

# CHAPTER 14

## BELOW-THE-HOOK LIFTING DEVICES

This chapter provides the requirements for below-the-hook lifting devices used in hoisting and rigging, such as spreader bars, lifting yokes, and lift fixtures. This section implements the requirements of ASME B30.20, “Below-the-Hook Lifting Devices” (for latest ASME standards, see <http://catalog.asme.org/home.cfm?Category=CS>).

NOTE: Special lifting devices for shipping containers weighing 10,000 lb or more that are used for radioactive materials are governed by ANSI N14.6 [“Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4,500 kg) or More for Nuclear Materials.”]

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## 14.1 GENERAL

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- a. Below-the-hook lifting devices are arranged in the following groups because of the diversity of types:
  - 1. Structural and mechanical lifting devices.
  - 2. Vacuum lifting devices.
  - 3. Close-proximity-operated magnets.
  - 4. Remote-operated magnets.
- b. Slings and rigging accessories that may be components in a below-the hook lifting device are covered in Chapters 11 and 12 (“Wire Rope and Slings,” and “Rigging Accessories,” respectively) of this standard..
- c. The working load limit (WLL) of below-the- hook lifting devices shall not be exceeded in their as configured application.
- d. Individual site programs shall describe how periodic inspections for below-the-hook lifting devices are recorded. These records may include an external coded mark or tag on the device (e.g. date, annually changed color stripe, etc.) indicating both periodicity and the satisfactory completion of the required periodic inspection, or a written record as acceptable documentation. (Refer to Sections 14.2.5.3.d, 14.3.4.3.d, 14.4.4.3.e, and 14.5.4.3.d.)

## 14.2 STRUCTURAL AND MECHANICAL LIFTING DEVICES

- a. Structural and mechanical lifting devices are often one-of-a-kind designs. Typical devices include:
  1. Load-supporting lifting devices (Figure 14-1).
  2. Friction-type pressure gripping lifting devices (Figure 14-2).
  3. Indentation-type gripping lifting devices (Figure 14-3).
  4. Cask lift fixtures (Figure 14-4).
  3. Lifter weight, if over 100 lb (45 kg)
  4. Cold current (amps) (when applicable)
  5. Rated voltage (when applicable)
  6. Rated load (as described in section 14.2.2.a)
  7. ASME BTH-1 Design Category
  8. ASME BTH-1 Service Class
- c. All repaired or modified structural and mechanical lifters shall be provided with identification displaying, but not limited to, the following information:

### 14.2.1 DESIGN/FABRICATION

Structural and mechanical lifting devices shall be designed, fabricated, labeled and assigned a design category according to the provisions of ASME B30.20 and ASME BTH-1.

### 14.2.2 MARKING

- a. The rated capacity of each lifting device shall be marked on the main structure where it is visible and legible. If the lifting device comprises several items, each detachable from the assembly, each lifting device shall be marked with its rated capacity. At a minimum, a nameplate, name tag, or other permanent marker shall be affixed displaying the following data.
  1. Manufacturer's name (contractor's name if fabricated onsite).
  2. Lifting device weight (if over 100 lb).
  3. Serial number (if applicable).
  4. Rated capacity.
  1. name and address of the repairer or modifier
  2. repairer's or modifier's unit identification
  3. lifter weight (if altered)
  4. cold current (amps) (if altered)
  5. rated voltage (if altered)
  6. rated load (if altered) [as described in section 14.2.2.a
  7. ASME BTH-1 Design Category (if altered)
  8. ASME BTH-1 Service Class (if altered)
- b. All new structural and mechanical lifting devices shall be marked with, but not limited to, the following information:
  1. Manufacturer's name and address
  2. Serial number
- d. A rerated lifting device shall be relabeled with the new rated capacity.
- e. Cases may exist where a lifting device cannot be marked with its rated capacity and weight. This may be due to the security classification of the load to be lifted or other reasons approved by the responsible manager. In these cases, the lifting device shall be marked with an identification number, and its documentation shall describe both its rated capacity and weight.

**14.2.3 MODIFICATION/RERATING**

- a. Structural and mechanical lifting devices may be modified or rerated if the changes are analyzed by a qualified engineer or the manufacturer of the lifting device.
- b. Rerated or modified lift fixtures shall be load-tested as described in Section 14.2.6.2, "Rated Load Test," below.

**14.2.4 GUARDING**

Exposed moving parts or pinch points, such as gearing, chain drives, and rotating shafts, that may be a hazard to personnel during lifting operations shall be guarded.

**14.2.5 INSPECTIONS****14.2.5.1 Initial Inspection**

Prior to their initial use, a qualified inspector shall inspect all new, modified, or repaired lifting devices to ensure compliance with Section 14.2.5.3, "Periodic Inspection."

**14.2.5.2 Frequent Inspection**

- a. The operator or other designated person shall visually inspect each lifting device at the beginning of each shift or prior to use, if it has not been in regular service, for the following items or conditions (records are not required):
  - 1. Structural deformation, cracks, or excessive wear on any part.
  - 2. Loose or missing guards, fasteners, covers, stops, or nameplates.
  - 3. All operating mechanisms and automatic hold-and-release mechanisms for maladjustments interfering with operation.
- b. The operator or designated person shall carefully examine any deficiencies and determine whether they constitute a hazard. Deficiencies noted during the inspection shall be corrected before the lifting device is used.

**14.2.5.3 Periodic Inspection**

- a. A qualified inspector shall perform a complete inspection at the following intervals:
  - 1. Normal service – yearly. Inspect equipment at site of use.
  - 2. Heavy service – semiannually. Inspect equipment at site of use unless external conditions indicate that disassembly should be done to permit detailed inspection.
  - 3. Severe service – quarterly. Inspect equipment at site of use unless external conditions indicate that disassembly should be done to permit detailed inspection.
  - 4. Special or infrequent service – as recommended by a qualified person before the first such use and as directed by the qualified person for any subsequent uses.
- b. Lifting device service is defined as follows:
  - 1. Normal – operation with various weights within the rated load limit, or uniform loads less than 65 percent of rated load.
  - 2. Heavy – operation within the rated load limit that exceeds normal service.
  - 3. Severe – operation at normal or heavy service under abnormal operating conditions.
- c. This inspection shall include the items listed in Section 14.2.5.2, "Frequent Inspection," in addition to the following:
  - 1. Loose bolts or fasteners.
  - 2. Check for suspect/counterfeit parts (see Terminology and Definitions, Chapter 1).
  - 3. Cracked or worn gears, pulleys, sheaves, sprockets, bearings, chains, and belts.
  - 4. Excessive wear of friction pads, linkages, and other mechanical parts.

5. Excessive wear at hoist-attaching points and load-support shackles or pins.
6. External evidence of damage to motors or controls.
- d. A qualified inspector shall inspect fixtures not in regular use according to periodic inspection requirements before placing them in service.
- e. Dated reports of each periodic inspection shall be prepared. They shall be kept on file and shall be readily available. A sample load test and inspection form is included as Exhibit I at the end of this section. This form is intended to be a sample only and is not intended to be mandatory.
- c. The rated load test shall consist of the following:
  1. Hoist the test load a sufficient distance to ensure that it is supported by the lifting device, or apply the required load if the test is made using a testing machine. Personnel shall remain clear of suspended loads.
  2. Visually inspect the lifting device for deformation, cracks, or other defects after the load test is completed.

