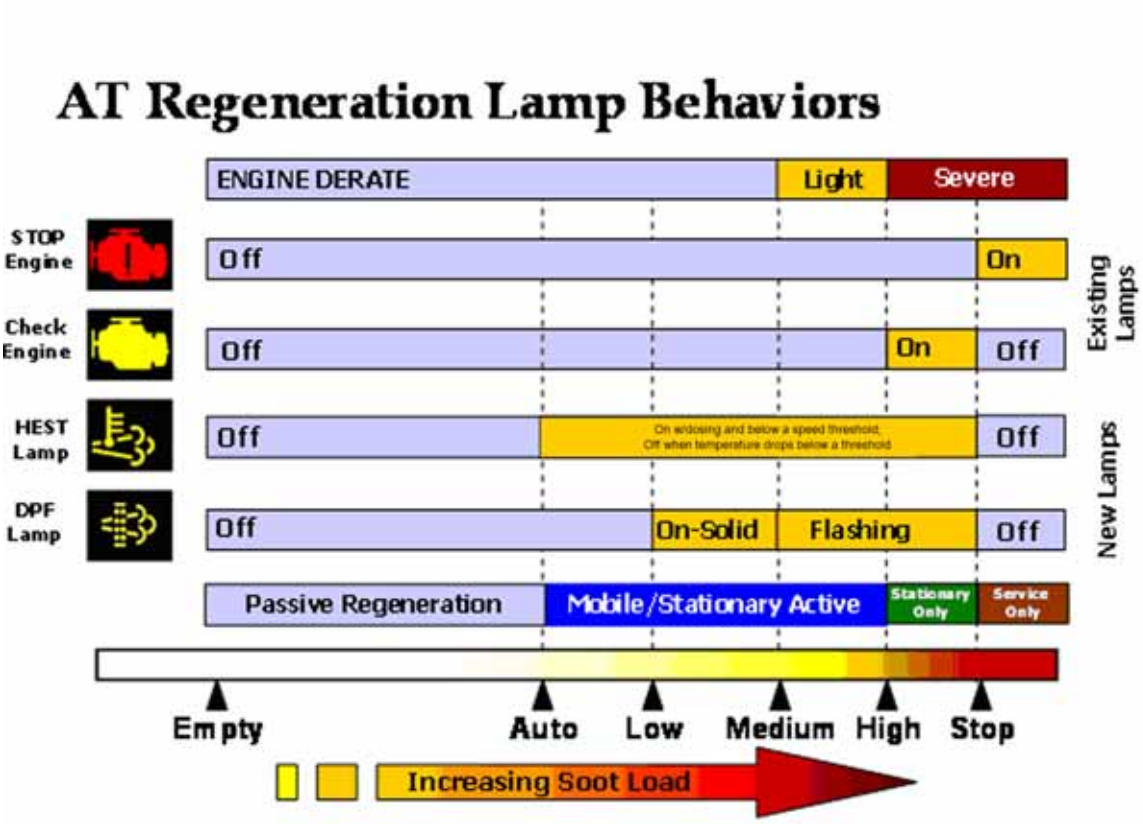
3-12.8a Basic Operation of the After Treatment Device

2010 EPA engines are required to use an After Treatment Device (ATD) and a Selective Catalytic Reduction (SCR) for controlling emissions. These two canisters have replaced the typical muffler.

The first canister in the exhaust stream contains the Diesel Oxidation Catalyst (DOC) and the Diesel Particulate Filter (DPF). The DPF will trap particulate matter while the engine is running. Over time, soot and ash build up in the filter and must be removed. Soot build-up is removed by heating the filter until the soot oxidizes and turns into carbon dioxide gas. This process is commonly known as regeneration. Ash build-up is removed from the filter by periodic cleaning in a special cleaning machine. The typical ATD is equipped with two pressure transducers and three temperature transducers. These sensors allow the engine to monitor soot build up for cleaning requirements. Engine and ATD status is displayed by instrument panel lights. Light functionality is explained in *"Instrument Panel Indicator Lights - Cummins Engines"* on *page 3-69*.

The second canister in the exhaust system contains the SCR device. This device will reduce nitrogen oxide (NOx) emissions created during the combustion process. The SCR is a catalytic converter that uses vaporized diesel exhaust fluid (DEF). DEF consists of purified water and urea, an organic nitrogen compound that becomes ammonia when heated. The combination of ammonia and nitrogen oxide in a heated environment creates a chemical reaction. The reaction results in the release of nitrogen gas and water vapor, both of which are found naturally in the atmosphere.

Figure 3-7: Cummins AT Regeneration Light Behaviors



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3-12.8b Passive Regeneration

The passive regeneration process removes collected soot in the Diesel Particulate Filter (DPF) under normal truck operations and does not require operator interaction. The operator will see no difference in vehicle performance during the passive regeneration process. When the engine is operating at higher speeds and loads, there is enough energy in the exhaust to remove the collected soot in the filter. This happens naturally and does not require any action by the engine control system or the operator. No extra fuel will be used, nor will excessive exhaust temperatures occur during passive regeneration. Operators may see the DPF light illuminate and turn off while operating the vehicle. This indicates that the soot level in the DPF temporarily reached a moderately high level, but because the engine operating conditions were right, the passive regeneration process reduced the soot load.

3-12.8c Active Regeneration

The active regeneration process removes collected soot in the DPF through the addition of hydrocarbons (unburned fuel) to the exhaust stream. When the hydrocarbons enter the DPF assembly, the temperature is elevated to a point where removal of the collected soot can occur. This can happen while the truck is being driven, when in stationary truck operations, or during pumping operations. The operator will be notified of the need for regeneration by illumination of the DPF light located in the cab. When the DPF light goes on, the operator can provide assistance by either changing the duty cycle or initiating a stationary regeneration using the Regeneration Switch, found in the following locations:

- Quantum® - located next to the engine diagnostic connector and diagnostic switch below the dash panel.
- Velocity™/Impel™ - located next to the engine diagnostic connector and diagnostic switch below the dash panel.
- Arrow XT™ with Hardwired Electrical Systems - located on the switch panel right of the dash panel.
- Arrow XT™ with Multiplexed Electrical Systems - located next to the engine diagnostic connector and diagnostic switch below the dash panel.
- Saber®/Custom Contender® - same switch as the diagnostic switch; located on the right hand side of the steering column below the dash panel.

Active Regeneration During Stationary Operations

The following vehicle conditions must be satisfied before a stationary regeneration can be started using the regeneration switch.

1. Zero vehicle speed
2. Accelerator pedal/remote accelerator at idle
3. Service brake released (brake pedal not depressed)
4. The transmission must be in neutral (confirmed by looking at the Allison Transmission Shift Selector and seeing current gear and selected gear are neutral “N”).
5. Engine control mode from accelerator pedal (not PTO, remote PTO, cruise control, etc.)

When a stationary regeneration event is initiated, the DPF light will go off. As the engine adds hydrocarbons to the exhaust stream, the exhaust system temperature goes up. When the exhaust temperature goes above 977°F (525°C), the HEST light will illuminate. Engine speeds will be increased and the sound coming from the turbocharger will change during the stationary active regeneration process. ISL engines will increase speed to 1000 rpm; ISX 11.9 engines will increase speed to 960 rpm; ISX 15 engines will increase speed to 900 rpm. The procedure will take 20 to 40 minutes (depending on the amount of soot accumulated in the filter). Breaking any of the required conditions will stop the regeneration process, and engine operation will return to normal. If excessive soot build up remains in the DPF, the DPF light will return to the appropriate indication stage until an adequate regeneration occurs.

After completion of regeneration, the HEST light will remain illuminated until the exhaust outlet temperature is below 977°F (525°C) or the vehicle speed exceeds 5 mph.

Automatic Active Regeneration During Driving or Pumping Conditions

The following vehicle conditions must be satisfied before the engine will initiate an automatic active regeneration:

1. Accumulation of soot in the filter to the point where the engine control system looks for opportunities to actively regenerate the DPF.
2. Sufficient exhaust flow and temperature conditions (typical pumping or driving conditions should be adequate).
3. Speedometer showing 5 mph or higher vehicle speed.

When the engine determines that it is appropriate to initiate an active regeneration, it adds hydrocarbons to the exhaust stream. When the exhaust system temperature goes above 977°F (525°C), the HEST light will illuminate. Breaking any of the required conditions will stop the regeneration process. If excessive soot build up remains in the DPF, the DPF light will return to the appropriate indication stage until an adequate regeneration occurs. No engine speed or load changes will occur during regeneration in pumping or driving modes.

3-12.8d DPF Build Up Without Regeneration

If the soot load in the DPF builds up and the necessary conditions for regeneration cannot be achieved, the engine lights will indicate a more serious condition. If this occurs, operators should be mindful of the potential for gradual power de-rates due to higher soot loading. If the DPF light begins to flash along with a solid Check Engine light, the operator may need to take action. This action could be: removing the truck from a mission that requires very high load operation, changing the duty cycle to allow a regeneration to occur, or initiating a stationary regeneration. When the soot load is reduced through effective regeneration, the engine will return to full torque output.

3-12.8e Maintenance

As the soot in the filter is removed in the regeneration process, a small amount of ash is left behind in the filter. Over time, this ash will build up to the point where it must be removed. The engine control system can differentiate between soot build-up and ash build-up. The ash is removed by disassembling the DPF, and cleaning the filter in a special machine. The target for regular maintenance is a 200,000 - 400,000 mile interval, which is dependent on duty cycle, type of oil used, and oil consumption rate. Using CES20081/API CJ-4/SL oil will maximize the DPF maintenance interval. When the engine senses a build-up of ash, it will light the check engine light and activate a fault code. The ash removal service event is expected to take less than 30 minutes, not including removal and installation.

3-12.8f Selective Catalytic Reduction (SCR) Operation

The operation of the SCR device does not require any driver involvement. The driver is responsible for filling the Diesel Exhaust Fluid (DEF) reservoir to maintain the proper amounts of DEF fluid required by the engine. The DEF reservoir on Pierce custom fire apparatus is 4 1/2 gallons. The fluid level sensor transmits the fluid level directly to the Dosing Control Unit (DCU). The DCU is programmed with specific operational parameters which will trigger the DEF indicator as well as induce vehicle performance derates.

As the fluid level drops in the DEF reservoir, the following reactions will occur:

- DEF level between full and 1/4 full: DEF Fluid Low light will remain off.
- DEF level between 1/4 full and 1/8 full: DEF Fluid Low light will illuminate solid.
- DEF level below 1/8 full: DEF Fluid Low light will flash.
- DEF level below 1/4 gallon: DEF Fluid Low light flashing and amber Check Engine lit solid. The engine will induce a 25% engine torque derate.
- DEF tank empty and system can no longer maintain DEF pressure: DEF Fluid Low light flashing, amber Check Engine lit solid, and MIL light lit solid. The engine will induce an engine torque derate that begins a 25% and ramps to 40% at a rate of 1% per minute of operation.
- DEF Tank Empty and engine intentionally shut down or in extended idle: DEF Fluid Low light flashing, amber Check Engine lit solid, red Stop Engine lit solid, and MIL light lit solid. The engine will induce an engine rpm limit of 1000 rpms, a 5 MPH vehicle speed limit and a 40% engine torque derate.

Refilling the DEF tank will deactivate any torque derates, speed limits, and warning lights.

3-12.9 Emergency Shutdown *(Optional)*

CAUTION

The emergency shutdown device is meant for occasional use only. Continual use of this device will place unnecessary stress on intake plumbing and engine parts and may lead to reduced component life.

The emergency shutdown feature provides positive shutdown capability even in the event that the engine is operated in an atmosphere rich in fuel vapors. The shutdown device is a clapper valve located in the air intake pipe or the charge air cooler pipe that blocks all airflow to the intake manifold. The valve is tripped electrically or pneumatically from a switch located at the driver's station or pump panel. Once the valve is tripped, it must be reset before the engine can be started again.

3-12.10 Fan Clutch

⚠WARNING

Fan clutches can engage and fan blades can spin without warning. Keep hands, hair, and clothes away from fan. Never operate the engine with personnel in the vicinity of the fan as the fan may engage without warning. Failure to heed this warning may lead to personal injury or death.

Engines equipped with a fan clutch will provide airflow to cool the engine when one or more of the following conditions are met.

- The engine coolant or air intake temperature reaches the engine manufacturer's preset temperature for fan engagement.
- Placing the truck in "pump mode" may activate the fan clutch.
- Activation of any generator PTO drive may engage the fan clutch.

3-12.11 Starting Engine Using Power From Another Vehicle

⚠WARNING

Pierce Custom Chassis have a 12-volt negative ground electrical system. Before using jumper cables, make sure the booster vehicle also has a negative ground system (negative terminal attached to a metal part of the vehicle). If unsure of the booster vehicle's voltage or ground, do not attempt to jump start as personal injury or severe damage to the electrical system may result.

The following procedures must be performed exactly as outlined. Otherwise injury to the face, eyes, body, limbs, and respiratory system could result from fire or acid due to battery explosion. Property damage could also result.

CAUTION

To avoid damage to vehicle electronic components, voltage supplied to a vehicle's electrical system must not exceed 16.0 volts.

If the battery charge is insufficient to crank the engine, the following procedure may be used to supplement battery power.

1. To prevent shorting of the electrical system, remove metal rings, watches, or other metallic accessories and do not allow metal tools to contact positive terminal of battery.
2. Position the vehicles so the jumper cables will reach easily between the batteries. Do not allow the vehicles to touch.
3. Turn off all electric motors and accessories in each vehicle. Turn off all lights not needed to protect the vehicles or to light the work area. In each vehicle, stop the engine, turn off the warning light master switch.
4. Apply the parking brake and shift the transmission to **N**eutral in both vehicles.
5. Connect the first jumper cable from the positive (+) terminal of the dead battery or the positive (+) terminal of the jump-start stud to the positive (+) terminal on the booster battery.
6. Connect one end of the second jumper cable to the negative (–) terminal on the booster battery, and the other end to the frame of the disabled vehicle at least 18 inches (450 mm) away from the battery. Do not attach the other end directly to the battery negative (–) terminal because a spark could occur and cause explosion of gases normally present around the battery.
7. With the jumper cables properly attached, start the engine of the vehicle with the good (charged) battery. Run the engine at moderate speed.
8. Start the engine in the vehicle with the discharged battery.

Remove the battery cables by reversing the above sequence exactly.

3-12.12 Operation of Engine in Fuel Rich Atmosphere

⚠WARNING

Diesel engines do not require a spark for ignition and will continue to run as long as there is fuel available. Varying the amount of fuel introduced into the chambers controls the speed of a diesel engine. If the engine is operated in an atmosphere that is laden with fuel vapors such as is found at a fuel spill, the engine may increase speed uncontrollably. Turning the ignition switch or battery switch off in this situation will not affect the speed of the engine. Before operating a diesel engine in this type of environment, ensure that the vehicle is equipped with a means of shutting off the air intake supply to the engine and that the driver is present to operate the shutdown whenever the engine is running.

3-12.13 Air Restriction Indicator

A diesel truck engine may consume over 12,500 gallons of air for every gallon of fuel that it burns. The air cleaner element filters this air to ensure that dirt and dust are not allowed to contaminate the engine. A dirty air cleaner element is a common cause of air restriction. The result is too little air to burn all the fuel. Some of the excess fuel will cause a smoky exhaust and lost horsepower. In addition, the excess fuel washes lubricating oil off cylinder walls resulting in seized pistons and bearing failures. Regular inspection and maintenance of the air intake tubing and connections is important to prevent any unfiltered air from entering the engine.

A pressure sensor located in the engine air intake tube triggers the air intake restriction indicator light located on the dash panel.

Vehicles equipped with Command Zone™: On multiplexed vehicles, air restriction is monitored by the Command Zone™ system. During a restricted air intake condition, a text message, caution light, and chime are activated on the Command Zone™ Information Center (CZIC).

If the light or CZIC remains activated, any of the following conditions may be present:

- The air cleaner filter element is dirty and requires replacement.
- The air cleaner filter element has become saturated with water over most or all of the element surface.
- The ductwork or screen in front of the air cleaner has become plugged or otherwise restricted.

The actual level of restriction at which the light comes on varies between chassis models and engine options.

3-12.14 Fluid Requirements

3-12.14a Diesel Fuel Requirements

⚠WARNING

Never blend gasoline, gasohol, alcohol, or other volatile substances with diesel fuel. This practice creates an extreme fire or explosive hazard that could cause property damage, personal injury, or death.

⚠CAUTION

2007 EPA & 2010 EPA engines require the use of specific oil and diesel fuel. The diesel fuel to be used in any 2007 EPA & 2010 EPA engine shall be Ultra Low Sulfur Diesel (ULSD) fuel containing 15 parts per million (PPM) sulfur content or less. Make sure the pump station being used has the proper fuel type when filling your fuel tank. If ultra-low-sulfur fuel is not used, the engine will not meet emissions regulations, and the After Treatment Device (ATD) can be damaged. Refer to the engine manufacturer's operation manual for additional fuel specifications.

Filling the fuel tank with other liquids can result in premature failure of the engine and/or emission components.

Refer to the engine manufacturer's operator's manual for proper fuels, additives, and fueling procedures.

3-12.14b Engine Oil Requirements

⚠CAUTION

Detroit Diesel engines only: **Engine oil must have sulfate ash levels less than 1.0 weight %. Oils meeting this requirement are marked as API CJ-4 oil. Using any other oil will cause damage to the ATD. Using oil that is not CJ-4 compliant for extended periods of time will damage components and require replacement of the ATD by an approved service facility.**

Cummins engines only: **Cummins Inc. recommends that 2007 EPA & 2010 EPA engines use a high quality 15W-40 multi viscosity heavy-duty engine oil that meets the requirements of Cummins Engineering Standard CES20081/API CJ-4/SL for maximum DPF maintenance intervals. Cummins allows the use of CES20078/API CI-4/SL oil with no change in oil drain intervals. However, the after-treatment maintenance interval will be reduced with the use of CES20078/CI-4 oil.**

Maintain engine oil at the proper level. Use engine dipstick to check oil level. Refer to the engine manufacturer's operator's manual for additional information on engine oil types and procedures.

3-12.14c Diesel Exhaust Fluid (DEF) - *2010 EPA engines*

Acceptable DEF fluid used shall meet ISO 22241-1 or DIN 70700 specifications. DEF fluid should be stored at temperatures between 10°F - 90°F and has a minimum shelf life of 12 months.

Figure 3-8: Typical DEF Reservoir Location

The Diesel Exhaust Fluid reservoir is typically located in the driver's side rear wheel fender behind the forward air bottle storage door. The DEF reservoir location on your apparatus may be different, depending on the rear body design. The reservoir has a blue cap and is accompanied by a DEF fluid only label.

⚠CAUTION

Filling the DEF tank with other liquids can result in premature failure of the engine and/or emissions components.

In the event that the incorrect fluid has been added to the DEF tank, such as, but not limited to:

- Water
- Diesel Fuel
- Hydraulic Fluid
- Coolant
- Windshield Washer Fluid

Contact Pierce Customer Service to determine the appropriate repair action.

If only water has been added to the DEF tank, drain the DEF tank, flush with distilled water and refill with new and/or known good DEF.

⚠CAUTION

Do NOT add any chemicals/additives to the DEF in an effort to prevent freezing. If chemicals/additives are added to the DEF, the aftertreatment system may be damaged.

DEF will freeze around 11°F (-12°C). The DEF system on the vehicle is designed to accommodate this and does not require any intervention from the operator.

3-12.15 Hand Throttle

⚠WARNING

Never attempt to use a hand throttle as a cruise control. Doing so may cause lack of vehicle control resulting in property damage, personal injury, or death.

3-12.16 Cold Weather Operation

CAUTION

Because diesel engines are highly efficient, they use very little fuel while idling. As a result, idling in cold weather will not heat the engine to its normal operating temperature. Operation of a diesel engine at low idle for extended periods of time can cause engine damage. The following cold weather guidelines must be followed:

- **Avoid extended idling (beyond 10 minutes) whenever possible.**
- **Use a minimum 45 Cetane diesel fuel or utilize Cetane index improvers from a reputable manufacturer.**
- **Maintain a minimum of 1250 rpm idle by use of the hand throttle or high idle system. Always make sure that parking brake is applied and transmission is in neutral before applying hand throttle.**
- **Maintain engine cooling system.**
- **For pumpers: Shut off water flow to the auxiliary cooler using the valve at the pump panel and avoid the use of pump panel heaters except when essential.**
- **Use engine block heaters when possible.**

As diesel engines have increased in efficiency, the amount of waste heat available to be drawn from the coolant has decreased, particularly when operated at idle under a no-load condition. In cold weather with all the heaters operating, the engine may not reach warm operating temperatures unless it is placed under load.

Cold Weather Pumper Operation

- Ensure that the engine cooler valve on the pump panel is in the closed position. This valve shuts off the flow of tank water to the auxiliary engine cooler. This cooler is only required during pumping in high ambient conditions.
- Keep the pump panel heater (if so equipped) in the off position when not required. This will draw less heat from the engine during warm-up.
- Turn the crew cab heater fan to low or off when the crew cab is not occupied. This will draw less heat from the engine during warm-up.
- Operation of the engine in a high-idle mode will increase the engine heat output somewhat, but is of limited benefit unless the engine is under load. To provide a load on the engine during long periods of idle time, operate the pump in the recirculation mode with the engine at 1500 rpm.

Refer to the engine manufacturer's operator's manual for further information.

Winter Front Usage

CAUTION

The use of a winter front increases the need for the operator to carefully monitor engine and transmission temperatures. Remove the winter front before operating the vehicle in warm temperatures. Excessive engine and transmission operating temperatures created by the inappropriate use of a winter front can cause operational failure leading to costly equipment damage.

Winter fronts are not necessary except in extremely cold temperatures or when light engine loads are combined with a high rate of engine idling. If a winter front is used, it must be placed over the grill on the outside of the vehicle only, never directly onto the face of the charge air cooler or radiator. On Pierce Custom Chassis this spacing will maintain a gap of 6 to 14 inches between the winter front and the heat exchanger cores. This installation will restrict the flow of air through the cooling system to that which can be drawn from below the bumper and will avoid cutting off cooling airflow entirely.

3-13. Fire Scene Operation

3-13.1 High Heat Sources

Direct exposure of the vehicle to extreme high temperatures can cause damage to electrical systems, rubber seals and gaskets, and plastic components. Always operate vehicle a safe distance away from flames or heat source.

3-13.2 Flying Embers

⚠WARNING

To avoid the risk of engine fire leading to property damage, serious injury, or death, do not operate the vehicle in an area where burning embers can be ingested directly into the air intake system.

Diesel engines consume as much as 1200 cubic feet of clean air every minute when operating under full load. Hot embers sucked into the air intake can cause the air cleaner element to ignite. Although Pierce Custom Chassis are equipped with ember barriers composed of mesh screens or perforated metal, they are not a foolproof guarantee of protection.

3-14. Heating, Ventilation, Air Conditioning (HVAC) - *Contender®/Quantum®/Saber®*

Comfort controls can be set to obtain a desired interior condition. Refer to the Instrument Panel Layout, located in the Electrical System Manual, for specific locations of HVAC controls.

To maximize air conditioning performance, shut off the heater valves during the summer months. Locate the heater lines on the engine and close the hand valves.

3-14.1 Heater/Defroster (Rotary Controls)

The mode controls can be set in any of the following positions:

Off	Placing the control in this position shuts off the blower motor, and outside air will not come through the outlet.
Panel 	Air blows through the outlets located in the instrument panel.
Bi-Level 	Air blows through the outlets located in the instrument panel and those on the floor.
Floor 	Air blows through the floor outlets located under the instrument panel.
Defrost/Floor 	Air blows through the floor outlets and the outlets at the base of the windshield.
Defroster 	Air is directed to the windshield through the outlets at the base of the windshield.
Blower Control 	A rotary knob that will increase or decrease blower motor speed.
Temperature Control	A rotary knob that controls the temperature of the interior air. You can choose your degree of comfort by positioning the temperature control along the blue/red scale. The coldest setting is in the blue and the warmest setting is in the red.

3-14.2 Air Conditioning

NOTE: When you turn off the engine, you may hear a hissing sound from the engine compartment for a short period of time. This is a normal condition that occurs if the air conditioning system has been on. It is not an indication of a problem with the air conditioning system.

The mode controls can be set in any of the following positions:

Off Placing the control in this position shuts off the blower motor, and outside air will not come through the outlet.

Recirc Select Recirc when the outside air contains odors or high humidity. This feature allows for recirculation of interior air only.

Panel Air blows through the outlets located in the instrument panel.

Bi-Level Air blows through the outlets located in the instrument panel and those on the floor.

Floor Air blows through the floor outlets located under the instrument panel.

NOTE: The air conditioning compressor will operate when the system is in either Defrost mode regardless of where the blower control is set.

Defrost/Floor Air blows through the floor outlets and the outlets at the base of the windshield.

Defroster Air is directed to the windshield through the outlets at the base of the windshield.

Blower Control A rotary knob that will increase or decrease blower motor speed.

Temperature Control A rotary knob that controls the temperature of the interior air. You can choose your degree of comfort by positioning the temperature control along the blue/red scale. The coldest setting is in the blue and the warmest setting is in the red.

3-14.3 Operating Tips

Fast Cool Down

For a fast cool down, turn the **Blower Control** to the extreme left position, turn the mode control to the **Panel** position and drive with the windows open for the first few minutes. Once the hot air has been expelled, close the windows and turn mode selector to **Recirc**. When a comfortable condition has been reached, choose a mode position and adjust the **Temperature Control** and **Blower Control** as necessary to maintain comfort.

NOTE: The **Recirc** mode opens and closes a door allowing fresh air into the system. Check to make sure the door is operating properly. Set the control in **Recirc** mode and look underneath the cab at the right front corner to ensure the door is shut. The door opens approximately 1 inch in the fresh air mode.

Window Fogging

In mild but rainy or humid weather, windows will fog on the inside. To clear the fog off all the windows, activate the air conditioning. Adjust the **Temperature Control** and **Blower Control** to maintain comfort. Interior fogging on the windshield can be quickly removed by selecting the **Defrost** mode.

WEATHER	CONTROL SETTINGS
HOT WEATHER – VEHICLE INTERIOR IS VERY HOT	Start vehicle and put Mode Control in position and turn on A/C. Set **Blower Control** to HIGH. Roll windows down to flush out hot air. Roll windows up after hot air is flushed out. Turn Mode Control to and set Blower and Temperature as desired once vehicle is cool.
WARM WEATHER	Set the Mode Control to position and turn A/C on in sunny weather. Choose the position for cloudy or dark conditions with A/C on.
COOL OR COLD HUMID CONDITIONS	Set the Mode Control to and turn the A/C on in sunny weather. Choose the position and turn on the A/C in cloudy or dark conditions.
COLD DRY CONDITIONS	Use the position in sunny weather, the position in cloudy or dark weather, and use the position in snowy or very cold weather for extra windshield heat.

3-15. Heating, Ventilation, Air Conditioning (HVAC) - *Arrow XT™*

Figure 3-9: HVAC Control Panel

1194

3-15.1 Defroster

IMPORTANT: As the defrost and heat are recirculation-only systems, the A/C may be required to dry the air in situations where the windshield might fog over.

This is heat-only, recirculation-only, in-dash unit. Air intake is the through the dash panel. Air outlets are contained in a fixed panel for maximum defrost performance. Defrost controls consist of temperature and fan speed.

3-15.2 Floor Heaters

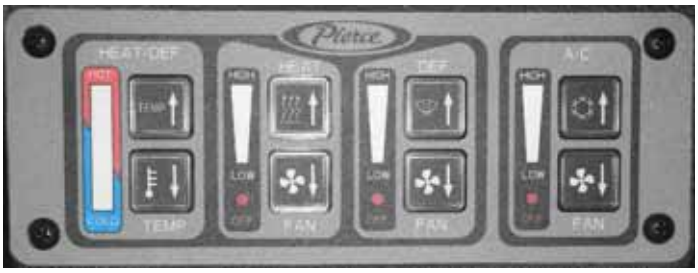
There are two heater units, one under each rear-facing seat. Each unit has an outlet at the floor, blowing rearward, and an inlet immediately above in the seat riser. In addition, each unit has a duct routed to the first officer and driver foot area. These outlets are located at floor level directly beneath each seat riser. Controls consist of temperature and fan speed. The left and right units are controlled simultaneously.

3-15.3 Air Conditioning Unit

The air conditioning system is completely external and consists of two boxes, each containing an evaporator and a condenser. Each unit has an air intake located in the headliner just behind the driver and first officer seats. The air is routed to the crew-cab through a headliner plenum and exits through three adjustable ball-style louvers per side. The driver and first officer each have two adjustable ball-style louvers as well. Controls consist of fan speed and an on/off switch. The left and right units are wired through the single control. The ball-style louvers used allow for shutoff or complete directional control of the airflow – these are operator adjustable.

3-16. Heating, Ventilation, Air Conditioning (HVAC) - *Velocity™/Impel™*

Figure 3-10: HVAC Control Panel



1100

3-16.1 Defrost

This is a heat-only, recirculation-only, in-dash unit. Air intake is through the dash panel upper grill openings. The air outlet is through a fixed louvered panel directly below the inlet grill. Controls consist of temperature and fan speed.

IMPORTANT: As the defrost and heat are recirculation-only systems, the A/C may be required to dry the air in situations where the windshield might fog over.

3-16.2 Heat

There are two heater units, one under each rear-facing seat. Each unit has an outlet at the floor, blowing rearward, and an inlet immediately above in the seat riser. In addition, each unit has a duct routed to the first officer and driver foot area. These outlets are located in the seat riser next to the engine tunnel. Controls consist of temperature and fan speed. The left and right units are controlled simultaneously.

