NFPA 1914
Standard for Testing Fire Department Aerial Devices

1997 Edition

National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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This edition of NFPA 1914, *Standard for Testing Fire Department Aerial Devices*, was prepared by the Technical Committee on Fire Department Apparatus and acted on by the National Fire Protection Association, Inc., at its Annual Meeting held May 19–22, 1997, in Los Angeles, CA. It was issued by the Standards Council on July 24, 1997, with an effective date of August 15, 1997, and supersedes all previous editions.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

This edition of NFPA 1914 was approved as an American National Standard on August 15, 1997.

Origin and Development of NFPA 1914

In 1954, the Fire Department Equipment Committee presented a report entitled *Standard Procedure for Aerial Ladder Testing* (NFPA 193-P) for tentative adoption. In 1955, it received final adoption. This document contained separate tests for wood and metal aerial ladders.

In 1958, new material covering the use, maintenance, and testing of ground ladders was added to the document, and a single procedure for testing both wood and metal aerial ladders was approved.

In 1959, a new section covering specifications for aluminum ground ladders for fire department use was adopted.

In May 1972, a complete revision of the 1959 edition of NFPA 193 was approved. This edition introduced tests for elevating platforms.

During 1974 and 1975, NFPA 193 was separated into two documents since the conditions of use for ground ladders and aerial ladders were so widely divergent. The new *Recommended Practice for the Maintenance, Care, Testing, and Use of Fire Department Aerial Ladders and Elevating Platforms* was designated as NFPA 1904 and approved in 1975.

In 1980, a complete revision of the document, which revised the document as a standard and renamed it as *Standard for Testing Fire Department Aerial Ladders and Elevating Platforms*, was approved.

The 1988 edition was again a complete revision to add more detail on required inspection, to require nondestructive testing of critical components on a periodic basis, and to include testing for water towers. The document was renumbered NFPA 1914 and renamed *Standard for Testing Fire Department Aerial Devices* to better describe its broader scope.

The 1991 edition added some clarification to the acceptance criteria for weld and other nondestructive testing inspections, revised the requirements for water system tests, and included for testing some additional components of the aerial devices. In addition, references and terminology were changed where necessary to correspond with the new editions of the fire apparatus standards.

The 1997 edition adds text to provide repair recommendations when the manufacturer is no longer in business, requires that free weights be used in testing, allows for acoustic emission testing, adds requirements for testing secondary operating controls, and adds a suggested form for recording the inspection and test results.

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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.

This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in membership may have occurred. A key to classifications is found at the back of this document.

NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

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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 5.

Chapter 1 Administration

1-1 Scope. This standard shall apply to the examination and testing of all fire apparatus, regardless of year of manufacture, that are equipped with an aerial ladder, an elevating platform, or a water tower as specified in NFPA 1901, *Standard for Automotive Fire Apparatus.*

1-2 Purpose. This standard specifies minimum inspection and testing requirements for aerial devices in an effort to ensure at least a minimum degree of safety under continued use. Because aerial devices can be misused and thereby overstressed, all aerial devices shall be periodically inspected and tested to determine continued serviceability.

1-3 Definitions.

Acoustic Emission Testing. A method of nondestructive testing (NDT) that utilizes acoustic or sound waves.

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

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.

Aerial Ladder Platform. A type of aerial device that combines an elevating platform with the continuous egress capabilities of an aerial ladder.

Aerial Ladder Sections. The structural members of the aerial ladder consisting of the base and fly sections.

Ambient Temperature. The temperature of the surrounding atmosphere.

American Society for Nondestructive Testing (ASNT). A professional organization that is devoted to promoting knowledge of nondestructive testing.

American Welding Society (AWS). An association that provides codes, guidelines, and standards utilized to evaluate welded structures and components in welded structures.

Ancillary Boom Ladder. A ladder or ladders affixed to a telescoping or articulating boom section.

Approved.* Acceptable to the authority having jurisdiction.

Articulating Boom. An aerial device consisting of two or more folding boom sections whose extension and retraction modes are accomplished by adjusting the angle of the knuckle joints.

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

Authorized Person. A person approved or assigned to perform specific types of duties or to be at a specific location at the job site.

Auxiliary Hydraulic Power. A small gasoline engine, diesel engine, or electric motor driven hydraulic pump used to operate an aerial device in an emergency or in lieu of the main hydraulic system.

Base Rail. The lower chord (i.e., rail) of an aerial ladder to which rungs and reinforcements are attached.

Base Section. The first or bottom section of an aerial device.

Bearing Raceway. The track in which the bearings are held between the upper and lower halves of a turntable rotation bearing.

Boom. An assembled section of an aerial device. The boom construction can be of the stressed skin box beam type, the truss-lattice–type, or the open "U" truss-type design.

Boom Boost Cylinders. The hydraulic cylinders located on the upper boom of an articulating boom aerial device that help lift the upper boom from the lower boom.

Boom Support. A structural component that is attached to the chassis frame and that is used to support the aerial device when it is in the cradled position.

Bow. The distance that the end of an aerial ladder or boom deviates from a straight line extension of the base section.

Cable. A wire rope used to transmit forces from one component to another for the purpose of extending or retracting an aerial device.

Cable Separation Guide. The mechanism that aligns and separates the cable when it is wound on the drum of an aerial ladder's extension winch.

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, or passengers, appliances, or equipment related to other than control. Common usage may, but need not, include a cab (or cowl).

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

Cylinder Links. The mechanisms that can be used in connecting an articulating boom to the end of the upper elevating cylinders or to the lower and upper booms.

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

Deflection. The deviation from a straight course or fixed direction.

Discontinuity. A change in the normal, physical structure of a material that can affect its serviceability.

Diverter Valve. A valve that, when actuated, diverts hydraulic fluid from one function to another or from one hydraulic system to another; in aerial devices, it is one valve that diverts oil from the stabilizers when the aerial device is in use and vice versa.

Drift. A time-dependent movement away from an established position.

Drip. A flow of liquid that lacks sufficient quantity or pressure to form a continuous stream.

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.

Elevating Platform Apparatus. A fire apparatus that is equipped with permanently mounted, power-operated booms of articulating or telescoping construction, or a combination thereof, and with a passenger-carrying platform that is attached to the uppermost boom.

Elevation Cylinder. The hydraulic components consisting of a cylinder barrel, cylinder rod, and related hardware that are used to vary the angle of the ladder or booms.

Elevation Indicator. An instrument on an aerial device that shows the angle of elevation of the aerial ladder or boom.

Elevation Lock. A manual- or positive-locking device (i.e., holding valve) that can be actuated to maintain indefinitely a desired angle or elevation without dependence upon engine power.

Emergency Hand-Crank Control. An auxiliary or supplemental control with which the operator can manually operate select functions of the aerial device.

Extension Cylinders. The hydraulic components consisting of a cylinder barrel, cylinder rod, and related hardware that are used to vary the length of extension of a telescoping aerial device.

Extension Indicator. A device on an aerial ladder or extensible boom aerial device that indicates the number of feet that the device has been extended.

Extension Sheave. A pulley through which an extension cable operates.

Fastener. A mechanical device, such as a rivet, bolt, screw, or pin, that is used to fasten two or more components together securely.

Ferromagnetic Materials. Materials that can be magnetized and strongly attracted to a magnetic field such as iron, steel, cobalt, and nickel.

Fly Locks. See Ladder Locks.

Fly Section. Any section of an aerial telescoping device beyond the base section.

Fracture. A type of defect found in welds that has a large length-to-width ratio and travels through or adjacent to the metal grain boundaries. Usually, this type of defect is referred to as a crack.

Hinge Pins. Pins that are used at either the swivel or point of articulation of an aerial device.

Holding Valve. A one-way valve that maintains hydraulic pressure in a cylinder until it is activated to release.

Instability. A condition of a mobile unit in which the sum of the moments tending to overturn the unit exceeds the sum of the moments tending to resist overturning.

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

Ironing. A term used for the damage caused to the bottom of a base rail by misalignment or malfunction of the rollers, which causes wear or indentation of the base rail material.

Knuckle. A point of connection between the upper and lower booms of an articulating device—the point at which lower and upper booms are hinged together.

Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Ladder Cradle. A structural component that supports an aerial ladder when it is bedded.

Ladder Locks. The mechanical locks or pawls that prevent movement of the sections of an aerial device when the power is shut off or in the event of loss of pressure in hydraulic circuits.

Leak. A continuous stream of liquid escaping from a hose, pipe, coupling, connection, or other confining structure at any point where the escape should not occur.

Level. An indicating device that is affixed to a turntable or truck body and is used to verify the levelness of a turntable prior to operating an aerial device.

Level II (ASNT). A tested and experienced level of proficiency for a nondestructive testing technician.

Leveling Linkages. The components and controls for achieving a level position of the elevating platform basket.

Liquid Penetrant Inspection. A nondestructive inspection method used to locate and determine the severity of surface discontinuities in materials based on the ability of a liquid to penetrate into small openings, such as cracks.

Listed.* Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets identified standards or has been tested and found suitable for a specified purpose.

Live Load. Forces acting on the aerial device from personnel, portable equipment, water, and nozzle reaction.

Load Limit Indicator. A load indicator or an instruction plate visible at the operator's position that shows the recommended safe load at any condition of aerial device elevation and extension.

Magnetic Particle Inspection. A nondestructive inspection method used to locate discontinuities in ferromagnetic materials by magnetizing the material and then applying an iron powder to mark and interpret the patterns that form.

Mobile Unit. A combination of an aerial device, its vehicle, and related equipment.

Monitor Nozzle. A water stream nozzle that is mounted on an aerial device and permanently connected to the waterway.

NDT (Nondestructive Testing). One of several methods used to inspect a structural component without physically altering or damaging the materials.

Neutral Position. The position of operating controls when the controls are not engaged.

Operator. A person qualified to operate an aerial device.

Override. The takeover of all aerial device movement control functions by an operator at a second control station.

