

NFPA®

1912

Standard for Fire Apparatus Refurbishing

2016



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NFPA®1912

Standard for

Fire Apparatus Refurbishing

2016 Edition

This edition of NFPA 1912, *Standard for Fire Apparatus Refurbishing*, was prepared by the Technical Committee on Fire Department Apparatus. It was issued by the Standards Council on November 14, 2015, with an effective date of December 4, 2015, and supersedes all previous editions.

This edition of NFPA 1912 was approved as an American National Standard on December 4, 2015.

Origin and Development of NFPA 1912

The first edition of NFPA 1912, *Standard for Fire Apparatus Refurbishing*, in 2001, was developed when a need was identified for a document to help both fire service administrators and refurbishing contractors in all phases of the refurbishing process. The first edition specified the requirements for two levels of refurbishing. Level I results in the assembly of a new fire apparatus by the use of a new chassis frame; driving and crew compartments; front axle, steering and suspension components; and, for the remainder of the apparatus, the use of either new components or components from an existing apparatus. Level II results in the upgrade of major components or systems of a fire apparatus with components or systems that comply with or exceed the applicable standards in effect at the time the original apparatus was manufactured.

The 2006 edition was reorganized to conform with the *Manual of Style for NFPA Technical Committee Documents*. It was updated to reflect changes that had been incorporated in NFPA 1901, *Standard for Automotive Fire Apparatus*. It was also revised to recognize that refurbishing of wildland fire apparatus must be based on NFPA 1906, *Standard for Wildland Fire Apparatus*, not NFPA 1901.

The extensive appendix material in the 2001 edition that was designed to assist users with the preparation of specifications for refurbishing a fire apparatus was further enhanced with the addition of the annex materials from NFPA 1901, *Standard for Automotive Fire Apparatus*, that provide the weights and dimensions of common equipment carried on fire apparatus, and the annex material on guidelines for first-line and reserve fire apparatus.

The 2011 edition of NFPA 1912 was reviewed by the Technical Committee on Fire Department Apparatus, which updated references and added Annex A material to the section on stability control to reflect the new requirements in NFPA 1901, *Standard for Automotive Fire Apparatus*.

For the 2016 edition, the majority of the changes focus on making the document current with the references and extracted materials and ensuring consistency with NFPA 1901 and NFPA 1906. The committee also has updated the safety sign requirements and has included as part of the requirements the Fire Apparatus Manufacturers' Association (FAMA) *Fire Apparatus Safety Guide* and the FAMA safety symbols.

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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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NFPA 1912

Standard for

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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 Annex A.

A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in mandatory sections of the document are given in Chapter 2 and those for extracts in informational sections are given in Annex E. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced publications can be found in Chapter 2 and Annex E.

Chapter 1 Administration

1.1* Scope. This standard specifies the minimum requirements for the refurbishing of automotive fire apparatus utilized for fire fighting and rescue operations, whether the refurbishing is done at the fire department or municipal maintenance facilities, or at the facilities of private contractors or apparatus manufacturers.

1.2 Purpose. This standard specifies the minimum requirements for the refurbishing of automotive fire/rescue apparatus, to ensure that any apparatus refurbished in accordance with this standard meets applicable motor vehicle regulations and applicable portions of the appropriate edition of the NFPA automotive fire apparatus standard.

1.2.1 Apparatus that receives a Level I refurbishing is intended to meet the current edition of the appropriate NFPA automotive fire apparatus standard.

1.2.2 Apparatus that receives a Level II refurbishing is intended to meet the appropriate NFPA automotive fire apparatus standard in effect when the apparatus was originally constructed.

1.3 Application.

1.3.1 This standard is applicable to fire apparatus contracted for refurbishing on or after July 1, 2006; however, nothing shall prevent the use of the standard prior to July 1, 2006, if the purchaser and contractor agree. The standard is not intended to be applied retroactively.

1.3.2 This standard shall not apply to the repair of fire apparatus.

1.4 Equivalency. Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard.

1.4.1 Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

1.4.2 The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

1.5* Units of Measure. In this standard, values for measurement in U.S. units are followed by an equivalent in metric units. Either set of values can be used but the same set of values (either U.S. units or metric units) shall be used consistently.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 1901, *Standard for Automotive Fire Apparatus*, 2016 edition.

NFPA 1906, *Standard for Wildland Fire Apparatus*, 2016 edition.

NFPA 1911, *Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus*, 2012 edition.

NFPA 1931, *Standard for Manufacturer's Design of Fire Department Ground Ladders*, 2015 edition.

NFPA 1961, *Standard on Fire Hose*, 2013 edition.

NFPA 1964, *Standard for Spray Nozzles*, 2013 edition.

2.3 Other Publications.

2.3.1 ANSI Publications. American National Standards Institute, Inc., 25 West 43rd Street, 4th floor, New York, NY 10036.

ANSI A14.2, *Ladders — Portable Metal — Safety Requirements*, 2007.

ANSI A14.5, *Ladders — Portable Reinforced Plastic — Safety Requirements*, 2007.

ANSI/NEMA Z535.4, *Product Safety Signs and Labels*, 2011.

2.3.2 FAMA Publications. Fire Apparatus Manufacturers' Association, P.O. Box 397, Lynnfield, MA 01940-0397. www.fama.org

FAMA TC010, *Standard Product Safety Sign Catalog for Automotive Fire Apparatus*, 2012.

Fire Apparatus Safety Guide, 2014.

