ASME HRT-1–2016

Rules for Hoisting, Rigging, and Transporting Equipment for Nuclear Facilities

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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The American Society of Mechanical Engineers
Two Park Avenue, New York, NY 10016-5990

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FOREWORD

This Standard, ASME HRT-1, provides requirements for the design and use of hoisting, rigging, and transporting equipment used in the delivery of nuclear facility components to a nuclear facility's point of receipt and the handling of such components until the start of the facility's operating phase, defined as the point of initial fuel load. The requirements of ASME HRT-1 may also be extended to the design and use of hoisting, rigging, and transporting equipment for modifications at operating nuclear facilities.

Requirements for hoisting, rigging, and transporting equipment used in the construction phase of a nuclear power plant were originally published in 1981 as ANSI/ASME N45.2.15, and, since 1994, have been maintained by ASME as Subpart 2.15 of ASME NQA-1. The ASME Committee on Cranes for Nuclear Facilities has rewritten that Subpart to create this first edition of ASME HRT-1. This Standard replaces ASME NQA-1, Subpart 2.15.

Following approval by the ASME Committee on Cranes for Nuclear Facilities and ASME, and after public review, ASME HRT-1 was approved by the American National Standards Institute on April 12, 2016.

PREPARATION OF TECHNICAL INQUIRIES TO THE COMMITTEE ON CRANES FOR NUCLEAR FACILITIES

Introduction. The ASME Committee on Cranes for Nuclear Facilities (CNF) will consider written requests for interpretations and revisions to CNF Standards and develop new requirements if dictated by technological development. The Committee's activities in this regard are limited strictly to interpretations of the requirements or to consideration of revisions to the present Standard on the basis of new data or technology. As a matter of published policy, ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity, and, accordingly, inquiries requiring such consideration will be returned. Moreover, ASME does not act as a consultant on specific engineering problems or on the general application or understanding of the Standard requirements. If, based on the inquiry information submitted, it is the opinion of the Committee that the inquirer should seek assistance, the inquiry will be returned with the recommendation that such assistance be obtained.

All inquiries that do not provide the information needed for the Committee's full understanding will be returned.

Inquiry Format. Inquiries shall be limited strictly to interpretations of the requirements or to the consideration of revisions to the present Standard on the basis of new data or technology.

Requests for interpretation shall be submitted through the Interpretation Submittal Form found at http://go.asme.org/InterpretationRequest.

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RULES FOR HOISTING, RIGGING, AND TRANSPORTING EQUIPMENT FOR NUCLEAR FACILITIES

1 INTRODUCTION

1.1 General

Hoisting, rigging, and transporting equipment covered in this Standard shall be in accordance with the Standard's requirements but not necessarily with its recommendations. The word "shall" is used to denote a requirement, the word "should" is used to denote a recommendation, and the word "may" is used to denote permission, which is neither a requirement nor a recommendation.

1.2 Scope

This Standard provides requirements for the design and use of hoisting, rigging, and transporting equipment used in the delivery of nuclear facility components to a nuclear facility's point of receipt and the handling of such components until the start of the facility's operating phase, defined as the point of initial fuel load. The requirements of this Standard are also applicable to the design and use of hoisting, rigging, and transporting equipment for modifications at operating nuclear facilities when such equipment is not already controlled by existing facility procedures (e.g., procedures for controlling heavy loads or implementing maintenance rules).

1.3 Responsibility

The owner shall determine the applicability of this Standard to special handling of a specific application, piece of equipment, or load. Special handling may be needed due to high cost of the load, component safety classification, safety program, or other project-critical requirements as determined by the owner or design organization. The equipment and load-handling activities covered by this Standard are dependent upon location and usage of the load-handling equipment at the facility. The owner is responsible for determining and specifying the type of load-handling equipment and the service conditions, performance, and degree of quality assurance required. The extent to which this Standard is used at other than nuclear facilities shall be the responsibility of those referencing this Standard.

