NFPA 1915

Standard for Fire Apparatus Preventive Maintenance Program

2000 Edition

NFPA, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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NFPA 1915

Standard for

Fire Apparatus Preventive Maintenance Program

2000 Edition

This edition of NFPA 1915, *Standard for Fire Apparatus Preventive Maintenance Program,* was prepared by the Technical Committee on Fire Department Apparatus and acted on by the National Fire Protection Association, Inc., at its World Fire Safety Congress and Exposition™ held May 14–17, 2000, in Denver, CO. It was issued by the Standards Council on July 20, 2000, with an effective date of August 18, 2000.

This edition of NFPA 1915 was approved as an American National Standard on August 18, 2000.

Origin and Development of NFPA 1915

The National Transportation Safety Board (NTSB) report "Special Investigation Report—Emergency Fire Apparatus," adopted March 19, 1991, raised concerns about the quality and type of service and repair being done on fire apparatus. Subsequent inquiries from the Federal Department of Transportation (DOT) about the different types, uses, and weights of apparatus and how they are maintained prompted the International Association of Fire Chiefs (IAFC) Apparatus Maintenance Section to petition the NFPA to write a preventive maintenance standard for fire apparatus. NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, also requires fire departments to establish a preventive maintenance program for their apparatus and equipment.

This first edition of NFPA 1915, *Standard for Fire Apparatus Preventive Maintenance Program*, was developed to provide the minimum requirements for a preventive maintenance program for fire apparatus. Implementation of the requirements in the standard should improve the safety and reliability of fire apparatus and support the requirements in other NFPA standards dealing with emergency vehicle maintenance programs.

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Committee Scope: This Committee shall have primary responsibility for documents on the design and performance of fire apparatus for use by the fire service.

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Appendix A.

Information on referenced publications can be found in Chapter 11 and Appendix B.

Chapter 1 Administration

1.1 Scope. This standard defines the minimum requirements for establishing a preventive maintenance program for fire apparatus. These requirements shall apply to public or private organizations utilizing fire apparatus.

The standard identifies the systems and items to be inspected, frequency of servicing and maintenance, and requirements for testing. This standard is not intended to supersede any instructions, specifications, or practices defined or required by the fire apparatus manufacturer, component manufacturer, equipment manufacturer, or the authority having jurisdiction.

1.2 Purpose. The purpose of this maintenance program standard is to ensure that fire apparatus are serviced and maintained to keep them in safe operating condition and are ready for response at all times. It is not the intent of this standard to restrict any jurisdiction from exceeding the minimum requirements described in this document.

1.3 Definitions.

1.3.1 Adjust. To maintain or regulate, within prescribed limits, by setting the operating characteristics to specified parameters.

1.3.2 Alignment. To adjust components to bring about optimum or desired performance.

1.3.3* Authority Having Jurisdiction. The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.

1.3.4 Calibrate. To correlate the reading of an instrument or system of measurement with a standard.

1.3.5 Collector Rings. A means of transmitting electrical power to the aerial device turntable from the main power supply; usually, concentric rings made of brass that are contacted by brushes to make the transfer to the specific electrical functions.

1.3.6 Component. A constituent part of a mechanical or electrical device.

1.3.7 Defect. A discontinuity in a part or a failure to function that interferes with the service or reliability for which the part was intended.

1.3.8 Defective. Having a defect, or faulty.

1.3.9 Deformation. Abnormal wear, defects, cracks or fractures, warpage, and deviations from the original condition that would affect safe and correct operation.

1.3.10 Documentation. The process of gathering, classifying, and storing information.

1.3.11 Failure. A cessation of proper functioning or performance.

1.3.12 Fire Apparatus. A vehicle used for fire suppression or support by a fire department, fire brigade, or other agency responsible for fire protection.

1.3.12.1 Combination Fire Apparatus. A vehicle consisting of a pulling tractor and trailer.

1.3.12.2 Single Fire Apparatus. A vehicle on a single chassis frame.

1.3.13 Frame. The basic structural system that transfers the weight of the fire apparatus to the suspension system.

1.3.14 Inspect. To determine the condition or operation of a component(s) by comparing its physical, mechanical, and/or electrical characteristics with established standards, recommendations, and requirements through examination by sight, sound, or feel.

1.3.15 Interlock. A device or arrangement by means of which the functioning of one part is controlled by the functioning of another.

1.3.16 Ironing. Damage in the form of wear or indentations caused to the bottom of the aerial device base rail material by misalignment or malfunction of the rollers.

1.3.17 Leakage. The escape of a fluid from its intended containment, generally at a connection. The three classes of leakage are defined.

1.3.17.1 Leakage, Class 1. Seepage of fluid, as indicated by wetness or discoloration, not great enough to form drops.

1.3.17.2 Leakage, Class 2. Leakage of fluid great enough to form drops, but not enough to cause drops to fall from the item being inspected.

1.3.17.3 Leakage, Class 3. Leakage of fluid great enough to cause drops to fall from the item being inspected.

1.3.18 Maintenance. The act of servicing a fire apparatus or a component within the time frame prescribed by the authority having jurisdiction, based on manufacturer's recommendations, local experience, and operating conditions in order to keep the vehicle and its components in proper operating condition.

1.3.18.1 Preventive Maintenance. The act or work of keeping something in proper condition by performing necessary preventive actions, in a routine manner, to prevent failure or breakdown.

1.3.19 Manufacturer's Recommendation (Specification). Any requirement or suggestion a fire apparatus builder or component producer makes in regard to care and maintenance of its product(s).

1.3.20 Modification. An alteration or adjustment to any component that is a deviation from the original specifications or design of the fire apparatus.

1.3.21 Operator Alert Device. Any device, whether visual, audible, or both, installed in the driving compartment or at an operator's panel, to alert the operator to either a pending failure, an occurring failure, or a situation that requires his or her immediate attention.

1.3.22* Optical Source. Any single, independently mounted, light-emitting component in a lighting system.

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1.3.23* **Overhaul.** To inspect, identify deficiencies, and make necessary repairs to return a component to operational condition.

1.3.24 Power Train. The parts of a fire apparatus that transmit power from the engine to the wheels, including the transmission, split shaft power takeoff, midship pump transmission, drive shaft(s), clutch, differential(s), and axles.

1.3.25 Powered Equipment Rack. A power-operated device that is intended to provide storage of hard suction hoses, ground ladders, or other equipment, generally in a location above apparatus compartments.

1.3.26 Proper. As recommended by the manufacturer.

1.3.27 Qualified Person. A person who, by possession of a recognized degree, certificate, professional standing, or skill, and who, by knowledge, training, and experience, has demonstrated the ability to deal with problems relating to a particular subject matter, work, or project.

1.3.28 Repair. To restore to sound condition after failure or damage.

1.3.29 Replace. To remove an unserviceable item and install a serviceable counterpart in its place.

1.3.30 Severe Service. Those conditions that apply to the rigorous, harsh, and unique applications of fire apparatus, including but not limited to local operating and driving conditions, frequency of use, and manufacturer's severe service (duty) parameters.

1.3.31 Shall. Indicates a mandatory requirement.

1.3.32 Should. Indicates a recommendation or that which is advised but not required.

1.3.33 Steering Axle. Any axle designed such that the wheels have the ability to turn the vehicle.

1.3.34 Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards.

1.3.34.1 Operational Test. A test to determine the operational readiness of a component on a fire apparatus by observing the actual operation of the component.

Chapter 2 General Requirements

2.1 Inspections.

2.1.1* All inspections shall be conducted in accordance with the manufacturer's recommended procedures.

2.1.2 It shall be the responsibility of the authority having jurisdiction to develop and implement a schedule of service and maintenance for the fire apparatus, systems, and components described in this document, based on manufacturer's recommendations, local experience, and operating conditions. Inspections shall be performed at least as frequently as the manufacturer's recommended intervals and when the fire apparatus or any component is suspected or reported to have defects or deficiencies.

2.1.3* All defects or deficiencies found during an inspection shall be repaired or corrected by a qualified person.

2.1.4* It shall be the responsibility of the authority having jurisdiction to develop written criteria for when the apparatus is to be taken out of service. The presence of defects and deficiencies that reduce the operational safety and performance of the apparatus below the level established in the 49 *CFR*, part 390, "Federal Motor Carrier Safety Regulations"; applicable federal, state, and local regulations; applicable nationally recognized standards; manufacturers' recommendations; and guidelines established by the fire department or its designated service and maintenance organization shall be considered when developing the out-of-service criteria. The apparatus shall be returned to service only after defects and deficiencies have been corrected.

