

## CHAPTER 11.0 TABLE OF CONTENTS

TABLE OF CONTENTS.....	1
PAGINATION TABLE.....	2
11.0 BELOW-THE-HOOK LIFTING DEVICES .....	3
11.1 SCOPE.....	3
11.2 GENERAL FEATURES.....	3
11.2.1 Special Lifting Devices .....	3
11.3 DESIGN AND FABRICATION.....	4
11.3.1 Design Factor.....	4
11.3.2 Welding .....	4
11.3.3 Guarding.....	4
11.3.4 Electrical.....	4
11.3.5 Analysis .....	4
11.4 MARKING .....	4
11.5 MODIFICATIONS .....	5
11.6 OPERATION.....	5
11.6.1 Operators .....	5
11.6.2 Operator Qualifications .....	5
11.6.3 Operator Responsibilities .....	6
11.6.4 Operating Practices.....	6
11.7 INSPECTIONS .....	7
11.7.1 Initial Inspection.....	7
11.7.2 Frequent Inspections.....	7
11.7.3 Periodic Inspections.....	7
11.7.4 Inspection Records .....	8
11.7.5 Repairs.....	8
11.8 MAINTENANCE .....	8
11.8.1 Preventive Maintenance .....	8
11.8.2 Replacement Parts .....	8
11.9 TESTING.....	8
11.9.1 Structural and Mechanical Below-the-Hook Lifting Devices .....	8
11.9.2 Vacuum Devices.....	10
11.9.3 Close Proximity Operated Magnets.....	10
11.9.4 Remotely Operated Lifting Magnets .....	10
11.10 MAINTENANCE FILES.....	10
11.10.1 Intent of Maintenance Files .....	10
11.10.2 Maintenance File Contents .....	11

### Attachments

Attachment 11.1 Typical Lifting Devices.....	12
Attachment 11.1-1. Load-Supporting Lifters.....	12
Attachment 11.1-2. Indentation-Type Pressure Gripping Lifters.....	13
Attachment 11.1-3. Friction-Type Pressure Gripping Lifters.....	14
Attachment 11.1-4. Typical Cask Lift Fixture.....	15
Attachment 11.1-5. Below-the-Hook Lifting Device.....	16

**PAGINATION TABLE**

<u>Page</u>	<u>Release.</u>	<u>Date</u>
1	44	09/28/2004
2	44	09/28/2004
3	44	09/28/2004
4	44	09/28/2004
5	44	09/28/2004
6	44	09/28/2004
7	44	09/28/2004
8	44	09/28/2004
9	44	09/28/2004
10	44	09/28/2004
11	44	09/28/2004
12	44	09/28/2004
13	44	09/28/2004
14	44	09/28/2004
15	44	09/28/2004
16	44	09/28/2004

## 11.0 BELOW-THE-HOOK LIFTING DEVICES

### 11.1 SCOPE

As defined by ASME B30.20, *Below-the-Hook Lifting Devices*, there are four types of below-the-hook lifters. They are arranged in groups as follows:

Group I     Structural and Mechanical Lifting Devices

Structural lifter--a lifter consisting of an assembly of rigid parts designed to hold and attach a load to a hoisting device.

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.

Group II     Vacuum lifting device--a below-the-hook lifting device using a holding force by means of vacuum.

Group III    Magnet, lifting, close proximity operated--a lifting magnet used in such a fashion that the operator manually positions the magnet on the load and manually guides the magnet and load during a lift.

Group IV    Magnet, lifting, remotely operated--a lifting magnet that does not require the operator or other personnel to be in close proximity to the magnet or its load while the magnet is in use

**NOTE:** Unless otherwise stated, as used in this section, the term “operator” applies to the operator of a below-the-hook lifting device.

**NOTE:** Refer to 29 CFR 1926, Subpart R for special requirements relating to steel erection.

This section provides the requirements for Group I, structural and mechanical below-the-hook lifting devices. The majority of below-the-hook lifting devices used at the Hanford Site include, but are not limited to, supporting lifting devices, indentation-type pressure lifting devices, friction-type pressure lifting devices, spreader bars, lifting jigs, lifting yokes, and load test fixtures. Slings and rigging hardware that may be components in a below-the-hook lifting device are covered in previous sections of this manual.