#### **14.2.6 TESTING**

##### **14.2.6.1 Operational Test**

- a. Modified or repaired lifting devices shall be tested before initial use to ensure compliance with the requirements of this section (test reports kept on file). Testing shall include the following:
  1. Lifting devices with moving parts shall be tested to confirm that the lifting device operates in accordance with manufacturer's instructions.
  2. Lifting devices with manually operated or automatic latches shall be tested to verify that the latches operate in accordance with manufacturer's instructions.

##### **14.2.6.2 Rated Load Test**

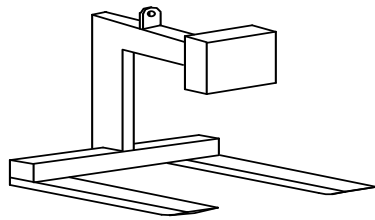
- a. All new, altered, modified, or repaired lifting devices shall be tested and inspected before use. The results of the test and inspection shall be documented in the equipment history file.
- b. The rated capacity shall not be more than 80 percent of the maximum load sustained during the test. Test loads shall not be more than 125 percent of the rated capacity unless otherwise recommended by the manufacturer. Test weights shall be accurate to within -5 percent, +0 percent of stipulated values.

#### **14.2.7 MAINTENANCE**

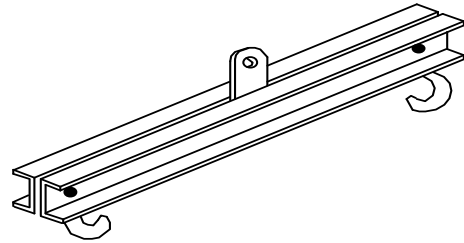
- a. A preventive maintenance program shall be established based upon manufacturer's recommendations. If equipment maintenance procedures deviate from published manufacturer's recommendations, the alternate procedures shall be approved in advance by the manufacturer or another qualified person and be kept readily available.
- b. Replacement parts shall be equivalent to the original specifications.

#### **14.2.8 TRAINING/QUALIFICATION**

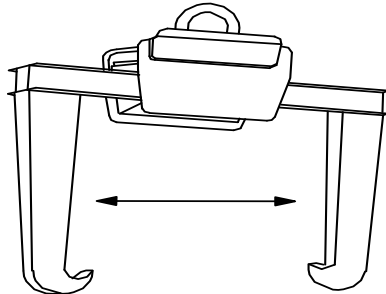
- a. Below-the-hook lifting device operators shall be trained and qualified as required in Chapter 6, "Personnel Qualification and Training." At a minimum, instruction should include the following:
  1. Application of the lifting device to the load and adjustments to the device, if any, that adapt it to various sizes or kinds of loads.
  2. Any special operations or precautions.
  3. Condition of the load itself required for operation of the lifting device such as balance, degree of order of stacked loads, surface cleanliness, bending, and load thickness.
  4. Procedure for storage of lifting device to protect it from damage.



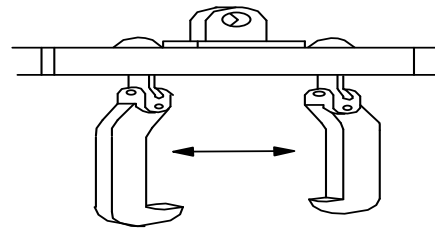
Balanced pallet



Lifting beam (spreader beam)



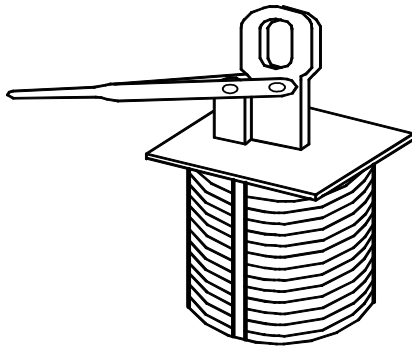
Telescoping coil grab



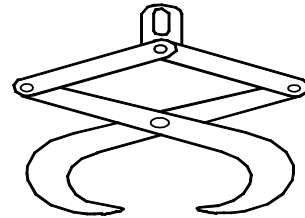
Coil lifting hook beam

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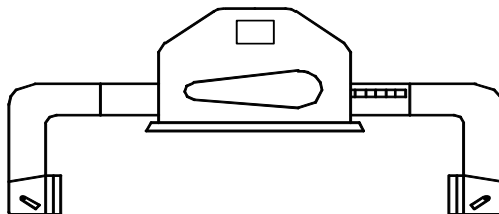
**Figure 14-1. Load-supporting lifting devices**



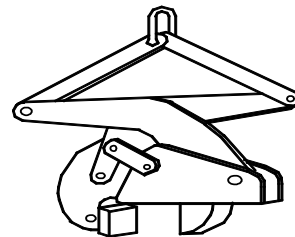
Roll grab, core grip



Bar Tong



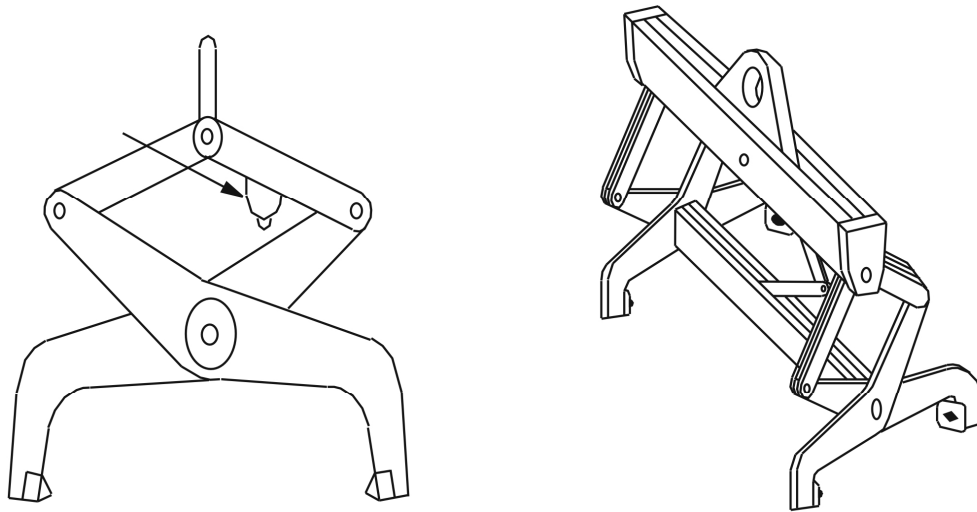
Motor-driven roll grab, end grip



Vertical Axis Coil Grab

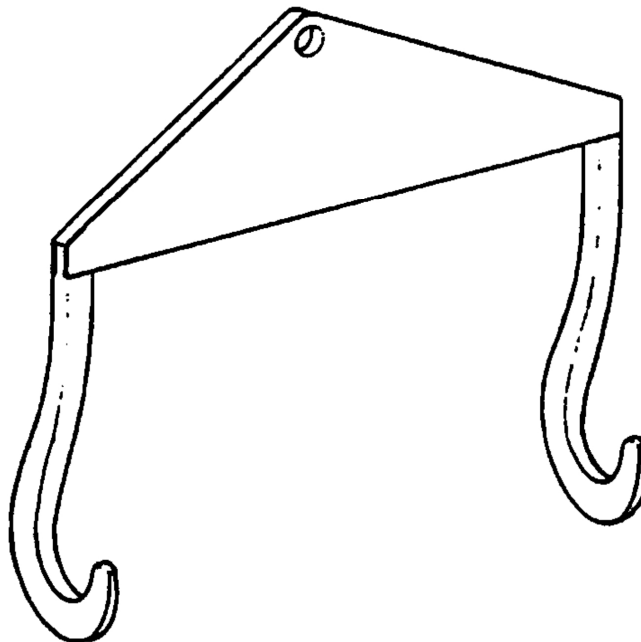
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**Figure 14-2. Friction-type pressure gripping lifting devices.**