3-16.3 Air Conditioning

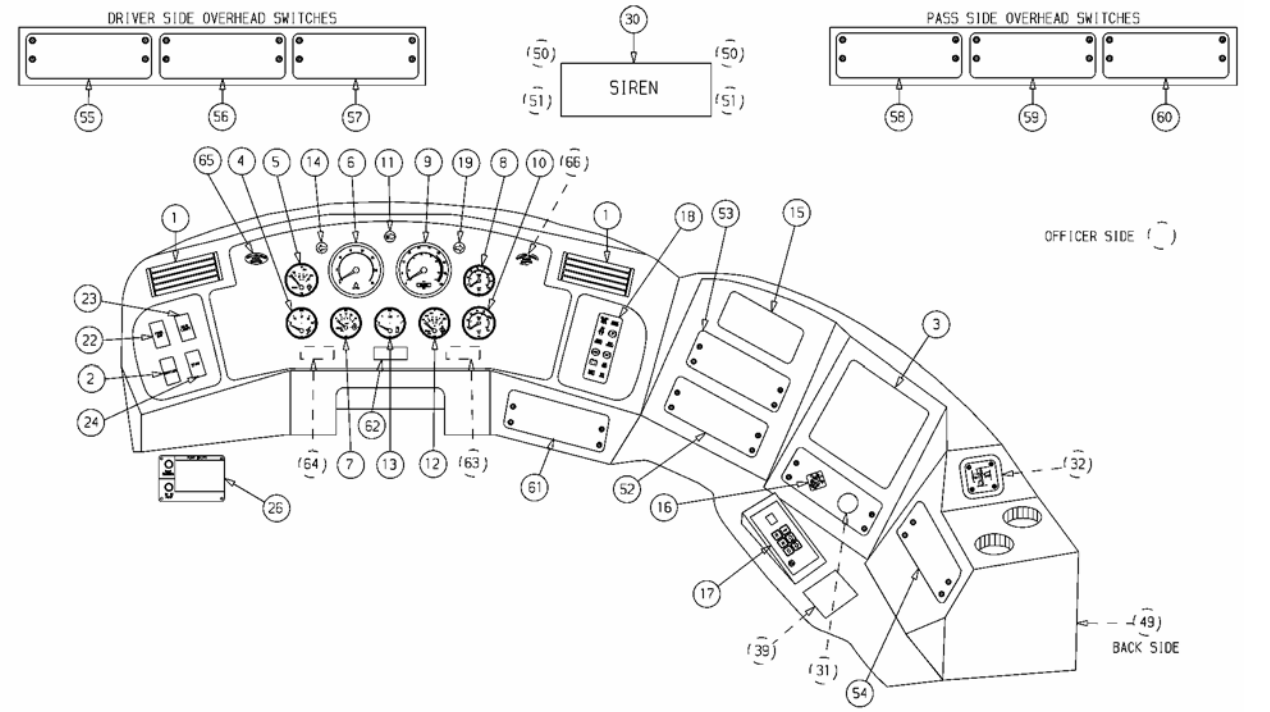
The air conditioning system has a roof mounted condenser and a ceiling mounted evaporator unit. The evaporator is mounted in the center of the cab. There are six fully adjustable circular louvers for the driver and first officer and six louvers for the rear seating positions. The temperature and fan speed are controlled with electronic keypad style switches. One switch controls both front and rear.

3-17. Instrument Panel Controls & Indicators

The exact layout of gauges, switches, indicators, and controls on Pierce Custom Chassis varies between models. Instrumentation layouts between vehicles of the same model will vary depending on the level of customization. The following layouts of controls and indicators are the most common. The layout in your Pierce Custom Chassis may vary. Refer to the Instrument Panel Layout drawings, found in the Electrical System Manual, for more information.

3-17.1 Typical Quantum® Cab Instrument Panel

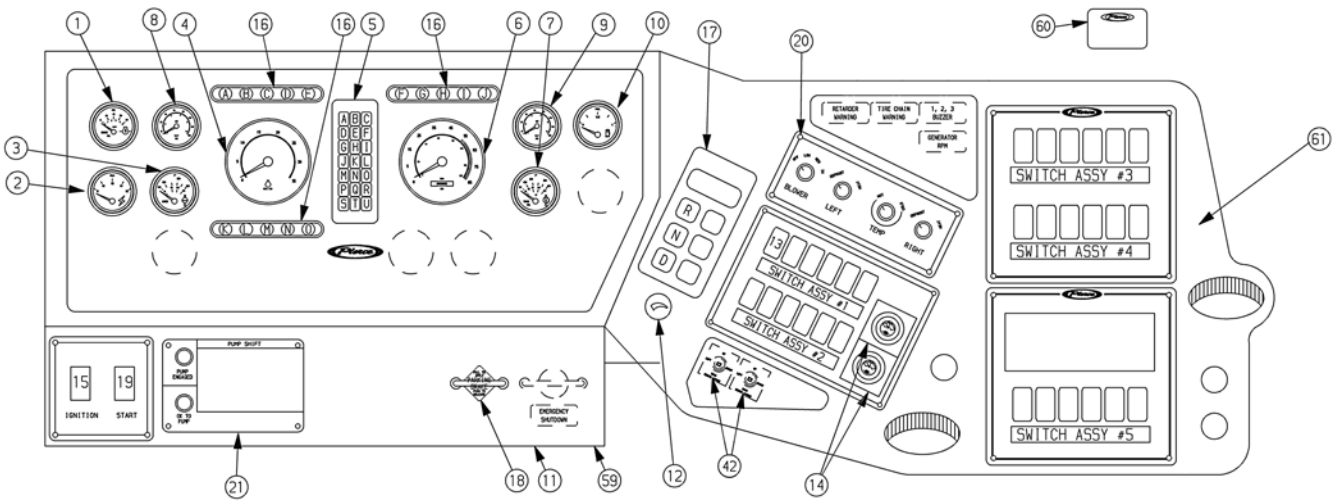
Figure 3-11: Quantum® Controls and Indicators



Item #	Description	Item #	Description
1.	Vents (Heating/Vent/AC)	30.	Electronic Siren
2.	Ignition Switch w/Indicator Light Prove Out	31.	Front Wheel Lock
3.	Information Display	32.	Mirror Remote
4.	Volt Meter	39.	Interaxle Differential Lock
5.	Engine Coolant Temperature Gauge	49.	Cigar Lighter
6.	Tachometer	50.	Air Horn Pushbutton
7.	Engine Oil Pressure Gauge	51.	Mechanical Siren Pushbutton
8.	Front Air Pressure Gauge	52.	Switch Assembly 52
9.	Speedometer	53.	Switch Assembly 53
10.	Rear Air Pressure Gauge	54.	Switch Assembly 54
11.	High Beam Indicator	55.	Switch Assembly 55
12.	Transmission Oil Temperature Gauge	56.	Switch Assembly 56
13.	Fuel Level Gauge	57.	Switch Assembly 57
14.	Left Turn Signal Indicator	58.	Switch Assembly 58
15.	Heater/Defroster Controls	59.	Switch Assembly 59
16.	Parking Brake Actuator	60.	Switch Assembly 60
17.	Transmission Shift Selector	61.	Switch Assembly 61
18.	Indicator Light Module: Do Not Move Truck, Check Gauges, Seat Belt Fastened, Parking Brake Applied, Check Engine, Stop Engine, ABS, ATC, Battery System ON, Air Restriction, Check Transmission, Low Coolant	62.	Retarder Warning Tag
		63.	Tire Chain Warning Tag
		64.	1, 2, 3 Buzzer Tag
		65.	ABS Equipped Tag
		66.	Traction Control System Equipped Tag
22.	Panel Lights Dimmer	NI	Steering Column Switch: Headlight Dimmer, Turn Signal, Windshield Wiper/Washer, Hazard Lights
23.	Headlights		
24.	Start Button		

3-17.2 Typical Saber®/Custom Contender® Cab Instrument Panel

Figure 3-12: Saber®/Custom Contender® Controls and Indicators



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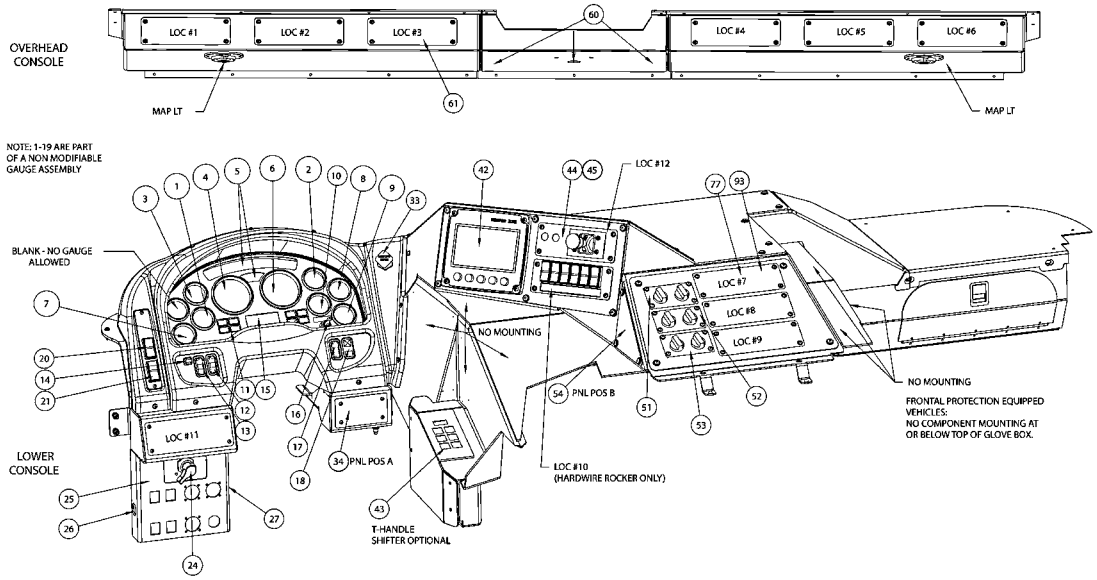
Item #	Description	Item #	Description
1.	Engine Oil Pressure Gauge	10.	Fuel Gauge
2.	Volt Meter	11.	Truck Alarm (steady tone)
3.	Engine Coolant Temperature Gauge	12.	Dimmer Control
4.	Tachometer with Engine Hourmeter	13.	Headlight Switch
5.	Indicator Light Module	14.	Wiper/Washer Controls
	A. Left Directional (Green)	15.	Ignition Switch
	B. High Beam (Blue)	16.	Gauge Panel Indicators
	C. Right Directional (Green)		A. High Engine Coolant (Red)
	D. Check Engine (Amber)		B. Low Engine Oil Pressure (Red)
	E. Stop Engine (Red)		C. Low Aux Battery Voltage (Red)
	F. Check Transmission (Amber)		D. Check Transmission (Red)
	G. PMC Fault (Amber)		E. Low Voltage (Red)
	H. ABS (Amber)		F. Low Fuel (Amber)
	I. ASR (Amber)		G. High Trans Oil Temp
	J. Retarder Engaged (Green)		H. Low Front Air PSI (Red)
	K. Retarder Overheat (Amber)		I. Low Rear Air PSI (Red)
	L. Low Coolant (Amber)		J. Spare
	M. Driver's Side Door Open (Red)		K. DPF Regeneration Required
	N. Tower Raised Indicator (Red)		L. Hi Exhaust Temperature
	O. First Officer Side Door Open (Red)		M. DPF Malfunction
	P. Air Restriction (Amber)		N. Intake Air Heater Active
	Q. Parking Brake ON (Red)	17.	Shift Selector
	R. Ladder Rack Down (Red)	18.	Parking Brake
	S. "A" Battery System ON (Green)	19.	Start Switch
	T. Ignition ON (Green)	20.	Heater and Defroster Controls
	U. "B" Battery System ON (Green)	21.	Air Shift Pump Control with Indicator
6.	Speedometer	42.	Mirror Remote
7.	Trans Oil Temp Gauge	59.	Diagnostic/Manual Regen Switch (Cummins)
8.	Front Air Pressure Gauge	60.	Seat Belt Monitor Display
9.	Rear Air Pressure Gauge	61.	VDR Diagnostic Plug

3-17.3 Typical Arrow XT™ Cab Instrument Panel

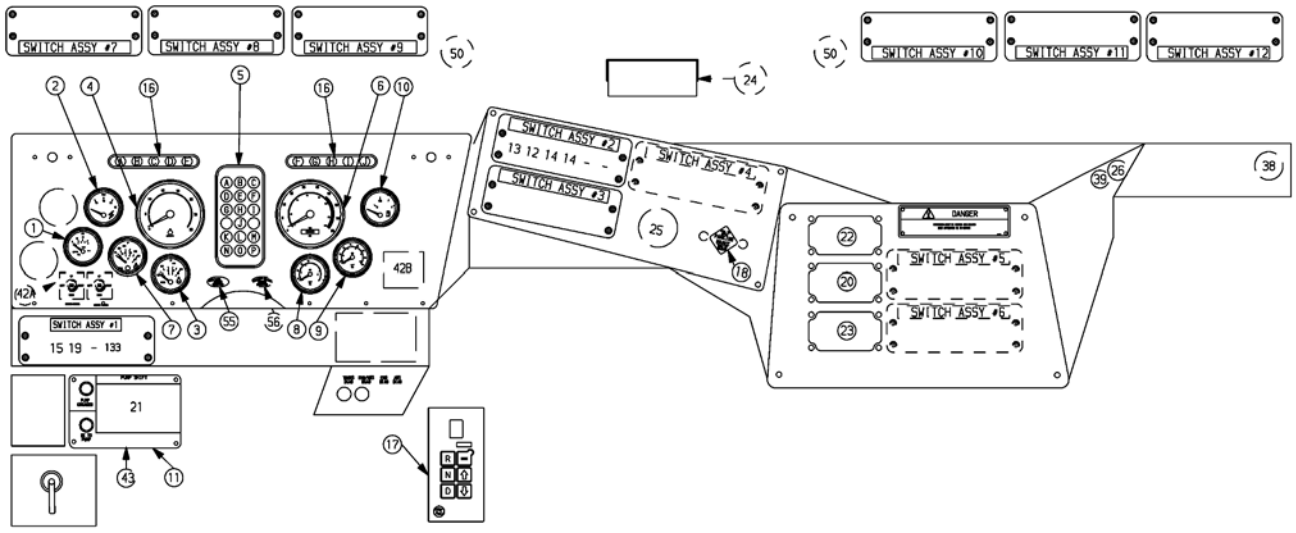
Figure 3-13: Arrow XT™ Controls and Indicators (with Command Zone™)



1193

Item #	Description	Item #	Description
1.	Engine Oil PSI	9.	Rear Air PSI
2.	Voltmeter	10.	Fuel Gauge
3.	Engine Coolant Temperature	11.	Hard-wired Indicator Lights
4.	Tachometer	12.	Panel Dimmer Control
5.	Multiplex Indicator Lights	13.	Headlight/Parking Light Switch
	A. Left Directional	14.	Emergency Master E-M Button/Indicator
	B. Right Directional	15.	LCD Display
	C. High Beam Indicator	16.	LCD Multi-Function Control
	D. Low Coolant	17.	High Idle Switch/Indicator
	E. Check Engine	18.	OK to High Idle Indicator
	F. Aux Brake Overheat	20.	Start Switch
	G. Caution	21.	Ignition Switch/Indicator
	H. Warning	24.	Battery Switch
	I. Park Brake Applied	25.	Diagnostics Panel
	J. Stop Engine	26.	Alarm #1
	K. DPF Regeneration	27.	Alarm #2
	L. ABS Trailer Fault	33.	Park Brake
	M. Wait to Start	34.	Interaxle Differential Lock/Indicator
	N. Traction Control	42.	Command Zone System Display
	O. Check Transmission	43.	Shift Selector
	P. Air Restriction	44.	Air Shift Pump Control
	Q. Water in Fuel	45.	PUC Pump Control
	R. Seat Belt Fastened	51.	Defroster Controls
	S. Rack Down	52.	Heater Controls
	T. Engine High Exhaust Temp	53.	Air Conditioning Controls
	U. ABS Tractor Fault	54.	Mirror Remote
	V. Emission System Malfunction	60.	Defrost Fans
6.	Speedometer	61.	PUC Display
7.	Transmission Oil Temp	77.	Airhorn Pushbutton Switch
8.	Front Air PSI	93.	Mechanical Siren Pushbutton

Figure 3-14: Arrow XT™ Controls and Indicators (without Command Zone™)



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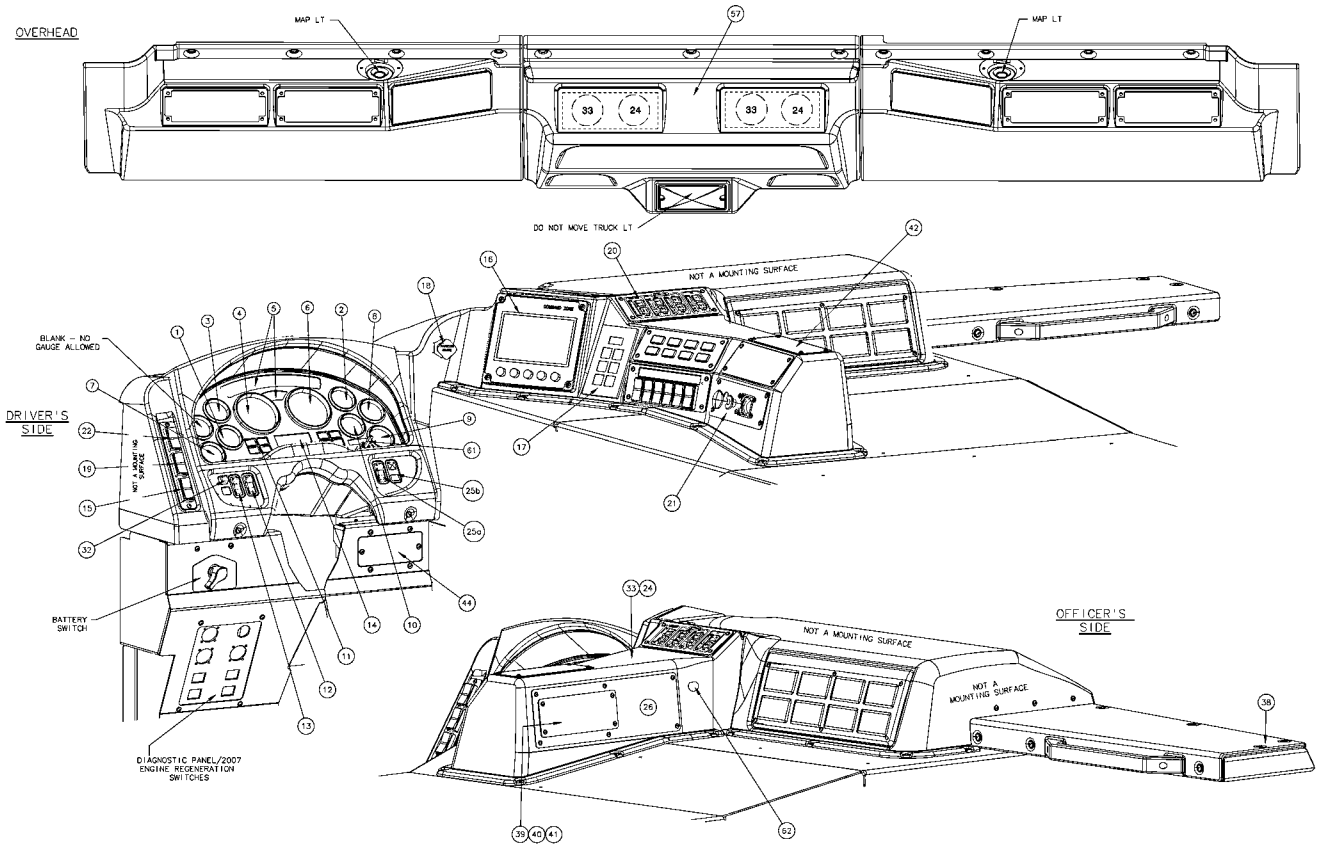
Item #	Description	Item #	Description
1.	Engine Oil PSI Gauge	15.	Ignition Switch w/Indicator Light Prove Out
2.	Voltmeter	16.	Gauge Panel Indicators
3.	Engine Coolant Temperature Gauge		A. High Engine Coolant
4.	Tachometer w/Engine Hourmeter		B. Low Engine Oil Pressure
5.	Indicator Light Module		C. Check Transmission
	A. Check Engine		D. Low/High Voltage
	B. High Beam		E. Left Directional
	C. Stop Engine		F. Right Directional
	D. ABS		G. Low Fuel
	E. ASR		H. High Transmission Oil Temperature
	F. Low Coolant		I. Low Front Air Pressure
	G. Auxiliary Brake Engaged		J. Low Rear Air Pressure
	H. Auxiliary Brake Overheat	17.	Shift Selector
	I. Air Restriction	18.	Parking Brake
	J. Parking Brake	19.	Start Switch
	K. Ignition ON	20.	Heater Controls
	L. Battery ON	21.	Air Shift Pump w/Indicator Parking Brake
	M. Ladder Rack Down	22.	Defroster Controls
	N. Driver's Door Open	23.	Air Conditioner Controls
	O. Tower Raised	24.	Electronic Siren
	P. First Officer Door Open	25.	Front Wheel Lock
6.	Speedometer	26.	Handheld Spotlight
7.	Transmission Oil Temperature Gauge	38.	Map Light
8.	Front Air Pressure Gauge	39.	Cigar Lighter
9.	Rear Air Pressure Gauge	42A.	Mirror Remote (Ramco/Moto - left)
10.	Fuel Gauge	42B.	Mirror Remote (Velvac - right of gauges)
11.	Truck Alarm - Steady Tone	43.	Tiller Jackknife Alarm
12.	Dimmer Control	50.	Defroster Fan
13.	Headlight Switch	55.	Anti-Lock Brake System Equipped Tag
14.	Wiper/Washer Controls	56.	Traction Control System Equipped Tag

3-17.4 Typical Velocity™/Impel™ Cab Instrument Panel

Figure 3-15: Velocity™/Impel™ Controls and Indicators



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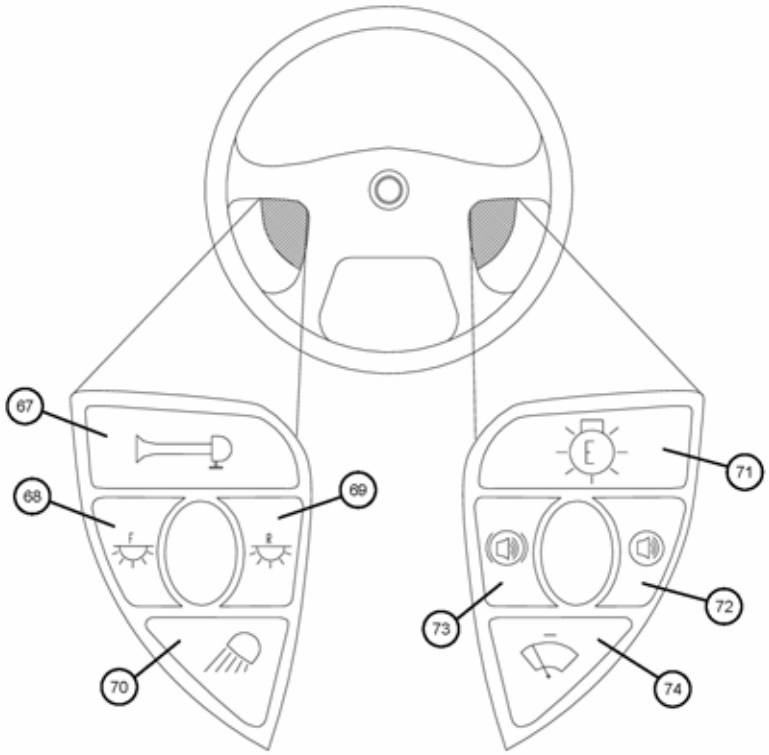
Item #	Description	Item #	Description
1.	Engine Oil PSI Gauge	20.	Heater/Defrost/Air Conditioning Switch
2.	Voltmeter	21.	Air Shift Pump with Indicator Light
3.	Engine Coolant Temperature Gauge	22.	4-Way Hazard Switch
4.	Tachometer	24.	Electronic Siren Control
5.	Multiplex Indicator Lights	25a.	High Idle Switch
6.	Speedometer	25b.	OK to Engage High Idle Indicator Light
7.	Transmission Oil Temperature Gauge	26.	Handheld Spotlight Switch
8.	Front Air PSI Gauge	32.	Emergency Master Switch
9.	Rear Air PSI Gauge	33.	AM/FM Radio
10.	Fuel Gauge	38.	Map Light
11.	Indicator Lights	39.	Cigar Lighter
12.	Panel Dimmer Control	40.	Air Horn Pushbutton Switch
13.	Headlight Switch	41.	Digital Clock
14.	LCD Display on Gauge Assembly	42.	Mirror Remote Controls
15.	Ignition Switch with Indicator Light	44.	Inter Axle Differential Lock Control
16.	Display Location	57.	Seat Belt Monitoring Display
17.	Shift Selector	61.	Low Sulfer Fuel Only Tag
18.	Parking Brake	62.	VDR Diagnostics Plug
19.	Start Switch		

3-17.5 Steering Wheel Controls *(Optional)*

Figure 3-16: Steering Wheel Controls *(Optional)*



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Item #	Description	Item #	Description
67.	Air Horn	71.	Emergency Master
68.	Dome Light – Front	72.	Mechanical Siren
69.	Dome Light – Rear	73.	Siren Brake
70.	Area Lighting	74.	Windshield Wipers

3-17.6 Instrument Panel Indicator Lights - *Detroit Diesel Engines*

2007 EPA & 2010 EPA Detroit Diesel engines have five instrument panel lights to monitor engine and exhaust after-treatment status. The Check Engine light and Stop Engine light refer to basic engine functions. The three after-treatment lights are the Diesel Particulate Filter (DPF) light, the High Exhaust System Temperature (HEST) light, and the Malfunction Indicator Lamp (MIL) light.

In addition, 2010 EPA Detroit Diesel engines have an additional Diesel Exhaust Fluid (DEF) light.

Table 3-1: Detroit Diesel Engine Instrument Panel Lights

	The amber **Check Engine** warning light indicates a fault with the engine controls has occurred. The operator can drive the vehicle to the end of their shift and call service to remedy the problem.
	The red **Stop Engine** warning light indicates a major engine fault that may result in engine damage has occurred. The operator should move the vehicle to a safe location and shutdown the engine.
	The **Diesel Particulate Filter (DPF)** light will illuminate when a regeneration is necessary. There are progressive stages of need for regeneration indicated by this light: • The first stage (on solid) should allow the vehicle to complete a typical shift of operation depending on vehicle duty cycle. This provides time for a vehicle to return to a maintenance facility or change duty cycle (increase exhaust temperatures by normal truck use) without impacting the current mission. In the event the DPF light has recently activated, the truck can be driven onto a highway or put into pump mode to put load on the engine allowing an automatic regeneration to clean the DPF. Regeneration should take place within a reasonable amount of time. • The second stage (flashing) indicates that the filter has become loaded to a point where a regeneration is required immediately. This requires the operator to initiate a regeneration immediately to clean the DPF. This can be accomplished through either automatic regeneration (driving or pumping) or a parked regeneration. The DPF light will turn off during the parked regeneration event. • The third stage (DPF flashing and Check Engine light illuminated) indicates that an automatic regeneration will no longer be allowed. The vehicle should be moved to a safe location where a parked regeneration can be immediately initiated. • The fourth stage (DPF flashing, Check Engine light illuminated, and Stop Engine light illuminated) indicates that damage to the after-treatment device is eminent and a parked regeneration should be performed immediately. As the DPF limits are exceeded, the engine will shut down to prevent complete failure of the DPF. In this situation, the engine can be restarted but a parked regeneration must be initiated within the first 30 seconds or the engine will shutdown again.
	The **High Exhaust System Temperature (HEST)** light provides an indication to the vehicle operator that an active regeneration has been initiated and that the exhaust system temperature is elevated beyond the temperature threshold. This light will flash when parked regeneration is in process and the system has not reached proper temperatures. This light does not indicate a failure of any type, it merely indicates elevated operating temperatures. The HEST light will not illuminate if road speed exceeds 5 mph.

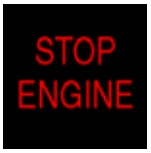
	The **Malfunction Indicator (MIL)** light provides an indication to the vehicle operator that a fault has occurred on an emission related component. This light may illuminate at the same time as the Check Engine light. The operator can drive the vehicle to the end of their shift and call service to remedy the problem.
	The **Diesel Exhaust Fluid (DEF) Level Low** light *(2010 EPA engines only)* provides an indication to the vehicle operator that the fluid level has reached a level where a refill is needed. This light indicates the reservoir has reached a low level. The operator should refill the reservoir when refilling the vehicle with diesel fuel or at the end of their shift.

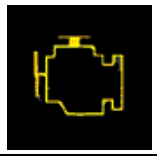
3-17.7 Instrument Panel Indicator Lights - *Cummins Engines*

2007 EPA & 2010 EPA Cummins engines have four instrument panel lights to monitor engine and exhaust after-treatment status. The Check Engine light and Stop Engine light refer to basic engine functions. The two after-treatment lights are the Diesel Particulate Filter (DPF) light and the High Exhaust System Temperature (HEST) light.

In addition, 2010 EPA Cummins engines have an additional Diesel Exhaust Fluid (DEF) light. ISX 15 2010 EPA engines also have a Malfunction Indicator Lamp (MIL) light.

Table 3-2: Cummins Engine Instrument Panel Lights

	The amber **Engine Warning** light indicates a non-critical system fault with the engine has occurred. The operator can drive the vehicle to the end of their shift and call service to remedy the problem.
	The red **Engine Stop** light indicates a serious engine fault that may result in engine damage has occurred. The operator should move the vehicle to a safe location and shutdown the engine.
	The **Diesel Particulate Filter (DPF)** light provides an indication that the filter has not been able to regenerate under the previous engine operating conditions and is in need of assistance in order to perform an active regeneration. There are progressive stages of need for regeneration indicated by this light as depicted in the following points. • On solid (indicates low to medium levels of particulate build up) • Flashing (indicates medium to high levels of particulate build up and a signal that a DPF regeneration is needed). • Flashing with amber Engine Warning light (indicates a high level of particulate build up and a DPF cleaning is required immediately). The first stage (on solid) should allow the vehicle to complete a typical shift of operation depending on vehicle duty cycle. This provides time for a vehicle to return to a maintenance facility or change duty cycle (increase exhaust temperatures by normal truck use) without impacting the current mission. The DPF light will turn off to acknowledge when effective assistance (changing duty cycle or initiating a stationary regeneration) has been provided. However, if assistance has not been provided long enough to complete the regeneration, the light will return to the appropriate indication stage.