2.3.3 ISO Publications. International Organization for Standardization, ch. de la Voie-Creuse, Case postale 56, CH-1211 Geneva 20, Switzerland, www.standardsinfo.net.

ISO 9244, *Earth-moving machinery — Machine safety labels — General principles*, 2008.

2.3.4 Other Publications. *Merriam-Webster's Collegiate Dictionary*, 11th edition, Merriam-Webster, Inc., Springfield, MA 2003.

2.4 References for Extracts in Mandatory Sections. NFPA 58, *Liquefied Petroleum Gas Code*, 2014 edition.

NFPA 58, *Liquefied Petroleum Gas Code*, 2014 edition.

NFPA 1901, *Standard for Automotive Fire Apparatus*, 2016 edition.

NFPA 1906, *Standard for Wildland Fire Apparatus*, 2016 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Shall. Indicates a mandatory requirement.

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

3.2.5 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1 Acceptance. An agreement between the purchasing authority and the contractor that the terms and conditions of the contract have been met. [1901, 2016]

3.3.2 Acceptance Tests. Tests performed on behalf of or by the purchaser at the time of delivery to determine compliance with the specifications for the fire apparatus. [1901, 2016]

3.3.3 Aerial Device. An aerial ladder, elevating platform, or water tower that is designed to position personnel, handle materials, provide continuous egress, or discharge water. [1901, 2016]

3.3.4 Aerial Fire Apparatus. A vehicle equipped with an aerial ladder, elevating platform, or water tower that is designed and equipped to support fire fighting and rescue operations by positioning personnel, handling materials, providing continuous egress, or discharging water at positions elevated from the ground.

3.3.5 Aerial Ladder. A self-supporting, turntable-mounted, power-operated ladder of two or more sections permanently attached to a self-propelled automotive fire apparatus and designed to provide a continuous egress route from an elevated position to the ground. [1901, 2016]

3.3.6 Angle of Approach. The smallest angle made between the road surface and a line drawn from the front point of ground contact of the front tire to any projection of the apparatus in front of the front axle. [1901, 2016]

3.3.7 Angle of Departure. The smallest angle made between the road surface and a line drawn from the rear point of ground contact of the rear tire to any projection of the apparatus behind the rear axle. [1901, 2016]

3.3.8 Auxiliary Pump. A water pump mounted on the fire apparatus in addition to a fire pump and used for fire fighting either in conjunction with or independent of the fire pump. [1901, 2016]

3.3.9 Center of Gravity. The point at which the entire weight of the fire apparatus is considered to be concentrated so that, if supported at this point, the apparatus would remain in equilibrium in any position. [1901, 2016]

3.3.10 Chassis. The basic operating motor vehicle including the engine, frame, and other essential structural and mechanical parts, but exclusive of the body and all appurtenances for the accommodation of driver, property, passengers, appliances, or equipment related to other than control. Common usage might, but need not, include a cab (or cowl). [1901, 2016]

3.3.11 Component. A constituent part of a fire apparatus or system.

3.3.12 Continuous Egress. A continuous exit or rescue path down an aerial device from an elevated position to the ground. [1901, 2016]

3.3.13* Contractor. The person or company responsible for fulfilling an agreed-upon contract. [1901, 2016]

3.3.14 Defect. A discontinuity in a part or a failure to function that interferes with the service or reliability for which the part was intended. [1901, 2016]

3.3.15 Elevating Platform. A self-supporting, turntable-mounted device consisting of a personnel-carrying platform

attached to the uppermost boom of a series of power-operated booms that articulate, telescope, or both and that are sometimes arranged to provide the continuous egress capabilities of an aerial ladder. [1901, 2016]

3.3.16 Estimated In-Service Weight. The amount that the fire apparatus manufacturer estimates the apparatus will weigh when it is placed in service with all fixed and portable equipment installed, all tanks full, and all personnel seating positions occupied. [1906, 2016]

3.3.17 Final-Stage Manufacturer. An entity that performs such manufacturing operations on an incomplete vehicle that it becomes a complete vehicle. [1906, 2016]

3.3.18 Fire Apparatus. A vehicle designed to be used under emergency conditions to transport personnel and equipment or to support the suppression of fires or mitigation of other hazardous situations. [1901, 2016]

3.3.19 Fire Pump. A water pump with a rated capacity of at least 250 gpm (1000 L/min) but less than 3000 gpm (12,000 L/min) at 150 psi (1000 kPa) net pump pressure, or a water pump with rated capacity of 3000 gpm (12,000 L/min) or greater at 100 psi (700 kPa) net pump pressure that is mounted on a fire apparatus and intended for fire fighting. [1901, 2016]

3.3.20 Gallon, U.S. Standard. 1 U.S. gal = 0.833 Imperial gal = 231 in.³ = 3.785 L. [58, 2014]

3.3.21 Gauge. A visual device that indicates a measurement.

3.3.22* GAWR (Gross Axle Weight Rating). The final-stage chassis manufacturer's specified maximum load-carrying capacity of an axle system, as measured at the tire-ground interfaces.

3.3.23* GCWR (Gross Combination Weight Rating). The final-stage manufacturer's specified maximum loaded weight for a combination (articulated) vehicle consisting of a tow vehicle and one or more towed units.

