

ASME B30.20-2025
(Revision of ASME B30.20-2021)

Below-the-Hook Lifting Devices

**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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Mechanical Engineers**

Two Park Avenue • New York, NY • 10016 USA

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FOREWORD

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

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

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

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

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

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

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

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

B30.20, Below-the-Hook Lifting Devices, was first published in 1985; new editions were published in 1993, 1999, 2003, and 2006. In the 2010 edition, maintenance was made mandatory, definitions were revised and other changes were made to improve clarity. The 2013 revision added requirements for personnel competence, operating controls marking and inspection, translation of non-English documentation into English, and updates to the definition of Duty Cycle to align with revisions made to BTH-1. In addition, responsibilities for Owners and Operators are defined for each piece of equipment.

The 2018 edition added Chapter 6 on clamps, revisions to product safety labeling, addition of rated load marking requirements for remotely operated magnets, expanded and clarified magnet testing requirements, revision to the permanent magnet rating factor, revisions to align with changes to ASME BTH-1, and updates to the operating practices sections to align with revisions to the standards applicable to the equipment used with below-the-hook lifting devices. The 2021 edition improved clarity and readability of inspection requirements, added removal criteria, and contained revisions to load test.

This 2025 edition addresses adjustable and modular spreader bars and clamps, includes new figures for load-containing lifters, and clarifies lifting devices. It also adds Nonmandatory Appendix A and an updated method to load test lifting devices, among other revisions. References have been updated.

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 January 22, 2025.

ASME B30 COMMITTEE

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

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

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Revisions and Errata. The committee processes revisions to this Standard on a continuous basis to incorporate changes that appear necessary or desirable as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published in the next edition of the Standard.

In addition, the committee may post errata on the committee web page. Errata become effective on the date posted. Users can register on the committee web page to receive email notifications of posted errata.

This Standard is always open for comment, and the committee welcomes proposals for revisions. Such proposals should be as specific as possible, citing the paragraph number, the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent background information and supporting documentation.

Cases. The committee does not issue cases for this Standard.

Interpretations. Upon request, the committee will issue an interpretation of any requirement of this Standard. An interpretation can be issued only in response to a request submitted through the online Inquiry Submittal Form at <https://go.asme.org/InterpretationRequest>. Upon submitting the form, the inquirer will receive an automatic email confirming receipt.

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Interpretations are published in the ASME Interpretations Database at <https://go.asme.org/Interpretations> as they are issued.

Committee Meetings. The B30 Standards Committee regularly holds meetings that are open to the public. Persons wishing to attend any meeting should contact the secretary of the committee. Information on future committee meetings can be found on the committee web page at <https://go.asme.org/B30committee>.

B30 STANDARD INTRODUCTION

SECTION I: SCOPE

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

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

- | | | | |
|--------|---|--------|--|
| B30.1 | Jacks, Industrial Rollers, Air Casters, and Hydraulic Gantries | B30.21 | Lever Hoists |
| B30.2 | Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist) | B30.22 | Articulating Boom Cranes |
| B30.3 | Tower Cranes | B30.23 | Personnel Lifting Systems |
| B30.4 | Portal and Pedestal Cranes | B30.24 | Container Cranes |
| B30.5 | Mobile and Locomotive Cranes | B30.25 | Scrap and Material Handlers |
| B30.6 | Derricks | B30.26 | Rigging Hardware |
| B30.7 | Winches | B30.27 | Material Placement Systems |
| B30.8 | Floating Cranes and Floating Derricks | B30.28 | Balance Lifting Units |
| B30.9 | Slings | B30.29 | Self-Erecting Tower Cranes |
| B30.10 | Hooks | B30.30 | Ropes |
| B30.11 | Monorails and Underhung Cranes (withdrawn 2018 — requirements found in latest revision of B30.17) | B30.31 | Self-Propelled, Towed, or Remote-Controlled Hydraulic Platform Transporters ¹ |
| B30.12 | Handling Loads Suspended From Rotorcraft | B30.32 | Unmanned Aircraft Systems (UAS) Used in Inspection, Testing, Maintenance, and Load-Handling Operations |
| B30.13 | Storage/Retrieval (S/R) Machines and Associated Equipment | | |
| B30.14 | Side Boom and Rotating Pipelayers | | |
| B30.15 | Mobile Hydraulic Cranes (withdrawn 1982 — requirements found in latest revision of B30.5) | | |
| B30.16 | Overhead Underhung and Stationary Hoists | | |
| B30.17 | Cranes and Monorails (With Underhung Trolley or Bridge) | | |
| B30.18 | Stacker Cranes (Top or Under Running Bridge, Multiple Girder With Top or Under Running Trolley Hoist) | | |
| B30.19 | Cableways | | |
| B30.20 | Below-the-Hook Lifting Devices | | |

SECTION II: SCOPE EXCLUSIONS

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

SECTION III: PURPOSE

The B30 Standard is intended to

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

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

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

SECTION IV: USE BY REGULATORY AGENCIES

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

¹ This volume is currently in the development process.

SECTION V: EFFECTIVE DATE

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

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

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

SECTION VI: REQUIREMENTS AND RECOMMENDATIONS

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

SECTION VII: USE OF MEASUREMENT UNITS

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

SECTION VIII: ADDITIONAL GUIDANCE

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

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

- (a) the condition of the equipment or material
- (b) the loads
- (c) the acceleration or speed of the ropes, chains, sheaves, sprockets, or drums
- (d) the type of attachments
- (e) the number, size, and arrangement of sheaves or other parts
- (f) environmental conditions causing corrosion or wear
- (g) many variables that must be considered in each individual case

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

ASME B30.20-2025

SUMMARY OF CHANGES

Following approval by the ASME B30 Standards Committee and ASME, and after public review, ASME B30.20-2025 was approved by the American National Standards Institute on January 22, 2025.

Throughout ASME B30.20-2025, the term “lifting device” or “lifting magnet” has replaced “lifter,” “magnet lifter,” and related variations. The term “rated load” has replaced “load rating,” “rated capacity,” and “rated load limit.” Gender pronouns have been eliminated. ASME B30.20-2025 also includes the following changes identified by a margin note, (25).

<i>Page</i>	<i>Location</i>	<i>Change</i>
ix	Correspondence With the B30 Committee	Added
x	B30 Standard Introduction	Updated
1	Section 20-0.2	(1) Definition of <i>below-the-hook lifting device</i> revised (2) Definition of <i>load block</i> added
1	Section 20-0.3	(1) Definition of <i>lifting beam</i> revised (2) Definition of <i>load-containing lifting device</i> added
2	Section 20-0.5	Definition of <i>normal service</i> revised
3	Section 20-0.6	Definition of <i>normal service</i> revised
3	Section 20-0.7	Definition of <i>heavy service</i> revised
4	Section 20-0.11	Updated
5	Section 20-1.1	Revised
5	20-1.2.1	In subpara. (a), second and third paragraphs added
9	Figure 20-1.1-4	Added
10	20-1.3.3	Subparagraphs (a) through (d) deleted by errata
12	20-1.3.9.2	Subparagraph (b) revised in its entirety
12	20-1.4.2	Subparagraph (a)(6) revised
13	20-1.4.3.1	Subparagraph (f)(2) revised and subpara. (f)(3) added
13	20-1.4.3.2	Subparagraph (n) revised
14	20-1.4.4	In subpara. (a)(2), punctuation revised
17	20-2.3.3	Penultimate sentence revised
18	20-2.3.9.2	(1) In subpara. (a), last sentence revised (2) Subparagraph (d) added and subsequent subparagraph redesignated
19	20-2.4.2	Subparagraph (a)(6) revised
20	20-2.4.3.1	Subparagraph (f)(2) revised
20	20-2.4.3.2	Subparagraph (n) revised
21	20-2.4.4	In subpara. (a)(2), punctuation revised
21	Section 20-2.5	Subparagraphs (c), (f), and (h) revised
24	20-3.2.2	In subpara. (e), last sentence revised
25	20-3.3.3	Penultimate sentence revised

<i>Page</i>	<i>Location</i>	<i>Change</i>
25	20-3.3.4	In first sentence, “performed and recorded at intervals” corrected by errata to “performed at intervals”
26	20-3.3.7	First paragraph and subpara. (i) corrected by errata
27	20-3.4.2	Subparagraph (a)(6) revised
28	20-3.4.3.1	Subparagraph (f)(2) revised
28	20-3.4.3.2	Subparagraph (n) revised
29	20-3.4.4	(1) In subpara. (a)(2), punctuation revised (2) Subparagraph (a)(14) revised
33	20-4.3.2	(1) First sentence corrected by errata to “Lifting magnets shall be inspected at intervals” (2) Penultimate sentence revised
33	20-4.3.6	Subparagraph (j) revised
34	20-4.3.7	In first sentence, “the damage” corrected by errata to “the deficiency”
34	20-4.3.8.2	Subparagraph (a) revised
35	20-4.4.2	Subparagraph (a)(6) revised
35	20-4.4.3.1	Subparagraph (f)(2) revised
36	20-4.4.3.2	Subparagraph (n) revised
36	20-4.4.4	In subpara. (a)(2), punctuation revised
37	Section 20-4.5	Subparagraphs (a) and (b) revised
40	20-5.3.2	Penultimate sentence revised
41	20-5.4.3.1	Subparagraph (f)(2) revised
42	20-5.4.3.2	Subparagraph (n) revised
42	20-5.4.4	In subpara. (a)(2), punctuation revised
49	20-6.3.3	Last sentence revised
50	20-6.3.9.2	Subparagraph (b) revised in its entirety
51	20-6.4.2	Subparagraph (a)(6) revised
51	20-6.4.3.1	Subparagraph (f)(2) revised
52	20-6.4.3.2	Subparagraph (n) revised
52	20-6.4.4	In subpara. (b)(2), punctuation revised
53	Section 20-6.5	First paragraph and subpara. (e) revised
54	Nonmandatory Appendix A	Added

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Chapter 20-0

Scope, Definitions, Personnel Competence, Translations, and References

SECTION 20-0.1: SCOPE OF ASME B30.20

Volume B30.20 includes provisions that apply to the marking, construction, installation, inspection, testing, maintenance, and operation of below-the-hook lifting devices, other than components addressed by other ASME B30 volumes or other standards, used for attaching loads to a hoist. The requirements in this Volume also apply to clamps used for positioning and anchoring. The devices are arranged in six chapters as follows:

Chapter 20-1:	Structural and Mechanical Lifting Devices
Chapter 20-2:	Vacuum Lifting Devices
Chapter 20-3:	Close Proximity Operated Lifting Magnets
Chapter 20-4:	Remotely Operated Lifting Magnets
Chapter 20-5:	Scrap and Material-Handling Grapples
Chapter 20-6:	Clamps

(25) SECTION 20-0.2: DEFINITIONS — GENERAL

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

altered: a physical change, addition, or deletion that modifies the original design, or intended functioning, of the equipment.

below-the-hook lifting device: a device, other than a load block, used for attaching a load to a hoist. The lifting device may be reeved directly into the hoist. The lifting device may contain components such as slings, hooks, and rigging hardware addressed by other ASME B30 volumes or other standards.

design category: lifting device classification that specifies the design factor to be used to establish static stress limits for the design.

hoist: a machinery unit that is used for lifting and lowering.

lifter: see *below-the-hook lifting device*.

lifting device: see *below-the-hook lifting device*.

load block: the assembly of hook or shackle, swivel, bearing, sheaves, pins, and frame suspended by the hoisting rope or load chain.

maintenance parts: parts designated by the manufacturer that may be periodically replaced as part of normal operation of the lifting device.

modification: see *altered*.

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

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

rated load: the maximum load designated by the manufacturer for which the equipment is designed and built.

repair: the process of reconditioning, renewing, or replacing parts, components, or subsystems to a condition equal to the original manufacturer's specifications for the purpose of ensuring performance in accordance with the applicable requirements.

service class: a lifting device classification that establishes the allowable stress range for the specified fatigue life (load cycles).

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

shall: a word indicating a requirement.

should: a word indicating a recommendation.

special or infrequent service: service that involves operation other than normal, heavy, or severe.

SECTION 20-0.3: DEFINITIONS FOR CHAPTER 20-1 (25)

heavy service: service that involves operation within the rated load that exceeds the limits of normal service.

latch: a device for holding a lifting device in the open or closed position.

latch, automatic: a sequencing latch mechanism operated by lifting device motion.

lifting beam (spreader beam): a load-supporting lifting device [see Figure 20-1.1-1, illustration (a)].

load-containing lifting device: a lifting device that is used to handle loose or flowable materials (see Figure 20-1.1-4).

manipulating lifting device: a lifting device that rotates the load about one or more axes during the lifting process (see Figure 20-1.1-2).

mechanical lifting device: a mechanism composed of two or more rigid parts that move with respect to each other for attaching a load to a hoisting device.

normal service:

Design Category A lifting devices (for ASME BTH-1): service that involves operation with various weights within the rated load with not more than four operations above 65% of the rated load per 24-hr period.

Design Category B lifting devices (for ASME BTH-1): service that involves operation with various weights within the rated load, averaging less than 65% of rated load.

structural lifting device: a lifting device consisting of an assembly of rigid parts designed to hold and attach a load to a hoisting device.

supporting lifting device: a lifting device that carries the load on rigid projections or bearing surfaces [see Figure 20-1.1-3, illustrations (b), (c), (d), and (e)].

SECTION 20-0.4: DEFINITIONS FOR CHAPTER 20-2

heavy service: service that involves operation within the rated load that exceeds the limits of normal service.

horizontal surface lift: a condition where the surface to which the vacuum pad (or pads) is attached is in a horizontal plane.

nonporous material: a material that is not permeable by fluid or air.

normal service:

Design Category A lifting devices (for ASME BTH-1): service that involves operation with various weights within the rated load with not more than four operations above 65% of the rated load per 24-hr period.

Design Category B lifting devices (for ASME BTH-1): service that involves operation with various weights within the rated load, averaging less than 65% of rated load.

porous material: a material that is permeable by fluid or air.

seal ring: that part of the vacuum pad that forms the seal of the vacuum chamber between the vacuum pad body or vacuum lifting device and the attached material.

single-pad mechanical vacuum lifting device: see Figure 20-2.1-1, illustration (b).

two-pad mechanical vacuum lifting device: see Figure 20-2.1-1, illustration (a).

vacuum: pressure less than ambient atmospheric pressure.

vacuum lifting device: a below-the-hook lifting device for lifting and transporting loads using a holding force by means of vacuum (see Figure 20-2.1-1).

vacuum manipulator: a vacuum lifting device capable of repositioning the load while suspended.

vacuum pad: a device that applies a holding force on the load by means of vacuum.

vacuum reservoir: the evacuated portion of the vacuum system that functions to compensate for leakage into the vacuum system or to provide a vacuum reserve in the event of vacuum generator failure.

vertical surface lift: a condition where the surface to which a vacuum pad is attached is in a vertical plane.

SECTION 20-0.5: DEFINITIONS FOR CHAPTER 20-3

(25)

battery backup system: batteries used to guard against inadvertent load release due to the loss of primary power to the system.

battery-powered lifting electromagnet: a lifting magnet that requires continuous current supplied by a battery to maintain holding force [see Figure 20-3.1-1, illustration (a)].

breakaway force: the force required to detach a properly engaged lifting magnet from a piece of ferromagnetic material when the force is applied normal to the lifting surface of the magnet.

breakaway force test: a test that is carried out per para. 20-3.3.9.2 in order to establish the rated breakaway force.

close proximity operated lifting magnet: a lifting magnet used in such a fashion that the operator manually positions the lifting magnet on the load and manually guides the lifting magnet and load during a lift.

cold current: the current drawn by the lifting magnet when its coil is at 68°F (20°C) and at rated voltage.

electrically controlled permanent lifting magnet: a lifting magnet that derives holding force from permanent magnet material and requires electrical current during attachment or release. Also called *electro perm*, *perm electro*, or similar names [see Figure 20-3.1-1, illustration (b)].

externally powered lifting electromagnet: a lifting magnet suspended from a crane that requires power from an external source.

general application lifting magnet: a lifting magnet that is intended by the manufacturer to be used on a number of different geometrical shapes and that does not fall under the category of remotely operated lifting magnets.

heavy service: service that involves operation within the rated load that exceeds the limits of normal service.

internal control function indicator: an indicator that shows that the permanent magnet material in one type of electrically controlled permanent magnet has been positioned internally to provide full magnetic attraction.

magnet duty cycle: the percentage of time an electromagnet can be energized, T_e , relative to total cycle time. Deenergized time equals T_d . If not rated as continuous, the magnet duty cycle rating includes information on maximum continuous energized time and minimum deenergized time to prevent overheating.

$$\text{magnet duty cycle} = \frac{T_e}{T_e + T_d} \times 100$$

EXAMPLE: 3 min energized, 2 min deenergized equal

$$\frac{3}{3 + 2} \times 100 = 60\%$$

manually controlled permanent lifting magnet: a lifting magnet that derives holding force from permanent magnet material and requires a manual effort during period of attachment or release [see Figure 20-3.1-1, illustration (c)].

normal service: service that involves operation with various weights within the rated load, averaging less than 65% of rated load with the lifting magnet operating at, or below, the magnet duty cycle.

rated load: the maximum load that the lifting magnet is designated by the manufacturer to handle.

remotely operated lifting magnet: a lifting magnet that does not require the operator or other personnel to be in close proximity to the lifting magnet or its load while the lifting magnet is in use.

specified application breakaway force test: a test that is carried out in accordance with instructions from the manufacturer of the lifting magnet in order to establish the application breakaway force.

specified application lifting magnet: a lifting magnet that is designed for lifting specified geometrical configurations and weights of designated parts, identified by part number or other controlled definition and used in a controlled manner.

specified application load: a load applied to the lifting magnet when it is used to handle a specified load.

SECTION 20-0.6: DEFINITIONS FOR CHAPTER 20-4

(25)

close proximity operated lifting magnet: a lifting magnet used in such a fashion that the operator manually positions the lifting magnet on the load and manually guides the lifting magnet and load during a lift.

cold current: the current drawn by the lifting magnet when its coil is at 68°F (20°C) and at rated voltage.

heavy service: service that involves operation within the rated load that exceeds the limits of normal service.

magnet duty cycle: the percentage of time an electromagnet can be energized, T_e , relative to total cycle time. Deenergized time equals T_d . If not rated as continuous, the magnet duty cycle rating includes information on maximum continuous energized time and minimum deenergized time to prevent overheating.

$$\text{magnet duty cycle} = \frac{T_e}{T_e + T_d} \times 100$$

EXAMPLE: 3 min energized, 2 min deenergized equal

$$\frac{3}{3 + 2} \times 100 = 60\%$$

normal service: service that involves operation with various weights within the rated load, averaging less than 65% of rated load with the lifting magnet operating at, or below, the magnet duty cycle over one shift (8 hr).

rated load: the maximum load that the lifting magnet is designated by the manufacturer to handle.

remotely operated lifting magnet: a lifting magnet that does not require the operator or other personnel to be in close proximity to the lifting magnet or its load while the lifting magnet is in use [see Figure 20-4.1-1, illustrations (a) and (b)].

SECTION 20-0.7: DEFINITIONS FOR CHAPTER 20-5

(25)

heavy service: service that involves operation within the rated volume capacity and rated load for

(a) one work shift per day working in material that will not crush or deform as the grapple closes

(b) two or more work shifts per day working in material that will crush or deform as the grapple closes

normal service: service that is limited to operation for a period of one shift or less per day working within the rated load in material that will crush or deform as the grapple closes.

rated volume capacity: the volume of scrap or material that can be handled with the grapple closed and the tine tips touching. This is expressed in cubic yards or cubic meters.

tine: the hinged portion of the grapple that comes in contact with or encompasses the load.

SECTION 20-0.8: DEFINITIONS FOR CHAPTER 20-6

friction-type pressure-gripping clamps: clamps that grip the load without significant or harmful permanent deformation of the load surface (see [Figure 20-6.1-2](#)).

heavy service: service that involves operation within the rated load that exceeds the limits of normal service.

indentation-type pressure-gripping clamps: clamps that carry the load by applying force to indent the sides of the load (see [Figure 20-6.1-3](#)).

normal service:

Design Category A lifting devices (for ASME BTH-1): service that involves operation with various weights within the rated load with not more than four operations above 65% of the rated load per 24-hr period.

Design Category B lifting devices (for ASME BTH-1): service that involves operation with various weights within the rated load, averaging less than 65% of rated load.

SECTION 20-0.9: PERSONNEL COMPETENCE

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

SECTION 20-0.10: TRANSLATIONS

20-0.10.1 Technical and Safety-Related Information

The manufacturer shall provide instructions (manuals) for the operation, inspection, testing, maintenance, assembly, and disassembly of the equipment.

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

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

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

- (1) translating the complete paragraph message, instead of word by word
- (2) ensuring grammatical accuracy
- (3) preserving the source document content without omitting or expanding the text
- (4) translating the terminology accurately
- (5) reflecting the level of sophistication of the original document
- (d) The finished translation shall be verified for compliance with (c)(1) through (c)(5) by a qualified person having an understanding of the technical content of the subject matter.

20-0.10.2 Translation of Technical and Safety-Related Information and Manuals

The entities responsible for the operation, use, inspection, testing, and maintenance of the covered equipment shall have the technical and safety-related information available in a language that their employees can read and understand. The entities shall obtain a translation of the original manufacturer's written safety information and manuals from the manufacturer or from a translation service provider if the manuals are not in a language understood by their employees. The translations shall meet the requirements of [paras. 20-0.10.1\(c\)](#) and [20-0.10.1\(d\)](#).

SECTION 20-0.11: REFERENCES TO OTHER CODES AND STANDARDS (25)

The following is a list of publications referenced in this Volume:

- ANSI Z535.4-2011(R2017). Product Safety Signs and Labels. American National Standards Institute.
- ASME B30.9-2021. Slings. The American Society of Mechanical Engineers.
- ASME B30.10-2019. Hooks. The American Society of Mechanical Engineers.
- ASME B30.26-2015 (R2020). Rigging Hardware. The American Society of Mechanical Engineers.
- ASME BTH-1-2023. Design of Below-the-Hook Lifting Devices. The American Society of Mechanical Engineers.
- ISO 7000:2019. Graphical symbols for use on equipment — Registered symbols. International Organization for Standardization.
- ISO 7296:1991. Cranes — Graphic symbols — Part 1: General. International Organization for Standardization.
- NFPA 70-2023. National Electrical Code. National Fire Protection Association.

Chapter 20-1

Structural and Mechanical Lifting Devices

(25) SECTION 20-1.1: SCOPE

Chapter 20-1 applies to the classification, marking, construction, installation, inspection, testing, maintenance, and operation of structural and mechanical lifting devices. Structural and mechanical lifting devices directly support or contain the load, or include a positive connection to the load or other component, such as a hook, or pinned or bolted connection (see Figures 20-1.1-1 through 20-1.1-4). These devices frequently contain components within the scope of Chapters 20-2 through 20-6 for load attachment. Lifting devices that are addressed by other standards for design and safety requirements do not fall within the scope of this volume.

Lifting attachments (e.g., lifting lugs, padeyes, trunnions or similar appurtenances) designed and manufactured as a part of the lifted load and either remain attached to the load or are removed and not reused are not within the scope of ASME B30.20.

SECTION 20-1.2: MARKING, CONSTRUCTION, AND INSTALLATION

(25) 20-1.2.1 Marking

(a) *Rated Load.* The rated load of the lifting device shall be legibly marked on its main structure or on a tag attached to its main structure where it is visible. If the lifting device is made up of several lifting devices, each detachable from the group, these lifting devices shall also be marked with their individual rated loads.

Some lifting devices can be assembled or rigged in numerous configurations, each with a different rated load. A conventional rated load marking may not be practical for such lifting devices. The lifting device manufacturer or a qualified person shall determine a type of marking that will meet the requirements of this section for the approved uses of the device. The information presented in [Nonmandatory Appendix A](#) provides example methods of marking these lifting devices.

When a lifting device label refers the user to additional information such as a load chart or engineering calculations, that information shall be contained in a document with a unique identifier clearly tying the document to the lifting device and shall be readily available to the lifting device user.

(b) *Identification.* Structural and mechanical lifting devices shall be marked with, but not limited to, the following information:

- (1) manufacturer's name and contact information
- (2) serial number (unique unit identifier)
- (3) lifting device weight, if over 100 lb (45 kg)
- (4) cold current (amps) (when applicable)
- (5) rated voltage (when applicable)
- (6) rated load [as described in (a)]
- (7) ASME BTH-1 Design Category
- (8) ASME BTH-1 Service Class

(c) *Repaired or Altered Lifting Devices.* Repaired or altered structural and mechanical lifting devices shall be provided with identification displaying, but not limited to, the following information:

- (1) name and contact information of the repairer or alterer
- (2) repairer's or alterer's unit identification
- (3) lifting device weight (if altered)
- (4) cold current (amps) (if altered)
- (5) rated voltage (if altered)
- (6) rated load (if altered) [as described in (a)]
- (7) ASME BTH-1 Design Category (if altered)
- (8) ASME BTH-1 Service Class (if altered)

This requirement is not applicable to repairs limited to replacement of maintenance parts.