2.1.4.1* Driving and Crew Areas, Apparatus Body, and Compartmentation. The following defects and deficiencies of the driving and crew areas, the apparatus body, and the compartmentation reduce the operational safety and performance of the fire apparatus and shall be considered when developing the out-of-service criteria:

(1) Body mounting that is defective
(2) Cab mounting that is defective
(3) Seat belts that are torn or have melted webbing, missing or broken buckles, or loose mountings. Due to the extreme safety-related consequences of a defective seat belt, and the fact that one defective seat belt (unless it is the driver's seat belt) does not render a piece of apparatus unusable, the authority having jurisdiction shall take any seating position with a defective seat belt out of service
(4) Cracked or broken windshield that obstructs the driver's/operator's view
(5) Missing or broken rearview mirrors that obstruct the driver's/operator's view
(6) Windshield wipers that are missing or inoperable
(7) Steering wheel that has a deficiency
(8) Oil pressure gauge or engine or transmission temperature gauges that have failed
(9) Air gauge or audio low air warning device that has failed
(10) Door latches that are defective
(11) Defrosters that are defective
(12) Foot throttle that is defective

2.1.4.2* Chassis, Axles, Steering and Suspension Systems, Driveline, Wheels, and Tires. The following defects and deficiencies of the chassis, axles, steering and suspension systems, driveline, wheels, and tires reduce the operational safety and performance of the fire apparatus and shall be considered when developing the out-of-service criteria:

(1) Tires that have cuts in the sidewall that penetrate to the cord
(2) Tires that are defective
(3) Tires that have a tread depth of $^4/_{32}$ in. (3.2 mm) or less on any steering axle or $^2/_{32}$ in. (1.6 mm) or less on any non-steering axle at any two adjacent major tread grooves anywhere on the tire
(4) Suspension components that are defective
(5) Wheel fasteners that are missing or broken
(6) Wheels that are defective
(7) Axle flanges that have Class 3 leakage
(8) An axle that has any Class 3 leakage
(9) Steering components that are defective
(10) A steering component that has Class 3 leakage
(11) Driveline components that are defective

2.1.4.3* Engine Systems. The following defects and deficiencies of the engine systems reduce the operational safety and

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performance of the fire apparatus and shall be considered when developing the out-of-service criteria:

(1) Air filter restriction indicator that shows maximum restriction
(2) Engine that won't crank or start
(3) Engine system that has Class 3 leakage of oil
(4) Engine that is overheating
(5) Oil that contains coolant
(6) Oil that is diluted with fuel
(7) A fuel system component that has Class 2 leakage of fuel
(8) Fuel tank, mountings, or straps that are defective
(9) Stop-engine light that fails to turn off after engine is started

2.1.4.4 Engine Cooling System. The following defects and deficiencies of the engine cooling system reduce the operational safety and performance of the fire apparatus and shall be considered when developing the out-of-service criteria:

(1) Cooling system component that has Class 3 leakage
(2) Coolant that contains oil
(3) Radiator that is defective
(4) Water pump bearing that is defective
(5) Cooling fan that is defective
(6) Coolant system components that are defective

2.1.4.5 Transmission and Clutch. The following defects and deficiencies of the transmission and clutch reduce the operational safety and performance of the fire apparatus and shall be considered when developing the out-of-service criteria:

(1) Clutch components that are defective
(2) Transmission components that are defective
(3) Shift linkages that are defective
(4) Automatic transmission that overheats in any range
(5) Automatic transmission that has a "Do not shift" light on
(6) Transmission components that have Class 3 leakage of transmission oil

2.1.4.6* Low-Voltage and Line Voltage Electrical Systems. The following defects and deficiencies of the low voltage electrical system and the line voltage electrical system reduce the operational safety and performance of the fire apparatus and shall be considered when developing the out-of-service criteria:

(1) Federal Department of Transportation lighting that is defective
(2) Ignition system that is defective
(3) Charging system that is defective
(4) Grounding and bonding of the line voltage electrical system that is defective

2.1.4.7 Braking Systems.

2.1.4.7.1* Air Brake Systems. The following defects and deficiencies of the air brake system reduce the operational safety and performance of the fire apparatus and shall be considered when developing the out-of-service criteria:

(1) Service brakes that have an air pressure drop of more than 2 psi (13.8 kPa) in 1 minute for single fire apparatus or more than 3 psi (20.7 kPa) in 1 minute for combination fire apparatus, with the engine stopped and the service brakes released
(2) Leak-down rate (time) of the applied side of the air brake that is more than 3 psi (20.7 kPa) in 1 minute for single fire apparatus or more than 4 psi (27.6 kPa) in 1 minute for combination fire apparatus, with the engine stopped and the service brakes applied
(3) Brakes that are out of adjustment
(4) Braking system components that are defective
(5) Braking operation that is ineffective
(6) Parking brake operation that is ineffective
(7) Air compressor that fails to build air pressure
(8) Air compressor that fails to maintain 80–90 psi (552–621 kPa) pressure in the system with the service brakes applied and the engine at idle, or air compressor that fails to fill the air system to the air compressor governor cutout pressure with the service and parking brakes released
(9) Friction surfaces, brake shoes, or disc brake pads that have grease or oil on them
(10) Brake lining or pads that are worn beyond the brake system manufacturer's minimum specifications
(11) Rotors and drums that are worn beyond the brake system manufacturer's minimum specifications
(12) Antilock braking system (ABS) warning indicator that is activated

2.1.4.7.2* Hydraulic Brake Systems. The following defects and deficiencies of the hydraulic brake system reduce the operational safety and performance of the fire apparatus and shall be considered when developing the out-of-service criteria:

(1) Brake system components that have Class 2 leakage of brake fluid
(2) Friction surfaces, brake shoes, or disc brake pads that have grease or oil on them
(3) Braking system components that are defective
(4) Braking operation that is ineffective
(5) Parking brake operation that is ineffective
(6) Brake warning light that is activated or brake pedal that falls away or drifts toward the flooring when brake pressure is applied
(7) Brake lining or pads that are worn beyond the brake system manufacturer's minimum specifications
(8) Rotors and drums that are worn beyond the brake system manufacturer's minimum specifications
(9) ABS warning indicator that is activated

2.1.4.8* Fire Pump System. The following defects and deficiencies of the fire pump system reduce the operational safety and performance of the fire apparatus and shall be considered when developing the out-of-service criteria:

(1) Pump test results that fall below 90 percent of the original rating of the pump when tested in accordance with NFPA 1911, *Standard for Service Tests of Fire Pump Systems on Fire Apparatus*
(2) Pump that will not engage
(3) Water tank that will not hold water
(4) Pressure control system that is not operational
(5) Pump transmission components that have Class 3 leakage of fluid
(6) Pump transmission lubricant that is contaminated
(7) Pump panel throttle that is defective

2.1.4.9* Aerial Device Systems. The following defects and deficiencies of the aerial device and its systems reduce the operational safety and performance of the fire apparatus and shall be considered when developing the out-of-service criteria:

(1) Power takeoff (PTO) that will not engage
(2) Stabilizer system that is defective
(3) Aerial device that is defective
(4) Hydraulic system components that are defective
(5) Cable sheaves that are defective

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(6) Cables that are defective or frayed
(7) Base and section rails that show ironing beyond the manufacturer's recommendations
(8) Aerial device that is structurally deformed
(9) Torque box structure or fasteners that are defective
(10) Turntable fasteners that are defective or missing

2.2 Maintenance and Repairs. Maintenance and repairs shall be made in accordance with manufacturer's recommendations. Parts or components used to maintain or repair the fire apparatus shall meet or exceed the original manufacturer's specifications.

2.3 Qualification of Personnel.

2.3.1* Inspections, maintenance, and repairs on fire apparatus shall be performed by qualified personnel.

2.3.2 The authority having jurisdiction shall determine who is qualified to inspect and maintain fire apparatus and what levels of maintenance each person is qualified to perform.

2.4 Safety.

2.4.1* All federal, state, and local laws and regulations governing workplace safety shall be followed when performing maintenance on fire apparatus.

2.4.2 All federal, state, and local laws shall be followed in the use and disposal of chemicals and hazardous materials.

2.4.3 Remediation equipment and methods shall be used prior to and during preventive maintenance when dealing with possible contamination and exposure to hazardous materials, medical and biological waste, and other hazards. Personal protection, including eye protection, hearing protection, and suitable respirators for breathing protection, shall be used when the maintenance operations require such protection.

2.4.4 A system or method shall be utilized to remove exhaust emissions from an operating engine in a confined area.

2.4.5 Proper methods shall be utilized to lift, support, secure, and/or stabilize the fire apparatus undergoing maintenance.

2.4.6 Proper tools and equipment shall be selected for the task to be performed.

2.5* Documentation. Records shall be maintained on all inspections, maintenance requests, preventive maintenance, repairs, and testing results. Separate files shall be established and maintained for each individual fire apparatus.

Chapter 3 General Inspection and Maintenance

3.1* General. All components and systems commonly found on all fire apparatus shall be inspected and maintained in accordance with this chapter.

3.2 Frame and Suspension.

3.2.1 All frame rails and members shall be inspected for defects, structural integrity, perforations, and missing or loose parts.

3.2.2 All suspension components, including but not limited to the following components, shall be inspected for defects and functional operation and shall be lubricated:

(1) Springs and spring hangers
(2) Air springs (bags), mounting brackets, and attaching hardware
(3) Equalizer beams and torque arms
(4) Shock absorbers

3.2.3 The frame and suspension shall be inspected for proper alignment.

3.3 Axles, Tires, and Wheels.

3.3.1 All axle components, including but not limited to the following components, shall be inspected for security of mounting, structural integrity, deformation, abnormal wear, and leakage, shall be operationally tested, and shall be lubricated:

(1) Ball joints
(2) King pins
(3) Spindles and bushings
(4) Attaching hardware
(5) Axle beams and housings
(6) Axle shafts
(7) Axle power dividers
(8) Differentials and controls
(9) Two-speed axle shift units
(10) Upper and lower control arms

3.3.2 Wheel bearings and seals shall be cleaned, shall be inspected for deformation, wear, cracks, and leakage, and shall be lubricated.

3.3.3* Tires shall be inspected for damage and shall be inflated to the tire manufacturer's recommended pressure.

3.3.4 Tires shall be replaced when the tread wear exceeds state or federal standards. Tread wear shall be measured with a tread depth gauge. *[See 2.1.4.2(3).]*

3.3.5* Wheel-attaching nuts shall be torqued to the wheel manufacturer's recommendation.

3.3.6 Wheels and rims shall be inspected for cracks, deformation, structural integrity, and corrosion.

3.4 Engine.

3.4.1 The engine oil shall be inspected for contamination and maintained at the level specified by the engine manufacturer.

3.4.2 The engine shall be inspected for security of mounting and fluid leaks.

3.4.3 Engine oil and filters shall be serviced in accordance with the engine manufacturer's severe service recommendation. If no severe service recommendation exists, the shortest interval recommended by the engine manufacturer, based on time or mileage, shall be adhered to.

3.4.4 Emissions systems shall be inspected to determine that they are in working order and meet all federal, state, and local requirements.