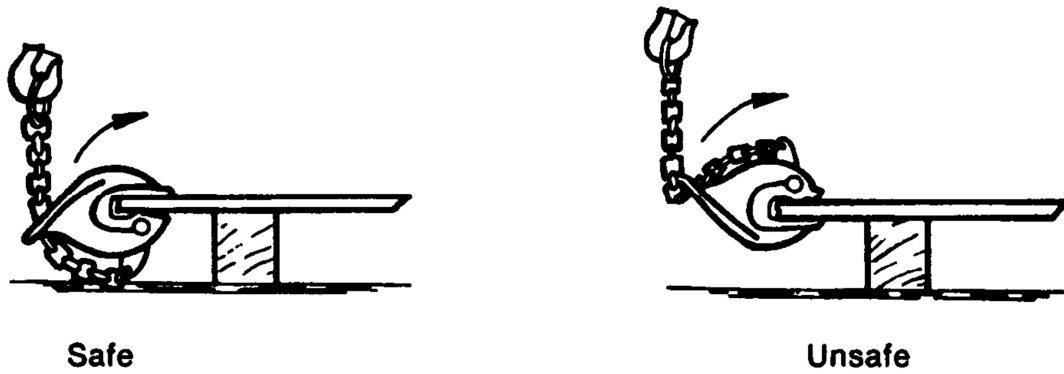
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**Figure 14-3. Indentation-type gripping lifting device**



**Figure 14-4. Typical cask lift fixture**





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**Figure 14-5. Metal-plate clamps.**

5. Instructions for not exceeding the rated capacity of the lifting device or the capacity of the hoisting equipment by the combined weight of the load, the lifting device, and the rigging.
- b. Operators shall demonstrate the ability and competence to operate the lifting device as instructed before assuming responsibility for using it.

#### 14.2.9 OPERATION

- a. Only the following personnel shall operate structural and mechanical lifting devices:
  1. Qualified operators or riggers.
  2. Trainees under the direct supervision of a qualified operator.
  3. Maintenance and test personnel, when it is necessary in the performance of their duties.
  4. Inspectors of lifting devices.
- b. The following shall apply to all personnel who operate structural and mechanical lifting devices:
  1. Observe the condition of the lifting device before use and during operation. If you observe a defect that affects the continued safe use of the lifting device, remove it from service.
  2. Place any attached load on the floor or ground and, after use, properly store the lifting device before leaving.
  3. Before they are used on each shift, test the lifting device controls. If any controls do not operate properly, adjust or repair them before operations begin.
  4. Do not load the lifting device in excess of its rated capacity (except for test

loads) or handle any load for which it is not designed.

5. Apply the lifting device to the load in accordance with established procedures.
6. Before lifting, ensure that lifting-device ropes or chains are not kinked and multiple-part lines are not interwoven.
7. Ensure that the load is correctly distributed for the lifting device being used.
8. Do not use the lifting device for side pulls or sliding the load unless specifically authorized by a qualified person or by an approved procedure.
9. Do not use a lifting device that is tagged "Danger – Do Not Operate" or otherwise designated as nonfunctional.
10. Do not remove "Danger – Do Not Operate" tags from lifting devices without the approval of the person who placed them or an authorized person.
11. Store the lifting device in a dry, inside location when not in use.
12. Ensure that markings or tags are not removed or defaced. Replace missing or defaced markings or tags.

#### 14.2.10 CRITICAL LIFTS

See Chapter 2, "Critical Lifts," for critical lift requirements.

- a. Structural and mechanical lifting devices for critical-lift service shall have an initial proof-load test of not less than 125 percent of its rated capacity or as specified by the design standard to which it was built. If proof-testing cannot be verified, the lifting device shall be proof-tested before being used to make a critical lift.

## 14.3 VACUUM LIFTING DEVICES

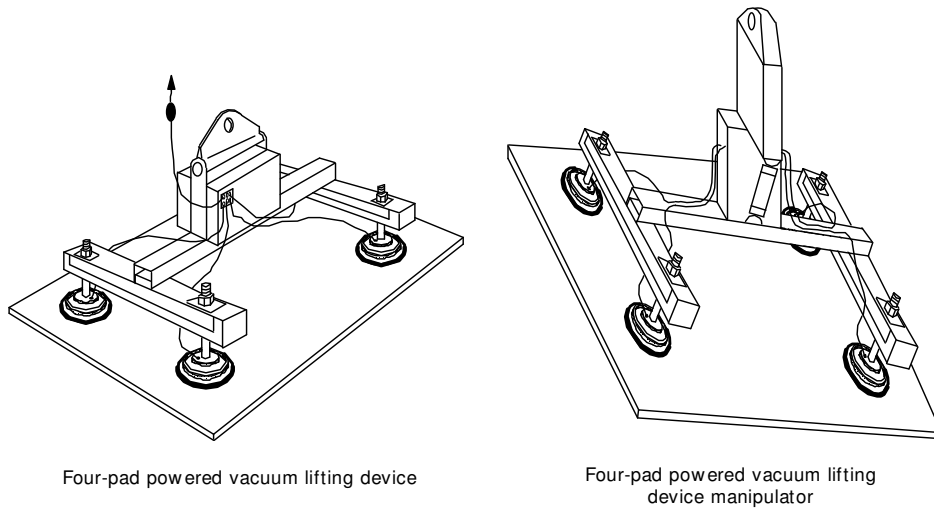
Typical power-operated and mechanically operated vacuum lifting and manipulating devices are shown in Figures 14-5 and 14-6. This section does not cover devices used to handle porous materials, which requires special design and construction.

### 14.3.1 DESIGN/FABRICATION

Power- and mechanically-operated vacuum lifting devices shall be designed and fabricated according to the provisions of ASME B30.20, 20-2.2.2.

