The American Society of Mechanical Engineers

PERFORMANCE STANDARD FOR AIR CHAIN HOISTS

AN AMERICAN NATIONAL STANDARD

REAFFIRMED 2004

FOR CURRENT COMMITTEE PERSONNEL
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ASME HST-5-1999
[Revision of ASME HST-5M-1991 (R1996)]

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FOREWORD

This Standard is one in a series that provide performance requirements for hoists and was originally issued in 1985. It was developed by the ASME Standards Committee HST, Hoists — Overhead. It is intended to serve as a guide to manufacturers of the equipment, and to the purchasers and users of the equipment.

Standards in this series are:

HST-1 Electric Chain Hoists
HST-2 Hand Chain Manually Operated Chain Hoists
HST-3 Manually Lever Operated Chain Hoists
HST-4 Electric Wire Rope Hoists
HST-5 Air Chain Hoists
HST-6 Air Wire Rope Hoists

This revision adds a new appendix that, in conjunction with ASME HST-5, is intended to replace MIL-H-2813 and MIL-H-24591.

Suggestions for improvement of this Standard are welcome. They should be sent to The American Society of Mechanical Engineers; Attn: Secretary, HST Committee, Three Park Avenue, New York, NY 10016-5990.

This Standard was approved as an American National Standard on July 12, 1999.

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Hoists — Overhead

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PERFORMANCE STANDARD FOR AIR CHAIN HOISTS

1 GENERAL

1.1 Scope

(a) This Standard establishes performance requirements for air powered chain hoists for vertical lifting service involving material handling of freely suspended (unguided) loads using load chain of the roller or welded link types with one of the following types of suspension:

(1) lug;

(2) hook or clevis;

(3) trolley.

(b) This Standard is applicable to hoists manufactured after the date on which this Standard is issued. It is not applicable to:

(1) damaged or malfunctioning hoists;

(2) hoists that have been misused or abused;

(3) hoists that have been altered without authorization of the manufacturer or a qualified person;

(4) hoists used for lifting or supporting people;

(5) hoists used for the purpose of drawing both the load and the hoist up or down the hoist's own load chain(s); or

(6) hoists used for marine and other applications as required by the Department of Defense (DOD).

1.2 The Appendix

Nonmandatory Appendix A, Performance Requirements for Air Chain Hoists Used in Marine and Other Applications as Required by the U.S. Department of Defense (DOD), applies to the performance requirements for hoists used in marine and other applications. The requirements stated in Appendix A are in addition to the requirements of ASME HST-5-1999 and shall be specifically invoked.

1.3 Reference Standards

The following documents form a part of this Standard to the extent specified herein. The latest issue shall apply.

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Publisher: National Electrical Manufacturers Association (NEMA), 1300 North 17th Street, Rosslyn, VA 22209

ANSI/NFPA 70, National Electrical Code

Publisher: National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02269-9101

ASME B29.1M, Precision Power Transmission Roller Chains, Attachments, and Sprockets

ASME B30.9, Slings

ASME B30.10, Hooks

ASME B30.11, Monorails and Underhung Cranes

ASME B30.16, Overhead Hoists (Underhung)

ASME B30.17, Overhead and Gantry Cranes (Top Running Bridge, Single Girder, and Underhung Hoist)

Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, Box 2900, Fairfield, NJ 07007-2900

1.4 Definitions

abnormal operating conditions: environmental conditions that are unfavorable, harmful, or detrimental to or for the operation of a hoist, such as excessively high or low ambient temperatures, exposure to weather, corrosive fumes, dust laden or moisture laden atmospheres, and hazardous locations.

ambient temperature: the temperature of the atmosphere surrounding the hoist.

beam: an overhead standard structural or specially fabricated shape on which the trolley operates.

brake: a device, other than a motor, used for retarding or stopping hoist or trolley motion by friction or power means.

Class 1 locations: locations in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures.

Class 2 locations: locations that are hazardous because of the presence of combustible dust.

Class 3 locations: locations that are hazardous because of the presence of easily ignitable fibers or flyings,

Product Safety Signs and Labels

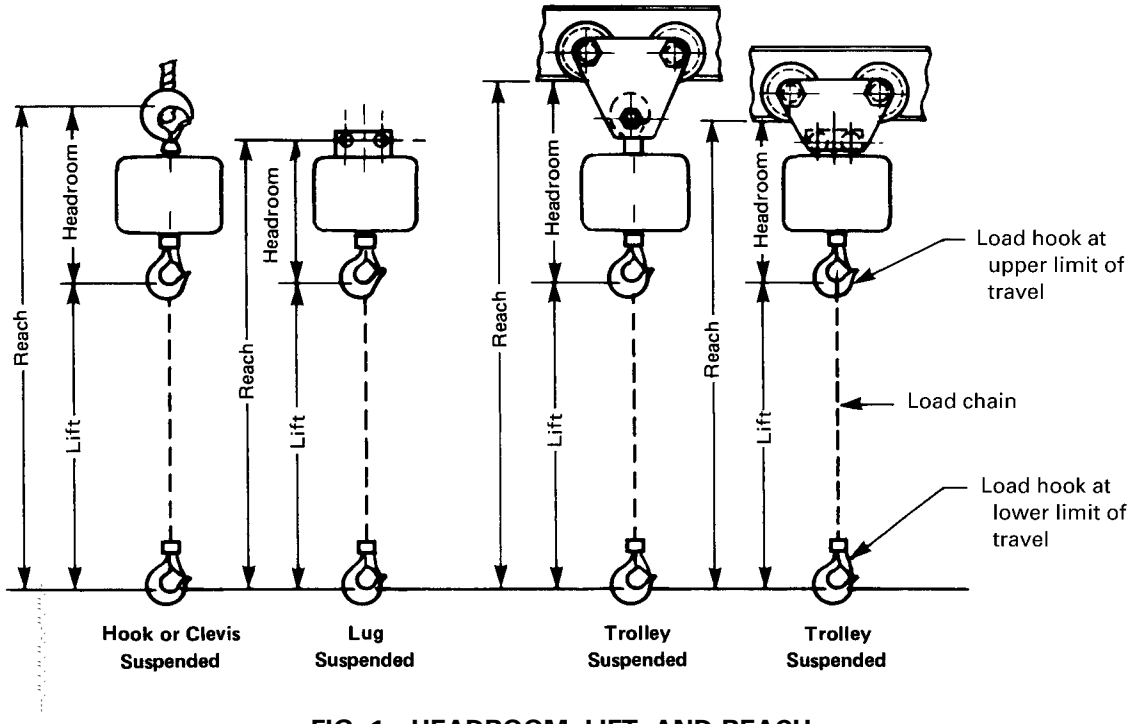

FIG. 1 HEADROOM, LIFT, AND REACH

but in which such fibers or flyings are not likely to be in suspension in the air in quantities sufficient to produce ignitable mixtures.

control: a manual means at the operator station by which hoist or trolley controls are energized.

control braking means: a method of controlling speed by removing energy from the moving body or by imparting energy in the opposite direction.

dynamic: a method of controlling speed by using the motor as a compressor.

hand chain: the chain provided to control movement of a hand chain operated trolley.

hazardous (classified) location: location where fire or explosion hazards may exist. Locations are classified depending on the properties of the flammable vapors, liquids, or gases, or combustible dusts or fibers that may be present, and the likelihood that a flammable or combustible concentration or quantity is present (refer to ANSI/NFPA 70).

headroom: (see Fig. 1) measured with the load hook at its upper limit of travel. Headroom is the distance from the saddle of the load hook to the following locations:

(a) top hook on suspended hoist;

(b) center line of the suspension holes on lug suspended hoists;

(c) bottom of the beam on trolley suspended hoists.

hoist: a suspended machinery unit that is used for lifting or lowering a freely suspended (unguided) load.

hoist speed: the rate of motion of the load hook.

holding brake: a friction brake for a hoist that is automatically applied and prevents motion when the air supply is interrupted.

hook-suspended: suspension of the hoist from a trolley or rigid structure by means of a hook(s) at the top of the hoist.

idler sprocket: a freely rotating device that changes the direction of the load chain; this device is sometimes called idler wheel, idler sheave, pocket wheel, or chain wheel (see Fig. 2).

lift: the maximum vertical distance through which the load hook can travel, and is the total hook movement between its upper limit of travel and its position when at the lower limit of travel (see Fig. 1).

lifting devices: devices that are not normally reeved onto the hoist ropes, such as hook-on-buckets, magnets, grabs, and other supplemental devices used for handling

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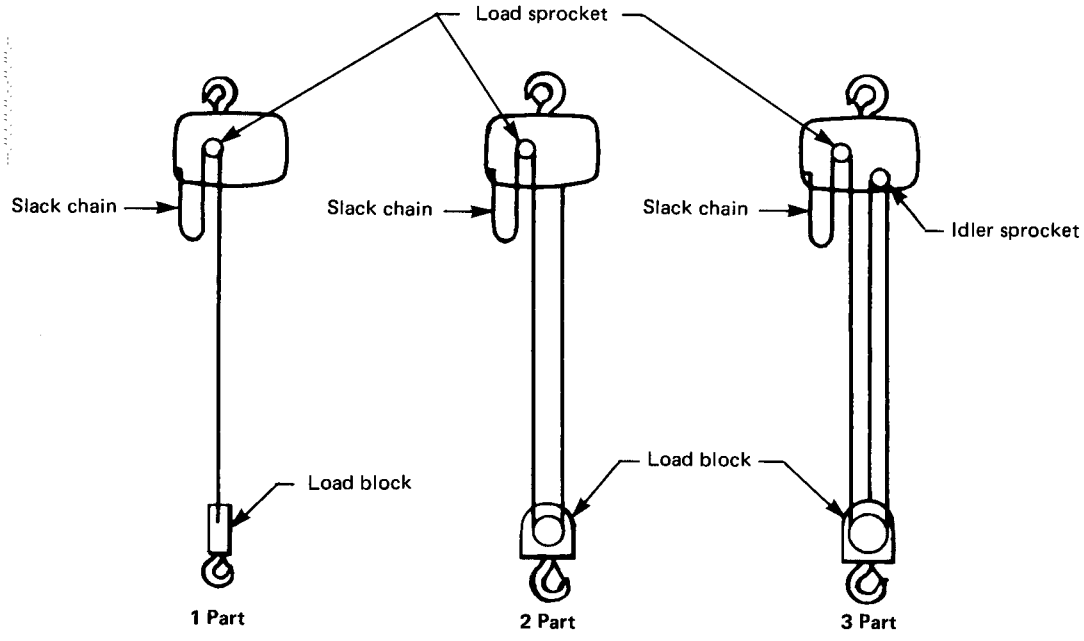

FIG. 2 REEVING

certain types of loads; the weight of these devices is to be considered part of the load to be lifted.

lift limiting device: a pneumatic, mechanical device for limiting the upward or downward travel of the load hook at the extremities of lift; this device may limit lift at any point within the extremities of lift, if designed to be adjustable.

load: the total imposed weight on the load block or load hook including lifting devices.

load block: the assembly of hook or shackle, swivel, bearing, pins, sprocket, and frame suspended by the load chain; this shall include all appurtenances reeved in the load chain.

load chain: the load suspension chain in the hoist.

load hook: the hook used to connect the load to the hoist.

load sprocket: a hoist component that transmits motion to the load chain; this component is sometimes called load wheel, load sheave, pocket wheel, chain wheel, or lift wheel (see Fig. 2).

load suspension parts: the parts providing the means of suspension (trolley, hook, or lug), the chain, the sprocket(s), the structure or housing that supports the load block.

lug-suspended: suspension of the hoist from a trolley or permanent structure by means of bolt(s) or pin(s) through a rigid or swivel type lug.

mechanical braking means: a method of controlling or reducing speed by friction.

mechanical load brake: an automatic type of friction brake used for controlling loads in a lowering direction; this unidirectional device requires torque from the motor to lower a load, but does not impose additional load on the motor when lifting a load.

minimum radius: the smallest radius of the beam, measured to the center line of the web of the beam, on which the trolley will operate.

normal operating conditions: conditions during which a hoist is performing functions within the scope of the original design.

overload: any load greater than the rated load.

parts (lines): number of lines of chain supporting the load block or hook.

pendant control: a valve system, connected to the hoist or trolley by hoses, which either directly controls flow of air to the motor, or controls a pilot-operated valve system at the motor inlet.

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power transmission parts: the parts of the hoist consisting of the machinery components, including the gears, shafts, couplings, clutches, bearings, motors, and brakes.

pull control: cords or chains suspended from the hoist, by means of which a valve system on the hoist can be operated.

qualified person: a person who, by possession of a recognized degree or certificate of professional standing, or who, by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work.

rated air pressure: the air pressure, at the hoist inlet, at which the hoist is designed to lift rated load at rated speed.

rated load: the maximum load for which a hoist or trolley is designated by the manufacturer.

reach: the distance from the saddle of the load hook at its lower limit of lift to the upper point of the headroom measurement; reach is equal to lift plus headroom (see Fig. 1).

reeving: a system in which a chain travels around sprockets (see Fig. 2).

rod control: a rigid rod suspended from the hoist, with which a valve system on the hoist can be operated.

roller chain: a series of alternately assembled pin links and roller links in which the pins articulate inside the bushings and the rollers are free to turn on the bushings; pins and bushings are press fit in their respective link plates.

NOTE: Load chain properties do not conform to those shown in ASME B29.1M, Precision Power Transmission Roller Chains, Attachments, and Sprockets.

shall: use of the word *shall* indicates that adherence to the particular requirement is necessary in order to conform to the Standard.

should: use of the word *should* indicates that the rule is a recommendation, the advisability of which depends upon the facts in each situation.

trolley: a wheeled mechanism from which a hoist is suspended to provide horizontal motion of the hoist

trolley speed (rated): the rate of motion that a motor operated trolley (and hoist) attains while traveling along a beam.

trolley-suspended: suspension of hoist from a trolley; the hoist can be connected to trolley by hook, clevis, or lug suspension, or the hoist can be integral with trolley.

valve: a device for starting, stopping, or changing the flow in a pneumatic circuit.

welded link chain: a chain consisting of a series of interwoven links formed and welded.

NOTE: Hand chain and load chain properties do not conform to those shown in ASME B30.9.

2 PERFORMANCE

2.1 General

All equipment selected in accordance with this Standard is designed to perform satisfactorily when installed in accordance with para. 4.4, used in accordance with para. 4.5, and used within the rated load and hoist duty service classification. All equipment shall provide speeds, lifts, and headroom in accordance with the manufacturer's specifications, or to specifications agreed upon by the manufacturer and user.

