ASME ASP-2010

Safety Standard for Automotive Service and Maintenance Products

AN AMERICAN NATIONAL STANDARD

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AN AMERICAN NATIONAL STANDARD

ASME
SETTING THE STANDARD
Three Park Avenue • New York, NY • 10016 USA

Date of Issuance: August 16, 2010

This Standard will be revised when the Society approves the issuance of a new edition. There will be no addenda issued to this edition.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Standard. Periodically certain actions of the ASME PALD Committee may be published as Cases. Cases and interpretations are published on the ASME Web site under the Committee Pages at http://cstools.asme.org as they are issued.

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

CONTENTS

FOREWORD

This ASME Standard, Safety Standard for Automotive Service and Maintenance Products, has been developed under the policies and procedures as outlined by the ASME Codes and Standards development committees. This Standard had its beginning in April 2007 when the ASME Committee for Portable Automotive Lifting Devices (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 as follows:

> The charter of the ASME PALD Committee on Safety Standards for Portable Automotive Lifting Devices, hereafter called the Standards Committee, shall be the standardization of safety and performance requirements for portable automotive lifting devices and related equipment. These codes or standards may include requirements for safety, health, design, quality, testing, production, construction, measurement, maintenance, performance, or operation of equipment or qualification of personnel.

The Committee determined that the format of this Standard would be structured similar to that of the ASME PALD Standard, that is, one Standard with multiple Parts covering the different types of automotive service and maintenance products that would be included. Each of these Parts would include guidelines as to design, marking, identification, testing, operation, inspection, and maintenance.

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 February 3, 2010.

ASME PALD COMMITTEE
Safety Standard for Automotive Service and Maintenance Products

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

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ASP — SUBCOMMITTEE ON AUTOMOTIVE SERVICE AND MAINTENANCE PRODUCTS

F. G. Heath, Heath & Associates
R. Joos, SPX Corp.
S. McKee, Gray Manufacturing Co., Inc.

PREFACE

1 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 automotive service and maintenance products 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, flying, or slipping of components caused primarily by improperly securing or containing loads, overloading, and off-centered loads; using the equipment on other than hard, level surfaces; and using the equipment for a purpose for which it was not designed.

The PALD Subcommittee 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 vehicles and their components, under variable working conditions. These conditions have been considered to provide safety and flexibility. The requirements given in this Standard must be interpreted accordingly, and judgment should be used in determining their application.

2 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.

3 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.

4 PROPOSING REVISIONS

Comments on the requirements of this Standard and suggestions for its improvement, based on experience in its application, may be sent to the PALD Subcommittee. Suggestions for changes to the Standard should be submitted to the Secretary of the Committee on Automotive Service and Maintenance Products, ASME, Three 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 PALD Subcommittee will consider each suggested change in a timely manner according to its procedures.

5 INTERPRETATIONS

Upon request, the PALD Subcommittee 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 PALD Subcommittee 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.

SAFETY STANDARD FOR AUTOMOTIVE SERVICE AND MAINTENANCE PRODUCTS

Part 1
Introduction

1-1 SCOPE

The scope of this Standard is the standardization of safety and performances requirements for automotive service and maintenance products including, but not limited to

(a) shop presses
(b) oil filter crushers
(c) strut spring compressors
(d) oil and antifreeze handlers
(e) portable hydraulic power kits

This Standard may include requirements for safety and health; design, production, construction, maintenance, performance, or operation of 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 this Subcommittee, additional equipment classified as PALD-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 the design, construction, marking, operation, maintenance, and owner or operator inspection of the listed automotive service and maintenance equipment, used during automotive service and maintenance 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 operation and maintenance instructions.

This Standard does not apply to lifting devices covered under the ASME Standard for Portable Automotive Lifting Devices (PALD).

1-3 PURPOSE

This Standard is designed to

(a) guard against and mitigate injury to workers, 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 DEFINITIONS

alteration: any change to an automotive service and maintenance product (ASMP) other than maintenance, repair, or replacement.

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

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

ASMP: any one of the various types of automotive service and maintenance products listed in the scope of this Standard.

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 the ASMP and designated by the owner to use or maintain the equipment.

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 the ASMP.

cylinder: a means by which force is transmitted to an object by hydraulic or air pressure. The word "ram" can be used interchangeably for cylinder. Unless otherwise specified, these two words are treated as synonyms.

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

electric power source: a device that utilizes electricity as the force- or delivery-transmitting medium.

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

functional damage: any detrimental, permanent deformation of the ASMP's structure that results in the loss of sealing capability to its hydraulic or pneumatic components or both; loss of motion; or failure to meet or exceed the design qualification limits established in sections 3-4, 4-4, 5-4, 6-4, and 7-4.

guard: see definition in para. 3-1.4.

hydraulic power source: a device that utilizes hydraulics as the force- or delivery-transmitting medium.

internal load-limiting device: a device that limits the output force of the ASMP.

listed: refers to a product that has been tested, found compliant, and approved to a specific standard, and can be supported by the appropriate documentation confirming such.

load: the total superimposed force to be overcome by the ASMP.

manufacturer: a company that produces goods for sale.

mobile: describes an ASMP that is readily movable from one work area to another.

OSHA: Occupational Safety and Health Administration, the arm of the U.S. government that establishes rules and regulations for workplace safety.

overload: a force or volume that exceeds the rated capacity of the ASMP.

pneumatic power source: 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 work area to another.

proof load: a force greater than the rated capacity, applied centrally to a work surface as defined by the ASMP's loading apparatus to confirm the integrity of the structure.

qualified personnel: individuals with characteristics or abilities gained through training or experience or both, as measured against established requirements or criteria, such as standards or tests that enable them to perform a required function or service.

ram: see *cylinder.*

rated capacity: the maximum published operating load or volume that the ASMP is designated to output, contain, receive, or transport throughout its range of travel.

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.

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

standard: any nationally, state, or locally published set of criteria with which a product or service shall comply that is recognized by a governing body, such as The American Society of Mechanical Engineers (ASME), American National Standards Institute (ANSI), National Fire Protection Association (NFPA), OSHA, and Underwriters Laboratories (UL).

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

1-5 REFERENCES

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

ANSI B11.2, Hydraulic Power Presses
ANSI B15.1, Safety Standard for Mechanical Power Transmission Apparatus
Publisher: Association for Manufacturing Technology (AMT), 7901 Westpark Drive, McLean, VA 22102-4206 (www.amtonline.org)

ANSI Z87.1, Occupational and Educational Personal Eye and Face Protection Devices
Publisher: American Society of Safety Engineers (ASSE), 1800 East Oakton Street, Des Plaines, IL 60018 (www.asse.org)

ANSI Z535, Color Chart
ANSI Z535.1, Safety Colors
ANSI Z535.2, Environmental and Facility Safety Signs
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)

ISO/IEC Guide 22, General Criteria for Supplier's Declaration of Conformity
Publisher: International Organization for Standardization (ISO), 1, ch. de la Voie-Creuse, Case postale 56, CH-1211 Geneva 20, Switzerland (www.iso.org)

SAE J-517, Hydraulic Hose
Publisher: SAE International, SAE World Headquarters, 400 Commonwealth Drive, Warrendale, PA 15096-0001 (www.sae.org)

UL 201, Standard for Safety for Garage Equipment
UL 2089, Standard for Safety for Vehicle Battery Adapters
Publisher: Underwriters Laboratories (UL), 2600 N.W. Lake Road, Camas, WA 98607-8542 (www.ul.com)

Part 2
General Requirements

2-1 PRODUCT MARKING AND INDENTIFICATION

2-1.1 Rated Capacity

All ASMPs shall have the rated capacity marked in a prominent location on the ASMP 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 ASMP.

