ASME HST-4–2021
(Revision of ASME HST-4–2016)

Performance Standard for Overhead Electric Wire Rope Hoists

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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

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

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FOREWORD

This Standard is one in a series that provides performance requirements for hoists and was originally issued in 1986. It was developed by The American Society of Mechanical Engineers (ASME) HST Standards Committee, 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

Designator	Title
HST-1	Performance Standard for Electric Chain Hoists
HST-2	Performance Standard for Hand Chain Manually Operated Chain Hoists
HST-3	Performance Standard for Manually Lever Operated Chain Hoists
HST-4	Performance Standard for Overhead Electric Wire Rope Hoists
HST-5	Performance Standard for Air Chain Hoists
HST-6	Performance Standard for Air Wire Rope Hoists

This edition contains a Nonmandatory Appendix A that, in conjunction with this Standard, is intended to replace MIL-H-15317.

This Standard has been formatted in accordance with the 2019 ASME Codes and Standards Writing Guide and Style Guide.

This Standard is available for public review on a continuing basis. This provides an opportunity for additional public review input from industry, academia, regulatory agencies, and the public-at-large.

This Standard was approved by ANSI as an American National Standard on July 6, 2021.

ASME HST COMMITTEE
Hoists — Overhead

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Two Park Avenue
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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.

This Standard is always open for comment, and the Committee welcomes proposals for revisions. 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.

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Interpretations. Upon request, the HST Standards Committee will render an interpretation of any requirement of the Standard. Interpretations can only be rendered in response to a written request sent to the Secretary of the HST Standards Committee.

Requests for interpretation should preferably be submitted through the online Interpretation Submittal Form. The form is accessible at http://go.asme.org/InterpretationRequest. Upon submittal of the form, the Inquirer will receive an automatic e-mail confirming receipt.

If the Inquirer is unable to use the online form, he/she may mail the request to the Secretary of the HST Standards Committee at the above address. 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 in one or two words.
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. Please provide a condensed and precise question, composed in such a way that a "yes" or "no" reply is acceptable.
Proposed Reply(ies):	Provide a proposed reply(ies) in the form of "Yes" or "No," with explanation as needed. If entering replies to more than one question, please number the questions and replies.
Background Information:	Provide the Committee with any background information that will assist the Committee in understanding the inquiry. 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 the format described above may be rewritten in the appropriate format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

Moreover, ASME does not act as a consultant for specific engineering problems or for the general application or understanding of the Standard requirements. If, based on the inquiry information submitted, it is the opinion of the Committee that the Inquirer should seek assistance, the inquiry will be returned with the recommendation that such assistance be obtained.

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Chapter 4-0
Scope, Definitions, References, and Appendices

SECTION 4-0.1: SCOPE

(a) This Standard establishes performance requirements for electric wire rope hoists for vertical lifting service involving material handling of freely suspended (unguided) loads using wire rope with one of the following types of suspension:

(1) lug
(2) hook
(3) trolley
(4) base or deck mounted (does not include base-mounted winches of the type covered by ASME B30.7)
(5) wall or ceiling mounted (does not include base-mounted winches of the type covered by ASME B30.7)

(b) This Standard is applicable to hoists manufactured after the date on which this Standard is issued. This Standard 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 the purpose of lifting or lowering people
(5) hoists used for the purpose of drawing both the load and the hoist up or down the hoist's own wire rope
(6) hoists used for marine and other applications as required by the U.S. Department of Defense (DOD) unless Nonmandatory Appendix A is invoked

(c) 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 4-0.2: DEFINITIONS

abnormal operating conditions: environmental conditions that are unfavorable, harmful, or detrimental to the operation of a hoist, such as excessively high or low 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.

base or deck mounted: a type of mounting where the hoist is mounted to the top side of a horizontal supporting surface.

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

block, load: the assembly of hook or shackle, swivel, bearing, pins, sheaves, and frame suspended by the rope. This shall include all appurtenances reeved into the hoisting rope.

brake: a device, other than a motor, used for retarding or stopping 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 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. A mechanical load brake may also be used as a holding brake if designed as such by the manufacturer.

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

braking, countertorque (plugging): a method of controlling speed by applying a variable motor torque in the direction opposite to the direction that the motor is rotating as it is being overhauled by the load.

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

braking, eddy current: a method of controlling or reducing speed by means of an electrical induction load brake.

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.

ceiling mounted: a type of hoist mounting where the hoist is mounted to the underside of a horizontal supporting surface.

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

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

control: a device or group of devices that serves to govern in some predetermined manner the power delivered to the apparatus to which it is connected.

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

control enclosure: the housing containing the electrical control components.

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

drum: the cylindrical member around which the rope is wound for lifting and lowering the load.

hazardous (classified) locations: locations 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: 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 Figure 4-0.2-1):

(a) centerline of the suspension holes on lug suspended hoists
(b) saddle of the top hook on hook-suspended hoists
(c) wheel tread line on trolley-suspended hoists
(d) supporting surface on base-, deck-, and ceiling-mounted hoists
(e) uppermost point of hoist on wall- and ceiling-mounted hoists

hoist: 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 a rated load.

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

lateral hook travel: the lateral movement of the load hook between its position at the upper limit of travel and its position at the lower limit of travel.

lift: the maximum vertical distance through which the load hook can travel; it is the total hook movement between its upper limit of travel and its position at the lower limit of travel (see Figure 4-0.2-1).

lifting devices, below-the-hook: devices that are not normally reeved onto the hoist ropes, 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: a device that limits equipment motion or takes control of particular functions without action of the operator when a limiting condition is reached.

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

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

load, working: the external load applied to the hoist, including the weight of load attaching equipment such as shackles or slings.

load suspension parts: the means of suspension (trolley, hook, or lug), the structure, or housing that supports the drum, the rope, the sheaves, and the load block.

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

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 rope supporting the load block or hook.

pendant station: electrical controls suspended from the hoist for operating the unit.

pitch diameter: the distance from center to center of a rope passing over a sheave or wound on a drum, measured across the diameter of the sheave or drum.

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

qualified person: a person who, by possession of a recognized degree in an applicable field 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 frequency: the electrical operating frequency listed on the hoist nameplate or hoist motor nameplate.

reach: the distance from the saddle of the load hook at its lower limit of travel to the upper point of the headroom measurement. Reach is equal to lift plus headroom (see Figure 4-0.2-1).

reeving: a system in which the wire rope travels around rope sheaves (see Figure 4-0.2-2).
reeving, double: two parts of line leading off of the drum.
reeving, single: one part of the line leading off of the drum.

rope: refers to wire rope unless otherwise specified.

NOTE: Rope properties do not conform to those shown in ASME B30.9. See ASME B30.16-2017 for hoist rope properties.

shall: a word indicating a requirement.

sheave, nonrunning: a sheave used to equalize tension in opposite parts of the rope. Because of its slight movement, it is not termed a running sheave.

sheave, rope: a grooved wheel used with a rope to change direction and point of application of a pulling force.

sheave, running: a sheave that rotates as the hook is lifted or lowered.

should: a word indicating a recommendation.

single-speed magnetic control: a type of control providing one speed.

stop-start control function: a control function used to close and open a mainline contactor that provides or removes line power to or from all other function contactors. Normally, the control function does not remove power from the control circuit or pendant station. Also called "off-on" or "power off-power on" control function.

switch: a device for making, breaking, or 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 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 the trolley.

