

ASME B30.1-2020
(Revision of ASME B30.1-2015)

Jacks, Industrial Rollers, Air Casters, and Hydraulic Gantries

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

AN AMERICAN NATIONAL STANDARD



**The American Society of
Mechanical Engineers**

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**The American Society of
Mechanical Engineers**

Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: February 19, 2021

The next edition of this Standard is scheduled for publication in 2025. This Standard will become effective 1 year after the Date of Issuance.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Standard. Interpretations are published on the ASME website under the Committee Pages at <http://cstools.asme.org/> as they are issued.

Errata to codes and standards may be posted on the ASME website under the Committee Pages to provide corrections to incorrectly published items, or to correct typographical or grammatical errors in codes and standards. Such errata shall be used on the date posted.

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

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This code or standard was developed under procedures accredited as meeting the criteria for American National Standards. The Standards Committee that approved the code or standard was balanced to assure that individuals from competent and concerned interests have had an opportunity to participate. The proposed code or standard was made available for public review and comment that provides an opportunity for additional public input from industry, academia, regulatory agencies, and the public-at-large.

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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 the ASME.

Meetings and discussions regarding safety on cranes, derricks, and hoists were held from 1920 to 1925, involving the ASME Safety Code Correlating Committee, the Association of Iron and Steel Electrical Engineers, the American Museum of Safety, the American Engineering Standards Committee (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, 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

systems. It also addressed responsibilities of personnel, personnel competence, and translations. This 2020 edition contains changes to definitions, added responsibilities of riggers, and several other changes.

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 December 11, 2020.

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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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
- B30.2 Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)
- B30.3 Tower Cranes
- B30.4 Portal and Pedestal Cranes
- B30.5 Mobile and Locomotive Cranes
- B30.6 Derricks
- B30.7 Winches
- B30.8 Floating Cranes and Floating Derricks
- B30.9 Slings
- B30.10 Hooks
- B30.11 Monorails and Underhung Cranes (withdrawn 2018 — requirements found in latest revision of B30.17)
- B30.12 Handling Loads Suspended From Rotorcraft
- B30.13 Storage/Retrieval (S/R) Machines and Associated Equipment
- B30.14 Side Boom Tractors
- B30.15 Mobile Hydraulic Cranes (withdrawn 1982 — requirements found in latest revision of B30.5)
- B30.16 Overhead 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
- B30.21 Lever Hoists
- B30.22 Articulating Boom Cranes
- B30.23 Personnel Lifting Systems
- B30.24 Container Cranes
- B30.25 Scrap and Material Handlers
- B30.26 Rigging Hardware
- B30.27 Material Placement Systems
- B30.28 Balance Lifting Units
- B30.29 Self-Erecting Tower Cranes
- B30.30 Ropes
- B30.31 Self-Propelled, Towed, or Remote-Controlled Hydraulic Platform Transporters¹
- B30.32 Unmanned Aircraft Systems (UAS) Used in Inspection, Testing, Maintenance, and Lifting Operations¹

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.

¹This 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: REQUESTS FOR REVISION

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

Secretary, B30 Standards Committee
ASME Standards and Certification
Two Park Avenue
New York, NY 10016-5990

Requests should be in the following format:

Volume: Cite the designation and title of the volume.
Edition: Cite the applicable edition of the volume.
Subject: Cite the applicable paragraph number(s) and the relevant heading(s).
Request: Indicate the suggested revision.
Rationale: State the rationale for the suggested revision.

Upon receipt by the Secretary, the request will be forwarded to the relevant B30 Subcommittee for consideration and action. Correspondence will be provided to the requester defining the actions undertaken by the B30 Standards Committee.

SECTION IX: REQUESTS FOR INTERPRETATION

The B30 Standards Committee will render an interpretation of the provisions of the B30 Standard. An Interpretation Submittal Form is available on ASME's website at <http://cstools.asme.org/Interpretation/Interpretation-Form.cfm>.

Phrase the question as a request for an interpretation of a specific provision suitable for general understanding and use, not as a request for approval of a proprietary design or situation. Plans or drawings that explain the question may be submitted to clarify the question. However, they should not contain any proprietary names or information. Read carefully the note addressing the types of requests that the B30 Standards Committee can and cannot consider.

Upon submittal, the request will be forwarded to the relevant B30 Subcommittee for a draft response, which will then be subject to approval by the B30 Standards Committee prior to its formal issuance. The B30 Standards Committee may rewrite the question for the sake of clarity.

Interpretations to the B30 Standard will be available online at <https://cstools.asme.org/Interpretation/SearchInterpretation.cfm>.

SECTION X: ADDITIONAL GUIDANCE

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

The B30 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

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- (b) the loads

ASME B30.1-2020

SUMMARY OF CHANGES

Following approval by the ASME B30 Committee and ASME, and after public review, ASME B30.1-2020 was approved by the American National Standards Institute on December 11, 2020.

ASME B30.1-2020 includes the following changes identified by a margin note, **(20)**.

<i>Page</i>	<i>Location</i>	<i>Change</i>
x	B30 Standard Introduction	Updated
1	1-0.1.1	First cross-reference to figure revised
1	Section 1-0.2	Definitions and alphabetical listings of <i>air caster system, air-lifting bag system, auxiliary load point, double-acting hydraulic jack, gap crossing air caster, high-lift air caster, hydraulic jack, integral auxiliary load point, load, load handling equipment (LHE), load point, low-lift air caster, mechanical jack, normal service, rated load, screw extension, self-contained jack, severe service, shall, should, single-acting hydraulic jack, and special service</i> revised
2	Section 1-0.3	Revised
5	1-0.4.4	Added
5	1-0.4.5	Former 1-0.4.4 redesignated and revised
6	Figure 1-0.4.5-1	Former Figure 0.4.4-1 redesignated
11	1-1.9.5.2	In subpara. (b), cross-reference to figure updated
17	1-2.9.5.2	In subpara. (b), cross-reference to figure updated
22	1-3.9.5.2	In subpara. (b), cross-reference to figure updated
28	1-4.9.5.2	In subpara. (b), cross-reference to figure updated
33	1-5.9.5.2	In subpara. (b), cross-reference to figure updated
39	1-6.9.5.2	In subpara. (b), cross-reference to figure updated
45	1-7.9.5.2	In subpara. (b), cross-reference to figure updated

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Chapter 1-0

Scope, Translations, Definitions, Personnel Competence, Responsibilities, and References

SECTION 1-0.1: SCOPE OF B30.1

Volume B30.1 includes provisions that apply to the construction, operation, inspection, testing, and maintenance of mechanical ratchet jacks, hand- or power-operated mechanical screw jacks, hand- or power-operated hydraulic jacks, air-lifting bags, industrial rollers, air casters, telescopic hydraulic gantry systems, and strand jacks.

Not included in this Volume are jacks designed for automotive service, trip-lowered jacks, jacks designed for static support rather than load handling, and jacks, industrial rollers, air-lifting bags or air casters that are an integral part of other equipment.

(20) 1-0.1.1 Illustrations

Figures 1-0.4.5-1 through 1-7.1.1-1 show typical equipment and hand signals addressed in this Volume. They are not intended to be all-inclusive.

1-0.1.2 Translations

(a) Translation of non-English documentation into English

(1) The wording of written non-English safety information and manuals regarding use, inspection, and maintenance shall be translated into English by professional translation industry standards, which include, but are not limited to the following:

(-a) translation of the complete paragraph message, instead of word by word

(-b) grammatical accuracy

(-c) respectfulness of the source document content without omitting or expanding the text

(-d) accurate translation of the terminology

(-e) reflection of the level of sophistication of the original document

(2) The finished translation shall be verified for compliance with (1)(-a) through (1)(-e) by a qualified person having an understanding of the technical content of the subject matter.

(3) Pictograms used to identify controls shall be described in the manuals. The pictograms should comply with ISO 7000, ISO 7296, or other recognized

source, if previously defined. The text of the description shall meet the criteria of (1) and (2).

(b) Any non-English documentation provided in addition to English shall be translated and reviewed in accordance with the requirements listed above.

SECTION 1-0.2: DEFINITIONS

(20)

air bladder (air caster): a monofilm or fabric-reinforced material enclosure that directs air flow beneath the air caster's module structure.

air caster: a device that can provide lift and travel of a load using air flow as the support medium, often referred to as air skates or air bearings.

air caster system: a system consisting of an air supply, air hoses, pressure control console, and air casters.

air-lifting bag: a reinforced, flat, rubberized single-chamber inflatable bag designed to contain air at pressures above 100 psi.

air-lifting bag system: a system consisting of an air supply, air hoses, pressure control unit, and air-lifting bag.

authorized service center: an independent service facility designated by the manufacturer to repair and test equipment of their manufacture.

auxiliary load point: any point of load application other than the primary load point.

birdcaging: the permanent deformation of a section of strand in which the wires spread apart.

double-acting hydraulic jack: a jack that is extended and retracted under hydraulic pressure.

drift: horizontal displacement of the top of a telescopic lift boom that results from clearances between boom sections.

gap crossing air caster: a fabricated module that contains a load support plate, a landing pad, and a perforated air bladder that provides the ability to travel across gaps and steps in the operating surface.

high-lift air caster: a fabricated module that contains a load support plate, a landing pad, and an air bladder that provides approximately twice the effective lift height of

a low-lift air caster and inflates without requiring contact with the operating surface for inflation.

hydraulic jack: a jack using pressurized liquid to move the load.

industrial roller: a structural frame containing interlinked rollers or wheels designed to support and transport a load, often referred to as skates or dollies.

integral auxiliary load point: any nonremovable point of load application other than the primary load point.

jack: a portable hand or a power-operated mechanism with a base and a load point designed for controlled linear movement.

landing pads: structural spacer(s) mounted below an air caster module structure, which provides support while the air bladder is deflated.

lateral: the horizontal direction perpendicular to the length of the gantry system track.

load: the total superimposed weight or force to be overcome by the equipment.

load handling equipment (LHE): equipment used to move a load vertically or horizontally.

load point: the primary point of load application established by the jack manufacturer.

longitudinal: the horizontal direction parallel to the length of the gantry system track.

low-lift air caster: a fabricated module that contains a load support plate, a landing pad, and an air bladder that provides approximately half the effective lift height of a high-lift air caster and requires contact with the operating surface for inflation.

mechanical jack: a jack using any means other than fluid to move the load.

module structure (air caster): the load support platform that interfaces between the load and the air bladder.

normal service: service that involves handling of loads within the rated load.

overload: any load greater than the rated load.

overtravel: movement beyond maximum travel (mechanical jack) or stroke (hydraulic jack) for which the jack was designed.

ply separation: a delamination of at least two layers of rubber and/or reinforcement material.

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 allowable working load established by the manufacturer. The terms *rated capacity* and *working load limit* are commonly used to describe rated load.

screw extension: a device that increases the hydraulic jack's length.

self-contained jack: a hydraulic jack whose hydraulic reservoir and pump are contained within the jack's housing.

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

shall: a word indicating a requirement.

should: a word indicating a recommendation.

side shift: lateral movement of a suspended load along the header beams of a telescopic hydraulic gantry system.

single-acting hydraulic jack: a jack that is extended using hydraulic pressure and retracted by release of the hydraulic pressure.

special service: service that involves operation other than normal or severe that is identified by a qualified person.

strand jack: hydraulic cylinder(s) configured to sequentially grip and release single or multiple strands to move a load.

strand jack system: one or more strand jacks, strands, anchors, a hydraulic power unit, control console, hoses, rigging, and accessories required to guide and manage the strands to move a load.

stroke: linear extending or retracting movement of the hydraulic jack ([Chapter 1-2](#)) or gantry leg ([Chapter 1-6](#)).

telescopic hydraulic gantry leg: a structural base that is supported on wheels or a frame and that has one or more vertical lift cylinders or boom.

telescopic hydraulic gantry system: two or more telescopic hydraulic gantry legs, a hydraulic power unit, control console, hoses, and one or more header beams that span between the legs.

travel: linear extending or retracting movement of the mechanical jack ([Chapter 1-1](#)); horizontal movement of the telescopic hydraulic gantry system along the track ([Chapter 1-6](#)).

tube guide: component of a strand jack that reduces the unsupported length of strand inside the jack to decrease the occurrence of birdcaging inside the jack.

SECTION 1-0.3: PERSONNEL COMPETENCE

(20)

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 1-0.4: 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.

(a) *LHE Operator*: directly controls the LHE's functions.

(b) *LHE Owner*: has custodial control of the LHE by virtue of lease or ownership.

(c) *LHE User*: arranges the LHE's presence on a work site and controls its use there.

(d) *LHE Director*: directly oversees the work being performed by the LHE and the associated crew.

(e) *Site Supervisor*: exercises supervisory control over the work site on which the LHE is being used and over the work that is being performed on that site.

1-0.4.1 Responsibilities of the LHE Owner and LHE User

In some situations, the LHE Owner and the LHE User may be the same entity and is therefore accountable for all of the following responsibilities. In other cases, the LHE User may lease or rent LHE from the LHE Owner without supervisory, operational, maintenance, support personnel, or services from the LHE Owner. In these situations, paras. 1-0.4.1.1 and 1-0.4.1.2 shall apply.

1-0.4.1.1 The LHE Owner's responsibilities shall include the following:

(a) providing LHE that meets the requirements of this Volume, as applicable, as well as specific job requirements defined by the LHE User.

(b) providing LHE and all necessary components, specified by the LHE manufacturer, that meet the LHE User's requested configuration and capacity.

(c) providing all applicable load/capacity chart(s) and diagrams.

(d) providing additional technical information pertaining to the LHE, necessary for LHE operation, when requested by the LHE User.

(e) providing field assembly, disassembly, operation and maintenance information, and warning decals and placards installed as prescribed by the LHE manufacturer.

(f) establishing an inspection, testing, and maintenance program in accordance with the applicable chapter and informing the LHE User of the requirements of this program.

(g) designating personnel for maintenance, repair, transport, assembly, and disassembly.

(h) designating personnel for inspections as required in the applicable chapter.

1-0.4.1.2 The LHE User's responsibilities shall include the following:

(a) complying with the requirements of this Volume, LHE manufacturer's requirements, and those regulations applicable at the work site

(b) using supervisors for LHE activities that meet the requirements for a qualified person as defined in Section 1-0.2

(c) ensuring that the LHE is in proper operating condition prior to initial use at the work site by

(1) verifying that the LHE Owner has provided periodic inspection documentation, if applicable

(2) verifying that a frequent inspection has been performed

(d) verifying that the LHE has the necessary capacity to perform the proposed LHE operations in the planned configuration

(e) ensuring the assigned LHE Operator(s) has been notified of adjustments or repairs that have not yet been completed, prior to commencing LHE operations

(f) designating personnel for inspections as required in the applicable chapter

(g) designating personnel for maintenance, repair, transport, assembly, and disassembly

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

(i) ensuring that the inspection, testing, and maintenance programs specified by the LHE Owner are followed

1-0.4.2 Responsibilities of Site Supervisor and LHE Director

In some situations, the Site Supervisor and the LHE Director may be the same person.

1-0.4.2.1 The Site Supervisor's responsibilities shall include the following:

(a) ensuring that the LHE meets the requirements of the appropriate chapter prior to initial site usage

(b) determining if additional regulations or requirements are applicable to LHE operations

(c) ensuring that a qualified person is designated as the LHE Director

(d) ensuring that LHE operations are coordinated with other jobsite activities that will be affected by or will affect LHE operations

(e) ensuring that the area for the LHE is adequately prepared. The preparation includes, but is not limited to, the following:

(1) access for the LHE and associated equipment

(2) sufficient room to assemble and disassemble the LHE

(3) an operating area that is suitable for the LHE with respect to levelness, surface conditions, support capability, proximity to power lines, excavations, slopes, underground utilities, subsurface construction, and obstructions to LHE operation

(4) traffic control as necessary to restrict unauthorized access to the LHE's working area

(f) ensuring that work involving the assembly and disassembly of LHE is supervised by a qualified person

(g) ensuring that operators meet the physical, knowledge, and skill requirements of the LHE's applicable chapter

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

(1) poor soil or support conditions

(2) wind velocity or gusting winds

(3) weather conditions

(4) extreme temperatures

(5) inadequate lighting

(6) operating surface conditions

(7) excessive noise

(8) proximity to energized sources (e.g., power lines, pressurized lines)

(i) ensuring that work performed by the rigging crew is supervised by a qualified person

(j) ensuring that LHE maintenance is performed by a designated person

1-0.4.2.2 The LHE Director's responsibilities shall include the following:

(a) being present at the jobsite during LHE operations.

(b) stopping LHE operations if alerted to an unsafe condition affecting those operations.

(c) ensuring that the preparation of the area needed to support LHE operations has been completed before LHE operations commence.

(d) ensuring necessary traffic controls are in place to restrict unauthorized access to the LHE's work area.

(e) ensuring that personnel involved in LHE operations understand their responsibilities, assigned duties, and the associated hazards.

(f) addressing safety concerns raised by the LHE Operator or other personnel and being responsible if he decides to overrule those concerns and directs LHE operations to continue. In all cases, the manufacturer's criteria for safe operation and the requirements of this Volume shall be followed.

(g) designating the signalperson(s) and conveying that information to the LHE Operator.

(h) evaluating LHE operation in proximity to energized sources.

(i) ensuring precautions are implemented when hazards associated with special load handling operations are present. Such LHE operations may include, but are not limited to, the following:

(1) multiple types of LHE used simultaneously

(2) shifting center(s) of gravity or lifting below the center of gravity

(3) shifting, inclined, or moving surfaces

(4) LHE operating on barges

(j) informing the LHE Operator of the weight and planned movement of the loads to be handled.

(k) obtaining the LHE Operator's verification that this weight does not exceed the LHE's rated load.

(l) ensuring that load rigging personnel have been designated for the LHE.

(m) ensuring that the load is properly rigged and stable.