3.4.5 The diagnostic codes for electronically controlled engines shall be inspected.

3.4.6* The engine performance shall be maintained in accordance with the engine manufacturer's recommendations.

3.4.7 Engine braking systems shall be maintained in accordance with the manufacturer's recommendations.

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3.5 Engine Cooling System.

3.5.1 The coolant shall be inspected for contamination and maintained at the level specified by the manufacturer.

3.5.2 The radiator assembly shall be inspected and cleaned of dirt, debris, and obstructions to airflow.

3.5.3 All hoses and fittings shall be inspected for condition and leakage.

3.5.4 The water pump(s) shall be inspected for condition and leakage.

3.5.5 The cooling system shall be pressure tested for leakage.

3.5.6 All belts shall be inspected for wear, deformation, and proper adjustment.

3.5.7 The chemical components of the coolant shall be tested and maintained at the proper balance.

3.5.8 Cooling system temperature indicators and gauges shall be operationally tested.

3.5.9 Temperature control devices, including but not limited to the following devices, shall be operationally tested:

(1) Thermostats
(2) Clutch fans
(3) Radiator shutters
(4) Electric cooling fans

3.5.10 Auxiliary heat exchangers installed in the engine cooling system shall be inspected for security of mounting, deformation, and leaks.

3.6* Engine Fuel System.

3.6.1 Fuel filters and fuel–water separators shall be maintained in accordance with the manufacturers' recommendations.

3.6.2 The fuel tank, lines, and all connections shall be inspected for security of mounting, deformation, and leakage.

3.6.3 The carburetor or the injection pump and injectors shall be maintained in accordance with the engine manufacturer's recommendations.

3.6.4 Gauges, indicators, and sending units shall be operationally tested.

3.6.5 Fuel level shall be maintained at the specified level.

3.6.6* All mechanical throttle linkage and stops shall be inspected for proper adjustment and operationally tested.

3.6.7 All electronic throttle components and throttle position sensors (TPS) shall be inspected for counts and operationally tested.

3.7 Engine Air Filtration System.

3.7.1 The air filtration system shall be maintained in accordance with the manufacturer's severe service recommendation. If no severe service recommendation exists, the shortest service interval recommended by the engine manufacturer, based on time or mileage, shall be adhered to. The air system shall include but not be limited to the following:

(1) Air cleaner element
(2) Piping
(3) Turbocharger
(4) After-cooler
(5) Intercooler
(6) Air-to-air cooler
(7) Blower

3.7.2 With engines so equipped, the charged air after-cooler shall be inspected visually for outward signs of damage or deformation.

3.7.3 All hoses, tubes, and fittings shall be inspected for deformation and leakage.

3.7.4 The airflow shall be tested for restriction greater than that recommended by the engine manufacturer.

3.8 Engine Exhaust System. The exhaust system shall be inspected for security of mounting, deformation, and exhaust leaks and shall be maintained in accordance with the engine manufacturer's recommendations. The exhaust system shall include but not be limited to the following:

(1) Exhaust manifold(s)
(2) Exhaust pipes
(3) Muffler(s)
(4) Tailpipe(s)
(5) Exhaust clamps, brackets, and mounting hardware
(6) Turbocharger
(7) Catalytic converter(s)
(8) Exhaust filtration system

3.9 Transmission.

3.9.1 The transmission shall be inspected for security of mounting, structural integrity, and leakage and shall be operationally tested.

3.9.2 The clutch and linkage, if the fire apparatus is so equipped, shall be inspected for condition and adjustment, shall be operationally tested, and shall be maintained in accordance with the manufacturer's recommendations.

3.9.3 Transmission lubricants and filters shall be inspected for contamination. Lubricants shall be maintained at the level specified by the manufacturer.

3.9.4 The lubricant and filters shall be serviced in accordance with the transmission manufacturer's severe service recommendation. If no severe service recommendation exists, the shortest interval recommended by the transmission manufacturer, based on time or mileage, shall be adhered to.

3.9.5 The transmission controls and shift linkage shall be inspected for condition and maintained in accordance with the manufacturer's recommendations.

3.9.6 All transmission indicators and gauges shall be tested for proper operation and accuracy.

3.9.7 The diagnostic codes for all electronically controlled transmissions shall be inspected.

3.9.8 PTOs (power takeoffs) shall be inspected for security of mounting and leakage and shall be operationally tested.

3.9.9 The lockup system for pumps and other accessories shall be inspected for leakage and shall be operationally tested.

3.9.10 Transmission braking systems shall be maintained in accordance with the manufacturer's recommendations.

3.9.11 Auxiliary heat exchangers installed in the transmission cooling system shall be inspected for security of mounting, deformation, and leaks.

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3.10 Drive Line.

3.10.1 All drive shafts, universal joints, carrier bearings, flanges, bearing cap bolts, and slip yokes shall be inspected for alignment, security of mounting, and wear and shall be lubricated.

3.10.2 Drive-line retarding systems shall be cleaned, shall be inspected for security of mounting, shall be operationally tested, and shall be lubricated.

3.11 Steering System.

3.11.1 All steering components shall be inspected for structural integrity, security of mounting, leakage, and condition, shall be operationally tested, and shall be lubricated. The steering components shall include but not be limited to the following:

(1) Power steering pump, filters, and reservoir
(2) Steering valve(s), cylinders, and hydraulic components
(3) Steering gear box(es)
(4) Steering gear mounting brackets
(5) Steering arms, drag links, pitman arms, tie rods, and tie rod ends
(6) Steering column assembly and steering wheel

3.11.2 The steering gear box(es) and power steering reservoir lubricant levels shall be maintained in accordance with the manufacturer's recommendations.

3.11.3 The steering valve(s), steering arms, drag links, pitman arms, tie rod ends, and steering column assembly shall be lubricated.

3.11.4 All belts, hoses, and lines shall be inspected for wear, adjustment, and deformation.

3.11.5 Electronic steering controls and indicators shall be maintained in accordance with the manufacturer's recommendations.

3.12 Braking System.

3.12.1* The braking system shall be inspected and maintained in accordance with the manufacturer's severe service recommendation. If no severe service recommendation exists, the shortest interval recommended by the braking system manufacturer, based on time or mileage, shall be adhered to.

3.12.2 The parking brake shall be inspected for structural integrity, security of mounting, missing or broken parts, and wear and shall be operationally tested.

3.12.3 The parking brake controls and activating mechanism shall be inspected for structural integrity, security of mounting, and missing or broken parts, shall be operationally tested, and shall be lubricated.

3.12.4 The brake linings shall be replaced when they are contaminated, when the lining is worn to the minimum thickness for safe operation as defined by the brake manufacturer, or when the brake drum or rotor is replaced. Linings shall be replaced in accordance with the brake manufacturer's severe service recommendation.

3.12.5 The drums or rotors shall be inspected during scheduled maintenance, when there is a suspected problem, or at the time of brake lining replacement. The inspection shall consist of, but not be limited to, the following:

(1) Evidence of extensive heat or heat cracking
(2) Out of round
(3) Wear beyond manufacturer's specifications
(4) Rust
(5) Taper
(6) Rotor parallelism
(7) Metal fatigue

3.12.6 Machining of brake drums or rotors shall be done only in accordance with manufacturer's recommendations.

3.12.7 All components of the braking system shall be inspected for damage and wear when performing a brake overhaul.

3.12.8 Antilock braking systems, including the electronic control unit, cables, switches, relays, sensors, and valves, shall be inspected for any deficiencies and shall be operationally tested.

3.12.9 If the fire apparatus has a hydraulic brake system, the components to be inspected and maintained shall include, but not be limited to, the following:

(1) Pedal and linkage
(2) Brake switches
(3) Master cylinder
(4) Brake booster
(5) Hydraulic lines
(6) Valves
(7) Wheel cylinders or calipers
(8) Brake shoes or pads
(9) Brake drums or rotors
(10) Warning devices
(11) Mounting hardware
(12) Fluid level and contamination

3.12.10 If the fire apparatus has an air brake system, the components to be inspected and maintained shall include but not be limited to the following:

(1) Air compressor
(2) Pedal assembly
(3) All valves
(4) Hoses and lines
(5) Brake switches
(6) Brake air chambers
(7) Slack adjusters
(8) Cams and wedges
(9) Brake shoes or pads
(10) Brake drums or rotor
(11) Calipers
(12) Air dryers
(13) Drain valves
(14) Air tanks
(15) Warning devices
(16) Mounting hardware

3.12.10.1 Air brake system pressure protection valves shall be operationally tested (to the shutoff point). If air accessories connected to the chassis air brake system drop the air pressure below 80 psi (552 kPa), the pressure protection valve shall disable the air accessories to ensure adequate air pressure for the braking system.

3.12.10.2 Air reservoir tanks, air dryers, and drains shall be inspected for security of mounting, deformation, and leakage and shall be maintained in accordance with the manufacturer's recommendations.

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3.12.10.3 All valves, lines, cylinders, and chambers shall be inspected for security of mounting, deformation, and leakage and shall be operationally tested.

3.12.10.4 The compressor and inlet filter system shall be inspected for security of mounting and shall be maintained in accordance with the manufacturer's recommendations.

3.12.10.5 All chassis air system belts shall be inspected for wear and deformation and shall be maintained at the manufacturer's recommended adjustment.

3.12.10.6 The cut-in and cut-out pressure settings of the air compressor governor shall be tested and maintained at the manufacturer's recommended settings.

3.12.10.7 The low-air warning systems shall be tested to ensure that activation occurs at the manufacturer's recommended setting.

3.12.10.8 Air pressure indicators shall be operationally tested.

3.12.10.9 Leak-down rate (time) of the applied side of the air-brake system shall be tested. An air pressure drop of more than 3 psi (20.7 kPa) in 1 minute for single fire apparatus or more than 4 psi (27.6 kPa) in 1 minute for combination fire apparatus, with the engine stopped and the service brakes applied, shall be considered unacceptable.