2-1.2 Identification

Each ASMP 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 or supplier shall be able to identify the date of manufacture of each ASMP.

2-1.3 Safety Markings

Each ASMP 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 each ASMP in a location visible to the operator. The ANSI Z535 series of standards containing guidelines for product safety signs shall be followed.

Examples of safety markings for specific types of ASMPs are listed in paras. 3-3.1, 4-3.1, 5-3.1, 6-3.1, and 7-3.1 of this Standard.

2-2 PRODUCT INSTRUCTIONS AND SAFETY MESSAGES

2-2.1 Product Manuals and Instructions

Each ASMP 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 specify the recommended replacement fluids and the 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 2-3 shall be included with the instructions. Consideration should be given to multilanguage literature and decals.

2-2.2 Safety Messages

The instructions shall convey the safety markings and messages listed in paras. 3-3.1, 3-3.2, 4-3.1, 4-3.2, 5-3.1, 5-3.2, 6-3.1, 6-3.2, 7-3.1, and 7-3.2 of this Standard, but need not be verbatim or limited to those listed.

2-3 OPERATION, MAINTENANCE, AND INSPECTION

2-3.1 Operation

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

2-3.2 Maintenance

The ASMP shall be maintained in accordance with the product instructions.

2-3.3 Inspection

(a) Visual inspection shall be made before each use of the ASMP 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) Each ASMP shall be inspected immediately if the device is believed to have been subjected 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. An annual inspection of the ASMP 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 the manufacturer's or supplier's specified parts. A list of authorized repair facilities is available from the manufacturer or supplier.

2-3.4 Damaged Equipment

Any ASMP 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 a manufacturer's or supplier's authorized repair facility if repairs are permitted by the manufacturer or supplier.

2-3.5 Alterations

Because of potential hazards associated with this type of equipment, no alterations shall be made to the product.

2-3.6 Attachment 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 2-1 of this Standard. The use of adapters with the host ASMP shall not increase the capacity of the host. When attachments or adapters are used with the host, the rated capacity of the system shall be that of the lowest-rated component that makes up the unit.

2-4 QUALITY ASSURANCE

Producers of ASMPs shall adhere to a planned, written system of policies and procedures that will assure consistent and continuing conformance to the requirements of this Standard. Conformance to the Standard shall be demonstrated by the testing requirements set forth herein. ISO/IEC Guide 22, "General Criteria for Supplier's Declaration of Conformity," should be used as a guide.

2-5 DESIGN

2-5.1 Durability Assessment

As part of the design process of all ASMPs, a durability assessment shall be conducted and documented for the anticipated useful life of the product, and the cumulative effects of repeated use and other potential change in properties shall be considered. In this assessment process, the rated capacity shall be considered.

2-5.2 Electrically Powered Products

ASMPs that are powered by electricity shall be listed to an applicable national standard such as UL 201 or UL 2089, depending upon whether the power is AC or DC.

2-5.3 Guards

Where applicable, guards shall be required on all ASMPs. Guards shall comply with ANSI B15.1.

2-5.4 Related Standards

Consideration shall be given in the design of each ASMP regarding the other standards that might influence the design or use of the product for issues involving health, ergonomics, and OSHA and applicable state and local requirements. This Standard dictates design parameters for each type of ASMP. There may be other standards that should be followed in the design of any product. For example, this includes NFPA standards dealing with products that handle flammable fluids or mixtures. When there is no directly applicable standard, thought should be given to offering options for different environments.

2-5.5 OSHA Requirements

It shall be the responsibility of the employer to ensure that applicable personal protective equipment (PPE) as mandated by OSHA is employed.

2-5.6 Design Qualification Testing

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

2-6 EFFECTIVE DATE

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

Part 3
Shop Presses

3-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

3-1.1 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, "Hydraulic Power Presses," 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 to 200 tons of force. These presses may be table mounted or freestanding.

3-1.2 Classification

Shop presses covered by this Part are powered by the following means:

(a) pneumatics
(b) hydraulics
(c) a combination of pneumatics and hydraulics
(d) a combination of electricity and hydraulics

3-1.3 Illustrations

Figures 3-1.3-1 through 3-1.3-3 show typical shop presses; they are not intended to be all-inclusive.

3-1.4 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.

Fig. 3-1.3-1 Shop Press, Air or Hydraulic

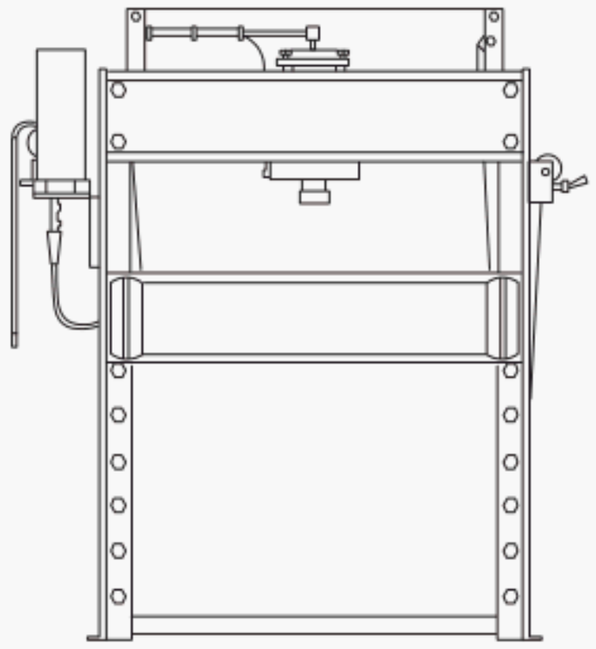
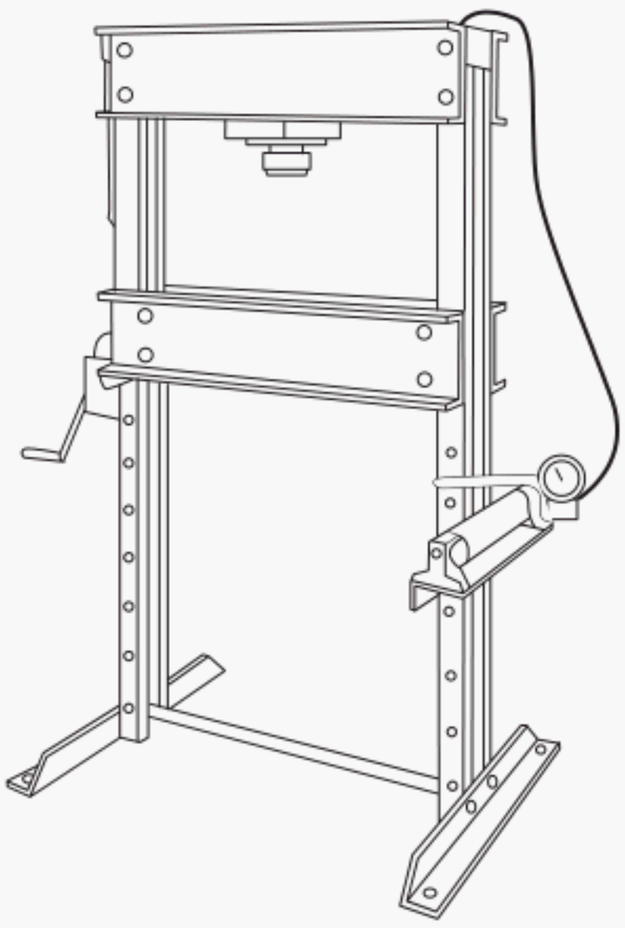


