ASME B30.21-2005
(Revision of ASME B30.21-1999)

# Manually Lever Operated 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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Three Park Avenue • New York, NY 10016

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The next edition of this Standard is scheduled for publication in 2008. There will be no addenda issued to this edition.

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://www.asme.org/codes/ as they are issued, and will also be published within the next edition of the Standard.

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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 (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 ASME Committee on the Protection of Industrial Workers, was presented to the annual meeting of the 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 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 standards (each complete as to construction and installation; inspection, testing, and maintenance; and operation) would 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 the ASME and accredited by the American National Standards Institute.

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 III, before rendering decisions on disputed points.

This volume of the Standard, which was approved by the B30 Committee and by ASME, was approved by ANSI and designated as an American National Standard on February 16, 2005.

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.



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# Safety Standards 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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**J. D. Wendler,** *Secretary*

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

(05)

# B30 STANDARD INTRODUCTION

## GENERAL

This Standard is one of a series of safety standards on various subjects that have been formulated under the general auspices of the American National Standards Institute. One purpose of the Standard is to serve as a guide to governmental authorities having jurisdiction over subjects within the scope of the Standard. It is expected, however, that the Standard will find a major application in industry, serving as a guide to manufacturers, purchasers, and users of the equipment.

For the convenience of the user, the Standard has been divided into separate volumes.

B30.1 Jacks
B30.2 Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)
B30.3 Construction Tower Cranes
B30.4 Portal, Tower, and Pedestal Cranes
B30.5 Mobile and Locomotive Cranes
B30.6 Derricks
B30.7 Base Mounted Drum Hoists
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
Note: B30.15-1973 has been withdrawn. The revision of B30.15 is included in the latest edition 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[1]
B30.25 Scrap and Material Handlers
B30.26 Rigging Hardware
B30.27 Material Placement Systems[1]
B30.28 Balance-Lifting Units[1]

If these standards are 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.

The use of cableways, cranes, derricks, hoists, hooks, jacks, and slings is subject to certain hazards that cannot be met 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 safe operation of the equipment and the handling of the loads. Serious hazards are overloading, dropping or slipping of the load caused by improper hitching or slinging, obstructing the free passage of the load, and using equipment for a purpose for which it was not intended or designed.

The Standards Committee fully realizes the importance of proper design factors, minimum or maximum sizes, and other limiting dimensions 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 depend on many different factors, often varying with the installation and uses. These factors depend on the condition of the equipment or material; the loads; the acceleration or speed of the ropes, chains, sheaves, sprockets, or drums; the type of attachments; the number, size, and arrangement of sheaves or other parts; environmental conditions causing corrosion or wear; and many variables that must be considered in each individual case. The rules given in the Standard must be interpreted accordingly, and judgment must be used in determining their application.

The Standards Committee will be glad to receive criticisms of this Standard's requirements and suggestions

[1] B30.24, B30.27, and B30.28 are in the developmental stage.



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for its improvement, especially those based on actual experience in application of the rules.

Suggestions for changes to the Standard should be submitted to the Secretary of the B30 Committee, ASME, Three Park Avenue, New York, NY 10016-5990, and should be in accordance with the following format:

*(a)* Cite the specific paragraph designation of the pertinent volume.

*(b)* Indicate the suggested change (addition, deletion, revision, etc.).

*(c)* Briefly state the reason and/or evidence for the suggested change.

*(d)* Submit suggested changes to more than one paragraph in the order that the paragraphs appear in the volume.

The B30 Committee will consider each suggested change in a timely manner in accordance with its procedures.

## SECTION I: SCOPE OF B30 STANDARD

This Standard applies to the construction, installation, operation, inspection, maintenance, and safe use of lifting equipment used in construction and industrial settings. This includes, but is not limited to: articulating-boom, container, gantry, mobile, pedestal, portal, tower and stacker cranes; balance-lifting units; below-the-hook lifting devices; cableways; derricks; jacks; hoists; hooks; loads suspended from rotorcraft; material placement systems; monorails; rigging hardware; and scrap and material handlers.

This Standard does not apply to track and automotive jacks, railway or automobile wrecking cranes, shipboard cranes, shipboard cargo-handling equipment, well-drilling derricks, skip hoists, mine hoists, truck body hoists, car or barge pullers, conveyors, excavating equipment, or equipment falling within the scope of the following Committees: A10, A17, A90, A92, A120, B20, B56, and B77.

## SECTION II: PURPOSE

This Standard is designed to

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

*(b)* provide direction to owners, employers, supervisors, 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 III: INTERPRETATIONS

Upon request, the B30 Committee will render an interpretation of any requirement of the Standard. Interpretations can only be rendered in response to a written request sent to the Secretary of the B30 Committee, ASME, Three Park Avenue, New York, NY 10016-5990.

The request for interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his request utilizing the following format

Subject: Cite the applicable paragraph number(s) and provide a concise description.

Edition: Cite the applicable edition of the pertinent volume for which the interpretation is being requested.

Question: Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for approval of a proprietary design or situation. The inquirer may also include any plans or drawings that are necessary to explain the question; however, they should not contain any proprietary names or information.

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

ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

## SECTION IV: NEW AND EXISTING INSTALLATIONS

*(a) Effective Date.* The effective date of this volume for the purpose of defining new and existing installations shall be 1 year after its date of issuance.

*(b) New Installations.* 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.

*(c) Existing Installations.* Inspection, testing, maintenance, and operation of equipment manufactured and facilities constructed prior to the effective date of this volume shall be done, as applicable, in accordance with the requirements of this volume.

It is not the intent of this volume to require retrofitting of existing equipment. However, when an item is being modified, its performance requirement shall be reviewed



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relative to the current volume. If the performance differs substantially, the need to meet the current requirement shall be evaluated by a qualified person selected by the owner (user). Recommended changes shall be made by the owner (user) within 1 year.

## SECTION V: MANDATORY AND ADVISORY RULES

Mandatory rules of this Standard are characterized by use of the word *shall*. If a provision is of an advisory nature, it is indicated by use of the word *should* and is a recommendation to be considered, the advisability of which depends on the facts in each situation.

## SECTION VI: METRIC CONVERSIONS

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 customary units.



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# ASME B30.21-2005
# SUMMARY OF CHANGES

Following approval by the ASME B30 Committee and ASME, and after public review, ASME B30.21-2005 was approved by the American National Standards Institute on February 16, 2005.

ASME B30.21-2005 includes editorial changes, revisions, and corrections identified by a margin note, **(05)**.

| *Page* | *Location* | *Change* |
|---|---|---|
| viii, x | B30 Standard Introduction | General, Section I, and Section VI revised |
| 1 | Section 21-0.1 | Revised in its entirety |
| 7 | Section 21-0.3 | References updated |
| 8 | Section 21-1 | Revised in its entirety |
| 11 | Table 1 | Revised |
| 16 | Chapter 21-2 | Revised in its entirety |
| 18 | Table 2 | Revised |
| 23 | Chapter 21-3 | Revised in its entirety |
| 25 | Table 3 | Revised |

**SPECIAL NOTE:**

The interpretations to ASME B30.21 are included in this edition as a separate section for the user's convenience.



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# MANUALLY LEVER OPERATED HOISTS

# Chapter 21-0
# Scope, Definitions, and References

## (05) SECTION 21-0.1: SCOPE OF B30.21

Volume B30.21 includes provisions that apply to the construction, installation, operation, inspection, and maintenance of ratchet and pawl and friction brake type manually lever operated chain, wire rope, and web strap hoists used for lifting, pulling, and tensioning applications. (See Figs. 1 through 3.)

The requirements for a hoist that is used for a special purpose, such as lifting personnel, or drawing both the load and the hoist up or down the load chain, rope, or web strap when the hoist is attached to the load, and a specially insulated hoist used for handling energized electrical power lines are not included in this volume.

## SECTION 21-0.2: DEFINITIONS

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

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

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

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

*block, load:* the assembly of hook or shackle, swivel, bearings, sheaves, sprockets, pins, and frame suspended by the load chain, wire rope, or web strap. This shall include any appurtenances reeved in the load chain, wire rope, or web strap (see Fig. 4).

*brake:* a device for retarding and stopping motion of the load (see *load controlling mechanism*).

*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 (see Fig. 5). Rollerless chain may be provided on some equipment.

*chain, rollerless:* a series of alternately assembled roller links and pin links in which the pins articulate inside the bushings with rollers on the bushings omitted. 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 (see Fig. 5).

*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 the wire rope or web strap is wound for lifting and lowering the load.

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

*friction brake:* see *load controlling mechanism*.

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

*guide, web strap:* a means to guide the web strap at the load sprocket (drum) (see Fig. 6).

*guide, wire rope:* a means to guide the wire rope at the load sprocket (drum) [see Fig. 7, sketch (b)].

*hazardous (classified) locations:* locations where fire or explosion hazards may exist. Locations are classified according to the properties of the flammable vapors, liquids, gases, or combustible dust or fibers that may be present, and the likelihood that a flammable or combustible concentration or quantity is present (see ANSI/NFPA 70).

*headroom (closed height):* the distance between the saddle of the suspension hook and the saddle of the load hook when the load block is in its fully retracted position (upper limit of travel) (see Fig. 4).

*hoist, lever operated:* a lever operated manual device used to lift, lower, or pull a load and to apply or release tension.



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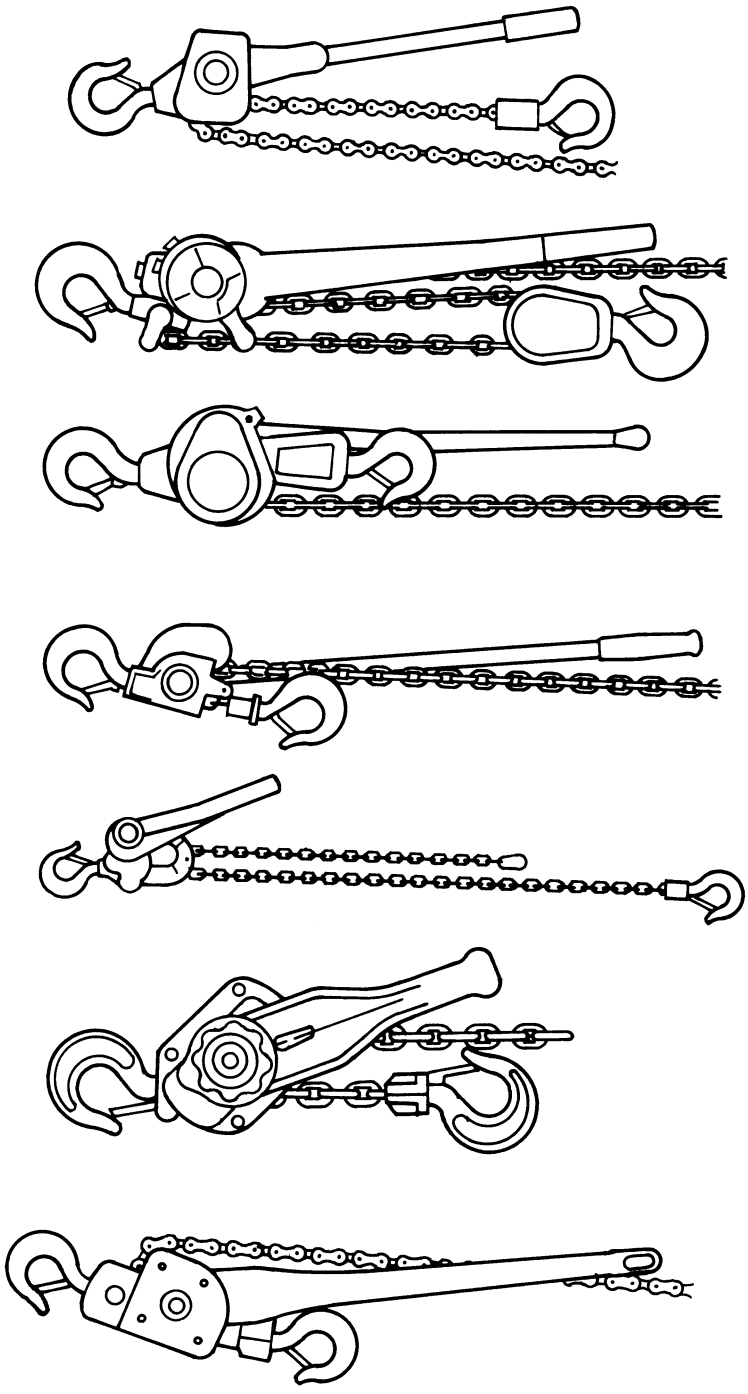