1.4 Definitions

The following definitions are provided to ensure a uniform understanding of terms as they are used in this Standard.

accepted industry standard: a standard established by a group representing individual members from various facets of an industry who normally are those engaged in design and manufacture. This type of standard is accepted by the responsible organization. Examples include AISC 303, ANSI/AGMA 2001-C95, and CMAA Specification No. 70 (see para. 1.5).

consensus standard: a standard established by a group representing a cross section of a particular industry or trade, or a part thereof. A cross section includes those who purchase or use a product of the industry or trade, as well as those who produce these products. Examples of consensus standards include ASME B30 standards, ASME NOG-1, and ASME NUM-1 (see para. 1.5).

dynamic load test: a test wherein designated loads are hoisted, lowered, rotated, or transported through motions and accelerations required to simulate handling of the intended item.

equipment: manufactured assemblies used for the handling of items.

failure stress: the stress within a component at which failure is imminent due to direct loads, excessive deflections or vibrations, or permanent deformations that may lead to unsafe conditions.

handling: hoisting, rigging, or transporting of loads.

handling system: a combination of components arranged for a handling operation.

lifted load: the weight of the item to be moved plus the weight of any required rigging, such as lifting beam, slings, hooks, and blocks.

person-in-charge (PIC): the person responsible for load-handling operations.

principal structural load-carrying members: those components of a system whose structural integrity must be maintained to ensure safe operation.

principal structural welds: those welds that join or affect the integrity of principal load-carrying members.

responsible organization: the organization in direct control of the equipment and manpower engaged in a handling operation.

special handling: hoisting, rigging, or transporting of a load that requires additional safety measures to protect the integrity of the load during handling due to its weight, cost, or safety classification; its critical impact on the schedule; or its potential to harm personnel or damage the facility should handling mishap occur.

1.5 References

The following is a list of codes and standards referenced in this Standard. These codes and standards apply to the extent invoked at the point of reference. Unless otherwise noted, the most recent edition applies.

ACI 318, Building Code Requirements for Structural Concrete and Commentary
Publisher: American Concrete Institute (ACI), 38800 Country Club Drive, Farmington Hills, MI 48331 (www.concrete.org)

AISC 303, Code of Standard Practice for Buildings and Bridges
AISC 325, Steel Construction Manual, 14th Ed.
ANSI/AISC 360, Specification for Structural Steel Buildings
Publisher: American Institute of Steel Construction (AISC), 1 East Wacker Drive, Suite 700, Chicago, IL 60601 (www.aisc.org)

ANSI/AGMA 2001-C95, Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth
ANSI/AGMA 9005-E02, Industrial Gear Lubrication
Publisher: American Gear Manufacturers Association (AGMA), 1001 North Fairfax Street, Suite 500, Alexandria, VA 22314 (www.agma.org)

ANSI/ASSE A10.5-2013, Safety Requirements for Material Hoists
Publisher: The American Society of Safety Engineers (ASSE), 520 N. Northwest Hwy, Park Ridge, IL 60068 (www.asse.org)

ANSI N14.6-1993, Radioactive Materials — Special Lifting Devices for Shipping Containers Weighing 10 000 Pounds (4500 kg) or More
Publisher: American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036 (www.ansi.org)

ASCE/SEI 7, Minimum Design Loads for Buildings and Other Structures
Publisher: American Society of Civil Engineers (ASCE), 1801 Alexander Bell Drive, Reston, VA 20191 (www.asce.org)

ASME B30.2, Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)
ASME B30.10, Hooks
ASME B30.20, Below-the-Hook Lifting Devices
ASME BTH-1, Design of Below-the-Hook Lifting Devices
ASME NOG-1, Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)
ASME NQA-1, Quality Assurance Requirements for Nuclear Facility Applications
ASME NUM-1, Rules for Construction of Cranes, Monorails, and Hoists (With Bridge or Trolley or Hoist of the Underhung Type)
Publisher: The American Society for Mechanical Engineers, Two Park Avenue, New York, NY 10016 (www.asme.org)

ASNT CP-189, Qualification and Certification of Nondestructive Testing Personnel
ASNT SNT-TC-1A, 2011, Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing
Publisher: American Society for Nondestructive Testing (ASNT), 1711 Arlingate Lane, P.O. Box 28518, Columbus, OH 43228 (www.asnt.org)

