ASME HST-1–2012
[Revision of ASME HST-1–1999 (R2004)]

Performance Standard for Electric Chain Hoists

AN AMERICAN NATIONAL STANDARD

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The American Society of Mechanical Engineers
Three Park Avenue • New York, NY • 10016 USA

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FOREWORD

This Standard is one in a series that provides performance requirements for hoists that was originally issued in 1982. It was developed by the ASME HST Standards Committee, Hoists — Overhead. It is intended to serve as a guide to manufacturers, purchasers, and users of the equipment.

The other Standards in this series are

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 includes an appendix that, in conjunction with ASME HST-1–2012, is intended to replace MIL-H-15317, previously used to procure electric chain hoists by the Department of Defense (DOD).

Suggestions for improvement of this Standard are welcome. They should be addressed to the Secretary, ASME HST Standards Committee, Three Park Avenue, New York, NY 10016-5990.

ASME HST-1–2012 was approved by ANSI as an American National Standard on October 4, 2012.

ASME HST COMMITTEE
Hoists — Overhead

(The following is the roster of the Committee at the time of approval of this Standard.)

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Secretary, HST Standards Committee
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Proposing Revisions. Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Proposing a Case. Cases may be issued for the purpose of providing alternative rules when justified, to permit early implementation of an approved revision when the need is urgent, or to provide rules not covered by existing provisions. Cases are effective immediately upon ASME approval and shall be posted on the ASME Committee Web page.

Requests for Cases shall provide a Statement of Need and Background Information. The request should identify the Standard, the paragraph, figure or table number(s), and be written as a Question and Reply in the same format as existing Cases. Requests for Cases should also indicate the applicable edition(s) of the Standard to which the proposed Case applies.

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The request for an interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his/her request in the following format:

Subject:	Cite the applicable paragraph number(s) and the topic of the inquiry.
Edition:	Cite the applicable edition of the Standard for which the interpretation is being requested.
Question:	Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. The inquirer may also include any plans or drawings that are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in this format may be rewritten in the appropriate format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

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ASME HST-1–2012
SUMMARY OF CHANGES

Following approval of the ASME HST Standards Committee and ASME, and after public review, ASME HST-1–2012 was approved by the American National Standards Institute on October 4, 2012.

ASME HST-1–2012 is rewritten and reorganized to conform to current ASME format for standards, and harmonized with ASME B30.16 to eliminate duplication and conflicts in content. The requirements of this Standard shall be applied together with the requirements of ASME B30.16 for the products covered.

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PERFORMANCE STANDARD FOR ELECTRIC CHAIN HOISTS

Chapter 1-0
Scope, Definitions, References, and Appendices

SECTION 1-0.1: SCOPE

(a) This Standard establishes performance requirements for electric 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)
(6) hoists used for marine and other applications as required by the Department of Defense (DOD)

The requirements of this Standard shall be applied together with the requirements of ASME B30.16. Please also refer to ASME B30.16 for requirements pertaining to marking, construction, and installation; inspection, testing, and maintenance; and operation.

SECTION 1-0.2: DEFINITIONS

abnormal operating conditions: environmental conditions that are unfavorable, harmful, or detrimental to the operation of a hoist, such as excessively high or low temperature, 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 the hoist or trolley motion by friction or power means.

brake, holding: a friction brake for a hoist that is automatically applied and prevents motion when power is off.

brake, mechanical load: an automatic type of 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.

chain, load: the load-bearing chain in the hoist.

chain, roller: a series of alternately assembled roller links and pin links in which 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.

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

NOTE: Load chain properties do not conform to those shown in ASME B30.9 or ASME B29.1.

contactor: an electromechanical device for opening and closing an electric power circuit.

control actuator: a manual means at the operating station by which hoist controls are energized.

control enclosure: the housing containing the electrical control components.

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

braking, dynamic: a method of controlling speed by using the motor as a generator, with the energy being dissipated by resistance.

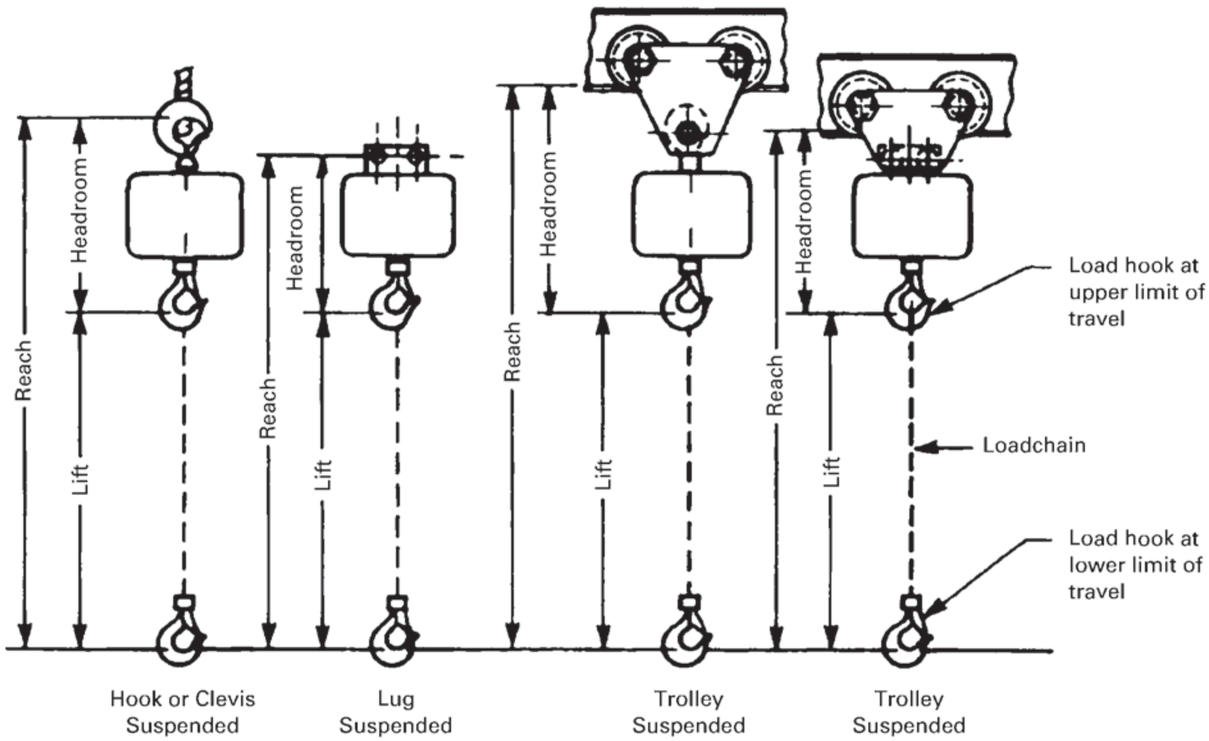
braking, mechanical: a method of controlling or reducing speed by friction.

braking, regenerative: a method of controlling speed in which the electrical energy generated by the motor is fed back into the power system.

cushioned start: an electrical or mechanical method for reducing the rate of acceleration of trolley motion.

hazardous (classified) locations: locations where fire or explosion hazards may exist. Locations are classified depending on the properties of the flammable vapors,

Fig. 1-0.2-1 Headroom, Lift, and Reach



liquids or gases, or combustible dusts or fibers that maybe present, and the likelihood that a flammable or combustible concentration or quantity is present. Refer to ANSI/NFPA 70.

class 1: 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 that are hazardous because of the presence of combustible dust.

class 3: locations that are hazardous because of the presence of easily ignitable fibers or flyings, but in which such fibers or flyings are not likely to be in suspension in the air in quantities sufficient to produce ignitable mixtures.

headroom: headroom is measured with the load hook at its upper limit of travel and is the distance from the saddle of the load hook to the following locations (see Fig. 1-0.2-1):

(a) saddle of the top hook on hook suspended hoists

(b) centerline of the suspension holes on lug suspended hoists

(c) wheel treadline 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 that the load hook obtains while lifting rated load.

hook suspended: suspension of hoist from a trolley or rigid structure by means of a hook at top of 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. 1-0.2-2).