1-0.4.3 Responsibilities of LHE Operators

The LHE Operator shall be responsible for the following listed items. The LHE Operator shall not be responsible for hazards or conditions that are not under his direct control and that adversely affect the LHE operations. Whenever the LHE Operator has doubt as to the safety of LHE operations, the LHE Operator shall stop the LHE's functions in a controlled manner. LHE operations shall resume only after safety concerns have been addressed and the continuation of the operation is directed by the LHE Director.

The LHE Operator's responsibilities shall include the following:

(a) reviewing the requirements for the LHE with the LHE Director before LHE operations.

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

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

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

(e) using the LHE's load/capacity chart(s) and diagrams and applying all notes and warnings related to the charts to confirm the correct LHE configuration to suit the load, site, and load handling conditions.

(f) refusing to operate the LHE when any portion of the load or LHE could be adversely affected by proximity to energized sources until evaluated and approved by a qualified person.

(g) performing inspections as specified in the applicable chapter.

(h) promptly reporting the need for any adjustments or repairs.

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

(j) not operating the LHE when physically or mentally unfit.

(k) ensuring that all controls are in the off or neutral position and that all personnel are in the clear before energizing the LHE.

(l) not engaging in any practice that will divert his attention while actually operating the LHE controls.

(m) testing the LHE function controls that will be used and operating the LHE only if those function controls respond properly.

(n) operating the LHE's functions, under normal operating conditions, in a smooth and controlled manner.

(o) knowing and following the procedures specified by the LHE manufacturer or approved by a qualified person for assembly, disassembly, and setting up the LHE.

(p) knowing how to travel the LHE, if applicable.

(q) ensuring that the load and rigging weight(s) have been provided.

(r) calculating or determining the rated load for all configurations that will be used and verifying, using the load/capacity chart(s), that the LHE has sufficient capacity for the proposed LHE operation.

(s) considering all factors known that might affect the LHE capacity and informing the LHE Director of the need to make appropriate adjustments.

(t) knowing the standard and special signals as specified in the applicable chapter and responding to such signals from the signalperson. When a signalperson is not required, the LHE Operator is then responsible for the movement of the LHE. However, the LHE Operator shall obey a stop signal at all times, no matter who gives it.

(u) understanding basic load rigging procedures. For responsibility of rigging the load and ensuring that the load is rigged properly; see [paras. 1-0.4.2.2\(l\)](#) and [1-0.4.2.2\(m\)](#)

(v) if power fails during LHE operations

(1) set all LHE locking devices

(2) move all LHE power controls to the OFF or neutral position

(3) secure and stabilize the load, if practical

(w) before leaving the LHE unattended

(1) secure and stabilize the load

(2) set all LHE locking devices

(3) put LHE controls in the OFF or neutral position

(4) turn off the LHE power source

(5) follow the recommendations of the LHE manufacturer or a qualified person for securing the LHE

1-0.4.4 Responsibilities of Riggers

(20)

Riggers assigned to a load handling activity shall, at a minimum, be responsible for

(a) ensuring the weight of the load and its approximate center of gravity have been obtained, provided, or calculated

(b) selecting the proper rigging equipment, inspecting it, and complying with the applicable operating practices according to the criteria of the applicable ASME volume

(c) ensuring the rated load of the rigging equipment as selected and configured is sufficient for the load to be handled, based on the number of legs, hitch configuration, and effects of angles

(d) ensuring that the rigging equipment is properly attached to the hook, shackle, or other load handling device

(e) ensuring that the rigging equipment is adequately protected from abrasion, cutting, or other damage during load handling activities

(f) ensuring that the load is rigged to be balanced and stable during the load handling activity

(g) knowing and understanding the applicable signals for the equipment in use

(h) ensuring that a tag line(s) is installed and used when additional load control is required

1-0.4.5 Standard Hand Signals

(20)

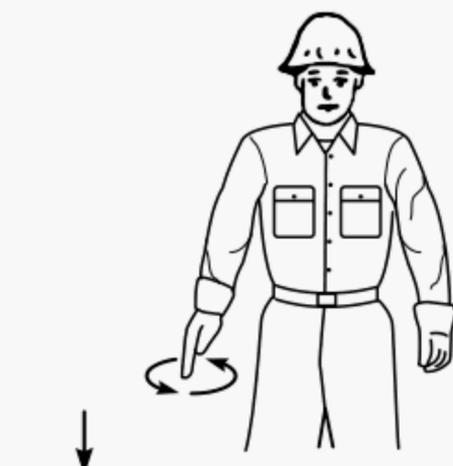
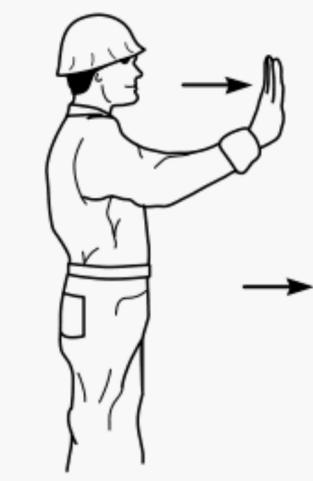
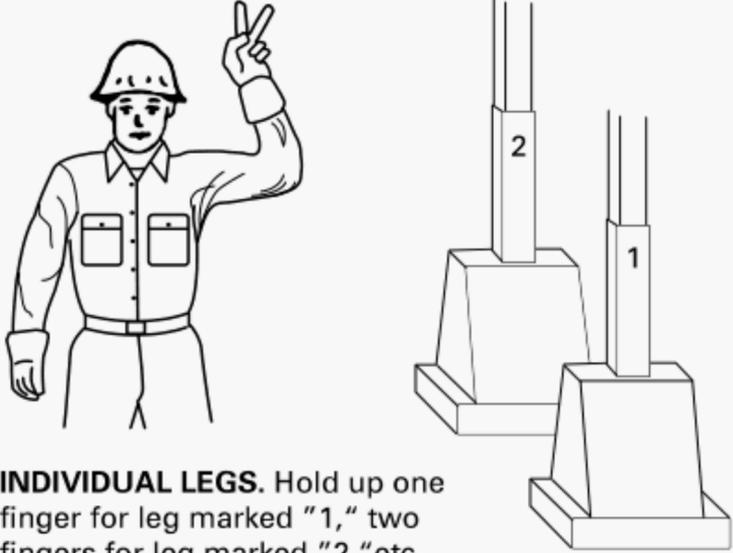
See [Figure 1-0.4.5-1](#).

SECTION 1-0.5: REFERENCE

Recommended Practices for Telescopic Hydraulic Gantry Systems

Publisher: Specialized Carriers and Rigging Association, 5870 Trinity Parkway, Suite 200, Centreville, VA 20120 (www.scranet.org)

(20) **Figure 1-0.4.5-1 Standard Hand Signals When Using Jacks, Industrial Rollers, Air Casters, and Telescopic Hydraulic Gantry Systems**

 <p>RAISE. With forearm vertical, forefinger pointing up, move hand in small horizontal circle.</p>	 <p>LOWER. With arm extended downward, forefinger pointing down, move hand in small horizontal circle.</p>	 <p>GANTRY TRAVEL. Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.</p>
 <p>SIDE SHIFT. Palm up, fingers closed, thumb pointing in direction of motion, jerk hand horizontally.</p>	 <p>STOP. Arm extended, palm down, move arm back and forth horizontally.</p>	 <p>EMERGENCY STOP. Both arms extended, palms down, move arms back and forth horizontally.</p>
 <p>DOG EVERYTHING. Clasp hands in front of body.</p>	 <p>INDIVIDUAL LEGS. Hold up one finger for leg marked "1," two fingers for leg marked "2," etc. Regular signals follow.</p>	

Chapter 1-1

Mechanical Jacks

SECTION 1-1.0: SCOPE

This Chapter applies to mechanical jacks.

SECTION 1-1.1: TYPES AND DESIGN

1-1.1.1 Types

(a) Types are screw and ratchet style (see [Figures 1-1.1.1-1 through 1-1.1.1-4](#)) and are primarily used in a vertical position.

(b) All jacks covered by this Chapter shall incorporate a positive stop or method to prevent over travel.

1-1.1.2 Design

(a) The load-bearing materials in the jack shall have sufficient strength and ductility to raise, lower, and support the rated load at the temperatures at which it will be used.

(b) The jack shall be designed to meet the proof load requirements in [para. 1-1.4.2\(a\)](#).

(c) The jack should be designed to ensure that the computed stress in the structural components of the jack does not exceed 50% of the yield strength of the material at the appropriate rated load for the components.

(d) Control parts and accessory equipment shall be designed to provide a means of operation and adjustment that will minimize exposure of the operator to injury.

(e) Carrying handles, if provided, shall be capable of statically supporting 200% of the weight of the jack.

(f) Changes in physical properties caused by welding handles, eyes, or other approved attachments to a mechanical jack shall be taken into account.

SECTION 1-1.2: DESIGN FACTOR

The design factor for mechanical jacks shall be determined by the manufacturer.

SECTION 1-1.3: RATED LOADS

Rated load shall be established by the mechanical jack manufacturer.

SECTION 1-1.4: PROOF TEST AND PROOF LOAD

1-1.4.1 Proof Test Requirements

(a) Each newly designed mechanical jack shall be proof tested by the manufacturer.

(b) All newly manufactured mechanical jacks shall be proof tested by the manufacturer with the jack extended to a point of at least 25% of travel.

(c) The manufacturer or a qualified person shall determine if a proof test is required for any altered, modified, or repaired mechanical jack.

(d) After proof testing, the mechanical jack shall be thoroughly inspected for the conditions stated in [para. 1-1.8.4](#).

1-1.4.2 Proof Load Requirements

(a) When proof testing a newly designed mechanical jack

(1) the jack's load point shall be loaded to 110% of its lifting rated load and operated to its full length of travel through ten cycles (dynamic test).

(2) the jack's load point shall be loaded three times to 150% of its rated load. The rack bar or screw shall be at least 90% of full travel. After this test, the jack shall be functional for full extension under 100% of rated load (static test).

(3) each auxiliary load point shall be proof tested in accordance with the same cycles and percentages described in (1) and (2).

(b) The proof load for each newly manufactured mechanical jack shall be a minimum of 100% of the rated load.

(c) The proof load for each altered, modified, or repaired mechanical jack shall be a minimum of 100% of the rated load unless otherwise determined by the manufacturer or a qualified person.

SECTION 1-1.5: IDENTIFICATION

1-1.5.1 Marking

Each new mechanical jack shall have forged, cast, die stamped, etched, or fixed label markings by the manufacturer to show