2.2 Hoist Duty Service Classification

2.2.1 General Considerations. Service conditions have an important influence on the performance of wearing parts of a hoist such as gears, bearings, load chain, sprockets, brake linings, load and lift limit devices, wheels, and pneumatic components. Careful consideration of the hoist duty service classifications described in this Section will enable the user to evaluate the application and to obtain a hoist designed for optimum performance and minimum maintenance. If doubt exists regarding hoist selection, the hoist supplier should be consulted. Many factors enter into the selection of the proper hoist to perform a given function. Hoisting equipment consists of both mechanical and pneumatic components and both must be considered when analyzing the service the hoist must perform. The factors that influence the performance of any hoist include:

(a) Load Distribution. The actual distribution or proportion of full and partial loads to be handled by the equipment, including lifting devices;

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TABLE 1 AIR CHAIN HOIST DUTY SERVICE CLASSIFICATION

Hoist Duty Class	Description
A4	Loads normally less than 50% of rated load with running time up to continuous; or Loads normally above 50% of rated load with running time up to 50% of work period
A5	Loads normally above 50% of rated load with running time above 50% of work period

(b) Operational Time. The total running time of the hoist per hour or per work period;

(c) Repetitive Long Lowering Operations. Such operations generate heat in mechanical load brake;

(d) Environmental Conditions. Examples are high or low ambient temperatures, dust, moisture, corrosive fumes, etc.

2.2.2 Hazardous Locations. When hoists are used in hazardous locations as defined by ANSI/NFPA 70 or other special codes, modifications or additional precautions not covered by this Standard may be required. In these locations, only hoists designed in a manner suitable for the conditions encountered shall be used.

2.2.3 Duty Classification. While all the factors listed in para. 2.2.1 must be considered in selecting the proper class of hoist, most industrial applications can be generalized according to the percentage of rated load normally handled and the running time. Listed in Table 1 are the two duty classes that have been established for air powered chain hoists. The majority of hoist applications will fall into the A4 category.

2.3 Specifications of Lift, Headroom, and Reach

2.3.1 Lift. Most air chain hoists are manufactured with standard lifts of 10 ft, 15 ft, and 20 ft (3.3 m, 4.9 m, and 6.6 m). One of these standard lifts will normally be adequate for the particular requirement. It is recommended that the purchaser specify the required lift in the inquiry or bid request.

2.3.2 Headroom. Headroom should be specified if important to the application.

2.3.3 Reach. Reach should be specified if important to the application.

2.4 Hoist and Trolley Speeds

Hoisting equipment is available over a wide range of hoist and trolley speeds. Listed in Table 2 are typical speed ranges commonly available.

2.5 Types of Trolleys

Hoist trolleys are available in plain, hand chain operated, and motor driven types. Selection of each type depends upon the application.

2.5.1 Plain Type. This type is recommended where trolley motion is infrequent or relatively short. Due to the required force to manually operate this type of trolley, it is also recommended that the use of plain trolleys be limited to a maximum load of 3 tons or 3,000 kg with the elevation of the beam not more than 20 ft (6 m) above the operator's floor level.

2.5.2 Hand Chain Operated. This type is recommended where trolley motion is relatively infrequent or short and for those loads and beam heights where a plain-type trolley would be impractical. The hand chain operated trolley provides good load spotting ability obtained by pulling on the hand chain, which is connected to trolley wheels through gears or sprockets.

2.5.3 Motor Operated. This type is recommended where the operating frequency, distance of travel, or the type of load being handled would cause unsatisfactory operation if the trolley were the plain or hand chain operated type. Design of motor operated trolleys shall be based on operation on a straight beam, unless otherwise specified. Where trolley travel involves a curved beam, beam switches, or execptionally long runs, special design may be required, and full particulars should be provided with the inquiry.

3 MECHANICAL REQUIREMENTS

3.1 Design Stresses

(a) The hoist and the means of suspension supplied with the hoist shall be designed to withstand all stresses imposed under normal operating conditions while handling loads within the rated load.

(b) Load suspension parts shall be designed so that

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TABLE 2 TYPICAL HOIST AND MOTORIZED TROLLEY SPEEDS

Rated Load		Hoist Speed, ft/min (m/min) [Note (3)]	Motorized Trolley Speed, ft/min (m/min) [Note (3)]
Tons (kg) [Note (1)]	Tonnes (kg) [Note (2)]		
1/8 (114)	1/8 (125)	16–100 (5–30)	
1/4 (227)	1/4 (250)	7–100 (2–30)	30–100 (9–30)
1/2 (454)	1/2 (500)		
1 (909)	1 (1,000)		
1 1/2 (1,364)	1 1/2 (1,500)	4–40 (1–12)	
2 (1,818)	2 (2,000)		
3 (2,727)	3 (3,000)		
4 (3,636)	4 (4,000)	4–24 (2–7)	
5 (4,545) and over	5 (5,000) and over		

GENERAL NOTE:
Table 2 is to be used as a guide only and is not intended to restrict either the manufacturer or buyer from offering or specifying speeds outside the ranges shown, nor should it be inferred that speeds above or below the ranges shown are not compatible with the required class of hoist.

NOTES:
(1) Tons of 2,000 lb.
(2) Tonnes of 1,000 kg.
(3) Lifting and lowering speeds will vary depending on the percent of rated load. Inherently, lowering speeds are greater than lifting speeds. Refer to manufacturer's catalog.

the static stress calculated for the rated load shall not exceed 20% of the average ultimate material strength. Elements specially provided to give a visible warning of severe overload by structural deformation shall be designed so that the static stress calculated for the rated load shall not exceed 35% of the average ultimate strength.

(c) Power transmission parts shall be designed so that the dynamic stresses calculated for the rated load shall not exceed the fatigue and endurance limit established by the manufacturer.

(d) Modifications to upgrade or rerate hoist equipment shall be as authorized only by the original equipment manufacturer. If it is impossible or impractical to contact the manufacturer, the work shall be authorized by a qualified person. After such modifications are made, the hoist shall be tested in accordance with ASME B30.16.

3.2 Load Sprockets (Pocket Wheels)

(a) Load sprockets shall have pockets or teeth formed to fit the engagement of the load chain.

(b) Load sprockets shall be guarded to minimize entrance of foreign objects.

(c) Provision shall be made to guard against jamming of the load chain within the hoist mechanism.

3.3 Load Chain

(a) Load chain may be either roller or welded link type and shall be suitable for powered hoist service. Chain shall be accurately pitched and sized to pass over load sprockets without binding.

(b) Load chain shall be proof-tested by the chain manufacturer or hoist manufacturer with a load at least equivalent to 1 1/2 times the hoist rated load, divided by the number of chain parts (lines) supporting the load.

(c) If a load is supported by more than one part of the load chain, the tension of the parts (lines) shall be equalized.

3.4 Hooks

(a) If the hooks are of the swiveling type, they should be free to rotate. Load block hooks should be

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capable of rotating through 360 deg. when supporting the rated load.

(b) Hooks shall be equipped with latches unless the application makes use of the latch impractical. When required, a latch shall be provided to bridge the opening of the hook for the purpose of retaining slings, chains, etc., under slack conditions.

3.5 Load Blocks

Load blocks shall be of the enclosed type and shall guard against load chain jamming under normal operating conditions.

3.6 Hoist Brakes

(a) The braking system shall perform the following functions under normal operating conditions with rated load, and under test conditions with test loads up to 125% of rated load.

(1) Stop and hold the load when controls are released.

(2) Prevent an uncontrolled lowering of the load in the event of a loss of air pressure.

(b) The braking system shall have heat dissipation capability for the frequency of operation required by the hoist duty service classification.

(c) The braking system shall have provision for adjustment, where necessary, to compensate for wear.