	The **High Exhaust System Temperature (HEST)** light provides an indication to the vehicle operator that an active regeneration has been initiated and that exhaust system temperatures will be elevated above normal levels for the operating condition. The HEST light will remain on until the exhaust system temperatures have dropped below 977°F (525°C). If the HEST light is ON and the vehicle speed has dropped below the threshold of 5 miles per hour, the light will remain ON until the vehicle speed increases ~3 mph back above the speed threshold and the regeneration process finishes.
	The **Diesel Exhaust Fluid (DEF) Level Low** light (*2010 EPA engines only)* provides an indication to the vehicle operator that the fluid level has reached a level where a refill is needed. This light indicates the reservoir has reached a low level. The operator should refill the reservoir when refilling the vehicle with diesel fuel or at the end of their shift.
	The **Malfunction Indicator (MIL)** light (*ISX 15 2010 EPA engine only)* provides an indication to the vehicle operator that a fault has occurred on an emission related component which may result in an engine derate or engine protection shutdown. When the MIL light illuminates, the operator should take the vehicle to a service center as soon as possible.

3-18. Mirrors

Adjust all side view mirrors before operating the vehicle. Check mounting hardware to ensure that mirror heads are secure and will not lose adjustment during operation.

3-19. Command Zone™ System - *Arrow XT™/Impel™/Quantum®/Velocity™*

3-19.1 Introduction

The Pierce Command Zone™ system is a control and monitoring device for your vehicle that works in conjunction with the SAE J1939 data bus and J1587 and J1922 data links. The Command Zone™ system communicates with assigned components of your vehicle to inform the operator of current status of those components. Each vehicle with a Command Zone™ system may be programmed to monitor and/or control different systems on that vehicle.

3-20. Command Zone™ Information Center (CZIC) – General Information

Figure 3-17: Command Zone™ Information Center

1108

Command Zone™ Information Centers (CZIC) are found on the main instrument panel, on the pump panel (most trucks), and on some Pierce aerial devices. They are the operators' main source of information and communication with Command Zone™ system.

Velocity™, Impel™, Quantum® and Arrow XT™ chassis also have a 4-line LCD display that is part of the instrument panel. This display shows the same 2-line CAUTION, WARNING, and Command Zone™ text messages (no graphics) that appear on the CZIC screens.

3-20.1 Care and Maintenance

The CZIC screen is manufactured with coatings to reduce glare and resist scratches. Despite these design features, care should be taken to avoid damage to the lens. Clean with mild glass cleaner and a soft cloth. Avoid pressure washing around the CZIC, particularly toward the back of the unit. The CZIC incorporates a micro-filter vent on the rear casing that allows the unit to adjust to changes in atmospheric pressure while keeping out dust and moisture. High-pressure water sprayed directly on this vent may allow damaging moisture to contaminate the electronics.

3-20.2 Interior and Exterior Versions

The CZIC comes in interior and exterior versions. The interior version has a black case and soft touch buttons. The exterior version has a gray case and booted buttons. The booted buttons are resistant to water and ice, and have a heavy tactile feel for ease of use with gloved hands. The electronics and connections are identical in each version, and either version will operate in any position in a Command Zone™ system.

3-20.3 Chassis and Aerial Information Center Differences

Pierce apparatus may be equipped with Command Zone™ electronics on the chassis, the aerial device, or both. The chassis and aerial circuits may share some information, but for the most part are separate systems. A CZIC installed on a chassis Command Zone™ bus will display chassis data, and a CZIC installed on an aerial bus will display aerial information. Any exterior version of CZIC has the ability to be installed on either bus without modification.

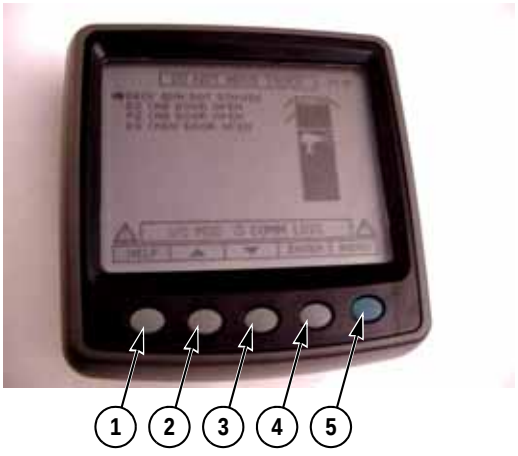
3-20.4 Replacing a Command Zone™ Information Center

Any damaged CZIC can be replaced with any similar CZIC provided the version number and interior or exterior type are the same. Once installed, the CZIC will read the ground matrix code inherent in the vehicle wire harness to determine whether it is installed in a Command Zone™ chassis or aerial device, and at what location in each. Each time the vehicle is powered on, the CZIC communicates with the Command Zone™ control module, letting it know that it is present and functional.

3-21. Command Zone™ Information Center (CZIC) – CANTrak Display

3-21.1 Screen Navigation Buttons

Figure 3-18: CANTrak Display Screen Navigation Buttons



POM0074

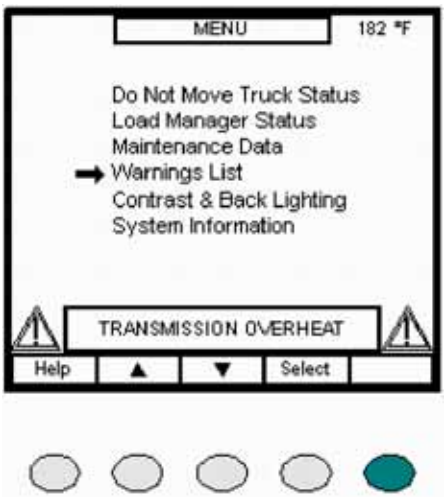
Each CANTrak display is equipped with five “soft” buttons (software controlled) *(Figure 3-18)*. The function of the soft buttons, located along the bottom the CANTrak display, changes with each screen as shown in *Table 3-3*.

Table 3-3: CANTrak Button Functions

SCREEN HEADING	BUTTON FUNCTION				
	1	2	3	4	5
Menu	Help	Scroll Up	Scroll Down	Select	—
Do Not Move Truck	Help	Scroll Up	Scroll Down	—	Menu
Loads	Help	Scroll Up	Scroll Down	—	Menu
Maintenance Data	Help	Scroll Up	Scroll Down	Enter	Menu
Warning List	Help	Scroll Up	Scroll Down	Enter	Menu
Lighting	Contrast (–)	Contrast (+)	Lighting (–)	Lighting (+)	Menu
System	Help	Scroll Up	Scroll Down	Select	Menu
Control Module	Help	Back	Inputs/Outputs	1-8 or 9-16	Menu
Power Module	Help	Back	—	—	Menu
Input Module	Help	Back	—	1-8 or 9-16	Menu
Output Module	Help	Back	—	1-8 or 9-16	Menu
I/O Module	Help	Back	Inputs/Outputs	—	Menu
CC Module	Help	Back	Inputs/Outputs	—	Menu

3-21.2 Caution and Warning Messages

Figure 3-19: Typical Warning Message



POM0075

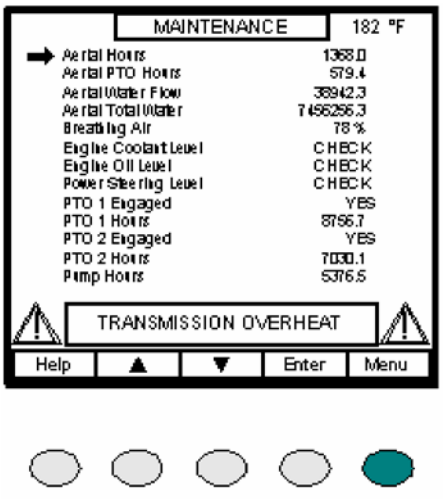
WARNING messages will appear in the warning text box on any screen *(Figure 3-19)*. The warning triangles and dialog box will not appear until a WARNING or CAUTION message is received. The message text will flash to attract the attention of the operator. If more than one message is received, the dialog box will flash the first message twice before flashing the next message. Flashing messages will cycle through with two flashes per message until the message is no longer received.

3-21.3 Common Screens

The screen name and outside ambient temperature are displayed at the top of each screen.

Maintenance Screen

Figure 3-20: Maintenance Screen



POM0076

The Maintenance screen *(Figure 3-20)* displays a scrolling list of data messages. This screen is intended for system analysis and troubleshooting by operators or maintenance personnel familiar with the Command Zone™ electronics.

To the right of each item is the value of the data message currently active on the system. The value may be a numerical value such as a voltage level or rpm. Data on the list can be viewed by scrolling with the up or down arrows. Pressing the ENTER button will return a general description for that data item.

Warnings Screen

Figure 3-21: Warnings Screen

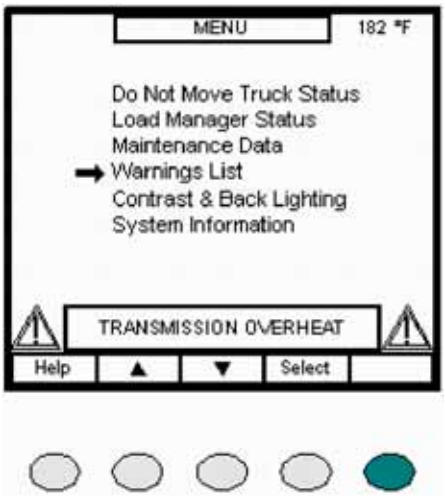
POM0077

The Warnings screen *(Figure 3-21)* displays a scrolling list of alarm messages. This screen is intended to assist in system analysis and troubleshooting by operators or maintenance personnel familiar with the Command Zone™ electronics.

Predefined warning messages (those common to all Command Zone™ vehicles) will be listed alphabetically. Warning messages customized for a particular vehicle or series of vehicles is sent to the CANTrak display by the Electronic Control Unit (ECU) at each initialization and can be found at the beginning of the list.

Menu Screen

Figure 3-22: Menu Screen

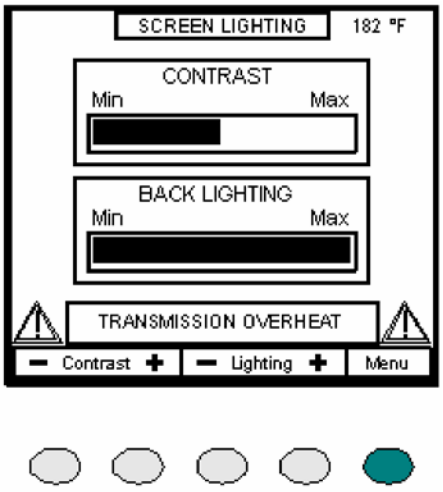


POM0078

The Menu screen *(Figure 3-22)* displays a list of all available screens. Only available screens will be included in the list. An indictor arrow to the left of the list can be moved by the up or down soft buttons. Pressing the SELECT soft button or the ENTER button will cause the selected screen to be displayed.

Screen Lighting

Figure 3-23: Screen Lighting Display

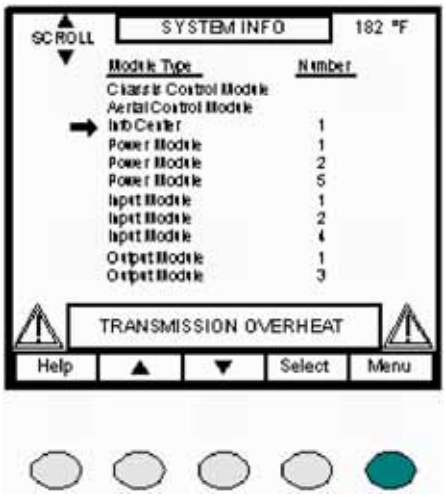


POM0079

The contrast and brightness of the CANTrak display can be adjusted. Adjust the brightness from the Menu screen by positioning the indicator arrow to the Contrast & Back Lighting row. Press the ENTER or SELECT button to access the Screen Lighting screen *(Figure 3-23)*. Press the appropriate soft button to increase or decrease contrast or brightness. Each time the vehicle is powered on, the CANTrak display will default to the brightest setting.

System Information Screen

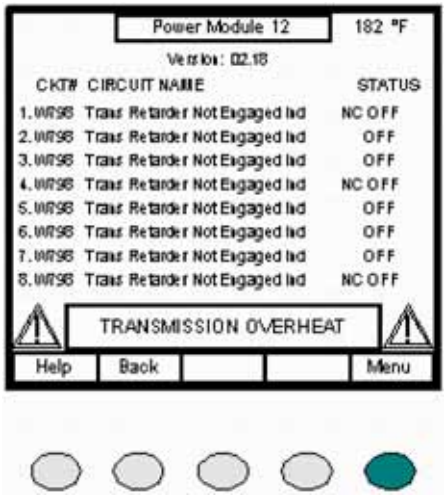
Figure 3-24: System Information Screen



POM0080

Module Screen

Figure 3-25: Typical Module Screen



POM0081

The System Information screen *(Figure 3-24)* provides information on each of the Command Zone™ modules installed on the system. The screen lists the module type and module number of each module on the network. This is a “live” screen meaning that if a module goes off line, the module will not be shown on this list and a warning message indicating the “Module Comm. Loss” will be displayed. If the module comes back online, the module name and number will reappear on the System Information page. If further information is required for a module, move the indicator arrow to the correct module name/number and press the ENTER button. A “Module” screen similar to that shown in *Figure 3-25* will appear. At the top of the screen will be the module name and number. The time, date, and outside ambient temperature are located adjacent to the module name. All of this information combined makes the page heading. Below the page heading is the software version of the module.

Listed is information about each individual input and/or output of that module. Starting at the left the information is as follows:

- Input/output number
- Circuit number connected to that input or output
- Circuit name (item connected to the circuit)
    - A blank line indicates that the input/output is not programmed.
- Status of the input or output (all module types)
    - Inputs
        - On
        - Off
            - G = Ground at the input will activate the input.
            - B = Battery power at the input will activate the input.
            - A = Analog signal at the input. No value is given.
    - Outputs
        - On
        - Off
        - FLA (Flashing)
- Additional Status (Power Module Outputs only, diagnostic information)
    - **OC** – Over current or short to ground. The system can only detect this condition if the output status is on.
    - **SB** – Short to battery. The system can only detect this condition if the output status is off.
    - **NC** – No connection or open. The system can only detect this condition if the output status is off.

On modules that contain more than 8 inputs and/or outputs, a soft button will appear at the bottom right-hand corner of the System Information screen. Pressing the associated soft button will toggle the inputs/outputs shown on the screen. While in the Module screen, press the BACK button to return to the System Information screen.

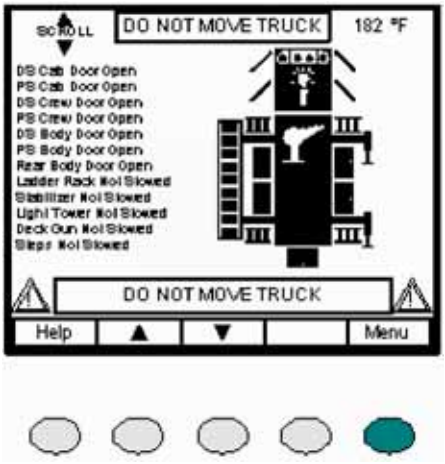
On power modules, a soft button will appear at the bottom right-hand corner of the Module screen. Pressing the associated soft button will toggle the status and the amp draw of the outputs shown on the screen. While in the Module screen, press the BACK button to return to the System Information screen.

3-21.4 Chassis Screens

The CANTrak display will display two chassis related data screens: Door screen and Load Manager screen.

Door Screen

Figure 3-26: Door Screen

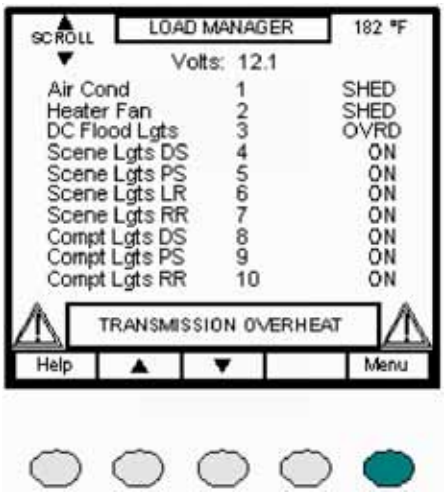


POM0082

The Door Screen *(Figure 3-26)* indicates the status of doors, hatches, or other items which must be in their closed or stowed position before moving the vehicle and which are sensed by the vehicle interlock circuitry. This screen displays automatically when the “DO NOT MOVE TRUCK” warning message is active. Pressing any of the soft buttons on the right will cause that screen to appear.

Load Manager Screen

Figure 3-27: Load Manager Screen



POM0083

The Load Manager Screen *(Figure 3-27)* displays the status of each electrical function selected to be terminated as the electrical load exceeds the chassis alternator capacity. Each truck is programmed to include a specific number of electrical devices that will be load managed and load sequenced. Load management begins to shut off major electrical loads in a predetermined sequence as the vehicle electrical loads exceed the alternator capacity. This screen shows the real-time status of the major electrical loads. The load managing sequence is preset at the factory depending on the range of options and alternator capacity.

3-22. Command Zone™ Information Center (CZIC) – Color Display

Figure 3-28: Command Zone™ Information Center (CZIC) – Color Display

POM0084

3-22.1 Items Common to All Screens

Caution and Warning Messages

Messages will appear in a text box at the top of all screens. The text box will not appear until a WARNING or CAUTION message is received. If a WARNING message is active, the box will be red. If a CAUTION message is active, the box will be yellow. If more than one message is active, the active messages will alternate every two seconds.

Time and Temperature

The time will be displayed in the upper left corner and the outside ambient temperature in the upper right corner.

Screen Navigation Buttons

Each color display is equipped with five buttons. The function of each button, located along the bottom of the color display, will change with each screen.

Basic Functions

The MENU button will bring up a list of items for setting up the display or will allow maintenance personnel familiar with Command Zone™ electronics to access troubleshooting and analysis screens. See Setup/Diagnostics for additional information.

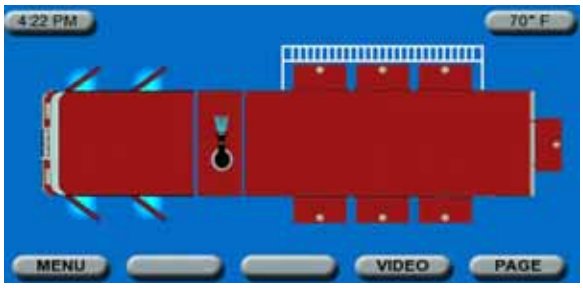
When the video function is enabled, a camera or “other video source” can be viewed by pressing the VIDEO button. The color display has an NTSC compatible video input. This is generally used with a backup camera.

The PAGE button will toggle through screens with information pertaining to the vehicle or apparatus. The screens vary, depending on the options and status of the vehicle.

3-22.2 Common Screens

Do Not Move Truck Screen

Figure 3-29: Do Not Move Truck Screen



POM0085

The Do Not Move Truck screen *(Figure 3-29)* indicates the status of doors and other items that must be closed or stowed before moving the vehicle. This screen displays automatically when the “DO NOT MOVE TRUCK” warning message becomes active.

Engine Information Screen

Figure 3-30: Engine Information Screen

POM0086

The Engine Information screen *(Figure 3-30)* displays engine rpm, engine temperature, engine oil pressure, battery voltage, and fuel level. The color of the box containing the data will be GREEN when the data is within an optimal range, YELLOW when the data has entered a caution range, and RED when the data has entered a warning range.

Load Manager Screen

Figure 3-31: Load Manager Screen

POM0087

Load management begins to shut off (shed) major electrical loads in a predetermined sequence as the electrical system voltage decreases. The Load Manager screen *(Figure 3-31)* displays the status of each electrical function that has been selected to be load managed. Each truck is programmed to include a specific number of electrical devices which will be load managed. The load managing sequence is preset at the factory depending on the range of options and their amperage draw. This screen can only be viewed when the parking brake is set.

Seat Belt Screen *(Optional)*

Figure 3-32: Seat Belt Screen

POM0088

The Seat Belt screen *(Figure 3-32)* indicates when an occupant is seated but not wearing a seat belt. This screen displays automatically when the “SEAT BELT NOT BUCKLED” warning becomes active and there is no “DO NOT MOVE TRUCK” warning.

Alarms Screen

Figure 3-33: Alarm Screen

POM0089

The ALARM button will appear on the Alarms screen *(Figure 3-33)* whenever there is a warning or caution message. Pressing this button will list all active messages. The messages are displayed in order of occurrence. The SILENCE button is used to silence the audible alarm. While the silence feature is active, the buzzer will continue to chirp for 1 second every 30 seconds for as long as any message is active. After silencing the current alarm message, the Command Zone™ system continues monitoring for new alarms. If the alarm status changes, the silence feature is deactivated and the alarm buzzer will sound.

3-22.3 System Menu

Figure 3-34: System Menu

1372

The MENU button will bring up a list of items for setting up the display or will allow maintenance personnel familiar with Command Zone™ electronics to access troubleshooting and analysis screens. An indicator arrow to the left of the list can be moved by pressing the UP or DOWN button. Pressing the SELECT button will cause the selected screen to be displayed. If the parking brake is not set, the MENU button will need to be held for several seconds before it will activate.

3-22.3a Set Display Backlight

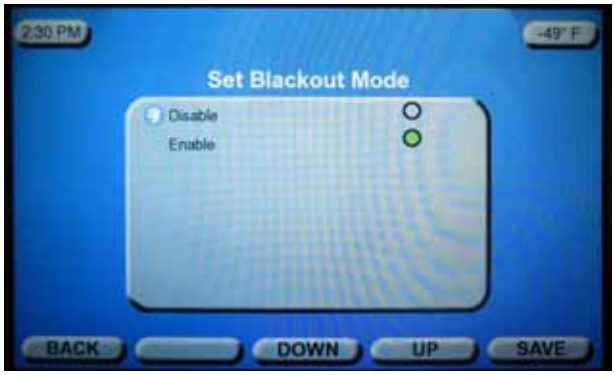
Figure 3-35: Set Display Brightness Screen

POM0091

When this button is selected, the operator will be allowed to change the brightness of the display by pressing either the UP or DOWN button. Separate adjustments are available for daytime and nighttime settings; press the DAY/ NIGHT to toggle between the two settings. The value will be saved when pressing the BACK button.

3-22.3b Set Blackout Mode

Figure 3-36: Set Blackout Mode Screen



1373

The Set Blackout Mode screen is used to control the blackout mode operation of the display. When enabled, the blackout mode will turn off the display when the parking brake is released, reducing the amount of light the driver is exposed to while driving, especially at night. The screen will reactivate automatically if an alarm becomes active.

3-22.3c Configure Video

Figure 3-37: Configure Video Mode Screen

1374

The Configure Video Mode screen *(Figure 3-37)* is used to control remote video inputs. The “Camera Connected” selection must be changed to YES if a video device (cameras, DVD player, etc.) is present, at which point the user will be allowed to change the video screen contrast, tint, and brightness. Changes made to these items are only reflected on the video screen.

3-22.3d Set Startup Screen

Figure 3-38: Set Startup Screen

POM0093

Selecting this screen will bring up a menu of the default screens available *(Figure 3-38)*. The selected screen will be displayed each time the truck battery switch is turned ON. To change the Startup screen, use the UP and DOWN buttons to scroll to a different screen name, then press the SAVE button.

3-22.3e Set Date and Time

Figure 3-39: Set Date and Time Screen

POM0094

Pressing this button will allow the operator to change the date and/or time, which are displayed at the top of each screen. Time can be displayed in standard or military format (12 or 24 hour). Pressing the NEXT button advances the indicator arrow to the next position. The “–” button will decrease the current value and the “+” button will increase the current value.

3-22.3f Set Language

Figure 3-40: Set Language Screen

1375

The Set Language screen is used to select the language displayed by the Command Zone™ screens. Available selections are English and Spanish.

3-22.3g View Active Alarms

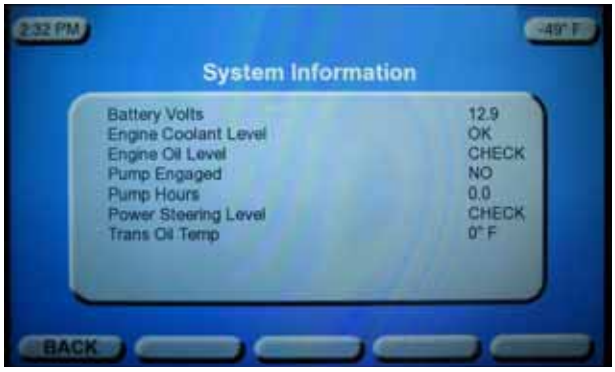
Figure 3-41: Active Alarms Screen

POM0095

Selecting this will display all active messages *(Figure 3-41)*. The active messages are sorted by occurrence. The SILENCE button will silence the audible alarm (See *"Alarms Screen"* on *page 3-81* for specific alarm screen details).

3-22.3h View System Information

Figure 3-42: System Information Screen



1376

The System Information screen *(Figure 3-42)* is intended for system analysis and troubleshooting by operators or maintenance personnel who are familiar with Command Zone™ electronics. To the right of each item is the value of the data currently active on the system.

3-22.3i System Diagnostics

Figure 3-43: System Diagnostics Screen

POM0097

The System Diagnostics screen *(Figure 3-43)* provides information for each of the Command Zone™ modules installed on the system. The screen lists the module type and module number of each module on the network. This is a “live” screen, meaning that if a module goes off line, the module will not be shown on this list and a warning message indicating the “Module Comm. Loss” will be displayed.

Module Screen

Figure 3-44: Module Screen

POM0098

If the user wishes to troubleshoot individual circuits within a given module, move the indicator arrow to the correct module name/number and press the ENTER button. The Module screen *(Figure 3-43)* will appear. The module name and number will appear at the top of the screen. The module’s software version can be found to the right of the module name.

Listed is information about each individual input and/or output of that module. Starting at the left the information is as follows:

- Input/output number
- Circuit number connected to that input or output
- Circuit name (item connected to the circuit)
    - A blank line indicates that the input/output is not programmed.
- Status of the input or output (all module types)
    - Inputs
        - On
        - Off
            - G = Ground at the input will activate the input.
            - B = Battery power at the input will activate the input.
            - A = Analog signal at the input. No value is given.
    - Outputs
        - On
        - Off
        - FLA (Flashing)
- Additional Status (Power Module Outputs only, diagnostic information)
    - **OC** – Over current or short to ground. The system can only detect this condition if the output status is on.
    - **SB** – Short to battery. The system can only detect this condition if the output status is off.

On modules that contain more than 8 inputs and/or outputs, a soft button will appear at the bottom right-hand corner of the System Information screen. Pressing the associated soft button will toggle the inputs/outputs shown on the screen. Press the BACK button to return to the System Information screen.

On power modules, a soft button will appear at the bottom right-hand corner of the Module screen. Pressing the associated soft button will toggle the status and the amp draw of the outputs shown on the screen. Press the BACK button to return to the System Information screen.

3-23. Pump

IMPORTANT: In the event that the throttle control at the pump operator's panel becomes inoperative, the accelerator pedal in the cab may be used as an alternative means to control the engine speed while pumping. *(Detroit Diesel engines only.)*

Some Pierce fire apparatus are equipped with a driveline driven water pump. For pump operating information, refer to the *Pierce Pumpers Operation & Maintenance Manual* (PM-P-OM260) or the *Pierce Ultimate Configuration (PUC) Pumpers Operation & Maintenance Manual* (PM-P-OM420), as well as the pump manufacturer's literature provided with the unit.

3-24. Stability Control *(Optional)*

3-24.1 Roll Stability Control (RSC)

Roll Stability Control (RSC) is an Anti-Lock Braking System (ABS) based system that senses when impending rollover conditions occur, and if detected, intervenes in the operation of the truck by automatically reducing the vehicle speed. All measuring and processing needed to calculate, and continuously update, the rollover risk is done within the ABS Electronic Control Unit (ECU).

RSC is automatic. It becomes active when the ECU senses lateral acceleration that exceeds thresholds. It then attempts to quickly reduce vehicle speed until the lateral acceleration falls below the determined threshold.

The type and magnitude of an RSC intervention depends on the amount that the actual vehicle lateral acceleration exceeds the control limit. Intervention starts with an engine torque reduction command (you may sense a decrease in engine power), followed by application of the engine brake *(if the vehicle has an engine brake, you will feel the additional deceleration)*, and if necessary, application of the drive axle brakes (you will feel braking take place).

For additional RSC information, refer to the Pierce Service Manual, group 0251-V-015, Meritor Wabco Anti-Lock Braking System (ABS) and group 0995-V-003, Meritor Roll Stability Control (RSC) Driver Tips.

3-24.2 Electronic Stability Control (ESC)

Electronic Stability Control (ESC) is a system that can apply any and all brakes of the vehicle, in an effort to regain control, when the vehicle becomes directionally unstable. ESC contains lateral measurement for roll, with the addition of sensing for skidding or drift out.

3-24.3 Safe Vehicle Operation

⚠WARNING

Note that RSC and ESC systems cannot prevent accidents and/or loss of control of the vehicle. RSC and ESC systems are not a reason to take unnecessary risks. A driver can still exceed the physical limitations of the system with either excess speed and/or extreme cornering, causing a loss of directional control or roll over. Training is recommended when using either system.

When operating your vehicle, always use safe driving techniques. The driver is ALWAYS the most important part of a safe vehicle operation.

