ASME PASE-2014

(Revision, Redesignation, and Consolidation of
ASME PALD-2009 and ASME ASP-2010)

Safety Standard for Portable Automotive Service Equipment

AN AMERICAN NATIONAL STANDARD

The American Society of
Mechanical Engineers

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Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: December 29, 2014

The next edition of this Standard is scheduled for publication in 2019. 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 Web site under the Committee Pages at http://cstools.asme.org/.

Errata to codes and standards may be posted on the ASME Web site 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.

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The American Society of Mechanical Engineers
Two Park Avenue, New York, NY 10016-5990

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FOREWORD

This ASME Standard, Safety Standard for Portable Automotive Service Equipment, has been developed under the procedures for ASME Codes and Standards development committees. This Standard had its beginning in June 1979 when the Jack Institute addressed the B30 Committee on Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings. The Jack Institute requested the B30 Committee either to develop a standard for automotive jacks or to include this equipment as part of the revision of ASME B30.1, Jacks. The B30 Committee declined this request.

As a result, the Jack Institute petitioned the American National Standards Institute (ANSI) in July 1979 for the formation of a committee to promulgate safety and/or performance standards for portable automotive lifting devices, requesting the designation of ASME as sponsor of the project.

In September 1979, ASME's Policy Board, Codes and Standards, approved sponsorship of the committee to operate under the procedures developed by ASME and accredited by ANSI. A nominating committee was appointed to recommend a proposed membership to the ASME Safety Codes and Standards Committee for approval. The membership was approved at the beginning of May 1980.

The inaugural meeting of the ASME Committee on Portable Automotive Lifting Devices (PALD) was held in July 1980. The Committee determined that the format of this Standard would be such that separate volumes, each complete as to design, marking, identification, testing, operation, inspection, and maintenance, would cover the different types of equipment included in the PALD scope. In the 1993 edition, the various volumes were combined into one Standard with common requirements in one place and the information specific to a particular type of equipment set out in succeeding Parts. This allowed for greater consistency in requirements and eliminated redundancy.

In April 2007, the ASME Committee on PALD recognized the need to develop a standard for PALD-related equipment not covered under the ASME PALD Standard. As a result, an ASME PALD subcommittee was appointed by members currently serving on the ASME PALD Committee to propose a new standard for these products. This subcommittee then drafted a basic scope and outline of this new Standard and petitioned the ASME Council of Codes and Standards for permission to proceed with the development of this Standard to cover equipment described in the charter of the ASME PALD Committee. The Standard was approved by the American National Standards Institute on February 3, 2010, as the Safety Standard for Automotive Service and Maintenance Products (ASP).

In July 2011, the PALD Committee approved changing the name and charter of the PALD Committee to the Portable Automotive Service Equipment (PASE) Committee to encompass both the ASME PALD and ASME ASP published Standards. As a result of this change, the Committee decided to combine the two Standards into this new Safety Standard for Portable Automotive Service Equipment. This Standard presents a coordinated set of rules that may serve as a guide to manufacturers, to government and other regulatory bodies, to municipal authorities, and to commercial users responsible for the inspection, maintenance, and instruction in the use of the equipment falling within its scope.

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

This Standard was approved by the American National Standards Institute on October 30, 2014.

ASME PASE COMMITTEE
Portable Automotive Service Equipment

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

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PREFACE

GENERAL

This Standard is one of many safety standards on various subjects that have been formulated under the general auspices of The American Society of Mechanical Engineers (ASME). One purpose of the Standard is to serve as a guide to governmental authorities having jurisdiction over subjects within the scope of the Standard. It is expected, however, that the Standard will find a major application in industry, serving as a guide to manufacturers, suppliers, purchasers, and operators of the equipment. If adopted for governmental use, the references to other national standards in this Standard may be changed to refer to the corresponding regulations of the governmental authorities.

The use of portable automotive service equipment (PASE) is subject to certain hazards that cannot be precluded 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 careful, competent, trained, and qualified in the safe operation of the equipment and its proper use when servicing motor vehicles and their components. Examples of hazards are dropping, tipping, or slipping of motor vehicles or their components caused primarily by improperly securing loads; overloading; off-centered loads; use on other than hard, level surfaces; and using equipment for a purpose for which it was not designed.

The PASE Committee fully realizes the importance of proper size, strength, and stability as safety factors in the design of this equipment. This equipment is used on various motor vehicles and their components under variable working conditions. These conditions have been considered to provide safety and flexibility in its use. The requirements given in this Standard must be interpreted accordingly and judgment should be used in determining their application.

MANDATORY AND ADVISORY RULES

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

SI (METRIC) CONVERSIONS

This Standard contains SI (metric) units as well as U.S. Customary units. The values stated in U.S. Customary units are to be regarded as the standard. The SI units in the text have been directly (soft) converted from the U.S. Customary units.

PROPOSING REVISIONS

Comments on the Standard's requirements and suggestions for its improvement, based on experience in the application of the rules, may be sent to the PASE Committee.

Suggestions for changes to the Standard should be submitted to the Secretary of the Committee on Portable Automotive Service Equipment, ASME, Two Park Avenue, New York, NY 10016-5990, and should be in accordance with the following format:

(a) Cite the specific Part or section and paragraph designation.

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

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

(d) Submit suggested changes to more than one paragraph in the order in which the paragraphs appear in the Standard.

The PASE Committee will consider each suggested change in a timely manner according to its procedures.

INTERPRETATIONS

Upon request, the PASE Committee will render an interpretation of any requirement of the Standard. Interpretations can be rendered only in response to a written request sent to the Secretary of the PASE Committee at the address shown above.

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

Subject:	Cite the applicable part or section and paragraph number, and provide a concise description.
Edition:	Cite the applicable edition of the pertinent standard for which the interpretation is being requested.
Question:	Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for approval of a

proprietary design or situation. The inquirer also may include any plans or drawings that are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in this format will be rewritten in this format by the Committee before being answered, which may inadvertently change the intent of the original request.

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

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SAFETY STANDARD FOR PORTABLE AUTOMOTIVE SERVICE EQUIPMENT

Part 1
Introduction

1-1 SCOPE

The scope of this Standard is the standardization of safety and performance requirements for portable automotive service equipment (PASE) including, but not limited to, the following:

(a) attachments, adapters, and accessories
(b) hydraulic hand jacks
(c) transmission jacks
(d) engine stands
(e) vehicle support stands
(f) emergency tire-changing jacks
(g) mobile lifts
(h) service jacks
(i) wheel dollies
(j) shop cranes
(k) auxiliary stands
(l) automotive ramps
(m) high-reach supplementary stands
(n) forklift jacks
(o) vehicle transport lifts
(p) vehicle-moving dollies
(q) wheel lift jacks
(r) shop presses
(s) oil filter crushers
(t) strut spring compressors
(u) oil and antifreeze handlers
(v) portable hydraulic power kits

This Standard includes requirements for safety, health, design, production, construction, maintenance, performance, or operation of electrical, mechanical, hydraulic, or pneumatically powered equipment, and qualification of personnel. Safety and construction requirements for electrical equipment are included in UL 201, Standard for Safety for Garage Equipment, and UL 2089, Standard for Safety for Vehicle Battery Adapters. As deemed necessary by the ASME PASE Committee, additional equipment classified as PASE-related equipment can be added as the need arises to ensure the safe operation of the equipment by the end user.

1-2 APPLICATION

This Standard applies to design, construction, marking, operation, maintenance, and owner or operator inspection of the portable automotive service equipment listed in section 1-1 used during service, maintenance, and storage of components, vehicles, or both. Operation and maintenance instructions in this Standard are intended for general application. The equipment manufacturer or supplier shall be consulted for specific operating and maintenance instructions. This Standard does not apply to similar lifting devices designed and manufactured for other commercial or industrial uses, such as those within the scope of ASME B30.1, Jacks, Industrial Rollers, Air Casters, and Hydraulic Gantries; and automotive lift standards ANSI/ALI ALCTV, Safety Requirements for Construction, Testing, and Validation; ANSI/ALI ALIS, Safety Requirements for Installation and Service; and ANSI/ALI ALOIM, Safety Requirements for Operation, Inspection, and Maintenance.

1-3 PURPOSE

This Standard is designed to

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

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

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

1-4 REFERENCES

The following is a list of standards and specifications referenced in this Standard:

ANSI/ALI ALCTV, Standard for Automotive Lifts — Safety Requirements for Construction, Testing, and Validation

ANSI/ALI ALIS, Standard for Automotive Lifts — Safety Requirements for Installation and Service
ANSI/ALI ALOIM, Standard for Automotive Lifts — Safety Requirements for Operation, Inspection, and Maintenance

Publisher: Automotive Lift Institute (ALI), Inc., P.O. Box 85, Cortland, NY 13045 (www.autolift.org)

ANSI B11.2, Safety Requirements for Hydraulic and Pneumatic Power Presses

Publisher: American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036 (www.ansi.org)

ANSI/ISEA Z87.1, Occupational and Educational Personal Eye and Face Protection Devices

Publisher: International Safety Equipment Association (ISEA), 1901 N. Moore Street, Arlington, VA 22209 (www.safetyequipment.org)

ANSI Z535, Color Chart
ANSI Z535.1, Safety Colors
ANSI Z535.3, Criteria for Safety Symbols
ANSI Z535.4, Product Safety Signs and Labels
ANSI Z535.5, Safety Tags and Barricade Tapes (for Temporary Hazards)
ANSI Z535.6, Product Safety Information in Product Manuals, Instructions, and Other Collateral Materials

Publisher: National Electrical Manufacturers Association (NEMA), 1300 North 17th Street, Suite 1752, Rosslyn, VA 22209 (www.nema.org)

ASME B30.1, Jacks, Industrial Rollers, Air Casters, and Hydraulic Gantries

Publisher: The American Society of Mechanical Engineers (ASME), Two Park Avenue, New York, NY 10016; Order Department: 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900 (www.asme.org)

ISO/IEC 17050-1, Conformity assessment — Supplier's declaration of conformity — Part 1: General requirements
ISO/IEC 17050-2, Conformity assessment — Supplier's declaration of conformity — Part 2: Supporting documentation

Publisher: International Organization for Standardization (ISO), Central Secretariat, 1, ch. de la Voie-Creuse, Case postale 56, CH-1211 Genève 20, Switzerland/Suisse (www.iso.org)

SAE J517, Hydraulic Hose

Publisher: Society of Automotive Engineers (SAE International), 400 Commonwealth Drive, Warrendale, PA 15096 (www.sae.org)

UL 201, Standard for Safety for Garage Equipment
UL 2089, Standard for Safety for Vehicle Battery Adapters

Publisher: Underwriters Laboratories, Inc. (UL), 333 Pfingsten Road, Northbrook, IL 60062-2096; Order Address: Comm 2000, 151 Eastern Avenue, Bensenville, IL 60106 (www.ul.com)

Part 2
General Requirements

2-1 SCOPE AND DEFINITIONS

2-1.1 Scope

This Part applies to all PASE defined in this Standard.

2-1.2 Definitions

adapter: a device attached to PASE that is used to support and/or stabilize those components for which it is especially designed.

alteration: any change to PASE other than maintenance, repair, or replacement.

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

appropriate means: the use of any device, such as blocking, cribbing, or vehicle-support stands, that adequately supports a vehicle off the ground by providing a stable support preventing the vehicle from tipping over or falling down to the ground.

approved: accepted as satisfactory by a duly constituted administrative or regulatory authority.

authorized: approved by a duly constituted administrative or regulatory authority.

authorized personnel: persons who have been instructed in the operation or maintenance, or both, of PASE and designated by the owner to use or maintain the equipment.

authorized service center: an independent service facility designated by the manufacturer to repair, service, and functionally test PASE.

base: see definition in Parts 7, 9, 12, 13, 15, 16, and 19.

controls, operating: the mechanisms that must be manipulated by the operator to govern the starting, stopping, direction of motion, acceleration, speed, and retardation of the moving member(s) of PASE.

cylinder: a means by which force is transmitted to an object by hydraulic or air pressure. Also referred to as a ram.

designated: selected or assigned by the employer or the employer's representative as being competent to perform specific duties.

electric: term used to describe a device that utilizes electricity as the force or delivery-transmitting medium.

extender: an optional device supplied by the manufacturer to mechanically increase PASE height prior to applying the load.

filler plug: a removable component to allow adding fluid to PASE.

fixed: permanently set in one location and not readily moveable to another work area.

frame: see definition in Parts 6, 11, 18, 19, and 20.

functional damage: any detrimental permanent deformation of the PASE structure that results in the loss of sealing capability to its hydraulic and/or pneumatic components, loss of load, loss of motion, or failure to meet or exceed the design qualification limits established.

hydraulic: term used to describe a device that utilizes hydraulics as the force or delivery-transmitting medium.

internal load-limiting device: a device that limits the lifting capacity of PASE.

lifting member: the moving portion of PASE upon which saddles (if any) are mounted.

lift point: the location at which the PASE lifting member or saddle contacts the vehicle component as designated by the vehicle manufacturer.

listed: refers to an electrical product that has been tested, found compliant, and approved by a Nationally Recognized Testing Laboratory to a specific standard.

load: the total superimposed weight of force to be overcome by PASE.

manufacturer: a company that produces goods for sale.

mechanical: term used to describe a device that utilizes manual energy as the force for operation.

mobile: term used to describe PASE that is readily movable from one work area to another without load.

overload: a load that exceeds the rated capacity of PASE.

PASE: any one of the various types of portable automotive service equipment listed in the scope of this Standard.

pawl: a pivoted component that, when engaged with the teeth of a ratchet, prevents undesired movement in a specific direction.

pneumatic: term used to describe a device that utilizes compressed air as the force or delivery-transmitting medium.

portable: not permanently fixed in one location and able to be moved from one workplace to another.

proof load: a load, greater than the rated capacity, applied centrally to PASE lifting or attaching points, or to the work surface as defined by the loading apparatus, to confirm the integrity of the structure.

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

raised height: the distance from the ground to the top of the saddle at the full extension of PASE.

ram: see *cylinder*.

ratchet: a toothed member for engagement with the pawl.

rated capacity: the maximum published operating load or volume that PASE is designed to lift, support, deliver, contain, receive, or transport.

repair: the process of rehabilitation or replacement of parts that are the same as the original for the purpose of ensuring performance in accordance with the applicable requirements.

saddle: the portion of PASE that comes in contact with and/or engages a vehicle component.

stability: a measure of resistance to tipping or slipping while under load.

standard: any international, national, state, or local published set of criteria with which a product or service shall comply that is recognized by a governing body.

supplier: a company that controls the performance specification and design, or both, of the products distributed to the general public.

travel: extending or retracting movement of PASE.

2-2 DESIGN

2-2.1 Durability Assessment

In the design of all PASE, consideration shall be given to the anticipated useful life of each product, and the cumulative effects of repeated use and other potential changes in properties.

2-2.2 Ergonomic Considerations

The design of all PASE shall consider the operator interface for control size and placement; the interface to lift, support, output, contain, receive, or transport throughout its range of travel operation; and the force requirements at rated capacity for operation and movement of PASE.

2-2.3 Design Qualification Testing

In the design qualification testing of all PASE, the same sample shall be used for all tests where this is feasible.

2-2.4 Electrically Powered Products

All PASE utilizing electrical power shall, at a minimum, meet the following requirements:

(a) The PASE shall provide overcurrent protection, which shall not automatically reset.

(b) The PASE shall meet an applicable standard, such as UL 201 or UL 2089.

(c) The PASE shall provide a means to permit controlled lowering, or safe removal of a load if electrical power fails.

2-3 PRODUCT MARKING AND IDENTIFICATION

2-3.1 Rated Capacity

All PASE shall have the rated capacity marked in a prominent location on the PASE by casting imprint, metal stamp, or use of durable materials and attachment methods. These rated capacities should be stated as required based upon the nature of the PASE. PASE designed or intended to be used together in pairs or other multiple configurations shall display the rated capacity of each individual unit.

2-3.2 Identification

All PASE shall include identification or identifying marks of the original manufacturer or supplier by casting imprint, metal stamp, or use of durable materials and attachment methods. The manufacturer shall be able to identify the date of manufacture of all PASE.

2-3.3 Safety Markings

All PASE shall include safety signs, labels, or both, developed by the manufacturer or supplier. The signs or labels shall be affixed by use of durable materials and attachment methods to all PASE in a location visible to the operator to avoid the hazard. The ANSI Z535 series of standards containing guidelines for product safety signs shall be followed.

Examples of safety markings for specific types of PASE are shown in section *X*-3 of Parts 4 through 24.

2-4 PRODUCT INSTRUCTIONS AND SAFETY MESSAGES

2-4.1 Product Manuals and Instructions

All PASE shall be provided with an owner's manual or operator's instructions. The instructions shall specify the proper operating procedures and basic function of the components. The instructions shall contain the recommended replacement fluid, maintenance, and inspection procedures and intervals, as applicable. Formats shall follow the ANSI Z535 series of standards containing guidelines for instructions and manuals. Copy conveying the intent of section 2-6 shall be included with the instructions. Consideration should be given to multilanguage instructions.

2-4.2 Safety Messages

The instructions shall convey the safety markings and messages shown in section X-3 of Parts 4 through 24 but need not to be verbatim or limited to those listed.

2-5 QUALITY ASSURANCE

Producers of PASE shall adhere to a planned, written system of policies and procedures that will ensure consistent and continuing conformance to this Standard. Conformance to this Standard shall be demonstrated by the testing requirements set forth herein. ISO/IEC 17050-1 and ISO/IEC 17050-2 may be used as guides.

2-6 OPERATION, MAINTENANCE, AND INSPECTION

2-6.1 Operation

The owner and/or operator shall have an understanding of the product, its operating characteristics, and safety operating instructions before operating PASE. Safety information shall be understood. If the operator is not fluent in English, the product and safety instructions shall be discussed with the operator in the operator's native language by the purchaser, owner, or owner's designee, making sure that the operator comprehends their contents.

2-6.2 Maintenance

PASE shall be maintained by a qualified person.

2-6.3 Inspection

(a) Visual inspection shall be made before each use of PASE by checking for abnormal conditions, such as cracked welds, leaks, and damaged, loose, or missing parts.

(b) Other inspections shall be made per product operating instructions.

(c) PASE shall be inspected immediately if the device is believed to have been subject to an abnormal load or shock. This inspection should be made by a manufacturer's or supplier's authorized repair facility.

(d) Owners and operators should be aware that repair of this equipment may require specialized knowledge and facilities.

(e) An annual inspection of PASE should be made by a manufacturer's or supplier's authorized repair facility, and any defective parts, decals, or safety labels or signs should be replaced with manufacturer's or supplier's specified parts. A list of authorized repair facilities should be available from the manufacturer or supplier.

2-6.4 Damaged Equipment

Any PASE that appears to be damaged in any way, is found to be worn, or operates abnormally SHALL BE REMOVED FROM SERVICE UNTIL REPAIRED. Necessary repairs should be made by manufacturer's or supplier's authorized repair facility if repairs are permitted by the manufacturer or supplier.

2-6.5 Alterations

Repairs made to or replacement parts used with PASE shall be as specified by the manufacturer or qualified personnel. All replacement parts shall meet or exceed the original equipment manufacturer's specifications.

2-6.6 Attachments and Adapters

Only attachments and adapters supplied by or approved by the manufacturer shall be used. Attachments and adapters shall be marked in accordance with section 2-3. When attachments and adapters are used with the host PASE, the published rated capacity of the system shall be no greater than the rated capacity of the lowest rated component or combination of components that makes up the system.

2-6.7 Personal Protective Equipment

It shall be the responsibility of the employer to ensure that applicable personal protective equipment (PPE) complies with applicable local safety codes.

2-7 RELATED STANDARDS

Consideration shall be given in the design of each PASE regarding standards that might influence the design or use of the product for issues involving health, ergonomics, and applicable state and local requirements.

2-8 EFFECTIVE DATE

The effective date of this Standard shall be 12 months after the Date of Issuance.

Part 3
Attachments, Adapters, and Accessories

3-1 SCOPE AND CLASSIFICATION

3-1.1 Scope

This Part applies to attachments, adapters, and accessories that are intended to be used in conjunction with PASE described herein for the purpose of enhancing their functionality. This Part does not apply to those attachments, adapters, or accessories described elsewhere in this Standard that are specific to host PASE.

Representative devices covered by this Part include, but are not limited to, mobile lift attachments, transmission jack adapters or accessories for other vehicle components, below-the-hook devices for shop cranes, and load-positioning devices.

3-1.2 Classification

Attachments, adapters, and accessories with or without operating controls or adjustment capability are the classifications covered by this Part.

3-1.3 Definitions

accessory: a device that, when used with PASE, provides an alternative or supplementary function for the PASE.

adapter: a device that, when connected to a load, facilitates lifting by PASE.

attachment: a device that, when connected to PASE, facilitates the intended purpose of the host PASE.

below-the-hook device: an accessory that is used to connect a load to a shop crane.

3-2 DESIGN

3-2.1 Operating Controls

Operating controls shall be designed in such a manner that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls should be clear to the operator by position, function, labeling, or a combination thereof. The handle (if employed), or other operating device, shall be capable of being operated to the rated capacity of the attachment, adapter, or accessory without sustaining functional damage. To prevent accidental operation, the handle (if employed), or other operating device, shall require intentional positive action by the operator to move or reposition the load.

3-2.2 Design Requirement

Attachments, adapters, or accessories shall not increase the rated capacity of the host PASE. The attachment, adapter, or accessory shall be capable of holding, moving, or repositioning its rated capacity throughout its range of travel. It is the responsibility of the manufacturer of the attachment, adapter, or accessory that the device does not compromise the design integrity of the host PASE. The manufacturer of the attachment, adapter, or accessory shall also designate the intended use by stating the applicable make and model of the host PASE.

3-2.3 Travel Limit

Each attachment, adapter, or accessory shall be provided with a positive means to prevent the load from being moved or repositioned beyond the design limit of travel in all possible directions.

3-2.4 Proof Load

Attachments, adapters, or accessories shall be capable of performing the proof load test of para. 3-4.1.3 with a proof load of 150% of rated capacity.

3-2.5 Stability

Attachments, adapters, or accessories shall not have loading positions that extend beyond the peripheral limits of the host device. The host PASE with the attachment, adapter, or accessory loaded to its rated capacity shall meet the stability requirements of the host PASE.

3-2.6 Lubrication

If needed, the attachment, adapter, or accessory shall be lubricated by the manufacturer.

3-3 SAFETY MARKINGS AND MESSAGES

3-3.1 Safety Markings

Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings:

(a) Study, understand, and follow all instructions before operating the device.

(b) Do not exceed rated capacity.

(c) Ensure load is secured to the device.

(d) To be used only with the following PASE: [list].

(e) Failure to heed these markings may result in personal injury and/or property damage.

3-3.2 Safety Messages

Additional safety messages include the following:

(a) Release load-locking devices (if employed) slowly and carefully.

(b) No alterations shall be made to this product.

3-4 DESIGN QUALIFICATION TESTING

3-4.1 Proof Tests

For each design or design change that may affect the ability of the attachment, adapter, or accessory to meet this Standard, sample attachments, adapters, or accessories built to design specifications shall be proof tested on host PASE. To conform to this Standard, the attachment, adapter, or accessory shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected.

3-4.1.1 Operating Test. The attachment, adapter, or accessory shall be operated in the most adverse positions, throughout the full range of travel with a connected load equal to the rated capacity.

3-4.1.2 Travel Limit Test. The attachment, adapter, or accessory shall be operated to the full extent of travel in all possible directions with a connected load equal to the rated capacity.

3-4.1.3 Proof Load Test. A proof load, as defined in para. 3-2.4, shall be connected to the attachment, adapter, or accessory. The attachment, adapter, or accessory shall be capable of holding, moving, and repositioning the load throughout the range of travel. Should the original operating handle (if supplied) not be capable of operating the attachment, adapter, or accessory, a substitute handle may be used for the performance of this test.

Part 4
Hydraulic Hand Jacks

4-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

4-1.1 Scope

This Part applies to self-contained hydraulic hand jacks designed for lifting but not sustaining loads in either the vertical (primary) or horizontal (secondary) direction. This Part does not include hydraulic hand jacks used for emergency tire-changing jacks or hydraulic bumper jacks and their assorted attachments.

4-1.2 Classification

Hydraulic and hydraulic/pneumatic self-contained jacks are the classifications covered by this Part.

4-1.3 Illustrations

Figures 4-1.3-1 through 4-1.3-4 show typical jacks covered by this Part; the illustrations are not intended to be all-inclusive.

4-1.4 Definitions

jack, hydraulic hand: portable self-contained device consisting of a ram, saddle, and hydraulic pump.

pump, hydraulic: a device consisting of a pump, pump handle, reservoir, and release valve, and utilizing a relatively incompressible fluid, such as oil, as the force-transmitting means.

4-2 DESIGN

4-2.1 Operating Controls

Operating controls shall be designed in such a manner that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls should be clear to the operator by position, function, labeling, or a combination thereof. The release system shall require intentional positive action by the operator for release to prevent accidental lowering.

4-2.2 Actuating-Handle Force

The actuating handle shall be capable of being operated to the jack's rated capacity without sustaining functional damage. The jack shall be capable of lifting the load at rated capacity when the operator, while in the operating position, exerts force on the lifting-device actuating handle.

4-2.3 Internal Load-Limiting Device

All jacks shall have an internal load-limiting device that can be deactivated during the proof load test. The load-limiting device shall activate when lifting no less than 100% of rated capacity but no more than 125% of rated capacity.

4-2.4 Travel Limit

Each hand jack shall be provided with a positive means to prevent the load from being raised, lowered, or moved beyond the design limit of travel.

4-2.5 Proof Load

All hydraulic hand jacks shall be capable of performing the proof load tests of paras. 4-4.1.1 and 4-4.1.4, with a proof load of 150% of rated capacity.

4-2.6 Carrying Handle

If provided, the carrying handle shall be affixed and capable of sustaining 150% of the jack's weight.

4-3 SAFETY MARKINGS AND MESSAGES

4-3.1 Safety Markings

Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings:

(a) Study, understand, and follow all instructions before operating this device.

(b) Do not exceed rated capacity.

(c) Use only on a hard, level surface.

(d) Support the vehicle with appropriate means immediately after lifting.

(e) Failure to heed these markings may result in personal injury and/or property damage.

4-3.2 Safety Messages

Additional safety messages include the following:

(a) Lift only on areas of the vehicle as specified by the vehicle manufacturer.

(b) No alterations shall be made to this product.

(c) Only attachments and/or adapters supplied by the manufacturer shall be used.

Fig. 4-1.3-1 Typical Single-Stage Hydraulic Hand Jack

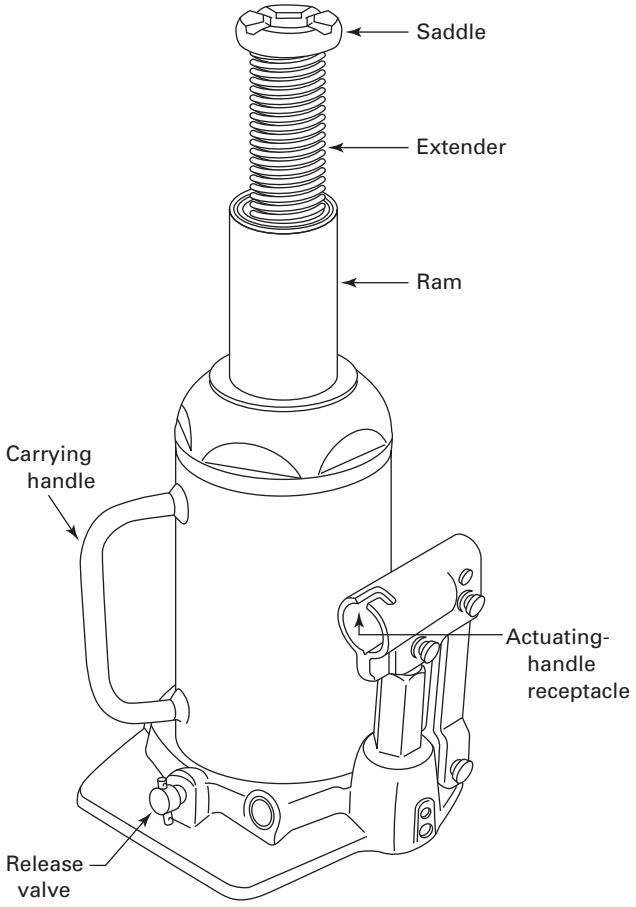


Fig. 4-1.3-2 Typical Wheeled Pneumatic/Hydraulic Hand Jack

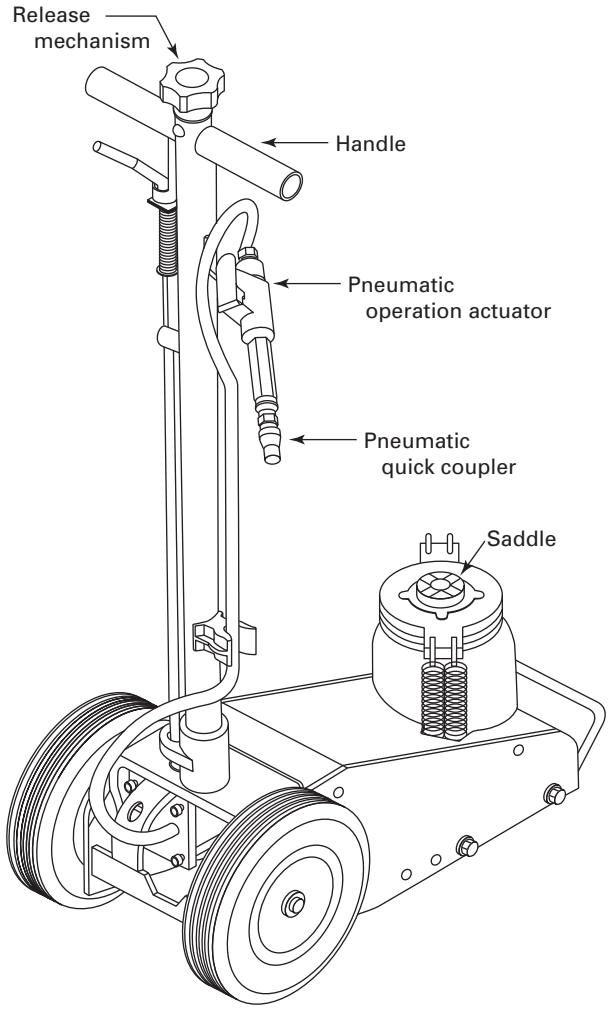


Fig. 4-1.3-3 Typical Pneumatic/Hydraulic Hand Jack

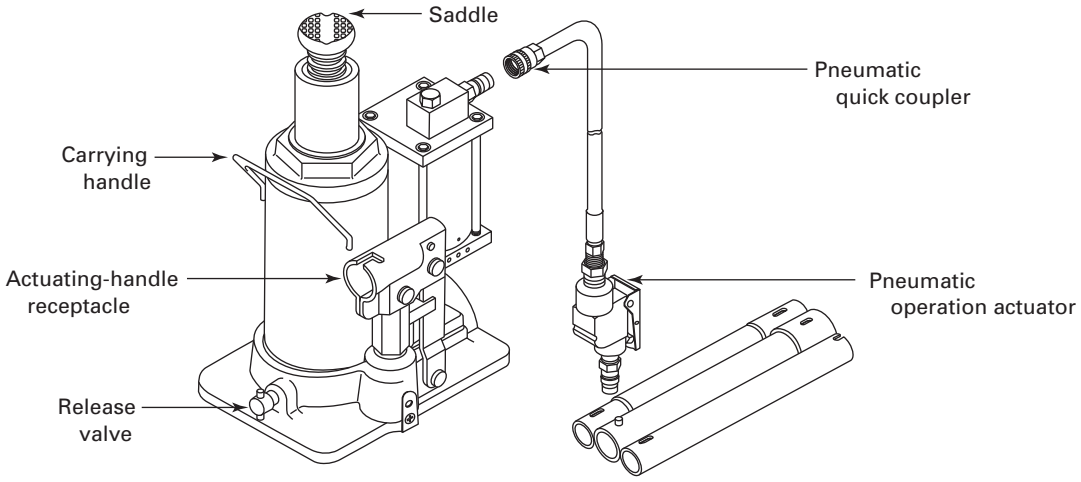
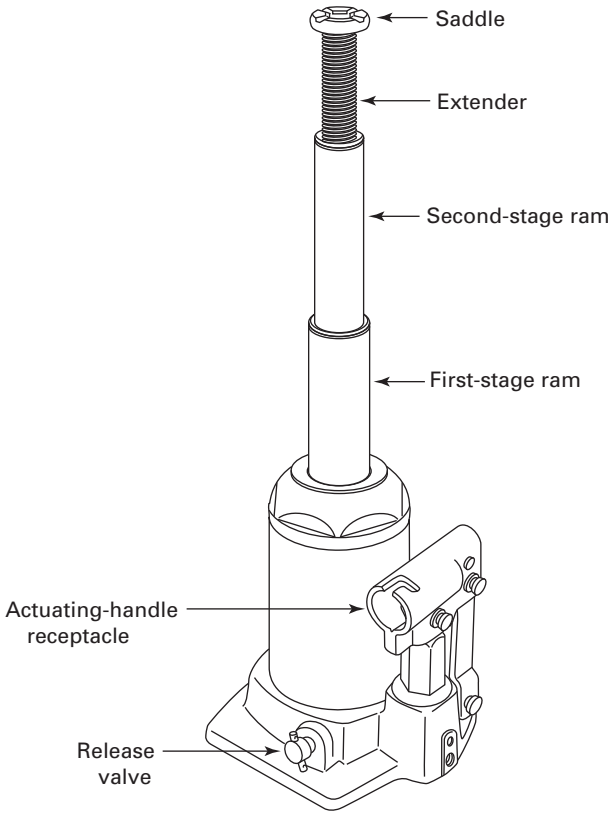


Fig. 4-1.3-4 Typical Multiple-Stage Hydraulic Hand Jack



4-4 DESIGN QUALIFICATION TESTING

4-4.1 Proof Tests

For each design or design change that may affect the jack's ability to meet this Standard, sample jacks built to design specifications shall be proof tested. To conform to this Standard, the jacks shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected. Multiple rated jacks shall be tested at the full extension of the first stage and last stage.