3.3.24* Grade. A measurement of the angle used in road design and expressed as a percentage of elevation change over distance. [1901, 2016]

3.3.25* GVWR (Gross Vehicle Weight Rating). The final-stage manufacturer's specified maximum load-carrying capacity of a single vehicle. [1901, 2016]

3.3.26 Initial Attack Apparatus. Fire apparatus with a fire pump of at least 250 gpm (1000 L/min) capacity, water tank, and hose body whose primary purpose is to initiate a fire suppression attack on structural, vehicular, or vegetation fires, and to support associated fire department operations. [1901, 2016]

3.3.27 Line-Voltage Circuit, Equipment, or System. An ac or dc electrical circuit, equipment, or system where the voltage to ground or from line to line is greater than 30 V rms (ac), 42.4 V peak (ac), or 60 V dc. [1901, 2016]

3.3.28 Low-Voltage Circuit, Equipment, or System. An electrical circuit, equipment, or system where the voltage does not exceed 30 V rms (ac), 42.4 V peak (ac), or 60 V dc; usually 12 V dc in fire apparatus. [1901, 2016]

3.3.29 Manufacturer. The entity responsible for the assembly of a finished product from materials or components. [1901, 2016]

3.3.30 Mobile Foam Fire Apparatus. Fire apparatus with a permanently mounted fire pump, foam proportioning system, and foam concentrate tank(s) whose primary purpose is the control and extinguishment of flammable and combustible liquid fires in storage tanks and spills. [1901, 2016]

3.3.31 Mobile Water Supply Apparatus (Tanker, Tender). A vehicle designed primarily for transporting (pickup, transporting, and delivering) water to fire emergency scenes to be applied by other vehicles or pumping equipment. [1901, 2016]

3.3.32* Net Pump Pressure. The sum of the discharge pressure and the suction lift converted to psi or kPa when pumping at draft, or the difference between the discharge pressure and the intake pressure when pumping from a hydrant or other source of water under positive pressure. [1901, 2016]

3.3.33 Operator. A person qualified to operate a fire apparatus.

3.3.34 Pump Operator's Panel. The area on a fire apparatus that contains the gauges, controls, and other instruments used for operating the pump. [1901, 2016]

3.3.35 Pump Operator's Position. The location from which the pump operator operates the pump. [1901, 2016]

3.3.36 Pumper. Fire apparatus with a permanently mounted fire pump of at least 750 gpm (3000 L/min) capacity, water tank, and hose body whose primary purpose is to combat structural and associated fires. [1901, 2016]

3.3.37* Purchaser. The authority having responsibility for the specification and acceptance of the apparatus. [1901, 2016]

3.3.38 Purchasing Authority. The agency that has the sole responsibility and authority for negotiating, placing, and, where necessary, modifying each and every solicitation, purchase order, or other award issued by a governing body. [1901, 2016]

3.3.39* Quint. Fire apparatus with a permanently mounted fire pump, a water tank, a hose storage area, an aerial ladder or elevating platform with a permanently mounted waterway, and a complement of ground ladders. [1901, 2016]

3.3.40 Rated Capacity (Aerial Device). The total amount of weight of all personnel and equipment that can be supported at the outermost rung of an aerial ladder or on the platform of an elevating platform with the aerial device placed in the horizontal position at its maximum horizontal extension when the stabilizers are fully deployed. [1901, 2016]

3.3.41 Rated Capacity (Water Pump). The flow rate to which the pump manufacturer certifies compliance of the pump when it is new. [1901, 2016]

3.3.42 Refurbishing.

3.3.42.1* Level I Refurbishing. The assembly of a new fire apparatus by the use of a new chassis frame, driving and crew compartment, front axle, steering and suspension components, and the use of either new components or components from an existing apparatus for the remainder of the apparatus.

3.3.42.2* Level II Refurbishing. The upgrade of major components or systems of a fire apparatus with components or systems that comply with the applicable standards in effect at the time the original apparatus was manufactured.

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

3.3.44 Replacement. The removal of an existing component or system and the installation of a similar component or system generally of the same model or the same capability (i.e., “like for like” replacement).

3.3.45* Special Services Fire Apparatus. A multipurpose vehicle that primarily provides support services at emergency scenes. [1901, 2016]

3.3.46 Suspension System. The components utilized to attach the axle(s) to the frame assembly.

3.3.47 Tanker. See 3.3.31, Mobile Water Supply Apparatus.

3.3.48 Tender. See 3.3.31, Mobile Water Supply Apparatus.

3.3.49 Turntable. A structural component that connects the aerial device to the chassis and stabilization system through a rotating bearing that permits 360-degree continuous rotation of the aerial device. [1901, 2016]

3.3.50 Unequipped Fire Apparatus. The completed fire apparatus excluding personnel, agent(s), and any equipment removable without the use of tools. [1901, 2016]

3.3.51* Upgrade. The substitution or addition of components or systems with new components or systems with improved performance or capability.

3.3.52 Water Tower. An aerial device consisting of permanently mounted power-operated booms that articulate, telescope, or both, and a waterway designed to supply a large-capacity, mobile, elevated water stream.

3.3.53 Wildland Fire Suppression Apparatus. A fire apparatus designed for fighting wildland fires that is equipped with a pump, a water tank, limited hose and equipment, and pump-and-roll capability. [1906, 2016]

Chapter 4 General Requirements

4.1* General.

4.1.1 Fire apparatus receiving Level I refurbishing shall meet the requirements of applicable chapters of the current edition of NFPA 1901 if the apparatus is not a wildland fire apparatus, or NFPA 1906 if the apparatus is a wildland fire apparatus, except as noted in Chapter 5.