3-25. Steering

⚠WARNING

Do not adjust the steering column with the vehicle in motion to avoid uncontrolled steering inputs that could lead to property damage, personal injury, or death.

IMPORTANT: Pay attention to the feel of the steering system during driving. Check for looseness, pulling, strange noises, etc. Any change in the feel should be investigated by a qualified mechanic.

3-25.1 Steering Column Adjustment

Adjust the tilt of the steering column by pulling up on the adjusting lever while tilting the column to the desired position. Adjust the height of the steering wheel by pushing down on the adjustment lever and moving the wheel to the desired position.

3-25.2 ALL STEER® All-Wheel Steering *(Optional)*

⚠WARNING

The use of all-wheel steering significantly changes vehicle handling, particularly on a slippery road surface caused by rain, snow, or icy conditions. Do not drive a vehicle equipped with the ALL-STEER® option in any ALL-STEER® mode until you have thoroughly read the manual and had behind-the-wheel training from an individual who is an experienced ALL-STEER® all wheel steering system vehicle operator. Failure to complete proper training could lead to property damage, serious injury, or death.

The operation of the ALL STEER® all-wheel steering system is covered in detail in the ALL STEER® Operator's Manual.

3-26. Tire Chains

3-26.1 Chain Clearance

Front Tires

⚠WARNING

Installation of tire chains on the front tires may cause extensive damage to the cab as well as safety critical parts of the steering and brake systems. Damage to these components may lead to serious injury or death.

Pierce Custom Chassis do not provide clearance for tire chain installation on the front tires.

Rear Tires

Installation of chains on the rear tires may be possible depending on the chassis model, tire size, suspension type, and body style. Before installing chains on rear tires, ensure that adequate clearance exists between the tire and fender liner at full axle jounce.

Table 3-4: All Wheel Steer® Tire Chain Availability

Single Rear Axle			
Configuration / Chassis	Tires	Automatic Tire Chains	Wrap-Around Tire Chains Application
26,000 lb. GAWR	445	On-Spot	
Saber®, Quantum®			Not Available

Tandem Rear Axle			
Configuration / Chassis	Tires	Automatic Tire Chains	Wrap-Around Tire Chains Application
36,000 lb. GAWR	385	On-Spot	
Quantum®			Available
48,000 lb & 52,000 lb GAWR	445	On-Spot	
Quantum®			Not Available

3-26.2 Automatic Tire Chains

Automatic tire chains are designed to provide additional traction during slippery conditions at slow vehicle speeds only. Do not operate vehicle with automatic tire chains engaged at speeds over 35 mph.

- On trucks equipped with Command Zone™ D-Series modules *(Arrow XT™, Impel™, Quantum®, Velocity™)*:
  - — The tire chains will activate instantly if the parking brake is set and the switch is activated.
  - — If the parking brake is released, the switch must be held for two seconds before the tire chains will activate (to prevent accidental activation).
- Engage automatic chains before reaching slippery conditions.
- Engage automatic chains while traveling at vehicle speeds between 2 and 25 mph.
- Vehicle can be stopped and started again as long as the control switch remains in the engaged position.
- Disengage automatic chains while traveling at vehicle speeds between 2 and 35 mph.
- To engage chains when the vehicle is already stuck, spin tires up to 5 mph and engage chains. Stop spinning the tires and proceed slowly once the action of the chains is apparent.
- On trucks equipped with All Steer® all-wheel steering (AWS), the AWS system monitors the system and prevents the engagement of the tire chains in those conditions where the chains could damage the body or other components.

Refer to the chain system manufacturer’s instructions for maintenance and service requirements.

3-27. Tire Pressure Management System

3-27.1 Tire Pressure Management *(Standard)*

NOTE: The tire must be inflated to the correct pressure before installing the tire sensor valve cap to calibrate and ensure proper operation.

Your apparatus is equipped with a VECSAFE LED tire alert pressure management system that will monitor the pressure of each tire. The VECSAFE valve cap is a chrome plated brass sensor that is installed on the valve stem of each tire. This sensor will calibrate to the tire pressure when first installed on the valve stem. The sensor will activate an integral battery operated LED when the pressure of that tire drops 8 psi.

The sensor can be checked for functionality and battery condition by simply unscrewing the cap. If it is in working condition, the LED will immediately start blinking.

3-27.2 Tire Pressure Management *(Optional)*

Your apparatus may be equipped with a SMARTIRE tire pressure management system that will monitor each tires pressure and temperature. A 2.00" gauge located in the cab instrument panel will indicate each tires position, pressure and temperature. An alarm will sound when the tire pressure deviates 10% or more. A wireless sensor is mounted to each wheel.

The system has three (3) alert levels:

- Critical Low Pressure Alert
- Pressure Deviation Alert
- High Temperature Alert

Each alert will trigger an audible alarm and an indicator light within the gauge to signal the driver of the problem.

3-28. Transmission

3-28.1 Automatic Transmission

⚠WARNING

Whenever it becomes necessary to leave the vehicle, even momentarily, while the engine is running, place the transmission shift selector in Neutral, set the parking brake, and chock the wheels. Failure to follow this procedure may lead to loss of vehicle control resulting in possible property damage, personal injury, or death.

The Allison automatic transmission supplied with most Pierce Custom Chassis will only start in the **N**eutral mode. Select the **D**rive mode for normal driving. Completely stop the vehicle before shifting from any forward range to the **R**everse range. Turn off the vehicle high idle switch before attempting to shift from **N**eutral to **D**rive or **R**everse.

For further information refer to the Allison Transmission Operator's Manual.

3-28.2 Transmission Operating Temperature

NOTE: The transmission temperature gauge does not indicate the sump temperature. The gauge indicates the temperature of the oil as it exits the torque converter and before the oil enters the transmission cooler. This reading provides a much more immediate indication of temperature rise due to heavy use or retarder applications. If the sump fluid temperature reaches 250°F, the Electronic Control Unit (ECU) will inhibit operation in the higher ranges.

Maximum sump operating temperature is 250°.

Vehicles equipped with Command Zone™: On multiplexed vehicles, this information is monitored by the Command Zone™ system. During a high temperature condition, a text message, caution light, and chime tone are displayed on the Command Zone™ Information Center (CZIC).

3-28.3 Neutral to Drive Shift Growl - Allison MD Transmission

A growling noise may sometimes be heard in the cab when shifting the transmission from neutral to drive. This is caused by electric solenoids within the transmission that control (modulate) the clutch hydraulic pressure. These solenoids modulate clutch pressure by turning on and off very fast, similar to the operation of an alternator voltage regulator. Increasing or decreasing the time the solenoid spends in the “on” state controls the clutch pressure.

The rapid on-off operation of the solenoids results in pressure oscillations at the clutch. These pressure oscillations result in a cyclical piston load on the clutch, which can cause torque oscillations. These torque oscillations are transferred through the transmission and driveline, into the axle, axle shafts, and any suspension members attached to the drivetrain.

If vehicle components such as body panels, drivelines, and frame members are excited by the frequency of the torque oscillations, an audible noise may be heard inside the cab. These torque oscillations (and resulting noise) are well below the design limits of the transmission and do not affect the life of the transmission or other vehicle driveline components.

3-28.4 4x4 Transfer Case (All Wheel Drive)

CAUTION

Operation of the vehicle in all wheel drive mode increases the wear on the driveline components, tires, and axles. Avoid engaging the front axle drive except in slippery or off-road conditions, or premature component wear may result.

Use extreme caution when backing up a steep grade while the front drive axle is engaged. Weight transfer from the rear axle to the front axle can cause overloading of the front drive gear and component damage may result.

Most Pierce Custom Chassis with all wheel drive use a power-divider rear axle with integral transfer case. Torque to the front axle is delivered via a clutched differential. The front drive axle can be engaged or disengaged while the vehicle is in motion.

To Engage Front Axle Drive

1. Reduce vehicle speed to less than 50 mph.
2. Ensure that rear wheels are not spinning faster than the front wheels and that the steering wheel is centered.
3. Remove foot pressure from the accelerator pedal and allow vehicle to coast.
4. Shift engagement switch.
5. Proceed with caution.

To Disengage Front Axle Drive

1. Remove foot pressure from the accelerator pedal and allow vehicle to coast.
2. Shift engagement switch.
3. Proceed with caution.

3-28.5 4x4 (All Wheel Drive) and Two-Speed Axle Combination

On certain chassis models a 4x4 option is offered in conjunction with a two-speed rear axle option. This configuration is provided for those departments that require maximum grade climbing ability and 4x4 operation, while still desiring normal highway speed capability. This configuration provides an interlock so that the 4x4 mode is available only when the two-speed axle is in low range. Follow the same instructions for shifting into and out of 4x4 mode as outlined above, but be sure that the two-speed axle is in low range.

3-28.6 Power Take-Off Control

⚠WARNING

During extremely cold weather, hot-shift PTO clutches may momentarily transmit power even though they are disengaged. Never operate the engine with personnel in the vicinity of any driveshaft as it may engage without warning. Hands, clothes, hair, etc., can get caught on spinning shafts and U-joints. Failure to heed this warning may lead to personal injury or death.

Engage Power Take-Off (PTO) operated accessories with engine at idle speed.

Consult the PTO operator's manual for further explanation. Refer to the Power Take-Off Operation section of the Allison Transmission Operator's Manual for additional operation instructions.

3-29. Vehicle Data Recorder (VDR)

Most Pierce apparatus are equipped with a Vehicle Data Recorder (VDR). The VDR is capable of reading and storing the most recent 100 hours of vehicle information. The VDR is capable of operating in a voltage range from 8VDC to 16VDC and will continue operation upon termination of power or at voltages below 8VDC for a minimum of 10ms. The VDR will not interfere with, suspend, or delay any communications that may exist on the CAN data link during the power up, initialization, runtime, or power down sequence.

The vehicle data recorder is capable of recording the following data via hard-wired and/or CAN inputs:

- Vehicle Speed - MPH
- Acceleration - MPH/sec
- Deceleration - MPH/sec
- Engine Speed - RPM
- Engine Throttle Position - % of Full Throttle
- ABS Event- On/Off
- Seat Occupied Status - Yes/No by Position (1-6 Seating Capacity)
- Seat Belt Buckled Status - Yes/No by Position (1-6 Seating Capacity)
- Master Optical Warning Device Switch - On/Off
- Time - 24 Hour Time
- Date - Year/Month/Date

Stored VDR data can be downloaded and viewed using a laptop computer and the Weldon Vehicle Data Recorder Software; provided with your vehicle on a CD-ROM (Pierce PN PV-C-SW490). This software can also be downloaded from www.weldoninc.com.

The Weldon Vehicle Data Recorder Software contains three different software applications. The purpose of each software application is explained below:

- VDR Configuration Tool. This application is used to name individual VDR modules, change the password required to access data, and synchronize the clock (if necessary). The ability to name individual VDRs permits customers to give each VDR a unique name. This beneficial for customers whose vehicle fleet contain several vehicles equipped with VDRs.
- VDR Extraction Tool. This application is used to download data from the vehicle's VDR to a laptop computer. Once downloaded, the data is viewed using the Viewer Tool.
- VDR Viewer Tool. This application is used to view and manipulate the downloaded VDR data.

3-30. Water Fording Capability

3-30.1 General Fording Instructions

CAUTION

If the rear axle breathers are submerged for more than a brief period, drain and replace the lubricant. See axle manufacturer's lubrication specifications found in the Service Manual. After fording, lubricate all grease fittings below the fording depth to displace water and contaminated grease. Failure to follow these precautions may lead to premature wear or damage to the axles, suspension, and driveline components.

For vehicles equipped with electromagnetic driveline retarders, turn off retarder before fording water. Inspect for debris and grease unit before returning the vehicle to service after fording. Failure to follow these precautions may lead to damage of the retarder.

Low engine tunnel designs in some Pierce Custom Chassis models require the engine air intake port to be located at or below frame level. This configuration places inherent restrictions on the ability of the apparatus to negotiate areas of high water. Certain chassis components, such as cooling fans and axle breathers, can restrict the safe negotiation of high water. Since the depth of water that can be safely traversed is a function of water depth and complex hydrodynamics, no definitive fording capability can be established. Note the location of the air intake port on your Pierce apparatus and avoid operation in standing water that will cause water ingestion into the engine.

If water ingestion into the air intake system is suspected, or the vehicle has been driven in high water conditions, then the following procedures should be followed:

1. **Check air intake for moisture.**

   Remove the air intake piping ahead of the air cleaner and check the filter for moisture. If the filter is only partially wet with some dry paper area, then the chances are very good that no water entered the engine. Allow the filter to dry or install a new filter.

2. **Inspect components for damage.**

   If the entire filter element is saturated, then proceed to have the engine checked by an authorized service center. Check fan for cracks in blades or missing blades. Analyze samples of oil from the axles, engine, and transmission for water content. Change fluids as required.

3-30.2 Fording Water with Command Zone™ Vehicles

CAUTION

After any high water use where the boxes are partially or fully submerged, they should be opened and inspected for moisture. If water has entered the box, allow to dry completely before using the vehicle.

Battery box distribution may be located under the driver's side battery box. Battery box distribution is not waterproof but its components are and can be fully submerged. Chassis rear distribution is located behind the fuel tank on units with aerial devices and in the substructure on pumpers.

If water has entered the box, inspect the lid seal and ALL wires that pass through for leaks. Seal, or repair as instructed by Pierce Customer Service.

3-31. Winch Operation

⚠WARNING

Make only straight winch pulls, and do not double the cable back to the vehicle using a snatch block. Failure to observe these limitations may over-stress the bumper or winch mounting and cause component failure leading to property damage, personal injury, or death.

Read the winch operators manual (included in the Pierce Service Manual) carefully before operating the winch and follow all winch manufactures safety precautions and guidelines.

Exercise extreme caution when operating any winch device. Inspect the cable carefully before operation to ensure that there are no cut strands, kinks, or corrosion. Operate the winch only with the remote control unit when under load and stand well clear of the path of the cable should it fail. Orient the vehicle so that the winch cable will pull in a line perpendicular to the axis of the winch drum (no side pulls).

4-1. Aerial Device Boom Support

Inspect the boom support for structural integrity. Tighten any loose fasteners to the proper torque per the Frame Fastener Torque Chart. Inspect welds for signs of fatigue cracking.

4-2. Automatic Lubrication Systems

4-2.1 Reservoir

Visually check the reservoir to ensure there is an adequate grease supply for the impending work day. If the lubricant level in the reservoir gets too low, air will be induced into the system. This will not allow pressure to build up which will cause a system fault.

4-2.2 Inspection

Inspect the vehicle for over or under lubrication before it is washed or pressure cleaned. Verify that all originally attached lubrication lines are still connected. Pay particular attention to those points closest to the road surface.

4-2.3 Condition of Lube Points

Inspect all points being lubricated. A seal of lubricant around the outside of the bushings should be visible as this assures that bearings are being flushed of contaminants. If the entire system appears to be over or under lubricated, adjust the control unit accordingly. If an individual lubrication point appears to be over or under lubricated, replace the metering cap for that line with a different size (too wet = smaller size; too dry = larger size).

4-3. Axles

4-3.1 Front Axle – Non-Driving

Inspect the front axle for damaged, binding, or worn parts. Check the kingpins for excessive wear. Refer to the axle manufacturer's maintenance manual (included in the Pierce Service Manual) for maintenance schedules, lubrication recommendations, and inspection procedures.

4-3.2 Front Axle Alignment

WARNING

Most tire wear is caused by incorrect toe settings. Do not change camber or caster settings to correct tire wear problems. If the axle assembly is bent to change caster or camber, the strength of the axle is reduced and the warranty is voided. An axle damaged by bending may cause a vehicle accident and result in serious personal injury or death.

Kingpin inclination and camber are factory set by the axle manufacturer and are not adjustable. Caster is set at the factory by including tapered shims in the front spring pack as required.

Check toe-in adjustment by following the instructions in the axle manufacturer's maintenance manual. Set toe-in to the following values:

Unloaded Vehicle: 1/16-inch ± 1/32 inch
Loaded Vehicle: 1/32-inch ± 1/32 inch

4-3.3 Front Axle – TAK-4™ Suspension

Refer to the Pierce Service Manual, group 0152-P-002, TAK-4™ Independent Front Suspension, for suspension inspection and alignment information.

4-3.4 Rear Axle

Inspect the rear axle for damage, leaks, or interference's with other chassis components. Refer to the axle manufacturer's maintenance manual (included in the Pierce Service Manual) for maintenance schedules, lubrication recommendations, and inspection procedures.

4-3.5 Rear Axle Alignment

IMPORTANT: U-bolt nut torque is critical to maintaining rear axle alignment. It is natural for the paints and lubricants in the spring pack to compress over time and cause the U-bolt clamp force to drop. This is particularly true soon after factory assembly or whenever the U-bolts are loosened or the springs are replaced. It is the owner's responsibility to torque the U-bolts after the first 500 miles of operation or six months whichever comes first, and then at the recommended maintenance intervals or axle alignment will likely be affected. Refer to *"Spring Suspension (Front and Rear)"* on *page 4-34* for U-bolt torque.

Check that the rear axle is aligned perpendicular to the chassis frame using high quality and properly calibrated laser alignment equipment operated by a trained technician. Slight adjustment may be made by loosening the U-bolts and repositioning the axle within the clearance of the axle locating pins.

4-4. Brakes

4-4.1 Brakes – General

⚠WARNING

All new Pierce Custom Chassis are equipped with non-asbestos lining material. Even so, great care should be taken to avoid the inhalation of brake lining material dust during the servicing of the brakes, as brake lining fiber dust may be extremely hazardous to your health. Read and follow the precautions listed in the Brake section of the Pierce Service Manual or serious personal injury may result.

IMPORTANT: Replace brake parts with genuine OEM equipment only to avoid nullification of warranty coverage.

IMPORTANT: Do not use Lithium base grease on disc brake calipers. Lithium base grease may not adequately lubricate the calipers. Only use clay-based NLGI Grade numbers 1 or 2, or equivalent. Disc brake calipers are NOT to be connected to automatic chassis lubrication systems. For vehicles equipped with an automatic lubrication system, disc brake calipers will need to be greased separately.

The inherent duty cycle of fire apparatus requires the use of very aggressive brake lining material. For this reason, fire apparatus vehicles are very sensitive to brake balance. Refer to *"Brake Balance"* on *page 2-2* before addressing brake related service problems.

Brake wear varies widely depending on vehicle use factors such as operator driving habits, terrain, speeds, road conditions, and use of auxiliary braking devices. Establish a regular schedule for inspection, maintenance, and lubrication based on the duty cycle of the vehicle. Inspect brake linings weekly until a normal wear rate can be determined and an appropriate inspection schedule established. Refer to the axle manufacturer's maintenance manual (included in the Pierce Service Manual) for maintenance schedules, lubrication recommendations, and inspection procedures.

Inspect the entire brake system for the following:

- Air leaks.
- Condition of drums, rotors, brake chambers, and slack adjusters.
- Condition of hoses, fittings, and tubes.
- Proper operation of service, and parking brakes.

4-4.2 Brakes – TAK-4™ Suspension

Brake information for the TAK-4™ suspension can be found in the Pierce Service Manual, group 0251-V-016, Bendix SB-6 & SB-7 Air Disc Brakes.

4-4.3 Air Dryer

Inspect the air dryer to ensure that it is exhausting properly at each cycle of the air compressor governor. Replace the desiccant cartridge every 2 to 3 years or more often depending on usage. Refer to the air dryer maintenance manual (included in the Pierce Service Manual) for maintenance schedules, lubrication recommendations, and inspection procedures.

4-5. Cab Step System - *Quantum*®

4-5.1 General Inspection

- Observe operation. Retract and deploy times should average less than 3 seconds in either direction. Speed may vary between steps due to slight manufacturing variances.
- Open each door and then close it gently making sure that the door closes to the first latch catch only. If any step fails to retract with the door closed to the first latch catch, follow valve adjustment procedure below.
- Ensure that step surfaces are clean and that dirt, ice, or debris has not been trapped in the step below the grip surface. Clean as required.
- Open petcocks and drain condensation from the step system wet tank and filter located behind the first officer side rear step.

4-5.2 Step System Air Dryer

To ensure reliable operation, replace the desiccant in the step system air dryer annually just prior to the cold weather season. Replace desiccant as follows:

- Remove right side fender liner.
- Engine must be off while servicing desiccant dryer.
- Open drain on coalescing filter to relieve system pressure.
- Remove air lines going to the dryer assembly.
- Remove dryer assembly by removing dryer assembly bracket.
- Remove desiccant dryer.
- Remove desiccant dryer cover and discard desiccant (desiccant is non-hazardous).
- Refill dryer (follow instructions on package).
- Inspect filter element inside coalescing filter. Replace as necessary.
- Reinstall desiccant dryer and reconnect air lines.
- Inspect all air lines for leakage.
- Reinstall fender liner.

4-5.3 Service Parts

Desiccant recharge kit (four-year supply):	Pierce P/N 55-4940
Filter element for coalescing filter:	Pierce P/N 55-4941

4-5.4 Step System Pressure

The step system is designed to operate at 85 psi. The pressure regulator is located behind the right-hand fender liner beside the air compressor and is preset at the factory. Supply pressure to either side of each step cylinder actuator should maintain 85 psi. If low air pressure is determined, adjust to 85 psi by rotating the yellow knob on the regulator.

4-5.5 Step Pivot Components

CAUTION

Use of any lubricant other than the type indicated here may cause binding of the step in cold weather.

Lubricate the pivot bearings monthly through grease fitting at middle of step pivot tube. Use Lubriplate Low Temp multi purpose grease, Pierce P/N 95-0786. Add grease until clean white colored grease exits at each end of tube.

Inspect for proper operation of the step pivot bearings and shaft as follows:

1. Disengage the auxiliary compressor or unplug all auxiliary air supplies.
2. Drain all air from the step system.
3. Remove the rod-end cylinder mount from the step housing.
4. Grasp the sides of a step and attempt to move side to side. Any movement greater than .125" at the furthest point from the pivot will indicate bearing wear.
5. If excess play is observed, disassemble step from step box.
6. Inspect shaft for wear marks, if required replace with Pierce P/N 46-2291.
7. Grooved or noticeably worn shafts should be replaced.
8. Remove existing axle bearings and replace.
9. After reassembling step into box, refill tube with grease as described above.
10. Torque pivot nut to 113 ft-lbs.
11. Verify that the step without the actuator cylinder attached will rotate freely. If the step does not drop quickly and freely, remove one .02-inch spacer from the pivot shaft.

4-5.6 Step Valve Adjustment

1. Loosen the 1/4" fasteners that attach the valve bracket assembly to the step box side.
2. Close the door until the first latch is secured; the door is not completely closed.
3. While grasping the valve bracket at the closet point near the box side, pull firmly until the valve button contacts the door pin and depresses. The step will try to retract at this time. Hold the step down to prevent it from rising.
4. While maintaining pressure on the valve bracket, tighten the two 1/4" fasteners tight enough to hold the assembly from shifting.
5. Open the door and close gently to the first latch; the step should rise at this point. Close the door the rest of the way to the second latch.
6. If the step does not rise on the first catch, close the door the rest of the way to see if it rises at the second catch. Judgment is required at this point; the distance from the first latch to the second latch is about 1/8". Move the valve bracket this amount and retry.
7. Once the proper valve position is attained, torque the mounting fasteners to 6 ft-lbs.
8. Repeat this process for the remaining steps.

4-5.7 Cab Dome Light Switch Replacement

1. Locate faulty switch and remove.
2. Disconnect wire connection at rear of switch.
3. Remove switch and discard.
4. Reconnect wire to switch.
5. Set switch position.

6. The switch will set to the proper location with the first step retraction.
7. Open and close door to verify dome light operation.

This switch can only be set 1 time. If the switch setting needs to be reset, a new switch will be required (Pierce P/N 64-2695).

4-6. Cab Tilt System

4-6.1 Cold Weather Operation

Cab lift cylinders on all Pierce Custom Chassis tilt cabs include a velocity fuse in the tilt system. This is a safety device designed to lock fluid in the cylinders in the event that pressure is lost suddenly due to pump failure or a broken line. The velocity fuse becomes more sensitive to actuation at low temperatures. To avoid the possibility of locking up the cylinders when lifting the cab in extreme cold weather, replace the fluid in the cab lift system as specified in *Table 4-1*.

Table 4-1: Cab Lift Cylinder Fluid Chart

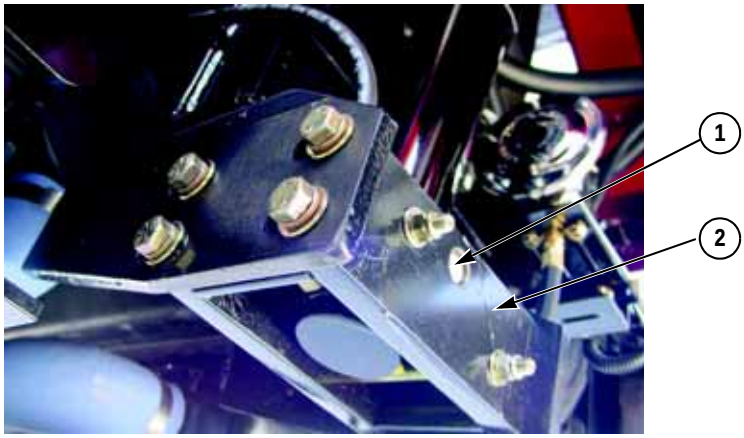
Temperature		
F	**C**	**Fluid Type**
0 to 120	-18 to 49	DEXRON III
Below 0	Below -18	MIL-H-5606 (Mobil HFA or Equivalent)

Purge all air from the cab tilt system whenever replacing fluid.

4-6.2 Lift Cylinder Trunnion Cleaning & Lubrication - *Arrow XT*™

To prevent corrosion, the following procedure should be followed every 90 days or 2,000 miles, whichever comes first. This procedure should also be performed any time the area is pressure washed. Penetrant, lubricant, and grease required for this procedure can be obtained using Pierce PN 1753125.

Figure 4-1: Typical Lift Cylinder Trunnion & Bracket



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1. Apply CORTEC VpCI™ Super Penetrant to the joints between the trunnions (1) and mounting brackets (2). This penetrant is formulated to free rusted parts and displace any trapped moisture or water. Allow chemical to penetrate for three minutes.
2. Apply EcoLine® All Purpose Lubricant liberally to the joints between the trunnions (1) and mounting brackets (2). This lubricant prevents corrosion on un-coated and difficult to reach areas, as well as contains an extreme pressure additive for extra wear protection.
3. Apply CORTEC EcoLine® Heavy Duty Grease to the outside, exposed surfaces of the trunnion joints after each cleaning and lubrication cycle. This grease provides lubrication, moisture displacement and corrosion protection.

4-7. Care of Vehicle

4-7.1 Graphics, Lettering, and Striping

Pierce Custom Cabs may be adorned with graphics using any or all of the following methods:

Goldstar	A process which encapsulates 22-karat gold leaf paint or vinyl between two laminations for maximum protection. Goldstar is applied to the vehicle using an aggressive bonding agent.
Gold leaf	A 22-karat gold leaf applied directly over a painted surface and protected with a clear polyurethane topcoat.
Reflective Vinyl	A vinyl product available in either regular or reflective sheeting using an aggressive bonding agent.
Paint	A lettering enamel brushed directly on top of a painted surface.

4-7.2 Washing Instructions

CAUTION

Avoid washing with high water pressure, hot wash solutions, abrasive detergents, or rough cleaning motions.

Washing removes small particulate that can scratch the painted surfaces. It also removes contaminants that can etch the paint and accelerate corrosion.

- Your vehicle has been washed at the factory during pre-delivery and can be washed any time after delivery.
- Never wash in direct sunlight, as the surface temperature may be too hot.
- To wash, use a mild non-abrasive liquid detergent or a “wash and wax” type soap that is specifically formulated for vehicle washing (3M Car Wash Soap – P/N 39000). This type soap has been formulated to have minimal effect on waxed surfaces. Mix with warm water at the recommended dilution. Pre-wet the entire surface to be washed. Apply the soapy wash solution with cotton towels or soft bristle brush and a gentle cleaning motion. Rinse off all washed areas thoroughly with tap water at gentle pressure before the wash solution has dried. Once the entire vehicle has been washed, rinse the entire vehicle with “pure” water from the top down. Water is too hard if above 120ppm; pH should be between 6 and 8. Water that has a pH below 7 is acidic. Acidic water will etch the paint and accelerate corrosion in crevices, under hardware and around fasteners. Dry all surfaces with a clean, soft, non-abrasive cloth or chamois. Allow to completely dry in an environment where relative humidity is below 60%.
- As a rule, pressure washing should only be done on the underside of the vehicle. Pressure washing should not be done on any surface that has Goldstar, gold leaf, vinyl striping, labels, or overlays. When washing using high water pressure, all grease fittings outside and underneath the vehicle chassis must be lubricated after washing to dissipate water and contaminated grease.
- Wash the vehicle only when dirty. Excessive daily washing should be avoided, unless the vehicle is dirty. To remove light dust without getting the truck wet, wipe off with a clean damp cloth or chamois. A “dry wash” commercial product can also be used to remove light soils. (Follow product manufacturer’s instructions.)
- Wash all soils off as soon as possible, especially road salts, fuel, industrial fallout, etc., from inside and outside surfaces.
- Tar removal can be done with Naphtha thinner applied with soft tissue or with a commercially available tar remover (follow product manufacturer’s instructions).
- Rust and tarnish removal can be cleaned away with a special mixture of 1 part laundry detergent, 1 part kerosene, and 1 part lukewarm water.
- After washing and rinsing, or after vehicle use in the rain, always blow-dry or wipe dry with a soft cotton towel, especially areas that will trap water. Open up all doors and dry off the interior surfaces and door latches. **NEVER LET THE VEHICLE SIT WET.** Ceiling fans and/or floor ventilation is recommended. When possible, park the vehicle outdoors and open up all vehicle doors to let all areas dry out.
- Clean Goldstar, gold leaf, vinyl, painted surfaces using mild, non-abrasive liquid “wash-n-wax” type solutions. Follow manufacturer’s mixing instructions. Wash with warm water (not hot), using gentle water pressure and a clean, soft cloth.
- Clean anodized aluminum trim using only mild detergents and lukewarm water. Damage to these parts can occur if cleaning solutions having excessive acidity or alkalinity are used.