Fig. 3-1.3-2 Shop Press, Manual Hydraulic

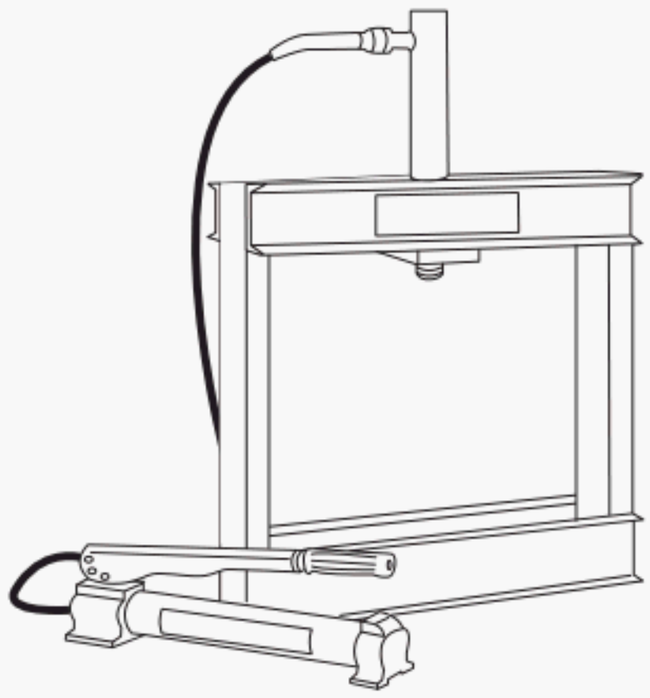


frame: the structure of the press that typically comprises two uprights, a lower bolster, and an upper bolster.

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.

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



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.

3-2 DESIGN

3-2.1 Cylinders

The cylinder shall be designed to meet the stated capacity of the press. In addition, it shall meet the requirements outlined in para. 3-2.9.

3-2.2 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. 3-2.9.

3-2.3 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).

3-2.4 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. 3-2.9.

3-2.5 Holding Device

The holding 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 holding device shall conform to the requirements outlined in para. 3-2.9.

3-2.6 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 either by position, function, labeling, or a combination thereof.

3-2.7 Stability

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

3-2.8 Guarding

3-2.8.1 Manufacturer's Responsibility. The manufacturer of the press shall provide a guard that complies with ANSI B15.1.

3-2.8.2 Owner's Responsibility. The owner shall be responsible for making sure the operator is trained in how to use the guarding and that he wears the required personal protective equipment (PPE) as described in OSHA regulations.

3-2.9 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.

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) 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 Z87.1 and OSHA standards.

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

3-3.2 Safety Messages

Additional safety messages include, but are not limited to, 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) Use only press accessories having a capacity rating equal to or greater than the capacity of the press.

(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.

3-3.3 Operating Instructions and Owner's Manuals

Operating instructions and owner's manuals shall conform to the ANSI Z535.6 standard for product manuals, instructions, and other collateral materials.

3-4 DESIGN QUALIFICATION TESTING

3-4.1 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.

3-4.1.1 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. The load shall be held for 1 min and then released. The press's ability to retain the load shall not be adversely affected. Permanent increase in the dimension between the bottom of the upper bolster and the top of the lower bolster shall not exceed 0.125 in. (3.18 mm). This test shall be repeated with the movable bolster in its minimum and maximum positions. A centered preload of no more than 100% of rated capacity should be applied to establish overall dimensional data points. The preload should be applied in both the minimum and the maximum positions. If the dimension increases more than 0.125 in. (3.18 mm), it constitutes failure of this test.

3-4.1.2 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 and no more than 125% of its rated capacity.

3-4.1.3 Proof Load Test. A proof load, as defined in para. 3-2.9, shall be applied centrally between the upper and lower bolsters in both the minimum and the maximum positions. The load shall be applied for at least 10 min. Permanent increase in the dimension between the bottom of the upper bolster and the top of the lower bolster shall not exceed 0.125 in. (3.18 mm). This test shall be repeated with the movable bolster in its minimum and maximum elevation. A preload of no more than 100% of rated capacity should be applied to establish overall dimensional data points. A preload should be applied in both the minimum and the maximum positions. If the dimension increases more than 0.125 in. (3.18 mm), it constitutes failure of this test. Any load-limiting device should be deactivated for the purposes of this test.

Part 4
Oil Filter Crushers

4-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

4-1.1 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.

4-1.2 Classification

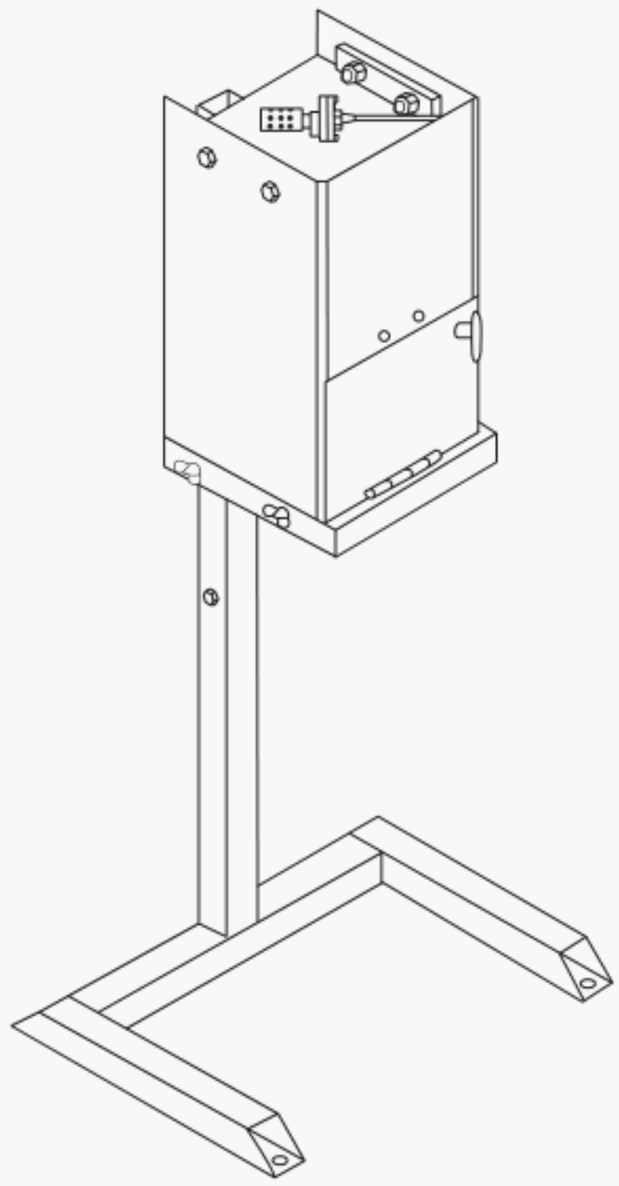
Oil filter crushers covered by this Part are powered by the following means:

(a) pneumatics
(b) hydraulics
(c) a combination of pneumatics and hydraulics
(d) a combination of electricity and hydraulics

4-1.3 Illustrations

Figures 4-1.3-1 through 4-1.3-4 show typical oil filter crushers; they are not intended to be all-inclusive.