AWS D1.1/D1.1M:2010, Structural Welding Code — Steel
AWS D1.2/D1.2M:2003, Structural Welding Code — Aluminum
AWS D1.6/D1.6M:2007, Structural Welding Code — Stainless Steel
AWS D14.1/D14.1M:2005, Specification for Welding of Industrial and Mill Cranes and Other Material Handling Equipment
Publisher: American Welding Society (AWS), 8669 NW 36 Street, No. 130, Miami, FL 33166 (www.aws.org)

CMAA Specification No. 70, Specifications for Top Running Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes
CMAA Specification No. 74, Specifications for Top Running and Under Running Single Girder Electric Overhead Traveling Cranes Utilizing Under Running Trolley Hoist
Publisher: Crane Manufacturers Association of America, Inc. (CMAA), 8720 Red Oak Boulevard, Charlotte, NC 28217 (www.mhi.org/cmaa)

ISO 9712, Non-destructive testing — Qualification and certification of NDT personnel
Publisher: International Organization for Standardization (ISO), Central Secretariat, Chemin de Blandonnet 8, Case Postale 401, 1214 Vernier, Geneva, Switzerland (www.iso.org)

NFPA 70-2011, National Electric Code (NEC)
Publisher: National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169 (www.nfpa.org)

Timber Construction Manual

Publisher: American Institute of Timber Construction (AITC), 7012 S. Revere Parkway, Suite 140, Centennial, CO 80112 (www.aitc-glulam.org)

2 GENERAL REQUIREMENTS

Use of permanent facility handling equipment for construction load handling is permitted only if authorized by the facility owner and conducted in accordance with the owner's requirements. If load-handling equipment is used during construction, when temporary use is completed, conditions of temporary use shall be evaluated to verify that the load-handling equipment continues to satisfy the specified requirements for its permanent intended use; the evaluation shall include an estimate of the number of load cycles. After construction use and prior to release for permanent operations, the permanent facility handling equipment shall be restored to its design configuration, and the facility handling equipment used for construction load handling shall be inspected and tested as specified in a procedure. The total load cycles used during construction shall be included in the fatigue evaluations for the permanent facility handling equipment.

The provisions of this Standard may be used for other than construction activities, including modifications and construction activities at operating facilities, when specified in contract documents.

Where this Standard references the use of consensus standards, they shall include the applicable requirements of the ASME B30 safety standards; ASME BTH-1, ASME NOG-1, and ASME NUM-1, or CMAA 70 and CMAA 74; and ANSI/ASSE A10.5.

2.1 Planning and Procedures

Planning, procedures, and instructions shall contain details such as weights, sling locations, center of gravity, ground (or floor) and support loading, methods of attachment, operating speeds, environmental conditions, and other pertinent features to be considered as necessary for safe handling. Planning shall provide for compliance with applicable federal, state, and local regulations.

2.2 Classification of Items Handled

The requirements for activities are based on classifying the items into three categories according to their important physical characteristics. It is recognized that within the scope of each category there may be a range of controls, and that the need for, and extent of, detailed handling requirements for an item is dependent on the importance of the item to safe, reliable operation of the facility and the complexity of the operation. Pertinent manufacturer's requirements shall be considered when classifying the items. Items for which handling activities are covered by this Standard shall be classified into one of the three categories described in paras. 2.2.1 through 2.2.3. An item shall not be reclassified to a lower status without approval by the responsible organization that assigned the original category.