**Fig. 1 Manually Lever Operated Hoist — Chain Type**



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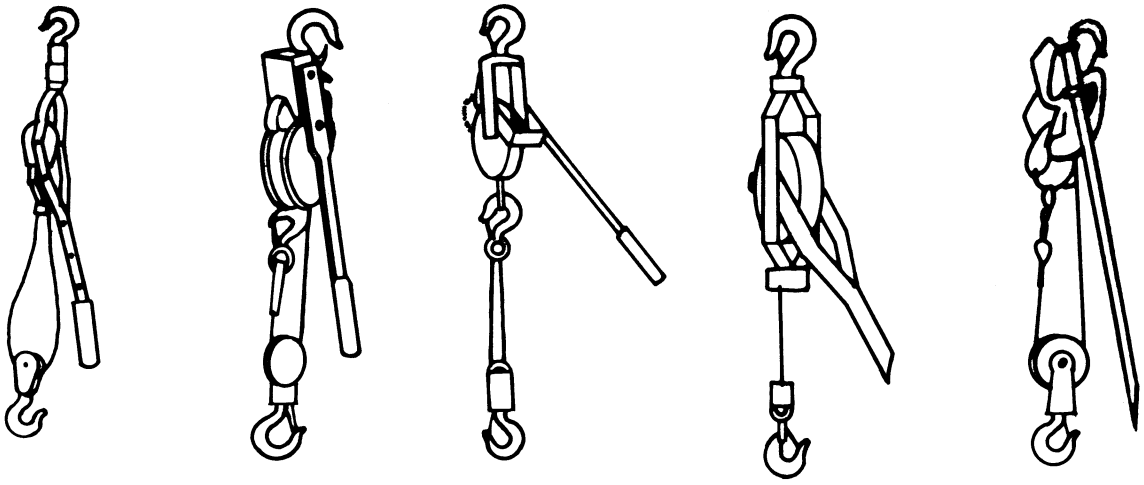


**Fig. 2 Manually Lever Operated Hoist — Wire Rope**

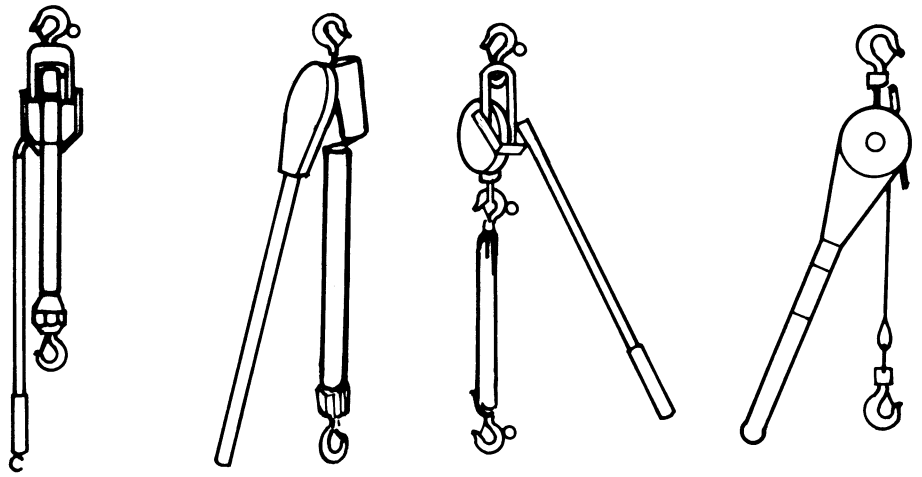


**Fig. 3 Manually Lever Operated Hoist — Web Strap**

*hook latch:* a mechanical device to bridge the throat opening of a hook.

*lift:* the maximum distance through which the load hook can travel (see Fig. 4).

*lifting devices:* devices that are not normally reeved onto the hoist chain, wire rope, or web strap, such as 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.

*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.

*load controlling mechanism:* a mechanism that functions automatically to hold and control the load. In each of the following general types, a reciprocating force must be applied to the hoist lever to lower the load.

*friction brake type:* an automatic type of brake used for holding and controlling loads. This unidirectional device requires a force applied to the operating lever to lower the load, but does not impose additional lever pull when lifting the load [see Fig. 7, sketch (a)].

*ratchet and pawl type:* a load controlling mechanism consisting of interlocking pawl(s) and ratchet that act to hold the load by mechanical engagement [see Fig. 7, sketch (b)].

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

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



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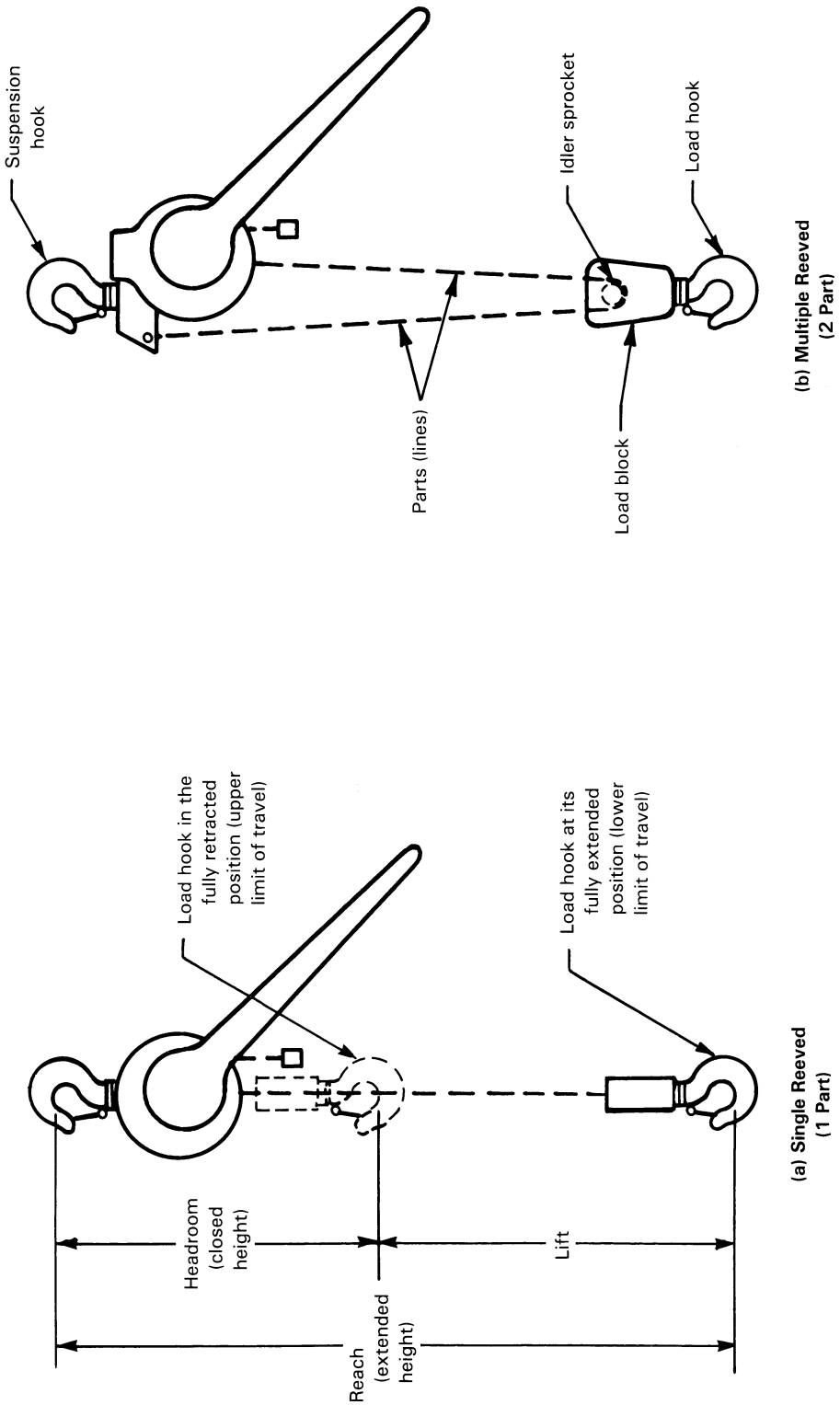



**Fig. 4 Manually Lever Operated Hoist — Chain Type**



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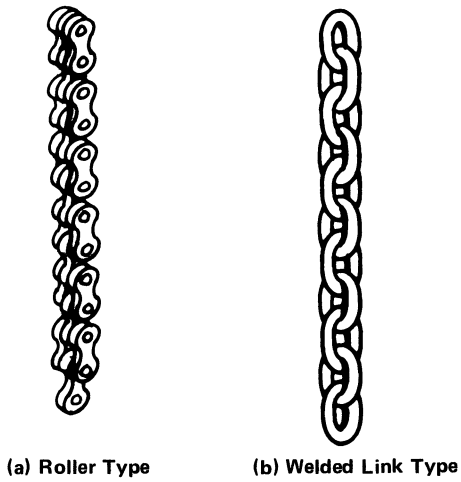