Fig. 4-1.3-1 Oil Filter Crusher, Pneumatic



4-1.4 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.

4-2 DESIGN

4-2.1 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. 4-2.7.

4-2.2 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. 4-2.7.

Fig. 4-1.3-2 Oil Filter Crusher, Pneumatic

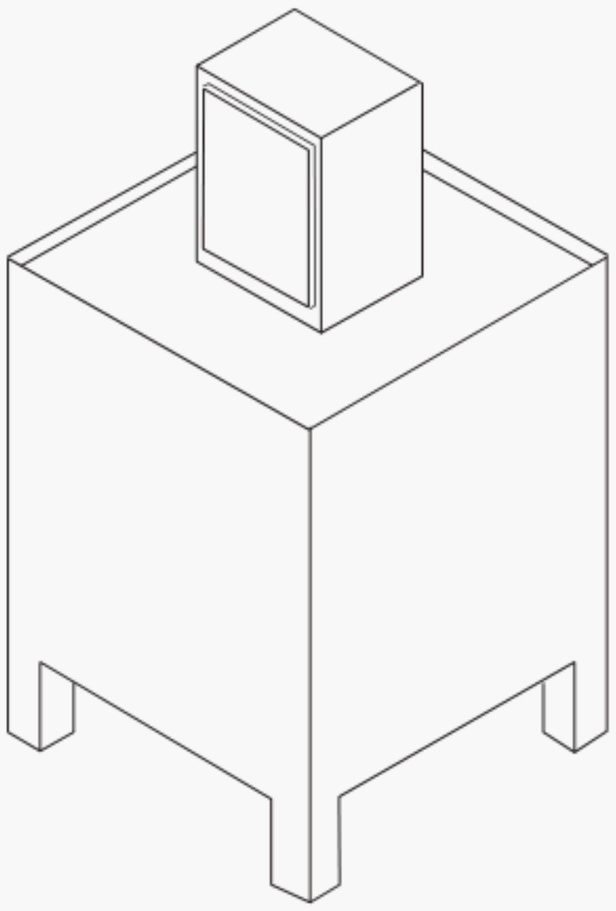


Fig. 4-1.3-3 Oil Filter Crusher, Hydraulic

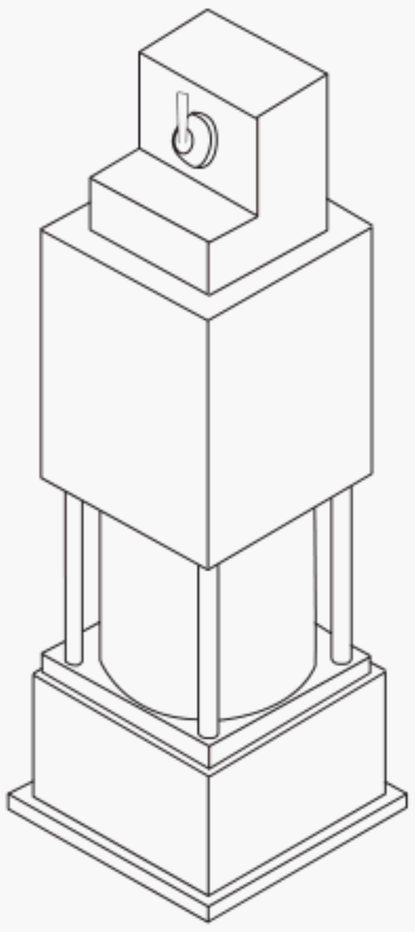
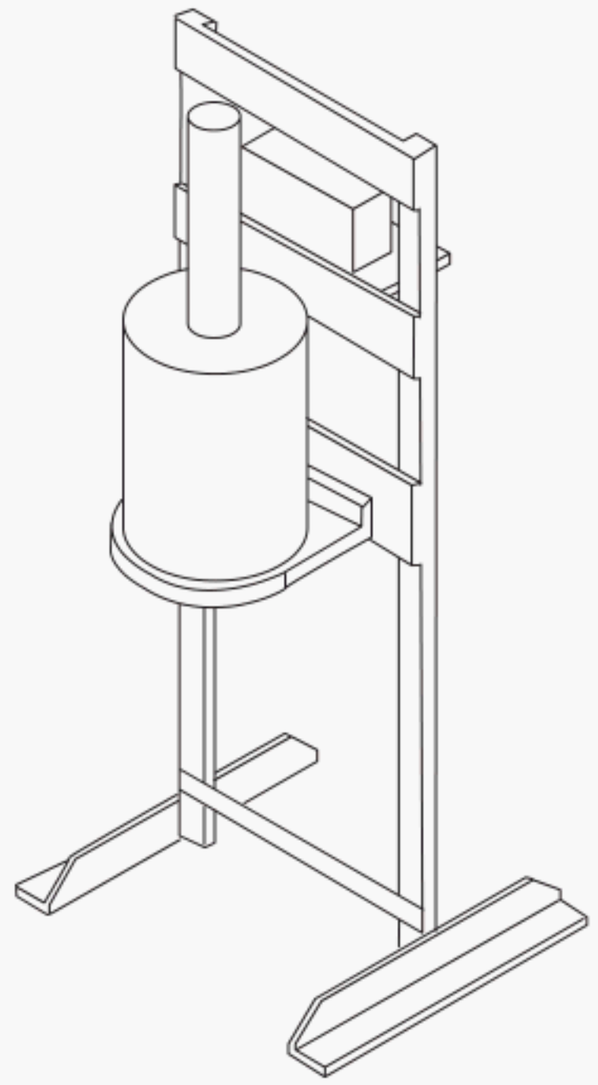


Fig. 4-1.3-4 Oil Filter Crusher, Hydraulic



4-2.3 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).

4-2.4 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. 4-2.7.

4-2.5 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. 4-2.7.

4-2.6 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.

4-2.7 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.

4-3 SAFETY MARKINGS AND MESSAGES

4-3.1 Safety Markings

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

below. 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 level surfaces.

(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, property damage, or both.

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

4-3.2 Safety Messages

Additional safety messages include, but are not limited to, the following:

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

(b) Only accessories supplied by the manufacturer shall be used.

4-3.3 Operating Instructions and Owner's Manuals

Operating instructions and owner's manuals shall conform to the ANSI Z535.6 standard for product manuals, instructions, and other collateral materials.

4-4 DESIGN QUALIFICATION TESTING

4-4.1 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.

4-4.1.1 Off-Center Load Test. A solid steel test cylinder 3 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 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.

4-4.1.2 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 and no more than 125% of its rated capacity.

4-4.1.3 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.

4-4.1.4 Proof Load Test. A solid steel test cylinder 3 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. 4-2.7. 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 5
Strut Spring Compressors

5-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

5-1.1 Scope

This Part applies to strut spring compressors for replacement and installation of components in strut-style vehicle suspension systems.

