ASME B30.16-2022
(Revision of ASME B30.16-2017)

Overhead Underhung and Stationary Hoists

Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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Two Park Avenue • New York, NY • 10016 USA

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The next edition of this Standard is scheduled for publication in 2027. This Standard will become effective 1 year after the Date of Issuance.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Standard. Interpretations are published on the ASME website under the Committee Pages at http://cstools.asme.org/ as they are issued.

Errata to codes and standards may be posted on the ASME website under the Committee Pages to provide corrections to incorrectly published items, or to correct typographical or grammatical errors in codes and standards. Such errata shall be used on the date posted.

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

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FOREWORD

This American National Standard, Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings, has been developed under the procedures accredited by the American National Standards Institute (ANSI). This Standard had its beginning in December 1916, when an eight-page Code of Safety Standards for Cranes, prepared by the American Society of Mechanical Engineers (ASME) Committee on the Protection of Industrial Workers, was presented at the annual meeting of ASME.

Meetings and discussions regarding safety on cranes, derricks, and hoists were held from 1920 to 1925 involving the ASME Safety Code Correlating Committee, the Association of Iron and Steel Electrical Engineers, the American Museum of Safety, the American Engineering Standards Committee (AESC) [later changed to American Standards Association (ASA), then to the United States of America Standards Institute (USASI), and finally to ANSI], Department of Labor — State of New Jersey, Department of Labor and Industry — State of Pennsylvania, and the Locomotive Crane Manufacturers Association. On June 11, 1925, the AESC approved the ASME Safety Code Correlating Committee's recommendation and authorized the project with the U.S. Department of the Navy, Bureau of Yards and Docks, and ASME as sponsors.

In March 1926, invitations were issued to 50 organizations to appoint representatives to a Sectional Committee. The call for organization of this Sectional Committee was sent out October 2, 1926, and the Committee was organized on November 4, 1926, with 57 members representing 29 national organizations..

Commencing June 1, 1927, and using the eight-page Code published by ASME in 1916 as a basis, the Sectional Committee developed the Safety Code for Cranes, Derricks, and Hoists. The early drafts of this safety code included requirements for jacks, but, due to inputs and comments on those drafts, the Sectional Committee decided in 1938 to make the requirements for jacks a separate code. In January 1943, ASA B30.2-1943 was published addressing a multitude of equipment types, and in August 1943, ASA B30.1-1943 was published addressing only jacks. Both documents were reaffirmed in 1952 and widely accepted as safety standards

Due to changes in design, advancement in techniques, and general interest of labor and industry in safety, the Sectional Committee, under the joint sponsorship of ASME and the Bureau of Yards and Docks (now the Naval Facilities Engineering Command), was reorganized on January 31, 1962, with 39 members representing 27 national organizations. The new Committee changed the format of ASA B30.2-1943 so that the multitude of equipment types it addressed could be published in separate volumes that could completely cover the construction, installation, inspection, testing, maintenance, and operation of each type of equipment that was included in the scope of ASA B30.2. This format change resulted in B30.3, B30.5, B30.6, B30.11, and B30.16 being designated as revisions of B30.2 with the remainder of the B30 volumes being published as totally new volumes. ASA changed its name to USASI in 1966 and to ANSI in 1969, which resulted in B30 volumes from 1943 to 1968 being designated as either ASA B30, USAS B30, or ANSI B30, depending on their date of publication.

In 1982, the Committee was reorganized as an Accredited Organization Committee, operating under procedures developed by ASME and accredited by ANSI. This Standard presents a coordinated set of rules that may serve as a guide to government and other regulatory bodies and municipal authorities responsible for the guarding and inspection of the equipment falling within its scope. The suggestions leading to accident prevention are given both as mandatory and advisory provisions; compliance with both types may be required by employers of their employees.

In case of practical difficulties, new developments, or unnecessary hardship, the administrative or regulatory authority may grant variances from the literal requirements or permit the use of other devices or methods but only when it is clearly evident that an equivalent degree of protection is thereby secured. To secure uniform application and interpretation of this Standard, administrative or regulatory authorities are urged to consult the B30 Committee, in accordance with the format described in Section IX of the Introduction, before rendering decisions on disputed points.

Safety codes and standards are intended to enhance public safety. Revisions result from committee consideration of factors such as technological advances, new data, and changing environmental and industry needs. Revisions do not imply that previous editions were inadequate.

The first edition of ASME B30.16 was published in 1973. New editions were published in 1981, 1987, 1993, 1998, 2003, 2007, 2012, and 2017. The 2012 edition of this Standard included a major revision to Chapter 16-2 and the addition of Chapter 16-4. The sections on maintenance of hoist components in Chapter 16-2 were moved to Chapter 16-4, along with other updates to the Standard. In the 2017 edition, revisions were made to reflect current technology and terminology. The 2017 edition addressed overhead underhung and stationary hoists and included new information regarding

personnel competence, inclusion of hoist duty service classification on labels of powered hoists, requirements for presentation of technical and safety-related information, pitch diameter requirements for sheaves and drums, a referenced standard for supporting structures, general inspection requirements, and responsibilities for riggers and signalpersons. This 2022 edition includes references to ASME B30.30; updates sections pertaining to inspections, overtravel protection, translation language, and load test; and adds the *angle of loading* definition.

This Volume of the Standard, which was approved by the B30 Committee and ASME, was approved by ANSI and designated an American National Standard on March 1, 2022.

ASME B30 COMMITTEE
Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings

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

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B30 STANDARD INTRODUCTION

(22)

SECTION I: SCOPE

The ASME B30 Standard contains provisions that apply to the construction, installation, operation, inspection, testing, maintenance, and use of cranes and other lifting and material-movement-related equipment. For the convenience of the reader, the Standard has been divided into separate volumes. Each volume has been written under the direction of the ASME B30 Standards Committee and has successfully completed a consensus approval process under the general auspices of the American National Standards Institute (ANSI).

As of the date of issuance of this Volume, the B30 Standard comprises the following volumes:

B30.1 Jacks, Industrial Rollers, Air Casters, and Hydraulic Gantries

B30.2 Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)

B30.3 Tower Cranes

B30.4 Portal and Pedestal Cranes

B30.5 Mobile and Locomotive Cranes

B30.6 Derricks

B30.7 Winches

B30.8 Floating Cranes and Floating Derricks

B30.9 Slings

B30.10 Hooks

B30.11 Monorails and Underhung Cranes (withdrawn 2018 — requirements found in latest revision of B30.17)

B30.12 Handling Loads Suspended From Rotorcraft

B30.13 Storage/Retrieval (S/R) Machines and Associated Equipment

B30.14 Side Boom Tractors

B30.15 Mobile Hydraulic Cranes (withdrawn 1982 — requirements found in latest revision of B30.5)

B30.16 Overhead Underhung and Stationary Hoists

B30.17 Cranes and Monorails (With Underhung Trolley or Bridge)

B30.18 Stacker Cranes (Top or Under Running Bridge, Multiple Girder With Top or Under Running Trolley Hoist)

B30.19 Cableways

B30.20 Below-the-Hook Lifting Devices

B30.21 Lever Hoists

B30.22 Articulating Boom Cranes

B30.23 Personnel Lifting Systems

B30.24 Container Cranes

B30.25 Scrap and Material Handlers

B30.26 Rigging Hardware

B30.27 Material Placement Systems

B30.28 Balance Lifting Units

B30.29 Self-Erecting Tower Cranes

B30.30 Ropes

B30.31 Self-Propelled, Towed, or Remote-Controlled Hydraulic Platform Transporters[1]

B30.32 Unmanned Aircraft Systems (UAS) Used in Inspection, Testing, Maintenance, and Lifting Operations

SECTION II: SCOPE EXCLUSIONS

Any exclusion of, or limitations applicable to, the equipment, requirements, recommendations, or operations contained in this Standard are established in the affected volume's scope.

SECTION III: PURPOSE

The B30 Standard is intended to

(a) prevent or minimize injury to workers, and otherwise provide for the protection of life, limb, and property by prescribing safety requirements

(b) provide direction to manufacturers, owners, employers, users, and others concerned with, or responsible for, its application

(c) guide governments and other regulatory bodies in the development, promulgation, and enforcement of appropriate safety directives

SECTION IV: USE BY REGULATORY AGENCIES

These volumes may be adopted in whole or in part for governmental or regulatory use. If adopted for governmental use, the references to other national codes and standards in the specific volumes may be changed to refer to the corresponding regulations of the governmental authorities.

[1] This volume is currently in the development process.

SECTION V: EFFECTIVE DATE

(a) Effective Date. The effective date of this Volume of the B30 Standard shall be 1 yr after its date of issuance. Construction, installation, inspection, testing, maintenance, and operation of equipment manufactured and facilities constructed after the effective date of this Volume shall conform to the mandatory requirements of this Volume.

(b) Existing Installations. Equipment manufactured and facilities constructed prior to the effective date of this Volume of the B30 Standard shall be subject to the inspection, testing, maintenance, and operation requirements of this Standard after the effective date.

It is not the intent of this Volume of the B30 Standard to require retrofitting of existing equipment. However, when an item is being modified, its performance requirements shall be reviewed relative to the requirements within the current volume. The need to meet the current requirements shall be evaluated by a qualified person selected by the owner (user). Recommended changes shall be made by the owner (user) within 1 yr.

SECTION VI: REQUIREMENTS AND RECOMMENDATIONS

Requirements of this Standard are characterized by use of the word *shall*. Recommendations of this Standard are characterized by the word *should*.

SECTION VII: USE OF MEASUREMENT UNITS

This Standard contains SI (metric) units as well as U.S. Customary units. The values stated in U.S. Customary units are to be regarded as the standard. The SI units are a direct (soft) conversion from the U.S. Customary units.

SECTION VIII: REQUESTS FOR REVISION

The B30 Standards Committee will consider requests for revision of any of the volumes within the B30 Standard. Such requests should be directed to

Secretary, B30 Standards Committee
ASME Standards and Certification
Two Park Avenue
New York, NY 10016-5990

Requests should be in the following format:

Volume:	Cite the designation and title of the volume.
Edition:	Cite the applicable edition of the volume.
Subject:	Cite the applicable paragraph number(s) and the relevant heading(s).
Request:	Indicate the suggested revision.
Rationale:	State the rationale for the suggested revision.

Upon receipt by the Secretary, the request will be forwarded to the relevant B30 Subcommittee for consideration and action. Correspondence will be provided to the requester defining the actions undertaken by the B30 Standards Committee.

SECTION IX: REQUESTS FOR INTERPRETATION

The B30 Standards Committee will render an interpretation of the provisions of the B30 Standard. An Interpretation Submittal Form is available on ASME's website at http://cstools.asme.org/Interpretation/InterpretationForm.cfm.