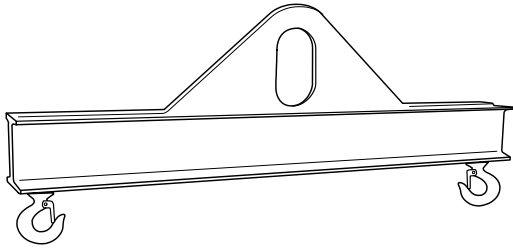
(d) *Product Safety Labels*

(1) Where size and shape of the lifting device allow, lifting devices shall have labels affixed to them in a readable position that include the appropriate signal word, according to ANSI Z535.4-2011, to bring the label to the attention of the operator. The label should include cautionary language identifying hazards and methods for accident prevention, and it should reference instruction manuals for additional information.

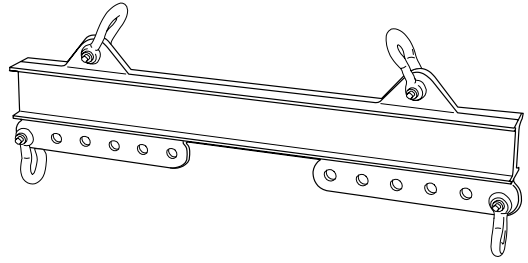
(2) Where size or shape of the lifting device prohibits the inclusion of all or any such markings, a label shall be affixed that refers the user to consult the manufacturer's instruction manual for product safety information.

(e) *Operating Controls.* Each control shall be clearly marked describing resulting motion or function of the lifting device.

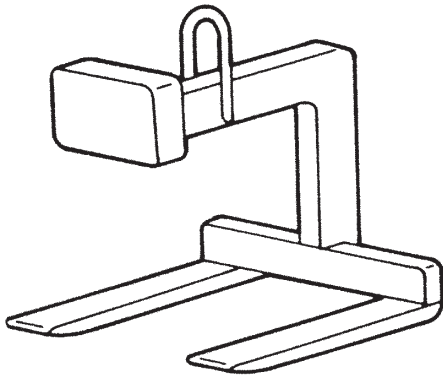
**Figure 20-1.1-1
Structural Lifting Devices**



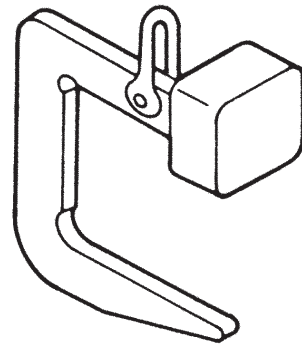
(a) Spreader Beam



(b) Adjustable Spreader Bar

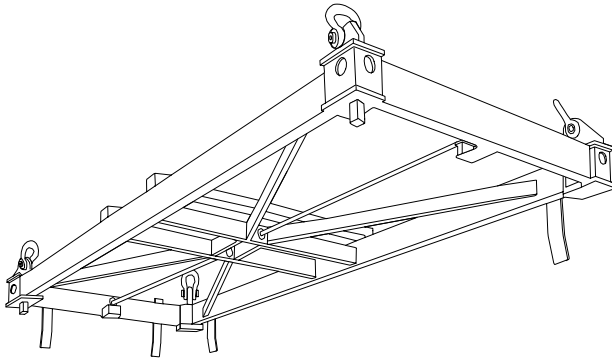


(c) Balanced Pallet Lifting Device

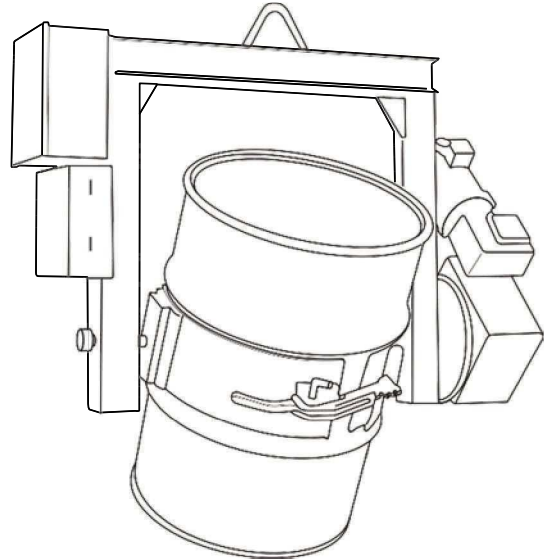


(d) Balanced "C" Lifting Device

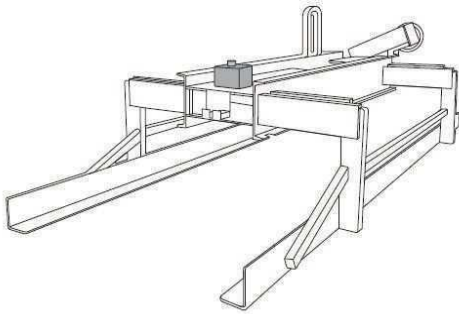
**Figure 20-1.1-2
Mechanical Lifting Devices**



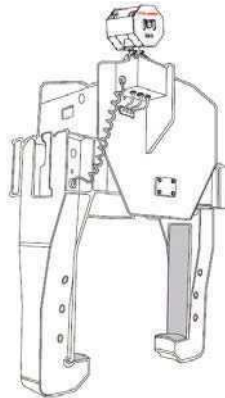
(a) Container Lifting Device



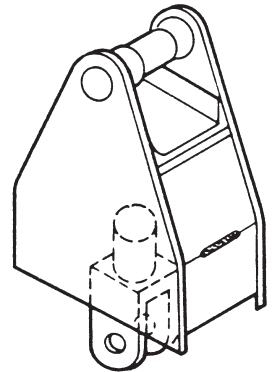
**(b) Drum-Turning Lifting Device
(Supports Ribs of Drum)**



(c) Telescoping Sheet Lifting Device

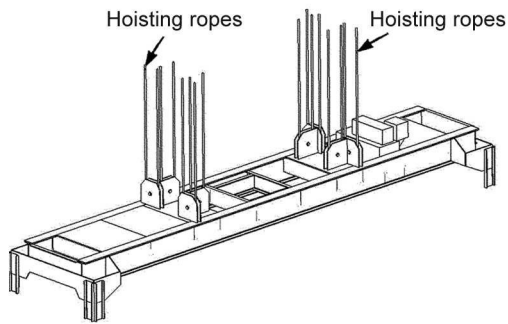


(d) Telescoping Coil Grab

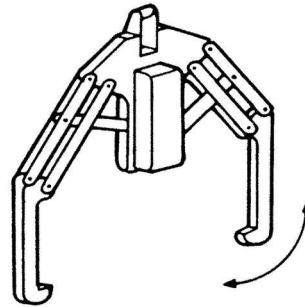


(e) Power Rotator

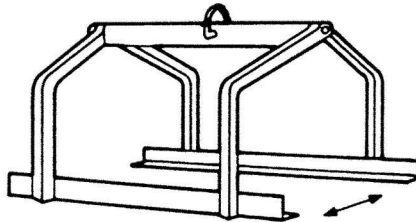
**Figure 20-1.1-3
Mechanical Supporting Lifting Devices**



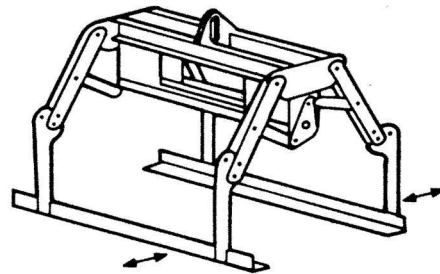
**(a) Lifting Beam
(Reeved Into Hoist Ropes)**



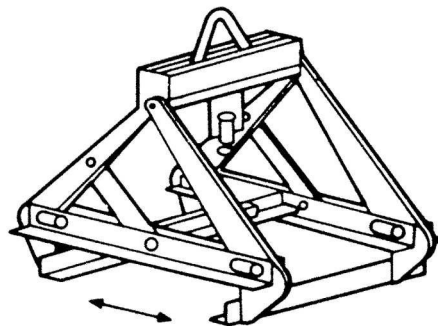
(b) Parallel Coil Grab



(c) Simple Sheet Lifting Device



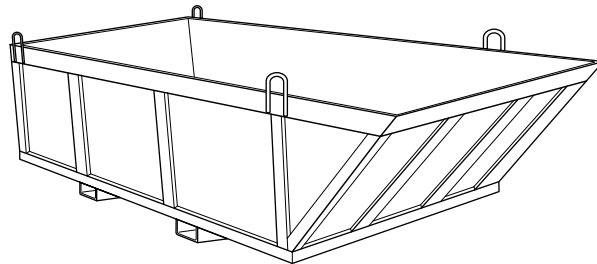
(d) Lock Bar Sheet Lifting Device



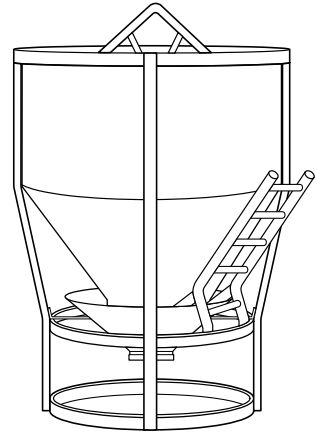
(e) Rack Lifting Device

Figure 20-1.1-4
Load-Containing Lifting Devices

(25)



(a) Skip Pan



(b) Concrete Bucket

20-1.2.2 Construction

The manufacturer shall verify that structural and mechanical lifting devices are designed in accordance with ASME BTH-1.

Structural and mechanical lifting devices shall be designed to ASME BTH-1 Design Category B (static strength criteria) and the proper Service Class (fatigue life criteria) selected for its number of load cycles, unless a qualified person representing the owner, purchaser, or user of the lifting device determines and can demonstrate that ASME BTH-1 Design Category A is appropriate.

Design Category A shall only be designated when the magnitude and variation of loads applied to the lifting device are predictable and do not exceed the rated load, where the loading and environmental conditions are accurately defined, service is not severe, and the anticipated number of load cycles does not exceed Service Class 0.

(a) *Welding.* Welding shall be in accordance with ASME BTH-1, para. 1-4.6.

(b) *Guards for Moving Parts.* Exposed moving parts, such as, but not limited to, gearing, projecting shafts, and chain drives that constitute a hazard under normal operating conditions, should be guarded.

(c) *Electrical Equipment.* External power supply, electrical equipment, and wiring for below-the-hook lifting devices shall be in accordance with ASME BTH-1.

(d) *Alterations.* Structural and mechanical lifting devices may be altered or rerated, provided such alterations are analyzed and approved by the equipment manufacturer or a qualified person. A rerated lifting device, or one whose components have been altered, shall conform to [para. 20-1.2.2](#) and be tested according to [para. 20-1.3.9](#).

The new rated load shall be displayed in accordance with [para. 20-1.2.1](#).

(e) *Slings.* When employed, slings shall meet the requirements of ASME B30.9.

(f) *Hooks.* When employed, hooks shall meet the requirements of ASME B30.10.

(g) *Rigging Hardware.* When employed, rigging hardware shall meet the requirements of ASME B30.26.

20-1.2.3 Installation

(a) The lifting device shall be installed in accordance with the manufacturer's instructions.

(b) The installer shall check for correct rotation of all motors.

SECTION 20-1.3: INSPECTION, TESTING, AND MAINTENANCE

20-1.3.1 Inspection Classification

General. All inspections shall be performed by a designated person. Any deficiencies identified shall be examined and a determination made by a qualified person as to whether they constitute a hazard, and if so, what additional steps need to be taken to address the hazard.

Inspection of slings (ASME B30.9), hooks (ASME B30.10), rigging hardware (ASME B30.26), or other special devices shall comply with the inspection requirements in the applicable volume.

(a) Initial Inspection

(1) New and reinstalled lifting devices shall be inspected prior to initial use to verify compliance with applicable provisions of this Volume.

(2) Altered or repaired lifting devices shall be inspected. The inspection may be limited to the components affected by the alteration or repair, as determined by a qualified person.

(b) *Inspection Intervals.* Inspection procedure for lifting devices in regular service is divided into three general classifications based upon the intervals at which inspection should be performed. The intervals, in turn, are dependent upon the critical components of the lifting devices and the degree of their exposure to wear, deterioration, or malfunction. The three general classifications are herein designated as *every lift*, *frequent*, and *periodic*, with respective intervals between inspections as defined below.

(1) *Every Lift Inspection.* Visual examination by the operator before and during each lift made by the lifting device.

(2) *Frequent Inspection.* Visual examination by the operator or other designated persons 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

(3) *Periodic Inspection.* Documented visual inspection of apparent external conditions to provide the basis for a continuing evaluation.

(-a) normal service for equipment in place — yearly

(-b) heavy service — semiannually

(-c) severe service — quarterly

(-d) special or infrequent service — as recommended by a qualified person before the first such lift and as directed by the qualified person for any subsequent lifts

20-1.3.2 Every Lift Inspection

Structural and mechanical lifting devices shall be inspected by the operator before and/or during every lift for any deficiencies as specifically indicated, including

(a) surface of the load for debris

(b) condition and operation of the controls

(c) condition and operation of the indicators and meters when installed

20-1.3.3 Frequent Inspection (See Also Table 20-1.3.3-1)

(25)

Lifting devices shall be inspected at intervals as defined in [para. 20-1.3.1\(b\)\(2\)](#). Conditions such as those listed in [para. 20-1.3.7](#), or any other condition that may constitute a hazard, shall cause the lifting device to be removed from service. A qualified person shall determine whether any deficiency constitutes a hazard, requires a repair, requires disassembly for further inspection, or will require more

frequent inspection. The lifting device shall not be returned to service until approved by a qualified person.

20-1.3.4 Periodic Inspection (See Also Table 20-1.3.3-1)

Complete inspection of lifting devices shall be performed at intervals as defined in [para. 20-1.3.1\(b\)\(3\)](#). Conditions such as those listed in [para. 20-1.3.7](#), or any other condition that may constitute a hazard, shall cause the lifting device to be removed from service. A qualified person shall determine whether any deficiency constitutes a hazard, requires repair, requires disassembly for further inspection, or will require more frequent inspection. The lifting device shall not be returned to service until approved by a qualified person. The inspection shall be based on the manufacturer's instructions, [para. 20-1.3.7](#), or the recommendations of a qualified person.

20-1.3.5 Lifting Devices Not in Regular Use

A lifting device that has been idle for a period of 1 month to 1 yr shall be inspected in accordance with [para. 20-1.3.3](#) before being placed in service. A lifting device that has been idle for a period of 1 yr or more shall be inspected in accordance with [para. 20-1.3.4](#) before being returned to service.

20-1.3.6 Inspection Records

Dated inspection reports shall be made on critical items such as those listed in [para. 20-1.3.4](#). Records should be available for each periodic inspection and when the lifting device is either altered or repaired.

20-1.3.7 Removal Criteria

A structural and mechanical lifting device shall be removed from service if any conditions (if applicable) such as the following are present (limits established by the manufacturer or qualified person) and would result in unsafe performance. A structural and mechanical lifting device shall only be returned to service when approved by a qualified person.

(a) deformation, cracks, or wear

(b) loose or missing guards, fasteners, covers, stops, or nameplates

(c) excessive pitting or corrosion

(d) excessive nicks or gouges

(e) indications of heat damage

(f) unauthorized welds or modifications

(g) unauthorized replacement components

(h) improper assembly or function

(i) impaired, seized, or bound moving parts

(j) supporting surfaces

(1) contamination

(2) excessive surface wear

Table 20-1.3.3-1
Minimum Inspection for Below-the-Hook Lifting Devices

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 (3)]	Record Quarterly [Note (3)]
Frequent inspection (see para. 20-1.3.3) — structural deformation, cracks, or excessive wear of any part of the lifting device	X	...	X	...	X	...
Loose or missing guards, fasteners, covers, stops, or nameplates	X	...	X	...	X	...
All functional operating mechanisms and automatic hold-and-release mechanisms for misadjustments interfering with operation	X	...	X	...	X	...
Periodic inspection (see para. 20-1.3.4) — loose bolts or fasteners	...	X	...	X	...	X
Cracked or worn gears, pulleys, sheaves, sprockets, bearings, drive chains, and belts	...	X	...	X	...	X
Excessive wear of linkages and other mechanical parts	...	X	...	X	...	X
Excessive wear at hoist hooking points and load support clevises, or pins	...	X	...	X	...	X

NOTES:

(1) By operator or designated person with records not required.

(2) Visual inspection by designated person making records of apparent external conditions to provide the basis for a continuing evaluation.

(3) As in Note (2), unless external conditions indicate that disassembly should be done to permit detailed inspection.

(3) lack of integrity of the supporting surface material

(4) lack of bond between supporting surface material and metal backing

(k) damaged, distorted, or worn threads, including foreign material on the threads

(l) missing, damaged, or unreadable gauges if so equipped

(m) missing or illegible operating control markings or product safety labels

(n) other conditions, including visible damage, that cause doubt as to continued safe use

20-1.3.8 Repairs

Deficiencies disclosed by the inspection requirements of Section 20-1.3 shall be corrected according to the procedures outlined in para. 20-1.3.10 before operation of the lifting device is resumed, unless a qualified person determines the deficiency does not constitute a hazard. Repairs of slings (ASME B30.9), hooks (ASME B30.10), rigging hardware (ASME B30.26), or other special devices shall comply with repair requirements in the applicable volumes or standards.

20-1.3.9 Testing

20-1.3.9.1 Operational Tests

(a) New and reinstalled lifting devices shall be tested by a qualified person, or a designated person under the direction of the manufacturer or a qualified person, prior to initial use to verify compliance with applicable provisions of this Volume, including, but not limited to, the following:

(1) *Moving Parts.* Lifting devices with moving parts shall be tested to determine that the lifting device operates in accordance with manufacturer's instructions.

(2) *Latches.* Lifting devices with manually operated or automatic latches shall be tested to determine that the latch operates in accordance with manufacturer's instructions.

(b) Altered or repaired lifting devices shall be tested by a qualified person or a designated person under the direction of the manufacturer or a qualified person. This test may be limited to the components affected by the alteration or repair, as determined by a qualified person with guidance from the manufacturer.

(c) All indicator lights, gauges, horns, bells, alarms, pointers, and other warning devices shall be tested.

(d) Dated reports of all operational tests shall be filed.

(25) 20-1.3.9.2 Load Test

(a) Prior to initial use, all new, altered, or repaired lifting devices should be tested and inspected. If performed, tests shall be done under the direction of the manufacturer or a qualified person and a written report be furnished by such a person, confirming the rated load of the lifting device. Test loads shall be 125% +5%/–0% of the rated load unless otherwise recommended by the manufacturer or a qualified person. Test reports should be available.

(b) The load test, if made, shall at a minimum consist of the following operations:

(1) Hoist the test load a sufficient distance to ensure the load is supported by the lifting device, or apply the required load if the test is made using a testing machine.

(2) The load test shall develop all forces, including those due to gravity, (e.g., tension, compression, shear, bending moment) in all components based on the design requirements defined in ASME BTH-1.

(3) If the lifting device can be used in multiple configurations, load testing shall be defined by the manufacturer or a qualified person that will subject the load carrying components of the lifting device to a load test force or combination of forces that correspond to the maximum forces that are expected to occur during the use of the lifting device.

(4) Load testing of the lifting device may be performed on either individual components or complete assemblies.

(5) After the test load is released, visually inspect the lifting device for deformation, cracks, or other defects.

(c) Tests of altered or repaired lifting devices may be limited to the components affected by the alteration or repair, as determined by a qualified person with guidance from the manufacturer.

20-1.3.10 Maintenance

(a) *Maintenance Program.* A maintenance program shall be established and be based on recommendations made by the lifting device manufacturer. If a qualified person determines it is appropriate, the program should also include that individual's additional recommendations based on a review of the lifting device application and operations.

(b) Maintenance Procedure

(1) Before adjustments and repairs are started on a lifting device, the following precautions shall be taken:

(-a) All sources of power shall be disconnected, locked out, and tagged "Out of Service."

(-b) A lifting device removed from service for repair shall be tagged "Out of Service."

(-c) Fluid pressure shall be relieved from all circuits before loosening or removing fluid power components.

(2) Only designated persons shall perform adjustments, repairs, and tests when required.

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

(4) After adjustments and repairs have been made, the lifting device shall not be returned to service until it has been inspected according to [para. 20-1.3.4](#).

(5) Dated records of repairs and replacements should be made.

SECTION 20-1.4: OPERATION**20-1.4.1 Operators**

Below-the-hook lifting devices shall be operated only by trained, designated persons.

20-1.4.2 Qualifications**(25)**

Qualifications for operators of below-the-hook lifting devices are as follows:

(a) The operator shall be instructed in the use of the device by a designated person. Instructions should include, but not be limited to, the following:

(1) application of the lifting device to the load and material-handling device, and adjustments, if any, that adapt the lifting device to various sizes or kinds of loads

(2) instructions in any special operations or precautions

(3) the manufacturer's suggested operating procedures

(4) condition of the load itself required for operation of the lifting device, such as, but not limited to, balance, surface cleanliness, flatness, bending, and load thickness

(5) storage of the lifting device to protect it from damage

(6) not exceeding the rated load of the lifting device nor the rated load of the hoisting equipment by the combined weight of the load, the lifting device, and rigging

(7) the proper attachment of adapters to lifting device for special load handling

(b) The operator shall demonstrate the ability to operate the lifting device as instructed before assuming responsibility for using the lifting device.

(c) The operator shall demonstrate an understanding of standard hand signals when applicable.

20-1.4.3 Responsibilities

While the organizational structure of various projects may differ, the following roles are described here for purposes of delineating responsibilities. All responsibilities listed below shall be assigned in the work site organization. (A single individual may perform one or more of these roles.)

operator: directly controls the lifting device's functions.

owner: has custodial control of a lifting device by virtue of lease or ownership.

These persons and roles may or may not match the persons and roles associated with the hoisting equipment in use.

(25) **20-1.4.3.1 Responsibilities of the Lifting Device Owner.** The responsibilities of the lifting device owner shall include the following:

(a) providing a lifting device, and all necessary components specified by the manufacturer, that meets the requirements of [Sections 20-1.2](#) and [20-1.3](#) as well as specific job requirements.

(b) providing all applicable operating instructions.

(c) providing field assembly, disassembly (if applicable), operation and maintenance information, and warning decals and placards installed as prescribed by the lifting device manufacturer.

(d) establishing an inspection, testing, and maintenance program in accordance with [Section 20-1.3](#).

(e) using designated personnel to perform the required maintenance, repair, and inspections.

(f) ensuring that the lifting device is in proper operating condition prior to initial use at the work site by the following:

(1) verifying that all inspections have been performed as required by [Section 20-1.3](#).

(2) verifying that the lifting device has the necessary rated load to perform the proposed lifting operations in the planned configuration.

(3) verifying the lifting device has the necessary rated load markings to perform the proposed lifting operations in the planned configuration [also see (f)(2)]. [Nonmandatory Appendix A](#) provides additional guidance for markings of multiple-rated-load lifting devices.

(g) using operators that meet the requirements of [para. 20-1.4.2](#).

(h) ensuring that all personnel involved in maintenance, repair, assembly, disassembly, and inspection are aware of their responsibilities, assigned duties, and the associated hazards.

(i) determining if additional regulations are applicable to lifting device operations.

(j) ensuring that conditions that may adversely affect lifting device operations are addressed. Such conditions include, but are not limited to, the following:

(1) wind velocity or gusting winds

(2) precipitation

(3) fog

(4) extreme temperatures

(5) lighting

(k) addressing safety concerns raised by the operator or other personnel and being responsible if the operator and a qualified person decide to overrule those concerns and direct lifting device operations to continue. (In all

cases, the manufacturer's criteria for safe operation and the requirements of this Volume shall be followed.)

20-1.4.3.2 Responsibilities of Operators. The operator shall be responsible for the following listed items. The operator shall not be responsible for hazards or conditions that are not under the operator's direct control and that adversely affect operation of the lifting device. Whenever the operator has doubt as to the safety of lifting device operations, the operator shall place the load in a safe condition and stop the lifting device's functions in a controlled manner. Use of the lifting device shall resume only after safety concerns have been addressed or the continuation of lifting device operations is directed by the owner.

The operator's responsibilities shall include the following:

(a) reviewing the requirements for the lifting device with the owner before operations.

(b) knowing what types of site conditions could adversely affect the operation of the lifting device and consulting with the owner concerning the possible presence of those conditions.

(c) understanding and applying the information contained in the lifting device manufacturer's operating manual.

(d) understanding the lifting device's functions and limitations as well as its particular operating characteristics.

(e) ensuring an inspection is performed prior to every lift as specified in [para. 20-1.3.2](#).

(f) promptly reporting the need for any adjustments or repairs to a designated person.

(g) following applicable lock out/tag out procedures.

(h) not operating the lifting device when physically or mentally unfit.

(i) ensuring that all controls are in the off or neutral position and that all personnel are in the clear before energizing the lifting device.

(j) not engaging in any practice that will divert the operator's attention while operating the lifting device.

(k) testing the lifting device function controls that will be used and operating the lifting device only if those function controls respond properly.