3.12.10.10 Leak-down rate (time) of the supply-side of the chassis air system shall be tested. An air pressure drop of more than 2 psi (13.8 kPa) in 1 minute for single fire apparatus or more than 3 psi (20.7 kPa) in 1 minute for combination fire apparatus, with the engine stopped and the service brakes released, shall be considered unacceptable.

3.13 Chassis Air-Powered Accessories. All chassis air-powered accessories, including but not limited to the following accessories, shall be operationally tested:

(1) Air horn
(2) Windshield wiper and washer
(3) Air-ride seats
(4) Air-powered steps
(5) Fire pump valves

3.14 Low-Voltage Electrical Circuits, Equipment, or Systems (12/24 V).

3.14.1 All components of the electrical system shall be maintained in a clean condition and free of corrosion.

3.14.2 All components of the starting system, including but not limited to the following components, shall be inspected for security of mounting and deformation and shall be operationally tested:

(1) Batteries, cabling, and connections
(2) Cranking motor
(3) Solenoid, relays, and switches
(4) Interlock systems

3.14.3 The battery(ies) shall be tested for storage and performance capabilities in accordance with the manufacturer's recommendations.

3.14.4 All components of the charging system, including but not limited to the following components, shall be inspected for security of mounting, deformation, and alignment, and shall be operationally tested:

(1) Alternator, regulator, and associated wiring and cables
(2) Rectifiers
(3) Isolators
(4) Alternator drive belts
(5) Solenoids, relays, switches, instrumentation, and lighting
(6) Interlock systems

3.14.5 The alternator shall be operationally tested for the output performance.

3.14.6 All components of the ignition system, including but not limited to the following components, shall be inspected for security of mounting and deformation and shall be operationally tested:

(1) Associated wiring and cables
(2) Solenoid, relays, switches, instrumentation, and lighting
(3) Primary and secondary systems
(4) Glow plugs

3.14.7 If so equipped, all components of the automatic electrical load management system, including but not limited to the following components, shall be inspected for security of mounting and deformation:

(1) Electronic hardware
(2) Associated wiring and cables
(3) Solenoid, relays, switches, instrumentation, and lighting
(4) Low-voltage warning devices

3.14.8* The electrical load management system shall be tested for activation and operation of low-voltage warning devices in accordance with the manufacturer's recommendations.

3.14.9 Miscellaneous electrical components, including but not limited to the following components, shall be inspected for security of mounting and deformation and shall be operationally tested:

(1) Battery conditioners and chargers
(2) Shoreline receptacles
(3) Radios and intercoms
(4) Converters and inverters
(5) Fast idle system
(6) Interlock system(s)
(7) Operator alert devices

3.14.10 All fire apparatus lighting, including but not limited to the following apparatus lighting, shall be inspected for security of mounting and deformation and shall be operationally tested:

(1) Headlights
(2) Marker lights
(3) Clearance lights
(4) Turn signals and hazard lights
(5) Brake lights
(6) Backup lights
(7) Dash lights

3.14.11 All work lighting, including but not limited to the following work lighting, shall be inspected for security of mounting and deformation and shall be operationally tested:

(1) Ground lights
(2) Step lights
(3) Flood, spot, and scene lights
(4) Cab interior lights
(5) Compartment lights

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3.14.12 All electrical accessories, including but not limited to the following accessories, shall be operationally tested:

(1) Heater and defroster
(2) Air-conditioning system
(3) Windshield wipers and washers
(4) Instrumentation
(5) Traffic preemption

3.14.13 All warning devices, including but not limited to the following warning devices, shall be inspected for security of mounting and deformation and shall be operationally tested:

(1) Emergency warning lights
(2) Electric and electronic sirens
(3) Automotive traffic horn
(4) Air horns
(5) Backup alarm

3.15 Crew and Passenger Compartments.

3.15.1 All glass, windows, and mirrors shall be inspected for condition and shall be operationally tested.

3.15.2 All seats shall be inspected for security of mounting and condition and shall be operationally tested.

3.15.3 All seat belts shall be inspected for security of mounting and condition and shall be operationally tested.

3.15.4 Doors, door hinges, latches, and door stops shall be inspected for security of mounting and condition, shall be operationally tested, and shall be lubricated.

3.15.5 All components of the cab mounting system, including but not limited to the following components, shall be inspected for security of mounting and deformation:

(1) Mounting brackets
(2) Cab base structure
(3) Resilient cushions
(4) Securing fasteners

3.15.6 All equipment mounting systems shall be inspected for security of mounting and deformation and shall be maintained free of corrosion. This inspection and maintenance shall include but not be limited to mounting systems for the following:

(1) Radios, computers, and siren controls
(2) Self-contained breathing apparatus (SCBA)
(3) Portable lights
(4) Hand tools
(5) Emergency medical service (EMS) equipment
(6) Books, street directories, and maps

3.15.7 Cab Tilting Systems. If the apparatus has a cab tilting system, it shall be inspected and maintained in accordance with 3.15.7.1 and 3.15.7.2.

3.15.7.1 All components of the cab tilting system, including but not limited to the following components, shall be inspected for security of mounting and leaks and shall be operationally tested:

(1) Switches and remote controls
(2) Interlocks
(3) Motors and pumps
(4) Reservoirs
(5) Hoses and fittings
(6) Cylinders and lifting devices
(7) Cab support devices
(8) Split cab seals
(9) Pivot points
(10) Latches and hold-down devices

3.15.7.2 Fluids shall be inspected for contamination and maintained to the levels recommended by the manufacturer.

3.16 Body and Compartmentation.

3.16.1 All compartments and storage areas shall be inspected for structural integrity, deformation, and leaks.

3.16.1.1 Hinges, latches, seals, and door positioning shall be operationally tested and shall be lubricated.

3.16.1.2 The hazard warning light and interlocks associated with but not limited to the following conditions shall be operationally tested:

(1) Any open passenger or equipment compartment door
(2) Any ladder or equipment rack not in the stowed position
(3) A deployed stabilizer system
(4) An extended powered light tower

3.16.2 All steps, platforms, handrails, and access ladders shall be inspected for security of mounting, structural integrity, and deformation.

3.16.2.1 All antislip, skid-resistant surfaces shall be inspected for security of mounting and condition.

3.16.2.2 All mechanical steps shall be operationally tested and shall be lubricated.

3.16.3 All equipment mounting racks and brackets shall be inspected for security of mounting and deformation, shall be operationally tested, and shall be lubricated.

3.16.4 All finishes, signs, labels, and reflective striping shall be inspected for defects, corrosion, and damage.

3.16.5 Powered Equipment Racks. If the apparatus is equipped with powered equipment racks, they shall be inspected and maintained in accordance with 3.16.5.1 through 3.16.5.4.

3.16.5.1 All locks used to hold the equipment rack in the road travel position and all interlocks to prevent operation of the equipment rack when the fire apparatus is in motion shall be inspected for security of mounting and deformation. The rack and interlocks shall be operationally tested.

3.16.5.2 All warning lights and visual signals for the equipment racks shall be operationally tested.

3.16.5.3 Reflective striping or reflective paint shall be inspected for defects, corrosion, and damage.

3.16.5.4 Equipment-holding devices shall be inspected for security of mounting and deformation, shall be operationally tested, and shall be lubricated.

3.17 Water and Agent Tanks. If the apparatus is equipped with a water or agent tank, the tank shall be inspected and maintained in accordance with 3.17.1 through 3.17.3.

3.17.1 All water and agent tanks shall be inspected for security of mounting, structural integrity, deformation, and leakage.

3.17.2 The tank sumps, if so equipped, shall be opened and cleaned.

3.17.3 When so equipped, anodes and other means to prevent electrolysis shall be inspected and maintained as recommended by the manufacturer.

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Chapter 4 Pumping Systems

4.1* General. Any fire pump, auxiliary pump, or transfer pump and its associated systems on a fire apparatus shall be inspected and maintained in accordance with this chapter.

4.2 Fire Pump, Auxiliary Pump, and Transfer Pump.

4.2.1 All fire pumps, auxiliary pumps, and transfer pumps shall be inspected for security of mounting, structural integrity, and leakage and shall be operationally tested.

4.2.2 All pump shaft seals shall be inspected and maintained in accordance with manufacturer's recommendations.

4.2.3 Renewable anodes, intake strainers, or any other means to prevent electrolysis shall be inspected for condition.

4.3 Pump Drive System.

4.3.1* The pump drive system shall be inspected for security of mounting and leakage, shall be operationally tested, and shall be lubricated.

4.3.2* All pump shift controls, indicators, and interlocks of the pump drive system shall be inspected for security of mounting and leakage, shall be operationally tested, and shall be lubricated.

4.3.3 All fluids in the pump drive system shall be inspected for contamination and maintained at the level and condition specified by the manufacturer.

4.4 Piping and Valves. All pump piping, valves and valve controls, fire hose connections, caps, chains, and gaskets shall be inspected for security of mounting, structural integrity, deformation, and leakage and shall be lubricated.

4.5 Instrumentation and Gauges.

4.5.1 All instrumentation, gauges, and lighting shall be inspected for security of mounting and condition and shall be operationally tested.

4.5.2 All instrumentation and gauges shall be tested for accuracy.

4.6 Pump Controls. All pump control systems shall be operationally tested. These systems shall include but not be limited to the following:

(1) Engine speed control and interlock
(2) Pressure control devices
(3) Transfer valve
(4) Transmission lockup system

4.7 Pump Priming System.

4.7.1 The pump priming system shall be inspected for security of mounting and leakage and shall be operationally tested.

4.7.2 The priming fluid shall be inspected for contamination and proper type and shall be maintained at the level recommended by the manufacturer.

4.8 Pump Drive Engine. If the pump has a separate drive engine, that engine shall be inspected and maintained in accordance with Sections 3.4 through 3.8 as applicable.