**Fig. 5 Load Chain**

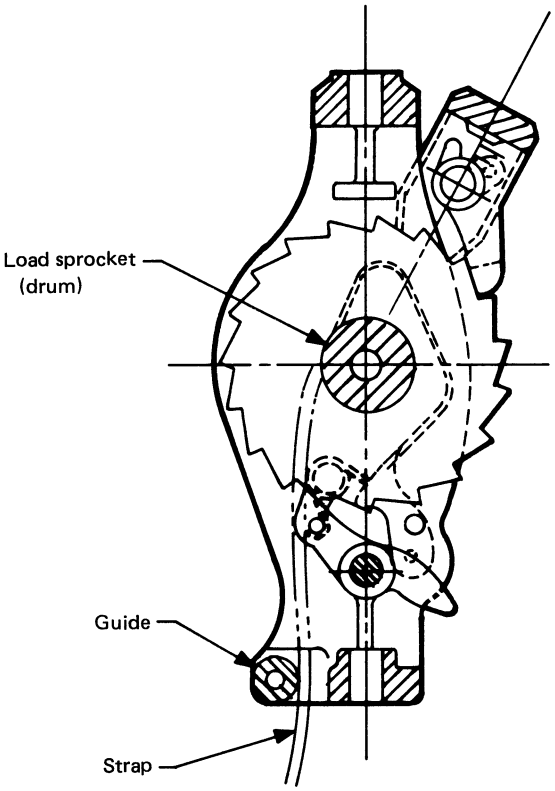



**Fig. 6 Guide and Load Sprocket-Strap**



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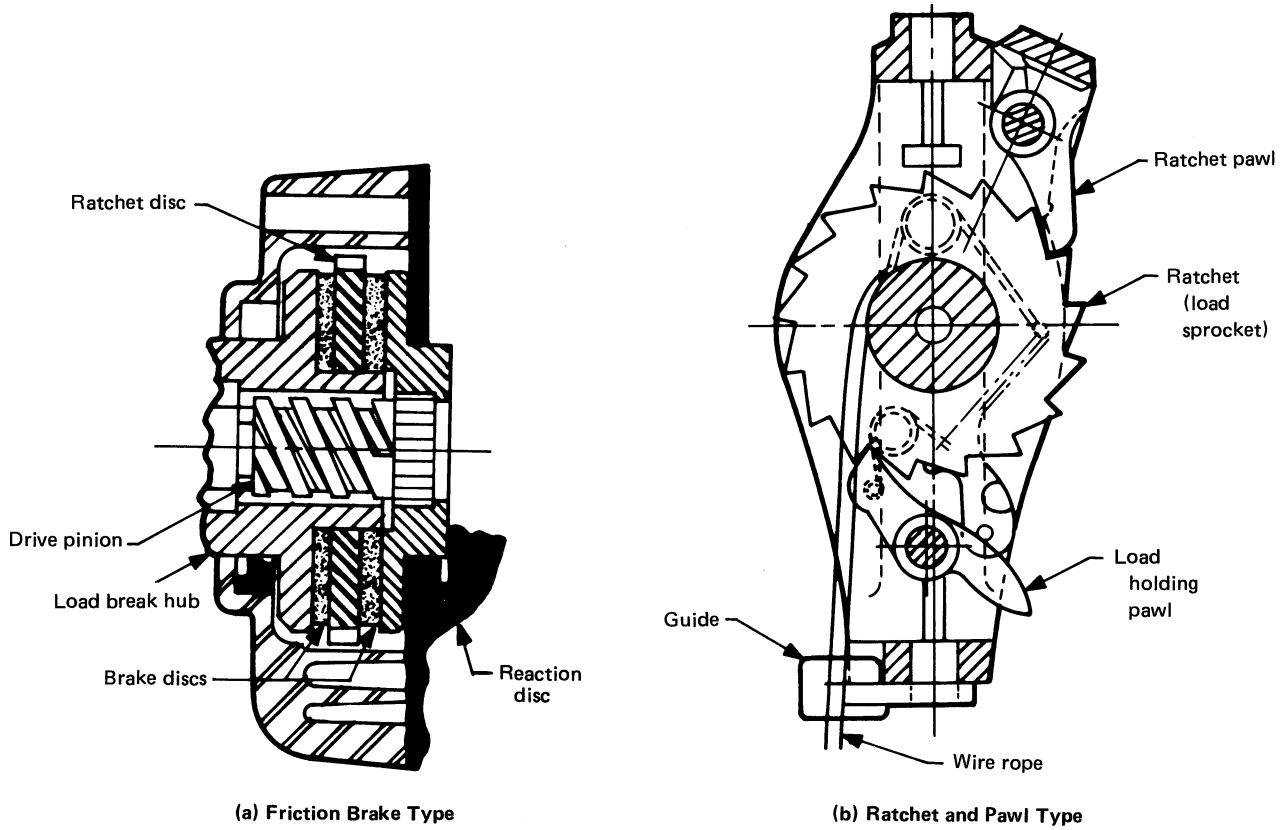



**Fig. 7 Load Controlling Mechanism**

*operating lever:* the lever or handle provided to operate the hoist.

*overload:* any load greater than the rated load.

*overtravel restraint:* a device used to prevent the slack load chain from inadvertently being lowered past the load sprocket (see Fig. 8).

*parts (lines):* number of lines of chain, wire rope, or web strap supporting the load block or hook (see Fig. 4).

*pawl:* a device for holding the machinery against undesired rotation by engaging a ratchet [see Fig. 7, sketch (b)].

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

*ratchet:* a toothed member for engagement with the pawl [see Fig. 7, sketch (b)].

*reeving:* a system in which the chain, wire rope, or web strap travels around sprockets (drums) and sheaves (see Fig. 4).

*rope:* refers to wire rope unless otherwise specified.

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

*service, normal:* distributed 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.

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

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

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

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



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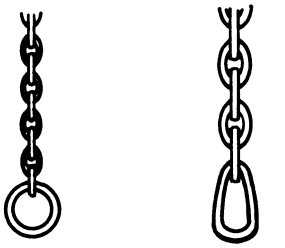



**Fig. 8 Overtravel Restraint**

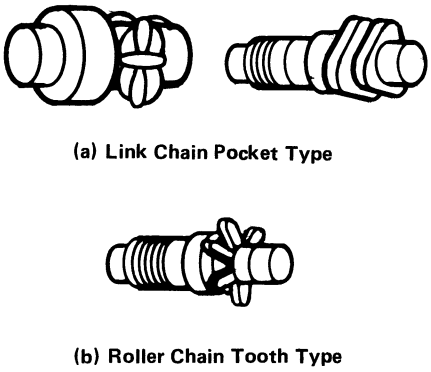



**Fig. 9 Load Sprockets**

*side pull:* any force or operating condition that restricts the load block, chain, wire rope, or web strap, and hoist body from forming a straight line with the direction of loading.

*sprocket, idler:* a freely rotating device that changes the direction of the load chain, wire rope, or web strap (see Fig. 4).

*sprocket, load:* a hoist component that transmits motion to the load chain, wire rope, or web strap. This component is sometimes called the load wheel, load sheave, pocket wheel, chain wheel, or drum (see Fig. 9).

*strap, web:* a fabric woven of high tenacity synthetic yarns (see Fig. 6).

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

*unattended:* a condition in which the operator of a hoist is not at the operating lever. If the hoist is within an unobstructed distance of 26 ft (8.0 m) and within sight of the operator, the hoist should be considered attended.

## SECTION 21-0.3: REFERENCES (05)

The following is a list of publications referenced in this Standard.[1]

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

ASME B30.10-1993, Hooks

ASME HST-3M-1991, Performance Standard for Manually Lever Operated Chain Hoists

Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016; Order Department: 22 Law Drive, Box 2300, Fairfield, NJ 07007

ANSI/NFPA 70-1993, National Electrical Code[1]

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

ANSI Z535.4-1991, Product Safety Signs and Labels[1]

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

[1] May also be obtained from the American National Standards Institute, 25 West 43rd Street, New York, NY 10036.



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(05)

# Chapter 21-1
# Chain Type

## SECTION 21-1.1: MARKING

### 21-1.1.1 Rated Load

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

### 21-1.1.2 Controls

Each control actuator of a manually lever operated hoist shall be marked to indicate the direction of resultant motion.

### 21-1.1.3 Identification

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

*(a)* name of manufacturer

*(b)* manufacturer's model or serial number

### 21-1.1.4 Warnings

Manually lever 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

*(a)* lifting more than the rated load

*(b)* operating the hoist when it is restricted from forming a straight line with the direction of loading

*(c)* operating the hoist with a twisted, kinked, or damaged chain

*(d)* operating a damaged or malfunctioning hoist

*(e)* lifting people

*(f)* lifting loads over people

*(g)* operating a hoist with lever extension

*(h)* removing or obscuring the warning label

## SECTION 21-1.2: CONSTRUCTION

### 21-1.2.1 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-bearing parts of lever operated hoists, except for roller load chain, shall be designed so that the static stress calculated for the rated load shall not exceed 25% of the average ultimate material strength. Roller load chain shall be designed so that the static stress calculated for the rated load shall not exceed 25% of the minimum ultimate tensile strength. Elements specifically intended to give visible warning of severe overload by permanent deformation while operating the hoist should be designed to show obvious deformation before failure of other load suspension parts.

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

*(d)* The hoist should be designed in accordance with applicable hoist design and performance standards. Refer to ASME HST-3M.

### 21-1.2.2 Load Sprockets

See Fig. 9.

*(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 hoist mechanism, under normal operating conditions.

### 21-1.2.3 Load Chain

See Fig. 5.

*(a)* Load chain may be either roller or welded-link type. Chain shall be pitched (calibrated) so as to pass over all 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 is specific to the equipment addressed in ASME B30.21. Other types of chain shall not be substituted for the welded link type load chain used in this equipment.

*(f)* Load chain properties do not conform to those shown in ASME B30.9 or ASME B29.1M.

### 21-1.2.4 Hooks

If hooks are of the swiveling type, they should rotate freely (see Fig. 10). Hooks shall be equipped with latches unless the use of the latch creates a hazardous condition. When required, a latch shall be provided to bridge the throat opening of the hook for the purpose of retaining slings, chains, etc. under slack conditions (see ASME B30.10).



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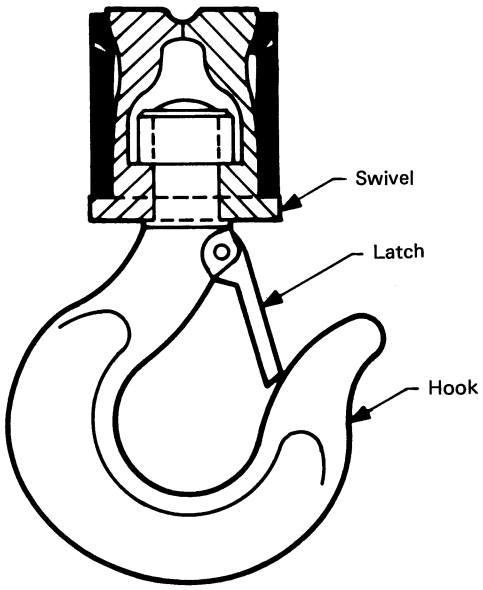



**Fig. 10 Swivel Type Hook**

### 21-1.2.5 Load Blocks

Means shall be provided to guard against load chain jamming in the load block under normal operating conditions.

### 21-1.2.6 Load Controlling Mechanism

The hoist shall be equipped with a load controlling mechanism, which shall perform the following functions under normal operating conditions with test loads up to 125% of rated load.

*(a)* Stop and hold the load when the lever force is removed and the lever stroke is completed.

*(b)* Provide for incremental movement of the load when lifting or lowering.