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 lower limit of travel (see Fig. 1-0.2-1).

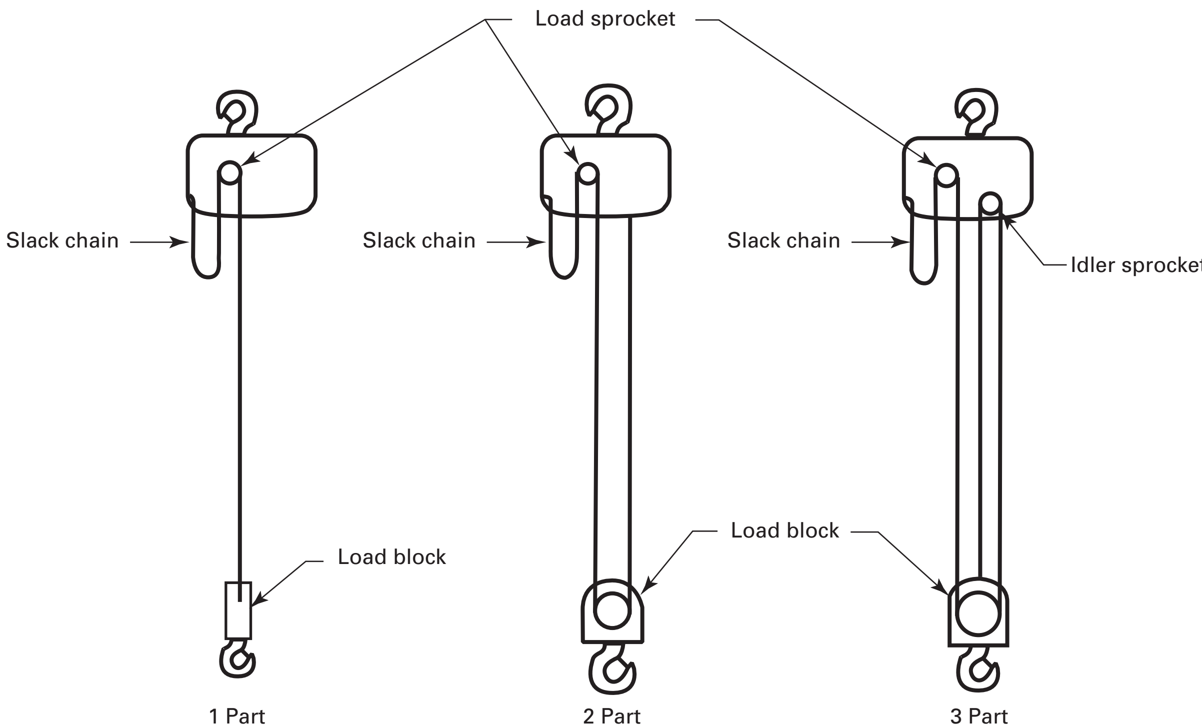
lifting devices, below-the-hook: devices that are not normally reeved onto the hoist chains such as hook-on buckets, magnets, grabs, and other supplemental devices used for handling certain types of loads. The weight of these devices is to be considered part of the load to be lifted.

limit device: an electrical, mechanical, or electromechanical 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 superimposed weight on the load block or hook.

load block: the assembly of hook or shackle, swivel, bearing, pins, sprocket, and frame suspended by the load

Fig. 1-0.2-2 Reeving



chain. This shall include all appurtenances reeved in the load chain.

load chain container: a device used to collect the slack load chain.

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. 1-0.2-2).

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

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

magnetic control: a means of controlling the direction and speed of the hoist and trolley by using magnetic contactors and relays.

minimum radius: the smallest radius of the beam, measured to the centerline 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 station: electrical controls suspended from the hoist for operating the unit.

power transmission parts: machinery components, including the gears, shafts, clutches, coupling, bearings, motors, and brakes.

qualified person: a person who, by possession of a recognized degree in an applicable field, 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 load: the maximum load for which a hoist or trolley is designated by the manufacturer or qualified person.

reach: the distance from saddle of 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. 1-0.2-1).

reeving: a system in which a chain travels around sprockets (see Fig. 1-0.2-2).

shall: indicates that the rule is mandatory and must be followed.

should: indicates that the rule is a recommendation, the advisability of which depends on the facts in each situation.

STOP–START, OFF–ON, POWER OFF–POWER ON control functions: control functions that are used to close and open a mainline contactor that provides or removes line power to or from all other function contactors.

switch: a device for making, breaking, or for changing the connections in an electric circuit.

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

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

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

SECTION 1-0.3: REFERENCES

The following is a list of publications referenced in this Standard. The latest edition shall apply.

ANSI/NFPA 70, National Electrical Code
Publisher: National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02269 (www.nfpa.org)

ASME B29.1, Precision Power Transmission Roller Chains, Attachments, and Sprockets
ASME B30.9, Slings
ASME B30.16, Overhead Hoists (Underhung)

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

SECTION 1-0.4: APPENDICES

Nonmandatory Appendix A 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-1–2012 and ASME B30.16 and must be separately invoked.

Nonmandatory Appendix B includes examples of hoist applications as an aid to users in making the selection of the proper hoist for the application.

Chapter 1-1
Performance

SECTION 1-1.1: GENERAL

All equipment selected in accordance with this Standard is designed to perform satisfactorily when used in accordance with Chapters 16-2 through 16-4 of ASME B30.16 and used within the rated load and hoist duty service classification. All equipment shall provide speeds, lifts, and headroom in accordance with manufacturer's specifications or to specifications agreed upon by the manufacturer and the user.

SECTION 1-1.2: HOIST DUTY SERVICE CLASSIFICATION

1-1.2.1 General Considerations

Service conditions have an important influence on the performance of the wearing parts of a hoist, such as gears, bearings, load chain, sprockets, electrical equipment, brake linings, load and lift limiting devices, and wheels. 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 electrical components and both must be considered when analyzing the service the hoist must perform. The factors that influence the mechanical and electrical 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, has an important effect on the life of power transmission components. For example, ball-bearing life varies according to the cube of the load. A 2-ton (1814.4-kg) hoist operated at a mean effective load of 1 ton (907.2 kg) will have a ball bearing life eight times that of the same hoist used steadily at its rated load.

(b) operational time: the total running time of the hoist per hour or per work period.

