Performing Apparatus Check-Out and Maintenance

CHAPTER 6

NFPA 1002 Standard

4.2 Preventive Maintenance. [p. 128–148]

4.2.1* Perform routine tests, inspections, and servicing functions on the systems and components specified in the following list, given a fire department vehicle, its manufacturer's specifications, and policies and procedures of the jurisdiction, so that the operational status of the vehicle is verified:

(1) Battery(ies)
(2) Braking system
(3) Coolant system
(4) Electrical system
(5) Fuel
(6) Hydraulic fluids
(7) Oil
(8) Tires
(9) Steering system
(10) Belts
(11) Tools, appliances, and equipment [p. 130–148]

(A) Requisite Knowledge. Manufacturer specifications and requirements, policies, and procedures of the jurisdiction. [p. 129–130]

(B) Requisite Skills. The ability to use hand tools, recognize system problems, and correct any deficiency noted according to policies and procedures. [p. 130–148]

4.2.2 Document the routine tests, inspections, and servicing functions, given maintenance and inspection forms, so that all items are checked for operation and deficiencies are reported. [p. 130–148]

(A) Requisite Knowledge. Departmental requirements for documenting maintenance performed and the importance of keeping accurate records. [p. 130–148]

(B) Requisite Skills. The ability to use tools and equipment and complete all related departmental forms. [p. 130–148]

5.1.1 Perform the routine tests, inspections, and servicing functions specified in the following list in addition to those in 4.2.1, given a fire department pumper, its manufacturer's specifications, and policies and procedures of the jurisdiction, so that the operational status of the pumper is verified:

(1) Water tank and other extinguishing agent levels (if applicable)
(2) Pumping systems
(3) Foam systems [p. 130–148]

(A) Requisite Knowledge. Manufacturer's specifications and requirements, and policies and procedures of the jurisdiction. [p. 130–148]

(B) Requisite Skills. The ability to use hand tools, recognize system problems, and correct any deficiency noted according to policies and procedures. [p. 130–148]

6.1.1 Perform the routine tests, inspections, and servicing functions specified in the following list in addition to those specified in 4.2.1, given a fire department aerial apparatus, and policies and procedures of the jurisdiction, so that the operational readiness of the aerial apparatus is verified:

(1) Cable systems (if applicable)
(2) Aerial device hydraulic systems
(3) Slides and rollers
(4) Stabilizing systems
(5) Aerial device safety systems
(6) Breathing air systems
(7) Communication systems [p. 130–148]

(A) Requisite Knowledge. Manufacturer's specifications and requirements, and policies and procedures of the jurisdiction. [p. 130–148]

(B) Requisite Skills. The ability to use hand tools, recognize system problems, and correct any deficiency noted according to policies and procedures. [p. 130–148]

Additional NFPA Standards

NFPA 1720 *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Volunteer Fire Departments* (2004)

NFPA 1901 *Standard for Automotive Fire Apparatus* (2009)

NFPA 1911 *Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus* (2007)

Knowledge Objectives

After studying this chapter, you will be able to:

- Describe the inspection and maintenance procedures required by your fire department.
- Describe the inspection and maintenance procedures recommended by the manufacturer on each of the fire apparatus that you will be required to inspect, test, or maintain.
- Describe the items on the written inspection and maintenance forms required to be completed by your fire department.
- Describe the procedures to be followed when an inspection reveals maintenance problems beyond the scope of the driver/operator's abilities.
- Describe the type of problems found during the inspection and routine maintenance of fire apparatus that warrant taking the fire apparatus or equipment out of service.
- Describe the equipment carried on fire apparatus that requires inspection and maintenance.

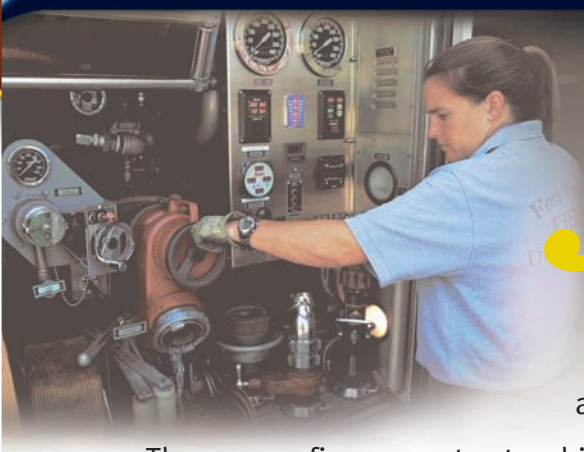
- Describe the routine maintenance procedures or adjustments to be completed by the driver/operator.
- Describe the maintenance procedures and items that will be performed by specially trained personnel other than the driver/operator.
- Describe the process to initiate required maintenance procedures.
- Describe the schedule for routine inspection and maintenance procedures for all fire apparatus and equipment that the driver/operator will be responsible for inspecting, maintaining, or testing.

Skill Objectives

After studying this chapter, you will be able to:

- Perform the daily inspection of fire apparatus and equipment in a safe and effective manner.

You Are the Driver/Operator



You are the driver/operator of a very busy engine company. Your fire apparatus has been scheduled for maintenance at the local repair facility and will be out of service for several weeks. To prepare for this event, all of the tools and equipment from your fire apparatus must be moved to a reserve fire apparatus provided by the fleet maintenance division of the fire department. The fire department uses this reserve fire apparatus while the regular fire apparatus receives any necessary repairs—a practice that ensures the engine company can remain in service.

The reserve fire apparatus to which you have been assigned while your rig is being repaired is much older than your regular fire apparatus. Although the same company built both fire apparatus, the two vehicles differ in terms of their features. The reserve fire apparatus does not have as many electrical devices as the newer fire apparatus; it also has some older features that you have not encountered since you were training to become a driver/operator. Your fire officer has asked that you thoroughly inspect this reserve fire apparatus before the rest of the crew starts to move any equipment onto it.

1. As you walk around the reserve fire apparatus, which features should you inspect?
2. When you check the engine oil, transmission fluid, and power steering fluid levels, what are some problems that may indicate that this fire apparatus may or may not be serviceable?
3. How are the emergency lights and sirens operated on the reserve fire apparatus?

Introduction

Being assigned as the driver/operator of a fire apparatus is a great responsibility. Duties assigned to this position include safely driving the fire apparatus and operating the equipment on the fire apparatus such as the pump or aerial device. In addition, the driver/operator is often given the responsibility to inspect and maintain the fire apparatus in as perfect condition as possible. Each fire apparatus must always be ready to respond and perform on the emergency scene in the manner it was designed to do so. If the fire apparatus is equipped with a **fire pump** Figure 6-1, it must be capable of flowing water at the required pressures. If the fire apparatus has an **aerial device**, the driver/operator is responsible for making sure that equipment is capable of operating as required Figure 6-2. Ensuring serviceability of all components of the apparatus is a key aspect of the **preventive maintenance program** that each fire department establishes for its fire apparatus. A quality preventive maintenance program ensures that the fire apparatus in the fire department's fleet are adequately maintained by qualified and trained personnel, the vehicles are inspected on a regular basis by the members who use the fire apparatus, and all documentation is accurate and complete.

Many fire departments—and especially career-oriented departments—may perform these inspections at least daily. In contrast, in a **volunteer fire department** where no specific

Figure 6-1 If the fire apparatus is equipped with a fire pump, it must be capable of flowing water at the required pressures.

Figure 6-2 A fire apparatus equipped with an aerial device.

member is assigned as the fire apparatus driver/operator, such inspections may be done on a less frequent basis. The bottom line is that the fire apparatus must be maintained in a state of readiness to respond to emergencies on a moment's notice Figure 6-3. To ensure their readiness, the fire apparatus and equipment must be inspected, tested, and maintained according to the manufacturer's recommendations. Safety is the most important and obvious reason for inspecting the fire apparatus regularly.

Inspection

The **fire apparatus inspection** is an evaluation of the fire apparatus and its equipment to ensure its safe operation. This inspection should be planned, methodical, and performed in an organized manner. Driver/operators typically conduct such inspections at the start of the shift, when the fire apparatus is being put back into service after repairs were made, and after a large incident during which the fire apparatus was used extensively at the scene of an emergency. This process identifies deficiencies with the fire apparatus or the equipment that might limit or incapacitate the fire apparatus from performing as required. Although most of the inspection can be performed by a single individual, thoroughly inspecting some of the features of the fire apparatus requires two crew members. For example, when inspecting the brake lights on the fire apparatus, one crew member will need to be behind the fire apparatus while the other member operates the brake pedal inside the cab Figure 6-4.