4-4.1.1 Angular Load Test. A proof load as defined in para. 4-2.5 shall be applied to the saddle of the jack with the extender, if so equipped, fully extended, and the jack at its full extension while the jack's vertical axis is at a 5-deg angle relative to the axis of the applied load.

4-4.1.2 Load-Limiting Device Test. The load-limiting device shall activate when the jack is lifting no less than 100% of rated capacity but no more than 125% of rated capacity. Jacks with multiple-stage hydraulics shall meet these requirements with the final stage extended at least 1.0 in. (25.4 mm) above its low height.

4-4.1.3 Release Valve Test. A load equal to or greater than the rated capacity shall be applied to the saddle with the jack at its full extension. The release valve shall be operated to control the rate of descent to no more than 1.0 in./sec (25.4 mm/s).

4-4.1.4 Load-Sustaining Test. A proof load, as defined in para. 4-2.5, shall be applied to the saddle of the jack with the extender, if so equipped, fully extended. The load shall not lower more than 0.125 in. (3.18 mm) in the first minute nor more than a total of 0.1875 in. (4.76 mm) in 10 min. The initial measurement shall be taken when the load is applied, and the other measurements at the time period specified.

Part 5
Transmission Jacks

5-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

5-1.1 Scope

This Part applies to transmission jacks that are used to support and stabilize transmissions, differential assemblies, and related components during installation in or removal from automobiles and trucks.

5-1.2 Classification

Hydraulic, pneumatic, and mechanical are the classifications for which this Part applies. When a combination of these force-transmitting means is used, each system shall be tested to conform with this Part.

5-1.3 Illustrations

Figures 5-1.3-1 and 5-1.3-2 show typical transmission jacks covered by this Part; the illustrations are not intended to be all-inclusive.

5-1.4 Definitions

controls, tilt: controls provided to adjust the angular position of the lift platform assembly about two principal independent axes (longitudinal and transverse).

jack, hydraulic transmission: a device that utilizes a hydraulic pump to raise and lower an automotive transmission into position for assembly and disassembly.

jack, mechanical transmission: a transmission jack that utilizes mechanical means, such as levers, cables, gears, screws, ratchets, and pawls.

jack, pneumatic transmission: a transmission jack that employs compressed air as the force-transmitting medium.

jack, transmission: a mobile lifting device having a lift platform assembly suited to retaining an automotive transmission and other driveline components such as transfer cases and transaxles, and designed to support and stabilize the component during its installation in or removal from a vehicle.

lift platform assembly: the portion of the PASE that contacts the transmission or differential assembly and includes the brackets, adapters, and load restraints provided by the manufacturer.

load restraint: a device supplied by the manufacturer to retain the load on the lift platform.

mechanism, tilt: a device that allows the lifting member to be angularly adjusted relative to the horizontal plane.

5-2 DESIGN

5-2.1 Operating Controls

Operating controls shall be designed in such a manner that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls should be clear to the operator by position, function, labeling, or a combination thereof. The release system shall require intentional positive action by the operator for release to prevent accidental lowering.

5-2.2 Actuating-Handle Force

Transmission jacks shall be capable of lifting the load at rated capacity when the operator, while in the operating position, exerts force on the lifting-device actuating handle. The actuating handle shall be capable of being operated to the jack's rated capacity without sustaining functional damage.

5-2.3 Internal Load-Limiting Device

All hydraulic transmission jacks shall have an internal load-limiting device that can be deactivated during the proof load test. The load-limiting device shall activate when lifting no less than 100% of rated capacity but no more than 125% of rated capacity.

5-2.4 Mobility

The force to move the transmission jack when loaded to rated capacity shall be accomplished by the operator pushing or pulling the jack. Wheels and/or casters shall be configured to allow movement in the desired direction of travel.

5-2.5 Lift Platform Assembly

The lift platform assembly shall be equipped with load restraints and adapters and shall be capable of sustaining a proof load, as defined in para. 5-2.7, at any angle within the desired tilt range to a maximum of 10 deg in all directions. Provision shall be made to prohibit separation of the jack and the lift platform assembly when the lift platform assembly is loaded.

Fig. 5-1.3-1 Typical Hydraulic Transmission Jack

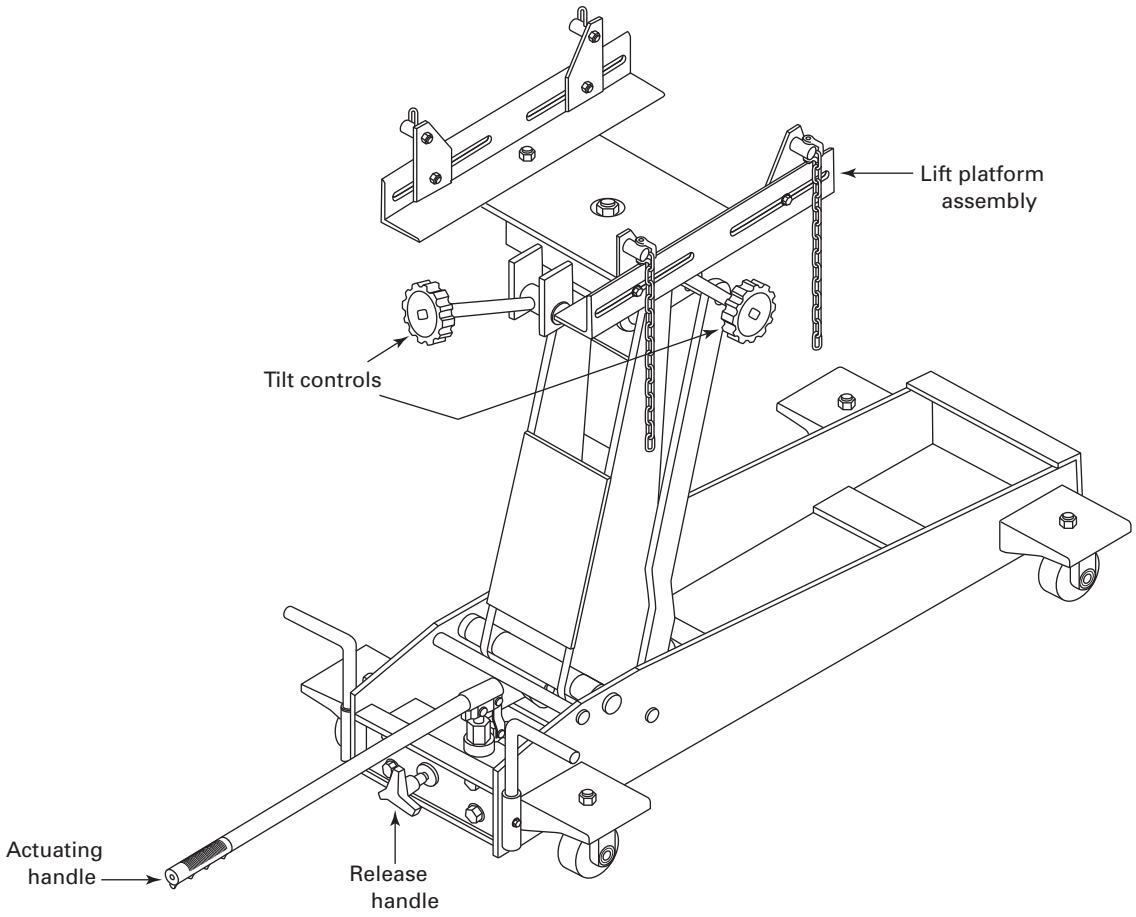
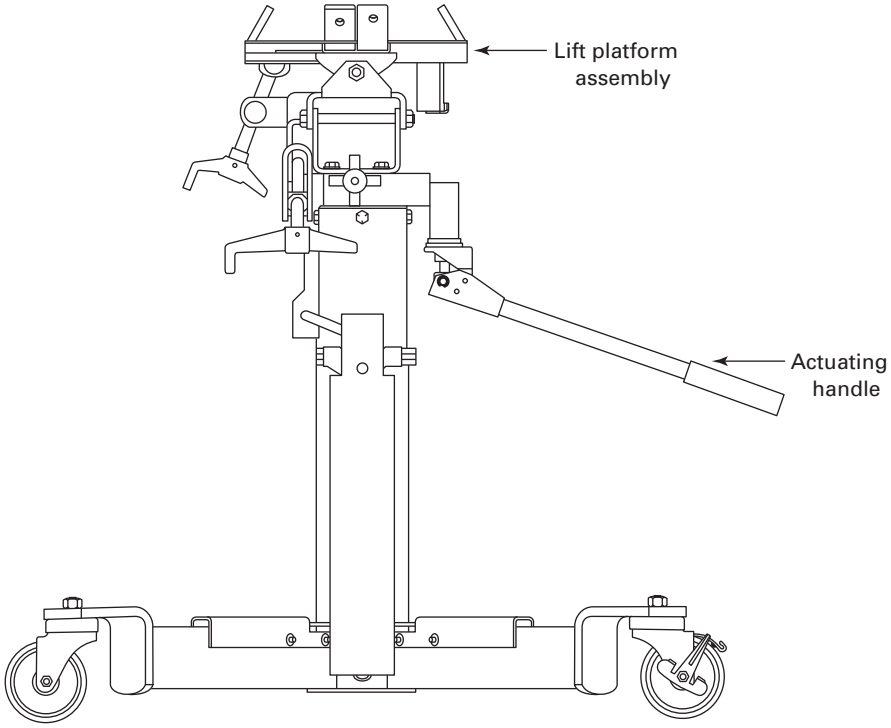
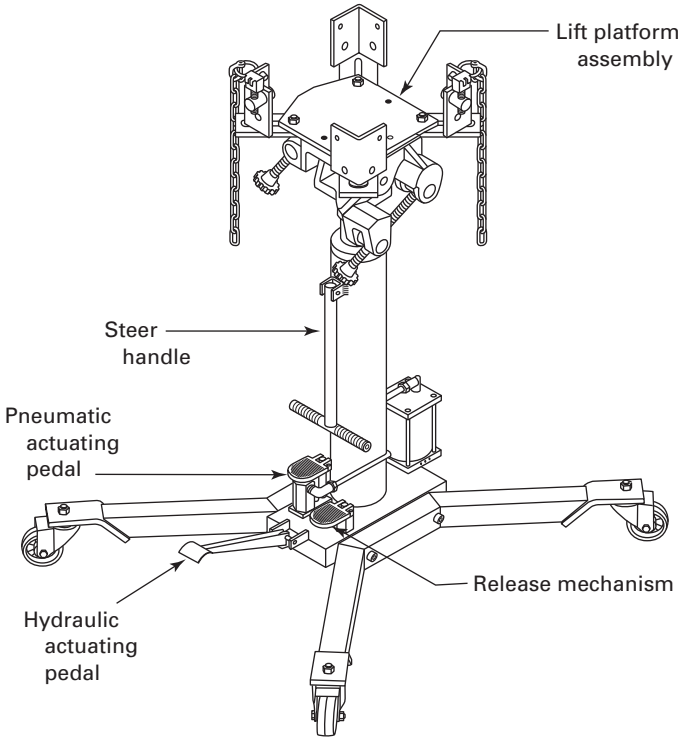


Fig. 5-1.3-2 Typical Pneumatic/Hydraulic Transmission Jacks



(a)



(b)

5-2.6 Tilt Control

When tilt control adjustment mechanisms are provided, they shall require intentional positive action by the operator to change the angle of tilt.

5-2.7 Proof Load

All transmission jacks shall be capable of performing the proof load test of para. 5-4.1.3 with a proof load of 150% of rated capacity.

5-2.8 Travel Limit

Each transmission jack shall be provided with a positive means to prevent the load from being raised or lowered beyond the design limit of travel.

5-2.9 Adapters

All adapters manufactured specifically for a jack shall be capable of performing their intended function with that jack. All adapters shall be capable of supporting a proof load of 150% of the load they are designed to support with the lift platform at any angle within the designed tilt range to a maximum of 10 deg in all directions.

5-3 SAFETY MARKINGS AND MESSAGES

5-3.1 Safety Markings

Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings:

(a) Study, understand, and follow all instructions before operating this device.

(b) Do not exceed rated capacity.

(c) Use only on a hard, level surface.

(d) Adequately support the vehicle before starting repairs.

(e) Failure to heed these markings may result in personal injury and/or property damage.

(f) Use of this product is limited to the removal, installation, and transportation in the lowered position, of transmissions, transfer cases, and transaxles.

5-3.2 Safety Messages

Additional safety messages include the following:

(a) No alterations shall be made to this product.

(b) Only attachments and/or adapters supplied by the manufacturer shall be used.

5-4 DESIGN QUALIFICATION TESTING

5-4.1 Proof Tests

For each design or design change that may affect the jack's ability to meet this Standard, sample jacks built to design specifications shall be proof tested. To conform to this Standard, the jacks shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected.

5-4.1.1 Loaded Operational Test. The tests specified in paras. 5-4.1.1-1 through 5-4.1.1-5 shall be conducted with a deadweight load not less than the rated capacity of the jack and configured such that the entire load is above the lifting platform; the load shall be centrally located and restrained by the lifting platform.

The center of gravity (CG) of the deadweight load shall be as listed in the following table, as defined by the jack's rated capacity:

Capacity, lb (kg)	CG of Load Above the Lift Platform, in. (mm)
500 (227)	5.5 (139.7)
1,000 (454)	7.5 (190.5)
2,000 (907)	10.0 (254.0)

5-4.1.1.1 Release Mechanism Test. With the jack fully extended, the release mechanism shall be operated to control the rate of descent to no more than 1.0 in./sec (25.4 mm/s).

5-4.1.1.2 Tipping Test. The jack shall support the deadweight load, as defined in para. 5-4.1.1, with the lift platform at maximum height and tilted to its greatest angle in all directions. The jack shall be moved forward and backward at least 1 ft (305 mm) without the wheels or casters lifting from the surface. The force to move the jack shall be applied closely beneath the lift platform.

5-4.1.1.3 Mobility Test. The jack, with the lift platform at the lowest possible lift height, shall be moved in any direction over the floor surface. The jack, while loaded as described in para. 5-4.1.1, shall be moved at 1.5 ft/sec (457 mm/s) to 2.0 ft/sec (610 mm/s) across a 0.5-in. (12.7-mm) high, 15-deg-slope rise in the floor and a 0.5-in. (12.7-mm) drop to the floor, at an approach angle that will bring only one caster or wheel at a time in contact with the rise and drop. The jack shall traverse the rise and drop without loss of load or tipping over.

5-4.1.1.4 Stability Test. The jack, with the lift platform at the lowest possible lift height, shall be moved at 1.5 ft/sec (457 mm/s) to 2.0 ft/sec (610 mm/s) against a 2.0-in. (51-mm) high vertical rise 90 deg to the direction of movement at an approach angle that will bring two wheels or casters in contact with the rise at the point of greatest instability. The jack shall not lose the load or tip over.

5-4.1.1.5 Load-Sustaining Test. With the lift platform at its maximum height, the jack shall sustain the load and shall not lower more than 0.125 in. (3.18 mm) in the first minute nor more than a total of 0.1875 in. (4.76 mm) in 10 min. The initial measurement shall be taken when the load is applied, and the other measurements at the time period specified.

5-4.1.2 Load-Limiting Device Test. The load-limiting device in hydraulic transmission jacks shall activate when lifting no less than 100% of rated capacity but no more than 125% of rated capacity. Jacks with multiple-stage hydraulics shall meet these requirements with the final stage extended at least 1.0 in. (25.4 mm) above its low height. Jacks with lift arms shall meet these requirements with the lift arm in the horizontal position.

5-4.1.3 Proof Load Test. A proof load, as defined in para. 5-2.7, shall be applied centrally to the lifting platform of the jack. The load shall be lifted and sustained throughout the lifting range. For purposes of this test, any internal load-limiting device should be deactivated.

Part 6
Engine Stands

6-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

6-1.1 Scope

This Part applies to self-contained portable engine stands designed primarily to support an automobile engine while the engine is being rebuilt or repaired. This Part does not apply to permanently mounted engine stands.

6-1.2 Classification

This Part applies to self-contained portable engine stands of single- or twin-post construction.

6-1.3 Illustrations

Figures 6-1.3-1 and 6-1.3-2 show typical engine stands covered by this Part; the illustrations are not intended to be all-inclusive.

6-1.4 Definitions

attachments: a means to adapt to various automotive components and engine bolt patterns through the use of separate adapters or adjustable arms that fasten to a mounting plate.

engine stand: an automotive engine mounting device equipped with suitable means to support, rotate, and lock the engine in a working position.

frame: a structure consisting of at least one upright column equipped with a means to accept a mechanical rotating mechanism.

mechanical rotating mechanism: a device that provides controlled rotation of the mounting plate.

plate, mounting: a component of the PASE lifting or rotating mechanism equipped with slots or holes to accept the use of attachments or direct mounting of an automotive component.

rear: the part of the engine stand the operator faces to use the operating controls.

rotational locking device: a means to prevent unintentional movement of the mounting plates.

6-2 DESIGN

6-2.1 Operating Controls

Operating controls shall be designed in such a manner that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls should be clear to the operator by position, function, labeling, or a combination thereof. Stands shall be equipped with a handle or friction device to permit controlled rotation of the mounting plate. The release system shall require intentional positive action by the operator for release to prevent unintentional rotation of the load.

6-2.2 Proof Load

Engine stands shall be capable of performing the proof load test of para. 6-4.1.5 with a proof load of 200% of rated capacity.

6-2.3 Mechanical Rotating Mechanism

The stand shall be equipped with a rotating mounting plate for attaching the engine. Controlled rotation shall be provided by a handle or other device, which shall be retained to prevent loss. An antifriction method utilizing lubrication, bearings, or other means shall be used to ensure the operator can rotate the engine with the rotational device provided. Heavy-duty stands may employ a device to elevate the engine for clearance of the frame while rotating the engine.

6-2.4 Rotational Locking Device

The stand shall be equipped with a means to prevent rotation of the mounting plate and shall require intentional positive action by the operator to activate the device. Friction-type locking devices shall be functional in at least six equal rotational increments. The loaded rotational locking device shall remain functional in any position provided during the test of para. 6-4.1.4.

6-2.5 Attachments and Adapters

All attachments and/or adapters shall be capable of supporting a proof load of 200% of the load they are designed to support.

6-2.6 Mobility

The force to move the engine stand when loaded to rated capacity shall be accomplished by the operator pushing or pulling the stand. Wheels and/or casters shall be configured to allow movement in the desired direction of travel without veering sideways and shall have locking means to prevent movement during repair operations.

Fig. 6-1.3-1 Typical Single-Post Engine Stands

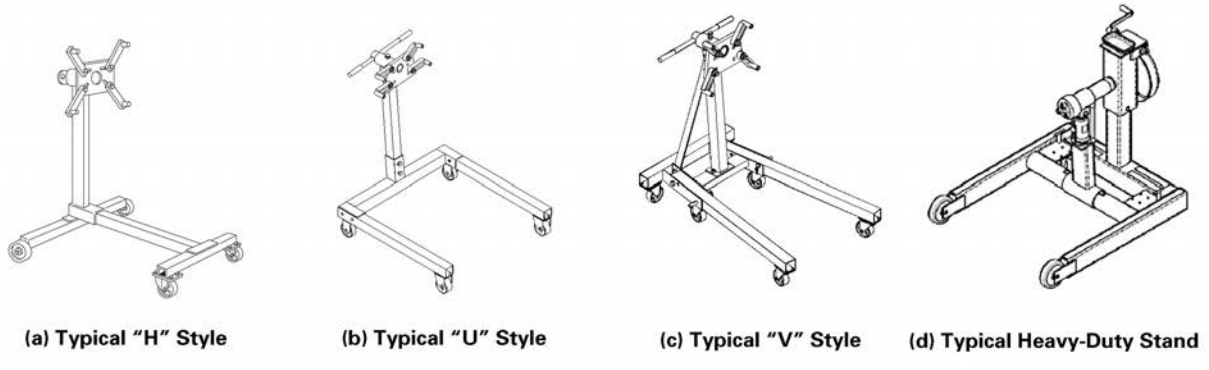
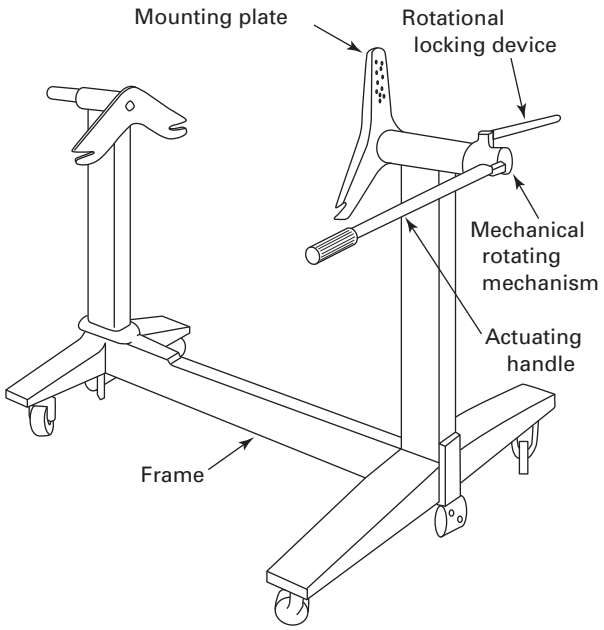


Fig. 6-1.3-2 Typical Twin-Post Engine Stand



6-2.7 Stability

Wheels and/or casters shall be positioned to provide four points of contact with the floor. The lateral spacing of the pair of wheels and/or casters supporting the front or rear shall not be less than one-half the lateral spacing of the other pair.

6-3 SAFETY MARKINGS AND MESSAGES

6-3.1 Safety Markings

Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings:

(a) Study, understand, and follow all instructions before operating this device.

(b) Do not exceed rated capacity.

(c) Use only on a hard, level surface.

(d) Lock mounting-plate rotating mechanism before applying a load.

(e) Ensure load is centered and secured to attachments.

(f) Lock the wheels and/or casters before working on the engine.

(g) Rotate the engine using the handle or device provided.

(h) Failure to heed these markings may result in personal injury and/or property damage.

6-3.2 Safety Messages

Additional safety messages include the following:

(a) Off-center loads may make the load and handle rotate in either direction when the rotational locking device is released.

(b) Release rotational locking devices slowly and carefully.

(c) No alterations shall be made to this product.

(d) Only attachments and/or adapters supplied by the manufacturer shall be used.

6-4 DESIGN QUALIFICATION TESTING

6-4.1 Proof Tests

For each design or design change that may affect the stand's ability to meet this Standard, sample stands built to design specifications shall be proof tested. The load shall be positioned a minimum of 14.5 in. (368 mm) from the mounting plate and offset 1.0 in. (25.4 mm) from the rotational axis of the mounting plate. To conform to this Standard, the stands shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected.

6-4.1.1 Mobility Test. The stand, while loaded to rated capacity with the load offset parallel to the floor, shall be moved in any direction for which the stand was designed. The stand, while loaded as described above, shall be moved at 1.5 ft/sec (457 mm/s) to 2.0 ft/sec (610 mm/s) across a 0.5-in. (12.7-mm) high, 15-deg-slope rise in the floor and a 0.5-in. (12.7-mm) drop in the floor, at an approach angle that will bring only one caster or wheel at a time in contact with the rise and drop. The stand shall traverse the rise and drop without loss of load or tipping over.

6-4.1.2 Stability Test. The stand, while loaded to rated capacity with the load offset parallel to the floor, shall be moved at 1.5 ft/sec (457 mm/s) to 2.0 ft/sec (610 mm/s) against a 2.0-in. (51-mm) high vertical rise 90 deg to the direction of movement at an approach angle that will bring two wheels or casters into contact with the rise at the point of greatest instability. The stand shall not lose the load or tip over.

6-4.1.3 Rotating Mechanism Test. The rotating mechanism, while loaded to rated capacity, shall be rotated throughout the range of rotation, without the wheels or casters lifting from the floor. This shall be performed using the supplied handle or device used for rotation. If the stand has a means to elevate the engine, the load shall be placed in the maximum elevated position.

6-4.1.4 Rotational Locking Device Test. The rotational locking device, while fully engaged, shall be subjected to a torsional load not less than 150 lb-ft (203 N·mm). The device shall sustain the load without radial movement.

6-4.1.5 Proof Load Test. A horizontally constrained vertical load, as described in para. 6-2.2, shall be applied to the stand for 10 min. The centerline of the rotational axis shall not exceed a total of 1 deg permanent deformation from the initially established angle of the rotational axis. A preload of no more than 100% of rated capacity may be applied to establish the initial condition.

Part 7
Vehicle Support Stands

7-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

7-1.1 Scope

This Part applies to stands used in pairs for supporting one end of a vehicle at predetermined heights as recommended by the stand manufacturer or supplier. This Part also applies to self-contained high-reach stands designed to support a vehicle with two or more identical pairs after the vehicle has been raised by an automotive lift and the automotive lift has been removed. This Part does not apply to devices classified as auxiliary stands (see Part 13) or devices classified as high-reach supplementary stands (see Part 15).

7-1.2 Classification

This Part applies to vehicle-support stands and high-reach stands, with or without an adjustable column or columns.

7-1.3 Illustrations

Figures 7-1.3-1 and 7-1.3-2 show typical vehicle support stands and Figs. 7-1.3-3 and 7-1.3-4 show typical high-reach stands and their components that are covered by this Standard. The illustrations are not intended to be all-inclusive.

7-1.4 Definitions

base: that portion of the stand that rests on the ground and holds the column.

column: that portion of the stand that can be either fixed or extended and retracted to vary the overall height.

freestanding: when initially positioned vertically, without a load, able to stand upright without the application of external forces.

high-reach stands: self-contained devices to be used to support a vehicle after the vehicle has been raised by an automotive lift and the lift has been removed.

locking device: the mechanism used to hold the column in the selected height position.

vehicle support stands: devices for supporting one end of a vehicle at fixed heights but lacking the means for raising and lowering the vehicle.

7-2 DESIGN

7-2.1 Base

The base may be any configuration that provides the equivalent of three or more points of contact with the ground. A circular, triangular, or polygon base shape (see Fig. 7-1.3-2) is considered equivalent to the above. The upper portion of the base structure shall be designed to house and guide the column.

7-2.2 Column

Stands utilizing rack-and-pawl-type locks [see Fig. 7-1.3-1, illustration (b)] shall have a means provided to prevent the inadvertent separation of the column from the base. In the fully retracted position, the lower end of the column shall not extend below the plane made where the base contacts the ground. The column-and-base juncture of high-reach stands shall be configured to eliminate potential for a pinch point between the base and the column when the column is fully retracted.

7-2.3 Locking Device

The locking device shall prevent adjustment of the column height after the load has been applied. If the column is supported by means of a locking pin, the pin shall be attached to the stand to prevent its removal.

7-2.4 Operating Controls

Operating controls shall be designed in such a manner that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls should be clear to the operator by position, function, labeling, or a combination thereof. The release system shall require positive action by the operator for release to prevent accidental lowering.

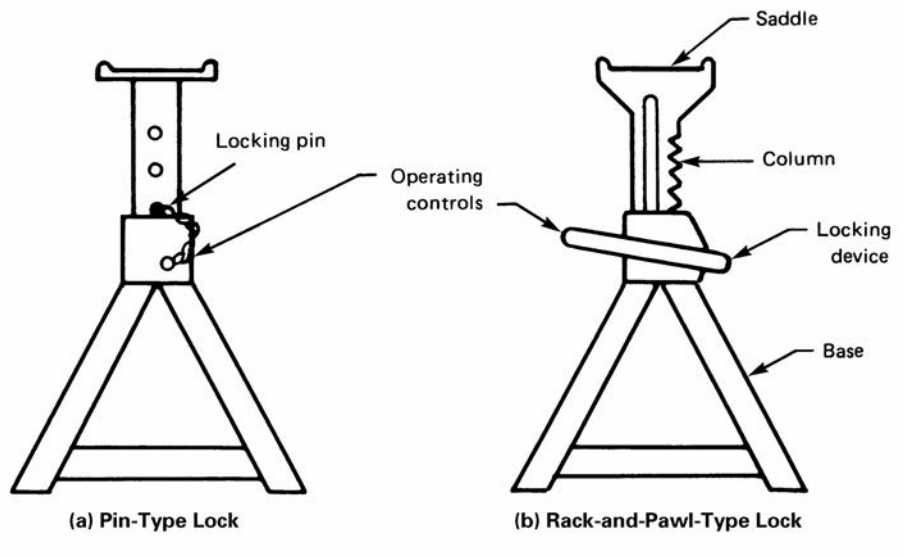
7-2.5 Saddle

The saddle configuration shall be such as to aid in the proper positioning, supporting, and retaining of the load.

7-2.6 Wheels

If wheels are provided on the base to facilitate relocation of the stand, then the wheels shall not be subject to load when the stand is loaded.