(c) work distribution: whether the operational time is uniformly distributed over the work period or concentrated in a short time span. Work distribution generally does not appreciably affect mechanical wear, but does materially affect the electrical components such as motors, brakes, and controls. For example, a hoist motor designed to operate 15 min out of each hour of an 8-hr shift cannot handle 2 hr of steady run and 6 hr of idle time even though either condition only requires 2 hr of operational time per 8-hr shift.

(d) number of starts and stops: directly affects all electromechanical devices, such as motors, contactors, brakes, and solenoids.

(e) repetitive long lowering operations: such operations generate heat in control braking means.

(f) environmental conditions: hoist equipment is designed to operate in ambient temperatures between 0°F (−18°C) and 104°F (40°C) and in atmospheres reasonably free from dust, moisture, and corrosive fumes unless otherwise specified.

(g) 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.

SECTION 1-1.3: DUTY CLASSIFICATION

While all the factors listed in para. 1-1.2.1 must be considered in selecting the proper class of hoist, most industrial applications, having randomly distributed loads or uniform loads up to 65% of rated load handled periodically throughout the work period, can be generalized according to the type of work shop or area of application. Listed in column 1 of Table 1-1.3-1 are the three duty classes that have been established for electric chain hoists. In column 2 are listed typical areas of application where each class can normally be applied. The majority of hoist applications will fall into one of the two categories, H2 or H3, and the use of the generalized description in column 2 of Table 1-1.3-1 for selection of the hoist will be adequate.

1-1.3.1 Operational Time Ratings

If in doubt as to the required duty classification for an application, refer to the data in columns 3 through 6 of Table 1-1.3-1, which show the operational time ratings for each class.

(a) Uniformly Distributed Work Periods

(1) Maximum on Time in Minutes Per Hour (column 3): the maximum running time in minutes per hour permitted for duty class when hoist utilization is uniformly distributed over a given work period

Table 1-1.3-1 Duty Classifications

Host Duty Class (Column 1)	Typical Areas of Application (Column 2)	Operational Time Ratings at $K = 0.65$ [Note (1)]: Uniformly Distributed Work Periods: Max. On Time, min/hr (Column 3)	Uniformly Distributed Work Periods: Max. No. of Starts/hr (Column 4)	Infrequent Work Periods: Max. On Time From Cold Start, min (Column 5)	Infrequent Work Periods: Max. No. of Starts (Column 6)
H2	Light machine shop fabricating, service, and maintenance; loads and utlization randomly distributed; rated loads infrequently handled	7.5 (12.5%)	75	15	100
H3	General machine shop fabricating, assembly, storage, and warehousing; loads and utilization randomly distributed	15 (25%)	150	30	200
H4	High volume handling in steel warehouses, machine shops, fabricating plants and mills, and foundries; manual or automatic cycling operations in heat treating and plating; loads at or near rated load frequently handled	30 (50%)	300	30	300

NOTE:
(1) See paras. 1-1.3.1 and 1-1.3.2.

(2) Maximum Number of Starts Per Hour (column 4): the maximum number of motor starts per hour permitted for the duty class when hoist utilization is uniformly distributed over a given work period

(b) Infrequent Work Periods

(1) Maximum on Time From Cold Start in Minutes (column 5): the maximum total running time for hoist utilization for the duty class starting with hoist at ambient temperature. These values cover infrequent periods of extended use and are applicable only with hoist at ambient temperature and cannot be repeated unless hoist is allowed to cool down to ambient temperature between periods. Typical examples would include setting machinery in place, unloading a truck-load of steel, filling a stock order from a stock room, etc.

(2) Maximum Number of Starts (column 6): the maximum total number of motor starts permitted for infrequent work periods specified in column 5.

1-1.3.2 Mean Effective Load

Mean effective load denotes a theoretical single load value that has the same effect on the hoist as various loads actually applied to the hoist over a specified period of time. K is the mean effective load factor and is expressed as

$$K = \sqrt[3]{W_1^3 P_1 + W_2^3 P_2 + W_3^3 P_3 \ldots + W_n^3 P_n}$$

where

K = mean effective load factor. Mean effective load factor is the ratio of mean effective load to rated load.

P = load probability. Load probability is the ratio of running time under each load magnitude condition to the hoist total running time. The sum total of all load probabilities used in the above equation must equal 1.0.

W = load magnitude. Load magnitude is the ratio of the hoist operating load to the hoist rated load. Operation with no load must be included along with the weight of any dead load such as lifting attachment of devices.

1-1.3.3 Randomly Distributed Loads

Randomly distributed implies that loads applied to the hoist are assumed to be evenly distributed within the rated load of the hoist in decreasing steps of 20% of the previous load value. Random loads are, therefore, considered as 100%, 80%, 64%, 51%, 41%, 33%, 26%, etc., of rated load. Operation with random loads is considered on an equal-time basis for the operating time remaining after accounting for the time the hoist is operating at no load and with rated load. Randomly distributed loads will result in a mean effective load factor of 0.65.

SECTION 1-1.4: APPLICATION ANALYSIS

1-1.4.1 General

(a) If the operation consists of lowering loads over long distances of more than 50 ft (15 m), the mechanical load brake heat dissipation capability (overheating) may become a factor. Consult manufacturer for particulars.

(b) Motor heating generated by the number of starts is not appreciably affected by the load on the hook and therefore the limits imposed by columns 3 through 6 are applicable for the motor regardless of the load being handled.

1-1.4.2 Fundamental Application Analysis

It is not necessary to perform a detailed application analysis or calculate mean effective load factor if all of the conditions listed below are met.

(a) The hoist is operating at no load during one-half of its operating time (load probability equals 0.5).

(b) The hoist is operating with rated load for a period of time not exceeding 20% of its operating time (load probability equal to or less than 0.2).

(c) Other loads applied to the hoist during the remainder of its operating time are randomly distributed.

Conditions wherein the above operating criteria are met will result in a mean effective load factor of 0.65 or less. If any one of these conditions cannot be met, or if a below-the-hook lifting device is attached to the load hook, a detailed application analysis using a calculated mean effective load factor should be conducted.

1-1.4.3 Detailed Application Analysis

The following general method may be used to make a detailed application analysis. Several examples of this detailed analysis method are given in Appendix B.

(a) Select a hoist class from Table 1-1.3-1 based on the general descriptions given in column 2.

(b) Select a hoist with a rated load rating equal to or greater than maximum load to be lifted.

(c) Using the information in columns 3 through 6, select the hoist speed that will meet the operational time ratings for hoist duty class.

(d) Determine value of K. If K is greater than 0.65, select a hoist with a higher rated load rating and recalculate K to make sure it is equal to or less than 0.65.

(e) If the requirements of the operational time values in Table 1-1.3-1 and K equal to or less than 0.65 cannot be met, contact the manufacturer.

SECTION 1-1.5: SPECIFICATION OF LIFT, HEADROOM, AND REACH

1-1.5.1 Lift

Most electric chain hoists are manufactured with standard lifts of 10 ft (3.1 m), 15 ft (4.6 m), and 20 ft (6.1 m). One of these standard lifts will normally be adequate for the particular requirement. It is recommended that the purchaser specify the required lift on his inquiry or bid request.

1-1.5.2 Headroom

Headroom should be specified if it is important to the application.

1-1.5.3 Reach

Reach should be specified if important to the application.