Payload. The weight specified by the manufacturer that can be supported safely and moved via the aerial device.

Platform. The structure that is attached to the tip of a boom or aerial ladder for carrying personnel and equipment. The platform is comprised of a support structure, floor, railings, and an operator control station for controlling the aerial device from the platform position.

Platform Load Capacity. The amount of weight that the platform can support safely. Load capacity is dependent upon added equipment weight on the platform, personnel, and the nozzle reaction force when the water system is discharging water.

Pneumatic Lines. The lines that supply air, which is normally for a breathing system or for pneumatic power tools, to an elevating platform or the tip of an aerial ladder.

Properly. As recommended by the manufacturer.

PTO. Power takeoff.

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.

Radiography. A nondestructive inspection method that uses X-rays, nuclear radiation, or both to detect discontinuities in material and to present their images on a recording medium.

Rated Capacity. The total amount of weight of all personnel and equipment that can be safely supported at the outermost rung of an aerial ladder or on the platform of an elevating platform with the waterway uncharged.

Rated Vertical Height. The vertical distance measured by a plumb line from the rated working height to the ground. For an aerial ladder, it is measured from the top rung of the fly section; for an aerial with an elevating platform, it is measured from the top of the platform handrails to the ground; and for a water tower, it is measured from the discharge end of the water monitor nozzle. All measurements are taken at the maximum elevation allowed by the original equipment manufacturer (OEM) and published in the operator's manual.

Relief Valve. A pressure-controlling device that allows the bypass of hydraulic fluids to limit the pressures in a hydraulic system.

Rotation Gear. The main gear of an aerial device that is used for the rotation of the turntable.

Rotation Gear Reduction Box. The mechanism of an aerial device that transfers hydraulic or electric power to the rotation gear, creating the torque necessary to rotate the turntable.

Rotation Lock. A strong friction or other positive-locking device (e.g., holding valve) that retains the turntable in any desired position.

Rung Cap Casting. A casting that can be riveted to the outside of the base rail over the ends of each rung on an aerial ladder.

Safety Stop Mechanism. A device that is located on the aerial device and prevents raising the elevating platform booms or sections beyond safe, operating, horizontal or vertical angles.

Shall. Indicates a mandatory requirement.

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

Slide Blocks. Blocks made of a variety of materials (i.e., brass, nylatron) that act as spacing devices, wear strips, or wear pads.

Stability. The truck is considered to be in a state of stability when no sign of overturning is evident with the aerial ladder or elevating platform in operation. The lifting of a tire or stabilizer on the opposite side of the vehicle from the load does not necessarily indicate a condition of instability. Instability occurs when an aerial device can no longer support a given load and overturning is imminent.

Stabilizer. A device integral with or separately attached to the chassis of an aerial fire apparatus which is used to increase the moments tending to resist overturning the apparatus.

Stabilizer Pad. A plate inserted beneath a stabilizer shoe to give greater surface bearing area.

Stabilizer Shoe. A permanently mounted shoe on a stabilizer to provide a ground surface area.

Stressed-Skin–Type Boom Section. A boom framework that is fabricated by the welding of metal into full box sections with internal torsional members.

Telescopic. Extended or retracted by sliding of the overlapping sections.

Top Rail. The top chord (i.e., rail) of an aerial ladder to which reinforcements are attached.

Torque Box (also known as Torsion Box or Mainframe). A structural component placed between the turntable and the chassis of an aerial device to absorb the stresses of operation. It can be integrated into the chassis frame design.

Torque Value. A measure of tightness or the amount of stress that is put on a fastening device (i.e., bolt) to secure it properly.

Trussed-Lattice–Type Boom Section. An open truss boom framework with vertical and diagonal braces that are fastened to horizontal beams of the frame.

Turntable. A rotating structural component that allows rotation of an aerial device through a rotating bearing and that connects the aerial device to the chassis and stabilization system. It is normally designed to permit continuous 360-degree rotation and may or may not contain an operator's control station.

Turntable Alignment Indicator. An indicator that facilitates alignment of the aerial device with the boom support for bedding purposes.

Twist. The degree of rotational movement from a given position.

Ultrasonic Inspection. A nondestructive method of inspection in which high frequency vibrations are injected through the surface of the test material and bounced back to their source from the opposite surface; if a flaw exists, signals return in a different pattern, revealing the location and extent of the flaw.

Visual Inspection. Inspection by the eye without recourse to any optical devices, except prescription eyeglasses.

Water Tower. A device consisting of permanently mounted power-operated booms and a waterway designed to supply a large capacity mobile elevated water stream. The booms can be of articulating design or telescoping design.

Weldment. A structure that is formed by the welding together of several components.

1-4 General.

1-4.1 The visual inspections, operational tests, and load tests specified in this standard shall be conducted at least annually; after major repairs or overhaul; following the use of the aerial device when the aerial device could have been subjected to unusual operating conditions of stress or load; or when there is reason to believe that usage has exceeded the manufacturer's recommended aerial device operating procedures.

1-4.2* The complete inspections and tests, including the nondestructive testing (NDT) defined in this standard, shall be done at least every 5 years. Nondestructive testing shall be conducted whenever visual inspection or load testing indicates a potential problem or there is a desire to further confirm continued operational safety.

1-4.3* If the aerial device is involved in a situation that produces any structural damage, or if the inspections and tests that are required in this standard reveal any problems that affect the structural integrity of the aerial device, the aerial device shall be placed out of service. The aerial device shall be repaired to an acceptance level in accordance with the manufacturer's standard. If the manufacturer is no longer in business and, therefore, cannot be consulted with regard to repair of the aerial device, the repairs shall be performed by a repair facility that is acceptable to the authority having jurisdiction. The aerial device shall be tested to the full operational load and NDT of this standard before it is placed back in service.

1-4.4* The inspections and tests specified herein shall be considered the minimum service test requirements for all aerial devices. Since each manufacturer's unit will be somewhat different, specific attention shall be given to the manufacturer's instructions concerning periodic maintenance and inspection checks.

1-4.5* Only qualified persons, acceptable to the authority having jurisdiction, shall be allowed to operate the apparatus during testing procedures or to conduct any load tests.

1-4.6 Tests of aerial ladders specified in Chapter 2 of this standard shall apply only to metal aerial ladders.

1-5 Inspection Personnel. Most of the inspections and tests outlined in this standard are intended to be performed by qualified fire department personnel. However, if the department prefers, the inspections and tests can be performed by a third-party testing company or the manufacturer. The person actually performing the nondestructive test work shall be certified as an ASNT Level II NDT technician in the test method used, as specified in CP-189, *Standard for Qualification and Certification of Nondestructive Testing Personnel.*

If a third-party test company is employed to do NDT, that company shall comply with ASTM E543, *Standard Practice for Evaluating Agencies that Perform Nondestructive Testing.*

1-6 Visual Inspection. A visual inspection, prior to any operational or load testing, is an important part of this procedure and shall be carried out in a systematic sequence with proper attention to detail. This visual inspection of the equipment shall be for the detection of any visible defects, damage, or improperly secured parts.

1-7 Weld Inspection. When the inspections as required by 1-4.1 are performed, all accessible structural welds shall be inspected visually for fractures. When the nondestructive testing as required by 1-4.2 is performed, all accessible structural welds shall be inspected by ASNT Level II NDT technicians that are certified in the test methods used.

1-7.1 All accessible structural welds on steel shall be inspected in accordance with the appropriate provisions of AWS D1.1, *Structural Welding Code—Steel.* All structural welds shall comply with the weld quality as defined in 10.17.1, Visual Inspection, of AWS D1.1.

1-7.2 All accessible structural welds on aluminum shall be inspected in accordance with the appropriate provisions of AWS D1.2, *Structural Welding Code—Aluminum.* All structural welds shall comply with the weld quality as outlined in Table 10.15.1 of AWS D1.2.

1-7.3 The application of a particular nondestructive weld inspection technique shall be as recommended by AWS B1.10, *Guide for the Nondestructive Inspection of Welds.*

1-8 Bolt, Pin, and Washer Inspection. Bolts and pins that are subjected to ultrasonic testing shall contain no ultrasonic CRT indications that can be interpreted as cracks or elongated material. All washers shall be inspected for correct installation.

1-9 Nondestructive Testing Procedures.

1-9.1 All test procedures shall be consistent with ASTM E1316, *Standard Terminology for Nondestructive Examinations.*

1-9.2 All ultrasonic inspections shall be conducted in accordance with the following standards:

(a) ASTM E114, *Standard Practice for Ultrasonic Pulse-Echo Straight-Beam Examination by the Contact Method*

(b) ASTM E797, *Standard Practice for Measuring Thickness by Manual Ultrasonic Pulse-Echo Contact Method*

1-9.3 All magnetic particle inspections shall be conducted in accordance with ASTM E709, *Standard Guide for Magnetic Particle Examination.*

1-9.4 All liquid penetrant inspections shall be conducted in accordance with ASTM E165, *Standard Test Method for Liquid Penetrant Examination.*

1-9.5 All radiographic inspection shall be conducted in accordance with ASTM E1032, *Standard Test Method for Radiographic Examination of Weldments.*

1-9.6 All hardness readings shall be conducted in accordance with the following standards:

(a) ASTM B647, *Standard Test Method for Indentation Hardness of Aluminum Alloys by Means of a Webster Hardness Gauge*

(b) ASTM B648, *Standard Test Method for Indentation Hardness of Aluminum Alloys by Means of a Barcol Impressor*

(c) ASTM E6, *Standard Terminology Relating to Methods of Mechanical Testing*

(d) ASTM E10, *Standard Test Method for Brinell Hardness of Metallic Materials*

(e) ASTM E18, *Standard Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials*

(f) ASTM E92, *Standard Test Method for Vickers Hardness of Metallic Materials*

1-9.7 All acoustic emission inspections shall be conducted in accordance with ASTM E569, *Standard Practice for Acoustic Emission Monitoring of Structures During Controlled Stimulation.*

Chapter 2 Testing Metal Aerial Ladders

2-1 General. In addition to the manufacturer's recommendations, the inspections and tests detailed below shall be performed. An inspection preceded by a plus sign (+) indicates that an appropriate nondestructive test (NDT) shall be conducted as required by 1-4.2 of this standard.