2.2.1 Category A. Items classified in Category A are those that require specially selected equipment [not necessarily limited to special designed equipment (see para. 3.3)] and detailed procedures for handling operations because of large size and weight or potential for damage or safety hazard if mishandled. Items that may be assigned to this category include the following:

(a) reactor vessels
(b) steam generators
(c) major components of reactor vessel internals
(d) primary system pressurizers
(e) spent fuel casks
(f) subassemblies requiring specially selected equipment
(g) lifts over safety-related structures, systems, and components
(h) major turbine generator components

2.2.2 Category B. Items classified in Category B are those that shall be handled with conventional handling equipment but that require detailed procedures because of susceptibility to damage. Items that may be assigned to this category include the following:

(a) reactor vessel head
(b) primary and intermediate coolant pumps and their internals
(c) designated instrument cabinets and control boards
(d) control rod drive mechanisms
(e) helium circulators
(f) fuel-handling equipment
(g) purification equipment
(h) fuel
(i) core components (small)

2.2.3 Category C. Items classified in Category C are those that may be safely handled with conventional equipment using good rigging and handling practices as described in safety handbooks, consensus standards, and corporate or contractor standards designated for the job, and in compliance with regulations.

3 TYPES OF HANDLING EQUIPMENT

Equipment covered by this Standard can be divided into four general types, as defined in paras. 3.1 through 3.4.

3.1 Standard Manufactured Components

A standard manufactured component is normally a catalog item available from several sources. This equipment is generally kept in stock and may be used as a

component of a handling system. Examples of standard manufactured components include the following:

(a) chains and chain accessories such as hooks, shackles, swivels, eyebolts, and links

(b) slings and sling accessories (shackles, swivels, sling protectors, etc.)

(c) hooks such as link or eye type, single, and sister

(d) transporting devices such as casters, rollers, and wheels

(e) wire rope and wire-rope accessories such as blocks, clamps, sockets, thimbles, and turnbuckles

3.2 Commercial Standard Handling Equipment

Commercial standard handling equipment is equipment available as standard models or catalog items (not designed for a specific load-handling application). Examples of commercial standard handling equipment include the following:

(a) gantry, mobile, overhead, and jib cranes

(b) derricks

(c) hoists, winches, and trolleys

(d) jacks and jacking systems, including hydraulic gantries

(e) forklift trucks, railcars, tractors, trailers, and transporters

(f) elements of commercial standard design equipment, such as booms, masts, guys, and struts

(g) below-the-hook lifting devices, including standard lift beams and standard spreader beams

3.3 Special Designed Equipment

Special designed equipment is designed and built to specifications for a particular application, or is equipment for which no consensus standard exists. It may incorporate standard manufactured components and commercial standard designed equipment, or may include a combination of nonstandard and standard components. Examples of special designed equipment include the following:

(a) special gin poles, derricks, and jacking towers

(b) special crane supports such as runways, columns, and frames

(c) rigging devices such as spreader beams, strong backs, up-end and down-end devices, bolsters, and yokes

(d) transporting systems such as dollies, special railcars, and transporters

(e) special overhead, gantry, or jib cranes

(f) special hoists and trolleys, including those utilizing strand jacks

(g) special below-the-hook lifting devices

3.4 Permanent Facility Handling Equipment

Permanent facility handling equipment is intended primarily for maintenance and operation of the nuclear facilities but may also be used for construction. It may incorporate standard manufactured components as defined in para. 3.1, commercial standard handling equipment as defined in para. 3.2, or special designed equipment as defined in para. 3.3. Examples of permanent facility handling equipment include the following:

(a) fuel-handling equipment

(b) turbine-component-handling equipment

(c) overhead, gantry, and jib cranes, and permanently installed monorails and hoists

4 DESIGN REQUIREMENTS

4.1 General

This section describes design criteria that are appropriate for most applications covered by this Standard and that are recommended for general use. If these criteria are not appropriate for a specific application, the engineer responsible shall select and document the justification for appropriate criteria. Load-handling equipment shall comply with all applicable standards. If other applicable standards are more stringent than this Standard, the more stringent shall govern.

Hoisting, rigging, and transporting equipment that is to be used exclusively during the facility construction phase shall be designed in accordance with paras. 4.2 through 4.4 or, alternatively, in accordance with accepted industry or consensus standards applicable to the type of handling equipment used.

The organization responsible for the design shall establish a program for ensuring that the handling equipment conforms to the design requirements of the applicable portions of this Standard.

4.2 Standard Manufactured Components

The standard manufactured components selected shall be structurally, mechanically, and electrically capable of safely performing the intended operations. They shall be designed to conform to accepted industry standards.