5-1.2 Classification

The classification for which this Part applies includes 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.

5-1.3 Illustrations

Figures 5-1.3-1 through 5-1.3-4 show typical strut spring compressors; they are not intended to be all-inclusive.

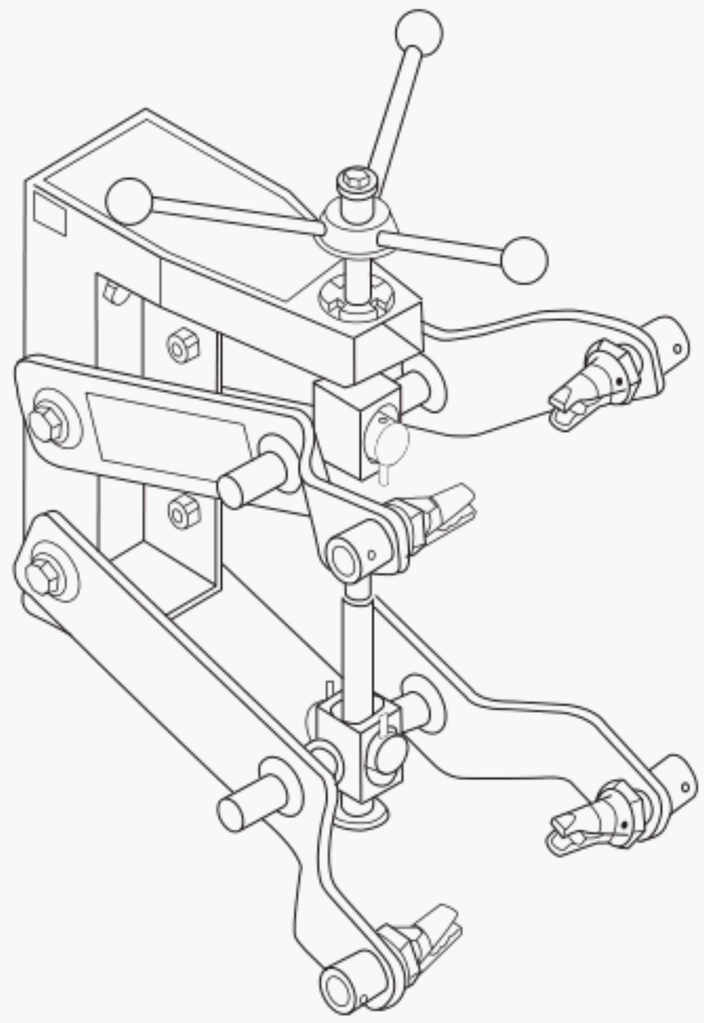
5-1.4 Definitions

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.

Fig. 5-1.3-1 Fixed Strut Spring Compressor (Wall Mounted)



5-2 DESIGN

5-2.1 Operating Controls

Operating controls shall be readily visible and accessible to the operator and shall not expose the operator to pinch points, sharp edges, or snagging hazards. The operation shall be clear to the operator either by position, function, labeling, or a combination thereof.

5-2.2 Travel Limits

Each strut spring compressor shall be provided with a positive means to prevent operation beyond its intended limits.

5-2.3 Spring Retention

A means shall be provided to positively restrain the spring while it is being compressed, to prevent uncontrolled ejection from the jaws.

5-2.4 Spring Protection

The jaws shall be designed to prevent damage to spring coating.

Fig. 5-1.3-2 Portable Strut Spring Compressor (Stand Mounted)