(a) name or trademark of manufacturer

Figure 1-1.1.1-1 Ratchet Jack

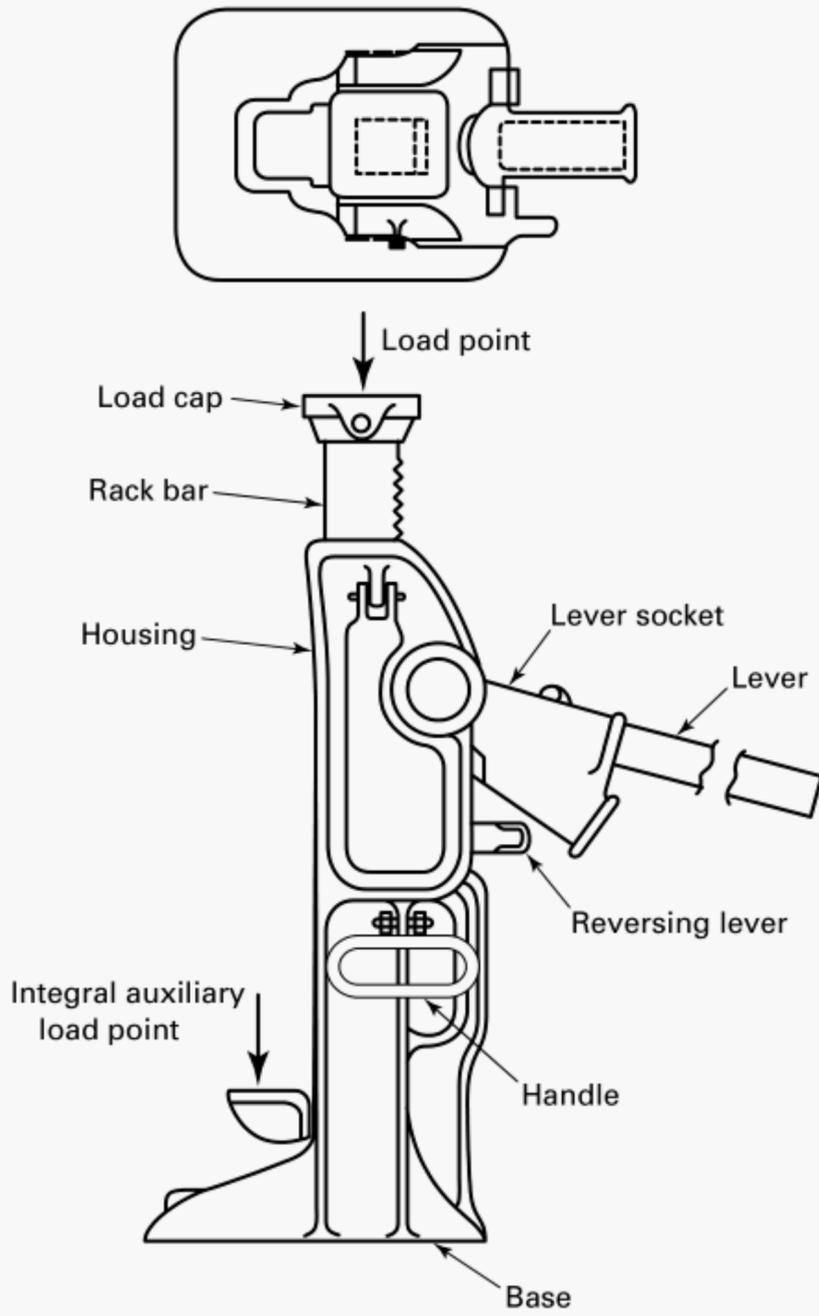


Figure 1-1.1.1-2 Screw Jack

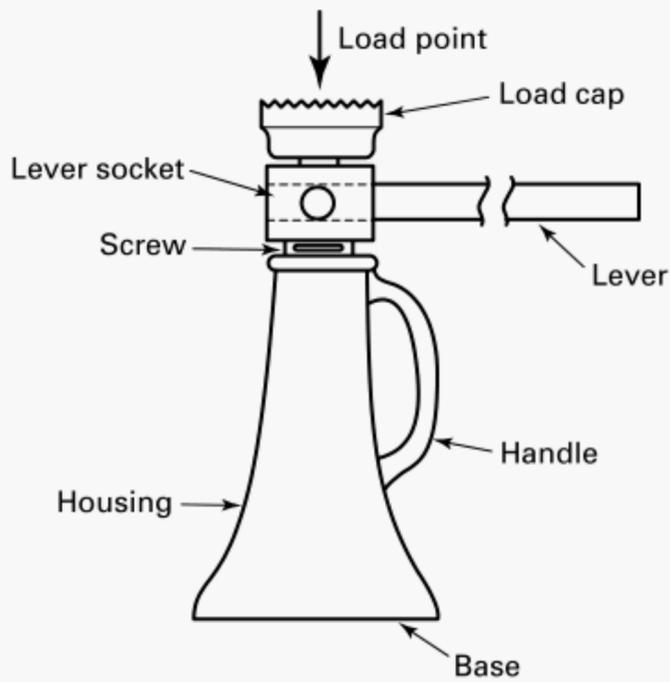


Figure 1-1.1.1-3 Power-Driven Screw Jack

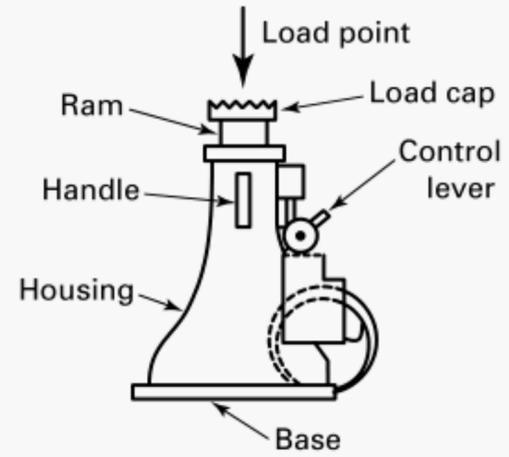


Figure 1-1.1.1-4 Screw Jack With Ratchet

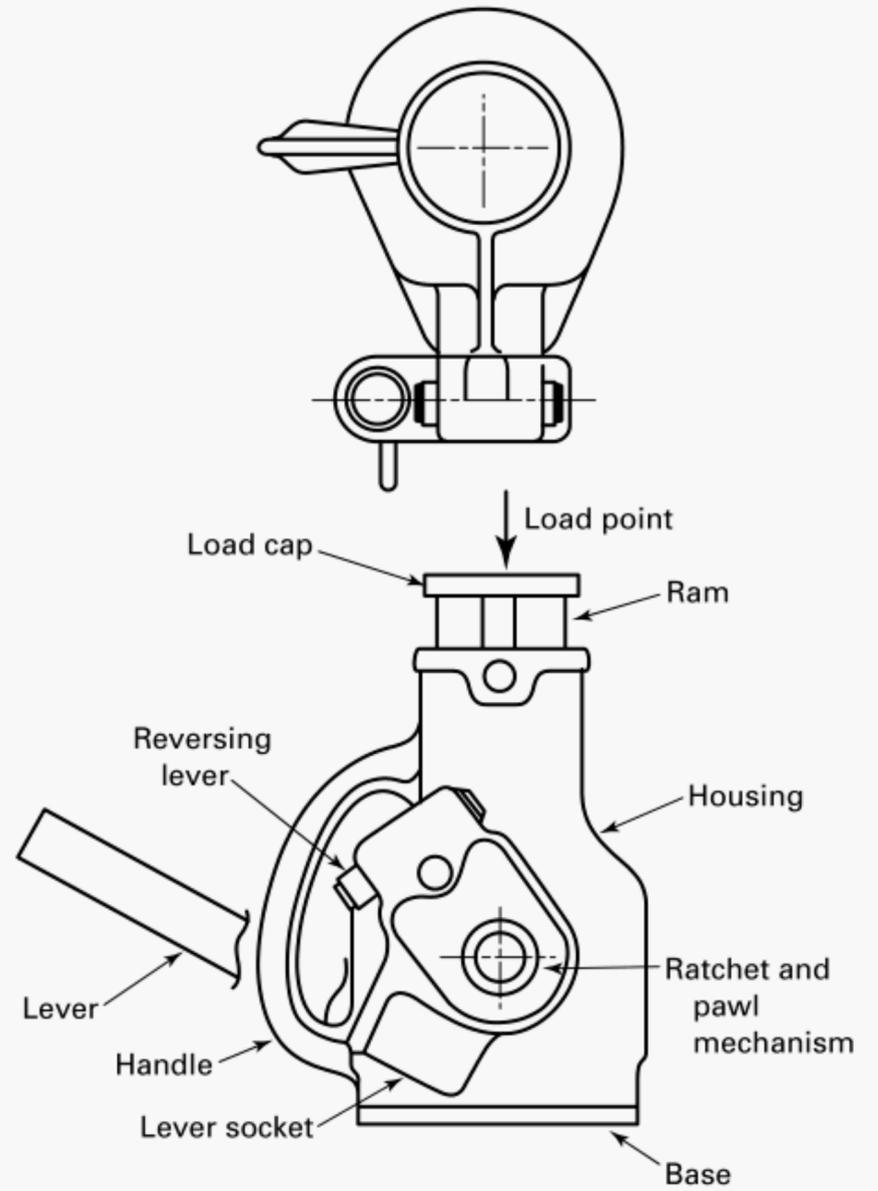


Figure 1-1.1.1-1 Ratchet Jack

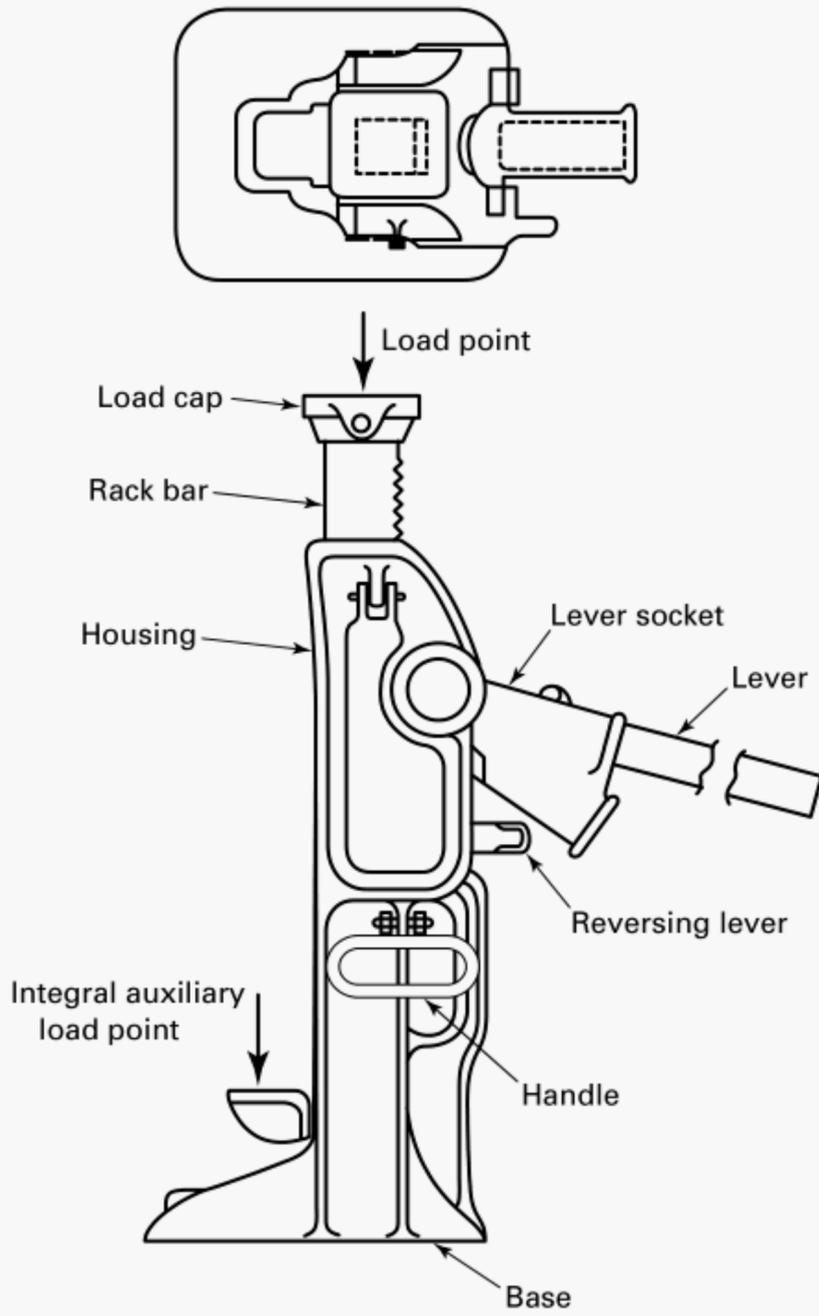


Figure 1-1.1.1-2 Screw Jack

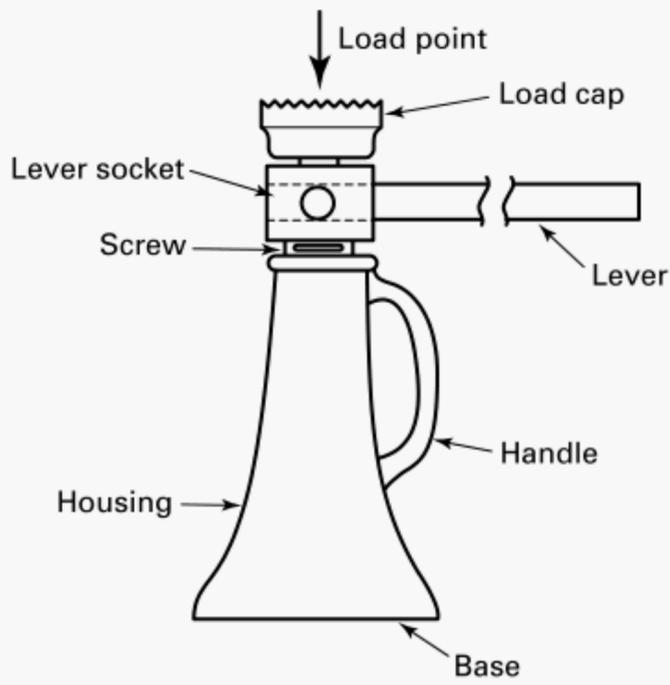


Figure 1-1.1.1-3 Power-Driven Screw Jack

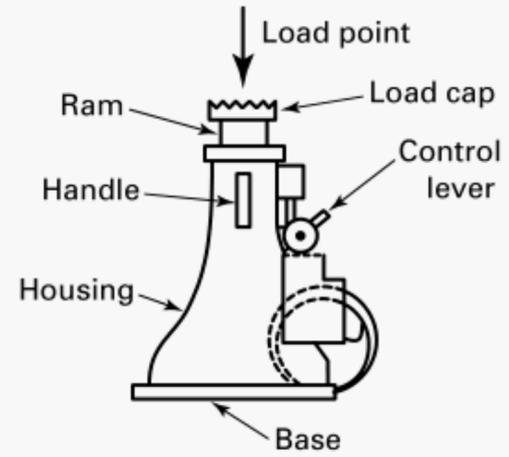
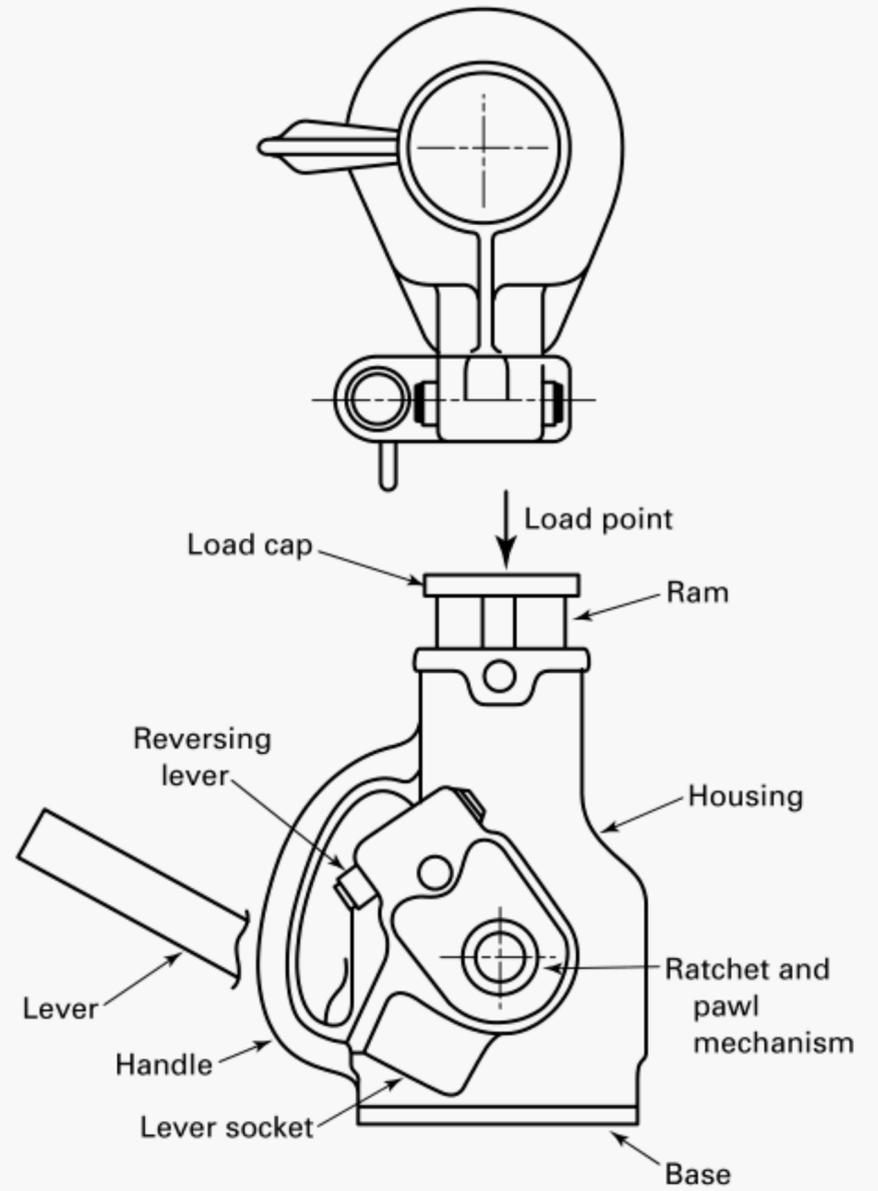


Figure 1-1.1.1-4 Screw Jack With Ratchet



- (a) missing or illegible identification
- (b) pawl or rack teeth that are chipped, cracked, broken, or excessively worn
- (c) cracked or damaged housing
- (d) excessive pitting or corrosion
- (e) excessive nicks or gouges
- (f) improper engagement between rack bar and the pawls or wear plate
- (g) indications of structural damage due to heat, or evidence of unauthorized welding
- (h) excessive wear, bending, or other damage to threads
- (i) improperly functioning or damaged load cap or integral auxiliary load point
- (j) loose bolts or rivets
- (k) damaged or improperly assembled accessory equipment
- (l) other conditions including visible damage that cause doubt as to the continued use of the mechanical jack
- (m) other items as specified in manufacturer's instruction that may affect operation

1-1.8.5 Repairs and Modifications

- (a) Repairs, alterations, or modifications shall be as specified by the mechanical jack manufacturer or a qualified person.
- (b) All replacement parts including pins, bolts, caps, and keepers shall meet or exceed the original equipment manufacturer's specifications.

SECTION 1-1.9: OPERATING PRACTICES

1-1.9.1 Mechanical Jack Selection

- (a) Mechanical jacks shall be selected for the type of load and environment in accordance with the recommendations of the manufacturer or a qualified person.
- (b) The rated load of the mechanical jack shall not be exceeded.
- (c) Mechanical jacks shall not be used until inspected and accepted as usable under [Section 1-1.8](#).

1-1.9.2 Maintenance

- (a) A preventive maintenance program shall be established and should be based on the recommendations outlined in the air caster manufacturer's manual.
- (b) All moving parts of the jack should be regularly cleaned.
- (c) Lubricate parts as required by the manufacturer's specifications. The type of lubricant should be as specified by the manufacturer or a qualified person. Lubrication systems should be checked to verify proper operation.
- (d) If additional maintenance is required, it should be completed in accordance with the instructions of the manufacturer or qualified person.

1-1.9.3 Storage

- (a) Mechanical jacks should be stored in an area where they will not be subjected to damage.
- (b) If extreme temperatures or chemically active or abrasive environments are involved, the guidance provided in [Section 1-1.6](#) shall be followed.

1-1.9.4 Cautions to Personnel

- (a) Personnel shall not place any part of their body between the jack and the load during load handling operations.
- (b) Personnel shall not place any part of their body under a load supported by a jack.
- (c) Personnel should not place any part of their body under blocking that is positioned to support the load, when the load is supported by a jack.
- (d) Personnel shall not straddle the handle of the jack.
- (e) Personnel should ensure there is sufficient swing area to avoid pinch points while using the jack handle.
- (f) Personnel should not be on a load supported by jacks.
- (g) The jack operator should have firm footing and handle control while operating the jack.
- (h) Unsynchronized operation of multiple ratchet jacks may produce increased or uncontrollable handle force.
- (i) Personnel should avoid placing their head in the swing arc of the handle. Ratchet jack handles may produce sudden kickback while lifting or lowering the load. Ensure the handle load has been transferred to the jack before releasing the handle.

1-1.9.5 Jacking Practices

1-1.9.5.1 General

- (a) All mechanical jacks shall be used according to the manufacturer's recommendations.
- (b) A plan should be developed and communicated to affected personnel before the jacking operation begins. The plan should include load handling procedures and communication methods.
- (c) A piece of wood or other compressible material should be used between the jack load point and the load surface to promote the mating of the two surfaces and increase friction.
- (d) Off-center loading of the primary load point should be avoided.
- (e) When jacking, ensure that the load avoids contact with any obstructions.
- (f) When jacking, ensure that the primary or auxiliary load point is properly positioned under the load to avoid tip or edge loading.
- (g) When jacking one side or end of a load, ensure the opposing side or end is stabilized with sufficient blocking.

(h) When jacking a load, it should be raised in stages. Jack one side or end, insert blocking, and lower the load down to the blocking. Jack from the opposite side or end, insert blocking, and then lower down to blocking. Reverse this process when lowering the load.

(i) The jack handle, primary and auxiliary load points, and the jack base should be free of slippery material or fluids.

(j) When jacking, a load should be raised or lowered in a limited range. Avoid jacking the side or end of the load more than 4-in. lift over a 100-in. run (4% grade) unless approved by the manufacturer or a qualified person.

(k) When lifting one side of an object with a high center of gravity, personnel should be on the side of the load that is being lifted.

(l) After the raising or lowering operation is completed, remove the jack handle from the socket to avoid accidental dislocation of the jack and to reduce the tripping hazard.

(m) A load shall not be left unattended while supported by jacks. Blocking should be used to support unattended loads.

(n) The load weight and center of gravity shall be determined prior to selecting and placing jacks and blocking.

(o) Before jacking a load, consideration shall be given to fluids or other shifting materials that can change the location of the center of gravity.

(p) The base of the jack should be supported by a hard level surface (such as concrete, steel, or wood blocking) capable of supporting the load.

(q) The force of the jack's load point should be placed or distributed to prevent damage to the load.

(r) A jack handle of the size and length specified by the manufacturer shall be used. Never use an over length jack handle, extender, or "cheater pipe" over the handle.

(s) Ensure there is adequate range of motion for the jack handle to completely engage the operating linkage of the jack.

(20) **1-1.9.5.2 Communication**

(a) Communication between personnel involved in the lift operation shall be maintained continuously during all jack movement. If at any time communication is disrupted, the jack operator(s) shall stop all movements until communication is restored.

(b) Signals to the jack operator should be in accordance with the standards prescribed in [Figure 1-0.4.5-1](#). If special signals are required, they shall be agreed upon by the load handling personnel prior to jacking operations. Signals shall be discernible or audible at all times. No action shall be taken unless signals are clearly understood.

(c) Jack operators shall obey any stop signal.

1-1.9.5.3 Synchronized Lifts

(a) When using jacks to lift the entire load in a synchronized lift, uneven raising and lowering can cause cross loading, instability, and overloading.

(b) Some loads may require multiple lifting points and complex lifting procedures. A qualified person shall analyze the operation and instruct all personnel involved in the proper selection and positioning of the jacks and the movements to be made.

(c) When using multiple ratchet jacks simultaneously, ensure they are identical type (manufacturer, make, model, and capacity), or lifting rate to ensure they are evenly loaded during jacking.

(d) Unsynchronized lowering can cause an overload to a jack and may result in kickback of the jack handle or instability of the load.

1-1.9.5.4 Blocking

(a) While jacking, blocking should follow the load up or down to serve as an arresting device if the load falls.

(b) Wedges or shims should be used as necessary to ensure the load is completely supported at its blocking points.

(c) Blocking should never be taller than twice the width of the blocking base.

(d) Blocking shall be of sufficient thickness, width, and length to prevent shifting, toppling, or excessive settlement of the load.

(e) Blocking shall be of sufficient strength to prevent crushing, bending failure or shear failure, and to adequately transmit the load's weight to the supporting surface.