4.3 Commercial Standard Handling Equipment

The commercial standard handling equipment selected shall be structurally, mechanically, and electrically capable of safely performing the intended operations. The design shall conform to accepted industry standards and appropriate consensus standards.

4.4 Special Designed Equipment

Special designed equipment shall be structurally, mechanically, and electrically designed to safely perform the intended operations. Standard manufactured components or commercial standard handling equipment, or elements thereof, incorporated into the final system shall meet the requirements of paras. 4.2 and 4.3.

4.4.1 Structural Design of Equipment. Structural design of the equipment, except as noted in (a) through (j), shall be in accordance, as applicable, with the latest accepted editions of ACI 318, AISC 325, and the AITC Timber Construction Manual.

(a) Equipment components shall be designed for the appropriate combination of vertical and horizontal loads.

(b) The effects of seismic activity need not be included in combination with lifting or transporting operations during construction. For handling operations at an operating nuclear facility, seismic activity shall be considered if specified by the owner.

(c) Winds in excess of 50 mph (80.5 km/h) normally need not be considered in combination with lifting or transporting operations as these operations are normally suspended before winds exceed 50 mph (80.5 km/h). If historical wind data indicate the likelihood of operations occurring during winds greater than 50 mph (80.5 km/h), such data shall be used as the basis of design. ASCE/SEI 7 shall be used to determine appropriate wind loads. If these forces have not been considered in design, lifting and transporting activities shall be suspended before winds reach 50 mph (80.5 km/h).

(d) Special designed equipment normally is designed for a limited number of operations. Fatigue factors shall be included where applicable.

(e) Vertical impact shall be considered in the design, and selection of loads shall be supported by analysis. In no case shall vertical impact load be less than 10% of maximum handled load, excluding test load.

(f) Longitudinal and transverse horizontal forces shall be determined by the maximum acceleration or deceleration that can be delivered by the complete hoisting or transporting system, the maximum grades or slide slopes encountered, maximum out-of-plumb lift, wind, and similar loads. In no case shall longitudinal or transverse horizontal forces be less than 2% of maximum handled load.

(g) For the entire system considered as a whole, the ratio of failure stress to calculated stress shall be no less than 1.67 for ductile steels and similar materials that demonstrate a distinct yield point, but never less than 2.5 when compared with the ultimate stress. This minimum ratio shall exist after considering such factors as unequal load distribution, stability, slenderness ratios, and joint efficiencies.

(h) Calculated stress developed by handling the combination of dynamic test load and vertical impact, plus longitudinal or transverse horizontal loads, if applicable, shall not exceed 133% of allowable stress.

(i) Nondestructive examinations to be performed during manufacture and the acceptance criteria for these examinations shall be specified by the responsible design organization. Particular attention shall be given to lamellar tearing, highly restrained connections, and welds joining load-carrying members.

(j) Guys and guyed systems, such as column-supported girders with traveling hoists, gallows, frames, guyed derricks, and similar equipment, shall be designed to provide system stability and restraint by maintenance columns, poles, or masts in the desired position and within desired tolerances, and by providing capability to resist forces caused by handling operations, impact, wind, opposing guys, eccentricity, and similar causes.

(k) The design shall consider the following, as a minimum:

(1) handled load
(2) height of column and column capability
(3) slope of the guys
(4) load sharing of multiple guyed systems
(5) pre-tension requirements
(6) physical characteristics of wire rope, such as area, modulus of elasticity, and spring constant
(7) footing and anchorage adequacy
(8) secondary loads caused by stretch of guys
(9) safety factors
(10) end connections
(11) nil-ductility transition temperatures

Design criteria shall be selected by the organization responsible for the design.

4.4.2 Mechanical Design of Equipment. The following special conditions apply to the mechanical design of the equipment:

(a) Special designed equipment normally is designed for a single operation, or for a limited number of operations. Life, durability, and fatigue factors shall be included where applicable.

(b) Gearing shall be designed by use of AGMA formulas, or equivalent formulas, for strength only.