*(c)* Friction brake mechanism shall have provision for adjustment where necessary to compensate for wear.

### 21-1.2.7 Overtravel Restraint

See Fig. 8. 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 operating lever force of twice the force required to lift the rated load, or the hoist with rated load can withstand a lowering operating lever force equivalent to the force required to lift the rated load.

### 21-1.2.8 Convertible Load Rating

On hoists with a convertible load rating feature, the rated load is converted by changing the number of parts (lines) of load chain supporting the load (see Fig. 4). This conversion shall be accomplished as recommended by the manufacturer without the use of additional components that are not furnished with the hoist.

### 21-1.2.9 Lubrication

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

### 21-1.2.10 Manual

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

*(a)* operation

*(b)* inspection and testing

*(c)* lubrication, maintenance, and repair

## SECTION 21-1.3: INSPECTION

### 21-1.3.1 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) Inspection Procedures.* Inspection procedures for hoists in regular service are divided into two 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 two general classifications are herein designated as frequent and periodic, with respective intervals between inspections as defined below.

*(1) Frequent Inspection.* Visual examinations by the operator or other designated person with records not required.

*(a)* normal service — monthly

*(b)* heavy service — weekly to monthly

*(c)* severe service — daily to weekly

*(d)* special or infrequent service — as recommended by a qualified person before and after each occurrence

*(2) 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 metal stamp mark shall not be made in a highly stressed area.)

*(a)* normal service — yearly.

*(b)* heavy service — semiannually. If external conditions indicate, disassembly should be done to permit detailed inspection.

*(c)* severe service — quarterly. If external conditions indicate, disassembly should be done to permit detailed inspection.



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*(d)* special or infrequent service — as recommended by a qualified person before the first such occurrence and as directed by the qualified person for any subsequent occurrences.

### 21-1.3.2 Frequent Inspection

See also Table 1.

*(a)* Frequent inspections shall be performed at intervals defined in para. 21-1.3.1(b)(1) and shall include observations during operation.

*(b)* A designated 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 for unusual sounds such as, but not limited to, binding noise of the chain, bearing squeal

*(2)* hooks in accordance with ASME B30.10, frequent inspection

*(3)* hook latches, if used, for proper operation

*(4)* load chain in accordance with para. 21-1.6.1(c) or 21-1.7.1(c)

*(5)* load chain reeving for compliance with the recommendations of the hoist manufacturer or a qualified person

*(6)* hoist lever for bends, cracks, or other damage

*(7)* damage to the support for the hoist

### 21-1.3.3 Periodic Inspection

See also Table 1.

*(a)* Periodic inspections shall be performed at intervals defined in para. 21-1.3.1(b)(2). These inspections may be performed with the hoist at its location, and do not require the hoist to be disassembled.

*(b)* Covers and other items normally supplied to allow inspection of components should be opened or removed for the inspection and then closed or replaced before restoring the hoist to normal operation unless further maintenance is required.

*(c)* A designated 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. 21-1.3.2

*(2)* fasteners for evidence of loosening

*(3)* load blocks, suspension housings, levers, 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 or idler sprockets for evidence of damage and wear

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

*(7)* supporting structure or trolley, if used, for evidence of damage

*(8)* labels, required by para. 21-1.1.4, for legibility and replacement

*(9)* end connections of load chains for evidence of wear, corrosion, cracks, damage, and distortion including overtravel restraints

*(10)* the hoist and hoist mounting for evidence of missing items

### 21-1.3.4 Hoists Not in Regular Service

*(a)* A hoist that has been idle for a period of one month or more, but less than one year, shall be given an inspection conforming with the requirements of para. 21-1.2.2 before it is placed in service.

*(b)* A hoist that has been idle for a period of one year shall be given an inspection conforming with the requirements of para. 21-1.2.3 before it is placed in service.

## SECTION 21-1.4: TESTING

### 21-1.4.1 Operational Tests

All new hoists shall be tested by the hoist manufacturer. All altered or repaired hoists, or hoists that have not been used within the preceding 12 months, shall be tested before being placed in service by, or under the direction of, a designated person to ensure compliance with this volume, including the following:

*(a)* All functions of the hoist shall be checked with the hoist suspended in the unloaded state. (Some hoists may require a nominal load or pull on the load hook to test the lowering motion.)

*(b)* After testing in the unloaded state, a load of at least 100 lb (46 kg) times the number of load-supporting parts of chain shall be applied to the hoist in order to check proper load control.

### 21-1.4.2 Load Test

*(a)* New hoists shall be tested by the manufacturer with a test load of at least 125% of the rated load.

*(b)* A hoist in which load-suspension parts have been altered, replaced, or repaired should be statically or dynamically load tested.

*(1)* A qualified person shall determine the need to load test the hoist.

*(2)* A written report of the test should be prepared and placed on file.

*(3)* 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.



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## Table 1 Minimum Inspection for Lever Operated Hoists — Chain (05)

| Item | Normal Service | | Heavy Service | | Severe Service | |
|---|---|---|---|---|---|---|
| | Visual Monthly [Note (1)] | Record Yearly [Note (2)] | Visual Weekly to Monthly [Note (1)] | Record Semiannually [Note (3)] | Visual Daily to Weekly [Note (1)] | Record Quarterly [Note (3)] |
| **Frequent Inspection** (see para. 21-1.3.2) | | | | | | |
| All functional mechanisms for maladjustment and unusual sounds | 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. 21-1.6.1(c) and 21-1.7.1(c) | x | ... | x | ... | x | ... |
| Load chain reeving for compliance with the recommendations of the hoist manufacturer | x | ... | x | ... | x | ... |
| Lever for bends, cracks, etc. | x | ... | x | ... | x | ... |
| Hoist support for damage | x | ... | x | ... | x | ... |
| **Periodic Inspection** (see para. 21-1.3.3) | | | | | | |
| Requirements of frequent inspection | ... | 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, levers, 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 |



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**Table 1 Minimum Inspection for Lever Operated Hoists — Chain (Cont'd)**

| Item | Normal Service | | Heavy Service | | Severe Service | |
|---|---|---|---|---|---|---|
| | Visual Monthly [Note (1)] | Record Yearly [Note (2)] | Visual Weekly to Monthly [Note (3)] | Record Semiannually [Note (3)] | Visual Daily to Weekly [Note (1)] | Record Quarterly [Note (3)] |
| Evidence of damage or excessive wear of load sprockets or idler sprockets | . . . | 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 |
| Label or labels required by para. 21-1.1.4 | . . . | x | . . . | x | . . . | x |
| End connections of load chain, including overtravel restraints | . . . | x | . . . | x | . . . | x |

NOTES:
(1) By operators or other designated personnel 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 indicate that disassembly should be done to permit detailed inspection.

*(4)* 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. 21-1.4.1(b) prior to placing the hoist back in service.

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

## SECTION 21-1.5: MAINTENANCE

### 21-1.5.1 Preventive Maintenance

*(a)* A preventive maintenance program should be established and should be:

*(1)* based on the recommendations outlined in the hoist manufacturer's manual

*(2)* reviewed by a qualified person for the application of the hoist, when required

*(b)* Replacement parts shall be at least equal to the original manufacturer's specifications.

### 21-1.5.2 Adjustments, Repairs, and Replacements

*(a)* Conditions disclosed by the inspections performed in accordance with the requirements of Section 21-1.2 that are determined to be a hazard during continued operation shall be corrected by adjustment, repair, or replacement before continuing the use of the hoist.

*(b)* Adjustments, repairs, and replacements shall be performed by a designated person.

*(c)* Components shall be adjusted or repaired as needed. The following are examples:

*(1)* operating mechanisms

*(2)* brakes and pawls

*(d)* Repairs or replacements shall be made as needed. The following are examples:

*(1)* excessively worn braking components such as friction disks, ratchets, pawls, and pawl springs

*(2)* critical parts, including load suspension components, that are cracked, broken, bent, or excessively worn

*(3)* bent, cracked, or otherwise damaged levers

*(4)* worn, corroded, or otherwise damaged load chain in accordance with paras. 21-1.5.1 and 21-1.6.1

*(5)* replace hooks showing conditions described in ASME B30.10. Repairs by welding or reshaping are not permitted

*(6)* missing or illegible warning labels

*(7)* items that are determined to be missing

### 21-1.5.3 Lubrication

All moving parts of the hoist for which lubrication is specified should be regularly lubricated. Care should be taken to follow manufacturer's recommendations outlined in the hoist manufacturer's manual as to points and frequency of lubrication, and quantity and types of lubricant to be used.



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## SECTION 21-1.6: WELDED LINK CHAIN INSPECTION, REPLACEMENT, AND MAINTENANCE

### 21-1.6.1 Welded Link Chain Inspection

*(a)* 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.

*(b)* If the chain binds, jumps, or is noisy, first see that it is clean and properly lubricated. If the trouble persists, inspect the chain and mating parts for wear, distortion, or other damage.

*(c)* Examine visually 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 according to the hoist manufacturer's instructions. If instructions are not available, proceed as follows.

*(1)* Select an unworn, unstretched length of the chain (e.g., at the slack end).

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

*(3)* Measure the same number of links in the used sections and calculate the percentage increase in length.

### 21-1.6.2 Welded Link Chain Replacement

*(a)* If the used chain exceeds the hoist manufacturer's recommended length (or in the absence of such recommendation, if the used chain is $2\frac{1}{2}\%$ longer than the unused chain), replace the chain. Repairing of load chain by welding or any other means shall not be attempted by anyone other than the chain manufacturer.

*(b)* The existence of gouges, nicks, corrosion, weld spatter, or distorted links is sufficient reason for questioning chain safety and considering chain replacement. Safety in this respect depends largely upon the use of good judgment by an appointed or designated person in evaluating the degree of deficiency.

*(c)* Replacement chain shall be the same size, grade, and construction as the original chain furnished by the hoist manufacturer, unless otherwise recommended by the hoist manufacturer due to actual working conditions.

*(d)* Load chain links that pass over the hoist load sprocket on edge (as opposed to those that lie flat in the pockets) shall be installed with the welds away from the center of the sprocket. This precaution is not required on idler sprockets that change the direction but not the tension in the chain.

*(e)* The chain shall be installed without any twist between the hoist and an anchored end on either the load side or slack side.

*(f)* When chain is replaced, inspect the mating parts (sprockets, guides, stripper) for wear and replace, if necessary.

*(g)* Load chain, discarded or new, shall not be used for slings.

### 21-1.6.3 Welded Link Chain Maintenance

*(a)* Load chain should be kept clean and free from any coating or deposit that will build up and change the dimensions of the load chain or reduce flexibility. The cleaning process shall not damage the chain, and any solution used in the cleaning process shall be acid-free.

*(b)* Load chain should be lubricated as specified by the hoist manufacturer or by a qualified person.

## SECTION 21-1.7: ROLLER CHAIN INSPECTION, REPLACEMENT, AND MAINTENANCE

### 21-1.7.1 Roller Chain Inspection

*(a)* 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.