Chapter 5 Aerial Device Systems

5.1 General. Any aerial ladder, elevating platform, or water tower and its associated systems on a fire apparatus shall be inspected and maintained in accordance with this chapter.

5.2 Aerial Device.

5.2.1 All components of the aerial device shall be maintained in a clean condition and free of corrosion.

5.2.2 All components of an aerial device, including but not limited to the following components, shall be inspected for structural integrity, security of mounting, deformation, wear, and alignment and shall be lubricated:

(1) Ladder sections
(2) Booms
(3) Platforms
(4) Cradle

5.2.3 All components of lifting, rotating, and extension systems, including but not limited to the following components, shall be inspected for structural integrity, security of mounting, deformation, leaks, wear, and alignment, shall be operationally tested, and shall be lubricated:

(1) Lifting and extension hydraulic cylinders and attachment systems
(2) Extension cabling system and holding devices
(3) Guides, holder brackets, rollers, trunnions, and slide blocks
(4) Turntable and rotation bearing
(5) Winch-type extension system

5.3 Stabilization System. All components of the stabilization system, including but not limited to the following components, shall be inspected for structural integrity, security of mounting, deformation, leaks, wear, and alignment and shall be operationally tested:

(1) Torque box or subframe
(2) Turntable attachment system
(3) Stabilizer beams, shoes, and pads

5.4 Hydraulic System.

5.4.1 All components of the aerial hydraulic system, including but not limited to the following components, shall be inspected for structural integrity, security of mounting, deformation, leaks, wear, and alignment, shall be operationally tested, and, where required, shall be lubricated:

(1) PTO drive
(2) Hydraulic pump
(3) Hydraulic reservoir
(4) Filters and breathers
(5) Hoses and couplings
(6) Transfer valves
(7) Pressure relief valves
(8) Pressure and flow gauges
(9) Electrical controls
(10) Operator controls
(11) Hydraulic motors
(12) Hydraulic cylinders
(13) Auxiliary hydraulic power system

5.4.2 All components of a hydraulic drive unit, including but not limited to the following components, shall be inspected

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for security of mounting, deformation, and leaks and shall be operationally tested as recommended by the manufacturer:

(1) Hydraulic pump
(2) Hydraulic motor
(3) Hydraulic fluid reservoir
(4) Hydraulic fluid cooler
(5) Control systems
(6) Hoses, lines, and valves

5.4.3 All fluids in the hydraulic system(s) shall be inspected for contamination and proper type and shall be maintained at the level recommended by the manufacturer.

5.5 Warning Systems, Instruction Plates, and Signage.

5.5.1 All visual and audible warning systems shall be operationally tested.

5.5.2 All instruction plates and hazards and warning signage shall be inspected for condition.

5.6 Electrical Systems. All components of the electrical systems, including but not limited to the following systems, shall be inspected for security of mounting, deformation, and wear and shall be operationally tested:

(1) Lighting system
(2) Intercom system
(3) Auxiliary power systems
(4) Line voltage systems
(5) Interlock systems
(6) Collector rings

5.7 Waterway System. All components of the waterway system, including but not limited to the following components, shall be inspected for structural integrity, security of mounting, deformation, leaks, wear, and alignment, shall be operationally tested, shall be maintained as recommended by the manufacturer, and, where required, shall be lubricated:

(1) Attaching brackets
(2) Flowmeter
(3) Gauges
(4) Valves
(5) Pressure control devices
(6) Seals, rings, packing, and gaskets
(7) Monitor and remote controls

Chapter 6 Line Voltage Electrical Systems (120/240 V)

6.1 General. Any line voltage (120/240 V) electrical system on a fire apparatus shall be inspected and maintained in accordance with this chapter.

6.2 Line Voltage Generation Units.

6.2.1 All components of the line voltage generation unit shall be maintained in accordance with the recommendations of the manufacturer.

6.2.2 All line voltage generation units shall be inspected for security of mounting, condition, fluid leakage, and proper operation.

6.2.3 Inverters shall be inspected for security of mounting and condition and shall be operationally tested.

6.2.4 Remote controls for electric power generation units shall be inspected for condition and shall be operationally tested.

6.3 Wiring. All wiring and wire looms shall be inspected for security of mounting, proper routing, grommets in place, condition, and cleanliness.

6.4 Appliances and Controls. All line voltage appliances and controls, including but not limited to the following appliances and controls, shall be inspected for security of mounting and condition and shall be operationally tested:

(1) Cord reels
(2) Extension cords
(3) Scene lights
(4) Switches
(5) Relays
(6) Receptacles
(7) Inlet devices

6.5 Circuit Protection. Circuit breakers and ground fault circuit interrupters (GFCIs) shall be inspected for condition and operationally tested.

6.6 Instrumentation. Instrumentation, including voltmeter(s), ammeter(s), and frequency meter(s); warning and indicator lights; and associated interlock systems shall be inspected for condition and operationally tested.

6.7 Engine-Driven Generators.

6.7.1* All components of an air-cooled engine–driven line voltage generator shall be inspected for security of mounting, deformation, cleanliness, and leaks and shall be operationally tested as recommended by the manufacturer. In addition, the engine shall be inspected and maintained in accordance with the following portions of this document:

(1) Paragraphs 3.4.1 through 3.4.6
(2) Section 3.6
(3) Paragraphs 3.7.1 and 3.7.3
(4) Section 3.8

6.7.2 All components of a water-cooled engine–driven line voltage generator shall be inspected for security of mounting, deformation, cleanliness, and leaks and shall be operationally tested as recommended by the manufacturer. In addition, the engine shall be inspected and maintained in accordance with the following portions of this document:

(1) Paragraphs 3.4.1 through 3.4.6
(2) Section 3.5
(3) Section 3.6
(4) Paragraphs 3.7.1 and 3.7.3
(5) Section 3.8

6.8 Power Takeoff (PTO)–Driven Line Voltage Generators.

6.8.1 All components of PTO-driven line voltage generators, including but not limited to the following components, shall be inspected for security of mounting, deformation, and leaks and shall be operationally tested as recommended by the manufacturer:

(1) PTO
(2) Drive shafts
(3) Transfer case
(4) Gear box
(5) Generator

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6.8.2 All fluids in the PTO system(s) shall be inspected for contamination and shall be maintained at the level recommended by the manufacturer.

6.9 Hydraulic-Driven Line Voltage Generators.

6.9.1 All components of hydraulic-driven line voltage generators, including but not limited to the following components, shall be inspected for security of mounting, deformation, and leaks and shall be operationally tested as recommended by the manufacturer:

(1) Hydraulic pump
(2) Hydraulic motor
(3) Hydraulic fluid reservoir
(4) Hydraulic fluid cooler
(5) Control systems
(6) Hoses, lines, and valves

6.9.2 All fluids in the hydraulic system(s) shall be inspected for contamination and proper type and shall be maintained at the level recommended by the manufacturer.

Chapter 7 Foam Proportioning Systems

7.1* General. Any foam proportioning system on fire apparatus shall be inspected and maintained in accordance with this chapter.

7.2 System Components.

7.2.1 All components of the foam proportioning system shall be maintained in accordance with the recommendations of the manufacturer.

7.2.2 All components of the foam proportioning system shall be inspected for security of mounting, structural integrity, and leakage and shall be operationally tested.

7.3 Cleaning.

7.3.1* The foam proportioning system shall be thoroughly flushed, cleaned, and inspected after each use to ensure that all foam concentrate is clear of all piping and components in the foam proportioning system.

Exception: Components that are designed to stay in continuous contact with foam concentrate shall not need to be flushed or cleaned.

7.3.2 Special attention shall be paid to check valves and ball valves during any flushing and cleaning process, as they can be susceptible to the corrosive effects of some foam concentrates.

7.4 Instrumentation and Controls. All instrumentation, gauges, and controls shall be inspected for security of mounting and condition and shall be operationally tested.

7.5 Strainer or Filter. Where foam concentrate strainer(s) or filter(s) are utilized, the strainer/filter assembly shall be serviced at routine scheduled intervals.

7.6 Foam Concentrate Pump.

7.6.1 Where the foam proportioning system is equipped with a foam concentrate pump, it shall be maintained as recommended by the manufacturer.

7.6.2 The oil for the pump lubrication system shall be inspected for possible water/foam contamination and shall be maintained at the level recommended by the manufacturer.

7.7 Testing. If there is a desire to test the accuracy of the foam proportioning system, the procedures outlined by the manufacturer shall be followed. If the manufacturer has not provided procedures for testing the accuracy of the foam proportioning system, the procedures in NFPA 1901, *Standard for Automotive Fire Apparatus*, shall be followed.

Chapter 8 Compressed Air Foam Systems (CAFS)

8.1 General. Any compressed air foam system on a fire apparatus shall be inspected and maintained in accordance with this chapter.

8.2 System Components.

8.2.1 All components of the compressed air foam system shall be maintained in accordance with the recommendations of the manufacturer.

8.2.2 All components of the compressed air foam systems shall be inspected for security of mounting, structural integrity, and leakage and shall be operationally tested.

8.2.3 The foam proportioning system shall be maintained, serviced, and flushed as required by Chapter 7.

8.3 System Testing.

8.3.1 The accuracy of the water and air pressure gauges shall be tested as part of an annual test of the fire pump.

8.3.2* The system shall be tested to ensure that the water pressure and the air pressure automatically balance within ±5 percent up to the rated pressure of the air compressor.

