

MIL-T-52585B(AL)  
 31 May 1988  
 SUPERSEDING  
 MIL-T-52585A(ME)  
 29 November 1979

## MILITARY SPECIFICATION

### Tester, Hydraulic Systems, Portable

This specification is approved for use within the US Army Armament Research, Development and Engineering Center, Department of the Army and is available for use by all Department and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This specification describes minimum Government requirements of Portable Hydraulic Systems Testers (PHST) necessary to meet field military needs.

#### 2. APPLICABLE DOCUMENTS

##### 2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issue of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS), and supplement thereto, cited in the solicitation.

#### SPECIFICATIONS

##### MILITARY

MIL-R-196 - Repair Parts, Accessories, and Kits, Mechanical, Packaging of

##### FEDERAL

PPP-B-601 - Boxes, Wood, Cleated-Plywood  
 PPP-B-636 - Boxes, Shipping, Fiberboard  
 PPP-P-440 - Preservation and Packing of Hand Tools; Tools and Tool Accessories For Power Driven, Metal and Woodworking Machinery

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, US Army Armament Research, Development and Engineering Center, ATTN: SMCAR-EST-S, Rock Island, IL 61299-7300 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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## STANDARDS

## FEDERAL

- FED-STD-4128 - Screw-Thread Standards For Federal Services
- FED-STD-376 - Preferred Metric Units for General Use by the Federal Government

## MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
- MIL-STD-129 - Marking for Shipment and Storage
- MIL-STD-130 - Identification Marking of US Military Property
- MIL-STD-889 - Dissimilar Metals
- MIL-STD-1190 - Minimum Guidelines for Level C Preservation, Packing and Marking

(Copies of specifications, standards, handbooks, drawings, and publications required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.

2.2 Other publications. The following document(s) forms a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted shall be those listed in the issue of the DoDISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS shall be the issue of the nongovernmental documents which is current on the date of the solicitation.

## SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

- SAE Standard - SAE J514 Hydraulic Tube Fittings
- SAE Recommended Practice - SAE J1276 Standardized Fluid for Hydraulic Component Tests, Recommended Practice

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

## 3. REQUIREMENTS

3.1 First article. When specified in the contract or purchase order, a sample shall be subjected to first article inspection (see 4.3 and 6.2.1).

3.2 Design. The PHST, attachments and adapters, in their devoted case, shall not exceed a envelope dimensions of 12.70 inches by 9.45 inches by 7.00 inches and shall not exceed a total weight of 40 pounds. The PHST, attachments and adapters shall conform to all requirements specified herein.

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3.3 Material. Materials not specifically designated herein or in the contract shall be of a quality commensurate with commercial practice within the producing industry, shall be suitable for the intended purpose of the design of the end item, and shall meet all requirements specified herein. Materials shall be free from defects which would adversely affect the performance or maintainability of the individual components or the overall assembly. Reclaimed parts shall not be used as is, or rebuilt from scrap or other used equipment. When dissimilar metals are used in contact with each other, suitable protection against galvanic corrosion shall be applied in accordance with MIL-STD-889.

3.4 Construction. The hydraulic system tester shall be complete so that when installed in its intended application and connected to the hydraulic system being tested, it can be used for any operation for which it was designed. The tester shall be constructed of parts which are new, without defects and free of repairs. The structure shall be capable of withstanding all forces encountered during operation of the equipment to its maximum rating and capacity without distortion.

3.4.1  Casting and forgings. All castings and forgings shall be free from defects, scale, and mismatching. No process such as welding, peening, plugging, or filling with solder or paste shall be used for reclaiming any defective part.

3.4.2 Welding, brazing, and soldering. Welding, brazing, and soldering shall be of a quality which shall sustain all requirements of the welded, brazed, or soldered parts. These operations shall not be employed as repair measures for defective parts.

3.4.3 Fastening devices. All screws, pins, bolts, and similar parts shall be installed with means for adjustment and preventing loss of tightness. All parts subject to removal or adjustment shall not be swaged, peened, staked, or otherwise permanently deformed.

3.4.4 Threads. Threads shall conform to FED-STD-H28 and the applicable detailed standards referenced therein.

3.4.5 Measuring and indicating devices. Measuring and indicating devices shall be graduated in both the US Customary System of Measurement and the Standard International Metric System of Measurement in accordance with FED-STD-376.

3.4.6 Workmanship. The quality of workmanship imparted to the PHST and its components shall equal or exceed that typically provided to commercial products by domestic producers of these type testers. The PHST's presented for acceptance shall have been manufactured with skill and care; shall be uniform, neat and clean; and shall be free of irregularities and anomalies which degrade form, fit, function, performance or appearance.

3.4.7 Mercury restriction. The PHST shall not contain mercury or mercury compounds nor be exposed to free mercury during manufacture.

3.4.8 Asbestos restriction. Asbestos and materials containing asbestos shall not be used on or in the PHST.

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**3.4.9 Interchangeability.** All parts of the end item shall be manufactured to definite standards and tolerances that will provide for the interchangeability of respective parts between end items of the same model. All parts of the end item shall be interchangeable with their respective replacement parts and mating components.