SECTION 1-1.6: SPEEDS, HOIST, AND TROLLEY

Hoisting equipment is available over a wide range of hoist and trolley speeds. Listed in Table 1-1.6-1 are typical speed ranges commonly available. Hoist and trolley speeds may vary ±10% from the specified speed.

NOTE: Table 1-1.6-1 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 range shown are not compatible with the required class of hoist.

SECTION 1-1.7: TROLLEYS

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

1-1.7.1 Plain Trolleys

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 use of plain trolleys be limited to a maximum load of 3 tonnes (3 000 kg) with the elevation of the beam not more than 20 ft (6 m) above the operator's floor level.

1-1.7.2 Hand Chain Operated Trolleys

Motion is obtained by pulling on the hand chain that is connected to trolley wheels through gears or sprockets. This type is recommended where trolley motion is relatively infrequent or short, and especially for those loads and beam heights where a plain type trolley would be impractical.

The hand chain operated trolley provides good load spotting ability.

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

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

1-1.7.3 Motor-Driven Trolleys

This type is recommended where operating frequency, distance of travel, or the type of load to be handled would cause unsatisfactory operation if trolley were plain or of the hand chain operated type. Design of motor operated trolleys shall be based on intermittent operation on a straight beam, unless otherwise specified. Where trolley travel involves curved beam, beam

Table 1-1.6-1 Typical Hoist and Motorized Trolley Speeds

Rated Load		Hoist Speed [Note (3)]	Motorized Trolley Speed [Note (3)]
tons (kg) [Note (1)]	tonnes (kg) [Note (2)]	ft/min (m/min)	ft/min (m/min)
$\frac{1}{8}$ (114)	$\frac{1}{8}$ (125)	16–64 (5–20)	30–100 (9–30)
$\frac{1}{4}$ (227)	$\frac{1}{4}$ (250)	7–64 (2–20)	30–100 (9–30)
$\frac{1}{2}$ (454)	$\frac{1}{2}$ (500)	7–64 (2–20)	30–100 (9–30)
1 (908)	1 (1 000)	7–64 (2–20)	30–100 (9–30)
$1\frac{1}{2}$ (1 361)	$1\frac{1}{2}$ (1 500)	4–40 (1–12)	30–100 (9–30)
2 (1 815)	2 (2 000)	4–40 (1–12)	30–100 (9–30)
3 (2 722)	3 (3 000)	4–40 (1–12)	30–100 (9–30)
4 (3 629)	4 (4 000)	4–24 (2–7)	30–100 (9–30)
5 and over (4 536)	5 and over (5 000)	4–24 (2–7)	30–100 (9–30)

GENERAL NOTES:
(a) Hoist and trolley speeds should be determined by an analysis of the number and length of cycles required for the work period.
(b) For trolley speeds above 100 ft/min (30 m/min) or for use on beams with curved sections, it is recommended that a cusioned start or multispeed drive be specified.
(c) In applications requiring close load spotting for hoist or trolley, refer to manufacturer for reduced speed or multiple speed control.

NOTES:
(1) 1 ton = 2,000 lb
(2) 1 tonne = 1 000 kg
(3) Ranges shown are for single-speed hoists and trolleys.

switches, exceptionally long runs, or near continuous operation, a special design may be required and full particulars should be provided with inquiry.

Brakes, when specified, may be actuated by mechanical or electrical 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 load speed in ft/min (m/min) when traveling at rated speed with rated load.

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

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

1-1.7.4 Trolley Wheels

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

1-1.7.5 Current Conductor Systems

A length of flexible power cord shall be provided unless otherwise specified. The user should contact hoist manufacturer for special arrangements to accommodate systems for trolley suspended hoists such as the following:

(a) flexible cable
(b) coiled cord
(c) festooned cable
(d) cable reel
(e) rigid conductor

SECTION 1-1.8: OVERLOAD LIMITING DEVICE

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.

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 the hoist. This does not imply that any overload is to be intentionally applied to the hoist.

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.

SECTION 1-1.9: PULL CORD CONTROL

Pull cord control, when furnished, shall consist of a self-centering, return-to-neutral controller or master switch for the motion of hoist or trolley. Two nonconducting pull cords with suitable handles, clearly marked for direction, shall be provided for operation of each controller or master switch. Unless otherwise specified, the standard pull cord control shall have a cord length that will locate the control handles approximately 4 ft to 5 ft (1.2 m to 1.5 m) above the lower limit of lift.

SECTION 1-1.10: TYPICAL HOIST AND TROLLEY INQUIRY DATA

See Form 1-1.10-1 and Table 1-1.6-1.

Form 1-1.10-1 Typical Hoist and Trolley Inquiry Data Form

HOIST

Quantity required ____________

Rated capacity ________ tons (________ kg)

Lift[1] ________ ft (________ m)

Reach ________ ft (________ m)

Headroom ________ in. (________ m)

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

________ ft ________ in. (________ m)

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

Type of control: ☐ Single-speed ☐ Two-speed

☐ Other ____________

POWER SUPPLY

Voltage	Phase	Hertz	Control Voltage
☐ 200	3	60	☐ 24
☐ 230	3	60	☐ 115
☐ 460	3	60	☐ Other ____
☐ 575	3	60	
☐ 115	1	60	
☐ 230	1	60	
☐ ____	____	____ Other	

Performance Requirements (see Chapter 1-1 and Appendix B):

Average lift ________ ft (________ m)

Number of lifts/hr ____________

Number of starts/hr ____________

Shift hrs/day ____________

Hoist service classification H- ____________

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 Chapter 1-1)

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

☐ Trolley brake required

Type of control

☐ Single-speed ☐ Two-speed ☐ Cushioned-start

☐ 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) ____________

____

____

Current conductor system:

☐ Flexible cable or ☐ Festooned cable

☐ Cable reel ☐ Rigid conductor ☐ Coiled cord

☐ Other ____________

Type of conductors (manufacturer) ____________

Location of conductors on beam (use sketch if necessary)

____

____

____

OPTIONAL EQUIPMENT

____

____

____

____

____

____

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

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

A-1 GENERAL

A-1.1 Scope

This Appendix provides performance requirements beyond those cited in ASME HST-1–2012 for electric chain hoists for use in marine and other applications as required by the Department of Defense (DOD).

This Appendix, in conjunction with ASME HST-1–2012, is replacing the requirements of MIL-H-15317 for electric chain hoists.

A-1.2 Classification

Chain electric powered hoists shall be of the following types, as specified [see para. A-6.1(b)]:

Type I	electric chain hoist, lug suspension, double-acting
Type II	electric chain hoist, lug suspension, single-acting
Type III	electric chain hoist, parallel or right angle geared, or plain trolley suspension
Type IV	electric chain hoist, two-wheel tandem
Type V	electric chain hoist, hook suspension
Type VI	electric chain hoist, powered trolley

A-1.3 Definitions

brittle material: material showing less than 10% elongation in gauge 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. The following 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%

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.