To perform the inspection, you must have some basic knowledge and skills related to vehicle maintenance. That is not to say that you should be capable of *performing* the actual maintenance of the fire apparatus; rather, you should be capable of *identifying* any potential problems before they become critical safety issues. Some fire departments prohibit their members from making any repairs on the fire apparatus, whereas other fire departments encourage fire station crews to make simple repairs to these apparatus. If the fire apparatus is under factory warranty, be aware that you may void the warranty by completing any repairs on the fire apparatus. Always refer to your fire department's inspection procedures before attempting to make any repairs to the fire apparatus.

Conducting an inspection may require using basic vehicle maintenance equipment such as tire pressure gauges, screwdrivers, wrenches, flashlights, and other small tools Figure 6-5. Every fire station should have a basic set of tools to aid the driver in performing the fire apparatus inspection. You should also have access to replacement fluids if you are required to maintain the fluid levels of the fire apparatus.

It is critical that the driver/operator performing the inspections, tests, or maintenance be familiar with the operating procedures of the fire department as well as the recommendations of the fire apparatus manufacturer. NFPA 1901, *Standard for Automotive Fire Apparatus,* requires each fire apparatus manu-

Figure 6-3 Fire apparatus should always be prepared to respond at a moment's notice.

Figure 6-4 Some parts of the fire apparatus inspection may involve more than one crew member. Teamwork is essential to completing a thorough inspection.

Figure 6-5 The inspection of a fire apparatus involves many of the same tools that you may use to maintain your own vehicle.

facturer to provide documentation of the following items for the entire fire apparatus and each major operating system of the fire apparatus:

- The manufacturer's name and address, for contact purposes
- Country of manufacture
- Source for service and technical information regarding the fire apparatus
- Parts replacement information
- Descriptions, specifications, and ratings of the chassis, pump (if applicable) and aerial device (if applicable)
- Wiring diagrams for low-voltage and line-voltage systems
- Lubrication charts
- Operating instructions for the chassis, any major components such as a pump or aerial device, and any auxiliary systems
- Precautions related to multiple configurations of aerial devices, if applicable
- Instructions regarding the frequency and procedure for recommended maintenance
- Overall fire apparatus operating instructions
- Safety considerations
- Limitations of use
- Inspection procedures
- Recommended service procedures
- Troubleshooting guide
- Fire apparatus body, chassis, and other component manufacturer's warranties
- Copies of required manufacturer test data or reports, manufacturer certifications, and independent third-party certifications of test results
- A material safety data sheet (MSDS) for any fluid that is specified for use on the fire apparatus

As a driver/operator, you should use the fire department's procedures and the manufacturer's recommendations as a reference to help you properly maintain the fire apparatus. For example, if the fluid level is low in a radiator cooling system, should you add water or antifreeze coolant? If the oil level is found to be low following a **dip stick** test, which type of oil should be added? Specific fluids are required to ensure proper functioning of specific systems. For instance, oil for a hydraulic system may need to be of a different type or viscosity than oil for the engine. Likewise, the transmission will likely require a different type of oil than either the engine or the hydraulic system. You must adhere to the manufacturer's specification when adding fluids to the fire apparatus; otherwise, you risk damaging the equipment. Each department is responsible for educating members on how to properly maintain the fire apparatus.

Before you are assigned to perform the task of inspecting the fire apparatus, it is critical that the tasks are made clear and are well understood. It is also important that you consider your safety. Loosening a **radiator cap** on a hot engine, for example, may lead to a sudden release of hot liquid and steam. Working near a running engine may cause a shirt sleeve or body part to become entangled in a belt. Getting battery acid on your skin will cause burns and could damage your eyesight if it gets into your eyes. Each department is responsible for training its members on how to inspect a fire apparatus both safely and thoroughly. Always wear the appropriate personal protective equipment (PPE) while performing the fire apparatus inspection, including safety glasses, work gloves, and hearing protection Figure 6-6.

Figure 6-6 Personal safety is always the first priority when conducting an inspection of a fire apparatus.

DAILY ENGINE INSPECTION SHEET

Week of _____ Unit I.D. _____

Shop # _____

Date:							
	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.
Name:							
Knox box serial number							
Fuel level							
Motor oil							
Radiator							
Wipers							
Gauges							
Brakes							
Starter							
Lights/siren							
Generator							
Mirrors							
Body condition							
Water level							
Pump controls/gauges							
Press control device							
Hydrant tools							
Hose/nozzles							
Appliances							
Tools/ladders							
SCBA—PPE							
Radios							
Box-lights							
Map-books/computer							
Keys							
Accountability							
Clipboard							
Tire pressure		Comments:					
Batteries							
Transmission fluid							
Bleed air tanks							
Primer fluid							
Drain valves							
Tool box							
Power tools							

Figure 6-7 The fire apparatus inspection form is essential for maintaining an accurate record of the condition of the fire apparatus.

Safety Tip

When performing any maintenance functions on the fire apparatus or equipment, appropriate safety precautions must always be taken. Appropriate eye protection, hand protection, hearing protection, and inspection procedures must be utilized.

Driver/Operator Tip

If the inspection form is not organized in a logical format and process, then the inspection will not be performed properly. Make sure you take the time to organize the process you will use to complete the inspection process. As an example, similar items that will be examined in one process may be color-coded on the inspection form. Groupings such as electrical system components, drive-train components, pump-related components, and so on can all be logical methods of organizing your inspection. Being organized can help you manage your time effectively and ensure that items are not overlooked.

Inspection Process

The inspection process should begin with a review of the **apparatus inspection form** that was completed after the previous inspection Figure 6-7. This document identifies who performed the inspection and when it was performed. It also identifies any equipment that is damaged or has been repaired and points out any other preventive maintenance procedures performed on the fire apparatus. For example, the last member who inspected the fire apparatus may have documented items such as "one quart oil added to the engine," "right rear outside dual tire low and reinflated to the correct psi," "right rear warning light located on top rail not working and bulb replaced by mechanic." If during your inspection process you note that the engine is low on oil again, this finding may be an indication of some type of ongoing mechanical problem or leak. If the rear right dual tire is low again, it would indicate the tire is leaking and in need of repairs.

In many fire departments, the fire apparatus inspection form is simply attached to a clipboard and stored in the station, usually in the main office. Other departments may have an electronic version of the fire apparatus inspection form and use a computer program to track the inspections of their fire apparatus. Either way the driver/operator must review this material before beginning the inspection. Without reviewing the previous inspection report, some information identified in the current inspection may not seem relevant. Driver/operators from different shifts should also communicate to one another about the fire apparatus and any problems they encounter. Sometimes talking to the other members of the fire department who inspect the same fire apparatus can help to locate a potential problem. Taken in conjunction with the information from the previous report, your inspection process could reveal a need for an appropriate mechanic or qualified person to inspect the vehicle for defects.

Next, you must perform the actual inspection of the fire apparatus. This investigation may take some time depending on the size and complexity of the fire apparatus and its components. Fire apparatus inspections should be performed in a systematic manner. In other words, you should perform the inspection the same way each time to reduce the likelihood that something will be missed. While you are conducting your survey, the fire apparatus should be located in a safe area—either inside the fire apparatus bay, on the fire station driveway, or on an open lot devoid of traffic. The fire apparatus should be parked on a flat, level surface if possible. Check the area around the fire apparatus to determine if it is safe to operate the various components of the fire apparatus, such as lifting the cab of the fire apparatus or lowering the ladder rack on the side of the apparatus Figure 6-8.

During the inspection process, you should thoroughly document your findings on the fire apparatus inspection report. This step will help ensure that all documentation is as accurate as possible and no items are overlooked. Most of the items are inspected visually. In doing so, you are looking for any signs of damage, excessive wear, or defects. Some items must be operated during the inspection to ensure they function properly. For example, the emergency lights can be inspected visually by simply turning them on and walking around the fire apparatus looking for any inoperable lights.