4.1.2 Fire apparatus receiving Level II refurbishing shall meet the requirements of applicable chapters of the edition of the NFPA automotive fire apparatus standard that was in effect at the time of its original manufacture, except as noted in Chapter 6.

4.2* Responsibility of Purchaser. It shall be the responsibility of the purchaser to specify the details of the fire apparatus refurbishing; its required performance, including where operations at elevations above 2000 ft (600 m) or on grades greater than 6 percent are required; the maximum number of fire fighters to ride within the apparatus; specific added continuous electrical loads that exceed the minimum of this standard; and

any hose, ground ladders, or equipment to be carried by the apparatus that exceed the minimum requirements of this standard.

4.3 Responsibility of the Contractor.

4.3.1* The contractor shall provide a detailed description of the refurbished fire apparatus, a list of equipment to be furnished, and other construction and performance details to which the apparatus shall conform.

4.3.2* Responsibility for the fire apparatus and equipment shall remain with the contractor until such responsibilities are accepted by the purchaser.

4.4 Fire Apparatus Components. All components shall be installed in accordance with that component manufacturer's installation instructions.

4.4.1 Fire Pump. If the fire apparatus is equipped with a new fire pump, the pump and its associated equipment shall meet the requirements for fire pumps in the current edition of NFPA 1901.

4.4.2 Auxiliary Pump. If the fire apparatus is equipped with a new auxiliary pump, the pump and its associated equipment shall meet the requirements for auxiliary pumps in the current edition of NFPA 1901.

4.4.3 Wildland Water Pump. If the fire apparatus is equipped with a new wildland water pump, the pump and its associated equipment shall meet the requirements for water pumps in the current edition of NFPA 1906.

4.4.4 Water Tank. If the fire apparatus is equipped with a new water tank, the water tank shall meet the requirements for water tanks in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

4.4.5 Aerial Device. If the fire apparatus is equipped with a new aerial device (i.e., aerial ladder, elevating platform, or water tower), the aerial device shall meet the requirements for aerial devices in the current edition of NFPA 1901.

4.4.6 Foam Proportioning System. If the fire apparatus is equipped with a new foam proportioning system, the apparatus shall meet the requirements for foam proportioning systems in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

4.4.7 Compressed Air Foam System. If the fire apparatus is equipped with a new compressed air foam system, the system shall meet the requirements for compressed air foam systems in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

4.4.8 Line-Voltage Electrical System. If the fire apparatus is equipped with a new line-voltage electrical system or components, the system or components shall meet the requirements for line-voltage electrical systems in the current edition of NFPA 1901.

4.4.9 Command and Communications. If the fire apparatus is equipped with a new command and communications area, the area shall meet the requirements for command and communications areas in the current edition of NFPA 1901.

4.4.10 Air System. If the fire apparatus is equipped with a new air system, the system shall meet the requirements for air systems in the current edition of NFPA 1901.

4.4.11 Winch System. If the fire apparatus is equipped with a new winch system, the system shall meet the requirements for winches in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

4.5 Chassis Components. Each component shall be installed in accordance with that component manufacturer's installation instructions.

4.5.1 Engine. If the fire apparatus is equipped with a new engine, the system shall meet the requirements for engines in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

4.5.2 Transmission/Transfer Case. If the fire apparatus is equipped with a new transmission or transfer case, the component(s) shall meet the requirements for transmissions and transfer cases in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

4.5.3 Braking System. If the fire apparatus is equipped with a new braking system, the system shall meet the requirements for braking systems in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

4.5.4 Axle(s). If the fire apparatus is equipped with a new axle(s), the component(s) shall meet the requirements for axles in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

4.5.5 Suspension, Wheels, and Tires. If the fire apparatus is equipped with new suspension, wheels, or tires, the component(s) shall meet the requirements for new suspension, wheels, and tires in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

4.5.6 Cooling System. If the fire apparatus is equipped with a new cooling system, the system shall meet the requirements for cooling systems in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

4.5.7 Low-Voltage Electrical System. If the fire apparatus is equipped with a new low-voltage electrical system or components, the system or components shall meet the requirements for low-voltage electrical systems in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

4.5.8 Frame. If the fire apparatus is equipped with a new chassis frame, the frame shall meet the requirements for chassis frames in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

4.5.9 Driveline. If the fire apparatus is equipped with a new driveline, the components shall meet the requirements for drivelines in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

4.5.10 Lubrication System. If the fire apparatus is equipped with a new lubrication system, the system shall meet the requirements for lubrication systems in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

4.5.11 Fuel and Air System. If the fire apparatus is equipped with a new fuel and air system, the system shall meet the requirements for fuel and air systems in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

4.5.12 Exhaust System. If the fire apparatus is equipped with a new exhaust system, the system shall meet the requirements for

exhaust systems in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

4.5.13 Driving and Crew Compartment. If the fire apparatus is equipped with a new driving and crew compartment, the assembly shall meet the requirements for driving and crew compartments in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

4.6 Governmental Requirements. The fire apparatus shall comply with all applicable federal and state motor vehicle laws and regulations.

4.7 Personnel Protection.

4.7.1* Guards, shields, or other protection shall be added to refurbished fire apparatus where necessary to prevent injury to personnel by hot, moving, or rotating parts during normal nonmaintenance operations.

