ASME B30.16-2012
(Revision of ASME B30.16-2007)

Overhead Hoists (Underhung)

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

Date of Issuance: December 7, 2012

The next edition of this Standard is scheduled for publication in 2017. 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 Web site under the Committee Pages at http://cstools.asme.org/ as they are issued, and will also be published within the next edition of this Standard.

Errata to codes and standards may be posted on the ASME Web site 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.

The Committee Pages can be found at http://cstools.asme.org/. There is an option available to automatically receive an e-mail notification when errata are posted to a particular code or standard. This option can be found on the appropriate Committee Page after selecting "Errata" in the "Publication Information" section.

The American Society of Mechanical Engineers
Three 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, formerly the United States of America Standards Institute). This Standard had its beginning in December 1916 when an eight-page Code of Safety Standards for Cranes, prepared by an 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 [later changed to American Standards Association (ASA), and subsequently to the USA Standards Institute], 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 American Engineering Standards Committee 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 organized November 4, 1926, with 57 members representing 29 national organizations. The Safety Code for Cranes, Derricks, and Hoists, ASA B30.2-1943, was created from the eight-page document referred to in the first paragraph. This document was reaffirmed in 1952 and widely accepted as a safety standard.

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 Naval Facilities Engineering Command, U.S. Department of the Navy, was reorganized as an American National Standards Committee on January 31, 1962, with 39 members representing 27 national organizations.

The format of the previous code was changed so that separate Volumes (each complete as to construction and installation; inspection, testing, and maintenance; and operation) will cover the different types of equipment included in the scope of B30.

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 B30 Standard 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 2012 edition of this Standard includes 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 have been moved to Chapter 16-4, along with other updates to the Standard. This Volume of the Standard, which was approved by the B30 Standards Committee and by ASME, was approved by ANSI and designated as an American National Standard on September 5, 2012.

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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SAFETY STANDARD FOR CABLEWAYS, CRANES, DERRICKS, HOISTS, HOOKS, JACKS, AND SLINGS

B30 STANDARD INTRODUCTION

(12)

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 Standard 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
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 Hoists (Underhung)
B30.17 Overhead and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoist)
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 Manually Lever-Operated 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-Erect Tower Cranes[1]
B30.30 Ropes[1]

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.

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.

[1] These volumes are currently in the development process.

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

Secretary, B30 Standard Committee
ASME Codes and Standards
Three 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 Standard Committee.

SECTION IX: REQUESTS FOR INTERPRETATION

The B30 Standard Committee will render an interpretation of the provisions of the B30 Standard. Such requests should be directed to

Secretary, B30 Standard Committee
ASME Codes and Standards
Three 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).
Question:	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.

Upon receipt by the Secretary, the request will be forwarded to the relevant B30 Subcommittee for a draft response, which will then be subject to approval by the B30 Standard Committee prior to its formal issuance.

Interpretations to the B30 Standard will be published in the subsequent edition of the respective volume, and will be available online at http://cstools.asme.org/.

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 Standard 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 B30.16-2012
SUMMARY OF CHANGES

Following approval by the ASME B30 Committee and ASME, and after public review, ASME B30.16-2012 was approved by the American National Standards Institute on September 5, 2012.

ASME B30.16-2012 includes revisions that are identified by a margin note, **(12)**. The following is a summary of the latest revisions and changes.

Page	*Location*	*Change*
vii–ix	Introduction	Revised
6	Section 16-0.2	Definitions of *hoist operator, dedicated*; *hoist operator, nondedicated*; *minimum breaking force*; *sheave*; and *sheave, equalizer* revised
7	Section 16-0.3	Revised
8	16-1.1.2	Subparagraph (b) revised
	16-1.1.3	Subparagraph (b)(4) added
	16-1.1.4	Title revised
	16-1.2.1	Subparagraphs (b) and (c) revised
9	16-1.2.6	(1) Subparagraph (a) revised (2) Footnote 1 revised
10	16-1.2.8	Subparagraph (e) revised
	16-1.2.11	Subparagraphs (b)(1)(b), (b)(4), and (c)(1)(b) revised
11	16-1.2.14	Revised
	16-1.2.17	Subparagraph (c) revised
	16-1.3.3	Reference in subparagraph (c) revised
13, 16–18	Chapter 16-2	Revised in its entirety
19–23	Chapter 16-3	Revised in its entirety
24–27	Chapter 16-4	Added

The interpretations to ASME B30.16 are included in this edition as a separate section for the user's convenience.

OVERHEAD HOISTS (UNDERHUNG)

Chapter 16-0
Scope, Definitions, 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 hand chain-operated chain hoists and electric- 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 Figs. 16-0.1-1 through 16-0.1-5.)

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.

(12) SECTION 16-0.2: 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.

administrative or regulatory authority: governmental agency or the employer in the absence of governmental jurisdiction.

appointed: assigned specific responsibilities by the employer or the employer's representative.

authorized: appointed by a duly constituted administrative or regulatory authority.