(l) operating the lifting device's functions, under normal operating conditions, in a smooth and controlled manner.

(m) knowing and following the procedures specified by the manufacturer or approved by a qualified person for assembly, disassembly, setting up, and reeving or rigging of the lifting device.

(n) considering all known factors that might affect the lifting device rated load and informing the owner of the need to make appropriate adjustments.

(o) understanding basic load attachment procedures.

(p) responding only to instructions from designated persons. However, the operator shall obey a stop order at all times, no matter who gives it.

(q) ensuring that all personnel shall stay clear of the load.

(25) 20-1.4.4 Lifting Device Operating Practices

(a) Lifting devices shall be operated only by the following qualified personnel:

(1) designated persons

(2) trainees under the supervision of a designated person; the number of trainees permitted to be supervised by a single designated person, the physical location of the designated person while supervising, and the type of communication required between the designated person and the trainee shall be determined by a qualified person

(3) maintenance and test personnel, when it is necessary in the performance of their duties

(4) inspectors (lifting devices)

(b) Ensure the weight of the load and its approximate center of gravity have been obtained, provided, or calculated.

(c) The lifting device shall not be loaded in excess of its rated load or handle any load for which it is not designed.

(d) Properly attach the lifting device to the hook, shackle, or other load handling device.

(e) The lifting device shall be applied to the load in accordance with the instruction manual.

(f) Before lifting, the operator shall make sure that lifting device ropes or chains are not kinked and that multiple part lines are not twisted around each other.

(g) Care should be taken to make certain the load is correctly distributed for the lifting device being used.

(h) The temperature of the load should not exceed the maximum allowable limits of the lifting device.

(i) Verify that the load is well secured and properly balanced in the lifting device when it is initially lifted.

(j) Do not allow load or lifting device to come into contact with any obstruction.

(k) The operator shall ensure that the lifting device is adequately protected from damage during use.

(l) The lifting device shall not be used for side pulls or sliding the load unless specifically authorized by a qualified person.

(m) The operator shall land any attached load and store the lifting device before leaving the lifting device. The operator shall not leave suspended loads unattended.

(n) The operator shall not ride or allow others to ride loads or the lifting device.

(o) The operation of the lifting device shall be observed during use. Any deficiency observed shall be examined by a designated person. If the deficiency constitutes a hazard, the lifting device shall be removed from service and tagged "Out of Service." Any indication of a hazardous condition shall be reported to a qualified person for evaluation.

(p) Loads shall be guided in such a manner as to avoid endangering hands or other body parts as the load is moved, or if it drops.

20-1.4.5 Miscellaneous Operating Practices

(a) An operator shall not use a lifting device that is tagged "Out of Service" or otherwise designated as nonfunctioning.

(b) "Out of Service" tags on lifting devices shall not be removed without the approval of the person placing them or a designated person.

(c) The lifting device, when not in use, should be stored at an assigned location.

(d) Caution should be taken that operating markings or tags shall not be removed or defaced. Missing or illegible markings or tags shall be replaced.

SECTION 20-1.5: INSTRUCTION MANUALS

Operating instructions and maintenance and parts information shall be furnished by the manufacturer.

Chapter 20-2

Vacuum Lifting Devices

SECTION 20-2.1: SCOPE

Chapter 20-2 applies to the marking, construction, installation, inspection, testing, maintenance, and operation of vacuum below-the-hook lifting devices. The provisions of Chapter 20-2 apply to all power-operated and mechanically operated vacuum lifting and manipulating devices, except those vacuum lifting devices handling porous materials that require special design considerations (see Figure 20-2.1-1).

SECTION 20-2.2: MARKING, CONSTRUCTION, AND INSTALLATION

20-2.2.1 Marking

(a) *Rated Load.* The rated load of the lifting device and each pad shall be legibly marked on its main structure or on a tag attached to its main structure where it is visible. This marking shall refer to the instruction manual for information relating to decreases in rating due to additional considerations.

(b) *Identification.* Vacuum lifting devices shall be marked with, but not limited to, the following information:

- (1) manufacturer's name and contact information
- (2) serial number (unique unit identifier)
- (3) lifting device weight
- (4) electrical power requirements (when applicable)
- (5) pressure and volume of compressed air required (when applicable)

(6) rated load [as described in (a)]

(7) ASME BTH-1 Design Category

(8) ASME BTH-1 Service Class

(c) *Repaired or Altered Lifting Devices.* Repaired or altered vacuum lifting devices shall be provided with identification displaying, but not limited to, the following information:

- (1) name and contact information of the repairer or alterer
- (2) repairer's or alterer's unit identification
- (3) lifting device weight (if altered)
- (4) electrical power requirements (if altered)
- (5) pressure and volume of compressed air required (if altered)
- (6) rated load (if altered) [as described in (a)]
- (7) ASME BTH-1 Design Category (if altered)
- (8) ASME BTH-1 Service Class (if altered)

This requirement is not applicable to repairs limited to replacement of maintenance parts.

(d) *Product Safety Labels*

(1) Where size and shape of the lifting device allow, lifting devices shall have labels affixed to them in a readable position that include the appropriate signal word, according to ANSI Z535.4-2011, to bring the label to the attention of the operator. The label should include cautionary language identifying hazards, methods for accident prevention, and refer to instruction manuals for additional information.

(2) Where size or shape of the lifting device prohibits the inclusion of all or any such markings, a label shall be affixed referring the user to consult the manufacturer's instruction manual for product safety information.

(e) *Operating Controls*

(1) If the vacuum lifting device has manual shutoff valves that control pads or groups of pads, the valves shall be marked to show operating position. Should this marking be some type of coding, then a label or tag shall be attached at or near the valve that explains such markings.

(2) Each control shall be clearly marked describing resulting motion or function of the lifting device.

20-2.2.2 Construction

(a) *Vacuum Lifting Device Design.* The manufacturer shall verify that vacuum lifting devices are designed by or under the supervision of a qualified person. The design shall be in accordance with ASME BTH-1.

(b) *Welding.* Welding shall be in accordance with ASME BTH-1, para. 1-4.6.

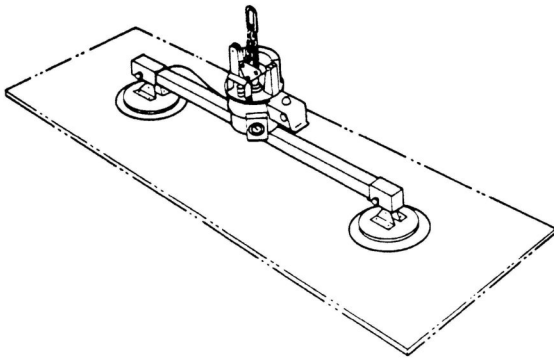
(c) *Electrical Equipment.* External power supply, electrical equipment, and wiring for below-the-hook lifting devices shall be in accordance with ASME BTH-1.

(d) *Alterations.* Vacuum lifting devices may be altered or rerated, provided such alterations are analyzed and approved by the equipment manufacturer or a qualified person. A rerated lifting device or one whose components have been altered shall conform to this paragraph and be tested according to para. 20-2.3.9. The new rated load shall be displayed in accordance with para. 20-2.2.1(a).

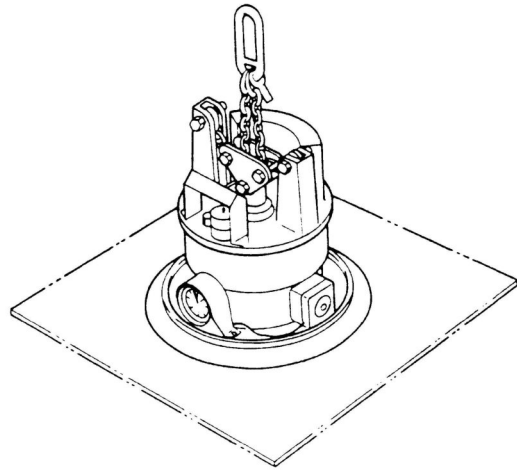
(e) *Slings.* When employed, slings shall meet the requirements of ASME B30.9.

(f) *Hooks.* When employed, hooks shall meet the requirements of ASME B30.10.

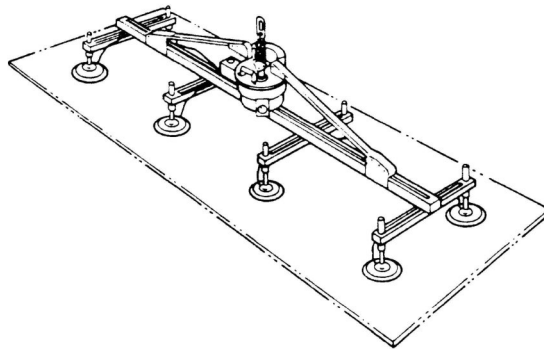
**Figure 20-2.1-1
Vacuum Lifting Devices**



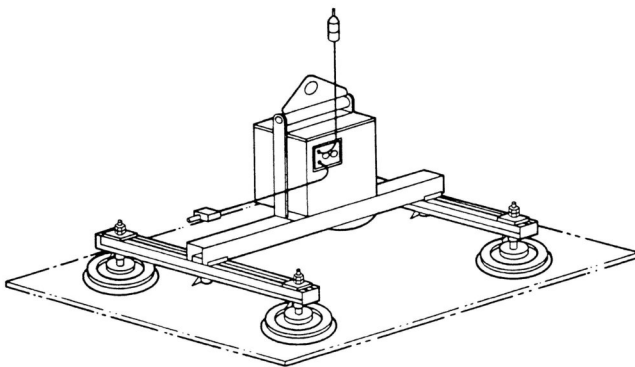
(a) Two-Pad Mechanical Vacuum Lifting Device



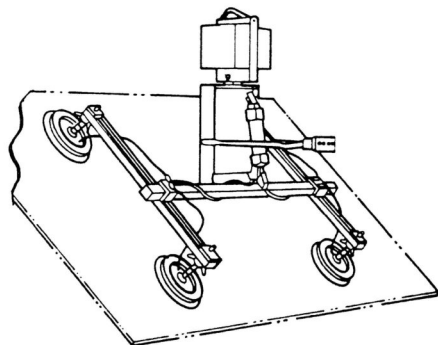
(b) Single-Pad Mechanical Vacuum Lifting Device



(c) Multiple-Pad Mechanical Vacuum Lifting Device



(d) Four-Pad Powered Vacuum Lifting Device



(e) Four-Pad Powered Vacuum Lifting Device Manipulator

(g) *Rigging Hardware*. When employed, rigging hardware shall meet the requirements of ASME B30.26.

20-2.2.3 Installation

(a) The vacuum lifting device shall be assembled and installed in accordance with the manufacturer's instructions.

(b) The installer shall ensure that the power supply is the same as that shown on the nameplate.

(c) The electrical power supply to the vacuum lifting device shall be connected to the line side of the crane disconnect or to an independent circuit.

(d) The installer shall check for correct rotation of all motors.

(e) Prior to initial use, the lifting device shall be tested per [para. 20-2.3.9](#).

(f) Operating instructions, maintenance, and parts information shall be furnished by the manufacturer.

(g) External power supply and electrical equipment for below-the-hook lifting devices shall comply with NFPA 70.

SECTION 20-2.3: INSPECTION, TESTING, AND MAINTENANCE

20-2.3.1 Inspection Classification

General. All inspections shall be performed by a designated person. Any deficiencies identified shall be examined and a determination made by a qualified person as to whether they constitute a hazard, and, if so, what additional steps need to be taken to address the hazard.

Inspection of slings (ASME B30.9), hooks (ASME B30.10), rigging hardware (ASME B30.26), or other special devices shall comply with the inspection requirements in the applicable volume.

(a) Initial Inspection

(1) New and reinstalled vacuum lifting devices shall be inspected prior to initial use to verify compliance with applicable provisions of this Volume.

(2) Altered or repaired vacuum lifting devices shall be inspected. The inspection may be limited to the components affected by the alteration or repair, as determined by a qualified person.

(b) *Inspection Intervals*. Inspection procedure for vacuum lifting devices in regular service is divided into three general classifications, based upon the intervals at which inspection should be performed. The intervals, in turn, are dependent upon the nature of the critical components of the vacuum lifting device and the degree of their exposure to wear, deterioration, or malfunction. The three general classifications are designated as *every lift*, *frequent*, and *periodic*, with respective intervals between inspections as defined below.

(1) *Every Lift Inspection*. Visual examination by the operator before and during each lift made by the vacuum lifting device.

(2) *Frequent Inspection*. Visual examination by the operator or other designated persons 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

(3) *Periodic Inspection*. Documented visual inspection of apparent external conditions to provide the basis for a continuing evaluation.

(-a) normal service for equipment in place — yearly

(-b) heavy service — semiannually

(-c) severe service — quarterly

(-d) special or infrequent service — as recommended by a qualified person before the first lift and as directed by the qualified person for any subsequent lifts

20-2.3.2 Every Lift Inspection

Vacuum lifting devices shall be inspected by the operator before and/or during every lift for any deficiencies as specifically indicated, including

(a) surface of the load for debris

(b) seal of the vacuum pad for debris

(c) condition and operation of the controls

(d) condition and operation of the indicators, meters, and pumps when installed

20-2.3.3 Frequent Inspection

(25)

Vacuum lifting devices shall be inspected at intervals as defined in [para. 20-2.3.1\(b\)\(2\)](#). Conditions such as those listed in [para. 20-2.3.7](#), or any other condition that may constitute a hazard, shall cause the vacuum lifting devices to be removed from service. A qualified person shall determine whether any deficiency constitutes a hazard, requires repair, requires disassembly for further inspection, or will require more frequent inspection. The vacuum lifting device shall not be returned to service until approved by a qualified person.

20-2.3.4 Periodic Inspection

Complete inspections of the vacuum lifting device shall be performed at intervals as defined in [para. 20-2.3.1\(b\)\(3\)](#). Conditions such as those listed in [para. 20-2.3.7](#), or any other condition that may constitute a hazard, shall cause the vacuum lifting device to be removed from service. A qualified person shall determine whether any deficiency constitutes a hazard, requires repair, requires disassembly for further inspection, or will require more frequent inspection. The vacuum lifting device shall not be returned to service until approved by a qualified person. The inspection shall be based on the manufacturer's instructions, [para. 20-2.3.7](#), or the recommendation of a qualified person.

20-2.3.5 Vacuum Lifting Devices Not in Regular Use

A vacuum lifting device that has been idle for a period of 1 month to 1 yr shall be inspected in accordance with [para. 20-2.3.3](#) before being placed in service. A vacuum lifting device that has been idle for a period of 1 yr or more shall be inspected in accordance with [para. 20-2.3.4](#) before being returned to service.

20-2.3.6 Inspection Records

Dated inspection reports shall be made on critical items such as those listed in [para. 20-2.3.4](#). Records should be available for each periodic inspection and when the vacuum lifting device is either altered or repaired.

20-2.3.7 Removal Criteria

A vacuum lifting device shall be removed from service if conditions (if applicable) such as the following are present (limits established by the manufacturer or qualified person) and shall only be returned to service when approved by a qualified person:

- (a) deformation, cracks, or wear
- (b) loose or missing guards, fasteners, covers, stops, or nameplates
- (c) excessive pitting or corrosion
- (d) excessive nicks or gouges
- (e) indications of heat damage
- (f) unauthorized welds or modifications
- (g) unauthorized replacement components
- (h) improper assembly or function
- (i) impaired, seized, or bound moving parts
- (j) vacuum leaks greater than manufacturer specification [see [para. 20-2.3.9.1\(c\)](#)]
- (k) vacuum pads
 - (1) contamination
 - (2) excessive surface wear
 - (3) lack of integrity of the seal material
 - (4) reduced coefficient of friction
- (l) damaged or distorted pins
- (m) vacuum hoses and fittings
 - (1) loose or disconnected hoses
 - (2) kinked, collapsed, or damaged hoses
 - (3) dirty or missing filters
- (n) deformed, broken, or missing components
- (o) missing or illegible operation control markings or product safety labels
- (p) other conditions, including visible damage, that cause doubt as to continued safe use
- (q) inability to achieve designated minimum vacuum level
- (r) incorrect operation or function of any controls, indicators, or warning devices

20-2.3.8 Repairs

Deficiencies disclosed by the inspection requirements of [Section 20-2.3](#) shall be corrected according to the procedures outlined in [para. 20-2.3.10](#) before operation of the vacuum lifting device is resumed, unless a qualified person determines the deficiency does not constitute a hazard. Repairs of slings (ASME B30.9), hooks (ASME B30.10), rigging hardware (ASME B30.26), or other special devices shall comply with repair requirements in the applicable volumes or standards.

20-2.3.9 Testing

20-2.3.9.1 Operational Tests

(a) New and reinstalled lifting devices shall be tested by, or under the direction of, the manufacturer or a qualified person prior to initial use to verify compliance with applicable provisions of this Volume, including, but not limited to, the following:

- (1) moving parts
- (2) latches
- (3) stops
- (4) limit switches
- (5) control devices
- (6) vacuum pad seals
- (7) vacuum lines

(b) Altered or repaired lifting devices shall be tested by a qualified person or a designated person under the direction of the manufacturer or a qualified person. This test may be limited to the components affected by the alteration or repair, as determined by a qualified person with guidance from the manufacturer.

(c) The seals and connections shall be tested for leaks by attaching a smooth, nonporous, clean material to the vacuum pad or pads and then stopping the vacuum source. Vacuum level in the system shall not decrease by more than the manufacturer's specified rate.

(d) All indicator lights, gauges, horns, bells, pointers, and other warning devices and vacuum level indicators shall be tested by the same method as in [para. 20-2.3.9.2](#).

(e) Dated reports of all operational tests shall be filed.

20-2.3.9.2 Load Test

(25)

(a) Prior to initial use, all new, altered, or repaired vacuum lifting devices shall be load tested and inspected by a qualified person or a designated person under the direction of the manufacturer or a qualified person. A written report shall be prepared by the qualified person and placed on file, confirming the rated load of the vacuum lifting device. Test loads shall be 125% +5%/–0% of the rated load of the system, unless otherwise recommended by the manufacturer or a qualified person.

(b) Altered or repaired vacuum lifting devices shall be tested by, or under the direction of, a qualified person. This test may be limited to the components affected by the alteration or repair, as determined by a qualified person with guidance from the manufacturer.

(c) The load test shall consist of one of the following procedures:

(1) *Actual Load Test*

(-a) Attach pads to the designated test load.

(-b) Raise the test load a minimum distance to ensure the load is supported by the vacuum lifting device.

(-c) Hold the load for 2 min.

(-d) Lower the load for release.

(2) *Simulated Load Test.* Using a test fixture, apply forces to all load-bearing components, either individually or in assemblies, equivalent to the force encountered by the components if they were supporting a load that was 125% of the rated load.

(d) The load test shall develop all forces, including those due to gravity (e.g., tension, compression, shear, bending moment), in all components based on the design requirements defined in ASME BTH-1.

(e) After the test, the vacuum lifting device shall be visually inspected. Any condition that constitutes a hazard shall be corrected before the lifting device is placed in service. If the correction affects the structure, then the lifting device shall be retested.

20-2.3.10 Maintenance

(a) *Maintenance Program.* A maintenance program shall be established and be based on recommendations made by the vacuum lifting device manufacturer. If a qualified person determines it is appropriate, the program should also include that individual's additional recommendations based on a review of the vacuum lifting device application and operations.

(b) *Maintenance Procedure*

(1) Before adjustments and repairs are started on a vacuum lifting device, the following precautions shall be taken:

(-a) Locate the vacuum lifting device where it will cause the least interference with other operations in the area.

(-b) All sources of power shall be disconnected, locked out, and tagged "Out of Service."

(-c) Relieve fluid pressure from all circuits before loosening or removing fluid power components.

(2) Only designated personnel shall perform adjustments, repairs, and tests when required.

(-a) Provisions should be made for designated persons to work on energized equipment when adjustments and tests are required.

(-b) All moving parts of the vacuum lifting device for which lubrication is specified should be regularly lubricated. The manufacturer's recommendations as to points and frequency of lubrication, maintenance of lubrication levels, and types of lubricant should be used.

(-c) Adjustments shall be maintained to assure correct functioning of components.

(-d) Repairs or replacements shall be made as needed.

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

(4) After adjustments and repairs have been made, the vacuum lifting device shall not be returned to service until it has been inspected according to [para. 20-2.3.4](#).

(5) Dated records of repairs and replacements should be made.

SECTION 20-2.4: OPERATION

20-2.4.1 Operators

Below-the-hook lifting devices shall be operated only by trained, designated persons.

20-2.4.2 Qualifications

(25)

Qualifications for operators of below-the-hook lifting devices are as follows:

(a) The operator shall be instructed in the use of the device by a designated person. Instructions should include, but not be limited to, the following:

(1) application of the lifting device to the load and material-handling device, and adjustments, if any, that adapt the lifting device to various sizes or kinds of loads

(2) any special operations or precautions

(3) the manufacturer's suggested operating procedures

(4) condition of the load required for operation of the lifting device, such as, but not limited to, balance, surface cleanliness, flatness, bending, and load thickness

(5) storage of the lifting device to protect it from damage

(6) not exceeding the rated load of the lifting device nor the rated load of the hoisting equipment by the combined weight of the load, the lifting device, and rigging

(7) charging of the battery (if required)

(8) the purpose of indicators, meters, or alarms on the vacuum lifting device

(9) the proper attachment of adapters to the lifting device for special load handling

(b) The operator shall demonstrate the ability to operate the lifting device as instructed before assuming responsibility for using the lifting device.

(c) The operator shall demonstrate an understanding of standard hand signals when applicable.

20-2.4.3 Responsibilities

While the organizational structure of various projects may differ, the following roles are described here for purposes of delineating responsibilities. All responsibilities listed below shall be assigned in the work site organization. (A single individual may perform one or more of these roles.)

operator: directly controls the lifting device's functions.

owner: has custodial control of a lifting device by virtue of lease or ownership.

These persons and roles may or may not match the persons and roles associated with the hoisting equipment in use.

(25) 20-2.4.3.1 Responsibilities of the Lifting Device Owner. The responsibilities of the lifting device owner shall include the following:

(a) providing a lifting device, and all necessary components specified by the manufacturer, that meets the requirements of [Sections 20-2.2](#) and [20-2.3](#) as well as specific job requirements.

(b) providing all applicable operating instructions.

(c) providing field assembly, disassembly (if applicable), operation and maintenance information, and warning decals and placards installed as prescribed by the lifting device manufacturer.

(d) establishing an inspection, testing, and maintenance program in accordance with [Section 20-2.3](#).

(e) using designated personnel to perform the required maintenance, repair, and inspections.

(f) ensuring that the lifting device is in proper operating condition prior to initial use at the work site by the following:

(1) verifying that all inspections have been performed as required by [Section 20-2.3](#)

(2) verifying that the lifting device has the necessary rated load to perform the proposed lifting operations in the planned configuration

(g) using operators that meet the requirements of [para. 20-2.4.2](#).

(h) ensuring that all personnel involved in maintenance, repair, assembly, disassembly, and inspection are aware of their responsibilities, assigned duties, and the associated hazards.

(i) determining if additional regulations are applicable to lifting device operations.

(j) ensuring that conditions that may adversely affect lifting device operations are addressed. Such conditions include, but are not limited to, the following:

(1) wind velocity or gusting winds

(2) precipitation

(3) fog

(4) extreme temperatures

(5) lighting

(k) addressing safety concerns raised by the operator or other personnel and being responsible if the operator and a qualified person decide to overrule those concerns and direct lifting device operations to continue. (In all cases, the manufacturer's criteria for safe operation and the requirements of this Volume shall be followed.)

20-2.4.3.2 Responsibilities of Operators. The (25) operator shall not be responsible for hazards or conditions that are not under the operator's direct control and that adversely affect operation of the lifting device. Whenever the operator has doubt as to the safety of lifting device operations, the operator shall place the load in a safe condition and stop the lifting device's functions in a controlled manner. Use of the lifting device shall resume only after safety concerns have been addressed or the continuation of lifting device operations is directed by the owner.

The operator's responsibilities shall include the following:

(a) reviewing the requirements for the lifting device with the owner before operations.

(b) knowing what types of site conditions could adversely affect the operation of the lifting device and consulting with the owner concerning the possible presence of those conditions.

(c) understanding and applying the information contained in the lifting device manufacturer's operating manual.

(d) understanding the lifting device's functions and limitations as well as its particular operating characteristics.

(e) ensuring an inspection is performed prior to every lift as specified in [para. 20-2.3.2](#).

(f) promptly reporting the need for any adjustments or repairs to a designated person.

(g) following applicable lock out/tag out procedures.

(h) not operating the lifting device when physically or mentally unfit.

(i) ensuring that all controls are in the off or neutral position and that all personnel are in the clear before energizing the lifting device.

(j) not engaging in any practice that will divert the operator's attention while operating the lifting device.

(k) testing the lifting device function controls that will be used and operating the lifting device only if those function controls respond properly.

(l) operating the lifting device's functions, under normal operating conditions, in a smooth and controlled manner.

(m) knowing and following the procedures specified by the manufacturer or approved by a qualified person for assembly, disassembly, setting up, and reeving or rigging of the lifting device.