Fig. 7-1.3-1 Typical Vehicle Support Stands



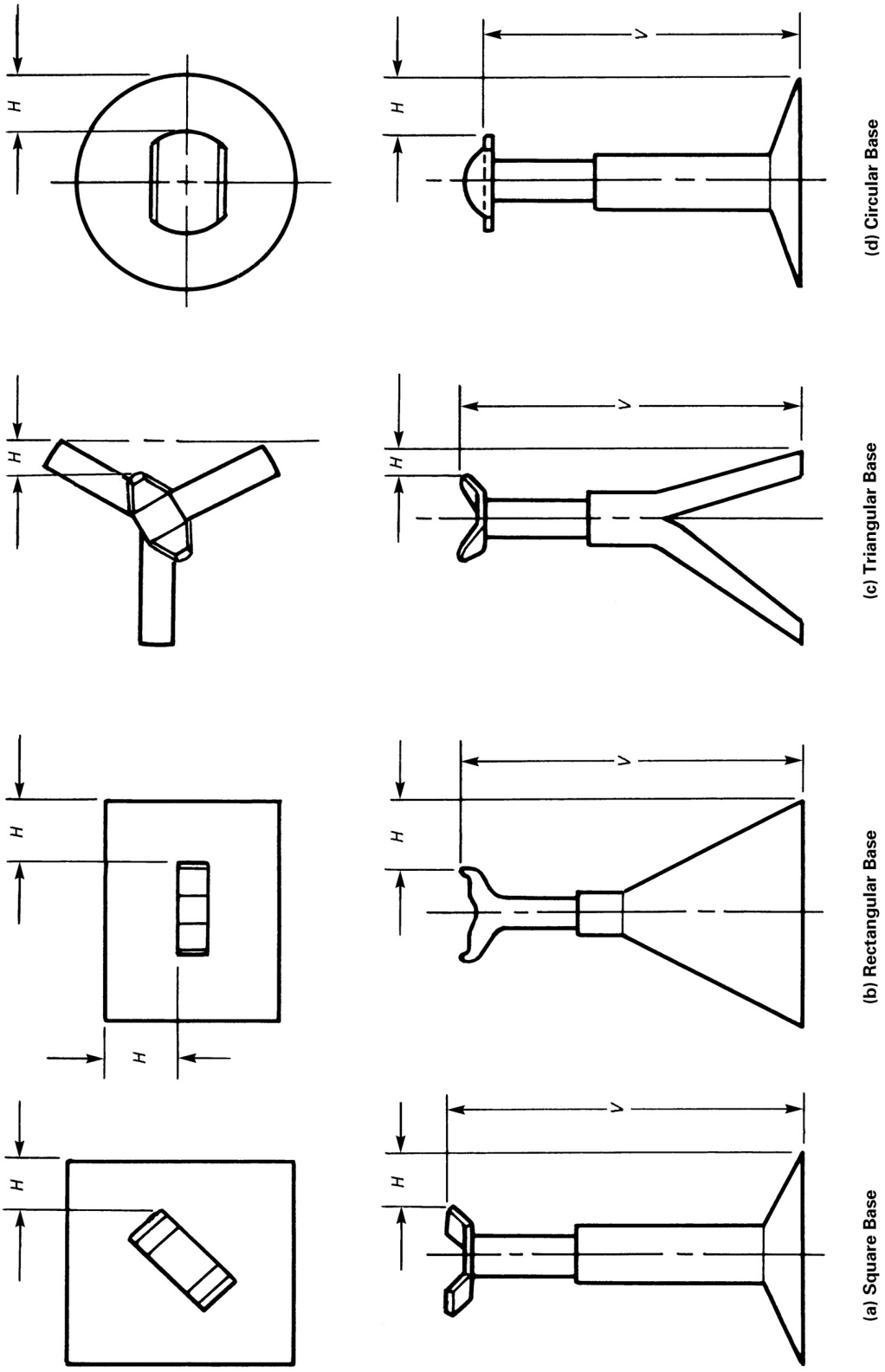
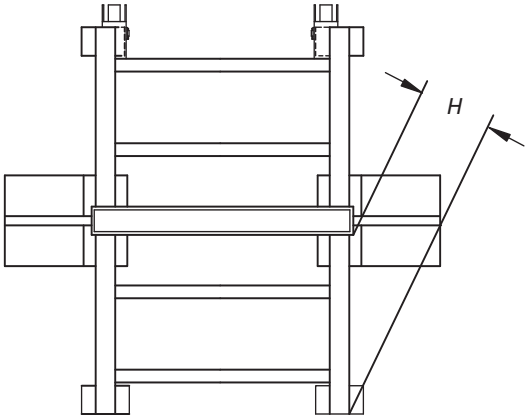
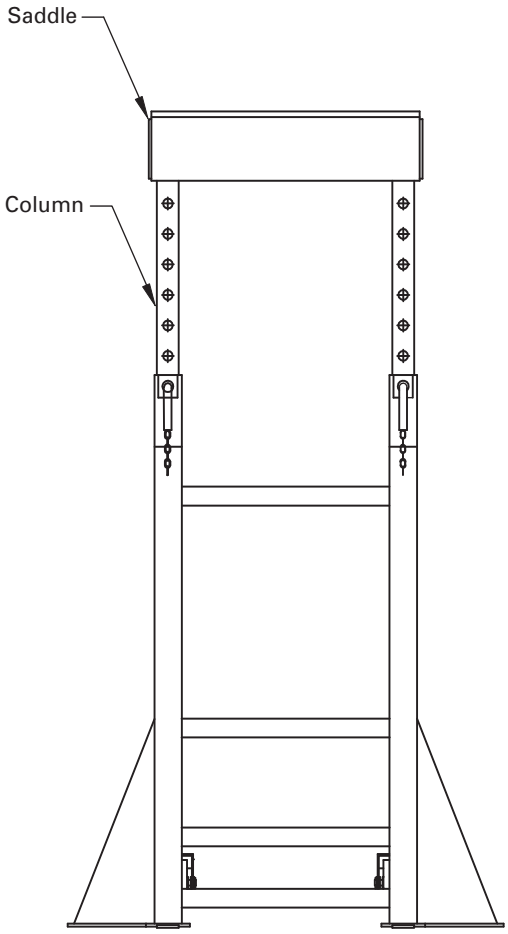


Fig. 7-1.3-2 Horizontal Dimensions and Vertical Heights for Stability Considerations

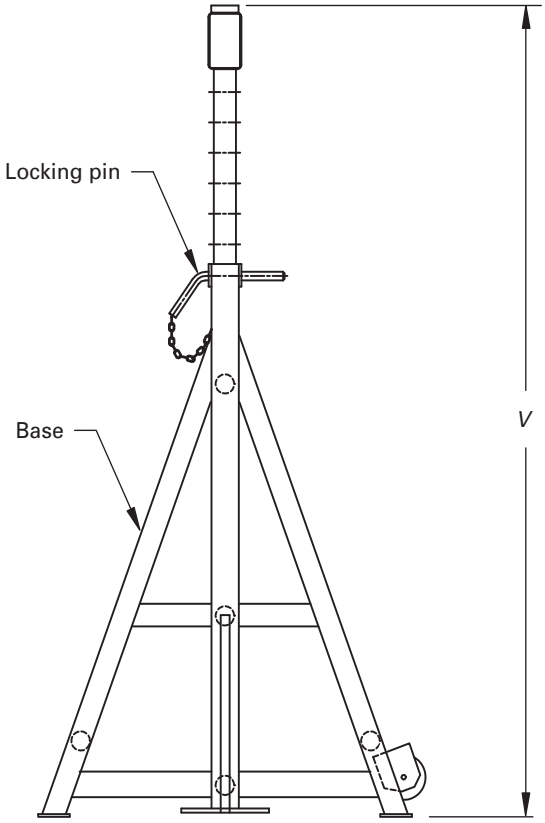
Fig. 7-1.3-3 Typical High-Reach Fixed Stand, Saw Horse Type



(a) Top View

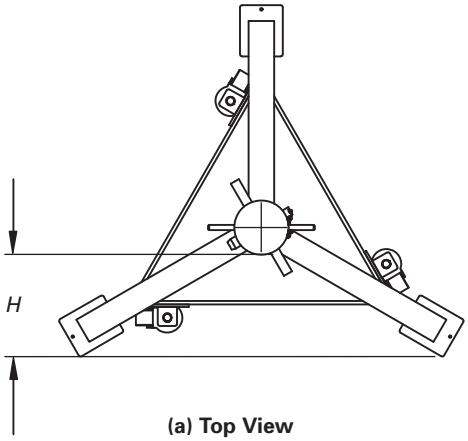


(b) Side View

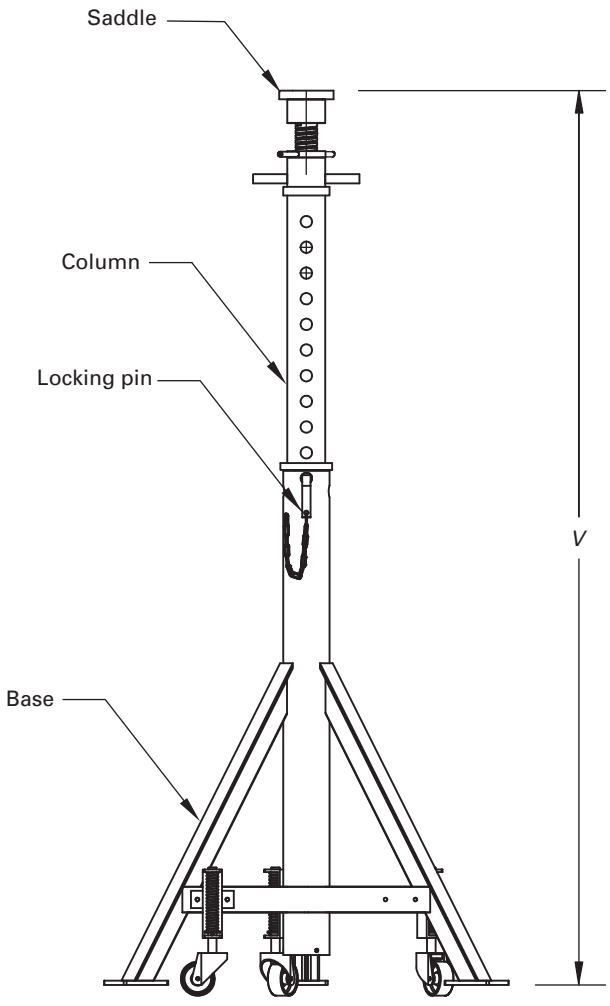


(c) End View

Fig. 7-1.3-4 Typical High-Reach Fixed Stand, Tripod Type



(a) Top View



(b) Side View

7-2.7 Stability

The stands shall be designed so that the minimum horizontal distance from the projected edge of the saddle to the nearest edge of the base shall be at least 8% of the maximum extended vertical height when the column is moved by hand to remove all slack in the direction of the vertical measurement. See Fig. 7-1.3-2, in which the horizontal dimension is shown as *H* and the vertical height as *V*.

7-2.8 Proof Load

Each vehicle support stand and high-reach stand shall be capable of performing the proof load test of para. 7-4.1.2 with a load of 200% of rated capacity.

7-3 SAFETY MARKINGS AND MESSAGES

7-3.1 Safety Markings

Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings:

(a) For Vehicle Stands

(1) Study, understand, and follow all instructions before operating this device.

(2) Use as a matched pair only.

(3) Maximum load capacity per matched pair shall not exceed the rated capacity of the individual stand.

(4) Use stands to support one end of a vehicle only.

(5) Use only on a hard, level surface.

(6) Center load on saddle.

(7) Failure to heed these markings may result in personal injury and/or property damage.

(b) For High-Reach Stands

(1) Study, understand, and follow all instructions before operating this device.

(2) Use a minimum of four stands to support and stabilize a vehicle, and a minimum of two additional stands for each additional axle assembly, before starting repairs.

(3) Do not exceed rated capacity.

(4) Use only on a hard, level surface.

(5) The vehicle shall be raised only once to place vehicle support stands under the entire vehicle.

(6) Ensure stands are stable and vehicle is balanced before lowering the vehicle onto stands.

(7) Locate saddles at vehicle manufacturer's designated support points.

(8) Carefully lower the vehicle onto all stands simultaneously.

(9) Center load on saddles.

(10) Do not apply horizontal forces or large torque loads to vehicle while the vehicle is supported on stands.

(11) Do not start engine while the vehicle is supported on stands.

(12) Failure to heed these markings may result in personal injury and/or property damage.

7-3.2 Safety Messages

Additional safety messages include the following:

(a) For Vehicle Stands

(1) Stands are not to be used to simultaneously support both ends of a vehicle.

(2) No alterations shall be made to this product.

(b) For High-Reach Stands

(1) Only attachments, restraints, or adapters supplied by the manufacturer shall be used.

(2) No alterations shall be made to this product.

7-4 DESIGN QUALIFICATION TESTING

7-4.1 Proof Tests

For each design or design change that may affect the stand's ability to meet this Standard, a sample stand built to design specifications shall be proof tested. To conform to this Standard, the stand shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected. For a stand that incorporates multiple load-holding devices within a single assembly, each device shall be tested independently.

7-4.1.1 Off-Center Load Test. A horizontally constrained vertical load equal to rated capacity shall be applied. The column shall be moved by hand to remove all slack laterally toward the point of load application, in both the fully extended position and the lowest possible position of the column that can be achieved regardless of whether the locking device is engaged, for at least 10 min on the lug or edge of the saddle as shown in Fig. 7-4.1.1-1. The saddle's ability to retain the load shall not be adversely affected by this test. A permanent reduction in height, measured after the removal of the load, at the point of load contact as shown in Fig. 7-4.1.1-2 shall not exceed 0.125 in. (3.18 mm). The test shall be repeated on all lugs and edges. A preload of no more than 100% of rated capacity may be applied and removed to establish initial overall height.

7-4.1.2 Proof Load Test. A proof load, as defined in para. 7-2.8, shall be applied centrally to the saddle, with the column in both the fully extended position and the lowest possible position of the column that can be achieved regardless of whether the locking device is engaged, with the base resting on a hard, level surface. The load shall be applied as shown in Fig. 7-4.1.1-2 for at least 10 min. A permanent reduction in overall height, measured after the removal of the load, at the point of load contact shall not exceed 0.125 in. (3.18 mm). A preload of no more than 100% of rated capacity may be applied and removed to establish initial overall height.

Fig. 7-4.1.1-1 Application of Load for Off-Center Load Test

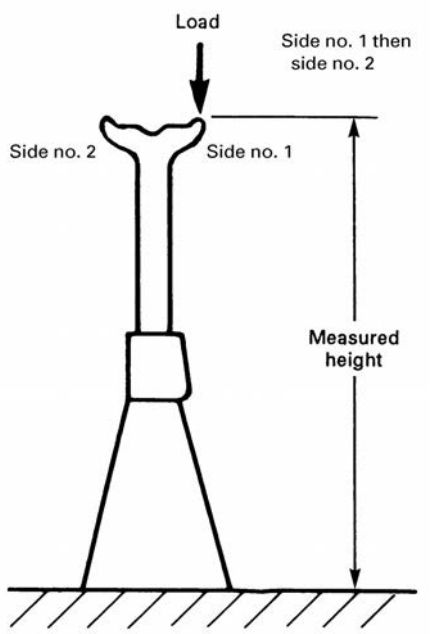
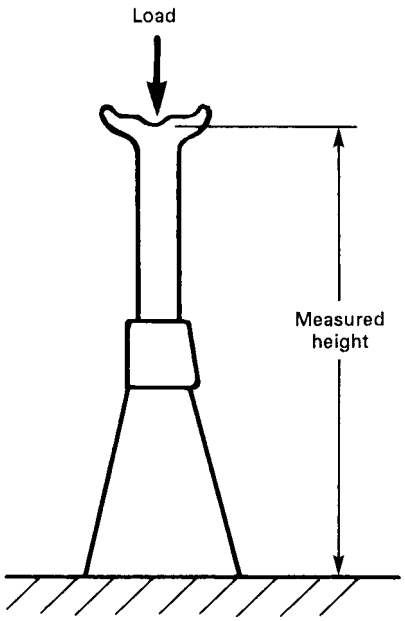


Fig. 7-4.1.1-2 Application of Load for Centered Load Test



Part 8
Emergency Tire-Changing Jacks

8-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

8-1.1 Scope

This Part applies to self-contained, emergency tire-changing jacks designed for lifting one wheel clear of the ground for emergency tire changing and for mounting tire chains on passenger cars, vans, and light-duty trucks.

8-1.2 Classification

The classifications for which this Part applies are as follows:

(a) mechanical screw jacks consisting of concentric telescoping screws, or a single screw, that actuate a rocker panel adapter, extended and retracted by a gear system, for engaging a vehicle frame or unibody

(b) mechanical bumper jacks consisting of a lever-actuated ratchet or a screw-and-nut system, for engaging a vehicle bumper system

(c) scissors jacks (mechanical, electrical, hydraulic, or pneumatic actuation) consisting of linkages united by pivotal joints for engaging a vehicle frame or unibody

(d) mechanical frame jacks consisting of a lever-actuated ratchet for engaging a vehicle frame or unibody

(e) hydraulic jacks similar to hydraulic hand jacks, for engaging a vehicle frame or unibody

8-1.3 Illustrations

Figures 8-1.3-1 through 8-1.3-4 show typical screw, bumper, scissors, and frame jacks, respectively, covered by this Part. The illustrations are not intended to be all-inclusive.

8-1.4 Definitions

bumper adapter: that portion of the jack that engages the vehicle manufacturer's specified lift point on the bumper.

durability test: a test to verify the jack's minimum cycle life and its load-lifting and load-sustaining capabilities.

front and rear GAWR (passenger car): the passenger-car front and rear gross axle weight rating (GAWR), as supplied by the vehicle manufacturer. This is model specific. In addition, the GAWR includes the sum of the weight reactions, shared by the appropriate wheels, of the following:

(a) the vehicle weight

(b) all fluid weight

(c) the sum of the weights of all options weighing 5 lbm (2.27 kg) or more

(d) the total luggage or cargo weight

(e) the total passenger load

front and rear GAWR (truck): the maximum load-carrying capacity of the front and rear axle systems, as supplied by the vehicle manufacturer. This rating is model specific.

GVWR (truck): the maximum gross vehicle weight rating (GVWR) of a fully loaded vehicle, as supplied by the vehicle manufacturer. This is predicated on the equipment ratings of the front and rear axles, but is always less than the arithmetic sum of the front and rear GAWRs.

maximum GVWR (passenger car): the passenger-car maximum gross vehicle weight rating (GVWR), as supplied by the manufacturer. This is model specific and usually includes the sum of the following:

(a) the vehicle base weight

(b) all fluid weight

(c) the sum of the weights of all options weighing 5 lbm (2.27 kg) or more

(d) the total luggage or cargo weight

(e) the total passenger load

(f) the same "added factor" or similar fixed weight that was assigned to either the front or rear to account for the additive effect of small weight increases not anticipated during the model run

rocker panel adapter: that portion of the jack that engages the vehicle manufacturer's specified lift point on the rocker panel.

8-2 DESIGN

8-2.1 Operating Controls

Operating controls shall be designed in such a manner that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls should be clear to the operator by position, function, labeling, or a combination thereof. The handle shall be capable of being operated to the jack's rated capacity without sustaining functional damage. To prevent accidental lowering, the jack shall require intentional positive action by the operator for lowering the load.

Reciprocating handles shall require no more than 65 lbf (288 N) to operate, and rotating handles shall require no more than 18 lbf (80 N) to operate, when lifting a load at rated capacity.

Fig. 8-1.3-1 Typical Screw Jack

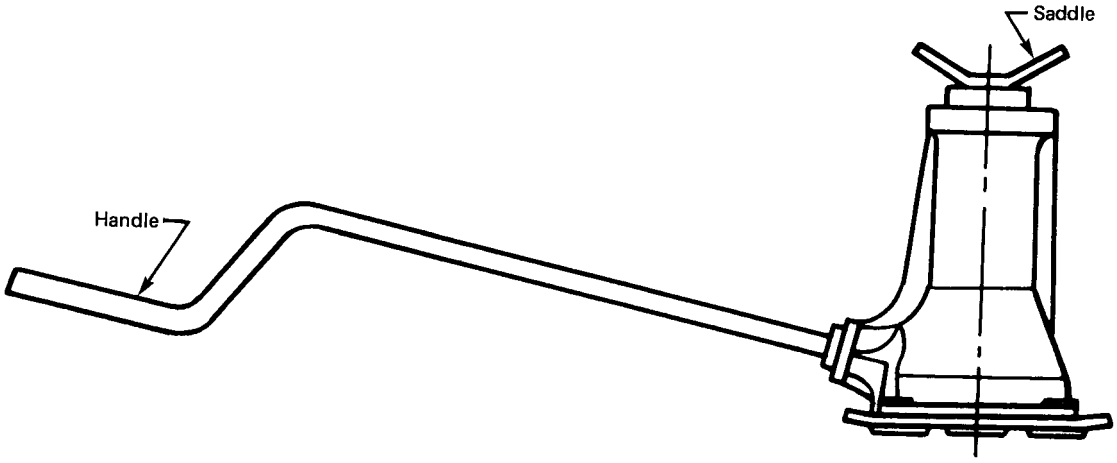


Fig. 8-1.3-2 Typical Bumper Jack

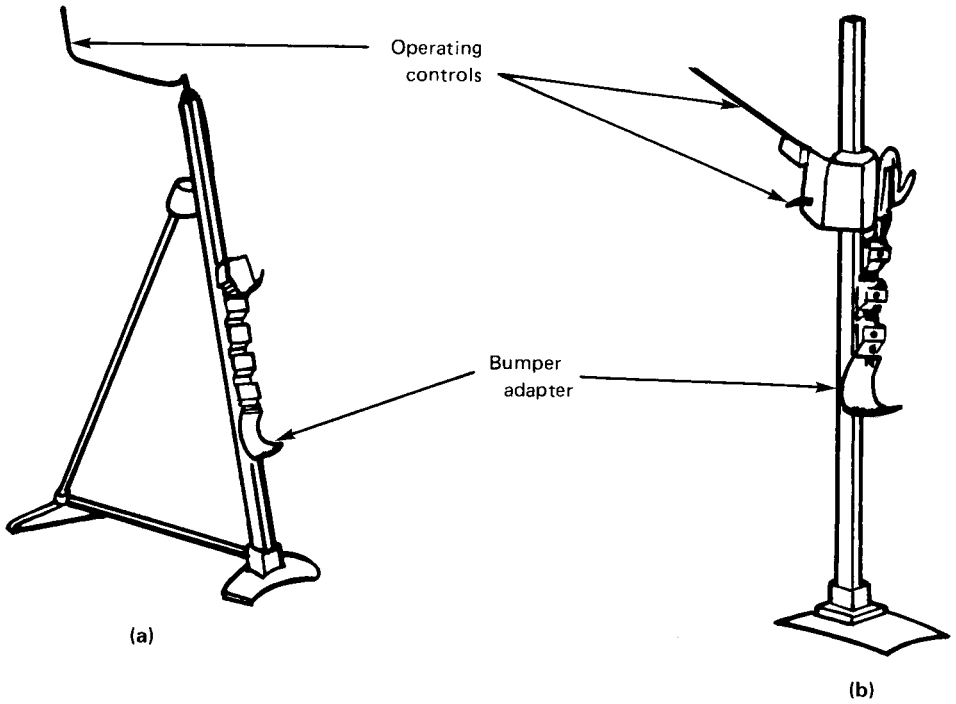


Fig. 8-1.3-3 Typical Scissors Jack

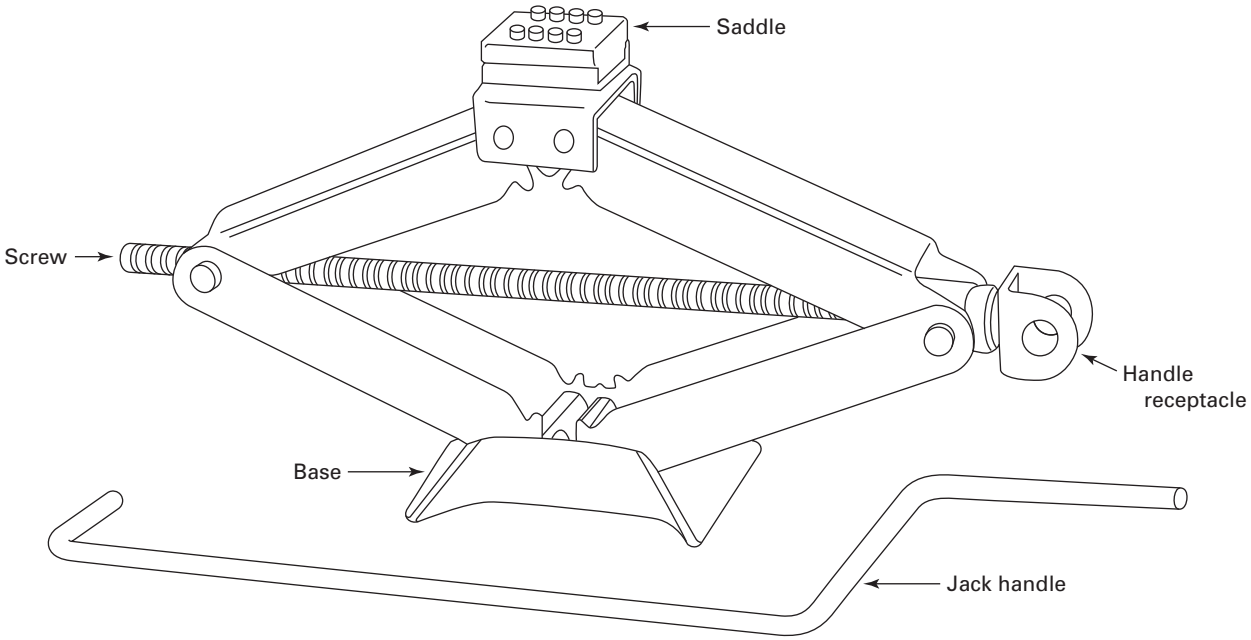
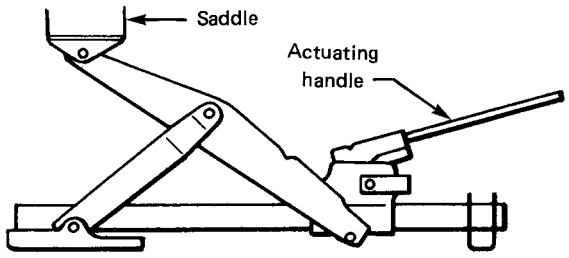


Fig. 8-1.3-4 Typical Frame Jack



8-2.2 Design Requirements

(a) The minimum rated capacity of the jack shall be equal to 50% of the GVWR of the intended vehicle.

(b) The jack may have a detachable handle, saddle, or rocker panel adapter so configured as to enable proper engagement with the vehicle frame or unibody at the lift points recommended by the vehicle manufacturer.

(c) The jack shall be capable of lifting and sustaining its rated capacity throughout its range of travel.

(d) Jack design shall accommodate the path of travel of the vehicle manufacturer's recommended jacking points throughout the full range of travel.

(e) It shall not be possible to assemble the jack incorrectly.

(f) Each jack shall be provided with a positive means to prevent inadvertent disassembly.

(g) The projected area of the base shall be sufficient to result in a maximum bearing pressure of 50 psi (344.74 kPa) when the jack is loaded to rated capacity.

8-2.3 Travel Limits

Each jack shall be provided with a positive means to prevent the load from being raised or lowered beyond the designed limit of travel.

8-2.4 Proof Load

Each jack shall be capable of performing the proof load test of para. 8-4.1.5 with a proof load of 200% of rated capacity.

8-2.5 Hinge Points

All hinge points shall be designed and assembled to resist lateral movement detrimental to the jack's performance.

8-2.6 Lubrication

The jack shall be lubricated by the manufacturer.

8-3 SAFETY MARKINGS AND MESSAGES

8-3.1 Safety Markings

Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings. The jack shall also include markings to identify those vehicles with which the jack shall be used.

(a) Study, understand, and follow all instructions before operating this device.

(b) Do not exceed rated capacity.

(c) Use only on a hard, level surface.

(d) Use only for emergency tire changing or for mounting tire chains.

(e) Never get beneath the vehicle when it is supported by the jack.

(f) If vehicle is pushed off of the jack, discard jack. Do not reuse.

(g) Failure to heed these markings may result in personal injury and/or property damage.

8-3.2 Safety Messages

Additional safety messages include the following:

(a) Activate the hazard warning flasher, turn off ignition, set parking brake, and move automatic shift selector to park position. In case of a manual transmission, move gear selector into reverse position. In addition, the wheel diagonally opposite from the wheel being lifted shall be chocked in both directions.

(b) Place jack only at points of the vehicle as specified by the vehicle manufacturer.

(c) Follow tire-changing procedure or tire-chain-mounting procedure specified in the vehicle manufacturer's owner's manual.

(d) No alterations shall be made to this product.

8-4 DESIGN QUALIFICATION TESTING

8-4.1 Proof Tests

For each design or design change that may affect the jack's ability to meet this Standard, sample jacks built to design specifications shall be proof tested. To conform to this Standard, the jacks shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected.

8-4.1.1 Laboratory Test. A new jack assembly shall be used to raise a load applied to the saddle, bumper adapter, or rocker panel adapter, through contact with a fixture simulating the vehicle jacking point. For mechanical screw jacks and mechanical bumper jacks, the load shall be equal to or greater than the rated capacity throughout 28 lifts. For scissors jacks and mechanical frame jacks, the load shall be equal to the load specified by the height-to-weight curve ±10% throughout 28 lifts. The operating handle force shall be measured during this test.

8-4.1.2 Vehicle Test. A new jack assembly shall be tested on an appropriately loaded passenger car in which the jack's maximum rated capacity is equal to 50% of the GVWR.

On vans and light-duty trucks, the rear axle shall be loaded to its rear GAWR. Additional weight shall be added to the front of the vehicle to attain front GAWR.

The test vehicle shall be raised on a hard, level surface from a flat-tire position to a 2.0-in. (51-mm) ground clearance, with an inflated maximum-size tire–wheel combination, for a total of 28 lifts, with an equal number of lifts at each jacking point recommended by the vehicle manufacturer.

8-4.1.3 Stability Test (Push Off). A new jack assembly shall be tested on an appropriately loaded passenger car in which the jack's maximum rated capacity is equal to 50% of the GVWR.

Fig. 8-4.1.4-1 Stability Test — Compound Slope (Downgrade)

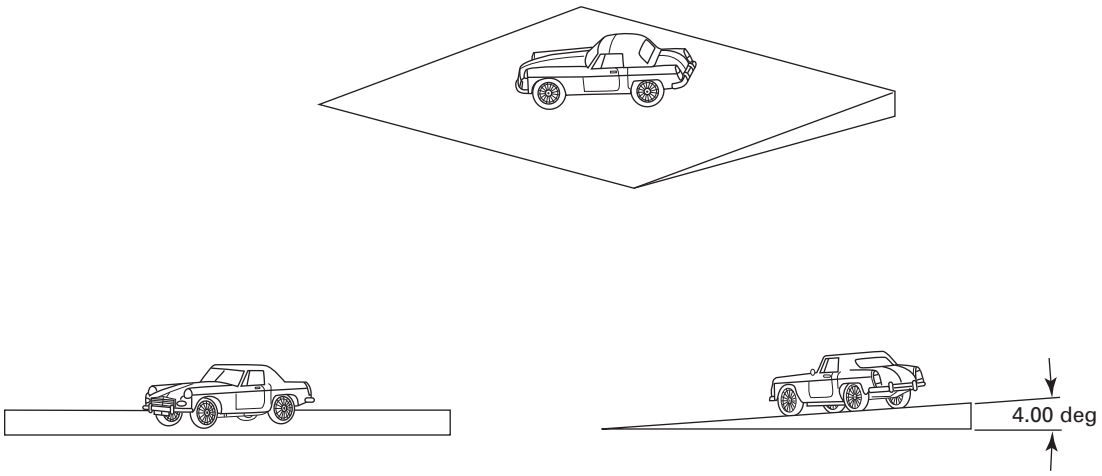
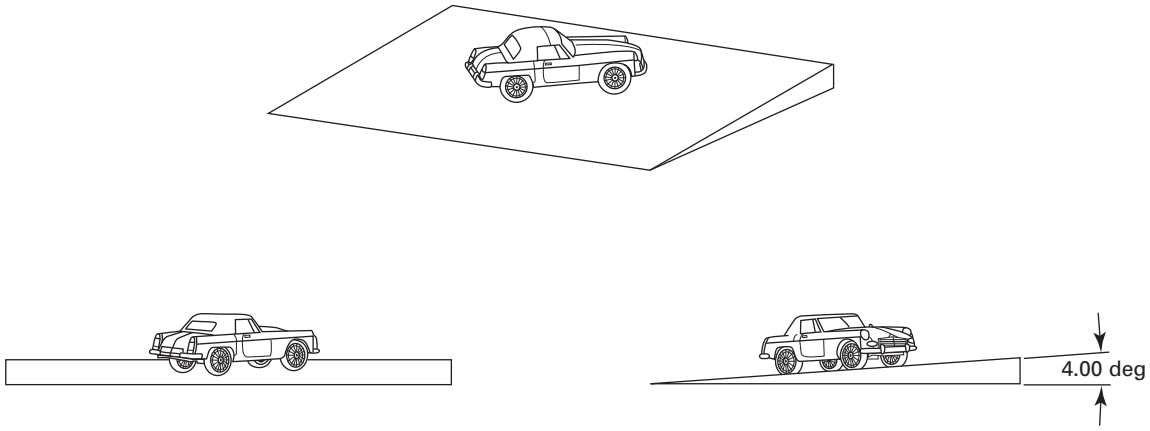


Fig. 8-4.1.4-2 Stability Test — Compound Slope (Upgrade)



On vans and light-duty trucks, the rear axle shall be loaded to its rear GAWR. Additional weight shall be added to the front of the vehicle to attain front GAWR.

The test vehicle shall be raised on a hard, level surface from a flat-tire position to a 2.0-in. (51-mm) ground clearance, with an inflated maximum-size tire–wheel combination. This test shall be performed with the transmission in neutral, the parking brake released, and wheel chocks stowed. A force of 50 lbf (222 N) shall be applied in a longitudinal direction to the vehicle, forward for 30 sec and rearward for 30 sec. The same force shall then be applied in the transverse direction to the raised side of the vehicle, at least 30.0 in. (762 mm) above the pavement near the jacking point, inward for 30 sec and outward for 30 sec. This test shall be performed at each jacking point recommended by the vehicle manufacturer. This stability test shall then be repeated on the same unloaded vehicle. Inability of the jack to support the vehicle during this test constitutes failure.

8-4.1.4 Stability Test (Compound Slope). A new jack assembly shall be tested on an appropriately loaded passenger car in which the jack's maximum rated capacity is equal to 50% of the GVWR.

On vans and light-duty trucks, the rear axle shall be loaded to its rear GAWR. Additional weight shall be added to the front of the vehicle to attain front GAWR.

The test vehicle shall be raised on a hard, level surface from a flat-tire position to a 2.0-in. (51-mm) ground clearance, with an inflated, vehicle-manufacturer-recommended, maximum-size tire–wheel combination. This test shall be performed with the automatic transmission in park or the manual transmission in the lowest gear, the parking brake set, and wheel chocks deployed, if supplied by the vehicle manufacturer. Park the test vehicle with the front driver side upgrade at a 45-deg angle on a 4-deg (7%) grade. See Figs. 8-4.1.4-1 and 8-4.1.4-2.

A force of 100 lbf (444 N) shall be applied in a longitudinal direction to the vehicle, forward for 30 sec and rearward for 30 sec. The same force shall then be applied to the raised side of the vehicle, at least 30.0 in. (762 mm) above the pavement near the jacking point, inward for 30 sec and outward for 30 sec. This test shall be performed at each jacking point recommended by the vehicle manufacturer. Inability of the jack to support the vehicle during this test constitutes failure.

Repeat these tests with the front driver side parked downgrade at a 45-deg angle on a 7% grade. Inability of the jack to support the vehicle during this test constitutes failure.

8-4.1.5 Proof Load Test. For mechanical screw jacks and mechanical bumper jacks, a proof load, as defined in para. 8-2.4, shall be applied to the saddle, bumper adapter, or rocker panel adapter. The load shall be lifted, sustained, and lowered throughout the range of travel. Should the originally supplied handle not be capable of activating the jack mechanism, a substitute handle may be used for the performance of this test. Inability of the jack to return, unloaded, to within 0.5 in. (12.7 mm) of the fully raised, pretest position at the completion of this test constitutes failure.

For scissors jacks and mechanical frame jacks, the jack shall sustain for 10 min a proof load, applied to the saddle, equal to 150% of the rated capacity based on the height-to-weight curve at the following positions: 35%, 60%, and 100% of the range of travel. Inability of the jack to return, unloaded, to within 0.5 in. (12.7 mm) of the fully raised, pretest position at the completion of this test constitutes failure.

Part 9
Mobile Lifts

9-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

9-1.1 Scope

This Part applies to mobile lifts characterized by a pair of laterally spaced lifting members that raise and lower in unison, and are so arranged as to contact the vehicle at two points across its axis of symmetry on the bumper, bumper supports, or frame members for the purpose of raising the wheels of one end of the vehicle free of the ground.

9-1.2 Classification

The classifications for which this Part applies are as follows:

(a) upright-type mobile lifts actuated by hydraulic, pneumatic, or mechanical means

(b) scissors-type mobile lifts actuated by hydraulic or pneumatic means

9-1.3 Illustrations

Figure 9-1.3-1 shows a typical upright-type mobile lift and Fig. 9-1.3-2 shows a typical scissors-type mobile lift covered by this Part. The illustrations are not intended to be all-inclusive.

9-1.4 Definitions

base: the stationary portion of a lift to which lifting members are attached.

dynamic restraint: a device used to prevent the lifting member from extending to its full stroke in an unrestrained manner if the load is suddenly removed from the lift.

lift, hydraulic: a lift that is actuated by a hydraulic power source.

lift, pneumatic: a lift that is actuated by a pneumatic power source.

load-limiting device: device that limits the lifting capacity of the lift.

9-2 DESIGN

9-2.1 Operating Controls

Operating controls shall be designed in such a manner that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls should be clear to the operator by position, function, labeling, or a combination thereof. The release system shall require intentional positive action by the operator for release to prevent accidental lowering.