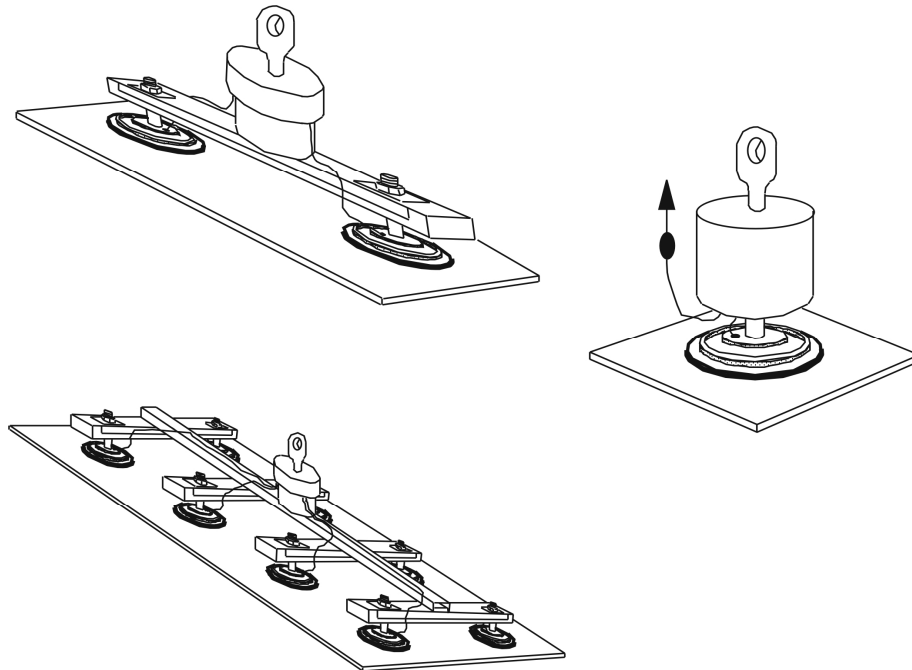
### 14.3.2 MARKING

- a. The rated capacity, maximum width and length, and minimum thickness of load shall be marked on the main structure where it is visible and legible.
- b. Individual pads or groups of pads, controlled by shutoff valves, shall be marked with the rated capacity of each pad or group of pads.
- c. At a minimum, a nameplate, name tag, or other permanent marker shall be affixed to each lifter displaying the following data:
  1. Manufacturer's name.
  2. Model number or unit identification.
  3. Weight of lifting-device.
  4. Electric power (when applicable).
  5. Pressure and volume of compressed air (when applicable).
  6. Rated capacity.
- d. Manual shutoff valves on individual pads or groups of pads shall be marked to show operating position.
- e. Cases may exist where a lifting device cannot be marked with its rated capacity and weight. This may be due to the security classification of the load to be lifted or other reasons approved by the responsible manager. In these cases, the lifting device shall be marked with an identification number, and its documentation shall contain both its rated capacity and weight.
- f. A label or labels shall be affixed to each vacuum lifting device in a readable position that displays the word "WARNING" or other legend designed to bring the label to the attention of the operator. The label shall also contain information cautioning against:
  1. Exceeding the rated capacity or lifting loads not specified in the manufacturer's instruction manual.
  2. Operating a damaged or malfunctioning unit or a unit with missing parts.
  3. Operating when vacuum indicators show insufficient vacuum.
  4. Operating the unit when vacuum pads are not spaced for equal loading.
  5. Incorrect positioning of the lifting device on the load.
  6. Lifting people.
  7. Moving loads above people.
  8. Removing/obscuring warning labels.
  9. Operating the lifting device when the rated capacity, lifting-device weight, or safety markings are missing (except in cases where the device cannot, for security or other reasons, be marked).
  10. Making alterations or modifications to the lifting device.
  11. Lifting loads higher than necessary and leaving suspended loads unattended.
- g. A label shall be affixed to each unit that directs the user to consult the manufacturer's manual if the size or shape of the unit prohibits the inclusion of the above markings.



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**Figure 14-5. Powered vacuum lifting devices.**



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**Figure 14-6. Mechanical vacuum lifting devices.**

## 14.3 VACUUM LIFTING DEVICES

### 14.3.3 INSTALLATION

- a. Vacuum lifting devices shall be assembled and installed in accordance with the manufacturer's instructions.
- b. The power supply to the vacuum lifting device shall be the same as that shown on the nameplate and shall be connected to the line side of the crane disconnect or to an independent circuit.
- c. The user shall check for correct rotation of all pumps.

### 14.3.4 INSPECTIONS

#### 14.3.4.1 Initial Inspection

Prior to their initial use, a qualified inspector shall inspect all new or repaired vacuum lifting devices to ensure their compliance with Section 14.3.4.3, "Periodic Inspection."

#### 14.3.4.2 Frequent Inspection

- a. The operator or other designated person shall inspect each vacuum lifting device at the beginning of each shift or prior to use, if it has not been in regular service.
- b. The inspection shall be for the following (records are not required):
  1. Deformation, cracks, and excessive wear of load-bearing parts.
  2. Adequate vacuum generator output.
  3. Cuts, tears, excessive wear, and foreign particles at vacuum pad seal rings.
  4. Leakage, cuts, kinks, and collapsed areas of vacuum lines/connections.
  5. Leaks or damage to the vacuum reservoir.
  6. Failure of the entire vacuum system to function properly by attaching a non-porous, clean test plate to the vacuum pads and then stopping the vacuum

source. Vacuum levels in the system shall not decrease by more than the manufacturer's specified rate.

#### 14.3.4.3 Periodic Inspection

- a. A qualified inspector shall perform a complete inspection at the following intervals:
  1. Normal service – yearly. Inspect equipment at site of use.
  2. Heavy service – semiannually. Inspect equipment at site of use unless external conditions indicate that disassembly should be done to permit detailed inspection.
  3. Severe service – quarterly. Inspect equipment at site of use unless external conditions indicate that disassembly should be done to permit detailed inspection.
  4. Special or infrequent service – as recommended by a qualified person before the first use and as directed by the qualified person for any subsequent occurrences.
- b. Lifting device service is defined as follows:
  1. Normal – operation with various weights within the rated load limit, or uniform loads less than 65 percent of rated load.
  2. Heavy – operation within the rated load limit that exceeds normal service.
  3. Severe – operation under normal or heavy service with abnormal operating conditions.
- c. This inspection shall include those conditions or items specified in Section 14.3.4.2, "Frequent Inspection," in addition to the following:
  1. External evidence of looseness, wear, deformation, cracking, or corrosion.

2. External evidence of damage to supporting structure, motors, controls, and other auxiliary components.
  3. Check for suspect/counterfeit parts (see Terminology and Definitions, Chapter 1).
  4. Presence of warning label required by Section 14.3.2, "Marking."
- d. A qualified inspector shall inspect fixtures not in regular use according to periodic inspection requirements before placing them in service.
  - e. Dated inspection reports shall be prepared for each inspection. Inspection records shall be kept on file and shall be readily available.

### **14.3.5 TESTING**

#### **14.3.5.1 Operational Test**

- a. All new, reinstalled, modified, or repaired vacuum lifting fixtures shall be tested prior to use. Tests shall be performed by a qualified inspector or under the direction of that inspector to ensure compliance with the requirements of this section. Dated reports shall be kept on file.
- b. Testing shall include the following:
  1. Seals and connections shall be tested for leaks by attaching a nonporous, clean test plate to the vacuum pads and then stopping the vacuum source. Vacuum level in the system shall not decrease by more than the rate specified by the manufacturer.
  2. Test indicator lights, gauges, horns, bells, pointers, or other warning devices and vacuum level indicators for proper operation.

#### **14.3.5.2 Rated Load Test**

- a. All new, reinstalled, repaired, or modified vacuum lifting devices shall be tested and inspected before use. Tests and inspections shall be performed by a qualified inspector or under the direction of that inspector. Test

and inspection results shall be documented and kept on file.