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 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 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.

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 by resistance.

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, pneumatic: a method of controlling or powering a drive or brake by means of a compressed gas.

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.

designated person: a person selected or assigned by the employer or the employer's representative as being competent to perform specific duties.

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

Fig. 16-0.1-1 Hand Chain-Operated Chain Hoist

(a) (b)

Fig. 16-0.1-2 Electric-Powered Chain Hoist

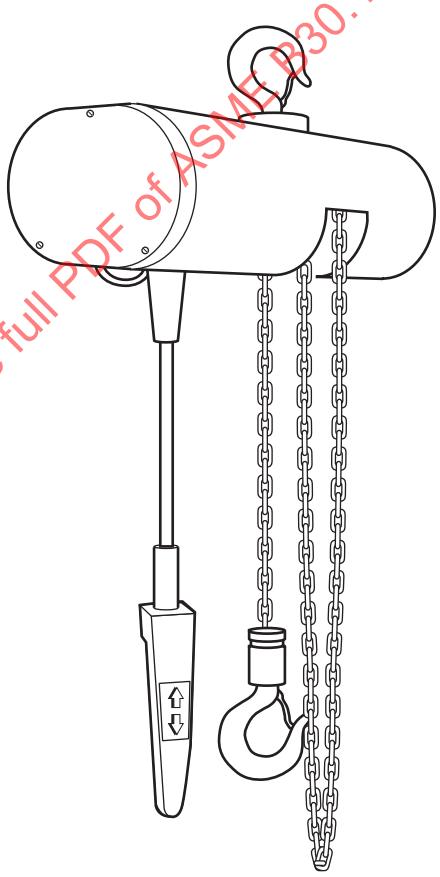


Fig. 16-0.1-3 Air-Powered Chain Hoist

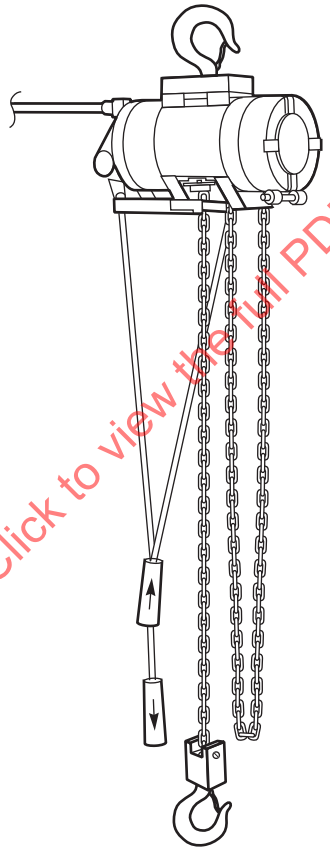
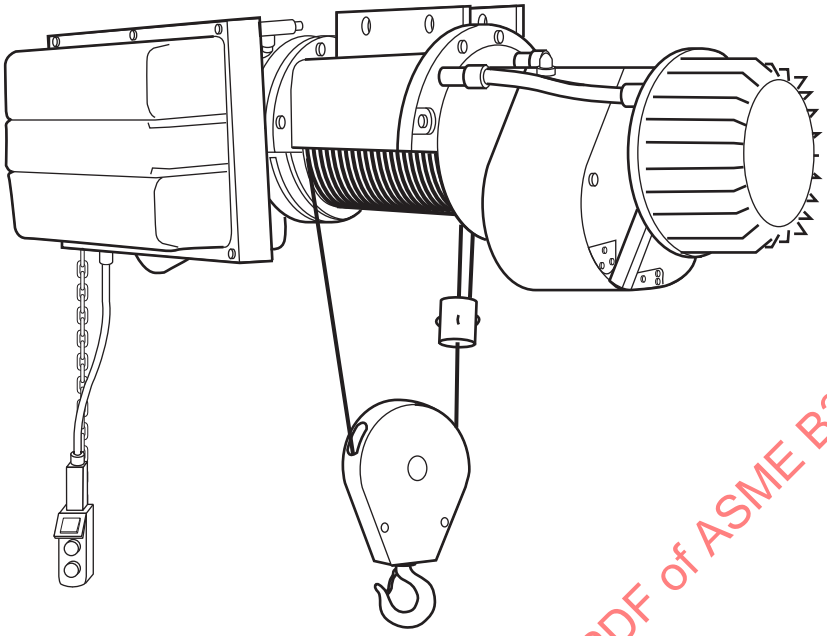
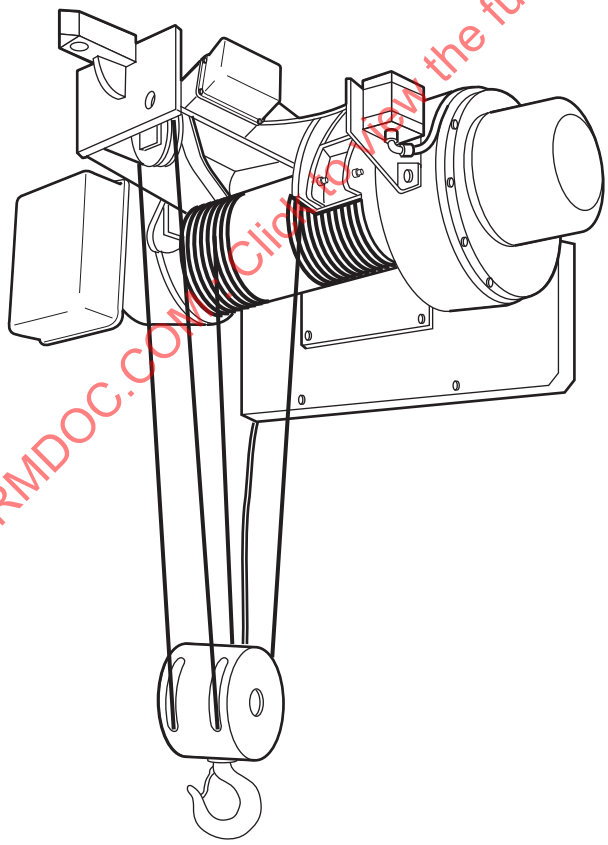