Phrase the question as a request for an interpretation of a specific provision suitable for general understanding and use, not as a request for approval of a proprietary design or situation. Plans or drawings that explain the question may be submitted to clarify the question. However, they should not contain any proprietary names or information. Read carefully the note addressing the types of requests that the B30 Standards Committee can and cannot consider.

Upon submittal, the request will be forwarded to the relevant B30 Subcommittee for a draft response, which will then be subject to approval by the B30 Standards Committee prior to its formal issuance. The B30 Standards Committee may rewrite the question for the sake of clarity.

Interpretations to the B30 Standard will be available online at https://cstools.asme.org/Interpretation/SearchInterpretation.cfm.

SECTION X: ADDITIONAL GUIDANCE

The equipment covered by the B30 Standard is subject to hazards that cannot be abated by mechanical means, but only by the exercise of intelligence, care, and common sense. It is therefore essential to have personnel involved in the use and operation of equipment who are competent, careful, physically and mentally qualified, and trained in the proper operation of the equipment and the handling of loads. Serious hazards include, but are not limited to, improper or inadequate maintenance, overloading, dropping or slipping of the load, obstructing the free passage of the load, and using equipment for a purpose for which it was not intended or designed.

The B30 Standards Committee fully realizes the importance of proper design factors, minimum or maximum dimensions, and other limiting criteria of wire rope or chain and their fastenings, sheaves, sprockets, drums, and similar equipment covered by the Standard, all of which are closely connected with safety. Sizes, strengths, and similar criteria are dependent on many different factors, often varying with the installation and uses. These factors depend on

(a) the condition of the equipment or material
(b) the loads

(c) the acceleration or speed of the ropes, chains, sheaves, sprockets, or drums

(d) the type of attachments

(e) the number, size, and arrangement of sheaves or other parts

(f) environmental conditions causing corrosion or wear

(g) many variables that must be considered in each individual case

The requirements and recommendations provided in the volumes must be interpreted accordingly, and judgment used in determining their application.

ASME B30.16-2022
SUMMARY OF CHANGES

Following approval by the ASME B30 Committee and ASME, and after public review, ASME B30.16-2022 was approved by the American National Standards Institute on March 1, 2022.

ASME B30.16-2022 includes the following changes identified by a margin note, **(22)**.

Page	*Location*	*Change*
ix	B30 Standard Introduction	Updated
1	Section 16-0.2	(1) Definition of *angle of loading* added (2) Definition of *rope* revised
3	Section 16-0.4	Revised in its entirety
10	Figure 16-0.2-1	Added
11	16-1.1.5	(1) First paragraph and subpara. (c) revised (2) Subparagraph (e) added
12	16-1.2.1	Subparagraphs (b) and (c) revised
13	16-1.2.6	Revised in its entirety
14	16-1.2.14	Revised in its entirety
14	16-1.2.17	(1) Subparagraph (e) revised (2) Subparagraphs (f) and (g) added
15	16-1.3.2	Revised
16	Section 16-2.1	(1) Paragraphs 16-2.1.1 through 16-2.1.5 revised (2) Paragraph 16-2.1.7 deleted
18	Table 16-2.1.4-2	Revised
20	16-2.2.2	Subparagraphs (a)(2)(-d) and (b)(2)(-d) revised
27	Section 16-3.6	In subpara. (b), reference updated
28	16-4.2.4	Subparagraphs (e) and (i) revised
30	Section 16-4.4	Revised in its entirety

Chapter 16-0
Scope, Definitions, Personnel Competence, and References

SECTION 16-0.1: SCOPE OF B30.16

Volume B30.16 includes provisions that apply to the construction, installation, operation, inspection, testing, and maintenance of overhead underhung and stationary hoists, including hand-chain-operated, electric-powered, and air-powered chain and wire rope hoists used for, but not limited to, vertical lifting and lowering of freely suspended, unguided loads that consist of equipment and materials (see Figures 16-0.1-1 through 16-0.1-6).

Requirements for a hoist that is used for a special purpose, such as, but not limited to, tensioning a load, nonvertical lifting service, lifting a guided load, lifting personnel, or drawing both the load and the hoist up or down the load chain or rope when the hoist is attached to the load, are not included in this Volume.

(22) SECTION 16-0.2: DEFINITIONS

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

angle of loading: the angle between a hoist rope or load chain and the vertical axis (see Figure 16-0.2-1).

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

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

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 or hand chain wheel to lower a load but does not impose any additional load on the motor or hand chain wheel when lifting a load. This 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 control by which the power to the motor is reversed to develop torque in the direction opposite to the rotation of the motor.

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

braking, eddy current: a method of controlling or reducing speed by means of an energy 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.

chain, hand: the chain grasped by a person to apply force required for the lifting or lowering motion.

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

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

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

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

equalizer: a device that compensates for unequal length or stretch of a rope or chain.

exposed: applies to hazardous objects not guarded or isolated and capable of being contacted inadvertently.

guide, chain: a means to guide the load chain at the load sprocket.

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 (see ANSI/NFPA 70).

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

hoist, stationary: a base or deck-, ceiling-, or wall-mounted hoist used for vertical lifting and lowering of freely suspended, unguided loads (see Figure 16-0.1-6).

hoist, underhung: trolley hoists or hoists suspended from trolleys traveling on the lower flanges of beams or similar hoists that are hook- or lug-suspended.

hoist operator, dedicated: an employee whose job is normally confined solely to the operation of the equipment.

lifting devices: devices that are not normally reeved onto the hoist rope or chain, such as hook-on buckets, magnets, grabs, and other supplemental devices used for ease of 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, rated (capacity): the maximum load designated by the manufacturer for which the equipment is designed and built.

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

load suspension parts: the load suspension parts of the hoist are the means of suspension (hook or lug), the structure or housing that supports the drum or load sprocket, the drum or load sprocket, the rope or load chain, the sheaves or sprockets, and the load block or hook.

lockout/tagout: the placement of a lock/tag on the energy-isolating device in accordance with an established procedure.

minimum breaking force: the minimum load at which a new and unused wire rope will break when loaded to destruction in direct tension.

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

operator, nondedicated: an employee who uses the equipment as a tool to assist in the performance of his/her regular job.

original language(s): language(s) used by the manufacturer to develop and verify product instructions and manual(s).

overload: any load greater than the rated load.

overtravel restraint: a device used to prevent the slack load chain from inadvertently being lowered out of the load sprocket.

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

pawl: a device that engages a ratchet to prevent rotation.

pendant station: controls suspended from the equipment for operating the unit from the floor.

power transmission parts: the 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 by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work.

ratchet: a toothed member for engagement with the pawl.

reeving: a system in which a rope or chain travels around drums, sheaves, or sprockets.

rope: refers to wire rope or synthetic rope per ASME B30.30.

service, heavy: service that involves operation within the rated load limit that exceeds normal service.

service, normal: service that involves operation with randomly distributed loads within the rated load limit, or uniform loads less than 65% of rated load for not more than 15% of the time for manually operated hoists and 25% of the time for electric- or air-powered hoists.

service, severe: service that involves normal or heavy service with abnormal operating conditions.

shall: a word indicating a requirement.

sheave: a wheel or pulley used with a rope or chain to change direction and point of application of a pulling force.

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

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

should: a word indicating a recommendation.

side pull: the component of the hoist pull acting horizontally when the hoist lines are not operated vertically.

sprocket, idler: a freely rotating device that changes the direction of the load chain.

sprocket, load: a hoist component that transmits motion to the load chain. This component is sometimes called *load wheel*, *load sheave*, *pocket wheel*, or *chain wheel*.

stripper: a device that aids the load chain in leaving the load sprocket.

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

transmitter: the device used for remote control that is not electrically connected to the hoist.

unattended: a condition in which the operator is not at the operating control devices. If, however, the control devices are within sight of the operator, the equipment should be considered attended.

wheel, hand chain: a wheel with formed pockets on its periphery to allow torque to be transmitted when a force is applied to the hand chain.

SECTION 16-0.3: PERSONNEL COMPETENCE

Persons performing the functions identified in this Volume shall meet the applicable qualifying criteria stated in this Volume and shall, through education, training, experience, skill, and physical fitness, as necessary, be competent and capable to perform the functions as determined by the employer or employer's representative.

(22) SECTION 16-0.4: REFERENCES

The following is a list of standards and specifications referenced in this Standard.

AA ADM-2020, Aluminum Design Manual
Publisher: Aluminum Association, Inc. (AA), 1400 Crystal Drive, Suite 430, Arlington, VA 22202 (www.aluminum.org)

ANSI/AISC 360-16, Specification for Structural Steel Buildings[1]
Publisher: American Institute of Steel Construction (AISC), 130 East Randolph Street, Suite 2000, Chicago, IL 60601 (www.aisc.org)

ANSI ECMA 15-2018, Specifications for Cable-less Controls for Electric Overhead Traveling Cranes
Publisher: Monorail Manufacturers Association, Inc. (MMA), 8720 Red Oak Boulevard, Charlotte, NC 28217 (www.mhi.org/mma)

ANSI/NEMA Standards Publication No. ICS 6-1993, Industrial Control and Systems: Enclosures[1]
ANSI Z535.4-2011, Product Safety Signs and Labels[1]
Publisher: National Electrical Manufacturers Association (NEMA), 1300 North 17th Street, Suite 900, Arlington, VA 22209 (www.nema.org)

ANSI/NFPA 70-2020, National Electrical Code[1]
Publisher: National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471 (www.nfpa.org)

ASME B29.24-2002 (R2016), Roller Load Chains for Overhead Hoists
ASME B30.9-2018, Slings
ASME B30.10-2019, Hooks
ASME B30.17-2015, Overhead and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoist)
ASME B30.20-2018, Below-the-Hook Lifting Devices
ASME B30.26-2020, Rigging Hardware
ASME B30.30-2019, Ropes
ASME HST-1–2017, Performance Standard for Electric Chain Hoists
ASME HST-2–2018, Performance Standard for Hand Chain Manually Operated Chain Hoists
ASME HST-4–2016, Performance Standard for Overhead Electric Wire Rope Hoists
ASME HST-5–2020, Performance Standard for Air Chain Hoists
ASME HST-6–2020, Performance Standard for Air Wire Rope Hoists
Publisher: The American Society of Mechanical Engineers (ASME), Two Park Avenue, New York, NY 10016-5990 (www.asme.org)