9-2.2 Travel Limits

Each lift shall be provided with a positive means to prevent the load from being raised or moved beyond the design limit of travel.

9-2.3 Proof Load

All mobile lifts shall be capable of performing the proof load test of para. 9-4.1.6 with a proof load of 150% of rated capacity.

9-2.4 Secondary Load-Holding Means

Lifts shall be equipped with a device to prevent unrestricted lowering of the load in the event of loss of pressure.

9-2.5 Saddles

The saddles shall have raised protrusions, such as a tang or rail, on the leading and trailing edges to act as a load restraint. Means shall be incorporated to limit the outward lateral adjustment of the saddles.

9-2.6 Dynamic Restraint

Pneumatic-operated mobile lifts shall have a dynamic restraint to prevent the lifting member from extending to its full stroke in an unrestrained manner if the load is suddenly removed from the lift.

9-2.7 Load-Limiting Device

Hydraulic-operated mobile lifts shall have an internal load-limiting device that can be deactivated during the proof load test. The load-limiting device shall activate when lifting no less than 100% of rated capacity but no more than 125% of rated capacity.

9-3 SAFETY MARKINGS AND MESSAGES

9-3.1 Safety Markings

Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings:

(a) Study, understand, and follow all instructions before operating this device.

Fig. 9-1.3-1 Typical Upright-Type Mobile Lift

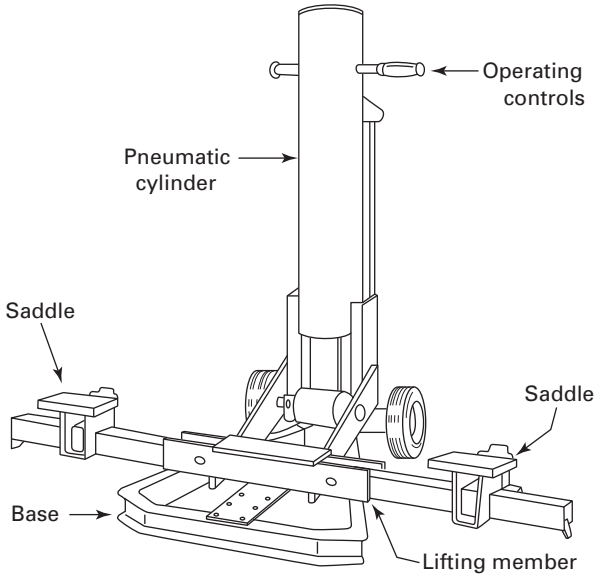
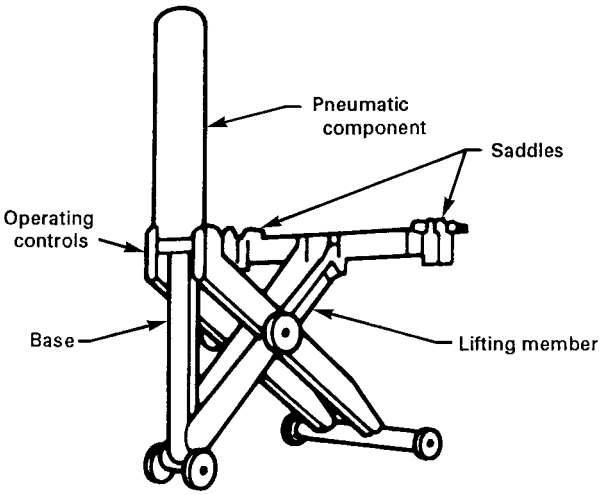


Fig. 9-1.3-2 Typical Scissors-Type Mobile Lift



(b) Do not exceed rated capacity.

(c) Use only on a hard, level surface.

(d) Load saddles equally.

(e) Support the vehicle with appropriate means immediately after lifting.

(f) Failure to heed these markings may result in personal injury and/or property damage.

9-3.2 Safety Messages

Additional safety messages include the following:

(a) Only attachments and/or adapters supplied by the manufacturer shall be used.

(b) Lift only on areas of the vehicle as specified by the vehicle manufacturer.

(c) No alterations shall be made to this product.

9-4 DESIGN QUALIFICATION TESTING

9-4.1 Proof Tests

For each design or design change that may affect the lift's ability to meet this Standard, sample lifts built to design specifications shall be proof tested. To conform to this Standard, the lifts shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected.

9-4.1.1 Instantaneous Load Loss Test. Pneumatic lifts shall be loaded to rated capacity and the lifting member raised to a height determined to provide the maximum momentum to the lifting member should the load be removed. The load shall be removed in such a manner that the vertical height of the lifting member shall not change until the load is completely removed. The lift shall not leave the ground more than 1.0 ft (305 mm). The lifting member, saddles, and attachments shall remain affixed to the lift assembly.

9-4.1.2 Load-Limiting Device Test. The load-limiting device in hydraulic lifts shall activate when lifting no less than 100% of rated capacity but no more than 125% of rated capacity. Lifts with multiple-stage hydraulics shall meet these requirements with the final stage extended at least 1.0 in. (25.4 mm) above its low height.

9-4.1.3 Load-Sustaining Test. A load not less than the rated capacity shall be applied to the lifting member at approximately 100% of its lifting range with the secondary load-holding means deactivated. The load shall not lower more than 0.125 in. (3.18 mm) in the first minute nor more than a total of 0.1875 in. (4.76 mm) in 10 min. The initial measurement shall be taken when the load is applied, and the other measurements at the time period specified.

9-4.1.4 Secondary Load-Holding Means Test. Lifts shall be loaded to not less than rated capacity and operated to raise the load. When the internal pressure is released, the secondary load-holding means shall automatically stop the lift and hold the load within a descent of 7.0 in. (178 mm).

9-4.1.5 Release Test. A load not less than the rated capacity shall be applied to the lifting member at approximately 100% of its lifting range. The release mechanism shall be operated to control the rate of descent to no more than 3.0 in./sec (76.2 mm/s).

NOTE: In normal use, a rate of descent greater than 3.0 in./sec (76.2 mm/s) is expected.

9-4.1.6 Proof Load Test. A proof load, as defined in para 9-2.3, shall be applied to the saddles. The load shall be lifted, sustained, and lowered throughout the range of travel at full extension of all saddles. For purposes of this test, any load-limiting device should be deactivated.

Part 10
Service Jacks

10-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

10-1.1 Scope

This Part applies to self-contained service jacks used for lifting, but not sustaining, a partial vehicular load.

10-1.2 Classification

Hydraulic, pneumatic, pneumatic/hydraulic, and mechanical are the four classifications for which this Part applies.

10-1.3 Illustrations

Figures 10-1.3-1 and 10-1.3-2 show typical jacks covered by this Part; the illustrations are not intended to be all-inclusive.

10-1.4 Definitions

jack, hydraulic service: a device in which the lift arm is actuated by a hydraulic pump.

jack, mechanical service: a service jack in which the lift arm is actuated by mechanical means such as levers, cables, gears, screws, ratchets, and pawls.

jack, pneumatic/hydraulic service: a service jack in which the lift arm is actuated by a mechanism that utilizes a relatively incompressible fluid, such as oil, as the force-transmitting means, actuated by a pneumatic power source.

jack, pneumatic service: a service jack in which the lift arm is actuated by a mechanism that utilizes compressed air as the force-transmitting medium.

jack, service: a self-contained device designed for lifting, but not sustaining, a partial vehicular load, consisting of a frame with wheels and/or swivel casters supporting a mechanism that actuates a pivoting lift arm equipped with a saddle.

lift arm: the main lifting member through which the force is transferred from the power unit to the saddle.

saddle periphery: the highest points of contact between the saddle and the load on the outermost edge of the saddle, including any upward protrusion such as lugs, lips, or tangs.

10-2 DESIGN

10-2.1 Operating Controls

Operating controls shall be designed in such a manner that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls should be clear to the operator by position, function, labeling, or a combination thereof. The release system shall require intentional positive action by the operator for release to prevent accidental lowering.

10-2.2 Actuating-Handle or Actuating-Pedal Force

The actuating handle or pedal shall be capable of being operated to the jack's rated capacity without sustaining functional damage. The jack shall be capable of lifting the load at rated capacity when the operator, while in the operating position, exerts force on the lifting-device actuating handle or pedal.

10-2.3 Saddle

The saddle configuration shall be such as to aid in the proper positioning, supporting, and retaining of the load.

10-2.4 Load-Limiting Device

Hydraulic service jacks shall have an internal load-limiting device that can be deactivated during the proof load test. The load-limiting device shall activate when lifting no less than 100% of rated capacity but no more than 125% of rated capacity.

10-2.5 Travel Limits

Each jack shall be provided with a positive means to prevent the load from being raised or lowered beyond the designed limit of travel.

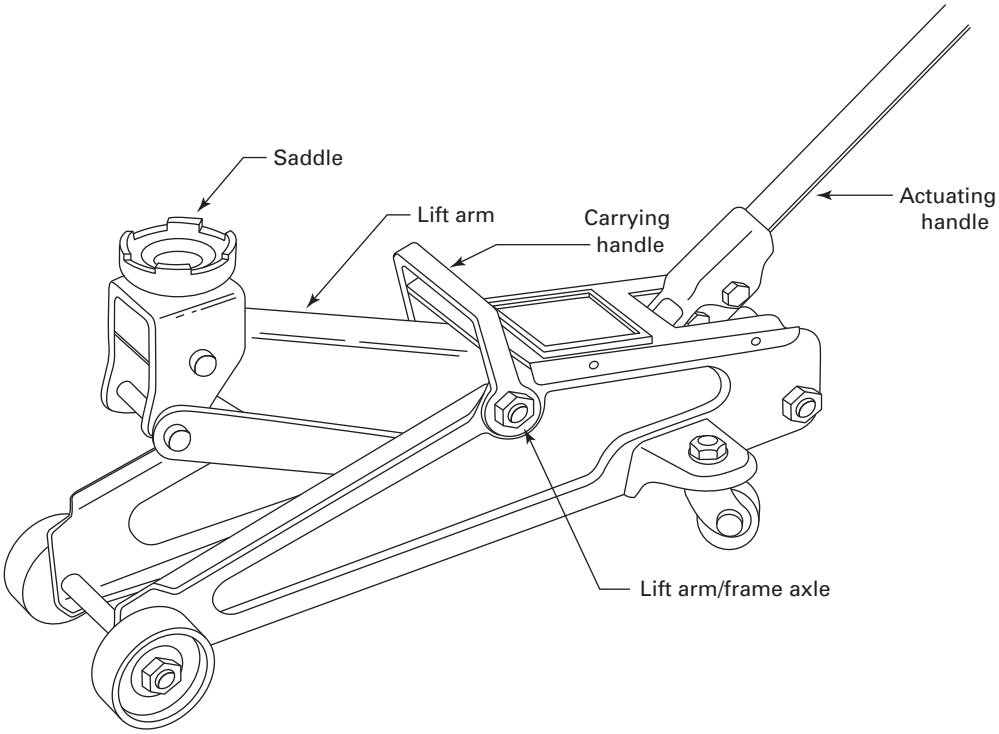
10-2.6 Proof Load

All service jacks shall be capable of performing the proof load test of para. 10-4.1.5 with a proof load of 150% of rated capacity.

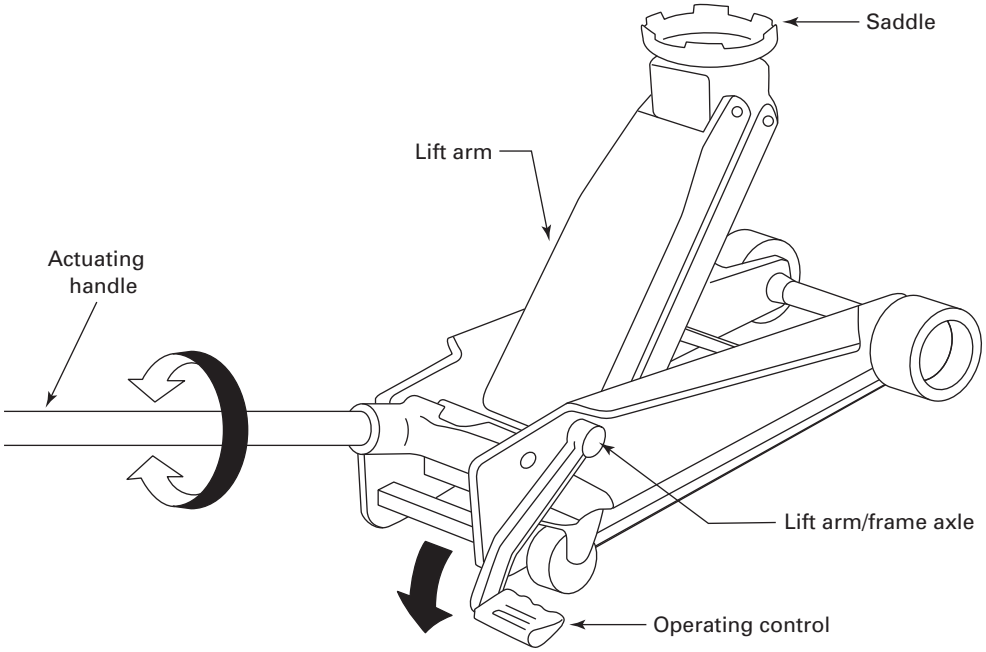
10-2.7 Saddle Periphery

The jack shall be designed to ensure that the saddle remains within 3 deg parallel (before and after performing each saddle periphery test of para. 10-4.1.4) to the jack-supporting surface throughout the range, from the lift arm parallel to the lifting surface to the maximum height (see Fig. 10-2.7-1). The saddle periphery, throughout the lifting range, as defined above, shall not move outside the imaginary perimeter established by lines connecting centerlines of the front and rear wheels and/or caster pivot points (see Fig. 10-2.7-2).

Fig. 10-1.3-1 Typical Hydraulic Service Jacks

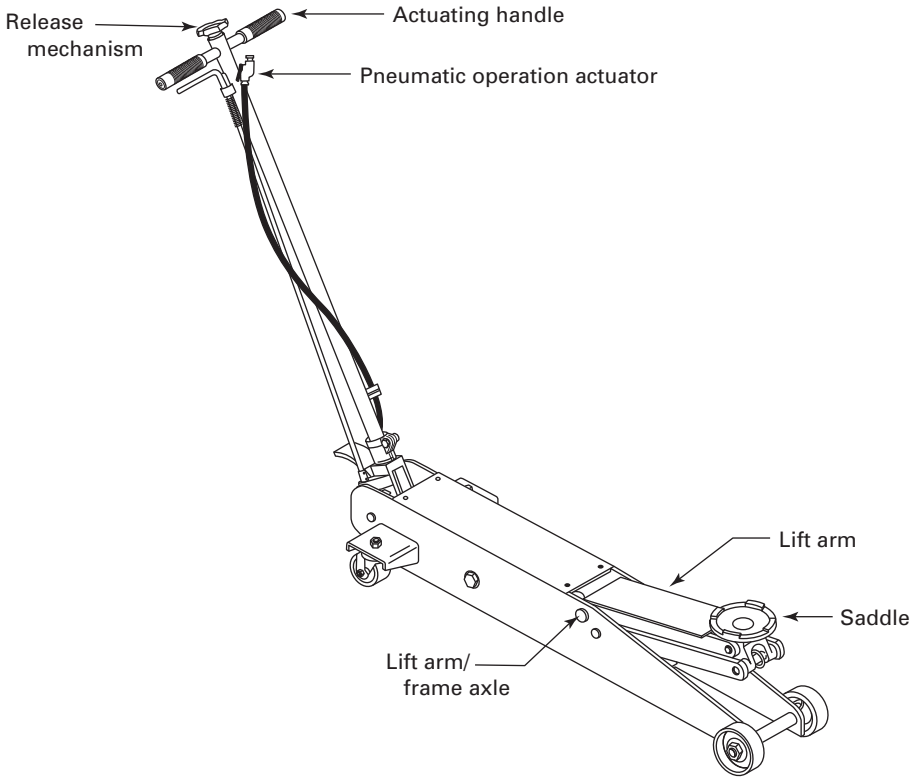


(a)

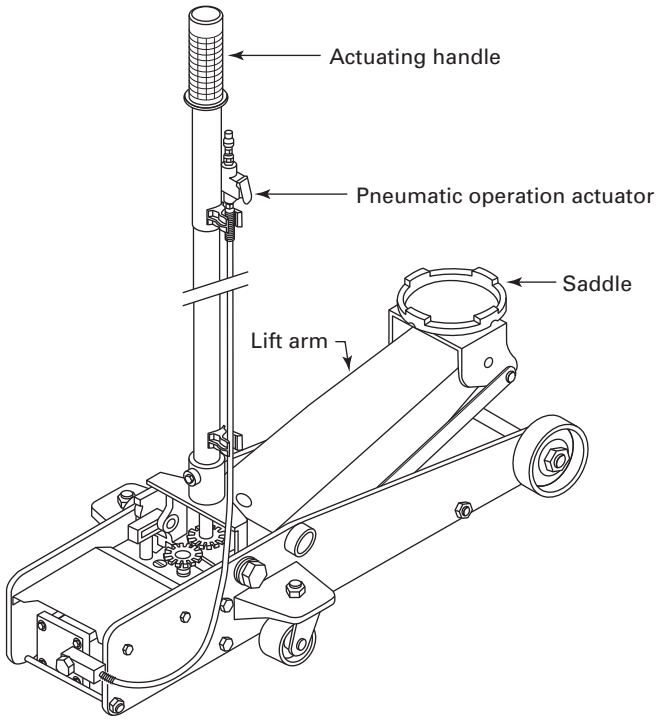


(b)

Fig. 10-1.3-2 Typical Pneumatic/Hydraulic Service Jacks

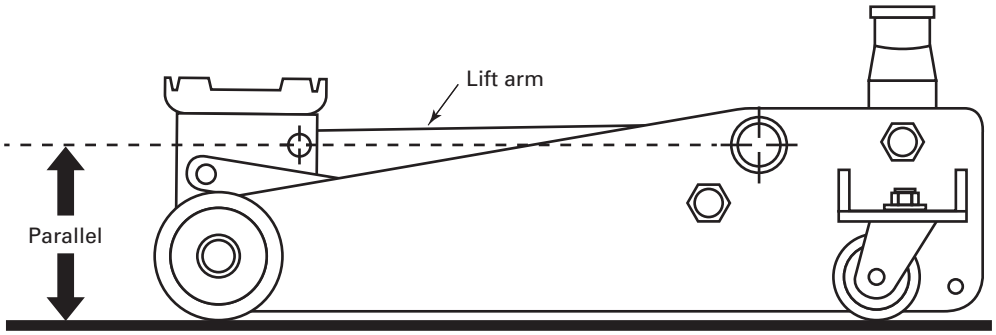


(a)

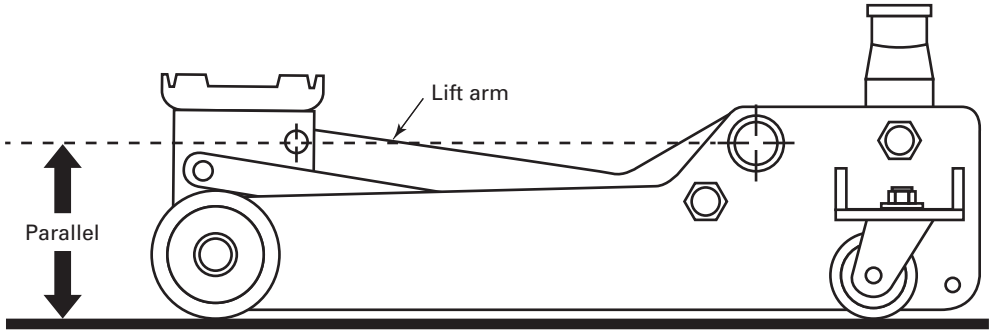


(b)

Fig. 10-2.7-1 Lift Arm Parallel

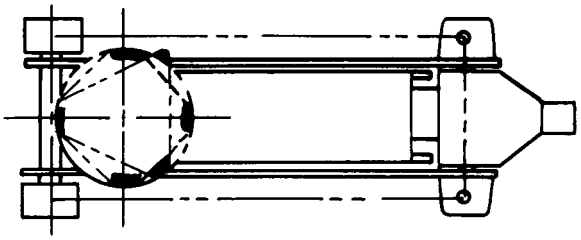


(a)



(b)

Fig. 10-2.7-2 Saddle Periphery Limits



10-3 SAFETY MARKINGS AND MESSAGES

10-3.1 Safety Markings

Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings:

(a) Study, understand, and follow all instructions before operating this device.

(b) Do not exceed rated capacity.

(c) Use only on a hard, level surface.

(d) Support the vehicle with appropriate means immediately after lifting.

(e) Do not move or dolly the vehicle while it is on the jack.

(f) Failure to heed these markings may result in personal injury/property damage.

10-3.2 Safety Messages

Additional safety messages include the following:

(a) Lift only on areas of the vehicle as specified by the vehicle manufacturer.

(b) No alterations shall be made to this product.

10-4 DESIGN QUALIFICATION TESTING

10-4.1 Proof Tests

For each design or design change that may affect the jack's ability to meet this Standard, sample jacks built to design specifications shall be proof tested. To conform to this Standard, the jacks shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected. Prior to each test described in paras. 10-4.1.1 through 10-4.1.5, the jack shall be placed on a smooth, flat surface with the rear wheels or casters in contact with the surface and loaded with sufficient force, not to exceed the rated capacity, to remove all vertical play in the wheels or casters.

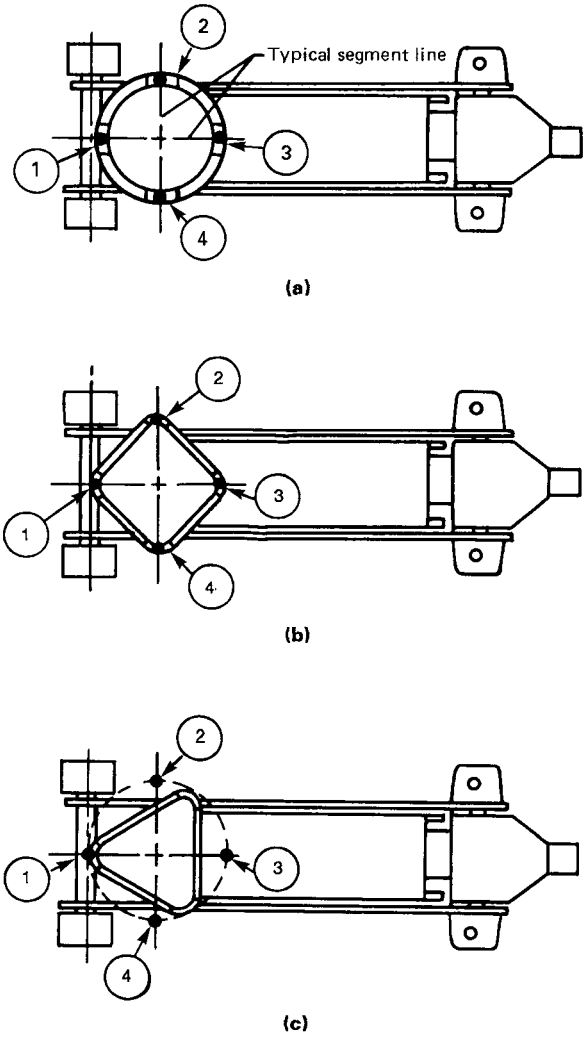
10-4.1.1 Load-Limiting Device Test. The load-limiting device in hydraulic jacks shall activate when lifting no less than 100% of rated capacity but no more than 125% of rated capacity.

10-4.1.2 Load-Sustaining Test. A load not less than the rated capacity shall be applied centrally to the saddle of the jack with the lift arm parallel to the lifting surface (see Fig. 10-2.7-1). The load shall not lower more than 0.125 in. (3.18 mm) in the first minute nor more than a total of 0.1875 in. (4.76 mm) in 10 min. The initial measurement shall be taken when the load is applied, and the other measurements at the time period specified.

10-4.1.3 Release Mechanism Test. A load not less than the jack's rated capacity shall be applied centrally to the saddle and the test performed at the following three points:

(a) lift arm parallel to the lifting surface (see Fig. 10-2.7-1)

Fig. 10-4.1.4-1 Saddle Periphery Test



(b) full extension

(c) a position measured midway between points (a) and (b)

The release mechanism shall be operated through 1.0 in. (25.4 mm) of travel to control the rate of descent to no more than 1.0 in./sec (25.4 mm/s) at each specified point.

10-4.1.4 Saddle Periphery Test. The lift point of the jack at the saddle shall be divided, using imaginary lines, into segments as shown in Fig. 10-4.1.4-1, illustrations (a), (b), and (c). Lift point no. 1 of the saddle periphery (see para. 10-1.4, Definitions) shall be loaded to rated capacity, the load to be applied over a contact area not greater than 1.0 in.^{2} (645 mm^2). The jack shall be tested throughout the range, from the lift arm parallel to the lifting surface to the maximum height. The load shall be removed and the jack checked for compliance with

para. 10-2.7. The procedure shall be repeated until all remaining lift points of the saddle periphery have been tested in lift point nos. 2 through 4. The orientation of the lift points of saddles that are neither square nor circular shall be rotated for each successive test to provide the maximum distance from the saddle centerline to the load point on the segment line. This test shall be repeated with the extender in the fully extended position and/or with the adapter in place.

10-4.1.5 Proof Load Test. A proof load, as defined in para. 10-2.6, shall be applied centrally to the saddle of the jack. The load shall be lifted throughout the range, from the lift arm parallel to the lifting surface to the maximum height. For purposes of this test, any internal load-limiting device should be deactivated. This test shall be repeated with the extender in the fully extended position with the adapter in place.

Part 11
Wheel Dollies

11-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

11-1.1 Scope

This Part applies to hydraulic and mechanical wheel dollies characterized by a pair of laterally spaced lifting members that raise and lower in unison and are so arranged as to contact the vehicle wheel(s) at two areas on its circumference for the purpose of raising, removing, transporting, and replacing wheel and tire assemblies.

11-1.2 Classification

Hydraulic and mechanical are the two classifications for which this Part applies.

11-1.3 Illustrations

Figure 11-1.3-1 shows typical wheel dollies covered by this Part; the illustrations are not intended to be all-inclusive.

11-1.4 Definitions

lift: PASE characterized by a pair of laterally spaced lifting members that raise and lower in unison, used to raise the wheels of one end of the vehicle free of the ground.

lifting frame: the stationary portion of a wheel dolly to which the lifting member is attached and on which it operates.

load restraint: a device supplied by the manufacturer to retain the load on the lift platform.

rollers: mechanisms attached to the lifting member that rotate about the lifting member.

wheel dolly: PASE characterized by a pair of laterally spaced lifting members that are used to raise, remove, transport, and replace automotive wheel and tire assemblies.

wheel dolly, hydraulic: a wheel dolly that employs a hydraulic pump.

wheel dolly, mechanical: a wheel dolly that employs mechanical means such as cables, gears, screws, or chains as the force-transmitting medium.

11-2 DESIGN

11-2.1 Operating Controls

Operating controls shall be designed in such a manner that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls should be clear to the operator by position, function, labeling, or a combination thereof. The release system shall require intentional positive action by the operator for release to prevent accidental lowering.

11-2.2 Actuating-Handle or Actuating-Pedal Force

Wheel dollies shall be capable of lifting the load at rated capacity when the operator, while in the operating position, exerts force on the lifting-device actuating handle or pedal.

11-2.3 Internal Load-Limiting Device

Hydraulic wheel dollies shall have an internal load-limiting device that can be deactivated during the proof load test. The load-limiting device shall be activated when lifting no less than 100% of rated capacity but no more than 125% of rated capacity.

11-2.4 Mobility

The force to move the wheel dolly when loaded to rated capacity shall be accomplished by the operator pushing or pulling the dolly. Wheels and/or casters shall be configured to allow movement in the desired direction of travel.

11-2.5 Travel Limit

Each wheel dolly shall be provided with a positive means to prevent the load from being raised or lowered beyond the design limit of travel.

11-2.6 Proof Load

Wheel dollies shall be capable of performing the proof load test of para. 11-4.1.2 with a proof load of 150% of rated capacity.

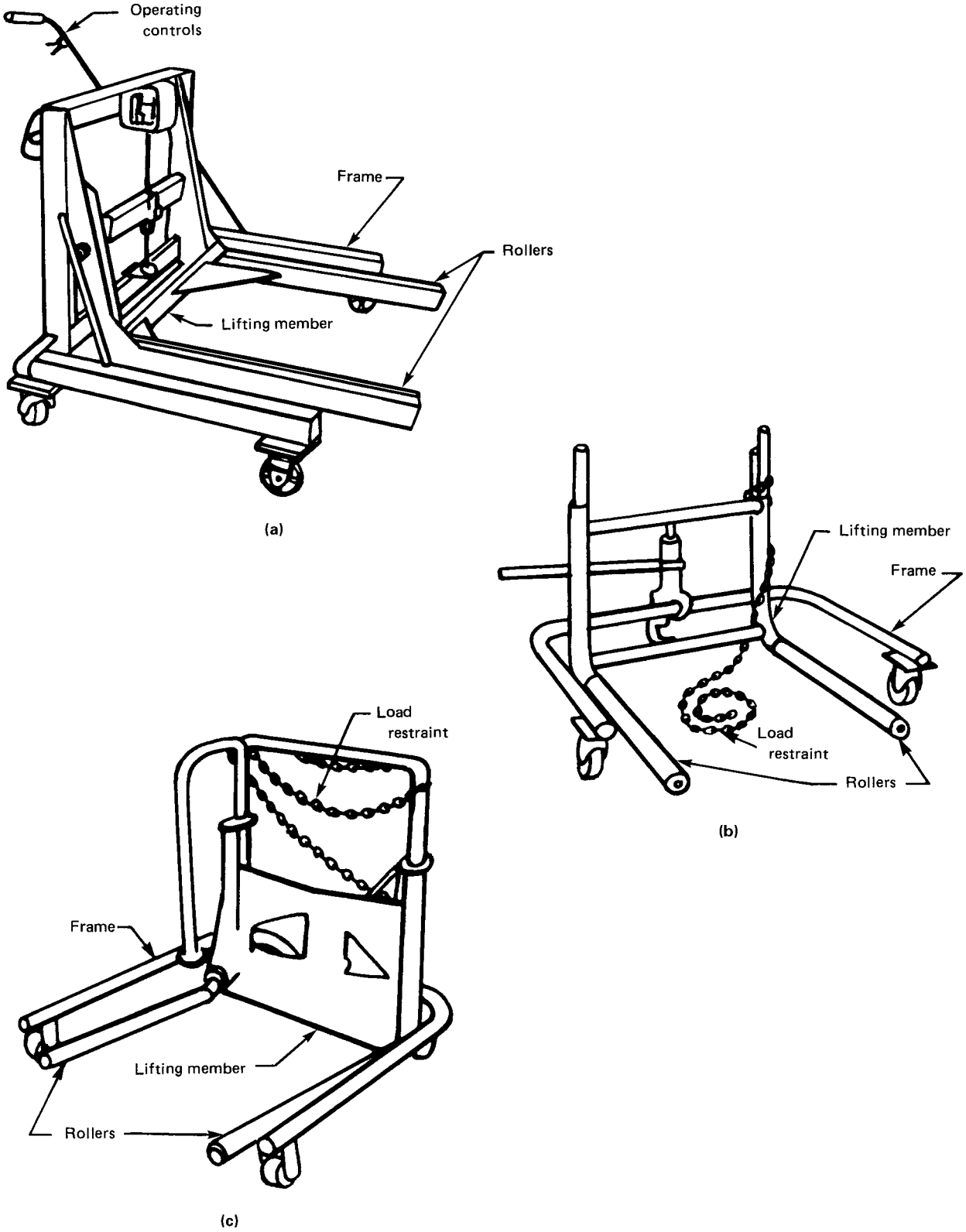
11-2.7 Rollers

The lifting member shall be equipped with rollers to permit the rotation of wheel assemblies for the purpose of aligning bolt holes to their mating wheel studs.

11-2.8 Load Restraint

The load restraint shall be so designed and positioned as to prevent the inadvertent loss of the load during operation and movement of the wheel dolly.

Fig. 11-1.3-1 Typical Wheel Dollies



11-2.9 Tilt Mechanism

When a tilt mechanism is provided, it shall be so designed to allow the lifting member to be adjusted relative to the horizontal plane, and it shall require intentional positive action by the operator to change the angle of tilt.

11-3 SAFETY MARKINGS AND MESSAGES

11-3.1 Safety Markings

Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings:

(a) Study, understand, and follow all instructions before operating this device.

(b) Do not exceed rated capacity.

(c) Use only on a hard, level surface.

(d) Before moving, lower the load to the lowest possible point.

(e) Failure to heed these markings may result in personal injury and/or property damage.

11-3.2 Safety Messages

Additional safety messages include the following:

(a) Apply load as close to the vertical portion of the lifting member as possible.

(b) Before moving the load, ensure that the load is centered and secured with a load-restraint device.

(c) No alterations shall be made to this product.

11-4 DESIGN QUALIFICATION TESTING

11-4.1 Proof Tests

For each design or design change that may affect the wheel dolly's ability to meet this Standard, sample wheel dollies built to design specifications shall be proof tested. To conform to this Standard, the wheel dolly shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected.

11-4.1.1 Operational Test. A static load, not less than the rated capacity of the wheel dolly, shall be applied centrally between the rollers, with the load center of gravity approximately 1.0 ft (305 mm) from the vertical portion of the lifting member. The load center of gravity shall be not less than 27.0 in. (686 mm) from the floor.

11-4.1.1.1 Load-Limiting Device Test. The load-limiting device in hydraulic wheel dollies shall activate when lifting no less than 100% of rated capacity but no more than 125% of rated capacity.