8.4 Compressed Air Source.

8.4.1 The components of the compressed air source, including but not limited to the following components, shall be inspected for security of mounting, deformation, cleanliness, and leaks and shall be operationally tested as recommended by the manufacturer:

(1) All filters
(2) Piping, clamps, tubing, and hose
(3) Moisture drains
(4) Air pressure relief valves
(5) Brackets on the air intake system

8.4.2* All components of an air-cooled engine–driven air compressor shall be inspected for security of mounting, deformation, cleanliness, and leaks and shall be operationally tested as recommended by the manufacturer. In addition, the engine shall be inspected and maintained in accordance with the following portions of this document:

(1) Paragraphs 3.4.1 through 3.4.6
(2) Section 3.6
(3) Paragraphs 3.7.1 and 3.7.3
(4) Section 3.8

8.4.3 All components of a water-cooled engine–driven air compressor shall be inspected for security of mounting, deformation, cleanliness, and leaks and shall be operationally tested as recommended by the manufacturer. In addition, the engine shall be inspected and maintained in accordance with the following portions of this document:

(1) Paragraphs 3.4.1 through 3.4.6
(2) Section 3.5

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(3) Section 3.6
(4) Paragraphs 3.7.1 and 3.7.3
(5) Section 3.8

8.4.4 Power Takeoff (PTO)–Driven Air Compressor.

8.4.4.1 All components of a PTO-driven air compressor, including but not limited to the following components, shall be inspected for security of mounting, deformation, and leaks and shall be operationally tested as recommended by the manufacturer:

(1) PTO
(2) Drive shafts
(3) Transfer case
(4) Gear box
(5) Air compressor

8.4.4.2 All fluids in the PTO system(s) shall be inspected for contamination and shall be maintained at the level recommended by the manufacturer.

8.4.5 Hydraulic-Driven Air Compressor.

8.4.5.1 All components of a hydraulic-driven air compressor, including but not limited to the following components, shall be inspected for security of mounting, deformation, and leaks and shall be operationally tested as recommended by the manufacturer:

(1) Hydraulic pump
(2) Hydraulic motor
(3) Hydraulic fluid reservoir
(4) Hydraulic fluid cooler
(5) Control systems
(6) Hoses, lines, and valves

8.4.5.2 All fluids in the hydraulic system(s) shall be inspected for contamination and proper type and shall be maintained at the level recommended by the manufacturer.

Chapter 9 Air Systems

9.1 General. Any air system on a fire apparatus, whether for breathing or utility air, shall be inspected and maintained in accordance with this chapter.

9.2 System Components.

9.2.1 All components of the air system shall be maintained in accordance with the recommendations of the manufacturer.

9.2.2 All thermal insulating material around air system components shall be inspected for security of mounting and condition.

9.2.3 If the air system has drive belts, they shall be inspected for proper adjustment.

9.2.4 Automatic shutdown systems shall be tested in accordance with the recommendations of the manufacturer.

9.3 Labels. All warning, function, and instruction labels shall be inspected for condition and legibility.

9.4 Piping, Hoses, Valves, and Instrumentation.

9.4.1 All rigid piping shall be inspected for security of mounting and deformation.

9.4.2 All flexible hose shall be inspected for cuts, abrasions, or damage.

9.4.3 All valves, quick couplers, and hose reels shall be inspected for security of mounting, proper operation, and leakage.

9.4.4 All gauges, instruments, and regulators shall be inspected for security of mounting, condition, and accuracy.

9.5 Air Compressors.

9.5.1 Compressors and boosters shall be inspected for security of mounting and proper operation.

9.5.2 Air intake filters and screens shall be inspected for security of mounting and airflow obstruction or restriction.

9.5.3 The compressor cooling system shall be inspected for cleanliness and operationally tested.

9.6 Purification System.

9.6.1 The purification system shall be inspected for security of mounting and deformation and tested for leakage and proper operation.

9.6.2 Filter elements and purifier cartridges shall be replaced when specified by the manufacturer.

9.7 Air Storage Tanks.

9.7.1 Air storage tanks shall be inspected for security of mounting and deformation and shall be tested for leakage.

9.7.2 Air storage tanks shall be inspected to verify that hydrostatic test dates are within the periods specified by the manufacturers and the applicable governmental agencies.

9.8 Refill Stations. Fragmentation tubes, guards, or any other safety devices associated with SCBA filling stations shall be inspected for security of mounting, deformation, and condition.

9.9 Air Compressor Drive Engines.

9.9.1* Air-Cooled Engines. All components of an air-cooled engine–driven air compressor shall be inspected for security of mounting, deformation, cleanliness, and leaks and shall be operationally tested as recommended by the manufacturer. In addition, the engine shall be inspected and maintained in accordance with the following portions of this document:

(1) Paragraphs 3.4.1 through 3.4.6
(2) Section 3.6
(3) Paragraphs 3.7.1 and 3.7.3
(4) Section 3.8

9.9.2 Water-Cooled Engines. All components of a water-cooled engine–driven air compressor shall be inspected for security of mounting, deformation, cleanliness, and leaks and shall be operationally tested as recommended by the manufacturer. In addition, the engine shall be inspected and maintained in accordance with the following portions of this document:

(1) Paragraphs 3.4.1 through 3.4.6
(2) Section 3.5
(3) Section 3.6
(4) Paragraphs 3.7.1 and 3.7.3
(5) Section 3.8

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9.9.3 Power Takeoff (PTO)–Driven Air Compressor.

9.9.3.1 All components of a PTO-driven air compressor, including but not limited to the following components, shall be inspected for security of mounting, deformation, and leaks and shall be operationally tested as recommended by the manufacturer:

(1) PTO
(2) Drive shafts
(3) Transfer case
(4) Gear box
(5) Air compressor

9.9.3.2 All fluids in the PTO system(s) shall be inspected for contamination and shall be maintained at the level recommended by the manufacturer.

9.9.4 Hydraulic-Driven Air Compressor.

9.9.4.1 All components of a hydraulic-driven air compressor, including but not limited to the following components, shall be inspected for security of mounting, deformation, and leaks and shall be operationally tested as recommended by the manufacturer:

(1) Hydraulic pump
(2) Hydraulic motor
(3) Hydraulic fluid reservoir
(4) Hydraulic fluid cooler
(5) Control systems
(6) Hoses, lines, and valves

9.9.4.2 All fluids in the hydraulic system(s) shall be inspected for contamination and proper type and shall be maintained at the level recommended by the manufacturer.

Chapter 10 System Testing

10.1 Fire Pumps. If the fire apparatus is equipped with a fire pump, the pump shall be service-tested in accordance with NFPA 1911, *Standard for Service Tests of Fire Pump Systems on Fire Apparatus*, at least annually and whenever major repairs or modifications to the pump or to any component of the apparatus that is used in pump operations have been made.

10.2 Aerial Devices. If the apparatus is equipped with an aerial device, the inspections and tests defined in 10.2.1 and 10.2.2 shall be conducted.

10.2.1 The visual inspections, operational tests, and load tests defined in NFPA 1914, *Standard for Testing Fire Department Aerial Devices*, shall be conducted at the following times:

(1) At least annually
(2) After major repairs or overhaul
(3) Following the use of the aerial device when the aerial device could have been subjected to unusual operating conditions of stress or load
(4) When there is reason to believe that usage has exceeded the manufacturer's recommended aerial device operating procedures

10.2.2 The complete inspections and tests including the nondestructive testing (NDT) defined in NFPA 1914, *Standard for Testing Fire Department Aerial Devices*, shall be conducted at least every 5 years. NDT shall be conducted whenever visual inspection or load testing indicates a potential problem or when there is a desire to further confirm continued operational safety.

10.3 Braking System.

10.3.1 Testing of the braking system, including antilock brake systems and auxiliary brake systems, shall be conducted at a prescribed interval, not to exceed the manufacturer's recommendations, at least annually, or whenever adjustments, repairs, or modifications have been performed on any component that can affect the proper operation of the braking system or systems. All testing shall be conducted at a location and in a manner that does not violate local, state, or federal traffic laws.

10.3.2* The braking system test procedure shall be as follows:

(1) Lay out a course that is 12 ft (3.7 m) wide with a start and stop line, with the stop line showing the stopping distance for the type of vehicle *(see Table 10.3.2)*.
(2) Approach the start line with the vehicle being tested centered in the course and at a speed of 20 mph (32 kmph).
(3) Apply the service brake firmly as the vehicle's front bumper crosses the start line.
(4) Observe whether the vehicle comes to a smooth stop within prescribed distance without pulling to the right or left beyond limits.

The vehicle stopping distance shall be not greater than that given in Table 10.3.2, and the vehicle shall not pull to the left or right across the sides of the course boundaries.

Table 10.3.2 Stopping Distances

GVWR*	Stopping Distance ft	Stopping Distance m
10,000 lb (4540 kg) or less	25	7.5
Single-unit vehicles over 10,000 lb (4540 kg), except truck tractor	35	10.5
Combination vehicles and truck tractors over 10,000 lb (4540 kg)	40	12.0

*GVWR = Gross Vehicle Weight Rating

10.4* Parking Brake System. The parking brake system shall hold a fully loaded fire apparatus on a grade of 20 percent or the steepest grade in the fire department's jurisdiction if a grade of 20 percent is not available. The parking brake shall be tested with the apparatus stopped while facing uphill and again facing downhill on a grade. The parking brake system shall be tested annually.

10.5* Roadability. A road test shall be conducted at least annually, after each scheduled maintenance interval, and after repair, adjustment, or modification of the engine, transmission, drive train, suspension, brakes, or steering. The roadability of the fire apparatus and the operation of the power train shall be inspected to determine if any defects exist.

10.6 Breathing Air Quality. If the fire apparatus is equipped with a breathing air system, the quality of breathing air shall be tested for compliance with the requirements for breathing air as specified in NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*.

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Chapter 11 Referenced Publications

11.1 The following documents or portions thereof are referenced within this standard as mandatory requirements and shall be considered part of the requirements of this standard. The edition indicated for each referenced mandatory document is the current edition as of the date of the NFPA issuance of this standard. Some of these mandatory documents might also be referenced in this standard for specific informational purposes and, therefore, are also listed in Appendix B.

11.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, 1997 edition.

NFPA 1901, *Standard for Automotive Fire Apparatus*, 1999 edition.