*(b)* If the chain binds, jumps, or is noisy, first see that it is clean and properly lubricated. If the trouble persists, inspect the chain in accordance with paras. 21-1.7.1(c) and 21-1.7.1(d) and inspect mating parts for wear distortion or other damage.

*(c)* Examine visually for gouges, nicks, weld splatter, corrosion, and distortion.

*(d)* Roller chain should first be inspected while it is in the hoist. With the hoist suspended in normal position, apply a light load of approximately 100 lb (46 kg).

*(1)* Check chain for elongation following the hoist manufacturer's instruction. In absence of specific instructions, the chain can be checked by determining the normal pitch and measuring a 12 in. (305 mm) section of chain that normally travels over the load sprocket. Using a caliper-type gage, check the dimension from the edge of one chain pin to the corresponding edge of another pin 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).

*(2)* Check chain for twist. The chain shall be replaced if the twist in any 5 ft (1.52 m) section exceeds 15 deg.

*(3)* Check for straightness in plane perpendicular to plane of rollers. A chain that has a bow exceeding $\frac{1}{4}$ in. (6.3 mm) in any 5 ft (1.52 m) section shall be replaced.

*(e)* Additional inspection of the chain should be made by removing chain from hoist and cleaning it thoroughly



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in an acid-free solvent. A check should then be made for any of the following deficiencies:

*(1)* pins turned from their original position

*(2)* rollers that do not run freely with light finger pressure

*(3)* joints that cannot be flexed by easy hand pressure

*(4)* 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)

*(5)* corrosion, pitting, or discoloration of chain (generally indicative of serious impairment)

*(6)* gouges, nicks, or weld spatter

### 21-1.7.2 Roller Chain Replacement

*(a)* Roller chain shall be replaced if any of the conditions exist as stated in paras. 21-1.6.1(c) and 21-1.6.1(d).

*(b)* Repairing of roller chain by welding or heating shall not be attempted.

*(c)* The existence of any of the conditions stated in para. 21-1.7.1(d) is reason to question chain safety and for a designated person to give consideration for replacement. Roller chains are subject to hidden wear and deterioration that must be considered.

*(d)* Replacement chain shall be the same size, grade, and construction as the original chain furnished by the hoist manufacturer unless otherwise recommended by the hoist manufacturer due to actual working conditions.

*(e)* When chain is replaced, disassemble and inspect the mating parts (sprockets, guides, stripper) for wear and replace, if necessary.

*(f)* When chain is replaced, it should be reeved in the recommended manner and should operate freely over all load and idler sprockets. All connecting links and chain end fastenings should be inspected and properly secured. Hoist manufacturer's recommendations should be followed on the selection and installation of connecting links.

*(g)* Roller chains, discarded or new, shall not be used for slings.

### 21-1.7.3 Roller Chain Maintenance

*(a)* Roller chains should be kept clean and free from rust. Excessively dirty chains should be soaked in a clean acid-free solvent. Chains should be agitated to ensure that all joints are free from grit and foreign matter.

*(b)* Roller chains should be lubricated as outlined in the hoist manufacturer's manual. In absence of specific lubrication instructions, the chains should be lubricated with a good grade of new automotive motor oil, SAE grades 20 or 30. Never apply grease to the chain.

## SECTION 21-1.8: OPERATION

### 21-1.8.1 Hoisting Practices for Operators

Safe operation of a lever hoist involves more than pulling on the lever. Refer to the B30 Introduction, which emphasizes that the use of hoists is subject to certain hazards that cannot be met by mechanical means, but only by the exercise of intelligence, care, common sense, and experience in anticipating the motions that will occur as a result of operating the controls.

### 21-1.8.2 Before Operating Hoist

*(a)* The supporting structure or anchoring means shall have a load rating at least equal to that of the hoist.

*(b)* The operator shall be familiar with all operating controls of the hoist, and shall be instructed as to warnings on the hoist, the hoisting practices listed in this section, and the operator's manual provided by the hoist manufacturer.

*(c)* If adjustments or repairs are necessary, or any defects are known, the operator shall report this promptly to the appointed person.

*(d)* Hoists shall be used only in locations that will allow the operator to be free of the load.

*(e)* The operator shall have firm footing or otherwise be secured before operating the hoist.

*(f)* The operator shall have access to the operating lever.

*(g)* The operator shall not operate a hoist that bears an out-of-order sign.

*(h)* The operator shall not adjust or repair a hoist unless qualified to perform maintenance on the hoist.

*(i)* The chain shall not be used as a ground for welding.

*(j)* A welding electrode shall not be touched to the chain or any other part of the hoist.

*(k)* Hoists shall not be operated by other than hand power of one operator.

*(l)* Hoists shall not be operated with an extension on the lever.

### 21-1.8.3 Handling the Load

*(a)* The hoist chain shall not be wrapped around the load.

*(b)* The load shall be attached to the load hook by suitable means.

*(c)* The sling or other device shall be properly seated in the base (bowl) of the hook. Hook latch shall not be allowed to support any part of the load.

*(d)* The load shall not be applied to the point of the hook.

*(e)* Before applying the load, the operator shall be sure the load chain is not kinked or twisted or that multiple parts of the chain are not twisted about each other.

*(f)* The hoist shall not be operated unless chain is seated properly on the sprockets.



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*(g)* The operator shall not apply a load beyond the rated load appearing on the hoist or load block, except during properly authorized tests.

*(h)* Hoists shall not be operated until the load block, chain, and hoist body are directly in line with the direction of loading to avoid side pull.

*(i)* The hoist body or frame shall not bear against any object or the supporting structure.

*(j)* Specific attention should be given to balancing of the load and hitching or slinging to prevent slipping of the load.

*(k)* The operator shall not release the hoist lever until the ratchet and pawl is engaged and the lever is at rest.

*(l)* The operator shall not engage in any activity that will divert the operator's attention while operating the hoist.

*(m)* The operator shall not apply a load to the hoist until the operator and all other personnel are clear of the load.

*(n)* The operator shall make sure a load clears any obstacles before moving.

*(o)* A load shall not be moved more than a few inches until it is well balanced in the sling or lifting device.

*(p)* When starting to lift or pull, the operator should move the load a few inches and then check the hoist for proper load holding action. The operation shall be continued only after the operator has verified that the hoist is operating properly.

*(q)* The hoist shall not be used to lift, support, or otherwise transport people.

*(r)* The operator should avoid carrying loads over people.

*(s)* The operator should not leave a loaded hoist unattended unless specific precautions have been instituted and are in place.

### 21-1.8.4 Performance

This volume includes safety considerations relative to operation of lever operated chain hoists. See ASME HST-3M for operational performance characteristics.



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(05)

# Chapter 21-2
# Wire Rope Type

## SECTION 21-2.1: MARKING

### 21-2.1.1 Rated Load

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

### 21-2.1.2 Controls

Each control actuator of a manually lever operated hoist shall be marked to indicate the direction of resultant motion.

### 21-2.1.3 Identification

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

*(a)* name of manufacturer

*(b)* manufacturer's model or serial number

### 21-2.1.4 Warnings

Manually lever 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

*(a)* lifting more than the rated load

*(b)* operating a hoist when it is restricted from forming a straight line with the direction of loading

*(c)* operating a hoist with a twisted, kinked, or damaged wire rope

*(d)* operating a damaged or malfunctioning hoist

*(e)* lifting people

*(f)* lifting loads over people

*(g)* operating a hoist with lever extension

*(h)* removing or obscuring warning labels

## SECTION 21-2.2: CONSTRUCTION

### 21-2.2.1 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 bearing parts of lever operated hoists shall be designed so that the static stress, calculated for the rated load, shall not exceed 25% of the average ultimate material strength. Elements specifically intended to give visible warning of severe overload by permanent deformation while operating the hoist should be designed to show obvious deformation before failure of other load suspension parts.

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

### 21-2.2.2 Load Sprockets (Drums)

See Fig. 7, sketch (b)

*(a)* Load sprockets should be guarded.

*(b)* Provision should be made to guard against jamming of the wire rope within the hoist mechanism under normal operating conditions.

### 21-2.2.3 Wire Rope

*(a)* Wire rope shall be of a construction specified by the hoist manufacturer or by a qualified person.

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

*(c)* Socketing shall be done in the manner specified by the manufacturer of the assembly or the rope manufacturer.

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

*(e)* Swaged or compressed fittings shall be applied as recommended by the rope, hoist, or fitting manufacturer.

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

*(g)* The rope ends should be attached to the hoist in a manner so as to prevent disengagement throughout rated hook travel. No less than two wraps of rope shall remain on the anchorage of the hoist load sprocket (drum) when the hook is in its fully extended position.

### 21-2.2.4 Hooks

See Fig. 4. If hooks are of the swiveling type, they should rotate freely. Hooks shall be equipped with latches unless the use of the latch creates a hazardous condition. When required, a latch shall be provided to bridge the throat opening of the hook for the purpose of retaining slings, chains, etc., under slack conditions. Refer to ASME B30.10.

### 21-2.2.5 Load Blocks

Means shall be provided to guard against wire rope jamming in the load block under normal operating conditions.



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### 21-2.2.6 Load Controlling Mechanism

The hoist shall be equipped with a load controlling mechanism, which shall perform the following functions under normal operating conditions with test loads up to 125% of rated load.

*(a)* Stop and hold the load when the lever force is removed and the lever stroke is completed.

*(b)* Provide for incremental movement of the load when lifting or lowering.

*(c)* Friction brake mechanism shall have provision for adjustment where necessary to compensate for wear.

### 21-2.2.7 Convertible Load Rating

On hoists with a convertible load rating feature, the rated load is converted by changing the number of parts (lines) of wire rope supporting the load. This conversion shall be accomplished as recommended by the manufacturer without the use of additional components that are not furnished with the hoist.

### 21-2.2.8 Lubrication

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

### 21-2.2.9 Manual

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

*(a)* operation

*(b)* inspection and testing

*(c)* lubrication, maintenance, and repair

## SECTION 21-2.3: INSPECTION

### 21-2.3.1 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) Inspection Procedures.* Inspection procedures for hoists in regular service are divided into two 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 two general classifications are herein designated as frequent and periodic, with respective intervals between inspections as defined below.

*(1) Frequent Inspection.* Visual examinations by the operator or other designated person with records not required.

*(a)* normal service — monthly

*(b)* heavy service — weekly to monthly

*(c)* severe service — daily to weekly

*(d)* special or infrequent service — as recommended by a qualified person before and after each occurrence

*(2) 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 metal stamp mark shall not be made in a highly stressed area.)

*(a)* normal service — yearly.

*(b)* heavy service — semiannually. If external conditions indicate, disassembly should be done to permit detailed inspection.

*(c)* severe service — quarterly. If external conditions indicate, disassembly should be done to permit detailed inspection.

*(d)* special or infrequent service — as recommended by a qualified person before the first such occurrence and as directed by the qualified person for any subsequent occurrences.

### 21-2.3.2 Frequent Inspection

See also Table 2.

*(a)* Frequent inspections shall be performed at intervals defined in para. 21-2.3.1(b)(1) and shall include observations during operation.