11-4.1.1.2 Load-Sustaining Test. The load, as defined in para. 11-4.1.1, shall be applied to the lifting member at full height. The load shall not lower more than 0.125 in. (3.18 mm) in the first minute nor more than a total of 0.1875 in. (4.76 mm) in 10 min. The initial measurement shall be taken when the load is applied, and the other measurements at the time period specified.

11-4.1.1.3 Release Test. The load, as defined in para. 11-4.1.1, shall be applied to the lifting member at full height. The release mechanism shall be operated to control the rate of descent to no more than 3.0 in./sec (76.2 mm/s).

11-4.1.1.4 Tilt Mechanism Test (If So Equipped). With the wheel dolly loaded as defined in para. 11-4.1.1 and with the lift member at its maximum height, the tilt mechanism shall be manipulated throughout its entire range of adjustment.

11-4.1.1.5 Mobility Test. The wheel dolly, while loaded as defined in para. 11-4.1.1, shall be moved at 1.5 ft/sec (457 mm/s) to 2.0 ft/sec (610 mm/s) across a 0.5-in. (12.7-mm) high, 15-deg-slope rise in the floor and a 0.5-in. (12.7-mm) drop to the floor, at an approach angle that will bring only one caster or wheel at a time in contact with the rise and drop. The wheel dolly shall not lose the load or tip over.

11-4.1.1.6 Stability Test. The wheel dolly, while loaded as defined in para. 11-4.1.1, shall be moved at 1.5 ft/sec (457 mm/s) to 2.0 ft/sec (610 mm/s) against a 2.0-in. (51-mm) high vertical rise 90 deg to the direction of movement at an approach angle that will bring one or two wheels or casters in contact with the rise at the point of greatest instability. The wheel dolly shall not lose the load or tip over.

11-4.1.2 Proof Load Test. A proof load, as defined in para. 11-2.6, shall be applied to the lifting member. The load shall be applied centrally between the rollers and located midway between the front and rear of the lifting member. The load shall be lifted throughout the range of travel.

Part 12
Shop Cranes

12-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

12-1.1 Scope

This Part applies to self-contained shop cranes characterized by a pair of laterally spaced legs, an upright mast, a pivoting boom with a boom extension and hook, and a power unit to move the boom up and down at a pivot point for the purpose of raising, removing, transporting in the lowered position, and replacing automobile engines/transmissions and other components. This Part applies to shop cranes of 8,000-lbm (3 636-kg) capacity or less.

12-1.2 Classification

Hydraulic and pneumatic/hydraulic are the two classifications for which this Part applies.

12-1.3 Illustrations

Figure 12-1.3-1 shows typical shop cranes covered by this Part; the illustrations are not intended to be all-inclusive.

12-1.4 Definitions

base: the structure of a shop crane to which the upright mast and leg extensions are attached.

boom: the pivoting portion of the PASE to which the hydraulic unit is attached to raise and lower loads.

boom extension: that integral portion of the boom that provides adjustment of the effective boom length.

leg extension: that integral portion of the leg that provides adjustment of the effective leg length.

load hook: a device at the end of the boom extension to which the load is applied.

mast, upright: the upright structure mounted to the base to which the boom is attached.

shop crane: PASE characterized by a pair of laterally spaced legs, an upright mast, a pivoting boom with a boom extension, and a hook that is used to raise and remove automotive components for service.

shop crane, hydraulic: a shop crane in which the boom is actuated by a mechanism that utilizes a relatively incompressible fluid, such as oil, as the force-transmitting means.

shop crane, pneumatic/hydraulic: a hydraulic shop crane that is actuated by a pneumatic power source.

sling: an assembly to be used for lifting when connected to a lifting mechanism at the sling's upper end and when supporting a load at the sling's lower end.

12-2 DESIGN

12-2.1 Operating Controls

Operating controls shall be designed in such a manner that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls should be clear to the operator by position, function, labeling, or a combination thereof. The release system shall require intentional positive action by the operator for release to prevent accidental lowering.

12-2.2 Actuating-Handle Force

All shop cranes shall be capable of lifting the load at rated capacity when the operator, while in the operating position, exerts force on the lifting-device actuating handle. The actuating handle shall be capable of being operated to the jack's rated capacity without sustaining functional damage.

12-2.3 Internal Load-Limiting Device

All hydraulic shop cranes shall have an internal load-limiting device that can be deactivated during the proof load test. The load-limiting device shall be activated when lifting no less than 100% of rated capacity but no more than 125% of rated capacity.

12-2.4 Mobility

The force to move the shop crane when loaded to rated capacity shall be accomplished by the operator pushing or pulling the crane. Wheels and/or casters shall be configured to allow movement in the desired direction of travel.

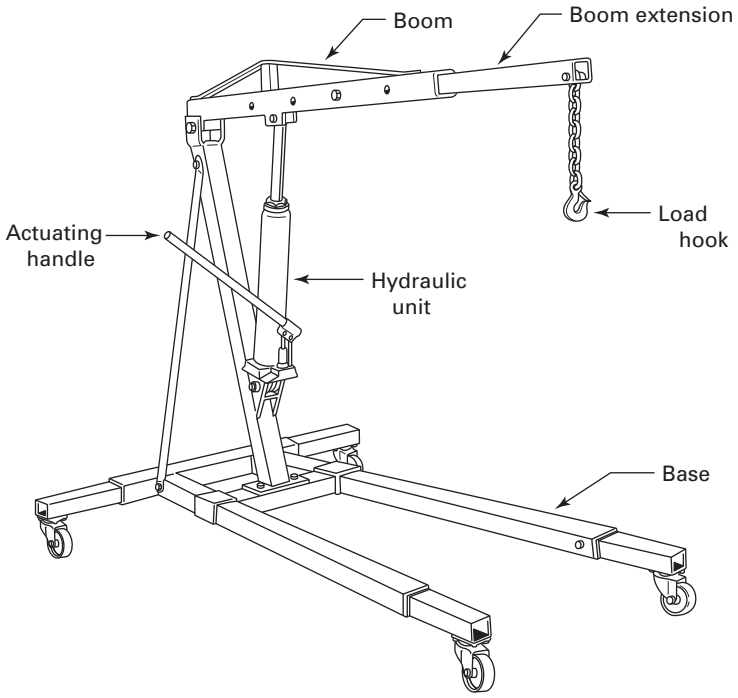
12-2.5 Travel Limit

Each shop crane shall be provided with a positive means to prevent the load from being raised or lowered beyond the design limit of travel.

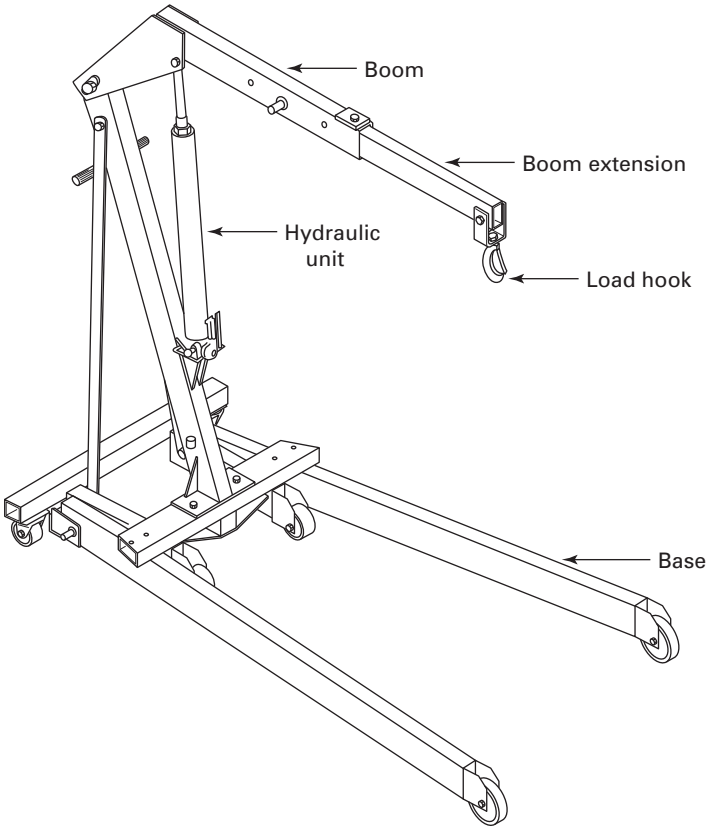
12-2.6 Proof Load

All shop cranes shall be capable of performing the proof load test of para. 12-4.1.6 with a proof load of 150% of rated capacity.

Fig. 12-1.3-1 Typical Shop Cranes



(a)



(b)

12-2.7 Load Hook

The shop crane shall be provided with a load hook and/or chain at the end of the boom extension that is capable of sustaining the proof loads of the unit. The load hook shall be provided with a latching mechanism.

12-2.8 Load Restraint

All shop cranes shall be equipped with restraints to minimize the load from swinging while the shop crane is moved, after the engine or component is removed from the vehicle.

12-3 SAFETY MARKINGS AND MESSAGES

12-3.1 Safety Markings

Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings:

(a) Study, understand, and follow all instructions before operating this device.

(b) Do not exceed rated capacity.

(c) Use only on a hard, level surface.

(d) Before moving, lower the load to the lowest possible point.

(e) Failure to heed these markings may result in personal injury and/or property damage.

12-3.2 Safety Messages

Additional safety messages include the following:

(a) Use only slings or chains with a rated capacity greater than the weight of the load being lifted.

(b) Do not allow load to swing or drop violently while lowering or moving.

(c) No alterations shall be made to this product.

12-4 DESIGN QUALIFICATION TESTING

12-4.1 Proof Tests

For each design or design change that may affect the shop crane's ability to meet this Standard, sample shop cranes built to design specifications shall be proof tested. To conform to this Standard, the shop crane shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected. The tests described in paras. 12-4.1.1 through 12-4.1.6 shall be performed with the boom at the fully extended and fully retracted positions.

12-4.1.1 Load-Sustaining Test. A load not less than the rated capacity shall be applied to the hook with the boom in the horizontal position. The load shall not lower more than 0.125 in. (3.18 mm) in the first minute nor more than a total of 0.1875 in. (4.76 mm) in 10 min. The initial measurement shall be taken when the load is applied, and the other measurements at the time period specified.

12-4.1.2 Release Mechanism Test. A load not less than the rated capacity shall be applied to the hook with the boom at its maximum lifting height. The release mechanism shall be operated to control the rate of descent to no more than 3.0 in./sec (76.2 mm/s).

12-4.1.3 Load-Limiting Device Test. With the boom in the horizontal position, the load-limiting device shall activate when lifting no less than 100% of rated capacity but no more than 125% of rated capacity.

12-4.1.4 Mobility Test. The shop crane, with rated-load center of gravity 2.0 ft (610 mm) off the floor and the boom in the horizontal position, shall be moved forward in a direction parallel to the boom at a minimum of 1.5 ft/sec (457 mm/s) to 2.0 ft/sec (610 mm/s) across a 0.5-in. (12.7-mm) high, 15-deg-slope rise in the floor and a 0.5-in. (12.7-mm) drop to the floor, at an approach angle that will bring only one caster or wheel at a time in contact with the rise and drop. The shop crane shall traverse the rise and drop without loss of load or tipping over.

12-4.1.5 Stability Test. The shop crane, with rated-load center of gravity 2.0 ft (610 mm) below the hook and the boom in the fully raised position, shall be moved forward in a direction parallel to the boom at 5.0 in./sec (127 mm/s) to 7.0 in./sec (178 mm/s) against a 2.0-in. (51-mm) high vertical rise 90 deg to the direction of movement that will bring the front wheels or casters in contact with the vertical rise. The shop crane shall not lose the load or tip over. The test shall be repeated with the movement in the opposite direction.

12-4.1.6 Proof Load Test. A proof load, as defined in para. 12-2.6, shall be applied to the boom extension. The load shall be lifted throughout the range of travel with the load located on the hook at the end of the boom extension. For this test, any internal load-limiting device should be deactivated.

12-5 ATTACHMENTS AND ADAPTERS

Slings and/or chains used in conjunction with a shop crane shall have a rated capacity greater than the weight of the object being lifted.

Part 13
Auxiliary Stands

13-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

13-1.1 Scope

This Part applies to self-contained auxiliary stands designed as a means of partial support for, and positioning of, vehicle components during their installation and removal, but not for use in stabilizing or supporting vehicles. This Part does not apply to devices classified as vehicle support stands (see Part 7), to units whose rated capacity is more than 1,500 lbm (680 kg), or to devices classified as stabilizing stands.

13-1.2 Classification

Mechanical is the only classification to which this Part applies, excluding units with a tripod, square, or other base design configuration (e.g., stabilizing stands).

13-1.3 Illustrations

Figure 13-1.3-1 shows typical auxiliary stands and their components that are covered by this Part; the illustrations are not intended to be all-inclusive.

13-1.4 Definitions

auxiliary stands: self-contained devices designed to be used as a means of partial support for vehicle components during their installation and removal, but not for use in supporting vehicles.

base: that portion of the stand that rests on the ground and holds the adjustable column.

freestanding: when initially positioned vertically, without a load, able to stand in an upright position without the application of external forces.

locking device: the mechanism used to hold the column in the selected height position.

13-2 DESIGN

13-2.1 Base

The base may be of any configuration that provides for a freestanding unit that is capable of being rocked to assist in the positioning of vehicle components. The upper portion of the base shall be designed to house and guide the column.

13-2.2 Column

A means shall be provided to prevent the inadvertent separation of the column from the base. In the fully retracted position, the lower end of the column shall not extend below the plane made where the base contacts the ground.

13-2.3 Operating Controls

Operating controls shall be designed in such a manner that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls should be clear to the operator by position, function, labeling, or a combination thereof. The release system shall require intentional positive action by the operator for release to prevent accidental lowering.

13-2.4 Saddle

The saddle configuration shall be such as to aid in the proper positioning and supporting of the load.

13-2.5 Proof Load

All auxiliary stands shall be capable of performing the proof load test of para. 13-4.1.1 with a proof load of 200% of rated capacity.

13-3 SAFETY MARKINGS AND MESSAGES

13-3.1 Safety Markings

Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings:

(a) Study, understand, and follow all instructions before operating this device.

(b) Do not exceed rated capacity.

(c) Use only on a hard, level surface.

(d) Adequately support the vehicle before starting repairs.

(e) Do not use to support or stabilize vehicle.

(f) Center load on saddle.

(g) Failure to heed these markings may result in personal injury and/or property damage.

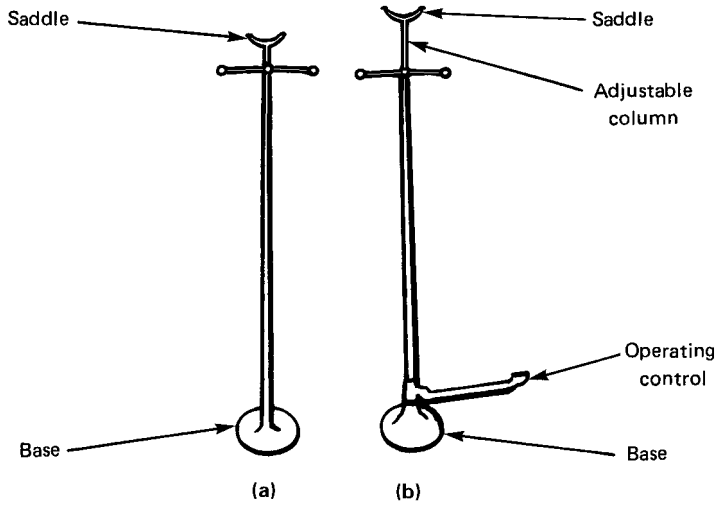
13-3.2 Safety Messages

Additional safety messages include the following:

(a) This stand is intended to provide partial support of vehicle components during removal and installation.

(b) No alterations shall be made to this product.

Fig. 13-1.3-1 Typical Auxiliary Stands



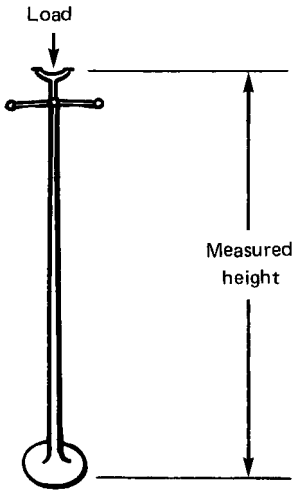
13-4 DESIGN QUALIFICATION TESTING

13-4.1 Proof Tests

For each design or design change that may affect the stand's ability to meet this Standard, sample stands built to design specifications shall be tested. To conform to this Standard, the stands shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected.

13-4.1.1 Proof Load Test. A horizontally constrained vertical load of 200% of rated capacity shall be applied centrally to the saddle, with the column in both the fully extended and the fully retracted positions, with the base resting on a hard, level surface. The load shall be applied as shown in Fig. 13-4.1.1-1 for at least 10 min. A permanent reduction in height, measured after the removal of the load, at the point of load contact shall not exceed 0.125 in. (3.18 mm). A preload of no more than 100% of rated capacity may be applied to establish initial overall height.

Fig. 13-4.1.1-1 Application of Load for Proof Load Test



Part 14
Automotive Ramps

14-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

14-1.1 Scope

This Part applies to automotive ramps to be used in matched pairs to support one end (front or rear) of a vehicle. They are not to be used to simultaneously support both ends or one side of a vehicle.

14-1.2 Classification

This Part applies to load-sustaining devices, used in matched pairs, upon which two front or rear wheels of a vehicle are driven to elevate either end of the vehicle.

14-1.3 Illustrations

Figure 14-1.3-1 shows typical automotive ramps that are covered by this Part; the illustrations are not intended to be all-inclusive.

14-1.4 Definitions

matched pair: a pair of ramps of similar height, length, and capacity.

platform: the top section of the ramp that locates and supports the vehicle tire.

ramp height: the maximum vertical distance between the platform and the base.

ramp stability: a measure of resistance to tipping and lateral movement while driving on or off the ramps, and while the ramps are supporting the load.

14-2 DESIGN

14-2.1 Base

The base may be of any configuration that provides ramp stability under proof load and that resists parallel and lateral movement while a vehicle is being driven onto and off the ramps.

14-2.2 Stability

The ramps shall be designed such that the width of the base is equal to or greater than the height of the ramp platform. The projected edges of the incline and platform shall align with or be within the area of the base.

14-2.3 Surfacing

The top surface of the inclined portion of the ramps shall be constructed to provide slip resistance.

14-2.4 Locating Devices

The platform of the ramp shall be equipped with a device or configuration so that the vehicle operator or the observer will be able to ascertain that the wheel of the vehicle is in the correct location.

14-2.5 Resistance to Roll-Off

Each ramp shall have an inherent means of resisting roll-off of a vehicle from the ramp.

14-3 SAFETY MARKINGS AND MESSAGES

14-3.1 Safety Markings

Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings:

(a) Study, understand, and follow all instructions before operating this device.

(b) Do not exceed rated capacity.

(c) Use only on a hard, level surface.

(d) Center load between the sides of the ramp.

(e) Use as a matched pair to support one end of a vehicle.

(f) Failure to heed these markings may result in personal injury and/or property damage.

14-3.2 Safety Messages

Additional safety messages include the following:

(a) Ramps are not to be used to simultaneously support both ends or one side of a vehicle.

(b) Maximum allowable tire width is [manufacturer to specify for each set of ramps].

(c) Do not use other lifting equipment in conjunction with the ramps.

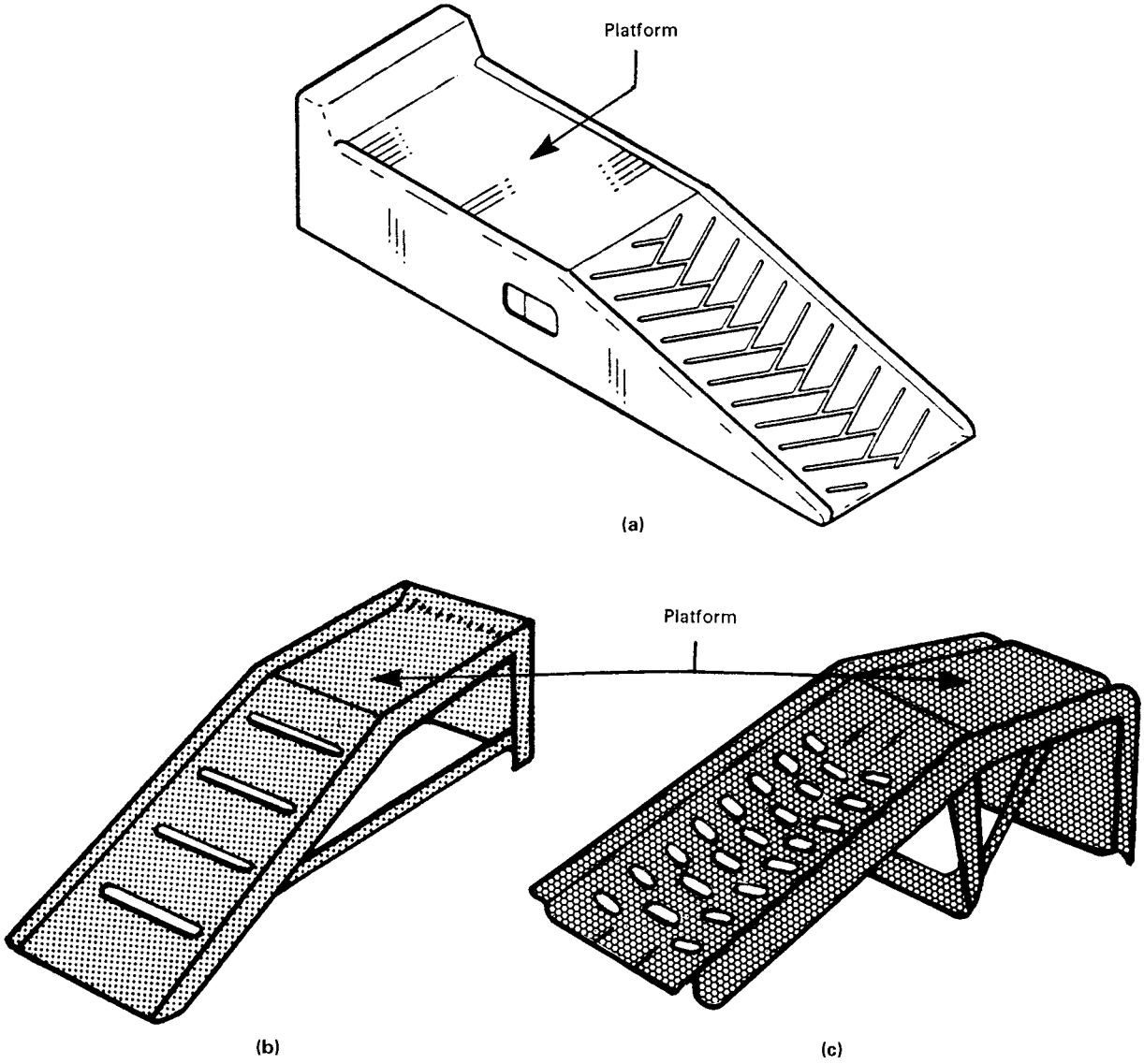
(d) Do not disconnect brakes, engine, transmission components, drive train, drive shaft, universal joints, or wheels while the vehicle is on the ramps.

(e) Be sure the wheels to be driven on the ramps are positioned straight forward in alignment with the ramps, and center the two ramps against the tires.

(f) Another person, standing clear from vehicle path, should observe and guide the vehicle operator when ascending and descending the ramps.

(g) Never accelerate or apply brakes suddenly. Proceed slowly and cautiously. Once the vehicle reaches the top of the ramps, apply brakes only to prevent overtravel.

Fig. 14-1.3-1 Typical Automotive Ramps



(h) Place the vehicle in neutral. Release brakes; vehicle should not move. Set emergency brake. Place vehicle in park (or in reverse gear for manual transmission). Chock wheels on the ground.

(i) Be sure that both tires are properly positioned on the ramp's support platform. Using caution in positioning your body clear of danger; shake vehicle sideways and endways to be sure that vehicle and ramps are stable. Check that ramps have not become damaged or bent during loading.

(j) Supplier may provide information to assist the user in the selection of appropriately rated ramps for different gross vehicle weights.

(k) If assembly is required, follow the assembly instructions provided.

(l) No alterations shall be made to this product.

14-4 DESIGN QUALIFICATION TESTING

14-4.1 Proof Tests

For each design or design change that may affect the ramp's ability to meet this Part, sample ramps built to design specifications shall be proof tested. To conform to this Standard, the ramps shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected. A platen nominally 4.0 in. (102 mm) long by 6.0 in. (152 mm) wide shall be used in conjunction with the tests specified in paras. 14-4.1.1 and 14-4.1.2.

NOTE: Material may be added to the platen to simulate a tire surface and prevent slippage of the platen.

14-4.1.1 Off-Center Load Test. A horizontally constrained vertical load equal to rated capacity shall be applied using the platen, first to the outside edge of the platform (one at a time) and second to the outside edges of the inclined portion of the ramp (one at a time), as shown in Fig. 14-4.1.1-1, for a period of 10 min with the base resting on a hard, level surface.

14-4.1.2 Proof Load Test. A horizontally constrained vertical load of 200% of rated capacity shall be applied for at least 10 min at the midpoint of the ramp incline using the platen. The load shall then be applied for at least 10 min to the portion of the platform designed to receive the tire footprint. See Fig. 14-4.1.2-1.

Fig. 14-4.1.1-1 Typical Test Area for Off-Center Load Test

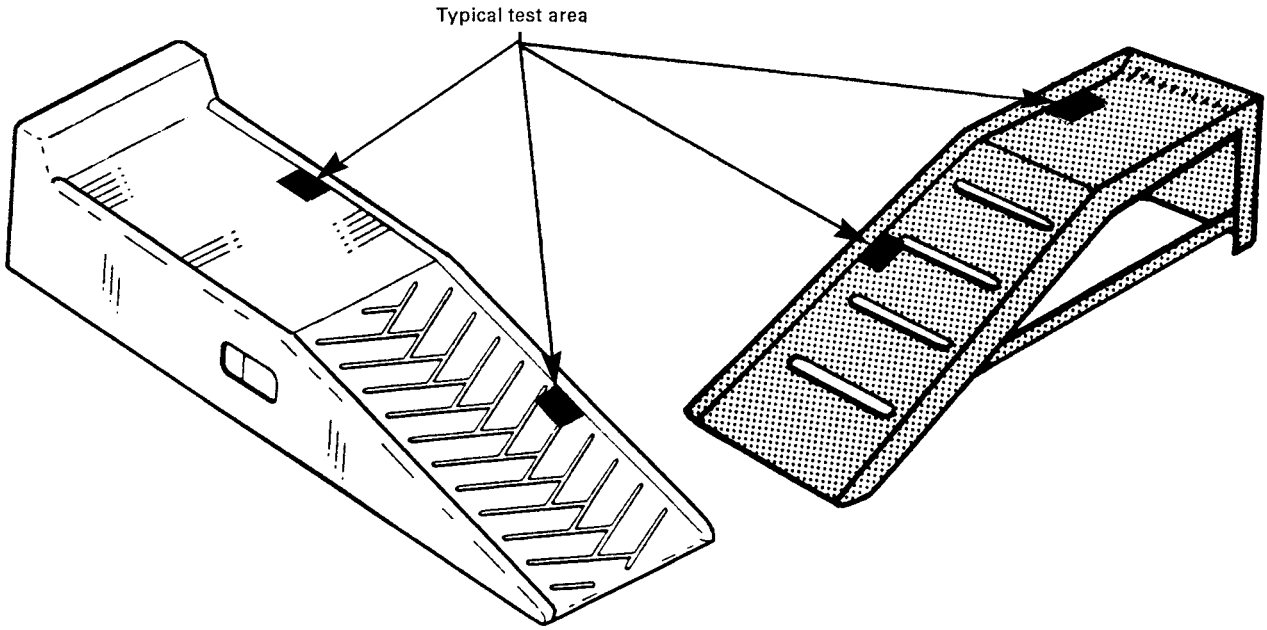
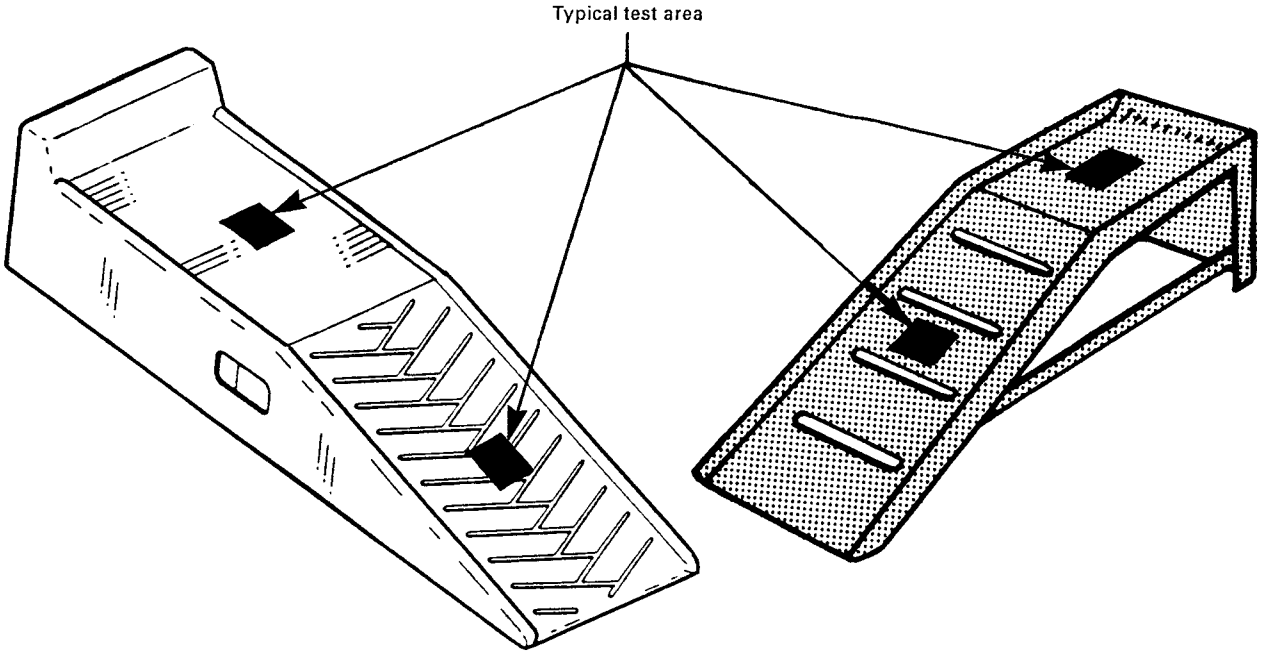


Fig. 14-4.1.2-1 Typical Test Area for Proof Load Test



Part 15
High-Reach Supplementary Stands

15-1 SCOPE, CLASSIFICATION, AND ILLUSTRATION

15-1.1 Scope

This Part applies to self-contained high-reach supplementary stands designed to help prevent the tipping or rocking of a vehicle while the vehicle is engaged on an automotive lift. This Part does not apply to devices classified as vehicle support stands (see Part 7) or devices classified as auxiliary stands (see Part 13).

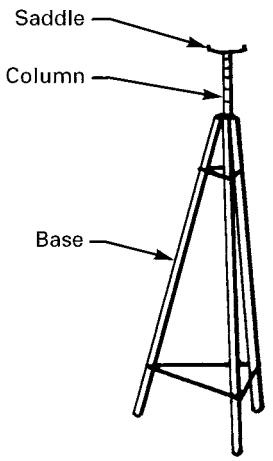
15-1.2 Classification

High-reach supplementary stands with an adjustable column is the classification for which this Part applies, excluding products with a convex base configuration (e.g., auxiliary stands).

15-1.3 Illustration

Figure 15-1.3-1 shows a typical high-reach supplementary stand and its components that are covered by this Standard; the illustration is not intended to be all-inclusive.

Fig. 15-1.3-1 Typical High-Reach Supplementary Stand



15-1.4 Definitions

base: that portion of the stand that rests on the ground and holds the adjustable column.

column: that portion of the stand that can be extended or retracted to vary the overall height.

freestanding: when initially positioned vertically, without a load, able to stand in an upright position without the application of external forces.

high-reach supplementary stands: self-contained devices to be used to add to the stability of a vehicle on an automotive lift by helping to prevent the tipping or rocking of the vehicle upon which work is being performed, but not to be used to support vehicles.

locking device: the mechanism used to hold the column in the selected height position.

15-2 DESIGN

15-2.1 Base

The base may be of any configuration that provides the equivalent of three or more points of contact with the ground. A circular, triangular, or polygonal base shape (in plan view) is considered equivalent to the above. The upper portion of the base shall be designed to house and guide the column.

15-2.2 Column

A means shall be provided to prevent the inadvertent separation of the column from the base. In the fully retracted position, the lower end of the column shall not extend below the plane made where the base contacts the ground.