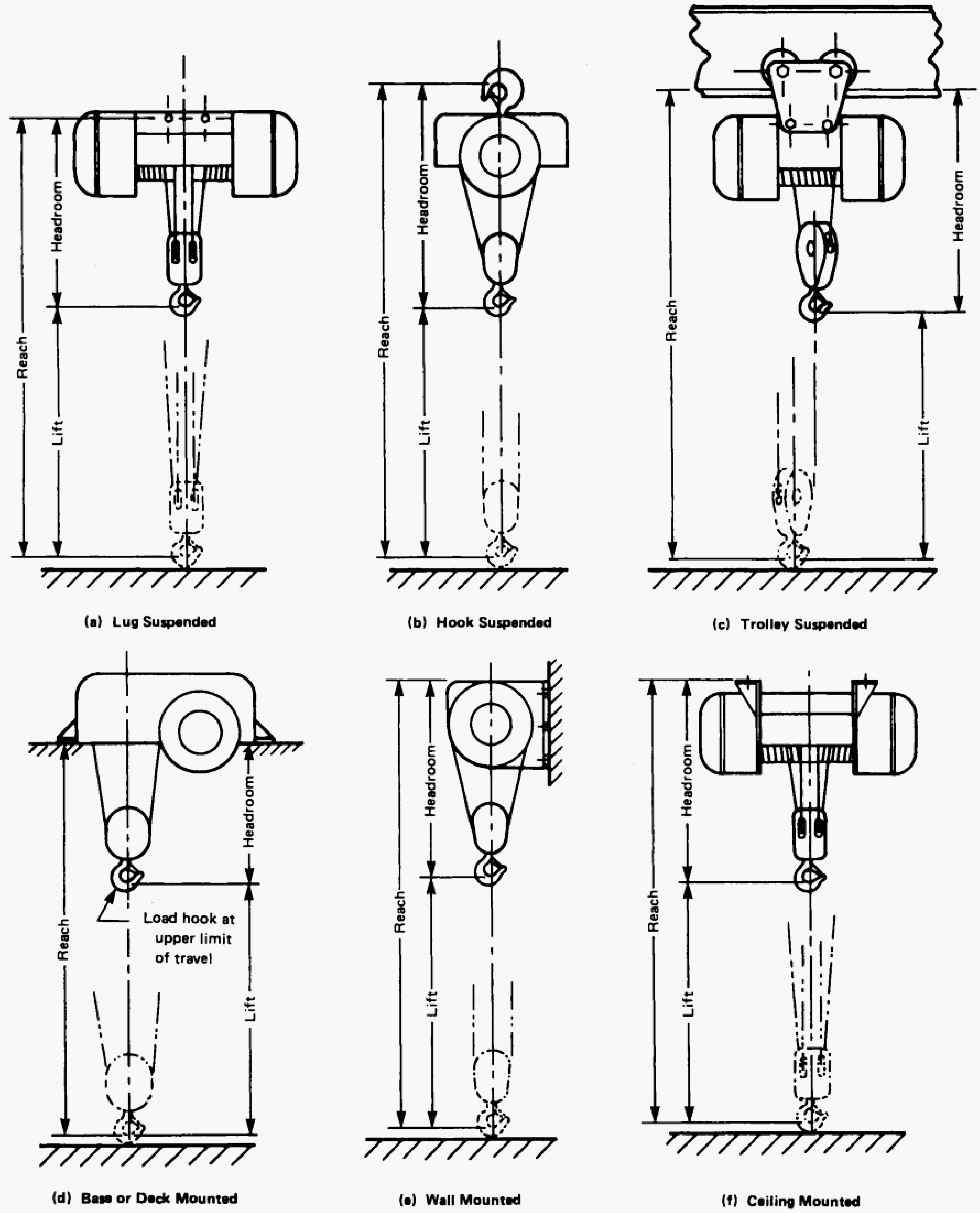
true vertical lift: a lift in which the load hook travels in a true vertical path between the lower limit of lift and the upper limit of lift (includes no lateral hook travel) [see Figure 4-0.2.2, illustration (b)].

two-speed control: a type of control providing two speeds; the lower speed usually is some fraction such as $\frac{1}{2}$ or $\frac{1}{3}$ of the higher speed.

variable-speed control: a type of control with three or more control positions.

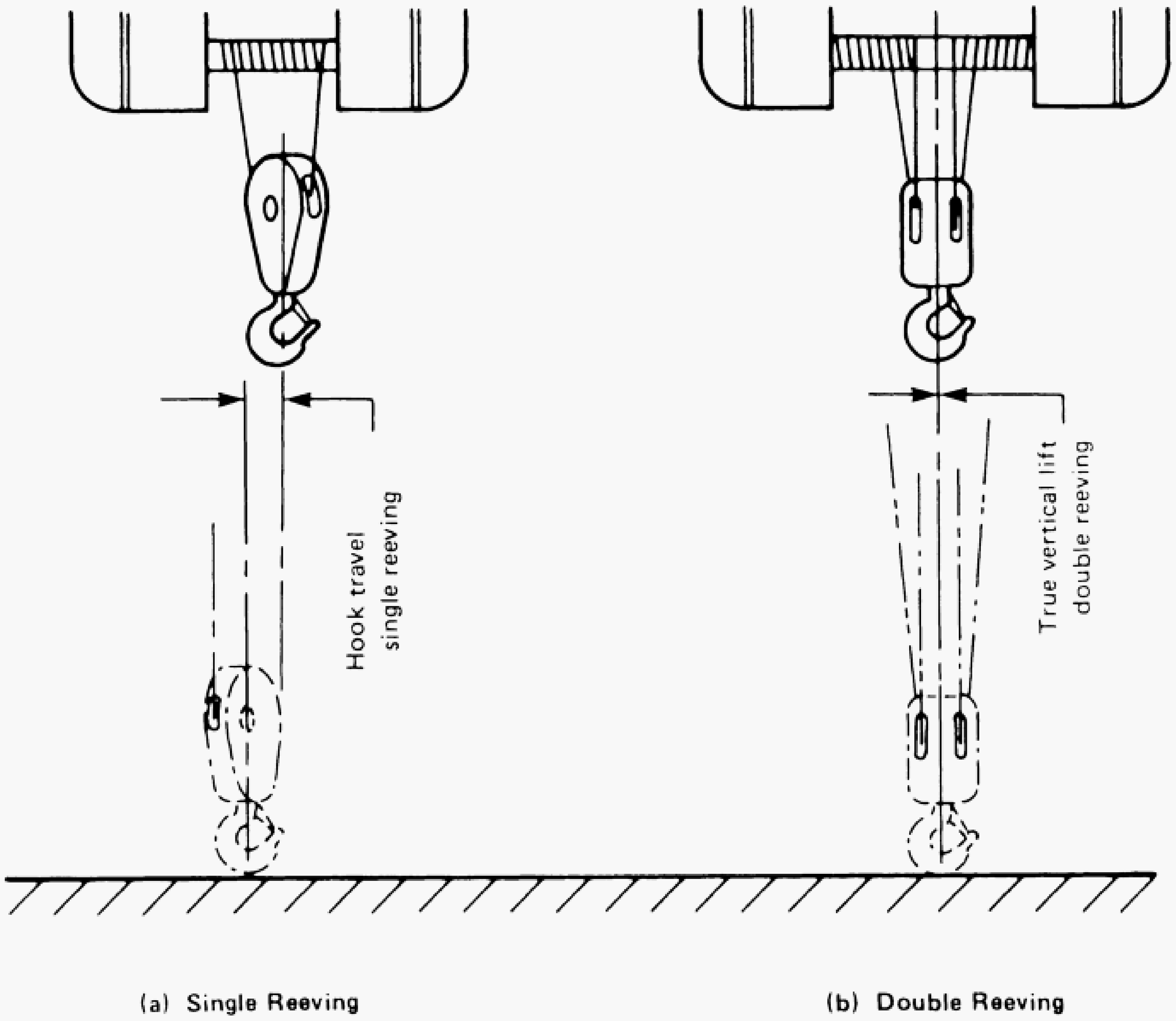
wall mounted: a type of mounting where the hoist is mounted to a vertical surface.

Figure 4-0.2-1 Hoist Mounting Headroom, Lift, and Reach



GENERAL NOTE: These illustrations are not intended to restrict the use of single or double reeving. Each of the mountings may be used with either type of reeving.

Figure 4-0.2-2 Single and Double Reeving



SECTION 4-0.3: REFERENCES

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

ANSI/NEMA ICS-6, Industrial Control and Systems: Enclosures
ANSI/NEMA MG1, Motors and Generators
Publisher: National Electrical Manufacturers Association (NEMA), 1300 North 17th Street, Suite 900, Arlington, VA 22209 (www.nema.org)

ANSI/NFPA 70, National Electrical Code
Publisher: National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169–7471 (www.nfpa.org)

ASME B30.7, Winches
ASME B30.16, Overhead Underhung and Stationary Hoists
Publisher: The American Society of Mechanical Engineers (ASME), Two Park Avenue, New York, NY 10016-5990 (www.asme.org)

SECTION 4-0.4: APPENDICES

Nonmandatory Appendix A, Performance Requirements for Electric Wire Rope 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 Nonmandatory Appendix A are in addition to the requirements of ASME HST-4 and shall be invoked.

Nonmandatory Appendix B, Examples of Detailed Application Analysis, includes examples of hoist applications as an aid to users in selecting the proper hoist for the application.

Nonmandatory Appendix C, Mechanical Spark Resistance Guidance for Applications in Hazardous (Potentially Explosive) Locations, applies to hoists used in locations defined as hazardous (potentially explosive). The guidance provided in Nonmandatory Appendix C is in addition to the requirements of ASME HST-4.

Chapter 4-1
Performance

SECTION 4-1.1: GENERAL

All equipment selected in accordance with this Standard is designed to perform satisfactorily when installed, inspected, tested, operated, and maintained in accordance with ASME B30.16, Chapters 16-1 through 16-4 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.