Remember, it does not always take a mechanic to recognize a problem. By visually inspecting and operating the equipment during every shift, you will become familiar with the fire apparatus and its normal condition. You will then be able to quickly recognize when components break down or are in need of maintenance and can recommend the fire apparatus undergo repairs when necessary. Always be guided by your fire department's policies regarding fire apparatus inspections, and do not be afraid to ask for a second opinion if you are unsure about something you find in the inspection.

After the inspection is complete, review the report and make sure that no items were missed. Many fire departments require their members to complete the inspection of the fire apparatus

Figure 6-8 Position the fire apparatus in a safe location prior to starting the inspection process.

by a certain time each day or else face disciplinary actions. The inspection of fire apparatus should be taken very seriously—because it *is* a serious matter. Failure to complete a thorough inspection may result in an unsafe fire apparatus operating on the road and the emergency scene.

Driver/Operator Tip

Each fire department's fire apparatus inspection forms should reflect the policies of the fire department and identify which items need to be checked. Some fire departments have set up inspection procedures that include items to be inspected daily, items to be inspected weekly, items to be inspected monthly, and items to be inspected quarterly.

While you may be responsible for the daily and weekly items, fire officers may be responsible for carrying out the more comprehensive inspections, tests, or maintenance procedures to be performed. For example, the fire officer may be accountable for scheduling the annual fire hose and ground ladder tests for the fire apparatus, though it is your responsibility as the driver/operator to ensure that the equipment is prepared for this inspection. You must be familiar with all of your fire department's required inspection and maintenance procedures.

Driver/Operator Tip

A good inspection of a fire apparatus will get you dirty. If you do not walk into the station after checking out the fire apparatus with dirt and grease from your elbows to your fingertips, then you probably did not do an adequate inspection.

Fire Apparatus Sections

Often the inspection process is broken down into sections. Dividing the inspection in this way allows you to focus on a single aspect of the fire apparatus and discourages you from jumping from one element of the inspection to another without a plan. Jumping around randomly leads to the possibility that critical elements may be missed. Each driver/operator should use whatever system or sequence is recommended by his or her fire department.

The following is a suggested fire apparatus inspection procedure that has been broken down into several sections. The first five sections apply to all fire apparatus. The last two apply only to those fire apparatus that meet the criteria for that section. Not all of the items in each section will apply to every fire apparatus; it is up to the driver/operator to determine which items are applicable to his or her fire apparatus. These sections should be inspected in the following order unless otherwise stated by your fire department:

- Exterior inspection
- Engine compartment
- Cab interior
- Brake inspection
- General tools/equipment inspection
- Pump inspection
- Aerial device inspection

Exterior Inspection

The first section to be completed is the inspection of the fire apparatus exterior. Physically walk around and look at the fire apparatus's general condition. Is the fire apparatus clean and well maintained, or is it worn and in need of several minor repairs? Determine if the fire apparatus is leaning to one side; this may indicate a broken suspension system or tires not inflated to the correct pressure. Visually inspect under the fire apparatus for any fresh oil, coolant, or other fluid leaks. Check for any damage to the body such as dents, scratches, and paint chips. Look for signs of stress or cracks on the body. Inspect the compartment doors, hinges, and latches for proper operation.

Driver/Operator Tip

As part of the exterior inspection, you may need to tilt the cab or crawl under the fire apparatus to properly inspect the items.

Safety Tip

If the fire apparatus will be moved outside to the apron for engine and pump operation, first make sure it is safe to do so. Confirm that all compartment doors are closed, all personal protective equipment is secure, and all cab doors are closed. Whenever the vehicle is operated inside the station, make sure that it is connected to an extractor exhaust system—a system designed to draw the fire apparatus exhaust to the outside so that it does not fill the fire apparatus bay with harmful gases. When the inspection is complete, before backing the vehicle into the station, verify that no one is behind the fire apparatus and have a spotter maintain a visual observation behind the fire apparatus while it is operating in reverse.

Tires are critical to many aspects of the safe operation of the fire apparatus—namely, proper stability of the fire apparatus, stopping capability, and ability to carry loads. When inspecting the tires, use a flashlight to get a better look at their overall condition. It is very dangerous to drive with tires in bad condition. Look for problems such as cuts, cracks, or fabric showing through the tread or sidewall.

The valve stems on all tires should be accessible and devoid of cracks and cuts, with the valve caps being securely fastened. The size and make of all tires should match those recommended by the manufacturer. Dual tires should not be in contact with each other or with other parts of the fire apparatus. Determine if the tread on the tire is wearing unevenly, as this may indicate

a possible problem with the suspension system, an issue related to the steering system, or inflation of the tire to an incorrect pressure. When inspecting the wear, the tire should have at least 1/8″ of tread depth in every major groove on all tires. U.S. coins can be substituted for a tire tread depth gauge as tires wear to the critical final few thirty-secondths of an inch of their remaining tread depth. To use this technique for measuring tread depth, place a quarter into several tread grooves across the tire. If part of George Washington's head is always covered by the tread, the tire has more than 1/8″ of tread depth remaining.

Refer to the manufacturer's recommendations to determine the appropriate tire pressures for each fire apparatus. Using a pressure gauge, check the tire pressure by removing the valve cap and applying the pressure gauge. If the tire pressure is adequate per the manufacturer's or department's specifications, then return the valve cap. If the tire pressure is low, then use an air hose to inflate the tire to the correct pressure. Check the tire again to obtain the pressure level. If necessary, add more air until the desired pressure level is obtained. Replace the valve cap and note that air was added to the tire on the inspection form.

A damaged wheel or rim can cause a tire to lose pressure or even slip off. This event can cause an accident if it occurs while the apparatus is operating on the roadway. Look for any sign of damage, including dents or large scratches along the edge that meets the tire. If rust is found around the wheel nuts, it may be an indication that the nuts are loose and need to be retightened. The wheel should not be missing any clamps, spacers, studs, lugs, or protective covers.

Today's fire apparatus are equipped with a **power steering system**. This system reduces the effort required to steer the vehicle by using an external power source to assist in turning the apparatus's wheels. While inspecting the steering system, look for any bent, loose, or broken parts, such as the steering column or tie rods. With the engine compartment exposed, examine the power steering pump, hoses, and fittings for leaks. While in the cab of the fire apparatus, inspect the amount of free play in the steering wheel. If the steering has more than 10 degrees of free play, a mechanic should service the fire apparatus. Ten degrees of free play is equivalent to 2″ of movement at the rim of a 20″ steering wheel Figure 6-9.

The suspension system keeps the vehicle's axles in place and holds up the fire apparatus and its load. A defect in this system may cause problems with the fire apparatus's braking or power steering system. Inspect the frame assembly to ensure that no parts are cracked, loose, broken, or missing. Look for any spring hangers or other axle positioning parts that are broken and might allow the axle to move out of position. Also, look for any broken sections or sections that have shifted out of place in the leaf springs. Identify whether the shock absorbers are leaking fluids or are bent out of shape. Torque rods and torsion bars should be free of damage.

Visually inspect the fire apparatus exhaust system to check for any loose, broken, or missing mounting brackets or parts. The exhaust piping should not rub against the tires or other moving parts of the fire apparatus, and no leaks should be found. A broken exhaust system may allow poisonous fumes to enter the cab, harming the crew members aboard the fire apparatus.

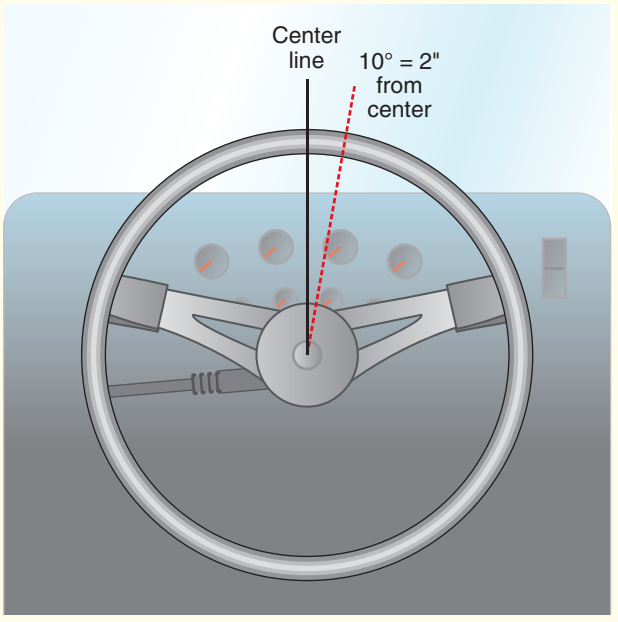


Figure 6-9 Ten degrees of play is equivalent to 2″ of movement at the rim of a 20″ steering wheel.