1-1.9.5.5 Horizontal Jacking

(a) Applications may arise where jacks are used in a position other than vertical. These applications, referred to as horizontal jacking, require special attention.

(b) Horizontal jacking shall comply with the requirements of [Section 1-1.9](#), as applicable.

(c) A plan shall be developed and communicated to affected personnel before horizontal jacking operations begin. The plan shall consider but not be limited to the following:

- (1) load weight
- (2) effects of friction
- (3) angle from horizontal plane
- (4) load stability and control
- (5) obstructions
- (6) jack base support
- (7) jack support
- (8) load contact point
- (9) handle clearance
- (10) center of gravity of the load
- (11) personnel safety

(d) When jacking horizontally, the base of the jack should be perpendicular to the direction of load movement.

(e) If multiple jacks are used, maintain parallel lines of force to prevent side loading of the jacks.

Chapter 1-2

Hydraulic Jacks

SECTION 1-2.0: SCOPE

This Chapter applies to hydraulic jacks.

SECTION 1-2.1: TYPES AND DESIGN

1-2.1.1 Types

(a) Types include single-acting and double-acting hydraulic style (see [Figures 1-2.1.1-1](#) through [1-2.1.1-3](#)) and are primarily used in a vertical position.

(b) All jacks covered by this Chapter shall incorporate a positive stop or method to prevent overtravel, but the stop shall not alter the operating characteristics of the jack.

1-2.1.2 Design

(a) The load-bearing materials in the jack shall have sufficient strength and ductility to raise, lower, and support the rated load at the temperatures at which it will be used.

(b) The jack shall be designed to meet the proof load requirements in [para. 1-2.4.2\(a\)](#).

(c) The jack should be designed to ensure that the computed stress in the structural components of the jack does not exceed 50% of the yield strength of the material at the appropriate rated load for the components.

(d) Control parts and accessory equipment shall be designed to provide a means of operation and adjustment that will minimize exposure of the operator to injury.

(e) Carrying handles, if provided, shall be capable of statically supporting 200% of the weight of the jack.

(f) Each double-acting hydraulic jack shall be fitted with a relief valve on the retract circuit, which allows hydraulic fluid to flow from the smaller effective area of the jack. A flow-restricting component shall not be present between the relief valve and the smaller area.

(g) Changes in physical properties caused by welding handles, eyes, or other approved attachments to a hydraulic jack shall be taken into account.

SECTION 1-2.2: DESIGN FACTOR

The design factor for hydraulic jacks shall be determined by the manufacturer.

SECTION 1-2.3: RATED LOADS

Rated load shall be established by the hydraulic jack manufacturer.

SECTION 1-2.4: PROOF TEST AND PROOF LOAD

1-2.4.1 Proof Test Requirements

(a) Each newly designed hydraulic jack shall be proof tested by the manufacturer.

(b) All newly manufactured hydraulic jacks shall be proof tested by the manufacturer with the jack extended to a point of at least 25% of travel for single-stage types, and sufficient travel to ensure testing of all stages for multiple-stage or threaded extension-type jacks.

(c) The manufacturer or a qualified person shall determine if a proof test is required for any altered, modified, or repaired hydraulic jack.

(d) After proof testing, the hydraulic jack shall be thoroughly inspected for the conditions stated in [para. 1-2.8.4](#).

1-2.4.2 Proof Load Requirements

(a) When proof loading a newly designed hydraulic jack

(1) the jack's load point shall be loaded to 110% of its lifting rated load and operated to its full length of travel through ten cycles (dynamic test).

(2) the jack or cylinder's load point shall be loaded 3 times to 150% of its rated load. The ram(s) and screw extension shall be extended to at least 90% of full travel. After this test, the jack shall be functional for full extension under 100% of rated load (static test) and be free of leaks.

(3) each auxiliary load point shall be proof tested in accordance with the same cycles and percentages described in (1) and (2).

(b) The proof load for each newly manufactured hydraulic jack shall be a minimum of 100% of the rated load.

(c) The proof load for each altered, modified, or repaired hydraulic jack shall be a minimum of 100% of the rated load unless otherwise determined by the manufacturer or a qualified person.

Chapter 1-2

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SECTION 1-2.0: SCOPE

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SECTION 1-2.1: TYPES AND DESIGN

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(a) Types include single-acting and double-acting hydraulic style (see [Figures 1-2.1.1-1](#) through [1-2.1.1-3](#)) and are primarily used in a vertical position.

(b) All jacks covered by this Chapter shall incorporate a positive stop or method to prevent overtravel, but the stop shall not alter the operating characteristics of the jack.

1-2.1.2 Design

(a) The load-bearing materials in the jack shall have sufficient strength and ductility to raise, lower, and support the rated load at the temperatures at which it will be used.

(b) The jack shall be designed to meet the proof load requirements in [para. 1-2.4.2\(a\)](#).

(c) The jack should be designed to ensure that the computed stress in the structural components of the jack does not exceed 50% of the yield strength of the material at the appropriate rated load for the components.

(d) Control parts and accessory equipment shall be designed to provide a means of operation and adjustment that will minimize exposure of the operator to injury.

(e) Carrying handles, if provided, shall be capable of statically supporting 200% of the weight of the jack.

(f) Each double-acting hydraulic jack shall be fitted with a relief valve on the retract circuit, which allows hydraulic fluid to flow from the smaller effective area of the jack. A flow-restricting component shall not be present between the relief valve and the smaller area.

(g) Changes in physical properties caused by welding handles, eyes, or other approved attachments to a hydraulic jack shall be taken into account.

SECTION 1-2.2: DESIGN FACTOR

The design factor for hydraulic jacks shall be determined by the manufacturer.

SECTION 1-2.3: RATED LOADS

Rated load shall be established by the hydraulic jack manufacturer.

SECTION 1-2.4: PROOF TEST AND PROOF LOAD

1-2.4.1 Proof Test Requirements

(a) Each newly designed hydraulic jack shall be proof tested by the manufacturer.

(b) All newly manufactured hydraulic jacks shall be proof tested by the manufacturer with the jack extended to a point of at least 25% of travel for single-stage types, and sufficient travel to ensure testing of all stages for multiple-stage or threaded extension-type jacks.

(c) The manufacturer or a qualified person shall determine if a proof test is required for any altered, modified, or repaired hydraulic jack.

(d) After proof testing, the hydraulic jack shall be thoroughly inspected for the conditions stated in [para. 1-2.8.4](#).

1-2.4.2 Proof Load Requirements

(a) When proof loading a newly designed hydraulic jack

(1) the jack's load point shall be loaded to 110% of its lifting rated load and operated to its full length of travel through ten cycles (dynamic test).

(2) the jack or cylinder's load point shall be loaded 3 times to 150% of its rated load. The ram(s) and screw extension shall be extended to at least 90% of full travel. After this test, the jack shall be functional for full extension under 100% of rated load (static test) and be free of leaks.

(3) each auxiliary load point shall be proof tested in accordance with the same cycles and percentages described in (1) and (2).

(b) The proof load for each newly manufactured hydraulic jack shall be a minimum of 100% of the rated load.

(c) The proof load for each altered, modified, or repaired hydraulic jack shall be a minimum of 100% of the rated load unless otherwise determined by the manufacturer or a qualified person.

SECTION 1-2.5: IDENTIFICATION

1-2.5.1 Marking

Each new hydraulic jack shall have forged, cast, die-stamped, etched, or fixed-label markings by the manufacturer to show

- (a) name or trademark of manufacturer
- (b) rated load of the load point and auxiliary load point if different
- (c) model number or tracing code
- (d) the maximum hydraulic pressure for single- or double-acting jacks

1-2.5.2 Maintenance of Identification

Hydraulic jack identification should be maintained by the user so as to be legible throughout the life of the hydraulic jack.

SECTION 1-2.6: EFFECTS OF ENVIRONMENT

1-2.6.1 Temperature

When hydraulic jacks are to be used at temperatures above 140°F (60°C) or below -20°F (-29°C), the hydraulic jack manufacturer or a qualified person should be consulted.

1-2.6.2 Chemically Active Environments

The strength and operation of hydraulic jacks can be affected by chemically active environments such as caustic or acid substances or fumes. The jack manufacturer or a qualified person should be consulted before hydraulic jacks are used in chemically active environments.

1-2.6.3 Other Environments

The internal workings of jacks can be affected by high moisture, gravel or sand, silt, grit, or other dust-laden air. Contaminated fluid can affect the operation of jacks. Jacks subject to these environments should have their components frequently cleaned and inspected.

SECTION 1-2.7: INSTRUCTIONS AND TRAINING

1-2.7.1 Instructions

The manufacturer shall furnish information about jack selection, inspection, maintenance, cautions to personnel, effects of environment, and operating practices with each jack.

1-2.7.2 Training

Hydraulic jack users shall be trained in the selection, inspection, maintenance, cautions to personnel, effects of environment, and operating practices as addressed by this Chapter and the manufacturer's instructions.

SECTION 1-2.8: INSPECTION, REPAIR, AND REMOVAL

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.

1-2.8.1 Initial Inspection

Prior to use, all new, altered, modified, or repaired hydraulic jacks shall be inspected by a designated person to verify compliance with the applicable provisions of this Chapter. Written records are not required.

1-2.8.2 Frequent Inspection

(a) A visual and functional inspection shall be performed each shift before the hydraulic jack is used.

(b) Conditions such as those listed in [para. 1-2.8.4](#), or any other condition that may be a hazard, shall cause the hydraulic jack to be removed from service. Hydraulic jacks shall not be returned to service until approved by a qualified person.

(c) Written records are not required for frequent inspections.

1-2.8.3 Periodic Inspection

(a) A complete inspection of the hydraulic jack shall be performed. The jack shall be examined for conditions such as those listed in [para. 1-2.8.4](#), and a determination made as to whether they constitute a hazard.

(b) *Periodic Inspection Frequency.* Periodic inspection intervals shall not exceed 12 months. The frequency of inspections should be based on

- (1) frequency of use
- (2) severity of service conditions
- (3) nature of jacking activity
- (4) experience gained on the service life of hydraulic jacks used in similar circumstances
- (5) guidelines for the time intervals listed below
 - (-a) normal service — 1 month to 12 months
 - (-b) severe service — daily to monthly
 - (-c) special service — as recommended by a qualified person

(c) If external appearances suggest internal damage, the jack shall be disassembled for cleaning and examined for internal wear or damage. The disassembly, inspection, and reassembly shall be performed by an authorized service center or under the supervision of a qualified person.

(d) A hydraulic jack that has been idle for more than 12 months shall be inspected prior to use, and subject to the removal criteria in [para. 1-2.8.4](#).

(e) Dated inspection records should be kept on all periodic inspections. A nondestructive external coded mark, tag, or other method of recording the inspection is acceptable in lieu of written records.

1-2.8.4 Removal Criteria

Hydraulic jacks shall be removed from service if damage such as the following is present and shall only be returned to service when approved by a qualified person:

- (a) excessively worn, scored, cracked, bent, or broken ram
- (b) cracked or broken jack housing or cylinder
- (c) internal or external hydraulic fluid leak
- (d) damaged seals or valves
- (e) excessive pitting or corrosion
- (f) excessive nicks or gouges
- (g) missing or illegible identification
- (h) indications of structural damage due to heat, or evidence of unauthorized welding
- (i) improperly functioning or damaged load cap or integral auxiliary load point
- (j) loose structural bolts or rivets
- (k) worn or damaged load-bearing threads
- (l) damaged or improperly assembled accessory equipment
- (m) missing relief valve for double-acting jack
- (n) damaged or severely worn hoses or couplings
- (o) contaminated hydraulic fluid
- (p) other conditions including visible damage that cause doubt as to the continued use of the hydraulic jack
- (q) other items as specified in manufacturer's instruction that may affect operation

1-2.8.5 Repairs and Modifications

(a) Repairs, alterations, or modifications shall be as specified by the hydraulic jack manufacturer or a qualified person.

(b) All replacement parts including the ram, hoses, couplings, seals, valves, and caps shall meet or exceed the original equipment manufacturer's specifications.

SECTION 1-2.9: OPERATING PRACTICES

1-2.9.1 Hydraulic Jack Selection

(a) Hydraulic jacks shall be selected for the type of load and environment in accordance with the recommendations of the manufacturer or a qualified person.

(b) The rated load of the hydraulic jack shall not be exceeded.

(c) Hydraulic jacks shall not be used until inspected and accepted as usable under [Section 1-2.8](#).

(d) The components of remote control jacks should have compatible pressure ratings to avoid overloading the jack.

(e) Gages should be used to assist the jack operator in determining jack loading. Check-valves or load-holding valves should be used to prevent uncontrolled lowering.

1-2.9.2 Maintenance

(a) A preventive maintenance program shall be established and should be based on the recommendations outlined in the hydraulic jack manufacturer's manual.

(b) All moving parts of the jack requiring lubrication should be regularly lubricated. Hydraulic jack fluid systems should be checked to verify proper operation and the type of fluid should be as specified by the manufacturer or a qualified person.

(c) The ram should be cleaned and seals replaced as necessary.

(d) If additional maintenance is required, it should be completed in accordance with the instructions of the manufacturer or qualified person.

1-2.9.3 Storage

(a) Hydraulic jacks should be stored in a vertical position and in an area where they will not be subjected to damage.

(b) If extreme temperatures or chemically active or abrasive environments are involved, the guidance provided in [Section 1-2.6](#) shall be followed.

1-2.9.4 Cautions to Personnel

(a) Personnel shall not place any part of their body between the jack and the load during load handling operations.

(b) Personnel shall not place any part of their body under a load supported by a jack.

(c) Personnel should not place any part of their body under blocking that is positioned to support the load, when the load is supported by a jack.

(d) Personnel should ensure there is sufficient swing area to avoid pinch points while using the jack handle.

(e) Personnel should not be on a load supported by jacks.

(f) The jack operator should have firm footing and handle control while operating the jack.

1-2.9.5 Jacking Practices

1-2.9.5.1 General

(a) All hydraulic jacks shall be used according to the manufacturer's recommendations.

(b) A plan should be developed and communicated to affected personnel before the jacking operation begins. The plan should include load handling procedures and communication methods.

(d) A hydraulic jack that has been idle for more than 12 months shall be inspected prior to use, and subject to the removal criteria in [para. 1-2.8.4](#).

(e) Dated inspection records should be kept on all periodic inspections. A nondestructive external coded mark, tag, or other method of recording the inspection is acceptable in lieu of written records.

1-2.8.4 Removal Criteria

Hydraulic jacks shall be removed from service if damage such as the following is present and shall only be returned to service when approved by a qualified person:

- (a) excessively worn, scored, cracked, bent, or broken ram
- (b) cracked or broken jack housing or cylinder
- (c) internal or external hydraulic fluid leak
- (d) damaged seals or valves
- (e) excessive pitting or corrosion
- (f) excessive nicks or gouges
- (g) missing or illegible identification
- (h) indications of structural damage due to heat, or evidence of unauthorized welding
- (i) improperly functioning or damaged load cap or integral auxiliary load point
- (j) loose structural bolts or rivets
- (k) worn or damaged load-bearing threads
- (l) damaged or improperly assembled accessory equipment
- (m) missing relief valve for double-acting jack
- (n) damaged or severely worn hoses or couplings
- (o) contaminated hydraulic fluid
- (p) other conditions including visible damage that cause doubt as to the continued use of the hydraulic jack
- (q) other items as specified in manufacturer's instruction that may affect operation

1-2.8.5 Repairs and Modifications

(a) Repairs, alterations, or modifications shall be as specified by the hydraulic jack manufacturer or a qualified person.

(b) All replacement parts including the ram, hoses, couplings, seals, valves, and caps shall meet or exceed the original equipment manufacturer's specifications.

SECTION 1-2.9: OPERATING PRACTICES

1-2.9.1 Hydraulic Jack Selection

(a) Hydraulic jacks shall be selected for the type of load and environment in accordance with the recommendations of the manufacturer or a qualified person.

(b) The rated load of the hydraulic jack shall not be exceeded.

(c) Hydraulic jacks shall not be used until inspected and accepted as usable under [Section 1-2.8](#).

(d) The components of remote control jacks should have compatible pressure ratings to avoid overloading the jack.

(e) Gages should be used to assist the jack operator in determining jack loading. Check-valves or load-holding valves should be used to prevent uncontrolled lowering.

1-2.9.2 Maintenance

(a) A preventive maintenance program shall be established and should be based on the recommendations outlined in the hydraulic jack manufacturer's manual.

(b) All moving parts of the jack requiring lubrication should be regularly lubricated. Hydraulic jack fluid systems should be checked to verify proper operation and the type of fluid should be as specified by the manufacturer or a qualified person.

(c) The ram should be cleaned and seals replaced as necessary.

(d) If additional maintenance is required, it should be completed in accordance with the instructions of the manufacturer or qualified person.

1-2.9.3 Storage

(a) Hydraulic jacks should be stored in a vertical position and in an area where they will not be subjected to damage.

(b) If extreme temperatures or chemically active or abrasive environments are involved, the guidance provided in [Section 1-2.6](#) shall be followed.

1-2.9.4 Cautions to Personnel

(a) Personnel shall not place any part of their body between the jack and the load during load handling operations.

(b) Personnel shall not place any part of their body under a load supported by a jack.

(c) Personnel should not place any part of their body under blocking that is positioned to support the load, when the load is supported by a jack.

(d) Personnel should ensure there is sufficient swing area to avoid pinch points while using the jack handle.

(e) Personnel should not be on a load supported by jacks.

(f) The jack operator should have firm footing and handle control while operating the jack.

1-2.9.5 Jacking Practices

1-2.9.5.1 General

(a) All hydraulic jacks shall be used according to the manufacturer's recommendations.

(b) A plan should be developed and communicated to affected personnel before the jacking operation begins. The plan should include load handling procedures and communication methods.