*(b)* A designated 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 mechanism for proper operation, proper adjustment, and for unusual sounds such as, but not limited to, binding noise of the wire rope, bearing squeal

*(2)* hooks in accordance with ASME B30.10, frequent inspection

*(3)* hook latches, if used, for proper operation

*(4)* wire rope in accordance with para. 21-2.5.1(a)

*(5)* wire rope reeving for compliance with hoist manufacturer's recommendations

*(6)* hoist lever for bends, cracks, or other damage

*(7)* damage to the support for the hoist

### 21-2.3.3 Periodic Inspection

See also Table 2.

*(a)* Periodic inspections shall be performed at intervals defined in para. 21-2.3.1(b)(2). These inspections may be performed with the hoist at its location, and do not require the hoist to be disassembled.

*(b)* Covers and other items normally supplied to allow inspection of components should be opened or removed for the inspection and then closed or replaced before restoring the hoist to normal operation unless further maintenance is required.



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## Table 2 Minimum Inspection for Lever Operated Hoists — Wire Rope

| Item | Normal Service | | Heavy Service | | Severe Service | |
|---|---|---|---|---|---|---|
| | Visual Monthly [Note (1)] | Record Yearly [Note (2)] | Visual Weekly to Monthly [Note (1)] | Record Semiannually [Note (3)] | Visual Daily to Weekly [Note (1)] | Record Quarterly [Note (3)] |
| **Frequent Inspection** (see para. 21-2.3.2) | | | | | | |
| All functional mechanisms for maladjustment and unusual sounds | x | ... | x | ... | x | ... |
| Hooks in accordance with ASME B30.10 | x | ... | x | ... | x | ... |
| Hook latch operation, if used | x | ... | x | ... | x | ... |
| Wire rope in accordance with para. 21-2.6.1 | x | ... | x | ... | x | ... |
| Wire rope reeving for compliance with the recommendations of the hoist manufacturer | x | ... | x | ... | x | ... |
| Lever for bends, cracks, etc. | x | ... | x | ... | x | ... |
| Hoist support for damage | x | ... | x | ... | x | ... |
| **Periodic Inspection** (see para. 21-2.3.3) | | | | | | |
| Requirements of frequent inspection | ... | 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, levers, wire rope 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 |



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**Table 2 Minimum Inspection for Lever Operated Hoists — Wire Rope (Cont'd)** (05)

| Item | Normal Service | | Heavy Service | | Severe Service | |
|---|---|---|---|---|---|---|
| | Visual Monthly [Note (1)] | Record Yearly [Note (2)] | Visual Weekly to Monthly [Note (3)] | Record Semiannually [Note (3)] | Visual Daily to Weekly [Note (1)] | Record Quarterly [Note (3)] |
| Evidence of damage or excessive wear of load sprockets | ... | x | .. | x | ... | x |
| Evidence of worn pawls, cams, or ratchets; corroded, stretched, or broken pawl springs in brake mechanism | ... | x | ... | x | ... | x |
| Label or labels required by para. 21-2.1.4 | ... | x | ... | x | ... | x |
| End connections of wire rope | ... | x | ... | x | ... | x |

NOTES:
(1) By operators or other designated personnel 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 indicate that disassembly should be done to permit detailed inspection.

*(c)* A designated 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. 21-2.3.2

*(2)* fasteners for evidence of loosening

*(3)* load blocks, suspension housings, levers, 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)* drums and sheaves for evidence of damage and wear

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

*(7)* supporting structure or trolley, if used, for evidence of damage

*(8)* label or labels, required by para. 21-2.1.1(d) for legibility and replacement

*(9)* end connections of wire rope for evidence of deterioration

*(10)* hoist rope shall be inspected in accordance with para. 21-2.6.1(b)

*(11)* the hoist and hoist mounting for evidence of missing items

### 21-2.3.4 Hoists Not in Regular Service

*(a)* A hoist that has been idle for a period of one month or more, but less than one year, shall be given an inspection conforming with the requirements of para. 21-2.2.2 before it is placed in service.

*(b)* A hoist that has been idle for a period of one year shall be given an inspection conforming with the requirements of para. 21-2.3.3 before it is placed in service.

## SECTION 21-2.4: TESTING

### 21-2.4.1 Operational Tests

All new hoists shall be tested by the hoist manufacturer. All altered or repaired hoists, or hoists that have not been used within the preceding 12 months, shall be tested before being placed in service by, or under the direction of, a designated person to ensure compliance with this volume, including the following:

*(a)* All functions of the hoist shall be checked with the hoist suspended in the unloaded state.

*(b)* After testing in the unloaded state, a load of at least 100 lb (46 kg) times the number of load supporting parts of wire rope shall be applied to the hoist in order to check proper load control.

### 21-2.4.2 Load Test

*(a)* New hoists shall be tested by the manufacturer with a test load of at least 125% of the rated load.

*(b)* A hoist in which load-suspension parts have been altered, replaced, or repaired should be statically or dynamically load tested.

*(1)* A qualified person shall determine the need to load test the hoist.

*(2)* A written report of the test should be prepared and placed on file.



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*(3)* 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.

*(4)* The replacement of wire rope is specifically excluded from this load test; however, an operational test of the hoist should be made in accordance with para. 21-2.4.1 prior to placing the hoist back in service.

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

## SECTION 21-2.5: MAINTENANCE

### 21-2.5.1 Preventive Maintenance

*(a)* A preventive maintenance program should be established and should be

*(1)* based on the recommendations outlined in the hoist manufacturer's manual.

*(2)* reviewed by a qualified person for the application of the hoist, when required.

*(b)* Replacement parts shall be at least equal to the original manufacturer's specifications.

### 21-2.5.2 Adjustments, Repairs, and Replacements

*(a)* Conditions disclosed by the inspections performed in accordance with the requirements of Section 21-2.2 that are determined to be a hazard during continued operation shall be corrected by adjustment, repair, or replacement before continuing the use of the hoist.

*(b)* Adjustments, repairs, and replacements shall be performed by a designated person.

*(c)* Components shall be adjusted or repaired as needed. The following are examples:

*(1)* operating mechanisms

*(2)* brakes and pawls

*(d)* Repairs or replacements shall be made as needed. The following are examples:

*(1)* excessively worn braking components such as friction disks, ratchets, pawls, and pawl springs

*(2)* critical parts, including load suspension components, that are cracked, broken, bent, or excessively worn

*(3)* bent, cracked, or otherwise damaged levers

*(4)* worn, corroded, or otherwise damaged wire rope in accordance with para. 21-2.5.2

*(5)* replace hooks showing conditions described in ASME B30.10. Repairs by welding or reshaping are not permitted

*(6)* missing or illegible warning labels

*(7)* items that are determined to be missing

### 21-2.5.3 Lubrication

All moving parts of the hoist for which lubrication is specified should be regularly lubricated. Care should be taken to follow manufacturer's recommendations outlined in the hoist manufacturer's manual as to points and frequency of lubrication, and quantity and types of lubricant to be used.

## SECTION 21-2.6: WIRE ROPE INSPECTION, REPLACEMENT, AND MAINTENANCE

### 21-2.6.1 Wire Rope Inspection

*(a) Frequent Inspection*

*(1)* Ropes should be visually inspected by the operator or other designated person at the start of each shift. These visual observations should be concerned with discovering gross damage that 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, distributions, and type of visible broken wires [see paras. 21-2.6.2(b)(1) and (2) for further guidance]

*(2)* When such damage is discovered, the rope shall either be removed from service or given an inspection as detailed in para. 21-2.6.1(b).

*(b) Periodic Inspection*

*(1)* The inspection frequency shall be determined by a qualified person and shall be based on such factors as expected rope life as determined by experience on the particular installation or similar installations; severity of environment; percentage of rated load lifts; frequency rates of operation; and exposure to shock loads.

Inspections need not be at equal calendar intervals and should be more frequent as the rope approaches the end of its useful life.

*(2)* Periodic inspections shall be performed by a designated person. This inspection shall cover the entire length of rope. The individual outer wires in the strands of the rope shall be visible to this person.

### 21-2.6.2 Rope Replacement

*(a)* No precise rules can be given for determination of the exact time for rope replacement, since many variable factors are involved. Once a rope reaches any one of the specified removal criteria, it may be allowed to operate to the end of the work shift, based on the judgment of a qualified person. The rope shall be replaced after that work shift, at the end of the day, or at the latest time prior to the equipment being used by the next work shift.

*(b)* Removal criteria for rope replacement shall be as follows:

*(1)* in running ropes, 12 randomly distributed broken wires in one lay or four broken wires in one strand in one lay

*(2)* one outer wire broken at the contact point with the core of the rope that has worked its way out of the



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rope structure and protrudes or loops out from the rope structure

*(3)* wear of one-third the original diameter of outside individual wires

*(4)* kinking, crushing, birdcaging, or any other damage resulting in distortion of the rope structure. Any deterioration resulting in appreciable loss of original strength, such as described below, shall be noted, and determination shall be made as to whether further use of the rope would constitute a hazard:

*(a)* points listed in para. 21-2.5.1(a)

*(b)* reduction of rope diameter below nominal diameter due to loss of core support, internal or external corrosion, or wear of outside wires

*(c)* severely corroded or broken wires at end connections

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

*(5)* special care should be taken when inspecting sections of rapid deterioration such as the following:

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

*(b)* sections of the rope at or near terminal ends where corroded or broken wires may protrude

*(c)* sections subject to reverse bends

*(d)* sections of rope that are normally hidden during visual inspection, such as parts passing over sheaves

*(6)* evidence of heat damage for any cause

*(7)* reductions from nominal diameter greater than those shown below:

| Rope Diameter | Maximum Allowable Reduction From Nominal Diameter |
|---|---|
| Up to $\frac{5}{16}$ in. (8 mm) | $\frac{1}{64}$ in. (0.4 mm) |
| Over $\frac{5}{16}$ in. to $\frac{1}{2}$ in. (13 mm) | $\frac{1}{32}$ in. (0.8 mm) |

*(c)* Broken wire removal criteria cited in this volume apply to wire rope operating on steel sheaves and drums. The user shall contact the sheave and drum or hoist manufacturer, or a qualified person, for broken wire removal criteria for wire ropes operating on sheaves and drums made of material other than steel.

*(d)* Attention shall be given to end connections. Upon development of two broken wires adjacent to a socketed end connection, the rope should be resocketed or replaced. Resocketing shall not be attempted if the resulting rope length will be insufficient for proper operation.

*(e)* Replacement rope and connections shall have a strength rating at least as great as the original rope and connections furnished by the hoist manufacturer. Any deviation from the original size, grade, or construction shall be specified by a rope manufacturer, the hoist manufacturer, or a qualified person.

### 21-2.6.3 Wire Rope Maintenance

*(a)* Rope should be stored to prevent damage or deterioration.

*(b)* Rope shall be unreeled or uncoiled in accordance with the manufacturer's recommendations to avoid kinking of or inducing a twist in the rope.

*(c)* Before cutting rope, means shall be used to prevent unlaying of the strands.

*(d)* During installation, care should be taken to avoid dragging the rope in dirt or around objects that will scrape, nick, crush, or induce sharp bends.