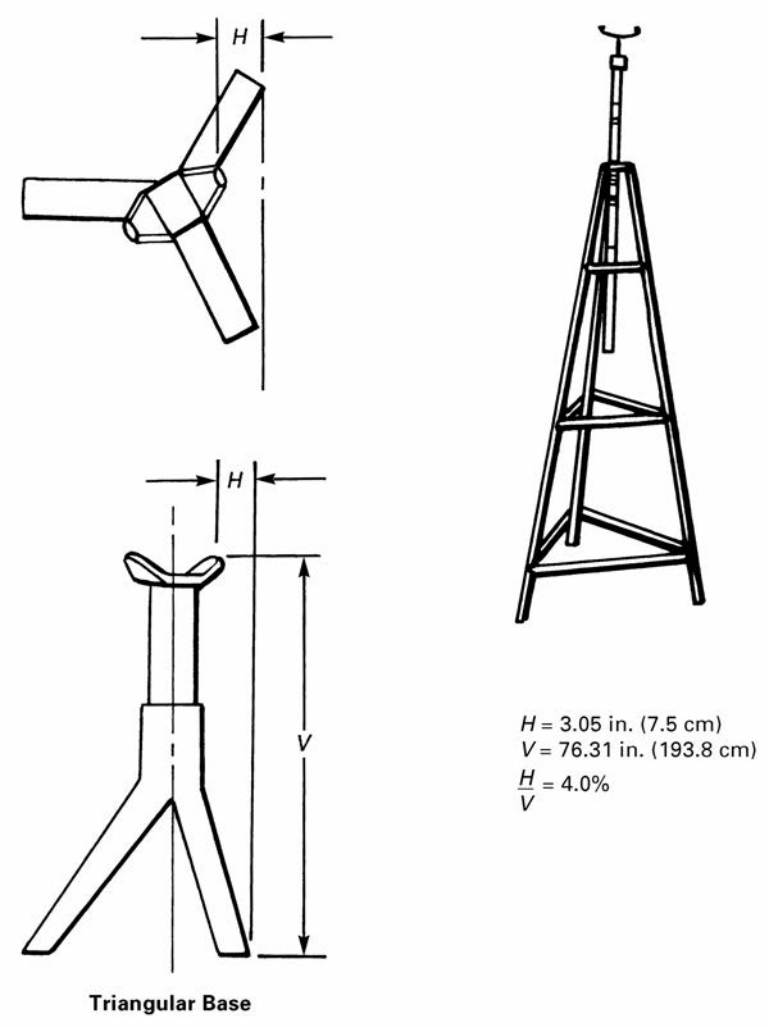
15-2.3 Locking Device

The locking device shall prevent adjustment of the column height after the load has been applied. If the column is supported by means of a locking pin, the pin must be secured to the stand to prevent its loss.

15-2.4 Operating Controls

Operating controls shall be designed in such a manner that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls should be clear to the operator by position, function, labeling, or a combination thereof. The release system shall require positive action by the operator for release to prevent accidental lowering.

Fig. 15-2.6-1 Stability



15-2.5 Saddle

The saddle configuration shall be such as to aid in the proper centering, positioning, and stabilization of the load.

15-2.6 Stability

The stands shall be designed so that the minimum horizontal distance from the projected edge of the saddle to the nearest edge of the base shall be at least 4% of the maximum extended vertical height. See Fig. 15-2.6-1, in which the horizontal dimension is shown as H and the vertical height as V.

15-2.7 Proof Load

All high-reach supplemental stands shall be capable of performing the proof load test of para. 15-4.1.1 with a load of 200% of rated capacity.

15-3 SAFETY MARKINGS AND MESSAGES

15-3.1 Safety Markings

Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings:

(a) Study, understand, and follow all instructions before operating this device.

(b) Do not exceed rated capacity.

(c) Use only on a hard, level surface.

(d) Do not use the stand to support a vehicle.

(e) Center load on saddle.

(f) Use stands in pairs to stabilize the vehicle before starting repairs.

(g) Failure to heed these markings may result in personal injury and/or property damage.

15-3.2 Safety Messages

Additional safety messages include the following: "No alterations shall be made to this product."

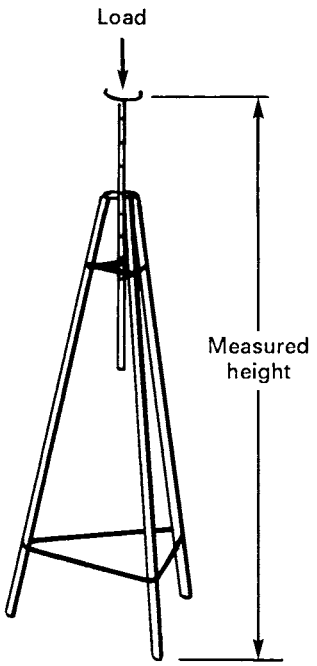
15-4 DESIGN QUALIFICATION TESTING

15-4.1 Proof Tests

For each design or design change that may affect the stand's ability to meet this Standard, sample stands built to design specifications shall be proof tested. To conform to this Standard, the stands shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected.

15-4.1.1 Proof Load Test. A static vertical load of 200% of rated capacity shall be applied centrally to the saddle, with the column in both the fully extended and the fully retracted positions, with the base resting on a hard, level surface. The load shall be applied as shown in Fig. 15-4.1.1-1 for at least 10 min. A permanent reduction in height, measured after the removal of the load, at the point of load contact shall not exceed 0.125 in. (3.18 mm). A preload of no more than 100% of rated capacity may be applied to establish initial overall height.

Fig. 15-4.1.1-1 Proof Load Test



Part 16
Forklift Jacks

16-1 SCOPE, CLASSIFICATION, AND ILLUSTRATION

16-1.1 Scope

This Part applies to hydraulic walking-beam-type jacks characterized by a lifting member that raises and lowers in a scissors action and is so arranged as to contact vehicles with low road clearance, on frame members for the purpose of raising the wheels of one end or one side of a vehicle free of the ground. Some jack designs may incorporate an auxiliary saddle not located on the lift member.

16-1.2 Classification

Hydraulic is the only classification for which this Part applies.

16-1.3 Illustration

Figure 16-1.3-1 shows a typical forklift jack covered by this Part; the illustration is not intended to be all-inclusive.

16-1.4 Definitions

base: the stationary portion of a jack to which lifting members are attached.

integrated lift point: notch or other means integrated into the lift member intended as a lift point.

jack, forklift: a self-contained device designed for lifting, but not sustaining, a partial vehicular load, consisting of a frame with wheels supporting a mechanism that actuates a pivoting lift arm equipped with a saddle that follows a path (arc) similar to that of the path (arc) of the vehicle being lifted.

primary saddle: saddle located on the lifting member.

secondary saddle: saddle not located on the lifting member.

16-2 DESIGN

16-2.1 Operating Controls

Operating controls shall be designed in such a manner that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls should be clear to the operator by position, function, labeling, or a combination thereof. The release system shall require intentional positive action by the operator for release to prevent accidental lowering.

16-2.2 Actuating-Handle Force

All jacks shall be capable of lifting the load at rated capacity when the operator, while in the operating position, exerts force on the lifting-device actuating handle. The actuating handle shall be capable of being operated to the jack's rated capacity without sustaining functional damage.

16-2.3 Internal Load-Limiting Device

All forklift jacks shall have an internal load-limiting device that can be deactivated during the proof load test. The load-limiting device shall activate when lifting no less than 100% of rated capacity but no more than 125% of rated capacity.

16-2.4 Travel Limit

Each jack shall be provided with a positive means to prevent the load from being raised or moved beyond the design limit of travel.

16-2.5 Proof Load

All forklift jacks shall be capable of performing the proof load test of para. 16-4.1.4 with a proof load of 150% of rated capacity.

16-2.6 Saddles

Primary saddles shall have raised protrusions, such as a tang, on the surface to act as a load restraint, and/or shall incorporate means intended to engage an edge on the load to be lifted. Auxiliary saddles, if so equipped, may be separately rated.

16-3 SAFETY MARKINGS AND MESSAGES

16-3.1 Safety Markings

If so equipped, secondary saddles shall be separately identified. Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings:

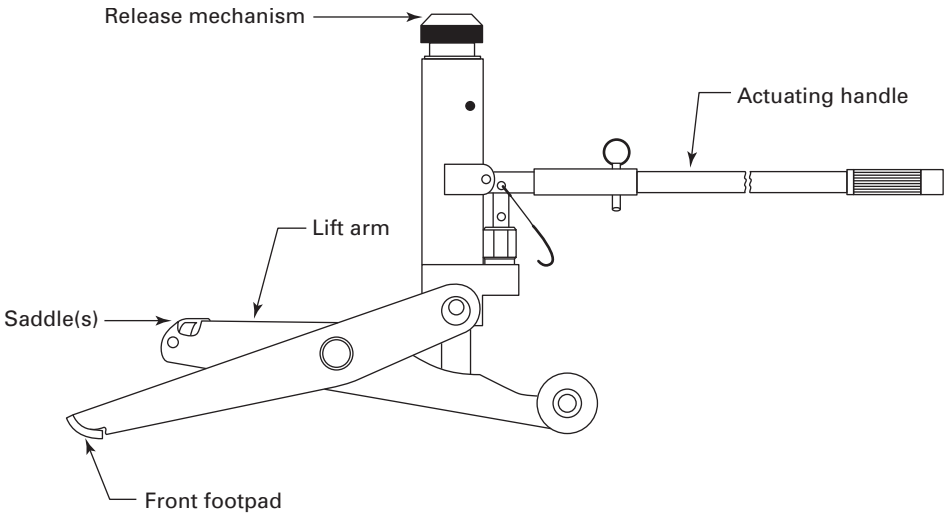
(a) Study, understand, and follow all instructions before operating this device.

(b) Do not exceed rated capacity.

(c) Use only on a hard, level surface.

(d) Support the vehicle with appropriate means immediately after lifting.

Fig. 16-1.3-1 Typical Forklift Jack



(e) Position this jack perpendicular to the vehicle such that the load is balanced by the remaining two wheels in contact with the surface.

(f) Failure to heed these markings may result in personal injury and/or property damage.

16-3.2 Safety Messages

Additional safety messages include the following:

(a) Ensure cylinder does not contact vehicle during lifting.

(b) Only attachments and/or adapters supplied by the manufacturer shall be used.

(c) Lift only on areas of the vehicle as specified by the vehicle manufacturer.

(d) No alterations shall be made to this product.

16-4 DESIGN QUALIFICATION TESTING

16-4.1 Proof Tests

Primary, integrated lift points and auxiliary saddles (if so equipped) shall be tested separately. For each design or design change that may affect the jack's ability to meet this Standard, sample jacks built to design specifications shall be proof tested. To conform to this Standard, the jacks shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected.

16-4.1.1 Load-Limiting Device Test. When the lift arm is in its lowest position, the load-limiting device shall activate when lifting no less than 100% of rated capacity but no more than 125% of rated capacity.

16-4.1.2 Load-Sustaining Test. A load not less than the rated capacity shall be applied to the lifting member raised approximately 0.5 in. (12.7 mm) above its lowest position. The load shall not lower more than 0.125 in. (3.18 mm) in the first minute nor more than a total of 0.1875 in. (4.76 mm) in 10 min. The initial measurement shall be taken when the load is applied, and the other measurements at the time period specified.

16-4.1.3 Release Test. A load not less than the jack's rated capacity shall be applied centrally to the saddle and the test performed at the following three points:

(a) lift arm horizontal[1]

(b) full extension

(c) a position measured midway between points (a) and (b)

16-4.1.4 Proof Load Test. A proof load, as defined in para. 16-2.5, shall be applied to the saddle. The load shall be lifted, sustained, and lowered throughout the range of travel. For purposes of this test, any internal load-limiting device should be deactivated.

16-4.1.5 Off-Center Load Test. A vertical load equal to the rated capacity shall be applied and sustained by means of a 1.0-in. (25.4-mm) wide rectangular block through the entire lifting range and maintained for 10 min on each outermost edge at full extension prior to lowering.

16-5 ATTACHMENTS AND ADAPTERS

Only the attachments or adapters supplied by the manufacturer or supplier for this equipment shall be used.

[1] For jacks with arched or curved lifting arms, the measurement for determining when the lift arm is in the horizontal position shall be taken at the highest point of the lifting arm's arch.

Part 17
Vehicle Transport Lifts

17-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

17-1.1 Scope

This Part applies to vehicle transport lifts that are used for lifting, transporting, servicing, and storing of automotive vehicles. It includes only those lifts that raise the automotive vehicle clear off the floor. It does not include those devices that are designed to lift one end or side of a vehicle, nor does it include stationary automotive lifts or automotive lifts that become stationary when loaded.

17-1.2 Classification

Hydraulic, pneumatic, and mechanical are the classifications for which this Part applies. When a combination of these force-transmitting means is used, each system shall be tested to conform with this Part.

17-1.3 Illustrations

Figure 17-1.3-1 shows typical vehicle transport lifts covered by this Part; the illustrations are not intended to be all-inclusive.

17-1.4 Definitions

lift, hydraulic: a movable device that utilizes a hydraulic pump as the force-transmitting means to raise and lower an automotive vehicle.

lift, mechanical: a movable device that utilizes mechanical-lifting means such as cables, gears, screws, chains, or the like as the force-transmitting means to raise and lower an automotive vehicle.

lift, pneumatic: a movable device that utilizes compressed air as the force-transmitting means to raise and lower an automotive vehicle.

lifting member: the portion of the lift that activates the lift platform.

lift platform: the portion of the lift that contacts the automotive vehicle, including any bracket(s) or adapter(s) provided.

load restraint: a device supplied by the manufacturer to restrain the load on the lift pad assembly.

mechanical load-holding means: mechanical means of securing the lift platform in a raised position.

vehicle transport lift: a lift equipped with wheels, rollers, or slides that render it capable of being moved while the load is in the raised position.

17-2 DESIGN

17-2.1 Operating Controls

Operating controls shall be designed in such a manner that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls should be clear to the operator by position, function, labeling, or a combination thereof. The release system shall require intentional positive action by the operator to prevent accidental lowering.

17-2.2 Actuating-Handle or Actuating-Pedal Force

Vehicle transport lifts shall be capable of lifting the load at rated capacity when the operator, while in the operating position, exerts force on the lifting-device actuating handle or pedal. The actuating handle or pedal shall be capable of being operated to the jack's rated capacity without sustaining functional damage.

17-2.3 Internal Load-Limiting Device

All hydraulic vehicle transport lifts shall have an internal load-limiting device that can be deactivated during the proof load test. The load-limiting device shall activate when lifting no less than 100% of rated capacity but no more than 125% of rated capacity.

17-2.4 Mobility

The force to move the vehicle transport lift when loaded to rated capacity shall be accomplished by the operator pushing or pulling the lift. Wheels and/or casters shall be configured to allow movement in the desired direction of travel.

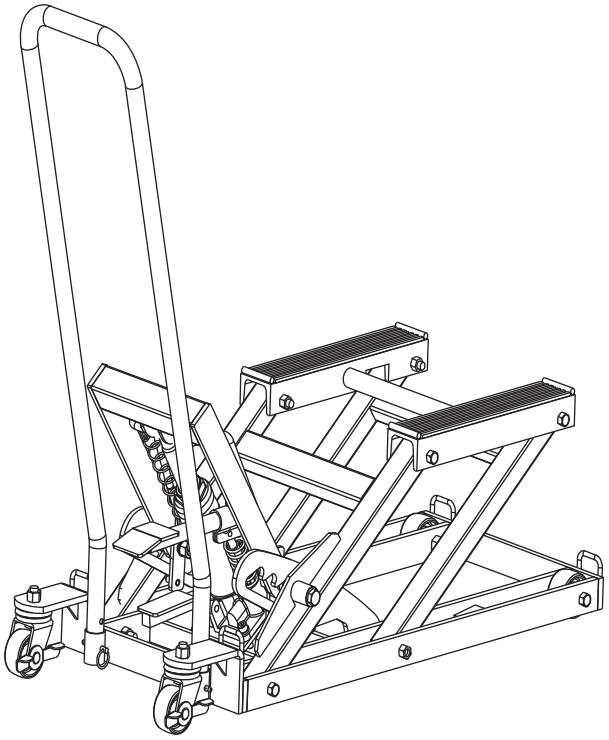
17-2.5 Lift Platform

A load restraint means shall be provided. The lift platform shall be designed to minimize slipping or sliding of the load along the platform's horizontal surface. The lift platform shall be designed in such a manner as to be capable of sustaining a proof load placed across its intended load contact member(s).

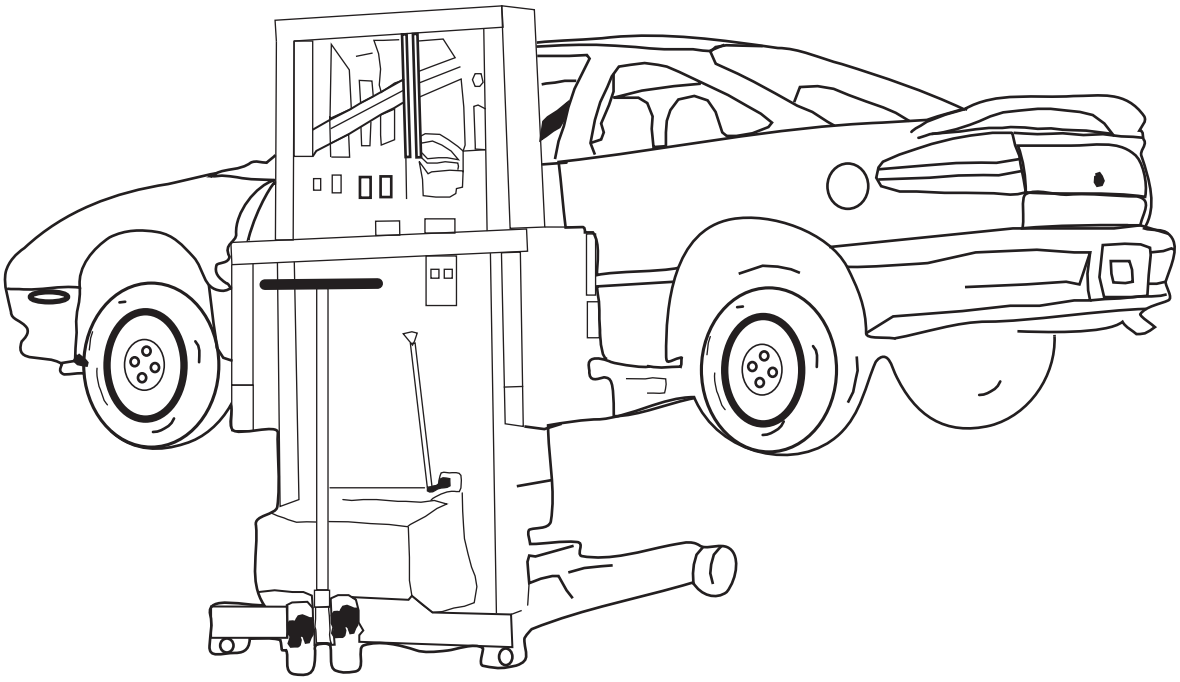
17-2.6 Mechanical Load-Holding Means

The lift shall be provided with a self-acting mechanical means of preventing inadvertent lowering of the load in the event of failure of the force-transmitting means. Such means shall prevent inadvertent lowering of more than 3.0 in. (76.2 mm) after raising to any position at

Fig. 17-1.3-1 Typical Vehicle Transport Lifts



(a)



(b)

or above the lowest designated storage position. Such means shall automatically reset upon full descent.

17-2.7 Travel Limit

Each lift shall be provided with a positive means to prevent the load from being raised or lowered beyond the design limit of travel.

17-2.8 Proof Load

All vehicle transport lifts shall be capable of performing the proof load test of para. 17-4.1.3 with a proof load of 200% of rated capacity.

17-2.9 Adapters and Restraints

All adapters and restraints manufactured specifically for a lift shall be capable of performing their intended function with that lift. All adapters and restraints shall be capable of supporting a proof load of 150% of the load they are designed to support.

17-3 SAFETY MARKINGS AND MESSAGES

17-3.1 Safety Markings

Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings:

(a) Study, understand, and follow all instructions before operating this device.

(b) Do not exceed rated capacity.

(c) Use only on a hard, level surface.

(d) Center load on lift platform.

(e) Lift only those areas of the automotive vehicle specified by its manufacturer.

(f) Immediately after lifting load, ensure lift mechanical load-holding means is engaged.

(g) Before moving, lower the load to the lowest possible point.

(h) Secure load with appropriate restraint device.

(i) Failure to heed these markings may result in personal injury and/or property damage.

17-3.2 Safety Messages

Additional safety messages include the following:

(a) Use of this product is limited to lifting, lowering, transporting, and storing in the lowered position loads consisting of a single motor vehicle whose lift points are compatible with the lift platform. Incompatibility is evident when the loaded vehicle wobbles, appears unstable, and/or does not securely engage the lift platform.

(b) Restraining an incompatible load will not make the load secure and may cause unexpected loss of load.

(c) Never work on, around, or under a load that is not secured and stable.

(d) Keep operator's and bystander's head, hands, and feet away from lift arms when raising and lowering.

(e) No alterations shall be made to this product.

(f) Only attachments, restraints, or adapters supplied by the manufacturer shall be used.

17-4 DESIGN QUALIFICATION TESTING

17-4.1 Proof Tests

For each design or design change that may affect the lift's ability to meet this Standard, sample lifts built to design specifications shall be proof tested. To conform to this Standard, the lift shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected.

17-4.1.1 Loaded Operational Test. A deadweight load equal to the rated capacity of the lift and configured such that the entire load is upon and above the lift platform shall be centrally located and restrained and the operational tests specified in paras. 17-4.1.1.1 through 17-4.1.1.6 shall be conducted. The mechanical load-holding means may be deactivated to facilitate testing.

17-4.1.1.1 Release Mechanism Test. With the lift fully extended, the release mechanism shall be operated to control the initial rate of descent to no more than 1.0 in./sec (25.4 mm/s). With the release mechanism fully open, the average rate of descent shall not exceed 4.0 in./sec (102 mm/s).

17-4.1.1.2 Mobility Test. The lift, with the lift platform at the highest locked height, shall be moved by means of the handle provided, in any direction over a smooth, level floor surface. The lift, while loaded as described in para. 17-4.1.1, shall be moved at 1.5 ft/sec (457 mm/s) to 2.0 ft/sec (610 mm/s) across a 0.5-in. (12.7-mm) high, 15-deg-slope rise in the floor and a 0.5-in. (12.7-mm) drop to the floor, at an approach angle that will bring each caster or wheel individually into contact with the rise and drop. The lift shall traverse the rise and drop without loss of load or tipping over.

17-4.1.1.3 Stability Test. The lift, with the lift platform at the highest locked height, shall be moved by means of the handle provided, while loaded as described in para. 17-4.1.1, at 1.5 ft/sec (457 mm/s) to 2.0 ft/sec (610 mm/s) against a 2.0-in. (51-mm) high vertical rise 90 deg to the direction of movement at an approach angle that will bring two wheels or casters in simultaneous contact (or the lift base frame in contact) with the rise in the direction of greatest instability. The lift shall not lose the load or tip over.

17-4.1.1.4 Loaded Operation Test. With the lift raised to its highest locked height, a force of 100 lbf (444 N) shall be applied centrally in the lateral and longitudinal directions both forward and rearward to the load for 10 sec in each direction, without the wheels

or casters lifting from the surface. The lift wheels may be restrained for this test.

17-4.1.1.5 Load-Sustaining Test. With the lift platform at its maximum height and the mechanical load-holding means disengaged, the lift shall sustain the load and shall not lower more than 0.125 in. (3.18 mm) in the first minute nor more than a total of 0.1875 in. (4.76 mm) in 10 min. The initial measurement shall be taken when the load is applied, and the other measurements at the time period specified.

17-4.1.1.6 Mechanical Load-Holding Means Test. The lift platform shall be raised with the mechanical load-holding means positioned to allow maximum disengaged distance from the nearest downward engagement. The release valve shall be fully opened to allow the maximum rate of descent of the lift. The lift shall be allowed to free-fall to the nearest engagement. The lift shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected.

17-4.1.2 Load-Limiting Device Test. The load-limiting device in hydraulic vehicle transport lifts shall activate when lifting no less than 100% of rated capacity but no more than 125% of rated capacity. Lifts with multiple-stage hydraulics shall meet these requirements with the final stage extended at least 1.0 in. (25.4 mm) above its low height. Jacks with lift arms shall meet these requirements with the lift arm in the horizontal position.

17-4.1.3 Proof Load Test. A proof load, as defined in para. 17-2.8, shall be applied centrally across the lift platform. The load shall be lifted and lowered throughout the lifting range. For purposes of this test, any internal load-limiting device should be deactivated.

Part 18
Vehicle-Moving Dollies

18-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

18-1.1 Scope

This Part applies to fixed-frame and lifting-frame vehicle-moving dollies to be used in matched pairs, which contact the vehicle wheels on the circumference, for the purpose of moving a vehicle.

18-1.2 Classification

The two classifications for which this Part applies are as follows:

(a) fixed-frame vehicle-moving dollies requiring the vehicle wheel to be lifted onto the dolly, characterized by a depressed platform or laterally spaced members that contact the vehicle wheels at two areas on the circumference

(b) lifting-frame vehicle-moving dollies, having hydraulic or mechanical means to raise the vehicle wheel, characterized by a pair of laterally spaced lifting members that raise and lower in unison and are so arranged as to contact the vehicle wheels at two areas on the circumference

18-1.3 Illustrations

Figure 18-1.3-1 shows typical vehicle-moving dollies covered by this Part; the illustrations are not intended to be all-inclusive.

18-1.4 Definitions

frame: the structure of a moving dolly used for supporting a load.

vehicle-moving dolly, hydraulic: a vehicle-moving dolly that utilizes a hydraulic pump to raise and lower the dolly.

vehicle-moving dolly, mechanical: a vehicle-moving dolly that utilizes mechanical means to raise and lower the dolly.

18-2 DESIGN

18-2.1 Operating Controls

Operating controls shall be designed in such a manner that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls should be clear to the operator by position, function, labeling, or a combination thereof. The release system shall require intentional positive action by the operator for release to prevent accidental lowering.

18-2.2 Resistance to Roll-Off

Each vehicle-moving dolly shall have an inherent means of resisting vehicle roll-off from the dolly or a means to retain the vehicle wheel.

18-2.3 Locking Devices

A means shall be provided to prevent the vehicle from lowering after it is lifted from the floor. If the lifting member is supported by means of a locking pin, the pin shall be secured to the dolly to prevent its loss. Wheel locks shall be provided to prevent the dolly from moving when it is placed in its destination location.

18-2.4 Mobility

The force to move the vehicle-moving dollies when loaded to rated capacity with a vehicle shall be accomplished by the operator pushing or pulling the vehicle. Wheels and/or casters shall be configured to allow movement in the desired direction of travel.

18-2.5 Lifting-Frame Vehicle-Moving Dollies

18-2.5.1 Travel Limit. Vehicle-moving dollies shall be provided with a positive means to prevent the load from being raised or lowered beyond the design limit of travel.

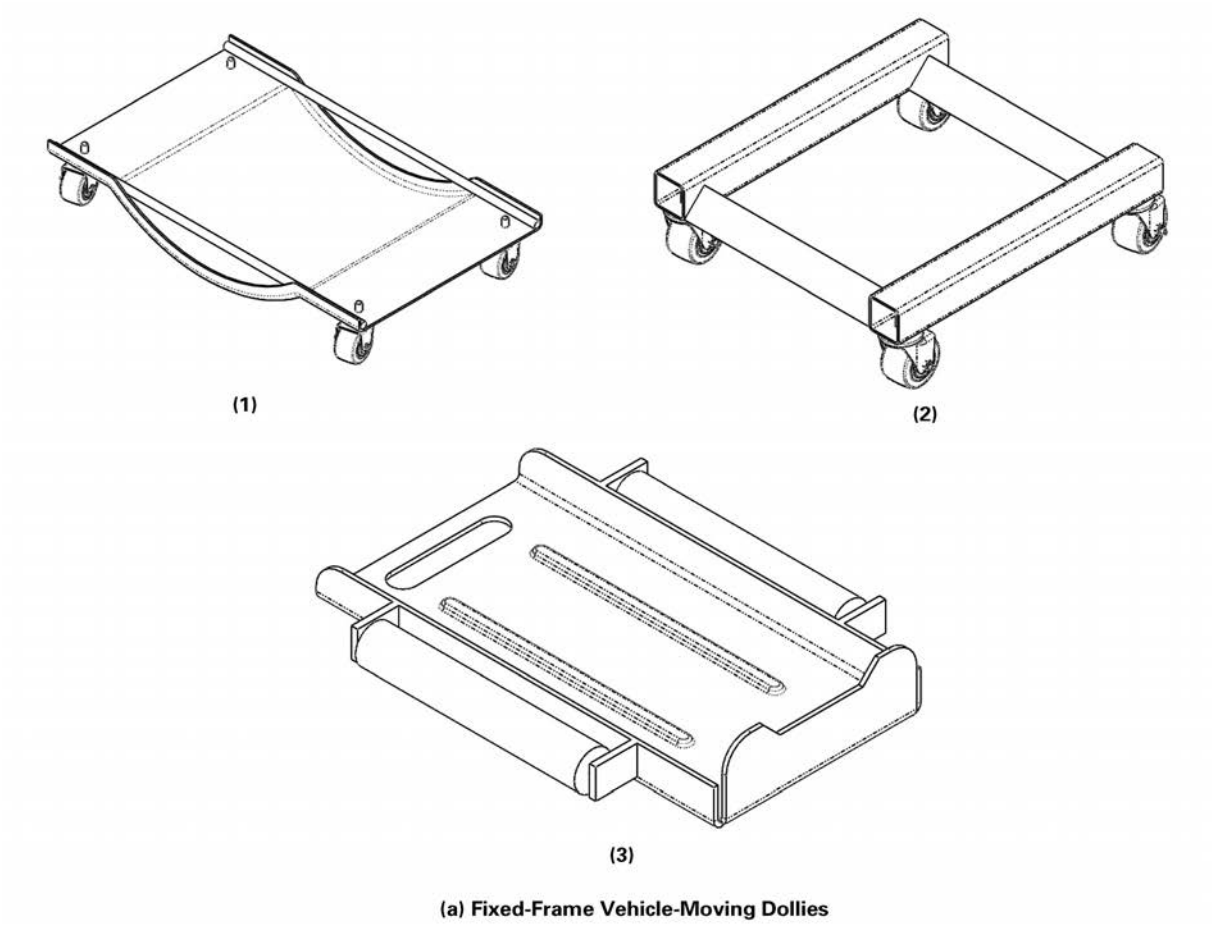
18-2.5.2 Actuating-Pedal Force. Vehicle-moving dollies shall be capable of lifting the load at rated capacity when the operator, while in the operating position, exerts force on the lifting-device actuating pedal. The actuating pedal shall be capable of being operated to the dolly's rated capacity without sustaining functional damage.

18-2.5.3 Internal Load-Limiting Device. All hydraulic vehicle-moving dollies shall have an internal load-limiting device that should be deactivated during the proof load test. The load-limiting device shall activate when lifting no less than 100% of rated capacity but no more than 125% of rated capacity.

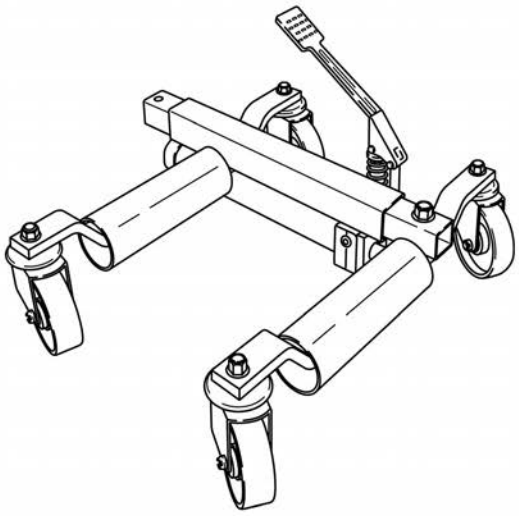
18-2.6 Proof Load

Each vehicle-moving dolly shall be capable of performing the proof load test of para 18-4.1.2 with a proof load of 150% of rated capacity.

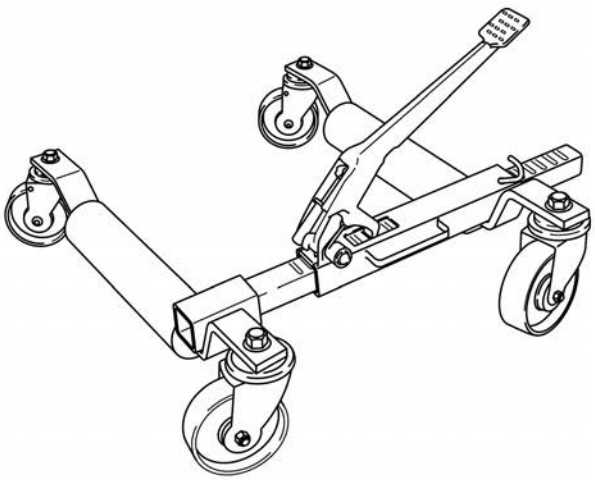
Fig. 18-1.3-1 Typical Vehicle-Moving Dollies



(a) Fixed-Frame Vehicle-Moving Dollies



(b) Hydraulic Lifting-Frame Vehicle-Moving Dolly



(c) Mechanical Lifting-Frame Vehicle-Moving Dolly

18-3 SAFETY MARKINGS AND MESSAGES

18-3.1 Safety Markings

Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings:

(a) Study, understand, and follow all instructions before operating the device.

(b) Do not exceed rated capacity.

(c) Use only on a hard, level surface.

(c) Before moving the vehicle, ensure that the vehicle wheels are centered and secure.

(d) Activate the wheel- and/or caster-locking devices after moving a vehicle.

(e) Never work on, around, or under a vehicle supported by vehicle-moving dollies.

(f) Failure to heed and understand these instructions may result in personal injury and/or property damage.

18-3.2 Safety Messages

Additional safety messages include the following:

(a) Use of this product is limited to transporting only.

(b) No alterations shall be made to this product.

18-4 DESIGN QUALIFICATION TESTING

18-4.1 Proof Tests

For each design or design change that may affect the dolly's ability to meet this Standard, sample vehicle-moving dollies built to design specifications shall be proof tested. To conform to this Standard, the vehicle-moving dolly shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected.

18-4.1.1 Operational Test. Identical vehicle-moving dollies shall be placed under the wheels of an appropriately loaded vehicle and the operational tests specified in paras. 18-4.1.1.1 and 18-4.1.1.2 shall be conducted.