(11) personnel safety

(d) When jacking horizontally, the base of the jack should be perpendicular to the direction of load movement.

(e) If multiple jacks are used, maintain parallel lines of force to prevent side loading of the jacks.

Chapter 1-3 Air-Lifting Bags

SECTION 1-3.0: SCOPE

This Chapter applies to air-lifting bags.

SECTION 1-3.1: TYPES AND DESIGN

1-3.1.1 Types

A reinforced, flat, rubberized, single-chamber inflatable bag (see [Figure 1-3.1.1-1](#)) designed to contain air at pressures above 100 psi.

1-3.1.2 Design

(a) The load-bearing materials in the air-lifting bag shall have sufficient strength to raise, lower, and support the rated load at the temperatures at which it will be used.

(b) The load-bearing materials in the air-lifting bag should provide puncture and abrasion resistance.

(c) The air couplers and interconnect and supply hoses shall be selected for the air pressures and volumes required by the air-lifting bag system.

(d) A pressure gauge shall be provided at the pressure control unit for the air-lifting bag(s).

(e) The pressure control unit shall regulate air pressure to the air-lifting bag(s).

(f) A pressure relief valve shall be installed to prevent over-pressurization of the air-lifting bag(s) under normal operating conditions.

(g) Control parts and accessory equipment shall be designed to provide a means of operation and adjustment that will minimize exposure of the operator to injury.

SECTION 1-3.2: DESIGN FACTOR

The design factor for air-lifting bags shall be at least 4 times the maximum working pressure.

SECTION 1-3.3: RATED LOADS

Rated load shall be established by the air-lifting bag manufacturer.

SECTION 1-3.4: PROOF TEST

1-3.4.1 Proof Test Requirements

(a) All newly manufactured air-lifting bags shall be proof tested by the manufacturer.

(b) Proof testing an altered, modified, or repaired air-lifting bag shall be performed as determined by the manufacturer or a qualified person.

(c) After proof testing, an air-lifting bag shall be thoroughly inspected for the conditions stated in [para. 1-3.8.4](#).

1-3.4.2 Proof Load Requirements

(a) When proof testing a newly manufactured air-lifting bag, the air-lifting bag shall be subjected to at least 200% of the maximum stated working pressure, in an unrestrained condition.

(b) The proof load for each altered, modified, or repaired air-lifting bag shall be a minimum of 100% of the maximum stated working pressure unless otherwise determined by the manufacturer or a qualified person.

SECTION 1-3.5: IDENTIFICATION

1-3.5.1 Marking

Each new air-lifting bag shall have molded, stamped, etched, or fixed label markings by the manufacturer to show

(a) name or trademark of manufacturer

(b) rated load

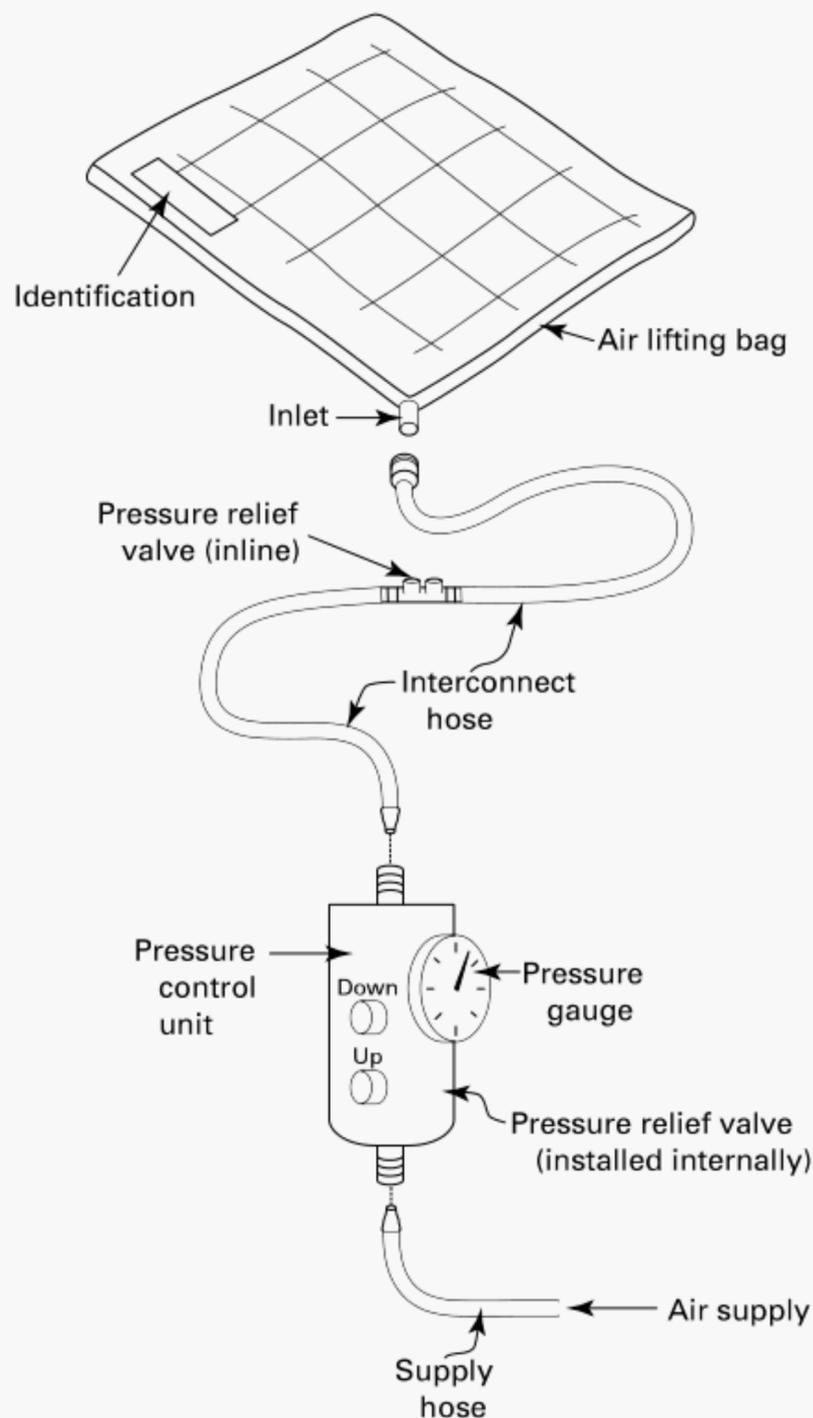
(c) model number

(d) serial number

(e) the maximum allowable air pressure

1-3.5.2 Maintenance of Identification

Air-lifting bag identification should be maintained by the user so as to be legible throughout the life of the air-lifting bag.

Figure 1-3.1.1-1 Air-Lifting Bags

SECTION 1-3.6: EFFECTS OF ENVIRONMENT

1-3.6.1 Temperature

When air-lifting bags are to be used at temperatures above 150°F (65°C) or below -40°F (-40°C), the air-lifting bag manufacturer or a qualified person should be consulted.

1-3.6.2 Chemically Active Environments

The strength and operation of air-lifting bags can be affected by chemically active environments such as caustic or acid substances or fumes. The air-lifting bag manufacturer's instructions or a qualified person should be consulted before air-lifting bags are used in chemically active environments.

1-3.6.3 Other Environments

The internal workings of pressure control units, hoses, and valves can be affected by high moisture, gravel or sand, silt, grit, or other dust-laden air. Air-lifting equipment subject to these environments should have their inner components cleaned, inspected, and lubricated in accordance with [para. 1-3.8.3\(b\)\(5\)\(-b\)](#).

SECTION 1-3.7: INSTRUCTIONS AND TRAINING

1-3.7.1 Instructions

The manufacturer shall furnish information about air-lifting bag selection, inspection, maintenance, cautions to personnel, effects of environment, and operating practices with each air-lifting bag.

1-3.7.2 Training

Air-lifting bag users shall be trained in the selection, inspection, maintenance, cautions to personnel, effects of environment, and operating practices as addressed by this Chapter and the manufacturer's instructions.

SECTION 1-3.8: INSPECTION, REPAIR, AND REMOVAL FROM SERVICE

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.

1-3.8.1 Initial Inspection

Prior to use, all new, altered, modified, or repaired air-lifting bags shall be inspected to verify compliance with the applicable provisions of this Chapter. Written records are not required.

1-3.8.2 Frequent Inspection

(a) A visual and functional inspection shall be performed each shift before the air-lifting bag system is used.

(b) Conditions such as those listed in [para. 1-3.8.4](#), or any other condition that may be a hazard, shall cause the air-lifting bag or other system component to be removed from service. An air-lifting bag system component shall not be returned to service until approved by a qualified person.

(c) Written records are not required for frequent inspections.

1-3.8.3 Periodic Inspection

(a) A complete inspection of the air-lifting bag system shall be performed. The system shall be examined for conditions such as those listed in [para. 1-3.8.4](#), and a determination made as to whether they constitute a hazard.

(b) *Periodic Inspection Frequency.* Periodic inspection intervals shall not exceed 12 months. The frequency of inspections should be based on

- (1) frequency of use
- (2) severity of service conditions
- (3) nature of lifting activity
- (4) experience gained on the service life of air-lifting bags used in similar circumstances
- (5) guidelines for the time intervals are
 - (-a) normal service — 1 month to 12 months
 - (-b) severe service — daily to monthly
 - (-c) special service — as recommended by a qualified person

(c) If the external appearance suggests internal damage, the air-lifting bag system components shall be disassembled for further examination. The disassembly, inspection, and reassembly should be performed by an authorized service center or a qualified person.

(d) An air-lifting bag or system that has been idle for more than 12 months shall be inspected prior to use, and subject to the removal criteria in [para. 1-3.8.4](#).

(e) Dated inspection records should be kept on all periodic inspections. A nondestructive external coded mark, tag, or other method of recording the inspection is acceptable in lieu of written records.

1-3.8.4 Removal Criteria

Air-lifting bag system components shall be removed from service if damage such as the following is visible and shall only be returned to service when approved by a qualified person:

- (a) missing or illegible identification
- (b) air-lifting bag punctures, cuts, abrasions, or surface cracks
- (c) air-lifting bag seam separation
- (d) air-lifting bag ply separation or delamination
- (e) heat or chemical damage
- (f) foreign material embedded in an air-lifting-bag surface
- (g) inhibited air flow from foreign objects
- (h) bent, cracked, or broken fittings, couplers, or valves
- (i) damaged air pressure control unit, gauges, regulators, or other components
- (j) hoses or couplers that are cut, severely abraded, gouged, cracked, or brittle
- (k) faulty engagement between a hose and fitting
- (l) missing, improper, or damaged air hose banding clamps
- (m) damaged or improperly assembled accessory equipment
- (n) missing or damaged O-ring, gasket, or seal on an air connection
- (o) evidence of unauthorized repairs
- (p) evidence of ultraviolet ray degradation of synthetic components

(q) missing components or other items as specified in manufacturer's instruction that may affect operation

(r) other conditions including visible damage that cause doubt as to the continued use of the air-lifting bag system

1-3.8.5 Repairs and Modifications

(a) Repairs, alterations, or modifications shall be as specified by the air-lifting bag manufacturer or a qualified person.

(b) All replacement parts including air-lifting bag components, hoses, fittings, regulators, gauges, valves, and accessories shall meet or exceed the original equipment manufacturer's specifications.

SECTION 1-3.9: OPERATING PRACTICES

1-3.9.1 Air-Lifting Bag Selection

(a) Air-lifting bags shall be selected for the type of load and environment in accordance with the recommendations of the manufacturer or a qualified person.

(b) The rated load of the air-lifting bag shall not be exceeded.

(c) Air-lifting bags shall not be used until inspected and accepted as usable under [Section 1-3.8](#).

1-3.9.2 Maintenance

(a) A preventive maintenance program shall be established and should be based on the recommendations outlined in the air-lifting bag manufacturer's manual.

(b) Keep the external surface of the air-lifting bag free of foreign material by cleaning with mild detergent and water.

(c) Accumulated moisture should be removed from the air-lifting bag system and its components.

(d) If additional maintenance is required, it should be completed in accordance with instructions of the manufacturer or qualified person.

1-3.9.3 Storage

(a) Air-lifting bags should be stored in an area where they will not be subjected to damage.

(b) When storing an air-lifting bag, protect the air inlet fitting from damage.

(c) If extreme temperatures or chemically active or abrasive environments are involved, the guidance provided in [Section 1-3.6](#) shall be followed.

1-3.9.4 Cautions to Personnel

(a) Personnel shall not place any part of their body between the air-lifting bag and the load during load handling operations.

(b) Personnel shall not place any part of their body under a load supported by an air-lifting bag(s).

(c) Personnel should avoid straddling an air hose in case of unexpected disconnection. Hose restraints should be used at all hose connections.

(d) Route hoses to minimize trip hazards.

(e) Personnel should not be on a load supported by air-lifting bags.

(f) A designated operator shall remain at the pressure control unit while the air-lifting bag system is pressurized.

(g) Personnel should avoid pinch points between the load and surrounding obstructions while the load is in motion.

(h) Personnel shall not place any part of their body between the air-lifting bag and floor surface while pressurized.

(i) Personnel should never disconnect a pressurized air hose.

(j) Personnel shall not ride an air-lifting bag.

(k) When lifting a load on an incline, personnel should remain uphill of the load.

1-3.9.5 Load Handling Practices

1-3.9.5.1 General

(a) All air-lifting bags shall be used according to the manufacturer's recommendations.

(b) A plan should be developed and communicated to affected personnel before the lifting operation begins. The plan should include load handling procedures and communication methods.

(c) Off-center loading of the air-lifting bag should be avoided.

(d) When lifting, ensure that the load avoids contact with any obstructions.

(e) When lifting one side or end of a load, ensure the opposing side or end is stabilized with sufficient blocking.

(f) When lifting a load, it should be raised in stages. Lift one side or end, insert blocking, and lower the load down to the blocking. Lift from the opposite side or end, insert blocking, and then lower down to blocking. Reverse this process when lowering the load.

(g) The air-lifting bag should be free of slippery material or fluids.

(h) When lifting, a load should be raised or lowered in a limited range. Avoid lifting the side or end of the load more than 4-in. (10-cm) lift over a 100-in. (2.54-m) run (4% grade) unless approved by the manufacturer or a qualified person.

(i) During an air-lifting bag operation, the air supply hoses and the control unit should be arranged to minimize tripping hazards.

(j) A load shall not be left unattended while supported by an air-lifting bag under pressure. The load should be secured by blocking.

(k) The load weight and center of gravity should be determined prior to selecting and placing air-lifting bags and blocking.

(l) Before lifting a load, consideration shall be given to fluids or other shifting materials that can change the location of the center of gravity.

(m) The base of the air-lifting bag should be supported by a surface capable of supporting the load.

(n) The air-lifting bag should be placed so the force of the lifting bag is distributed to prevent damage to the load or bag.

(o) When lifting on an incline, a rectangular air-lifting bag should be used. The long axis of the bag should be in the uphill-downhill direction to inhibit the inflated bag from rolling under the load.

(p) When lifting one side of an object with a high center of gravity, personnel should be on the side of the load that is being lifted.

(q) Blocking should be used to minimize inflation height and maximize lift capacity.

(r) When lifting, never stack more than two air-lifting bags. If stacking two different size bags, place the smaller one on top and inflate the lower bag first.

(s) The air hose should not be used to position the air bag. In hard to reach places, use a tagline.

(t) When operating two or more lifting bags, a different color hose or other identifier for each lifting bag should be used.

(u) To avoid puncturing or cutting an air bag, substantial bearing material should be placed between the air bag and the load.

(v) The air-lifting bag should be inflated only enough to achieve the desired lift.

(w) To inhibit uncontrolled load movement, the pressure control unit should be actuated slowly when lifting or lowering.

(x) All air valves in the pressure control unit should be closed before opening the main air supply valve.

(y) During transport, the air-lifting bags should be carried in such a way to avoid damage to the air inlet nipple.

1-3.9.5.2 Communication

(20)

(a) Communication between personnel involved in the lift operation shall be maintained continuously during all lifting movement. If at any time communication is disrupted, the lift operators shall stop all movements until communication is restored and a proper signal is given and understood.

(b) Signals to the pressure control unit operator should be in accordance with the standards prescribed in [Figure 1-0.4.5-1](#). If special signals are required, they shall be agreed upon by the load handling personnel prior to lifting operations. Signals shall be discernible or audible at all times. No action shall be taken unless signals are clearly understood.

(c) Load handling personnel shall obey any stop signal.

(c) Personnel should avoid straddling an air hose in case of unexpected disconnection. Hose restraints should be used at all hose connections.

(d) Route hoses to minimize trip hazards.

(e) Personnel should not be on a load supported by air-lifting bags.

(f) A designated operator shall remain at the pressure control unit while the air-lifting bag system is pressurized.

(g) Personnel should avoid pinch points between the load and surrounding obstructions while the load is in motion.

(h) Personnel shall not place any part of their body between the air-lifting bag and floor surface while pressurized.

(i) Personnel should never disconnect a pressurized air hose.

(j) Personnel shall not ride an air-lifting bag.

(k) When lifting a load on an incline, personnel should remain uphill of the load.

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(d) Route hoses to minimize trip hazards.

(e) Personnel should not be on a load supported by air-lifting bags.

(f) A designated operator shall remain at the pressure control unit while the air-lifting bag system is pressurized.

(g) Personnel should avoid pinch points between the load and surrounding obstructions while the load is in motion.

(h) Personnel shall not place any part of their body between the air-lifting bag and floor surface while pressurized.

(i) Personnel should never disconnect a pressurized air hose.

(j) Personnel shall not ride an air-lifting bag.

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(h) Personnel shall not place any part of their body between the air-lifting bag and floor surface while pressurized.

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(a) Communication between personnel involved in the lift operation shall be maintained continuously during all lifting movement. If at any time communication is disrupted, the lift operators shall stop all movements until communication is restored and a proper signal is given and understood.