The use of vacuum and magnetic lifting devices is very limited at the Hanford Site and these devices have not been covered in detail. If data on vacuum or magnetic lifting devices are required, a qualified engineer must be consulted. Only the marking requirements for magnetic lifters are included in this section. For direction regarding testing of vacuum and magnetic devices, see paragraphs 11.9.2, “Vacuum Devices,” 11.9.3, “Close-Proximity Operated Magnets,” and 11.9.4, “Remotely Operated Lifting Magnets.”

### 11.2 GENERAL FEATURES

Structural and mechanical lifting devices are often one-of-a-kind designs. Typical devices are shown in Attachment 11.1, “Typical Lifting Devices.”

#### 11.2.1 Special Lifting Devices

In accordance with design requirements, the responsible engineer may invoke ANSI N14.6 to a below-the-hook device. ANSI N14.6 invokes criteria similar to, but not identical to ASME B30.20. ANSI N14.6 may be invoked by the responsible engineer to govern the following criteria:

1. Design
2. Fabrication
3. Acceptance Testing
4. Maintenance
5. Assurance of continuing compliance
6. Inspection
7. Marking.

If questions arise as to how or if ANSI N14.6 applies, consult the responsible engineer.

### **11.3 DESIGN AND FABRICATION.**

#### **11.3.1 Design Factor**

Load-bearing structural components of a lifter shall be designed to withstand the stresses imposed by its rated load plus the weight of the lifter, with a minimum design factor of 3, based on the yield strength of the material, and with stress ranges that do not exceed the values given in ANSI/AWS D14.1, *Specification for Welding of Industrial and Mill Cranes and Other Material Handling Equipment* for the applicable conditions.

#### **11.3.2 Welding**

Welding shall be in accordance with the requirements of ANSI/AWS D14.1, *Specification for Welding of Industrial and Mill Cranes and Other Material Handling Equipment*.

**NOTE:** Requirements for weld nondestructive examination (NDE) of welds shall be determined by ANSI/AWS 14.1, *Specification for Welding of Industrial and Mill Cranes and Other Material Handling Equipment*, and the applicable fabrication specification.

#### **11.3.3 Guarding**

Guards will be provided for all moving parts or pinch points that constitute a hazard to the operator under normal operating conditions.

#### **11.3.4 Electrical**

Wiring and electrical equipment shall comply with the requirements of NFPA 70 (NEC), *National Electrical Code*, Article 610, "Cranes and Hoists."

#### **11.3.5 Analysis**

Site-fabricated, below-the-hook lifting devices shall be analyzed by the design engineer to verify that they conform to the required design factor.

### **11.4 MARKING**

Structural and mechanical below-the-hook lifting devices shall be provided with identification displaying the following data, as a minimum:

1. Rated load
2. Manufacturer's name (contractor's name if fabricated onsite)

3. Lifting device weight (if over 100 pounds)
4. Drawing number (if applicable)
5. Serial number (if applicable).

The identification data may be displayed on a name tag, nameplate, metal stamp, or other permanent marker

**NOTE:** If the lifting device comprises several lifting devices that can be detached from the assembly, these individual lifting devices shall be marked with their individual load rating also.

Lifting magnets shall include, but not be limited to, the following information:

1. Manufacturer's name
2. Manufacturer's model or unit identification
3. Weight of lifting magnet
4. Duty cycle (if applicable)
5. Cold current (coil is 68 °F [20 °C] and at rated voltage).

Repaired or modified magnets shall include, but not be limited to, the following information:

1. Name and address of the repairer or modifier
2. Repairer's unit identification
3. Weight of lifting magnet
4. Duty cycle (if applicable)
5. Cold current.

## 11.5 MODIFICATIONS

Any modification or re-rating of below-the-hook lifting devices requires documented analysis by a qualified engineer or the manufacturer of the lifting device.

Any re-rated or modified lifting device requires a new load test. A re-rated lifting device also must be appropriately relabeled with the new rated load capacity.

## 11.6 OPERATION

### 11.6.1 Operators

Below-the-hook lifting devices shall be operated only by qualified personnel.