Hydraulic components shall show no signs of hydraulic fluid leakage. A component shall be considered leaking if oil droplets are forming on the component. A film of oil on the component shall not be considered severe enough to categorize the component as leaking.

2-2 Service Records. The aerial ladder's service records shall be checked for any reports that could indicate defective conditions.

2-3 Turntable and Torque Box Inspection and Test. The turntable and torque box components, where applicable, shall be inspected on all aerial ladders in accordance with 2-3.1 through 2-3.28.

2-3.1 Rotation-Bearing Mounting Bolts. The rotation-bearing mounting bolts shall be inspected as follows:

(a) Inspect all accessible bolts for proper grade and installation as specified by the apparatus manufacturer.

(b) Using a properly calibrated torque wrench, verify that the bolt torque on all accessible bolts meets the apparatus manufacturer's specifications.

(c) (+) Inspect all accessible bolts for internal flaws.

2-3.2 Torque Box Mounting to Frame. The torque box-mounting to frame shall be inspected as follows:

(a) If the torque box is bolted to the frame, inspect all accessible bolts for proper grade and installation as specified by the apparatus manufacturer.

(b) If the torque box is bolted to the frame, use a properly calibrated torque wrench and verify that the torque on all accessible bolts meets the apparatus manufacturer's specifications.

(c) If the torque box is welded to the frame, visually inspect all accessible attaching welds for fractures.

(d) (+) If the torque box is bolted to the frame, inspect all bolts for internal flaws.

(e) (+) If the torque box is welded to the frame, inspect all accessible attaching welds.

2-3.3 Rotation Gear and Bearing. The rotation gear and bearing shall be inspected as follows:

(a) Inspect the rotation gear for missing or damaged teeth, pinion-to-gear alignment, proper lubrication, and backlash.

(b) Record the inner-bearing race to outer-bearing race clearance, if accessible, in accordance with the bearing manufacturer's procedures. Compare the clearance to the bearing manufacturer's specifications.

2-3.4 Rotation Gear Reduction Box Mounting. The rotation gear reduction box mounting shall be inspected as follows:

(a) If the reduction box is bolted to the turntable, inspect all bolts for proper grade and installation as specified by the apparatus manufacturer.

(b) If the reduction box is bolted to the turntable, use a calibrated torque wrench and verify that the torque on all bolts meets the apparatus manufacturer's specifications.

(c) Visually inspect all of the accessible weldments for defects and all of the welds for fractures.

(d) (+) If the reduction box is bolted to the turntable, inspect all bolts for internal flaws.

(e) (+) If the reduction box is welded to the turntable, inspect all reduction box attaching welds.

2-3.5 Turntable Structural Components. The turntable structural components shall be inspected as follows:

(a) Visually inspect all of the accessible turntable structural weldments for defects and all of the welds for fractures.

(b) (+) Inspect all accessible turntable structural component welds.

2-3.6 Rotation Hydraulic Swivel. Inspect the swivel for external hydraulic fluid leakage.

2-3.7 Hydraulic Lines and Hose in Turntable. Inspect all hydraulic lines and hose for kinks, cuts and abrasions, and hydraulic fluid leakage at connectors and fittings.

2-3.8 Elevation, Extension, and Rotation Lock. The elevation, extension, and rotation lock shall be inspected as follows:

(a) Inspect the manual valve elevation, extension, and rotation lock for external hydraulic fluid leakage.

(b) Test the manual valve elevation lock for proper operation by engaging the lock and then attempting to raise and lower the ladder while the main hydraulic system is operating. No detectable movement shall occur as determined by visual inspection.

(c) Test the manual valve extension lock for proper operation by engaging the lock and then attempting to extend or retract the ladder while the main hydraulic system is operating. No detectable movement shall occur as determined by visual inspection.

(d) Test the manual valve rotation lock for proper operation by engaging the lock and attempting to rotate the turntable clockwise and counterclockwise while the main hydraulic system is operating. The movement shall not exceed the manufacturer's specifications.

2-3.9* Hydraulic Oil. After the operational tests have been performed, remove a sample of the hydraulic oil from the hydraulic reservoir and subject the sample of the hydraulic oil to spectrochemical analysis.

2-3.10 Power Takeoff. Inspect the power takeoff for external hydraulic fluid leakage and proper operation (i.e., engagement and disengagement).

2-3.11 Hydraulic Pump. Inspect the hydraulic pump for external hydraulic fluid leakage.

2-3.12 Collector Rings. The collector rings shall be inspected as follows:

(a) If accessible, inspect the collector rings for foreign material buildup.

(b) If accessible, inspect the collector ring terminals for damage.

(c) Conduct tests to ensure the proper operation of the collector rings by rotating the aerial device while electric-powered devices are in operation.

2-3.13 Elevation Cylinder Anchor Ears and Plates. The elevation cylinder anchor ears and plates shall be inspected as follows:

(a) Visually inspect the elevation cylinder anchor ears and plates for defects and the attaching welds for fractures.

(b) (+) Inspect the elevation cylinder anchor ears and plate-attaching welds.

2-3.14 Elevation Cylinder Pins. The elevation cylinder pins shall be inspected as follows:

(a) Inspect cylinder pins for alignment, proper installation, lubrication, operation, and retention.

(b) (+) Inspect cylinder pins for internal flaws.

2-3.15 Elevation Cylinders. The elevation cylinders shall be inspected as follows:

(a) Inspect the cylinder rods for pitting, scoring, and other defects.

(b) Inspect the cylinder rod-to-barrel seal and the end gland seal for excessive external fluid leakage.

(c) *With the hydraulic oil at ambient temperature, subject the cylinders to a drift test by placing the aerial device at a 60-degree elevation at full extension, marking the cylinder position, closing manually operated locking valves, and allowing the device to stand for 1 hour with the engine off. The results of such a test shall not exceed the manufacturer's specifications for allowable cylinder drift.

2-3.16 Holding Valves on Elevation Cylinders. Inspect the holding valves for external hydraulic fluid leakage.

2-3.17 Operating Controls. The operating controls shall be inspected as follows:

(a) Inspect the operating controls for missing or damaged control handles, proper identification, and hydraulic fluid leakage.

(b) Verify that the controls operate smoothly, return to neutral position when released, and do not bind during operation.

2-3.18 Load Limit Indicators. Inspect the load limit indicators for proper operation and legibility.

2-3.19 Emergency Hand Crank Controls. Inspect the hand crank control for proper operation.

2-3.20 Auxiliary Hydraulic Power. Inspect the auxiliary hydraulic power for proper operation.

2-3.21 Turntable Alignment Indicator. Verify the presence of a turntable alignment indicator.

2-3.22 Throttle Control. Verify that the throttle control is operable, and record the operating rpm using a tachometer or a revolution counter, if so equipped, and a stopwatch.

2-3.23 Communication System. Inspect the communication system for proper installation and operation.

2-3.24 Relief Hydraulic Pressure. Verify that the main pump relief hydraulic pressure does not exceed the manufacturer's specifications.

2-3.25 Unit Main Frame. The unit main frame shall be inspected as follows:

(a) Visually inspect the main frame for any cracks, bends, dents, twists, or other weldment defects. Also, visually inspect any welds for fractures.

(b) (+) Inspect all main frame welds.

2-3.26 Transmission/Aerial Device Interlocks. If interlocks have been provided which prevent operation of the aerial device until both the chassis spring brakes have been set and the transmission has been disengaged properly, verify that the interlocks are operating properly.

2-3.27 Engine Speed Interlocks. If interlocks have been provided which allow operation of the engine speed control only after both the spring brakes have been set and the transmission has been positioned properly, verify that the interlocks are operating properly.

2-3.28 Breathing Air Systems. If a breathing air system is provided, the system shall be inspected as follows:

(a) Verify that the breathing air system—including the integrity of the air cylinder mounting, the regulator, and the air lines from the air cylinder(s) to the top of the aerial device—is properly installed.

(b) Verify that all the component parts of the system are present and in serviceable condition.

(c) Visually inspect the air cylinder mounting brackets for defects and the welds for fractures.

(d) (+) Inspect all welds on air cylinder mounting brackets.

(e) Check that the air pressure regulator is set at the apparatus manufacturer's recommended pressure.

2-4 Stabilizer Examination and Test. The stabilizer components, where applicable, shall be inspected on all aerial ladder apparatus in accordance with 2-4.1 through 2-4.14.

2-4.1 Stabilizer Structural Components. The stabilizer structural components shall be inspected as follows:

(a) Visually inspect all of the stabilizer components for defects and all of the welds for fractures.

(b) (+) Inspect all stabilizer structural component welds.

2-4.2 Stabilizer Pads. Verify that the stabilizer pads are present, are of proper construction, and are in serviceable condition.

2-4.3 Stabilizer Mounting to Frame or Torque Box. The stabilizer mounting to the frame or torque box shall be inspected as follows:

(a) Visually inspect the stabilizer to frame or torque box attachment for defects such as weld cracks, dents, and bends.

(b) (+) If welded, inspect the stabilizer to frame or torque box mounting welds.

(c) If bolted, inspect all bolts for proper fastener grade and installation as specified by the apparatus manufacturer.

(d) Using a properly calibrated torque wrench, verify that the torque on all bolts meets the apparatus manufacturer's specifications.

(e) (+) Inspect all bolts for internal flaws.

2-4.4 Hydraulic Lines and Hose in Stabilizer System. Inspect the hydraulic hose lines for kinks, cuts and abrasions, and leakage at connectors and fittings.

2-4.5 Stabilizer Interlock and Warning Device. Verify that the interlock system is operating properly.