18-4.1.1.1 Mobility Test. The force to move the vehicle shall be accomplished by the operator pushing or pulling the vehicle on the dollies. Wheels and/or casters shall be configured to allow movement in the desired direction of travel.

18-4.1.1.2 Horizontal Force Test. With the vehicle supported at the maximum height of the dollies, the wheel locks shall be actuated and a force of 100 lbf (444 N) shall be applied centrally to the vehicle, in the forward, rearward, and sideward directions for 10 sec. The vehicle shall remain on the dollies without roll-off, and the dollies shall sustain the vehicle without moving.

18-4.1.2 Proof Load Test. A proof load, as defined in para. 18-2.6, shall be applied centrally to the platform or between the supporting members. Hydraulic and mechanical vehicle-moving dollies shall be lifted throughout the range of travel. A permanent reduction in height, measured after the removal of the load, at the point of load contact shall not exceed 0.125 in. (3.18 mm). A preload of no more than 100% of rated capacity may be applied to establish initial overall height.

Part 19
Wheel Lift Jacks

19-1 SCOPE, CLASSIFICATION, AND ILLUSTRATION

19-1.1 Scope

This Part applies to mobile wheel lift jacks that are used to lift and support one end of a vehicle by cradling opposing tires. They are used in pairs to provide access to the undercarriage. Devices covered by this Part are not automotive lifts defined by ANSI/ALI ALCTV.

19-1.2 Classification

Wheel lift jacks can be powered by one of the following means or any combination thereof:

(a) pneumatic
(b) hydraulic
(c) electric
(d) mechanical

19-1.3 Illustration

Figure 19-1.3-1 shows a typical wheel lift jack covered by this Part.

19-1.4 Definitions

base: the portion of the lift that rests on the floor and supports the actuating cylinder and the carriage.

forks: the portion of the lift that cradles the wheel during lifting of the vehicle. The forks are part of the carriage that moves vertically to lift the vehicle.

hoses: conduits that transfer the pressurized fluid from the pump or compressor to the actuating cylinder.

mechanical supports: column members that are incrementally spaced to positively hold the carriage at one or more vertical positions.

pump: means to provide pressurized fluid to the actuating cylinder to lift the load.

wheel: tire-and-rim assembly mounted to the end of each axle.

19-2 DESIGN

19-2.1 Hoses (If Used)

Hoses shall be designed to be compatible with the contained fluid. Air hoses shall be rated at a minimum of 300 psi working pressure per SAE guidelines. Hydraulic hoses shall be able to resist 2 times working pressure at rated capacity without rupture.

19-2.2 Pumps (If Used)

Pumps shall be designed to deliver the pressures required to meet the requirements of para. 19-2.8.

19-2.3 Locking Device

A locking device such as a locking pin may be used to lock the lifts in position after they are lowered onto the mechanical supports.

19-2.4 Operating Controls

Operating controls shall be designed in such a manner that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls should be clear to the operator by position, function, labeling, or a combination thereof. Individual controls should be employed to allow level lifting. When used as a vehicle support stand, the wheel lift jack shall be locked on a mechanical support and the pressure removed. The unit shall not be moveable when loaded.

19-2.5 Mobility

When unloaded, the wheel lift jack shall be readily moveable to engage or disengage the tire. When loaded, the base of the unit shall be in full contact with the floor.

19-2.6 Stability

The forks of the wheel lift shall lie within the base envelope to prevent tipping when loaded.

19-2.7 Mechanical Supports

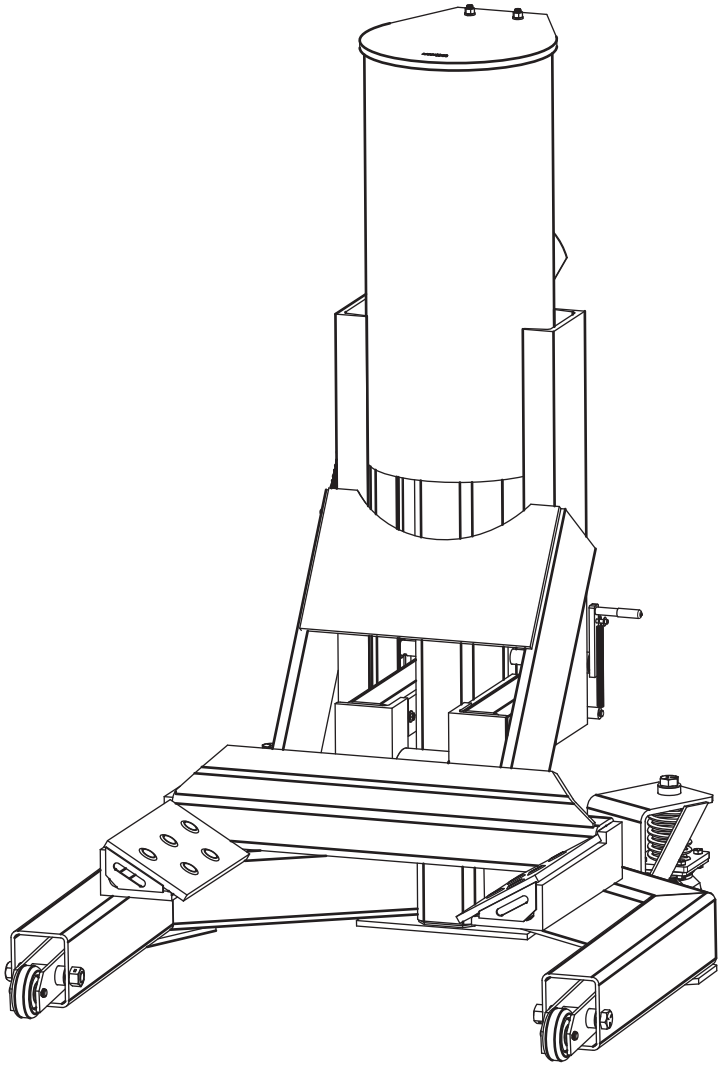
Wheel lift jacks shall have mechanical supports incrementally spaced on the lift column capable of supporting the loads as required in section 19-4.

19-2.8 Proof Load

Each wheel lift jack shall be tested to a proof load per para. 19-4.1.1. A fixture up to 6 in. by 6 in. (152 mm by 152 mm) may be used to simulate a tire engaged by each of the forks on the carriage. The load shall be applied so its centerline is 6 in. (152 mm) from the outermost edge of each of the forks on the carriage. The proof load shall be as follows based on the rated capacity of the jack:

(a) Jacks shall be able to withstand 150% of the rated capacity throughout their lifting range and remain functional.

Fig. 19-1.3-1 Typical Wheel Lift Jack



(b) Jacks shall withstand 200% of rated capacity without structural failure. Jacks shall remain functional such that the carriage assembly can be lowered to the stowed position.

19-3 SAFETY MARKINGS AND MESSAGES

19-3.1 Safety Markings

Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings:

(a) Study, understand, and follow all instructions before operating the device.

(b) Do not exceed rated capacity of the wheel lift jack.

(c) Do not raise one end of the vehicle if the other end is supported by vehicle support stands.

(d) Do not allow any part of your body under the vehicle until both the wheel lift jacks are pinned as stands.

(e) Wheel lift jacks shall be used in pairs.

(f) Do not raise or lower one side of a vehicle. Wheel lifts shall always be used in pairs to lift wheels on opposite ends of the same axle.

(g) Do not use with any other device.

(h) Disengage parking brake and place the transmission in neutral after the wheel lift jacks have been placed.

(i) Failure to heed and understand these instructions and markings may result in personal injury and/or property damage.

19-3.2 Safety Messages

Additional safety messages include the following:

(a) Do not lift the entire vehicle with multiple sets of wheel lift jacks.

(b) Use only on a hard, level surface.
(c) Use wheel lift jacks only beneath the vehicle tires.
(d) No alterations shall be made to this product.

19-4 DESIGN QUALIFICATION TESTING

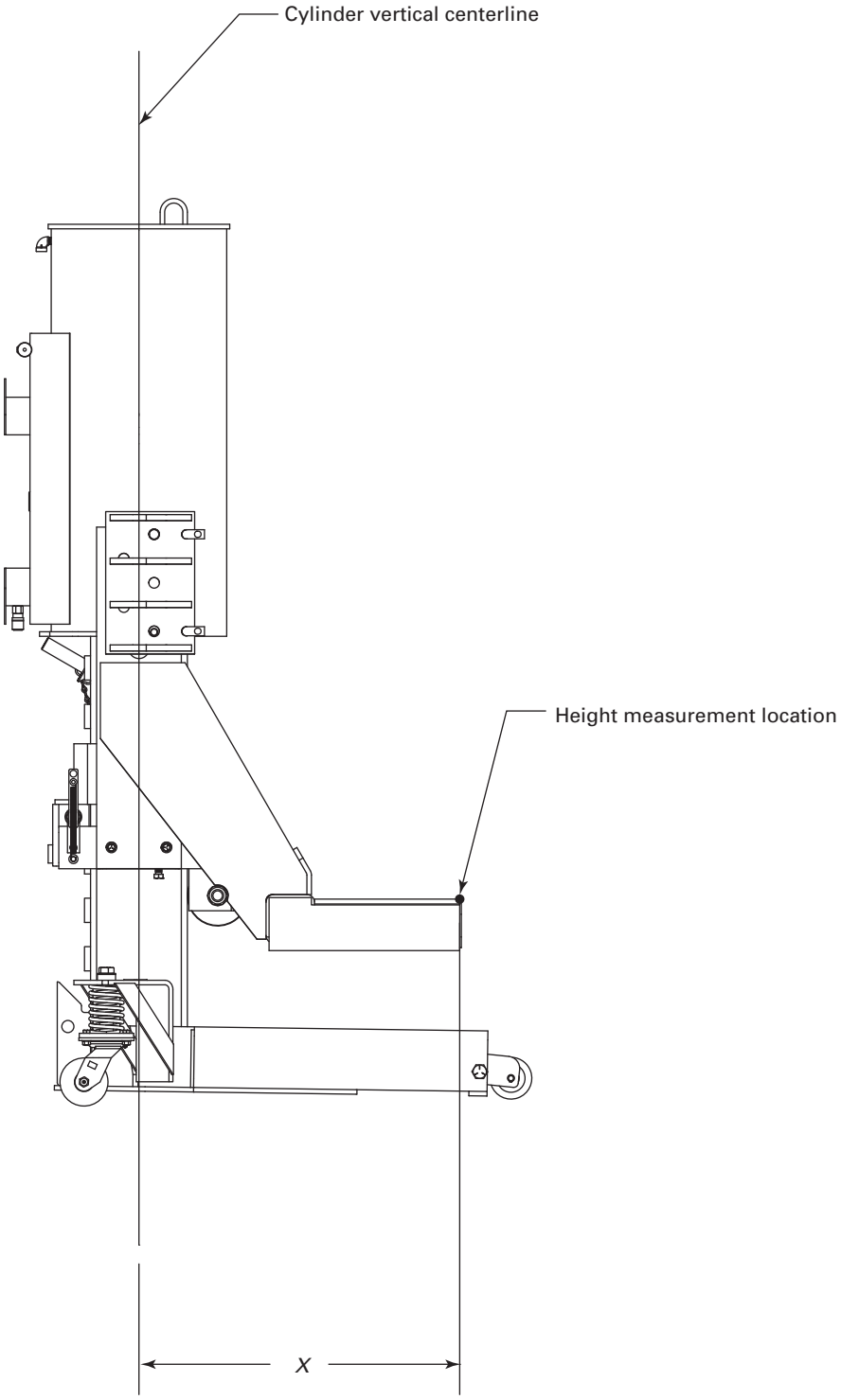
19-4.1 Proof Tests

For each design or design change that may affect the wheel lift jack's ability to meet this Standard, sample wheel lift jacks built to design specifications shall be proof tested as indicated in para. 19-2.8. To conform to this Standard, the wheel lift jacks shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected. Prior to any testing or measurements, a new jack may be loaded with up to rated capacity and operated through one full lifting and lowering cycle. A baseline height measurement at a convenient location on the carriage lift forks shall establish the start condition. The horizontal distance from the vertical centerline of the lift cylinder or drive screw to the baseline height measurement point on the carriage lift forks shall also be recorded as measurement *X*. Figure 19-4.1-1 shows an example of how *X* is measured.

19-4.1.1 Proof Load Test. The wheel lift jack shall be loaded to 150% of rated capacity and then raised and lowered throughout the full range of travel. The load shall be removed and a height measurement shall be taken at the same location on the carriage lift forks as was used for the baseline height measurement taken as specified in para. 19-4.1. The change in these measurements shall not exceed 3% of the measurement *X* taken as specified in para. 19-4.1.

19-4.1.2 Load-Sustaining Test. The wheel lift jack shall be engaged on its highest mechanical stop. If a locking device is present, it shall be engaged. The pressure shall be removed and a load equal to 200% of rated capacity shall be applied. The load shall be maintained for 10 min. The load shall be removed and the carriage assembly lowered to the ground without external force applied. There shall not be any critical failures or deformation that can cause loss of the load.

Fig. 19-4.1-1 Example Measurement Location for Dimension *X*



Part 20
Shop Presses

20-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

20-1.1 Scope

This Part applies to shop presses that are used in automotive and truck service centers and maintenance facilities in the removal and installation of bearings on shafts, removal of components that are rusted in place, straightening, and other uses. This Part does not apply to presses that are covered under ANSI B11.2, or presses that use manual power, such as a manual screw press.

Representative devices covered by this Part include shop presses that range from 4 tons of force to 200 tons of force. These presses may be table mounted or freestanding.

20-1.2 Classification

Shop presses covered by this Part are powered by one of the following means or a combination thereof:

(a) pneumatic
(b) hydraulic
(c) electromechanical
(d) electrohydraulic

20-1.3 Illustrations

Figures 20-1.3-1, 20-1.3-2, and 20-1.3-3 show typical shop presses; the illustrations are not intended to be all-inclusive.

20-1.4 Definitions

bolster, lower: the part of the frame that supports the workpiece. It is usually adjustable to accommodate different openings between the bottom of the retracted cylinder and the top of the lower bolster. The lower bolster is commonly pinned to the uprights so that it can be adjusted.

bolster, upper: the upper part of the frame that usually houses the cylinder. This portion of the press is typically fixed in position by welding or bolting to the uprights.

cables: a means used to adjust the elevation of the lower bolster. Cables typically run over sheaves and are wound around the drum of a winch.

cylinder: the means of exerting force to the workpiece that is being assembled, separated, straightened, or compressed. Hydraulic power is typically used, but this does not exclude the use of screw drives or pneumatic cylinders.

frame: the structure of the press that typically comprises two uprights, a lower bolster, and an upper bolster.

guard or scatter shield: a shroud that surrounds the work area of the press to inhibit flying objects caused by pushing on work that may break, separate, or be ejected by the high compressive forces developed.

hose: a flexible conduit for hydraulic fluid from the pump to the cylinder.

mounting feet or rails: feet or rails that are bolted or welded to the uprights and that rest on the floor or table or both. These are used to anchor the press to prevent jumping and tipping of the press while it is being used.

pump: means by which the hydraulic fluid is delivered to the cylinder to perform work. A pump may be manual, air powered, or electrically powered.

uprights: vertical members of the press that structurally hold and maintain the upper and lower bolsters during operation.

winch: a device that is mounted to the outside of the upright and is used in conjunction with cables to raise and lower the lower bolster of the press.

20-2 DESIGN

20-2.1 Cylinders

The cylinder shall be designed to meet the stated capacity of the press. In addition, it shall meet the requirements outlined in para. 20-2.10.

20-2.2 Frame

The frame may be of any configuration that incorporates uprights and an upper and lower bolster arrangement wherein one of the bolsters is adjustable. Normally the upper bolster houses or contains the cylinder. There are mounting feet to secure the press to a floor or table. Frames shall conform to the requirements outlined in para. 20-2.10.

20-2.3 Hoses

The hoses shall be rated at a minimum working pressure of 10,000 psi (68 900 kPa) and have a burst pressure of no less than 20,000 psi (138 000 kPa).

Fig. 20-1.3-1 Shop Press, Air or Hydraulic

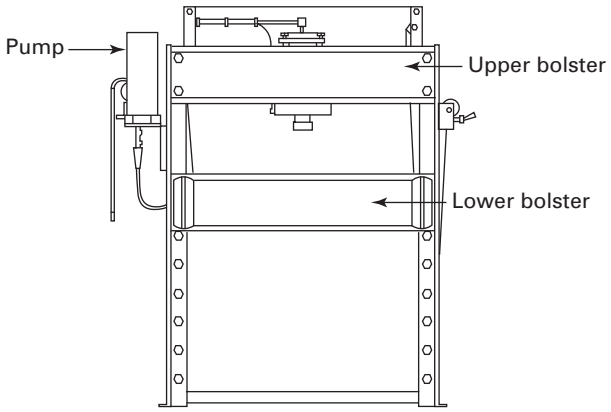


Fig. 20-1.3-2 Shop Press, Manual Hydraulic

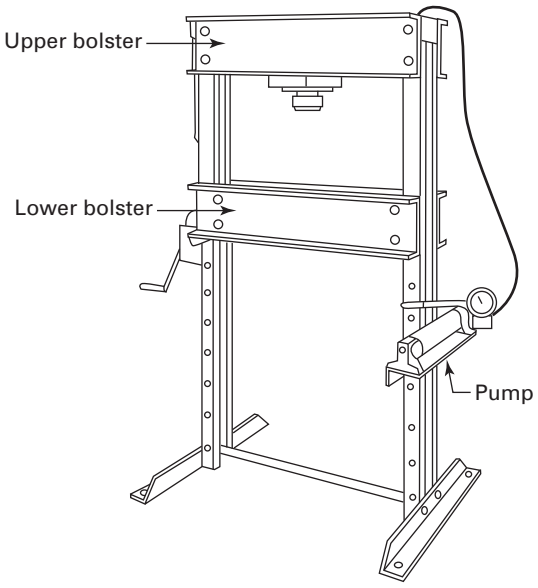
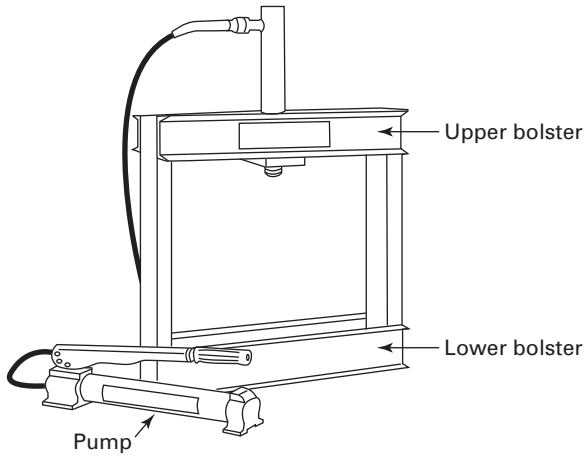


Fig. 20-1.3-3 Shop Press, Manual Hydraulic Bench



20-2.4 Pumps

Pumps shall be designed to handle the pressures required to deliver the stated capacities of the press. Pumps shall conform to the requirements outlined in para. 20-2.10.

20-2.5 Load Gauge

A gauge shall be provided to show the user the load being generated.

20-2.6 Locking Device

The locking device, normally a pin, shall be designed to hold the movable bolster in place during operation of the press when it is performing work. The locking device shall conform to the requirements outlined in para. 20-2.10.

20-2.7 Operating Controls

Operating controls shall be designed such that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls shall be clear to the operator by position, function, labeling, or a combination thereof.

20-2.8 Stability

The mounting feet or rails of the press shall be firmly anchored to the floor or table.

20-2.9 Guarding

20-2.9.1 Manufacturer's Responsibility. A point-of-operation guard shall be made available by the manufacturer and shall meet the following design, construction, application, and adjustment requirements:

(a) The guard shall prevent entry of hands or other body parts into the point of operation by reaching through, over, under, or around the guard.

(b) The guard shall create no pinch point between itself and moving parts.

(c) The guard shall offer visibility of the point of operation consistent with the operation being performed.

(d) The guard shall be of such design and strength so as to protect the operator and others from the hazards associated with the point of operation.

20-2.9.2 Owner's Responsibility. The owner shall be responsible for making sure the operator is trained in how to use the guarding and that the operator wears the required personal protective equipment (PPE) as described in Occupational Safety and Health Administration (OSHA) regulations.

20-2.10 Proof Load

Each press shall be tested to a proof load based on rated capacity and shall be functional and usable after

such a test. The proof load shall be based on the stated capacity of the press.

(a) Units with an overload protection circuit shall sustain an overload of 150% of rated capacity and meet the criteria stated above.

(b) Units without an overload protection circuit in the pump or power system shall sustain an overload of 200% of rated capacity and meet the criteria stated above.

20-3 SAFETY MARKINGS AND MESSAGES

20-3.1 Safety Markings

Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings:

(a) Study, understand, and follow all instructions before operating the device.

(b) Do not exceed rated capacity.

(c) Prior to use, make sure the press is securely anchored.

(d) The press shall be installed and operated in accordance with federal (OSHA), state, and local safety standards.

(e) Operators and observers shall wear eye protection that meets ANSI/ISEA Z87.1 and OSHA standards.

(f) Failure to heed and understand these instructions and markings may result in personal injury and/or property damage.

20-3.2 Safety Messages

Additional safety messages include the following:

(a) Keep hands, arms, feet, and legs out of the work area. Accidental slippage can result in personal injury.

(b) Use appropriate guarding to contain any pieces that may break or fly apart when applying force.

(c) When attachments and adapters are used, the rated capacity of the system shall be no greater than the rated capacity of the lowest-rated component or combination of components that make up the system.

(d) Verify lift cables are slack before pressing on the bolster.

(e) Avoid off-center loads.

(f) No alterations shall be made to the product.

20-4 DESIGN QUALIFICATION TESTING

20-4.1 Proof Tests

For each design or design change that may affect the press's ability to meet this Standard, sample presses built to design specifications shall be proof tested. To conform to this Standard, the presses shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected. A platen or bolster plate shall be used when the cylinder applies a load to the lower bolster. The width of the platen or bolster plate shall not exceed 3 times the diameter of the cylinder ram, and the platen or bolster plate shall be long enough to engage the top portion of the lower bolster bearing surfaces and thick enough to withstand the proof load without sustaining permanent deformation.

20-4.1.1 Off-Center Load Test. A compressive load equal to the rated capacity of the press shall be applied to the press between the upper and lower bolsters, with the cylinder set at maximum left and right offset from the center of the press if the press is equipped with a sliding cylinder feature. In each test, a centered preload of no more than 100% of rated capacity should be applied and then released to obtain the initial measurement. The measurement shall be taken between the bottom of the upper bolster and the top of the lower bolster. The comprehensive load equal to the rated capacity of the press shall be applied for 1 min and then released, at which time a second measurement shall be taken. The press's ability to retain the load shall not be adversely affected. Permanent increase in dimension between the bottom of the upper bolster and the top of the lower bolster shall not exceed 0.125 in. (3.18 mm). The same test protocol shall be conducted with the movable bolster in its minimum and maximum height positions.

20-4.1.2 Load-Limiting Test. Shop presses employing a hydraulic power source shall be pumped against a measured load until the load-limiting device is activated, at which time the force applied to the upper and lower bolsters shall be no less than 100% of the press's rated capacity but no more than 125% of its rated capacity.

20-4.1.3 Proof Load Test. A preload of no more than 100% of the rated capacity shall be applied centrally between the upper and lower bolsters. After the preload is removed, a measurement shall be taken between the bottom of the upper bolster and top of the lower bolster to establish the initial dimension. A proof load, as defined in para. 20-2.10, shall be applied centrally between the upper and lower bolsters for at least 10 min, after which time the load shall be removed and a second measurement taken. Permanent increase in the dimension between the bottom of the upper bolster and top of the lower bolster shall not exceed 0.125 in. (3.18 mm). If the dimension increases more than 0.125 in. (3.18 mm), it constitutes failure of test. The same test protocol shall be conducted with the movable bolster in its minimum and maximum height positions. Any load-limiting device should be deactivated for purposes of this test. Should the originally supplied pump handle or foot pump pedal not be capable of activating the pump mechanism, a substitute handle or pedal may be used for the performance of the test.

Part 21
Oil Filter Crushers

21-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

21-1.1 Scope

This Part applies to oil filter crushers that are used in automotive and truck service centers and maintenance facilities to extract excess oil from used engine oil filters and to reduce the filters' size for ease of recycling. This Standard is limited to nonmanual-type devices.

21-1.2 Classification

Oil filter crushers covered by this Part are powered by the following means:

(a) pneumatic
(b) hydraulic
(c) pneumatic/hydraulic
(d) electrohydraulic

21-1.3 Illustrations

Figures 21-1.3-1 and 21-1.3-2 show typical oil filter crushers; the illustrations are not intended to be all-inclusive.

21-1.4 Definitions

access door: a hinged, sliding, or otherwise moveable cover that acts as part of the enclosure when closed and allows insertion and removal of oil filters when open.

cylinder: a means of exerting crushing force to the oil filter, comprising compressed air or hydraulic fluid.

drain: a means for transferring waste oil extracted from the oil filter during the crushing process to a drum or other waste container.

enclosure: a structural cover that physically isolates the crushing area.

foot or feet: supporting member or members in contact with the floor or table. (In the case of a filter crusher mounted directly to a waste barrel, the bottom of the barrel shall be considered the foot.)

hose: a conduit for hydraulic fluid from the pump to the cylinder.

internal structure: the mechanical structure of the crusher that rigidly holds the cylinder and reaction plate so that the oil filter can be crushed between them. (This typically includes two or more tie rods.)

pump: a means by which the hydraulic fluid is delivered to the cylinder to perform work. A pump may be manual, air powered, or electrically powered.

reaction plate: the structure against which the oil filter is crushed by the cylinder.

safety lockout: a device that prevents the crushing process from starting when the access door is open.

21-2 DESIGN

21-2.1 Cylinders

The cylinder shall be designed to meet the stated capacity of the oil filter crusher. In addition, it shall meet the requirements outlined in para. 21-2.7.

21-2.2 Internal Structure

The frame may be of any configuration that incorporates the makeup of tie rods and an upper and lower plate arrangement. Typically the upper plate houses or contains the cylinder. There are mounting means to secure the oil filter crusher to a collecting drum, table, or floor. Internal structures shall conform to the requirements outlined in para. 21-2.7.

21-2.3 Hoses

The hoses shall be rated at a minimum working pressure of 10,000 psi (68 900 kPa) and have a burst pressure of no less than 20,000 psi (138 000 kPa).

21-2.4 Pumps

Pumps shall be designed to handle the pressures required to deliver the stated capacities of the oil filter crusher. Pumps shall conform to the requirements outlined in para. 21-2.7.

21-2.5 Access Door

The access door shall contain ejected fluids and objects that may break, separate, or be ejected during the crushing cycle. The access door shall have mechanical interlocks to prevent initiation of the crushing cycle until it is securely closed. The access door shall meet the requirements outlined in para. 21-2.7.

21-2.6 Enclosure

The oil filter crusher shall include an enclosure that surrounds the crushing area. The enclosure shall contain ejected fluids and objects that may break, separate, or be ejected during the crushing cycle.

Fig. 21-1.3-1 Oil Filter Crushers, Pneumatic

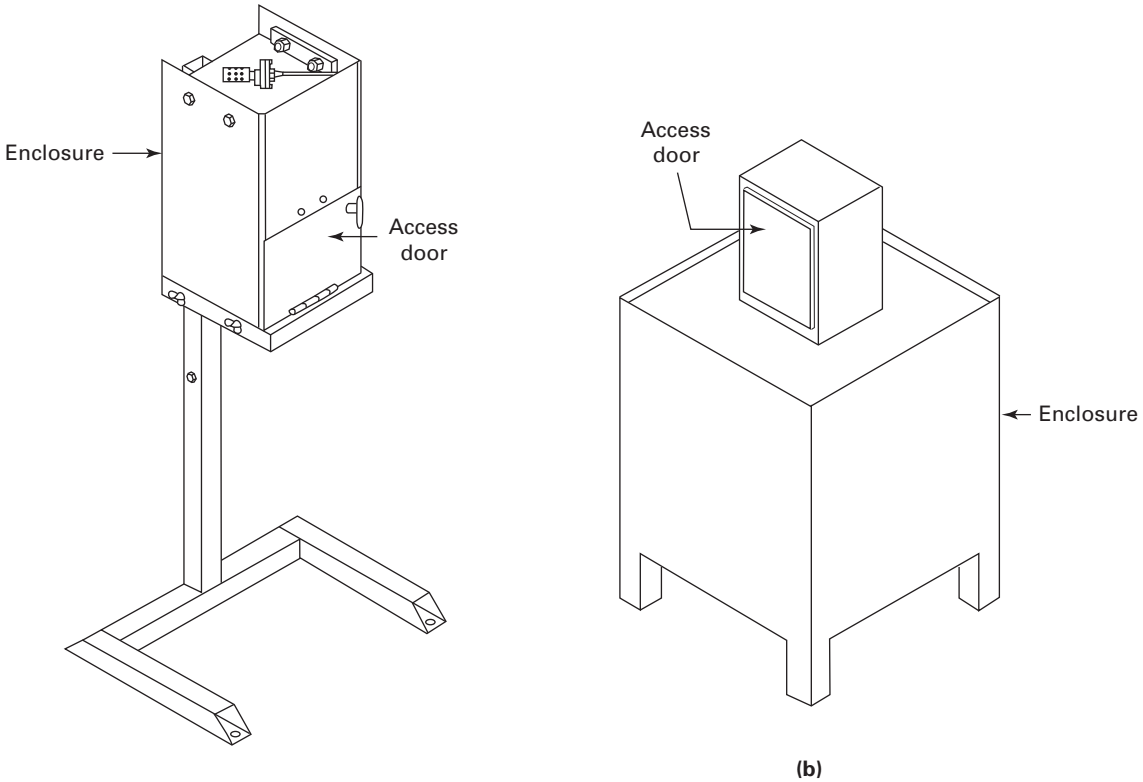
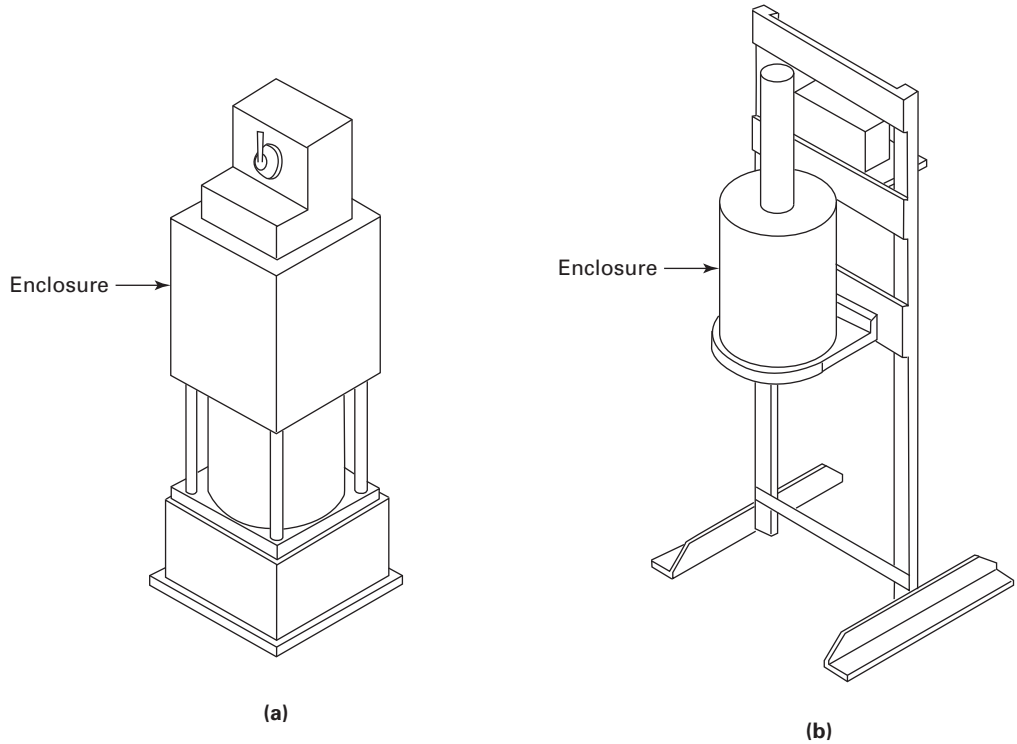


Fig. 21-1.3-2 Oil Filter Crushers, Hydraulic



21-2.7 Proof Load

Each crusher shall be tested to a proof load based on rated capacity and shall be functional and usable after such a test. The proof load shall be based on the stated capacity of the crusher.

(a) Units with an overload protection circuit shall sustain an overload of 150% of rated capacity and meet the criteria stated above.

(b) Units without an overload protection circuit shall sustain an overload of 200% of rated capacity and meet the criteria stated above.

21-2.8 Operating Controls

Operating controls shall be designed such that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls shall be clear to the operator by position, function, labeling, or a combination thereof.

21-3 SAFETY MARKINGS AND MESSAGES

21-3.1 Safety Markings

Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings. Maximum oil filter size shall be determined by the manufacturer and included in marking (f) below.

(a) Study, understand, and follow all instructions before operating this device.

(b) Do not exceed rated capacity.

(c) Use only on a hard, level surface.

(d) Do not disable or modify the safety lockout device.

(e) Failure to heed and understand these instructions and markings may result in personal injury and/or property damage.

(f) Use of this product is limited to crushing engine oil filters with a maximum size of _____.

21-3.2 Safety Messages

Additional safety messages include the following:

(a) No alterations shall be made to this product.

(b) Only accessories supplied by the manufacturer shall be used.

21-4 DESIGN QUALIFICATION TESTING

21-4.1 Proof Tests

For each design or design change that may affect the oil filter crusher's ability to meet this Standard, sample crushers built to design specifications shall be proof tested. To conform to this Standard, the crushers shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected.