(c) Each independent wire-rope or chain-and-sprocket hoisting unit shall have at least one holding brake. At the place where the brake is applied, the minimum static torque rating shall be 150% of the torque required to hold the maximum load to be handled, excluding the test load.

(d) Engines, gearboxes, torque converters, couplings, hydraulic jacks, pumps, valves, fittings, lines, and similar components used for hoisting operations shall be designed in conformance with the consensus standard and shall be sized to

(1) handle load, excluding test load, within the manufacturer's rated capacity
(2) operate continuously during the specified duty cycle
(3) safely resist maximum loads imposed by emergency braking

(e) Hydraulic circuit design shall take into consideration the need for design features that minimize possibilities of unexpected lowering of loads.

(f) Engines, electric motors, brakes, gearboxes, cylinders, bearing housings, and similar components that support any part of the load shall be secured to the

main structure in such a way that the entire system, including components, meets structural requirements to adequately support the load.

(g) Rigidity of machinery base, shafts, and similar components shall be adequate to permit proper functioning of the equipment under operating conditions.

4.4.3 Electrical Design of Equipment. The following conditions apply to the electrical design of the equipment:

(a) Electrical systems and components shall be designed in conformance with the NFPA NEC and other applicable accepted industry or consensus standards and shall be sized to

(1) handle the maximum load, excluding test load, within the manufacturer's rated capacity

(2) be suitable for the specified operating cycles and duty cycles

(3) be compatible with mechanical requirements for brakes in accordance with paras. 4.4.2(c) and 4.4.2(d)

(b) Electrical circuits shall contain provisions for protection of personnel, including grounding and arc flash, in accordance with applicable codes.

(c) Electrical circuits and components shall be designed to fail safe (i.e., motors stop and brakes set) upon loss of electrical power to minimize possibilities of unexpected lowering of load.

4.5 Permanent Facility Handling Equipment

Permanent facility handling equipment shall be designed in accordance with industry consensus standards such as ASME BTH-1, ASME NOG-1, and ASME NUM-1.

5 ACCEPTANCE CRITERIA FOR MANUFACTURED HANDLING EQUIPMENT

5.1 General

This section contains the requirements for manufacture and acceptance of the construction equipment, structures, and accessories used in the handling of nuclear facility items.

5.2 Standard Manufactured Components

Standard manufactured components shall be manufactured and accepted in accordance with available industry standards and applicable consensus standards.

5.3 Commercial Standard Handling Equipment

Commercial standard handling equipment shall be manufactured and accepted in accordance with available industry standards and applicable consensus standards.

5.4 Special Designed Equipment

Special designed equipment shall conform to the criteria listed in paras. 5.4.1 and 5.4.2.

5.4.1 Existing Equipment. Acceptance of existing equipment shall be based upon one of the following criteria:

(a) historical data showing satisfactory performance in handling loads that are within the design capability and equal to or greater than the intended loads. This history should include records of test, inspections, and maintenance performed on the equipment, along with the record of actual handling operations.

(b) a load test in accordance with section 6.

(c) recognition of capability by an engineer or other qualified materials-handling individual when the equipment is handling Category C items only.

5.4.2 New Equipment and Modifications to Existing Equipment. Acceptance criteria for new equipment and modifications to existing equipment shall conform to the following requirements:

(a) The equipment shall have been designed in accordance with section 4.

(b) Standard manufactured components or commercial standard design equipment incorporated in the total system shall meet the requirements of para. 5.2 or 5.3, respectively.

(c) Structural steel elements shall be fabricated and erected in accordance with the latest edition of AISC 303. The following additional criteria shall be met:

(1) Principal load-carrying members shall be designated by the design organization responsible for the design or the application, or both, of the equipment. Materials of principal load-carrying members shall meet any one of the following three qualifications:

(-a) record of meeting the minimum mechanical properties as documented by certified material test reports

(-b) mechanical test report of a sample of the material showing adequate mechanical properties (This may be made by the manufacturer or a testing laboratory.)

(-c) conservatism of design, documented by engineer's calculations [This option is acceptable only when an emergency situation exists, when last-minute changes have proved necessary by field conditions, and when options specified in (-a) and (-b) above are not available.]