A-1.4 References to Other Codes and Standards

Refer to the following publications, copies of which may be obtained from the publisher as indicated. The latest edition 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), 1001 North Fairfax Street, Alexandria, VA 22314 (www.agma.org)

ASTM A48, Standard Specification for Gray Iron Castings (DOD adopted)

ASTM A143, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement (DOD adopted)

ASTM B26, Standard Specification for Aluminum Alloy Sand Castings (DOD adopted)

ASTM B633, 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 (www.astm.org)

IEEE Std. 45, Recommended Practice for Electric Installations on Shipboard

Publisher: The Institute of Electrical and Electronics Engineers (IEEE), 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331 (www.ieee.org)

MIL-C-24643, Cables, Electric, Low Smoke, for Shipboard Use, General Specification for

MIL-E-917, Electric Power Equipment Basic Requirements

MIL-S-901, Shock Tests, H.I. (High Impact) Shipboard Machinery, Equipment, and Systems, Requirements for

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

UL 991, Tests for Safety-Related Controls Employing Solid-State Devices

Publisher: Underwriters Laboratories, Inc. (UL), Publication Stock, 333 Pfingsten Road, Northbrook, IL, 60062 (www.ul.com)

A-2 PERFORMANCE REQUIREMENTS

A-2.1 General

Performance requirements shall be in accordance with ASME HST-1–2012 and as specified in this Appendix.

A-2.2 Application

Metals susceptible to corrosion attack in a seawater 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. A-6.1(c)], hooks shall be zinc plated. Zinc plating shall be in accordance with ASTM B633, Type I, Class Fe/Zn12. The hook throat safety device shall be constructed of noncorrosive material or treated for corrosion resistance.

When specified [see para. A-6.1(d)], the load chain shall be protected from corrosion by zinc plating in accordance with ASTM B633, Type II, Class Fe/Zn.

The safeguarding against and procedure for detecting embrittlement of zinc coating shall be in accordance with ASTM A143.

A-2.3 Characteristics

A-2.3.1 Weight and Dimensions. Maximum weight and envelope dimensions of hoists shall be specified if important to the application [see para. A-6.1(e)].

A-2.4 Emergency Manual Operation

When specified [see para. A-6.1(f)], hoist shall be equipped with a hand wheel attached to an extension of the electric motor shaft for emergency manual operation of the hoist. It shall be possible to declutch the hand wheel when it is not in use. An interlock shall be provided to prevent operation of the hoist electrically while the hand wheel is engaged. A pull of not more than 1 lb per 200 lb (0.45 kg per 90.7 kg) of total hoist load shall be required to initiate movement.

A-2.4.1 Hand Chain. The hand wheel described in para. A-2.4 shall be operated by a removable chain, which when fitted, will have a drop of approximately 2 ft (0.61 m) less than the specified lift of the hoist.

Table A-2.8-1 Hook Throat Openings

Hoist Rated Load, lb	Minimum Hook Throat Opening, 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

A-2.5 Load Positioning Control

Hoist control systems shall vertically position a load to within ±$\frac{1}{4}$ in. (±6.4 mm).

A-2.6 Lubrication

Lubricants used shall be readily available and free of ozone depleting chemicals (ODC).

A-2.7 Painting

Paints and coatings shall be lead and chromate free.

A-2.8 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. See Table A-2.8-1 for hook throat openings.

A-2.9 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 hoists from the same manufacturer shall be interchangeable to the greatest extent possible.

A-3 MECHANICAL REQUIREMENTS

A-3.1 Design Stresses

Maximum combined stress in component parts shall not exceed 35% of the tensile yield strength of the material for hoist operation at rated capacity. Combined stresses in component parts shall not exceed 70% of its tensile yield strength, when the hoist is subjected to static or dynamic overload tests. For hoists requiring repair parts, all wear parts shall be readily accessible for replacement. For hoist operation, a pull of not more than 1 lb per 200 lb (0.45 kg per 90.7 kg) of total hoist load shall be exerted to initiate movement, and not more than 1 lb per 300 lb (0.45 kg per 136 kg) of total hoist load shall be required for manual operations of the trolley.

A-3.2 Load Hooks

Hook throat openings shall be in accordance with the dimensions shown in Table A-2.8-1. 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. Load hooks shall be readily detachable from the load chain.

A-3.2.1 Range of Load Hooks. Load hooks for hoists Types I, II, III, V, and VI shall pick up a load with the hook anywhere within a radius of 3.5 ft (1.07 m) below the wheel, without jamming or jumping the pockets of the load wheel.

Load hooks for hoists Type IV (with the arrangement specified in para. A-3.7.3 and with the trolley oscillating about the wire rope on which it operates) shall be capable of picking up a load from any point within a 19-in. (482.6-mm) radius, from an imaginary perpendicular, from the point of hoist suspension to a horizontal plane 7 ft (2.1 m) below this point (an angle of approximately 15 deg).

A-3.3 Construction

Rotating shafts shall be supported in antifriction 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 −20°F through 103°F (−29°C through 39.4°C) 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 working loose. Hoist parts shall be readily accessible for servicing and replacement as required.

A-3.3.1 Load Chain. The chain shall provide a safety factor of at least five for the rated load based on the ultimate strength of the material.

A-3.3.2 Gearing. Gears shall be manufactured in accordance with AGMA 6010 and 6034.

A-3.3.3 Overtravel Protection. The lift limiting device specified in paras. 16-1.2.13 and 16-1.2.14 of ASME B30.16 shall protect against upper and lower limits of travel. Type I hoists shall not have these devices (see para. A-4.2.4).

A-3.3.4 Overload Protection. Overload limiting devices shall not be used in naval applications.

A-3.3.5 Load-Chain Container. When specified, the hoist shall be equipped with a container attached to the hoist for receiving the chain as it is reeved in by the chain wheel.

A-3.3.6 Trolley Track. Trolley tracks for Types III and IV hoists shall be I-beam of the size and radius specified.

A-3.4 Type I Electric Chain Hoist, Lug Suspension, Double-Acting

A-3.4.1 Double-Acting Feature. The double-acting feature shall be obtained by arranging a load chain having two free ends, to operate back and forth over a power-driven chain wheel. Either end of the chain, when fitted with a load hook, shall handle the load for which the hoist is rated. The hoist will not be required to handle load on both hooks simultaneously. Separation of the load chains, when hanging vertically, shall be a maximum, to permit free passage of the empty and loaded hooks when traveling in the hoisting or lowering directions.

A-3.4.2 Control Stations. Controllers shall be operated by two pendant type push-button stations, separately suspended from the hoist. Push-button stations shall be connected in series, thus making it necessary that corresponding push-buttons be depressed simultaneously at each station, to move the load hooks in either direction. Length of one of the control cables shall be as specified [see para. A-6.1g)]. The other cable shall be of a length equal to the lift of the hoist. Each push-button station shall be provided with indicating lights. These lights shall be arranged to indicate to the controls operator which push-button has been depressed at any other station. Enclosure shall be spray tight.

A-3.5 Type II Electric Chain Hoist, Lug Suspension, Single-Acting

A-3.5.1 Control Stations. Control stations shall be pendant control type or bulkhead mounted as specified [see para. A-6.1(h)].

A-3.6 Type III Electric Chain Hoist, Parallel or Right Angle Geared or Plain Trolley Suspension

A-3.6.1 Trolleys. Trolleys shall be geared or plain, as specified [see para. A-6.1(i)].

A-3.6.1.1 Trolley Wheels. Trolley wheel spacing shall be suitable for use on an applicable standard I-beam flange size. Means shall be provided to prevent the trolley wheel flanges from riding up onto the supporting beam.