21-4.1.1 Off-Center Load Test. A solid steel test cylinder 3.0 in. (76.2 mm) in diameter shall be placed inside the enclosure as far off center as the enclosure will allow or until the cylinder engages 1.0 in. (25.4 mm) of the top surface of the test cylinder. The crusher shall be operated to its full rated capacity and held for 1 min and then released. Permanent deformation of the internal structure shall not exceed 0.125 in. (3.18 mm), nor shall operational characteristics be adversely affected. A preload of not more than 100% of rated capacity may be applied to establish overall dimensional data points.

21-4.1.2 Load-Limiting Test. Oil filter crushers having an overload protection circuit shall be tested until the load-limiting device is activated, at which time the force applied to the crusher shall be no less than 100% of its rated capacity but no more than 125% of its rated capacity.

21-4.1.3 Tipping Test. The following tests shall be conducted in the direction of greatest instability:

(a) Place the feet of the crusher against a 0.5-in. (12.7-mm) high barrier that will not allow the crusher to slide. Apply a force of 20 lb (9.07 kg) to the vertical center of the enclosure on the side opposite the 0.5-in. (12.7-mm) barrier. The crusher shall not tip over.

(b) Place the feet of the crusher against a 0.5-in. (12.7-mm) high barrier that will not allow the crusher to slide. Tip the crusher to a 3-deg angle against the barrier and release the crusher. When released, the crusher shall right itself without tipping over.

21-4.1.4 Proof Load Test. A solid steel test cylinder 3.0 in. (76.2 mm) in diameter shall be placed inside the enclosure and centered on the cylinder and the reaction plate. The oil filter crusher shall be operated to the proof load defined in para. 21-2.7. The load shall be applied for at least 10 min. Permanent deformation of the internal structure shall not exceed 0.125 in. (3.18 mm), nor shall operational characteristics be detrimentally affected. A preload of not more than 100% of rated capacity may be applied to establish overall dimensional data points. For purposes of this test, any internal load-limiting device should be deactivated.

Part 22
Strut Spring Compressors

22-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

22-1.1 Scope

This Part applies to strut spring compressors for replacement and installation of components in strut-style vehicle suspension systems.

22-1.2 Classification

The classifications for which this Part applies include the following:

(a) fixed strut spring compressors, wall or bench mounted, comprising a frame supported by mechanical, pneumatic, or hydraulic spring-compressing means in which the spring is held in place by clasps.

(b) portable strut spring compressors, which are similar to the fixed strut spring compressors except they are mounted on a stand that can be moved to the work area.

(c) clamshell strut spring compressors consisting of a hinged V-shaped frame with a screw for compressing the spring, which is held in place by clasps. These spring compressors can be used on or off the vehicle. They may have a mounting bracket for attachment to a bench or vice.

(d) individual-screw strut spring compressors consisting of two or three screws for compressing the spring, which is held in place by jaws. These spring compressors can be used on or off the vehicle.

22-1.3 Illustrations

Figures 22-1.3-1 through 22-1.3-4 show typical strut spring compressors; the illustrations are not intended to be all-inclusive.

22-1.4 Definitions

clasp: a mechanism attached to the frame to grasp the strut spring. The clasp has two or three jaws and is adjustable to accommodate differing spring diameter and length.

jaw: a holding device used to grasp and hold the strut spring in place.

mounting bracket: a structure fastened to the strut spring compressor to enable wall, bench, stand, or vise mounting.

22-2 DESIGN

22-2.1 Operating Controls

Operating controls shall be designed such that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls shall be clear to the operator by position, function, labeling, or a combination thereof.

22-2.2 Travel Limits

Each strut spring compressor shall be provided with a positive means to prevent operation beyond its intended limits.

22-2.3 Spring Retention

A means shall be provided to positively restrain the spring while it is being compressed, to prevent uncontrolled ejection from the jaws.

22-2.4 Spring Protection

The jaws shall be designed to prevent damage to spring coating.

22-2.5 Overload Capacity

All strut spring compressors shall be designed to meet the requirements outlined in para. 22-2.6 as minimum overload capacity.

22-2.5.1 Load-Limiting Device. Strut spring compressors using a hydraulic power source shall be equipped with an internal load-limiting device.

22-2.5.2 Power Source Connection. Means shall be provided to prevent inadvertent connection to a hydraulic power source not designed to be used with the strut spring compressor.

22-2.6 Proof Load

Each strut spring compressor shall be capable of performing the proof load test defined in para. 22-4.1.3 with a load of 200% of rated capacity.

22-2.7 Attachments and Adapters

22-2.7.1 Special Purpose Attachments and Adapters. All special purpose attachments and adapters shall be capable of sustaining a proof load as defined in para. 22-2.6.

Fig. 22-1.3-1 Fixed Strut Spring Compressor (Wall Mounted)

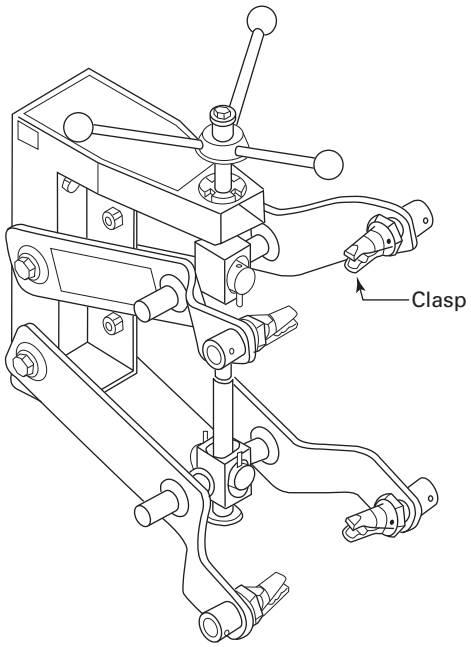


Fig. 22-1.3-2 Portable Strut Spring Compressor (Stand Mounted)

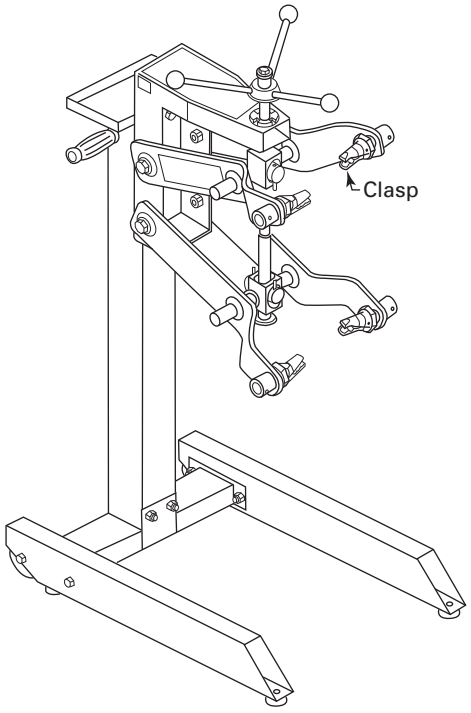


Fig. 22-1.3-3 Clamshell Strut Spring Compressor

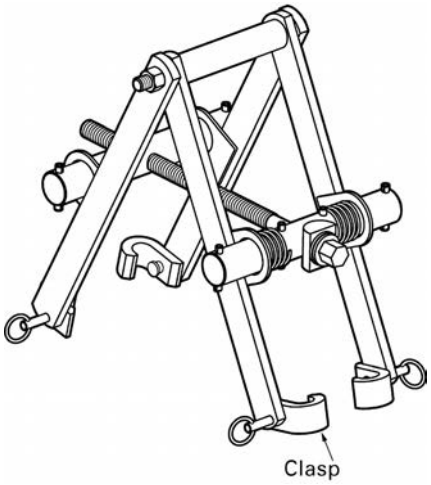
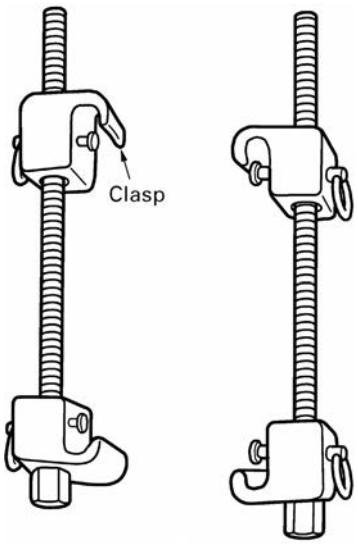


Fig. 22-1.3-4 Individual-Screw Strut Spring Compressor



22-2.7.2 Stands and Mounting Brackets. Stands and mounting brackets for stand, wall, bench, or vise mounting shall be designed to provide stability.

22-3 SAFETY MARKINGS AND MESSAGES

The minimum and maximum spring-coil diameter and the maximum spring-wire diameter shall be included with the rated capacity.

22-3.1 Safety Markings

Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings:

(a) Study, understand, and follow all instructions before operating the device.

(b) Do not exceed rated capacity.

(c) Use only for springs within coil and wire size limits.

(d) Securely fasten the jaws to the spring.

(e) Position the spring to compress evenly.

(f) Tools having screws that are tightened by wrenches shall include the following safety marking: "Do not compress spring with an impact wrench."

(g) Failure to heed and understand these instructions and markings may result in personal injury and/or property damage.

22-3.2 Safety Messages

Additional safety messages include the following:

(a) Do not use the strut spring compressor if it is worn or damaged.

(b) Do not compress strut springs exhibiting corrosion or damage.

(c) Individual-screw strut spring compressors shall include the following safety message: "Tighten and loosen the screws evenly."

(d) If the spring is difficult to compress, or it bows or tilts, release the spring and reposition.

(e) Compress the spring only enough for the strut to be loose in its mountings.

(f) Do not loosen the strut piston rod nut if there is pressure on the spring mounting.

(g) Replace damaged components immediately.

(h) Do not leave the spring compressed.

(i) Make sure the piston rod nut is fully engaged and tightened before releasing the compressed spring.

(j) No alterations shall be made to this product.

(k) Only attachments and adapters supplied by the manufacturer or supplier shall be used.

(l) Wear appropriate personal protective equipment (PPE) as required by OSHA regulations.

22-4 DESIGN QUALIFICATION TESTING

22-4.1 Proof Tests

For each design or design change that may affect the compressor's ability to meet this Standard, sample compressors built to design specifications shall be proof tested. To conform to this Standard, the compressors shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected.

22-4.1.1 Load-Limiting Device Test. Strut spring compressors employing a hydraulic or pneumatic power source shall be pumped against a measured load until the load-limiting device is activated, at which time the force applied to the spring shall be no less than 100% of its rated capacity but no more than 125% of its rated capacity.

22-4.1.2 Load-Sustaining Test. Rated load shall be applied centrally between the upper and lower clasps at the maximum and minimum opening with the jaws of the clasps positioned at the extreme position in the most unfavorable condition. The load shall be applied for at least 10 min. A permanent increase in distance between the upper and lower clasps, at maximum opening, measured after removal of the load shall not exceed 0.125 in. (3.18 mm). A preload of no more than 100% of rated capacity may be applied to establish initial overall height.

22-4.1.3 Proof Load Test. A proof load, as defined in para. 22-2.6, shall be applied centrally between the upper and lower clasps at the maximum and minimum opening with the jaws of the clasps positioned at the extreme position in the most unfavorable condition. Any load-limiting device should be deactivated for this test. The load shall be applied for at least 10 min. To pass this test, the unit shall not lose the load.

Part 23
Oil and Antifreeze Handlers

23-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

23-1.1 Scope

This Part applies to mobile pressurized oil and antifreeze handlers that are used in automotive and truck service centers and maintenance facilities for the removal of used oil or antifreeze from vehicles. Fluids are typically collected by gravity and dispensed to storage by pressure transfer. Devices covered by this Part operate at pressures below the pressure-vessel classification threshold. This does not include or cover open-type oil and antifreeze handlers.

23-1.2 Classification

For fluid dispensing, the oil and antifreeze handlers covered by this Part are powered by pneumatic or electrical means.

23-1.3 Illustrations

Figure 23-1.3-1 shows typical oil and antifreeze handlers; the illustrations are not intended to be all-inclusive.

23-1.4 Definitions

funnel: the structure of the handler that collects the fluid and directs it into the reservoir.

hose: a conduit for dispensing the fluid.

pump: a means by which the collected fluid is delivered to the storage or holding tank.

regulator: an adjustable pressure-control device that limits the discharge pressure.

relief valve: a device that senses pressure beyond a specified level and allows the elevated pressure to vent to an area of lower pressure.

reservoir: the part of the handler that holds the fluid until it is dispensed to a storage or holding tank.

23-2 DESIGN

23-2.1 Regulators

The regulator shall be permanently set to limit the air pressure delivered to the reservoir to 15 psi (103 kPa).

23-2.2 Reservoir

The reservoir may be of any configuration that incorporates the means to hold the fluid, transport it to the area it is to be evacuated, and house the regulator and relief valve. The reservoir shall be compatible with the media it is intended to store. The reservoirs shall conform to the requirements outlined in para. 23-2.9.

23-2.3 Hoses

Hoses shall be designed to be compatible with the fluid transmitted. Hoses shall meet SAE J517 standards for hydraulic hoses. Hoses shall have a minimum working pressure of 250 psi (1 720 kPa).

23-2.4 Pumps

Pumps shall be designed to handle the pressures required to deliver the stated capacities of the handler. Pumps shall conform to the requirements outlined in para. 23-2.9.

23-2.5 Relief Valve

The relief valve shall be designed and sized to prevent the reservoir pressure from exceeding 15 psi (103 kPa) when dispensing the fluid.

23-2.6 Operating Controls

Operating controls shall be designed in such a manner that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls shall be clear to the operator by position, function, labeling, or a combination thereof.

23-2.7 Stability

The oil or antifreeze handler shall be easily moved and guided into position to collect or dispense oil or antifreeze.

23-2.8 Shutoff

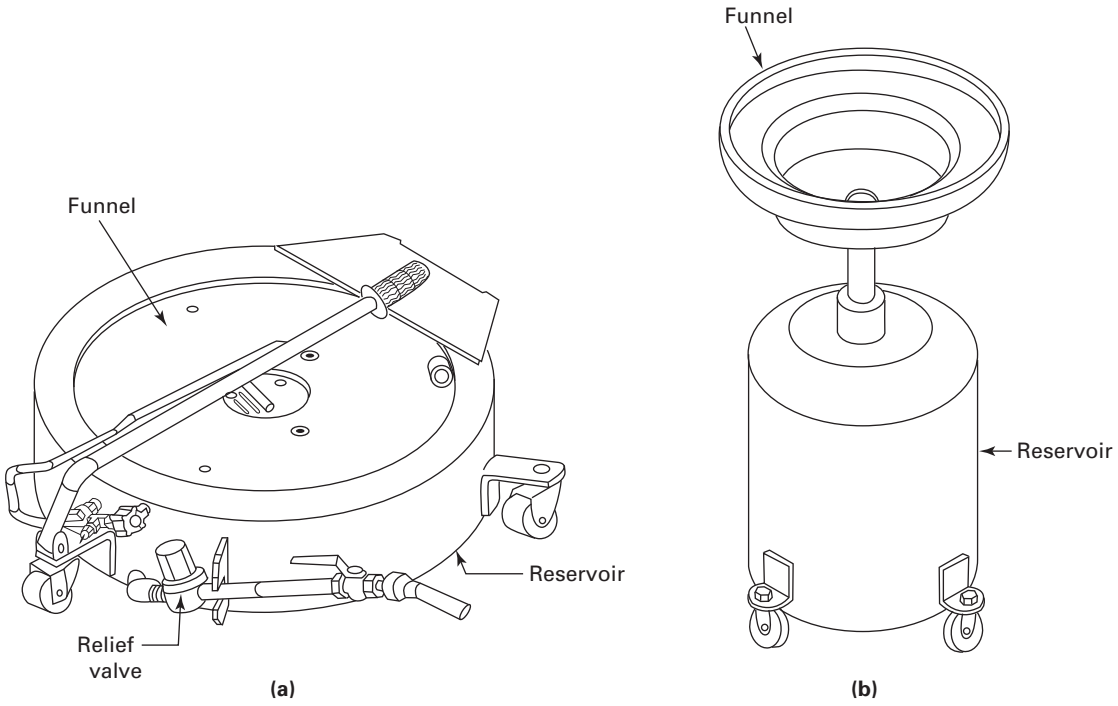
Pneumatic handlers shall have means provided to close off the oil or antifreeze intake to facilitate fluid dispensing.

23-2.9 Proof Load

Each handler shall be tested to a proof load based on rated capacity and shall be functional and usable after such a test. The proof load shall be based on the stated capacity of the handler.

(a) Units shall be able to withstand 150% of the rated air pressure without permanent deformation and remain functional.

Fig. 23-1.3-1 Oil or Antifreeze Handlers, Pneumatic



(b) Units shall be able to withstand 200% of the rated air pressure without rupture.

23-3 SAFETY MARKINGS AND MESSAGES

23-3.1 Safety Markings

Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings:

(a) Study, understand, and follow all instructions before operating the device.

(b) Do not exceed air pressure rating.

(c) Do not use without an air regulator or relief valve.

(d) Failure to heed and understand these instructions and markings may result in personal injury and/or property damage.

23-3.2 Safety Messages

Additional safety messages include the following:

(a) Keep handler closed when moving, to prevent spillage.

(b) Do not climb or stand on handler.

(c) No alterations shall be made to this product.

23-4 DESIGN QUALIFICATION TESTING

23-4.1 Proof Tests

For each handler design or design change that may affect the handler's ability to meet this Standard, sample handlers built to design specifications shall be proof tested. To conform to this Standard, the handler shall perform to design specifications and no functional damage shall occur, nor shall operational characteristics be detrimentally affected.

23-4.1.1 Loaded Operational Test. The handler shall be loaded with water to its rated capacity. The opening to the reservoir system (if any) shall be closed. If the reservoir opening is automatic and closes upon application of air pressure, then the reservoir shall be pressurized. The handler shall be readily movable and shall not leak fluid.

23-4.1.2 Load-Limiting Device Test. Oil or antifreeze handlers having an overload protection circuit shall be tested until the load-limiting device is activated, at which time the pressure applied to the handler shall be no less than 100% of its rated capacity but no more than 125% of its rated capacity.

23-4.1.3 Mobility Test. The handler shall be prepared as described in para. 23-4.1.1 and shall be moveable in all directions over the floor. It shall be moved at 1.5 ft/sec (457 mm/s) to 2 ft/sec (610 mm/s) across a 0.5-in. (12.7-mm) high, 15-deg step rise in the floor, at an approach angle that will bring only one caster at a time in contact with the rise and drop. The handler shall traverse the rise and drop without tipping over or spilling fluid.

23-4.1.4 Proof Test. Pneumatic collection tanks shall be proof tested as specified in para. 23-2.9. Tanks shall be able to withstand 150% of the rated air pressure without permanent deformation and remain functional. In addition, they shall be able to withstand 200% of rated air pressure without rupture. Any load-limiting device should be deactivated for the purposes of this test.

Part 24
Portable Hydraulic Power Kits

24-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

24-1.1 Scope

This Part applies to kits made up of hydraulic pumps, hoses, cylinders, feet, adapters, and spreaders used in conjunction with extension tubes and adapters to provide a method of performing tasks such as spreading, pushing, lifting, pressing, bending, stretching, and straightening. This Standard does not cover rescue tools.

24-1.2 Classification

The classifications for which this Part applies include the following:

(a) hydraulic, self-contained pumps with internal pressure-limiting devices

(b) hoses connected to cylinders

(c) additional adapters and accessories

24-1.3 Illustrations

Figures 24-1.3-1, 24-1.3-2, and 24-1.3-3 show typical kits, component arrangements, and applications covered by this Part; the illustrations are not intended to be all-inclusive.

24-1.4 Definitions

adapter: a device that, when connected to a cylinder or an extension tube, facilitates tasks such as spreading, pushing, lifting, pressing, bending, stretching, and straightening.

cylinder: the means of exerting force through the feet, adapters, or spreaders to the work.

hose: a conduit for hydraulic fluid from the pump to the cylinder or the spreader.

kit: any number of components, including pumps, cylinders, spreaders, hoses, adapters, and extension tubes, intended to be assembled in various configurations.

pump: a means by which the hydraulic fluid is delivered to the cylinder to position work. A pump may be manual, air powered, or electrically powered.

spreader: a pressure cylinder integrated with hinged arms that open at one end to exert outward force.

tube, extension: a device that, when used in conjunction with cylinders, increases the reach of force application.

24-2 DESIGN

24-2.1 Operating Controls

Operating controls shall be designed in such a manner that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls shall be clear to the operator by position, function, labeling, or a combination thereof. The pump handle shall be operable to the rated pump pressure without functional damage. The release valve shall require intentional positive action to prevent accidental lowering. The pump shall include a relief valve set to no more than 120% of rated pressure.

24-2.2 Travel Limit

Each cylinder or spreader shall include a positive means to prevent movement beyond the design travel limit.

24-2.3 Overload Capacity

24-2.3.1 Pumps. Pumps shall be capable of performing the proof load tests outlined in para. 24-4.1 with a proof load of 150% of the rated pump pressure. The pump shall have a pressure rating less than 10,000 psi (68 900 kPa). The pump shall meet this proof load without functional damage.

24-2.3.2 Hoses. The hoses shall be rated at a minimum working pressure of 10,000 psi (68 900 kPa) and have a burst pressure of no less than 20,000 psi (138 000 kPa).

24-2.3.3 Cylinders. Cylinders shall be capable of performing the proof load tests outlined in para. 24-4.2 with a proof load of 150% of rated capacity without functional damage.

24-2.3.4 Spreaders. Spreaders shall be capable of performing the proof load tests outlined in para. 24-4.3 with a proof load of 150% of rated capacity without functional damage.

24-2.3.5 Adapters. All adapters, feet, and extension tubes shall be capable of performing the proof load tests outlined in para. 24-4.4 with a proof load of 150% of rated capacity without functional damage. The requirement applies to all possible assembly configurations.

Fig. 24-1.3-1 Typical Portable Hydraulic Power Kit

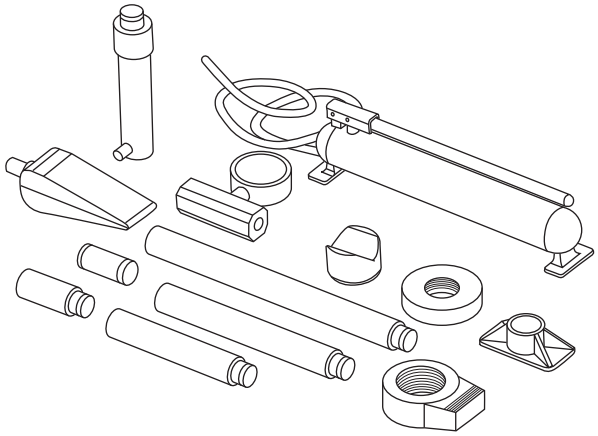
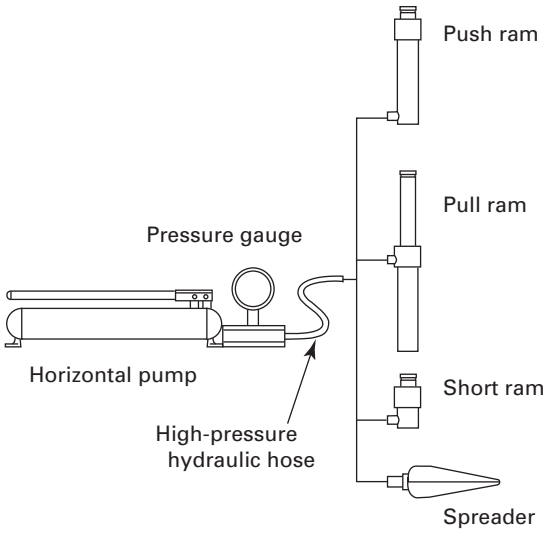


Fig. 24-1.3-2 Standard Kit Fit-Up



24-2.4 Carrying Handle

If provided, the carrying handle affixed to any component of the kit shall be capable of sustaining 200% of the component weight.

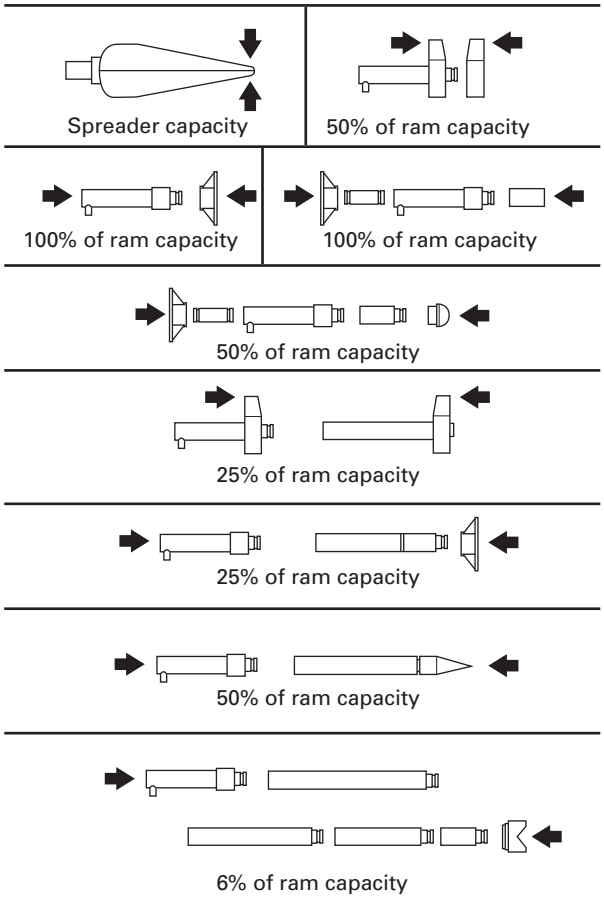
24-2.5 Capacity of a Kit or System

The rated capacity of all possible assembly configurations shall not exceed the capacity of the lowest-rated configuration possible. Each component shall have the rated capacity cast, engraved, or stamped in such thereon. The manufacturer shall publish the rated capacity of its configurations, as illustrated in Fig. 24-1.3-3.

24-2.6 Load Gauge

A gauge shall be provided to show the user the load being generated.

Fig. 24-1.3-3 Standard Kit Set for Applying Force



24-3 SAFETY MARKINGS AND MESSAGES

24-3.1 Safety Markings

Safety markings shall conform to the ANSI Z535 series of standards. The following are examples of safety markings:

(a) Study, understand, and follow all instructions before operating this device.

(b) Wear eye protection that meets ANSI/ISEA Z87.1 and OSHA standards.

(c) Do not exceed the rated capacity.

(d) Use a pressure gauge that indicates pounds of force applied.

(e) When using extension tubes, position the shortest tube farthest from the cylinder.

(f) Do not subject the hose to extreme cold, heat, sharp surfaces, abrasion, or impact.

(g) Do not allow the hose to kink, twist, curl, or bend so tightly that it restricts fluid flow.

(h) Make sure setup is stable and secure before performing any work.

(i) Failure to heed these markings may result in personal injury and/or property damage.

24-3.2 Safety Messages

Additional safety messages include the following:

(a) No alterations or modifications shall be made to this product.

(b) Only components supplied with this kit shall be used with this kit.

24-4 DESIGN QUALIFICATION TESTING

24-4.1 Proof Tests for Pumps

24-4.1.1 Proof Test. For each new design or design change that may affect the kit's ability to meet the Standard, samples shall be proof tested. The pump shall be operated to its proof pressure as defined in para. 24-2.3.1 and held for 10 min. The pump relief valve shall be disabled for this test. The pressure shall not decrease more than 2% during this period; the pump shall remain functional, and operational characteristics shall not be detrimentally affected.

24-4.1.2 Load-Limiting Device Test. Pumps employing a load-limiting device shall be pumped against a measured load until the load-limiting device is activated, at which time the force applied shall be no less than 100% of the pump's rated capacity but no more than 125% of its rated capacity.

24-4.2 Proof Tests for Cylinders

For each new design or design change that may affect the kit's ability to meet the Standard, samples shall be proof tested. The cylinder shall be pressurized with a pump and hose assembly to the proof load value stated in para. 24-2.3.3 and held at this pressure for 10 min. The operational characteristics of the cylinder shall not be detrimentally affected.

24-4.3 Proof Tests for Spreaders

Individual spreaders shall be installed on pump and hose assemblies for testing in accordance with the following:

(a) The spreader shall be located between two fixed plates that are parallel to each other such that the distance between the plates causes the faces of the upper and lower spreader jaws to be parallel to each other upon first contact.

(b) The pump shall be operated until the spreader force at the jaws equals the proof load value stated in para. 24-2.3.4.

(c) The spreader shall remain functional, and operational characteristics shall not be detrimentally affected.

24-4.4 Proof Tests for Extension Tubes and Adapters

Individual extension tubes and adapters shall be installed on the pump, hose, and cylinder assemblies for testing in accordance with paras. 24-4.4.1 through 24-4.4.9.

24-4.4.1 Extension Tubes. Each extension tube shall be tested independently. The extension tube shall be attached to the piston rod of the cylinder, and the cylinder and extension tube shall be placed perpendicular between two fixed surfaces that are parallel to each other. The pump shall be operated until the load on the cylinder reaches the proof load value stated in para. 24-2.3.5 and held for 10 min. The extension tube shall not kick out during this test, and operational characteristics shall not be detrimentally affected.

24-4.4.2 Plunger Toe. The plunger toe shall be attached to the piston rod of the cylinder, and the plunger toe and cylinder shall be placed perpendicular between two fixed surfaces that are parallel to each other. The pump shall be operated until the load on the plunger toe reaches the proof load value stated in para. 24-2.3.5 and held for 10 min. The plunger toe shall not kick out during this test, and operational characteristics shall not be detrimentally affected.

24-4.4.2.1 Plunger Toe With Extensions. The plunger toe with extensions shall be attached to the piston rod of the cylinder, and the plunger toe and cylinder shall be placed perpendicular between two fixed surfaces that are parallel to each other. The pump shall be operated until the load on the plunger toe reaches the proof load value stated in para. 24-2.3.5 and held for 10 min. The plunger toe and extensions shall not kick out during this test, and operational characteristics shall not be detrimentally affected.

24-4.4.3 Spreader Toe. The spreader toe shall be attached to the cylinder, and the spreader toe and cylinder shall be placed perpendicular between two fixed surfaces that are parallel to each other. The pump shall be operated until the load on the spreader toe reaches the proof load value stated in para. 24-2.3.5 and held for 10 min. The spreader toe shall not kick out during this test, and operational characteristics shall not be detrimentally affected.

24-4.4.4 Flat Base. The flat base shall be attached to the cylinder, and the flat base and cylinder shall be placed perpendicular between two fixed surfaces that are parallel to each other. The pump shall be operated until the load on the flat base reaches the proof load value stated in para. 24-2.3.5 and held for 10 min. The flat base shall not kick out during this test, and operational characteristics shall not be detrimentally affected.

24-4.4.5 Serrated Saddle. The serrated saddle shall be attached to the cylinder, and the serrated saddle and cylinder shall be placed perpendicular between two fixed surfaces that are parallel to each other. The pump shall be operated until the load on the serrated saddle reaches the proof load value stated in para. 24-2.3.5 and held for 10 min. The serrated saddle shall not kick out

during this test, and operational characteristics shall not be detrimentally affected.

24-4.4.6 90-Deg V-Base. The 90-deg V-base shall be attached to the cylinder, and the 90-deg V-base and cylinder shall be placed perpendicular between two fixed surfaces that are parallel to each other. The pump shall be operated until the load on the 90-deg V-base reaches the proof load value stated in para. 24-2.3.5 and held for 10 min. The 90-deg V-base shall not kick out during this test, and operational characteristics shall not be detrimentally affected.

24-4.4.7 Rubber Head. The rubber head shall be attached to the cylinder, and the rubber head and cylinder shall be placed perpendicular between two fixed surfaces that are parallel to each other. The pump shall be operated until the load on the rubber head reaches the proof load value stated in para. 24-2.3.5 and held for 10 min. The rubber head shall not kick out during this test, and operational characteristics shall not be detrimentally affected.

24-4.4.8 Wedge Head. The wedge head shall be attached to the cylinder, and the wedge head and cylinder shall be placed perpendicular between two fixed surfaces that are parallel to each other. The wedge head shall be inserted into a test block with a milled slot, and the cylinder axis and the test block shall be fixed and aligned with each other. The milled slot in the test block shall be wide enough to accept no less than 10% insertion of the wedge head's angled surfaces and narrow enough to accept no more than 25% insertion of the wedge head's angled surfaces, long enough to allow no contact at the wedge head's ends, and deep enough to allow no contact at the wedge head's tip. The outer edges of the milled slot shall be chamfered at 0.02 in. (0.508 mm) min. and 0.06 in. (1.52 mm) max. The pump shall be operated until the load on the cylinder reaches the proof load value stated in para. 24-2.3.5 and held for 10 min. The wedge head shall not kick out during this time test, and operational characteristics shall not be detrimentally affected.

24-4.4.9 Angular Load Test. Portable hydraulic power kits equipped with extension tubes shall be subjected to the angular load test. All extension tubes shall be attached to the piston rod of the cylinder starting with the longest tube first and adding the next longest tube until all tubes are connected. The number of extension tubes used is dependent upon the number of adapters that connect them together and are provided in the kit. A serrated saddle shall be attached to the last extension tube, and a flat base shall be attached to the bottom of the cylinder. The assembly shall be placed between two flat, fixed surfaces, with one surface being 90 deg relative to the cylinder's axis and the other surface being 85 deg relative to the cylinder's axis. The pump shall be operated until the load applied against the surfaces is equal to a rated capacity based on the number of extension tubes in the assembly. For every extension tube added to the piston rod, the rated capacity of the cylinder shall be reduced 50%. The extension tubes shall not kick out during the test, and operational characteristics shall not be detrimentally affected.

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ISBN 978-0-7918-6968-0

J18814