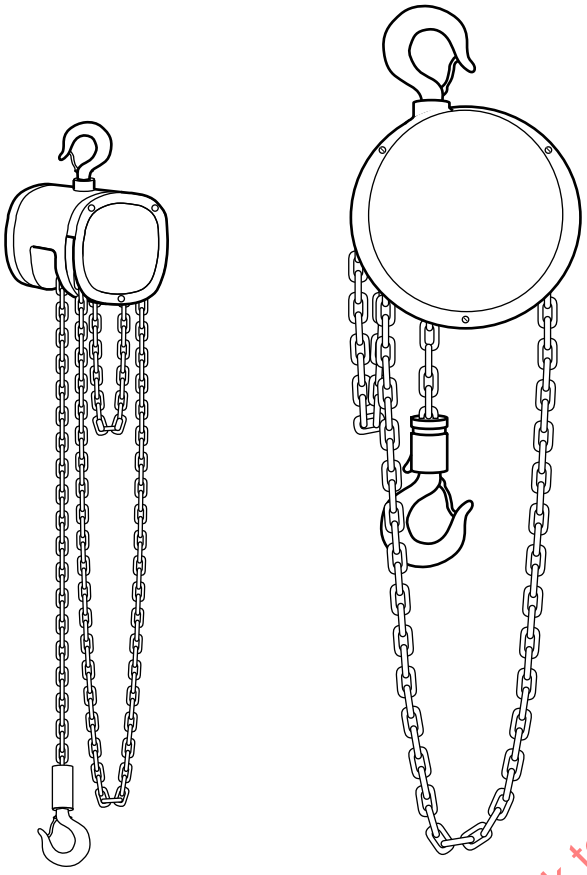
ASSP Z244.1-2016 (R2020), The Control of Hazardous Energy Lockout, Tagout and Alternative Methods[1]
Publisher: The American Society of Safety Professionals (ASSP), 520 N. Northwest Highway, Park Ridge, IL 60068 (www.assp.org)

ASTM A1023/A1023M-2021, Standard Specification for Carbon Steel Wire Ropes for General Purposes
ASTM E2349-2019, Standard Practice for Safety Requirements in Metal Casting Operations: Sand Preparation, Molding, and Core Making; Melting and Pouring; and Cleaning and Finishing[1]
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)

ISO 7000-2012, Graphical symbols for use on equipment — Registered symbols
ISO 7296-1991, Cranes—Graphical symbols—Part 1
Publisher: International Organization for Standardization (ISO), Central Secretariat, Chemin de Blandonnet 8, Case Postale 401, 1214 Vernier, Geneva, Switzerland (www.iso.org)

[1] May also be obtained from American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036 (www.ansi.org)

Figure 16-0.1-1
Hand-Chain-Operated Chain Hoist



(a) (b)

Figure 16-0.1-2
Electric-Powered Chain Hoist

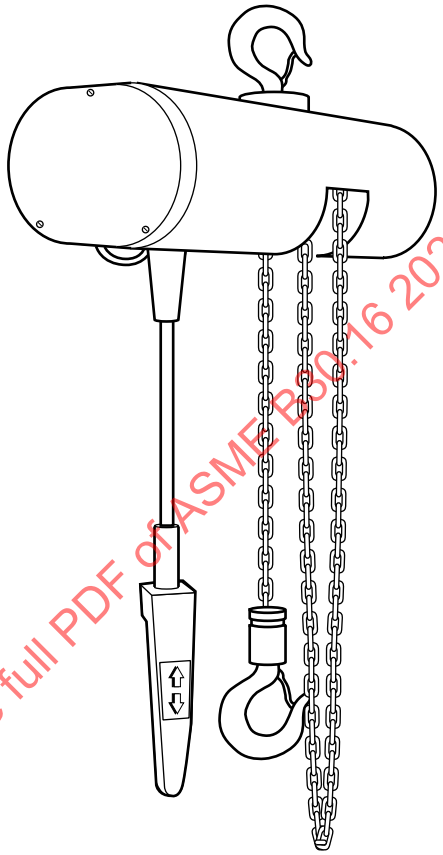


Figure 16-0.1-3
Air-Powered Chain Hoist

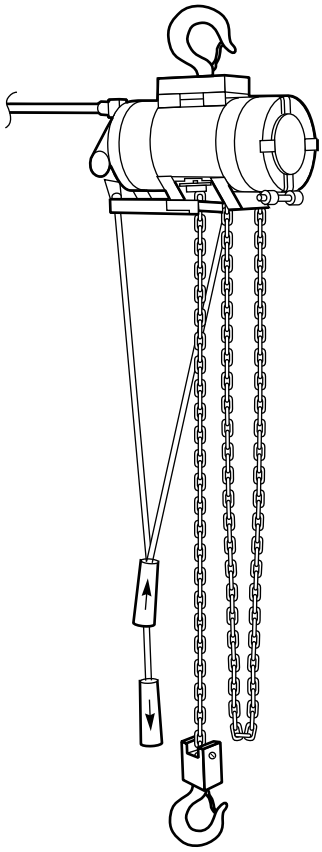
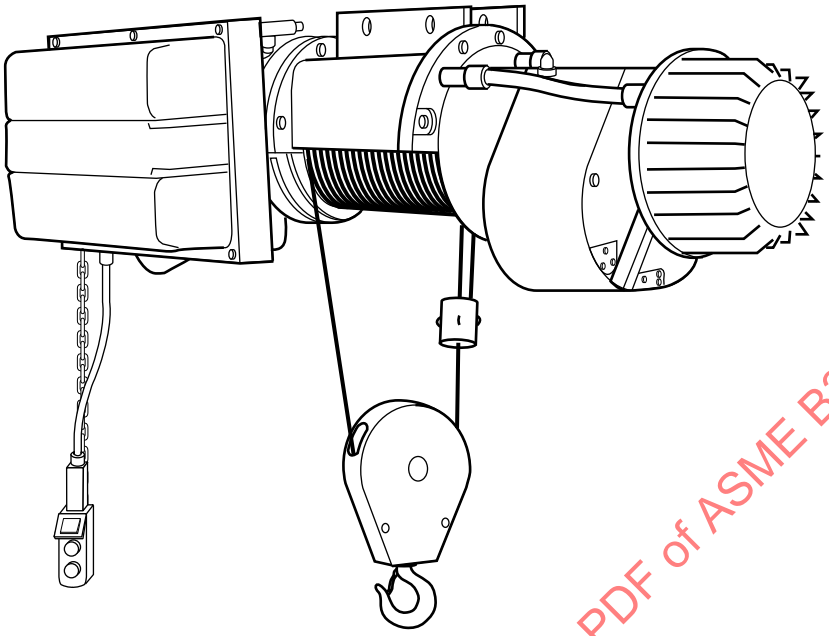
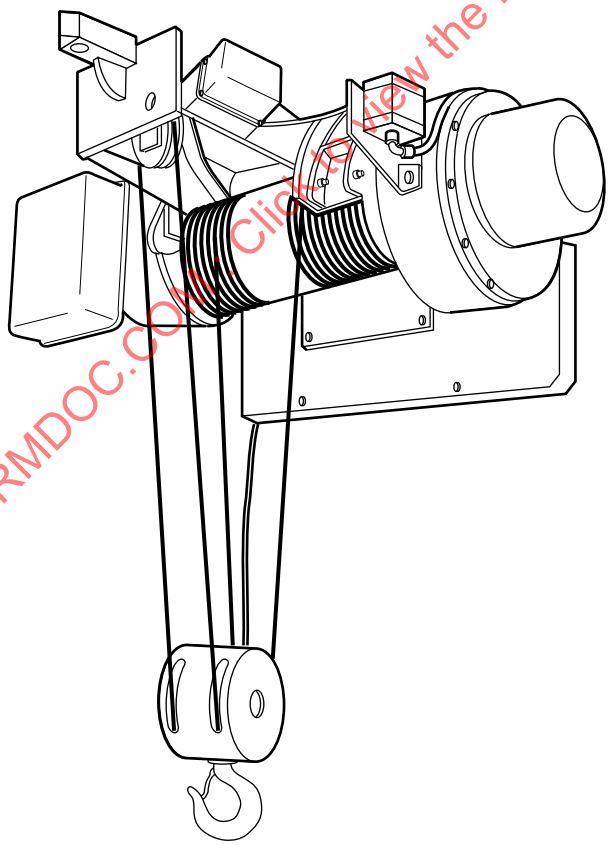


Figure 16-0.1-4
Electric-Powered Wire Rope Hoist



(a)



(b)