(n) considering all known factors that might affect the lifting device's lifting capacity and informing the owner of the need to make appropriate adjustments.

- (o) understanding basic load attachment procedures.
- (p) responding only to instructions from designated persons. However, the operator shall obey a stop order at all times, no matter who gives it.
- (q) ensuring that all personnel shall stay clear of the load.

(25) 20-2.4.4 Lifting Device Operating Practices

(a) Lifting devices shall be operated only by the following qualified personnel:

- (1) designated persons
- (2) trainees under the supervision of a designated person; the number of trainees permitted to be supervised by a single designated person, the physical location of the designated person while supervising, and the type of communication required between the designated person and the trainee shall be determined by a qualified person
- (3) maintenance and test personnel, when it is necessary in the performance of their duties
- (4) inspectors (lifting devices)

(b) Ensure the weight of the load and its approximate center of gravity have been obtained, provided, or calculated.

(c) The lifting device shall not be loaded in excess of its rated load or handle any load for which it is not designed.

(d) Properly attach the lifting device to the hook, shackle, or other load handling device.

(e) The lifting device shall be applied to the load in accordance with the instruction manual.

(f) Before lifting, the operator shall make sure that lifting device ropes or chains are not kinked, and that multiple part lines are not twisted around each other.

(g) Care should be taken to make certain the load is correctly distributed for the lifting device being used.

(h) The temperature of the load should not exceed the maximum allowable limits of the lifting device.

(i) Verify that the load is well secured and properly balanced in the lifting device when it is initially lifted.

(j) Do not allow the load to come into contact with any obstruction.

(k) The operator shall ensure that the lifting device is adequately protected from damage during use.

(l) The lifting device shall not be used for side pulls or sliding the load unless specifically authorized by a qualified person.

(m) If power goes off while making a lift, the operator shall immediately warn all persons in the vicinity of the lifting device and land the load if at all possible to do so.

(n) The vacuum lines shall be free from kinks and twists, and shall not be wrapped around or looped over portions of the lifting device that will move during the lift.

(o) The pad contact surface shall be clean and free of loose particles.

(p) Before starting to lift, verify that the vacuum level indicator has reached the required level.

(q) Before starting to lift, raise the load a few inches to establish that the vacuum lifting device has been correctly applied and that a stable vacuum level exists.

(r) The operator shall land any attached load and store the lifting device before leaving the lifting device. The operator shall not leave suspended loads unattended.

(s) The operator shall not ride or allow others to ride loads or the lifting device.

(t) The operation of the lifting device shall be observed during use. Any deficiency observed shall be examined by a designated person. If the deficiency constitutes a hazard, the lifting device shall be removed from service and tagged "Out of Service." Any indication of a hazardous condition shall be reported to a qualified person for evaluation.

(u) Loads shall be guided in such a manner as to avoid endangering hands or other body parts as the load is moved, or if it drops.

20-2.4.5 Miscellaneous Operating Practices

(a) An operator shall not use a lifting device that is tagged "Out of Service" or otherwise designated as nonfunctioning.

(b) "Out of Service" tags on lifting devices shall not be removed without the approval of the person placing them or a designated person.

(c) The lifting device, when not in use, should be stored at an assigned location.

(d) Caution should be taken that operating markings or tags shall not be removed or defaced. Missing or illegible markings or tags shall be replaced.

SECTION 20-2.5: INSTRUCTION MANUALS

(25)

The manufacturer shall provide operating instructions and maintenance and parts information. In addition, the manual shall provide a statement of those factors that alter the vacuum lifting device's lifting capacity and related limitations. Several factors known to affect the vacuum lifting device's lifting capacity are noted below.

(a) *Load Rigidity.* The rigidity may cause the vacuum pads and the structure to be loaded unevenly. The rigidity may vary depending on orientation.

(b) *Load Strength.* Stress induced by the load's own weight and the stress from the vacuum pads may damage the load.

(c) *Load Surface Conditions.* Uneven or rough surfaces may affect the vacuum pad's ability to attach or maintain a seal. Frictional properties may affect the lifting capacity.

(d) *Load Overhang.* As the load extends past the supports of the vacuum pads, the load may be damaged or deflect and peel away from the pad seal.

(e) *Angle of the Load.* The effect of the coefficient of friction between the load and the vacuum pad becomes significant when the load is not horizontal.

(f) Number of Pads Attached to the Load. The lifting capacity varies with the number of pads fully attached to the load.

(g) Load Temperature. Elevated temperatures may damage the vacuum pads or affect the function of the pads.

(h) Elevation and Vacuum Level. The vacuum pad rating varies with the vacuum level achieved under the pads. If the vacuum level decreases from the vacuum level used for lifting capacity calculations, the ultimate pad lifting capacity is reduced. At various elevations, the vacuum level that can be reached may vary.

Chapter 20-3

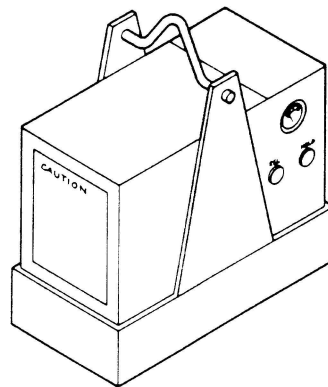
Close Proximity Operated Lifting Magnets

SECTION 20-3.1: SCOPE

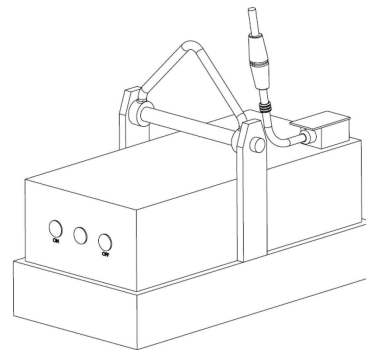
Chapter 20-3 applies to the marking, construction, installation, inspection, testing, maintenance, and operation of all lifting magnets when used for single or multiple steel piece handling operations in which the operator of the lifting magnet is required to manually position the lifting magnet on the load and manually guide the load during its movement, or in remotely operated lifting magnets when operated in close proximity to people.

For multimagnet systems where individual lifting magnets are suspended from a spreader beam or its equivalent, this section applies only to the individual lifting magnet, excluding the spreader beam or its equivalent and the associated control equipment (see Figure 20-3.1-1). This Chapter does not apply to remotely operated lifting magnets in areas where people are excluded during normal operation.

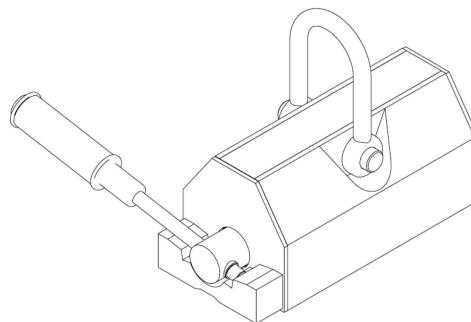
Figure 20-3.1-1
Close Proximity Operated Lifting Magnets



(a) Close Proximity Operated Battery-Powered Lifting Electromagnet



(b) Close Proximity Operated Electrically Controlled Permanent Lifting Magnet



(c) Close Proximity Operated Manually Controlled Permanent Lifting Magnet

SECTION 20-3.2: MARKING, CONSTRUCTION, AND INSTALLATION

20-3.2.1 Marking

(a) Rated Load

(1) *General Application Lifting Magnets.* The rated load of the lifting magnet shall be legibly marked on the lifting magnet or on a tag attached to the lifting magnet where it is visible. This marking shall refer to the instruction manual for information relating to decreases in rating due to the load surface condition, thickness, percentage of contact with the lifting magnet, temperature, metallurgical composition, and deflection.

(2) *Specified Application Lifting Magnets.* The rated load of the lifting magnet shall be legibly marked on the lifting magnet or on a tag attached to the lifting magnet where it is visible. This marking shall describe the specific loads for which this rating applies.

(b) *Identification.* Close proximity operated lifting magnets shall be provided with identification displaying, but not limited to, the following information:

- (1) manufacturer's name and contact information
- (2) serial number (unique unit identifier)
- (3) weight of lifting magnet
- (4) duty cycle (when applicable)
- (5) the cold current (amps) at 68°F (20°C) (when applicable)

(6) the voltage of the primary power supply or battery (when applicable)

- (7) rated load [as described in (a)]
- (8) ASME BTH-1 Design Category B
- (9) ASME BTH-1 Service Class

(c) *Repaired or Altered Lifting Magnets.* Repaired or altered lifting magnets shall be provided with identification displaying, but not limited to, the following information:

- (1) name and address of the repairer or alterer
- (2) repairer's or alterer's unit identification
- (3) weight of lifting magnet (if altered)
- (4) duty cycle (if altered)
- (5) the cold current or wattage at 68°F (20°C) (if altered)
- (6) the voltage of the primary power supply or battery (if altered)
- (7) rated load (if altered) [as described in (a)]
- (8) ASME BTH-1 Design Category B
- (9) ASME BTH-1 Service Class (if altered)

This requirement is not applicable to repairs limited to replacement of maintenance parts.

(d) Product Safety Labels

(1) Where size and shape of the lifting magnet allow, lifting magnets shall have labels affixed to them in a readable position, that include the appropriate signal word, according to ANSI Z535.4-2011, to bring the label to the attention of the operator. The label should include cautionary language identifying hazards, methods for

accident prevention, and refer to instruction manuals for additional information.

(2) Where size or shape of the lifting magnet prohibits the inclusion of all or any such markings, a label shall be affixed referring the user to consult the manufacturer's instruction manual for product safety information.

(3) Labels on battery-operated lifting magnets shall provide additional cautionary language about operating when the battery capacity is inadequate.

(4) Labels on externally powered electromagnets shall contain additional cautionary language against

(-a) exceeding lifting magnet duty cycle

(-b) disconnecting lifting magnet with power on

(5) Labels on electrically controlled permanent magnets shall contain additional cautionary language about operating if the internal control function indicator, where applicable, does not indicate a complete cycle.

(6) Labels on manually controlled permanent magnets shall contain additional precautionary language about operating with the control handle latch not fully in the "attach" position.

(e) *Operating Controls.* Each control shall be clearly marked describing resulting motion or function of the lifting magnet.

20-3.2.2 Construction

(25)

(a) General

(1) *Lifting Magnet Design.* The manufacturer shall verify that close proximity operated lifting magnets are designed in accordance with ASME BTH-1. Close proximity lifting magnets shall be designed to ASME BTH-1 Design Category B (static strength criteria) and the proper Service Class (fatigue life criteria) selected for the number of load cycles.

(2) *Welding.* Welding shall be in accordance with ASME BTH-1, para. 1-4.6.

(b) *Electrical Equipment.* External power supply, electrical equipment, and wiring for lifting electromagnets shall be in accordance with ASME BTH-1.

(c) *Lifting Magnet Controllers.* Lifting magnet controllers should have voltage and amperage indicators (when applicable).

(d) *Power Disconnects.* Disconnects are not required on externally powered lifting electromagnets operating from a 120 VAC single-phase power source.

(e) *Alterations.* Lifting magnets may be altered or rerated, provided such alterations and the supporting structure are analyzed and approved by the lifting magnet manufacturer or a qualified person. A rerated lifting magnet or one whose load-supporting components have been altered shall conform to (a)(1) and be tested in accordance with para. 20-3.3.8. New rated load and specified application load shall be displayed in accordance with para. 20-3.2.1.

(f) *Slings.* When employed, slings shall meet the requirements of ASME B30.9.

(g) *Hooks*. When employed, hooks shall meet the requirements of ASME B30.10.

(h) *Rigging Hardware*. When employed, rigging hardware shall meet the requirements of ASME B30.26.

20-3.2.3 Installation

(a) The lifting magnet shall be installed in accordance with the manufacturer's instructions.

(b) Determine that the external power input is in accordance with [paras. 20-3.2.2\(b\)](#) and [20-3.2.2\(f\)](#), is of the correct voltage and amperage, and that the power conductors and controls are of adequate rating and insulated and protected against accidental interruption or damage.

SECTION 20-3.3: INSPECTION, TESTING, AND MAINTENANCE

20-3.3.1 Inspection Classification

General. All inspections shall be performed by a designated person. Any deficiencies identified shall be examined and a determination made by a qualified person as to whether they constitute a hazard, and if so, what additional steps need to be taken to address the hazard.

Inspection of slings (ASME B30.9), hooks (ASME B30.10), rigging hardware (ASME B30.26), or other special devices shall comply with the inspection requirements in the applicable volume.

(a) Initial Inspection

(1) New and reinstalled lifting magnets shall be inspected prior to initial use to verify compliance with applicable provisions of this Volume.

(2) Altered or repaired lifting magnets shall be inspected. The inspection may be limited to the components affected by the alteration or repair, as determined by a qualified person.

(b) *Inspection Intervals*. Inspection procedures for lifting magnets in regular service are divided into three general classifications, based upon the intervals at which the inspections shall be performed. The intervals, in turn, are dependent upon the nature of the critical components of the lifting magnet and the degree of their exposure to wear, deterioration, or malfunction. The three general classifications are designated as *every lift*, *frequent*, and *periodic*, with respective intervals between inspections as defined below.

(1) *Every Lift Inspection*. Visual examination by the operator before and during each lift made by the lifting magnet.

(2) *Frequent Inspection*. Visual examination by the operator or other designated persons 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 lift

(3) *Periodic Inspection*. Documented visual inspection of apparent external conditions to provide the basis for a continuing evaluation.

(-a) normal service for equipment in place — yearly

(-b) heavy service for equipment in place — quarterly

(-c) severe service — monthly

(-d) special or infrequent service — as recommended by a qualified person before the first lift and as directed by the qualified person for any subsequent lifts

20-3.3.2 Every Lift Inspection

Lifting magnets shall be inspected by the operator before and/or during every lift for any deficiencies as specifically indicated, including

(a) lifting magnet face and surface of the load for foreign materials and smoothness

(b) condition and operation of the control handle of a manually controlled permanent magnet

(c) condition and operation of indicators and meters when installed

20-3.3.3 Frequent Inspection

(25)

Lifting magnets shall be inspected at intervals as defined in [para. 20-3.3.1\(b\)\(2\)](#). Conditions such as those listed in [para. 20-3.3.7](#), or any other condition that may constitute a hazard, shall cause the lifting magnet to be removed from service. A qualified person shall determine whether any deficiency constitutes a hazard, requires repair, requires disassembly for further inspection, or will require more frequent inspection. The lifting magnet shall not be returned to service until approved by a qualified person.

20-3.3.4 Periodic Inspection

(25)

Complete inspections of lifting magnets shall be performed at intervals as defined in [para. 20-3.3.1\(b\)\(3\)](#). Conditions such as those listed in [para. 20-3.3.7](#), or any other condition that may constitute a hazard, shall cause the lifting magnet to be removed from service. A qualified person shall determine whether any deficiency constitutes a hazard, requires repair, requires disassembly for further inspection, or will require more frequent inspection. The lifting magnet shall not be returned to service until approved by a qualified person. The inspection shall be based on the manufacturer's instructions, [para. 20-3.3.7](#), or the recommendations of a qualified person.

20-3.3.5 Lifting Magnets Not in Regular Use

A lifting magnet that has been idle for a period of 1 month to 1 yr shall be inspected in accordance with [para. 20-3.3.3](#) before being placed in service. A lifting magnet that has been idle for a period of 1 yr or more shall be inspected in accordance with [para. 20-3.3.4](#) before being returned to service.

20-3.3.6 Inspection Records

Dated inspection reports shall be made on critical items, such as those listed in [para. 20-3.3.4](#). Records should be available for each periodic inspection and when the lifting magnet is either altered or repaired.

(25) 20-3.3.7 Removal Criteria

A lifting magnet shall be removed from service if any conditions (if applicable) such as the following are present (limits established by the manufacturer or qualified person) and shall only be returned to service when approved by a qualified person:

- (a) deformation, cracks, or wear
- (b) loose or missing guards, fasteners, covers, stops, or nameplates
- (c) excessive pitting or corrosion
- (d) excessive nicks or gouges
- (e) indications of heat damage
- (f) unauthorized welds or modifications
- (g) unauthorized replacement components
- (h) improper assembly or function
- (i) lifting surfaces that display
 - (1) excessive surface wear
 - (2) nicks, gouges, or any parts impeding the lifting surface from full contact with the load
 - (3) foreign material
- (j) damaged or distorted pins
- (k) On/Off handle operation
 - (1) impeded movement or rotation of the handle
- (l) damaged, distorted, or worn threads, including foreign material on the threads
- (m) impaired, seized, or bound bail movement
- (n) deformed, broken, or missing springs
- (o) missing or illegible operating control markings or product safety labels
- (p) loose connections, loss of continuity, corrosion, or damage to insulation of electrical conductors
- (q) improper level of battery electrolyte or corrosion of either the battery posts or the connectors
- (r) other conditions, including visible damage, that cause doubt as to continued safe use

20-3.3.8 Repairs

Deficiencies disclosed by the inspection requirements of [Section 20-3.3](#) shall be corrected according to the procedures outlined in [para. 20-3.3.10](#) before operation of the lifting magnet is resumed, unless a qualified person deter-

mines the deficiency does not constitute a hazard. Repairs of slings ([ASME B30.9](#)), hooks ([ASME B30.10](#)), rigging hardware ([ASME B30.26](#)), or other special devices shall comply with repair requirements in the applicable volumes or standards.

20-3.3.9 Testing

20-3.3.9.1 Operational Tests

(a) New and reinstalled lifting magnets shall be tested by a qualified person, or a designated person under the direction of the manufacturer or a qualified person, prior to initial use to verify compliance with applicable provisions of this Volume, including, but not limited to, the following:

- (1) moving parts
- (2) latches
- (3) stops
- (4) switches
- (5) any control devices
- (6) alarms

(b) Altered or repaired lifting magnets shall be tested by a qualified person or a designated person under the direction of the manufacturer or a qualified person. The test may be limited to the components affected by the alteration or repair, as determined by a qualified person with guidance from the manufacturer.

(c) All indicator lights, gauges, horns, bells, alarms, pointers, and other warning devices shall be tested.

(d) Dated reports of all operational tests shall be filed.

20-3.3.9.2 Load Test

(a) Prior to initial use, all new, altered, or repaired lifting magnets shall be tested by, or under the direction of, the manufacturer or a qualified person. The rated load of all lifting components associated with the lifting magnet shall exceed the maximum breakaway force of the lifting magnet to avoid overload, or the components shall not be included in the test. The test results shall be recorded confirming the rated load of the lifting magnet.

(1) Breakaway Force Test

(-a) General application lifting magnets shall be required to satisfy the rated breakaway force test.

(-1) The rated load for permanent lifting magnets shall be less than 33% of the breakaway force measured in this test.

(-2) The rated load for electromagnetic lifting magnets shall be less than 50% of the breakaway force measured in this test.

(-b) Specified application lifting magnets shall be required to satisfy the specified application lifting magnet breakaway force test.

(-1) The rated load for permanent lifting magnets shall be less than 33% of the breakaway force measured in this test.

(-2) The rated load for electromagnetic lifting magnets shall be less than 50% of the breakaway force measured in this test.

(2) *Design Factor Test.* Close proximity operated lifting magnets should have an annual magnetic design factor test to verify the lifting magnet meets (a)(1)(-a) or (a)(1)(-b). This test should be performed to the actual breakaway point of the lifting magnet or may be performed at the calculated minimum breakaway force. The rated load of all components associated with the (magnetic) design factor test shall exceed the maximum breakaway load of the lifting magnet to avoid overload or the lifting hardware shall be removed. Caution should be exercised during the test. The test shall be performed under the direction of a qualified person.

(b) The general application lifting magnet breakaway force test shall establish the force required to vertically remove the lifting magnet from a low carbon, rolled steel plate of the minimum thickness stated by the lifting magnet manufacturer. The portion of this plate that is in contact with the lifting magnet shall not exceed 125 $\mu\text{in.}$ ($3.2 \times 10^{-3} \text{ mm}$) or better and be flat within 0.002 in./ft (0.05 mm/m), without exceeding 0.005 in. (0.127 mm) total. The full operating face of the lifting magnet shall be in contact with the steel plate, which shall be between 60°F (15°C) and 120°F (50°C). The steel plate, load cell, or other testing device shall be mounted to allow self-alignment so the load is applied to the lifting magnet through the magnet's center of force.

(c) The specified application lifting magnet breakaway force test shall establish the breakaway forces of the lifting magnet under the variety of loading conditions for which the lifting magnet is specified. The details of this test should be supplied by the manufacturer of the lifting magnet.

(d) Battery-operated lifting electromagnets and externally powered lifting electromagnets shall be operated at the manufacturer's recommended voltage and current levels.

(e) The test for altered or repaired lifting magnets may be limited to the components affected by the alteration or repair, as determined by a qualified person with guidance from the manufacturer.

20-3.3.10 Maintenance

(a) *Maintenance Program.* A maintenance program shall be established and be based on recommendations made by the lifting magnet manufacturer. If a qualified person determines it is appropriate, the program should also include that individual's additional recommendations based on a review of the lifting magnet application and operations.

(b) Maintenance Procedure

(1) Before adjustment and repairs are started on a lifting magnet or its controls, the following precautions shall be taken:

(-a) All sources of lifting magnet power shall be disconnected, locked out, and tagged "Out of Service."

(-b) A lifting magnet removed for repair shall be tagged "Out of Service."

(-c) Fluid pressure shall be relieved from all circuits before loosening or removing fluid power components.

(2) Only designated personnel shall work on equipment when adjustments, repairs, and tests are required.

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

(4) After adjustments and repairs have been made, the lifting magnet shall not be returned to service until it has been inspected according to [para. 20-3.3.4](#).

(5) Dated records of repairs and replacements should be made.

SECTION 20-3.4: OPERATION

20-3.4.1 Operators

Below-the-hook lifting devices shall be operated only by a trained, designated person.

20-3.4.2 Qualifications

(25)

Qualifications for operators of below-the-hook lifting devices are as follows:

(a) The operator shall be instructed in the use of the device by a designated person. Instructions should include, but not be limited to, the following:

(1) application of the lifting magnet to the load and material-handling device, and adjustments, if any, that adapt the lifting magnet to various sizes or kinds of loads

(2) any special operations or precautions

(3) the manufacturer's suggested operating procedures

(4) condition of the load required for operation of the lifting magnet, such as, but not limited to, balance, surface cleanliness, flatness, bending, and load thickness

(5) storage of the lifting magnet to protect it from damage

(6) not exceeding the rated load of the lifting device nor the rated load of the hoisting equipment by the combined weight of the load, the lifting device, and rigging

(7) charging of the lifting magnet battery (if required)

(8) the purpose of indicators, meters, or alarms on the lifting magnet

(9) the proper attachment of adapters to the lifting device for special load handling

(b) The operator shall demonstrate the ability to operate the lifting magnet as instructed before assuming responsibility for using the lifting magnet.

(c) The operator shall demonstrate an understanding of standard hand signals when applicable.

20-3.4.3 Responsibilities

While the organizational structure of various projects may differ, the following roles are described here for purposes of delineating responsibilities. All responsibilities listed below shall be assigned in the work site organization. (A single individual may perform one or more of these roles.)

operator: directly controls the lifting device's functions.

owner: has custodial control of a lifting device by virtue of lease or ownership.

These persons and roles may or may not match the persons and roles associated with the hoisting equipment in use.

(25) **20-3.4.3.1 Responsibilities of the Lifting Device Owner.** The responsibilities of the lifting device owner shall include the following:

(a) providing a lifting device, and all necessary components specified by the manufacturer, that meets the requirements of [Sections 20-3.2](#) and [20-3.3](#) as well as specific job requirements.

(b) providing all applicable operating instructions.

(c) providing field assembly, disassembly (if applicable), operation and maintenance information, and warning decals and placards installed as prescribed by the lifting device manufacturer.

(d) establishing an inspection, testing, and maintenance program in accordance with [Section 20-3.3](#).

(e) using designated personnel to perform the required maintenance, repair, and inspections.

(f) ensuring that the lifting device is in proper operating condition prior to initial use at the work site by the following:

(1) verifying that all inspections have been performed as required by [Section 20-3.3](#)

(2) verifying that the lifting device has the necessary rated load to perform the proposed lifting operations in the planned configuration

(g) using operators that meet the requirements of [para. 20-3.4.2](#).

(h) ensuring that all personnel involved in maintenance, repair, assembly, disassembly, and inspection are aware of their responsibilities, assigned duties, and the associated hazards.

(i) determining if additional regulations are applicable to lifting device operations.

(j) ensuring that conditions that may adversely affect lifting device operations are addressed. Such conditions include, but are not limited to, the following:

(1) wind velocity or gusting winds

(2) precipitation

(3) fog

(4) extreme temperatures

(5) lighting

(k) addressing safety concerns raised by the operator or other personnel and being responsible if the operator and a qualified person decide to overrule those concerns and direct lifting device operations to continue. (In all cases, the manufacturer's criteria for safe operation and the requirements of this Volume shall be followed.)