A-3.6.1.2 Trolley Equalizers. Means shall be provided for distributing the hoist load equally into trolley side frames.

A-3.6.1.3 Trolley Track Clamps. Quick acting track clamps shall be provided for locking fully loaded hoists to the track. Hand pull required to set or release the track clamps shall not exceed 80 lb (36.3 kg). Chain drop from beam shall be approximately 2 ft (0.61 m) less than the specified lift of the hoist.

A-3.6.2 Cable Reel. An automatic, clock spring type cable takeup reel for ceiling mounting shall be furnished for the hoist motor power supply cable.

A-3.6.3 Control Stations. Control stations shall be pendant control type or bulkhead mounted as specified [see para. A-6.1(h)].

A-3.7 Type IV Electric Chain Hoist, Two-Wheel Tandem Trolley Suspension

A-3.7.1 Load-Lifting Medium. Close link, coil type load chains shall be the load-lifting medium.

A-3.7.2 Hoist Trolley. Trolleys shall operate on high grade plow steel, constant tensioned wire rope, as specified [see para. A-6.1(j)]. The trolley shall not jump or fall from the wire rope under any condition. The trolley assembly shall be quickly removed from the rope for storage purposes. A hole shall be accessibly located at each end of the trolley structure to permit making a clevis connection, the clevis being located at the end of the ropes used to tow the trolley along the wire suspension. The trolley structure around the hole shall be reinforced so that pull on the clevis connection will not cause any permanent distortion.

A-3.7.3 Trolley Connection to Hoist. Trolleys shall be pin connected to the hoist with a degree of freedom to permit the hoist to swing forward or backward in the direction of trolley travel. Hoist swing angle shall be limited by stops on the trolley, to prevent the hoist from making contact with the trolley wire suspension.

A-3.7.4 Control Station. Motor controllers shall be operated from a pendant suspended, retractable, three-element push-button station. The retractable feature shall be provided through use of a clock spring actuated cable reel, which shall be included as part of the motor control enclosure. Push-button enclosure shall be fitted with a handle to enable the hoist operator to conveniently hold the push-button station at proper operating height.

Enclosure shall be fitted with an eyebolt or other means for securing a reach rope, which will be used to haul the control station down to the operator. When three elements are required, the pushbuttons shall be legibly and permanently marked "HOIST," "LOWER," and "EMERGENCY RUN," to indicate hoist operation. The function of the "EMERGENCY RUN" push-button shall be to bypass the thermal overload device.

A-3.8 Type V Electric Chain Hoist, Hook Suspension

A-3.8.1 Mounting. Mounting hooks shall have a spring loaded type safety gate resting against the tip of the hook. Safety gate shall be of sufficient strength to withstand a pull against the safety gate equal to the weight of the fully loaded hoist.

A-3.8.2 Control Stations. Control stations shall be pendant control type or bulkhead mounted as specified [see para. A-6.1(h)].

A-3.9 Type VI, Electric Chain Hoist, Powered Trolley Suspension

A-3.9.1 Hoist Trolley Connection. Hoists shall be suspended from their trolleys by means of a pin connection that will permit the hoist body to swing a maximum of 15 deg fore and aft in direction of trolley travel. When the hoist is allowed to swing, it shall be so restrained that no part of the hoist will contact the load lifting medium. Trolley motor and gearing, as specified herein, shall be attached to the hoist so as to permit the front of the hoist to approach the end of the trolley track, with the intent of bringing the hanging load chain as close to the end of the track as practicable.

A-3.9.2 Load Attachment Device. The lifting end of the load chain shall be fitted with a swivel connection device.

A-3.9.3 Power-Operated Trolley. Trolleys shall be positive traversing, shall operate on a standard I-beam, and shall traverse the hoist along the track through a speed of 0 ft/min to 40 ft/min (0 m/min to 12.2 m/min) with rated load. Trolley shall drive the hoist with rated load along a track tilted and inclined ±15 deg from horizontal. For this requirement, overloading of the trolley drive motor up to 50% of its rated capacity for 20 min during ship rolling and pitching conditions will be acceptable.

A-3.9.4 Positive Traversing Feature. To provide positive traversing of the hoist, the trolley shall be equipped with a sprocket, rotating in vertical plane, and driven by the trolley motor. Sprocket shall engage a strip of roller type chain attached to the flange of the I-beam trolley track. The roller chain shall be of the length as specified and shall be suitable for tack welding to the flange of the I-beam. This arrangement shall ensure that the hoist and trolley, when stopped, will hold its position on the trolley track. A brake, attached to the sprocket shaft or nonoverhauling worm gears, shall be provided.

A-3.9.5 Hoist and Trolley Control Station. Hoists and trolleys shall be operated by a pendant type handheld or bulkhead mounted control station, as specified. Control station design shall incorporate a four-element push-button circuit with the dead man feature (push-buttons automatically return to "OFF" position when released). Two push-buttons shall be marked "Hoist" and "Lower" for hoisting and lowering operations and the other two push-buttons shall be identified with arrows "<," ">" and color-coded to indicate direction of trolley operation. Corresponding color-coded arrows shall be affixed to the hoist and shall be visible from all operating positions of the hoist. If the control station is bulkhead mounted, the control leads shall be fed from a cable reel as specified herein (see para. A-3.6.2).

A-3.10 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.

A-3.11 Material

Material used on hoists and their components shall be of sufficient hardness and strength to withstand intended use and applicable tests.

A-3.11.1 Recycled, Recovered, or Environmentally Preferable Materials. Recycled, recovered (see para. A-1.3), 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.

A-3.11.2 Prohibited Material. Cadmium, asbestos, beryllium, brittle materials (see para. A-1.3), 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. Welded aluminum 6061-T6, 2XXX, and 7XXX material shall not be used.

A-3.11.3 Cast Iron. Cast iron shall not be used for load-bearing parts. Cast iron for nonload-bearing parts shall be in accordance with ASTM A48, Class 35 or better.

A-3.11.4 Aluminum. Aluminum castings, if used, shall be in accordance with ASTM B26.

A-4 ELECTRICAL

A-4.1 General

Motors, controllers, brakes, and power supply cable shall be in accordance with IEEE Std. 45 and, when specified [see para. A-6.1(k)], shall withstand high impact, grade A shock (see para. A-5.1.1). If shock testing is specified, the supply power cable shall be in accordance with MIL-C-24643.

A-4.1.1 Hazardous Locations. When hoists are used in hazardous locations as defined by IEEE Std. 45 or other special codes, modifications, or additional safety precautions not covered by this Appendix may be required.

A-4.2 Electrical Equipment Characteristics

A-4.2.1 Motors. Temperature rise of motors shall be in accordance with IEEE Std. 45 for the class of insulation and enclosure used.

A-4.2.2 Hoist Brakes. Hoists shall be equipped with an electric brake, and except Type I, a load brake. The load brake shall be provided to prevent operation of the hoist in the lower direction unless power is applied, and it shall be independent of the electric brake. The electrical brake shall stop and safely hold 150% of the hoist rated load at any operating speed. The electrical brake shall hold a static load equal to 200% of the hoist rating.

When specified [see para. A-6.1(l)], manual release of the electric brake shall be provided to permit manual operation by the hand wheel as specified herein (see para. A-2.4).