- b. The rated capacity shall not be more than 80 percent of the maximum load sustained during the test. Test loads shall not be more than 125 percent of the rated capacity unless otherwise recommended by the manufacturer. Test weights shall be accurate to within -5 percent, +0 percent of stipulated values.
- c. The rated load test shall consist of the following steps at a minimum:
  1. Attach pads to the designated test load.
  2. Raise the test load a minimum distance to ensure that it is supported by the vacuum lifting device, and hold it for 2 minutes.
  3. Remain clear of the suspended load.
  4. Lower and release the load.
  5. Visually inspect the vacuum lifting device for defects, and correct any deficiencies prior to returning the device to service.

### **14.3.6 MAINTENANCE**

- a. A preventive maintenance program shall be established and be based on recommendations made by the vacuum lifting device manufacturer or a qualified person.
- b. Replacement parts shall be equivalent to the original specifications.
- c. The vacuum generator, vacuum pads, sealing rings, mufflers, and filters shall be maintained and cleaned according to the manufacturer's specifications.

### **14.3.7 TRAINING/ QUALIFICATION**

- a. Vacuum lifting device operators shall be trained and qualified as specified in Chapter 6, "Personnel Qualification and Training." At a minimum, instruction shall include the following (as applicable):

1. Application of the lifting device to the load and adjustments of the device, if any, that adapt it to various sizes or kinds of loads.
  2. Any special operations or precautions.
  3. Condition of the load itself required for operation of the lifting device such as balance, degree of order of stacked loads, surface cleanliness, bending, and load thickness.
  4. Procedure for storage of lifting device to protect it from damage.
  5. Instructions for not exceeding the rated capacity of the lifting device or the capacity of the hoisting equipment by the combined weight of the load, the lifting device, and the rigging.
  6. Charging of the battery (if required).
  7. The purpose of indicators, meters, or alarms on the vacuum lifting device.
  8. The proper attachment of adaptors to vacuum lifting devices for handling of special loads.
- b. Users shall demonstrate the ability and competence to operate the lifting device as instructed before assuming responsibility for using it.
- 14.3.8 OPERATION**
- a. Only the following personnel shall operate vacuum lifting devices:
1. Qualified operators or riggers.
  2. Trainees under the direct supervision of a qualified operator.
  3. Maintenance and test personnel, when it is necessary in the performance of their duties.
  4. Inspectors of lifting devices.
- b. The following shall apply to all personnel who operate vacuum lifting devices:
1. Before starting the lift, verify that the “vacuum on” indicator has reached the required level. Also, verify that the vacuum lifting device has been correctly applied and a stable vacuum level exists by lifting the load a few inches and observing conditions.
  2. Observe the condition of the lifting device before use and during operation. If you observe a defect that affects the continued safe use of the lifting device, remove it from service.
  3. Place any attached load on the floor or ground and, after use, properly store the lifting device before leaving.
  4. Before they are used on a shift, test the lifting device controls. If any do not operate properly, adjust or repair them before operations begin.
  5. Do not load the lifting device in excess of its rated capacity (except for test loads) or handle any load for which it is not designed.
  6. Apply the lifting device to the load in accordance with established procedures.
  7. Before lifting, ensure that lifting-device ropes or chains are not kinked and multiple-part lines are not interwoven.
  8. Ensure that the load is correctly distributed for the lifting device being used.
  9. Do not use the lifting device for side pulls or sliding the load unless specifically authorized by a qualified person or by an approved procedure.
  10. Warn all personnel in the vicinity of the lifting device and place the load on the floor or ground, if possible to do so, if electrical power goes off while a load is being lifted.
  11. Do not leave your position at the controls.
  12. Do not use a lifting device that is tagged “Danger – Do Not Operate” or otherwise designated as nonfunctional.

13. Do not remove “Danger – Do not Operate” tags from lifting devices without the approval of the person who placed them or an authorized person.
14. Store the lifting device in a dry, inside location when not in use.
15. Ensure that markings or tags are not removed or defaced. Replace missing or defaced markings or tags.

#### **14.3.9 CRITICAL LIFTS**

See Chapter 2, “Critical Lifts,” for critical lift requirements.

- a. Vacuum lifting devices for critical-lift service shall have an initial proof-load test of not more than 125 percent of its rated capacity. If proof-testing cannot be verified, the lifting device shall be proof-tested before being used to make a critical lift.



## 14.4 MAGNETS, CLOSE-PROXIMITY-OPERATED

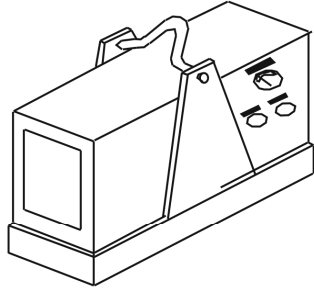
Close-proximity-operated magnetic lifting devices are used for single- or multiple-steel-piece handling operations in which the operator of the magnet is required to manually guide the load during its movement. They are also used in situations where remotely operated magnets are operated close to people. Typical close-proximity-operated magnetic lifting devices are shown in Figure 14-7.

### 14.4.1 DESIGN/FABRICATION

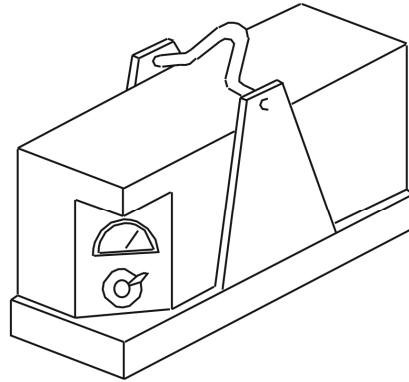
Close-proximity-operated magnetic lifting devices shall be designed and fabricated in accordance with the provisions of ASME B30.20, 20-3.2.2 and 20-3.2.3.

### 14.4.2 MARKING

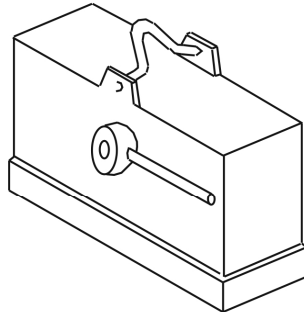
- a. At a minimum, a nameplate, name tag, or other permanent marker shall be affixed to each lifting magnet, and shall display the following data:
  1. Manufacturer's name, or if the magnet has been repaired or modified, the name and address of the repairer/modifier.
  2. Model or unit identification.
  3. Weight.
  4. Duty cycle, if applicable.
  5. Cold current.
  6. Rated capacity.
- b. Also, battery-powered and external-powered lifting electromagnets and electrically controlled permanent-magnet lifting magnets shall be marked with:
  1. The voltage of the battery or primary power supply.
  2. The cold current or watts at 68 degrees F (20 degrees C) and rated voltage.
- c. Cases may exist where a lifting device cannot be marked with its rated capacity and weight. This may be due to the security classification of the load to be lifted or other reasons approved by the responsible manager. In these cases, the lifting device shall be marked with an identification number, and its documentation shall contain both its rated capacity and weight.
- d. A label or labels shall be affixed to each lifting magnet in a readable position that displays the word "CAUTION" or other legend designed to bring the label to the attention of the operator. The label shall also contain information cautioning against:
  1. Operating when the battery capacity is inadequate.
  2. Exceeding magnet duty cycle and disconnecting the magnet with the power on (for externally powered electromagnets).
  3. Operating if the internal control function indicator, where applicable, does not indicate a complete cycle (on electrically controlled permanent magnets).
  4. Operating with the control handle not fully in the "Lift" position (on manually controlled permanent magnets).