4-7.3 Undercarriage Corrosion

CAUTION

As a rule, pressure washing should only be done on the underside of the vehicle. Pressure washing should NOT be done on any surface that has Goldstar, gold leaf, vinyl striping, labels, or overlays. When washing using high water pressure, all grease fittings outside and underneath the vehicle chassis must be lubricated after washing to dissipate water and contaminated grease.

The increased popularity of liquid de-icing agents along with traditional road salts has increased the risk of chassis-related corrosion. Liquid de-icing agents wick into narrow gaps even more readily than road salts and cause corrosion when humidity is present. The new chlorides tend to stick to surfaces more than traditional road salt.

Fire apparatus is no exception. The following are some suggestions that may inhibit the effects of corrosion:

- Thoroughly pressure wash the undercarriage of the apparatus frequently with plain water to remove salt and chemicals.
- Apply a rust proofing compound to the undercarriage of the apparatus, such as Ziebart.
- Inspect the undercarriage regularly to identify any corrosion at an early stage. Once identified, the area should be cleaned thoroughly, coated with a rust inhibiting system such as “POR-15®” and then painted. (Information on POR-15® can be found on their website at “www.por15.com”)
- Remove water from the floor where the apparatus sits. Use a fan to keep the area dry.
- Hose out the radiator with plain water.
- Keep mud flaps in good repair to minimize salt/chemical spray.
- Avoid splicing into wiring. If repairs are needed use shrink terminals.
- Clean out electrical connectors regularly with plain water and re-grease with dielectric grease.

4-7.4 Chrome Cleaning

- Wash chrome parts using mild soap and water, with a clean non-abrasive towel.
- After washing, rinse with water and hand dry chrome parts.
- If needed, apply a soft non-abrasive chrome polish.
- Never use any products that scratch or chemicals that are abrasive, as this will dull the chrome finish.
- Do not use any acid or hydrozide based chemicals.

4-7.5 Waxing Instructions

CAUTION

Avoid hand waxing Goldstar and vinyl surfaces. Wax solutions frequently consist of small abrasive materials. These materials will scratch and dull the vinyl surface. Hand wax around these products to avoid abrasion.

Wax makes the painted surfaces easier to clean and dry. Waxes produce a durable, high gloss finish that fills and minimizes minor surface scratches. Wax should be reapplied when water no longer beads up on the surface. Recommended products are: “Wax, 3M Perfect-It Show Car Wax – P/N 39021” and “Polish, 3M One Step Cleaner Wax – P/N 39006”. Follow manufacturer’s recommendations for application and removal.

- Paint finish may be hand waxed 90 days after delivery with a non-abrasive wax, applied lightly, and softly buffed. **Do not wax any of the Goldstar, gold leaf, or other vinyl. Wax around it!**
- Never wax in direct sunlight, as the surface temperature may be too hot.
- Properly wash vehicle first.
- Bright metals may be polished using a non-abrasive polish.
- Polish can be used in the event that surface contaminants remain on the surface after washing and waxing or if there are minor scratches in the painted surface that have reduced the gloss.

4-7.6 Touch-Up

Touch up paint if the surface has been nicked or scratched and the undercoat (primer) or bare metal has been exposed. Is bare metal is left untreated, moisture will penetrate the paint and corrosion will start. Once corrosion starts, it will continue to grow.

1. Clean the area with Wax & Grease Remover or Naphtha.
2. If bare metal is exposed, any corrosion must be removed. This should be done with a fine abrasive. Reclean surface if necessary.
3. If bare metal is exposed, primer should be applied.
4. Apply the color coat touch-up paint to a sample piece to ensure good a color match. Apply a thin coat of color. If a second coat is required, allow the first coat to dry.

4-7.7 Surface Restoration

If minor surface scratches or nicks cannot be repaired using methods previously explained, a trained professional should make the necessary repairs.

4-7.8 Re-coating Instructions

- Re-coat Gold Leaf painted surfaces every 12 to 18 months (depending on vehicle duty cycle) using a two part polyurethane clear coat.
- Repair any nicks or deep scratches in the paint as soon as discovered with commercially available touch-up primers and paints.
- If additional equipment is mounted with screws to a painted surface, seal all holes with a commercially available sealant to prevent corrosion starting from the screw holes. If possible do not use screws. Instead, electrically separate dissimilar metals with adhesive sealants, tapes, or vinyl barriers.

4-7.9 Goldstar Striping Repair Instructions

Any Goldstar product that is replaced must have all cut edges sealed. Seal all cut edges with a two part polyurethane clear coat. Paint all end borders with matching color lettering enamel before applying clear coat. Failure to apply clear coat to the edges of cut Goldstar products will cause delaminating.

4-7.10 ABS Plastic, Acrylic Curved Windows, and Clear LEXAN Component Care

1. Wash with a mild solution of soap or detergent and lukewarm water.
2. Using a soft cloth or sponge, gently wash the sheet to loosen dirt and grime and rinse well with water.
3. To prevent spotting, thoroughly dry with chamois or cellulose sponge.

Avoid the use of abrasive cleaners and/or cleaning implements, such as brushes that may mar or gouge the coating.

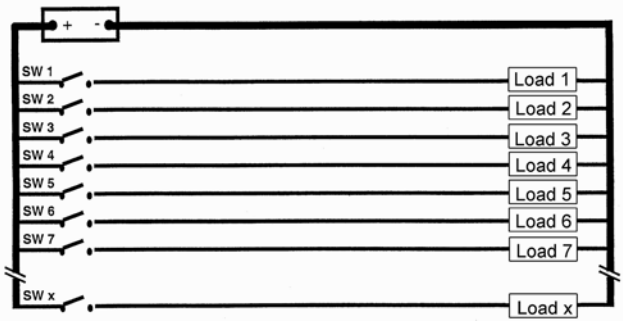
4-7.11 Product Availability

- 3M products, soap, wax and polish are readily available for sale. Detailed information is available at: http://mmm.com/market/automotive.
- Culligan is a good source for water testing and purifying equipment. Detailed information is available at: http://www.culligan.com
- Raabe is a good source for touch up paint. Detailed information is available at: http://www.raabecorp.com.

4-8. Command Zone™ System - *selected chassis*

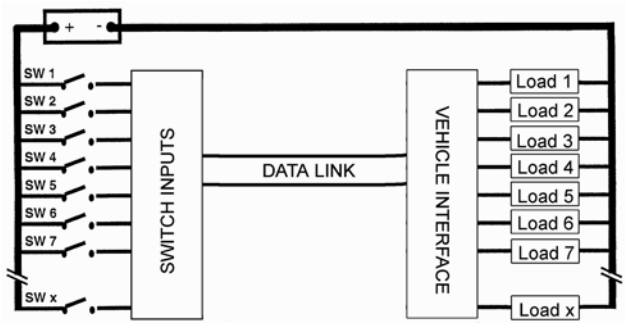
4-8.1 Overview

Figure 4-2: Traditional Electrical System



POM0111

Figure 4-3: Pierce Command Zone™ Multiplex System



POM0112

The multiplex electrical system is different from most traditional electrical systems. Traditional truck electrical systems *(Figure 4-2)* use individual wires, switches, and components to operate discrete systems. This usually results in the use of large power distribution boxes and large main wiring harnesses. Many electro-mechanical relays are also needed to perform operational interlock functions.

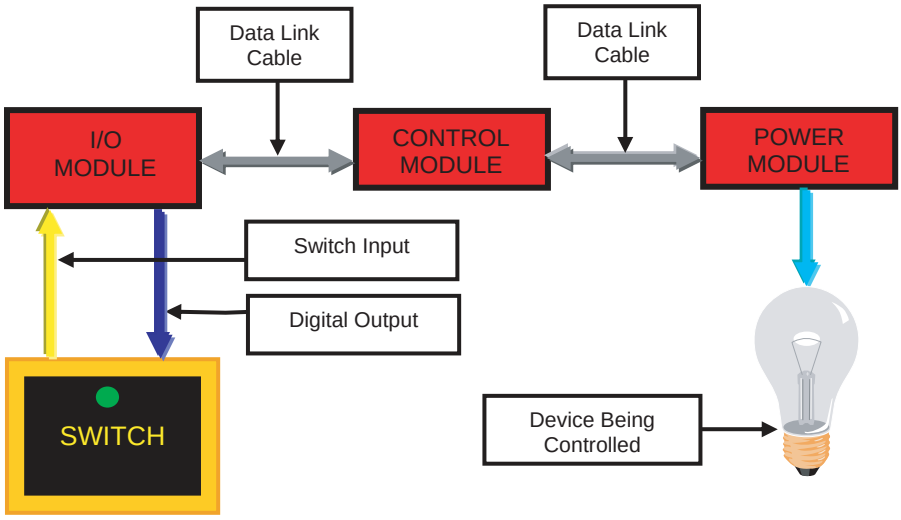
The Pierce Command Zone™ multiplex system *(Figure 4-3)* uses a single, three-wire, wire harness or data link to connect switches and controls (inputs) to system loads and devices (outputs). The use of this single data link vastly reduces the amount of wiring used within an electrical system. System inputs and outputs are connected to modules located along the single data link.

The input from several switches is combined together in an input/output or input module which connects to the data link. Similarly, many outputs are connected together in an output module or power module which also connects to the data link. In most cases the power module controls the higher amperage load of the components. A control module is used to interpret switch functions, facilitate communications with other multiplex devices, and perform desired interlock functions.

Additional information on the Command Zone™ system can be found in the Pierce Service Manual, group 0950-P-009, Command Zone™ Advanced Electronics.

4-8.2 Multiplex System Principals of Operation

Figure 4-4: Pierce Multiplex System Operation



POM0113

NOTE: The Command Zone™ Information Center (CZIC) also has switch input capabilities.

The functionality of a simple multiplex system is explained in the following paragraphs. While the system shown here has a single Input/Output (I/O) Module and Power Module, typical vehicles have several modules located in various places on the truck.

Step 1	The operator activates a switch (rocker or membrane) for a specific function. This information is received by the I/O Module, which transfers this information to the Control Module via the data link.
Step 2	The change in switch position information is received by the Control Module, which interprets the information and verifies that all necessary interlocks have been satisfied (if applicable).
Step 3	The Control Module then sends an indicator light activation message (via the data link) back to the I/O Module, which then causes the I/O Module to turn on the indicator light located on the switch.
Step 4	At the same time the indicator light information is processed, the Control Module determines which Power Module output should be turned on and sends that information via the data link.
Step 5	The power module - which is constantly monitoring the information on the data link - interprets the Control Module information and grounds the appropriate output pin location on the Power Module, which in turn activates the device.

4-8.3 Troubleshooting Tips

CAUTION

Make sure you are properly trained before attempting to service a multiplex system.

Because of significant differences between traditional electrical systems and the multiplex system, different tools and skills are required to troubleshoot multiplexing faults.

Command Zone™ Diagnostics

This computer software is used to connect a conventional laptop PC to the vehicle's control module. The software allows a mechanic to interrogate components within the multiplex system to determine the status of individual input and output circuits.

Input/Output Sheets (I/O Sheets)

IMPORTANT: I/O sheets may be required to diagnose some multiplex related faults. These sheets should be kept with the vehicle at all times. Replacement I/O sheets can be obtained by contacting Pierce Manufacturing.

These vehicle-specific information sheets are generated during the design of a new vehicle and are invaluable for troubleshooting. Due to the wide range of custom equipment found on Pierce apparatus, each electrical system is designed for that specific application. I/O sheets provide instructions for the specific input and output locations for each electrical circuit on the vehicle. Limited wiring diagram information is also included on the sheets.

Component LED Heartbeat (Red)

This is a blinking LED that is located on all multiplex modules. This LED blinks at the rate of one blink per second, and indicates that the module is capable of communicating with other modules on the data link. Also a steady green LED indicates B+ (battery) and ground to each module.

Input Module *(Clear Case Option)*

A label identifies the input corresponding to the LED. If the LED is on, the module is seeing an input from a device.

Input/Output Module *(Clear Case Option)*

A label identifies the input/output corresponding to the LED. If the LED is on, the module is seeing an input from a device or the module output is active.

Output/Power Module *(Clear Case Option)*

A label identifies the output corresponding to the LED. If the LED is on, the module output is active.

Data Link Troubleshooting

The data link consists of three wires: two insulated wires and one shielding wire. The two insulated wires are called “CAN L” and “CAN H.” CAN L is a green wire (Pin B); CAN H is a yellow wire (Pin A). Secondary locks are installed on all data link connectors to prevent the data link from coming apart.

A 120 ohm terminating resistor plug is installed at each end of each J1939 data link. When the system is functioning properly, the system will read 59-61 ohms across pins “A” and “B” of the data link connector. If this resistance is not maintained, an intermittent system fail or communication lost message may appear on the CZIC.

An ohm reading of approximately 120 ohms indicates a terminating resistor that is missing, or a data link that is open (loose connection). A 40-ohm reading indicates that an extra terminating resistor plug has been installed in the data link.

Non-Command Zone™ Components

Never assume that the cause of the problem is the multiplex system. Check the device; it may be defective. Perform all basic electrical checks (fuses, circuit breakers, wiring connections, terminals, etc.) before assuming the worst.

4-9. Cooling System

The most efficient cooling system is one that keeps the coolant at proper temperature for efficient engine operation regardless of engine speed or load. When coolant temperature is below normal, fuel may not burn readily or produce its full power. When water temperature is excessive and the engine is operating under full load, lubricating oil may get so hot and thin that it cannot lubricate effectively. Every part of the cooling system requires attention.

4-9.1 General Inspection and Service

⚠WARNING

Always allow the engine to cool before opening the pressure cap. Wrap a thick, heavy cloth around the cap. Push down, and turn the cap to the first notch position. Pause before opening completely to allow any remaining pressure to escape. Follow this procedure to avoid burns from hot steam or coolant.

Wear safety goggles when blowing debris from radiator, or damage to eyes may result.

CAUTION

Do not use antifreeze with a “stop leak” additive as this additive may clog the cooling system.

Always fill coolant system properly and completely, or serious engine damage may result.

1. Check the engine coolant level (with engine stopped). The engine water pump can draw air as well as coolant when the coolant level drops below the coolant make-up line connection at the radiator or the top of the radiator core.
2. Fill radiator or surge tank to proper level with permanent-type antifreeze and water. Water should be clean and free from any corrosive and scale forming chemicals (not softened water). Radiators and oil coolers that get dirty inside and outside lose their ability to absorb and radiate heat.

3. Clean radiator and charge air cooler using compressed air to remove bugs, dirt, and other debris. Steam clean annually. Clean from the side opposite the direction of airflow.
4. Check for leaks and straighten bent fins with needle-nose pliers.

4-9.2 Hoses

Check for soft, mushy feel or swelling. Also look for cracks in the hose around the clamp area. Replace defective hoses.

4-9.3 Hose Clamps

Constant torque type hose clamps are used on most coolant lines. These clamps should be installed during initial assembly or reassembly with to a torque of 100 in-lbs. The clamp will likely drop in torque value after exposure to hot coolant and should be maintained to a torque of 45 in-lbs thereafter.

Tighten standard worm-drive style clamps to 30-45 in-lbs. The clamp will likely drop in torque value after exposure to hot coolant and should be maintained to a torque of 30 in-lbs thereafter.

Replace clamps as required with same style as originally supplied.

4-9.4 Water Pump

Inspect water pump and hose connections for leaks.

4-9.5 Thermostats

Check thermostats yearly. Install new ones if necessary. Thermostats are stamped with the opening temperature. For example, a thermostat marked 175°F (70°C) indicates that this is the approximate temperature at which the thermostat starts to open. A thermostat is fully open at approximately 20°F (11°C) above the opening temperature. Observe engine temperature gauge to check thermostat operation.

4-9.6 Antifreeze Solution/Coolant Conditioner

CAUTION

Proper corrosion inhibitor levels must be maintained to prevent premature engine failure. Refer to the engine manufacturer's manuals for proper checking procedures.

Use a hydrometer to check antifreeze solution. Follow the manufacturer's mixing proportions to obtain desired protection.

Drain, flush, and refill cooling system annually as follows:

1. Open the radiator drain, remove plugs from engine block, remove plug from thermostat housing base, remove plug from oil cooler, and loosen or remove radiator cap. Remove hoses at any location that is lower than the nearest drain plug.
2. After system has drained, close valve and replace plugs and hoses.
3. Fill system with clean water.
4. Run engine until warm, shut off engine, reopen radiator drain valve, and remove plugs.
5. Repeat these steps until the water drained from the system runs clear.
6. Close the radiator drain valve tightly and replace plugs.
7. Fill system with coolant.

4-9.7 Coolant Fill Procedure

CAUTION

Do not overfill with coolant as this may degrade cooling system performance.

1. Park vehicle on level surface
2. Set all heater controls to the hottest position and verify that heater shut-off valves are open.
3. Fill system with the proper coolant mixture to the top of the sight glass.
4. Run engine at idle speed for 3 minutes, full throttle for 5 minutes, and idle again for 2 minutes. Note any electronic warning system messages displayed on the instrument panel. If the low coolant warning is displayed, shut off engine immediately and add coolant up to the level of the sight glass and repeat this step.
5. Shut off engine and add coolant up to the level of the sight glass (if required).

4-10. Doors and Windows

4-10.1 Latches and Window Regulators

Door latches and window regulators require lubrication to reduce component wear and continue to operate smoothly. To ensure smooth operation, remove the door panel and lubricate all moving parts on latches, paddle handles, linkages, and regulators. The door latch mechanism requires specific attention and needs to be lubricated. Liberally apply white lithium grease or Alpha 2000 grease between the pivot arm (cam shaped lever) and the pivot plate of the door latch. Operate the regulator and lubricate all moving parts until the lubricant is distributed evenly.

4-10.2 Exterior Door Handles - *Velocity™/Impel™*

- Exterior handles must be lubricated only with dry-film lubricants. Traditional lubricants can cause dirt and debris to become trapped in the handle mechanism resulting in binding of the handle.
- All other areas of the door mechanism may be lubricated using white lithium grease or Alpha 2000 grease.

4-10.3 Door Strikers

Inspect the door latch strikers. Tighten loose strikers on cab side doors to 55 ft-lbs. Adjust the striker in or out to obtain an even seal around the door with the latch closed completely. If the striker must be adjusted downward to line up with the latch, inspect the door hinge for damage or wear. To ensure smooth operation, avoid excessive seal compression that will require high opening forces at the paddle handle.

4-10.4 Doors - *Quantum®*

- Lubrication of the doors is most important. Use spray white lithium grease, LUBRIPLATE SPRAY LUBE ‘A’. Paddles must be lubricated at least every 90 days. If more frequent lubrication becomes necessary, the paddles may need to be replaced. Lubricate all moving parts of the latches.
- Check hinge mounting screws every 90 days for proper torque.
- Check “timing” of the paddle actuation to latch release. The required adjustment allows the latch trip lever to bottom out before the paddles, thus assuring that the paddle will continually trip the latch. Adjustment is accomplished by loosening the paddle mounting bolts and relocating the paddle within the cutout. If more adjustment is necessary, a slight bending of the rod may be required.
- Regularly apply silicone to the rubber door seals on the cab – monthly or whenever the truck is washed.

- If adjustment of the door is required due to leaking seals or rattling, the seals should be looked at closely for signs of deterioration first. If the seals have not been properly maintained, they can dry out and take a set. If adjustment of the door is required, the hinge screws should be loosened and the door hinge adjusted first. As a general rule, the doors were designed so that they are flush with the sides of the cab. Care should be taken that the door is not adjusted too far inboard, as the scuff-plate may bind on the floor threshold. A slip of paper should slide freely between these surfaces when the door is closed. Only after the hinge has been adjusted should the striker bolt be relocated (adjusted).

4-10.5 Hinges

IMPORTANT: Door hinges should be lubricated by spraying them with a light coating of silicone lubricant. After spraying, clean over-spray from surrounding painted surfaces and walk areas.

Inspect hinge fasteners. Tighten loose hinge fasteners as required. Inspect the hinge for wear or damage. Hinges can be “sprung” from the weight of crewmembers supporting themselves on the doors during entry. This will cause the door to sag and bind on the striker. Replace sprung hinges to ensure smooth door operation.

4-10.6 Weatherstrip

Inspect weatherstrip for tears or excessive abrasion. To extent life of rubber, spray weatherstrip and window rubber with a light coating of silicone lubricant. Clean over-spray from surrounding painted surfaces, glass, and walk areas.

4-11. Driveshafts

⚠WARNING

Fire apparatus are equipped with driveshafts and shafts used for Power Take-Off (PTO) operated accessories. Never operate the engine with shaft guards removed or with personnel in the vicinity of any rotating shaft, as they may engage without warning. Hands, clothes, hair, etc., can get caught on spinning shafts and U-joints. Failure to heed this warning may lead to personal injury or death.

CAUTION

Cease vehicle operation immediately if excessive driveline vibration occurs. Continued operation with excessive driveline vibration can cause expensive repairs to transmission, axle, or pump components.

For vehicles equipped with air suspensions, do not alter the ride height setting, or severe driveline vibration and component damage may result.

Lubricate according to the schedule found in the Pierce Service Manual, group 0501-V-001, Dana Spicer Driveshafts. Inspect driveshafts for signs of wear, interference, or looseness. Observe any loose wires, hoses, or other components that may become entangled in the spinning shaft and secure properly.

4-12. Electrical

4-12.1 Alternator

Proper belt tension is essential to avoid squealing, slipping, or throwing of alternator belts. Proper belt tension should be checked using a Burrows Tension Gauge or equivalent. Refer to *"Fan and Accessory Belts"* on *page 4-22* for belt installation instructions and proper belt tension values.

4-12.2 Batteries

Terminals

Make cable connections as corrosion resistant as possible by coating the connections with a heavy general purpose grease or battery terminal protection product. Tighten the cable clamps to the battery posts before applying the grease. This prevents the grease from getting between the clamps and the posts, and thereby restricting the flow of electrical current.

Cleaning

Batteries can be cleaned with a brush dipped in a baking soda or ammonia solution. Make sure the battery caps are tight to prevent the solution from entering the battery. After cleaning, flush with water. Clean battery terminals with a steel wool or a wire brush. Keep terminals clean and tight. Make sure vent holes in the battery caps are open.

4-12.3 Wire Harnesses and Electrical Connectors

CAUTION

When adding electrical accessories, choose mating connectors and terminals carefully to avoid electrolytic corrosion. Joining connectors of dissimilar material can cause a chemical reaction that will quickly corrode the joint, and electrical conductivity will be reduced or lost.

Inspect electrical connections for corrosion, looseness, or heat damage. Clean, tighten, or replace as necessary.

Inspect all wire harnesses and look for evidence of broken wires, chafing, or heat damage. Repair or replace as necessary.

4-12.4 Alternating Current (AC) Systems (120V-240V)

⚠WARNING

To avoid property damage, personal injury, or death, refer to the manufacturer's service information before working on any high voltage equipment. By definition, high voltage circuits and components contain voltage levels that may cause equipment damage, electrical shock and/or electrocution if handled incorrectly.

All electrical circuits associated with Auxiliary Power Units (APUs), shore power, and inverters should be considered high voltage.

Only trained technicians may perform service inside high voltage components. If you work around or maintain high voltage circuits, please seek high voltage training.

4-12.4a Alternating Current (AC)

The main difference between AC and Direct Current (DC) systems if that the voltage levels in DC systems remain constant, while the voltage levels in AC systems are constantly changing. When measuring an AC system, it is important to know that the average voltage is zero and that is why **A VOLTMETER SET TO DC WILL NOT INDICATE THE PRESENCE OF AC VOLTAGE WHEN CONNECTED TO AN AC CIRCUIT!**

High voltage can be lethal. Always refer to the high voltage equipment manufacturer's service information when maintenance or repairs are needed. In most cases, diagnostics and repair are performed after the high voltage circuits are disabled. If you work around or maintain high voltage circuits, please seek high voltage training.

⚠WARNING

To avoid property damage, personal injury or death, circuits must be checked using a voltmeter for the presence of both DC and AC voltages. A voltmeter set to DC will not indicate the presence of AC voltage when connected to an AC circuit. Contacting an unknown AC or DC voltage may cause equipment damage, electrical shock and/or electrocution.

Only trained technicians may perform service inside high voltage components. If you work around or maintain high voltage circuits, please seek high voltage training.

4-12.4b Auxiliary Power Units (APUs)

NOTE: High voltage APU wiring may NOT be marked for easy identification as high voltage.

APUs are basically small diesel powered generator units that are integrated into the vehicle's electrical system. APUs are utilized in combination with inverters and battery chargers. APUs are often set up to automatically start when the electrical management system deems it necessary to maintain battery charge or when the electrical demand requires it.

4-12.4c Shore Power

NOTE: High voltage shore power wiring may NOT be marked for easy identification as high voltage.

Shore power is a connection from a vehicle to and external 120V AC power source. The vehicle is equipped with an exterior receptacle that allows connection to an external "shore" power source.

4-12.4d Inverters

NOTE: High voltage inverter wiring may NOT be marked for easy identification as high voltage.

Inverters are electronic devices used to change Direct Current (DC) to Alternating Current (AC). Some inverters contain converters that also convert AC to DC for battery charging and/or running 12V equipment.

4-12.4e Before Servicing High Voltage Equipment

- Be aware of ALL high voltage equipment on the vehicle; review the high voltage equipment found on the electrical diagrams and in the service manual **BEFORE** starting any work.
- When working on this equipment, remain alert at all times. Never work on the equipment when you are physically or mentally fatigued and never work alone near high voltage equipment.
- Always stand on an insulated, dry surface when working on any electrical circuit. Do not handle any kind of electrical device while standing in water, while barefoot, or while hands or feet are wet.
- Always work in an adequately illuminated area.
- Always use appropriate protective equipment: insulated gloves, rubber gloves, goggles/face shield, safety shoes, protective clothing, and insulated tools when working on electrical components/circuits of the vehicle.
- Never wear jewelry when working on this equipment. Jewelry can conduct electricity, resulting in electrical shock or burns, and may get caught in moving components causing injury.
- When working on vehicles that have high voltage devices or equipment, use appropriate alerting techniques in plain view to warn people that may be in the general area and to prevent inadvertent activation of any disabled high voltage circuit(s) during service: safety signs, safety symbols, tags, barricades, cones, etc.
- Keep a fire extinguisher close by at all times. Extinguishers rated "ABC" by the National Fire Protection Association are appropriate for use on the electrical system. Make sure the extinguisher is properly charged and be familiar with its use.
- Ensure that the high voltage power, high voltage power generating equipment, and high voltage storage devices are disconnected, locked out, or otherwise disabled BEFORE working on or around the vehicle, its electrical circuits, or components. Unless disabled, Auxiliary Power Units (APUs) may start at any time without warning; when this occurs, the circuits associated with the APU become energized with potentially lethal high voltage. Some components may require a waiting period or special procedures to discharge the voltage completely.
- Use an appropriate electrical tester and procedures to confirm that the power is disconnected BEFORE performing any work on or near any high voltage components/circuits.
- Exercise caution around output circuits even when the input power is off. Parallel power sources and energy storage devices can still be dangerous. Be familiar with the high voltage equipment installed on the vehicle. Some systems contain high voltage condensers that may require time to discharge after power is removed.
- After disconnecting or exposing a high-voltage connector or terminal, insulate it immediately using insulation tape.
- After completion of any electrical work, BEFORE restoring the power, verify that parts and or tools are removed from the work area and that the fasteners are firmly tightened to the specified torque and the connectors are correctly connected.
- Voltage can be fatal at levels greater than 60 volts. High voltage can jump a larger air gap than low voltage. If contact is made with high voltage it may not be possible to simply "let go".
- If a high voltage fuse or circuit protection device trips, do not re-energize the circuit until it has been determined that the circuit is safe. See manufacturers troubleshooting procedures before servicing a high voltage system.
- Reference OSHA Regulations as necessary and applicable.

4-13. Engine

4-13.1 Air Intake System

CAUTION

Failure to inspect the air intake system for leaks in the tubing and connections may lead to extensive damage to internal engine parts.

Periodic Inspection

Inspect the following:

- Air filter housing for cracks caused by distortion or vibration.
- Flexible ducts for damage and loose fasteners.
- Air filter mounting for loose fasteners and cracks.
- Air tubing supports. Loose or broken supports can cause excessive vibration and open cracks in the system.
- Connecting clamps for dents, bends, and tightness.
- Tubing and elbow connections by wiping clean and checking thoroughly for cracks.
- Cables, control rods, hoses, or lines for chafing against tubing and connectors.
- If the air intake manifold or the compressor intake flange is suspected of being loose, consult the engine manufacturer's manual for torque values and tighten retaining nuts to specifications.

Air Filter Replacement

Replace the air filter or air filter element when indicated by the air intake restriction lamp on the instrument panel. When replacing the filter or filter element, be careful not to allow dust or dirt from the old filter to contaminate the clean side of the intake plumbing. Contact Pierce Customer Service for replacement filters.

Moisture and Ember Separators

Velocity™/Impel™ only: Velocity™/Impel™ chassis models are equipped with an ember and moisture separation screen located upstream of the air filter.The primary function of this screen is to remove water particles from the intake air before it reaches the air filter. The screen can be removed for cleaning. Inspect the screen for buildup of dirt or debris. This screen must be kept clean to minimize air intake restriction to the engine and ensure peak engine output. Remove the screen and clean with soap and water.

Quantum® only: The Quantum® chassis employs an air intake snorkel to remove moisture from the engine air intake stream. Moisture particles impinge on the back of the snorkel elbow and the water drains from a hole where the snorkel meets the vertical pipe. This hole must be kept free of dirt and debris. Inspect the drain hole to ensure that it is clear of dirt. Clean as required. A wide mesh screen keeps large particles from entering the snorkel. Remove any debris from the screen using a soft brush.