Fig. 16-0.1-4 Electric-Powered Wire Rope Hoist

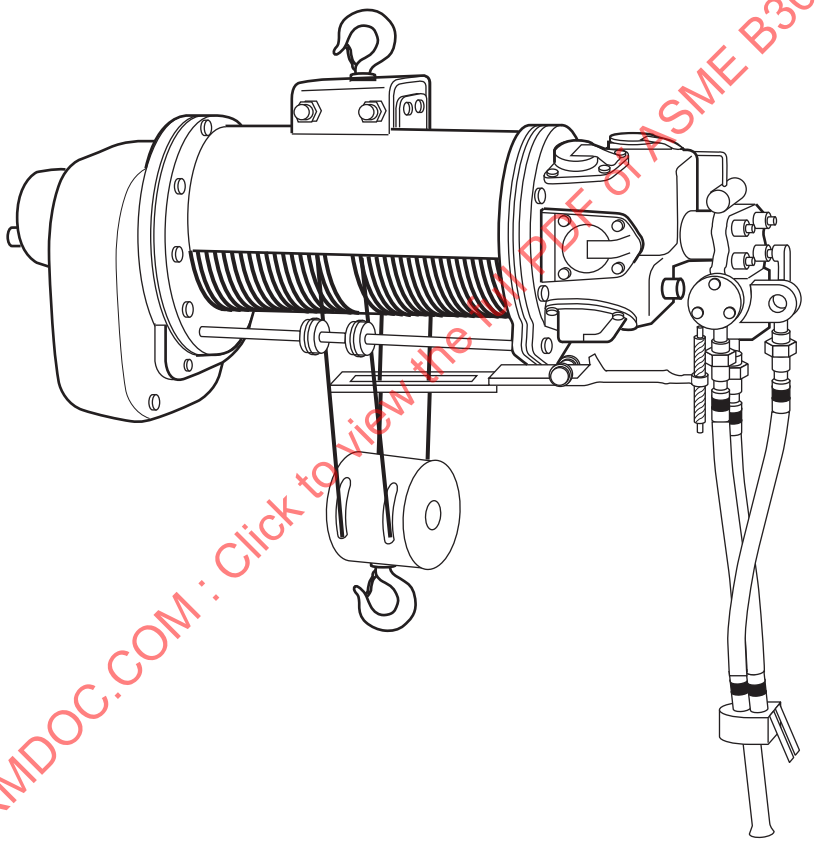


(a)



(b)

Fig. 16-0.1-5 Air-Powered Wire Rope Hoist



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

exposed: applies to hazardous objects not guarded or isolated (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. Refer to ANSI/NFPA 70.

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

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

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

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

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

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

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 is operated by some part or motion of a power-driven hoist to limit motion.

load: the total superimposed weight on the load block or hook.

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

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 a hoist is performing functions within the scope of the original design.

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 for holding the machinery against undesired rotation by engaging a ratchet.

pendant station: controls suspended from the hoist 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 unless otherwise specified.

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

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

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

slash (/): a slash (/) denotes and/or indicates that two words are to be taken together or individually.

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).

unattended: a condition in which the operator of a hoist is not at the operating control devices (pendant station or hand chain). If, however, the control devices are within an unobstructed distance of 26 ft (8 m) and within sight of the operator, the hoist 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.