20-3.4.3.2 Responsibilities of Operators. The (25) operator shall not be responsible for hazards or conditions that are not under the operator's direct control and that adversely affect operation of the lifting device. Whenever the operator has doubt as to the safety of lifting device operations, the operator shall place the load in a safe condition and stop the lifting device's functions in a controlled manner. Use of the lifting device shall resume only after safety concerns have been addressed or the continuation of lifting device operations is directed by the owner.

The operator's responsibilities shall include the following:

(a) reviewing the requirements for the lifting device with the owner before operations.

(b) knowing what types of site conditions could adversely affect the operation of the lifting device and consulting with the owner concerning the possible presence of those conditions.

(c) understanding and applying the information contained in the lifting device manufacturer's operating manual.

(d) understanding the lifting device's functions and limitations as well as its particular operating characteristics.

(e) ensuring an inspection is performed prior to every lift as specified in [para. 20-3.3.2](#).

(f) promptly reporting the need for any adjustments or repairs to a designated person.

(g) following applicable lock out/tag out procedures.

(h) not operating the lifting device when physically or mentally unfit.

(i) ensuring that all controls are in the off or neutral position and that all personnel are in the clear before attaching the lifting device.

(j) not engaging in any practice that will divert the operator's attention while operating the lifting device.

(k) testing the lifting device function controls that will be used and operating the lifting device only if those function controls respond properly.

(l) operating the lifting device's functions, under normal operating conditions, in a smooth and controlled manner.

(*m*) knowing and following the procedures specified by the manufacturer or approved by a qualified person for assembly, disassembly, setting up, and reeving or rigging of the lifting device.

(*n*) considering all known factors that might affect the lifting device's lifting capacity and informing the owner of the need to make appropriate adjustments.

(*o*) understanding basic load attachment procedures.

(*p*) responding only to instructions from designated persons. However, the operator shall obey a stop order at all times, no matter who gives it.

(*q*) ensuring that all personnel shall stay clear of the load.

(*r*) not lifting stacked loads with a permanent lifting magnet unless approved by the manufacturer.

(25) **20-3.4.4 Lifting Device Operating Practices**

(*a*) *All Lifting Magnets*

(1) Lifting devices shall be operated only by the following qualified personnel:

(-*a*) designated persons

(-*b*) trainees under the supervision of a designated person; the number of trainees permitted to be supervised by a single designated person, the physical location of the designated person while supervising, and the type of communication required between the designated person and the trainee shall be determined by a qualified person

(-*c*) maintenance and test personnel, when it is necessary in the performance of their duties

(-*d*) inspectors (lifting devices)

(2) Ensure the weight of the load and its approximate center of gravity have been obtained, provided, or calculated.

(3) The lifting device shall not be loaded in excess of its rated load or handle any load for which it is not designed.

(4) Properly attach the lifting device to the hook, shackle, or other load handling device.

(5) The lifting magnet shall be applied to the load in accordance with the instruction manual.

(6) Before lifting, the operator shall make sure that lifting magnet ropes or chains are not kinked and that multiple part lines are not twisted around each other.

(7) Verify that the load is well secured and properly balanced in the lifting device when it is initially lifted.

(8) Care should be taken to make certain the load is correctly distributed for the lifting magnet being used.

(9) The temperature of the load should not exceed the maximum allowable limits of the lifting magnet.

(10) Do not allow the load or lifting magnet to come into contact with any obstruction.

(11) The operator shall ensure that the lifting device is adequately protected from damage during use.

(12) The lifting magnet shall not be used for side pulls or sliding the load unless specifically authorized by a qualified person.

(13) The lifting magnet face and the lifting magnet contact area on the load shall be clean.

(14) The load to be lifted shall be within the lifting magnet's rated load or specified application load and lifting equipment rated load.

(15) The operator shall observe all meters and indicators on the lifting magnet to confirm proper operation prior to making a lift.

(16) Before raising the load more than 2 in. (50 mm), any adjustable input control should be switched to the "full power" or "full on" position and remain in this position until the load is removed from the lifting magnet.

(-*a*) Before lifting, the operator shall warn people near the lift.

(-*b*) The operator shall not switch the magnet to the "attach" position until the lifting magnet has been placed in contact with the load to be lifted. Prematurely switching the magnet to the "attach" position could cause unwanted materials to be attracted to the lifting magnet.

(-*c*) The operator shall land any attached load and release the load before leaving the lifting device. The operator shall not leave suspended loads unattended.

(-*d*) The operator shall not ride or allow others to ride loads or the lifting device.

(-*e*) The operation of the lifting magnet shall be observed during use. Any deficiency observed shall be examined by a designated person. If the deficiency constitutes a hazard, the lifting magnet shall be removed from service and tagged "Out of Service." Any indication of a hazardous condition shall be reported to a qualified person for evaluation.

(-*f*) Loads shall be guided in such a manner as to avoid endangering hands or other body parts as the load is moved, or if it drops.

(-*g*) When lifting loads that do not absorb all available flux, use caution to avoid lifting multiple loads.

(*b*) *Battery-Operated Lifting Electromagnets*

(1) Before lifting, the operator should confirm that the device indicating correct current flow remains stable for a minimum of 5 sec.

(2) For a lift of extended duration, the operator should observe the device indicating existing battery conditions every 5 min.

(3) The operator should open the ventilation lid before charging the battery.

(*c*) *Electrically Controlled Permanent Lifting Magnets.* Before lifting, the operator should check the internal control function indicator, where applicable, to confirm proper operation of the lifting magnet.

(*d*) *Manually Controlled Permanent Lifting Magnets.* Before lifting, the operator should confirm that the control handle is in the "attach" position and the control handle latch is operating.

(e) Battery Charging of Battery-Operated Lifting Electromagnets or Battery Backup Systems

(1) Vented wet cell batteries shall be recharged at the first indication of current flow or voltage below the manufacturer's recommended range.

(2) Vented wet cell batteries shall be charged

(-a) in a well-ventilated area to avoid accumulation of combustible gases

(-b) where personnel are least likely to be exposed to vented fumes or electrolyte spillage

(3) All batteries shall be charged prior to being returned to service according to the recommendations supplied by the lifting magnet manufacturer.

(4) Eye, hand, and body protection shall be worn while servicing batteries.

20-3.4.5 Miscellaneous Operating Practices

(a) An operator shall not use a lifting device that is tagged "Out of Service" or otherwise designated as nonfunctioning.

(b) "Out of Service" tags on lifting devices shall not be removed without the approval of the person placing them or a designated person.

(c) The lifting magnet, when not in use, should be stored at an assigned location.

(d) Caution should be taken that operating markings or tags shall not be removed or defaced. Missing or illegible markings or tags shall be replaced.

SECTION 20-3.5: INSTRUCTION MANUALS

The manufacturer shall provide operating instructions, safety precautions, and maintenance information. In addition, the manual shall provide a statement of those factors that alter the lifting magnet's lifting capacity and related limitations. Several factors known to affect the lifting magnet's lifting capacity are noted below.

(a) *Load Thickness.* The magnetic flux flowing from a lifting magnet into a load increases as the thickness of the load increases. Consequently, as a lifting magnet's lifting capacity is a function of this flux, the lift capacity increases with load thickness. For every lifting magnet design, there

is a critical load thickness where all of the lifting magnet's available flux flows into the load and the lift capacity reaches maximum. Loads thicker than the critical load thickness will not increase the lifting magnet's lift capacity beyond this level. As loads become thinner than the critical load thickness, the lifting magnet's lift capacity diminishes since the load cannot transmit all the flux generated by the lifting magnet.

(b) *Load Alloy.* Many alloys of iron do not accept magnetic flux as easily as low carbon steels do. Consequently, loads of such alloys will not accept all of the flux available in the lifting magnet, which reduces the lifting magnet's lift capacity.

(c) *Load Surface Conditions.* Anything that creates an air gap or nonmagnetic separation between a lifting magnet and the load reduces the flux flowing from the lifting magnet into the load, which reduces the lifting capacity of a lifting magnet. Typical causes of air gaps are rough surface finish, paper, dirt, rust, paint, and scale.

(d) *Load Length or Width.* As the length or width of the load increases, the load begins to deflect and to peel at the lifting magnet face. This may create an air gap between the load and the lifting magnet, which reduces the lifting capacity per (c). The manual shall contain manufacturer's recommendations pertaining to the maximum load dimensions.

(e) *Attitude of Load.* As the attitude of the surface of the load to which a lifting magnet is attached (lifting surface) changes from horizontal to vertical, the lifting capacity of the lifting magnet is greatly reduced and becomes dependent upon the coefficient of friction of the lifting surface.

(f) *Portion of Lifting Magnet Face in Contact With Load.* The full face of the lifting magnet must contact the load if the lifting magnet is to achieve maximum capabilities.

(g) *Load Temperature.* The temperature of the load can cause damage to the lifting magnet and, if high enough, even change the magnetic characteristics of the load. Consequently, the manual shall contain the manufacturer's recommendations pertaining to operation of the lifting magnet on loads at temperatures exceeding normal ambient temperatures.

Chapter 20-4

Remotely Operated Lifting Magnets

SECTION 20-4.1: SCOPE

Chapter 20-4 applies to the marking, construction, installation, inspection, testing, maintenance, and operation of remotely operated lifting magnets (see Figure 20-4.1-1). This Chapter applies to remotely operated lifting magnets in areas where people are excluded during normal operation. This Chapter does not apply to close proximity operated lifting magnets.

SECTION 20-4.2: MARKING, CONSTRUCTION, AND INSTALLATION

20-4.2.1 Marking

(a) Rated Load

(1) *General Application Lifting Magnets.* The rated load of the lifting magnet shall be legibly marked on the lifting magnet or on a tag attached to the lifting magnet where it is visible. This marking shall refer to the instruction manual for information relating to decreases in rating due to the load surface condition, thickness, percentage of contact with the lifting magnet, temperature, metallurgical composition, and deflection.

(2) *Specified Application Lifting Magnets.* The rated load of the lifting magnet shall be legibly marked on the lifting magnet or on a tag attached to the lifting magnet where it is visible. This marking shall describe the specific loads for which this rating applies.

(b) *Identification.* Remotely operated lifting magnets shall be provided with identification displaying, but not limited to, the following information:

- (1) manufacturer's name and contact information
- (2) serial number (unique unit identifier)
- (3) weight of lifting magnet
- (4) duty cycle (when applicable)
- (5) the cold current (amps) at 68°F (20°C) (when applicable)
- (6) the voltage of the primary power supply or battery (when applicable)
- (7) rated load [see (a)]
- (8) ASME BTH-1 Design Category B
- (9) ASME BTH-1 Service Class

(c) *Repaired or Altered Lifting Magnets.* Repaired or altered lifting magnets shall be provided with identification displaying, but not limited to, the following information:

- (1) name and contact information of the repairer or alterer
- (2) repairer's or alterer's unit identification
- (3) weight of lifting magnet (if altered)
- (4) duty cycle (if altered)
- (5) the cold current or wattage at 68°F (20°C) (if altered)
- (6) the voltage of the primary power supply or battery (if altered)
- (7) rated load [see (a)]
- (8) ASME BTH-1 Design Category B
- (9) ASME BTH-1 Service Class (if altered)

This requirement is not applicable to repairs limited to replacement of maintenance parts.

(d) Product Safety Labels

(1) Where size and shape of the lifting magnet allow, lifting magnets shall have labels affixed to them in a readable position that include the appropriate signal word, according to ANSI Z535.4-2011, to bring the label to the attention of the operator. The label should include cautionary language identifying hazards, methods for accident prevention, and refer to instruction manuals for additional information.

(2) Where size or shape of the lifting magnet prohibits the inclusion of all or any such markings, a label shall be affixed referring the user to consult the manufacturer's instruction manual for product safety information.

(3) Labels on battery-operated lifting magnets shall provide additional cautionary language about operating when the battery capacity is inadequate.

(4) Labels on externally powered lifting electromagnets shall contain additional cautionary language against

(-a) exceeding lifting magnet duty cycle

(-b) disconnecting lifting magnet with power on

(e) *Operating Controls.* Each control shall be clearly marked describing resulting motion or function of the lifting magnet.

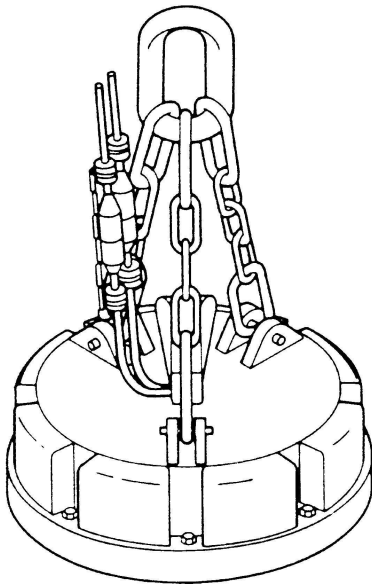
20-4.2.2 Construction

(a) General

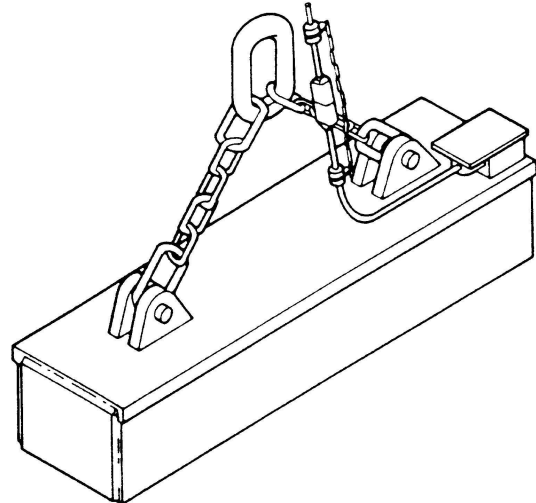
(1) *Suspension Devices.* Lifting magnet suspension devices should meet the lifting magnet manufacturer's recommendations.

(2) *Lifting Magnet Design.* The manufacturer shall verify that remotely operated lifting magnets are in accordance with ASME BTH-1. Remotely operated lifting

Figure 20-4.1-1
Remotely Operated Lifting Magnets



(a) Remotely Operated Lifting Electromagnet — Circular



(b) Remotely Operated Lifting Electromagnet — Rectangular

magnets shall be designed to ASME BTH-1, Design Category B (static strength criteria), and the proper Service Class (fatigue life criteria) selected for its number of load cycles.

(3) *Welding.* Welding shall be in accordance with ASME BTH-1, para. 1-4.6.

(b) *Electrical Equipment.* External power supply, electrical equipment, and wiring for lifting electromagnets shall be in accordance with ASME BTH-1.

(c) *Lifting Magnet Controllers.* Lifting magnet controllers should have voltage and amperage indicated (when applicable).

(d) *Power Disconnects.* Disconnects are not required on externally powered lifting electromagnets operating from a 120 VAC single-phase power source.

(e) *Alterations.* Lifting magnets may be altered or rerated, provided such alterations and the supporting structure are analyzed and approved by the lifting magnet manufacturer or a qualified person. A rerated lifting magnet or one whose load-bearing structural components have been altered shall conform to (a)(3) and be tested in accordance with para. 20-4.3.8.

(f) *Slings.* When employed, slings shall meet the requirements of ASME B30.9.

(g) *Hooks.* When employed, hooks shall meet the requirements of ASME B30.10.

(h) *Rigging Hardware.* When employed, rigging hardware shall meet the requirements of ASME B30.26.

20-4.2.3 Installation

(a) The lifting magnet shall be installed in accordance with the manufacturer's instructions.

(b) Determine that the external power input is in accordance with paras. 20-4.2.2(b) and 20-4.2.2(d), is of the correct voltage and amperage, and that the power conductors and controls are of adequate rating and insulated and protected against accidental interruption or damage.

SECTION 20-4.3: INSPECTION, TESTING, AND MAINTENANCE

20-4.3.1 Inspection Classification

General. All inspections shall be performed by a designated person. Any deficiencies identified shall be examined and a determination made by a qualified person as to whether they constitute a hazard, and if so, what additional steps need to be taken to address the hazard.

Inspection of slings (ASME B30.9), hooks (ASME B30.10), rigging hardware (ASME B30.26), or other special devices shall comply with the inspection requirements in the applicable volume.

(a) Initial Inspection

(1) New and reinstalled lifting magnets shall be inspected prior to initial use to verify compliance with applicable provisions of this Volume.

(2) Altered or repaired lifting magnets shall be inspected. The inspection may be limited to the components affected by the alteration or repair, as determined by a qualified person.

(b) Inspection Intervals. Inspection procedures for lifting magnets in regular service are divided into two general classifications, based upon the intervals at which the inspections shall be performed. The intervals, in turn, are dependent upon the nature of the critical components of the lifting magnet and the degree of their exposure to wear, deterioration, or malfunction. The two general classifications are designated as *frequent* and *periodic*, with respective intervals between inspections as defined below.

(1) *Frequent Inspection.* Visual examination by the operator or other designated persons 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

(2) *Periodic Inspection.* Documented visual inspection of apparent external conditions to provide the basis for a continuing evaluation.

(-a) normal service for equipment in place — yearly

(-b) heavy service for equipment in place — quarterly

(-c) severe service — monthly

(-d) special or infrequent service — as recommended by a qualified person before the first lift and as directed by the qualified person for any subsequent lifts

(25) 20-4.3.2 Frequent Inspection

Lifting magnets shall be inspected at intervals as defined in [para. 20-4.3.1\(b\)\(1\)](#), including during operation, for any deficiency that might appear between inspections. Conditions such as those listed in [para. 20-4.3.6](#), or any other condition that may constitute a hazard, shall cause the lifting magnet to be removed from service. A qualified person shall determine whether any deficiency constitutes a hazard, requires repair, requires disassembly for further inspection, or will require more frequent inspection. The lifting magnet shall not be returned to service until approved by a qualified person

20-4.3.3 Periodic Inspection

Complete inspections of lifting magnets shall be performed and recorded at intervals as defined in [para. 20-4.3.1\(b\)\(2\)](#). Conditions such as those listed in [para. 20-4.3.6](#), or any other condition that may constitute

a hazard, shall cause the lifting magnet to be removed from service. A qualified person shall determine whether any deficiency constitutes a hazard, requires repair, requires disassembly for inspection, or will require more frequent inspection. The lifting magnet shall not be returned to service until approved by a qualified person. The inspection shall be based on the manufacturer's instructions, [para. 20-4.3.6](#), or the recommendations of a qualified person.

20-4.3.4 Lifting Magnets Not in Regular Use

A lifting magnet that has been idle for a period of 1 month to 1 yr shall be inspected in accordance with [para. 20-4.3.2](#) before being placed in service. A lifting magnet that has been idle for a period of 1 yr or more shall be inspected in accordance with [para. 20-4.3.3](#) before being returned to service.

20-4.3.5 Inspection Records

Dated inspection reports shall be made on critical items, such as those listed in [para. 20-4.3.3](#). Records should be available for each periodic inspection and when the lifting magnet is either altered or repaired.

20-4.3.6 Removal Criteria

(25)

A lifting magnet shall be removed from service if conditions (if applicable) such as the following are present (limits established by the manufacturer or qualified person) and shall only be returned to service when approved by a qualified person:

(a) deformation, cracks, or wear

(b) loose or missing guards, fasteners, covers, stops, or nameplates

(c) excessive pitting or corrosion

(d) excessive nicks or gouges

(e) indications of heat damage

(f) unauthorized welds or modifications

(g) unauthorized replacement components

(h) improper assembly or function

(i) impaired, seized, or bound moving parts

(j) lifting surfaces that display

(1) excessive surface wear

(2) broken, chipped, or damaged

(3) foreign material

(k) damaged or distorted pins

(l) damaged, distorted, or worn threads, including foreign material on the threads

(m) lifting magnet exhibits electrical characteristics outside manufacturer recommendations

(n) cable or wiring shows signs of wear or damage

(o) plugs and connectors show signs of wear or damage

(p) missing, damaged, or unreadable gauges if so equipped

(q) missing or illegible operating control markings or product safety labels

(r) improper level of battery electrolyte or corrosion of either the battery posts or the connectors

(s) other conditions, including visible damage, that cause doubt as to continued safe use

(25) 20-4.3.7 Repairs

Deficiencies disclosed by the inspection requirements of [Section 20-4.3](#) shall be corrected according to the procedures outlined in [para. 20-4.3.9](#) before operation of the lifting magnet is resumed, unless a qualified person determines the deficiency does not constitute a hazard. Repairs of slings (ASME B30.9), hooks (ASME B30.10), rigging hardware (ASME B30.26), or other special devices shall comply with repair requirements in the applicable volumes or standards.

20-4.3.8 Testing

20-4.3.8.1 Operational Tests

(a) New and reinstalled lifting magnets shall be tested by a qualified person, or a designated person under the direction of the manufacturer or a qualified person, prior to initial use to verify compliance with applicable provisions of this Volume, including, but not limited to, the following:

(1) moving parts

(2) latches

(3) stops

(4) switches

(5) any control devices

(6) alarms

(7) indicator lights, gauges, horns, bells, alarms, pointers, and other warning devices

(b) Altered or repaired lifting magnets shall be tested by a qualified person or a designated person under the direction of the manufacturer or a qualified person. The test may be limited to the components affected by the alteration or repair, as determined by a qualified person with guidance from the manufacturer.

(c) Dated reports of all operational tests shall be filed.

(25) 20-4.3.8.2 Load Test

(a) Prior to initial use, all new, altered, or repaired lifting magnets shall be tested by a qualified person or a designated person under the direction of the manufacturer or a qualified person. The rated load for all components associated with the lifting magnet shall meet the maximum breakaway force of the lifting magnet to avoid overload or the components shall not be included in the test. The test results shall be recorded confirming the rated load of the lifting magnet.

(1) *Breakaway Force Test*

(-a) General application lifting magnets shall be required to satisfy the general application lifting magnet breakaway force test.

(-1) The rated load for permanent lifting magnets shall be less than 33% of the breakaway force measured in this test.

(-2) The rated load for electromagnet lifting magnets shall be less than 50% of the breakaway force measured in this test.

(-b) Specified application lifting magnets shall be required to satisfy the specified application lifting magnet breakaway force test.

(-1) The rated load for permanent lifting magnets shall be less than 33% of the breakaway force measured in this test.

(-2) The rated load for electromagnet lifting magnets shall be less than 50% of the breakaway force measured in this test.

(2) *Design Factor Test.* Remote operated lifting magnets should have an annual magnetic design factor test to verify the lifting magnet meets (a)(1)(-a) or (a)(1)(-b). This test should be performed to the actual breakaway point of the lifting magnet or may be performed at the calculated minimum breakaway force. The rated load of lifting hardware associated with the magnetic design factor test shall exceed the maximum breakaway load of the lifting magnet to avoid overload or the lifting hardware shall be removed. Caution should be applied during the test. The test shall be performed under the direction of a qualified person.

(b) The general application lifting magnet breakaway force test shall establish the force required to vertically remove the lifting magnet from a low carbon, rolled steel plate of the minimum thickness stated by the lifting magnet manufacturer. The portion of this plate that is in contact with the lifting magnet shall have a surface finish of 125 $\mu\text{in.}$ ($3.2 \times 10^{-3} \text{ mm}$) or better and be flat within 0.002 in./ft (0.05 mm/30 cm), without exceeding 0.005 in. (0.127 mm) total. The full operating face of the lifting magnet shall be in contact with the steel plate, which shall be between 60°F (15°C) and 120°F (50°C). The steel plate, load cell, or other testing device shall be mounted to allow self-alignment so the load is applied to the lifting magnet through the magnet's center of force.

(c) The specified application lifting magnet breakaway force test shall establish the breakaway forces of the lifting magnet under the variety of loading conditions for which the lifting magnet is specified. The details of this test should be supplied by the manufacturer of the lifting magnet.

(d) Battery-operated lifting electromagnets and externally powered lifting electromagnets shall be operated at the manufacturer's recommended voltage and current levels.

(e) The test for altered or repaired lifting magnets may be limited to the components affected by the alteration or repair, as determined by a qualified person with guidance from the manufacturer.

20-4.3.9 Maintenance

(a) *Maintenance Program.* A maintenance program shall be established and be based on recommendations made by the lifting magnet manufacturer. If a qualified person determines it is appropriate, the program should also include that individual's additional recommendations based on a review of the lifting magnet application and operations.

(b) *Maintenance Procedure*

(1) Before adjustments and repairs are started on a lifting magnet or its controls, the following precautions shall be taken:

(-a) All sources of lifting magnet power shall be disconnected, locked out, and tagged "Out of Service."

(-b) A lifting magnet removed from service for repair shall be tagged "Out of Service."

(-c) Fluid pressure shall be relieved from all circuits before loosening or removing fluid power components.

(2) Only designated personnel shall work on equipment when maintenance, repairs, and tests are required.

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

(4) After adjustments and repairs have been made, the lifting magnet shall not be returned to service until it has been inspected according to [para. 20-4.3.3](#).

(5) Dated records of repairs and replacements should be made.

SECTION 20-4.4: OPERATION

20-4.4.1 Operators

Below-the-hook lifting devices shall be operated only by trained, designated persons.