Saber® only: The Saber® chassis draws air for the air filter through perforations in the engine tunnel. These small perforations – located in a protected spot behind the grill, and dispersed over a large area – act to prevent moisture particles from entering the Saber® air intake stream. Inspect the perforated tunnel surface to ensure that the perforations are free from dirt or debris. Clean as required with a soft brush.

4-13.2 Air Intake and Charge Air Cooler Hose Clamps

Tighten T-Bolt style hose clamps to 90-100 in-lbs.

Tighten Spring T-bolt clamps to 45-70 in-lbs.

4-13.3 Fan and Accessory Belts

Belts should be checked for frayed areas, cracks, and general wear. Always replace all belts in a set even though only one may be defective.

Belt Inspection and Installation

Proper belt tension is critical to maintaining belt life. Too much tension will overstress the belt as well as the pulleys and bearings. Too little tension will allow the belt to slip during heavy loading. This will glaze the belt surface, reduce surface friction, increase slippage, and ultimately lead to belt failure. Inspect belt tension weekly.

Tension all new belts to the values indicated in the Belt Tension Table. Belt tension must be measured with a Burrows Tension Gauge (Dayco P/N 93862) or an equivalent gauge. Multi-groove drive belts with automatic tensioning devices are not adjustable.

New belts will stretch after run-in. To prevent slippage, it is important that new belts be tightened after running the engine for 3 to 5 minutes. After run-in, allow the belt to cool and reset the tension to the value recommended in the “In-Service” column of *Table 4-2* shown below.

Table 4-2: Belt Tension Table

Type of Belt	Number of Ribs	Tension at Initial Installation	In-Service Tension (Belt Cold)*
V-belt (0.50 Inch Wide)	1	130 lbs.	105 lbs.
Multi-Rib	4	150 lbs.	100 lbs.
Multi-Rib	5	150 lbs.	100 lbs.
Multi-Rib	6	150 lbs.	100 lbs.
Multi-Rib	7	180 lbs.	120 lbs.
Multi-Rib	8	180 lbs.	120 lbs.

* Check tension when belt is hot, but wait until the belt is cool before tightening.

Multi-rib drive designs may use pulleys that have more grooves than the belt. One of the pulleys in the drive system will match the belt width. Use this pulley to align the belt and install in the correct groove on the wider pulley. A straightedge against the face of the aligning pulley will provide an accurate guide for the alignment of the belt.

Chassis Alternator Belts – *Quantum® with Detroit Diesel Series 60 engine*

The alternator belt on the Quantum® Chassis with a Series 60 engine is too short to allow the use of a Burrows tension gauge. Check belt tension by applying 25 lbs of force at the mid-span of the belt. Measure the deflection of the belt and compare to the following table. Adjust tension in the belt to obtain the proper deflection. Alternate method: use Dayco Tension Tester P/N 93865.

Table 4-3: Alternator Belt Deflection Table

Type of Belt	Number of Ribs	Belt Deflection (in)
V-belt (0.50 Inch Wide)	1	0.50
Multi-Rib	8	0.25

4-13.4 Multi Rib Belt Fan Drive - *Quantum*®

WARNING

Fan clutches can engage and fan blades can spin without warning. Keep hands, hair, and clothes away from fan. Never operate the engine with personnel in the vicinity of the fan as the fan may engage without warning. Failure to heed this warning may lead to personal injury or death.

The belt driven cooling fans on the Quantum® Chassis built after December 1999 are equipped with a clutched fan, powered by the engine crankshaft via a drive shaft connected to a multi-rib belt drive assembly. The belt drive assembly consists of a drive hub, a fan clutch, a multi-rib v-belt, and an automatic tensioning device that eliminates belt tension inspection.

Periodic belt inspection is required. Replace belt if any signs of cracking or glazing appear. Replacement of this belt requires that the fan be unbolted from the hub and leaned forward within the shroud. Remove the drive shaft from the lower drive pulley. Use a one-half inch drive socket wrench on the automatic tensioner to remove the tension from the belt. With the tension off the belt, work the belt off the lower pulley and remove from the upper pulley. Reverse this process to install the new belt.

The fan clutch will automatically engage if any of the following conditions occur:

- When the engine coolant or air intake temperature reaches the engine manufacturer's preset temperature for fan engagement.
- When truck is placed in "pump mode," the fan clutch will engage.
- When any generator PTO drive is activated, the fan clutch will engage.

4-13.5 Engine Service Schedule

Maintenance, lubrication, and inspection schedules vary among engine models and manufacturers. Refer to the engine manufacturer's maintenance manual for maintenance schedules, lubrication recommendations, and inspection procedures.

It is the owner's responsibility to ensure that the engine is maintained properly. Retain all service reports and receipts, and transfer these records in the event that the vehicle changes hands.

Use only genuine Original Equipment Manufacturer (OEM) parts or parts of equivalent quality and functionality when servicing engines. Replacement of parts with those of inferior quality may lead to lower performance, reduced engine life, or component failure.

4-13.6 Engine Mount Isolators

Inspect the engine and transmission isolators for cracks, debonding or other signs of excessive wear. Replace worn isolators with Pierce supplied parts only to ensure that proper isolation is maintained.

4-13.7 Engine Diagnostic Software - *Detroit Diesel*

2010 EPA Detroit Diesel engines require Detroit Diesel Diagnostic Link (DDDL) software version 7.06 for diagnostic support. The DDDL 7.06 package supports both 2010 EPA and older engines. Contact a Detroit Diesel service location to obtain a copy of DDDL.

4-13.8 Engine Diagnostic Software - *Cummins*

2010 EPA Cummins engines require Cummins Insite software version 7.4.2 (or newer) for diagnostic support. Contact a Cummins service location to obtain a copy of Cummins Insite.

4-14. Exhaust System

⚠WARNING

On all 2007 EPA & 2010 EPA diesel engines, the exhaust temperature can reach 1350°F during an active regeneration cycle. An active regeneration cycle could occur automatically whenever the speedometer indicates a speed above 5 mph. This can occur when the vehicle is in motion, or when the apparatus is operating in stationary pump mode with an engine rpm sufficient to indicate 5 mph on the speedometer. An exhaust temperature mitigation device is included at the tailpipe to reduce high exhaust temperatures before the exhaust exits the tailpipe. Extreme caution should always be used when working in the vicinity of the exhaust outlet. Failure to heed this warning may lead to personal injury or death.

IMPORTANT: Periodic exhaust inspection is particularly important with all 2007 EPA & 2010 EPA diesel engines. The muffler is part of the Diesel Particulate Filter (DPF). The exhaust pipe ahead of the DPF will be wrapped with heat insulation. The insulation is critical to the DPF active regeneration performance. If the insulation is damaged or missing, the internal DPF temperature may not be high enough to burn off the particulates (soot). Likewise if pipe clamps are loose, critical heat may escape, affect the regeneration performance and emissions compliance.

Inspect exhaust pipe connections to check for loose clamps or corrosion. Repair or replace as necessary. Refer to the engine manufacturer's maintenance manual for additional information on the Diesel Oxidation Catalyst (DOC) and Diesel Particulate Filter (DPF).

4-14.1 General Notes for All 2007 EPA & 2010 EPA Engines

No modification of the exhaust between the engine, Diesel Particulate Filter (DPF), and Selective Catalytic Reduction (SCR) is allowed per the EPA. Only tailpipes after the SCR are allowed to be changed.

CAUTION

All customer installed hardware needs to be kept a minimum of 6 inches away from any exhaust pipe and After Treatment Device (ATD) housing. Failure to comply may result in heat related damage to the aftermarket components.

4-14.2 Exhaust Diffusers

NOTE: All 2007 EPA & 2010 EPA engines with Diesel Particulate Filters (DPFs) are equipped with exhaust diffusers. Some Cummins ISM engines, 450 HP and higher, do not have DPFs.

Pierce Custom Chassis may be outfitted with diffuser exhaust tips. These devices lower exhaust gas temperatures as they exit the tailpipe. Exhaust Diffusers reduce exhaust outlet temperature by mixing ambient air with engine exhaust. If equipped, the Exhaust Diffuser installed on your truck should not be removed or modified in any way and must be replaced if damaged or missing. Consult your Pierce Dealer for exhaust extraction systems that are compatible with the Pierce diffuser tips.

CAUTION

Performance of the Exhaust Diffuser can be adversely affected by:

- **Exhaust Diffuser ambient air inlet obstructions.**
- **Exhaust Diffuser outlet obstructions.**
- **Damage to the Exhaust Diffuser.**
- **Inadequate building exhaust extractor system flow capacity.**

Reduced Exhaust Diffuser function can result in exhaust temperatures approaching 1200°F (649°C) at the outlet during or shortly after Diesel Particulate Filter (DPF) regeneration.

DPF regeneration can take place and high exhaust temperatures can be present while operating the truck in a stationary pumping mode.

Building exhaust extractor systems used with 2007 EPA & 2010 EPA DPF equipped engines must be designed and installed to accommodate the larger diameter pipe, accept higher exhaust flow rates and higher exhaust temperatures present with 2007 EPA & 2010 EPA engines.

4-15. Fasteners

4-15.1 Frame Fasteners

Inspect all frame assembly fasteners. Tighten any loose fasteners using the values in *Table 4-4* or *Table 4-5* for the proper size/thread pitch of hardware. Torque fasteners using a calibrated torque wrench. Replace frame fasteners with quality hardware of the same type and grade only.

Table 4-4: Grade 8 Course Thread Fastener Torque Chart

Size	Torque	
	In-Lbs	Ft-Lbs
1/4-20	129	
5/16-18	265	
3/8-16		39
7/16-14		63
1/2-13		96
9/16-12		138
5/8-11		191
3/4-10		339
7/8-9		545
1-8		818

Table 4-5: Grade 8 Fine Thread Fastener Torque Chart

Size	Torque	
	In-Lbs	Ft-Lbs
1/4-28	147	
5/16-24	294	
3/8-24		44
7/16-20		70
1/2-20		108
9/16-18		154
5/8-18		216
3/4-16		378
7/8-14		602
1-12		895
1-14		918

4-15.2 Bumper Extension Carriage Bolts

Torque the 1.00-8 UNC carriage bolts that fasten the bumper extension to the frame assembly to 400 ft-lbs.

4-15.3 Other Fasteners

Refer to the component manufacturer’s service publications for the proper torque for fasteners installed into component housings such as axles, engine, transmission, steering gear, and suspensions.

4-16. Fifth Wheel Lubrication *(Tiller Only)*

NOTE: Every 3,000 miles or 6 months, grease the fifth wheel bearing connecting the tractor to the tiller trailer.

4-16.1 Grease Fitting Location

Figure 4-5: Fifth Wheel Bearing Grease Fittings

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There are two grease fittings (1) remotely mounted on the upper fifth wheel weldment (2), directly above the fifth wheel bearing. Each fitting is connected to the bearing with grease line tubing, spaced 180 degrees apart. Each of the grease fittings are easily reached by standing next to the rear chassis tires.

4-16.2 Lubrication Procedure

⚠WARNING

If an operator is being used to reposition the vehicle during this procedure, the service technician must remain clear of the vehicle when the tractor/trailer is being repositioned. Failure to comply may result in personal injury or death.

CAUTION

To distribute the grease throughout the circumference of the bearing, the bearing needs to be rotated by pivoting the tractor/trailer combination during the procedure. Failure to follow this procedure completely may result in areas of the bearing being under-lubricated.

1. Position the tractor / trailer in a jackknife condition, 90 degrees to one side.
2. Put the transmission in NEUTRAL and apply the parking brake.

3. Using a grease gun, dispense two pumps of grease into each grease fitting.
4. Reposition the unit approximately 20 degrees from the jackknife position (70 degrees from straight ahead), put transmission in neutral, apply parking brake and dispense two more pumps of grease into each fitting.
5. Repeat this procedure every 20 degrees (a total of 10 grease positions) until the unit is in the opposite jackknife position.

4-17. Frame

4-17.1 Welding on Frames

WARNING

Do not weld on heat-treated frame rails or frame failure leading to property damage, personal injury, or death may result.

All Pierce Custom Chassis frames are manufactured from high strength heat-treated steel that will lose its strength when welded upon. Do not weld on frame rails.

4-18. Fuel System

4-18.1 Fuel Delivery System

Inspect fuel system for signs of damage, leaking, or chafing. Replace or repair as necessary.

4-18.2 Fuel Filters

Diesel fuel injection nozzles are manufactured to an accuracy of a few thousandths of a millimeter and are matched precisely to each other. Impurities in the fuel can subject fuel injector components to premature damage or wear. Replace fuel filters in accordance with the engine manufacturer’s recommendations.

4-19. Heating, Ventilation, Air Conditioning (HVAC)

4-19.1 Heater Shut-Off *(Optional)*

⚠WARNING

Use of the heater shut-off valve will prevent warm air from circulating through the defroster system and may lead to a reduced ability to clear humidity from the windshield and subsequent reduced driver visibility.

Close heater line valves during warm weather to eliminate the warming affect of heater coils by slow leakage past the control valve.

4-19.2 Air Conditioning *(Optional)*

⚠WARNING

Use only refrigerants approved by Pierce Manufacturing for your air conditioning system. Some unapproved refrigerants are flammable and can explode, causing injury to personnel. Other unapproved refrigerant can cause the system to fail, requiring costly repairs.

The air conditioning system contains refrigerant under high pressure. To avoid risk of personal injury or damage to the system, adding refrigerant or any repair requiring lines to be disconnected should be done by a certified repairman.

⚠CAUTION

Air conditioning system contains R134A:

- **Avoid breathing refrigerant and lubricant vapor or mist;**
- **Exposure may irritate eyes, nose and throat;**
- **To remove R134A from air conditioning system, use equipment certified to meet SAE J2210;**
- **If R134A discharge occurs, ventilate work area before resuming service;**
- **Additional health and safety information may be obtained from refrigerant and lubricant manufacturers.**

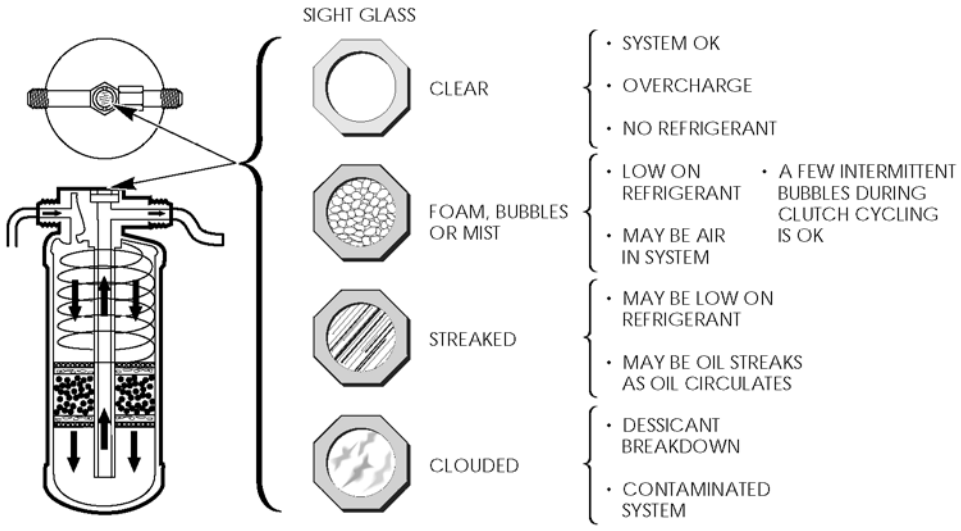
The air conditioning system should be shut down prior to tilting the cab. Failure to do so will result in water condensation build-up in the evaporator cover. This water will drip out through the openings in the cover and can pour out as the cab is tilted down after service.

NOTE: Do not add refrigerant unless the system is checked for leaks and any leaks found are repaired.

The air conditioning system should be checked at the start of the warm weather season. The service should include cleaning of the condenser fins and a refrigerant level check. Charge requirements for the system can be found on a tag on the rear unit. Drive belt tension should also be checked at this time. Some units will have air intake filters. This filter must be replaced if it becomes dirty. Condition of the filter will be based on conditions and use. Overhead units have a drain pan and hoses to direct condensed water to the outside of the vehicle. Clean the pan and make sure hoses are not blocked. The pan may have a foam pad that prevents water from sloshing. Replace the pad as necessary. Inspect all vents for looseness and operation. Replace if necessary.

4-19.2a Air Conditioning Sight Glass

Figure 4-6: Sight Glass Conditions



1115

The sight glass is the only point where you can actually see inside the air conditioner during operation. Check the sight glass through the window on top of the receiver-drier (or the separate in-line sight glass). If the system is functioning properly and cooling the cab adequately, the sight glass should be clear (you will not see anything in it). If it is not clear when the system is first turned on, wait a few minutes for the system to stabilize, then look again. *Figure 4-6* illustrates and explains what you may observe in the sight glass. Roof mounted condenser fans may run continuously or cycle on and off. If you can't tell by sound, you may have to climb a ladder and observe the fan blades.

4-19.2b Refrigerant Recovery and Recycling

Your Pierce Custom Chassis uses environmentally acceptable refrigerant. R-134a Air Conditioning Refrigerant is a hydrofluorocarbon (HFC) that is endorsed by the Environmental Protection Agency (EPA) and is an ozone-saving product. However, Pierce Manufacturing recommends that air conditioning service be performed by certified dealers or other service facilities using recovery and recycling equipment.

For additional air conditioning service information, refer to the Pierce Service Manual, group 0850-V-003, Red Dot Air Conditioning.

4-20. Rear Suspension

Refer to the rear suspension manufacturer's maintenance manual (included in the Pierce Service Manual) for maintenance schedules, lubrication recommendations, and inspection procedures.

4-21. Safety Restraints and Devices

4-21.1 Seat Belts

⚠WARNING

Do not bleach or dye seat belt webbing. Bleaching or dying may cause a severe loss of belt strength. This loss of strength could allow the seat belt to break under stress, thus resulting in personal injury.

The entire seat belt assembly should be inspected for corrosion, wear, fraying, or weak spots. The retractor, latch and buckle should be checked for proper function, and all seat belt mounting bolts should be tight at all times.

Any seat belt severely strained in a collision should be replaced before the vehicle is placed back in service.

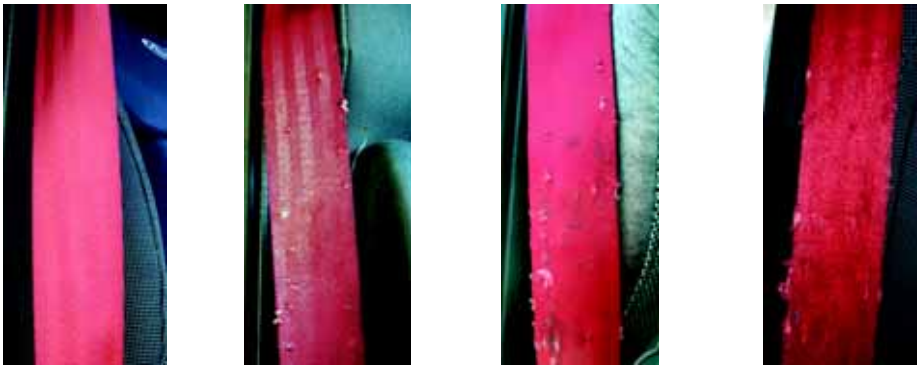
All seat belts should be replaced at least every five years.

The unique conditions of fire service application put stress and strain on seat belt assemblies not normally seen in typical automotive applications. Webbing can be abraded by interference with door hardware, bunker gear attachments, SCBA harnesses, etc. It is important to inspect and maintain seat belt webbing to ensure that it will function properly in a crash.

To ensure the safety of your fire fighters, establish a regimen of seat belt inspection. The following photos illustrate various levels of belt damage that can occur if care is not taken.

IMPORTANT: Seat belt webbing should be inspected and replaced if anything beyond slight damage is noticed.

Figure 4-7: Examples of Seat Belt Damage



No Damage | Slight Damage | Moderate Damage | Severe Damage

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4-21.2 Side Roll Protection System *(Optional)*

The following WARNING and CAUTION statements must be followed when working on a vehicle equipped with the Side Roll Protection System:

⚠WARNING

NEVER attempt to modify the Side Roll Protection System or remove system components, as injury could result. Tampering with, or removing, the roll sensor could cause an accidental deployment of the protective devices.

NEVER place any object in the deployment pathway of any Side Roll Protection component.

NEVER tamper with the wiring harnesses of any Side Roll Protection component.

CAUTION

Always follow labeled warnings and cautions on each component.

Before to welding on the vehicle, turn the vehicle power OFF. Ensure the power is removed before disconnecting or connecting the roll sensor(s). Disconnect both connectors from the master roll sensor and the slave roll sensor (if installed). When welding is completed, reconnect the connectors. Make sure the red locking tabs are latched. Refer to *"Welding Instructions"* on *page 4-50* for additional welding information.

The Side Roll Protection System is designed to be maintenance-free and fully functional for 20 years after installation. Service the Side Roll Protection System only if you are a Pierce authorized technician.

⚠CAUTION

The Suspension Seat Safety System (S4S), Inflatable Tubular Structure Side Airbags (ITS), Integrated Gas Pretensioners (IGP) / Integrated Belt Pretensioners (IBP) and Inflatable Head Curtains (IHC)/ Supplemental Restraint Air Bag (SRA) must be replaced every 20 years, as measured from the date of manufacture appearing on the FMVSS information decal; See *"FMVSS Information Decal"* on *page 1-6*. Expired devices may not provide protection in a crash.

Fault Light Information

If the Side Roll Protection fault light remains lit, or does not light during vehicle prove out, the vehicle should be brought to a Pierce Manufacturing authorized service facility. In certain cases, turning OFF the ignition and vehicle power and then turning them back ON may reset the fault light. The roll sensor(s) record all fault codes, which may be read with a diagnostic reader at a Pierce Manufacturing authorized service facility.

Precautions When Tilting the Cab During Maintenance Actions

The roll sensor(s) are programmed to allow for normal cab tilt using the cab lift system. Before to performing any maintenance activity that require tilting the cab beyond the capabilities of the cab lift system, turn OFF the vehicle power and disconnect the roll sensor(s). When the maintenance action is complete, restore the Side Roll Protection System by turning the vehicle power OFF and reconnecting the roll sensor(s) connectors, ensuring that the red locking tabs are latched.

Refer to the Pierce Service Manual, group 0010-P-020, Side Roll Protection Troubleshooting Guide; group 0845-P-001, Side Roll Protection Repair; or contact Pierce Customer Service for additional information concerning the maintenance and service of the Side Roll Protection System.

4-22. Spring Suspension (Front and Rear)

4-22.1 Springs

Inspect spring leaves for signs of wear, cracking, or bending.

Check for damage to spring stops.

CAUTION

Failure to follow these requirements for torquing and servicing U-bolts and nuts may allow the axle to shift on the spring pack causing misalignment of the axles.

IMPORTANT: Pierce Manufacturing does not approve, disapprove, or endorse the use of any aftermarket or add-on suspension systems, including aftermarket springs. Installation of any such aftermarket or add-on system is entirely at the discretion and risk of the customer.

Torque the U-bolt nuts (in conjunction with a wheel alignment) after the chassis has been operated for 500 miles or six months, whichever comes first. Re-torque nuts thereafter every 24,000 miles or annually, whichever comes first.
Torquing Procedure:

1. Clean around the U-bolt to nut joint to remove dirt and grime.
2. Lubricate joints liberally with Permatex 133k Lubricant.
3. Tighten U-bolt nuts evenly in a crisscross pattern.
4. Torque to proper value using a calibrated torque wrench per the following charts.

Table 4-6: U-Bolt Fastener Torque Chart- *Arrow XT™/Quantum®/Velocity™/Impel™*

U-Bolt Diameter	Torque	
	Ft-Lbs	N-m
3/4”-16	240-260	325-355
7/8”-14	400-420	540-570
1”-14	500-520	680-705

Table 4-7: U-Bolt Fastener Torque Chart - *Saber®/Contender®*

U-Bolt Diameter	Torque	
	Ft-Lbs	N-m
3/4”-16	240-260	325-355
7/8”-14	300-320	405-435
1”-14	400-420	540-570

Replace U-bolts with same size grade 8 U-bolts whenever they are removed. Reinstall using the torquing procedure noted above. Re-torque after 500 miles of service.

Spring seats, spacers, and shims act to support the spring pack and are important members of the suspension. Any additional spacers or shims must be selected properly. Upper and lower spring seats and any spacers that are replaced or added to the suspension assembly must be the same length and width as the original equipment. Replacing or adding spring seats, spacers, or shims incorrectly may affect spring performance or durability.

4-22.2 Suspension Shackles

Inspect suspension shackle and hanger clamp bolts. Tighten any loose fasteners to the proper values using a calibrated torque wrench *(Table 4-8)*:

Table 4-8: Clamp Bolt Torque Chart

Size	Torque	
	Ft-Lbs	N-m
3/8”-16	26	35
7/16”-14	42	57
1/2”-13	64	87

4-22.3 Spring Pins *(except Velocity™/Impel™)*

Lubricate spring pins with NLGI grade EP2 grease until grease oozes evenly from ends of each pin. If grease will not flow, raise chassis to remove the load on the springs and apply grease again. If grease will still not flow, disassemble spring pins and clean or replace as required.

4-22.4 TAK-4™ Suspension

Refer to the Pierce Service Manual, group 0152-P-002, TAK-4™ Independent Front Suspension.

4-23. Steering

4-23.1 General Inspection

⚠WARNING

Correct any steering problems immediately. Failure to properly maintain the steering system and its components may lead to loss of vehicle control resulting in property damage, personal injury, or death.

- Ensure that drag link, tie-rod, steering arm, and pitman arm retaining nuts and clamps are tight and properly torqued.
- Check that all cotter pins are installed, spread, and not corroded.
- Inspect hoses for any signs of leaking, kinking, chafing, or corrosion.
- Maintain power steering reservoir fluid level.
- Inspect steering column joint bolts and steering linkage.
- Carefully inspect steering gear mounting bracket for signs of damage, distortion, or fatigue cracking.

4-23.2 TAK-4™ Steering

Refer to the Pierce Service Manual, group 0152-P-002, TAK-4™ Independent Front Suspension.

4-23.3 Steering Reservoir

The power steering pump reservoir must be kept to the proper level and free of air. When filling the reservoir, start the engine and turn the steering wheel from left to right and continue filling until proper level is maintained.

A replacement-type filter element is located in the pump reservoir. Carefully clean any buildup of dirt and grease from the reservoir cover. Remove the reservoir cover and filter element. Clean inside of reservoir with a lint-free cloth. Install a new filter element, refill with oil, and replace cover.

The filter element should be changed when the oil in the steering system is changed. TRW and Sheppard power steering gears require the use of automatic transmission fluid type “E” or “F” or Dexron III. Highway vehicles should have the fluid changed annually or every 50,000 miles. Off-highway vehicles will require more frequent change intervals.

4-23.4 Steering System Fastener Torque

Inspect all steering system fasteners and tighten as required to the torque specified in *Table 4-9*.

Table 4-9: Steering System Fastener Torque Chart

Component	Location	Fastener Size	Torque	
			Ft-Lbs	N-m
Steering Gear - *Saber*®	Two top bolts securing the steering gear to the frame.	7/8 - 9 UNC	364	494
Steering Gear - *Saber*®	Two allen head bolts securing steering gear to the bracket.	7/8 - 9 UNC	576	781
Steering Gear - *Saber*®	Lower left bolt securing bracket to the frame.	5/8 - 11 UNC	201	272
Steering Gear - *Saber*®	Lower right bolt securing bracket to the frame.	3/4-10 UNC	357	484
Steering Gear - *Quantum*®	Two top bolts securing the steering gear to the bracket.	7/8 - 9 UNC	364	494
Steering Gear - *Quantum*®	Two top bolts securing the bracket to the frame.	3/4-10 UNC	357	484
Steering Gear - *Quantum*®	Two bottom bolts securing the bracket to the frame.	7/8 - 9 UNC	364	494
Steering Gear - *Arrow XT™/Velocity™/Impel™*	Top bolt securing the steering gear to the bracket.	7/8 - 14 UNF	635	860
Steering Gear - *Arrow XT™/Velocity™/Impel™*	Six lower bolts securing the steering gear to the bracket.	3/4 - 16 UNF	398	539
Steering Gear - *Arrow XT™/Velocity™/Impel™*	Four-Bolt pattern securing steering gear bracket to frame.	3/4-10 UNC	357	484
Steering Gear - *Arrow XT™/Velocity™/Impel™*	Six bolt pattern securing steering gear to bracket.	3/4-16 UNF	398	539
Steering Gear - *Arrow XT™/Velocity™/Impel™*	Lower bolt securing steering gear to bracket.	7/8-14 UNF	635	860
Steering Shaft Gear Box	Bolts securing 90-degree steering shaft gear box to the cab.	3/8 - 16 UNC	44	60
Steering Shafts	Keyway and spline clamp bolts.	3/8 - 24 UNF	48	65
Pitman Arm	Clamp bolt.	3/4 - 10 UNC	226	306
Drag Link	Clamp bolts.	5/8 - 11 UNC	125	169
Drag Link	Ball joint nuts.	7/8 - 14 UNF	150	205
Steering Assist Cylinder	Ball joint nuts.	7/8 - 14 UNF	150	205
Steering Assist Cylinder	Clamp bolts.	5/8 - 11 UNC	125	169
Steering Wheel	Center nut.		60	85

4-23.5 ALL STEER® All-Wheel Steering *(Optional)*

Refer to the Oshkosh ALL STEER® service group, 0611-P-001 (included in the Pierce Service Manual), for maintenance schedules, lubrication recommendations, and inspection procedures.

4-24. Tires

4-24.1 Tire Inflation

⚠WARNING

Maintain tire pressure at the tire manufacturer's pressure recommendations for the correct tire size, type, load range (ply rating), and measured in-service axle load of the vehicle. Failure to maintain proper tire pressure may result in loss of vehicle control, property damage, personal injury, or death.

Consult tire manufacturer's load and inflation tables for proper inflation pressures at a given in-service axle weight. Maximum inflation pressures, either published or special fire service recommendations, are only to be used on axles at or near the maximum rated capacity. Also follow the load and inflation tables for axles at less than maximum capacity.