Figure 16-0.1-5
Air-Powered Wire Rope Hoist

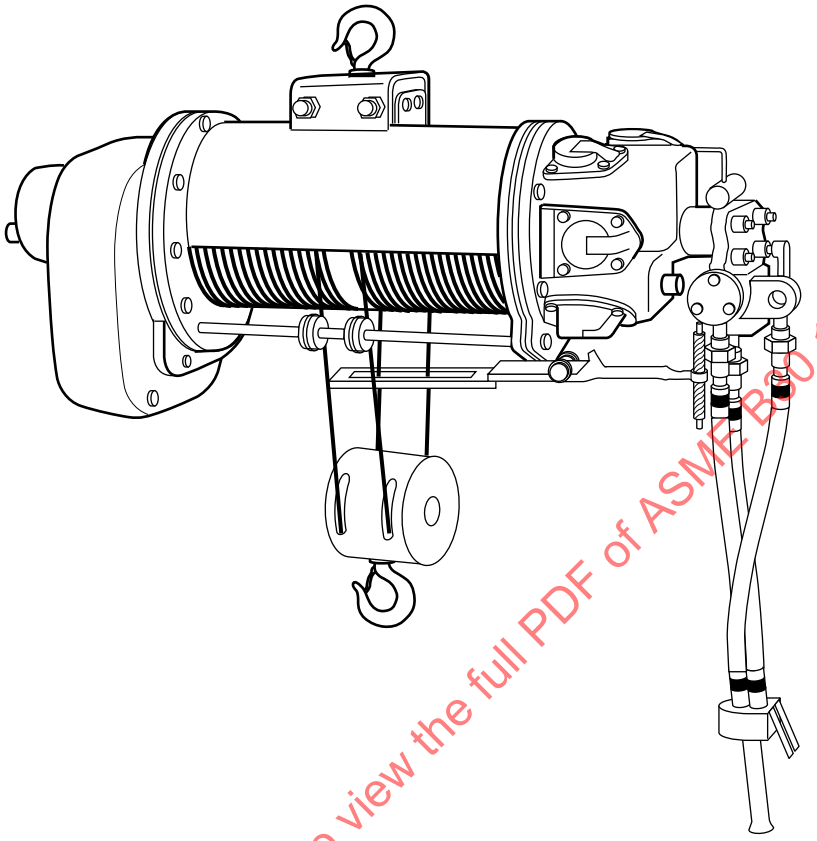
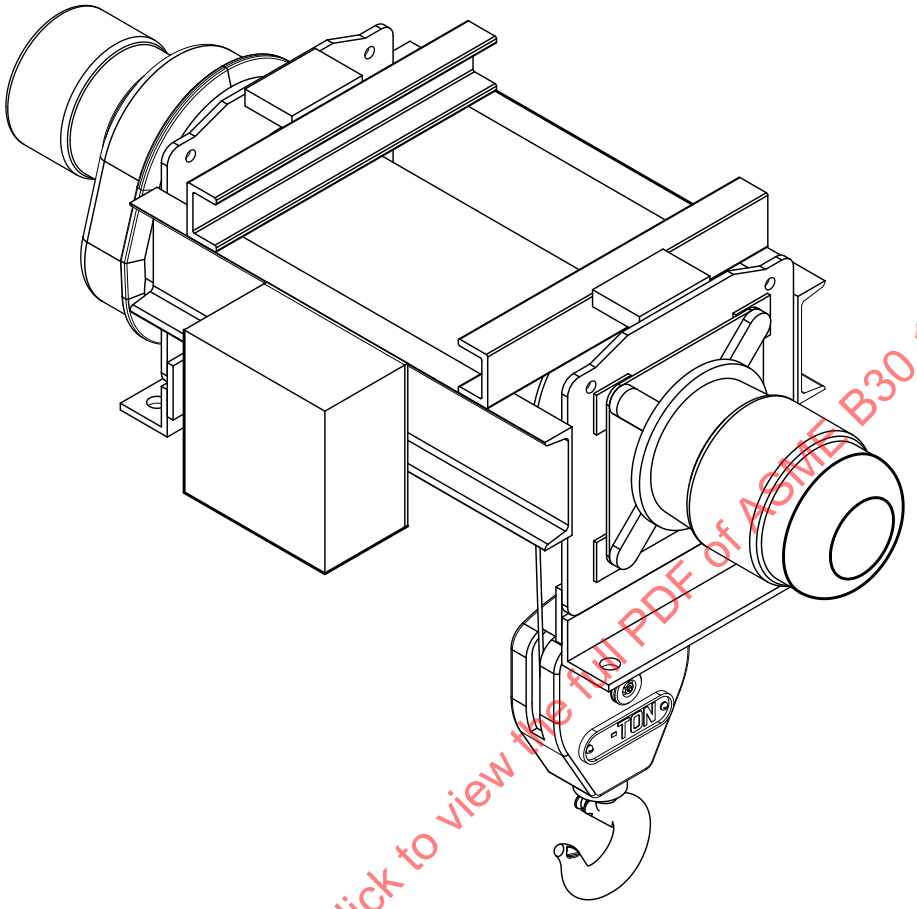
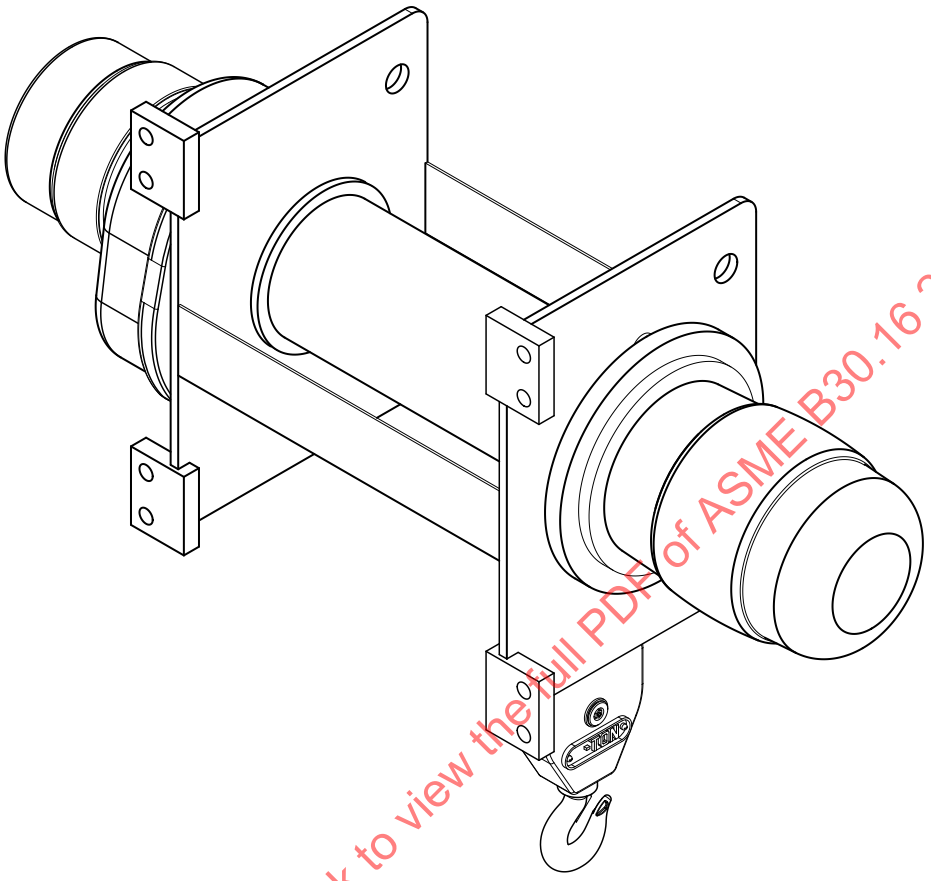


Figure 16-0.1-6
Stationary Hoist



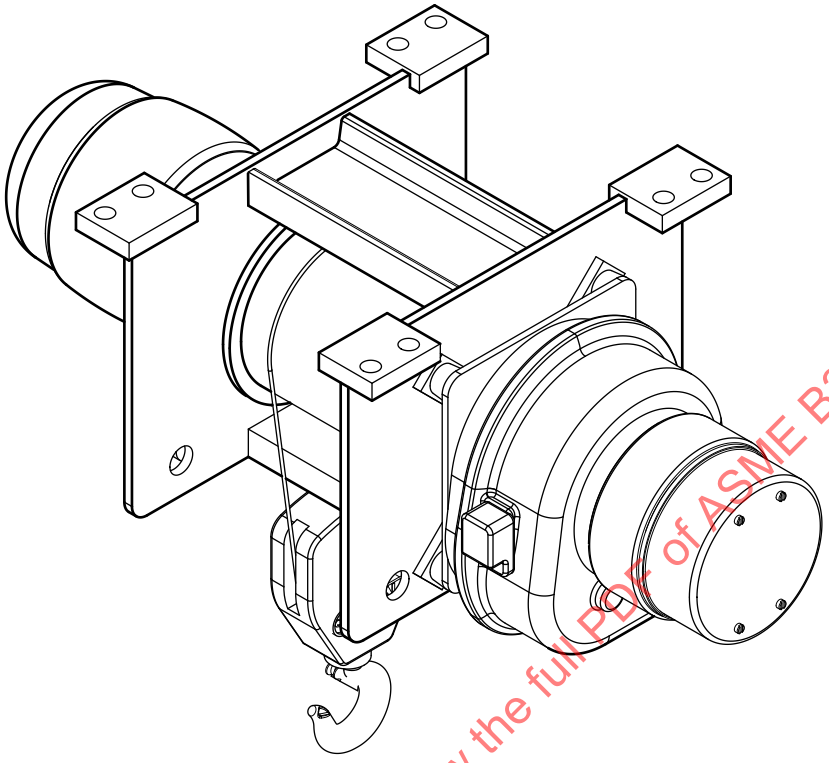
(a) Base or Deck Mounted

Figure 16-0.1-6
Stationary Hoist (Cont'd)



(b) Wall Mounted

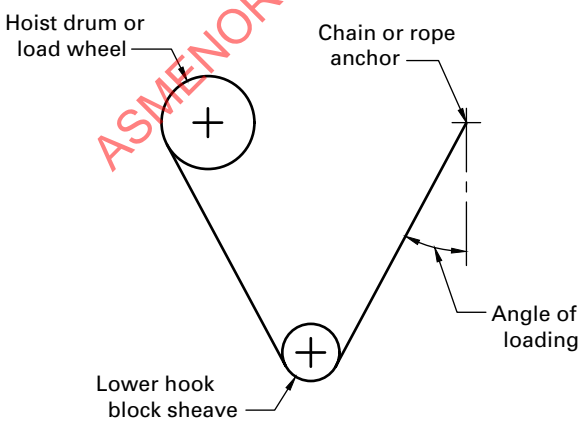
Figure 16-0.1-6
Stationary Hoist (Cont'd)



(c) Ceiling Mounted

(22)

Figure 16-0.2-1
Angle of Loading



Chapter 16-1
Marking, Construction, and Installation

SECTION 16-1.1: MARKING

16-1.1.1 Rated Load

The rated load of the hoist shall be marked on the hoist or its load block and shall be legible from the ground or floor.

16-1.1.2 Controls

(a) Each control actuator of an electric-powered or air-powered hoist shall be marked to indicate the direction of resultant motion.

(b) In locations or areas where multiple electric-powered or air-powered hoists are used, the arrangement of control actuator markings for directions of motion on pendant push-button stations and radio-controlled transmitters should be the same for all hoists in that location or area.

16-1.1.3 Identification

The hoist shall be marked with manufacturer's identification information on a plate or label attached to the hoist, or cast, forged, or stamped on the hoist, as follows:

(a) Hand-Chain-Operated Hoist
- *(1)* name of manufacturer
- *(2)* manufacturer's model or serial number

(b) Electric-Powered Hoist
- *(1)* name of manufacturer
- *(2)* manufacturer's model or serial number
- *(3)* voltage of AC or DC power supply and phase and frequency of AC power supply
- *(4)* full load amperage (FLA)
- *(5)* hoist duty service classification per ASME HST-1 or ASME HST-4, as appropriate

(c) Air-Powered Hoist
- *(1)* name of manufacturer
- *(2)* manufacturer's model and serial number
- *(3)* rated air pressure
- *(4)* hoist duty service classification per ASME HST-5 or ASME HST-6, as appropriate

16-1.1.4 Product Safety Information

(a) All hand-chain-operated hoists shall have affixed to the hoist or load block a label or labels displaying information concerning operating procedures. The label or labels shall be in compliance with ANSI Z535.4, and shall include cautionary language against
- *(1)* lifting more than rated load
- *(2)* operating hoist with twisted, kinked, or damaged chain
- *(3)* operating damaged or malfunctioning hoist
- *(4)* lifting people
- *(5)* lifting loads over people
- *(6)* operating hoist with other than manual power
- *(7)* removing or obscuring label

(b) All electric-powered or air-powered hoists shall have affixed to the hoist, load block, or controls a label or labels displaying information concerning operating procedures. The label or labels shall be in compliance with ANSI Z535.4, and shall include cautionary language against
- *(1)* lifting more than rated load
- *(2)* operating hoist when load is not centered under hoist
- *(3)* operating hoist with twisted, kinked, or damaged chain or rope
- *(4)* operating damaged or malfunctioning hoist
- *(5)* lifting people
- *(6)* lifting loads over people
- *(7)* operating a rope hoist with a rope that is not properly seated in its groove
- *(8)* removing or obscuring label

(c) A label shall be affixed on all electrical control enclosures. The label shall be in compliance with ANSI Z535.4, and shall include, but not be limited to, information such as
- *(1)* "DISCONNECT POWER AND LOCKOUT/TAGOUT DISCONNECTING MEANS BEFORE REMOVING COVER OR SERVICING THIS EQUIPMENT"
- *(2)* "DO NOT OPERATE WITHOUT COVER IN PLACE"

16-1.1.5 Technical and Safety-Related Information (22)

The manufacturer shall provide instructions for the operation, inspection, testing, maintenance, assembly, and disassembly of the hoist.