### 11.6.2 Operator Qualifications

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

1. The operator shall be instructed in the use of the device by a designated person. Instructions shall include, but not be limited to, the following:
  - a. Application of the lifter to the load and adjustments of the lifts, if any, that adapt it to various sizes or kinds of loads
  - b. Instructions in any special operations or precautions
  - c. Condition of the load itself required for operation of the lifter such as balance, or degree of order of stacked loads, or surface cleanliness, bending, load thickness
  - d. Procedure for storage of lifter to protect it from damage
  - e. An admonition that the rated load of the lifting device not be exceeded nor the capacity of the hoisting equipment be exceeded by the combined weight of the load, the lifting device, and rigging.

2. The operator shall demonstrate the ability to operate the lifter as instructed before assuming responsibility for using the lifter.

### 11.6.3 Operator Responsibilities

Basic responsibilities of the operator are as follows:

1. The condition of the lifting device shall be observed before use and during operation. A defect observed shall be carefully examined by an appointed person. If the defect constitutes a hazard, the lifter shall be removed from service.
2. The operator shall not leave an attached load unattended unless specific precautions have been implemented.
3. Lifting device controls shall be tested by the operator before they are used on a shift. If any controls do not operate properly, they should be adjusted or repaired before operations are started.

### 11.6.4 Operating Practices

Below-the-hook lifting devices shall be operated in accordance with the following practices:

1. The lifting device shall be operated only by the following personnel:
  - a. Qualified operators of below-the-hook lifting devices
  - b. Trainees under the direct supervision of a qualified operator
  - c. Maintenance and test personnel, when it is necessary in the performance of their duties
  - d. Inspectors (lifting devices) to the extent necessary for inspection.
2. The lifting device shall not be loaded in excess of its rated load (except for test loads) or handle any load for which it is not designed.
3. The lifting device shall be applied to the load in accordance with established procedures.
4. Before lifting, the operator shall ensure that lifting device ropes or chains are not kinked and multiple-part lines are not interwoven.
5. Care should be taken to ensure that the load is correctly distributed for the lifting device being used.
6. The lifting device shall not be used for side pulls or sliding the load unless specifically authorized by a qualified person or specified in an approved procedure.
7. An operator shall not use a lifting device which is tagged "Danger--Do Not Operate" or otherwise designated as nonfunctional.
8. "Danger--Do Not Operate" tags on lifting devices shall not be removed without the approval of the person placing them or an authorized person.
9. The lifting device, when not in use, should be stored in a dry, inside location.
10. Caution should be taken to ensure that markings or tags are not removed or defaced. Missing or defaced markings or tags shall be replaced.

## 11.7 INSPECTIONS

### 11.7.1 Initial Inspection

Before initial use, all new, modified, or repaired lifting devices shall be inspected by a designated person to ensure compliance with the provisions of ASME B30.20, *Below-the-Hook Lifting Devices* (see paragraphs. 11.9.1, “Structural and Mechanical Below-the-Hook Lifting Devices,” Item 1; 11.9.2; “Vacuum Devices,” 11.9.3; Close-Proximity Operated Magnets,” and 11.9.4, “Remotely Operated Lifting Magnets.”)

### 11.7.2 Frequent Inspections

The user shall inspect for the following deficiencies on each shift or before use. In addition, visual observations should be conducted during regular service for any damage or evidence of malfunction that appears between regular inspections. Deficiencies shall be carefully examined to determine whether they constitute a hazard:

1. Structural deformation, cracks, or excessive wear on any part of the lifter
2. Loose or missing guards, fasteners, covers, stops, or nameplates
3. All functional operating mechanisms and automatic hold and release mechanisms for maladjustments that interfere with operations
4. Periodic inspections are current via inspection sticker, other documentation or verbal confirmation from equipment custodian
5. All load-carrying portions of the device for deformation, cracks, and excessive wear.

<b>Service Classifications for Below-the-Hook Lifting Devices</b>	
<b>normal</b>	Distributed service that involves operation with various weights within the rated load limit, or uniform loads less than 65 percent of rated load.
<b>heavy</b>	Service that involves operation within the rated load limit which exceeds normal service.
<b>severe</b>	Service that involves normal or heavy service with abnormal operating conditions.