**Close-proximity-operated  
lifting electromagnet**



**Close-proximity-operated  
electrically controlled  
permanent magnet**



**Close-proximity-operated  
manually controlled  
permanent magnet**

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**Figure 14-7. Close-proximity-operated magnetic lifting devices.**

**14.4.2.1 Rated Load (Capacity)**

- a. General-application magnets shall include the rated load (capacity) of the magnet on the lifting magnet or on a tag attached to it. This capacity rating shall refer to the instruction manual for information relating to decreases in rating due to the load surface condition, thickness, percentage of contact with magnet, temperature, metallurgical composition, and deflection.
- b. Specified-application magnets shall include the application load (capacity) of the magnet on the lifting magnet or on a tag attached to it. This capacity rating shall refer to the specific loads for which it applies.

**14.4.2.2 Controls**

The position of the control switch or handle of a lifting magnet shall be marked with “Lift,” “Off,” and “Drop,” or equivalent terms indicating the mode of operation of the lifting magnet.

**14.4.3 INSTALLATION**

- a. Close-proximity-operated magnetic lifting devices shall be installed according to the manufacturer’s recommendations.
- b. Users shall ensure that:
  - 1. External power input is the correct voltage and amperage.
  - 2. Power conductors and controls are of adequate rating and are insulated or otherwise protected against accidental interruption or damage.

**14.4.4 INSPECTIONS****14.4.4.1 Initial Inspection**

Prior to their initial use, a qualified inspector shall inspect all new, modified, or repaired lifting magnets to ensure compliance with Section 14.4.4.3, “Periodic Inspection.”

**14.4.4.2 Frequent Inspection**

- a. The operator or other designated person shall visually inspect each magnetic lifting

device at the beginning of each shift or prior to use, if it has not been in regular service.

- b. The inspection shall be for the following (records are not required):
  - 1. Lifting magnet face for freedom from foreign materials and for smoothness.
  - 2. Lifting bail or sling suspension for proper condition.
  - 3. Control handle for proper condition and operation.
  - 4. Current indicator, where applicable, for proper condition and operation.
  - 5. Labels, markings, and indicators or meters for legibility.
  - 6. Electrical conductors, if applicable, for loose connections, continuity, corrosion, and damage to insulation.
  - 7. Battery for correct electrolyte level and lack of corrosion of battery posts or connectors, if applicable.

**14.4.4.3 Periodic Inspection**

- a. A qualified inspector shall perform a complete inspection with the equipment in place at the following intervals:
  - 1. Normal service – yearly.
  - 2. Heavy service – yearly.
  - 3. Severe service – quarterly.
- b. Lifting device service is defined as:
  - 1. Normal – operation with various weights within the rated load limit, or uniform loads less than 65 percent of rated load.
  - 2. Heavy – operation within the rated load limit that exceeds normal service.
  - 3. Severe – operation under normal or heavy service with abnormal operating conditions.

- c. This inspection shall include those items specified in Section 14.4.4.2, "Frequent Inspection," in addition to the following:
    - 1. Deformation, wear, and corrosion of all members, fasteners, locks, switches, warning labels, and lifting parts.
    - 2. Check for suspect/counterfeit parts (see Terminology and Definitions, Chapter 1).
    - 3. Operation and condition of electrical components (i.e., meters, indicators, and alarms).
    - 4. Magnet coil tested for ohmic/ground readings and readings compared to manufacturer's standards.
  - d. A qualified inspector shall inspect a lifting magnet that has been idle for 1 month or more according to periodic inspection requirements before placing it in service.
  - e. Dated inspection reports shall be prepared for each inspection. Inspection records shall be kept on file and shall be readily available.
- inspection results shall be documented and kept on file.
- b. General-application magnets are required to satisfy the rated breakaway-force test. The breakaway force measured in this test must exceed the rated load (capacity) by a factor of at least 2.
  - c. Specified-application magnets are required to comply with the application breakaway-force test. The breakaway forces measured in this test must exceed the specified application load (capacity) by a factor of at least 2.
  - d. The rated breakaway-force test shall establish the breakaway force required to vertically remove the lifting magnet from a low-carbon rolled-steel plate of the minimum thickness stated by the magnet manufacturer. The portion of this plate in contact with the magnet shall have a 125- $\mu$ in. ( $3.2 \times 10^{-3}$  mm) finish and be flat within 0.002 in./ft (0.05 mm/m), but not 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 degrees F (15 degrees C). Battery-operated electromagnets and external-powered lifting electromagnets shall be operated at the manufacturer's recommended current.
  - e. The application breakaway-force test shall establish the application breakaway forces of the lifting magnet under the variety of loading conditions for which the magnet is specified. The details of this test should be supplied by the manufacturer of the lifting magnet.

#### 14.4.5 TESTING

##### 14.4.5.1 Operational Test

- a. All new, modified, or repaired lifting magnets shall be tested prior to their initial use. Tests shall be performed by a qualified inspector or under the direction of that inspector. Dated reports shall be kept on file.
- b. Testing shall include the following:
  - 1. A check to ensure that the lifting magnet contains no visible defects.
  - 2. A check for proper operation of all electrical protective equipment, meters, indicators, alarms, etc.

##### 14.4.5.2 Rated Load Test

- a. All new, modified, or repaired lifting magnets shall be tested and inspected before initial use. Tests and inspections shall be performed by a qualified inspector or under the direction of that inspector. Test and

#### 14.4.6 MAINTENANCE

- a. A preventive maintenance program shall be established and be based on recommendations made by the manufacturer or a qualified person.
- b. Replacement parts shall be equivalent to the original specifications.
- c. Before adjustment and repairs are started on a lifting magnet or its controls, maintenance personnel shall take the following precautions:

1. Ensure that all sources of magnet power are disconnected and locked out, tagged out, or flagged.
2. Ensure that a magnet removed for repair is tagged as defective.
- d. Only qualified personnel shall work on equipment when adjustments and tests are required.
- e. After adjustments and repairs have been made, the lifting magnet shall not be returned to service until it has been inspected according to Section 14.4.4.3.
- f. Dated records of repairs and replacements shall be available.
- g. Maintenance personnel shall ensure that any defective condition disclosed by the inspection is corrected before operation of the lifting magnet is resumed. Repairs shall be done only by designated persons.
6. Charging of the lifting magnet battery (if required).
7. The purpose of indicators, meters, or alarms on the lifting magnet.
8. The proper attachment of adaptors to lifting magnets for handling of special loads.
- b. Operators shall demonstrate the ability and competence to operate the lifting device as instructed before assuming responsibility for using it.