SECTION 4-1.2: HOIST DUTY SERVICE CLASSIFICATION

4-1.2.1 General Considerations

Service conditions influence the performance of wearing parts of a hoist such as gears, bearings, rope, sheaves, electrical equipment, brake linings, load- and lift-limit 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 that the hoist must perform.

The factors that influence the performance of any hoist include the following:

(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 generally varies inversely according to the cube of the load. A 2-ton (1 814.4-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. Operational time is the total running time of the hoist per hour or work period.

(c) Work Distribution. This is determined by 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 both conditions require 2 hr of operational time per 8-hr shift.

(d) Number of Starts and Stops. This 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. Such conditions include ambient temperature and the presence of dust, moisture, corrosive fumes, etc. Hoist equipment is designed to operate in ambient temperatures between 0°F and 104°F (−18°C and 40°C) and in atmospheres reasonably free from dust, moisture, and corrosive fumes unless otherwise specified.

4-1.2.2 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. Nonmandatory Appendix C provides guidance for both the manufacturer and the end user to assist in configuring a hoist to make it suitable for use in a potentially explosive environment.

4-1.2.3 Duty Classification

All the factors listed in para. 4-1.2.1 must be considered in selecting the proper class of hoist. However, 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 workshop or area of application.

Column 1 of Table 4-1.2.3-1 lists the five duty classes that have been established for electric wire rope hoists. Column 2 lists typical areas of application for each class.

Most hoist applications fall into one of the first three classes — H1, H2, or H3 — and the use of the generalized descriptions in Column 2 of Table 4-1.2.3-1 for hoist selection will be adequate.

(a) 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 4-1.2.3-1, which shows the operational time ratings for each class.

(1) Uniformly Distributed Work Periods

(-a) Maximum on Time, min/hr. The maximum running time in minutes per hour permitted for the duty class when hoist utilization is uniformly distributed over a given work period (Column 3).

(-b) Maximum Number of Starts per Hour. The maximum number of motor starts per hour permitted for the duty class when hoist utilization is uniformly distributed over a given work period. For two-speed motors, the total number of starts is the sum of the starts made at each motor speed (Column 4).

(2) Infrequent Work Periods

(-a) Maximum on Time From Cold Start, min. This is the maximum total running time for hoist utilization for the duty class when the hoist is at ambient temperature. These values cover infrequent periods of extended use. They apply only when the hoist is at ambient temperature and cannot be repeated unless the hoist is allowed to cool down to ambient temperature between work periods (Column 5).

(-b) Maximum Number of Starts. The maximum total number of motor starts permitted for infrequent work periods is specified in Column 6. For two-speed motors, the total number of starts is the sum of the starts made at each motor speed.

(b) 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 period of time. K is the mean effective load factor and is expressed as

$$K = \sqrt[3]{W_1^3 P_1 + W_2^3 P_2 + W_3^3 P_3 + \ldots + W_n^3 P_n} \tag{4-1}$$

where

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

P = load probability, i.e., the ratio for the running time under each load magnitude condition to the hoist total running time. The sum of all load probabilities shall equal 1.0.

W = load magnitude, i.e., the ratio of the hoist operating load to the hoist rated load. Operation with no load shall be included along with the weight of any dead load such as lifting attachments or devices.

(c) 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 rated load. Randomly distributed loads will result in a mean effective load factor of 0.65.

SECTION 4-1.3: APPLICATION ANALYSIS

4-1.3.1 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 with 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 in Table 4-1.2.3-1 are applicable to the motor regardless of the load being handled.

4-1.3.2 Fundamental Application Analysis

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

Table 4-1.2.3-1 Hoist Duty Service Classification

Hoist Duty Class (Column 1)	Typical Areas of Application (Column 2)	Operational Time Ratings at K = 0.65 [Note (1)]			
		Uniformly Distributed Work Periods		Infrequent Work Periods	
		Maximum On Time, Min/hr (% of work period) (Column 3)	Maximum Number of Starts/hr (Column 4)	Maximum On Time From Cold Start, Min (Column 5)	Maximum Number of Starts (Column 6)
H1	Powerhouse and utilities, infrequent handling. Hoists used primarily to install and service heavy equipment, where loads frequently approach rated load, and where the hoist is idle for 1- to 6-month periods between periods of operation.	7.5 (12.5%)	75	15	100
H2	Light machine shop, fabricating service, and maintenance. Loads and utilization 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 of heavy loads, frequently near rated load in steel warehousing, machine and fabricating shops, mills, and foundries.	30 (50%)	300	30	300
	Manual or automatic cycling operations of lighter loads with rated loads infrequently handled, such as in heat-treating and plating operations.				
H5	Bulk handling of material in combination with buckets, magnets, or other heavy attachments. Equipment often cab operated. Duty cycles approaching continuous operation are frequently necessary. User must specify exact details of operation, including weight of attachments.	60 (100%)	600	N/A [Note (2)]	N/A [Note (2)]

GENERAL NOTES:

(a) *Two-Speed Operation.* Unless otherwise specified by the hoist manufacturer, electric hoists should not be operated at low speed for more than one-third of the maximum on time for any duty classification. Also, the end user should consider each transition from low to high speed or high to low speed a motor start when calculating the maximum number of starts per hour. For slow-speed operation beyond one-third of maximum on time, consult the hoist manufacturer.

(b) *Variable-Speed Operation.* For this Standard, variable-speed operation is categorized as follows:

(1) slow speed: operation at 25% to 50% of rated frequency

(2) normal speed: operation at 50% to 100% of rated frequency

(3) overspeed: operation above 100% of rated frequency

Unless otherwise specified by the hoist manufacturer, slow-speed operation of electric hoists equipped with variable frequency drive should be limited to no more than one-third of the maximum on time for any duty classification. For regular operating speeds below 25% of rated frequency, low-speed operation beyond one-third of the maximum on time, or overspeed operation, consult the hoist manufacturer. For calculation of the maximum number of starts per hour, a motor start is the starting of the motor from a stationary state. Any instances of starting the motor from a nonstationary state should not be considered in the calculation.

(c) See para. 4-1.2.3.

NOTES:

(1) K = mean effective load factor.

(2) Not applicable (N/A) since there are no infrequent work periods in Class H5 service.

If these operating criteria are met, the mean effective load factor will be 0.65 or less. If any 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. Refer to para. 4-1.3.3.

4-1.3.3 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 Nonmandatory Appendix B.

(a) Select a hoist class based on the general descriptions given in Column 2 of Table 4-1.2.3-1.

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

(c) Using the information in Columns 3 through 6 of Table 4-1.2.3-1, select the hoist speed that will meet the operational time ratings for the hoist duty class.

(d) Determine the value of K. If K is greater than 0.65, select a hoist of a higher rated load and recalculate K to ensure it is less than 0.65.

(e) Contact the manufacturer if the value of K exceeds 0.65 and the operational time required exceeds the values listed in Table 4-1.2.3-1.

SECTION 4-1.4: SPECIFICATION OF LIFT, HEADROOM, AND REACH

4-1.4.1 Lift

The purchaser should specify the required lift on their inquiry or bid request.

4-1.4.2 Headroom

Headroom should be specified if important to the application.

4-1.4.3 Reach

Reach should be specified if important to the application.

SECTION 4-1.5: SPEEDS: HOIST AND TROLLEY

Hoist and trolley speeds should be determined by an analysis of the number and length of cycles required for the work period. Table 4-1.5-1 lists typical speed ranges for hoists and trolleys that are commonly available from most hoist manufacturers. Actual speeds may vary ±10% from the specified rating.

NOTE: Table 4-1.5-1 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 ranges shown are not compatible with the required class of hoist.

Accurate load spotting applications for a hoist or trolley may require reduced speed or multiple speed control. Refer to para. 4-3.3.1.

SECTION 4-1.6: TYPES OF TROLLEYS

Hoist trolleys are available in plain, hand-chain-operated, and motor-driven types. Selection of each type depends upon the application. When a trolley is required for use with a hoist, the type and size of support beam shall be specified to ensure that the trolley is suitable for the minimum radius and the contour of the beam.

4-1.6.1 Plain Type

A plain-type trolley is recommended where trolley motion is infrequent or relatively short. Due to the force required 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 ton (2 722 kg) with the elevation of the beam not more than 20 ft (6 m) above the operator's floor level.

4-1.6.2 Hand-Chain Operated

A hand-chain-operated trolley is operated by pulling on the hand chain that is connected to the trolley wheel through gears or sprockets. This type of trolley is recommended where trolley motion is relatively infrequent or short and for those capacities and beam heights where a plain-type trolley would be impractical. The hand-chain-operated trolley provides good load spotting ability.