(12) SECTION 16-0.3: REFERENCES

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

ANSI/NEMA Standards Publication No. ICS 6-1993, Industrial Control and Systems: Enclosures[1]

ANSI Z535.4-2007, Product Safety Signs and Labels[1]

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

ANSI/NFPA 70-2011, National Electrical Code[1]

Publisher: National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169 (www.nfpa.org)

ASME B29.24-2002, Roller Load Chains for Overhead Hoists

ASME B30.9-2011, Slings

ASME B30.10-2009, Hooks

ASME B30.11-2010, Monorails and Underhung Cranes

ASME B30.17-2006, Overhead and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoist)

ASME HST-1–1999, Performance Standard for Electric Chain Hoists

ASME HST-2–1999, Performance Standard for Hand Chain Manually Operated Chain Hoists

ASME HST-4–1999, Performance Standard for Overhead Electric Wire Rope Hoists

ASME HST-5–1999, Performance Standard for Air Chain Hoists

ASME HST-6–1999, Performance Standard for Air Wire Rope Hoists

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

ASSE Z244.1-2003 (R2008), Safety Requirements for the Lockout/Tagout of Energy Sources[1]

Publisher: The American Society of Safety Engineers (ASSE), 1800 East Oakton Street, Des Plaines, IL 60018 (www.asse.org)

ASTM E2349-2009, Standard Practice for Safety Requirements in Metal Casting Operations: Sand Preparation, Molding, and Core Making; Melting and Pouring; and Cleaning and Finishing[1]

Publisher: The American Society for Testing and Materials (ASTM International), 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 (www.astm.org)

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

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.

(12) **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.

(12) **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)

(c) Air-Powered Hoist

(1) name of manufacturer

(2) manufacturer's model and serial number

(3) rated air pressure

(12) **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"

SECTION 16-1.2: CONSTRUCTION

16-1.2.1 Mechanical Design (12)

(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, except for roller load chain, 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. Roller load chain shall be designed so that the static stress calculated for the rated load shall not exceed 25% of the minimum tensile strength as stated in ASME B29.24.

(c) Load suspension parts, except for roller load chain, 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. Roller load chain shall be designed so that the static stress calculated for the rated load shall not exceed 20% of the minimum tensile strength as stated in ASME B29.24.

(d) Power transmission parts shall be designed so that the dynamic stress calculated for the rated load shall not exceed the endurance 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 should 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) Unless otherwise specified, control enclosures shall be NEMA Type 1, general purpose for indoor application, in accordance with ANSI/NEMA No. ICS 6.

(c) Electrical equipment shall be so located or enclosed that live parts will not be exposed to inadvertent contact under normal operating conditions.

(d) Enclosures for resistors (if required) shall provide means for heat dissipation and shall be installed to minimize the accumulation of combustible matter. Provision shall be made to prevent broken resistor parts or molten metal from falling onto the operator, other personnel, or combustible materials.

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.

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

(a) 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.

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

(c) 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)

Rope drums shall be grooved except when the hoist is provided by the manufacturer for a special application. This requirement does not preclude the use of multiple layer spooling. 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.

16-1.2.6 Ropes (Electric- or Air-Powered Hoists Only) (12)

(a) The hoisting ropes shall be of a construction recommended for hoist service. The rated load divided by the number of parts (lines) of rope shall not exceed 20% of the minimum breaking force[1] 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) Socketing shall be done in a manner recommended by the rope or fitting manufacturer or a qualified person.

(c) The rope ends shall be attached to the hoist in a manner to prevent disengagement throughout rated hook travel. No less than two wraps of rope shall remain on each anchorage of the hoist drum when the hook is in its extreme low position unless a lower-limit device is provided, in which case no less than one wrap shall remain on each anchorage of the hoist drum.

(d) Eye splices shall be made in a manner recommended by the rope or hoist manufacturer or a qualified person. Rope thimbles should be used in the eye.

(e) Wire-rope clips shall be drop-forged steel of the single saddle- (U-bolt) or double saddle-type clip. Malleable cast iron clips shall not be used. For spacing, number of clips, and torque values, refer to the clip manufacturer's recommendation. Wire-rope clips attached with U-bolts shall have the U-bolt over the dead end of the rope and the live rope resting in the clip saddle. Clips shall be tightened evenly to the recommended torque. After the initial load is applied to the rope, the clip nuts shall be retightened to the recommended torque to compensate for any decrease in rope

[1] *Minimum breaking force* formerly referred to as *minimum breaking strength.*

diameter caused by the load. Rope clip nuts should be retightened periodically to compensate for any further decrease in rope diameter during usage.

(f) Swaged or compressed fittings shall be applied as recommended by the rope, hoist, or fitting manufacturer or a qualified person.

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

(h) Wherever exposed to ambient temperatures at the rope in excess of 180°F (82°C), rope having an independent wire-rope or wire-strand core or other temperature damage-resistant core shall be used.

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.

(12) 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 1½ 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.

(12) 16-1.2.11 Brakes

(a) Hand Chain-Operated Hoist. Hand chain-operated hoist(s) 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 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 or, with rated load on the hoist, a hand chain force equivalent to the pull required to lift the rated load.