Driver/Operator Tip

Cleanliness is a very important part of proper fire apparatus maintenance. A clean fire apparatus is not only a source of pride in the station and its crew, but is also safer than a dirty fire apparatus. Dirt and grime build-up will damage moving parts and cover defects. By keeping the fire apparatus clean, you are gaining intimate knowledge of the equipment, thereby ensuring that any defects will be identified sooner.

To clean the fire apparatus, you must first rinse it with clean water to remove any loose dirt. This action also reduces the chance of scratching the paint during the remainder of the clean-up procedure. Wash the fire apparatus with an automotive soap, as recommended by the manufacturer. The entire fire apparatus should be thoroughly washed, including the top of the cab, wheel wells, and diamond plate surfaces, among other components. Rinse the vehicle with clean water, and then dry the fire apparatus with an approved chamois or towel. All trash should be removed from the cab's interior; this compartment should then be dusted, swept, or vacuumed and dressed with the appropriate surface treatment.

Glass should be cleaned and all painted surfaces waxed as necessary after the fire apparatus is completely dry. Metal surfaces should be polished to prevent tarnish and dull surfaces. Compartments should be cleaned out and all equipment maintained as necessary. If the engine compartment is clean, it makes the inspection process easier. Never use gasoline or other unapproved solvents to clean painted surfaces, as they may cause discoloration and damage.

The fuel cap should be securely fastened to prevent any spillage or fumes leaking from the tank. This cap should also be labeled with the appropriate fuel. Although larger fire apparatus use diesel fuel, some vehicles may require a specific grade or bio-diesel. Always consult the operator's manual provided by the manufacturer to determine which type of fuel to add to the fire apparatus. The fuel tank should be checked to make sure that no leaks are present and the mounting brackets are properly secured.

Engine Compartment

This section focuses on the process of inspecting the fluid levels, battery charge, cooling system, motor components such as belts, charging system, and drive train elements. NFPA 1901, *Standard for Automotive Fire Apparatus*, requires that all fire apparatus be designed so that the manufacturer's recommended routine maintenance checks of lubricants and fluid levels can be performed through a limited-access port without lifting the cab of the fire apparatus or without the need of special tools for routine maintenance checks of lubricants and fluid levels Figure 6-10. On most fire apparatus, you will still need to raise the cab to inspect most portions of the engine, including belts, hoses, and fan blades. Older fire apparatus may not have an access door through which to check the fluids; as a consequence, the cab must be tilted to determine the fluid levels in these vehicles. If this is the case, the cab should be secured with a locking device so that the cab does not fall on anyone operating underneath it Figure 6-11. While the engine is off, you can inspect the engine compartment. Examine this area for any fluid leaks; broken, cracked, or damaged hoses; and electrical wiring that shows signs of wear, chaffing, or damage from heat. Also, confirm that the cooling fan is free of any obstructions or defects. The air intake filter should be replaced as necessary and its housing should not have any cracks, loose fasteners, or broken supports.

Depending on your fire department's policy, the driver/operator may be required to maintain the appropriate fluid levels in the fire apparatus. Remember, when adding any fluids, you must record the amount on the fire apparatus inspection form. You should not rely solely on sensors and computer systems to give an accurate reading of fluid level—always physically check the fluid levels.

Figure 6-10 Access doors on newer fire apparatus allow you to inspect the fluids in the engine compartment without having to lift the cab.

Figure 6-11 Always use a locking device to secure the cab when operating underneath it.

The engine oil level is checked with a dip stick, usually after the engine has been turned off for at least 15 minutes; this delay allows the oil to settle back down and gives an accurate reading. The dip stick is pulled, wiped clean, and then replaced. It is then pulled a second time and the oil level compared to the marking on the dip stick. Generally a range is provided between "low" and "full." If the engine was operated just before the oil is checked, the dip stick level may appear low, as oil is still in the engine components and not totally drained to the crankcase. If the oil level is truly low, then the recommended amount of oil should be added via the correct port. After waiting a few minutes, check the level again to ensure the proper level has been achieved and record the amount of oil added on the inspection form.

The coolant level should be measured, observed, or checked in the manner recommended by the manufacturer.

Most systems in use today do not require the removal of the radiator cap and provide an exterior coolant reservoir that is marked with the appropriate level. Some manufacturers provide a sight glass on the radiator to determine the coolant level

Figure 6-12 A sight glass can be very useful to check the coolant levels.

Figure 6-12. If the coolant system is low on coolant, then you should consult your fire department's procedures to determine which coolant should be added to bring the reservoir to the proper level. Adding water will diminish the protection from freezing. Additionally, antifreeze fluid contains other materials designed to prevent rusting and act as a lubricant; it may be the only appropriate liquid to add to the cooling system. If the fire apparatus has been run recently, be aware that the coolant itself may be hot.

Always use caution when removing the radiator cap, as the coolant may be under pressure and be hot; if it boils over, it could cause an injury. For this reason, it is not recommended that you remove the cap when the fire apparatus is running or when the fire apparatus is hot.

Power steering system fluid is checked in the same way as the engine oil. A small dip stick is inserted to determine the fluid level. If the level is low, add power steering fluid as required.

The transmission fluid is the only fluid that may need to be inspected while the engine is running, although some manufacturers also recommend checking power steering fluid at operating temperature. Many manufacturers recommend that the transmission be operated at the normal operating temperature (usually 170°F) after the apparatus has run through all of its gears and that the vehicle be parked in neutral when the fluid is checked. To check the transmission fluid, use a dip stick in a similar manner as when performing an engine oil check.

Other fluid levels, such as the rear differential fluid (axle), hydraulic oil, and pump gear box oil levels, are often checked by a fire department mechanic on a periodic basis. Always refer to the manufacturer's recommendations when determining the correct levels of these fluids.

Belts that drive engine components such as alternators, the power steering pump, the air compressor, and other equipment may become loose due to wear. To check the tension on a belt, push against the belt in an area where there is no pulley. Depending on the manufacturer's recommendations, the belt may be able to be pushed to some extent, but should not have any excess slack. In some fire departments, a mechanic or specially trained inspector will check items such as belts on a frequent basis; thus the driver/operator may not be required to check them. Nevertheless, you should ensure that the belts do not show any signs of excessive wear or fraying. Always refer to the manufacturer's recommendations regarding belt inspections.

The fire apparatus's (one or more) batteries should be examined for signs of corrosion on the terminals where the wires connect to the battery post. It is important that you protect yourself from corrosion or the liquid inside the battery. Appropriate eye, hand, and/or body protection should be provided and worn during this part of the fire apparatus inspection. Corrosion may be removed by scraping the terminal with a wire brush; always wear eye protection when performing this activity.

The physical process of removing the electrical wire connection from the terminal is normally performed by a mechanic or other person specially trained to perform this task. Given that most of today's fire apparatus have computerized systems on board, severe damage could occur if removal of the battery cables is done improperly Figure 6-13. For example, the computer system that operates the fire apparatus may have to be reset by a qualified technician if it loses power for a significant amount of time. Although older vehicle batteries may have fluids cells that can be refilled as often as needed, many newer batteries are sealed, meaning there is no way to check the fluid cells. You should refer to the manufacturer's recommendations when inspecting batteries on any fire apparatus.

Voltage levels may be checked by observing the **voltage meter** on the dashboard if the vehicle is so equipped. A volt meter registers the voltage of the battery system. For example, the voltage of a 12-volt battery will typically be recorded as a number such as 14 volts. Batteries that are equipped with removable caps on the cells of the battery should be checked for appropriate liquid levels. Liquid should cover the cells, albeit not to overflowing. If the liquid level is low, follow the fire department's or manufacturer's recommendations regarding which liquid to use to refill the battery.