Table 4-1.5-1 Typical Hoist and Motorized Trolley Speeds

Rated Load, ton (kg) [Note (1)]	Hoist Speed, ft/min (m/min)	Motorized Trolley Speed, ft/min (m/min)
0.5 (454)	10 to 60 (3 to 18)	30 to 100 (9 to 30)
1 (907)	10 to 60 (3 to 18)	30 to 100 (9 to 30)
2 (1 814)	10 to 40 (3 to 12)	30 to 100 (9 to 30)
3 (2 722)	10 to 35 (3 to 10.5)	30 to 100 (9 to 30)
5 (4 536)	10 to 35 (3 to 10.5)	30 to 100 (9 to 30)
7.5 (6 804)	10 to 35 (3 to 10.5)	30 to 100 (9 to 30)
10 (9 072)	10 to 30 (3 to 9)	30 to 100 (9 to 30)
15 (13 608)	10 to 25 (3 to 7.5)	30 to 100 (9 to 30)
20 (18 144)	10 to 20 (3 to 6)	30 to 100 (9 to 30)
25 (22 680)	10 to 15 (3 to 4.5)	30 to 100 (9 to 30)

GENERAL NOTE: Single-line hoist speeds are excluded.

NOTE: (1) Ton of 2,000 lb.

The hand chain shall be guarded to prevent its disengagement from the hand chain wheel. The hand chain shall withstand, without permanent deformation, a force of three times the pull required to traverse the trolley with rated load.

4-1.6.3 Motor Operated

A motor-operated trolley is recommended where the operating frequency, distance of travel, rated load, beam elevation, or type of load being handled exceeds recommendations for the use of plain or hand-chain-operated trolleys. The design of motor-operated trolleys shall be based on intermittent operation on a straight beam unless otherwise specified. Where trolley travel involves a curved beam, beam switches, exceptionally long runs, or near continuous operation, a special design may be required. Full particulars should be provided with the inquiry.

A cushioned start or multispeed drive is recommended for trolley speeds above 100 ft/min (30 m/min) or for use on beams with curved sections. Brakes, when specified, should 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 speed in feet (meters) per minute when traveling at rated speed with rated load.

(b) Brakes shall have heat dissipation capability for the frequency of operation defined by the user.

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

4-1.6.4 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.

Chapter 4-2
Mechanical

SECTION 4-2.1: REEVING

Hoist reeving may be either single or double and may be one part or multiple parts.

4-2.1.1 Single Reeving

On single-reeved hoists, one end of the rope is attached to the drum. Continuous drum grooving runs in one direction. The load block moves laterally in the direction of the axis of the drum as the rope winds onto or off of the drum. Refer to Figure 4-0.2-2.

4-2.1.2 Double Reeving

On double-reeved hoists, both ends of the rope are attached to the drum. The drum is grooved with left- and right-hand grooves beginning at both ends of the drum then grooving toward the center of the drum. The load block will follow a true vertical path (true vertical lift) as the ropes wind toward or away from each other onto or off of the drum. Refer to Figure 4-0.2-2.

SECTION 4-2.2: BEARINGS

Bearings shall be selected to give a minimum B10 life expectancy based on full rated speed as follows:

Class	Minimum Life Expectancy, hr
H1	1,250
H2	2,500
H3	5,000
H4	10,000
H5	20,000

Bearing loads, for life computation purposes, shall be determined using a mean effective load factor of 0.65.

SECTION 4-2.3: 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 the hoist, trolley, or supports. This 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. It shall not be used to sense the overload imposed by a constrained load.

Chapter 4-3
Electrical

SECTION 4-3.1: GENERAL

All furnished electrical equipment shall conform to the applicable sections of the latest edition of ANSI/NFPA 70. The user shall specify the voltage, frequency, and phase of the power supply. The supply voltage shall be maintained within ±10% of the rated motor voltage at the hoist with motor operating at rated load.

4-3.1.1 Hazardous Locations

When hoists are used in hazardous locations as defined by ANSI/NFPA 70 or other special codes, modifications or additional safety precautions not covered by this Standard may be required. Only hoists designed for the conditions encountered shall be used in these locations.

4-3.1.2 Fungus Protection

In tropical areas or other warm and humid atmospheres, fungus growth may occur on unprotected organic materials or on accumulations of dust. There are materials and procedures that will minimize these effects. Refer to the hoist manufacturer.

SECTION 4-3.2: MOTORS

(a) Motors shall be reversible, with torque characteristics suitable for hoist or trolley service, and capable of operation at rated loads and speeds in accordance with the specified service class.

(b) Temperature rise of motors shall be in accordance with the latest NEMA MG1 Motor Standard for the class of insulation and enclosure used. The hoist manufacturer will assume 104°F (40°C) ambient temperature unless otherwise specified by the user.

(c) All AC motors at rated frequency and all DC motors shall be capable of operation within ±10% of rated motor voltage, but not necessarily at rated voltage performance.

(d) Standard rated motor voltage shall be in accordance with Table 4-3.2-1.

Table 4-3.2-1 Typical Rated Motor Voltages

	Voltage		
Power Supply	**Nominal System**	**Rated Motor Voltage**	**Permissible Motor Operating Range**
AC, single phase, 60 Hz	120	115	104 to 126
	240	230	207 to 253
AC, polyphase, 60 Hz	208	200	180 to 220
	240	230	207 to 253
	480	460	414 to 506
	600	575	518 to 632
AC, polyphase, 50 Hz	208	200	180 to 220
	230	220	198 to 242
	400	380	342 to 418
DC	125	115	104 to 126
	125	120	108 to 132
	250	230	207 to 253
	250	240	216 to 264

(e) For nominal system voltage other than shown in Table 4-3.2-1, the rated motor voltage should not be less than 95% of and should not exceed the nominal system voltage.

SECTION 4-3.3: CONTROLLERS

4-3.3.1 Types of Control

The following types of control are available:

(a) single-speed squirrel-cage motor with single-speed magnetic control for use on hoists and trolleys
(b) two-speed squirrel-cage motor with two-speed magnetic control for use on hoists and trolleys
(c) variable-speed wound rotor trolleys
  (1) three-position, or more, magnetic control for use on hoists with mechanical load brake and on trolleys
  (2) five-position magnetic electric load brake control for use on hoists without mechanical load brake
  (3) five-position magnetic counter-torque control for use on hoists without mechanical load brake
(d) single-speed squirrel-cage motor with cushioned start for use on trolleys
(e) two-speed squirrel-cage motor with cushioned start for use on trolleys

Other types of hoist and trolley control are available that are beyond the scope of this Standard. Consult the hoist manufacturer.

4-3.3.2 Contactors

Each magnetic control shall have contactors sized for the specified service. Reversing contactors shall be interlocked to guard against line-to-line faults.

4-3.3.3 Pendant Control

(a) Motion control actuators shall automatically return to the "OFF" position.
(b) The pendant control station shall be mechanically supported to protect the electrical conductors against strain.
(c) The pendant control station shall be clearly marked to indicate the function of each actuator.
(d) The order of control functions, unless otherwise specified and as applicable, from top to bottom should be
  (1) stop-start (off-on, power off-power on). The "STOP" ("OFF," "POWER OFF") control actuator shall be red.
  (2) hoist.
  (3) trolley.
  (4) other functions.
(e) Any pendant station that might present a hazard to the operator if a ground fault occurs shall be grounded.
(f) Unless otherwise specified, the standard pendant control shall have a cord length that will locate the pendant approximately 3 ft to 4 ft (0.9 m to 1.2 m) above the lower limit of lift.

4-3.3.4 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 (1.22 m to 1.52 m) above the lower limit of lift.

SECTION 4-3.4: CONTROL ENCLOSURES

Control enclosures, unless otherwise specified by the user, shall be NEMA Type 1 general purpose for indoor application in accordance with ANSI/NEMA ICS-6.

Other types, as defined by NEMA, include but are not limited to the following:

(a) NEMA Type 3 — dust-tight, rain-tight, sleet (ice) resistant, outdoor
(b) NEMA Type 3R — rainproof, sleet resistant, outdoor
(c) NEMA Type 4 — watertight, dust-tight, indoor and outdoor
(d) NEMA Type 4X — watertight, dust-tight, corrosion resistant, indoor and outdoor
(e) NEMA Type 12 — industrial use, dust-tight, drip-tight, indoor
(f) NEMA Type 7 — Class I, Groups C and D, indoor hazardous locations (explosive atmosphere)
(g) NEMA Type 9 — Class II, Groups E, F, and G, indoor hazardous locations (explosive atmosphere)

SECTION 4-3.5: RESISTORS

Resistors, when furnished, shall have sufficient thermal capacity for the class of service specified. Enclosures for resistors shall provide means for heat dissipation and shall be installed to minimize the accumulation of combustible matter. Provision shall be made to contain broken resistor parts or molten metal.

SECTION 4-3.6: CURRENT CONDUCTOR SYSTEMS

Current conductor systems are not normally supplied with electric wire rope hoists. When required, they must be specified by the user.