NFPA 1911, *Standard for Service Tests of Fire Pump Systems on Fire Apparatus*, 1997 edition.

NFPA 1914, *Standard for Testing Fire Department Aerial Devices*, 1997 edition.

11.1.2 U.S. Government Publication. U.S. Government Printing Office, Washington, DC 20402.

Title 49, *Code of Federal Regulations*, Part 390, Transportation, "Federal Motor Carrier Safety Regulations."

Appendix A Explanatory Material

Appendix A is not a part of the requirements of this NFPA document but is included for informational purposes only. This appendix contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.3.3 Authority Having Jurisdiction. The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.1.3.22 Optical Source. An optical source can consist of a single optical element or a fixed array of any number of optical elements where geometric positioning relative to each other is fixed by the manufacturer of the optical source and cannot be easily modified.

A.1.3.23 Overhaul. Overhaul does not normally return an item to like-new condition.

A.2.1.1 If the fire apparatus manufacturer is no longer in business, or the servicing and maintenance criteria or recommendations are no longer available from the manufacturer, the fire department should establish the criteria that are necessary to inspect and maintain that piece of fire apparatus. These criteria can be established by discussing inspection and maintenance procedures for similar types or styles of fire apparatus or components with persons experienced with such maintenance and by reviewing the industry standards that were in effect at the time the fire apparatus or component was built. The criteria should be developed in writing.

The *Vehicle Inspection Handbook, Passenger Cars & Light Trucks*, and the *Vehicle Inspection Handbook, Truck/Bus/School Bus*, prepared by the American Automobile Manufacturers Association in cooperation with the American Association of Motor Vehicle Administrators, provide a valuable resource in developing an inspection program.

A.2.1.3 During an inspection, the technician should conduct an operational check of the entire apparatus to detect abnormal vibrations that could indicate a component defect or possible failure.

A.2.1.4 Some deficiencies or problems might or might not make the apparatus unsafe but will render it unusable for some operations. The authority having jurisdiction should provide a list of conditions under which the apparatus can continue to be used pending repair of the deficiency.

A.2.1.4.1 The following deficiencies or problems might or might not make the apparatus unsafe but will render it unusable for some operations. The authority having jurisdiction should provide a list of conditions under which the apparatus can continue to be used pending repair of the deficiency:

(1) Compartment doors won't stay closed.
(2) Running boards are not secure.
(3) Tailboard is not secure.
(4) Accessory step (folding step) is broken or missing.

Although this standard identifies that cracked or broken windshields and mirrors should be consideration for taking the apparatus out of service, consideration should also be given to state or local regulations. The authority having jurisdiction should identify the state and local regulations that pertain and follow them to ensure the vehicle is safe to operate.

A.2.1.4.2. Tire defects include but are not limited to the following: punctures, cuts to the cord, bulges other than bumps or repairs, repair bulges greater than $^3/_8$ in. (10 mm), bulges or knots associated with tread, or sidewall separation.

Tread depth should be checked with a tread depth gauge. When inserted into the tire tread, the amount of tread left will be indicated in thirty-seconds of an inch.

A.2.1.4.3 See A.3.4.6 and A.3.6.

Loss of power can be the result of numerous items related to the engine, fuel system, and air intake system. Loss of power can be associated with loud or unusual noises. Loud or unusual noises can be the result of worn, damaged, or defective internal engine components such as main and connecting rod bearings, connecting rods, piston pins, broken or damaged pistons, defective valve train, and fuel system. Loss of power can be the result of something as simple as clogged fuel or air filters. Inspection of the air intake restriction gauge will allow determination of the condition of the air intake system. Many vehicles, especially those with water fuel separators, have both audible and visual indicators to show failure of fuel system filters or the presence of excessive water. Another indicator of factors resulting in loss of power is engine exhaust smoke. As a rule, white smoke indicates a cooling system leak into the combustion area; blue smoke indicates excessive oil consumption, normally engine oil but in some applications

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transmission fluid; and black smoke indicates excessive unburned fuel. In any case, any one of the aforementioned items can deter from proper and safe operation of the vehicle and should therefore be remedied as soon as possible.

A.2.1.4.6 Burned-out lamps and other deficiencies should be corrected immediately. While all systems have a degree of redundancy, they are not designed to operate with multiple deficiencies. When more than one optical source in the warning light system is inoperative or the audible warning system is inoperative and the apparatus must be used, it should be driven as a non-emergency vehicle.

A.2.1.4.7.1 Item 2.1.4.7.1(1) refers to the leak-down rate of the supply side of the air system. Item 2.1.4.7.1(2) refers to the leak-down rate of the applied side of the air system. Item 2.1.4.7.1(8) refers to the air compressor's ability to supply ample air for correct and safe operation of the vehicle.

Although this standard identifies out-of-service criteria for air brake systems, consideration should also be given to state or local regulations. The authority having jurisdiction should identify the state and local regulations that pertain and follow them to ensure the vehicle is safe to operate.

Lining thickness of less than $^{3}/_{16}$ in. (4.8 mm) for a brake shoe with a continuous strip of lining, $^{1}/_{4}$ in. (6.4 mm) to the wear indicator for a shoe with two pads for drum brakes, or disc pads with less than $^{1}/_{8}$ in. (3.2 mm) of lining should be considered worn out and should be replaced.

A.2.1.4.7.2 Although this standard identifies out-of-service criteria for hydraulic brake systems, consideration should also be given to state or local regulations. The authority having jurisdiction should identify the state and local regulations that pertain and follow them to ensure the vehicle is safe to operate.

Lining thickness of less than $^{1}/_{16}$ in. (1.6 mm) for a brake shoe or disk should be considered worn out and should be replaced.

A.2.1.4.8 The following deficiencies or problems might or might not make the apparatus unsafe but will render it unusable for some operations. The authority having jurisdiction should provide a list of conditions under which the apparatus can continue to be used pending repair of the deficiency:

(1) Discharge valves that are stuck closed and will not open
(2) Valve linkage that is missing or broken
(3) Pump shaft seals that leak beyond the manufacturer's specifications
(4) Pump piping that is leaking, which affects the performance of the pump operations
(5) Pressure indicating devices that are defective
(6) Valves that are leaking
(7) Pump panel throttle that is found not operational
(8) Water tank lid that leaks
(9) Water level indicator that is defective
(10) Structural components that are defective
(11) Restraining system that is defective

A.2.1.4.9 The following deficiencies or problems might or might not make the apparatus unsafe but will render it unusable for some operations. The authority having jurisdiction should provide a list of conditions under which the apparatus can continue to be used pending repair of the deficiency:

(1) Hydraulic relief valve that is defective
(2) Hydraulic system components that are defective
(3) Emergency hydraulic system that is defective
(4) Visual and audible alarm systems that are defective
(5) Aerial lighting system that is defective
(6) Aerial intercom system that is defective
(7) Rollers and slides that are worn beyond manufacturer's recommendations
(8) Rotation bearing that has clearances beyond the manufacturer's recommendations
(9) Labels or warning signs that are defective
(10) Aerial water delivery system that is defective

A.2.3.1 Any person performing inspections or maintenance should meet the qualifications of NFPA 1002, *Standard for Fire Apparatus Driver/Operator Professional Qualifications*. Additional qualifications can be identified by schooling, training, experience, and recognized certification programs such as those administered by Automotive Service Excellence (ASE), Emergency Vehicle Technician Certification Commission, Inc. (EVT), or other equivalent certifying agencies.

A.2.4.1 One area where there are regulations in the United States is in the area of tire and wheel service, which is covered under the Occupational Safety and Health Administration (OSHA) regulations defined in 29 *CFR* 1910.177.

A.2.5 Although this standard identifies the need for record retention, consideration should be given to state and local rules and regulations. The authority having jurisdiction should identify the state and local regulations that pertain to record retention and follow them as a minimum. It is strongly recommended that all records be kept for the life of the vehicle.

A.3.1 It is suggested that the authority having jurisdiction develop a specific table of inspection and maintenance frequencies and designate who is responsible for each inspection or maintenance procedure. Table A.3.1 is a sample table for the axle, tire, and wheel components. An "O" designates the operator as responsible for the procedure, and a "T" designates a technician as responsible.

A.3.3.3 It is important that tire inflation be maintained to ±5 psi of the fire apparatus manufacturer's recommended tire pressure, which is based on the weight of the completed apparatus, and not to the maximum pressure shown on the sidewall of the tire.

A.3.3.5 Wheel-attaching hardware should be torqued at the time of wheel installation to the manufacturer's recommendation. The wheel- or rim-attaching hardware should then be retorqued 50 to 100 miles after installation and periodically thereafter. Wheel covers or nut covers might have to be removed for proper inspection.

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Table A.3.1 Sample Table for Axle, Tire, and Wheel Components

Weekly/ Post Run	Semiannual	Annual	Inspection or Maintenance Procedure
		T	Inspect, clean, and lubricate wheel bearings and seals.
		T	Inspect chassis for correct alignment.
O	T	T	Inspect tires for damage and wear, and correct inflation.
		T	Inspect wheel-attaching hardware for correct torque.
O	T	T	Inspect wheels and rims for corrosion, damage, and integrity.
O	T	T	Inspect axles for security of mounting, structural integrity, deformation, abnormal wear, and leakage.
		T	Service drive axles and lubricate the other axle(s).
	T	T	Inspect all kingpins, upper and lower control arms, and spindles for abnormal and excessive wear.
	T	T	Lubricate all kingpins, upper and lower control arms, and spindles.
O	T	T	Inspect power dividers for security of mounting, damage, leaks, and correct operation.
		T	Service power dividers.
O	T	T	Inspect two-speed axle shift units for security of mounting, damage, leaks, and correct operation.
		T	Service two-speed axle shift units.

A.3.4.6 To ensure efficient engine performance and extended valve and injector service life, a scheduled valve lash and injector height measurement and adjustment schedule should be maintained. Certain engines might also require nozzle and pump calibration, timing, replacement of spark plugs, ignition system tests, or other adjustments.