(12) **16-1.2.14 Overtravel Protection (Electric- or Air-Powered Hoists Only)**

The hoist shall be so designed and constructed that the load hook, either loaded or empty, shall not exceed the upper limit of travel. On powered-chain hoists, the use of a travel-limiting clutch as overtravel protection is permitted. If installed, overtravel protection components shall be designed by the manufacturer according to the requirements of para. 16-1.2.1(a). On wire-rope hoists, 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.

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.

(12) **16-1.2.17 Manual**

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)

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.

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.

16-1.3.3 Location (12)

(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 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 B30.11 and 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 Check Points

After installation, a check should be made as indicated in para. 16-2.1.3.

Chapter 16-2
Inspection and Testing

(12)

SECTION 16-2.1: INSPECTION

16-2.1.1 Inspection Classification

(a) Initial Inspection. Prior to initial use, all new, altered, or modified hoists shall be inspected by a designated person to verify compliance with the applicable provisions of this Volume.

(b) Other Inspections. Inspection procedures for hoists in regular service are divided into three general classifications based upon the intervals at which inspection should be performed. The intervals in turn are dependent upon the nature of the critical components of the hoist and the degree of their exposure to wear, deterioration, or malfunction. The three general classifications are herein designated as preoperation, frequent, and periodic, with respective intervals between inspections as follows:

(1) preoperation inspection: visual inspection by a designated person with records not required, performed before the first use of each shift.

(2) frequent inspection: visual examinations by a designated person with records not required.

(a) normal service — monthly
(b) heavy service — weekly
(c) severe service — daily

(3) periodic inspection: visual inspection by a designated person who makes records of external conditions to provide the basis for a continuing evaluation. An external coded mark on the hoist is an acceptable identification in lieu of records.

(a) normal service — yearly
(b) heavy service — semiannually
(c) severe service — quarterly

16-2.1.2 Preoperation Inspection

(a) The preoperation inspection shall be performed before the first use of the hoist each shift by a designated person.

(b) A qualified person shall determine whether conditions found during the inspection constitute a hazard and whether a more detailed inspection is required.

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

(a) distortion of the rope such as kinking, crushing, unstranding, birdcaging, main strand displacement, or core protrusion
(b) general corrosion
(c) broken or cut strands
(d) number, distribution, and type of visible broken wires

(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) Test the hoist under load in lifting and lowering directions and observe the operation of the chain and sprockets. The chain should feed smoothly into and away from the sprockets.

16-2.1.3 Frequent Inspection (See Also Tables 16-2.1.3-1 and 16-2.1.3-2)

(a) Frequent inspections shall be performed at intervals defined in para. 16-2.1.1(b)(2) and shall include observations during operation.

(b) A qualified person shall determine whether conditions found during the inspection constitute a hazard and whether a more detailed inspection is required.

(c) 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 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.

Table 16-2.1.3-1 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. 16-2.1.3)						
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. 16-2.1.3(c)(8)	X	...	X	...	X	...
Load chain reeving for compliance with hoist manufacturer's recommendations	X	...	X	...	X	...
Periodic Inspection (Refer to para. 16-2.1.4)						
Requirements of frequent inspection	...	X	...	X	...	X
Load chain in accordance with paras. 16-2.1.4(d)(13), (14), and (15)	...	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 discs; 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	...	X	...	X	...	X

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

Table 16-2.1.3-2 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. 16-2.1.3)						
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 para. 16-2.1.3(c)(7)	X	...	X	...	X	...
Load chain in accordance with para. 16-2.1.3(c)(8)	X	...	X	...	X	...
Rope or load chain reeving for compliance with hoist manufacturer's recommendations	X	...	X	...	X	...
Periodic Inspection (Refer to para. 16-2.1.4)						
Requirements of frequent inspection	...	X	...	X	...	X
Hoist rope in accordance with paras. 16-2.1.4(d)(11) and (12)	...	X	...	X	...	X
Load chain in accordance with paras. 16-2.1.4(d)(13), (14), and (15)	...	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	...	X	...	X	...	X

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

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

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

(7) hoist rope for gross damage, which may be an immediate hazard, such as the following:

(a) distortion of the rope such as kinking, crushing, unstranding, birdcaging, main strand displacement, or core protrusion

(b) general corrosion

(c) broken or cut strands

(d) number, distribution, and type of visible broken wires

(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) Test the hoist under load in lifting and lowering directions and observe the operation of the chain and sprockets. 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.

16-2.1.4 Periodic Inspection (See Also Tables 16-2.1.3-1 and 16-2.1.3-2)

(a) Periodic inspections shall be performed at intervals defined in para. 16-2.1.1(b)(3) and may be performed with the hoist at its normal location. Periodic inspections do not require the hoist to be disassembled.

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

(c) A quallified person shall determine whether conditions found during inspection constitute a hazard and whether disassembly is required.

(d) The following items shall be inspected:

(1) the items listed in para. 16-2.1.3(c).