(b) Signals to the pressure control unit operator should be in accordance with the standards prescribed in [Figure 1-0.4.5-1](#). If special signals are required, they shall be agreed upon by the load handling personnel prior to lifting operations. Signals shall be discernible or audible at all times. No action shall be taken unless signals are clearly understood.

(c) Load handling personnel shall obey any stop signal.

1-4.6.3 Other Environments

Industrial rollers can be affected by high moisture, gravel or sand, silt, grit, or other dust-laden air. Industrial rollers subject to these environments should have their components frequently cleaned, inspected, and lubricated.

SECTION 1-4.7: INSTRUCTIONS AND TRAINING

1-4.7.1 Instructions

The manufacturer shall furnish information about industrial roller selection, inspection, maintenance, cautions to personnel, effects of environment, and operating practices with each set of industrial rollers.

1-4.7.2 Training

Industrial roller users shall be trained in the selection, inspection, maintenance, cautions to personnel, effects of environment, and operating practices as addressed by this Chapter and the manufacturer's instructions.

- (1) frequency of use
- (2) severity of service conditions
- (3) nature of rolling activity
- (4) experience gained on the service life of industrial rollers used in similar circumstances
- (5) guidelines for the time intervals listed below
 - (-a) normal service — 1 month to 12 months
 - (-b) severe service — daily to monthly
 - (-c) special service — as recommended by a qualified person
- (c) If the inspection indicates possible component damage, the industrial roller shall be disassembled for cleaning and further examination. The disassembly, inspection, and reassembly shall be performed by an authorized service center or under the supervision of a qualified person.
- (d) An industrial roller that has been idle for more than 12 months shall be inspected prior to use, and subject to the removal criteria in [para. 1-4.8.4](#).
- (e) Dated inspection records should be kept on all periodic inspections. A nondestructive external coded mark, tag, or other method of recording the inspection is acceptable in lieu of written records.

1-4.8.5 Repairs and Modifications

(a) Repairs, alterations, or modifications shall be as specified by the industrial roller manufacturer or a qualified person.

(b) All replacement parts including pins, bolts, links, rollers, axles, wheels, or keepers shall meet or exceed the original equipment manufacturer's specifications.

SECTION 1-4.9: OPERATING PRACTICES**1-4.9.1 Industrial Roller Selection**

(a) Industrial rollers shall be selected for the type of load and environment in accordance with the recommendations of the manufacturer or a qualified person.

(b) The rated load of the industrial roller shall not be exceeded.

(c) Industrial rollers shall not be used until inspected and accepted as usable under [Section 1-4.8](#).

1-4.9.2 Maintenance

(a) A preventive maintenance program shall be established and should be based on the recommendations outlined in the industrial roller manufacturer's manual.

(b) All moving parts of the industrial roller requiring lubrication should be regularly lubricated according to the manufacturer's specifications.

(g) To avoid injury if the load shifts, use an overhand grip (palm down) when manipulating the steering handle.

(h) Personnel should avoid pinch points between the load and surrounding obstructions while the load is in motion.

(i) Personnel shall not place any part of their body between the industrial roller and rolling surface during movement of the load.

(j) Personnel shall not ride an industrial roller.

1-4.9.5 Rolling Practices**1-4.9.5.1 General**

(a) All industrial rollers shall be used according to the manufacturer's recommendations.

(b) A plan should be developed and communicated to affected personnel before the moving operation begins. The plan should include load handling procedures and communication methods.

(c) When using industrial rollers, a minimum set of three rollers should be used to maintain continuous loading of the rollers.

(d) When placing rollers under one side or end of a load, ensure the opposing side or end is stabilized.

(e) Wood or other friction material should be used between the industrial roller and the load surface to prevent metal-to-metal slippage.

(f) The industrial roller should be placed in a support

(p) Remove or secure the steering handle when not in use to avoid accidental dislocation of the industrial roller and reduce the tripping hazard.

(q) The load should be parked while unattended. Block or restrain the load, or realign the rollers so they point toward the center of gravity to prevent movement.

(r) Load control shall be maintained at all times. Rate of travel should be governed by work environment, visibility, roller control, and ability to stop.

tion is disrupted, the load movement shall be stopped until communication is restored.

(b) Signals should be in accordance with the standards prescribed in [Figure 1-0.4.5-1](#). If special signals are required, they shall be agreed upon by the load handling personnel prior to roller operations. Signals shall be discernible or audible at all times. No action shall be taken unless signals are clearly understood.

(c) Load handling personnel shall obey any stop signal.

(20) **1-4.9.5.2 Communication**

(a) Communication between personnel involved in the industrial roller operation shall be maintained continuously during roller movement. If at any time communica-

Chapter 1-5

Air Casters

SECTION 1-5.0: SCOPE

This Chapter applies to air casters.

SECTION 1-5.1: TYPES, MATERIALS, AND DESIGN

1-5.1.1 Types

Types include low-lift, high-lift, and gap-crossing styles (see [Figures 1-5.1.1-1](#) and [1-5.1.1-2](#)).

1-5.1.2 Materials

(a) The air bladder may be constructed from monofilm or fabric-reinforced materials.

(b) The module structure (mounting assembly) shall be made from metal or synthetic materials.

1-5.1.3 Design

(a) The load-bearing materials in the air bladder and the mounting assembly shall have sufficient strength and ductility to support and move the load at the temperatures at which they will be used.

(b) The air couplers, interconnect, and supply hoses shall be designed for compressed air use, and selected for the air pressures and volumes required by the air caster system.

(c) A shut-off valve and pressure gauge shall be provided at the main air inlet to the pressure control console.

(d) The pressure control console shall regulate air pressure to each air caster.

(e) Pressure regulation device(s) shall be provided to limit upstream pressure and relieve downstream pressure to protect the air casters.

(f) Each air caster shall have its own pressure gage.

SECTION 1-5.2: DESIGN FACTOR

The air caster system shall be designed to withstand 2 times the rated load without damage.

SECTION 1-5.3: RATED LOADS

Rated load shall be in accordance with the recommendation of the air caster manufacturer.

SECTION 1-5.4: PROOF TEST

1-5.4.1 Proof Test Requirements

(a) Each newly designed air caster shall be proof tested by the manufacturer.

(b) Newly manufactured air casters are not required to be proof tested unless specified by the purchaser.

(c) The manufacturer or a qualified person shall determine if a proof test is required for any altered, modified, or repaired air caster.

(d) After proof testing, the air caster shall be thoroughly inspected for the conditions stated in [para. 1-5.8.4](#).

1-5.4.2 Proof Load Requirements

(a) When proof testing a newly designed air caster, the air caster shall be subjected to a load that is 200% of its rated load with no permanent deformation to the mounting assembly or damage to the air bladder.

(b) The proof load for each new, altered, modified, or repaired air caster shall be a minimum of 100% of the rated load unless otherwise determined by the manufacturer or a qualified person.

SECTION 1-5.5: IDENTIFICATION

1-5.5.1 Marking

Each new air caster shall have forged, cast, die stamped, etched, or fixed label markings by the manufacturer to show

(a) name or trademark of manufacturer

(b) rated load

(c) model number or tracing code

(d) maximum operating pressure

1-5.5.2 Maintenance of Identification

Air caster identification should be maintained by the user so as to be legible throughout the life of the air caster.

SECTION 1-5.6: EFFECTS OF ENVIRONMENT

1-5.6.1 Temperature

When air casters are to be used at temperatures above 100°F (38°C) or below 32°F (0°C), the air caster manufacturer or a qualified person should be consulted.

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Air Casters

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(c) A shut-off valve and pressure gauge shall be provided at the main air inlet to the pressure control console.

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1-5.5.1 Marking

Each new air caster shall have forged, cast, die stamped, etched, or fixed label markings by the manufacturer to show

(a) name or trademark of manufacturer

(b) rated load

(c) model number or tracing code

(d) maximum operating pressure

1-5.5.2 Maintenance of Identification

Air caster identification should be maintained by the user so as to be legible throughout the life of the air caster.

SECTION 1-5.6: EFFECTS OF ENVIRONMENT

1-5.6.1 Temperature

When air casters are to be used at temperatures above 100°F (38°C) or below 32°F (0°C), the air caster manufacturer or a qualified person should be consulted.

Chapter 1-5

Air Casters

SECTION 1-5.0: SCOPE

This Chapter applies to air casters.

SECTION 1-5.1: TYPES, MATERIALS, AND DESIGN

1-5.1.1 Types

Types include low-lift, high-lift, and gap-crossing styles (see [Figures 1-5.1.1-1](#) and [1-5.1.1-2](#)).

1-5.1.2 Materials

(a) The air bladder may be constructed from monofilm or fabric-reinforced materials.

(b) The module structure (mounting assembly) shall be made from metal or synthetic materials.

1-5.1.3 Design

(a) The load-bearing materials in the air bladder and the mounting assembly shall have sufficient strength and ductility to support and move the load at the temperatures at which they will be used.

(b) The air couplers, interconnect, and supply hoses shall be designed for compressed air use, and selected for the air pressures and volumes required by the air caster system.

(c) A shut-off valve and pressure gauge shall be provided at the main air inlet to the pressure control console.

(d) The pressure control console shall regulate air pressure to each air caster.

(e) Pressure regulation device(s) shall be provided to limit upstream pressure and relieve downstream pressure to protect the air casters.

(f) Each air caster shall have its own pressure gage.

SECTION 1-5.2: DESIGN FACTOR

The air caster system shall be designed to withstand 2 times the rated load without damage.

SECTION 1-5.3: RATED LOADS

Rated load shall be in accordance with the recommendation of the air caster manufacturer.

SECTION 1-5.4: PROOF TEST

1-5.4.1 Proof Test Requirements

(a) Each newly designed air caster shall be proof tested by the manufacturer.

(b) Newly manufactured air casters are not required to be proof tested unless specified by the purchaser.

(c) The manufacturer or a qualified person shall determine if a proof test is required for any altered, modified, or repaired air caster.

(d) After proof testing, the air caster shall be thoroughly inspected for the conditions stated in [para. 1-5.8.4](#).

1-5.4.2 Proof Load Requirements

(a) When proof testing a newly designed air caster, the air caster shall be subjected to a load that is 200% of its rated load with no permanent deformation to the mounting assembly or damage to the air bladder.

(b) The proof load for each new, altered, modified, or repaired air caster shall be a minimum of 100% of the rated load unless otherwise determined by the manufacturer or a qualified person.

SECTION 1-5.5: IDENTIFICATION

1-5.5.1 Marking

Each new air caster shall have forged, cast, die stamped, etched, or fixed label markings by the manufacturer to show

(a) name or trademark of manufacturer

(b) rated load

(c) model number or tracing code

(d) maximum operating pressure

1-5.5.2 Maintenance of Identification

Air caster identification should be maintained by the user so as to be legible throughout the life of the air caster.

SECTION 1-5.6: EFFECTS OF ENVIRONMENT

1-5.6.1 Temperature

When air casters are to be used at temperatures above 100°F (38°C) or below 32°F (0°C), the air caster manufacturer or a qualified person should be consulted.

(n) hoses or couplers that have been cut, severely abraded, gouged, cracked, or become brittle

(o) partial engagement between a hose and fitting

(p) missing, improper, or damaged air hose banding clamps

(q) missing or damaged O-ring, gasket, or seal on an air hose fitting

(r) evidence of unauthorized repairs

(s) evidence of ultraviolet ray degradation of synthetic components

(t) broken or damaged pressure gauges, regulators, or shut-off valves

(u) missing components or other items as specified in manufacturer's instruction that may affect operation

(v) other conditions including visible damage that cause doubt as to the continued use of the air caster system

1-5.8.5 Repairs and Modifications

(a) Repairs, alterations, or modifications shall be as specified by the air caster manufacturer or a qualified person.

(b) All replacement parts, including air caster components, hoses, fittings, regulators, gauges, and valves, shall meet or exceed the original equipment manufacturer's specifications.

SECTION 1-5.9: OPERATING PRACTICES

1-5.9.1 Air Caster Selection

(a) Air casters shall be selected for the type of load and environment in accordance with the recommendations of the manufacturer or a qualified person.

(b) The rated load of the air caster shall not be exceeded.

(c) Air casters shall not be used until inspected and accepted as usable under [Section 1-5.8](#).

1-5.9.2 Maintenance

(a) A preventive maintenance program shall be established and should be based on the recommendations outlined in the air caster manufacturer's manual.

(b) Keep the external surface of the air bladder free of foreign material by cleaning with mild detergent and water.

(c) Accumulated moisture should be removed from the air caster system and its components.

(d) If additional maintenance is required, it should be completed in accordance with the instructions of the manufacturer or qualified person.

1-5.9.3 Storage

(a) Air casters should be stored in an area where they will not be subjected to damage.

(b) If extreme temperatures, chemically active or abrasive environments are involved, the guidance provided in [Section 1-5.6](#) shall be followed.

1-5.9.4 Cautions to Personnel

(a) Personnel shall not place any part of their body between the air caster and the load during load handling operations.

(b) Personnel shall not place any part of their body under a load supported by an air caster(s).

(c) Personnel should avoid straddling an air hose in case of unexpected disconnection. Hose restraints should be used at all hose connections.

(d) Route hoses to minimize trip hazards.

(e) Personnel should not ride a load supported by air casters.

(f) Personnel should have firm footing while maneuvering a load being transported by an air caster system.

(g) A designated operator shall remain at the control console while the air caster system is pressurized.

(h) Personnel should avoid pinch points between the load and surrounding obstructions while the load is in motion.

(i) Personnel shall not place any part of their body between the air caster and floor surface while pressurized.

(j) Personnel should never disconnect a pressurized air hose.

(k) Personnel shall not ride an air caster.

1-5.9.5 Load Handling Practices

1-5.9.5.1 General

(a) All air casters shall be used according to the manufacturer's recommendations.

(b) A plan should be developed and communicated to affected personnel before the moving operation begins. The plan should include load handling procedures and communication methods.

(c) When using an air caster system, a minimum set of three air casters should be used to maintain stability of the load.

(d) When placing air casters under one side or end of a load, ensure the opposing side or end is stabilized.

(e) The air caster should be placed in a support location to prevent damage to the load.

(f) The air caster module should be kept parallel to the floor to ensure proper operation of the caster.

(g) Ensure proper air bladder inflation to avoid dragging the landing pads and the bladder against the floor surface.

(h) The load contact point for each air caster should be centered on the module.

(i) For loads with a minimal contact point (less than 10% of caster surface coverage), consult with the air caster manufacturer or a qualified person on how to

(n) hoses or couplers that have been cut, severely abraded, gouged, cracked, or become brittle

(o) partial engagement between a hose and fitting

(p) missing, improper, or damaged air hose banding clamps

(q) missing or damaged O-ring, gasket, or seal on an air hose fitting

(r) evidence of unauthorized repairs

(s) evidence of ultraviolet ray degradation of synthetic components

(t) broken or damaged pressure gauges, regulators, or shut-off valves

(u) missing components or other items as specified in manufacturer's instruction that may affect operation

(v) other conditions including visible damage that cause doubt as to the continued use of the air caster system

1-5.8.5 Repairs and Modifications

(a) Repairs, alterations, or modifications shall be as specified by the air caster manufacturer or a qualified person.

(b) All replacement parts, including air caster components, hoses, fittings, regulators, gauges, and valves, shall meet or exceed the original equipment manufacturer's specifications.

SECTION 1-5.9: OPERATING PRACTICES

1-5.9.1 Air Caster Selection

(a) Air casters shall be selected for the type of load and environment in accordance with the recommendations of the manufacturer or a qualified person.

(b) The rated load of the air caster shall not be exceeded.

(c) Air casters shall not be used until inspected and accepted as usable under [Section 1-5.8](#).

1-5.9.2 Maintenance

(a) A preventive maintenance program shall be established and should be based on the recommendations outlined in the air caster manufacturer's manual.

(b) Keep the external surface of the air bladder free of foreign material by cleaning with mild detergent and water.

(c) Accumulated moisture should be removed from the air caster system and its components.

(d) If additional maintenance is required, it should be completed in accordance with the instructions of the manufacturer or qualified person.

1-5.9.3 Storage

(a) Air casters should be stored in an area where they will not be subjected to damage.

(b) If extreme temperatures, chemically active or abrasive environments are involved, the guidance provided in [Section 1-5.6](#) shall be followed.

1-5.9.4 Cautions to Personnel

(a) Personnel shall not place any part of their body between the air caster and the load during load handling operations.

(b) Personnel shall not place any part of their body under a load supported by an air caster(s).

(c) Personnel should avoid straddling an air hose in case of unexpected disconnection. Hose restraints should be used at all hose connections.

(d) Route hoses to minimize trip hazards.

(e) Personnel should not ride a load supported by air casters.

(f) Personnel should have firm footing while maneuvering a load being transported by an air caster system.

(g) A designated operator shall remain at the control console while the air caster system is pressurized.

(h) Personnel should avoid pinch points between the load and surrounding obstructions while the load is in motion.

(i) Personnel shall not place any part of their body between the air caster and floor surface while pressurized.

(j) Personnel should never disconnect a pressurized air hose.

(k) Personnel shall not ride an air caster.

1-5.9.5 Load Handling Practices

1-5.9.5.1 General

(a) All air casters shall be used according to the manufacturer's recommendations.

(b) A plan should be developed and communicated to affected personnel before the moving operation begins. The plan should include load handling procedures and communication methods.

(c) When using an air caster system, a minimum set of three air casters should be used to maintain stability of the load.

(d) When placing air casters under one side or end of a load, ensure the opposing side or end is stabilized.

(e) The air caster should be placed in a support location to prevent damage to the load.

(f) The air caster module should be kept parallel to the floor to ensure proper operation of the caster.

(g) Ensure proper air bladder inflation to avoid dragging the landing pads and the bladder against the floor surface.

(h) The load contact point for each air caster should be centered on the module.