Typical systems used are listed here for reference.

(a) Hoists Without Trolleys. These have a length of flexible power cord.

(b) Trolley-Mounted Hoists. These have one of the following conductor systems:

(1) flexible cable
(2) coiled cord
(3) festooned cable arrangement
(4) cable reel
(5) rigid conductor

Chapter 4-4
Typical Electric Wire Rope Hoist and Trolley Inquiry Data Form

SECTION 4-4.1: INQUIRY DATA FORM

See Form 4-4.1-1. An editable digital copy of this form is available at http://go.asme.org/HSTForms.

Form 4-4.1-1 Typical Electric Wire Rope Hoist and Trolley Inquiry Data Form

HOIST

Quantity required ______________

Rated load ______________ tons (______________ kg)

Lift [Note (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:

☐ Single speed ☐ Two speed

☐ Variable speed ☐ Other ______________

POWER SUPPLY

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

Performance Requirements (see Chapter 4-1 and Nonmandatory Appendix B):

Average lift ______________ ft (______________ m)

Number of lifts/hr ______________

Number of starts/hr ______________

Work period hr/day ______________

Hoist service classification H ______________

Furnish complete information regarding any abnormal operating conditions. For hazardous locations, identify location classification as specified in NFPA 70, if applicable, and additional information that may impact a spark-resistance assessment: ______________

____

____

____

Type of suspension:

☐ Lug ☐ Hook ☐ Clevis

☐ Plain trolley ☐ Hand-chain-operated trolley

☐ Motor-driven trolley ☐ Other ______________

TROLLEY

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

☐ Trolley brake required

Type of control:

☐ Single speed ☐ Two speed

☐ Cushioned start ☐ Variable speed

☐ 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 (if required):

☐ Tagline ☐ Festooned cable

☐ Cable reel ☐ Conductor-collector system

☐ Other ______________

Type of conductors (make or manufacturer) ______________

____

Location of conductors on beam (use sketch if necessary) ______________

____

____

OPTIONAL EQUIPMENT REQUIRED

____

____

____

____

____

____

____

NOTE:

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

NONMANDATORY APPENDIX A
PERFORMANCE REQUIREMENTS FOR ELECTRIC WIRE ROPE 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-4 for wire rope electric-powered hoists for use in marine applications and other applications as required by the Department of Defense (DOD).

This Appendix, in conjunction with ASME HST-4, replaces the requirements of MIL-H-15317 for electric wire rope hoists.

A-1.2 Classification

Wire rope electric-powered hoists shall be of the following types:

Type I Electric wire rope hoist, parallel or right-angle geared, or plain trolley suspension
Type II Electric wire rope hoist, base (winch type), wall, or ceiling mounted
Type III Electric wire rope hoist, hook suspension

A-1.3 Definitions

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

continuous operation: lifting and lowering a rated load through the full hoisting range 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 Wormgear Speed Reducers and Gearmotors
Publisher: American Gear Manufacturers Association (AGMA), 1001 North Fairfax Street, Suite 500, Alexandria, VA 22314 (www.agma.org)

ASME B30.16, Overhead Hoists (Underhung)
Publisher: The American Society of Mechanical Engineers (ASME), Two Park Avenue, New York, NY 10016-5990 (www.asme.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
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 International), 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 (www.astm.org)

IEEE 45, Recommended Practice for Electric Installations on Shipboard
Publisher: Institute of Electrical and Electronics Engineers, Inc. (IEEE), 445 Hoes Lane, Piscataway, NJ 08854 (www.ieee.org)

MIL-C-24643, Cables and Cords, Electric, Low Smoke, for Shipboard Use, General Specification for
MIL-DLT-917, Detail Specification: Electric Power Equipment, Basic Requirements
MIL-STD-889, Detail Specification: Dissimilar Metals
MIL-S-901, Shock Tests, H.I. (High-Impact) Shipboard Machinery, Equipment, and Systems, Requirements for
Publisher: Department of Defense, Defense Logistics Agency (DLA), DLA Document Services, Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094 (http://quicksearch.dla.mil)

UL 991, Tests for Safety-Related Controls Employing Solid-State Devices
Publisher: Underwriters Laboratories, Inc. (UL), 333 Pfingsten Road, Northbrook, IL 60062-2096 (www.ul.com)

A-2 PERFORMANCE REQUIREMENTS

A-2.1 General

Performance requirements shall be in accordance with ASME HST-4 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. Assemblies containing dissimilar metals shall be protected against galvanic corrosion in accordance with MIL-DTL-917 and MIL-STD-889. 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(c)], hooks shall be zinc plated. Zinc plating shall be in accordance with ASTM B633, Type I, Class Fe/Zn 13. The hook throat safety device shall be constructed of noncorrosive material or treated for corrosion resistance. 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(d)].

A-2.4 Emergency Manual Operation

When specified [see para. A-6(e)], the hoist shall be equipped with a handwheel attached to an extension of the electric motor shaft for emergency manual operation of the hoist in the event of an electric power failure. It shall be possible to declutch the handwheel when it is not in use. An interlock shall be provided to prevent operation of the hoist electrically while the handwheel 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, and not more than 1 lb per 300 lb (0.45 kg per 136.1 kg) of total hoist load shall be required for manual operation of the trolley.

A-2.4.1 Hand Chain. The handwheel described in para. A-2.4 shall be operated by a removable chain, which, when fitted, will have a drop of approximately 2 ft (0.6 m) less than the specified lift of the hoist.

A-2.5 Load Positioning Control

The hoist control system shall vertically position a load to within ±$\frac{1}{4}$ in. (±6.35 mm).

A-2.6 Lubrication

Lubricants used shall be readily available and be 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.

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 Stress

The maximum combined stress in component parts shall not exceed 35% of the tensile yield strength of the material for hoist operation at rated capacity. The maximum combined stress 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 136.1 kg) of total hoist load shall be required for manual operation of the trolley.

A-3.2 Load Hooks

Hook throat openings shall be in accordance with the dimensions shown in Table A-3.2-1. 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.

Table A-3.2-1 Hook Throat Openings

Hoist Rated Load, lb (kg)	Minimum Hook Throat Opening, in. (mm)
1,000 (453.6)	0.75 (19.1)
2,000 (907.2)	0.906 (23.0)
3,000 (1 360.8)	1.0 (25.4)
4,000 (1 814.4)	1.125 (28.6)
5,000 (2 268.0)	1.125 (28.6)
6,000 (2 721.6)	1.5 (38.1)
7,500 (3 401.9)	1.375 (34.9)
10,000 (4 535.9)	1.625 (41.3)
11,000 (4 989.5)	2.0 (50.8)
13,000 (5 896.7)	2.063 (52.4)
15,000 (6 803.9)	2.063 (52.4)
17,000 (7 711.1)	2.063 (52.4)
20,000 (9 071.8)	2.25 (57.2)
25,000 (11 339.8)	2.25 (57.2)
30,000 (13 607.8)	2.75 (69.9)
40,000 (18 143.7)	3.0 (76.2)

A-3.2.1 Range of Hook. The hoist shall pick up a load with the hook within 3.5 ft (1.07 m) perpendicular to the drum centerline, at the point the rope reeves on the drum, and 7 ft (2.1 m) below the drum centerline.

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 to 130°F (−29°C to 54°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 Wire Rope. Wire rope shall provide a safety factor of at least 5 for the rated load based on the minimum breaking strength of the wire.

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

A-3.3.3 Overtravel Protection. The lift-limiting device specified in ASME B30.16, Section 16-1.2.14 shall ensure that the hoist automatically stops in the lowering position so as not to exceed the lower limit of travel.

A-3.3.4 Overload Protection. Mechanical overload limiting devices shall not be permitted in naval applications unless the hoist is provided with a mechanical load brake and the mechanical overload limiting device is not installed on the load side of the hoist.

A-3.4 Type I Electric Wire Rope Hoist, Parallel or Right-Angle Geared, or Plain Trolley Suspension

A-3.4.1 Trolleys. Trolleys shall be geared or plain, as specified [see para. A-6(f)].

A-3.4.2 Trolley Wheels. Trolley wheel spacing shall be suitable for use on applicable standard I-beam flange size. Means shall be provided to prevent the trolley wheel flanges from riding up onto the supporting beam.

A-3.4.3 Trolley Equalizers. Means shall be provided for distributing the hoist load equally into trolley side frames.

A-3.4.4 Trolley Track Clamps. Quick-acting track clamps shall be provided for locking fully loaded hoists to the track. Clamps shall be adjustable for wear and function equally well on curved or straight track. 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. Operation of the track clamps shall be with a chain wheel equipped with hand chain. Hand pull required to set or release the track clamps shall not exceed 80 lb (36.3 kg). Chain drop shall be approximately 2 ft (0.6 m) less than the specified lift of the hoist.