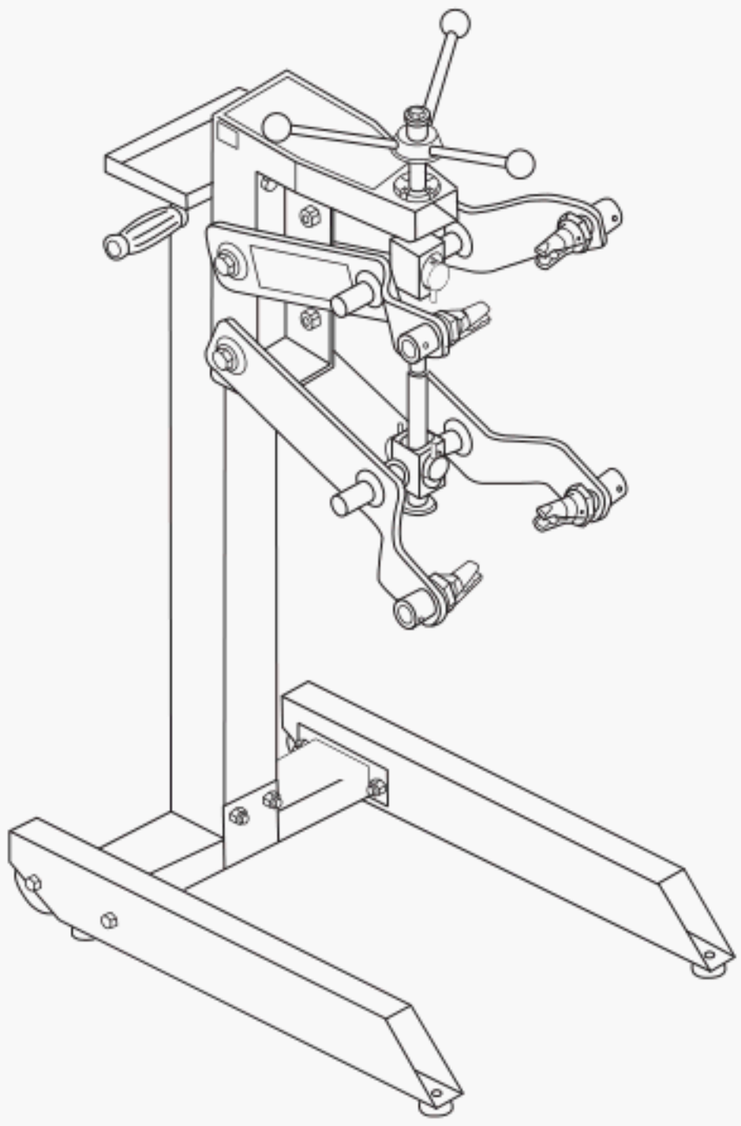


Fig. 5-1.3-3 Clamshell Strut Spring Compressor

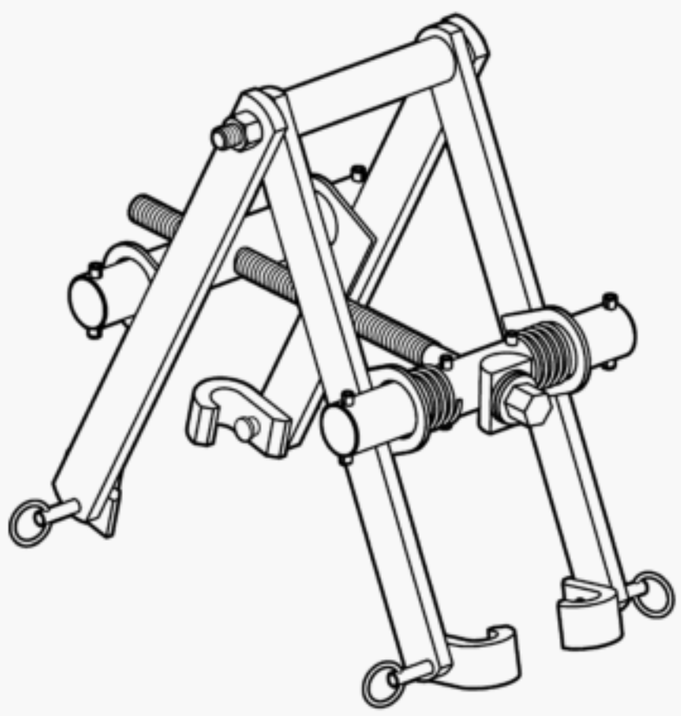
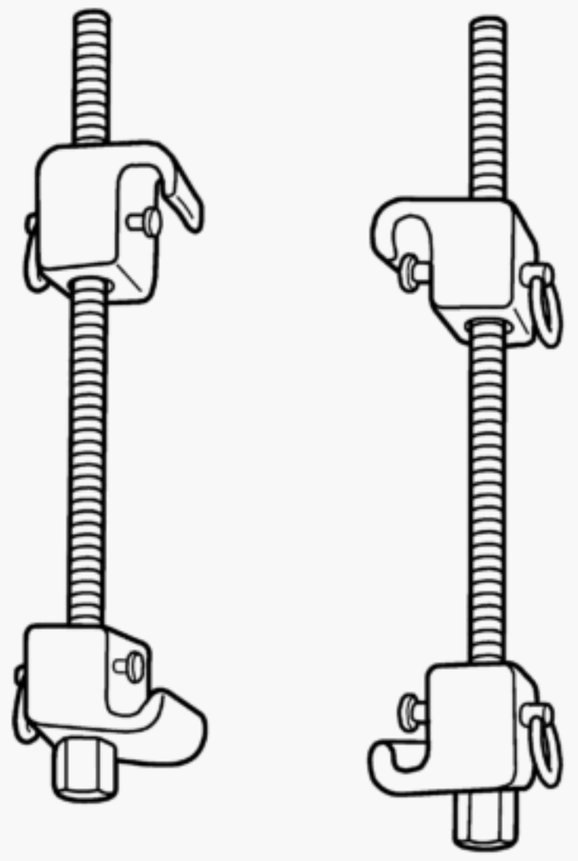


Fig. 5-1.3-4 Individual Screw Strut Spring Compressor



5-2.5 Overload Capacity

All strut spring compressors shall be designed to meet the requirements outlined in para. 5-2.6 as minimum overload capacity.

5-2.5.1 Load-Limiting Device. Strut spring compressors using a hydraulic power source shall be equipped with an internal load-limiting device.

5-2.5.2 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.

5-2.6 Proof Load

Each strut spring compressor shall be capable of performing the proof load test defined in para. 5-4.1 with a load of 200% of rated capacity.

5-2.7 Attachments and Adapters

5-2.7.1 Special Purpose Attachments and Adapters. All special purpose attachments and adapters shall be capable of sustaining a proof load as defined in para. 5-2.6.

5-2.7.2 Stands and Mounting Brackets. Stands and mounting brackets for stand, wall, bench, or vise mounting shall be designed to provide stability.

5-3 SAFETY MARKINGS AND MESSAGES

The minimum and maximum spring-coil diameter and the maximum spring-wire diameter shall be included with the rated capacity.

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 the device.

(b) Do not exceed the capacity rating.

(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, property damage, or both.

5-3.2 Safety Messages

Additional safety messages include, but are not limited to, 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.

5-3.3 Operating Instructions and Owner's Manuals

Operating instructions and owner's manuals shall conform to the ANSI Z535.6 standard for product manuals, instructions, and other collateral materials.

5-4 DESIGN QUALIFICATION TESTING

5-4.1 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.

5-4.1.1 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 and no more than 125% of its rated capacity.

5-4.1.2 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.

5-4.1.3 Proof Load Test. A proof load, as defined in para. 5-2.6, 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 6
Oil and Antifreeze Handlers

6-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

6-1.1 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.

6-1.2 Classification

For fluid dispensing, the oil and antifreeze handlers covered by this Part are powered by the following means:

(a) pneumatics
(b) electricity

6-1.3 Illustrations

Figures 6-1.3-1 and 6-1.3-2 show typical oil and antifreeze handlers; they are not intended to be all-inclusive.

6-1.4 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.

6-2 DESIGN

6-2.1 Regulators

The regulator shall be permanently set to limit the air pressure delivered to the reservoir to 15 psi (103 kPa).

Fig. 6-1.3-1 Oil or Antifreeze Handler, Pneumatic

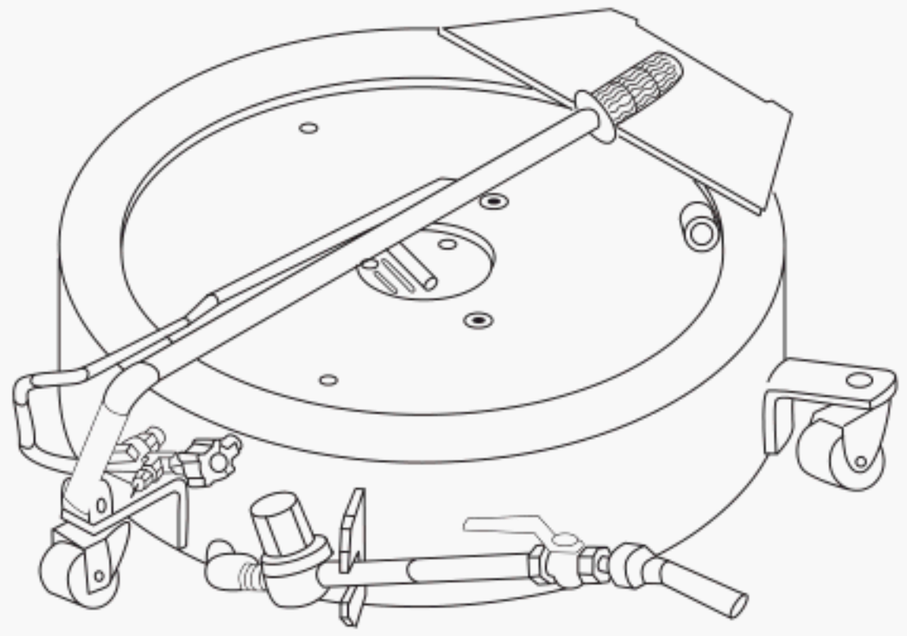
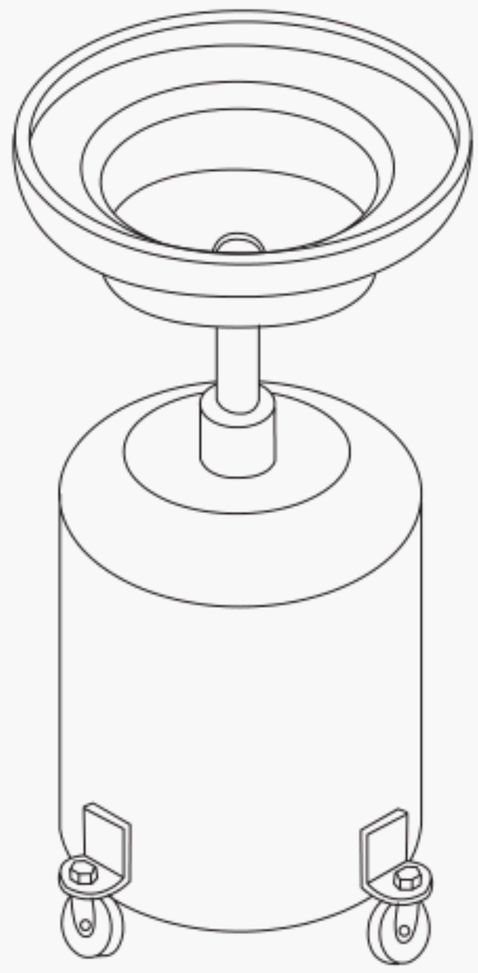


Fig. 6-1.3-2 Oil or Antifreeze Handler, Pneumatic



6-2.2 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. 6-2.9.