(i) For loads with a minimal contact point (less than 10% of caster surface coverage), consult with the air caster manufacturer or a qualified person on how to

Chapter 1-6

Telescopic Hydraulic Gantry Systems

SECTION 1-6.0: SCOPE

This Chapter applies to telescopic hydraulic gantry systems.

SECTION 1-6.1: TYPES AND DESIGN

1-6.1.1 Types

(a) Gantry leg types include bare cylinder and telescopic boom (see [Figure 1-6.1.1-1](#)).

(b) A gantry system consists of two or more gantry legs and one or more header beams that span between legs (see [Figure 1-6.1.1-2](#)).

1-6.1.2 Design

(a) The load-bearing structural, mechanical, and hydraulic components in the gantry leg shall have sufficient strength and ductility to raise, lower, and support the rated load at the temperatures at which it will be used.

(b) The gantry leg (see [Figure 1-6.1.1-1](#)) shall be designed in accordance with the following criteria:

(1) The design vertical load shall be equal to the rated load.

(2) The design transverse lateral load shall be equal to 1.50% of the rated load.

(3) The design transverse longitudinal load shall be equal to 1.50% of the rated load.

(c) Header beams, lift links, track beams, track supports, and other accessories and equipment used as a part of the gantry system shall be designed or selected by the manufacturer or a qualified person for its intended use.

SECTION 1-6.2: DESIGN FACTORS

(a) The design factors for gantry legs shall be as follows:

(1) The service stresses in individual components of a gantry leg shall be computed on the basis of the rated load and the specified transverse loads and shall not exceed the applicable allowable stress. Allowable stresses for yielding shall be based on a minimum design factor of 1.67. The minimum design factor for local buckling shall be 1.67. Allowable stresses for fracture shall be based on a minimum design factor of 2.00.

(2) The stability of a gantry leg shall be such that the overturning moment shall not exceed 95% of the stabilizing moment. The overturning moment acting on the gantry leg shall be equal to the horizontal load multiplied by the maximum height of the leg [see [paras. 1-6.1.2\(b\)\(2\)](#) and [1-6.1.2\(b\)\(3\)](#)]. The stabilizing moment of the gantry leg shall be equal to the rated load supported at the top of the leg and the leg self weight, each acting at its respective righting arm. The effects of an out-of-level support surface, lift boom drift, and lift boom or lift cylinder deflection as amplified by the axial load shall be considered. Stability shall be evaluated in both the lateral and longitudinal directions.

(b) The design factors for header beams, lift links, track beams, and other load-bearing components of the gantry system shall be determined by the manufacturer or a qualified person.

SECTION 1-6.3: RATED LOADS

The rated loads for the gantry legs shall be established by the manufacturer or a qualified person.

SECTION 1-6.4: PROOF TEST AND PROOF LOAD

1-6.4.1 Proof Test Requirements

(a) Each newly designed gantry leg shall be proof tested by the manufacturer.

(b) Each newly manufactured gantry leg should be proof tested by the manufacturer.

(c) The manufacturer or a qualified person shall determine if a proof test is required for any altered, modified, or repaired gantry leg.

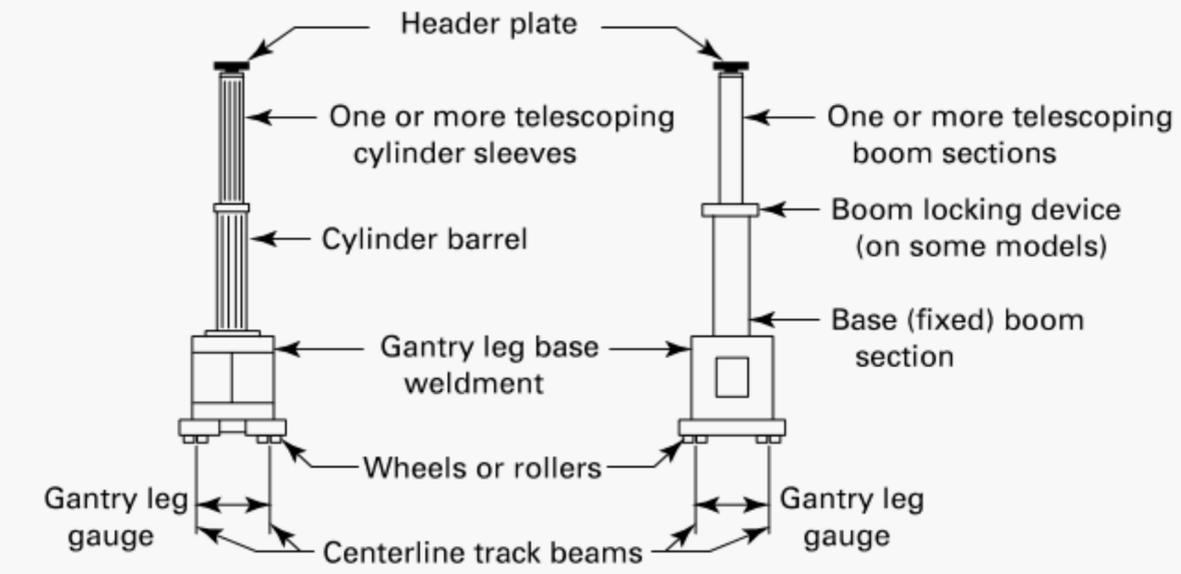
(d) After proof testing, the gantry leg shall be thoroughly inspected for the conditions stated in [para. 1-6.8.4](#).

(e) Proof test records shall be maintained by the manufacturer or the qualified person who has performed the test and be available to the user.

1-6.4.2 Proof Load Requirements

(a) When proof testing a newly designed gantry leg
(1) the leg shall be operated to the maximum allowable height corresponding to its maximum rated load and loaded to 110% of its maximum rated load. The suspended test load shall be lifted for a minimum of 12 in. (300 mm) during the test.

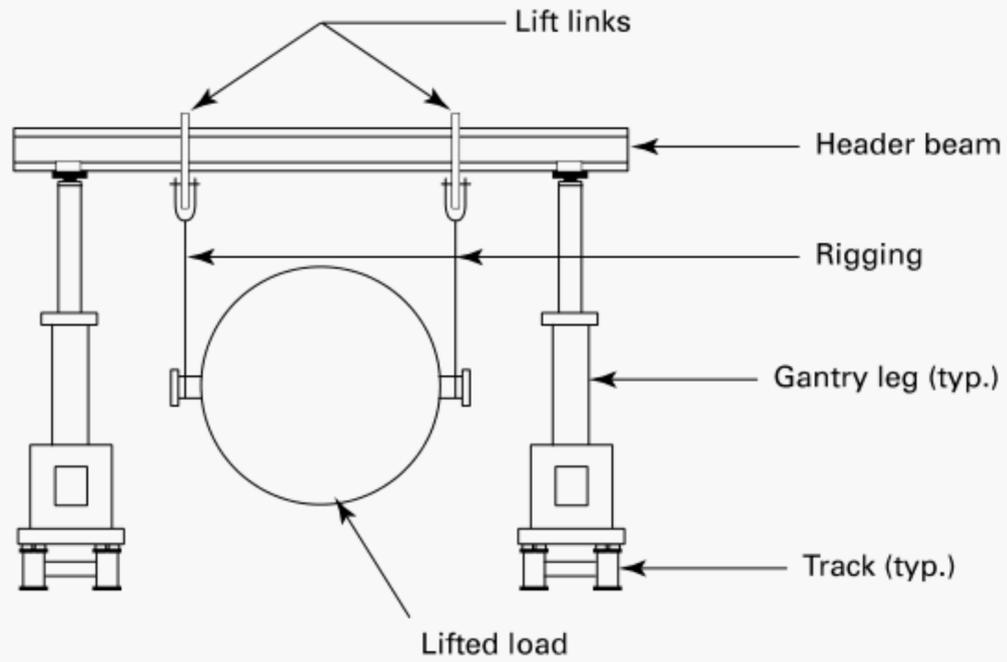
Figure 1-6.1.1-1 Gantry Leg Types



(a) Bare Cylinder Gantry Leg

(b) Telescopic Boom Gantry Leg

Figure 1-6.1.1-2 Basic Gantry System



(2) if the leg has two or more stages, the leg shall be operated to its maximum possible extension and loaded to 110% of its rated load. The suspended test load shall be lifted a minimum of 12 in. (300 mm) during the test.

(3) legs designed for horizontal travel shall be propelled along track or other suitable surface for at least 3 ft (1 m) while supporting the suspended test load.

(b) If performed, the proof load for each newly manufactured gantry leg shall be a minimum of 100% of the rated load unless otherwise determined by the manufacturer or a qualified person.

(c) The proof load for each altered, modified, or repaired gantry leg shall be a minimum of 100% of the rated load unless otherwise determined by the manufacturer or a qualified person.

SECTION 1-6.5: IDENTIFICATION

1-6.5.1 Marking

1-6.5.1.1 Gantry Legs and Control Unit. Each new gantry system's legs and/or control unit shall have markings by the manufacturer to show

- (a) name or trademark of manufacturer.
- (b) model number.
- (c) serial number.
- (d) control lever/button/switch function.
- (e) hydraulic oil type and fuel type if applicable.
- (f) weight of each major component.
- (g) gantry leg load chart. The load chart shall be readily accessible to the operator and shall identify the leg's rated load at each telescoped stage.

1-6.5.1.2 Beams. Beams shall be marked to identify

- (a) structural shape designation for rolled beams, or the major dimensions for fabricated beams
- (b) material grade
- (c) manufacturer (for fabricated beams only)
- (d) beam weight

1-6.5.1.3 Lift Links. Lift links shall be marked to identify

- (a) rated load
- (b) manufacturer
- (c) link weight

1-6.5.2 Maintenance of Identification

Gantry system component identification should be maintained by the user so as to be legible throughout the life of the system.

SECTION 1-6.6: EFFECTS OF ENVIRONMENT

1-6.6.1 Temperature

When hydraulic gantry systems are to be used at temperatures above 140°F (60°C) or below 25°F (-4°C), the gantry manufacturer or a qualified person should be consulted.

1-6.6.2 Chemically Active Environments

The strength and operation of hydraulic gantry systems can be affected by chemically active environments, such as caustic or acid substances or fumes. The gantry manufacturer or a qualified person should be consulted before hydraulic gantry systems are used in chemically active environments.

1-6.6.3 Wind

The effects of wind may cause additional loading conditions on a gantry system. The gantry manufacturer or a qualified person shall be consulted before a hydraulic gantry system is used in conditions where wind may be a factor.

1-6.6.4 Other Environments

The internal workings of hydraulic cylinders, wheels, and other mechanical components can be affected by high moisture, gravel or sand, silt, grit, or dust-laden air. Contaminated fluid can affect the operation of cylinders and hydrostatic drive motors. Gantry systems subject to these environments should have their components frequently cleaned and inspected.

SECTION 1-6.7: INSTRUCTIONS AND TRAINING

1-6.7.1 Instructions

The manufacturer shall furnish operating, inspection, and maintenance instructions with each telescopic hydraulic gantry system.

1-6.7.2 Training

Hydraulic gantry system users shall be trained in the selection, inspection, maintenance, cautions to personnel, effects of environment, and operating practices as addressed by this Chapter and the manufacturer's instructions.

SECTION 1-6.8: INSPECTION, REPAIR, AND REMOVAL

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.

1-6.8.1 Initial Inspection

Prior to use, all new, altered, modified, or repaired hydraulic gantry systems shall be inspected to verify compliance with the applicable provisions of this Chapter. Written records are not required.

1-6.8.2 Frequent Inspection

(a) A visual and functional inspection shall be performed each shift before the gantry system is used.

(b) Conditions such as those listed in para. 1-6.8.4 or any other condition that may be a hazard shall cause the gantry system to be removed from service. The gantry system shall not be returned to service until approved by a qualified person.

(c) Written records are not required for frequent inspections.

1-6.8.3 Periodic Inspection

(a) A complete inspection of the hydraulic gantry system shall be performed. The system shall be examined for conditions such as those listed in para. 1-6.8.4, and a determination made as to whether they constitute a hazard.

(b) *Periodic Inspection Frequency.* Periodic inspection intervals shall not exceed 12 months. The frequency of inspections should be based on

- (1) frequency of use
- (2) severity of service conditions
- (3) nature of lifting activity
- (4) experience gained on the service life of gantry systems used in similar circumstances
- (5) guidelines for the time intervals are
 - (-a) normal service — 1 month to 12 months
 - (-b) severe service — daily to monthly
 - (-c) special service — as recommended by a

qualified person

(c) If external appearances suggest internal damage, the component shall be disassembled for cleaning and examined for internal wear or damage. The disassembly, inspection, and reassembly shall be performed by an authorized service center or under the supervision of a qualified person.

(d) A hydraulic gantry system that has been idle for more than 6 months shall be inspected prior to use, and subject to the removal criteria in para. 1-6.8.4.

(e) Dated inspection records shall be kept on all periodic inspections.

1-6.8.4 Removal Criteria

Hydraulic gantry system components shall be removed from service if damage such as the following is present and shall only be returned to service when approved by a qualified person:

- (a) excessively worn, cracked, bent, or broken cylinder barrels, sleeves, or rods
- (b) cracked or broken structural parts or welds
- (c) internal or external hydraulic fluid leaks
- (d) damaged seals or valves
- (e) excessive pitting or corrosion on cylinder surfaces
- (f) excessive nicks or gouges on cylinder surfaces
- (g) missing or illegible identification
- (h) indications of structural damage due to heat, or evidence of unauthorized welding
- (i) loose, missing, or substandard structural fasteners
- (j) damaged or improperly assembled accessory equipment
- (k) damaged control unit or its levers, buttons, switches, or indicators
- (l) missing, damaged, or ill-fitting hydraulic system components
- (m) hoses or couplers that have been cut, severely abraded, gouged, cracked, or become brittle
- (n) contaminated hydraulic fluid
- (o) missing or damaged electrical system components
- (p) deformed or cracked lift links
- (q) bent, twisted, deformed, or gouged header or track beams
- (r) damaged wheels, bearings, or axles
- (s) damaged propel system or its components
- (t) other conditions including visible damage that cause doubt as to the continued use of the hydraulic gantry system
- (u) other items as specified in the manufacturer's instruction that may affect operation

1-6.8.5 Repairs and Modifications

(a) Repairs, alterations, or modifications shall be as specified by the hydraulic gantry system manufacturer or a qualified person.

(b) All replacement parts shall meet or exceed the original equipment manufacturer's specifications.

1-6.8.6 Inspection of Load Rigging

Slings, shackles, and other types of rigging shall be inspected according to the appropriate ASME B30 Volumes.

SECTION 1-6.9: OPERATING PRACTICES

1-6.9.1 Telescopic Hydraulic Gantry System Selection

(a) Telescopic hydraulic gantry systems shall be selected for the type and size of load, lift height, travel requirement, and environment in accordance with the recommendations of the manufacturer or a qualified person.

(b) The rated load of the hydraulic gantry system and of each individual gantry leg shall not be exceeded.

(c) Hydraulic gantry systems shall not be used until inspected and accepted as usable under [Section 1-6.8](#).

(d) Gages or other load-measuring devices should be used to assist the gantry system operator in determining gantry leg loading.

1-6.9.2 Maintenance

(a) A preventive maintenance program shall be established and should be based on the recommendations outlined in the gantry manufacturer's manual.

(b) All moving parts of the gantry system requiring lubrication should be regularly lubricated in accordance with the manufacturer's requirements. Hydraulic fluid systems should be checked to verify proper operation and the type of fluid should be as specified by the manufacturer or a qualified person.

(c) Hydraulic cylinders should be cleaned and seals replaced as necessary.

(d) Filters should be inspected and replaced according to the manufacturer's recommendations.

(e) Wheels shall be free of embedded materials that would cause them to roll unevenly.

(f) If additional maintenance is required, it should be completed in accordance with the instructions of the manufacturer or a qualified person.

1-6.9.3 Storage

(a) Hydraulic gantry system legs should be stored in a vertical position, unless otherwise permitted by the manufacturer, and in an area where they will not be subjected to damage.

(b) The control unit, hydraulic hoses, electrical cables, header beams, lift links, and track beams should be stored and protected so as not to sustain damage.

(c) If extreme temperatures or chemically active or abrasive environments are involved, the guidance provided in [Section 1-6.6](#) shall be followed.

1-6.9.4 Cautions to Personnel

(a) Personnel shall not place any part of their body under a load supported by a gantry system.

(b) Personnel shall remain clear of the suspended load and the gantry system during travel of the system.

(c) Personnel shall not ride on a gantry system, other than on an operator's station mounted on a gantry leg.

(d) Personnel shall not ride on the supported load while traveling or side shifting.

1-6.9.5 Load Handling Practices

1-6.9.5.1 General

(a) A lift plan should be developed and communicated to affected personnel before the lifting operation begins. The plan should include load handling procedures and communication methods.

NOTE: Suggestions for the content and level of detail needed in a lift plan may be obtained from the SC&RA, Recommended Practices for Telescopic Hydraulic Gantry Systems.

(b) Track beams or other support surfaces shall be aligned and leveled within tolerances specified by the gantry manufacturer. In the absence of manufacturer specifications, the track beams or other support surfaces shall be

(1) level within $\frac{1}{8}$ in. (3 mm) in 10 ft (3 m) in the direction of travel

(2) level within $\frac{1}{8}$ in (3 mm) across a width equal to the gauge (see [Figure 1-6.1.1-1](#)) of the gantry leg

(3) parallel within $\frac{1}{4}$ in. (6 mm) over the entire length of gantry system travel

(c) Ensure that the load avoids contact with a gantry leg or any obstructions while lifting, side shifting, or traveling.

(d) Ensure that the gantry legs, header beams, and other components of the gantry system avoid contact with any obstructions while traveling.

(e) The rigging (slings) should be maintained in a vertical position while the load is suspended.

(f) When lifting one side or end of a load, ensure that control of the opposing side or end is maintained.