(a) The instructions shall be provided in a language specified by the purchaser at the time of the initial sale by the manufacturer.

(b) Pictograms used to identify controls shall be described in the instructions. The pictograms should comply with ISO 7000, ISO 7296, or another recognized source, if previously defined.

(c) If the manufacturer no longer exists, or if the language required is not available from the manufacturer, translation of the instructions with the hoist is acceptable. Translations of the original-language instructions shall meet professional translation industry standards, which include, but are not limited to, the following:

(1) translating the complete paragraph message, instead of word by word

(2) ensuring grammatical accuracy

(3) preserving the source document content without omitting or expanding the text

(4) translating the terminology accurately

(5) reflecting the level of sophistication of the original document

(d) The finished translation shall be verified for compliance with (c)(1) through (c)(5) by a qualified person having an understanding of the technical content of the subject matter.

(e) The entities responsible for the operation, use, inspection, testing, maintenance, assembly, and disassembly of the hoist shall have the technical and safety-related information available in a language that their employees can read and understand. If the information is not available in a language understood by their employees, the entities shall obtain a translation of the original manufacturer's technical and safety-related information from the manufacturer or from a translation service provider. The translation(s) shall meet the requirements of (c) and (d).

SECTION 16-1.2: CONSTRUCTION

(22) ### 16-1.2.1 Mechanical Design

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

(b) Load suspension parts of hand-chain-operated hoists shall be designed so that the static stress calculated for the rated load shall not exceed 25% of the minimum tensile strength. The maximum angle of loading (see Figure 16-0.2-1), under normal operating conditions, shall be considered in determining the maximum load.

(c) Load suspension parts of electric-powered or air-powered hoists shall be designed so that the static stress calculated for the rated load shall not exceed 20% of the minimum tensile strength. The maximum angle of loading (see Figure 16-0.2-1), under normal operating conditions, shall be considered in determining the maximum load.

(d) Power transmission and load suspension parts shall be designed so that the dynamic stress calculated for the rated load shall not exceed the fatigue limits established by the manufacturer.

(e) Modifications to upgrade, rerate, or modernize hoist equipment shall be as authorized only by the original equipment manufacturer or a qualified person.

(f) The hoist shall be designed in accordance with applicable hoist design and performance standards. Refer to ASME HST-1, ASME HST-2, ASME HST-4, ASME HST-5, and ASME HST-6.

16-1.2.2 Electrical Design (Electric-Powered Hoists Only)

(a) Electrical construction shall comply with Article 610 of ANSI/NFPA 70.

(b) Electrical equipment shall be so located or enclosed such that personnel will not be exposed to inadvertent contact with energized parts under normal operating conditions.

(c) Enclosures for resistors (if required) shall provide means for heat dissipation. Provision shall be made to prevent broken resistor parts or molten metal from falling onto the operator, other personnel, or combustible materials. Conductors connected to resistors shall have a flame-resistant outer covering or be covered with flame-resistant tape.

(d) Control panels and other electrical equipment, such as switchboards and panelboards that are likely to require inspection, adjustment, servicing, or maintenance while energized, shall be marked to warn of potential electric arc flash hazards. The marking shall be located so as to be clearly visible to personnel before inspection, adjustment, servicing, or maintenance of the equipment.

16-1.2.3 Controls (Electric- or Air-Powered Hoists Only)

(a) Controls, except in automatic cycling operation, shall return to the off position when released, and hook motion shall stop.

(b) The reversing contactor of electric-powered hoists shall be mechanically or electrically interlocked to prevent line-to-line faults.

(c) The voltage at pendant push-button station of electric-powered hoists shall not exceed 150 V for AC or 300 V for DC.

(d) A pendant station shall be supported in a manner that will protect the electrical conductors or air hoses against strain. Any pendant station that might present a hazard to the operator, if a ground fault occurs, shall be grounded.

(e) Hoists using radio controls shall be provided in accordance with ANSI ECMA 15.

(f) Push buttons of pendant stations shall be guarded or shrouded to prevent accidental actuation of hoist motion.

(g) A minimum of two collectors for each runway conductor shall be furnished when a hoist uses inverters.

(h) For hoists utilizing brake failure detection, a unique visual or audible warning should be provided to alert the operator of a brake failure.

16-1.2.4 Rope Sheaves (Electric- or Air-Powered Hoists Only)

(a) The pitch diameter of running sheaves should not be less than 16 times the rope diameter.

(b) The pitch diameter of nonrunning sheaves should not be less than 12 times the rope diameter.

(c) The grooves shall be free from surface conditions or damage that could cause accelerated wear or damage to the rope. The cross-sectional radius at the bottom of the groove should be such as to form a close-fitting saddle for the size of rope used. The sides of the groove shall be tapered outward and rounded at the rim to facilitate entrance of the rope into the groove. Flange rims shall run true about the axis of rotation.

(d) Sheaves shall be so mounted as to guard against rope jamming during normal operating conditions.

(e) All running sheave bearings, except permanently lubricated bearings, should be equipped with means for lubrication.

16-1.2.5 Rope Drum (Electric- or Air-Powered Hoists Only)

(a) The pitch diameter of the drum should not be less than 18 times the rope diameter.

(b) For grooved drums, the grooves shall be free from surface conditions or damage that could cause accelerated wear or damage to the rope. The cross-sectional radius at the bottom of the groove should form a close-fitting saddle for the size of rope used. This requirement does not preclude the use of multiple layer spooling.

(22) 16-1.2.6 Ropes (Electric- or Air-Powered Hoists Only)

(a) The hoisting ropes shall be of a construction recommended for hoist service. For further guidance on rope selection, see ASME B30.30, Section 30-1.4 for wire rope or Section 30-2.4 for synthetic rope. The rated load divided by the number of parts (lines) of rope shall not exceed 20% of the minimum breaking force of the rope. The maximum angle of loading (see Figure 16-0.2-1), under normal operating conditions, shall be considered in determining the maximum load on the rope, and this maximum load shall not exceed 20% of the minimum breaking force of the rope. When rope and rope core may be exposed to an environmental condition under which rope or core would be damaged, a rope and core having resistance to the conditions shall be used.

(b) For environmental considerations, see ASME B30.30, Section 30-1.6 for wire rope or Section 30-2.6 for synthetic rope.

(c) End terminations shall be in accordance with ASME B30.30, para. 30-1.7.4 for wire rope or para. 30-2.7.4 for synthetic rope.

(d) If a load is supported by more than one part of rope, the tension on the parts shall be equalized.

16-1.2.7 Load Sprockets

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

(b) Load sprockets shall be guarded.

(c) Provision shall be made to guard against jamming of the load chain within the hoisting mechanism under normal operating conditions.

16-1.2.8 Load Chain

(a) Load chain may be either roller or welded link type. Chain shall be pitched (calibrated) so as to pass over all load sprockets without binding.

(b) Roller load chain shall comply with ASME B29.24.

(c) Welded-link-type load chain shall be proof tested by the chain or hoist manufacturer with a load at least equivalent to $1\frac{1}{2}$ times the hoist's rated load divided by the number of chain parts supporting the load.

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

(e) Welded-link-type load chain properties do not conform to those shown in ASME B30.9.

16-1.2.9 Hooks

If hooks are of the swiveling type, they should rotate freely. Hooks shall be equipped with latches unless use of the latch creates a hazardous condition. When required, a latch shall be provided to bridge the throat opening of the hook, and retain, under slack conditions, such items as, but not limited to, slings and chains. Refer to ASME B30.10.

16-1.2.10 Load Blocks

(a) Hand-Chain-Operated Hoist. Means shall be provided to guard against load chain jamming in the load block under normal operating conditions.

(b) Electric- or Air-Powered Hoist. Load blocks shall be of the enclosed type, and means shall be provided to guard against rope or load chain jamming in the load block under normal operating conditions.

16-1.2.11 Brakes

(a) Hand-Chain-Operated Hoist. Hand-chain-operated hoists shall be so designed that, when the actuating force is removed, it will automatically stop and hold any test load up to 125% of the rated load.

(b) *Electric-Powered Hoist*

(1) Under normal operating conditions with rated load and test conditions with test loads up to 125% of rated load, the braking system shall perform the following functions:

(-a) stop and hold the load hook when controls are released

(-b) limit the speed of load during lowering to a maximum speed of 120% of rated lowering speed for the load being handled

(-c) stop and hold the load hook in the event of a complete power failure

(2) The braking system shall have thermal capacity for the frequency of operation required by the service.

(3) The braking system shall have provision for adjustments where necessary to compensate for wear.

(4) Electric-powered hoists that handle molten material shall be equipped with one of the following arrangements, which may also be specified for other specific applications:

(-a) Two holding brakes shall be provided, one of which is applied to a gear reducer shaft, plus control braking means. Each holding brake shall have a torque rating not less than 100% of rated load hoisting torque at the point where the brake is applied.

(-b) One holding brake shall be provided if the hoisting unit has a mechanical load brake or a control braking means that provides controlled lowering of the load upon loss of power. The holding brake shall have a torque rating not less than 150% of rated load hoisting torque at the point where the brake is applied.

(c) *Air-Powered Hoist*

(1) Under normal operating conditions with rated load and test conditions with test loads up to 125% of rated load, the braking system shall perform the following functions:

(-a) stop and hold the load hook when controls are released

(-b) stop and hold the load hook in the event of a loss of air pressure when the controls are returned to neutral

(2) The braking system shall have thermal capacity for the frequency of operation required by the service.

(3) The braking system shall have provision for adjustments where necessary to compensate for wear.