**3.5 Performance requirements.** The PHST shall operate and perform as specified herein in any position (X, Y, Z axis).

**3.5.1 Flow measurement.** The PHST shall directly measure flow as specified herein. Flow measurement and indicating readout shall be calibrated with hydraulic fluid with viscosity equal to SAE J1276. The PHST shall measure flow from 5 gallon per minute (gpm) or less to 100 gpm or more while compensating for hydraulic back pressure applied to the tester up to and including 150 pounds per square inch gage (psig). The measurement accuracy shall be  $\pm 5$  percent at any reading except, the first 1/10 of a scale shall be accurate within  $\pm 10$  percent of any reading.

**3.5.2 Pressure measurement.** The PHST shall directly measure pressure from 0 to 6,000 psig and the equivalent metric value. The measurement accuracy shall be  $\pm 2$  percent of full scale English value.

**3.5.3 Temperature measurement.** The PHST shall measure and indicate hydraulic fluid temperature in degrees Fahrenheit from 32 degrees or less to 240 degrees or more and the equivalent metric value within  $\pm 2$  degrees on the English scale.

**3.5.4 Shock resistance.** The PHST, attachments and adapters shall withstand without malfunction or damage the shock resulting from being dropped, once through each of its three major axes, a vertical distance of 20 inches to a concrete surface. Parts, attachments or adapters shall not become loosened or damaged.

**3.5.5 Vibration resistance.** No malfunction or damage to the PHST, or components, shall result from being subjected to a vibration of simple harmonic motion at a frequency of 5 to 55 hertz (Hz), with a maximum amplitude of 0.030 inch (0.060 inch maximum total excursion), for a period of one continuous hour in each direction of its three major axes, totaling 3 hours.

**3.5.6 Endurance.** The PHST shall show no evidence of leakage and the tester shall return to zero after 1,800 pressure-flow cycles of 6,000 psi at 20 gpm and 200 pressure-flow cycles of 1,500 psi at 100 gpm. The tester shall withstand these pressure-flow cycles without erratic gage or readout fluctuation or flutter.

### 3.6 Components.

**3.6.1 Load valve.** A manually operated variable load valve shall be provided on the tester to permit the operator to hand load either the tester or any connected system. The force required to operate the load valve shall not exceed 10 foot-pounds at any pressure.

**3.6.2 Inlet and outlet connections.** The PHST shall be provided with 1-5/16-12, 37 degree flare, male, steel, inlet and outlet fittings in accordance with SAE J514. The fittings shall be provided with steel caps. The inlet connection shall be marked "INLET" and the outlet connection shall be marked "OUTLET". The marking shall be applied by embossing or stamping and shall be not less than 1/2 inch in size. When more than one set of adapters are used on the inlet and outlet ports of the tester, provisions shall be made in the case of the tester for stowing the adapters which are not attached for use. The stowage arrangement shall be such that

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when any one adapter is attached for use, all other adapters shall be securely stowed in a protected position. All attachments and adapters shall connect directly to the case without the use of hoses, tubing, or nipples.

3.6.3 Protective devices. Protective devices shall be provided to protect the tester from damage by relieving pressure at no more than 115 percent of the rated pressure, but not less than 105 percent of the rated pressure. Destructible protective devices, when used, shall be replaceable in the field. Four each of the destructible protective device shall be furnished with each tester and shall be stowed in or on the tester in a protected position.

3.6.4 Case. The tester gages, attachments and adapters shall be contained within a steel metal case not less than 0.047 inch in nominal thickness. When the loading test block is contained within the case the inlet and outlet connections shall project through the case to provide easy access. The case shall have an overlapping lid provided with fasteners that will keep the lid closed when the tester is subjected to vibration and shock. The case shall be provided with one or more handles for carrying the tester.

3.7 Protective finish. The protective finish shall be paint, anodizing, or plating. All surfaces to be painted shall, immediately prior to painting, be cleaned and dried free from all foreign matter. The protective paint coating shall be no less than 0.002 inch thickness. The adhesion of the paint shall prevent any peeling of paint when removing fiberglass tape applied over two intersecting cuts in the paint, the cuts being not less than 2 inches in length and through the paint thickness to the base metal. The surface hardness of the paint shall be within the range of H and HB lead. Aluminum parts that are not painted shall be anodized for protection. Steel parts that are not painted shall be plated to resist corrosion.

3.8 Identification marking. The PHST shall be marked for identification in accordance with MIL-STD-130 and when specified (see 6.2.1), shall include the National Stock Number.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specifications where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspections set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective materiel, either indicated or actual, nor does it commit the Government to acceptance of defective materiel.

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**4.2 Classification of inspection.** The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.3).
- b. Quality conformance inspection (see 4.4).

**4.3 First article inspection.** First article inspection shall be applied to the preproduction model or initial production item (see 3.1). Unless otherwise specified (see 6.2), first article inspection shall consist of the examination in 4.5 and all tests under 4.6. Failure of the first article to pass the examination or any of the tests shall be cause for rejection.