(2) Structural welds shall be made by qualified welders using qualified procedures in accordance with the applicable requirements of AWS D1.1/D1.1M.

(3) Welds joining principal load-carrying members shall be inspected as described in section 6.

(4) Structural elements of material other than steel shall be constructed in accordance with applicable consensus or accepted industry standards.

(d) Operational tests of the entire system shall be conducted in accordance with section 6.

(e) Recognition of capability by an engineer or other qualified materials-handling individual shall suffice in lieu of (a), (c)(1), and (d) above when the equipment is handling Category C items only.

6 TESTING, INSPECTION, AND MAINTENANCE

6.1 General

This section defines the technical requirements for testing, inspection, and maintenance to ensure that the equipment will perform as required for the safe handling of items at nuclear facilities. This Standard provides the design requirements for equipment, and ASME NQA-1 defines the programmatic quality assurance requirements for testing and inspection activities at nuclear facilities.

6.2 Testing

A test program shall be established to demonstrate that the handling component or equipment will perform satisfactorily in service. Testing may involve operational- or load-type tests, or a combination of the two. Operational-type tests ensure structural and mechanical capability. Test loads shall normally be handled at the same speeds and rates of acceleration (deceleration) as planned for the intended item. When dynamic test loads greater than 100% are designated, the rates of acceleration (deceleration) may be adjusted as long as the impact load does not exceed the maximum designed impact load. The combination of load and rate of acceleration (deceleration) shall not be lower than 100% dynamic load test. In addition, requirements specified in paras. 6.2.1 through 6.2.4 shall apply.

6.2.1 Standard Manufactured Components. One of the following shall satisfy the requirements for testing of standard manufactured components:

(a) tests as required by accepted industry standards or applicable consensus standard

(b) actual proof load tests by the manufacturer

(c) dynamic load tests as part of the system being tested to 110% of the maximum load to be handled

6.2.2 Commercial Standard Handling Equipment. One of the following shall satisfy the requirements for testing of commercial standard handling equipment:

(a) tests as required by accepted industry standards or applicable consensus standard

(b) a dynamic load test equal to 110% of the maximum load to be handled

6.2.3 Special Designed Equipment. Requirements for testing of special designed equipment shall be as follows:

(a) An operational test shall be performed. This test shall be over the portion of the motions applicable to the handling system tested.

(b) In addition to the required industry or consensus standard testing, a dynamic load test equal to 110% of the maximum load to be handled by the complete system shall be performed, except that documented proof of equivalent handling ability as described in para. 5.4.1(a) may be substituted. Transport equipment tests shall demonstrate adequacy of braking, drawbar pull, stability, and other similar factors. Testing shall take place with equipment in the location where it will be used for actual handling of the item, except that in cases in which the test would interfere with or needlessly endanger an existing item or the item to be lifted, testing may be conducted at another location, on or near the construction site. Where practical and useful, load tests shall be applied over the entire range of motions required for the actual handling of the item, with the following exceptions:

(1) Spreader bars, jacks, slings, or similar items whose loading is independent of travel may be tested in test fixtures at locations other than the construction site.

(2) Transporting vehicles need not be tested over the entire length of travel.

During subsequent use, the testing, inspection, and maintenance shall be performed as specified by other standards.

6.2.4 Rerated Equipment. For special lifts, hoisting equipment may be rerated, or modified and rerated, upon approval by the manufacturer, or, if the manufacturer's specifications are not available, the limitations assigned to the equipment shall be based on the determinations of a qualified engineer competent in this field and such determination shall be documented and recorded appropriately.

Rerated equipment shall be given a dynamic load test over the full range of the lift using a test weight equal to at least 110% of the lift weight. A dynamic test includes raising, lowering, and traversing the load, in contrast to a static test, in which the test weight may be increased incrementally with no movement.

6.3 Inspections

Handling equipment shall be subjected to periodic in-service inspections in accordance with applicable industry standards.

6.4 Maintenance

A maintenance program shall be implemented to ensure the handling equipment is maintained in operating condition. Inspections specified in para. 6.3 shall be performed and documented.