16-1.2.12 Hand Chain (Hand-Chain-Operated Hoists Only)

(a) The hand chain shall be of a shape and pitch to fit the hand chain wheel without binding or jamming under normal operating conditions.

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

(c) The hand chain shall withstand, without permanent distortion, a force of three times the pull required to lift the rated load.

(d) Hand chain properties do not conform to those shown in ASME B30.9.

16-1.2.13 Overtravel Restraint (Hand-Chain-Operated Hoists Only)

Before the load chain can be completely run out of the hoist, it shall be restrained in its fully extended position. The restraint shall be such that the unloaded hoist can withstand a lowering hand chain force equivalent to twice the pull required to lift the rated load on, with rated load on the hoist, a hand chain force equivalent to the pull required to lift the rated load.

16-1.2.14 Overtravel Protection (Electric- or Air-Powered Hoists Only) (22)

(a) *Rope Hoists.* The hoist shall be so designed and constructed that the load hook, either loaded or empty, shall not exceed the upper limit of travel. If a geared or other lift-limiting device that operates in relation to drum turns is used, an additional lift-limiting device that operates independently of drum rotations shall be provided. The activation point of all lift-limiting devices shall allow the braking system to safely stop motion at maximum operating speed.

(b) *Chain Hoists.* The hoist shall be so designed and constructed that it will prevent the load chain from being completely run out of the hoist, and the load hook, either loaded or empty, shall not exceed the upper limit of travel. Overtravel protection components shall be designed by the manufacturer according to the requirements of para. 16-1.2.1(a). The use of a travel-limiting clutch as overtravel protection is permitted. If a travel-limiting clutch is used, the hoist shall be equipped with a chain end restraint capable of withstanding a load on the chain equal to the load on the chain at full hoist capacity plus the load on the chain required to activate the travel-limiting clutch.

16-1.2.15 Power Failure Protection (Electric- or Air-Powered Hoists Only)

Partial or complete interruption of the power supply (air or electric) during operation shall not result in uncontrollable motion of the load.

16-1.2.16 Lubrication

If lubrication is required, accessible means for lubrication should be provided.

16-1.2.17 Manual (22)

The manufacturer shall furnish an instruction manual with each hoist. The manual shall include information on the following:

(a) installation

(b) operation

(c) inspection and testing (including travel limit clutches when used as limit devices)

(d) lubrication, maintenance, and repair

(e) wiring diagram (electric powered only) may be supplied separately

(f) wire rope information (wire rope hoists only) may be supplied separately

(1) nominal rope diameter

(2) rope classification (e.g., 6X19, 6X36, 8X19, 8X36, 19X19, 35X7)

(3) ASTM A1023/A1023M rotation resistance Category 1, 2, or 3 (if applicable)

(4) rope core (e.g., IWRC, fiber core)

(5) lay direction and lay type (e.g., RRL, RLL, LAL, sZ, zZ)

(6) minimum breaking force

(g) synthetic rope information (synthetic rope hoists only) may be supplied separately

(1) nominal rope diameter

(2) rope construction (e.g., 12-strand single braid, 6-strand cable laid)

(3) material type of load-bearing yarns

(4) operating temperature range

(5) minimum breaking force and test method (e.g., ISO, Cordage Institute)

SECTION 16-1.3: INSTALLATION

16-1.3.1 Procedure

(a) Procedures for installation recommended in the manual should be followed.

(b) When a hoist is suspended from a trolley, a trolley and monorail, or a trolley and crane, and the rated load of each of these pieces of equipment is different, the rated load for the system utilizing this combination of equipment shall be based on the lowest minimum rated load of any individual piece of equipment or structure within the system.

(22) ### 16-1.3.2 Support

The supporting structure, including trolleys, monorail, or crane, shall be designed to withstand the loads and forces imposed by the hoist for the rated load. The supporting structure should conform to the design parameters as specified in the applicable AISC Specification for Structural Steel Buildings, Aluminum Design Manual, or applicable design manual or standard for the material used.

16-1.3.3 Location

(a) Hoists shall be installed in locations that will allow movement of the operator to stay clear of the load.

(b) When hoists are used in hazardous locations as defined by ANSI/NFPA 70, modifications to these rules or additional safety requirements may be necessary.

(c) When hoists are used to handle molten material, modifications to these rules or additional safety requirements may be necessary. Refer to ASTM E2349.

(d) When electric hoists are used in locations other than general indoor applications, control enclosures should be selected in accordance with ANSI/NEMA Standards Publication No. ICS 6.

(e) Pendant controls of electric- or air-powered hoists should be located at a convenient level above the operating floor.

(f) An electric- or air-powered hoist shall not be installed where the load hook can be lowered beyond the rated hook travel under normal operating conditions unless the hoist is equipped with a lower-limit device.

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

(h) When hoists are supported and used on cranes, trolleys, or monorails, modifications to these rules or additional safety requirements may be necessary. Refer to ASME B30.17.

16-1.3.4 Power Connections

(a) Electric-powered hoists shall be connected in accordance with ANSI/NFPA 70.

(b) Air-powered hoists shall be connected to an air supply not exceeding the rated pressure at the hoist under normal operating conditions. To prevent excessive brake wear or heating, the air supply should be sufficient to operate the brake-release mechanism, if provided.

16-1.3.5 Direction of Motion (Electric- or Air-Powered Hoists Only)

(a) Electric-Powered Hoists. Polyphase hoist motors shall be connected to the power supply lines in such a manner that the hook motion agrees with the control marking. Internal connections in the hoist or pendant station wiring shall not be changed to accomplish this. Phase reversal (motor reversal), if necessary, shall be accomplished by reversing the power leads to the hoist unit.

(b) Air-Powered Hoists. Air hoist motors shall be connected in such a manner that the hook motion agrees with the control marking.

16-1.3.6 Checkpoints

After installation, a check should be made as indicated in para. 16-2.1.4.

Chapter 16-2
Inspection and Testing

(22) ## SECTION 16-2.1: INSPECTION

16-2.1.1 General

(a) All inspections shall be performed by a designated person in accordance with the manufacturer's recommendations and requirements of this Volume. Any deficiencies identified shall be examined and a determination made by a qualified person as to whether they constitute a hazard and whether disassembly or a more detailed inspection is required. Any condition disclosed by these inspections that is determined to be a hazard to continued operation shall be corrected before continuing the use of the equipment.

(b) There are five types of inspections required, each directed toward a different set of circumstances. They are the following:

(1) initial inspection
(2) preoperation inspection
(3) frequent inspection
(4) periodic inspection
(5) inspection of hoists not in regular use

(c) In addition, the inspection shall be based on the recommendations in the equipment manufacturer's manual and, when appropriate, recommendations by a qualified person based on review of the equipment application and operation.

16-2.1.2 Initial Inspection

(a) An initial inspection is a visual and audible examination of the hoist.

(b) New, reinstalled, altered, repaired, or modified hoists as defined in the scope of this Volume shall be inspected prior to initial use to verify compliance with the applicable provisions of Chapter 16-1.

(c) Inspection of altered, repaired, or modified hoists may be limited to the parts of the hoist affected by the alteration, repair, or modification as determined by a qualified person.

(d) Adjustments, repairs, or replacements necessary to satisfy the requirements of this Section shall be made in accordance with para. 16-4.3.4 prior to initial use.

(e) Dated and signed records of initial inspections shall be made.

16-2.1.3 Preoperation Inspection

(a) A preoperation inspection is a visual and audible operational examination of the hoist and shall be conducted before the hoist is first used during each shift. When the handling of a suspended load is transferred from operator to operator at shift change, this inspection shall be performed when that lift is completed.

(b) Records of preoperational inspections are not required.

(c) As a minimum, the following items shall be inspected:

(1) operating mechanisms for proper operation, proper adjustment, and unusual sounds.

(2) hoist limit device(s) of electric- or air-powered hoists without a load on the hook. The load block shall be inched into its limit device or run in at slow speed on multi-speed or variable-speed hoists. When travel-limiting clutches are used as limit devices, follow the methods for inspecting the travel-limiting clutch in the manual provided with the hoist.

(3) hooks for gross damage, which may be an immediate hazard.

(4) hook latches, if used, for proper operation.

(5) hoist rope for gross damage, which may be an immediate hazard.

(6) load chain for gross damage, which may be an immediate hazard.

16-2.1.4 Frequent Inspection (See Also Tables 16-2.1.4-1 and 16-2.1.4-2)

(a) A frequent inspection is a visual and audible examination of the hoist.

(b) Records of frequent inspections are not required.

(c) Frequent inspections shall be performed at intervals depending on the use of the hoist, as follows:

(1) normal service — monthly
(2) heavy service — weekly
(3) severe service — daily

(d) As a minimum, the following items shall be inspected:

(1) operating mechanisms for proper operation, proper adjustment, and unusual sounds.

(2) hoist limit device(s) of electric- or air-powered hoists without a load on the hook. The load block shall be inched into its limit device or run in at slow speed on

Table 16-2.1.4-1
Inspection for Hand-Chain-Operated Hoists

Item	Normal Service		Heavy Service		Severe Service	
	Visual Monthly [Note (1)]	Record Yearly [Note (2)]	Visual Weekly [Note (1)]	Record Semiannually [Note (3)]	Visual Daily [Note (1)]	Record Quarterly [Note (3)]
Frequent Inspection (Refer to Para. 16-2.1.4)						
All functional operating mechanisms for maladjustment and unusual sounds	X	...	X	...	X	...
Hoist braking system for proper operation	X	...	X	...	X	...
Hooks in accordance with ASME B30.10	X	...	X	...	X	...
Hook latch operation, if used	X	...	X	...	X	...
Load chain in accordance with para. 16-2.1.4(d)(8)	X	...	X	...	X	...
Load chain reeving for compliance with hoist manufacturer's recommendations	X	...	X	...	X	...
Periodic Inspection (Refer to Para. 16-2.1.5)						
Requirements of frequent inspection	...	X	...	X	...	X
Load chain in accordance with paras. 16-2.1.5(e)(12), 16-2.1.5(e)(13), and 16-2.1.5(e)(14)	...	X	...	X	...	X
Evidence of loose bolts, nuts, or rivets	...	X	...	X	...	X
Evidence of worn, corroded, cracked, or distorted parts such as load blocks, suspension housing, hand chain wheels, chain attachments, clevises, yokes, suspension bolts, shafts, gears, bearings, pins, rollers, and locking and clamping devices	...	X	...	X	...	X
Evidence of damage to hook-retaining nuts or collars and pins, and welds or rivets used to secure the retaining members	...	X	...	X	...	X
Evidence of damage or excessive wear of load sprockets, idler sprockets, or hand chain wheel	...	X	...	X	...	X
Evidence of worn, glazed, or oil-contaminated friction disks; worn pawls, cams, or ratchet; corroded, stretched, or broken pawl springs in brake mechanism	...	X	...	X	...	X
Evidence of damage of supporting structure or trolley, if used	...	X	...	X	...	X
Label or labels required by para. 16-1.1.4 for legibility	...	X	...	X	...	X
End connections of load chain for wear, cracks, corrosion, or distortion	...	X	...	X	...	X

NOTES:
(1) Records not required.
(2) Visual inspection with records of conditions to provide the basis for a continuing evaluation.
(3) As in Note (2), unless conditions indicate that disassembly should be done to permit detailed inspection.

multispeed or variable-speed hoists. When travel-limiting clutches are used as limit devices, follow the methods for inspecting the travel-limiting clutch in the manual provided with the hoist.