3.7 Hand Chain (Hand Chain Operated Trolleys)

(a) The hand chain shall be guarded to prevent hand chain disengagement from the hand chain wheel.

(b) The hand chain shall withstand, without permanent distortion, a force of three times the pull required to traverse the trolley with rated load.

3.8 Overtravel Protection

A lift limiting device shall be provided so that the load hook, either loaded or empty, shall not exceed the upper limit of travel.

3.9 Overload Limiting Device

(a) An overload limiting device, when furnished, shall be designed to permit operation of the hoist within its rated load and to limit the amount of overload that can be lifted by a properly maintained hoist under normal operating conditions.

(b) The overload limiting device may allow the lifting of an overload, but shall be designed to prevent the lifting of an overload that could cause damage to a hoist. That does not imply that any overload is to be intentionally applied to the hoist.

(c) The overload limiting device is an emergency device and shall not be used to measure the maximum load to be lifted and shall not be used to sense the overload imposed by a constrained load.

3.10 Trolley

When a trolley is required for use with a hoist, the type and size of support beam must be specified to ensure that the trolley is suitable for the minimum radius and the contour of the beam.

3.11 Brakes for Motor Driven Trolleys

Trolley brakes, when specified, should be actuated by mechanical or pneumatic means and shall have the following characteristics.

(a) Brakes shall have sufficient capacity to stop the trolley within a distance in feet (meters) equal to 10% of the rated speed in feet (meters) per minute when traveling at rated speed with rated load.

(b) Brakes on trolleys shall have heat dissipation capability for the frequency of operation.

(c) Brakes shall have provision for adjustment, where necessary, to compensate for wear.

3.12 Control

Hoists and trolleys shall have pendant, pull, or rod control. Control actuators shall automatically return to the off position.

3.12.1 Pendant Control. The pendant control station shall be supported to protect the pneumatic hoses and connections against strain. The pendant control station shall be clearly marked to indicate the function of each actuator. Unless otherwise specified, the standard pendant control shall have a length that will locate the pendant approximately 3 ft to 5 ft (0.9 m to 1.5 m) above the lower limit of lift.

3.12.2 Pull Control. Pull control shall consist of two pull chains or cords with suitable handle(s) clearly marked for direction. Unless otherwise specified, the standard pull control shall have a length that will locate the control handles approximately 3 ft to 5 ft (0.9 m to 1.5 m) above the lower limit of the lift.

3.12.3 Rod Control. Rod control shall permit control of hoist or trolley motion by linear or rotary movement of the rod handle, or a combination of both.

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Rod handle shall be clearly marked for direction of motion. Unless otherwise specified, rod handle shall be located 3 ft to 5 ft (0.9 m to 1.5 m) above the lower limit of lift.

4 TESTING, MARKING, MANUALS, INSTALLATION, MAINTENANCE, AND OPERATING PROCEDURES

4.1 Testing of Hoists

All hoists shall be tested in accordance with ASME B30.16.

4.2 Marking (by Manufacturer)

4.2.1 Rated Load. The rated load of the hoist shall be marked on the hoist or load block.

4.2.2 Controls. Each control actuator shall be marked to indicate the direction of resultant motion.

4.2.3 Identification. The hoist shall be marked with the following information:

(a) name of the manufacturer;

(b) manufacturer's model or serial number;

(c) rated air pressure.

4.2.4 Warnings. All hoists shall have affixed to the hoist, load block, or controls in a readable position a label or labels displaying information concerning operating procedures. The label or labels shall be in compliance with ANSI Z535.4, and shall include cautionary language against:

(a) lifting more than rated load;

(b) operating hoist when load is not centered under hoist;

(c) operating hoist with twisted, kinked, or damaged chain or rope;

(d) operating damaged or malfunctioning hoist;

(e) lifting people or loads over people;

(f) operating a rope hoist with a rope that is not properly seated in its groove;

(g) removing or obscuring warning label.

4.3 Manual

(a) The manufacturer shall furnish with each hoist one copy of an instruction manual.

(b) The manual shall include information on the following:

(1) installation;

(2) operation;

(3) inspection and testing;

(4) lubrication, maintenance, and repair;

(5) air circuit diagram, when requested.

4.4 Installation (User's Responsibility)

4.4.1 Procedures. All equipment should be installed according to the manufacturer's recommendations and the applicable sections of ASME B30.16. The application may also involve portions of ASME B30.11 and ASME B30.17. Consideration should also be given to any other pertinent federal, state, or local regulations.

4.4.2 Support

(a) Supporting structures, including trolleys, monorails, or cranes, if any, shall be designed to withstand the loads and forces imposed by the hoist.

(b) Trolley stops shall be installed at the limits of trolley travel.

4.4.3 Location

(a) Hoists shall be operated only in locations that will permit the operator to be clear of the load at all times.

(b) When hoists are used in hazardous locations, as defined by ANSI/NFPA 70, modifications to these rules or additional safety requirements may be necessary. In these locations, hoists shall be designed and installed in a manner suitable for the conditions encountered.

(c) Control actuators should be located at a convenient level above the operating floor.

(d) Hoists shall not be installed where the load hook can be lowered beyond the lower limit of travel under normal operating conditions, unless the hoist is equipped with a lower limit device.

(e) Hoists should be connected to an air supply that will provide rated air pressure at the hoist when operating under normal conditions. To prevent excessive wear or heating of pneumatically released brakes, air pressure should always be sufficient to fully disengage brakes.

(f) Air pressure at the hoist should not exceed rated pressure when operating under normal conditions.

(g) Where the slack load chain hanging from the hoist may create a hazard to operations or personnel, a chain container of a design recommended by the hoist manufacturer should be used.

4.4.4 Checkpoints. After installation, the following items should be checked:

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(a) trolley wheels for proper spacing with respect to the beam flange;

(b) hoist hook motion and trolley motion for agreement with control direction indication and prompt return of actuators to off position;

(c) hoist load chain for freedom from twists, damage, and improper seating in sprockets;

(d) lift and travel limit devices for proper operation;

(e) braking system for proper operation;

(f) load chain for proper lubrication;

(g) hoist and trolley for proper lubrication;

(h) manufacturer's manual for additional checkpoints.

4.5 Maintenance and Operating Procedures (User's Responsibility)

All equipment should be inspected, tested, operated, and maintained according to the manufacturer's recommendations and the applicable sections of ASME B30.16, ASME B30.11, and ASME B30.17. Consideration should also be given to pertinent federal, state, and local regulations.

5 TYPICAL AIR CHAIN HOIST AND TROLLEY INQUIRY DATA

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TYPICAL AIR CHAIN HOIST AND TROLLEY INQUIRY DATA FORM

HOIST

Quantity required _____

Rated capacity _____ ton (_____ kg)

Lift[1] _____ ft (_____ m) Reach _____ ft (_____ m)

Headroom _____ in. (_____ mm)

Distance from operating floor to underside of beam or to support point:

_____ ft _____ in. (_____ m)

Hoisting speed _____ ft/min (_____ m/min)

Type of control:

☐ Pendant ☐ Pull ☐ Rod

☐ Other _____

Air supply pressure at hoist under normal operating conditions _____ psig

Performance Requirements (see Section 2):

Average lift _____ ft (_____ m)

Number of lifts per hour _____

Number of starts per hour _____

Shift hours per day _____

Hoist service classification A–_____

Furnish complete information regarding any abnormal operating conditions: _____

_____

Type of Suspension:

☐ Lug ☐ Hook ☐ Clevis

☐ Plain trolley ☐ Hand chain operated trolley

☐ Motor operated trolley ☐ Other _____

TROLLEY (see Section 2)

Travel speed _____ ft/min (_____ m/min)

☐ Trolley brake required

Type of control:

☐ Pendant ☐ Pull ☐ Rod

☐ Other _____

Type and size of beam _____

Width of running flange _____ in. (_____ mm)

Minimum radius of beam curves

_____ ft _____ in. (_____ m)

Clearance dimensions of interlocks, switches, or beam splices (if used): _____

_____

Muffler ☐ Yes ☐ No

OPTIONAL EQUIPMENT

_____

_____

_____

_____

[1] Refer to manufacturer's catalog for standard lift that will meet the application requirement.