A-3.4.5 Cable Reel. An automatic, clock-spring-type cable take-up reel for ceiling mounting shall be furnished for the hoist motor power supply cable.

A-3.4.6 Trolley Track. Trolley track for Type I hoists shall be I-beam of the weight and radius specified [see para. A-6(g)].

A-3.4.7 Control Stations. Control stations shall be pendant control type or bulkhead mounted as specified [see para. A-6(h)].

A-3.5 Type II Electric Wire Rope Hoist, Base (Winch Type), Wall, or Ceiling Mounted

A-3.5.1 Mounting. Hoist shall be designed for deck, bulkhead, or overhead mounting.

A-3.5.2 Control Stations. Control stations shall be pendant control type or bulkhead mounted as specified [see para. A-6(h)].

A-3.6 Type III Electric Wire Rope Hoist, Hook Suspension

A-3.6.1 Mounting. The mounting hook shall have a spring-loaded-type safety gate resting against the tip of the hook. The 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-3.6.2 Control Stations. Control stations shall be pendant control type or bulkhead mounted as specified [see para. A-6(h)].

A-3.7 Materials

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

A-3.7.1 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-3.7.2 Prohibited Materials. 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-3.7.3 Cast Iron. Cast iron shall not be used for load-bearing parts. Cast iron for non-load-bearing parts shall be in accordance with ASTM A48, Class 35 or better.

A-3.7.4 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 45 and, when specified [see para. A-6(i)], shall withstand high-impact, grade A shock (see para. A-5.1.1). If shock testing is specified, the power supply 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 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 45 for the class of insulation and enclosure used.

A-4.2.2 Hoist Brakes. The hoist 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 electric brake shall stop and safely hold 150% of the hoist rated load at any operating speed. The electric brake shall hold a static load equal to 200% of the hoist rating.

When specified [see para. A-6(j)], manual release of the electric brake shall be provided to permit manual operation by the handwheel 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 returns to the "OFF" position when released). Push-button controls shall be fully enclosed in a shock-resistant watertight case with rounded corners. The enclosure shall be watertight.

A-4.2.4 Control Enclosures. Control enclosures, unless otherwise specified [see para. A-6(k)], shall be NEMA Type 12 in accordance with IEEE 45.

A-4.2.5 Electromagnetic Interference and Compatibility. Hoist electrical equipment shall operate satisfactorily under the electromagnetic environment specified in Table A-4.2.5-1.

A-5 TESTING, MARKING, AND DATA

A-5.1 Testing

A-5.1.1 High-Impact Shock. When specified [see para. A-6(i)], hoists shall undergo the high-impact shock test in accordance with the requirements of MIL-S-901. Hoists shall undergo the Type A test specified for a principal unit. 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 III 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 the 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 (0.6 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

Table A-4.2.5-1 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

from those specified, shall be submitted to the contracting activity. Shock tests shall comply with the requirements as specified. Following successful completion of the high-impact shock test, the hoist shall be subjected to the following tests.

A-5.1.2 Load. A hoist with an overload protection device 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. The hoist and trolley shall operate satisfactorily, and the brake shall exhibit no sign of slippage.

A-5.1.3 Operating. Hoists shall be tested 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 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. The hoist shall demonstrate its capability of accurately positioning a load. The test shall be conducted by establishing a reference height and then jogging the load to a position ±$\frac{1}{4}$ in. (±6.35 mm) above and below the reference height. Repeat each test at least six times. Each positioning shall be accomplished by energizing the motor not more than six times.

(e) Performance. The hoist shall be continuously operated at maximum speed [80 ft/min (24.4 m/min)] 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 I geared trolley hoists, 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 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 I 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 prevent the loaded hoist from moving in either direction when the trolley track is in a horizontal position.

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. Hoists shall accomplish this lift without the rope jumping the grooves on the cable drum. The lift shall be conducted four times; once forward, once aft, and once on each side of the hoist.

A-5.1.9 Mounting Hook for Type III Hoist. The safety gate of the mounting hook as specified shall demonstrate its ability to hold a load equal to the weight of the fully loaded hoist. This hook shall be attached to a pad eye 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 distortion and shall operate properly upon removal of the load.

A-5.1.10 Endurance. Hoists shall be subjected to 3,000 cycles of continuous operation (see para. A-1.3). A cycle of operation is defined as the lifting and lowering through the full hoisting range a rated load at the specified lifting and lowering speeds. 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 of ASME B30.16, para. 16-1.1.3, the hoist 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, ASME HST-4
(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(l)] 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

A-6 TYPICAL HOIST INQUIRY DATA

In addition to the typical hoist inquiry data of ASME HST-4, acquisition documents shall specify the following:

(a) compliance with Nonmandatory Appendix A, ASME HST-4 (if required)
(b) type of hoist required (see para. A-1.2)
(c) if zinc coating of hooks is required (see para. A-2.2)
(d) maximum weight and envelope dimensions required (see para. A-2.3.1)
(e) if handwheel is required (see para. A-2.4)
(f) geared or plain trolley on Type I hoists (see para. A-3.4.1)
(g) size and radius of the I-beam for Type I hoists (see para. A-3.4.6)
(h) type of control station required (see paras. A-3.4.7, A-3.5.2, and A-3.6.2)
(i) hoist shock-resistance grade A (see paras. A-4.1 and A-5.1.1)
(j) manual release of electric brake (see para. A-4.2.2)
(k) type of enclosure (see para. A-4.2.4)
(l) technical manuals (see para. A-5.3.1)

NONMANDATORY APPENDIX B
EXAMPLES OF DETAILED APPLICATION ANALYSIS

B-1 TYPICAL EXAMPLES OF HOIST CLASS SELECTION

See Table B-2-1, which may be used as a worksheet.

B-1.1 Example No. 1

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

(b) Selection. Review of Table 4-1.2.3-1 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 that the hoist is to be used periodically to unload a truckload of steel. 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 truckload of steel would require specifying Class H3.

B-1.3 Example No. 3

(a) Application. A hoist for foundry use is to be used to handle raw castings for storage. Two basic sizes of castings will be handled, one weighing 1,500 lb and the other 7,500 lb. A 10,000-lb 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 of the 15 min, the hoist will be operating 50% of the time with 7,500 lb on the hook, 25% with 1,500 lb, and 25% with no load, with a maximum of 150 starts/hr.

(b) Selection. The load distribution cannot be defined as randomly distributed. Therefore, choosing a hoist directly from Table 4-1.2.3-1 could lead to incorrect selection. Following the procedure outlined under para. 4-1.3.2, tentatively select a Class H3 hoist based on the 15-min utilization time, and calculate the value of K.

$$K = \left\{\left[\left(\frac{7{,}500}{10{,}000}\right)^3 \times 0.5\right] + \left[\left(\frac{1{,}500}{10{,}000}\right)^3 \times 0.25\right] + \left[\left(\frac{0}{10{,}000}\right)^3 \times 0.25\right]\right\}^{\frac{1}{3}} = 0.6 \qquad \text{(B-1-1)}$$

$K < 0.65$. Therefore, a Class H3 hoist rated 5 ton would be adequate to meet the requirements of the application.

B-1.4 Example No. 4

(a) Application. The application is basically the same as Example No. 3, except that the user has decided to purchase a 4-ton hoist.

(b) Selection. Follow the same procedure as in Example No. 3, para. B-1.3(b).

$$K = \left\{\left[\left(\frac{7{,}500}{8{,}000}\right)^3 \times 0.5\right] + \left[\left(\frac{1{,}500}{8{,}000}\right)^3 \times 0.25\right] + \left[\left(\frac{0}{8{,}000}\right)^3 \times 0.25\right]\right\}^{\frac{1}{3}} = 0.75 \qquad \text{(B-1-2)}$$

$K > 0.65$ and the selection is incorrect. The selection of the Class H3 hoist rated 5 ton, as in Example No. 3, is correct.

Table B-2-1 Example of Detailed Analysis Worksheet

Task	Load, L, lb	Load Magnitude, $W = L/C$	Lift, D, ft	Number of Lifts per Hour, N	Time, $T = (N \times 2 \times D)/V$	Probability, $P = T/R$
1						
2						
3						
-						
-						
-						
-						
-						
n						

GENERAL NOTE:
C = rated load of the hoist
D = distance the load is to be lifted, ft
L = load to be lifted, lb
N = number of lifts per hour
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 equation must equal 1.0.
= T/R
R = total hoist running time for all tasks, min
T = running time of the hoist for each task
= $(N \times 2 \times D)/V$
task = load to be lifted
V = hoist speed, ft/min
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, e.g., lifting attachments or devices.