The maximum tire pressure may be limited by the tire capacity (as stated on the side wall) or by the wheel capacity. Do not assume that the tire can be safely operated at the maximum pressure as stated on the sidewall since the wheel may be the limiting factor. Refer to the maximum tire pressure listed on the yellow Federal Motor Vehicle Safety Standard (FMVSS) information decal, located in the cab, for maximum tire pressure ratings.

Table 4-10 is for Michelin® tires only. Refer to the tire data book that matches the brand of tire on your vehicle or contact Pierce Customer Service for this information.

Table 4-10: Tire Data Chart

WHEEL DIAMETER - 22.5”

11R22.5 LRH – ALL TIRES

PSI		75	80	85	90	95	100	105	110	115
lbs. per axle	S	9385	9900	10430	10940	11510	12350	12490	12855	13220
	D	16895	17820	18770	19690	20720	22700	23110	23520	23800
kg per axle	S	4257	4491	4731	4962	5221	5602	5665	5831	6000
	D	7664	8083	8514	8931	9399	10297	10483	10669	10800

12R22.5 LRH – ALL TIRES

PSI		75	80	85	90	95	100	105	110	115
lbs. per axle	S	9980	10560	11140	11740	12310	12910	13480	14060	14780
	D	17700	18700	19800	20800	22000	23200	24400	25600	27000 (1)
kg per axle	S	4527	4790	5053	5325	5584	5856	6115	6378	6700
	D	8029	8482	8981	9435	9979	10524	11068	11612	12250

(1) Except 12R22.5 XDN26440 (D)

315/80R22.5 LRL – ALL TIRES

PSI		75	80	85	90	95	100	105	110	115	120	125	130
lbs. per axle	S	11700	12280	12870	13350	13990	14620	15260	15900	16540	16970	17500	18000
	D	19190	20420	21650	23120	24220	25320	26420	27540	28640	30240	31570	33020
kg per axle	S	5542	5763	5984	6056	6346	6632	6922	7212	7503	7698	7938	8165
	D	9265	9717	10169	10487	10986	11485	11984	12492	12991	13717	14320	14980

385/65R22.5 LRJ – ALL TIRES

PSI		75	80	85	90	95	100	105	110	115	120	125
lbs. per axle	S	12665	13280	13880	14560	15160	15780	16440	17060	17800	18300	18740
	D											
kg per axle	S	5745	6024	6296	6604	6877	7158	7457	7738	8000	8301	8500
	D											

425/65R22.5 LRL – ALL TIRES

PSI		75	80	85	90	95	100	105	110	115	120	125
lbs. per axle	S	15340	16000	16800	17680	18440	19180	20000	21000	21480	22220	22800
	D											
kg per axle	S	6958	7258	7620	8020	8364	8700	9072	9526	9743	10079	10300
	D											

445/65R22.5 LRL (2) – XZY®

PSI		75	80	85	90	95	100	105	110	115	120	125	130
lbs. per axle	S	16065	16930	17700	18660	19560	20480	21310	22140	22980	23890	24640	25600
	D												
kg per axle	S	7286	7679	8027	8463	8871	9288	9664	10041	10422	10834	11175	11600
	D												

S = Single configuration – 2 tires per axle

D = Dual configuration – 4 tires per axle

Proper inflation is vital! Under inflation is a tire’s worst enemy. Inflation pressure should be checked with an accurate tire pressure gauge only. “Thumping” with a tire bar is not a satisfactory method to use when checking pressure.

The practice of reducing inflation pressure to attain a softer ride is extremely hazardous, especially when steer axle tires are involved. Under inflation causes excessive flexing within a tire, resulting in heat buildup which can cause a blowout. An under inflated tire running at highway speeds and under heavy load can cause severe handling problems.

Under inflation can also result in general deterioration of the tire body, including separation of the tread from the body or fatigue breaks in the body cords. If one tire on a dual assembly is severely under inflated, the other one is prone to failure from overloading.

Over inflation detracts from a tire's ability to endure road shocks. The tire is more rigid, resulting in carcass and bead failures. Overinflated tires often exhibit groove cracking and rapid center tread wear, and are more likely to be cut or punctured.

Excessive pressure buildup resulting from overloading or high speed can cause the rim to fail. The load-carrying capacity of a tire cannot be increased over the maximum rated load by increasing the inflation pressure.

A tire that has become hot from normal use will have a higher pressure than it will when cool. Never bleed pressure from a hot tire that has increased pressure as a result of the normal pressure buildup. Always check tire pressure when the tire is cold.

4-24.2 Tire Loading

WARNING

Never load a tire beyond its rated capacity or sudden tire failure leading to a loss of vehicle control, property damage, personal injury, or death may result.

IMPORTANT: If tire manufacturer's maximum inflation and resulting load carrying capacity does not match the vehicle axle weight ratings, the tire has a special fire service rating. Contact Pierce Customer Service for the correct specifications and operating requirements for your tire and application, or refer to Michelin® special ratings chart for Michelin® tires.

Table 4-11: Michelin® Special Ratings Chart

MICHELIN® SPECIAL APPROVAL

FOR FIRE TRUCK SERVICE ONLY!

INTERMITTENT SERVICE, NOT TO EXCEED ONE HOUR LOADED TRAVEL WITH A ONE HOUR COOL DOWN PRIOR TO RETURN

TIRE SIZE	TREAD	LR		SINGLE	DUAL	PSI	SPEED
11R22.5	XZE*	H		14600	24820	120	75
	XDN	H			24820	120	75
	XDE A/T	H			24820	120	75
12R22.5	XZE*	H		15810	28880	120	75
	XDN	H			28880	120	75
315/80R22.5	XZA1	L		19260	33020	130	75
	XZY-1	L		19260	33020	130	75
	XDY	L			33020	130	75
385/65R22.5	XTE2	J		20000		120	75
	XZY	J		20000		120	65
425/65R22.5	XTE2	L		22800		120	75
	XZY	L		22800		120	65
445/65R22.5	XTE2	L		26000		120	75
	XZY	L		26000		120	65
	XZL	L		26000		120	65

* = cut and chip resistance tread compound

4-24.3 Matching

Match dual tires so that tires worn to the same diameter are placed together. Do not mount tires together that vary by more than 1/4 inch in diameter or 3/4 inch in circumference.

Match dual tires on tandem axles as directed above, but do not place the four largest tires on one axle as this may cause high axle oil temperatures and reduced axle life.

For 4x4 chassis, match front drive tires to the rear axle tires so that the rolling radius does not create a ratio difference between front and rear axles.

4-24.4 Tire Wear Inspection

WARNING

Never operate a vehicle without sufficient tire tread depth, or loss of vehicle control, property damage, personal injury, or death may result.

Inspect tires for signs of abnormal or excessive wear. Sufficient tread depth is essential to proper handling and braking performance. Refer to the tire manufacturer's owner's manual for minimum tread depth requirements. Replace tires before minimum tread depth is reached.

Tire tread life is dependent on many factors including the following:

- Tire load
- Proper inflation pressure
- Tire footprint (area of rubber in contact with the road)
- Frequency of dry-steer maneuvers (steering the vehicle in the absence of forward motion)
- Tandem scrub (inherent to all non-steering tandem suspensions)
- Engine horsepower
- Brake power
- Frequency of tight cornering maneuvers
- Driving habits of acceleration and braking
- Suspension alignment

Expect faster tread wear on fire apparatus when compared to standard line-haul trucks. Fire apparatus accelerate faster, brake harder, corner tighter, and have more horsepower flowing through the tires to the road than other heavy-duty trucks with the possible exception of waste haulers. Tandem axle aerial apparatus are particularly susceptible to accelerated tire wear due to the combination of the tandem scrub phenomenon and high suspension loading. Over-the-road tractor tandems do not exceed 34,000 pounds loading; whereas typical aerial apparatus tandems may be loaded from 44,000 pounds to 58,000 pounds or higher. Since most aerial apparatus only operate in congested areas with taller buildings, it is natural that they will experience a much greater proportion of their time in accelerating, braking, and cornering – three of the most detrimental influences on tire life.

While the steering action of the ALL STEER® all-wheel steering option will reduce the negative influence of tandem scrub when cornering, this advantage can be offset if the vehicle is subjected to dry-steer or crab-steer operation. The single tires on the ALL STEER® axle are also subjected to a higher load per footprint area and will naturally tend to wear faster than will dual tires at the same loading.

4-24.5 Tire Rotation

NOTE: When rotating tires with Counteract balancing beads, the technician should strike the tire tread to dislodge the beads to promote rebalancing in the new axle position. See *"Balancing"* on *page 4-42*.

Front Tires

If irregular tire wear is found on the front axle tires, they should be moved to the rear axle position (if same size and tread pattern) or replaced.

Rear Tires

If irregular wear such as heel and toe or alternate lug wear occurs, the tires should be rotated to reverse the rotation of the tires. In tandem axle units, swap the right rear tire pair with the left front pair, keeping the outside tires in the outside position. Swap left rear and right front pairs in the same manner.

4-24.6 Balancing

Wheel and tire assemblies should be balanced to avoid vibration or shimmy during road operation. Pierce balances all tires and wheels by adding Counteract balancing beads to the tire/wheel during assembly. Once the balancing beads are installed inside the tire, it is not possible to see them; no lead weights are used.

The beads automatically balance the complete wheel assembly as the tire rotates. The beads balance not only the tire and wheel, but also the hub and brake assembly of the axle.

The beads continually adjust to changes on the tire and wheel to maintain balance. As the tire wears, the beads will adjust properly so the assembly is always in balance. The beads will also adjust if tires become out of balance due to mud in the tire tread or stuck to the wheel.

4-24.7 Tire Pressure Management Sensors *(Standard)*

NOTE: The tire must be inflated to the correct pressure before installing the tire sensor valve cap to calibrate and ensure proper operation.

The VECSAFE valve cap tire pressure sensor can be checked for functionality and battery condition by simply unscrewing the cap. If it is in working condition, the LED will immediately start blinking. The sensor will activate an integral battery operated LED when the pressure of that tire drops 8 psi.

If replacing a defective valve cap, inflate tire to the proper operating pressure (see *"Tire Inflation"* on *page 4-37*) and install the new sensor on the valve stem.

4-25. Towing Instructions

⚠WARNING

Due to the many variables that exist in towing, positioning, attaching, and lifting of the vehicle - towing is the sole responsibility of the towing-vehicle operator who must be familiar with standard towing industry safety measures. Failure to follow standard industry safety measures may lead to property damage, personal injury, or death.

CAUTION

Towing of a vehicle equipped with an automatic transmission even in neutral for even short distances may cause serious damage to the transmission components.

NOTE: The towing vehicle used to develop this procedure was a Jerr-Dan®, Model HDL1000/565 50 Ton Wrecker (Integrated).

4-25.1 Preparation for Towing

1. Block the wheels and ensure that the personnel working around the vehicle will be safe from oncoming traffic.
2. Unload equipment when practical to reduce abnormal loads exerted on the chassis components caused by the towing process.
3. Drain all water from the water tank.

4-25.2 Front Towing

1. Single rear axle vehicle: Remove the rear-most driveshaft.

   Tandem rear axle vehicle: Remove axle shafts and cover the ends of the axles with metal plates or plywood cut to fit the axle opening and drilled to fit the axle shaft studs. This prevents lubricant from leaking out and contaminants from getting in.
2. Remove the front bumper extension and stainless steel bumper or attach in a manner that prevents damage to these components.
3. Remove any water pipes, air intake pipes, or accessories that may be damaged during the towing hook up procedure or during transit.
4. Attach the towing device.

⚠WARNING

Before releasing the parking brakes, secure the connection to the towing vehicle or block the wheels, or loss of vehicle control may cause property damage, personal injury or death.

5. Manually release the parking brakes or release the parking brake button and supply the air brake system with a constant source of air pressure to ensure that the spring brakes remain released during the towing process.

Additional considerations when towing a Custom Chassis tractor/aerial tiller combination:

- Ensure the rear tiller steering is locked out by inserting the steering column lock pin in the steering lockout hole.
- To minimize the possibility of damage to the tractor, the front tires should be lifted only as high as necessary to facilitate towing.

4-25.3 Rear Towing

1. Position the front tires straight ahead and secure the steering wheel in this position.
2. Remove any water pipes or accessories that may be damaged during the towing hook up procedure or during transit.
3. Attach the towing device.

4-25.4 Tow Hooks and Tow Eyes

WARNING

Tow hooks are designed to assist in pulling vehicles for short distance on flat and level surfaces. The hooks and mounting structures are designed based on the GVW of the vehicle and its rolling resistance on level ground. Vehicles stuck in off road conditions, on down-slopes, or in ditches can exert much higher forces on the tow hooks than they are designed to withstand. Towing or pulling in these conditions must be accomplished by experienced towing personnel with attachments to main structural members of the vehicle such as axles or frame rails. Towing safety is the sole responsibility of the towing-vehicle operator who must be familiar with standard towing industry safety measures. Use of tow hooks beyond their safe design limits as stated above may cause serious property damage, personal injury, or death.

CAUTION

Tow hooks are provided to assist in pulling the vehicle from directly in front of, or directly behind the vehicle; with all wheels in contact with the ground. Do not lift and tow vehicle from the tow hooks, front bumper extension, or rear platform. Failure to observe these cautions may cause serious property damage.

Tow hooks and tow eyes may be found on the front or rear of many Pierce apparatus. The specific location will vary based on the options selected. These tow eyes and tow hooks may be used for towing disabled vehicles for short distances on flat and level surfaces in an emergency. They are not meant for long distance towing on public highways.

4-25.5 TAK-4™ Suspension Towing

CAUTION

Towing of a vehicle equipped with the TAK-4™ front suspension by attaching to or lifting by any component or structure of the TAK-4™ assembly may result in damage to these components or assembly.

With some configurations of TAK-4™ equipped apparatus, towing will not be possible with the available equipment provided through local towing services. Pierce Manufacturing recommends using the tire lift method for towing TAK-4™; however in many cases the lift system, the truck configuration, or both are not rated for the vehicle's weight on the front axle. In the case of platform aerials, the reach required for the lift device may degrade the device's lifting capability to the point that towing is not possible.

For Quantum® units equipped with TAK-4™ front suspension, the use of a flatbed trailer is the only recommended alternative in the event that the truck cannot be towed using a tire-lift equipped towing vehicle. Pulling the fire truck with chains (flat-towing) is only recommended for extrication purposes or for very short duration towing (less than ¼ mile), and is not recommended for on-road towing.

4-25.6 Tire Lift Method *(Preferred)*

CAUTION

A typical Custom Chassis can be towed using an 138 inch underlift reach. Aerial Platforms should be towed with at least an 177 inch underlift reach. Ensure there will be enough clearance between the towing vehicle and components on the disabled vehicle to turn while being towed. Failure to comply may result in damage to equipment.

IMPORTANT: Tire lift attachment should have a minimum capacity rating of 25,000 lbs.

Figure 4-8: Underlift Device using Tire Lift Brackets

1253

On trucks equipped with TAK-4™ independent front suspension, lift the front of the disabled vehicle using an underlift device with proper tire lift brackets that support and secure the front tires *(Figure 4-8)*. Do not lift the front of the disabled vehicle by attaching to or lifting by any component or structure of the TAK-4™ suspension.

Figure 4-9: Safety Chains and Tire Straps

1254, 1255

Before transporting the disabled vehicle, ensure that safety chains and tire straps are properly installed and secure *(Figure 4-9)*.

4-25.7 Lift and Tow using Frame Forks - *Arrow XT™/Velocity™/Impel™*

NOTE: Tow forks with a minimum of 6.50" spread between tines are required (Jerr-Dan P/N 3-454-000057).

Arrow XT™, Velocity™ and Impel™ chassis, equipped with either a standard taper leaf spring front suspension or the TAK-4™ independent front suspension, can be lifted and towed using a standard under-lift device equipped with heavy duty frame forks. This is a third towing alternative, in addition to tire lift and flatbed transport. When lifting and towing using frame forks positioned in the disabled vehicles lift and tow saddle brackets, care must be taken to ensure that no damage to the chassis occurs. Securing the disabled vehicle to the tow vehicle may require some disassembly and is the responsibility of the tow vehicle operator. Pierce Manufacturing does not warranty any damage that may occur due to improper towing.

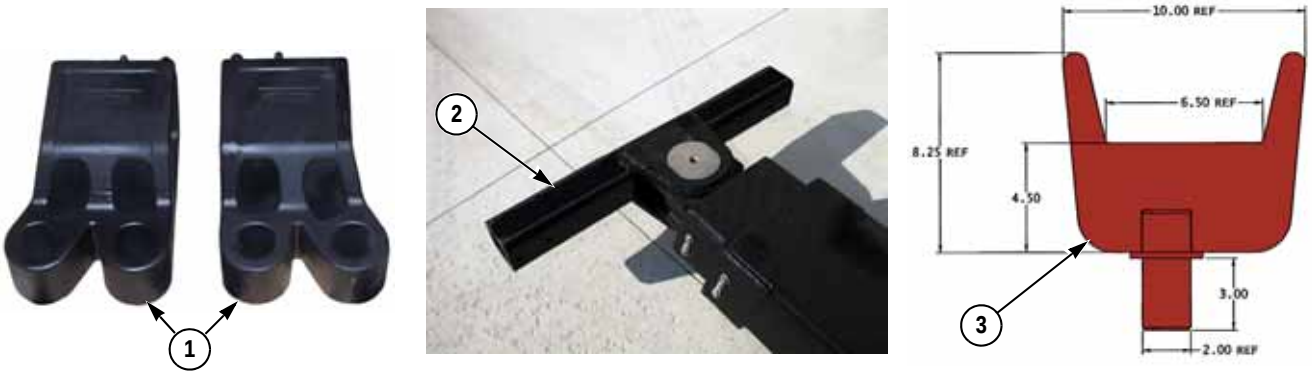
Figure 4-10: Lift and Tow Saddle Brackets with Integral Tow Eye

1256, 1257

A lift and tow saddle bracket, including an integral tow eye, is located beneath the left and right side frame rail extension *(Figure 4-10)*.

4-25.7a General Procedure

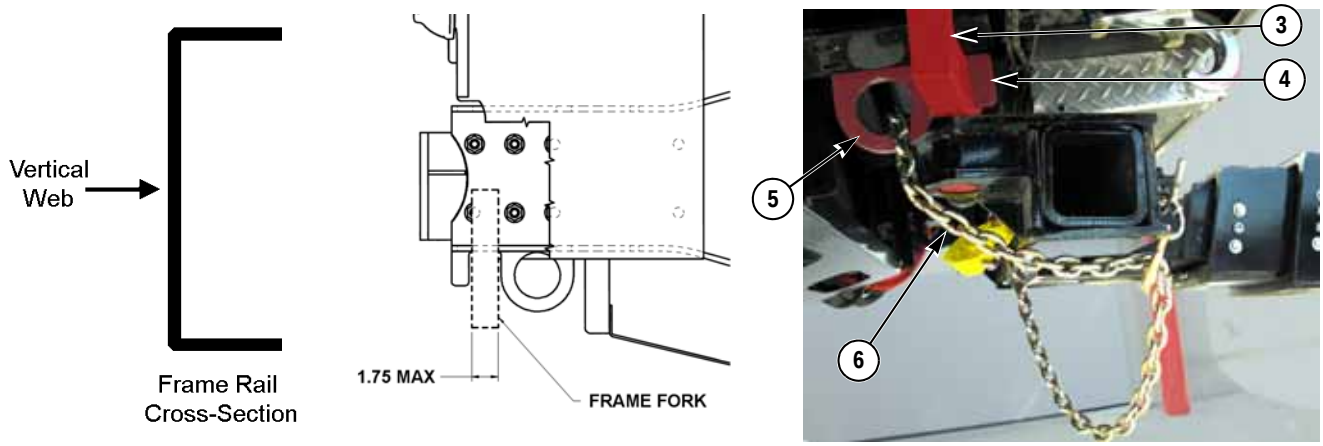
Figure 4-11: Frame Fork Adapters, Crossbar & Frame Forks



1259/1262/1261

1. Install the frame fork adapters (1) (Jerr-Dan® P/N's 7-007-000055 & 7-007-000056) to the crossbar (2) *(Figure 4-11)*.
2. Install the frame forks (3) (Jerr-Dan® P/N 3-454-000057) in the frame fork adapters (1) *(Figure 4-11)*.

Figure 4-12: Under Lift Towing Fork Positioning & Securing



1260/1107/1258

3. Move the crossbar (2) under the front of the truck locating the frame forks (3) under the lift and tow saddle brackets.

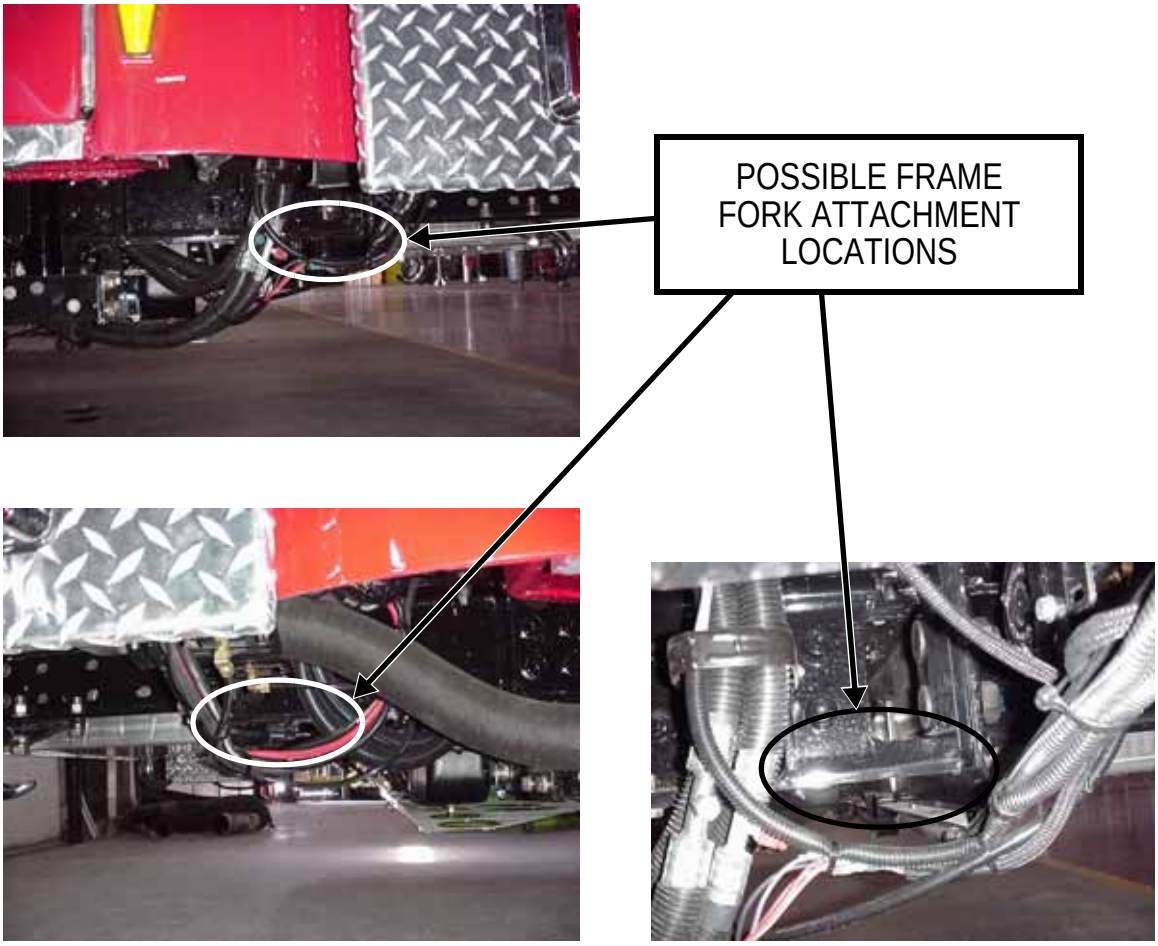
IMPORTANT: The frame forks posts are off-set. The post on the bottom of the fork should be positioned closest to the vertical web of the frame rail.

4. Raise the crossbar and position the frame forks in the opening of the lift and tow saddle brackets (4) just ahead of the tow eye (5) *(Figure 4-12)*.
5. Safety chains (6) should be installed to the frame fork adapters and through the frame fork tow eyes *(Figure 4-12)*.
6. Make sure the crossbar is secure. Lift the truck and tow carefully.

4-25.8 Lift and Tow using Frame Forks - *Saber®/Custom Contender®*

Saber® and Custom Contender® can be lifted and towed using a standard under-lift device equipped with heavy duty frame forks. This is a third towing alternative, in addition to tire lift and flatbed transport. When applying the frame forks to the frame extension, care must be taken to ensure that no damage to the chassis occurs. Securing the disabled vehicle to the tow vehicle may require some disassembly and is the responsibility of the tow vehicle operator. Pierce Manufacturing does not warranty any damage that may occur due to improper towing. The figures below give suggested areas where the frame forks may be attached to the frame extension.

Figure 4-13: Possible Frame Fork Attachment Locations



POM0104, POM0105, POM0106

4-26. Transmission

4-26.1 Transmission Fluid

When changing to a different type of transmission fluid, care should be taken to purge the system of the old fluid before installing the new fluid. See the transmission manufacturer's Operator's manual for recommended fluids and viscosity grades.

4-26.2 Transmission Fluid Analysis – *Allison Transmissions*

The presence of water and/or ethylene glycol coolant mixtures in the transmission oil is detrimental to the reliability and durability of the internal components. This foreign liquid has a deteriorating effect on non-metallic components (rubber, gasket material, etc.) and on highly loaded steel parts, such as bearings and gears, due to reduced lubricity. Frictional capacity of drive clutch plates can be greatly reduced, as a result of surface film or impregnation and the presence of glycol will physically deteriorate clutch plate material.

Local conditions, severity of operation, or duty cycle may require more or less frequent fluid change intervals that differ from the published recommended fluid change intervals of Allison Transmission. Transmission protection and fluid change intervals can be optimized by use of fluid analysis. The user should evaluate individual needs and determine the economics of performing an analysis. If it is suspected that foreign materials have entered the fluid system, then an analysis needs to be performed immediately.

Fire trucks are defined as severe vocation due to retarder use and similarity to transit coach operation. Fluid should be changed every 12,000 miles, 6 months, or 500 hours.

Conditions that indicate water and/or glycol in the fluid are:

- Rust or pitted transmission parts.
- Oil spewing out of the breather.
- Oil in the radiator.
- Gaskets blistered or wrinkled in uncompressed areas.
- Appearance of oil. Presence of water in oil when dispersed is a cloudy or gray, pink, or strawberry color.
- Steam from the breather.

Should the user suspect contamination, an oil sample should be obtained when transmission oil is at normal operating temperature to assure contaminate, if present, is thoroughly dispersed in the oil as sampled. The analysis of oil sample (by the oil supplier or any qualified laboratory) will provide the degree of contaminate and possibly a clue as to its source. A minimal amount of water may be due to uncovered oil drums or an open transmission filler tube or, in the case of glycol, the use on an all-purpose fill container or a defective transmission oil cooler. Any glycol contamination requires a complete disassembly and cleanup of the transmission and replacement of seals, gaskets, clutch plates, and bearings. The vehicle cooling system should be pressure tested as a possible source of contamination.

Nelco Company offers a kit that detects presence of ethylene glycol in oil. The kit is identified as “GLY-TEK” Test Kit and can be obtained from:

Nelco Company
1047 McKnight Road South
Saint Paul, Minnesota 55119
Telephone Number: (651) 738-2014

Refer to the Allison Transmission Operator’s Manual for additional information concerning maintenance schedules, lubrication recommendations, and inspection procedures. Have transmission serviced only by an authorized Allison service facility.

4-26.3 External Transmission Coolers

The use of external transmission coolers has become very popular with many transmission applications, especially those equipped with retarders. These components have a limited lifetime and should be considered a consumable. Customer environments with high retarder usage or high ambient temperatures are more likely to experience a shorter cooler lifetime. One of the failure modes of these coolers allows for water and coolant from the radiator to be transferred into the transmission fluids. Water and ethylene glycol can quickly deteriorate and eventually destroy the transmission. This type of transmission failure is not covered by the transmission or cooler warranty.

Daily inspections of the transmission fluid indicating a higher than normal level or showing a change to the normal physical appearance, might indicate a possible problem. Please refer to *"Transmission Fluid Analysis – Allison Transmissions"* on *page 4-49*. Pierce Manufacturing recommends you replace the cooler every 3-5 years depending on the in-service demands you put on your vehicle.

4-27. Transfer Case *(All Wheel Drive)*

Refer to the transfer case operator's manual, included in the Pierce Service Manual, for maintenance schedules, lubrication recommendations, and inspection procedures.

4-28. Welding Instructions

CAUTION

Before any welding is done on a multiplexed unit, make sure ALL electronic modules and control units (ECUs) are disconnected. Refer to the Pierce Service Manual, group 0950-P-008, ECU, PMC, and Power Module Location Guidelines, and the applicable multiplex documentation for component locations. Also be sure to disconnect the following, as applicable: engine ECU, transmission ECU, anit-lock brake system ECU, ALL STEER® all-wheel steering ECU.

This section defines the requirements for disconnecting electronic components before all welding operations. Welding on a truck may cause voltage surges to be distributed throughout the truck's electrical system. Electronic components, which are connected to the electrical system, may be damaged due to these high voltage surges. Electronic components may fail at relatively low voltages caused by a brief welding operation done on the truck.

Before welding, disconnect all electronic components listed in *Table 4-12*. Special electrical system configurations may include additional electronic control units that may require disconnection before welding on the vehicle. Most electronic component connectors that require disconnection when welding on the vehicle are identified by a "Connector Disconnect Tag" (P/N 91-0250).