4.7.2 Electrical insulation or isolation shall be provided where necessary to prevent electrical shock from onboard electrical systems.

4.7.3 Vehicular workmanship shall ensure a safe operating environment free of accessible sharp projections and edges.

4.7.4* Safety signs with text shall conform to the general principles of ANSI/NEMA Z535.4, *Product Safety Signs and Labels*. Safety signs without text shall conform to the general principles for two-panel safety signs of ISO 9244, *Earth-moving machinery — Machine safety labels — General principles*. [1901:4.9.4]

4.7.4.1 Apparatus built for sale in the United States shall employ safety signage that complies with ANSI/NEMA Z535.4. [1901:4.9.4.1]

4.7.4.2 Apparatus built for sale outside the United States shall employ safety signage that complies with either ANSI/NEMA Z535.4 or ISO 9244. [1901:4.9.4.2]

4.8* Carrying Capacity. The GAWR and GCWR or GVWR of the chassis shall be adequate to carry the weight of the fire apparatus when loaded to its estimated in-service weight as defined in 4.8.2.

4.8.1 The contractor shall establish the estimated in-service weight during the design of the work to be done in refurbishing the fire apparatus.

4.8.2 The estimated in-service weight shall include the following:

- (1) The chassis, body, and tank(s)
- (2) Full fuel, lubricant, and other chassis or component fluid tanks or reservoirs
- (3) Full water and other agent tanks
- (4)* 200 lb (90 kg) in each seating position
- (5) 70 lb (32 kg) for each seating position for personal gear unless specified as not applicable
- (6) Fixed equipment such as pumps, aerial devices, generators, reels, and air systems as installed
- (7) Ground ladders, suction hose, designed hose load in their hose beds and on their reels
- (8) An allowance for miscellaneous equipment as provided by the purchaser

4.8.3 The contractor shall engineer and design the work that will occur to the fire apparatus during the refurbishment such that the completed apparatus, when loaded to its estimated in-

service weight, with all movable weights distributed as close as practical to their intended in-service configuration, does not exceed the gross vehicle weight rating (GVWR).

Chapter 5 Level I Refurbishing

5.1* General. Fire apparatus refurbished to Level I standards shall meet the current requirements of NFPA 1901 or NFPA 1906, whichever is applicable, for those components unless specified otherwise in this chapter.

5.2* Carrying Capacity. If a fire apparatus system or component is to be upgraded, the contractor shall ensure that the completed apparatus does not exceed the GAWR and GCWR, or GVWR, of the chassis when carrying the estimated in-service weight of the unequipped apparatus as defined in 4.8.2.

5.3 Vehicle Stability.

5.3.1 When the apparatus is loaded to its estimated in-service weight, the height of the vehicle's center of gravity shall not exceed the chassis manufacturer's maximum limit.

5.3.2 When the apparatus is loaded to its estimated in-service weight, the front-to-rear weight distribution on the vehicle shall be within the limits set by the chassis manufacturer.

5.3.3 Front axle loads shall not be less than the minimum axle loads specified by the chassis manufacturer, under full load and all other loading conditions.

5.3.4* The fire apparatus, when loaded to its estimated in-service weight, shall have a side-to-side tire load variation of no more than 7 percent of the total tire load for that axle.

5.3.5* A lateral acceleration indicator that is adjustable for sensitivity and that provides both visual and audio signals and warnings to the driver shall be provided as an alternative to tilt table testing, or in circumstances where the vehicle is unable to meet tilt table requirements as referenced in NFPA 1901.

5.4 Frame. The fire apparatus frame shall be replaced with a new chassis frame meeting the current requirements of NFPA 1901 or NFPA 1906, whichever is applicable.

5.5 Drivetrain.

5.5.1 If the original drivetrain or associated components are used, the contractor shall perform a thorough inspection of the drivetrain components not scheduled for replacement (such as the drive shaft, end yokes or flanges, universal joints, and associated mountings) for wear, balance, stress cracks, or other damage.

5.5.2 The contractor shall notify the purchaser in writing of any damage discovered during the inspection.

5.5.3 If a new drivetrain or associated components are installed, the contractor shall certify that the installation meets the component manufacturer's recommendations.

5.6 Engine and Engine System Design.

5.6.1 If the original engine and accessories are used, the contractor shall perform a thorough inspection of the engine and related accessories including, but not limited to, mountings, fan belts, and filters.

5.6.1.1 The inspection shall check for wear, fluid leaks, loss of power, and other potential problems.

5.6.1.2 The contractor shall notify the purchaser in writing of all necessary repairs and services needed to bring the engine and related accessories within the engine manufacturer's original specifications.

5.6.1.3 All belts and filters shall be replaced.

5.6.2* If the existing engine and/or engine system is to be replaced, it shall be replaced with one that meets the current requirements of NFPA 1901 or NFPA 1906, whichever is applicable.

5.6.2.1 The contractor shall furnish certification that the engine meets Environmental Protection Agency (EPA) standards that were in effect at the time of contract signing as well as certification that the installation meets the engine manufacturer's specifications.

5.7 Cooling System.

5.7.1 If the original cooling system is to be reused, the contractor shall perform a thorough inspection of the cooling system for leaks, blockages, wear, or other problems that could affect vehicle engine cooling.

5.7.1.1 The contractor shall notify the purchaser in writing of any problems discovered during the inspection.

5.7.1.2 The cooling system shall be flushed, and new coolant meeting the engine manufacturer's specifications shall be added.