(g) The load weight and center of gravity should be determined prior to lifting the load to ensure that no individual gantry leg is overloaded.

(h) Before lifting a load, consideration should be given to fluids or other shifting materials that can change the location of the center of gravity.

(i) Before lifting a load, consideration should be given to wind and other environmental conditions.

(j) The gantry legs and the track or plate on which the legs bear shall be supported by a hard level surface (such as concrete, steel, compacted soil, or wood blocking) capable of supporting the load within predetermined deflection tolerances.

(k) The speed of lifting or lowering a load and the speed of gantry system travel should be moderated by the operator as required to maintain control of the load.

(l) A gantry leg shall not be supported in any manner other than that approved by the manufacturer or a qualified person.

(m) Slings, shackles, and other rigging hardware shall be used within their parameters as described in related ASME B30 volumes.

(n) The gantry operator should have an unobstructed view of the gantry system and load during operation of the system. If this is not possible, a signalperson(s) shall be

used with an effective means of communication to provide direction to the gantry operator.

(20) **1-6.9.5.2 Communication**

(a) Communication among personnel involved in the gantry operation shall be maintained continuously during all movement of the load. If at any time communication is disrupted, the gantry operator shall stop all movements until communication is restored.

(b) Signals to the gantry operator should be in accordance with the standards prescribed in [Figure 1-0.4.5-1](#). If special signals are required, they shall be agreed upon by the gantry operator and support personnel prior to lifting operations. Signals shall be discernible or audible at all

times. No action shall be taken unless signals are clearly understood.

(c) Load handling personnel shall obey any stop signal.

1-6.9.5.3 Special Lifting Considerations

(a) Uneven extension or retraction of the gantry legs in a gantry system can cause cross cornering, instability, or overloading.

(b) Some loads may require multiple lifting points and complex lifting procedures. A qualified person should analyze the operation and instruct all personnel involved in the proper use of the gantry system and the movements to be made.

Chapter 1-7

Strand Jack Systems

SECTION 1-7.0: SCOPE

This Chapter applies to strand jack systems.

SECTION 1-7.1: TYPES AND DESIGN

1-7.1.1 Types

Manually and automatically controlled double-acting strand gripping jacks (see [Figure 1-7.1.1-1](#)).

1-7.1.2 Design

(a) The strand jack system shall be designed in accordance with criteria established by the manufacturer or a qualified person.

(b) The load bearing structural, mechanical, and hydraulic components in the strand jack system shall have sufficient strength and ductility to move and support the rated load at the temperatures at which it will be used.

(c) Structures supporting a strand jack system, the attachment to the load, and other accessories and equipment used as a part of the strand jack system shall be designed or selected by the manufacturer or a qualified person.

(d) Each strand jack shall be fitted with a means of pressure relief on the retract circuit that allows hydraulic fluid to flow from the smaller effective area of the jack. Flow restricting components shall not be present between the means of pressure relief and the smaller effective area.

(e) The manufacturer shall provide a means to monitor the load on each strand jack at the operator's control console.

(f) A means shall be provided at the operator's control console to indicate the position (clamped or unclamped) of the top and bottom anchors (see [Figure 1-7.1.1-1](#)).

(g) A means for maintaining the intended pressure on the hydraulic clamps shall be provided during load handling operations.

(h) A means to decrease the occurrence of birdcaging of the strands within the jack shall be provided.

(i) Wedges shall be designed and manufactured from materials with sufficient hardness such that the teeth maintain their ability to grip the strand during jacking or holding.

(j) Anchor blocks shall be designed and manufactured from materials such that the wedges do not damage the anchor block.

(k) A means for controlling the speed of extension and retraction of the jack shall be provided.

(l) A means for preventing uncontrolled extension and retraction of the jack shall be provided.

(m) In an automatically controlled strand jack system, a means to prevent the fixed anchor from coming into contact with the bottom of the jack shall be provided.

(n) A stroke gage to monitor the travel or position of each jack during operation should be provided.

SECTION 1-7.2: DESIGN FACTORS

(a) The design factors for the strand jack system shall be determined by the manufacturer or a qualified person.

(b) The design factors for any structure supporting a strand jack system, the attachment to the load, other accessories or equipment used as a part of the strand jack system, or other load bearing components of the strand jack system shall be determined by the manufacturer or a qualified person.

(c) The minimum breaking force for a strand shall be a minimum of 2.5 times its rated load.

SECTION 1-7.3: RATED LOADS

The rated loads for the strand jack system shall be established by the manufacturer or a qualified person.

SECTION 1-7.4: PROOF TEST AND PROOF LOAD

1-7.4.1 Proof Test Requirements

(a) Each newly designed strand jack system shall be proof tested by the manufacturer.

(b) Each newly manufactured strand jack system should be proof tested by the manufacturer.

(c) The manufacturer or a qualified person shall determine if a proof test is required for any altered, modified, or repaired strand jack system.

(d) After proof testing, the strand jack system shall be thoroughly inspected for the conditions stated in [para. 1-7.8.4](#).

Chapter 1-7

Strand Jack Systems

SECTION 1-7.0: SCOPE

This Chapter applies to strand jack systems.

SECTION 1-7.1: TYPES AND DESIGN

1-7.1.1 Types

Manually and automatically controlled double-acting strand gripping jacks (see [Figure 1-7.1.1-1](#)).

1-7.1.2 Design

(a) The strand jack system shall be designed in accordance with criteria established by the manufacturer or a qualified person.

(b) The load bearing structural, mechanical, and hydraulic components in the strand jack system shall have sufficient strength and ductility to move and support the rated load at the temperatures at which it will be used.

(c) Structures supporting a strand jack system, the attachment to the load, and other accessories and equipment used as a part of the strand jack system shall be designed or selected by the manufacturer or a qualified person.

(d) Each strand jack shall be fitted with a means of pressure relief on the retract circuit that allows hydraulic fluid to flow from the smaller effective area of the jack. Flow restricting components shall not be present between the means of pressure relief and the smaller effective area.

(e) The manufacturer shall provide a means to monitor the load on each strand jack at the operator's control console.

(f) A means shall be provided at the operator's control console to indicate the position (clamped or unclamped) of the top and bottom anchors (see [Figure 1-7.1.1-1](#)).

(g) A means for maintaining the intended pressure on the hydraulic clamps shall be provided during load handling operations.

(h) A means to decrease the occurrence of birdcaging of the strands within the jack shall be provided.

(i) Wedges shall be designed and manufactured from materials with sufficient hardness such that the teeth maintain their ability to grip the strand during jacking or holding.

(j) Anchor blocks shall be designed and manufactured from materials such that the wedges do not damage the anchor block.

(k) A means for controlling the speed of extension and retraction of the jack shall be provided.

(l) A means for preventing uncontrolled extension and retraction of the jack shall be provided.

(m) In an automatically controlled strand jack system, a means to prevent the fixed anchor from coming into contact with the bottom of the jack shall be provided.

(n) A stroke gage to monitor the travel or position of each jack during operation should be provided.

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1-7.4.1 Proof Test Requirements

(a) Each newly designed strand jack system shall be proof tested by the manufacturer.

(b) Each newly manufactured strand jack system should be proof tested by the manufacturer.

(c) The manufacturer or a qualified person shall determine if a proof test is required for any altered, modified, or repaired strand jack system.

(d) After proof testing, the strand jack system shall be thoroughly inspected for the conditions stated in [para. 1-7.8.4](#).

SECTION 1-7.6: EFFECTS OF ENVIRONMENT

1-7.6.1 Temperature

When strand jack systems are to be used at temperatures above 140°F (60°C) or below 25°F (-4°C), the component manufacturers or a qualified person should be consulted, unless the manufacturers specifically allow use at the anticipated temperature.

1-7.6.2 Chemically Active Environments

The strength and operation of strand jack systems can be affected by chemically active environments, such as caustic or acid substances or fumes. The component manufacturers or a qualified person should be consulted before use in chemically active environments.

1-7.6.3 Other Environments

The internal workings of hydraulic cylinders, wheels, collets, sheaves, grips, wedges, cables, strands, and other mechanical components can be affected by high moisture, gravel or sand, silt, grit, or dust laden air. Contaminated fluid can affect the operation of cylinders and hydrostatic drive motors. Strand jack systems subject to these environments should have their components cleaned and inspected in accordance with [para. 1-7.8.3\(b\)\(5\)\(-b\)](#).

SECTION 1-7.7: INSTRUCTIONS AND TRAINING

1-7.7.1 Instructions

The manufacturer shall furnish operating, inspection, and maintenance instructions with each strand jack system.

1-7.7.2 Training

Strand jack system users shall be trained in the selection, inspection, maintenance, cautions to personnel, effects of environment, and operating practices as addressed by this Chapter and the manufacturer's instructions.

SECTION 1-7.8: INSPECTION, REPAIR, AND REMOVAL

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.

1-7.8.1 Initial Inspection

Prior to use, all new, altered, modified, or repaired strand jack system components shall be inspected to verify compliance with the applicable provisions of this

Chapter and the manufacturer's specifications. Written records are not required.

1-7.8.2 Frequent Inspection

1-7.8.2.1 Pre-assembly Inspection

(a) Prior to assembly, all strand jack system components shall be inspected to verify compliance with the applicable provisions of this Chapter and the manufacturer's specifications. Written records are not required.

(b) *Strand Inspection.* Strand ends shall be prepared in accordance with the manufacturer's recommendations so that they do not damage the wedges when inserted into the fixed anchor or jack assembly. Strands shall be inspected, at a minimum, for the following conditions:

(1) contamination with foreign materials that could cause fouling of the wedges

(2) reduction of diameter greater than 5% below the nominal diameter shall be cause for replacing the strand

(3) pitting or reduction in strand diameter caused by corrosion shall be cause for replacing the strand

(4) the presence of lubricants on the strand surface

(5) kinks or breaks of any kind in the strand

(6) birdcaging or similar distortions to the strand

(c) Wedges shall be inspected and removed from service if the following conditions are present:

(1) tooth wear that adversely affects the wedge's gripping ability

(2) tooth deformation or fracture

(3) teeth that are fouled or contain material build-up that will hamper the clamping action of the wedge on the strands

(4) the outer surfaces of the wedges are not lubricated in accordance with the manufacturer's recommendations

(5) wedge O-ring degradation due to dry rot, reduced elasticity, or damage

1-7.8.2.2 Pre-use Inspection

(a) A visual and functional inspection shall be performed each shift before the strand jack system is used.

(b) Conditions such as those listed in [para. 1-7.8.4](#) or any other condition that may be a hazard shall cause the strand jack system to be removed from service. The strand jack system shall not be returned to service until approved by a qualified person.

(c) Written records are not required for frequent inspections.

1-7.8.3 Periodic Inspection

(a) A complete inspection of the strand jack system shall be performed. The system shall be examined for conditions such as those listed in [para. 1-7.8.4](#), and a determination made as to whether they constitute a hazard.

(b) *Periodic Inspection Frequency.* Periodic inspection intervals shall not exceed 12 months. The frequency of inspections should be based on

- (1) frequency of use
- (2) severity of service conditions
- (3) nature of load handling activity
- (4) experience gained on the service life of strand jack systems used in similar circumstances
- (5) guidelines for the time intervals are
 - (-a) normal service — 1 month to 12 months
 - (-b) severe service — daily to monthly
 - (-c) special service — as recommended by a

qualified person

(c) If external appearances suggest internal damage, the component shall be disassembled for cleaning and examined for internal wear or damage. The disassembly, inspection, and reassembly shall be performed by an authorized service center or under the supervision of a qualified person.

(d) A strand jack system that has been idle for more than 6 months shall be inspected prior to use. The removal criteria in [para. 1-7.8.4](#) shall apply.

(e) Dated inspection records shall be kept on all periodic inspections.

1-7.8.4 Removal Criteria

Strand jack system components shall be removed from service if damage such as the following is present, and shall only be returned to service when approved by a qualified person:

- (a) worn, cracked, bent, or broken cylinder barrels, sleeves, or rams beyond manufacturer's recommendations
- (b) damaged or worn wedges
- (c) material build-up in wedge teeth that cannot be removed by cleaning
- (d) strand condition
 - (1) contamination with foreign materials that could cause fouling of the wedges
 - (2) reduction of diameter greater than 5% below the nominal diameter
 - (3) pitting or reduction in strand diameter caused by corrosion
 - (4) the presence of lubricants on the strand surface
 - (5) kinks or breaks of any kind in the strand
 - (6) birdcaging or similar distortions to the strand
- (e) cracked or broken structural parts or welds
- (f) internal or external hydraulic fluid leak
- (g) damaged seals or valves
- (h) excessive pitting or corrosion on cylinder surfaces
- (i) excessive nicks or gouges on cylinder surfaces
- (j) missing or illegible identification
- (k) indications of structural damage due to heat or evidence of unauthorized welding
- (l) loose, missing, or substandard structural fasteners

(m) damaged or improperly assembled accessory equipment

(n) damaged control unit or damage to its levers, buttons, switches, indicators, or markings

(o) missing, damaged, or ill-fitting hydraulic system components

(p) hoses or couplers that have been cut, severely abraded, gouged, cracked, or become brittle

(q) contaminated hydraulic fluid

(r) missing or damaged electrical system components

(s) damaged reels, wheels, bearings, or axles

(t) damaged propel system or its components

(u) other conditions including visible damage that cause doubt as to the soundness of the strand jack system for continued use

(v) other items as specified in the manufacturer's instructions which may affect operation

1-7.8.5 Repairs and Modifications

(a) Repairs, alterations, or modifications shall be as specified by the strand jack system manufacturer or a qualified person.

(b) All replacement parts shall meet or exceed the original equipment manufacturer's specifications.

1-7.8.6 Inspection of Load Rigging

Slings, shackles, and other types of rigging shall be inspected according to the appropriate ASME B30 Volumes.

SECTION 1-7.9: OPERATING PRACTICES

1-7.9.1 Strand Jack System Selection

(a) Strand jack systems shall be selected for the type and size of load, lift height, travel, and environmental requirements in accordance with the recommendations of the manufacturer or a qualified person.

(b) The rated load of the strand jack system and of each individual strand jack shall not be exceeded.

(c) Proper support of the strand jack and its associated load shall be provided. Engineering analysis of the support structure may be required to verify adequacy.

(d) Adequacy of lifting attachments and the ability of the load to support itself during lifting should be verified by a qualified person.

(e) The strand jack system shall not be used until inspected and verified as usable under [Section 1-7.8](#).

(f) Gages or other load measuring devices should be used to assist the strand jack system operator in determining the strand jack system loading.

(b) *Periodic Inspection Frequency.* Periodic inspection intervals shall not exceed 12 months. The frequency of inspections should be based on

- (1) frequency of use
- (2) severity of service conditions
- (3) nature of load handling activity
- (4) experience gained on the service life of strand jack systems used in similar circumstances
- (5) guidelines for the time intervals are
 - (-a) normal service — 1 month to 12 months
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(c) If external appearances suggest internal damage, the component shall be disassembled for cleaning and examined for internal wear or damage. The disassembly, inspection, and reassembly shall be performed by an authorized service center or under the supervision of a qualified person.

(d) A strand jack system that has been idle for more than 6 months shall be inspected prior to use. The removal criteria in [para. 1-7.8.4](#) shall apply.

(e) Dated inspection records shall be kept on all periodic inspections.

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Strand jack system components shall be removed from service if damage such as the following is present, and shall only be returned to service when approved by a qualified person:

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 - (4) the presence of lubricants on the strand surface
 - (5) kinks or breaks of any kind in the strand
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- (e) cracked or broken structural parts or welds
- (f) internal or external hydraulic fluid leak
- (g) damaged seals or valves
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- (i) excessive nicks or gouges on cylinder surfaces
- (j) missing or illegible identification
- (k) indications of structural damage due to heat or evidence of unauthorized welding
- (l) loose, missing, or substandard structural fasteners

(m) damaged or improperly assembled accessory equipment

(n) damaged control unit or damage to its levers, buttons, switches, indicators, or markings

(o) missing, damaged, or ill-fitting hydraulic system components

(p) hoses or couplers that have been cut, severely abraded, gouged, cracked, or become brittle

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(u) other conditions including visible damage that cause doubt as to the soundness of the strand jack system for continued use

(v) other items as specified in the manufacturer's instructions which may affect operation

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(b) The rated load of the strand jack system and of each individual strand jack shall not be exceeded.

(c) Proper support of the strand jack and its associated load shall be provided. Engineering analysis of the support structure may be required to verify adequacy.

(d) Adequacy of lifting attachments and the ability of the load to support itself during lifting should be verified by a qualified person.

(e) The strand jack system shall not be used until inspected and verified as usable under [Section 1-7.8](#).

(f) Gages or other load measuring devices should be used to assist the strand jack system operator in determining the strand jack system loading.

(t) The strand jack system operator should have an unobstructed view of the strand jack system or system control console and load during operation of the system. If this is not possible, a signalperson(s) shall be used with an effective means of communication to provide direction to the strand jack system operator.

(20) **1-7.9.5.2 Communication**

(a) Communication among personnel involved in the strand jack system operation shall be maintained continuously during all movement of the load. If at any time communication is disrupted, the strand jack system operator shall stop all movements until communication is restored.

(b) Signals to the strand jack system operator should be in accordance with the standard signals prescribed in [Figure 1-0.4.5-1](#). If special signals are required, they

shall be agreed upon by the strand jack system operator and support personnel prior to the jacking operation. Signals shall be discernible at all times. No action shall be taken unless signals are clearly understood.

(c) Load handling personnel shall obey any stop signal.

1-7.9.5.3 Special Load Handling Considerations

(a) Uneven load distributions, synchronized load handling, uneven raising and lowering, moving centers of gravity, or shifting loads presenting the potential for overloading or excessive side loading shall be given special consideration in the lift plan.

(b) Some loads may require multiple attachment points and complex load handling procedures. A qualified person should analyze the operation and instruct all personnel involved in the proper use of the strand jack system, the movements to be made, and associated hazards.

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