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PERFORMANCE REQUIREMENTS FOR AIR CHAIN HOISTS USED IN MARINE AND OTHER APPLICATIONS AS REQUIRED BY THE U.S. DEPARTMENT OF DEFENSE (DOD)

A1 GENERAL

A1.1 Scope

This Appendix provides performance requirements beyond those cited in ASME HST-5-1999 for air wire rope hoists for use in marine and other applications as required by the Department of Defense (DOD).

This Appendix, in conjunction with ASME HST-5-1999, replaces the requirements of MIL-H-2813 and MIL-H-24591 for air chain hoists.

A1.2 Classification

Air chain hoists shall be of the following classes and types as specified [see para. A5.1(b)]:

A1.2.1 Classes

Class 1 Conventional weight, for general material handling

Class 2 Light weight, for general material handling

A1.2.2 Types

Type A Air chain hoist, hook suspension

Type B Air chain hoist, plain trolley suspension, hand operated

Type C Air chain hoist, geared trolley suspension, hand operated

Type D Air chain hoist, geared trolley suspension, air motor operated

Type E Air chain hoist, geared trolley suspension, low headroom, air motor Operated

A1.3 Definitions

brittle material: material showing less than 10% elongation in gage length for the tensile test specimen.

continuous operation: lifting and lowering through the full hoisting range a rated load at the specified lifting and lowering speeds.

excessive wear: wear that is sufficient to impair safe operation of the hoist.

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conditions define excessive wear:

(a) increase in chain wheel pocket dimension in excess of 10%;

(b) increase in clearance tolerance between shaft and bearing in excess of 15%;

(c) life-lubricated bearings requiring lubrication;

(d) load-brake lining reduced in excess of 50% of useful life;

(e) reduction of bar diameter of link chain in excess of 10%;

(f) reduction of wall thickness for rollers and pins of roller chain in excess of 10%;

(g) reduction in gear tooth thickness of reduction gear drive in excess of 10%.

mean time to repair: the average time it takes to fix a failed item. It is calculated by dividing the total corrective maintenance time by the total number of corrective maintenance actions during a specified measurement interval.

recovered materials: materials that have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials.

A1.4 References to Other Codes and Standards

Refer to the following publications, copies of which may be obtained from the publisher as indicated. The edition bearing the latest date of issue shall be used.

AGMA 6010, Standard for Spur, Helical, Herringbone, and Bevel Enclosed Drives

AGMA 6034, Practice for Enclosed Cylindrical Worm Gear Speed Reducers and Gear Motors

Publisher: American Gear Manufacturers Association (AGMA), 1500 King Street, Alexandria, VA 22314

ASTM A 48, Standard Specification for Gray Iron Castings (DOD adopted)

ASTM A 143, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement (DOD adopted)

ASTM B 26, Standard Specification for Aluminum-Alloy Sand Castings. (DOD adopted)
ASTM B 633, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel (DOD adopted)

Publisher: American Society for Testing and Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA 19428

MIL-E-917, Electric Power Equipment, Basic Requirements
MIL-S-901 Shock Tests, H.I. (High-Impact) Shipboard Machinery, Equipment, and Systems, Requirements for
MIL-STD-167-1, Mechanical Vibrations of Shipboard Equipment (Type I – Environmental and Type II – Internally Excited)
MIL-STD-740-1, Airborne Sound Measurements and Acceptance Criteria of Shipboard Equipment

Publisher: Department of Defense (DOD), Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094

A2 PERFORMANCE REQUIREMENTS

A2.1 General

Performance requirements shall be in accordance with ASME HST-5-1999, and as specified in this Appendix.

A2.2 Application

Metals susceptible to corrosion attack in a sea water environment shall be treated, plated, or painted to provide corrosion resistance. In order to minimize electrolytic corrosion between dissimilar metals in contact with each other, metal-to-metal contacts shall be limited to those metals which, when coupled, are in accordance with sea water corrosion of galvanic couples requirements of MIL-E-917. If a metal is coated or plated, the coating or plating metal rather than the base metal shall be considered in metal-to-metal contact between parts that depend upon coating or plating for corrosion resistance.

When specified [see para. A5.1(c)], hooks shall be zinc plated. Zinc plating shall be in accordance with ASTM B 633, Type II, Class Fe/Zn 12. The hook throat safety device shall be constructed of noncorrosive for corrosion resistance.

When specified [see para. A5.1(d)], the load chain shall be protected from corrosion by zinc plating in accordance with ASTM B 633, Type II, Class Fe/Zn 12.

The safeguarding against and procedure for detecting embrittlement of zinc coating shall be in accordance with ASTM A 143.

A2.3 Characteristics

A2.3.1 Type A, Air Chain Hoist, Hook Suspension. Type A hoists shall be in accordance with Table A1 and the requirements specified herein.

A2.3.2 Type B, Air Chain Hoist, Plain Trolley Suspension, Hand Operated and Type C, Air Chain Hoist, Geared Trolley Suspension, Hand Operated. Type B and Type C hoists shall be in accordance with Table A2 and the requirements specified herein. Trolley track size shall be as specified [see para. A5.1(e)].

A2.3.3 Type D, Air Chain Hoist, Geared Trolley Suspension, Air-Motor Powered. Type D hoists shall be in accordance with Table A3 and the requirements specified herein. Type D hoists shall be equipped with a traversing air motor and controls for traversing the trolley. Trolley track size shall be as specified [see para. A5.1(e)].

A2.3.4 Type E, Air Chain Hoist, Geared Trolley Suspension, Low Headroom, 2,000 and 4,000 lb Rated Load, Air-Motor Powered. Type E air chain hoists shall be in accordance with Table A4 and the requirements specified herein. Hoist projections, excluding chain basket, shall extend not greater than 15 in. below the underside of the track. No part of the hoist shall extend 4 in. above the bottom of the trolley track. Trolley track size shall be as specified [see para. A5.1(e)].

A2.3.5 Air Supply Characteristics. The air supply line shall connect to the hoist. The hoist shall be capable of operating with an air supply having the following characteristics:

(a) rated air gauge pressure 90 psi;

(b) a maximum moisture content of 0.002 lb of water per pound of dry air at 60°F and 90 psi absolute;

(c) solid particle contamination limited to 25 microns;

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TABLE A1 TYPE A, AIR CHAIN HOIST, HOOK SUSPENSION

Rated Load, tons [Note (1)]	Standard Lift, Min., ft	Headroom, in.	Weight of Chain Hoists, Max.		Lifting Speed, Min., ft/min
			Class 1, lb	Class 2, lb	
1/4	8	14.5	68	48	40
1/2	8	15	68	48	30
1	8	18	100	61	19
1 1/2	8	23.5	155	107	15
2	8	23.5	233	107	10
3	8	32	270	130	10
4	8	37	320	138	8
5	8	45	413	172	8
6	8	45	420	195	8
8	8	49	500	305	6
10	8	54	620	322	4
12	8	54	875	350	4
16	8	60	1,120	600	4
20	8	71	1,300	1,100	4

NOTE:
(1) 2,000 lb/ton.