(25) 20-4.4.2 Qualifications

Qualifications for operators of below-the-hook lifting devices are as follows:

(a) The operator shall be instructed in the use of the device by a designated person before operating the device. Instructions should include, but not be limited to, the following:

(1) application of the lifting magnet to the load and material-handling device, and adjustments, if any, that adapt the lifting magnet to various sizes or kinds of loads

(2) any special operations or precautions

(3) the manufacturer's suggested operating procedures

(4) condition of the load required for operation of the lifting magnet, such as, but not limited to, balance, surface cleanliness, flatness, bending, and load thickness

(5) storage of the lifting magnet to protect it from damage

(6) not exceeding the rated load of the lifting device nor the rated load of the hoisting equipment by the combined weight of the load, the lifting device, and rigging

(7) charging of the lifting magnet battery (if required)

(8) the purpose of indicators, meters, or alarms on the lifting magnet

(9) the proper attachment of adapters to the lifting device for special load handling

(b) The operator shall demonstrate the ability to operate the lifting magnet as instructed before assuming responsibility for using the lifting magnet.

(c) The operator shall demonstrate an understanding of standard hand signals when applicable.

20-4.4.3 Responsibilities

While the organizational structure of various projects may differ, the following roles are described here for purposes of delineating responsibilities. All responsibilities listed below shall be assigned in the work site organization. (A single individual may perform one or more of these roles.)

operator: directly controls the lifting device's functions.

owner: has custodial control of a lifting device by virtue of lease or ownership.

These persons and roles may or may not match the persons and roles associated with the hoisting equipment in use.

20-4.4.3.1 Responsibilities of the Lifting Device

Owner. The responsibilities of the lifting device owner (25) shall include the following:

(a) providing a lifting device, and all necessary components specified by the manufacturer, that meets the requirements of [Sections 20-4.2](#) and [20-4.3](#) as well as specific job requirements.

(b) providing all applicable operating instructions.

(c) providing field assembly, disassembly (if applicable), operation and maintenance information, and warning decals and placards installed as prescribed by the lifting device manufacturer.

(d) establishing an inspection, testing, and maintenance program in accordance with [Section 20-4.3](#).

(e) using designated personnel to perform the required maintenance, repair, and inspections.

(f) ensuring that the lifting device is in proper operating condition prior to initial use at the work site by the following:

(1) verifying that all inspections have been performed as required by [Section 20-4.3](#)

(2) verifying that the lifting device has the necessary rated load to perform the proposed lifting operations in the planned configuration

(g) using operators that meet the requirements of [para. 20-4.4.2](#).

(h) ensuring that all personnel involved in maintenance, repair, assembly, disassembly, and inspection are aware of their responsibilities, assigned duties, and the associated hazards.

(i) determining if additional regulations are applicable to lifting device operations.

(j) ensuring that conditions that may adversely affect lifting device operations are addressed. Such conditions include, but are not limited to, the following:

- (1) wind velocity or gusting winds
- (2) precipitation
- (3) fog
- (4) extreme temperatures
- (5) lighting

(k) addressing safety concerns raised by the operator or other personnel and being responsible if the operator and a qualified person decide to overrule those concerns and direct lifting device operations to continue. (In all cases, the manufacturer's criteria for safe operation and the requirements of this Volume shall be followed.)

- (25) **20-4.4.3.2 Responsibilities of Operators.** The operator shall be responsible for the following listed items. The operator shall not be responsible for hazards or conditions that are not under the operator's direct control and that adversely affect operation of the lifting device. Whenever the operator has doubt as to the safety of lifting device operations, the operator shall place the load in a safe condition and stop the lifting device's functions in a controlled manner. Use of the lifting device shall resume only after safety concerns have been addressed or the continuation of lifting device operations is directed by the owner.

The operator's responsibilities shall include the following:

- (a) reviewing the requirements for the lifting device with the owner before operations.
- (b) knowing what types of site conditions could adversely affect the operation of the lifting device and consulting with the owner concerning the possible presence of those conditions.
- (c) understanding and applying the information contained in the lifting device manufacturer's operating manual.
- (d) understanding the lifting device's functions and limitations as well as its particular operating characteristics.
- (e) performing a frequent inspection as specified in [para. 20-4.3.2](#).
- (f) promptly reporting the need for any adjustments or repairs to a designated person.
- (g) following applicable lock out/tag out procedures.
- (h) not operating the lifting device when physically or mentally unfit.
- (i) ensuring that all controls are in the off or neutral position and that all personnel are in the clear before attaching the lifting device.

(j) not engaging in any practice that will divert the operator's attention while operating the lifting device.

(k) testing the lifting device function controls that will be used and operating the lifting device only if those function controls respond properly.

(l) operating the lifting device's functions, under normal operating conditions, in a smooth and controlled manner.

(m) knowing and following the procedures specified by the manufacturer or approved by a qualified person for assembly, disassembly, setting up, and reeving or rigging of the lifting device.

(n) considering all known factors that might affect the lifting device's lifting capacity and informing the owner of the need to make appropriate adjustments.

(o) understanding basic load attachment procedures.

(p) responding only to instructions from designated persons. However, the operator shall obey a stop order at all times, no matter who gives it.

(q) ensuring that all personnel shall stay clear of the load.

(r) not lifting stacked loads with a permanent lifting magnet unless approved by the manufacturer.

20-4.4.4 Lifting Device Operating Practices

(25)

(a) Lifting devices shall be operated only by the following personnel:

- (1) designated persons
- (2) trainees under the supervision of a designated person; the number of trainees permitted to be supervised by a single designated person, the physical location of the designated person while supervising, and the type of communication required between the designated person and the trainee shall be determined by a qualified person

(3) maintenance and test personnel, when it is necessary in the performance of their duties

(4) inspectors (lifting devices)

(b) Ensure the weight of the load and its approximate center of gravity have been obtained, provided, or calculated.

(c) The lifting device shall not be loaded in excess of its rated load or handle any load for which it is not designed.

(d) Properly attach the lifting device to the hook, shackle, or other load handling device.

(e) The lifting magnet shall be applied to the load in accordance with the instruction manual.

(f) Before lifting, the operator shall make sure that lifting magnet ropes or chains are not kinked and that multiple part lines are not twisted around each other.

(g) Verify that the load is well secured and properly balanced in the lifting device when it is initially lifted.

(h) Care should be taken to make certain the load is correctly distributed for the lifting magnet being used.

(i) The temperature of the load should not exceed the maximum allowable limits of the lifting magnet.

(j) Do not allow load or lifting magnet to come into contact with any obstruction.

(k) The operator shall ensure that the lifting device is adequately protected from damage during use.

(l) The lifting magnet shall not be used for side pulls or sliding the load unless specifically authorized by a qualified person.

(m) The operator shall land any attached load and store the lifting magnet before leaving the lifting device. The operator shall not leave suspended loads unattended.

(n) The operator shall not ride or allow others to ride loads or the lifting magnet.

(o) The operation of the lifting magnet shall be observed during use. Any deficiency observed shall be examined by a designated person. If the deficiency constitutes a hazard, the lifting magnet shall be removed from service and tagged "Out of Service." Any indication of a hazardous condition shall be reported to a qualified person for evaluation.

(p) When lifting loads that do not absorb all available flux, use caution to avoid lifting multiple loads.

20-4.4.5 Miscellaneous Operating Practices

(a) An operator shall not use a lifting device that is tagged "Out of Service" or otherwise designated as nonfunctioning.

(b) "Out of Service" tags on lifting devices shall not be removed without the approval of the person placing them or a designated person.

(c) The lifting magnet, when not in use, should be stored at an assigned location.

(d) Caution should be taken that operating markings or tags shall not be removed or defaced. Missing or illegible markings or tags shall be replaced.

(25) SECTION 20-4.5: INSTRUCTION MANUALS

The manufacturer shall provide operating instructions, safety precautions, and maintenance information. In addition, the manual shall provide a statement of those factors that alter the lifting magnet's lifting capacity and related limitations. Several key factors known to affect the lifting magnet's lifting capacity are noted below.

(a) *Load Thickness.* For every lifting magnet design, there is a critical load thickness where all of the lifting magnet's available flux flows into the load and the lifting magnet's lifting capacity reaches maximum. Loads thicker than the critical load thickness will not increase the lifting magnet's lifting capacity beyond this level. As loads become thinner than the critical load thickness, the lifting magnet's lifting capacity diminishes since the load cannot transmit all the flux generated by the lifting magnet.

(b) *Load Alloy.* Many alloys of iron do not accept magnetic flux as easily as low carbon steels do. Consequently, loads of such alloys will not accept all of the flux available in the lifting magnet, which reduces the lifting magnet's lifting capacity.

(c) *Load Surface Conditions.* Anything that creates an air gap or nonmagnetic separation between a lifting magnet and the load reduces the flux flowing from the lifting magnet into the load, which reduces the lifting capacity of a lifting magnet. Typical causes of air gaps are rough surface finish, paper, dirt, rust, paint, and scale.

(d) *Load Length or Width.* As the length or width of the load increases, the load begins to deflect and to peel at the lifting magnet face. This may create an air gap between the load and the lifting magnet, which reduces the lifting capacity per (c). The manual shall contain manufacturer's recommendations pertaining to the maximum load dimensions for a particular lifting magnet.

(e) *Attitude of Load.* As the attitude of the surface of the load to which a lifting magnet is attached (lifting surface) changes from horizontal to vertical, the lifting capacity of the lifting magnet is greatly reduced and becomes dependent upon the coefficient of friction of the lifting surface.

(f) *Portion of Lifting Magnet Face in Contact With Load.* The full face of the lifting magnet must contact the load if the lifting magnet is to achieve maximum capabilities.

(g) *Load Temperature.* The temperature of the load can cause damage to the lifting magnet and, if high enough, even change the magnetic characteristics of the load. Consequently, the manual shall contain the manufacturer's recommendations pertaining to operation of the lifting magnet on loads at temperatures exceeding normal ambient temperatures.

Chapter 20-5

Scrap and Material-Handling Grapples

SECTION 20-5.1: SCOPE

[Chapter 20-5](#) applies to the marking, construction, installation, inspection, testing, maintenance, and operation of hydraulically operated scrap and material-handling grapples (see [Figure 20-5.1-1](#)).

SECTION 20-5.2: MARKING, CONSTRUCTION, AND INSTALLATION

20-5.2.1 Marking

(a) *Identification.* Scrap and material-handling grapples shall be marked with, but not limited to, the following information:

- (1) manufacturer's name and contact information
- (2) serial number (unique unit identifier)
- (3) grapple weight
- (4) rated voltage (when applicable)
- (5) operating hydraulic pressures
- (6) rated load
- (7) ASME BTH-1 Design Category B
- (8) ASME BTH-1 Service Class

(b) *Repaired or Altered Grapples.* Repaired or altered scrap and material-handling grapples shall be provided with identification displaying, but not limited to, the following information:

- (1) name and contact information of the repairer or alterer
- (2) repairer's or alterer's unit identification
- (3) grapple weight (if altered)
- (4) operating hydraulic pressures (if altered)
- (5) rated voltage (if altered)
- (6) rated load (if altered)
- (7) ASME BTH-1 Design Category B
- (8) ASME BTH-1 Service Class (if altered)

This requirement is not applicable to repairs limited to replacement of maintenance parts.

(c) *Operating Controls.* Each control shall be clearly marked describing resulting motion or function of the lifting device (if altered).

20-5.2.2 Construction

(a) *General.* The manufacturer shall verify that scrap and material-handling grapples are designed by or under the supervision of a qualified person. The design shall be in accordance with ASME BTH-1.

Scrap and material-handling grapples shall be designed to ASME BTH-1 Design Category B (static strength criteria) and the proper Service Class (fatigue life criteria) selected for the number of load cycles.

(b) *Welding.* Welding shall be in accordance with ASME BTH-1, para. 1-4.6.

(c) *Electrical Equipment.* External power supply, electrical equipment, and wiring for below-the-hook lifting devices shall be in accordance with ASME BTH-1.

(d) *Grapple Magnets.* Lifting magnet construction shall comply with [para. 20-4.2.2](#).

(e) *Alterations.* Grapples may be altered or rerated, provided such modifications are analyzed and approved by the equipment manufacturer or a qualified person. A rerated grapple or one whose components have been altered shall be tested according to [para. 20-5.3.7](#). New rated load shall be displayed in accordance with [para. 20-5.2.1\(b\)](#).

(f) *Slings.* When employed, slings shall meet the requirements of ASME B30.9.

(g) *Hooks.* When employed, hooks shall meet the requirements of ASME B30.10.

(h) *Rigging Hardware.* When employed, rigging hardware shall meet the requirements of ASME B30.26.

20-5.2.3 Installation

(a) The grapple shall be installed in accordance with the manufacturer's instructions.

(b) The user shall confirm that the hydraulic flows and pressures are the same as indicated on the grapple nameplate.

(c) Determine that the external power input is in accordance with [para. 20-5.2.2\(c\)](#) and is of the correct voltage and amperage.

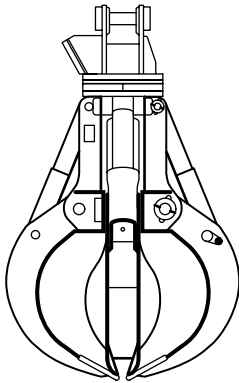
(d) Confirm that the electrical power conductors and controls are of adequate rating and insulated and protected against inadvertent interruption or damage.

SECTION 20-5.3: INSPECTION, TESTING, AND MAINTENANCE

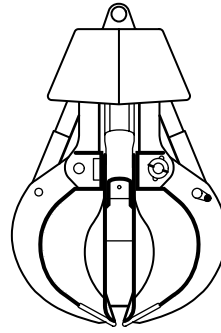
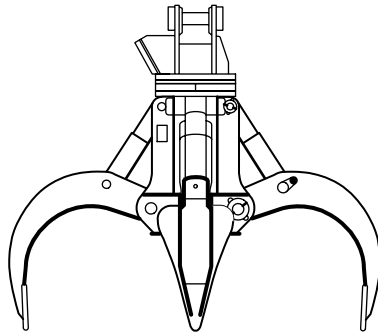
20-5.3.1 Inspection Classification

General. All inspections shall be performed by a designated person. Any deficiencies identified shall be examined and a determination made by a qualified person as to

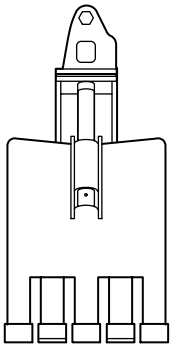
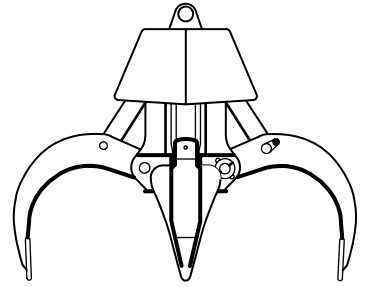
Figure 20-5.1-1
Scrap and Material-Handling Grapples



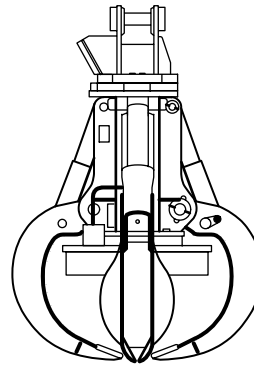
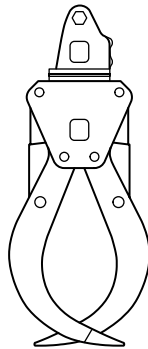
(a) Four-Tine Orange Peel Grapple



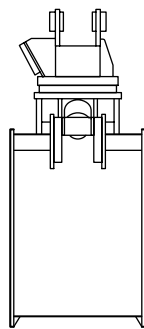
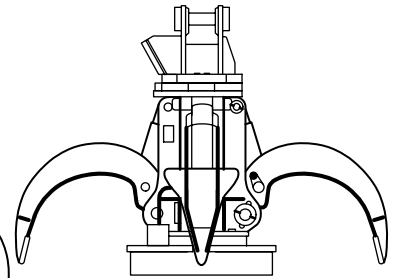
(b) Electrohydraulic Grapple



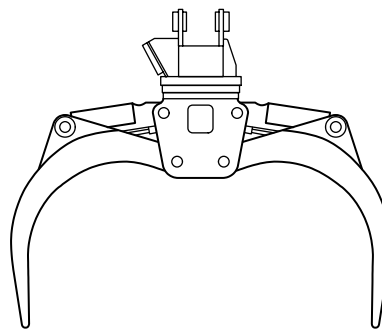
(c) Three-in-One Grapple



(d) Magnet Grapple



(e) Car Body Grapple



whether they constitute a hazard, and if so, what additional steps need to be taken to address the hazard.

Inspection of slings (ASME B30.9), hooks (ASME B30.10), rigging hardware (ASME B30.26), or other special devices shall comply with the inspection requirements in the applicable volume.

(a) Initial Inspection

(1) New and reinstalled grapples shall be inspected prior to initial use to verify compliance with applicable provisions of this Volume.

(2) Altered or repaired grapples shall be inspected. The inspection may be limited to the components affected by the alteration or repair, as determined by a qualified person.

(b) Inspection Intervals. Inspection procedures for grapples in regular service are divided into two general classifications, based upon the intervals at which the inspections shall be performed. The intervals, in turn, are dependent upon the nature of the critical components of the grapple and the degree of their exposure to wear, deterioration, or malfunction. The two general classifications are designated as *frequent* and *periodic*, with respective intervals between inspections as defined below.

(1) Frequent Inspection. Visual examination by the operator or other designated persons 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

(2) Periodic Inspection. Documented visual inspection of apparent external conditions to provide the basis for a continuing evaluation.

(-a) normal service for equipment in place — yearly

(-b) heavy service for equipment in place — quarterly

(-c) severe service for equipment in place — monthly

(-d) special or infrequent service — as recommended by a qualified person before the first lift and as directed by the qualified person for any subsequent lifts

(25) **20-5.3.2 Frequent Inspection**

Grapples shall be inspected at intervals as defined in [para. 20-5.3.1\(b\)\(1\)](#), including during operation for any deficiencies that might appear between inspections. Conditions such as those listed in [para. 20-5.3.7](#), or any other condition that may constitute a hazard, shall cause the grapple to be removed from service. A qualified person shall determine whether any deficiency constitutes a hazard, requires repair, requires disassembly for further inspection, or will require more frequent

inspection. The grapple shall not be returned to service until approved by a qualified person.

20-5.3.3 Periodic Inspection

Complete inspections of grapples shall be performed and recorded at intervals as defined in [para. 20-5.3.1\(b\)\(2\)](#). Conditions such as those listed in [para. 20-5.3.7](#), or any other condition that may constitute a hazard, shall cause the grapple to be removed from service. A qualified person shall determine whether any deficiency constitutes a hazard, requires repair, requires disassembly for further inspection, or will require more frequent inspection. The grapple shall not be returned to service until approved by a qualified person. The inspection shall be based on the manufacturer's instructions, [para. 20-5.3.7](#), or the recommendations of a qualified person.

20-5.3.4 Grapples Not in Regular Use

A grapple that has been idle for a period of 1 month to 1 yr shall be inspected in accordance with [para. 20-5.3.2](#) before being placed in service. A grapple that has been idle for a period of 1 yr or more shall be inspected in accordance with [para. 20-5.3.3](#) before being returned to service.

20-5.3.5 Inspection Records

Dated inspection reports shall be made on critical items such as those listed in [para. 20-5.3.3](#). Records should be available for each periodic inspection and when the grapple is either altered or repaired.

20-5.3.6 Repairs

Deficiencies disclosed by the inspection requirements of [Section 20-5.3](#) shall be corrected according to the procedures outlined in [para. 20-5.3.8](#) before normal operation of the grapple is resumed, unless a qualified person determines the deficiency does not constitute a hazard. Repairs of slings (ASME B30.9), hooks (ASME B30.10), rigging hardware (ASME B30.26), or other special devices shall comply with repair requirements in the applicable volumes or standards.

20-5.3.7 Removal Criteria

A grapple shall be removed from service if conditions (if applicable) such as the following are present (limits established by the manufacturer or qualified person) and shall only be returned to service when approved by a qualified person:

(a) deformation, cracks, or wear

(b) loose or missing guards, fasteners, covers, stops, or nameplates

(c) excessive pitting or corrosion

(d) excessive nicks or gouges

(e) indications of heat damage

- (f) unauthorized welds or modifications
- (g) unauthorized replacement components
- (h) improper assembly or function
- (i) impaired, seized, or bound moving parts
- (j) incorrect operation or function of any controls, indicators, or warning devices
- (k) improper assembly or function
- (l) damaged magnet (see [para. 20-4.3.6](#))
- (m) damaged connecting link
- (n) missing or illegible operating control markings or product safety labels
- (o) other conditions, including visible damage, that cause doubt as to continued safe use

20-5.3.8 Testing

(a) New and reinstalled grapples shall be tested by a qualified person, or a designated person under the direction of the manufacturer or a qualified person, prior to initial use to verify compliance with applicable provisions of this Volume, including a visual inspection to verify that the grapple contains no visible indications of hazardous conditions.

(b) Altered or repaired grapples shall be tested by a qualified person, or a designated person under the direction of the manufacturer or a qualified person. This test may be limited to the components affected by the alteration or repair, as determined by a qualified person with guidance from the manufacturer.

(c) All indicator lights, gauges, horns, bells, alarms, pointers, and other warning devices shall be tested.

(d) Dated reports of all operational tests shall be filed.

20-5.3.9 Maintenance

(a) *Maintenance Program.* A maintenance program shall be established and be based on recommendations made by the grapple manufacturer. If a qualified person determines it is appropriate, the program should also include that individual's additional recommendations based on a review of the grapple application and operations.

(b) *Maintenance Procedure*

(1) Before maintenance is started on a grapple or its controls, the following precautions shall be taken:

(-a) All sources of grapple power shall be disconnected, locked out, and tagged "Out of Service."

(-b) Fluid pressure shall be relieved from all circuits before loosening or removing fluid power components.

(-c) A grapple removed from service for repair shall be tagged "Out of Service."

(2) Only designated personnel shall perform maintenance, repairs, and tests when required. All moving parts of the grapple for which lubrication is specified should be regularly lubricated. The manufacturer's rec-

ommendations as to the points and frequency of lubrication, and types of lubricant, should be used.

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

(4) After adjustments and repairs have been made, the grapple shall not be returned to service until it has been inspected according to [para. 20-5.3.3](#).

(5) Dated records of repairs and replacements should be made.

SECTION 20-5.4: OPERATION

20-5.4.1 Operators

Grapples shall be operated only by trained, designated persons.

20-5.4.2 Qualifications

Qualifications for operators of grapples are as follows:

(a) The operator shall be instructed in the use of the grapple by a designated person before handling the grapple. Instructions should include, but not be limited to, the following:

(1) any special operations or precautions

(2) the manufacturer's suggested operating procedures

(3) storage of the grapple to protect it from damage

(4) not exceeding the rated load of the grapple nor the material handler by the combined weight of the grapple and the load

(b) The operator shall demonstrate the ability to operate the grapple as instructed before assuming responsibility for using the grapple.

(c) The operator shall demonstrate an understanding of standard hand signals when applicable.

20-5.4.3 Responsibilities

While the organizational structure of various projects may differ, the following roles are described here for purposes of delineating responsibilities. All responsibilities listed below shall be assigned in the work site organization. (A single individual may perform one or more of these roles.)

operator: directly controls the lifting device's functions.

owner: has custodial control of a lifting device by virtue of lease or ownership.

These persons and roles may or may not match the persons and roles associated with the hoisting equipment in use.

20-5.4.3.1 Responsibilities of the Lifting Device Owner. The responsibilities of the lifting device owner shall include the following: (25)

(a) providing a lifting device, and all necessary components specified by the manufacturer, that meets the requirements of [Sections 20-5.2](#) and [20-5.3](#) as well as specific job requirements.

(b) providing all applicable operating instructions.

(c) providing field assembly, disassembly (if applicable), operation and maintenance information, and warning decals and placards installed as prescribed by the lifting device manufacturer.

(d) establishing an inspection, testing, and maintenance program in accordance with [Section 20-5.3](#).

(e) using designated personnel to perform the required maintenance, repair, and inspections.

(f) ensuring that the lifting device is in proper operating condition prior to initial use at the work site by the following:

(1) verifying that all inspections have been performed as required by [Section 20-5.3](#)

(2) verifying that the lifting device has the necessary rated load to perform the proposed lifting operations in the planned configuration

(g) using operators that meet the requirements of [para. 20-5.4.2](#).

(h) ensuring that all personnel involved in maintenance, repair, assembly, disassembly, and inspection are aware of their responsibilities, assigned duties, and the associated hazards.

(i) determining if additional regulations are applicable to lifting device operations.

(j) ensuring that conditions that may adversely affect lifting device operations are addressed. Such conditions include, but are not limited to, the following:

(1) wind velocity or gusting winds

(2) precipitation

(3) fog

(4) extreme temperatures

(5) lighting

(k) addressing safety concerns raised by the operator or other personnel and being responsible if the operator decides to overrule those concerns and directs lifting device operations to continue. (In all cases, the manufacturer's criteria for safe operation and the requirements of this Volume shall be followed.)