6-2.3 Hoses

Hoses shall be designed to be compatible with the fluid transmitted. Hoses shall meet SAE J-517 standards for hydraulic hoses. Hoses shall have a minimum working pressure of 250 psi (1,720 kPa).

6-2.4 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. 6-2.9.

6-2.5 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.

6-2.6 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 either by position, function, labeling, or a combination thereof.

6-2.7 Stability

The oil or antifreeze handler shall be easily moved and guided into position to collect or dispense oil or antifreeze.

6-2.8 Shut-Off

Pneumatic handlers shall have means provided to close off the oil or antifreeze intake to facilitate fluid dispensing.

6-2.9 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.

(b) Units shall be able to withstand 200% of the rated air pressure without rupture.

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 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, property damage, or both.

6-3.2 Safety Messages

Additional safety messages include, but are not limited to, 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.

6-3.3 Operating Instructions and Owner's Manuals

Operating instructions and owner's manuals shall conform to the ANSI Z535.6 standard for product manuals, instructions, and other collateral materials.

6-4 DESIGN QUALIFICATION TESTING

6-4.1 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.

6-4.1.1 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.

6-4.1.2 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 and no more than 125% of its rated capacity.

6-4.1.3 Mobility Test. The handler shall be prepared as described in para. 6-4.1.1 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.

6-4-1.4 Proof Test. Pneumatic collection tanks shall be proof tested as specified in para. 6-2.9. 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 shall be deactivated for the purposes of this test.

Part 7
Portable Hydraulic Power Kits

7-1 SCOPE, CLASSIFICATION, AND ILLUSTRATIONS

7-1.1 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.

7-1.2 Classification

The classification for which this Part applies includes the following:

(a) hydraulic, self-contained pumps with internal pressure-limiting devices

(b) hoses connected to cylinders

(c) additional adaptors and accessories

7-1.3 Illustrations

Figures 7-1.3-1 through 7-1.3-3 show typical kits, component arrangements, and applications covered by this Part; they are not intended to be all-inclusive.

7-1.4 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, adaptors, 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.

Fig. 7-1.3-1 Typical Portable Hydraulic Power Kit

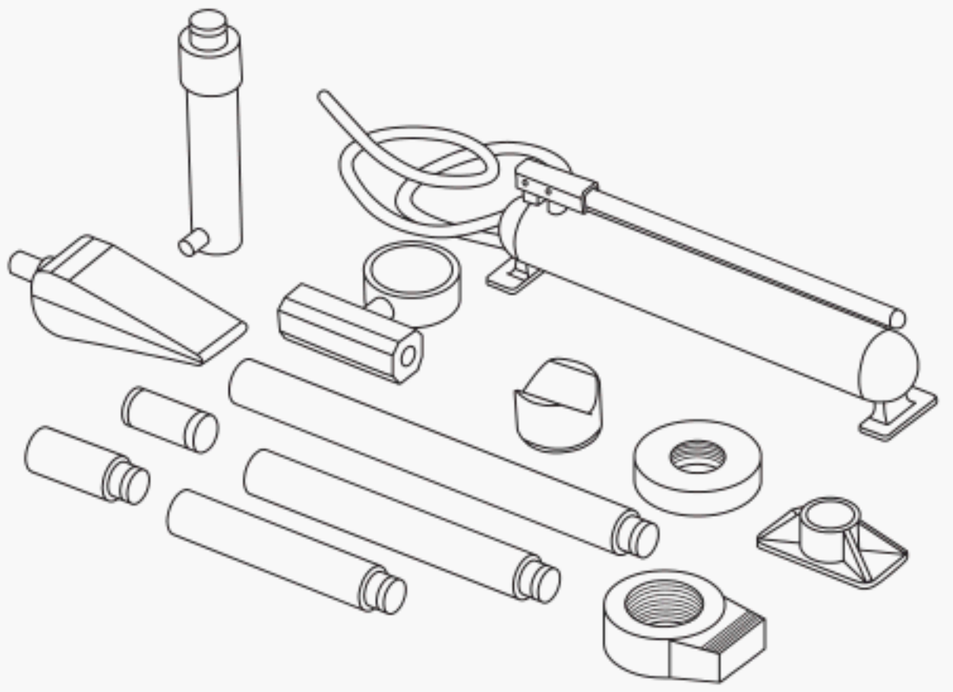
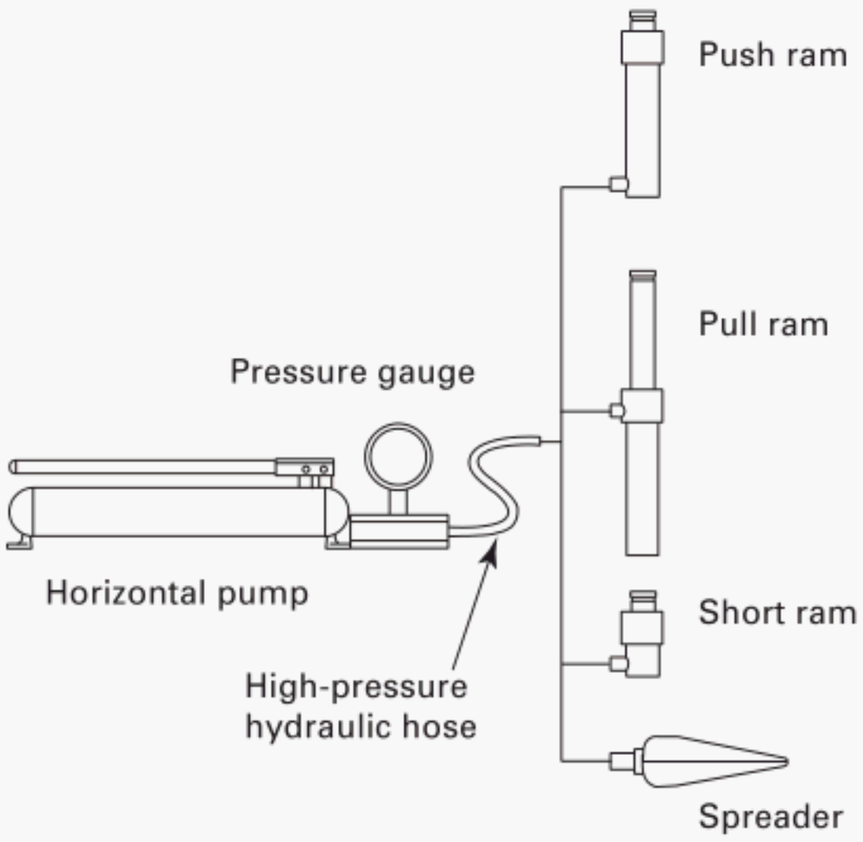