### 11.7.3 Periodic Inspections

A complete inspection of lifting devices shall be performed by a qualified inspector at 12-month intervals for normal service, 6-month intervals for heavy service, and 3-month intervals for severe service. Fixtures not in use do not require periodic inspection, but the inspection must be performed before use. Any deficiencies shall be examined and a determination made as to whether they constitute a hazard. These inspections shall include the requirements of paragraph. 11.7.2, “Frequent Inspections,” and items such as the following, as applicable:

1. Loose bolts or fasteners
2. Cracked or worn gears, pulleys, sheaves, sprockets, bearings, chains, belts, and welds
3. Excessive wear of linkages and other mechanical parts
4. Excessive wear at hoist-hooking points and load-support clevises or pins

5. Marking required by paragraph. 11.4, "Marking"
6. External evidence of damage to structure, motors, and controls.

#### 11.7.4 Inspection Records

Dated inspection reports and records are to be made for each periodic inspection and any time the lifting device requires adjustment or repair. The most recent inspection records shall be retained in an equipment maintenance file by the equipment custodian.

#### 11.7.5 Repairs

Any deficiencies disclosed by the inspection shall be corrected before normal operation of the lifting device is resumed.

### 11.8 MAINTENANCE

#### 11.8.1 Preventive Maintenance

A preventive maintenance program should be established, if appropriate, and be based on recommendations made by the lifting device manufacturer or designer.

#### 11.8.2 Replacement Parts

Replacement parts shall be at least equivalent to the original specifications.

### 11.9 TESTING

#### 11.9.1 Structural and Mechanical Below-the-Hook Lifting Devices

Keep dated reports of operational tests, rated load tests, and manufacturers' certification, as applicable, so long as the device is available for use.

1. **Operational Tests.** Operationally test and inspect before initial use all new, altered, modified, or repaired lifting devices to confirm the lifter is suitable for its intended purpose and to ensure compliance with the following functions, as applicable:
  - a. **Moving Parts.** Test lifters with moving parts to determine that the lifter operates in accordance with the manufacturer's instructions.
  - b. **Latches.** Test lifters with manually operated or automatic latches to determine that the latch operates in accordance with the manufacturer's instructions.
  - c. **Markings.** Determine that the lifter is properly marked (see paragraph 11.4).
  - d. **Welding.** Determine that welding had been satisfactorily performed (see paragraph 11.3.2).
  - e. **Nondestructive Testing.** NDE of welds is required by controlling documents (example ANSI/AWS D14.1, *Specification for Welding of Industrial and Mill Cranes and Other Material Handling Equipment*, the fabrication specification, contract, or purchase order). Determine that NDE and weld repair, if necessary, are complete (see paragraph 11.3.2, "Welding").

**Note:** In accordance with ANSI/AWS D14.1, *Specification for Welding of Industrial and Mill Cranes and Other Material Handling Equipment*, all welds shall be visually examined. In addition, Joint Class I and Joint Class II weld joints, as defined in ANSI/AWS D14.1, Section 4, "Weld Joint Design," require either radiographic or ultrasonic examination and magnetic particle examination as required by ANSI/AWS D14.1, Section 8, "Weld Quality and Inspection." Except for visual inspection, nondestructive examination of weld joints other than Joint Class I or II, when required by the specification, shall be announced in the information furnished to bidders. The information provided should designate the inspection process to be used, the welds to be examined, and the extent of examination for each weld. Such nondestructive examination shall be conducted in conformance to the requirements of ANSI/AWS D14.1, or as modified by mutual agreement between the manufacturer and purchaser.