(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 over its entire length. The individual outer wires in the strands of the rope shall be visible to the inspecting person during the inspection. Any deterioration resulting in appreciable loss of original strength, such as the following, shall be noted and determination shall be made by a qualified person as to whether further use of the rope would constitute a hazard:

(a) points listed in para. 16-2.1.3(c)(7)

(b) reduction of rope diameter due to loss of core support or internal or external corrosion

(c) reduction of nominal diameter of more than 5%

(d) severely corroded or broken wires at end connections

(e) severely corroded, cracked, bent, worn, or improperly applied end connections

(12) sections of rope subject to rapid deterioration, such as the following:

(a) rope in contact with saddles, equalizer sheaves, or other sheaves where rope travel is limited

(b) rope at or near terminal ends where corroded or broken wires may protrude

(c) rope subject to reverse bending

(d) rope normally hidden during visual inspection, such as parts passing over sheaves

(13) 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

(14) 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 plane perpendicular to plane of 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.

(15) 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

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

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

16-2.1.5 Hoists Not in Regular Service

(a) A hoist that is used infrequently and has been idle for a period of 1 mo or more, but less than 1 yr, shall be inspected in accordance with the requirements listed in para. 16-2.1.3 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. 16-2.1.4 before being placed in service.

16-2.1.6 Inspection Records

(a) Dated inspection reports and records should be maintained at time intervals specified in para. 16-2.1.1(b)(3). Records should be stored where they are available to appointed persons.

(b) A long-range rope or chain inspection program should be established and should include records on examination of ropes or chains removed from service so a relationship can be established between visual observation and actual condition of the rope or chain.

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 para. 16-2.2.1(a) or (b). Altered or repaired hoists, or hoists that have not been used within the preceding 12 mo, shall be tested by a designated person prior to the hoist being placed in service to verify compliance with this Volume as specified in para. 16-2.2.1(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) Trip-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.

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; however, an operational test of the hoist should 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 (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; however, an operational test of the hoist should be made in accordance with paras. 16-2.2.1(b)(1), (2), and (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

(12)

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 and 16-3.3.4.

(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 its 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 16-3.4.

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

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

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

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

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

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

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

(t) 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.

(u) 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).

(v) 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 and 16-3.3.4).

(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 examination required in para. 16-3.3.3(c).

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 persons other than the hoist operator.

(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.

(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.

(7) verify that no worker is on or adjacent to the hoist before closing the main disconnect switch or opening the main valve.

(8) perform a preoperation inspection before the first use of each shift in accordance with para. 16-2.1.2.

(9) not remove or obscure the safety labels, plates, or tags furnished on the hoist.

(10) be familiar with and understand hand signals (see Section 16-3.5).

(11) verify that the hook travels in the same direction as shown on the controls.

(12) verify that chains or wire ropes are not kinked or twisted, or that multiple-part chain or wire ropes are not twisted about each other.

(13) verify that the hoist chain or wire rope is not wrapped around the load.

(14) attach the load to the hook or have the load attached to the hook by means of slings or other lifting devices.

(15) verify that the load, sling, or lifting device is seated in the bowl of the hook.

(16) verify that the hook latch (when provided) is closed, functioning properly, and not supporting any part of the load.

(17) verify that the hoist load chain or rope is seated in the sprockets or drum grooves and in the sheave(s) sprockets or grooves if there is or has been a slack condition.

(18) verify that the transmitter (if provided) is the correct transmitter for the hoist to be operated.

(19) verify that the hoist unit is centered over the load's center of gravity, except when authorized by a qualified person [see para. 16-3.3.2(k)].

(20) verify that the load to be lifted does not exceed the rated load of the hoist [see para. 16-3.3.2(l)].

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

(21) verify operation of the upper-limit device under no-load conditions prior to the initial use of any electric-powered or air-powered hoist during each shift. If more than one upper-limit device is present, only the operation of the primary upper-limit device need be verified. Care shall be exercised; the block shall be inched into the limit device or run in at slow speed. If the device does not operate properly, the operator shall immediately notify a qualified person. When travel-limiting clutches are used as limit devices, follow hoist manufacturer instructions when checking the travel-limiting clutch.

(22) verify that the hoist limit device that controls the upper limit of travel of the load block is not used as an operating control in normal operation unless additional means are provided to prevent damage from overtravel. When travel-limiting clutches are used as limit devices, follow hoist manufacturer instructions when checking the travel-limiting clutch.

(c) *During the Lift (Lifting/Lowering).* Operators shall

(1) be responsible for the hoist operation.

(2) respond to commands from the person directing the lift or a designated signalperson.

(3) obey any stop signal regardless of who gives it.

(4) verify that multiple-part chains or ropes are not twisting around each other when the lift is made.

(5) take up slack load chain or rope carefully, lift the load a few inches (centimeters) to check the hoist operation, and verify that the load is secured, balanced, and positioned on the hook and in the sling or lifting device.

(6) minimize swinging the load or load hook.

(7) maintain firm footing when operating lifting equipment.

(8) avoid sudden acceleration and deceleration of the load.