Table 4-12: Electronic Components Disconnect Table (Before Welding)

Before any welding can be done on this unit, you MUST disconnect the following.	
DETROIT DIESEL DDEC	Disconnect the three tagged plugs that are on the Detroit Diesel ECU. Located on the driver side of the engine on Series 60 and Series 50.
BOSCH or WABCO ABS	Disconnect the tagged plug that attaches to the Bosch or Wabco ECU. ABS ECU locations: • Saber®: under the first officer side of dash. • Arrow XT™ - in the PMC box in the dash. • Arrow XT™ with Command Zone™ - on chassis crossmember or under center tunnel cover. • Quantum® - behind the pump in the frame rails. • Velocity™/Impel™ - on the chassis cab lockdown crossmember.
CUMMINS ISM/ISC	Disconnect plugs on the Cummins C83 Electronic Engine. Located on the Cummins ISC engine.
ALLISON TRANSMISSION	Disconnect plugs on the Allison Transmission ECU. Allison Transmission ECU locations: • Saber® - in driver side instrument panel. • Arrow XT™ - on backside of brake cover. • Arrow XT™ with Command Zone™ - in the first officer side front distribution enclosure. • Quantum® - behind the driver's seat under the wire cover. • Velocity™/Impel™ - in the cab power distribution enclosure in front of the first officer seat.
FOAM PRO FOAM SYSTEM	All parts of the “Foam Pro” system must be disconnected before welding. This includes the positive and negative battery cable and vendor-supplied cable to the pump and gauges.
ALL STEER® ALL-WHEEL STEER ECU	AWS I: Disconnect both plugs on the ECU. Located in the cab. AWS II: Disconnect the VIM. Located inside the first officer side frame rail, just in front of the rear axle.
ALL FLASHERS	Check electrical layouts for locations.
SIDE ROLL PROTECTION	Disconnect both connectors from the Master Roll Sensor and the Slave Roll Sensor (if installed).
COMMAND ZONE™	If TIG welding on a Command Zone™ truck, all Command Zone™ modules must be disconnected.

Before disconnecting any electronic component connection, place the Battery Switch in the OFF position. The switch remains in the OFF position throughout the welding process. Before disconnecting any electronic component connection, disconnect the negative battery connection from each “bank” of batteries. The battery cables remain disconnected throughout the welding process.

Electronic components are reconnected after all welding is completed. After reconnecting the required electronic component connections, reconnect the negative battery connection for each “bank” of batteries.

4-29. Wheels

4-29.1 Bearings

Inspect wheel bearings in accordance with the axle manufacturer's recommended schedule. Use inspection procedures found in the axle manufacturer's maintenance manuals.

4-29.2 Wheel Installation – General

⚠WARNING

Improper installation methods or component selection can cause loss of torque, broken studs, or cracked wheels. Improperly seated wheels can run loose, cause stud breakage, or disengage from the vehicle. Any of these problems may lead to loss of vehicle control, serious property damage, personal injury, or death.

Wheel nuts must be checked for proper torque after the first 50 to 100 miles of service, then frequently as part of periodic maintenance. Failure to verify wheel nut torque may lead to loss of vehicle control, serious property damage, personal injury, or death.

Proper installation of rims and wheels on a vehicle is essential to safe, economical, trouble-free service. Use only the specified sizes of studs, nuts, and clamps. Check all parts for damage, including wheels and rims. Ensure that studs, nuts, and mounting faces of hub and wheels are sound, clean, and free from grease. Clean hub surfaces with wire brush if scale is present. Do not lubricate wheel studs. Replace any damaged parts.

Consult wheel manufacturer's installation procedures for detailed instructions and replacement part recommendations.

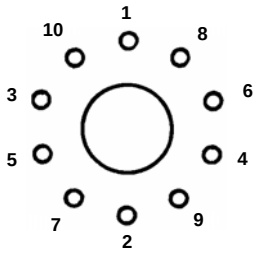
4-29.3 Hub Piloted Wheel Installation

⚠WARNING

Hubs designed for steel hub piloted wheels may not have sufficient depth or stud length to properly accommodate aluminum wheels. Installation of hub piloted wheels on a hub with insufficient pilot depth or stud length may cause wheel assembly failure leading to loss of vehicle control, personal injury, or death.

1. Slide front wheel or inner rear wheel over studs, being careful not to damage stud threads.
2. Slide outer rear wheel over studs.
3. Snug up flange nuts alternately in the sequence shown. Rotate wheel assembly one-half turn to allow the wheel to seat. DO NOT tighten them fully until all have been seated. This procedure will permit the uniform seating of nuts and ensure the even, face-to-face contact of wheels and hub.

Figure 4-14: Wheel Nut Tightening Sequences



Hub Pilot
Front and Rear Duals

POM0115

Table 4-13: Wheel Nut Torque Chart

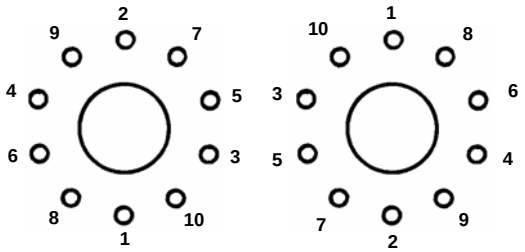
Mounting	Thread Size	Torque Ft-Lbs (Dry)
10 Hole, 285.75 mm – Hub Piloted	M22 x 1.5	450–500
10 Hole, 285.75 mm – Hub Piloted with Meritor ADB 1560 disc brakes	M22 x 1.5	390–450

4. Tighten flange nuts fully, using the same alternating sequence. In each case, be sure to tighten wheel nuts only to the torque level recommended in the table and to maintain them at that level through planned, periodic checks.
5. Check torque on wheel nuts after the first 50 to 100 miles of service.

4-29.4 Stud Piloted Wheel Installation *(Optional)*

1. Mount wheel or inner dual wheel over studs, being careful not to damage stud threads.
2. Spin on the outer cap nuts on the front wheel, or inner cap nut on the rear wheel.

Figure 4-15: Wheel Nut Tightening Sequences



Stud Pilot
Outer Dual

Stud Pilot
Front and Inner Dual

POM0115

3. Snug up nuts alternately in the sequence shown. DO NOT tighten them fully until all have been seated. This procedure will permit the uniform seating of nuts and ensure the even, face-to-face contact of wheels and hub.
4. Tighten nuts fully per the values listed in the Torque Chart using a calibrated torque wrench and following the same alternating sequence.
5. Mount the outer rear wheel and repeat the entire procedure. In each case, be sure to tighten wheel nuts only to the torque level recommended in the table and to maintain them at that level through planned, periodic checks.

⚠WARNING

Never check torque on a fastener that has already been tightened. This will give a false torque reading. To obtain the correct torque on a fastener that has already been tightened, break the fastener loose and then retighten to the appropriate torque.

NOTE: Whenever the outer cap nut is loosened, always loosen and retighten the inner cap nut before torquing the outer cap nut.

6. Check torque on wheel nuts, including inner cap nuts on duals after the first 50 to 100 miles of service. When inner cap nuts are tightened, be sure to first loosen outer cap nuts several turns, loosen and retighten inner cap nuts and then tighten outer cap nuts. Torque to recommended levels as specified in *Table 4-14*. To avoid loosing the seating of the outer wheel when checking the inner wheel torque, first loosen alternate outer nuts. Then tighten the inner nuts and retighten the outer nuts. Then loosen the remaining outer nuts, tighten the inner nuts, and retighten the outer nuts.

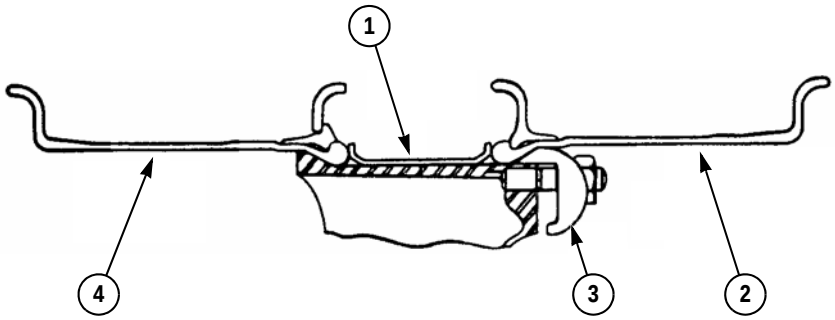
Table 4-14: Wheel Nut Torque Chart

Mounting	Thread Size	Torque Ft-Lbs (Dry)
10 Hole, 11.25 inch – Stud Piloted	3/4-16	450–500
10 Hole, 11.25 inch – Stud Piloted	1-1/8-16	450–500

4-29.5 Cast Spoke Wheels *(Optional)*

Installation

Figure 4-16: Cross-Section of Cast Spoke Wheel



POM0116

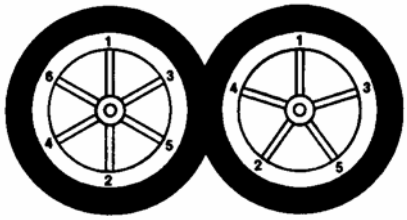
Item #	Description
1.	Spacer Band
2.	Outer Dual Rim
3.	Rear Clamp
4.	Inside Rim

NOTE: All 8.5-5 rims require special size hubs and spacer bands.

1. Place the inside rim (4) over the cast spoke wheel as far as possible.
2. Push the spacer band (1) over the cast spoke wheel with constant pressure on both sides. Guard against cocking.

3. Place the outer dual rim (2) in position.

Figure 4-17: Cast Spoke Wheel Nut Tightening Sequence



3 and 6 spoke 5 spoke

POM0117

4. Align the valve locators between the spokes. Secure clamps (3) evenly in position. Snug up nuts in the sequence shown. Do not tighten nuts fully.
5. After the nuts are properly seated and the rim is centered on the spoke wheel, tighten the nuts one-quarter turn at a time in the criss-cross sequence until they are tightened to 200-260 ft-lbs. This will permit the rims to properly align themselves on the 28° mounting surfaces of the cast spoke wheel.
6. If the heel of the rear clamp touches the spoke before reaching 80% of the recommended torque level, check to be sure that the proper clamps and spacer bands are being used.

Wheel Torque

CAUTION

Demountable rims are not all the same offset. Use the proper size tires, rims, spacer bands, and clamps to get adequate dual spacing and vehicle clearance.

1. Be sure to tighten wheel nuts to the recommended torque. Do not overtighten.
2. After the first 50 to 100 miles of operation, recheck the torque levels and retighten nuts to the proper torque level.
3. Maintain the nut torque at the recommended level through planned, periodic checks or at 10,000-mile intervals, whichever comes first. Individual fleet experience may dictate shorter intervals or allow for longer intervals.
4. If air wrenches are used, they must be periodically calibrated for proper torque output. Use a manual torque wrench to check the air wrench output and adjust the line pressure accordingly to give the correct torque.

4-29.6 Aluminum Rear Disc Wheels with Flange Nuts (Hub Piloted)

Prior to reinstalling rear aluminum hub-piloted wheels, clean each wheel locator pad on the hub of all dirt, rust and foreign material. Apply a light coat of chassis grease or never seize.

4-29.7 Rim and Wheel Inspection

⚠WARNING

Wheels and rims are manufactured with capacity ratings based on maximum tire pressure and load. Inflate tires to only the recommended air pressure, being sure not to exceed the rim/wheel inflation rating. Failure to observe these precautions may cause wheel damage leading to loss of vehicle control, serious property damage, personal injury or death.

Inspect wheels during all pre-trip inspections and at periodic maintenance intervals depending upon road and environmental conditions of operation.

Check all metal surfaces thoroughly while making tire inspections, including areas between duals and on inboard side of wheel. Watch for:

- Excessive rust or corrosion buildup;
- Cracks in metal;
- Bent flanges;
- Deep rim tool marks on rings or in gutter areas;
- Loose, missing, or damaged nuts or clamps;
- Bent or stripped studs;
- Severe marring or gouging beneath fasteners;
- Damaged or missing rim valve-locator plates;
- Incorrectly matched rim parts.

Mark damaged or broken areas, when seen, so that rim will be removed from service at the first opportunity. Replace the assembly that has damaged rims or wheels. Determine the cause of the damage before installing another wheel or rim. If nuts are found to require frequent tightening, studs break frequently, or wheel bolt holes become damaged, review hardware and mounting practices to determine cause.

4-30. Windshield Wiper System

The Velocity™/Impel™ windshield wiper control is located on the turn signal lever on the left side of the steering column. The Velocity™/Impel™ chassis utilize three wiper blades controlled by a single motor and linkage arrangement to drive the wiper arms, providing for synchronous movement.

The windshield wipers on Arrow XT™, Quantum®, and Saber® have separate motors and switches for the left and right arms.

4-30.1 Wiper Blades

CAUTION

Windshield wipers should not be run on dry windows for an extended length of time as this will induce higher than normal loads into the system and decrease the life of the motors, linkages, and wiper blades substantially.

Inspect wiper blades to ensure proper clearing of the windshield. Wipe the blades with a clean towel soaked in windshield washer fluid. If this does not remedy wiper blade problems such as chatter and streaking, then the blades should be replaced.

SECTION 5

SERVICE AND LUBRICATION INTERVALS

Refer to the following charts for service and lubrication requirements. Perform services at the indicated interval of miles or time, whichever comes first.

Table 5-1: Initial Inspection Maintenance Schedule

Description	Action	Miles	Time
Spring U-Bolts	Check torque and tighten as required (after initial delivery).	500	Initial Inspection

Table 5-2: Daily Maintenance Schedule

Description	Action	Miles	Time
Air Cleaner	Check air intake restriction indicator.		Daily
Air Intake Tubes and Clamps	Inspect for leaks and clamp tightness.		Daily
Air Tanks	Drain water.		Daily
Coolant	Inspect for signs of coolant leaks. Check coolant level using sight glass or electronic monitor.		Daily
Engine	Inspect for signs of oil or coolant leaks.		Daily
Engine Oil	Inspect for signs of oil leaks. Check oil level using dipstick, sight glass, or electronic monitor.		Daily
Exhaust	Inspect for leaks and clamp tightness.		Daily
Throttle Pedal	Check for smooth operation and return ability.		Daily
Tires	Check inflation pressure. Inflate to correct pressure per the tire manufacturer's load/inflation recommendations.		Daily
Transmission Fluid	Inspect for signs of oil leaks. Check level using dipstick or electronic monitor. Also note physical appearance of transmission fluid.		Daily

Table 5-3: Weekly Maintenance Schedule

Description	Action	Miles	Time
Aerial Boom Support	Inspect fasteners for tightness and integrity.		Weekly
Air Dryer	Test purge pressure.		Weekly
Air Inlet	Inspect engine air inlet for dirt, debris, or plugging.		Weekly
Axle, Front	Inspect for signs of wear, damage, or looseness.		Weekly
Belts	Inspect for damage and check tension.		Weekly
Brake Linings	Inspect for sufficient lining thickness.		Weekly
Brakes	Inspect all brake parts for integrity. (See *"Brakes – General"* on *page 4-3*.)		Weekly
Cab Tilt System	Check fluid level. (See *"Cab Tilt System"* on *page 4-6* for fluid type.)		Weekly

Description	Action	Miles	Time
Driveshafts	Inspect for signs of damage.		Weekly
Electrical Connectors	Inspect for tightness, corrosion, and integrity.		Weekly
Electrical Harnesses and Wires	Inspect for rubbing, fraying, or looseness.		Weekly
Fan Drive - *Quantum*®	Check fluid level using sight glass. Fill with MOBIL SHC 630 synthetic oil. Inspect coupling for wear or misalignment.		Weekly
Frame Fasteners	Inspect for looseness, wear, or corrosion.		Weekly
Fuel System	Inspect for signs of damage, leaking, or chafing.		Weekly
Fuel-Water Separator	Check water collection bowl and drain condensate.		Weekly
Mirror Hardware	Inspect fasteners for tightness and integrity.		Weekly
Seat Belt Assemblies	Inspect for signs of damage, wear, or corrosion. (See *"Seat Belts"* on *page 4-32* for additional information.)		Weekly
Springs	Inspect for signs of wear, cracking, or bending.		Weekly
Steering Hydraulic System	Check oil level using dipstick, sight glass, or electronic monitor. Fill with DEXRON III.		Weekly
Steering System	Inspect all steering parts for integrity. (See *"Steering"* on *page 4-35* for additional information.)		Weekly
Suspension Hangers and Shackles	Inspect for signs of wear, corrosion, or damage.		Weekly
Tires	Inspect tread depth and check for damage.		Weekly
Wiper Blades	Clean wiper blades.		Weekly

Table 5-4: Monthly Maintenance Schedule

Description	Action	Miles	Time
Axle, Rear	Check oil level in carrier.	10,000	Monthly
Battery Posts	Clean and grease after cleaning.	3,000	Monthly
Cab Step Pivot - *Quantum*®	Lubricate with Lubriplate low temperature grease.	3,000	Monthly
Cab Tilt Pivot Pins - *except Velicity™/ Impel™*	Lubricate with Lithium NLGI Grade EP2 grease.	3,000	Monthly
Cab Tilt Remote Control Receptacle	Lubricate with NYK corrosion preventative compound (Trucklite 97944 or equivalent).	3,000	Monthly
Driveshaft Slip Joints	Lubricate with Lithium NLGI grade EP2 grease.	3,000	Monthly
Driveshaft U-Joints	Lubricate with Lithium NLGI grade EP2 grease.	3,000	Monthly
Radiator and Charge Air Cooler Cores	Clean debris to ensure unimpeded air flow through cores.	3,000	Monthly
Spring Pins	Lubricate with Lithium NLGI grade EP2 grease.	3,000	Monthly
Steering Intermediate Links	Lubricate with Lithium NLGI grade EP2 grease.	3,000	Monthly

Description	Action	Miles	Time
Wheel Bearings, Oil (Front Axle)	Check fluid level and add as required.	3,000	Monthly
Wheel Nuts	Check torque and tighten as required.	3,000	Monthly
Windshield Wipers - *Velocity™/Impel™*	Check torque and tighten as required.	3,000	Monthly

Table 5-5: Quarterly Maintenance Schedule

Description	Action	Miles	Time
Cab Lift Cylinder Trunnion Joints - Arrow XT™	Clean and lubricate cab lift cylinder trunnion joints. See *"Lift Cylinder Trunnion Cleaning & Lubrication - Arrow XT™"* on *page 4-6* for additional information.	2,000	Quarterly

Table 5-6: Semi-Annual Maintenance Schedule

Description	Action	Miles	Time
Air Conditioning	Inspect sight glass. See *"Air Conditioning Sight Glass"* on *page 4-31* for additional information.		6 Months
Automatic Slack Adjusters	Lubricate with clay-based NLGI Grade 1 or 2 grease. (See Meritor lube chart for additional information.)		6 Months – See Axle Manual
Disc Brake Calipers	Lubricate with clay-based NLGI Grade 1 or 2 grease (See Meritor lube chart for additional information.)		6 Months – See Axle Manual
Door Hinges	Inspect and Adjust. Spray with silicone lubricant.		6 Months
Door Latches	Lubricate with Lubriplate105 grease or equivalent.		6 Months
Door Strikers	Inspect and adjust.		6 Months
Door Window Regulators	Lubricate with Lithium NLGI grade EP2 grease.		6 Months
Fifth Wheel - *Tiller Only*	Lubricate the fifth wheel bearing connecting the tractor to the tiller trailer. See *"Fifth Wheel Lubrication (Tiller Only)"* on *page 4-27* for additional information.	3,000	6 Months
Hood - *Velocity™/ Impel™*	Lubricate hinges with Lithium NLGI grade EP2 grease.		6 Months
Seat Adjuster Slides	Lubricate with Lithium NLGI grade EP2 grease.		6 Months
Shock Absorbers, Front - *Arrow XT™ with conventional spring suspension*	Replace.	6,000	
Steering Gear	Lubricate with Lithium NLGI grade EP2 grease.		6 Months
Tire Alignment (Front Axle)	Check toe-in on front tires.		6 Months
Transmission Fluid	Trucks in *severe duty* applications, or trucks equipped with *transmission retarders*, should have transmission fluid tested for water and glycol contamination. See *"Transmission Fluid Analysis – Allison Transmissions"* on *page 4-49* for additional information.	12,000	6 months or 500 hours

Table 5-7: Annual Maintenance Schedule

Description	Action	Miles	Time
Air Cleaner	Replace air cleaner or filter element.		Annual or as required
Axle, Front Kingpin	Lubricate with Lithium NLGI grade EP2 grease.	100,000	Annual
Axle, Tie Rod Ball Joints	Lubricate with Lithium NLGI grade EP2 grease.	100,000	Annual
Spring U-Bolts	Check torque and tighten as required.	24,000	Annual
Steering Drag Link Ball Joints	Lubricate with Lithium NLGI grade EP2 grease.	100,000	Annual
Steering Hydraulic System	Replace filter and hydraulic fluid in power steering reservoir(s) with DEXRON III.		Annual

Table 5-8: 3-5 Year Maintenance Schedule

Description	Action	Miles	Time
External Transmission Cooler	Replace external transmission cooler. See *"External Transmission Coolers"* on *page 4-49* for additional information.		3-5 years

Table 5-9: Vendor Component Maintenance Schedule

Description	Action	Miles	Time
Air Dryer Desiccant	Replace desiccant.		See Air Dryer Manual
Axle, Rear	Replace lubricant (initial drain and fill).		See Axle Manual
Axle, Rear	Replace oil & oil filter (if applicable) in carrier.		See Axle Manual
Coolant	Replace coolant after flushing system.		See Engine Manual
Coolant Filter	Replace.		See Engine Manual
Engine Oil	Replace with engine manufacturer's recommended grade and viscosity.		See Engine Manual
Engine Oil Filter	Replace.		See Engine Manual
Engine Thermostats	Test and replace if defective.		See Engine Manual
Fuel Filter	Replace element.		See Engine Manual
Rear Suspension	Refer to the rear suspension manufacturer's maintenance manual for maintenance schedules, lubrication recommendations, and inspection procedures.		See Rear Suspension Manual
Transmission Filters	Replace with transmission manufacturer's approved filters.		See Transmission Manual

Description	Action	Miles	Time
Transmission Fluid	Replace with transmission manufacturer's recommended fluids and viscosity.		See Transmission Manual
Wheel Bearings, Grease (Front Axle)	Lubricate with Lithium NLGI grade EP2 grease.		See Axle Manual
Wheel Bearings, Oil (Front Axle)	Replace lubricant.		See Axle Manual

Additional Information

- See the Pierce Service Manual, group 0152-P-002, TAK-4™ Independent Front Suspension, for additional TAK-4™ suspension service and lubrication requirements.
- See the Pierce Service Manual, group 0611-P-001, All Steer II® Service Manual, for additional All Steer II® service and lubrication requirements.

APPENDIX A MOBILE RADIO INSTALLATION GUIDE

SPECIAL NOTE:

The information contained in this guide has been prepared for use by persons installing two-way radio equipment (transmitters and receivers) in Pierce apparatus. It has been prepared in accordance with current engineering principles and generally accepted practices, using the best information available at the time of publication. These guidelines are intended to supplement, but not be used in place of, detailed instructions for such installations which are the sole responsibility of the manufacturer of the land mobile radio. Since it is not possible to cover all possible installations of two-way radio equipment, Pierce Manufacturing cannot be held responsible for incidental or consequential damages arising from the use of the information contained herein. Certain land mobile radios, or the way in which they are installed, may affect vehicle operations such as the performance of the engine and driver information, entertainment, and electrical charging systems. Expenses incurred to protect the vehicle systems from any diverse effect of any such installation are not the responsibility of Pierce Manufacturing.

1. General Information

Pierce apparatus are designed and tested for safe operation with properly installed and properly used land mobile radio communications equipment with up to 150 watts of transmitter power.

Special design considerations are incorporated into all Pierce apparatus electronic systems to provide immunity to radio frequency signals. In addition, Pierce installed electrical systems and components are designed to control undesired electromagnetic radiation and radio frequency interference resulting from the use of such equipment. To maintain compatibility with vehicle electronic systems, mobile two-way radio and telephone equipment must be installed properly by trained personnel, observing these general guidelines:

- Power and ground connections should be made directly to the battery or radio power and ground distribution terminals located inside the chassis power distribution box.
- When possible, solder should be applied to power and ground wire terminations.
- Avoid cigar lighter or “power point” receptacles as power sources for radio communication equipment.
- The radio equipment circuit protection devices (fuses) should be installed as close as possible to the power and ground source.
- Antennas for two-way radios should be permanently mounted on the roof of the vehicle.
- The antenna cable should be high quality, fully shielded coaxial cable, and kept as short as practical.
- Avoid routing the antenna cable in parallel with vehicle wiring over long distances.
- Carefully match the antenna and cable to the radio to achieve a low Standing Wave Ratio (SWR) and to avoid RF currents on the antenna cable shield.

All installations should be checked for possible interference between the communications equipment and vehicle electronics. Mobile radio equipment with greater than 150 watts output may require special precautionary measures beyond those outlined in this document.

This pamphlet is provided as a supplement to the radio manufacturer’s installation instructions for installing communications equipment in Pierce apparatus. Additional sources of information are listed in *“Additional Information”* on *page A-3*.

Radio transmitters are regulated by the Federal Communications Commission (FCC) in the United States. Compliance with FCC regulations is the responsibility of the manufacturer and/or user of the transmitter equipment, not Pierce Manufacturing.

2. Installation Guidelines

2.1. Transceiver Location

- A transceiver location should be selected that provides a solid mounting point which does not interfere with the vehicle operator controls and provides adequate ventilation.
- Locate transceiver for remote radios away from other electronic devices and as near to the vehicle body side as possible.
- Before using screws to mount the transceiver equipment, be sure to check for vehicle wiring behind the instrument panel which could be pinched, cut, or otherwise damaged.

2.2. Radio Wiring and Routing

- Transceiver power connections should be made directly to the battery or radio power and ground distribution terminals and appropriately fused at that location.
- Any negative lead from a handset or control unit must return to battery negative. It is preferable that the positive lead for a handset or control unit be connected directly to the radio power distribution terminal.
- It is also recommended that the handset or control unit positive and negative leads be appropriately fused separately from the transceiver positive and negative leads.
- When possible, solder should be applied to power and ground wire terminations.
- Use caution when routing wires between the passenger and engine compartments to avoid chafing or pinching of wires. Use grommets over any exposed sharp edges and strain reliefs to keep wires in place. Seal all holes to prevent moisture intrusion.
- Route and secure all under-hood wiring away from mechanical hazards such as exhaust manifolds and moving parts (steering shaft, throttle linkage, fans, etc.).
- Maintain as great a distance as possible between mobile radio power leads and the vehicle's electronic modules and wiring. Avoid running power leads in parallel with vehicle wiring over long distances.

2.3. Antenna Location and Installation

- Every vehicle model and body style reacts to radio frequency energy differently. Antenna location is a major factor is these effects.
- Permanently installed antennas are preferable over magnetic, glass, or body lip mounts for anything other than for low power or temporary installations. Most of these alternate antennas can reflect significant power back at the feed point; this reflected power could then radiate from the feed line inside the passenger compartment and be picked up by the vehicle wiring. However, a magnetic mount antenna is a good tool for checking the proposed fixed antenna location for unwanted effects on the vehicle, since antenna location is a major factor in these effects.

IMPORTANT: The antenna should be tuned properly and reflected power be kept to less than 10% (VSWR less than 2:1). Never adjust antenna length while the radio is being keyed.

NOTE: Your installation should be checked periodically for proper SWR and any signs of damage or deterioration to maintain proper operation with your vehicle.

- The United States Department of Labor, through provisions of the Occupational Safety and Health Act of 1970 (OSHA), has established an electromagnetic safety standard which applies to the use of mobile radios. Proper installation and use will result in exposure below the OSHA limit. Antennas must be located at least two feet (0.6 meters) from vehicle operators and passengers, unless shielded by a metallic surface.

- Pierce Manufacturing recommends that mobile antennas be located as near the center of the cab roof as possible.
- Antennas should not be located within six inches (15.24 cm) of roof mounted equipment, e.g., emergency lights, air conditioner evaporators.

2.4. Antenna Cable Routing

- Always use a high quality, one-piece coaxial cable (at least 95% shield coverage). Connector quality and termination techniques are just as important. The ARRL handbook provides excellent guidelines for terminating coaxial cables.
- The cables should be kept as short as possible to minimize RF loss for all frequency ranges, except 470–512 Mhz. When the antenna operates in the 470–512 Mhz range, do not cut the antenna cable unless absolutely necessary! If the cable must be shortened, refer to the table on the antenna kit tag for proper output setting.
- The antenna cable should be treated in the same way as the control and power cables. Avoid sharp edges and pinches, and keep the cable as short as possible.
- Avoid routing the antenna cable in parallel with vehicle wiring over long distances. If it is necessary to cross over wiring, cross at right angles. (In some cases, additional shielding between the antenna cable and the vehicle wiring may be helpful.)

3. Additional Information

3.1. Troubleshooting

Should vehicle-radio interaction develop following installation, the source of the problem should be identified prior to further operation of the vehicle. Most interaction problems can be eliminated by following these installation guidelines:

Possible causes of vehicle-radio interaction include:

- Antenna location (move antenna to another position);
- Antenna feed line routing (locate as far as possible from vehicle electronics and wiring);
- Inadequate shielding or loose/corroded connectors associated with the antenna feed line;
- Mismatched antenna or high SWR;
- Power and ground feeds not connected directly to the vehicle battery or radio power distribution points;
- Power feed routing (locate as far as possible from vehicle electronics and wiring).

If any vehicle-radio interaction problems exist after following these guidelines, contact your radio manufacturer or the Pierce Customer Service for additional assistance.

3.2. Additional Sources of Information

Radio Frequency Interference: How to Find It and Fix It
ISBN: 0-87259-375-4
The American Radio Relay League, Inc.
Newington, Connecticut 06111-1494
Phone: (203) 666-1541
Fax: (203) 665-7531

Giving Two-Way Radio Its Voice (booklet)
Champion Spark Plug Company
Automotive Technical Service Department
Box 910
Toledo, Ohio 43661

3.3. Internet News Groups

rec.radio.amateur.equipment

rec.radio.amateur.misc

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