- f. **Guarding.** When guards are required, determine that guards are secure and properly installed (see paragraph 11.3.3, "Guarding").
  - g. **Electrical.** If applicable, determine that electrical equipment is properly installed and in good working order (see paragraph 11.3.4).
2. **Rated Load Test.** Before initial use, load test and inspect all new, altered, modified, or repaired lifting devices unless paragraph 11.9.1, "Structural and Mechanical Below-the-Hook Lifting Devices," Item 3, applies. Rated load tests shall be done under the direction of a qualified person. A written report furnished by such person confirms the load rating of the lifter. The load rating should 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 load unless otherwise recommended by the manufacturer.
- a. The rated load test includes the following operations as a minimum:
    - i) Hoist the test load a sufficient distance to ensure that the load is supported by the lifter, or apply the required load if the test is made using a testing machine.
    - ii) After the test load is released, visually inspect the lifter for deformation, cracks, or other defects.
    - iii) If a lifter fails a load test, it shall be repaired and retested before initial use.
    - iv) Prepare a test report that identifies the device by serial number, drawing number, or other unique identifier and includes: name and title of person directing the test, date of test, and the test load.
  - b. The rated load test may be done by one of the following:
    - i) The manufacturer
    - ii) A third-party testing company
    - iii) Under the direction of the using organization.
3. **Manufacturer's Certification In Lieu of Rated Load Test.** At the option of the using organization, a manufacturer's certification may be used in lieu of a rated load test only if all the following criteria apply:

- a. The lifter is manufactured by a reputable manufacturer that customarily manufactures structural and/or mechanical lift devices.
- b. The lifter is a standard ready-made item in the manufacturer's normal inventory. (One-of-a-kind items shall be load tested.)
- c. The manufacturer furnishes a written statement, signed and stamped by a registered professional engineer, certifying that
  - i) the lifter is designed to withstand the forces imposed by its rated load, with a minimum design factor of 3, based on yield strength, for load-bearing structural components, and
  - ii) the lifter fully complies with ASME B30.20, *Below-The-Hook Lifting Devices*.

The lifter passes operational tests (see paragraph 11.9.1, "Structural and Mechanical Below-the-Hook Lifting Devices," Item 1)

### 11.9.2 Vacuum Devices

Before initial use, test all new, modified, or extensively repaired vacuum below-the-hook lifting devices under the direction of a qualified person in accordance with ASME B30.20-2.3.4, "Testing." Keep reports of operational tests and the rated load test so long as the device is available for use.

### 11.9.3 Close Proximity Operated Magnets

Before initial use, test all new, modified, or extensively repaired close proximity operated lifting magnets under the direction of a qualified person in accordance with ASME 30.20-3.3.2, "Testing." Keep dated reports of operational tests and the rated load test so long as the device is available for use.

### 11.9.4 Remotely Operated Lifting Magnets

Before initial use, test all new, modified, or extensively repaired, remotely operated lifting magnets under the direction of a qualified person in accordance with ASME 30.20-4.3.2, "Testing." Keep reports of operational tests and the rated load test so long as the device is available for use.

## 11.10 MAINTENANCE FILES

The maintenance file is a compilation of various documents and records relating to operation, maintenance, inspection, testing, evaluating and repair of the lifter. The file may be centrally located or proportioned into satellite holding areas. The method(s) selected for establishing adequate information retention and retrieval shall be determined by the equipment custodian, who is the responsible person for assuring a safe and reliable maintenance program is in place.

### 11.10.1 Intent of Maintenance Files

The maintenance file shall contain, as a minimum, the required current dated periodic inspection records and other documentation to provide the user with evidence of a safe and reliable maintenance program. Keep dated reports of operational tests and the rated load test so long as the device is available for use. Inspection records should be retained in a format and location that provides for ease in accessibility. Maintenance file information should provide a source for comparing present conditions with past conditions to determine whether existing conditions show a trending pattern of wear,

deterioration, or other comparable factors that may compromise safe, continued use of the lifter. Length of record retention shall be determined by the equipment custodian's established maintenance program.