A-4.2.3 Operator's Control Station. Push-button controls shall be momentary contact type (spring return to the "OFF" position when released). Push-button controls shall be fully enclosed in a shock resistant, watertight case, with rounded corners. Enclosure shall be watertight.

A-4.2.4 Lower Limit Switch. A lower limit switch shall be provided on Type I hoists to prevent the load hook from over travel. The switch shall be arranged to automatically stop the hoist motor and apply the motor brake when the hook reaches its lower travel limit position.

A-4.2.5 Control Enclosures. Control enclosures, unless otherwise specified [see para. A-6.1(m)], shall be NEMA Type 12 in accordance with IEEE Std. 45.

A-4.2.6 Speed Governor. When specified [see para. A-6.1(n)], Type I hoists shall be equipped with a centrifugal type speed governor to limit lowering speed to a maximum of 80 ft/min (24.4 m/min). Stopping of the hoist shall be accomplished by the electric brake specified herein (see para. A-4.2.2).

Table A-4.2.7-1 Electromagnetic Environment

Frequency Range	Units	
Communications 250 kHz to 30 MHz	V/m 50	
Radar:	Average (mW/cm^2)	Peak (mW/cm^2)
200 MHz to 225 MHz	7	1,600
400 MHz to 450 MHz	5	300
850 MHz to 942 MHz	12	400
1.215 GHz to 1.365 GHz	3	3,900
2.7 GHz to 3.7 GHz	78	32,000
5.4 GHz to 5.9 GHz	2	1,400
16.3 GHz to 33 GHz	1	1,000

A-4.2.7 Electromagnetic Interference and Compatibility. Hoist electrical equipment shall operate satisfactorily under the electromagnetic environment specified in Table A-4.2.7-1.

A-5 TESTING, MARKING, AND DATA

A-5.1 Testing

A-5.1.1 High Impact Shock. When specified, hoists shall undergo the high impact shock test in accordance with the requirements of MIL-S-901. Resilient mountings shall not be used. Trolley hoists shall be secured only by their own track clamps. Trolley hoists and hook suspension hoists shall be mounted in their normal position. Type V hoists shall be tested in the stowed position (horizontal attitude), constrained (not fastened) to prevent lateral movement, and clamped or strapped to resist vertical movement and to prevent test unit from becoming a missile hazard to test personnel. Hoists shall have the load hook retracted for the test. The chain shall be looped in bights not to exceed 2 ft (0.61 m), and secured in or lashed to the load hook during the test. Test fixture for mounting the hoist shall conform, as applicable, to the deck-platform or bulkhead mounting figures shown in MIL-S-901. A request to deviate from the test fixture, for mounting hoists differing from those specified, shall be submitted to the contracting activity. Shock tests shall comply with the requirements as specified. Following successful completion of high-impact shock test, the hoist shall be subjected to the tests as shown in Table A-4.2.7-1.

A-5.1.2 Load. Hoists with overload protection devices shall demonstrate its ability to lift and hold a load equal to $1\frac{1}{2}$ times its rated capacity without slippage.

A-5.1.2.1 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 (0.3 m), 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.

A-5.1.2.2 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 (2.4 m) or more in length, with the 150% load in suspension. This test shall be performed 10 times. Hoists and trolleys shall operate satisfactorily and brakes shall exhibit no sign of slippage.

A-5.1.3 Operating. Hoists shall be tested to determine that they are satisfactory for operation with rated loads 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 of 80 ft/min (24.4 m/min) and timed 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 their capability of accurately positioning a load. The test shall be conducted by establishing a reference height and then jogging the load to a position $\pm\frac{1}{4}$ in. (±6.4 mm) above and below the reference height. Repeat each test at least six times. Each positioning shall be accomplished by energizing the motor no more than six times.

(e) *Performance.* Hoists shall be continuously operated at maximum speed (80 ft/sec [24.4 m/s]) through approximately 90% of lift height for a period of not less than 30 min. During this test, the hoist shall operate satisfactorily without any indication of malfunction.

A-5.1.4 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 electrical operation

A-5.1.5 Electromagnetic Interference Measurements. Electromagnetic interference testing shall be done in accordance with UL 991.

A-5.1.6 Geared Trolley Traverse. On Type III geared trolley hoists, a pull of no more than 1 lb per 200 lb (0.45 kg per 90.7 kg) of total hoist load shall be exerted on the hand chain to initiate movement of the hoist load and a pull of not more than 1 lb per 300 lb (0.45 kg per 136.1 kg) to initiate hoist and trolley movement.

A-5.1.7 Track Clamp. Track clamps on Type III hoists shall be tested by subjecting the loaded hoist to a pull equal to one-third of the rated capacity of the hoist. The pull shall be exerted in either direction parallel to the trolley tracks. Clamps shall hold the loaded hoist from moving in either direction when the trolley track is in a horizontal position. Track clamps shall have no sign of slipping or of permanent deformation.

A-5.1.8 Fleet Angle. Hoists shall demonstrate their ability to pick up a load with the hook attached to the load at 3.5 ft (1.07 m) out from an imaginary perpendicular 7 ft (2.1 m) below the hoist. Chain hoists shall accomplish this without the chain jamming or jumping the pockets of the load wheel. The lift shall be conducted four times, once forward, once aft, and once on each side of the hoist.

A-5.1.9 Trolley Test for Type IV Hoist. Hoist trolleys shall be tested to demonstrate their capability of maintaining its positioning on the wire rope on which it operates under the following conditions:

(a) with the hoist attached to the trolley and load hook empty, oscillating the suspended hoist ten times about the axis of the wire rope through an included angle of 70 deg (35 deg on either side).

(b) repeat (a) with rated load.

(c) repeat (a) with 150% rated load.

(d) demonstrate the hoist capability to pickup a load in any direction that is at an angle of 15 deg from the point of hoist suspension to a perpendicular, from the same point on the hoist (see para. A-3.2.1).

(e) Plain Trolley Test. The pull required to move the capacity-loaded hoist (plain trolley suspension) along a straight portion of track shall be determined by attaching a wire rope or cord to the trolley so that the pull is exerted parallel to the track, and then over a sheave hanging from the track at a reasonable distance from the trolley, and measuring the required pull by means of weights or spring balance attached to cable or cord. Failure to comply to the requirements for maximum pull to traverse the hoist shall constitute failure of this test.

(f) Geared Trolley Test. The pull required on geared trolley hand chain to move a capacity-loaded hoist (gear trolley suspension) along a straight portion of track shall be determined by attaching weights or a spring balance to the hand chain. Failure to comply to the requirements for maximum pull to traverse the hoist shall constitute failure of this test.

(g) Hand Operation. The hoist and the trolley of Types III, IV, and VI shall be operated by hand on straight and curved track with rated load. A pull of not more than 1 lb per 200 lb (0.45 kg per 90.7 kg) of hoist load shall be required to initiate movement, and no more than 1 lb per 300 lb (0.45 kg per 136.1 kg) of hoist load shall be required to sustain this load (without assistance from the hook) without any distortion and shall operate properly upon removal of the load.