B-1.5 Example No. 5

(a) Application. An electric wire rope hoist is to be used for dipping racks of parts into a series of tanks. The total lift distance is 6 ft. The operation is repetitive, requiring 70 lift-lower cycles/hr. The total load is 1,000 lb including racks. An empty rack weighs 160 lb. The hoist is operating 90% of the time with 1,000 lb and 10% of the time with 160 lb.

(b) Selection. A 1-ton hoist has been selected.

$$K = \left\{\left[\left(\frac{1{,}000}{2{,}000}\right)^3 \times 0.9\right] + \left[\left(\frac{160}{2{,}000}\right)^3 \times 0.1\right]\right\}^{\frac{1}{3}} = 0.48 \tag{B-1-3}$$

$K < 0.65$. Selection of a 1-ton hoist is correct. Total lifting and lowering distance per hour 6 ft × 2 ft × 70 = 840 ft/hr. A hook speed of 30 ft/hr is selected. The resulting "ON" time per hour is

$$\frac{840\ \text{ft/hr}}{30\ \text{ft/hr}} = 28\ \text{min/hr}$$

requiring a Class H4 hoist. The user estimated that 4 starts are required per lift-lower cycle, resulting in 280 starts/hr, also requiring a Class H4 hoist. Note that the selection of a 60-ft/min hook speed would result in 14-min/hr "ON" time, but the hoist would still have to be Class H4 because of the 280 motor starts/hr.

B-2 DETAILED ANALYSIS WORKSHEET

See Table B-2-1.
Total running time: $R = \sum T$.
Maximum number of starts per hour: $S = 2 \times \sum N$

$$K = \left(W_1^3 P_1 + W_2^3 P_2 + W_3^3 P_3 + \ldots + W_n^3 P_n\right)^{1/3} \quad \text{(B-1-4)}$$

If $K > 0.65$, pick a hoist with higher capacity, C, and recalculate.

NONMANDATORY APPENDIX C
MECHANICAL SPARK RESISTANCE GUIDANCE FOR APPLICATIONS IN HAZARDOUS (POTENTIALLY EXPLOSIVE) LOCATIONS

C-1 GENERAL

C-1.1 Introduction

The electrical requirements for hoists used in hazardous locations in North America are well defined by recognized standards and codes published by NEMA, NFPA, and ANSI. However, none of these documents address mechanical spark resistance for hoists used in these locations.

In general, spark avoidance is required for applications in explosion hazard areas to address the explosive potential of the following three areas:

(a) buildup of electrostatic charges

(b) sparking caused by the impacting and friction of components

(c) excessive surface temperatures

Grounding and bonding of equipment to avoid the buildup of electrostatic charges and maximum surface temperatures for electrical components used in hazardous locations are addressed in these electrical codes and are not addressed in this Appendix.

This Appendix focuses on recommendations for physical features aimed at reducing the potential for generating sparks caused by the impacting and sliding of components and of excessive surface temperatures that could result from operation of the hoist's mechanical components.

Ensuring that a hoist is suitable for use in a potentially explosive atmosphere requires a collaborative effort of the hoist manufacturer and the end user of the hoist. The end user of the hoist must identify one or more qualified persons who are familiar with the specifics of the application and can work with the manufacturer to provide application details. Such details may include a detailed specification for the hoist to allow the manufacturer to configure the hoist to suit the application. This configuration will be based on the information provided by the end user, any applicable standards, and the manufacturer's experience. However, the ultimate responsibility for ensuring the hoist is suitable for the application remains with the qualified person(s) identified by the end user. Collaboration between the manufacturer and the end user during the design and procurement portion of the project is recommended.

After installation, the equipment must be operated and maintained per the manufacturer's recommendations, as verified by the overseeing qualified person, to ensure continued successful operation in hazardous atmospheres.

C-1.2 Scope

This Appendix provides guidance and recommendations for providing mechanical spark resistance for hoists covered under this Standard when hoists are to be used in hazardous (potentially explosive) locations as defined by the NFPA 70 National Electric Code (NEC). These recommendations are not intended to be all inclusive, and the features required to render a hoist suitable for use in a specific hazardous location and application must be determined by a qualified person who is familiar with that location and application.

C-1.3 Hazardous Location Classification

The NFPA 70 defines hazardous locations by class, division, and group as follows:

Class I: a location where explosive gases, vapors, or liquids are present.

Class II: a location where explosive or combustible dust is present.

Class III: a location where combustible fibers or flyings are present.

Division I: a location where the hazardous material is present continuously, long term, or frequently.

Division II: a location where the hazardous material is not likely to be present or is present only in the short term.

Groups A, B, C, and D: a location where the hazardous material is a specific gas, liquid, or vapor.

Groups E, F, and G: a location where the hazardous material is specific dust, fiber, or flyings.

General guidelines for mechanical spark resistance are not dependent on the specific hazardous material present in the location. Therefore, the recommendations made in this Appendix focus on the likelihood that the material will be present. Recommendations are made for both Division I and Division II locations.

C-1.4 References to Other Codes and Standards

Refer to the following publications, copies of which may be obtained from the publisher as indicated. Unless otherwise specified, the latest edition shall apply.

DIN EN ISO 80079-36, Explosive atmospheres — Part 36: Non-electrical equipment for explosive atmospheres — basic method and requirements

DIN EN ISO 80079-37, Explosive atmospheres — Part 37: Non-electrical equipment for explosive atmospheres— Non-electrical type of protection constructional safety “c”, control of ignition sources “b,” liquid immersion “k”

DIN EN 1127-1, Explosive atmospheres — Explosion prevention and protection — Part 1: Basic concepts and methodology

Publisher: DIN Deutsches Institut für Normung e. V., Am DIN-Platz, Burggrafenstraße 6, 10787 Berlin, Germany (www.din.de)

FEM 9.751, Power Driven Series Hoist Mechanisms Safety — Annex C, Additional Requirements for Explosion Hazard Areas

Publisher: European Materials Handling Federation (FEM), BluePoint Brussels, 80 Boulevard Auguste Reyers, B - 1030 Brussels, Belgium (www.fem-eur.com)

NFPA 70 (2017), National Electrical Code (NEC)

Publisher: National Fire Protection Association (NFPA), One Batterymarch Park, Quincy, MA 02169-7471 (www.nfpa.org)

C-2 USE OF REFERENCED DOCUMENTS

NFPA 70 includes specific definitions for the various classified areas where hoists may be used. These definitions and requirements shall be considered correct for this Appendix. NFPA 70 provides the requirements for all electrical aspects of electric-powered hoists used in areas classified per NPFA 70, such as motors, electrically controlled brakes, controls, wiring methods, and grounding.

FEM 9.751, DIN EN ISO 80079-36, DIN EN ISO 80079-37, and DIN EN 1127-1 are standards used within the European Union (EU) for machinery used in potentially explosive environments. EU standards define potentially explosive environments differently than NFPA 70. As such, there is no direct correlation between the two approaches. However, there is sufficient similarity to allow application of the EU standards as a basis for a hazard analysis methodology and for potential design solutions for nonelectrical aspects of hoists for all power sources.

Other standards that are not referenced within this Appendix may be used at the discretion of the user to assess the nature of the hazard and to select a viable design solution. The referenced standards are provided as potential sources of additional information.

C-3 MECHANICAL SPARK RESISTANCE

C-3.1 General

Hoist performance requirements will be in accordance with ASME HST-4. This Appendix provides general guidance and recommendations for special features aimed at providing mechanical spark resistance for hoists covered under this Standard when these hoists are to be used in hazardous (potentially explosive) locations as defined by NFPA 70.

C-3.2 Materials

In general, austenitic stainless steels and alloys of bronze, brass, and copper are preferred for spark resistance. However, coatings of zinc, copper, and nickel alloys may be used in place of solid spark-resistant materials depending on the specific hazardous location and application.

Aluminum, carbon steels, magnesium, and corroded materials are to be avoided in components when spark resistance is desired.

C-3.3 Trolley Wheels

Spark generation from trolley wheels rolling on a beam or other surface is normally not an issue at trolley speeds of 180 ft/min or less. However, spark resistance is recommended for high-speed applications or applications where side loading, impact loading, or load swing may occur that could shift the trolley and cause the trolley wheels to slide or impact the running surface of the trolley or runway rail.

(a) For Division I locations, it is recommended that trolley wheels be manufactured from a solid nonsparking material.

(b) For Division II locations, trolley wheels should be manufactured from either solid nonsparking material or sparking materials provided with a nonsparking coating. However, the end user must be aware of the potential for the coating to be worn or otherwise damaged, negating the spark-resistant protection.

C-3.4 Lower Hooks and Blocks

The potential of an unloaded lower hook and block to swing and impact other surfaces is relatively high in most applications. In applications where metal rings, metal slings, or wire ropes are used to rig the load to the hoist hook, the potential for the rigging to shift in the hook saddle is similarly high. Therefore, spark resistance is recommended for all lower hooks and blocks used in hazardous locations.