#### **11.10.2 Maintenance File Contents**

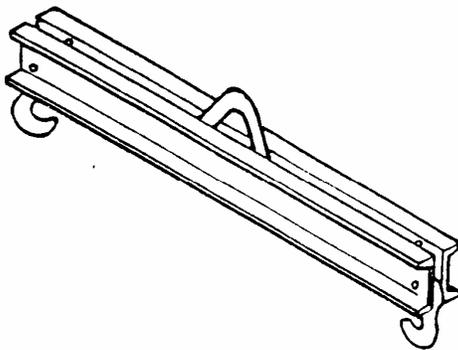
Maintenance files shall contain the following documentation, as applicable:

1. Operational test reports
2. Periodic inspection records.
3. Load test reports or manufacturer's certification in lieu of load tests
4. Documentation of altered, replaced, or repaired load-sustaining parts.
5. Engineering analysis of modifications or re-rating of the lifting device.
6. Copies of waivers, exemptions, hostile environment plans, or similar documentation applicable to the lifter (to include manufacture's safety bulletins, safety alerts, and product recall information).

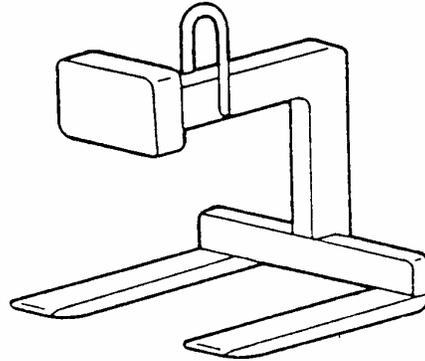
**NOTE:** Although complete maintenance information for old below-the-hook lifting devices may not be available, the custodian should acquire as much of the pertinent information as possible.

ATTACHMENT 11.1 TYPICAL LIFTING DEVICES

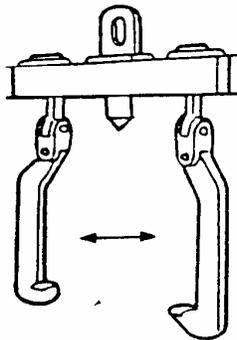
Attachment 11.1-1. Load-Supporting Lifters.



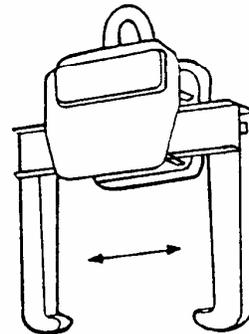
Lifting Beam (Spreader Beam)