A-5.1.10 Mounting Hook for Type V Hoist. The safety gate of the mounting hook shall demonstrate its ability to hold a load equal to the weight of the fully loaded hoist. This hook shall be attached to a padeye of sufficient strength and a cable shall be rigged through the hook and safety gate to a load equal to the weight of the fully loaded hoist. The safety gate shall hold this load (without assistance from the hook) without any distortion and shall operate properly upon removal of the load.

A-5.1.11 Trolley for Type VI Hoist. Powered trolley hoists shall be subjected to the following tests to determine capability of trolley operation:

(a) Traversing Speed Test. The power-operated trolley shall traverse the hoist with rated load along a horizontal trolley track, simulating a ship at an even keel to verify compliance with the traversing speed specified.

(b) Trolley Drive Test (rolling conditions). The trolley shall traverse the loaded hoist on a trolley track inclined at an angle of 15 deg from a horizontal centerline, to verify satisfactory operation during ship rolling. The trolley will not be required to operate at a specified speed on this incline but shall move along steadily.

(c) Trolley Brake Test. With the hoist fully loaded and the trolley on an inclined and tilted track at an angle of 15 deg, it shall be demonstrated that when stopped, the trolley shall maintain its position on the track by means of the braking arrangement specified in para. A-3.9.4.

A-5.1.12 Endurance. Hoists shall be subjected to 3,000 cycles of continuous operation (see para. A-1.3). After completion of the above tests, gears, chain, bearings, chain sprockets, brakes, and other wearing parts shall be examined for excessive wear (see para. A-1.3).

A-5.2 Marking

A-5.2.1 Identification. In addition to the requirements in Section 16-1.1 of ASME B30.16, hoists shall be identified with the following:

(a) hoist weight and shock grade, as applicable
(b) type, as applicable
(c) rated load
(d) Nonmandatory Appendix A of ASME HST-1–2012
(e) national stock number (NSN) (if established)
(f) contract or order number
(g) date of manufacture

A-5.3 Data

A-5.3.1 Technical Manuals. When specified [see para. A-6.1(o)], 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

A-6 TYPICAL HOIST INQUIRY DATA

A-6.1 Acquisition

In addition to the typical hoist inquiry data of ASME HST-1–2012, acquisition documents must specify the following:

(a) Nonmandatory Appendix A, ASME HST-1–2012

(b) type of hoist required (see para. A-1.2)

(c) if zinc coating of hooks is required (see para. A-2.2)

(d) whether zinc plating is required for load chain (see para. A-2.2)

(e) maximum weight and dimensions required (see para. A-2.3.1)

(f) whether manual operation is required (see para. A-2.4)

(g) length of control cable required for Type I hoist (see para. A-3.4.2)

(h) type of control station, if other than pendant control (see paras. A-3.5.1, A-3.6.3, and A-3.8.2)

(i) geared or plain trolley on Type III hoists (see para. A-3.6.1)

(j) Type IV hoist trolley requirements (see para. A-3.7.2)

(1) size and type of wire rope required

(2) speed and acceleration rates

(3) load pull on clevis connection

(k) whether shock resistance grade A is required (see para. A-4.1)

(l) whether manual brake release is required (see para. A-4.2.2)

(m) control enclosures if other than specified (see para. A-4.2.5)

(n) whether speed governor is required (see para. A-4.2.6)

(o) if technical manual is required (see para. A-5.3.1)

NONMANDATORY APPENDIX B
TYPICAL EXAMPLES OF HOIST CLASS SELECTION

B-1 TYPICAL EXAMPLES OF HOIST CLASS SELECTION

B-1.1 Example No. 1

(a) *Application.* The hoist is to be used for machine shop work, to be operated no more than 10% of the time with no more than 50 starts/hr and will have randomly distributed loads. No unusually heavy work periods are expected.

(b) *Selection.* A review of Table 1-1.3-1 shows that hoist utilization does not exceed that specified for Class H2. Class H2 can be specified with no further analysis needed.

B-1.2 Example No. 2

(a) *Application.* Same as Example No. 1 except the hoist will be used periodically to unload a truck. It is estimated that it will take up to 1 hr to unload the truck, with the hoist running 50% of that time.

(b) *Selection.* The normal utilization still falls within the Class H2 rating. However, the periodic unloading of the truck of steel would require the necessity of specifying Class H3 (see columns 5 and 6 of Table 1-1.3-1).

B-1.3 Example No. 3

(a) *Application.* A foundry hoist is to be used to handle raw castings for storage. Two basic sizes of castings will be handled, one weighing 300 lb (136 kg), and the other 1,500 lb (681 kg). A 1-ton (908-kg) capacity hoist is being considered. It is estimated that it will take 15 min of running time per hour to handle the duty cycle, and that out of the 15 min, the hoist will be operating 50% of the time with 1,500 lb (681 kg) on the hook, 25% with 300 lb (136 kg), and 25% with no load, with a maximum of 150 starts/hr.

(b) *Selection.* The load distribution is not randomly distributed. Therefore, choosing a hoist directly from column 2 of Table 1-1.3-1 could lead to incorrect selection.

Tentatively select a Class H3 hoist, based on the 15 min utilization time. Calculate mean effective load K as follows:

$$K = \sqrt[3]{(0.75^3 \times 0.50) + (0.15^3 \times 0.25) + (0^3 \times 0.25)}$$

$$K = 0.60$$

K is less than 0.65, so that selection is correct.

B-1.4 Example No. 4

(a) *Application.* Basically the same as Example No. 3, except that the user has decided to purchase a $\frac{3}{4}$ ton (681 kg) capacity hoist.

(b) *Selection.* Following the same procedure as in Example No. 3:

$$K = \sqrt[3]{(1.0^3 \times 0.50) + (0.2^3 \times 0.25) + (0^3 \times 0.25)}$$

$$K = 0.79$$

K is in excess of 0.65 and the selection is incorrect.

B-1.5 Example No. 5

(a) *Application.* An electric chain hoist is to be used for dipping several racks of part into a series of tanks. Racks are 3.5 ft (1.1 m) high and about 0.5 ft (0.2 m) clearance is required over the edge of the tank so that the total lift distance is 4 ft (1.2 m). The operation is repetitive requiring 50 lift-lower cycles/hr. The total load is 500 lb (227 kg) including racks. Empty racks weigh 80 lb (36 kg). The hoist is operating 90% of the time with 500 lb (227 kg) and 10% of the time with 80 lb (36 kg).

(b) *Selection.* A $\frac{1}{2}$-ton (454-kg) hoist has been selected.

$$K = \sqrt[3]{(0.5^3 \times 0.90) + (0.08^3 \times 0.10)}$$

$$K = 0.48, \text{ which is less than } 0.65$$

Selection of $\frac{1}{2}$-ton (454-kg) capacity is correct. Total lifting and lowering distance/hr equals

$$4 \text{ ft} \times 2 \times 50 = 400 \text{ ft/hr } (122 \text{ m/h})$$

A hook speed of 15 ft/min (4.6 m/min) is selected. The resulting "ON" time per hour is 400/15 = 27 min/hr, which requires the use of a Class H4 hoist. The user estimated that five starts are required per lift-lower cycle resulting in 250 starts/hr, also requiring a Class H4 hoist. Note that the selection of a 30 ft/min (9.2 m/min) hook speed would result in a 13 min/hr "ON" time, but the hoist would still have to be Class H4 because of the 250 starts/hr.

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