(d) a minimum of one drop of atomized lubrication for every 10 cfm of air.

A2.3.6 Interchangeability. In no case shall parts be physically interchangeable or reversible unless such parts are also interchangeable or reversible with regard to function, performance, and strength. Component parts for the same type of hoists from the same manufacturer shall be interchangeable to the greatest extent possible.

A2.4 Manual Operation

When specified [see para. A5.1(f)], means shall be provided for manual lowering and traversing of the hoist at rated load. To provide hand clearance for operator safety, the length and location of a hand crank shall provide for a minimum of 1 in. operational hand clearance measured vertically between the hand crank and the top of the smallest specified I-beam trolley track, track foundation, or hull structure. The force required on a crank to lower rated load shall not exceed 40 lbf. The load shall not lower unless the brakes are intentionally and manually released, or the hand crank is manually cranked. Means shall be provided so that powered operation shall not be possible when the hand crank is removed from its stowage position.

A2.5 Lubrication

Lubricants used shall be readily available and be

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eting chemicals (ODC).

A2.6 Painting

Paints and coatings shall be lead and chromate free.

A2.7 Workmanship

The hoist shall withstand any operation specified herein without malfunction or component failure caused by faulty workmanship. Edges and surfaces exposed to operating and maintenance personnel shall be smooth and rounded so that a hazardous surface does not exist.

A2.8 Availability, Reliability, and Maintainability

The minimum acceptable inherent availability (Ai) of the hoist shall be 0.90. This requirement establishes threshold values for reliability, maintainability, and supportability of the hoist.

A2.8.1 Reliability. The hoist shall operate for an average period of 3,000 continuous cycles without failure [this value of 3,000 mean cycles between failure (MCBF) is equivalent to 90 days of normal ship's operation without hoist failure].

A2.8.2 Maintainability. Routine corrective maintenance at the organizational level shall be accomplished by replacing complete assemblies and subassemblies. Mean time to repair (MTTR) for the hoist shall be 4 hr. At least 95% of all corrective maintenance actions shall require no more than 10 hr to complete.

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TABLE A2 TYPES B AND C, AIR CHAIN HOISTS, PLAIN AND GEARED TROLLEY SUSPENSION, HAND OPERATED

Rated Load, tons [Note (1)]	Standard Lift, Min., ft	Lifting Speed, Min., ft/min	Standard Size of I-Beam, in.	Headroom, Max., in.	Pull to Transverse Hoist, Max., lbf		Radius of Track Curve, Min., in.	Hoist Weight Less Track Clamp, Max., lb			
					Plain Trolley, Type B [Note (2)]	Geared Trolley, Type C [Note (3)]		Type B		Type C	
								Class 1	Class 2	Class 1	Class 2
1/4	8	40	5	14.5	15	. . .	21	137	118	275	. . .
1/2	8	30	5	15	20	5	21	137	118	275	. . .
1	8	19	6	18	40	10	21	240	170	284	205
1 1/2	8	15	7	19.5	45	13	36	322	270	335	270
2	8	10	8	19.5	60	15	36	456	328	500	360
3	8	10	10	26.5	65	21	48	560	430	525	480
4	8	8	10	26.5	70	23	66	765	534	900	630
5	8	8	12	32	75	28	66	1,080	730	1,100	800
6	8	8	12	32	100	35	66	1,090	730	1,120	800

NOTES:
(1) 2,000 lb/ton.
(2) Direct pull on trolley (along direction of track when moving on straight level track).
(3) Pull on gear trolley hand chain (when moving on straight level track).

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TABLE A3 TYPE D, AIR CHAIN HOIST, GEARED TROLLEY SUSPENSION, AIR-MOTOR POWERED

Rated Load, ton [Note (1)]	Weight, Max., lb		Standard Lift, ft		Lifting Speed, Min., ft/min [Note (2)]		Headroom, Max., in.		Radius of Track Curve, Min., in.
	Class 1	Class 2	Class 1	Class 2	Class 1	Class 2	Class 1	Class 2	
1	280	225	12	8	40	30	35	20	26
2	475	225	12	8	20	15	40	20	26
3	660	300	12	8	14	10	43	27.5	36
4	860	365	12	8	12	8	46	30	48
5	1,050	550	12	8	10	8	49	32	66
10	2,000	750	12	8	4	4	66	48	66

NOTES:
(1) 2,000 lb/ton.
(2) Minimum lift speed for fully opened control valve.

A3 MECHANICAL REQUIREMENTS

A3.1 Design Stress

Hoist mechanical components shall use the loading factors specified in para. A3.1.1. The maximum combined stresses of mechanical components of the hoist, hoist tractor, and trolley shall not exceed 35% of the yield strength of the material used, when operating with rated load under 10 deg incline condition (see para. A3.2). The maximum combined stress in structural and mechanical components under 15 deg incline condition (see para. A3.2) shall not exceed 70% of the yield strength of the material used when the hoist or hoist tractor is subjected to maximum torque or braking conditions.

A3.1.1 Loading Factor. Hoist components shall incorporate the following loading factors:

(a) Dynamic loading based on inertial forces – 1.5 times rated load.

(b) Static loading based on inertial forces – 2.0 times rated load.

A3.2 Incline Consideration

Hoisting and traversing brakes shall be provided which shall hold the rated load on an incline of ±15 deg with the horizontal in any direction. The hoist shall operate on a ±10 deg incline with the horizontal in any direction, with rated load, at reduced speed, through the full lift range.

A3.3 Frame or Housing

The frame or housing shall contain the hoist mechanisms including gears, sprockets, load chain stowage, air drum, hoist and trolley brakes protection of air controls and piping, air motors, and other operating components. Hoist or frame side tilt shall be kept to a minimum when operating on the trolley rail. In case of any inclination of rail or effects of ship motion, no part of the hoist shall project above the top flange of the trolley rail. Means shall be provided to afford protection from damage due to bumping of two or more hoists on the same track. This protection may be provided through use of bumpers or inherent frame or housing features.

A3.4 Hoist Drives

Hoist lift and Types D and E powered trolley drives shall be powered by a reversible air motor of enclosed construction that shall operate with air gauge pressures between 80 psi and 100 psi. The air motor shall have adequate power and starting torque and shall operate without perceptible vibration at any of the hoist loads or speeds within the rated load and speed capacity.

A3.4.1 Hoist Lift. The hoist lift drive motor shall be coupled through a speed reducer or drive gear to the load chain sprocket.

A3.4.2 Hoist Trolley. The hoist trolley air drive motor shall be coupled through drive gears to the trolley drive wheels, friction wheel, or positive drive sprocket wheel. For positive drive unit, the motor shall be coupled through a speed reducer to a chain sprocket for use on a 1-in. pitch single strand No. 80-1 RC-A standard roller chain welded to the bottom of the trolley track.

A3.5 Hoist Load Lifting Medium

The hoist load lifting medium shall be a link chain or roller chain, as specified [see para. A5.1(g)].

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TABLE A4 TYPE E AIR CHAIN HOIST REQUIREMENTS

Rated Load, Min., ton	Lifting Speed, Min., ft/min	Lift Range, Min., ft	Weight, Max., lb	Width, Max., in.	Length, in.	Headroom, Max., in.	Radius of Track, Min., in.
1	25	8	185 (1)	12	26	6.5	26
2	16	8	185 (2)	12	26	6.5	26
3	10	8	225 (1)	12.5	31	9.5	36

NOTES:
(1) Excluding chain and hook.
(2) Excluding chain and hook. Cumulative weight of hoist, trolley, and hoist tractor units may total not greater than 225 lb with 8 ft of lift chain and hook, if readily disconnected.