5.7.2 If the cooling system is to be replaced, it shall be replaced with one that meets the current requirements of NFPA 1901 or NFPA 1906, whichever is applicable, as well as the engine manufacturer's specifications.

5.8 Lubrication System.

5.8.1 If the original lubrication system is to be reused, the contractor shall perform a thorough inspection of the lubrication system for leaks, blockages, or other problems that could affect vehicle lubrication.

5.8.1.1 The contractor shall notify the purchaser in writing of any problems discovered during the inspection.

5.8.2 If the lubrication system is to be replaced, it shall be replaced with one that meets the current requirements of NFPA 1901 or NFPA 1906, whichever is applicable, and the engine manufacturer's standards.

5.9 Fuel and Air Systems. The fire apparatus fuel and air intake systems shall be replaced with new fuel and air intake systems that meet the current requirements of NFPA 1901 or NFPA 1906, whichever is applicable, and the engine manufacturer's standards.

5.10 Exhaust System. The original fire apparatus exhaust system shall be replaced with a new exhaust system that meets the current requirements of NFPA 1901 or NFPA 1906, whichever is applicable, and the engine manufacturer's standards.

5.11 Vehicle Components.

5.11.1 Braking System.

5.11.1.1 The contractor shall certify that the braking system meets the performance requirements of the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

5.11.1.2 When a new braking system or brake components are installed, the contractor shall certify that the installation meets the component manufacturer's requirements.

5.11.1.3 Parking brakes shall control the rear wheels, or all wheels, and shall be of the positive, mechanically actuated type.

5.11.1.3.1* When the fire apparatus, as delivered, is loaded to its GVWR or GCWR, if applicable, the parking brake system shall hold the apparatus on at least a 20 percent grade.

5.11.1.3.2 A lockup device to retain applied pressure on hydraulically actuated service brake systems, or the use of the "park" position on an automatic transmission shall not be substituted for a separate parking brake system.

5.11.1.3.3 Parking brakes on steerable axles of tiller vehicles shall be provided where necessary to meet the requirements of this standard.

5.11.1.3.4 Air-applied brakes or mechanically actuated brakes shall be acceptable on steerable axles of tiller vehicles.

5.11.1.4 All fire apparatus with a GVWR of 36,000 lb (16,000 kg) or greater shall be equipped with an auxiliary braking system.

5.11.2 Suspension, Wheels, and Tires.

5.11.2.1 The suspension system shall be replaced with a new suspension system that meets the current requirements of NFPA 1901 or NFPA 1906, whichever is applicable.

5.11.2.2* If the existing axle(s), wheels, or tires are utilized, the contractor shall inspect and verify the condition of these components for continued use in emergency service.

5.11.2.2.1 Damaged components shall be repaired or replaced.

5.11.2.3 The contractor shall certify that the axles, wheels, and tires of the completed fire apparatus meet all current federal and state GVWR, GCWR, and GAWR requirements.

5.11.2.4 Angle of Approach and Departure.

5.11.2.4.1 If the fire apparatus is being refurbished to NFPA 1901, an angle of approach and an angle of departure of at least 8 degrees shall be maintained at the front and rear of the vehicle when it is loaded to its GVWR or GCWR, if applicable.

5.11.2.4.2 If the fire apparatus is being refurbished to NFPA 1906, an angle of approach and an angle of departure of at least 20 degrees shall be maintained at the front and rear of the vehicle when it is loaded to its GVWR or GCWR, if applicable.

5.11.3 Steering. The fire apparatus steering system shall be replaced with a new steering system meeting the current requirements of NFPA 1901 or NFPA 1906, whichever is applicable.

5.11.4 Transmission/Transfer Case.

5.11.4.1 If either the original transmission or the transfer case is reused, the contractor shall inspect the transmission or transfer case, its mountings, and any associated accessories for wear, damage, and fluid leaks.

5.11.4.1.1 The contractor shall notify the purchaser in writing of any problems discovered during the inspection.

5.11.4.1.2 All fluids and filters shall be changed.

5.11.4.2 In the event a new or refurbished transmission or transfer case is installed in the fire apparatus, the contractor shall certify that the installation meets the transmission or transfer case manufacturer's specifications for installation on that specific type of apparatus.

5.11.5 Fuel Tank. The fire apparatus fuel tank shall be replaced with a new tank that meets the current requirements of NFPA 1901 or NFPA 1906, whichever is applicable.

5.11.6 Tow Hooks. Front or rear tow hooks or tow eyes shall be attached to the frame structure to allow towing (not lifting) of the fire apparatus without damage.

5.12 Low-Voltage Electrical Systems and Warning Devices. The fire apparatus electrical wiring system and warning devices shall be replaced with a complete new system that meets the current requirements of NFPA 1901 or NFPA 1906, whichever is applicable.

5.13* Driving and Crew Compartments. The fire apparatus driving and crew compartments shall be replaced with new driving and crew compartments that meet the current requirements of NFPA 1901 or NFPA 1906, whichever is applicable, and the chassis manufacturer's standards.

5.14 Body, Compartmentation, and Hose Storage.

5.14.1 If the original fire apparatus body is to be reused, it shall be inspected for serviceability and upgraded to meet the current requirements of NFPA 1901 or NFPA 1906, whichever is applicable.

5.14.2 If the fire apparatus body, compartmentation, and hose storage areas are to be replaced, they shall be replaced with components that meet the current requirements of NFPA 1901 or NFPA 1906, whichever is applicable.