2-4.6 Stabilizer Extension Cylinder Pins and Hinge Pins. The extension cylinder pins and hinge pins shall be inspected as follows:

(a) Inspect all stabilizer cylinder pins and hinge pins for proper installation, lubrication, operation, and retention.

(b) (+) Inspect all stabilizer pins and hinge pins for internal flaws.

2-4.7 Stabilizer Extension Cylinder. The stabilizer extension cylinder shall be inspected as follows:

(a) Inspect the stabilizer extension cylinder rods for pitting, scoring, and other defects.

(b) Inspect the cylinder rod-to-barrel seal and the end gland seal for excessive external fluid leakage.

(c) With the hydraulic oil at ambient temperature and with the stabilizer's cylinders properly set, measurements shall be taken to determine the amount of drift present in 1 hour with the engine off. The results shall not exceed the manufacturer's specification for allowable stabilizer cylinder drift.

2-4.8 Holding Valves on Extension Cylinders. Inspect the holding valves for external leakage of hydraulic fluid.

2-4.9 Operating Controls. Verify that the controls operate smoothly, return to the neutral position (if designed to do so) when released, do not bind during operation, and are free of hydraulic fluid leakage.

2-4.10 Diverter Valve. Inspect the diverter valve for external hydraulic fluid leakage.

2-4.11 Positive Stops and Alignment. Inspect the mechanical stabilizers for proper operation of the positive stops to prevent overextension.

2-4.12 Stabilizer Deployment. If the stabilizer system is operated hydraulically, verify that the system can be deployed within the time frame designated by the aerial device manufacturer.

2-4.13 Manual Spring Locks. Inspect the condition and operation of stabilizer manual spring locks for stowed position.

2-4.14 Tractor Spring Lockout Device. Inspect the spring lockout device for any discontinuities and for proper operation.

2-5 Aerial Ladder Inspection and Test. The aerial ladder shall be inspected in accordance with 2-5.1 through 2-5.28.

2-5.1 Aerial Ladder Weldments. All aerial ladder weldments shall be inspected as follows:

(a) Visually inspect all of the accessible aerial ladder weldments for defects and all of the welds for fractures.

(b) (+) Inspect all accessible welds on the ladder.

2-5.2 Aerial Ladder Fasteners. Visually inspect all aerial ladder structural fasteners and fastened connections for cracked fasteners and material cracks around the fasteners.

2-5.3 Ladder Section Alignment. Measurements shall be taken to determine the amount of ladder section twist or bow in the aerial ladder. Results shall not exceed manufacturer's specifications for allowable ladder section twist or bow.

2-5.4 Hydraulic, Pneumatic, and Electrical Lines in Ladder Sections. Inspect all lines for proper mounting, wear, cracking, kinks, and abrasions.

2-5.5 Top Rails. The top rails shall be inspected as follows:

(a) Inspect the top rails for straightness or any signs of misalignment.

(b) (+) Hardness readings shall be taken at intervals of 28 in. (710 mm) or less along the entire length of both top rails of aluminum ladders. Results of this inspection shall be compared with the manufacturer's specifications for the hardness of the material used for construction of the top rail.

2-5.6* Base Rails. The base rails shall be inspected as follows:

(a) Inspect the base rail for straightness and any signs of wear, ironing, dents, and corrosion.

(b) (+) Inspect the bottom of all hollow I-beam base rails to determine the thickness of the rail. Results shall be not less than the manufacturer's minimum specifications.

(c) (+) Hardness readings shall be taken at intervals of 28 in. (710 mm) or less along the entire length of both base rails of aluminum ladders. Results of this inspection shall be compared with the manufacturer's specifications for the hardness of the material used for construction of the base rail.

2-5.7 Rungs. Inspect all rungs of the aerial ladder for straightness, signs of fly lock damage, damaged or loose rung covers and rung cap castings, and signs of cracks or missing rivets, if applicable.

2-5.8 Folding Steps. The folding steps on the ladder shall be inspected as follows:

(a) Visually inspect the folding steps and folding step mounting brackets for defects and the welds for fractures.

(b) (+) Inspect all welds on the folding step(s) and folding step mounting brackets.

2-5.9 Rollers. Inspect all rollers for proper lubrication, operation, and any signs of wear.

2-5.10 Guides, Babbits, Wear Strips, Pads, and Slide Blocks. Visually inspect the guides for cracked welds, loose rivets, alignment, and any irregularities. Inspect babbits for signs of wear. Inspect wear strips, pads, and slide blocks for wear, gouging, and proper mounting.

2-5.11 Extension Sheaves. The extension sheaves shall be inspected as follows:

(a) Inspect extension sheaves for signs of wear, free movement during operation, proper retainers, and lubrication.

(b) Visually inspect all extension sheave mounting brackets for defects and the welds for fractures.

(c) (+) Inspect all welds of extension sheave mounting brackets.

2-5.12 Extensions Cables. Inspect extension cables for compliance with Appendix A of SAE J959, *Lifting Crane, Wire-Rope Strength Factors.*

2-5.13 Extension and Retraction Motor. Inspect the extension and retraction motor for signs of external hydraulic fluid leakage and, where applicable, brake wear and brake alignment with the shaft.

2-5.14 Cable Separation Guide. During operation of the aerial ladder, visually inspect the cable separation guide for free travel and any signs of misalignment.

2-5.15 Winch Holding Capacity. Inspect the winch for holding capacity by fully elevating the aerial ladder and extending it 10 ft (3 m). Winch slippage shall be measured for a 5-minute period. Slippage shall not exceed the manufacturer's specifications.

2-5.16 Brake Holding Capacity. Inspect the brake holding capacity of the extension motor by fully elevating the aerial ladder and extending it 10 ft (3 m). Brake slippage shall be measured for a 5-minute period. Slippage shall not exceed the manufacturer's specifications.

2-5.17 Extension and Elevation Indicators. Inspect the elevation and extension indicators for legibility, clarity, and accuracy.

2-5.18 Fly Locks. Inspect the fly lock mechanisms for proper mounting, alignment, lubrication, and operation.

2-5.19 Ladder Cradle. Inspect the aerial ladder cradle for wear and proper alignment.

2-5.20 Ladder Bed Lock. Inspect the ladder bed lock mechanism and hydraulic lines for proper mounting, signs of wear, and hydraulic fluid leakage at fittings.

2-5.21 Stop Mechanism. Inspect the stop mechanisms to ensure that they prevent overextension or overretraction of the aerial ladder.

2-5.22 Maximum Extension Warning Device. During operation of the aerial ladder, verify the proper operation of the audible device that warns of the approach of maximum extension.

2-5.23 Ladder Illumination. Inspect the operation of the lights that are used to illuminate the ladder.

2-5.24 Extension Cylinder Anchor Ears and Plates. The extension cylinder anchor ears and plates shall be inspected as follows:

(a) Visually inspect the extension cylinder anchor ears and plates for defects and the attaching welds for fractures.

(b) (+) Inspect the attaching welds of the extension cylinder anchor ears and plates.

2-5.25 Extension Cylinder Pins. The extension cylinder pins shall be inspected as follows:

(a) Inspect the cylinder pins for proper installation and retention.

(b) (+) Inspect the cylinder pins for internal flaws.

2-5.26 Extension Cylinder. The extension cylinders shall be inspected as follows:

(a) Inspect the cylinder rods for pitting, scoring, and other defects.

(b) Inspect the cylinder rod-to-barrel seal and the end gland seal for excessive external fluid leakage.

(c) With the hydraulic oil at ambient temperature, subject the cylinder(s) to drift by placing the aerial device at full elevation and 10 ft (3 m) of extension, marking the cylinder piston or the second section in relation to the base section, and allowing the ladder to stand for 1 hour with the engine off. The results shall not exceed the manufacturer's specifications for allowable cylinder drift.

2-5.27 Holding Valves on Extension Cylinder. Inspect the holding valves for external and internal hydraulic fluid leakage.

2-5.28 Tip Controls. If the aerial ladder is equipped with a secondary operating position at the tip, the controls shall be inspected as follows:

(a) Inspect the operating controls for identification of functions, posted operating instructions, and warnings.

(b) Verify that the controls operate smoothly, return to neutral when released, and do not bind during operation.

(c) Verify that the turntable or lower controls will override the tip controls.

(d) Verify that any safety devices, which are designed to operate in conjunction with the tip controls, are fully operational.

(e) Verify that the speed of the aerial ladder when being operated from the tip controls does not exceed the aerial ladder manufacturer's allowable speed.

2-6 Operating Test.

2-6.1 A complete cycle of aerial ladder operation shall be carried out after starting the engine, setting the stabilizers, and transmitting power to the ladder. The ladder shall be fully elevated out of the bed, shall be rotated 90 degrees, and shall be extended to full extension.

2-6.2 The ladder shall complete this test smoothly and without jerking or undue vibration within the time allowed by the standard in effect at the time of manufacture.

2-6.3 The ladder shall be retracted, the turntable rotation shall be completed through 360 degrees, and then the ladder shall be lowered to its bed. After this procedure a thorough inspection shall be made of all moving parts. Special attention shall be given to the security and adjustment of the ladder cables or chains.

2-6.4 The test shall demonstrate successful operation of all ladder controls.

2-7 Load Testing.

2-7.1* Tests shall be conducted when wind velocity is less than 10 mph (16 kmph).

2-7.2 A close watch shall be maintained during all load tests. Only those personnel who are essential to conduct the test shall be permitted near the apparatus during the test. If the ladder shows any excessive twist at any time, the test shall be discontinued immediately, and the aerial ladder shall be placed out of service.

2-7.3 Horizontal Load Test.

2-7.3.1 The aerial turntable shall be level. The aerial apparatus vehicle shall be on a firm, level surface or road. All stabilizers shall be down and have a firm footing on the ground.

2-7.3.2* A test cable hanger shall be attached to the top rung of the top section of the ladder and properly centered.