Balanced Pallet Lifter

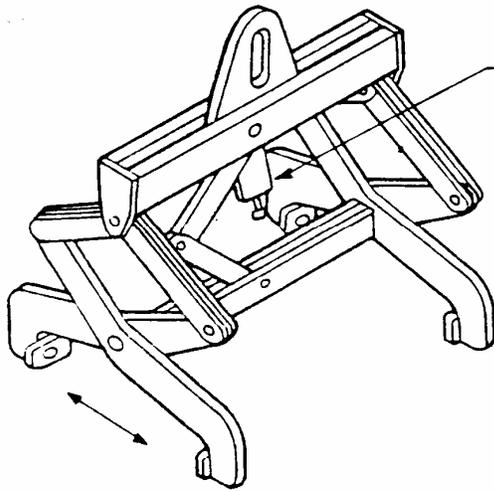


Coil Lifting Hook Beam

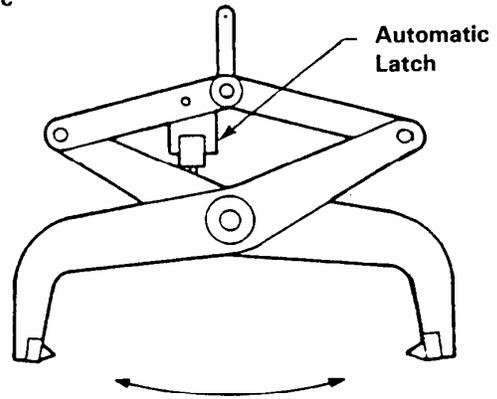


Telescoping Coil Grab

**Attachment 11.1-2. Indentation-Type Pressure Gripping Lifters.**



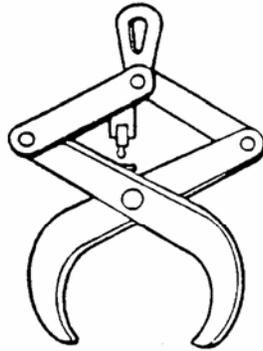
**Automatic Slab Tong  
(Four-Point)**



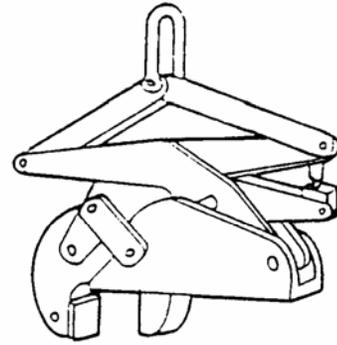
**Automatic Ingot Tong  
(Two-Point)**

38805-185.2

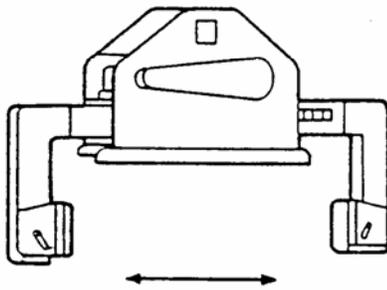
Attachment 11.1-3. Friction-Type Pressure Gripping Lifters.



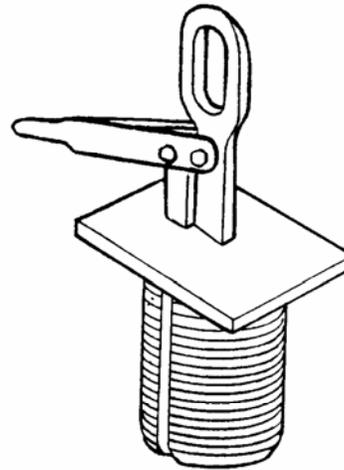
Bar Tong



Vertical Axis Coil Grab

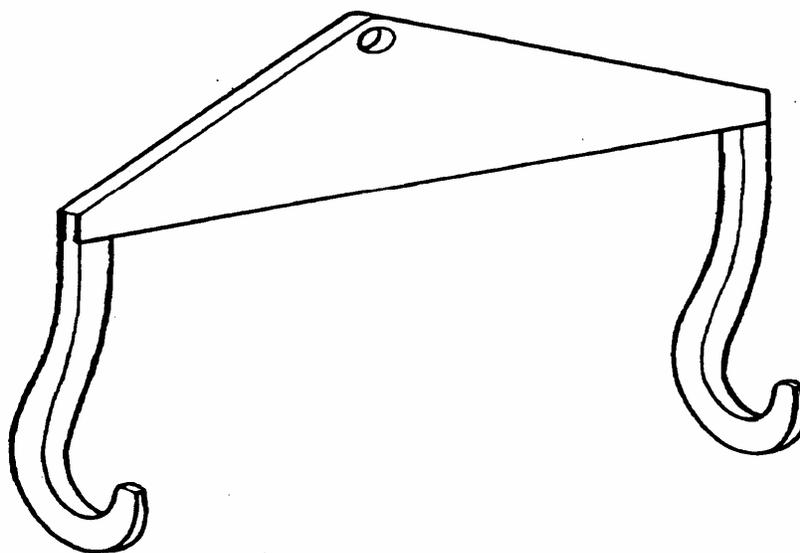


Motor Driven Roll Grab,  
End Grip

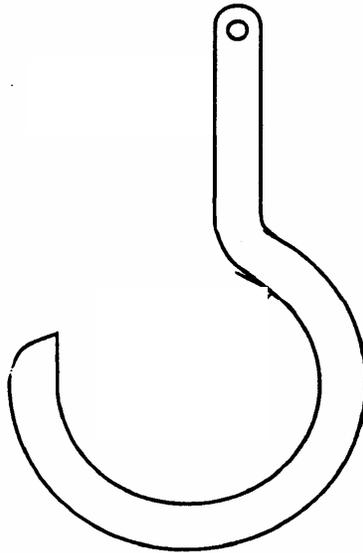


Roll Grab, Core Grip

Attachment 11.1-4. Typical Cask Lift Fixture.



**Attachment 11.1-5. Below-the-Hook Lifting Device.**



**NOTE:** The "hook" shown in Attachment 11.1-5 is categorized as a below-the-hook lifting device because of its use, not its shape. This hook may be picked up directly with a hoist hook or may have an intermediate device such as a shackle.