Cab Interior

When inspecting the cab interior, first check that all cab-mounted equipment is present and accounted for, including the following items:

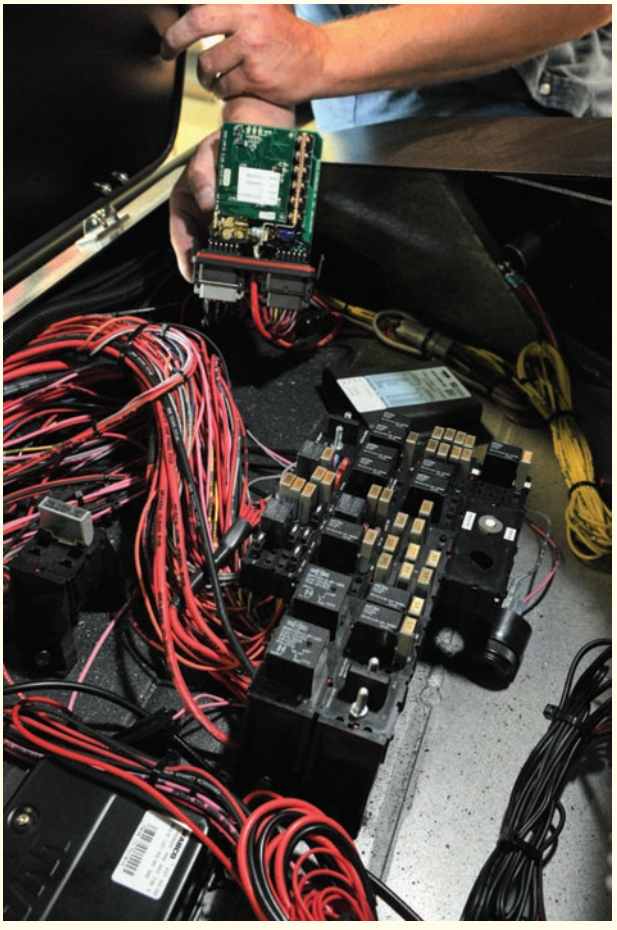


Figure 6-13 Do not disconnect the batteries on newer-model fire apparatus, as this step may cause damage to the computer system.

Figure 6-14 NFPA 1901 requires that seat belts be red or orange so that fire fighters can tell them apart from the waist belts on SCBA units.

- Portable radios
- Self-contained breathing apparatus (SCBA)
- Maps
- Traffic vests
- Hearing protection
- Medical gloves
- Box lights

Also, check for worn or torn seats, cushions, dashboards, and headliners. Ensure that all seat belts are functioning properly and are free of cuts and frays. NFPA 1901 requires that all seated positions in the modern-day fire apparatus cab be equipped with bright orange or red seat belts so they are not confused with seat-mounted SCBA belts and straps Figure 6-14 ▸.

The interior of the cab is where most of the controls for the fire apparatus are located. For this section of the inspection, set the parking brake and start the fire apparatus by engaging its normal starting sequence. This provides the opportunity to observe the gauges such as those measuring oil pressure, electrical system, engine temperature, and air pressure. Once you are sitting inside the cab, adjust the seat and the mirrors and familiarize yourself with the functional controls. As a driver/operator, you must be familiar with all of the controls in the cab so that you do not need to take your eyes off the road to make any adjustments while driving.

Make sure that all of the gauges indicate performance within the normal operating ranges. Each fire apparatus may have different ranges for normal operations; refer to the manufacturer's recommendations. Determine whether any indicator lights are activated and need attention. For example, if the oil light is activated and you have recently added more oil to the engine, either the sensor is faulty or another problem may exist. Check the operation of the functional control switches—that is, the controls that operate interior functions as well as those that operate exterior functions.

Interior Functional Control Switches

Interior functional control switches include the controls for items that are located inside the cab itself—for example, the heater, air conditioner, defroster, map lights, dash lights, MDT, radio, and other devices. All of these items should be inspected to ensure that they are operating correctly. Some fire departments require members to check the MDT and radio to ensure that they are transmitting information appropriately. Always refer to your department's policies when conducting this part of the fire apparatus inspection.

Exterior Functional Control Switches

Exterior functional control switches include the controls for items that are located outside of the cab but are operated from controls

Figure 6-15 You will have to walk around the fire apparatus and visually inspect the operation of the lights on the fire apparatus.

in the cab—for example, the emergency lights, headlights, directional lights, brake lights, side marker lights, spotlights, and taillights. All of the lights should be clean and operating correctly. To inspect the lights of the fire apparatus, you must activate the lights and walk around the fire apparatus visually inspecting their operation Figure 6-15. Another fire fighter should assist you in checking the brake and reverse lights.

Check the mirrors, windows, and windshield. All of the windows of the fire apparatus should be clean and free of cracks or chips. If any defects are found during the inspection, document them on the report. All of the windows should roll down properly, whether they are manually or electronically controlled. Windshield wipers and fluid level should be checked as well. The wiper blades should be soft, flexible, and clean. If the blades are too hard or cracked, then they should be replaced. The wiper fluid level should be topped off with the appropriate liquid as recommended by the manufacturer.

Driver/Operator Tip

The emergency warning equipment must be checked to confirm that all components are functioning appropriately. Driving lights (head, tail, marker) and warning lights should be checked for appropriate function, and audible warning devices should be tested to ensure they operate correctly. Likewise, all other electrical equipment—such as scene lighting devices and traffic directional arrows—should be tested to make sure they are functioning correctly. If the emergency lights do not operate properly, for example, the fire apparatus is not capable of operating safely during an emergency response.

Brake Inspection

The brakes of the fire apparatus should be given special attention when performing the inspection, as this equipment is clearly vital to the safe and efficient operation of the fire apparatus. First, you should inspect the brakes for the following conditions:

Driver/Operator Tip

The vehicle's fuel level can easily be checked by observing the fuel gauge when the electrical system is energized. Be familiar with your fire department's policies stating when the fuel tank must be replenished or topped off. Many fire departments have a policy that states the fuel level for any fire apparatus should never go below half a tank.

cracked drums or rotors; shoes or pads contaminated with oil, grease, or brake fluid; and shoes or pads that are worn dangerously thin, missing, or broken. Next, you should test the brakes of the apparatus. Your department's policies and procedures will dictate if and when the following tests are to be completed.

Parking Brake Test

Make sure that the fire apparatus is in a safe position and has plenty of room to perform this simple brake test. With the fire apparatus turned on, allow it to move forward at a speed less than 5 mi/h (8 km/h). Apply the parking brake. If the fire apparatus does not stop, bring it to a halt using the service brakes and have the fire apparatus inspected by a qualified mechanic.

Brake Pedal Test

Make sure the fire apparatus is in a safe position and has plenty of room to perform this test. Accelerate to 5 mi/h (8 km/h). Push the brake pedal firmly. If the fire apparatus demonstrates excessive pulling to one side or the other, if it exhibits a delayed stopping action, or if the "feel" of the pedal is off, this may indicate a potential problem. In such a case, have the fire apparatus inspected by a qualified mechanic.

The following tests are applicable only to fire apparatus equipped with air brake systems. Your department's policies and procedures will dictate if and when the following tests are to be completed. Those vehicles without air brake systems may not be required to complete any additional brake tests. For the following tests, you should chock both sides of the front left wheel with the fire apparatus wheel chocks Figure 6-16.

Figure 6-16 Chock the wheels of the fire apparatus when conducting a dual air brake system warning and buzzer test.

Dual Air Brake System Warning Light and Buzzer Test

Many fire apparatus are operated with a dual air brake system. With this system, a mechanically operated parking brake is activated in the event of a service brake failure. A dual air brake system actually consists of two separate air brake systems that use a single set of brake controls—a setup that provides more air capacity and, therefore, a safer system. Each system has its own air tank and hoses; they are split so that one system operates the front of the fire apparatus and the other operates the rear. On the dash of the fire apparatus, the gauges for each system are labeled as "front" and "rear," respectively.

To complete the test, follow these steps. First, turn the fire apparatus on and allow time for the air compressor to build up to a minimum of 110 pounds per square inch (psi) in both the front and rear systems. Next, shut the engine off. Leave the battery in the "on" position, and step on and off the brake pedal to reduce air tank pressure. An audible alarm should signal before the pressure drops to less than 60 psi in the air tank with the lowest air pressure. Have the fire apparatus inspected by a qualified mechanic if the audible alarm does not work properly, as such a malfunction could cause the system to lose air pressure without your knowledge. Without the proper air pressure, the brakes will become less effective, thereby increasing the stopping distance of the fire apparatus and leading to unsafe operation.