2-7.3.3 The maximum-rated live load in the horizontal position shall be determined from the manufacturer's load chart or operator's manual. If full extension is not permitted in the horizontal position with a specified live load, then the maximum permissible extension with a specified live load shall be used for the purpose of this test.

2-7.3.4 For single chassis apparatus, the ladder shall be rotated, if necessary, until it is positioned over the rear and parallel to the vehicle centerline. For a tractor-drawn apparatus, the ladder shall be positioned in the most stable position as recommended by the manufacturer.

2-7.3.5 The ladder shall be placed in the horizontal position and extended to full extension or maximum-permitted extension as determined in 2-7.3.3. The base section shall not be allowed to rest in the bed.

2-7.3.6 The ladder section locks, either manual pawls or hydraulic holding valves, shall be applied properly.

2-7.3.7 The elevation cylinders' integral holding valve or shutoff safety valve shall be properly closed or applied.

2-7.3.8 The ladder sections' twist shall not exceed the manufacturer's tolerance.

2-7.3.9* A free-hanging weight that is equal to the manufacturer's specified rated live load, as determined in 2-7.3.3, shall be applied gradually to the top rung of the aerial ladder by utilizing a test weight container or other suitable means of applying the weight. The combined weight of the test cable hanger and cable, the test weight container, and the test weights shall not exceed the rated live load.

CAUTION: Dropping the weights and shock loading the ladder can damage the ladder and shall not be permitted.

2-7.3.10 The test weight shall be sustained by the unsupported aerial ladder for 5 minutes.

2-7.3.11 The test weight shall hang freely from the tip of the aerial ladder. If the test weight hanger and ladder deflection are such that the test weight comes to rest on the ground, it shall be permissible to raise the ladder elevation slightly above the horizontal position.

CAUTION: At no time during the load test shall the ladder be moved with the test weight applied.

2-7.3.12 After removal of the test weight, a complete visual inspection shall be made of all load-supporting elements. Any visually detectable signs of damage, permanent deformation, or twist exceeding the manufacturer's allowance shall constitute noncompliance with the load test requirements. The aerial device shall also meet the requirements of Section 2-6 after the load test.

2-7.4 Maximum Elevation Load Test.

2-7.4.1 The aerial turntable shall be level. The aerial apparatus vehicle shall be on a firm, level surface or road. All ground stabilizers shall be down and have a firm footing on the ground.

2-7.4.2 A test cable hanger shall be attached to the top rung of the top section of the ladder and properly centered. *(See Figure A-2-7.3.2.)*

2-7.4.3 The maximum-rated live load in the maximum-elevated position at full extension shall be determined from the manufacturer's load chart or operator's manuals.

2-7.4.4 The ladder shall be rotated, if necessary, until the ladder is positioned over the rear and parallel to the vehicle centerline. Midship-mounted devices may have to be rotated slightly off of the vehicle centerline to apply the test load without interference with the body of the apparatus.

2-7.4.5 The ladder shall be elevated to maximum elevation and fully extended.

2-7.4.6 The ladder section locks, either manual pawls or hydraulic holding valves, shall be applied properly.

2-7.4.7 The elevation cylinders' integral holding valve or shutoff safety valve shall be properly closed or applied.

2-7.4.8 The ladder section twist shall not exceed the manufacturer's tolerance.

2-7.4.9 A free-hanging weight that is equal to the manufacturer's specified rated live load, as determined in 2-7.4.3, shall be applied gradually to the top rung of the aerial ladder by utilizing a test weight container or other suitable means of applying the weight. The weight shall be suspended by a cable and shall not be more than 3 ft (1 m) above the ground. The combined weight of the test cable hanger and cable, the test weight container, and the test weights shall not exceed the rated live load.

CAUTION: Dropping the weights and shock loading the ladder can damage the ladder and shall not be permitted.

2-7.4.10 The test weight shall be sustained by the unsupported aerial ladder for 5 minutes.

2-7.4.11 The test weight shall hang freely from the tip of the aerial ladder.

CAUTION: At no time during the load test shall the ladder be moved with the test weight applied.

2-7.4.12 After removal of the test weight, a complete visual inspection shall be made of all load-supporting elements. Any visually detectable signs of damage, permanent deformation, or twist exceeding the manufacturer's allowance shall constitute noncompliance with the load test requirements. The aerial device shall also meet the requirements of Section 2-6 after the load test.

2-8 Water System Test.

2-8.1 The following examination and test shall apply only to permanently piped, aerial ladder pipes.

2-8.2 The waterway system shall be inspected for proper operation of all components. It shall be free of rust, corrosion, blockage, or other defects.

2-8.3 The waterway-attaching brackets shall be inspected as follows:

(a) Inspect the brackets for loose bolts, weld fractures, or other defects.

(b) (+) Inspect all attaching welds.

2-8.4 Pressure Test. The water system shall be pressure tested.

2-8.4.1* The aerial ladder shall be positioned between 0 degrees and 10 degrees elevation and fully retracted. The water system shall be filled with water, and the valve at the discharge end shall be closed. If there is not a valve at the discharge end, a valve shall be attached for the purpose of this test.

CAUTION: or safety reasons, all air must be removed from the system.

The pressure on the system shall be raised to the water system manufacturer's maximum-rated working pressure and maintained for the duration of the test. The aerial ladder shall be raised to full elevation and rotated 360 degrees. The water system, including the turntable swivel, shall be checked for leaks. Care shall be taken not to overheat the water pump.

2-8.4.2* The aerial ladder shall be positioned between 0 degrees and 10 degrees elevation and extended to its maximum permissible limit. The water system shall be filled with water, and the valve at the discharge end shall be closed. If there is not a valve at the discharge end, a valve shall be attached for the purpose of this test.

CAUTION: For safety reasons, all air must be removed from the system.

The pressure on the system shall be raised to the water system manufacturer's maximum-rated working pressure and maintained for the duration of the test. The entire length of the water system shall be checked for leaks. Care shall be taken to not overheat the water pump.

2-8.4.3* The water system shall operate properly and with an absence of leaks during these tests.

2-8.5 If the waterway system is equipped with a flow meter, the flow meter shall be checked for accuracy. Flow meters shall be tested at the water system manufacturer's maximum-rated water system flow. Any meter that reads off by more than 10 percent shall be recalibrated or repaired.

2-8.6 If the waterway system is equipped with a water pressure gauge(s), each water pressure gauge shall be checked for accuracy. Pressure gauges shall be checked to at least 3 points, including 150 psi (1034 kPa), 200 psi (1379 kPa), and 250 psi (1723 kPa). Any gauge that reads off by more than 10 psi shall be replaced.

2-8.7 If the waterway system is equipped with a relief valve, this relief valve shall be checked to verify that it is operational at the waterway manufacturer's recommended pressure setting.

2-9 Signs. Ensure that all signs are in place and legible.

2-10* Records. A proper record shall be completed for all tests of the aerial ladder by the person responsible for the test. The test record shall include the following items:

(a) When the torque verification of mounting bolts is performed as required by this standard, the bolt size, grade, and torque specifications shall be recorded.

(b) When NDT is conducted, the test record shall indicate the NDT method used in each inspected area.

(c) Where this standard requires measurements—such as bearing clearance and backlash, cylinder drift, relief pressure, ladder section twist, hardness readings, base rail thickness, extension brake drift, winch drift, and the like—to be taken, these measurements shall be recorded in the test record so that a year-to-year comparison can be made.

Chapter 3 Testing Elevating Platforms

3-1 General. In addition to the manufacturer's recommendations, the inspections and tests detailed below shall be performed. An inspection preceded by a plus sign (+) indicates that an appropriate nondestructive test (NDT) shall be conducted as required by 1-4.2 of this standard.

Hydraulic components shall show no signs of hydraulic fluid leakage. A component shall be considered leaking if oil droplets are forming on the component. A film of oil on the component shall not be considered severe enough to categorize the component as leaking.

3-2 Service Records. The elevating platform's service records shall be checked for any reports that could indicate defective conditions.

3-3 Turntable and Torque Box Inspection and Test. The turntable and torque box components, where applicable, shall be inspected on all elevating platforms in accordance with 2-3.1 through 2-3.12 and 2-3.17 through 2-3.28.

3-4 Stabilizer Examination and Test. The stabilizer components, where applicable, shall be inspected on all elevating platform apparatus in accordance with 2-4.1 through 2-4.14.

3-5 Elevating Platform and Boom Inspection and Test. All platforms and booms shall be inspected in accordance with 3-5.1 through 3-5.12.

3-5.1 Platform Mounting Brackets. The platform mounting brackets shall be inspected as follows:

(a) Visually inspect all platform mounting brackets for defects, such as weld cracks, dents, or bends.

(b) (+) Inspect all welds in the platform mounting brackets.

(c) (+) Inspect all bolts and pins structurally involved with the platform mounting to the ladder or boom for internal flaws.

3-5.2 Platform. The platform shall be inspected as follows:

(a) Visually inspect platform for defects, such as weld cracks, dents, or bends.

(b) (+) Inspect all welds on platforms.

3-5.3 Hydraulic, Pneumatic, and Electrical Lines in Platform. Inspect all lines for proper mounting, wear, cracking, kinks, and abrasions.

3-5.4 Auxiliary Winch Mounting. The auxiliary winch mounting shall be inspected as follows:

(a) Inspect all mounting bolts for proper grade and installation as specified by the apparatus manufacturer.

(b) Using a calibrated torque wrench, verify that the torque on all winch mounting bolts meets the apparatus manufacturer's specifications.

(c) If welded, visually inspect the winch mounting for weld fractures.

(d) (+) Inspect the mounting bolts for internal flaws.

(e) (+) If brackets are welded, inspect all welds on mounting brackets.

3-5.5 Winch Controls. The winch controls shall be inspected as follows:

(a) Inspect controls for proper identification as to function and operation.

(b) Verify smooth operation of the winch controls.