*(e)* Rope should be maintained in a well-lubricated condition. Lubricant applied as part of a maintenance program shall be compatible with the original lubricant. Lubricant applied shall be of the type that does not hinder visual inspection. Those sections of rope that are located over sheaves or otherwise hidden during inspection and maintenance procedures require special attention when lubricating rope. The object of rope lubrication is to reduce internal friction and to prevent corrosion.

## SECTION 21-2.7: OPERATION

### 21-2.7.1 Hoisting Practices for Operators

Safe operation of a lever hoist involves more than pulling the lever. Refer to the B30 Introduction, which emphasizes that the use of hoists is subject to certain hazards that cannot be met by mechanical means, but only by the exercise of intelligence, care, common sense, and experience in anticipating the motions that will occur as a result of operating the controls.

### 21-2.7.2 Before Operating Hoist

*(a)* The supporting structure or anchoring means shall have a load rating at least equal to that of the hoist.

*(b)* The operator shall be familiar with all operating controls of the hoist, and shall be instructed as to warnings on the hoist, the hoisting practices listed in this Section, and the operator's manual provided by the hoist manufacturer.

*(c)* If adjustments or repairs are necessary, or any defects are known, the operator shall report this promptly to the appointed person.

*(d)* Hoists shall be used only in locations that will allow the operator to be free of the load.

*(e)* The operator shall have firm footing or otherwise be secured before operating the hoist.

*(f)* The operator shall have access to the operating lever.

*(g)* The operator shall not operate a hoist that bears an out-of-order sign.

*(h)* The operator shall not adjust or repair a hoist unless qualified to perform maintenance on the hoist.



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*(i)* The wire rope shall not be used as a ground for welding.

*(j)* A welding electrode shall not be touched to the wire rope or any other part of the hoist.

*(k)* Hoists shall not be operated by other than hand power of one operator.

*(l)* Hoists shall not be operated with an extension on the lever.

### 21-2.7.3 Handling the Load

*(a)* The hoist wire rope shall not be wrapped around the load.

*(b)* The load shall be attached to the load hook by suitable means.

*(c)* The sling or other device shall be properly seated in the base (bowl) of the hook. Hook latch shall not be allowed to support any part of the load.

*(d)* The load shall not be applied to the point of the hook.

*(e)* Before applying the load, the operator shall be sure the wire rope is not kinked or twisted or that multiple parts of the wire rope are not twisted about each other.

*(f)* Hoists shall not be operated until the load block, wire rope, and hoist body are directly in line with the direction of loading to avoid sidepull.

*(g)* The hoist body or frame shall not bear against any object or the supporting structure.

*(h)* The operator shall not apply a load beyond the rated load appearing on the hoist or load block, except during properly authorized tests.

*(i)* Specific attention should be given to balancing of the load and hitching or slinging to prevent slipping of the load.

*(j)* The operator shall not release the hoist lever until the ratchet and pawl is engaged and the lever is at rest.

*(k)* The operator shall not engage in any activity that will divert the operator's attention while operating the hoist.

*(l)* The operator shall not apply a load to the hoist until the operator and all other personnel are clear of the load.

*(m)* The operator shall make sure a load clears obstacles before moving.

*(n)* A load shall not be moved more than a few inches until it is well balanced in the sling or lifting device.

*(o)* When starting to lift or pull, the operator should move the load a few inches and then check the hoist for proper load holding action. The operation shall be continued only after the operator has verified that the hoist is operating properly.

*(p)* Hoist shall not be used to lift, support, or otherwise transport people.

*(q)* The operator should avoid carrying loads over people.

*(r)* The operator should not leave a loaded hoist unattended unless specific precautions have been instituted and are in place.

*(s)* Care shall be exercised when removing a sling from under a landed and blocked load.



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# Chapter 21-3
# Web Strap Type

(05)

## SECTION 21-3.1: MARKING

### 21-3.1.1 Rated Load

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

### 21-3.1.2 Controls

Controls shall be identified to indicate function or direction of motion.

### 21-3.1.3 Identification

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

*(a)* name of manufacturer

*(b)* manufacturer's model or serial number

### 21-3.1.4 Warnings

Manually lever 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

*(a)* lifting more than the rated load

*(b)* operating a hoist when it is restricted from forming a straight line with the direction of loading

*(c)* operating a hoist with a twisted, kinked, or damaged web strap

*(d)* operating a damaged or malfunctioning hoist

*(e)* lifting people

*(f)* lifting loads over people

*(g)* operating a hoist with lever extension

*(h)* removing or obscuring warning labels

## SECTION 21-3.2: CONSTRUCTION

### 21-3.2.1 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 bearing parts of lever operated hoists shall be designed so that the static stress, calculated for the rated load, shall not exceed 25% of the average ultimate material strength. Elements specifically intended to give visible warning of severe overload by permanent deformation while operating the hoist should be designed to show obvious deformation before failure of other load suspension parts.

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

### 21-3.2.2 Load Sprockets

See Fig. 6. The load sprocket (drum) shall be designed to avoid jamming of the web strap within the hoist mechanism under normal operating conditions.

### 21-3.2.3 Web Strap

*(a)* The web strap should be nylon, polyester, or similar synthetic material.

*(b)* If a load is supported by more than one part of the web strap, the tension on the parts shall be equalized.

*(c)* End terminations shall be done in the manner specified by the manufacturer of the assembly or the web strap manufacturer.

*(d)* Eyes shall be made in a manner recommended by the hoist manufacturer or a qualified person.

*(e)* Nylon and polyester web straps shall not be exposed to an ambient temperature in excess of 200°F (93°C).

*(f)* The web strap shall be attached to the hoist in a manner to prevent disengagement throughout rated hook travel. No less than two wraps of web strap shall remain on the hoist load sprocket (drum) when the hook is extended to its full rated lift.

### 21-3.2.4 Hooks

See Fig. 4. If hooks are of the swiveling type, they should rotate freely. Hooks shall be equipped with latches unless the use of the latch creates a hazardous condition. When required, a latch shall be provided to bridge the throat opening of the hook for the purpose of retaining slings, chains, etc., under slack conditions. The latch is not intended to support the load. See ASME B30.10.

### 21-3.2.5 Load Blocks

Means shall be provided to guard against web strap jamming in the load block under normal operating conditions.

### 21-3.2.6 Load Controlling Mechanism

The hoist shall be equipped with a load controlling mechanism, which shall perform the following functions



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under normal operating conditions and with test loads up to 125% of rated load.

*(a)* Stop and hold the load when the lever force is removed and the lever stroke is completed.

*(b)* Provide for incremental movement of the load when lifting or lowering.

*(c)* The friction brake mechanism shall have provision for adjustment where necessary to compensate for wear.

### 21-3.2.7 Convertible Load Rating

On hoists with a convertible load rating feature, the rated load is converted by changing the number of parts (lines) of web strap supporting the load. This conversion shall be accomplished as recommended by the manufacturer without the use of additional components that are not furnished with the hoist.

### 21-3.2.8 Lubrication

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

### 21-3.2.9 Manual

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

*(a)* operation

*(b)* inspection and testing

*(c)* lubrication, maintenance, and repair

## SECTION 21-3.3: INSPECTION

### 21-3.3.1 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) Inspection Procedures.* The inspection procedures for hoists in regular service are divided into two 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 two general classifications are herein designated as frequent and periodic, with respective intervals between inspections as defined below.

*(1) Frequent Inspection.* Visual examinations by the operator or other designated person with records not required.

*(a)* normal service — monthly

*(b)* heavy service — weekly to monthly

*(c)* severe service — daily to weekly

*(d)* special or infrequent service — as recommended by a qualified person before and after each occurrence

*(2) 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 indication in lieu of records. (A metal stamp mark shall not be made in a highly stressed area.)

*(a)* normal service — yearly.

*(b)* heavy service — semiannually. If external conditions indicate, disassembly should be done to permit detailed inspection.

*(c)* severe service — quarterly. If external conditions indicate, disassembly should be done to permit detailed inspection.

*(d)* special or infrequent service — as recommended by a qualified person before the first such occurrence and as directed by the qualified person for any subsequent occurrences.

### 21-3.3.2 frequent inspection

See also Table 3.

*(a)* Frequent inspections shall be performed at intervals defined in para. 21-3.3.1(b)(1) and shall include observations during operation.

*(b)* A designated 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 for unusual sounds such as, but not limited to, binding noise of the web strap or bearing squeal.

*(2)* hooks in accordance with ASME B30.10, Frequent Inspection.

*(3)* hook latches, if used, for proper operation.

*(4)* web strap in accordance with para. 21-3.6.1.

*(5)* web strap reeving for compliance with the recommendations of the hoist manufacturer or a qualified person.

*(6)* hoist lever for bends, cracks, or other damage.

*(7)* damage to the support for the hoist.

### 21-3.3.3 Periodic Inspection

See also Table 3.

*(a)* Periodic inspections shall be performed at intervals defined in para. 21-3.3.1(b)(2). These inspections may be performed with the hoist at its location, and do not require the hoist to be disassembled.

*(b)* Covers and other items normally supplied to allow inspection of components should be opened or removed for the inspection and then closed or replaced before restoring the hoist to normal operation unless further maintenance is required.



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## Table 3 Minimum Inspection for Lever Operated Hoists — Web Strap (05)

| Item | Normal Service | | Heavy Service | | Severe Service | |
|---|---|---|---|---|---|---|
| | Visual Monthly [Note (1)] | Record Yearly [Note (2)] | Visual Weekly to Monthly [Note (1)] | Record Semiannually [Note (3)] | Visual Daily to Weekly [Note (1)] | Record Quarterly [Note (3)] |
| **Frequent Inspection** (see para. 21-3.3.2) | | | | | | |
| All functional mechanisms for maladjustment and unusual sounds | x | ... | x | ... | x | ... |
| Hooks in accordance with ASME B30.10 | x | ... | x | ... | x | ... |
| Hook latch operation, if used | x | ... | x | ... | x | ... |
| Web strap in accordance with para. 21-3.6.1 | x | ... | x | ... | x | ... |
| Web strap reeving for compliance with the recommendations of the hoist manufacturer | x | ... | x | ... | x | ... |
| Lever for bends, cracks, etc. | x | ... | x | ... | x | ... |
| Hoist support for damage | x | ... | x | ... | x | ... |
| **Periodic Inspection** (see para. 21-3.3.3) | | | | | | |
| Requirements of frequent inspection | ... | 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, levers, web strap 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 |



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(05)

**Table 3 Minimum Inspection for Lever Operated Hoists — Web Strap (Cont'd)**

| Item | Normal Service | | Heavy Service | | Severe Service | |
|---|---|---|---|---|---|---|
| | Visual Monthly [Note (1)] | Record Yearly [Note (2)] | Visual Weekly to Monthly [Note (3)] | Record Semiannually [Note (3)] | Visual Daily to Weekly [Note (1)] | Record Quarterly [Note (3)] |
| Evidence of damage or excessive wear of load sprockets | . . . | x | . . | x | . . . | x |
| Evidence of worn pawls, cams, or ratchets; corroded, stretched, or broken pawl springs | . . . | x | . . . | x | . . . | x |
| Label or labels required by para. 21-3.1.1(d) | . . . | x | . . . | x | . . . | x |
| End connections and terminations of web strap | . . . | x | . . . | x | . . . | x |

NOTES:
(1) Visual inspection by operators or other designated personnel.
(2) Visual inspection by a designated person of conditions.
(3) As in Note (2) unless conditions indicate that disassembly should be done to permit detailed inspection.