- (25) **20-5.4.3.2 Responsibilities of Operators.** The operator shall be responsible for the following listed items. The operator shall not be responsible for hazards or conditions that are not under the operator's direct control and that adversely affect operation of the lifting device. Whenever the operator has doubt as to the safety of lifting device operations, the operator shall place the load in a safe condition and stop the lifting device's functions in a controlled manner. Use of the lifting device shall resume only after safety concerns have been addressed or the continuation of lifting device operations is directed by the owner.

The operator's responsibilities shall include the following:

(a) reviewing the requirements for the lifting device with the owner before operations.

(b) knowing what types of site conditions could adversely affect the operation of the lifting device and consulting with the owner concerning the possible presence of those conditions.

(c) understanding and applying the information contained in the lifting device manufacturer's operating manual.

(d) understanding the lifting device's functions and limitations as well as its particular operating characteristics.

(e) performing a frequent inspection as specified in [para. 20-5.3.2](#).

(f) promptly reporting the need for any adjustments or repairs to a designated person.

(g) following applicable lock out/tag out procedures.

(h) not operating the lifting device when physically or mentally unfit.

(i) ensuring that all controls are in the off or neutral position and that all personnel are in the clear before energizing the lifting device.

(j) not engaging in any practice that will divert the operator's attention while operating the lifting device.

(k) testing the lifting device function controls that will be used and operating the lifting device only if those function controls respond properly.

(l) operating the lifting device's functions, under normal operating conditions, in a smooth and controlled manner.

(m) knowing and following the procedures specified by the manufacturer or approved by a qualified person for assembly, disassembly, setting up, and reeving or rigging of the lifting device.

(n) considering all known factors that might affect the lifting device's rated load and informing the owner of the need to make appropriate adjustments.

(o) understanding basic load attachment procedures.

(p) responding only to instructions from designated persons. However, the operator shall obey a stop order at all times, no matter who gives it.

20-5.4.4 Grapple Operating Practices

(25)

(a) Grapples shall be operated by the following qualified personnel:

(1) designated persons

(2) trainees under the supervision of a designated person; the number of trainees permitted to be supervised by a single designated person, the physical location of the designated person while supervising, and the type of communication required between the designated person and the trainee shall be determined by a qualified person

(3) maintenance and test personnel, when it is necessary in the performance of their duties

(b) The grapple shall not be loaded in excess of its rated load or handle any load for which it is not designed.

(c) Properly attach the lifting device to the hook, shackle, or other load handling device.

(d) The grapple shall be applied to the load in accordance with the instruction manual.

(e) The temperature of the load shall not exceed the maximum allowable limits of the grapple.

(f) Do not allow load or grapple to come into contact with any obstruction.

(g) The operator shall ensure that the lifting device is adequately protected from damage during use.

(h) The operator shall land any attached load and store the lifting device before leaving the lifting device. The operator shall not leave suspended loads unattended.

(i) The operator shall not ride or allow others to ride loads or the grapple.

(j) The operation of the lifting device shall be observed during use. Any deficiency observed shall be examined by a designated person. If the deficiency constitutes a hazard,

the lifting device shall be removed from service and tagged "Out of Service." Any indication of a hazardous condition shall be reported to a qualified person for evaluation.

20-5.4.5 Miscellaneous Operating Practices

(a) An operator shall not use a grapple that is tagged "Out of Service" or otherwise designated as nonfunctioning.

(b) "Out of Service" tags on grapples shall not be removed without the approval of the person placing them or a designated person.

(c) The grapple, when not in use, shall be stored.

(d) Caution should be taken that operating markings or tags shall not be removed or defaced. Missing or illegible markings or tags shall be replaced.

SECTION 20-5.5: INSTRUCTION MANUALS

Operating instructions and maintenance and parts information shall be furnished by the manufacturer.

Chapter 20-6 Clamps

SECTION 20-6.1: SCOPE

Chapter 20-6 applies to the classification, marking, construction, installation, inspection, testing, maintenance, and operation of clamps. For proper function, a clamp relies on a nonvertical force against the surface of the load to generate a vertical lifting force, or a force normal to the surface of the load or anchorage to prevent motion of the clamp relative to the load or anchorage, or both. These forces may be generated by gravity or by screw, cam, or similar device. Clamps included in this Chapter may be used for attaching loads to a hoist, or for other load handling purposes such as anchoring or positioning. Within Chapter 20-6, the clamps are categorized as follows:

(a) supporting clamps (see Figure 20-6.1-1 for examples).

(b) friction-type pressure-gripping clamps (see Figure 20-6.1-2 for examples).

(c) indentation-type pressure-gripping clamps (see Figure 20-6.1-3 for examples).

(d) anchoring and positioning clamps. Anchoring clamps are used for suspending or attaching detachable rigging hardware. Positioning clamps are used to hold or locate parts during assembly operations (see Figure 20-6.1-4 for examples).

(e) hybrid clamps that use a combination of categories above (see Figure 20-6.1-5 for example).

SECTION 20-6.2: MARKING, CONSTRUCTION, AND INSTALLATION

20-6.2.1 Marking

(a) *Rated Load.* The rated maximum and minimum (if applicable) loads of the clamp shall be legibly marked on its main structure or on a tag attached to its main structure

**Figure 20-6.1-1
Load-Supporting Clamps**

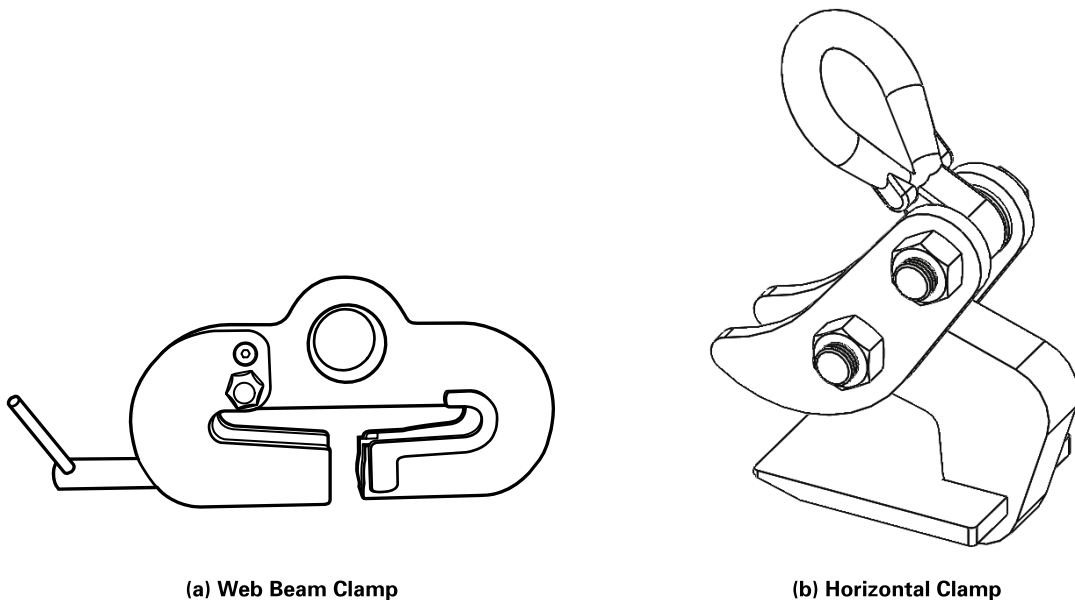
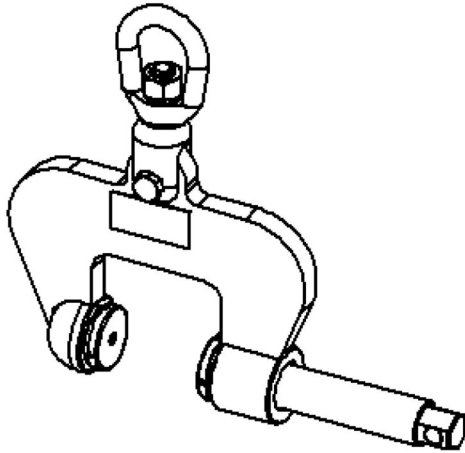
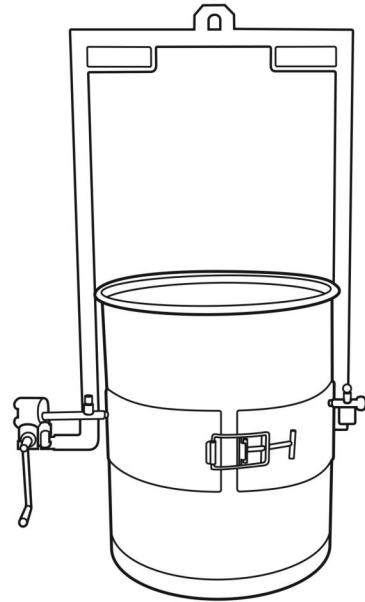


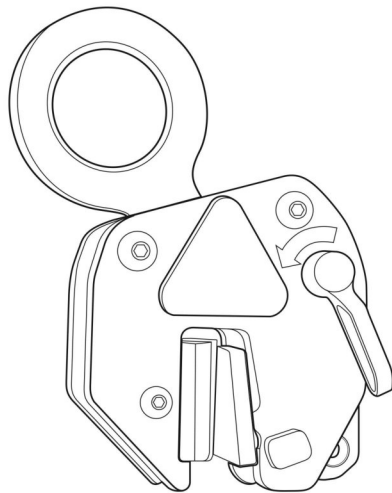
Figure 20-6.1-2
Friction-Type Pressure-Gripping Clamps



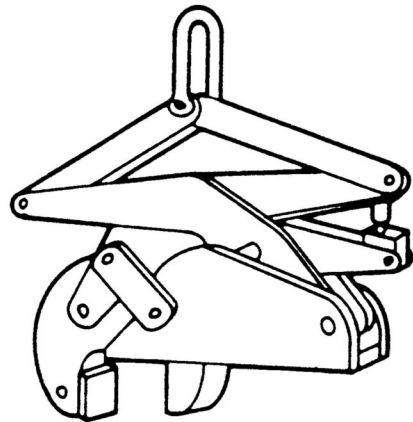
(a) Screw Clamp



**(b) Drum of Cylinder Friction-Type Cam Clamp
(Lifts by Friction)**

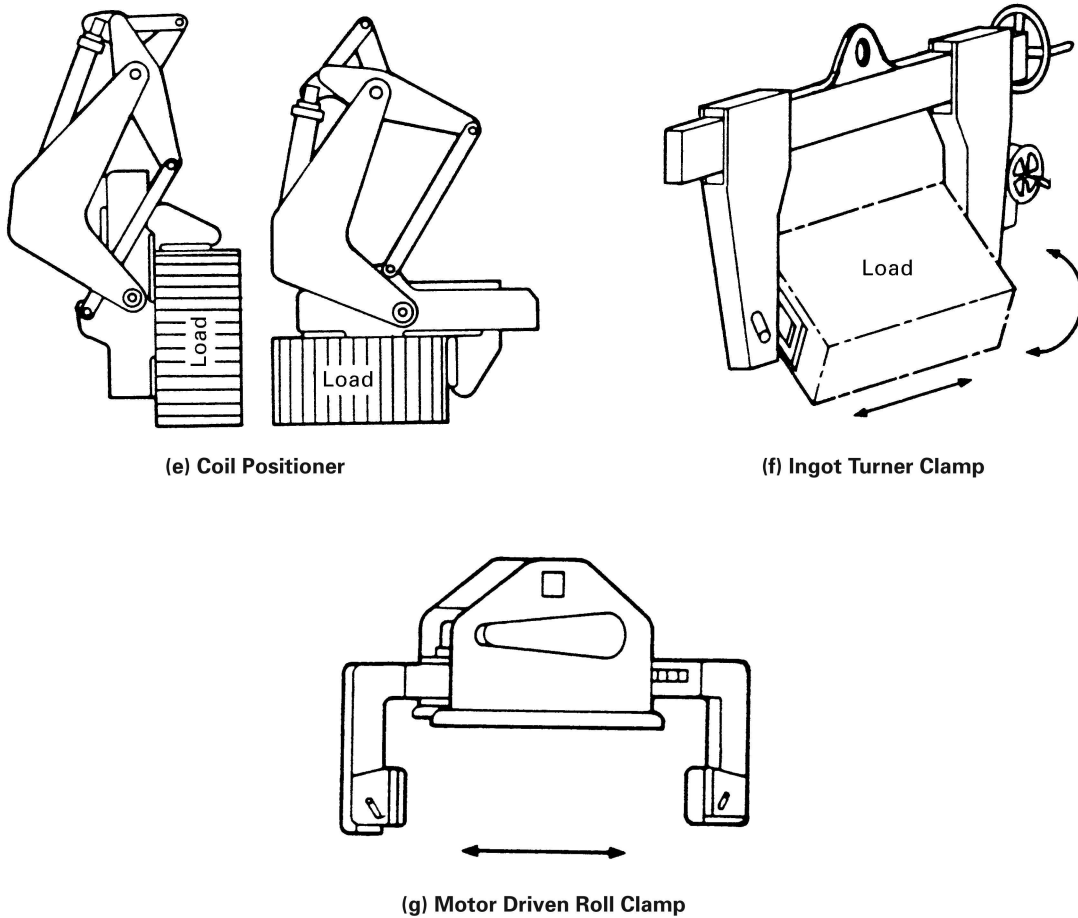


(c) Plate Clamp



(d) Vertical Axis Coil Clamp

Figure 20-6.1-2
Friction-Type Pressure-Gripping Clamps (Cont'd)



where it is visible. The minimum load (if applicable) shall be defined by the manufacturer or a qualified person.

(b) *Identification.* Clamps shall be marked with, but not limited to, the following information:

- (1) manufacturer's name and contact information
- (2) serial number (unique unit identifier)
- (3) clamp weight, if over 100 lb (45 kg)
- (4) rated maximum load [as described in (a)]
- (5) rated minimum load [as described in (a)]
- (6) ASME BTH-1 Design Category
- (7) ASME BTH-1 Service Class
- (8) clamps that are designed only for anchoring or positioning shall be marked accordingly

(c) *Repaired or Altered Clamps.* Repaired or altered clamps shall be provided with identification displaying, but not limited to, the following information:

- (1) name and contact information of the repairer or alterer

- (2) repairer's or alterer's unit identification

- (3) clamp weight (if altered)

- (4) rated maximum load (if altered) [as described in

(a)]

- (5) rated minimum load (if altered) [as described in

(a)]

- (6) ASME BTH-1 Design Category (if altered)

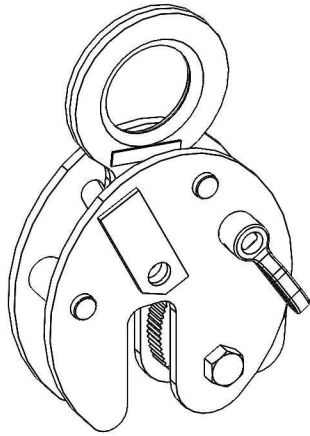
- (7) ASME BTH-1 Service Class (if altered)

This requirement is not applicable to repairs limited to replacement of maintenance parts.

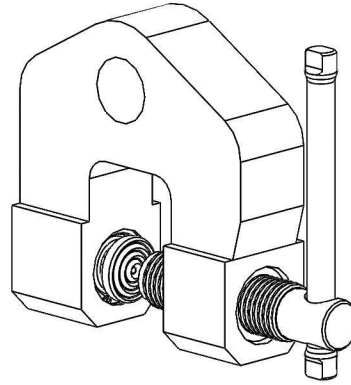
(d) *Product Safety Labels*

- (1) Where size and shape of the clamp allow, clamps shall have labels affixed to them in a readable position that include the appropriate signal word, according to ANSI Z535.4-2011, to bring the label to the attention of the operator. The label should include cautionary language identifying hazards, methods for accident prevention,

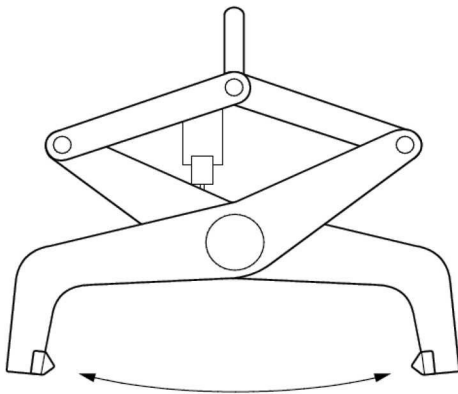
Figure 20-6.1-3
Indentation-Type Pressure-Gripping Clamps



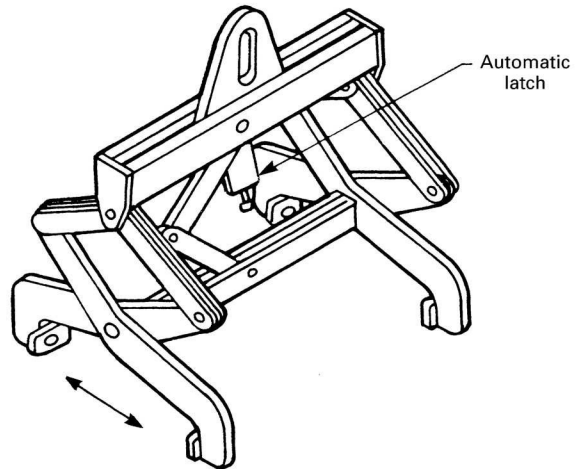
(a) Plate Clamp



(b) Screw Clamp



(c) Automatic Slab Tong (Two Point)



(d) Automatic Slab Tong (Four Point)

and refer to instruction manuals for additional information.

(2) Where size or shape of the clamp prohibits the inclusion of all or any such markings, a label shall be affixed referring the user to consult the manufacturer's instruction manual for product safety information.

20-6.2.2 Construction

The manufacturer shall verify that clamps are designed in accordance with ASME BTH-1.

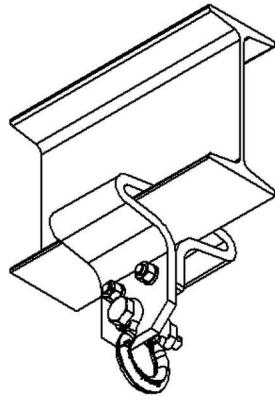
Clamps shall be designed to ASME BTH-1 Design Category B (static strength criteria) and the proper Service Class (fatigue life criteria) selected for its number of

load cycles, unless a qualified person representing the owner, purchaser, or user of the clamp determines that ASME BTH-1 Design Category A is appropriate.

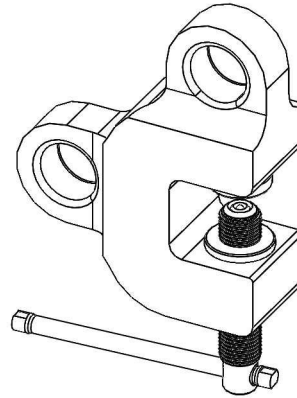
Design Category A shall only be designated when the magnitude and variation of loads applied to the clamp are predictable and where the loading and environmental conditions are accurately defined, where service is not severe, and where the anticipated number of load cycles does not exceed Service Class 0.

(a) *Welding.* Welding shall be in accordance with ASME BTH-1, para. 1-4.6.

Figure 20-6.1-4
Anchoring and Positioning Clamps

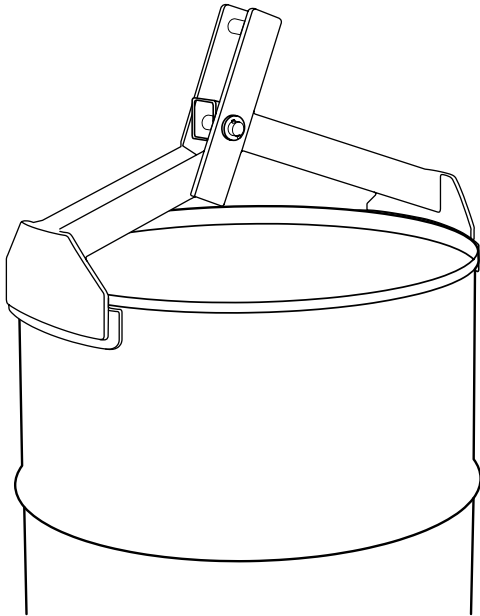


(a) Anchoring Clamp

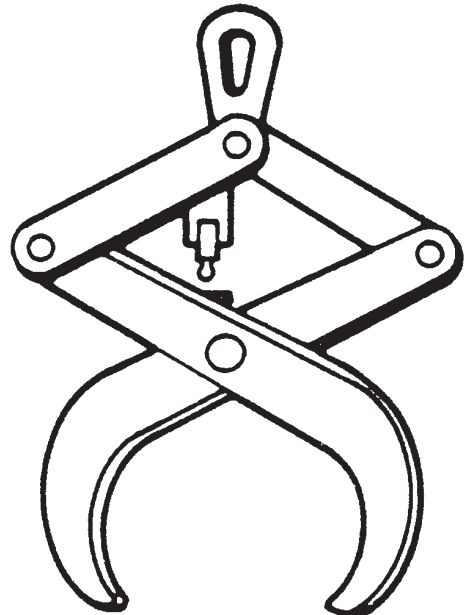


(b) Positioning Clamp

Figure 20-6.1-5
Hybrid Clamps



(a) Barrel Lip Clamp



(b) Bar Tong

(b) *Guards for Moving Parts.* Exposed moving parts, such as, but not limited to, gearing and projecting shafts, that constitute a hazard under normal operating conditions shall be guarded.

(c) *Electrical Equipment.* External power supply, electrical equipment, and wiring for clamps shall be in accordance with ASME BTH-1.

(d) *Alterations.* Clamps may be altered or rerated, provided such alterations are analyzed and approved by the equipment manufacturer or a qualified person. A rerated clamp, or one whose components have been altered, shall conform to this paragraph and be tested according to [para. 20-6.3.8](#). The new rated load shall be displayed in accordance with [para. 20-6.2.1](#).

(e) *Slings.* When employed, slings shall meet the requirements of ASME B30.9.

(f) *Hooks.* When employed, hooks shall meet the requirements of ASME B30.10.

(g) *Rigging Hardware.* When employed, rigging hardware shall meet the requirements of ASME B30.26.

20-6.2.3 Installation

The clamp shall be installed in accordance with the manufacturer's instructions.

SECTION 20-6.3: INSPECTION, TESTING, AND MAINTENANCE

20-6.3.1 Inspection Classification

General. All inspections shall be performed by a designated person. Any deficiencies identified shall be examined and a determination made by a qualified person as to whether they constitute a hazard, and if so, what additional steps need to be taken to address the hazard.

Inspection of slings (ASME B30.9), hooks (ASME B30.10), rigging hardware (ASME B30.26), or other devices shall comply with the inspection requirements in the applicable volume.

(a) Initial Inspection

(1) New and reinstalled clamps shall be inspected prior to initial use to verify compliance with applicable provisions of this Volume.

(2) Altered or repaired clamps shall be inspected. The inspection may be limited to those components affected by the alteration or repair, as determined by a qualified person.

(b) *Inspection Intervals.* Inspection procedure for clamps in regular service is divided into three general classifications based upon the intervals at which inspection should be performed. The intervals, in turn, are dependent upon the critical components of the clamps and the degree of their exposure to wear or deterioration. The three general classifications are herein designated as *every lift*, *frequent*, and *periodic*, with respective intervals between inspections as defined below.

(1) *Every Lift Inspection.* Visual examination before and during each use of the clamp.

(2) *Frequent Inspection.* Visual examination 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

(3) *Periodic Inspection.* Documented visual inspection of apparent external conditions to provide the basis for a continuing evaluation.

(-a) normal service — yearly

(-b) heavy service — semiannually

(-c) severe service — quarterly

(-d) special or infrequent service — as recommended by a qualified person before the first such lift and as directed by the qualified person for any subsequent lifts

20-6.3.2 Every Lift Inspection

Clamps shall be inspected by the operator before and/or during every lift for any deficiencies as specifically indicated, including

(a) clamp load contact surface condition

(b) engagement

(c) obvious clamp damage

20-6.3.3 Frequent Inspection

(25)

Clamps shall be inspected at intervals as defined in [para. 20-6.3.1\(b\)\(2\)](#). Conditions such as those listed in [para. 20-6.3.7](#), or any other condition that may constitute a hazard, shall cause the clamp to be removed from service. A qualified person shall determine whether any deficiency constitutes a hazard, requires repair, requires disassembly for further inspection, or will require more frequent inspection. The clamp shall not be returned to service until approved by a qualified person.

20-6.3.4 Periodic Inspection

Complete inspection of the clamp shall be performed at intervals as defined in [para. 20-6.3.1\(b\)\(3\)](#). Conditions such as those listed in [para. 20-6.3.7](#), or any other condition that may result in a hazard, shall cause the clamp to be removed from service. A qualified person shall determine whether any deficiency constitutes a hazard, requires repair, requires disassembly for further inspection, or will require more frequent inspection. Clamps shall not be returned to service until approved by a qualified person. The inspection shall be based on the manufacturer's instructions, [para. 20-6.3.7](#), or the recommendations of a qualified person.

20-6.3.5 Clamps Not in Regular Use

A clamp that has been idle for a period of 1 month to 1 yr shall be inspected in accordance with [para. 20-6.3.3](#) before being placed in service. A clamp that has been idle for a period of 1 yr or more shall be inspected in accordance with [para. 20-6.3.4](#) before being returned to service.