A3.5.1 Link Chain. Link chain shall provide a safety factor not less than 5 for the hoist rated load based on the ultimate strength of the material.

A3.5.2 Roller Chain. Roller chain shall be manufactured from an alloy steel. Each roller chain link shall be of uniform size and shape and shall seat properly in the hoist chain sprocket. The roller chain shall provide a safety factor of at least 5 for the rated load based on the ultimate strength of the material. The chain shall be securely attached to the hoist and easily removed.

A3.5.3 Load Chain Stowage. Hoist construction shall include the means for stowing the full length of load chain in chain reels, bags, or baskets when the hook is in the "UP" position. Chain reels shall be provided for stowage of chain for 8 ft of lift. Bags or baskets shall be used for stowage of chain for lifts greater than 8 ft. The chain reel shall maintain a relatively constant tension force to prevent chain slack between the load sprocket and the chain stowage. Construction of load sprocket and load chain stowage shall provide a constant chain feed without binding or jamming in the chain guide, stowage, or hoist frame.

A3.6 Load Hooks

Hook throat openings shall be in accordance with the dimensions shown in Table A5. The hook shall be clearly marked with manufacturer identification and allowable hook load or allowable hook load designator. Positive means shall be provided to prevent the load hook from loosening due to rotation of the load.

A3.6.1 Range of Load Hook. The hoist shall lift rated loads from any point within a 19 in. radius from an imaginary perpendicular under the chain sprockets to a horizontal plane 7 ft below the trolley track. The rated loads at this offset range without binding or jamming of the load chain in the sprocket guide.

A3.7 Construction

Rotating shafts shall be supported in anti-friction bearings or bushings, or both, and shall be enclosed against entry of foreign matter. Rotating and sliding surfaces shall be lubricated. Hoists shall operate through a temperature range of –40°F through 140°F for a minimum of 3,000 cycles without a failure. Gears shall be totally enclosed in a readily accessible casing that will permit examination, servicing, and cleaning. Positive means shall be provided to prevent any component from working loose. Hoist parts shall be readily accessible for servicing and replacement as required. Airborne noise level shall be kept to a minimum (maximum MIL-STD-740-1, Grade D).

A3.7.1 Controls. The speed of the motor shall be regulated. The controls shall vertically position a load within ±0.250 in.

A3.7.2 Hoist Brake. The hoist brake shall be spring loaded, of the automatic operating type which shall stop hoist motion when the air pressure is reduced below the safe motor operating pressure. The hoist brake shall be self-adjusting or readily accessible for easy adjustment to compensate for wear of the brake lining. The hoist brake shall hold the test loads required from a stopped position and shall stop and hold rated loads without slipping. The brake shall be equipped with a manual release for use in the event of a loss of air pressure. Manual release mechanisms shall be arranged so that they can be operated without endangering the operator.

A3.7.3 Gears. Gears shall be spur, helical, or worm and wheel type manufactured in accordance with AGMA 6010 and AGMA 6034.

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TABLE A5 HOOK THROAT OPENINGS

Hoist Rated Load, lb	Hook Throat Opening, Min., in.
1,000	0.75
2,000	0.906
3,000	1.0
4,000	1.125
5,000	1.125
6,000	1.5
7,500	1.375
10,000	1.625
11,000	2.0
13,000	2.063
15,000	2.063
17,000	2.063
20,000	2.25
25,000	2.25
30,000	2.75
40,000	3.0

A3.7.4 Overtravel Protection. The lift limiting device specified in para. 3.8 of ASME HST-5-1999 shall ensure that the hoist shall automatically stop in the lowering position, so as not to exceed the lower limit of travel.

A3.7.5 Overload Protection. Overload limiting devices shall not be used in naval applications.

A3.8 Chain Guides

Enclosed chain guides shall be provided to ensure that the hoist load chain enters the sprocket in the proper position to prevent misalignment or jamming of the hoist load chain and sprocket. These guides, if bolted on, shall have means to prevent loosening under vibration.

A3.9 Trolleys

A3.9.1 Trolley. Trolleys shall be constructed with no less than four wheels. Trolley wheels shall be of ferrous material. Trolley wheels shall have treads hardened to a minimum of 285 Brinell hardness number (Bhn). Trolleys up to and including 3 ton capacity shall have wheels of solid or pressed steel with treads hardened to a minimum depth of 0.020 in. For trolleys over 3 ton capacity, wheels shall be forged or solid with treads hardened to a minimum depth of 0.063 in. Trolley wheels shall be concentric within 0.030 in., and cast wheels shall have machined treads. For Type E hoist, zero load eccentricity of the hoist shall be maintained when the wheels are positioned for each

A3.9.2 Trolley Brake. The trolley power unit shall be equipped with a brake coupled to the drive transmission. The brake shall be of the spring loaded automatic operating type that shall actuate upon reduction of air pressure below the safe motor operating pressure. The brake shall be equipped with a manual release for emergency operation. The manual release mechanism shall be arranged so that it can be operated without endangering the operator. The brake shall hold the test loads without slipping from a stopped position with rated load on the hoist.

A3.9.3 Trolley Equalizers. Means shall be provided for distributing the hoist load equally into the trolley side frame (side plates).

A3.9.4 Track Clamps. When specified for Types B and C hoists [see para. A5.1(h)], quick acting track clamps shall be provided for locking fully loaded trolley hoists to the track. The clamps shall be adjustable for wear and shall function on a curved or straight track. The clamps shall function without increasing the trolley wheel shaft or wheel bearing load, and in such a manner that the stresses resulting from locking will be taken up in the trolley frame. The hand pull required to set or release the trolley track clamps shall be no greater than 80 lbf. The chain or lanyard drop from the beam shall end approximately 2 ft less than the specified lift of the hoist.

A3.10 Materials

Materials used shall be of sufficient hardness and strength to withstand intended use and applicable tests.

A3.10.1 Recycled, Recovered, or Environmentally Preferable Materials. Recycled, recovered (see para. A1.3), or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

A3.10.2 Prohibited Materials. Cadmium, asbestos, beryllium, brittle materials (see para. A1.3), and magnesium or magnesium based alloys (except steel or aluminum alloys that contain less than 0.5% magnesium) shall not be used unless otherwise specified. Pressed steel shall not be used except as specified for a particular application. Welded aluminum 6061-T6, 2XXX, and 7XXX material shall not be used.

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A3.10.3 Cast Iron. Cast iron in any form shall not be used except where permitted by referenced specifications. The use of cast iron is limited to those alloys conforming to ASTM A 48, Class 35, or better.

A3.10.4 Aluminum. Aluminum castings, if used, shall be in accordance with ASTM B 26.

A4 TESTING, MARKING, AND DATA

A4.1 Tests

A4.1.1 High-Impact Shock. When specified [see para. A5.1(i)], high-impact shock tests shall be conducted in accordance with MIL-S-901. Testing shall be done on one complete unloaded hoist of each type and class.

A4.1.2 Mechanical Vibration. An unloaded hoist shall be tested in accordance with the vibration test requirements of MIL-STD-167-1, Type I.