#### 14.4.8 OPERATION

#### 14.4.7 TRAINING/ QUALIFICATION

- a. Magnetic lifting device operators shall be trained and qualified as specified in Chapter 6, "Personnel Qualification and Training." At a minimum, instruction shall include the following:
  1. Application of the lifting device to the load and adjustments of the device, if any, that adapt it to various sizes or kinds of loads.
  2. Any special operations or precautions.
  3. Condition of the load itself required for operation of the lifting device such as balance, degree of order of stacked loads, surface cleanliness, bending, and load thickness.
  4. Procedure for storage of lifting device to protect it from damage.
  5. Instructions for not exceeding the rated capacity of the lifting device or the capacity of the hoisting equipment by the combined weight of the load, the lifting device, and the rigging.
- a. Only the following qualified personnel shall operate lifting devices:
  1. Designated persons.
  2. Trainees under the direct supervision of a designated person.
  3. Maintenance and test personnel, when it is necessary in the performance of their duties.
  4. Inspectors of lifting devices.
- b. The following shall apply to personnel who use close-proximity-operated magnets:
  1. Place any attached load on the floor or ground and, after use, properly store the lifting device before leaving it.
  2. Before they are used during a shift, test all controls. If any do not operate properly, adjust or repair them before operations begin.
  3. Do not load the lifting device in excess of its rated capacity or handle any load for which it is not designed.
  4. Apply the lifting device to the load in accordance with established procedures.
  5. Before lifting, ensure that lifting-device ropes or chains are not kinked and that multiple-part lines are not interwoven.

6. Ensure that the load is correctly distributed for the lifting device being used.
7. Ensure that the temperature of the load does not exceed the maximum allowable limits of the lifting device.
8. Do not use the lifting device for side pulls or sliding the load unless specifically authorized by a qualified person.
9. Keep the lifting magnet face and the magnet contact area clean.
10. Ensure that the load to be lifted is within the magnet's rated capacity or application capacity and lifting equipment rated capacity.
11. Observe all meters and indicators on the lifting magnet to confirm proper operation prior to making a lift.
12. Before starting the lift, lift the load a few inches to establish that it is securely attached to the magnet.
13. Do not use a lifting magnet that is tagged "Danger – Do Not Operate" or otherwise designated as nonfunctional.
14. Do not remove "Danger – Do Not Operate" tags from magnetic lifting devices without the approval of the person who placed them or an authorized person.
15. Store the lifting device in a dry, inside location when not in use.

#### **14.4.8.1 External-Powered Electromagnets**

Before raising the load more than 2 in (50 mm), ensure that any adjustable input control is switched to the "FULL POWER" or "FULL ON" position and remains in this position until the load is removed from the magnet.

#### **14.4.8.2 Battery-Operated Electromagnets**

- a. Before lifting, confirm that the device indicating correct current flow remains stable for a minimum of 5 seconds.
- b. For a lift of extended duration, observe the device indicating correct current flow every 5 minutes.
- c. Open the ventilation lid before charging the battery.
- d. Before raising the load more than 2 inches (50 mm), ensure that any adjustable input control is switched to the "FULL POWER" or "FULL ON" position and remains in this position until the load is removed.

#### **14.4.8.3 Electrically Controlled Permanent Magnets.**

Before raising the load, check the internal control function indicator, where applicable, to confirm proper operation of the lifting magnet.

#### **14.4.8.4 Manually Controlled Permanent Magnets**

Before raising the load, confirm that the control handle is in the "LIFT" or "ON" position and the control handle latch is operating.

#### **14.4.9 CRITICAL LIFTS**

See Chapter 2, "Critical Lifts," for critical lift requirements.

- a. General-application magnets are required to satisfy the rated breakaway-force test. The breakaway force measured in this test must exceed 200 percent of the rated load. If the rated breakaway-force test cannot be verified, the lifting device shall be required to satisfy the rated breakaway-force test before being used to make a critical lift.
- b. Specified-application magnets are required to satisfy the rated breakaway-force test. The breakaway force measured in this test must exceed 200 percent of the rated load. If the rated breakaway-force test cannot be verified, the lifting device shall be required to satisfy the rated breakaway-force test before being used to make a critical lift.

## 14.5 MAGNETS, REMOTE-OPERATED

Typical remote-operated magnetic lifting devices are shown in Figure 14-8.

### 14.5.1 DESIGN/FABRICATION

Remote-operated magnetic lifting devices shall be designed and fabricated in accordance with the provisions of ASME B30.20, 20-4.2.2.

### 14.5.2 MARKING

- a. At a minimum, all new lifting magnets shall be provided with a nameplate, name tag, or other permanent marker displaying the following information.
  1. Manufacturer's name and address, or if the magnet has been repaired or modified, the name and address of the repairer/modifier.
  2. Manufacturer's model or unit identification.
  3. Weight.
  4. Duty cycle, if applicable.
  5. Cold current.
- b. Cases may exist where a lifting device cannot be marked with its rated capacity and weight. This may be due to the security classification of the load to be lifted, or other reasons approved by the responsible manager. In these cases, the lifting device shall be marked with an identification number, and its documentation shall contain both its rated capacity and weight.

### 14.5.3 INSTALLATION

- a. Remote-operated magnets shall be installed according to the manufacturer's recommendations.
- b. Operators shall ensure that:
  1. External power input is of the correct voltage and amperage.

2. Power conductors and controls are of adequate rating and are insulated or otherwise protected against accidental interruption or damage.

### 14.5.4 INSPECTIONS

#### 14.5.4.1 Initial Inspection

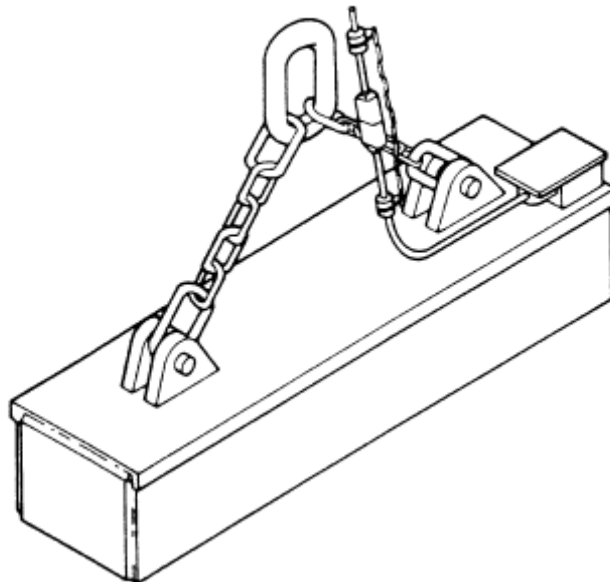
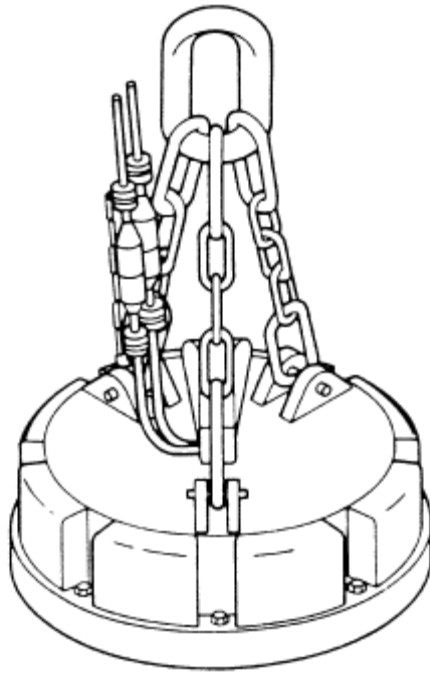
Prior to their initial use, a qualified inspector shall inspect all new, modified, or repaired lifting magnets to ensure compliance with Section 14.5.4.3, "Periodic Inspection."