(9) use the hoist to lift vertically, without side pull, except when specifically authorized by a qualified person [see para. 16-3.3.2(k)].

(10) verify that the load and rigging are free to move and will clear all obstructions.

(11) test the hoist brake(s) for proper operation by lifting the load a few inches (centimeters) and applying the brake(s).

(12) stop the lifting of the load before the upper-limit device is engaged. The hoist limit device that controls the upper limit of travel of the load block shall not be used as an operating control in normal operation unless additional means are provided to prevent damage from overtravel.

(13) avoid carrying loads over people.

(14) concentrate on operating the hoist, and do not allow attention to be diverted while operating the equipment.

(15) protect the load chain or rope, so far as it is practical, from weld spatter or other damaging contaminants.

(16) promptly report to the person responsible for the hoist any malfunction, unusual performance or sound or damage of equipment.

(17) place all controllers or master switches in the off position when power is interrupted during operation.

(18) check the controllers for correct direction of motion when power is restored after a power outage.

(19) follow the directions of the designated person in charge of the operation when two or more hoists are used to lift a single load.

(20) not leave a suspended load unattended unless provisions have been made to provide auxiliary supporting means under the suspended load, or guards or barriers are used on the floor to prevent people from entering the area affected by the suspended load.

(21) not lower the load 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.

(22) stop the lowering of the load before the lower-limit device is engaged, when furnished, and not use it as an operating control in normal operation.

(23) not wear gloves that interfere with the operation of the controls.

(24) use the harness or belt, if provided, for use with the transmitter, or place the transmitter in the location intended for its support.

(25) not override safety devices on the transmitter.

(26) shut off the transmitter when a power failure occurs.

(27) stop the hoist in a controlled manner when the operator has doubt as to the safety of the operations. Lift operations shall resume only after safety concerns have been addressed.

(d) After the Lift (Lifting/Lowering). Operators shall

(1) lift the load block above the highest moveable obstruction under the hoist when the hoist is not in use

(2) notify the next operator or supervisor of adjustments, repairs, or replacements that need to be made

(3) place the controllers in the off position before leaving

(4) shut off and store the transmitter in a designated and protected location

(5) not use the hoist to remove slings from under a landed load

SECTION 16-3.4 PLANNED ENGINEERED LIFTS

Lifts in excess of the rated load may be required from time to time on a limited basis for specific purposes such as new construction or major repairs. Every planned engineered lift exceeding the rated load shall be treated as a special and separate event.

Limitations and planned requirements shall be applicable as follows:

(a) Planned engineered lifts shall be limited to powered hoists.

(b) When planned engineered lifts are made, the load shall not exceed 125% of the hoist load rating, except as provided in para. 16-3.4(d).

(c) Planned engineered lifts shall be limited to two occurrences on any hoist within any continuous 12-mo period, except as provided in para. 16-3.4(d). If greater lift frequency is desired, consideration shall be given to rerating or replacing the hoist.

(d) The equipment manufacturer or a qualified person shall be consulted if the planned engineered lift exceeds 125% of rated load or if the frequency of planned engineered lifts exceeds two during a continuous 12-mo period.

(e) Each planned engineered lift shall comply with the following requirements:

(1) A written review of the hoist's service history shall be prepared, including reference to previous planned engineered lifts, structural repairs, and modifications of original design.

(2) The design of the structural, mechanical, electrical, pneumatic, and hydraulic components of the equipment shall be reviewed by means of applicable calculations for the load to be lifted and approved by the equipment manufacturer or a qualified person according to accepted hoist design standards (refer to Chapter 16-1).

(3) The design of the equipment's supporting structure shall be reviewed and approved by a qualified person for conformance to applicable design criteria. The supporting structure shall be inspected and any deterioration or damage shall be taken into consideration in design calculations for the load to be lifted.

(4) The equipment shall be inspected in accordance with para. 16-2.1.4 just prior to making the lift.

(5) The lift shall be made under the direction of a designated person in accordance with a previously prepared lift plan. All persons in the area of the equipment shall be alerted that the lift is being made.

(6) The operator shall test the hoist at the planned engineered load by lifting the load a few inches (centimeters) and setting the brakes. The lift shall only be continued if the brake stops and holds the load. Any failure to hold the load shall be corrected before proceeding with the lift.

(7) The hoist shall be inspected in accordance with para. 16-2.1.4 after the lift is completed and prior to being used for the lifting of any other load.

(8) A record of the planned engineered lift, including calculations, inspections, and all distances moved, shall be placed on file for availability to appointed personnel.

(f) The load test specified in para. 16-2.2.2 is not applicable to planned engineered lift provisions.

SECTION 16-3.5 SIGNALS

16-3.5.1 Standard Signals

Signals to the operator shall be in accordance with the standards prescribed in Fig. 16-3.5.1-1, unless voice communication equipment (telephone, radio, or equivalent) is used. Signals shall be discernible or audible at all times. Some special operations may require additions to, or modifications of, the basic signals.