Spring Brake Test

This test ensures that the parking brake operates as it was designed. The parking brakes should engage whenever brake pressure drops below 40 psi in the rear brake system. The spring brake test is performed by allowing enough air pressure to build up in the braking system to release the parking brake. Depress the parking brake knob to release it. Next, step on and off the brake pedal to reduce the pressure in the system. The parking brake knob should activate when the air pressure drops below 40 psi. The spring brakes will then activate and help to prevent the vehicle from moving.

As a result of normal condensation of moisture in the air and moisture created during the compression phase, some water may enter into the air supply of the braking system. The danger from the presence of moisture in the air supply is that in cold weather it may collect and freeze, thereby preventing the braking system from operating properly. Fire apparatus equipped with air brakes may be equipped with automatic moisture exhaustion valves to overcome this problem. In addition, some fire apparatus is equipped with a manual water drain valve that must be opened to drain moisture from the air system Figure 6-17. Refer to the operator's manual to determine which procedures are recommended to maintain the system. Automatic moisture reduction systems will make a spitting noise when they are removing moisture from the system; this is normal and not a cause for alarm. As a driver/operator, you must become familiar with the air brakes and the moisture removal system with which your fire apparatus is equipped.

Figure 6-17 Manual valves to drain the moisture in the brake system are found underneath the fire apparatus.

General Tools/Equipment Inspection

All other equipment carried on the fire apparatus—such as breathing apparatus, cascade systems (including compressors), generators, fans, hydraulic rescue tools, hand tools, power tools, hose, nozzles, ground ladders, and so on—must also be inspected to make sure that it is operational Figure 6-18. The SCBA should be checked in accordance with the fire department's respiratory protection program, which may require completion of a separate inspection form. A record of this inspection process

Figure 6-18 Equipment found in the compartments of the fire apparatus must be inspected and the results of the investigation documented on the inspection report.

must be kept by the member in charge of the respiratory protection equipment in accordance with OSHA 29 CFR 1910.134.

Power tools such as saws, fans, and hydraulic rescue tools should be checked for oil level (if appropriate) and fuel supply. All equipment should be started and operated. Equipment such as power saws may have two-cycle engines, in which the lubricating oil is mixed with the gasoline or another fuel; that is, they may not have a crankcase with a separate oil supply serving as the lubricant. Devices such as portable pumps will typically have four-cycle engines and an oil reservoir that must be checked. When refueling power tools, it is critical to make sure the appropriate fuel is used.

Many fire apparatus carry equipment on board that needs to be recharged as the fire apparatus sits in the station bay. This equipment may include portable radios, thermal imaging cameras, or batteries for electrical equipment Figure 6-19. If the fire apparatus is not operated for an extended duration, its batteries may be drained of power by the ongoing recharging of equipment stored on board the fire apparatus. Therefore, it is critical to keep the vehicle's batteries properly charged at all times. To do so, many fire apparatus are equipped with a charging system that connects to an electrical outlet in the fire station. This electrical line recharges the battery(s) while the fire apparatus is not running, thereby ensuring that the fire apparatus has enough electrical power in its batteries to recharge any equipment and start the fire apparatus as required.

Safety Tip

Extreme caution should be used when adding fuel to power tools. Never fuel equipment inside the station, and never fuel equipment while it is running. If the engine is hot, allow it to cool before refueling the equipment. Use the appropriate fuel dispensing device(s).

Pump Inspection

The pump inspection process includes the following items:

- Water supply tank
- Foam supply tank
- Intakes and discharges
- Primer pump
- Centrifugal fire pump

A visual inspection of the water supply tank should be conducted, even if it has a water tank level gauge. This step will help verify that the gauge is correct. Tank gauges may not be accurate because of fluctuations caused by the materials in "hard water" and electrical malfunctions. Always visually confirm that the water tank is full.

In fire apparatus that is equipped with foam systems, the foam tank levels should also be checked. This inspection is typically completed at the same time as the water tank check. As with the water tank, always visually confirm the fluid level in the foam tank.

Before opening any valve and allowing water to drain, check the floor area under the fire apparatus for the presence of water.

Figure 6-19 Small electrical equipment may be charged while mounted on the fire apparatus.

A puddle of water or dripping water may indicate a loose pump seal or some other leak in the system Figure 6-20. A loose pump seal may not be considered a significant problem if the pump is always operated from a pressurized water supply, such as a hydrant. It is a problem, however, if the pump needs to be operated in draft mode. It may not be possible to prime the pump in such a case owing to the leaking seal. Repairing this problem requires a mechanic who is specially trained to adjust the seals. In addition, leaking water from the pump seals during operations in cold weather will cause additional ice to build up in and around the fire apparatus.

In areas subject to cold weather, pumps may be kept in a dry state during winter months. If this is the case, do not open the tank-to-pump valve, as this maneuver will cause the pump to fill with water. Always refer to your department's policy regarding the use of wet versus dry fire pumps.

While the pump is not engaged, open and close each discharge valve several times to ensure that it operates properly. Remove all of the caps on the discharges and open the drain valve for each discharge to ensure it functions properly. Confirm that all caps are easily operated and free of corrosion.

Figure 6-20 Water or other liquids dripping from underneath the fire apparatus should be inspected to determine whether the leak is serious.

The intakes—that is, the piping that allows water to enter the fire pump—are inspected next. To do so, remove the plugs, caps, or **piston intake valve (PIV)** and visually inspect the piping. The PIV is a large appliance that connects directly to the pump's intake and controls the amount of water that flows from a pressurized water source into the pump. Hard water and corrosion can cause the plugs or caps from the intakes or at the end of the PIV to stick and make it difficult to open them. In such a case, it is better to fix the problem at the fire station during the fire apparatus inspection than to wait until it happens at the next fire scene.

Intake strainers are located at the front of all intakes directly on the pump. These small screens prevent debris such as rocks from entering the pump and causing damage. These screens should be checked at least weekly or as directed by your department. Be careful when completing this portion of the inspection, because water will be released as the pump partially drains. Check the grids of the strainers to make sure they are clear and no pieces are bent or missing Figure 6-21. Repeat this process for each intake. After the intake strainers are checked and the caps or PIV replaced, it is critical that the fire pump be refilled with water as required.

Because the fire apparatus is equipped with a centrifugal pump, it will have a priming pump; the oil reservoir of this priming pump most likely must be checked daily Figure 6-22. The priming pump is used to draw air out of the centrifugal pump for proper operation. Some of these pumps allow a small amount of oil to enter the centrifugal pump during priming operations to help seal and lubricate the pump.

If the priming pump is wet, then a stream of water should be observed within a few seconds. If the pump is being carried dry, then no water should be seen. If the pump drains are open, then no negative pressure will be recorded on the compound gauge.

If the priming pump is being carried in a wet condition and after the pump valves and components have been operated, the fire apparatus engine should be started and the pump engaged in appropriate gear. Before starting the engine, make sure that the parking brake is set and that the wheels are chocked. Once the engine is started and the pump engaged, observe the fire apparatus's speedometer to see whether a speed is being recorded, indicating the pump is in gear. Some fire apparatus may use a power take-off drive system for the centrifugal pump and, therefore, will not record any speed on the speedometer because the truck is not in gear. On the pump panel, observe the tachometer to observe that the pump is activated. Ensure that all of the gauges and instruments are operating properly.

Figure 6-21 The strainer should be in good condition and should not have any missing or damaged pieces.

Figure 6-22 A priming pump is used to draw air out the centrifugal pump.

To set the pressure relief valve, open the tank-to-pump valve and the tank fill valve. Next, increase the engine speed to bring the pump pressure up to an operating pressure, such as 125 psi. Then set the pressure relief valve and confirm that it is functioning properly. To do so, increase the engine speed and the pressure to cause the relief valve to operate or open. If the relief valve is functioning properly, the pressure will not increase more than the set pressure. For engines equipped with a pressure governor both the tank-to-pump and tank fill valves should be open and the pressure governor should be turned to the "on" position. Increase the pressure to about 125 psi, which will in turn set the pressure governor at this pressure. Once water flow is established and the governor set, close the tank fill valve halfway. The governor should adjust the engine speed to maintain the desired pressure. Reopen the tank fill valve all the way.

Be sure not to operate the pump for more than a few minutes without circulating water back to the tank or the other discharge line. Without the cooling provided by the circulating water, friction will cause the water to heat and boil, which may damage the pump.