5.14.3 If new compartments are to be added to an existing fire apparatus body, they shall meet the current requirements of NFPA 1901 or NFPA 1906, whichever is applicable.

5.14.4* The fire apparatus shall comply with the current requirements for metal finish in NFPA 1901 or NFPA 1906, whichever is applicable, including the application of reflective striping.

5.15 Fire Pump and Associated Equipment.

5.15.1 If the original fire pump is reused, the contractor shall inspect the fire pump, its mountings, and its associated accessories for wear, damage, and leaks.

5.15.2 The contractor shall notify the purchaser in writing of any problems discovered during the inspection.

5.15.3 All new or upgraded parts or components shall meet the current requirements of NFPA 1901 or NFPA 1906, whichever is applicable.

5.15.4 The pump packing shall be adjusted according to the pump manufacturer's recommendations.

5.16 Water Tanks.

5.16.1 If the existing water tank is to be reused, the contractor shall inspect the water tank for serviceability and report any defects to the purchaser in writing.

5.16.2* If a new water tank is installed, it shall meet the current requirements of NFPA 1901 or NFPA 1906, whichever is applicable.

5.16.2.1 Installation of a new water tank shall not result in the completed fire apparatus exceeding the GAWR and GCWR or GVWR of the chassis under the conditions specified in Section 5.2.

5.17 Aerial Devices.

5.17.1 If the original aerial device is to be used, a full inspection and test as defined in NFPA 1911 shall be performed.

5.17.1.1 A test shall be performed prior to refurbishing to determine the condition of the aerial device.

5.17.2 If the original aerial device is reused, it shall meet the requirements of the NFPA automotive fire apparatus standard in effect at the time of the contract signing for the original manufacture of the apparatus.

5.17.3 After the aerial device upgrade work has been performed, a full inspection and test as defined in NFPA 1911 shall be performed.

5.18 Equipment Carried on Fire Apparatus.

5.18.1 If new ground ladders are furnished, they shall meet the requirements of NFPA 1931.

5.18.1.1 Stepladders and other types of multipurpose ladders meeting ANSI A14.2, *Ladders — Portable Metal — Safety Requirements*, or ANSI A14.5, *Ladders — Portable Reinforced Plastic — Safety Requirements*, with duty ratings of Type 1A or 1AA shall be permitted to be substituted for a folding ladder.

5.18.1.2 Stepladders and other types of multipurpose ladders shall be permitted to be carried in addition to the minimum fire department ground ladders specified in NFPA 1901 provided they meet either ANSI A14.2 or ANSI A14.5 with duty ratings of Type 1A or 1AA.

5.18.2 If new hose is furnished, it shall meet the requirements of NFPA 1961.

5.18.3 If new nozzles are furnished, they shall meet the requirements of NFPA 1964.

5.19 Tests and Delivery Data Requirements.

5.19.1 Fire Apparatus Certification Tests.

5.19.1.1 If the refurbished fire apparatus is equipped with a fire pump that has a rated capacity of 750 gpm (3000 L/min) or greater, the pump system shall be tested after the pump and all its associated piping and equipment have been installed on the apparatus.

5.19.1.1.1 The tests shall be conducted at the contractor's approved facility and certified by an independent testing organization approved by the purchaser.

5.19.1.1.2 The certification shall include at least the tests defined in 5.19.2 through 5.19.6.

5.19.1.1.3 If the apparatus is equipped with a water tank, the water tank-to-pump flow test defined in 5.19.7 shall be included.

5.19.1.2 If the refurbished fire apparatus is equipped with a fire pump that has a rated capacity of less than 750 gpm

(3000 L/min), the pump shall be tested after the pump and all its associated piping and equipment have been installed on the apparatus.

5.19.1.2.1 The tests shall be conducted at the manufacturer's approved facility and certified by the contractor.

5.19.1.2.2 The certification shall include at least the tests defined in 5.19.2 and 5.19.4 through 5.19.6.

5.19.1.2.3 If the apparatus is equipped with a water tank, the water tank-to-pump flow test defined in 5.19.7 shall be included.

5.19.2 Pumping Tests. A pumping certification test shall be conducted in accordance with the test requirements defined in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

5.19.3 Pumping Engine Overload Test.

5.19.3.1 If a new fire pump is installed, a pumping engine overload test shall be conducted in accordance with the test requirements defined in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

5.19.3.2 If the original fire pump is retained or reused, a pumping engine overload test shall be conducted in accordance with the test requirements of the NFPA automotive fire apparatus standard that was in effect at the time of the contract signing for the original manufacture of the apparatus.

5.19.4 Pressure Control System Test.

5.19.4.1 If the refurbished fire apparatus is equipped with a new pressure control system on the fire pump, it shall be tested in accordance with the test requirements defined in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

5.19.4.2 If the original pressure control system is retained or reused, it shall be tested in accordance with the pressure control device testing requirements of NFPA 1911.

5.19.5 Priming System Test.

5.19.5.1 If the refurbished fire apparatus is equipped with a new priming system on the fire pump, it shall be tested in accordance with the test requirements defined in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

5.19.5.2 If the original priming system is retained or reused, it shall be tested in accordance with the priming system test requirements of NFPA 1911.