16-3.5.2 Hand Signals

When hand signals are used, they should be posted conspicuously and should be as illustrated in Fig. 16-3.5.1-1.

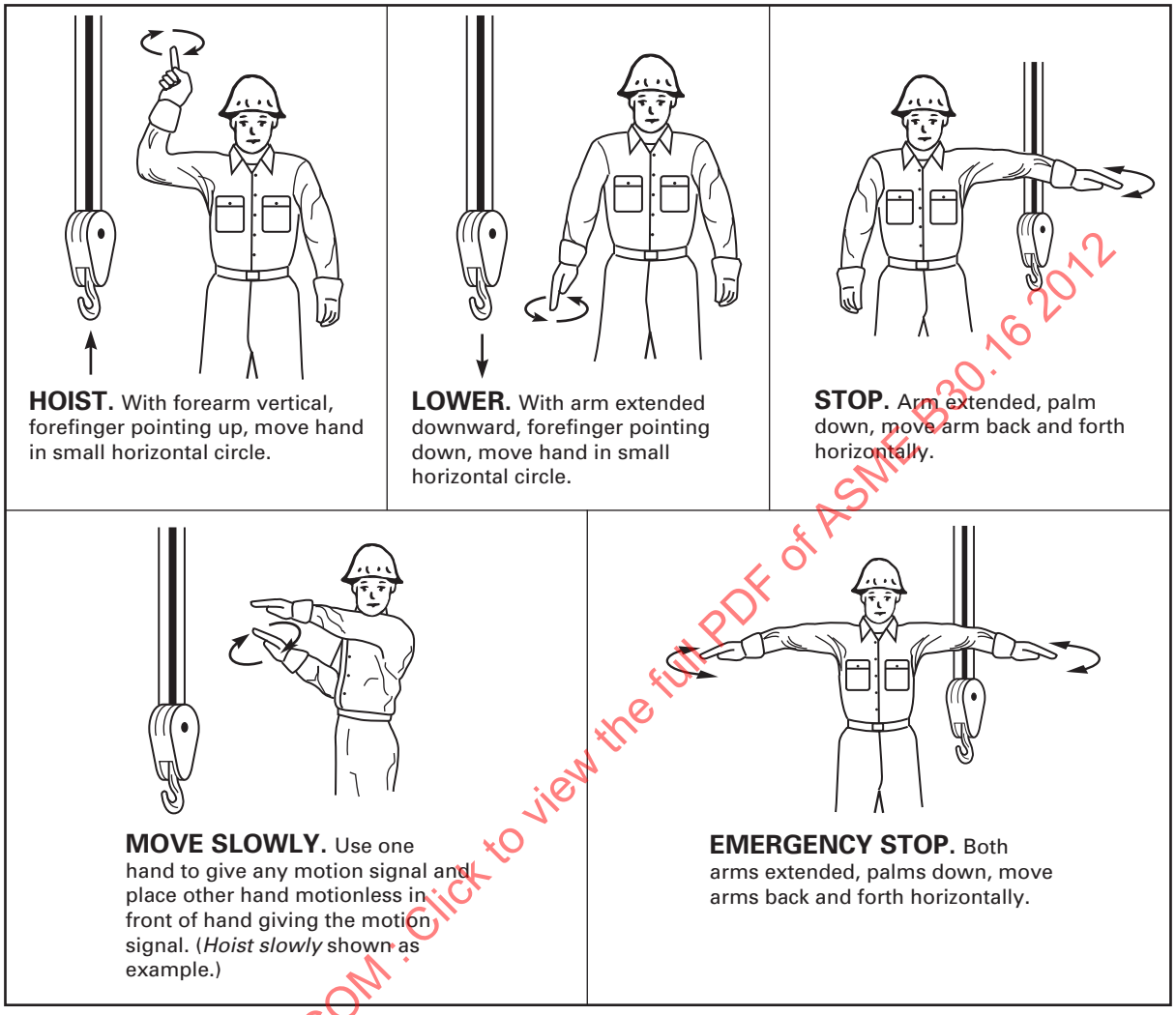
SECTION 16-3.6 EQUIPMENT LOCKOUT/TAGOUT

(a) A lockout/tagout policy and procedure shall be developed, documented, and implemented by the owner or user of the hoist.

(b) The lockout/tagout policy and procedure shall comply with the requirements of ASSE Z244.1.

(c) The policy shall include, but not be limited to, hoists and may also include other related equipment, such as trolleys.

Fig. 16-3.5.1-1 Standard Hand Signals for Controlling Hoists



HOIST. With forearm vertical, forefinger pointing up, move hand in small horizontal circle.

LOWER. With arm extended downward, forefinger pointing down, move hand in small horizontal circle.

STOP. Arm extended, palm down, move arm back and forth horizontally.

MOVE SLOWLY. Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (*Hoist slowly* shown as example.)

EMERGENCY STOP. Both arms extended, palms down, move arms back and forth horizontally.