(3) hoist braking system for proper operation.

(4) lines, valves, and other parts of air systems for leakage.

(5) hooks, in accordance with ASME B30.10.

(6) hook latches, if used, for proper operation.

(7) hoist rope per ASME B30.30, para. 30-1.8.1(b) for wire rope or para. 30-2.8.1(b) for synthetic rope.

(8) load chain for gross damage, which may be an immediate hazard, such as the following:

(-a) Examine visually for gouges, nicks, weld spatter, corrosion, and distorted links.

(-b) Observe operation of the chain and sprockets with a load to remove chain slack, in lifting and lowering directions. The chain should feed smoothly into and away from the sprockets.

(9) rope or load chain reeving for compliance with recommendations of the hoist manufacturer.

(e) Adjustments, repairs, or replacements shall be made, as necessary, in accordance with para. 16-4.3.4.

16-2.1.5 Periodic Inspection (See Also Tables 16-2.1.4-1 and 16-2.1.4-2)

(a) A periodic inspection is a visual and audible examination of the hoist and may be performed with the hoist at its normal location. Periodic inspections do not require the hoist to be disassembled.

(22)

Table 16-2.1.4-2
Inspection for Electric- or Air-Powered Hoists

Item	Normal Service		Heavy Service		Severe Service	
	Visual Monthly [Note (1)]	Record Yearly [Note (2)]	Visual Weekly [Note (1)]	Record Semiannually [Note (3)]	Visual Daily [Note (1)]	Record Quarterly [Note (3)]
Frequent Inspection (Refer to Para. 16-2.1.4)						
All functional operating mechanisms for maladjustment and unusual sounds	X	...	X	...	X	...
Limit devices for operation	X	...	X	...	X	...
Hoist braking system for proper operation	X	...	X	...	X	...
Air lines, valves, and other parts for leakage	X	...	X	...	X	...
Hooks in accordance with ASME B30.10	X	...	X	...	X	...
Hook latch operation, if used	X	...	X	...	X	...
Hoist rope in accordance with ASME B30.30, para. 30-1.8.1(b) for wire rope or para. 30-2.8.1(b) for synthetic rope	X	...	X	...	X	...
Load chain in accordance with para. 16-2.1.4(d)(8)	X	...	X	...	X	...
Rope or load chain reeving for compliance with hoist manufacturer's recommendations	X	...	X	...	X	...
Periodic Inspection (Refer to Para. 16-2.1.5)						
Requirements of frequent inspection	...	X	...	X	...	X
Hoist rope in accordance with ASME B30.30, para. 30-1.8.1(c) for wire rope or para. 30-2.8.1(c) for synthetic rope	...	X	...	X	...	X
Load chain in accordance with paras. 16-2.1.5(e)(12), 16-2.1.5(e)(13), and 16-2.1.5(e)(14)	...	X	...	X	...	X
Evidence of loose bolts, nuts, or rivets	...	X	...	X	...	X
Evidence of worn, corroded, cracked, or distorted parts such as load blocks, suspension housing, chain attachments, clevises, yokes, suspension bolts, shafts, gears, bearings, pins, rollers, and locking and clamping devices	...	X	...	X	...	X
Evidence of damage to hook-retaining nuts or collars and pins, and welds or rivets used to secure the retaining members	...	X	...	X	...	X
Evidence of damage or excessive wear of load sprockets, idler sprockets, and drums or sheaves	...	X	...	X	...	X
Evidence of excessive wear on motor or load brake	...	X	...	X	...	X
Electrical apparatus for signs of pitting or any deterioration of visible controller contacts	...	X	...	X	...	X
Evidence of damage of supporting structure or trolley, if used	...	X	...	X	...	X
Function labels on pendant control stations for legibility	...	X	...	X	...	X
Label or labels required by para. 16-1.1.4 for legibility	...	X	...	X	...	X
End connections of rope or load chain for wear, cracks, corrosion, or distortion	...	X	...	X	...	X

NOTES:
(1) Records not required.
(2) Visual inspection with records of conditions to provide the basis for a continuing evaluation.
(3) As in Note (2), unless conditions indicate that disassembly should be done to permit detailed inspection.

(b) Dated and signed records of periodic inspections shall be maintained to provide the basis for continuing evaluation. An external coded mark on the hoist is an acceptable identification in lieu of records.

(c) Covers and other items supplied to allow inspection of components shall be opened or removed.

(d) Periodic inspections shall be performed at intervals depending on the use of the hoist as follows:

(1) normal service — yearly

(2) heavy service — semiannually

(3) severe service — quarterly

(e) As a minimum, the following items shall be inspected:

(1) the items listed in para. 16-2.1.4(d).

(2) fasteners for evidence of loosening.

(3) load blocks, suspension housings, hand chain wheels, chain attachments, clevises, yokes, suspension bolts, shafts, gears, bearings, pins, rollers, and locking and clamping devices for evidence of wear, corrosion, cracks, and distortion.

(4) hook-retaining nuts or collars, and pins, welds, or rivets used to secure the retaining members for evidence of damage.

(5) load sprockets, idler sprockets, drums, and sheaves for evidence of damage and wear.

(6) the brake mechanism on hand chain hoists for evidence of worn, glazed, or oil-contaminated friction disks; worn pawls, cams, or ratchets; and corroded, stretched, or broken pawl springs.

(7) the motor brake and load brake on electric- or air-powered hoists for evidence of wear.

(8) electrical apparatus on electric-powered hoists for evidence of pitting or deterioration of controller contacts.

(9) supporting structure or trolley, if used, for evidence of damage.

(10) label or labels required by para. 16-1.1.4 for legibility.

(11) hoist rope per ASME B30.30, para. 30-1.8.1(c) for wire rope or para. 30-2.8.1(c) for synthetic rope.

(12) welded link chain for gouges, nicks, weld spatter, corrosion, and distorted links. Slacken the chain and move the adjacent links to one side to inspect for wear at the contact points. If wear is observed or if stretching is suspected, the chain should be measured as outlined in the hoist manufacturer's manual. If instructions are not available, proceed as follows:

(-a) select an unworn, unstretched length of the chain (e.g., at the slack end)

(-b) suspend the chain vertically under tension and, using a caliper-type gauge, measure the outside length of any convenient number of links approximately 12 in. (305 mm) to 24 in. (610 mm) in overall length

(-c) measure the same number of links in the used sections and calculate the percentage increase in length

(13) roller chain, which should first be inspected while it is in the hoist. With the hoist suspended in normal position, a light load of approximately 50 lb (23 kg) shall be applied.

(-a) Chain shall be inspected for elongation as outlined by the hoist manufacturer. In absence of specific instructions, the chain should be inspected by determining the nominal pitch and measuring a 12-in. (305-mm) section of chain that normally travels over the chain sprocket. The dimension from the edge of one chain pin to the corresponding edge of another pin shall be measured using a caliper-type gauge for the number of pitches per foot. If elongation exceeds $\frac{1}{4}$ in. (6.3 mm) in 12 in. (305 mm), the chain shall be replaced. For example, a $\frac{3}{4}$-in. (19-mm) pitch chain should measure 12 in. (305 mm) over 16 pitches. Chain shall be rejected if measurement over 16 pitches exceeds $12\frac{1}{4}$ in. (311 mm).

(-b) Chain shall be inspected for twist. The chain shall be replaced if the twist in any 5-ft (1.52-m) section exceeds 15 deg.

(-c) The chain shall be inspected for side bow in the plane perpendicular to the plane of the roller. A chain that has a side bow exceeding $\frac{1}{4}$ in. (6.3 mm) in any 5-ft (1.52-m) section shall be replaced.

(14) Additional inspection of the roller chain should be made by removing the chain from the hoist and cleaning it thoroughly in an acid-free solvent. A check should then be made for any of the following deficiencies:

(-a) pins turned from their original position

(-b) rollers that do not run freely with light finger pressure

(-c) joints that cannot be flexed by easy hand pressure

(-d) side plates that are spread open (a visual check of the pin head extension at the damaged area, as compared to the pin extension at the free end of the chain, can determine the amount of spread and the condition of the chain)

(-e) corrosion, pitting, or discoloration of chain (generally indicative of serious impairment)

(-f) gouges, nicks, or weld spatter

(15) function labels on pendant control stations on electric- and air-powered hoists for legibility.

(16) the hoist and hoist mounting for evidence of missing items.

(f) Adjustments, repairs, or replacements shall be made, as necessary, in accordance with para. 16-4.3.4.

16-2.1.6 Hoists Not in Regular Service

(a) A hoist that is used infrequently and has been idle for a period of 1 month or more, but less than 1 yr, shall be inspected in accordance with the requirements listed in para. 16-2.1.4 before being placed in service.

(b) A hoist that is used infrequently and has been idle for a period of 1 yr or more shall be inspected in accordance with the requirements listed in para. 16-2.1.5 before being placed in service.

SECTION 16-2.2: TESTING

16-2.2.1 Operational Tests

New hoists shall be tested by the hoist manufacturer to verify compliance with this Volume as specified in (a) or (b). Altered or repaired hoists, or hoists that have not been used within the preceding 12 months, shall be tested by a designated person prior to the hoist being placed in service to verify compliance with this Volume as specified in (a) or (b).

(a) Hand-Chain-Operated Hoists

(1) Lifting and lowering functions shall be tested under no-load conditions (testing through complete rated lift length is not required).

(2) After testing under no-load conditions, a load of at least 50 lb (23 kg) times the number of load-supporting parts of chain shall be applied to the hoist, and the hoist shall be tested to check proper load control.

(b) Electric-Powered or Air-Powered Hoists

(1) Lifting and lowering functions shall be tested under no-load conditions (testing through complete rated lift length is not required).

(2) Operation of brake(s) shall be tested under no-load conditions.