A4.1.3 Static Load. Hoists shall support a static load of twice the maximum rated capacity for a period of 10 min. This load shall be suspended with the hoist load chain extended to the limit of the hoist's rated lift height. This extension may be changed to a minimum of 1 ft provided the contractor demonstrates that the entire length of chain is capable of 200% load. The suspended test load shall be held by the hoist brake.

A4.1.4 Dynamic Load. Hoists shall be loaded to 150% of rated capacity and operated by hoisting and lowering the test load through the full operating range. Trolley type hoists shall be operated back and forth over a section of track, 8 ft or more in length, with the 150% load in suspension ten times. Hoists and trolleys shall operate satisfactorily and brakes shall exhibit no sign of slippage.

A4.1.5 Manual Operation. Hoists shall be tested to demonstrate:

(a) the ability to lift and lower through the full hoisting range a rated load by means of the handwheel arrangement;

(b) the interlock prevents pneumatic operation;

(c) the operator can safely control load speed at all

A4.1.6 Endurance. Hoists shall be subjected to 3,000 cycles of continuous operation (see para. A1.3). After completion of the above tests, gears, chain, bearings, chain sprockets, brakes, and other wearing parts shall be examined for excessive wear (see para. A1.3).

A4.1.7 Operating. Hoists shall be tested to determine that they are satisfactory for operation with rated load as follows:

(a) Hoisting speed. Hoists shall be operated for approximately 90% of lift height to verify conformance with the hoisting speed requirements.

(b) Lowering speed. Hoist load hooks shall be lowered at a maximum speed to determine conformance with the speed governor requirements.

(c) Travel limit. Hoists shall be operated in the up and down directions so as to engage the limit switches to demonstrate hoist ability to prevent load hook overtravel.

(d) Load positioning control. Hoists shall demonstrate the capability of accurately positioning a load. The test shall be conducted by establishing a reference height and then jogging the load to a position $\pm 1/4$ in. above and below the reference height. Repeat each test at least six times.

(e) Performance. Hoists shall be continuously operated at maximum speed through approximately 90% of lift height for a period of no less than 30 min. During this test, the hoist shall operate satisfactorily without any indication of malfunction.

A4.1.8 Inclined Hoist (Type E). The load hook carrying rated load shall be raised and lowered with the hoist alternately on a ±10 deg incline parallel to the rail and with the hoist tilted 10 deg to either side of the rail. There shall be no traverse movement along the rail, no binding of the drive or jamming of the load chain in the guides, and no degradation of any operating function specified herein. After this test, the hoist shall be operated on a horizontal track without evidence of binding or inability to perform the required functions. With the hoist mounted on a 15 deg inclined rail, a rated load shall be suspended from the load hook for a period of 2 min without any hoist movement along the rail. The hoist shall be traversed at reduced speed up a 10 deg incline with the rated load suspended from the load hook through the full lift range.

A4.1.9 Load Hook Range (Type E). The hoist shall lift a rated load, placed in such a geometric configuration that the angle of load chain to load chain sprocket would be the same angle resulting from picking up a load along a radius of 19 in., centered directly

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under the load chain sprocket, in a horizontal plane at 7 ft below the trolley track. The load shall be lifted at least four times with the load being placed, for each lift, in progressive 90 deg positions of a projected plane described above. In each case, the hoist shall successfully pick up the load, without jamming, binding, or fouling of the load chain or any component of the drive assembly.

A4.1.10 Airborne Noise. Airborne noise tests shall be in accordance with MIL-STD-740-1. Airborne noise level shall be kept to a minimum with a maximum level of Grade D in accordance with MIL-STD-740-1.

A4.1.11 Geared Trolley Traverse (Type C). A pull of no greater than 1 lbf per 200 lb of total hoist load exerted on the hand chain shall initiate hoist movement, and a pull of no greater than 1 lbf per 300 lb of total hoist load shall sustain hoist and trolley movement.

A4.1.12 Plain Trolley. The pull required to move the hoist loaded to its rated load (plain trolley suspension) along a straight portion of track shall be determined by attaching a cable or cord to the trolley, passing the cable or cord over a sheave suspended from the track at a reasonable distance from the trolley, and measuring the required pull by means of weights or a spring balance attached to the cable or cord.

A4.1.13 Track Clamp (Types B and C). Track clamps shall be tested by subjecting the loaded hoist to a pull equal to $\frac{1}{3}$ of the rated load of the hoist. The pull shall be exerted in both directions parallel to the trolley track. The clamps shall hold the loaded hoist from moving in either direction when the trolley track is in a horizontal direction.

A4.1.14 Fleet Angle (Types B, C, and D Hoists). The hoist shall pick up a load with the hook attached to the load 2 ft out from an imaginary perpendicular point 7 ft below the hoist. The chain shall not jam or jump the pockets of the load sprocket. The test shall be conducted four times, once forward, once aft, and once on each side of the hoist.

A4.1.15 Mounting Hook Test (Type A). The ability of the safety gate of the mounting hook to hold a load equal to the rated load of the hoist shall be A test load shall be attached to the closed and latched safety device in four directions. The load shall be applied to the safety device at a point measured from the hook tip along the safety device, a distance equal to $\frac{1}{3}$ of the throat opening as shown in Table A5. The load shall first be applied alternately to opposite sides of the safety device along the sides of the safety device at 90 deg to the safety device in a plane perpendicular to the hook plane. The test load shall be 75 lb for safety hoist hooks with safe working loads between 1,200 and 4,000 lb inclusive; 150 lb for safe working loads between 4,000 and 10,000 lb inclusive; and 200 lb for safe working loads greater than 10,000 lb. The safety device shall suffer no permanent deformation due to the test load applications and shall be functional upon completion of testing.

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A4.2 Marking

A4.2.1 Identification. In addition to the requirements of para. 4.2.3 of ASME HST-5-1999, the hoist shall be identified with the following:

(a) weight and shock (grade), as applicable;
(b) rated load;
(c) Appendix A, ASME HST-5-1999;
(d) class and type, as applicable;
(e) contract or order number;
(f) date of manufacture;
(g) National Stock Number (NSN) (if established).

A4.3 Data

A4.3.1 Technical Manuals. When specified [see para. A5.1(j)] in the contract or order, the manufacturer shall prepare technical manuals in accordance with the data ordering documents and include the following:

(a) complete list of material;
(b) identification of each component for replacement;
(c) final drawings.

A5 TYPICAL HOIST INQUIRY DATA

A5.1 Acquisition

In addition to the typical hoist inquiry data of ASME HST-5-1999, acquisition documents must specify the following:

(a) Appendix A, ASME HST-5-1999;
(b) class, type, and rated load of hoist required (see para. A1.2);
(c) whether zinc coating of hooks is required (see para. A2.2);

(d) whether zinc coating of the load chain is required (see para. A2.2);

(e) types B, C, D, and E hoists; trolley track size and radius (see paras. A2.3.2, A2.3.3, and A2.3.4);

(f) if manual operation capability is required (see para. A2.4);

(g) type of load chain, link or roller (see para. A3.5);

(h) if track clamps are required (see para. A3.9.4);

(i) if high-impact shock test is required (see para. A4.1);

(j) if technical manual is required (see para. A4.3.1).

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AMERICAN NATIONAL STANDARDS FOR HOISTS, PALLETS, AND TRANSMISSION CHAINS

Performance Standard for Electric Chain Hoists HST-1-1999
Performance Standard for Hand Chain Manually Operated Chain Hoists HST-2-1999
Performance Standard for Manually Lever Operated Chain Hoists HST-3-1999
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Performance Standard for Air Chain Hoists..... HST-5-1999
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