Voices of Experience

Routine maintenance is just that: routine. But Daily Apparatus Checks are not an area where short cuts can be taken. That expectation needs to be made clear on the first day a new driver/operator reports to the company. In addition, senior driver/operators must stay diligent in taking these checks seriously every single day of their careers.

The criteria and sequence for fire apparatus maintenance are established by detailed fire department check-off lists. However, the steps for developing a positive safety attitude towards fire apparatus maintenance within the company are not written down—that is up to the driver/operator.

Remember, the fire apparatus is both your office and your toolbox. Daily Apparatus Checks will ensure its safety. And these tips will help ensure that your Daily Apparatus Check is both thorough and effective:

- The vibration that takes place while the fire apparatus is on the road tends to loosen certain pieces of equipment. All attack lines, whether pre-connected or not, have a nozzle attached and have to be physically checked. Ensure that the nozzle is firmly attached to the hose and make sure the tip of the nozzle is screwed down tightly at the ball-valve shut-off.
- Many departments carry their monitor tips "stacked" at the end of the deck gun. Ensure that all tips are firmly screwed on to the appliance.
- Whenever sections of hose are changed out, make sure there is a gasket inside the female swivel of the coupling.
- Make sure that your fire extinguishers are properly charged and that the gauge is "in the green."
- Check the chain on the chainsaw. There have been incidents when a fire fighter has unknowingly put the chain on backwards on the bar.
- The apparatus floors should be swept and mopped right after the Daily Apparatus Checks. Be alert to any puddles forming throughout the shift from water, oil, fuel or other fluids. This may be your only indication that there is a slow leak in the tank, a loose pump seal, an oil, fuel or hydraulic system leak. Some companies have members wipe down the apparatus before shift change with a chamois. Some even go so far as to wipe down the undercarriage. Though this may seem excessive, it gets the members under the rigs with creepers and forces them to take notice of the inside tires, belts, bolts, and mounting brackets, etc.

> *"Remember, the fire apparatus is both your office and your toolbox."*

Daily Apparatus Checks are more than checking a diesel engine for fuel and oil. Take these checks seriously. The lives of your crewmembers and their families are depending on you to prepare that apparatus for a safe response. Taking short cuts can make your rig unsafe on the road and unreliable on the fireground.

Raul A. Angulo
Seattle Fire Department
Seattle, Washington

Near Miss REPORT

Report Number: 09-0000695
Report Date: 07/16/2009 10:16

Synopsis: Faulty brakes almost cause collision.

Event Description: During an emergency response to a reported structure fire, a near-miss incident occurred between an engine company and a ladder company. As the two companies approached a controlled intersection from opposite directions, the engine company driver was unable to slow the apparatus down and narrowly avoided running head-on into the ladder company. Fortunately, the ladder driver was able to quickly react to the situation and the collision was averted. If we would have collided, multiple fire fighters could have been injured and/or killed. Brake failure of the engine contributed to the cause of the incident.

Lessons Learned: Keep the apparatus maintained by performing daily checks.

Demographics

Department type: Paid Municipal

Job or rank: Lieutenant

Department shift: 24 hours on—48 hours off

Age: 34–42

Years of fire service experience: 11–13

Region: FEMA Region V

Service Area: Urban

Event Information

Event type: Vehicle event: responding to, returning from, routine driving, etc.

Event date and time: 07/12/1999 17:00

Event participation: Involved in the event

Weather at time of event: Clear and Dry

What were the contributing factors?
- Human Error
- Decision-Making
- Command
- Situational Awareness
- Equipment

What do you believe is the loss potential?
- Property damage
- Life-threatening injury
- Lost time injury

For fire apparatus with multistage pumps, the **transfer valve** should be set to change from pressure to volume operation or from series to parallel operation. The pressure should change appropriately with about half the pressure in parallel (volume) from the series (pressure) setting. This change should be made two or three times to exercise the valve.

Aerial Device Inspection

The aerial device should be inspected according to the manufacturer's recommendations. NFPA 1911, *Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus*, requires that aerial devices be tested annually. As part of their inspection, you should record the amount of time it takes to perform each of the three recommended tests: full lift, extension, and 90-degree rotation. An increase in the amount of time it takes to complete a test may indicate problems with the hydraulic system. All tests are meant to check for the proper operation and adjustment of components if necessary. Inspection that ensures the availability of a properly maintained and adjusted aerial device may prevent an accident or a catastrophic failure of the device.

Many departments require the driver/operator to not only inspect the aerial device, but also to clean and lubricate it. Follow the manufacturer's recommended maintenance schedule for the replacement of hydraulic filters and hydraulic fluid replacement.

Always follow your department's policies for this inspection process. Many different aerial devices exist, and each has different features. Before operating the aerial device, always make sure that it is in a safe position and that no overhead obstructions are present in the immediate area.

Some of the components most commonly found on an aerial device include the following items:

- Aerial device hydraulic system
- Stabilizing system
- Cable systems
- Slides and rollers
- Aerial device safety system
- Breathing air system
- Communications system

The main component of the aerial device is the hydraulic system that powers it. Using the hydraulic fluid and large cylinders that constitute this system, the aerial device can be maneuvered into almost any position. The hydraulic system is made up of a reservoir of hydraulic fluid, a pump, pressurized lines, and hydraulic cylinders that power the stabilizers and the aerial device.

To inspect this system, with the aerial device and stabilizers in the stored position, you should first check the fluid stored in the reservoir. Depending on the manufacturer, a simple dip stick or a sight glass may be used to determine the fluid level. The hydraulic lines should also be visually inspected for any leaks or signs of chafing. In addition, engage the hydraulic system and verify that all of the functions and alarms are operating correctly.

Next, place the wheel chocks on the fire apparatus and prepare to deploy the stabilizers. The stabilizers should be checked for their full range of motion; they should also operate smoothly and evenly. Check the stabilizer arms for any leaks, cracks, broken welds, or loose parts. The stabilizers should be clean and free of rust, and all working parts should be lubricated as required Figure 6-23. All of the controls should be properly labeled.

Figure 6-23 Clean stabilizers are easier to inspect for defects.

Once the stabilizers are set, put the aerial device through its full range of operation using the main controls. The controls' response should be smooth and even with no unusual noise or vibration.

Inspect the aerial device for any cracks, loose parts, damage, or signs of heat stress. Check the turntable gears for any missing teeth, broken welds, leaking hydraulic lines/cylinders, or damage to the lifting cylinders. Inspect the cables for looseness, frays, broken strands, or other signs of damage. Next, inspect the slides and rollers of the aerial, which allow the different sections of the aerial device to move in and out with out rubbing against each other Figure 6-24. Ensure that there is no metal-to-metal contact and that the slides and rollers are properly lubricated and functioning properly.

Many aerial devices are equipped with safety systems that will not allow the device to perform specific functions if the apparatus is not in a safe position. For example, if the stabilizers are not fully extended on one side of the fire apparatus, the aerial device will not be allowed to operate on that side. A sensor will

A.

B.

Figure 6-24 The slides and rollers prevent the sections of the aerial device from contacting each other. **A.** The roller. **B.** The aerial.

Figure 6-25 A communication system allows the driver/operator at the turntable to remain in contact with the crew members who are working at the tip of the aerial device.

stop the aerial device from operating on that side so as to prevent the fire apparatus from tipping over. Each manufacturer provides different safety systems and overrides for these systems. You must be very comfortable operating the aerial device and know how and why to perform an override of any system. Remember, however, that these safety systems are designed for the protection of the fire fighter.

Many times fire fighters will operate at the tip of the aerial device during firefighting operations. During this time the fire fighters may use the air supply from the fire apparatus rather than the SCBA that they carry on their backs—a strategy that allows them to work for longer periods of time than would be possible with SCBA. To check the functioning of the fire apparatus's air supply system, first make sure the air tanks are full. Many fire departments have the driver/operator document this information on the fire apparatus inspection form. Look for any cracked hoses or loose parts.

A communication system at the turntable enables the driver/operator of the fire apparatus to speak with a fire fighter working at the tip of the aerial device. This system should be checked for proper operation as part of the fire apparatus inspection Figure 6-25 ▸.