20-6.3.6 Inspection Records

Dated inspection reports shall be made on critical items such as those listed in [para. 20-6.3.7](#). Records should be available for each periodic inspection and when the clamp is either altered or repaired.

20-6.3.7 Removal Criteria

A clamp shall be removed from service if conditions (if applicable) such as the following are present (limits established by the manufacturer or qualified person) and shall only be returned to service when approved by a qualified person:

- (a) deformation, cracks, or wear
- (b) loose or missing guards, fasteners, covers, stops, or nameplates
- (c) excessive pitting or corrosion
- (d) excessive nicks or gouges
- (e) indications of heat damage
- (f) unauthorized welds or modifications
- (g) unauthorized replacement components
- (h) improper assembly or function
- (i) impaired, seized, or bound moving parts
- (j) gripping teeth that are
 - (1) severely worn
 - (2) broken, chipped, or damaged
 - (3) clogged with foreign material
- (k) gripping surfaces that show
 - (1) contamination
 - (2) excessive surface wear
 - (3) lack of integrity of the gripping material
 - (4) lack of bond between gripping material and metal backing
- (l) damaged or distorted pins
- (m) bail that is
 - (1) severely worn
 - (2) bent, twisted, distorted, stretched, cracked, or broken
- (n) damage to the body, including
 - (1) cracked welds
 - (2) bent, twisted, distorted, stretched, elongated pin holes, or cracks
- (o) damaged, distorted, or worn threads including foreign material on the threads
- (p) deformed, broken, or missing springs
- (q) broken, worn, or loose cam
- (r) missing or illegible operating control markings or product safety labels

(s) other conditions, including visible damage, that cause doubt as to continued safe use

20-6.3.8 Repairs

Deficiencies disclosed by the inspection requirements of [Section 20-6.3](#) shall be corrected according to the procedures outlined in [para. 20-6.3.10](#) before operation of the clamp is resumed, unless a qualified person determines the deficiency does not constitute a hazard. Repairs of slings (ASME B30.9), hooks (ASME B30.10), rigging hardware (ASME B30.26), or other devices shall comply with repair requirements in the applicable volumes or standards.

20-6.3.9 Testing

20-6.3.9.1 Operational Tests

(a) New clamps shall be tested by a qualified person, or a designated person under the direction of the manufacturer or a qualified person, prior to initial use to verify compliance with applicable provisions of this Volume, including, but not limited to, the following operations:

(1) *Moving Parts*. Clamps with moving parts shall be tested to determine that the clamp operates in accordance with manufacturer's instructions.

(2) *Locking Mechanisms*. Clamps with manually operated or automatic locking mechanisms shall be tested to determine that the locking mechanism operates in accordance with manufacturer's instructions.

(b) Altered or repaired clamps shall be tested by a qualified person or a designated person under the direction of the manufacturer or a qualified person. This test may be limited to the components affected by the alteration or repair, as determined by a qualified person with guidance from the manufacturer.

(c) All indicator lights, gauges, horns, bells, alarms, pointers, and other warning devices shall be tested.

(d) Dated reports of all operational tests shall be filed.

20-6.3.9.2 Load Test

(25)

(a) Prior to initial use, all new, altered, or repaired clamps should be tested and inspected. If performed, tests shall be done by a qualified person, or a designated person under the direction of the manufacturer or a qualified person, and a written report be furnished, confirming the rated load of the clamp. Test loads shall be 125% +5%/-0% of the rated load unless otherwise recommended by the manufacturer or a qualified person. Test reports should be available.

(b) The load test, if made, shall at a minimum consist of the following operations:

(1) Hoist the test load a sufficient distance to ensure the load is supported by the clamp, or apply the required load if the test is made using a testing machine.

(2) The load test shall develop all forces, including those due to gravity (e.g., tension, compression, shear, bending moment), in all components, based on the design requirements defined in ASME BTH-1.

(3) If the lifting device can be used in multiple configurations, load testing shall be defined by the manufacturer or a qualified person that will subject the load carrying components of the lifting device to a load test force or combination of forces that correspond to the maximum forces that are expected to occur during the use of the lifting device.

(4) Load testing of the lifting device may be performed either on individual components or complete assemblies.

(5) After the test load is released, visually inspect the clamp for deformation, cracks, or other defects.

(c) Tests of altered or repaired clamps may be limited to the components affected by the alteration or repair, as determined by a qualified person with guidance from the manufacturer, and shall be tested to at least the rated load.

20-6.3.10 Maintenance

(a) *Maintenance Program.* A maintenance program shall be established and be based on recommendations made by the clamp manufacturer. If a qualified person determines it is appropriate, the program should also include that individual's additional recommendations based on a review of the clamp application and operation.

(b) *Maintenance Procedure*

(1) Before adjustments and repairs are started on a clamp, the following precautions shall be taken:

(-a) All sources of power shall be disconnected, locked out, and tagged "Out of Service."

(-b) A clamp removed from service for repair shall be tagged "Out of Service."

(2) Only designated persons shall perform adjustments, repairs, and tests.

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

(4) After adjustments and repairs have been made, the clamp shall not be returned to service until it has been inspected according to [para. 20-6.3.4](#).

(5) Dated records of repairs and replacements should be made.

(6) Any hazardous conditions disclosed by the inspection of [para. 20-6.3.1](#) shall be corrected before normal operation of the clamp is resumed. Adjustments and repairs shall be done under the direction of, or by, a qualified person.

SECTION 20-6.4: OPERATION

20-6.4.1 Operators

Clamps shall be operated only by trained, designated persons.

20-6.4.2 Qualifications

(25)

Qualifications for operators of clamps are as follows:

(a) The operator shall be instructed in the use of the clamp by a designated person. Instructions should include, but not be limited to, the following:

(1) application of the clamp to the load and material-handling device and adjustments, if any, that adapt the clamp to various sizes or kinds of loads

(2) any special operations or precautions

(3) the manufacturer's suggested operating procedures

(4) characteristics of the load itself required for operation of the clamp, such as, but not limited to, balance, surface cleanliness, flatness, rigidity, and thickness

(5) storage of the clamp to protect it from damage

(6) not exceeding the rated load of the clamp nor the rated load of the hoisting equipment by the combined weight of the load, the clamp, and rigging

(7) the proper attachment of adapters to the clamp for special load handling

(b) The operator shall demonstrate the ability to operate and inspect the clamp as instructed before assuming responsibility for using the clamp.

(c) The operator shall be familiar with standard hand signals when applicable.

20-6.4.3 Responsibilities

While the organizational structure of various projects may differ, the following roles are described here for purposes of delineating responsibilities. All responsibilities listed below shall be assigned in the work site organization. (A single individual may perform one or more of these roles.)

operator: directly controls the clamp's functions.

owner: has custodial control of a clamp by virtue of lease or ownership.

These persons and roles may or may not match the persons and roles associated with the hoisting equipment.

20-6.4.3.1 Responsibilities of the Clamp Owner. The responsibilities of the clamp owner shall include the following: (25)

(a) providing a clamp, and all necessary components specified by the manufacturer, that meets the requirements of [Sections 20-6.2](#) and [20-6.3](#) as well as specific job requirements.

(b) providing all applicable operating instructions.

(c) providing field assembly, disassembly (if applicable), operation and maintenance information, and warning decals and placards installed as prescribed by the clamp manufacturer.

(d) establishing an inspection, testing, and maintenance program in accordance with [Section 20-6.3](#).

(e) using designated personnel to perform the required maintenance, repair, and inspections.

(f) ensuring that the clamp is in proper operating condition prior to initial use at the work site by the following:

(1) verifying that all inspections have been performed as required by [Section 20-6.3](#)

(2) verifying that the clamp has the necessary rated load to perform the proposed lifting operations in the planned configuration

(g) using operators that meet the requirements of [para. 20-6.4.2](#).

(h) ensuring that all personnel involved in maintenance, repair, assembly, disassembly, and inspection are aware of their responsibilities, assigned duties, and the associated hazards.

(i) determining if additional regulations are applicable to clamp operations.

(j) ensuring that conditions that may adversely affect clamp operations are addressed. Such conditions include, but are not limited to, the following:

(1) wind velocity or gusting winds

(2) precipitation

(3) fog or humidity

(4) extreme temperatures

(5) lighting

(k) addressing safety concerns raised by the operator or other personnel and being responsible if they and a qualified person decide to overrule those concerns and direct clamp operations to continue. (In all cases, the manufacturer's criteria for safe operation and the requirements of this Volume shall be followed.)

- (25) **20-6.4.3.2 Responsibilities of Operators.** The operator shall be responsible for the following listed items. The operator shall not be responsible for hazards or conditions that are not under the operator's direct control and that adversely affect operation of the clamp. Whenever the operator has doubt as to the safety of lifting operations, the operator shall place the load in a safe condition and stop the lift in a controlled manner. Use of the clamp shall resume only after safety concerns have been addressed or the continuation of clamp usage is directed by the owner and a qualified person.

The operator's responsibilities shall include the following:

(a) reviewing the requirements for the clamp with the owner before operations.

(b) knowing what types of site conditions could adversely affect the operation of the clamp and consulting with the owner concerning the possible presence of those conditions.

(c) understanding and applying the information contained in the clamp manufacturer's operating manual.

(d) understanding the clamp's functions and limitations as well as its particular operating characteristics.

(e) ensuring an inspection is performed prior to every lift as specified in [para. 20-6.3.2](#).

(f) promptly reporting the need for any adjustments or repairs to a designated person.

(g) following applicable lock out/tag out procedures.

(h) not using the clamp when physically or mentally unfit.

(i) ensuring that all personnel are in the clear before initiating the lift.

(j) not engaging in any practice that will divert the operator's attention while using the clamp.

(k) inspecting the clamp for proper function before use.

(l) using the clamp in a smooth and controlled manner.

(m) knowing and following the procedures specified by the manufacturer or approved by a qualified person concerning attachment of the clamp.

(n) considering all known factors that might affect the clamp's lifting capacity and informing the owner of the need to make appropriate adjustments.

(o) responding only to instructions from designated persons. However, the operator shall obey a stop order at all times, no matter who gives it.

(p) not making alterations or modifications to the clamp.

20-6.4.4 Clamp Operating Practices

(25)

(a) Selection of the clamp and proper setup is as follows:

(1) Follow manufacturer's procedures to prevent load disengagement.

(2) Verify the load meets or exceeds the minimum load required for proper clamp function.

(3) Use proper clamp for material hardness, material type, surface conditions, etc.

(4) Do not lift multiple or sagging plates unless approved by the manufacturer.

(5) Assure all moving clamp components move freely.

(6) Do not use two or more vertical clamps on opposite ends of a plate to lift the plate in the horizontal position unless approved by the manufacturer.

(7) When locks are provided on the clamp, they shall be used.

(8) A clamp shall only be used within its thickness range.

(9) Reduce the rated load as required by the manufacturer for lifts other than a straight lift.

(b) Clamps shall be operated only by the following qualified personnel:

(1) designated persons

(2) trainees under the supervision of a designated person; the number of trainees permitted to be supervised by a single designated person, the physical location of the designated person while supervising, and the type of communication required between the designated person and the trainee shall be determined by a qualified person

(3) maintenance and test personnel, when it is necessary in the performance of their duties

(4) inspectors

(c) Ensure the weight of the load and its approximate center of gravity have been obtained, provided, or calculated.

(d) The clamp shall not be loaded in excess of its rated load or handle any load for which it is not designed.

(e) Properly attach the lifting device to the hook, shackle, or other load handling device.

(f) Clamps and the load must be clean in accordance with the instruction manual.

(g) The clamp shall be applied to the load in accordance with the instruction manual.

(h) Before lifting, make sure that clamp slings (as applicable) are not kinked or twisted.

(i) Care should be taken to make certain the load is correctly distributed for the clamps being used.

(j) The temperature of the load shall not exceed the maximum allowable limits of the clamp unless approved by the manufacturer or qualified person.

(k) Verify that the load is well secured and properly balanced in the lifting device when it is initially lifted.

(l) Do not allow load or clamp to come into contact with any obstruction.

(m) Ensure that the lifting device is adequately protected from damage during use.

(n) Recheck clamp engagement and clamping force whenever the load has been placed on a supporting surface.

(o) The clamp shall not be used for side pulls or sliding the load unless specifically authorized by the manufacturer or a qualified person.

(p) The operator shall land any attached load and disengage the clamp before leaving the clamp. The operator shall not leave suspended loads unattended. Anchoring clamps are exempt from this requirement.

(q) The operator shall not ride or allow others to ride loads or the clamp.

(r) The operation of the clamp shall be observed before use and during a shift. Any deficiency observed shall be examined by a designated person. If the deficiency constitutes a hazard, the clamp shall be removed from service and tagged "Out of Service." Any indication of a hazardous condition shall be reported to a qualified person for evaluation.

(s) Loads shall be guided in such a manner as to avoid endangering hands or other body parts as the load is moved, or if it drops.

(t) When using two or more clamps, follow the manufacturer's instructions for multiple clamp use.

(u) Plate clamps shall only be used to lift a single plate unless otherwise approved by the clamp manufacturer.

20-6.4.5 Miscellaneous Operating Practices

(a) An operator shall not use a clamp that is tagged "Out of Service" or otherwise designated as nonfunctioning.

(b) "Out of Service" tags on clamps shall not be removed without the approval of either the person placing them or a designated person.

(c) The clamp, when not in use, should be stored at an assigned location.

(d) Caution should be taken to ensure that operating markings or tags shall not be removed or defaced. Missing or illegible markings or tags shall be replaced.

SECTION 20-6.5: INSTRUCTION MANUALS

(25)

The manufacturer shall provide operating instructions, inspection and removal criteria, and maintenance and parts information. In addition, the manual shall provide a statement of those factors that alter the clamp's lifting capacity and related limitations. Several factors known to affect a clamp's lifting capabilities are noted below and shall be included in the manual.

(a) *Temperature of Load.* The manufacturer's recommendations pertaining to operation of the clamp on loads at temperatures exceeding normal ambient temperatures.

(b) *Load Dimensions.* Define the limitations on the size of the load that is recommended.

(c) *Surface, Shapes, Material, and Surface Hardness Configuration.* Provide specific information on what surfaces, shapes, materials, and surface hardness the device is designed to handle, including factors such as rough surface finish, paper, dirt, rust, paint, and any other factors deemed important to the handling of loads.

(d) *Maintenance of Interfacing Surfaces.* Define the permissible amount of wear, distortion, or damage of the interface components.

(e) *Environmental.* Define conditions that adversely affect the rated load including but not limited to wind, rain, snow, etc.

(f) *Lifting Angle Range.* Define limitations on the lifting angle range.

(g) *Minimum Lifting Force.* Define the minimum lifting force necessary to actuate the clamping action. Minimum loads for pressure-gripping lifting and structural shape clamps are dependent on clamp wear and material hardness.

NONMANDATORY APPENDIX A

MARKING OF MULTIPLE-RATED-LOAD LIFTING DEVICES

(25)

A-1 INTRODUCTION

The Owner of the lifting device has the responsibility of verifying the correct markings, including rated load, on the device prior to performing the proposed lifting operations in the planned configuration [see [para. 20-1.4.3.1\(f\)\(2\)](#)].

Some lifting devices have more than one rated load, possibly numerous rated loads, depending on how they are configured for use. The typical marking of lifting devices where one rated load is shown may not be practical for these devices. The provisions of [Nonmandatory Appendix A](#) define example methods of addressing this marking issue.

A-2 TYPES OF MULTIPLE-RATED-LOAD LIFTING DEVICES

An adjustable lifting device may have a different rated load for each approved configuration. Three examples of adjustable lifting devices are shown in [Figures A-2-1 through A-2-3](#).

[Figure A-2-1](#) is an end cap spreader bar. In the most common style, the end caps are manufactured products and the insert is a length of pipe provided and cut to length by the lifting device user. The rated load of the assembled spreader bar varies based on the grade of the pipe, the size of the pipe, the spread (center-to-center of the lower rigging connections), the angle of the upper rigging and the angle of the lower rigging, any or all of which may vary from one assembled configuration to the next. The rated load may also be limited by the strength of the end cap pin holes to which the rigging is connected.

[Figure A-2-2](#) is a modular spreader bar. This bar is made up of two end fittings and one or more center sections that are bolted together end to end. All of the components of a modular spreader bar are most commonly manufactured products. The manufacturer provides documentation to the user that shows the approved combinations of components and the corresponding rated loads.

[Figure A-2-3](#) is a lifting beam with numerous upper rigging points and numerous lower rigging points. If the bending strength of the beam controls the rated load, then the rated load may vary for each selection of upper and lower rigging points. As with the end cap and modular spreader bars, the rated load may also be limited by the strength of the pin holes to which the rigging is connected. If the rated load of such a lifting beam is controlled by characteristics of the beam such

that the beam has one rated load for all rigging configurations, then the marking requirements of [para. 20-1.2.1\(b\)](#) or [para. 20-1.2.1\(c\)](#), as applicable, apply without modification.

A-3 MARKING OF A MULTIPLE-RATED-LOAD LIFTING DEVICE

A-3.1 Marking of Lifting Device Components

Lifting device components that have defined rated loads should be marked as such. For example, a spreader bar end cap should be marked to indicate the maximum allowable rigging tension at each pin hole. The other marking requirements of [para. 20-1.2.1](#) also apply.

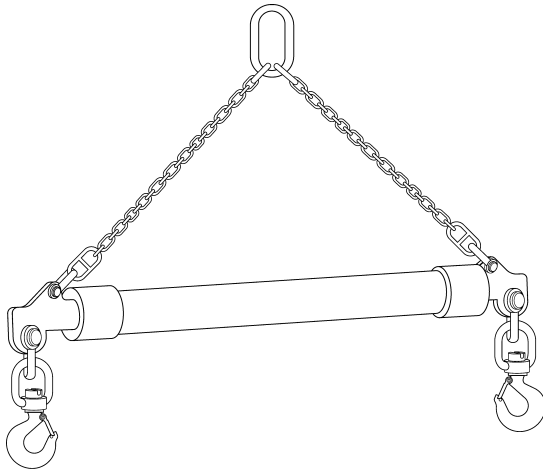
Lifting device components that do not have defined rated loads, such as the insert pipe used in an end cap spreader bar, should be marked with identifying dimensions (e.g., outside diameter and wall thickness), material grade, weight, and other properties that are needed by the lifting device user to determine the rated load of the assembled lifting device.

Lifting device components that are manufactured items that do not have defined rated loads, such as the center sections of a modular spreader bar, should be marked with part numbers or serial numbers, or both, that clearly identify the components with respect to the manufacturer's documentation.

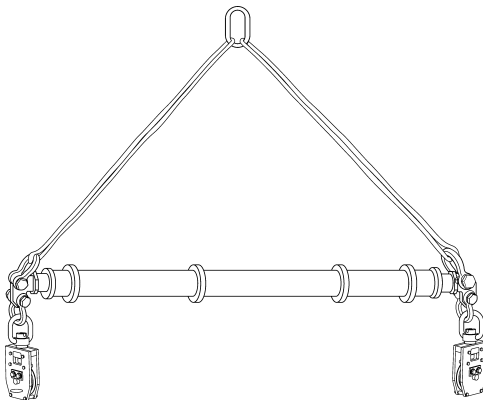
A-3.2 Marking of Lifting Device — Single-Use Label

The marking requirements of [para. 20-1.2.1](#), in some cases, can be met through the use of a single-use lifting device label. Consider as an example the required marking for an end cap spreader bar such as shown in [Figure A-2-1](#). If the lower rigging is vertical (a common case), the rated load is affected by the size, type, and length of the insert pipe, the angle of the upper rigging, and the strength of the pin holes in the end caps. The weight of the device is affected by the weights of the end caps and the weight of the insert pipe. The lifting device labels shown in [Figure A-3.2-1](#) illustrate the form of a single-use label that may be used for an end cap spreader bar. All of the required information is shown, with the geometry and rated load of only that configuration to be used given on the label.

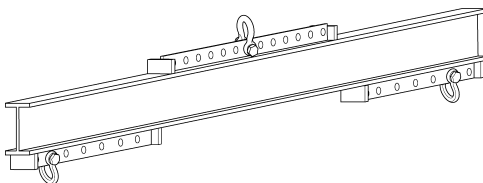
**Figure A-2-1
End Cap Spreader Bar**



**Figure A-2-2
Modular Spreader Bar**



**Figure A-2-3
Lifting Beam**



A single-use label of this style should be created on a project-by-project basis. Other than showing the information required by [para. 20-1.2.1](#), the single-use label must be durable enough to hold up for the duration of the use of the lifting device.

A lifting device, such as the modular spreader bar shown in [Figure A-2-2](#), can have numerous rated loads. The rated load is affected by the size, type, and length of the center sections, the angles of the upper and lower rigging, and the strength of the pin holes in the end fittings. These systems are assembled from modular components that can be reconfigured on the job to accommodate different rigging arrangements. Individually, these components each have a maximum rated load, but the system may be limited based on the configuration used.

In most cases, the manufacturer of the lifting device system provides a data sheet or load chart to determine the rated load of the system in its various configurations. As with the end cap spreader bar, a single-use label should be used to identify the rated load and weight of the assembled spreader bar for the specific configuration to be used. An example of this type of label is shown in [Figure A-3.2-2](#).

A-3.3 Marking of Lifting Device — Load Chart Label

A lifting device, such as the lifting beam shown in [Figure A-2-3](#), is fixed in geometry but can be rigged in a number of different configurations. Considering the rigging configuration shown in the figure, in which the load is rigged symmetrically to two lower pin holes and the beam is rigged to the lifting equipment from the center upper pin hole, a lifting device label with a load chart, as illustrated in [Figure A-3.3-1](#), may be practical.

The load chart shown on this type of label should define rated loads for only a limited number of approved rigging configurations to keep the size of the label practical. A single-use label should be used to allow the use of the lifting device in alternate rigging configurations that have been determined to be acceptable by the required combination of calculations, in accordance with ASME BTH-1, and load testing, in accordance with [para. 20-1.3.9.2](#).

A-4 COMPLETION OF USE OF MULTIPLE-RATED-LOAD LIFTING DEVICE

At the completion of the planned lifting operation in the planned configuration, the single-use label should be removed prior to future use of the device.

Figure A-3.2-1
Examples of Single-Use Labels for End Cap Spreader Bars

Manufacturer	<manufacturer's name> <manufacturer's address - first line> <manufacturer's address - second line> <manufacturer's phone number, email address, and/or website URL>			
Serial Numbers	<assembly serial number and end cap serial numbers>			
Insert Pipe Details	12.75" Ø x 0.375" ASTM A53 Grade B			
Configuration and Rated Load	Spread	Minimum Upper Rigging Angle	Assembly Weight	Rated Load
	20'-0"	60°	4,500 pounds	400,000 pounds
ASME BTH-1 Design Category B		ASME BTH-1 Service Class 0		
Refer to engineering document <unique document identifier> for additional information regarding the use and load ratings of this spreader bar assembly.				

Manufacturer	<manufacturer's name> <manufacturer's address - first line> <manufacturer's address - second line> <manufacturer's phone number, email address, and/or website URL>		
Serial Number	<assembly serial number or component serial numbers>		
Configuration Description	<configuration description>		
Specific Configuration Weight	XXXX pounds		
Specific Configuration Rated Load	ZZZZ tons See Assembly Drawing <drawing number> for additional information		
ASME BTH-1 Design Category A		ASME BTH-1 Service Class 0	
Refer to engineering document <unique document identifier> for additional information regarding the use and load ratings of this spreader bar assembly.			

Figure A-3.2-2
Example of a Single-Use Label for Modular Spreader Bars

Manufacturer	<manufacturer's name> <manufacturer's address - first line> <manufacturer's address - second line> <manufacturer's phone number, email address, and/or website URL>			
Serial Numbers	<assembly serial number and end cap serial numbers>			
	Insert section part identifiers and serial numbers			
Configuration and Rated Load	Spread	Minimum Upper Rigging Angle	Assembly Weight	Rated Load
	20'-0"	60°	1,500 pounds	110,000 pounds
ASME BTH-1 Design Category B		ASME BTH-1 Service Class 0		
Refer to engineering document <unique document identifier> for additional information regarding the use and load ratings of this spreader bar assembly.				

Figure A-3.3-1
Load Chart Label for a Lifting Beam

Manufacturer	<manufacturer's name> <manufacturer's address - first line> <manufacturer's address - second line> <manufacturer's phone number, email address, and/or website URL>	
Serial Number	<serial number>	
Weight	7,150 pounds	
Rated Loads	Spread	Rated Load (for Symmetrical Rigging Only)
	18'-0"	83,500 pounds
	20'-0"	75,000 pounds
	22'-0"	68,000 pounds
	24'-0"	62,500 pounds
	26'-0"	58,000 pounds
	28'-0"	53,000 pounds
	30'-0"	43,000 pounds
ASME BTH-1 Design Category B		ASME BTH-1 Service Class 0
Refer to engineering document <unique document identifier> for additional information regarding the use and load ratings of this lifting beam.		

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