(3) Activation-setting of limit devices shall be determined by tests under no-load conditions. Tests shall be conducted first by hand, if practical, and then under slowest speed obtainable. Test with increasing speeds up to maximum speed. Actuating mechanisms shall be located so that they will trip the switches or limiting devices in sufficient time to stop motion without damage to any part of the hoisting arrangement. On hoists with adjustable trip-setting limit devices, care shall be exercised to achieve adjustment setting without the load block striking the hoist frame, or without all the slack being taken out of the unloaded chain or less than one wrap of rope on the drum. When travel-limiting clutches are used as limit devices, follow the methods for testing the travel-limiting clutch in the manual provided with the hoist.

(22) ### 16-2.2.2 Load Test

(a) Hand-Chain-Operated Hoists

(1) New hoists shall be load tested by the manufacturer using the method specified in para. 16-2.2.1(a)(1) with a test load of not less than 125% of the rated load. If load testing of the hoist cannot be performed by the manufacturer, the user shall be notified and the load test shall be accomplished at another location or job site, by or under the direction of a designated person, prior to the hoist being placed in service.

(2) Hoists in which load-suspension parts have been altered, replaced, or repaired should be statically or dynamically load tested as determined by a qualified person. If a qualified person determines that a load test is required, the load test shall be performed.

(-a) If a load test is conducted, the load test shall be conducted by or under the direction of a designated person. Lifting and lowering functions shall be tested. (Testing through complete rated lift length is not required.)

(-b) If the load test is conducted, the test load shall not be less than 100% of the rated load of the hoist or more than 125% of the rated load of the hoist unless otherwise recommended by the hoist manufacturer or a qualified person.

(-c) If a load test is conducted, the person conducting the load test shall prepare a written report of the load sustained during the test and the operations performed during the test. Reports shall be placed on file.

(-d) The replacement of load chain is specifically excluded from this load test if a qualified person determines the replacement chain is suitable for the intended use. However, an operational test of the hoist shall be made in accordance with para. 16-2.2.1(a)(2) prior to putting the hoist back in service.

(b) Electric-Powered or Air-Powered Hoists

(1) Complete new hoists shall be dynamically load tested by the manufacturer using the method specified in paras. 16-2.2.1(b)(1) and 16-2.2.1(b)(2) with a test load of not less than 125% of the rated load. If testing of the hoist cannot be performed by the manufacturer, the user shall be notified and the load test shall be accomplished at another location or job site, by or under the direction of a designated person, prior to the hoist being placed in service.

(2) Hoists in which load-suspension parts have been altered, replaced, or repaired should be statically or dynamically load tested as determined by a qualified person.

(-a) If a load test is conducted, the load test shall be conducted by or under the direction of a designated person.

(-1) Lifting and lowering functions shall be tested. (Testing through complete rated lift length is not required.)

(-2) Operation of brake(s) shall be tested.

(-b) If a load test is conducted, the test load shall not be less than 100% of the rated load of the hoist or more than 125% of the rated load of the hoist unless otherwise recommended by the hoist manufacturer or a qualified person.

(-c) If a load test is conducted, the person conducting the load test shall prepare a written report of the load sustained during the test and the operations performed during the test. Reports shall be placed on file.

(-d) The replacement of load chain or rope is specifically excluded from this load test if a qualified person determines the replacement chain or rope is suitable for the intended use. However, an operational test of the hoist shall be made in accordance with paras. 16-2.2.1(b)(1), 16-2.2.1(b)(2), and 16-2.2.1(b)(3) prior to putting the hoist back in service.

(c) Test anchorages or suspensions shall be approved by a qualified person.

Chapter 16-3
Operator Training and Operation

SECTION 16-3.1: OPERATOR TRAINING

When the hoist is a component of equipment addressed by another B30 volume, the training and operation requirements of that volume shall apply.

16-3.1.1 Purpose of Operator Training

Operator training shall be provided to ensure proper operation of the equipment in compliance with instructions provided by the equipment manufacturer and the provisions of this Volume.

16-3.1.2 Operator Training — General

(a) Training shall include those items that apply to the equipment and the particular application of the hoist. Refer to para. 16-3.1.3 as a guide for sources of training material.

(b) Training programs and their contents shall be based upon, but not be limited to

(1) physical characteristics of the workplace.

(2) performance characteristics and complexity of the equipment.

(3) types of load to be handled.

(4) responsibilities of the hoist operator and other persons involved in the movement of the load. Refer to paras. 16-3.3.3 through 16-3.3.6.

(c) Trainees shall operate equipment under the supervision of a designated person.

16-3.1.3 Sources of Training Material

Examples of sources of training material are as follows:

(a) information outlined in the manual provided with the hoist

(b) information available through trade associations

(c) government training resources such as the Department of Labor

(d) organized labor groups

(e) courses, seminars, and literature offered by manufacturers of hoists, consultants, trade schools, continuing education schools, employers, and manufacturers of hoist component parts

(f) requirements and recommendations found in national consensus standards such as this Volume

SECTION 16-3.2: TRAINING FOR PERSONS OTHER THAN HOIST OPERATORS

When it is necessary for other persons, such as, but not limited to, maintenance personnel, test personnel, and inspectors, to operate a hoist in the performance of their duties, they shall be trained in accordance with the training requirements of this Volume for their duties.

SECTION 16-3.3: OPERATION

16-3.3.1 Scope of Hoist Operation

The operation of hoists shall be in accordance with the provisions included in this Volume and in manuals furnished by the equipment manufacturer.

The requirements of an operator of a hoist apply to both dedicated operators, whose primary job is the operation of a hoist, and nondedicated operators, who use a hoist as another tool in performing their job.

16-3.3.2 General Requirements to Be Followed During Hoist Operation

All personnel involved with the hoist operation shall comply with the following:

(a) Equipment lockout/tagout procedures (see Section 16-3.6).

(b) Safety signs, labels, plates, or tags.

(c) The hoist shall not be used to lift or lower while anyone is on the load or hook.

(d) The hoist chain or rope shall be free from kinks or twists and shall not be wrapped around the load.

(e) A hook latch shall be used when provided.

(f) The hook latch (when provided) shall be closed and shall not be used to support any part of the load.

(g) The load, sling, or lifting device shall be seated in the bowl of the hook.

(h) The hoist chain(s) or rope(s) shall be seated in the chain sprockets or drum and sheave grooves.

(i) Persons shall stay clear of a suspended load.

(j) Caution shall be exercised when using a hoist to maneuver a lifting magnet.

(k) Hoists shall be used to lift loads vertically without side pull except when specifically authorized by the manufacturer(s) or a qualified person for the equipment and a qualified person for the supporting structure who have determined that

(1) the various parts of the equipment, support system, and supporting structure will not be overstressed

(2) the stability of the equipment is not thereby endangered

(3) such side pulls will not cause the hoist rope to be pulled out of the sheave or across drum grooves

(4) such side pulls will not cause damage to the hoist

(l) The hoist shall not be used to lift loads in excess of the rated load of the hoist except during properly authorized tests or planned engineered lifts in accordance with Section 16-3.5.

NOTE: Devices such as load cells, dynamometers, and scales may be used to determine the load to be lifted. Notify a qualified person before attempting to lift an unknown load.

(m) The hoist should not be used in any way that subjects it to shock loads.

(n) A load-limiting device shall not be used to measure the weight of the load.

(o) The hoist rope or chain shall be protected, so far as it is practical, from weld spatter or other damaging contaminants.

(p) Gloves that interfere with the operation of the controls shall not be worn.

(q) The harness or belt (when provided) shall be used with the wireless transmitter, or the transmitter shall be placed in the location intended for its support.

(r) The safety devices on the wireless transmitter shall not be overridden.

(s) The wireless transmitter shall be stored in a designated and protected location.

(t) The wireless transmitter shall be shut off when a power failure occurs.

(u) When two or more hoists are used to lift a single load, one designated person shall be in charge of the operation. This person shall analyze the operation and instruct all personnel involved in the proper positioning and rigging of the load and the movements to be made.

(v) The operator shall test the hoist brake(s) at the start of each shift for proper operation. This shall be done by lifting the load a few inches (centimeters) and applying the brake(s).

(w) The load shall not be lowered below the point where less than two wraps of rope remain on each hoisting drum unless a lower-limit device is provided, in which case no less than one wrap shall remain.

16-3.3.3 Responsibilities of Management (Owners/Users)

Management (owners/users) shall

(a) identify, document, and assign responsibilities of the hoist operator and other persons involved in the movement of the load(s) (see paras. 16-3.3.2, 16-3.3.4, 16-3.3.5, and 16-3.3.6).

(b) provide training or verify that persons who will operate the hoist have been trained.

(c) provide a written and practical examination that verifies that the person has acquired the knowledge and skill to properly operate the specific type of hoist that will be used. The examinations shall be defined by the owner/user and shall be in accordance with any local, state, and federal provisions that may apply.

(d) issue a certificate or formal record that verifies that the person has been trained and has passed the examinations required in (c).

(e) translate technical and safety-related information and manual(s). The entities responsible for the operation, use, inspection, testing, and maintenance of the covered equipment shall have the technical and safety-related information available in a language that their employees can read and understand. If the information is not available in a language understood by their employees, the entities shall obtain a translation of the original manufacturer's written safety information and manuals from the manufacturer or from a translation service provider. The translation(s) shall meet the requirements of paras. 16-1.1.5(c) and 16-1.1.5(d).

16-3.3.4 Responsibilities of Operators

(a) Lifting/Lowering the Load

(1) Three phases of lifting/lowering the load shall be addressed

(-a) before the lift (lifting/lowering)

(-b) during the lift (lifting/lowering)

(-c) after the lift (lifting/lowering)

(2) Rigging the load, attaching the load to the hook, and other tasks related to lifting/lowering the load may be performed by the hoist operator or by persons other than the hoist operator (see para. 16-3.3.5).

(3) Hoist operation may require the use of a signalperson(s) or other personnel who have responsibility for directing the lift/lower functions and shall be assigned prior to the lift (see para. 16-3.3.6).

(b) Before the Lift (Lifting/Lowering). Operators shall

(1) be familiar with the applicable provisions of the equipment safety standards and the instructions listed in the manual(s) provided with the hoist.

(2) be familiar with controls, instructions, and product safety information located on the hoist.

(3) operate the hoist only when physically and otherwise fit.

(4) not energize the main switch or open the main valve if a warning sign, lock, or tag is on the device until the sign, lock, or tag is removed by the person who placed it on the device or by an authorized person.

(5) not remove a warning sign, lock, or tag that is on any device that controls power to the hoist, such as, but not limited to, the hoist disconnect, if the sign, lock, or tag was placed on the device by another person.

(6) place all controllers in the off position before closing the main line disconnect or opening the main valve.