(a) For Division I locations, it is recommended that lower hooks and blocks be manufactured from a solid nonsparking material. If the use of solid nonsparking materials for the lower hook and block is not practical, sparking materials provided with a nonsparking coating may be used. However, the end user must be aware of the potential for the coating to be worn or otherwise damaged, negating the spark-resistant protection. The use of metal rings, metal slings, wire ropes, or other metallic rigging with coated hooks is not recommended.

(b) For Division II locations, lower hooks and blocks should be manufactured either from solid nonsparking material or from sparking materials provided with a nonsparking coating. However, the end user must be aware of the potential for the coating to be worn or otherwise damaged, negating the spark-resistant protection.

C-3.5 Hook Latches

The potential of a spring-loaded hook latch to be released and strike the hook and rigging with enough energy to produce a spark is relatively high in most applications and therefore spark resistance is recommended.

For both Division I and Division II locations, it is recommended that hook latches and their hardware be manufactured from a nonsparking material.

C-3.6 Wire Ropes and Load Chains

The potential of a loaded hoist wire rope or load chain to contact a hoist drum, sheave, load wheel, or other hoist component with enough energy to create a spark is relatively high in most applications. A swinging lower block could also result in the wire rope or load chain striking another surface. Therefore, spark resistance is recommended.

(a) For Division I locations, it is recommended that wire ropes and load chains be manufactured from a solid nonsparking material. For chain hoists, nickel-diffused load chain is also an acceptable method for attaining spark resistance.

(b) For Division II locations, wire ropes and load chains should be manufactured either from solid nonsparking material or from sparking materials provided with a nonsparking coating. However, the end user must be aware of the potential for the coating to be worn or otherwise damaged, negating the spark-resistant protection.

C-3.7 Wire Rope or Load Chain Guides

Spark resistance is recommended in hoist designs where contact between the wire rope and guides is expected and may result in impact or sliding friction. In these cases, spark resistance can be obtained by addressing either the wire rope and load chain or the guides.

(a) For Division I locations, it is recommended that wire ropes and load chains or the guides be manufactured from a solid nonsparking material. Guides may also be produced from polymer materials to attain spark resistance.

(b) For Division II locations, wire ropes and load chains or their guides should be manufactured either from solid nonsparking material or from sparking materials provided with a nonsparking coating. However, the end user must be aware of the potential for the coating to be worn or otherwise damaged, negating the spark-resistant protection. Guides may also be produced from polymer materials to attain spark resistance.

C-3.8 Hoist Load Brakes

The requirements for electrical hoist load brakes used in hazardous locations are addressed in the NFPA 70 and are not addressed in this Appendix.

Mechanical spark resistance is recommended for hoist mechanical load brakes that are not enclosed and immersed in lubricant in the hoist transmission and that use a spring-actuated pawl contacting a brake ratchet.

For both Division I and Division II locations, it is recommended that the brake ratchet in these mechanical load brakes be manufactured from a nonsparking material.

C-3.9 Trolley Bumpers

In most applications, the potential of a trolley bumper to contact an end stop or other object with enough energy to generate a spark is relatively high. Therefore, spark resistance is recommended.

For both Division I and Division II locations, it is recommended that trolley bumpers be made from a solid nonsparking material or be faced with a nonsparking material. In most applications, an industrial-quality elastomeric material capable of providing long service for the intended application is an acceptable method for providing spark resistance.

C-3.10 Trolley Drop Stops

In most applications, the potential of a trolley wheel or axle to fail and cause the trolley drop stop to impact or slide on the rail or other running surface with enough energy to generate a spark is relatively low.

(a) For Division I locations, it is recommended that trolley drop stops be made from solid nonsparking materials.

(b) For Division II locations, spark resistance is not recommended for trolley drop stops unless a qualified person familiar with the application recommends the drop stops be spark resistant.

C-3.11 Hand Chain

In most applications, the potential of hand chains used to operate a manual hoist or trolley to contact a chain guide, chain wheel, or other component with enough energy to create a spark is relatively high. As a result, spark resistance is recommended.

(a) For Division I locations, it is recommended that the hand chain be made from solid nonsparking materials.

(b) For Division II locations, it is recommended that the hand chain be made from solid nonsparking material or from sparking materials provided with a nonsparking coating. However, the end user must be aware of the potential for the coating to be worn or otherwise damaged, negating the spark-resistant protection.

C-3.12 Gearing

The precision gearing used in most hoist mechanisms has a very tight mesh with limited backlash and does not present a sparking hazard in most applications. Most hoist gearing is enclosed and immersed in lubricants that further reduce the potential for sparking. However, the exposed gearing on traverse drives or similar mechanisms that normally exhibits significant clearance and backlash has a much higher potential for spark generation. Therefore, spark resistance is recommended for exposed gearing in such drives.

(a) For exposed gearing in Division I locations, it is recommended that either the pinion or driven gear be made from solid nonsparking materials.

(b) For exposed gearing in Division II locations, it is recommended that either the pinion or driven gear be made from solid nonsparking material unless a qualified person reviews the application and determines spark resistance is not required.

C-3.13 Sliding Components

The friction from sliding contact between components has the potential to generate a spark. This is a major concern in hazardous locations and must be addressed. In general, the best approach is to avoid sliding contact. However, when sliding contact is unavoidable, such as in friction bearings or guides, spark resistance is recommended.

(a) For Division I locations, it is recommended that one of the sliding surfaces be made from solid nonsparking materials.

(b) For Division II locations, it is recommended that one of the sliding surfaces be made from solid nonsparking material or that the surfaces be properly lubricated to reduce the potential for sparking.

In both Division I and Division II applications with sliding contact, care must be taken to ensure the surfaces are properly lubricated and not corroded.

C-3.14 Corrosion

The presence of corrosion on any surface will increase the sparking potential of the surface. Therefore, corrosion-resistant materials or coatings are recommended for all surfaces that have the potential of generating a spark from sliding friction or impact.

C-4 EXCESSIVE SURFACE TEMPERATURE

Maximum surface temperatures for hazardous locations are provided in NFPA 70, and these values for the specified hazardous location class should be used for all electrical and mechanical components. This Appendix covers excessive surface temperatures that could result from the operation of the hoist's mechanical components.

C-4.1 Mechanical Hoist and Trolley Brakes

Mechanical hoist and trolley brakes can be the source of excessive surface temperatures due to frequent operation or to the brake not fully releasing (dragging). Analysis, testing, or both should be performed to determine the worst-case surface temperature that may occur during regular equipment use.

C-4.2 Gears and Gearboxes

Gears, whether open to the atmosphere or enclosed within a gearbox, are normally lubricated to prevent heat buildup and thereby minimize excessive surface temperatures. Gears that are inadequately lubricated may be a source of excessive heat. The lubricant within a sealed gearbox may also be a source of excessive heat if the hoist is operated frequently, at high loads, or both. Analysis, testing, or both should be performed to determine the worst-case surface temperature that may occur during regular equipment use.

C-4.3 Bearings

Bearings are normally used to prevent heat buildup and thereby minimize excessive surface temperatures. However, a bearing that is improperly lubricated or seized may be a source of excessive heat. Analysis, testing, or both should be performed to determine the likelihood of these conditions, and to determine the worst-case surface temperature that may occur during regular equipment use.

C-5 HOIST INSPECTION CONSIDERATIONS

ASME B30.16 provides specific requirements for preoperation, frequent, and periodic inspections of overhead hoists. Preoperation inspections are performed before the first use of each shift. Frequent and periodic inspection intervals depend on the application in which the hoist is being used. ASME B30.16 identifies normal service, heavy service, and severe service application groups. It does not specifically address applications in hazardous locations but does include hazardous locations in its definition of "abnormal operating conditions."

Since inspection requirements in ASME B30.16, Chapter 16-2, do not specifically address hoists used in hazardous locations, it is recommended that these requirements be amended for hoists used in hazardous locations. All mechanically spark-resistant features of such hoists should be added to the lists of items to be inspected as specified below.

(a) For hoists used in Division I applications, all components provided with nonsparking coatings should be included in preoperation inspections to ensure the integrity of the coating and its continued ability to provide mechanical spark resistance. Components made from nonsparking materials should be included in frequent inspections.

(b) For hoists used in Division II applications, all components provided with nonsparking coatings should be included in frequent inspections to ensure the integrity of the coating and its continued ability to provide mechanical spark resistance. Components made from nonsparking materials should be included in periodic inspections.

(c) Mechanical components that have the potential to produce high surface temperatures as discussed in para. C-4 should be inspected during frequent inspections in line with the established inspection frequency for the hoist to ensure they are being maintained.

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