Follow the steps in Skill Drill 6-1 ▸ to perform an inspection of a fire apparatus:

1. Review the previous apparatus inspection reports for information regarding the fire apparatus. (Step 1)
2. Inspect the exterior of the apparatus in accordance with the department's policies and procedures. (Step 2)
3. Inspect the engine compartment of the fire apparatus in accordance with the department's policies and procedures. (Step 3)
4. Inspect the cab interior of the fire apparatus in accordance with the department's policies and procedures. (Step 4)
5. Complete a brake inspection of the fire apparatus in accordance with the department's policies and procedures. (Step 5)
6. Inspect the tools and equipment of the fire apparatus in accordance with the department's policies and procedures. (Step 6)
7. Inspect the pump of the fire apparatus and all of the features associated with its function in accordance with the department's policies and procedures (if applicable). (Step 7)
8. Inspect the aerial device and all of the features associated with its function in accordance with the department's policies and procedures (if applicable). (Step 8)

Skill Drill 6-1

4.2.1, 5.1.1, 6.1.1

Performing an Apparatus Inspection

1 Review the previous fire apparatus inspection report.

2 Inspect the exterior of the fire apparatus.

3 Inspect the engine compartment.

4 Inspect the cab interior.

5 Inspect the fire apparatus's brakes.

6 Inspect the tools and equipment carried on the fire apparatus.

7 If applicable, inspect the pump of the fire apparatus and all the features associated with its function.

8 If applicable, inspect the aerial device and all the features associated with its function.

Safety

Not only is it critical that you perform the fire apparatus inspection in a safe manner, but you must also ensure that the fire apparatus is prepared for a safe response. This includes making sure that the fire apparatus is in proper working condition, the emergency warning equipment is operating correctly, tools and equipment are functional, and the vehicle is ready to support sustained operations.

The final portion of the safety evaluation focuses on making sure that the fire apparatus is safe to ride on and operate. As part of that safety check, all tools and equipment should be secured, breathing apparatus secured, equipment properly placed and secured on compartment shelves, and equipment carried on the outside of the apparatus properly secured. Hose lines should be loaded and ready for deployment, ground ladders securely nested, portable tanks secured on water tankers/tenders, and other tools or equipment properly secured to the fire apparatus Figure 6-26. In case of a sudden stop or use of evasive driving techniques, all equipment in the passenger compartment must stay firmly secured. A sudden stop can cause a hammer, for example, to become a dangerous projectile.

Figure 6-26 Exterior-mounted equipment should be properly stored before the fire apparatus moves.

Weekly, Monthly, or Other Periodic Inspection Items

In addition to undergoing its daily inspection, each fire apparatus will typically be subject to other inspections that are performed on a less frequent basis. For example, some elements of the inspection process—such as checking hydraulic oil levels, checking pump bearing oil reservoir levels, and so on—may be done on a weekly, monthly, or even quarterly basis.

Consider tire inspections. In addition to the daily visual inspection and evaluation of air pressure, more comprehensive inspection of tires may include items such as tread depth measurement, age from wear, and examination for cuts or abrasions. This examination may be done on a periodic basis and may be performed by a person other than the driver/operator. Vehicles with hydraulic braking systems may require the hydraulic fluid level to be checked in both the main and backup reservoir. This assessment may be performed by a mechanic.

Completing Forms

The forms recording the inspection and maintenance process are filled out as the inspection process takes place. At the conclusion of the fire apparatus and equipment inspection, the forms should be completed and filed in accordance with the fire department's procedures. Any abnormalities should be reported to the officer in charge so that he or she can make a determination on the best method of corrective action. In some instances, a situation found during your inspection may require that the fire apparatus be immediately taken out of service. In other situations, appropriate maintenance and repairs may be scheduled to be performed at a later date.

Wrap-Up

Chief Concepts

- The fire apparatus inspection is an evaluation of the fire apparatus and its equipment that is intended to ensure its safe operation.
- The inspection should be planned, methodical, and performed in an organized manner.
- The inspection process should begin with a review of the apparatus inspection form that was completed after the previous inspection.
- Dividing the inspection into sections allows you to focus on a single aspect of the fire apparatus and discourages you from jumping from one element of the inspection to another without a plan; jumping during an inspection leads to the possibility that critical elements may be missed.
- Not only is it critical that you perform the inspection in a safe manner, but you must also ensure that the fire apparatus is prepared for a safe response. This includes making sure that the fire apparatus is in proper working condition, the emergency warning equipment is operating, tools and equipment are functional, and the vehicle is ready for sustained operations.

Hot Terms

aerial device An aerial ladder, elevating platform, aerial ladder platform, or water tower that is designed to position personnel, handle materials, provide continuous egress, or discharge water. (NFPA 1901)

apparatus inspection form A document that identifies who performed the inspection and when the fire apparatus inspection was performed, identifies any equipment that is damaged and/or repaired, and details other preventive maintenance procedures performed on the apparatus.

dip stick A graduated instrument for measuring the depth or amount of fluid in a container, such as the level of oil in a crankcase.

extractor exhaust system A system used inside the fire apparatus bay that connects to the fire apparatus tailpipe and draws its exhaust outside the building.

fire apparatus inspection An evaluation of the fire apparatus and its equipment that is intended to ensure its safe operation.

fire pump A water pump with a rated capacity of 250 gpm (1000 L/min) or greater at 150 psi (10 bar) net pump pressure that is mounted on an fire apparatus and used for firefighting. (NFPA 1901)

piston intake valve (PIV) A large appliance that connects directly to the pump's intake and controls the amount of water that flows from a pressurized water source into the pump.

power steering system A system for reducing the steering effort on vehicles in which an external power source assists in turning the vehicle's wheels.

preventive maintenance program A program designed to ensure that apparatus are capable of functioning as required and are maintained in working order.

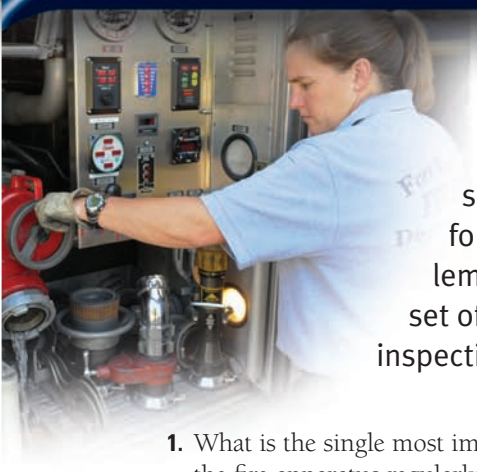
radiator cap The pressure cap that is screwed onto the top of the radiator, and through which coolant is typically added.

transfer valve An internal valve in a multistage pump that enables the user to change the mode of operation to either series/pressure or parallel/volume.

voltage meter A device that registers the voltage of a battery system.

volunteer fire department A fire department in which volunteer emergency service personnel account for 85 percent or more of its department membership. (NFPA 1720)

Driver/Operator *in Action*



While you are inspecting the reserve fire apparatus for any deficiencies, a fire fighter asks if he can assist you. His help would be very beneficial to you because several items on the fire apparatus are difficult—if not impossible—to inspect by yourself, such as the brake lights. In the past, you have found that it is very useful to have another set of eyes looking for any problems with the fire apparatus or the equipment on the fire apparatus. An extra set of eyes helps to ensure that nothing critical is missed and makes for a better inspection.

1. What is the single most important reason for inspecting the fire apparatus regularly?
   - **A.** Department policy
   - **B.** Locate new items
   - **C.** Maintenance of the fire apparatus
   - **D.** Safety
2. What is the NFPA's Standard for Automotive Fire Apparatus?
   - **A.** NFPA 1931
   - **B.** NFPA 1002
   - **C.** NFPA 1901
   - **D.** NFPA 1500
3. The inspection process should begin with a review of which document?
   - **A.** Fire apparatus inspection form
   - **B.** Fire apparatus owner's manual
   - **C.** Fire department's standard operating procedure
   - **D.** Fire apparatus identification form
4. How long should you wait before checking the engine's oil?
   - **A.** 5 minutes
   - **B.** 15 minutes
   - **C.** 45 minutes
   - **D.** More than 1 hour
5. Many fire departments have a policy that requires that their fire apparatus fuel tanks do not go below what level?
   - **A.** ¼ of a tank
   - **B.** ½ of a tank
   - **C.** ¾ of a tank
   - **D.** None of the answers are correct