It is imperative that all engine components and accessories that can affect engine performance be inspected, adjusted, and maintained. Visual inspections along with air restrictions tests performed on a regular scheduled basis will ensure proper operating components. Examples of engine performance concerns are abnormal black, blue, or white exhaust smoke or abnormal engine noises.

There might be other pertinent tests required for the engine to perform at maximum efficiency on an emergency scene. All recommended tests and adjustments should be performed to ensure proper operation.

Failure to perform factory-recommended engine adjustments or inspections at the required initial period and at regular intervals thereafter and to make necessary adjustments or part replacements (i.e., spark plugs on gas engines) might result in gradual degradation of engine performance and reduced fuel combustion efficiency.

A.3.6 Fuel systems are essential components of the engine. To ensure that the engine is capable of obtaining proper performance and operation, the fuel system should be inspected and tested to the manufacturer's specifications. Quality fuel must be utilized. The fuel filters (primary and secondary if equipped) should be replaced or serviced on a regular basis, normally recommended at six-month intervals or at every oil change. Fuel pressure should be tested utilizing factory-recommended procedures. Fuel spill-back (return) should also be included in fuel system checks. Some manufacturers recommend a fuel suction test be performed to test the suction capabilities of the fuel pump and suction side of the fuel system.

A.3.6.6 All linkage should be inspected for freedom of movement, adjustment, full throttle position, idle position, and smooth operation.

A.3.12.1 Severe duty (conditions) scheduling applies to brake system maintenance due to the normal hard braking encountered with fire apparatus.

A brake maintenance schedule for each fire apparatus should be set after the brakes have been inspected several times. This schedule should include both minor inspections and major inspections as follows.

(a) For minor inspections, the brakes, brake linings or pads, and slack adjusters should be inspected for freedom of movement, security of mounting, and deformation and should be tested for proper operation. The slack adjuster should be lubricated according to a schedule that gives the most frequent inspection and lubrication based on one of the following:

(1) The schedule for chassis lubrication used by your fire department
(2) The schedule for chassis lubrication recommended by the manufacturer of the chassis
(3) At least four times during the life of the linings

(b) Major inspections should be performed whenever the brakes are relined, or at least once a year, whichever comes first. Major inspections should include the following:

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(1) All the procedures, inspections, and measurements recommended by the manufacturer for relining the brakes
(2) Lubrication of the slack adjuster and caliper (if equipped)
(3) Adjustment of the brakes as described in the manufacturer's literature

A.3.14.8 Starting with the 1996 edition of NFPA 1901, *Standard for Automotive Fire Apparatus*, the low-voltage alarm is required to sound if the system voltage at the battery or at the master load disconnect switch drops below 11.8 V for a 12-V nominal system or 23.6 V for a 24-V nominal system for more than 120 seconds (2 minutes). This alarm can be tested easily by loading the electrical system, at idle, and waiting for the alarm to sound. In many cases, once the alarm has sounded, the fire apparatus's engine will proceed to fast idle to recuperate the voltage loss.

A.4.1 Fire pumps are required to be service tested at least annually and after certain repairs. The purpose of the operational tests defined in this chapter is not to duplicate the tests required in the annual service test but to ensure the component is functionally working.

A.4.3.1 Components of the pump drive system could include but are not be limited to the following:

(1) Split shaft PTO
(2) Pump transmission
(3) Pump transfer case
(4) Power takeoff
(5) Pump clutch
(6) Pump drive shafts
(7) Hydraulic drive systems
(8) Auxiliary drive engine

A.4.3.2 Some pumps have manual backup shift controls. Those controls need to be inspected, operationally tested, and lubricated as part of a preventive maintenance program.

A.6.7.1 Special attention should be paid to the cleanliness and security of engine covers, cooling fins, and fans on air-cooled engines, as they are critical to the proper operation of the engine.

A.7.1 It is important for the operator, maintenance personnel, and fire apparatus technician to understand the types and properties of mechanical foam and its application to maintain a foam proportioning system. Specific information regarding foam concentrates, their corrosive concerns, biodegradability, and their application is available in NFPA 11, *Standard for Low-Expansion Foam*. Information on foam concentrates for Class A fires is available in NFPA 1150, *Standard on Fire-Fighting Foam Chemicals for Class A Fuels in Rural, Suburban, and Vegetated Areas*. A thorough knowledge of foam and foam systems will enhance the ability to maintain systems in peak operating conditions at all times.

There are many designs for foam proportioning systems. These systems include but are not limited to the following:

(1) Eductor systems
(2) Self-educting master stream nozzles
(3) Intake-side foam proportioning systems
(4) Around-the-pump foam proportioning systems
(5) Balanced pressure foam proportioning systems
(6) Direct injection foam proportioning systems

NFPA 1901, *Standard for Automotive Fire Apparatus*, describes these systems and variations thereof in Appendix A. A review of that material will assist with the understanding of foam proportioning systems.

A.7.3.1 Most foam system manufacturers differentiate in the materials they recommend for foam proportioning system components that are designed to be flushed with water after operation and those components that are intended to be wetted continuously with foam concentrate (i.e., some positive displacement pumps are designed to be completely full of foam concentrate).

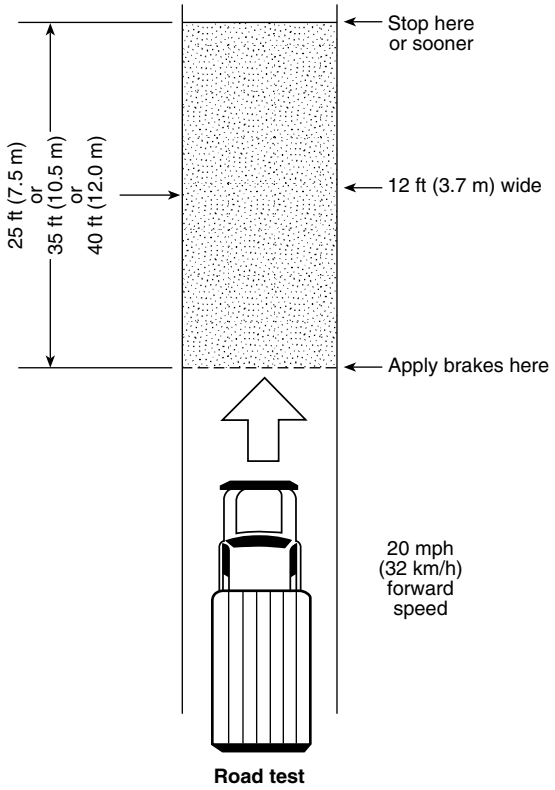
A.8.3.2 It is very important that the proper pressure balance be maintained between the fire pump and the air compressor or air system, as failure to maintain a balance could become a safety issue.

A.8.4.2 Special attention should be paid to the cleanliness and security of engine covers, cooling fins, and fans on air-cooled engines, as they are critical to the proper operation of the engine.

A.9.9.1 Special attention should be paid to the cleanliness and security of engine covers, cooling fins, and fans on air-cooled engines, as they are critical to the proper operation of the engine.

A.10.3.2 Figure A.10.3.2 shows the layout of the brake test area.

FIGURE A.10.3.2 Layout of a brake test area.



A.10.4 The parking brake should be tested to the manufacturer's recommendations. NFPA 1901, *Standard for Automotive Fire Apparatus*, has required a parking brake system to hold a fully loaded apparatus on at least a 20 percent grade since 1991. If the fire apparatus parking brake system was not

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designed to perform up to these or applicable federal standards or if the authority having jurisdiction operates the apparatus beyond these standards, the authority having jurisdiction should develop a standard operating guideline to supplement the apparatus parking brake system.

A.10.5 As part of a road test, the driver might wish to replicate the test that was required when the apparatus was manufactured. Since 1968, NFPA 1901, *Standard for Automotive Fire Apparatus*, has required the following test.

The apparatus is fully equipped and loaded as required by the appropriate edition of NFPA 1901. The test is conducted on dry, level, paved roads that are in good condition, and the engine is not operated in excess of the maximum governed speed. The test consists of two runs in opposite directions over the same route. The apparatus should be able to attain the following:

(1) A true speed of 35 mph (56 kmph) from a standing start within 25 seconds, except that prior to 1991 an apparatus carrying over 800 gal (3000 L) of water or equipped with an aerial ladder or elevating platform was allowed 30 seconds
(2) A minimum top speed of not less than 50 mph (80 kmph)

Appendix B Referenced Publications

B.1 The following documents or portions thereof are referenced within this standard for informational purposes only and are thus not considered part of the requirements of this standard unless also listed in Chapter 11. The edition indicated here for each reference is the current edition as of the date of the NFPA issuance of this standard.

B.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 11, *Standard for Low-Expansion Foam*, 1998 edition.

NFPA 1002, *Standard for Fire Apparatus Driver/Operator Professional Qualifications*, 1998 edition.

NFPA 1150, *Standard on Fire-Fighting Foam Chemicals for Class A Fuels in Rural, Suburban, and Vegetated Areas*, 1999 edition.

NFPA 1901, *Standard for Automotive Fire Apparatus*, 1999 edition.

B.1.2 Other Publications.

B.1.2.1 American Automobile Manufacturers Association Publications. American Automobile Manufacturers Association, Engineering Affairs Division, 7430 Second Avenue, Suite 300, Detroit, MI 48202.

Vehicle Inspection Handbook, Passenger Cars & Light Trucks, with manufacturers' recommendations, 1996 edition.

Vehicle Inspection Handbook, Truck/Bus/School Bus, with manufacturers' recommendations, 1996 edition.

B.1.2.2 U.S. Government Publication. U.S. Government Printing Office, Washington, DC 20402.

Title 29, *Code of Federal Regulations*, Section 1910.177, "Servicing multi-piece and single-piece rim wheels."

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