*(c)* A designated 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. 21-3.3.2

*(2)* fasteners for evidence of loosening

*(3)* web strap, suspension housings, levers, 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 or idler sprockets (drums) for evidence of damage and wear

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

*(7)* supporting structure or trolley, if used, for evidence of damage

*(8)* label or labels, required by para. 21-3.1.4 for legibility and replacement

*(9)* end connections of web strap for evidence of deterioration

*(10)* web strap shall be inspected in accordance with para. 21-3.6.1(b)

*(11)* the hoist and hoist mounting for evidence of missing items

### 21-3.3.4 Hoists Not in Regular Service

*(a)* A hoist that has been idle for a period of one month or more, but less than one year, shall be given an inspection conforming with the requirements of para. 21-3.3.2 before it is placed in service.

*(b)* A hoist that has been idle for a period of one year or more shall be given an inspection conforming with the requirements of para. 21-3.3.3 before it is placed in service.

## SECTION 21-3.4: TESTING

### 21-3.4.1 Operational Tests

All new hoists shall be tested by the hoist manufacturer. All altered or repaired hoists, or hoists that have not been used within the preceding 12 months, shall be tested before being placed in service by, or under the direction of, a designated person to ensure compliance with the applicable provisions of this volume including the following.

*(a)* All functions of the hoist shall be checked with the hoist suspended in the unloaded state.

*(b)* After testing in the unloaded state, a load of at least 100 lb (46 kg) times the number of load supporting parts of web strap shall be applied to the hoist in order to check proper load control.

### 21-3.4.2 Load Test

*(a)* New hoists shall be tested by the manufacturer with a test load of at least 125% of the rated load.



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*(b)* A hoist in which load-suspension parts have been altered, replaced, or repaired shall be statically or dynamically load tested.

*(1)* A qualified person should determine the need to load test the hoist.

*(2)* A written report of the test should be prepared and placed on file.

*(3)* 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.

*(4)* The replacement of web strap is specifically excluded from this load test; however, an operational test of the hoist should be made in accordance with para. 21-3.4.1 prior to placing the hoist back in service.

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

## SECTION 21-3.5: MAINTENANCE

### 21-3.5.1 Preventive Maintenance

*(a)* A preventive maintenance program should be established and should be

*(1)* based on the recommendations outlined in the hoist manufacturer's manual

*(2)* reviewed by a qualified person for the application of the hoist, when required

*(b)* Replacement parts shall be at least equal to the original manufacturer's specifications.

### 21-3.5.2 Adjustments, Repairs, and Replacements

*(a)* Conditions disclosed by the inspections performed in accordance with the requirements of Section 21-3.3 that are determined to be a hazard during continued operation shall be corrected by adjustment, repair, or replacement before continuing the use of the hoist.

*(b)* Adjustments, repairs, and replacements shall be performed by a designated person.

*(c)* Components shall be adjusted or repaired as needed. The following are examples:

*(1)* operating mechanisms

*(2)* brakes and pawls

*(d)* Repairs or replacements shall be made as needed. The following are examples:

*(1)* excessively worn braking components such as friction disks, ratchets, pawls, and pawl springs.

*(2)* critical parts, including load suspension components, that are cracked, broken, bent, or excessively worn.

*(3)* bent, cracked, or otherwise damaged levers.

*(4)* worn, corroded, or otherwise damaged web strap in accordance with para. 21-3.6.2.

*(5)* replace hooks showing conditions described in ASME B30.10. Repairs by welding or reshaping are not permitted.

*(6)* missing or illegible safety warning labels.

*(7)* items that are determined to be missing.

### 21-3.5.3 Lubrication

All moving parts of the hoist for which lubrication is specified should be regularly lubricated. Care should be taken to follow manufacturer's recommendations outlined in the hoist manufacturer's manual as to points and frequency of lubrication, and quantity and types of lubricant to be used.

## SECTION 21-3.6: WEB STRAP INSPECTION, REPLACEMENT, AND MAINTENANCE

### 21-3.5.1 Web Strap Inspection

*(a) Frequent Inspection*

*(1)* Web straps should be visually inspected by the operator or other designated person at the start of each shift. These visual observations should be concerned with discovering gross damage, such as that listed below, which may be an immediate hazard:

*(a)* melting or charring

*(b)* acid or caustic burns

*(c)* weld spatter

*(d)* broken stitching

*(e)* cuts or tears

*(f)* damaged eyes or fittings

*(g)* abrasive wear

*(h)* knots

*(b) Periodic Inspection*

*(1)* The inspection frequency shall be determined by a qualified person and shall be based on such factors as expected web strap life as determined by experience on the particular installation or similar installations; severity of environment; percentage of rated load lifts; frequency of operation; and exposure to shock loads.

Inspections need not be at equal calendar intervals and should be more frequent as the web strap approaches the end of its useful life.

*(2)* Periodic inspections shall be performed by a designated person. This inspection shall cover the entire length of web strap.

*(3)* Special care should be taken when inspecting sections for rapid deterioration, such as the following:



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*(a)* sections in contact with saddles, equalizer sheaves, or other sheaves where web strap travel is limited

*(b)* sections of the web strap at or near terminal ends where broken threads or cuts may be evident

*(c)* sections subject to reverse bends

*(d)* sections of web strap that are normally hidden during visual inspection, such as parts passing over sheaves

### 21-3.6.2 Web Strap Replacement

*(a)* No precise rules can be given for determination of the exact time for the replacement of web strap, since many variable factors are involved. Continued use in this respect depends largely upon good judgment by an appointed or authorized person in evaluating remaining strength in a used web strap after allowance for deterioration disclosed by inspection. Continued web strap operation depends upon this remaining strength.

*(b)* Conditions such as the following shall be reason for questioning continued use of the web strap or increasing the frequency of inspection:

*(1)* severely worn end connections

*(2)* distortion of the web strap structure

*(3)* evidence of heat damage

*(c)* The web strap shall be removed from service when damage such as the following is discovered:

*(1)* melting or charring

*(2)* acid or caustic burns

*(3)* weld spatter

*(4)* broken stitching

*(5)* cuts or tears

*(6)* damaged eyes or fittings

*(7)* abrasive wear

*(8)* knots

### 21-3.6.3 Web Strap Maintenance

*(a)* Web strap should be stored to prevent damage or deterioration.

*(b)* Web strap should be protected from dirt, oil, water, and other foreign materials.

*(c)* During installation, care should be taken to avoid dragging the web strap in the dirt or around objects that will scrape, nick, cut, or induce other damage.

## SECTION 21-3.7: OPERATION

### 21-3.7.1 Hoisting Practices for Operators

Safe operation of a lever hoist involves more than pulling the lever. Refer to the B30 Introduction, which emphasizes that the use of hoists is subject to certain hazards that cannot be met by mechanical means, but only by the exercise of intelligence, care, common sense, and experience in anticipating the motions that will occur as a result of operating the controls.

### 21-3.7.2 Before Operating Hoist

*(a)* The supporting structure or anchoring means shall have a load capacity at least equal to that of the hoist.

*(b)* The operator shall be familiar with all operating controls of the hoist, and shall be instructed as to warnings on the hoist, the hoisting practices listed in this Section, and the operator's portion of the manual provided by the hoist manufacturer.

*(c)* If adjustments or repairs are necessary, or any defects are known, the operator shall report this promptly to the appointed person.

*(d)* Hoists shall be used only in locations that will allow the operator to be free of the load.

*(e)* The operator shall have access to the operating lever.

*(f)* The operator shall not operate a hoist that bears an out-of-order sign.

*(g)* The operator shall not adjust or repair a hoist unless qualified to perform maintenance on the hoist.

*(h)* Hoists shall not be operated by other than the hand power of one operator.

*(i)* Hoists shall not be operated with an extension on the lever.

### 21-3.7.3 Handling the Load

*(a)* The hoist web strap shall not be wrapped around the load.

*(b)* The load shall be attached to the load hook by suitable means.

*(c)* The sling or other device shall be properly seated in the base (bowl) of the hook. The hook latch shall not be allowed to support any part of the load.

*(d)* The load shall not be applied to the point of the hook.

*(e)* Before applying the load, the operator shall be sure that the web strap is not twisted or that multiple parts of the web strap are not twisted about each other.

*(f)* Hoists shall not be operated until the load block, web strap, and hoist body are directly in line with the direction of loading to avoid sidepull.

*(g)* The hoist body or frame shall not bear against any object or the supporting structure.

*(h)* The operator shall not apply a load beyond the rated load appearing on the hoist or load block, except during properly authorized tests.

*(i)* Specific attention should be given to balancing of the load and hitching or slinging to prevent slipping of the load.



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*(j)* The operator shall not release the hoist lever until the ratchet and pawl is engaged and the lever is at rest.

*(k)* The operator shall not engage in any activity that will divert the operator's attention while operating the hoist.

*(l)* The operator shall not apply a load to the hoist until the operator and all other personnel are clear of the load.

*(m)* The operator shall make sure a load clears any obstacles before moving.

*(n)* A load shall not be moved more than a few inches until it is well balanced in the sling or lifting device.

*(o)* When starting to lift or pull, the operator should move the load a few inches and then check the hoist for proper load holding action. The operation shall be continued only after the operator has verified that the hoist is operating properly.

*(p)* Hoist shall not be used to lift, support, or otherwise transport people.

*(q)* The operator should avoid carrying loads over people.

*(r)* The operator should not leave a loaded hoist unattended unless specific precautions have been instituted and are in place.

*(s)* Care shall be exercised when removing a sling from under a landed and blocked load.



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# ASME B30.21-2005 INTERPRETATIONS

## Replies to Technical Inquiries
## March 2000 through October 2004

### FOREWORD

This publication includes all of the written replies issued between the indicated dates by the Secretary, speaking for the ASME B30 Standards Committee, Safety Standards for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings, to inquiries concerning interpretations of technical aspects of ASME B30.21, Manually Lever Operated Hoists.

These replies are taken verbatim from the original letters except for a few minor typographical and editorial corrections made for the purpose of improved clarity. In some few instances, a review of the interpretation revealed a need for corrections of a technical nature; in these cases, a corrected interpretation follows immediately after the original reply.

These interpretations were prepared in accordance with the accredited ASME procedures. ASME procedures provide for reconsideration of these interpretations when or if additional information is available that the inquirer believes might affect the interpretation. Further, persons aggrieved by this interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.



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**Interpretation: 21-2**

Subject: ASME B30.21-1999, Manually Level Operated Hoists, Section 21-1.3, Testing

Date Issued: September 11, 2003

Question: What kind of load test, static or dynamic, is required to meet para. 21-1.3.2?

Reply: The load test may be either static or dynamic.



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# ASME B30.21-2005

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