5.19.6 Vacuum Test.

5.19.6.1 If the refurbished fire apparatus is equipped with a new fire pump, a vacuum test shall be conducted in accordance with the test requirements defined in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

5.19.6.2 If the original fire pump is retained or reused, a vacuum test shall be conducted in accordance with the test requirements of NFPA 1911.

5.19.7 Water Tank-to-Pump Flow Test.

5.19.7.1 If the refurbished fire apparatus has a new water tank(s), fire pump(s), or pump piping, a water tank-to-pump flow test shall be conducted in accordance with the test

requirements in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

5.19.7.2 If the original water tank(s), pump(s), and pump piping is retained or reused, a water tank-to-pump flow test shall be conducted to ensure the installation meets the requirements of the NFPA automotive fire apparatus standard in effect at the time of the contract signing for the original manufacture of the apparatus.

5.19.8 Engine Speed Advancement Interlock Test. An engine speed advancement interlock test meeting the test requirements in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable, shall be conducted.

5.19.9 Aerial Device Certification Tests. If a new or reutilized aerial device is installed on the refurbished fire apparatus, the completed apparatus shall be tested at the manufacturer's approved facility and certified by an independent testing organization approved by the purchaser.

5.19.9.1 New aerial devices shall be tested according to the current edition of NFPA 1901.

5.19.9.2 Reutilized aerial devices shall be tested to the NFPA automotive fire apparatus standard in effect at the time of the original aerial device manufacture.

5.19.10 Refurbisher's Pre-Delivery Tests.

5.19.10.1 Water Tank Capacity Test. If the refurbished fire apparatus has a new water tank, the water tank manufacturer shall certify the capacity of the water tank and the certification shall be provided to the purchaser when the apparatus is delivered.

5.19.10.1.1 If the refurbished fire apparatus retains or reuses the original water tank, the tank shall be tested to ensure it meets the requirements of the NFPA automotive fire apparatus standard in effect at the time of the contract signing for the original manufacture of the apparatus.

5.19.10.2 Piping Hydrostatic Test.

5.19.10.2.1 If the refurbished fire apparatus has a new fire pump or pump piping system, a piping hydrostatic test shall be conducted in accordance with the test requirements in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

5.19.10.2.2 If the refurbished fire apparatus retains or reuses the original pump(s) and pump piping, a piping hydrostatic test shall be conducted to ensure the integrity of the piping installation meets the requirements of the NFPA automotive fire apparatus standard in effect at the time of the contract signing for the original manufacture of the apparatus.

5.19.10.3 Electrical System Tests. Electrical system tests shall be conducted in accordance with the test requirements in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable, on all refurbished fire apparatus.

5.19.10.4* Foam System Tests.

5.19.10.4.1 If the refurbished fire apparatus has a newly installed foam system or system components, the system shall be tested in accordance with the test requirements in the current edition of NFPA 1901 or NFPA 1906, whichever is applicable.

5.19.10.4.2 If the refurbished fire apparatus reuses the original foam systems and system components, the system shall be

tested to ensure it meets the requirements of the NFPA automotive fire apparatus standard in effect at the time of the contract signing for the original manufacture of the apparatus.

5.19.11* Road Tests.

5.19.11.1 If the refurbished fire apparatus has any upgraded powertrain components (engine, transmission, driveline, or axles), it shall be road tested in accordance with 5.19.11.4 through 5.19.11.8.

5.19.11.2 If the refurbished fire apparatus reuses all of the original powertrain components (engine, transmission, driveline, and axles), it shall be tested to ensure it meets the requirements of the NFPA automotive fire apparatus standard in effect at the time of the contract signing for the original manufacture of the apparatus.

5.19.11.3 The tests shall be conducted at a location and in a manner that does not violate local, state, or federal traffic laws.

5.19.11.4 The fire apparatus shall be loaded to its estimated in-service weight.

5.19.11.4.1 The tests shall be conducted on dry, level, paved roads that are in good condition.

5.19.11.4.2 The engine shall not be operated in excess of the maximum governed speed.

5.19.11.5 Acceleration tests shall consist of two runs in opposite directions over the same route.

5.19.11.5.1 The vehicle shall attain a speed of 35 mph (55 km/hr) from a standing start within 25 seconds.

5.19.11.5.2 The vehicle shall attain a minimum top speed of not less than 50 mph (80 km/hr).

5.19.11.6 If the fire apparatus is equipped with an auxiliary braking system, the manufacturer shall road test the system to confirm that the system is functioning as intended by the auxiliary braking system manufacturer.

5.19.11.7 If the apparatus is equipped with an air brake system, the service brakes shall bring the apparatus, when loaded to its GVWR, to a complete stop from an initial speed of 20 mph (32.2 km/hr), in a distance not exceeding 35 ft (10.7 m) by actual measurement on a paved, level, dry surface road that is free of loose material, oil, or grease.

5.19.11.8 If the apparatus is equipped with a hydraulic brake system, the service brakes shall bring the apparatus, when loaded to its GVWR, to a complete stop from an initial speed of 30 mph (48.2 km/hr), in a distance not exceeding 88 ft (26.8 m) by actual measurement on a paved, level, dry surface road that is free of loose material, oil, or grease.

5.19.12 Tests on Delivery.

5.19.12.1 If acceptance tests are required at the point of delivery, the purchaser shall specify the details of the tests to be performed and they shall not be performed in a manner that requires the apparatus or a component to operate outside its designed operating range.

5.19.12.2 Aerial device stability tests shall not be run at other than the refurbisher's or the aerial device manufacturer's facility.