3-5.6 Platform Load Capacity Identification. Verify that the proper platform capacity identification plate exists and is legible.

3-5.7 Platform Gate Latches and Hinge Points. Inspect the platform gate latches for proper alignment and the latch and hinges for smooth operation.

3-5.8 Platform Hinge Pins. The platform hinge pins shall be inspected as follows:

(a) Inspect platform hinge pins for proper installation, lubrication, and any irregularities.

(b) (+) Inspect the platform hinge pins for internal flaws.

3-5.9 Platform Controls. The platform controls shall be inspected as follows:

(a) Inspect the platform operating controls for identification of functions, posted operating instructions, and warnings.

(b) Verify that the controls operate smoothly, return to neutral when released, and do not bind during operation.

(c) Verify that the turntable or lower controls will override the platform controls.

3-5.10 Unauthorized Modifications and Added Weight. Verify that no unauthorized modifications or extra equipment have been added to the platform without subtracting the weight of such from the platform net operating capacity.

3-5.11 Platform Monitor and Nozzle. The platform monitor and nozzle shall be inspected as follows:

(a) Inspect the complete operation of the platform monitor and nozzle.

(b) Inspect the monitor's mounting brackets for any defects and their welds for fractures.

3-5.12 Boom Illumination. Verify the operation of spotlights used to illuminate the boom.

3-6 Articulating Boom–Lower Boom Examination and Test. For apparatus equipment with an articulating boom, the lower boom shall be inspected and tested in accordance with 3-6.1 through 3-6.14.

3-6.1 Hinge Pins. The hinge pins shall be inspected as follows:

(a) Inspect the boom hinge pins for proper installation, lubrication, operation, and any discontinuities.

(b) (+) Inspect the boom hinge pins for internal flaws.

3-6.2 Lower Boom Elevation Cylinder Anchor Ears and Plates. The lower boom elevation cylinder anchor ears and plates shall be inspected as follows:

(a) Visually inspect the anchor ears and plates for defects and the attaching welds for fractures.

(b) (+) Inspect all welds on the anchor ears and plates.

3-6.3 Lower Boom Elevation Cylinders. The boom elevation cylinder shall be inspected as follows:

(a) Inspect the cylinder rod(s) for pitting, scoring, or other defects.

(b) Inspect the cylinder rod-to-barrel seal and the end gland seal for excessive external hydraulic fluid leakage.

(c) With the hydraulic oil at ambient temperature, measurements shall be taken in accordance with the manufacturer's recommendations to determine the amount of drift present in the boom elevation cylinders. Results of this test shall not exceed the manufacturer's specifications for allowable lower boom cylinder drift.

3-6.4 Holding Valves on Boom Elevation Cylinder. Inspect the holding valves for signs of external hydraulic fluid leakage.

3-6.5 Boom Assembly. The lower boom assembly shall be inspected as follows:

(a) Visually inspect the boom for defects, such as weld cracks, dents, or bends.

(b) Visually inspect all structural fasteners and fastened connections for cracked fasteners and material cracks around the fasteners.

(c) (+) Inspect all welds on the boom for any structural discontinuities.

(d) (+) Hardness readings shall be taken at intervals of 28 in. (710 mm) or less on booms that are constructed of aluminum. Results of this inspection shall be compared with the manufacturer's specifications for the hardness of the material used for construction of the boom assembly.

3-6.6 Cylinder Link Pins. The cylinder link pins shall be inspected as follows:

(a) Inspect the cylinder link pins for proper installation, lubrication, operation, and any fractures.

(b) (+) Inspect the cylinder link pins for internal flaws.

3-6.7 Platform Leveling Linkages. The platform leveling linkages shall be inspected as follows:

(a) Visually inspect linkages for defects, such as weld cracks, dents, and bends.

(b) (+) Inspect all welds of the leveling assembly.

(c) (+) Inspect all leveling linkage pins for any internal flaws.

3-6.8 Hydraulic Lines and Hose in Lower Boom. Inspect all hydraulic lines in the lower boom for proper mounting, abrasion, hydraulic fluid leakage, and wear.

3-6.9 Hydraulic Lines in Knuckle. Inspect all hydraulic lines in the knuckle for hydraulic fluid leakage, abrasion, and any signs of wear.

3-6.10 Cables, Chains, and Rods. Inspect all cables, chains, and rods for signs of wear and for proper adjustment.

3-6.11 Sprockets, Pulleys, and Hooks. Inspect all sprockets, pulleys, and hooks for proper lubrication, signs of wear, distortion, and proper operation.

3-6.12 Boom Support. The boom support shall be inspected as follows:

(a) Visually inspect the boom support for defects, such as weld cracks, dents, or bends.

(b) (+) Inspect the boom support welds and bracket attachment.

3-6.13 Lower Boom Angle Indicator Lights. Verify the proper operation of the lower boom angle indicator lights.

3-6.14 Pneumatic and Electrical Lines. Inspect all pneumatic and electrical lines in the lower boom and the knuckle for proper mounting, wear, cracking, kinks, and abrasions.

3-7 Articulating Boom–Upper Boom Examination and Test. For apparatus equipment with an articulating boom, the upper boom shall be inspected and tested in accordance with 3-7.1 through 3-7.15.

3-7.1 Upper Boom for Alignment with Lower Boom. Verify that the upper boom is aligned with the lower boom.

3-7.2 Platform Leveling Linkages. The platform leveling linkages shall be inspected as follows:

(a) Visually inspect linkages for defects, such as weld cracks, dents, or bends.

(b) (+) Inspect all welds of leveling assemblies.

(c) (+) Inspect all leveling linkage pins for any internal flaws.

3-7.3 Boom Boost Cylinder Brackets. The boom boost cylinder brackets shall be inspected as follows:

(a) Visually inspect the boom boost cylinder brackets for defects, such as weld cracks, dents, or bends.

(b) (+) Inspect the boom boost cylinder bracket welds.

3-7.4 Boom Boost Cylinders. Inspect the boom boost cylinders for any external hydraulic fluid leakage.

3-7.5 Cylinder Link Pins. The cylinder link pins shall be inspected as follows:

(a) Visually inspect the cylinder link pins for proper installation, lubrication, operation, and any irregularities.

(b) (+) Inspect the cylinder link pins for internal flaws.

3-7.6 Boom Assembly. The upper boom assembly shall be inspected as follows:

(a) Visually inspect the boom for defects, such as weld cracks, dents, or bends.

(b) Visually inspect all structural fasteners and fastener connections for cracked fasteners and material cracks around the fasteners.

(c) (+) Inspect all welds on the boom.

(d) (+) Hardness readings shall be taken at intervals of 28 in. (710 mm) or less on booms that are constructed of aluminum. Results of this inspection shall be compared with the manufacturer's specifications for the hardness of the material used for construction of the boom assembly.

3-7.7 Hydraulic Lines and Hose in Upper Boom. Inspect all hydraulic hose/lines in the upper boom for proper mounting, abrasions, hydraulic fluid leakage, and wear.

3-7.8 Cables, Chains, and Rods. Inspect all cables, chains, and rods for signs of wear and for proper adjustment.

3-7.9 Sprockets, Pulleys, and Hooks. Inspect all sprockets, pulleys, and hooks for proper lubrication, signs of wear, distortion, and proper operation.

3-7.10 Upper Boom Hold-Down Device. The upper boom hold-down device shall be inspected as follows:

(a) Visually inspect the upper boom hold-down device for defects and for proper operation.

(b) (+) Inspect all welds of the upper boom hold-down device.

3-7.11 Safety Stop Mechanism. Verify that the safety stop mechanism operates properly.

3-7.12 Upper Boom Elevation Cylinder Anchor Ears and Plates. The upper boom elevation anchor ears and plates shall be inspected as follows:

(a) Visually inspect the anchor ears and plates for defects and the welds for fractures.

(b) (+) Inspect all welds on the anchor ears and plates.

3-7.13 Upper Boom Elevation Cylinder(s). The upper boom elevation cylinder(s) shall be inspected as follows:

(a) Inspect the cylinder rod(s) for pitting, scoring, and other defects.

(b) Inspect the cylinder rod-to-barrel seal and the end gland seal for excessive external hydraulic fluid leakage.

(c) With the hydraulic oil at ambient temperature, measurements shall be taken in accordance with the manufacturer's recommendations to determine the amount of drift present. Results of this test shall not exceed the manufacturer's tolerance for allowable upper boom cylinder drift.

3-7.14 Holding Valves on Upper Boom Elevation Cylinder. Inspect the holding valve(s) for signs of external hydraulic fluid leakage.

3-7.15 Pneumatic and Electrical Lines. Inspect all pneumatic and electrical lines in the upper boom for proper mounting, wear, cracking, kinks, and abrasions.

3-8 Telescoping Boom Examination and Test. For platforms equipped with a telescoping boom, the boom shall be inspected and tested in accordance with 2-3.13 through 2-3.16, 3-6.10 through 3-6.12, and 3-8.1 through 3-8.14.

3-8.1 Boom Assemblies. The boom assemblies shall be inspected as follows:

(a) Visually inspect booms for defects, such as weld cracks, dents, or bends.

(b) Visually inspect all structural fasteners and fastened connections for cracked fasteners and material cracks around the fasteners.

(c) (+) Inspect all welds on booms.

(d) (+) Hardness readings shall be taken at intervals of 28 in. (710 mm) or less on booms that are constructed of aluminum. Results of this inspection shall be compared with the manufacturer's specifications for the hardness of the material used for construction of the boom assembly.

3-8.2 Ancillary Boom Ladder. The ancillary boom ladder shall be inspected as follows:

(a) Inspect the ancillary boom ladder for any defects and the welds for fractures.

(b) Inspect the mounting brackets for loose bolts, weld fractures, or other defects.

(c) (+) Inspect all welds on the ladder and attaching welds.

3-8.3 Guides, Wear Strips and Pads, and Slide Blocks. Inspect guides, wear strips and pads, and slide blocks for proper installation and signs of wear.