Fig. 7-1.3-2 Standard Kit Fit-Up

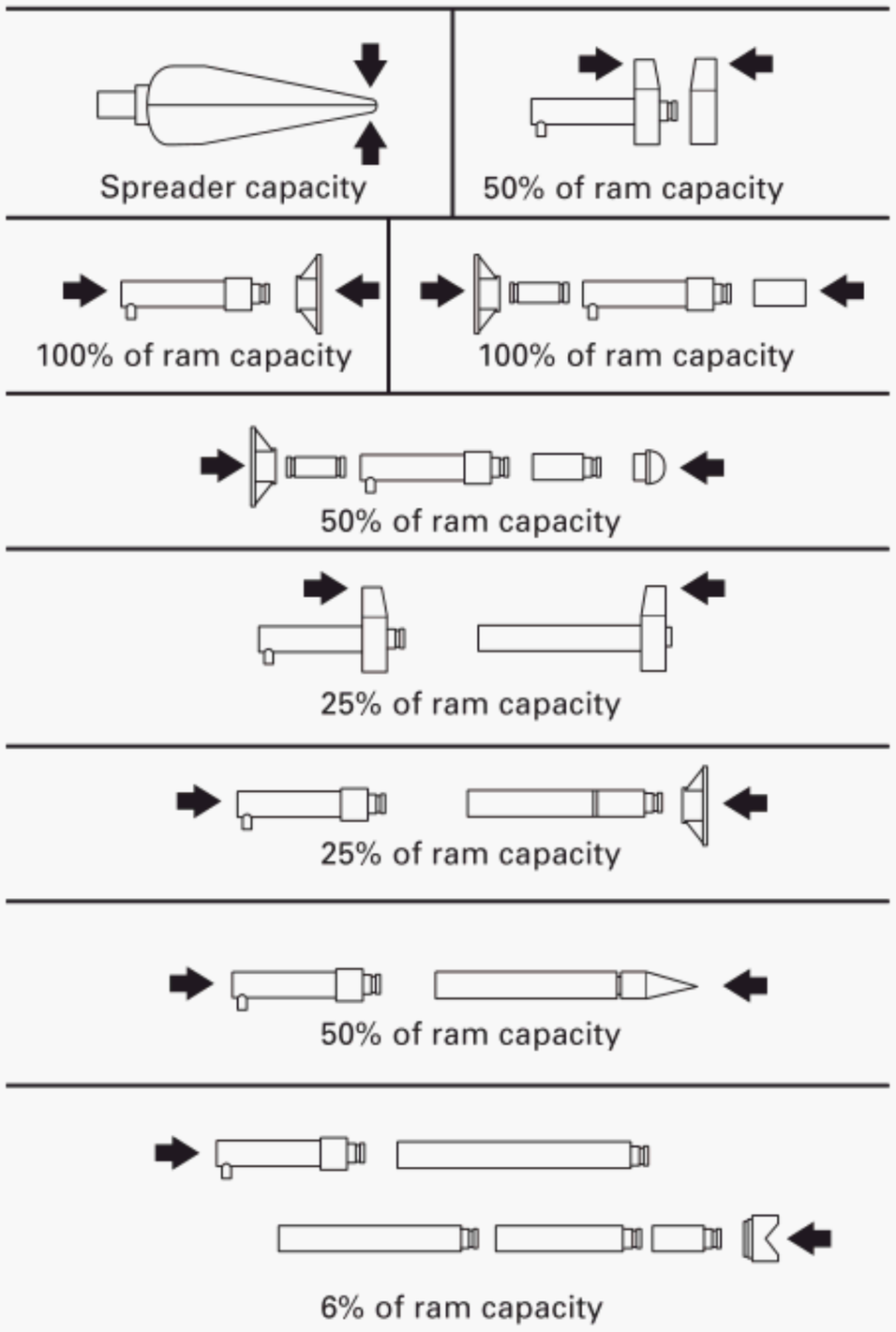


7-2 DESIGN

7-2.1 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 either by position, function, labeling, or a combination thereof. The

Fig. 7-1.3-3 Standard Kit Set for Applying Force



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.

7-2.2 Travel Limit

Each cylinder or spreader shall include a positive means to prevent movement beyond the design travel limit.

7-2.3 Overload Capacity

7-2.3.1 Pumps. Pumps shall be capable of performing the proof load tests outlined in para. 7-4.1 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.

7-2.3.2 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).

7-2.3.3 Cylinders. Cylinders shall be capable of performing the proof load tests outlined in para. 7-4.2 with a proof load of 150% of rated capacity without functional damage.

7-2.3.4 Spreaders. Spreaders shall be capable of performing the proof load tests outlined in para. 7-4.3 with a proof load of 150% of rated capacity without functional damage.

7-2.3.5 Adapters. All adapters, feet, and extension tubes shall be capable of performing the proof load tests outlined in para. 7-4.4 with a proof load of 150% of rated capacity without functional damage. The requirement applies to all possible assembly configurations.

7-2.4 Carrying Handle

If provided, the carrying handle affixed to any component of the kit shall be capable of sustaining 200% of the component weight.

7-2.5 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. 7-1.3-3.

7-2.6 Load Gauge

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

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

(b) Wear eye protection that meets ANSI 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, property damage, or both.

7-3.2 Safety Messages

Additional safety messages include, but are not limited to, 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.

7-4 DESIGN QUALIFICATION TESTING

7-4.1 Proof Tests for Pumps

7-4.1.1 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. 7-2.3.1 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.

7-4.1.2 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 and no more than 125% of its rated capacity.

7-4.2 Proof Test 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. 7-2.3.3 and held at this pressure for 10 min. The operational characteristics of the cylinder shall not be detrimentally affected.

7-4.3 Proof Test 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. 7-2.3.4.

(c) The spreader shall remain functional, and operational characteristics shall not be detrimentally affected.

7-4.4 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. 7-4.4.1 through 7-4.4.9.

7-4.4.1 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. 7-2.3.5 and held for 10 min. The extension tube shall not kick out during this test, and operational characteristics shall not be detrimentally affected.

7-4.4.2 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. 7-2.3.5 and held for 10 min. The plunger toe shall not kick out during this test, and operational characteristics shall not be detrimentally affected.

7-4.4.2.1 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. 7-2.3.5 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.

7-4.4.3 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. 7-2.3.5 and held for 10 min. The spreader toe shall not kick out during this test, and operational characteristics shall not be detrimentally affected.

7-4.4.4 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. 7-2.3.5 and held for 10 min. The flat base shall not kick out during this test, and operational characteristics shall not be detrimentally affected.

7-4.4.5 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. 7-2.3.5 and

held for 10 min. The serrated saddle shall not kick out during this test, and operational characteristics shall not be detrimentally affected.

7-4.4.6 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. 7-2.3.5 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.

7-4.4.7 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. 7-2.3.5 and held for 10 min. The rubber head shall not kick out during this test, and operational characteristics shall not be detrimentally affected.

7-4.4.8 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. 7-2.3.5 and held for 10 min. The wedge head shall not kick out during this time test, and operational characteristics shall not be detrimentally affected.

7-4.4.9 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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