#### 14.5.4.2 Frequent Inspection

- a. The operator or other designated personnel shall visually inspect each magnetic lifting device at the beginning of each shift or prior to use, if it has not been in regular service.
- b. The inspection shall be for the following (records are not required):
  1. Lifting magnet face for smoothness or presence of foreign materials, if applicable.
  2. Magnet suspension system.
  3. All visible electrical conductors (without disassembly).

#### 14.5.4.3 Periodic Inspection

- a. A qualified inspector shall perform a complete inspection of the lifting device with the equipment in place at the following intervals:
  1. Normal service – yearly.
  2. Heavy Service – quarterly.
  3. Severe service – quarterly.
  4. Special or infrequent service – as authorized by a qualified person before the first use and as directed by the qualified for any subsequent occurrences.



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**Figure 14-8. Remote-operated magnetic lifting devices.**



## b. Lifting device service is defined as follows:

1. Normal – operation with various weights within the rated load limit, or uniform loads less than 65 percent of rated load.
2. Heavy – operation within the rated load limit that exceeds normal service.
3. Severe – operation under normal or heavy service with abnormal operating conditions.

## c. This inspection shall include those items specified in Section 14.5.4.2, “Frequent Inspection,” in addition to the following:

1. Deformation, wear, and corrosion of all members, fasteners, and lifting parts.
2. Check for suspect/counterfeit parts (see Terminology and Definitions, Chapter 1).
3. Proper operation and condition of electrical components.
4. Magnetic coil tested for ohmic/ground readings and compared to manufacturer’s standards.

## d. Dated inspection reports shall be prepared for each inspection. Inspection records shall be kept on file and shall be readily available.

**14.5.5 TESTING****14.5.5.1 Operational Test**

- a. All new, modified, or repaired lifting magnets shall be tested prior to initial use. Tests shall be performed by a qualified inspector or under the direction of that inspector. Dated reports shall be kept on file.
- b. Testing shall include the following:
  1. A check for proper operation of all electrical equipment.
  2. A visual inspection of the lifting magnet for visible defects.

**14.5.6 MAINTENANCE**

- a. A preventive maintenance program shall be established and be based on the recommendations of the manufacturer or a qualified person.
- b. Replacement parts shall be equivalent to original specifications.
- c. Before maintenance is started on a lifting magnet or controls, maintenance personnel shall take the following precautions:
  1. Ensure that all sources of magnet power are disconnected and locked out, tagged out, or flagged.
  2. Ensure that a magnet removed for repair is tagged as defective.
- d. Only qualified personnel shall work on equipment when maintenance and test are required.
- e. After repairs have been made, the lifting magnet shall not be returned to service until it has been inspected according to Section 14.5.4.3.
- f. Dated records of repairs and replacements shall be available.
- g. Any defective condition disclosed by the inspection shall be corrected before the lifting magnet is returned to service.

**14.5.7 TRAINING/  
QUALIFICATION**

- a. Operators shall be trained and qualified as specific in Chapter 6, “Personnel Qualification and Training.” At a minimum, instruction shall include the following:
  1. Application of the lifting device to the load and adjustments of the device, if any, that adapt it to various sizes or kinds of loads.
  2. Any special operations or precautions.
  3. Condition of the load itself required for operation of the lifting device, such as balance, degree of order of stacked

- loads, surface cleanliness, bending, and load thickness.
4. Procedure for storage of the lifting device to protect it from damage.
  5. Instructions for not exceeding the rated capacity of the lifting device or the capacity of the hoisting equipment by the combined weight of the load, the lifting device, and the rigging.
  6. Charging of the lifting magnet battery (if required).
  7. The purpose of indicators, meters, or alarms on the lifting magnet.
  8. The proper attachment of adaptors to lifting magnets for handling of special loads.
- b. Operators shall demonstrate the ability and competence to operate the lifting device as instructed before assuming responsibility for using it.
- 14.5.8 OPERATION**
- a. Only the following qualified personnel shall operate lifting devices:
1. Designated persons.
  2. Trainees under the direct supervision of a designated person.
  3. Maintenance and test personnel, when it is necessary in the performance of their duties.
  4. Inspectors of lifting devices.
- b. The following shall apply to all personnel who operate remote-operated magnets:
1. Place any attached load on the floor or ground and, after use, properly store the lifting device before leaving it.
  2. Before they are used during a shift, test all controls. If any do not operate properly, adjust or repair them before operations begin.
  3. Do not load the lifting device in excess of its rated capacity or handle any load for which it is not designed.
  4. Apply the lifting device to the load in accordance with established procedures.
  5. Before lifting, ensure that lifting-device ropes or chains are not kinked and that multiple-part lines are not interwoven.
  6. Ensure that the load is correctly distributed for the lifting device being used.
  7. Ensure that the temperature of the load does not exceed the maximum allowable limits of the lifting device.
  8. Do not use the lifting device for side pulls or sliding the load unless specifically authorized by a qualified person.
  9. Do not use a lifting magnet that is tagged "Danger – Do Not Operate" or otherwise designated as nonfunctional.
  10. Do not remove "Danger – Do Not Operate" tags without the approval of the person who placed them or an authorized person.
  11. Store the lifting device in a designated location when not in use.
- 14.5.9 CRITICAL LIFTS**
- See Chapter 2, "Critical Lifts," for critical lift requirements.
- a. Remote-operated magnets for critical-lift service shall have been tested for proper operation of all electrical equipment and a visual inspection of the lifting device for defects. If testing and inspection cannot be verified, the lifting device shall be tested and inspected before being used to make a critical lift.

Exhibit I is intended to be a sample form only.  
The equipment manufacturer's inspection/testing  
criteria supercede any other criteria.  
In cases where the equipment manufacturer does not include  
inspection/testing criteria, other forms developed to facilitate  
required inspection/testing are acceptable.

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**EXHIBIT I**  
**(SAMPLE FORM)**

LIFTING BARS AND SPREADERS LOAD TEST

INSPECTOR: \_\_\_\_\_ INSPECTION DATE: \_\_\_\_\_

- NOTES:    1. Proof-test to not more than 125 percent of rated capacity for critical lift service. The test load shall be accurate to within -5%, +0% of stipulated values.
2. Qualified inspector shall witness all steps below.

INSPECTION

Lifting bars and spreaders shall be checked for signs of incipient failure in bending and shall be replaced if permanently bent more than ½ inch in 10 feet, or twisted more than 5 degrees out of the original plan. Hook attachment welds shall be examined for cracks and signs of failure in tension.

Qualified inspector shall perform test by visual examination, liquid-penetrant examination, or magnetic-particle examination.

Acceptance: No cracks, linear indication, laps, or seams.

STATIC TEST: Hold weight for 10 minutes and visually inspect for deformation.

Type \_\_\_\_\_ Size \_\_\_\_\_

Rated Capacity (SWL) \_\_\_\_\_ lb    Actual Load Test \_\_\_\_\_ lb

Serial Number \_\_\_\_\_

Qualified Inspector Verify (Load Test) \_\_\_\_\_

Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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