3-8.4 Extension Sheaves. The extension sheaves shall be inspected as follows:

(a) Inspect the extension sheaves for proper mounting, alignment, and signs of wear.

(b) (+) Inspect all welds of the extension sheave mounting brackets.

(c) (+) Inspect retaining bolt for internal flaws.

3-8.5 Extension Cables. Inspect extension cables for compliance with Appendix A of SAE J959, *Lifting Crane, Wire-Rope Strength Factors.*

3-8.6 Elevation Indicator. Inspect the elevation cylinder indicator for legibility and clarity.

3-8.7 Maximum Extension Warning. During operation, verify the proper operation of the audible device that warns of the approach of maximum extension, if so equipped.

3-8.8 Platform Leveling Cylinders. The platform leveling cylinders shall be inspected as follows:

(a) Inspect the cylinder rod(s) for pitting, scoring, and other defects.

(b) Inspect the cylinder rod-to-barrel seal and the end gland seal for excessive external hydraulic fluid leakage.

(c) Visually inspect the leveling system for proper installation.

(d) Visually inspect the mounting of the leveling system for defects and the welds for fractures.

(e) (+) Inspect all welds for mounting of the leveling system.

(f) (+) Inspect all leveling cylinder pins for any internal flaws.

3-8.9 Hydraulic Lines and Hose in Boom Assemblies. Inspect all hydraulic lines and hose in the boom assemblies for hydraulic fluid leakage, abrasions, and any signs of wear.

3-8.10 Extension Cylinder Anchor Ears and Plates. The extension cylinder anchor ears and plates shall be inspected as follows:

(a) Visually inspect the extension cylinder anchor ears and plates for defects and the attaching welds for fractures.

(b) (+) Inspect the extension cylinder anchor ears and the plate-attaching welds.

3-8.11 Extension Cylinder Pins. The extension cylinder pins shall be inspected as follows:

(a) Inspect the cylinder pins for proper installation and retention.

(b) (+) Inspect the cylinder pins for internal flaws.

3-8.12 Extension Cylinder. The extension cylinders shall be inspected as follows:

(a) Inspect the cylinder rods for pitting, scoring, and other defects.

(b) Inspect the cylinder rod-to-barrel seal and the end gland seal for excessive external hydraulic fluid leakage.

(c) With the hydraulic oil at ambient temperature, subject the cylinder(s) to drift by placing the aerial device at full elevation and 10 ft (3 m) of extension, marking the cylinder piston or the second section in relation to the base section, and allowing the ladder to stand for 1 hour with the engine off. The results shall not exceed the manufacturer's specifications for allowable cylinder drift.

3-8.13 Holding Valves on Extension Cylinder. Inspect the holding valves for external hydraulic fluid leakage.

3-8.14 Pneumatic and Electrical Lines. Inspect all pneumatic and electrical lines in the booms for proper mounting, wear, cracking, kinks, and abrasions.

3-9 Operational Tests from Lower Controls.

3-9.1 With engine speed set to allow maximum speed as permitted by the manufacturer, the elevating platform shall be operated in all positions, as allowed by the manufacturer, using the lower or ground controls.

3-9.2 The operation of the elevating platform shall include, but not be limited to, movement of the platform basket from ground to maximum elevation as well as revolving the platform basket 360 degrees to the left and to the right while the unit is at its maximum horizontal reach.

3-9.3 The boom shall operate without any improper or unusual motion or sound.

3-9.4 All safety devices shall operate properly.

3-9.5 All controls shall operate smoothly, return to the neutral position when released, and not bind during operation.

3-9.6 If equipped with a spirit level, check the level for accuracy and legibility.

3-9.7 For telescoping elevating platforms, rollers, slides, and sheave wheels shall demonstrate proper alignment, function, and free operation.

3-9.8 A complete cycle of elevating platform operation shall be carried out after starting the engine, setting the stabilizers, and transmitting power to the platform booms or sections.

3-9.8.1 Operating the machine from the lower control station, the elevating platform shall be raised out of the bed, extended to full specified height, and rotated through a 90-degree turn. This procedure shall be completed smoothly and without undue vibration within the manufacturer's recommended time.

3-9.8.2 The elevating platform shall be retracted, and the turntable rotation shall be completed through 360 degrees. The elevating platform shall be lowered to its bed and a thorough inspection shall be made of all moving parts. Special attention shall be given to the platform leveling system.

3-9.8.3 The test shall demonstrate successful operation of all elevating platform controls.

3-10 Operational Tests from Platform Controls.

3-10.1 With engine speed set to allow maximum speed as permitted by the manufacturer, the elevating platform shall be operated in all positions, as allowed by the manufacturer, with only one operator in the platform basket operating from the platform control station.

3-10.2 The operation of the elevating platform shall include, but not be limited to, movement of the platform basket from ground to maximum elevation, as well as revolving the platform basket 360 degrees to the left and to the right while the unit is at its maximum horizontal reach.

3-10.3 All safety devices shall operate properly.

3-10.4 The platform basket deactivation control, from the ground or lower controls, shall be demonstrated to operate properly.

3-10.5 The platform basket shall level properly as the booms are moved through all allowable positions.

3-10.6 The mechanical override on a hydraulically-leveled elevating platform basket shall operate properly during emergency lowering of the boom without hydraulic power.

3-11 Load Test.

3-11.1 With the unit located on a hard, level surface and allowing sufficient room for unrestricted boom movements, a stability and structural test shall be performed. This test shall determine the elevating platform's ability to perform properly while carrying rated capacity loads in the platform basket.

3-11.2 The unit shall be stabilized properly according to the manufacturer's recommendation.

3-11.3 The platform basket shall be placed near the ground and loaded to the manufacturer's rated payload capacity. Care shall be exercised to assure that the weight of equipment added to the platform basket after delivery is subtracted from the weight of the test load being added. The platform basket load shall be secured properly.

3-11.4 The unit shall be operated from the lower controls through all allowable phases of operation. The manufacturer's operational limits shall not be exceeded.

3-11.5 The stabilizers shall show no evidence of any instability. If instability is observed, testing shall cease and the apparatus shall be repositioned.

3-11.6 All boom movements shall exhibit no abnormal noise, vibration, or deflection.

3-11.7 The platform basket shall level properly as the booms are moved through all allowable positions.

3-11.8 At the conclusion of the load test, weld joints at stabilizer structure, stabilizers, frame, main frame, frame reinforcements, turntable, cylinder anchors, boom joints, leveling system, platform basket, and pivot pin bosses shall be inspected and shall show no signs of deterioration.

3-12 Water System Examination and Test.

3-12.1 The waterway and system shall be inspected for proper operation of all components. It shall be free of rust, corrosion, blockage, or other defects.

3-12.2 The waterway attaching brackets shall be inspected as follows:

(a) Inspect the brackets for loose bolts, weld fractures, or other defects.

(b) (+) Inspect all attaching welds.

3-12.3 Pressure Test. The water system shall be pressure tested.

3-12.3.1 If the elevating platform has a telescoping boom, the water system shall be tested following the procedure in 2-8.4.1 and 2-8.4.2.

3-12.3.2* If the elevating platform has an articulating boom, the boom shall be positioned in the road travel position. The water system shall be filled with water and the valve at the discharge end shall be closed. If there is not a valve at the discharge end, a valve shall be attached for the purpose of this test.

CAUTION: For safety reasons, all air must be removed from the system.

The pressure on the system shall be raised to the water system manufacturer's maximum-rated working pressure and maintained while the elevating platform is raised to its rated vertical height and rotated 360 degrees. The water system, including the turntable swivel, shall be checked for leaks. Care shall be taken not to overheat the water pump.

3-12.3.3 If the elevating platform has both a telescoping boom and an articulating boom, it shall be tested in accordance with 3-12.3.1 and 3-12.3.2.

3-12.3.4* The water system shall operate properly and with an absence of leaks during these tests.

3-12.4 If the waterway system is equipped with a flow meter, the flow meter shall be checked for accuracy. Flow meters shall be tested at the water system manufacturer's maximum-rated water system flow. Any meter that reads off by more than 10 percent shall be recalibrated or repaired.

3-12.5 If the waterway system is equipped with a water pressure gauge(s), each water pressure gauge shall be checked for accuracy. Pressure gauges shall be checked to at least 3 points including 150 psi (1034 kPa), 200 psi (1379 kPa), and 250 psi (1723 kPa). Any gauge that reads off by more than 10 psi shall be replaced.

3-12.6 If the waterway system is equipped with a relief valve, this relief valve shall be checked to verify that it is operational at the waterway manufacturer's recommended pressure setting.

3-13 Signs. Ensure that all signs are in place and legible.

3-14* Records. A proper record shall be completed for all tests of the elevating platform and signed by the person responsible for the tests. The test record shall include the following items:

(a) When the torque verification of mounting bolts is performed as required by this standard, the bolt size, grade, and torque specifications shall be recorded.

(b) When NDT is conducted, the test record shall indicate the NDT method used in each inspected area.

(c) Where this standard requires measurements—such as bearing clearance and backlash, cylinder drift, relief pressure, ladder section twist, hardness readings, base rail thickness, extension brake drift, winch drift, and the like—to be taken, these measurements shall be recorded in the test record so that a year-to-year comparison can be made.

Chapter 4 Testing Water Towers

4-1 General. In addition to the manufacturer's recommendations, the inspections and tests detailed below shall be performed. An inspection preceded by a plus sign (+) indicates an appropriate nondestructive test (NDT) shall be conducted as required by 1-4.2 of this standard.

Hydraulic components shall show no signs of hydraulic fluid leakage. A component shall be considered leaking if oil droplets are forming on the component. A film of oil on the component shall not be considered severe enough to categorize the component as leaking.

4-2 Service Records. The water tower's service records shall be checked for any reports that could indicate defective conditions.

4-3 Turntable and Torque Box Inspection and Test. The turntable and torque box components, where applicable, shall be inspected on all water tower apparatus in accordance with 2-3.1 through 2-3.27.

4-4 Stabilizer Examination and Test. The stabilizer components, where applicable, shall be inspected on all water tower apparatus in accordance with 2-4.1 through 2-4.13.

4-5 Aerial Ladder Examination and Test. For a water tower apparatus that is equipped with an aerial ladder, the aerial ladder shall be inspected and tested in accordance with Section 2-5 and Section 2-7.

4-6 Articulating Boom–Lower Boom Examination and Test. For a water tower apparatus that is equipped with an articulating boom, the lower boom shall be inspected and tested in accordance with 3-6.1 through 3-6.6 and 3-6.8 through 3-6.14, as applicable.

4-7 Articulating Boom–Upper Boom Examination and Test. For a water tower apparatus that is equipped with an articulating boom, the upper boom shall be inspected and tested in accordance with 3-7.1 and 3-7.3 through 3-7.15, as applicable.

4-8 Telescoping Boom Examination and Test. For a water tower apparatus that is equipped with a telescoping boom, the boom shall be inspected and tested in accordance with 3-6.10 through 3-6.14, 3-8.1 through 3-8.7, and 3-8.9 through 3-8.14, as applicable.

4-9 Operating Test.

4-9.1 A complete cycle of water tower operation shall be carried out after starting the engine, setting the stabilizers, and transmitting power to the water tower. The water tower shall be elevated fully out of the bed, shall be rotated 90 degrees, and shall be extended to full extension.

4-9.2 A water tower shall complete this test smoothly and without undue vibration within the time allowed by the standard in effect at the time of manufacture.

4-9.3 The water tower shall be retracted, the turntable rotation shall be completed through 360 degrees, and then the water tower shall be lowered to its bed, after which a thorough inspection shall be made of all moving parts.

4-9.4 The test shall demonstrate successful operation of all water tower controls.

4-10 Water System Examination and Test.

4-10.1 The waterway and system shall be inspected for proper operation of all components. They shall be free of rust, corrosion, other defects, or blockage.

4-10.2 The waterway-attaching brackets shall be inspected as follows:

(a) Inspect the brackets for loose bolts, weld fractures, or other defects.

(b) (+) Inspect all attaching welds.

4-10.3 Pressure Test. The water system shall be pressure tested.

4-10.3.1 If the water tower has a telescoping boom, the water system shall be tested following the procedures in 2-8.4.1 and 2-8.4.2.

4-10.3.2 If the water tower has an articulating boom, the water system shall be tested following the procedure in 3-12.3.2.

4-10.3.3 If the water tower has both a telescoping boom and an articulating boom, it shall be tested in accordance with 4-10.3.1 and 4-10.3.2.

4-10.3.4* The water system shall operate properly and with an absence of leaks during these tests.

4-10.4 If the waterway system is equipped with a flow meter, the flow meter shall be checked for accuracy. Flow meters shall be tested at the water system manufacturer's maximum-rated water system flow. Any meter that reads off by more than 10 percent shall be recalibrated or repaired.

4-10.5 If the waterway system is equipped with a water pressure gauge(s), each water pressure gauge shall be checked for accuracy. Pressure gauges shall be checked to at least 3 points including 150 psi (1034 kPa), 200 psi (1379 kPa), and 250 psi (1723 kPa). Any gauge that reads off by more than 10 psi shall be replaced.

4-10.6 If the waterway system is equipped with a relief valve, this relief valve shall be checked to verify that it is operational at the waterway manufacturer's recommended pressure setting.

4-11 Signs. Ensure that all signs are in place and legible.

4-12* Records. A proper record shall be completed for all tests of the water tower by the person responsible for the test. The test record shall include the following items:

(a) When the torque verification of mounting bolts is performed as required by this standard, the bolt size, grade, and torque specifications shall be recorded.

(b) When NDT is conducted, the test record shall indicate the NDT method used in each inspected area.

(c) Where this standard requires measurements—such as bearing clearance and backlash, cylinder drift, relief pressure, ladder section twist, hardness readings, base rail thickness, extension brake drift, winch drift, and the like—to be taken, these measurements shall be recorded in the test record so that a year-to-year comparison can be made.

Chapter 5 Referenced Publications

5-1 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.

5-1.1 NFPA Publication. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 1901, *Standard for Automotive Fire Apparatus*, 1996 edition.

5-1.2 ASNT Publication. American Society for Nondestructive Testing, Inc., 1711 Arlingate Lane, Columbus, OH 43228-0518.

CP-189, *Standard for Qualification and Certification of Nondestructive Testing Personnel*, 1991.

5-1.3 ASTM Publications. American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM B647, *Standard Test Method for Indentation Hardness of Aluminum Alloys by Means of a Webster Hardness Gauge*, 1984 (Reconfirmed 1994).

ASTM B648, *Standard Test Method for Indentation Hardness of Aluminum Alloys by Means of a Barcol Impressor*, 1978 (Reconfirmed 1994).

ASTM E6, *Standard Terminology Relating to Methods of Mechanical Testing*, 1989 (Reconfirmed 1994).

ASTM E10, *Standard Test Method for Brinell Hardness of Metallic Materials*, 1993.

ASTM E18, *Standard Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials*, 1994.

ASTM E92, *Standard Test Method for Vickers Hardness of Metallic Materials*, 1982 (Reconfirmed 1992).

ASTM E114, *Standard Practice for Ultrasonic Pulse-Echo Straight-Beam Examination by the Contact Method*, 1995.

ASTM E165, *Standard Test Method for Liquid Penetrant Examination*, 1995.

ASTM E543, *Standard Practice for Evaluating Agencies that Perform Nondestructive Testing*, 1995.

ASTM E569, *Standard Practice for Acoustic Emission Monitoring of Structures During Controlled Stimulation*, 1985 (Reconfirmed 1991).

ASTM E709, *Standard Guide for Magnetic Particle Examination*, 1995.

ASTM E797, *Standard Practice for Measuring Thickness by Manual Ultrasonic Pulse-Echo Contact Method*, 1995.

ASTM E1032, *Standard Test Method for Radiographic Examination of Weldments*, 1995.

ASTM E1316, *Standard Terminology for Nondestructive Examinations*, 1996.

5-1.4 AWS Publications. American Welding Society, Inc., 550 NW LeJeune Road, Miami, FL 33126.

AWS B1.10, *Guide for the Nondestructive Inspection of Welds*, 1986 (Reconfirmed 1992).

AWS D1.1, *Structural Welding Code—Steel*, 1996.

AWS D1.2, *Structural Welding Code—Aluminum*, 1990.

5-1.5 SAE Publication. Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.

SAE J959, *Lifting Crane, Wire-Rope Strength Factors*, 1991.

Appendix A Explanatory Material

This appendix is not a part of the recommendations of this NFPA document but is included for informational purposes only.

A-1-3 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A-1-3 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 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A-1-4.2 Full nondestructive testing can be desirable on a more frequent basis than every 5 years, depending on the service to which the aerial device is subjected. Extensive use of the aerial device in urban environments would be a reason for more frequent testing. Many departments have found aerial devices damaged not by use but by transport over rough roads that rack the device in its bed.

A-1-4.3 If possible, the manufacturer of the aerial device should be consulted when structural defects are revealed by the service test in this standard. The recommendations for repair that are made by the manufacturer should be strictly followed. However, situations can arise in which the manufacturer cannot be consulted because the company is no longer in business. In these cases, the authority having jurisdiction must choose a repair facility to conduct the repair work. Choosing a repair facility to perform structural repair on an aerial apparatus is a process that requires a great deal of research and careful thought. Some of the items that should be considered are the following:

(a) Does the facility have past experience with the same structural repair as your aerial device needs and will the facility provide a reference list?

(b) Does the facility have the original design, construction, and operation specifications for the make and model of your aerial device?

(c) Does the facility have in its possession written procedures for structural repair that were developed previously by the manufacturer of your aerial device?

(d) Does the facility employ an engineering staff to analyze structures and recommend structural repair methods?

(e) Will the facility provide an engineering analysis used to substantiate the structural repair method recommended?

(f) Will the facility provide an independent certification by a professional engineer of the analysis used to substantiate the recommended structural repair method?

(g) Will the facility warrant the work performed?

A-1-4.4 Specific, written checklists, which combine the manufacturer's recommended checks with the inspection procedures of this standard and any other checks found desirable by the department, should be developed by each fire department for their style and brand of apparatus to ensure a systematic and complete inspection.

A-1-4.5 Qualified vehicle operators are either those who have been schooled in the operation of the vehicle by the manufacturer or fire department instructors who have received special training in all phases of vehicle operations. Operators of fire department apparatus should complete a course in driver training and aerial ladder or elevating platform operational procedures, including positioning on the fireground. Specific training should be given in procedures to be followed should the hydraulic system fail. A thorough understanding of safe load capacity, stabilizing procedures, and operational limits is paramount. Safety procedures, proper shutdown, and boom-lowering procedures are also critical. Operators should be tested upon completion of training. Periodic retraining and retesting should also be required.

A-2-3.9 Spectrochemical analysis of the hydraulic oil is intended to identify contaminants in the hydraulic system. Typically, the analysis will identify contaminants in parts per million (ppm) or by percent. Many laboratories that perform the analysis will provide service recommendations with their oil analysis report. In most cases, recommendations are limited unless a reference analysis has been performed. The reference analysis is an analysis of new oil from the oil manufacturer/supplier prior to being put into the aerial hydraulic system. Subsequent oil analyses are then compared to the reference analysis. By comparing the contaminant levels, trends can be identified and can give the analyzing laboratory specific service recommendations.

A-2-3.15(c) If the aerial device is operated for a considerable time period prior to the drift test, the hydraulic oil temperature will be elevated. During the 1-hr test, the oil will cool to ambient temperature, and it can change in volume by 3 to 4 percent, leading to erroneous test results.