**4.4 Quality conformance inspection.** Unless otherwise specified (see 6.2), quality conformance inspection shall be applied to production items offered for acceptance under the contract. Unless otherwise specified (see 6.2), quality conformance inspection shall consist of a. through g. below. Failure of any unit to pass an examination or test shall be cause for rejection of the unit.

- a. Product examination (see 4.5).
- b. Temperature gage test (see 4.6.1.1.1).
- c. Flow measurement test (see 4.6.1.1.2).
- d. Pressure gage test (see 4.6.1.1.3).
- e. Pressure and flow test (see 4.6.1.1.4).
- f. Protective finish test (see 4.6.6).
- g. Packaging inspection (see 4.7).

**4.4.1 Sampling.** Sampling for quality conformance inspection shall be in accordance with MIL-STD-105, using the following:

<u>Inspection or Test</u>	<u>Inspection Level</u>	<u>AQL</u>
Product examination 4.5	II	1.0
Temperature gage test 4.6.1.1.1	S-2	4.0
Flow measurement test 4.6.1.1.2	S-2	4.0
Pressure gage test 4.6.1.1.3	S-2	4.0
Pressure and flow test 4.6.1.1.4.	S-2	4.0
Protective finish test 4.6.6	S-2	4.0
Packaging inspection 4.7	S-4	4.0

**4.5 Product examination.** Visually, dimensionally, and manually examine each tester to determine conformance with the requirements of 3.2 through 3.4.8, and 3.6 through 3.8. Visual examination shall include verification of completeness of manufacture, and assembly, conformance to specified standards, adequacy of markings, proper cleaning, and freedom from identified defects. Dimensional examination includes measuring dimensions as specified. Manual examinations shall include the operation of movable parts by hand to assure proper functioning. The examination provisions may be applied at the earliest practical point in manufacture at which it is feasible to inspect for acceptance without risk of change in the characteristic by subsequent operations. Failure of the contractor to provide objective evidence that the tester and its components have passed the examinations prescribed for them by the contractor's inspection system shall be cause for rejection. In addition, failure of the contractor to provide objective evidence that all parts are manufactured to definite standards, clearances, and tolerances so that no replacement part will degrade the form, fit, or function of the end item (see 3.4.9), shall be cause for rejection.

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4.6 Tests.4.6.1 Performance test.

4.6.1.1 Test preparation and tests. Connect the tester to a flow source. Conduct the tests utilizing hydraulic fluid with viscosity equal to SAE J1276. Install calibrated temperature and pressure instruments in the inlet line of the tester. The pickup of the pressure and temperature instruments shall be within 1 foot of the inlet or outlet connection of the tester. Install a calibrated flow indicator in the outlet line from the tester. The calibrated instruments shall be accurate within 1/2 of 1 percent. Perform the following tests in the sequence indicated below.

4.6.1.1.1 Temperature gage test. Check the temperature show on the tester temperature gage at four different temperatures falling within the ranges of 60 to 80 degrees F, 140 to 160 degrees F, 165 to 185 degrees F, and 230 to 250 degrees F.

4.6.1.1.2 Flow measurement test. Check the flow on the tester flow gage at 10, 25, 50, 75, and 100 gpm. With flow to the inlet side of the tester, restrict the outlet line by applying a 150 psi back pressure for a period of one minute.

4.6.1.1.3 Pressure gage test. At a flow of not less than 20 gpm, actuate the load valve on the tester to show readings on the tester pressure gage at 500, 1000, 2000, 4500, and 6000 psi.

4.6.1.1.4 Pressure and flow test. At a flow of not less than 100 gpm, actuate the tester load valve to show readings on the tester pressure gage at 500, 1000, and 1500 psi.

4.6.1.2 Acceptance-rejection criteria. Any of the following occurrences shall constitute failure of this test:

- a. Permanent deformation.
- b. Damage.
- c. Protective device actuation.
- d. Deviation in excess of 2 percent of the tester reading from the calibrated instrumented readings.
- e. Leakage.
- f. Erratic fluctuation or flutter of a flow or pressure gage.
- g. Failure of a gage to return to zero.

4.6.2 Endurance test. Cycle the tester 1800 times from a pressure of zero psi, plus 50 psi, to a pressure of 6000 psi, plus or minus 50 psi, with a flow of 20 gpm, plus or minus 5 gpm. After the 1800 pressure cycles, cycle the tester 200 times from a pressure of zero psi, plus 50 psi, to a pressure of 1500 psi, plus or minus 50 psi, with a flow of 100 gpm, plus or minus 5 gpm. Leakage, erratic fluctuation or flutter of a flow or pressure gage or failure to return to zero shall constitute failure of this test (see 3.5.6). Burst disks may be substituted with plugs for the endurance testing.

4.6.3 Shock test. Drop the tester four times on a hard concrete surface from a height of not less than 20 inches. The drop height shall be measured between the concrete surface and the lowest point of the tester. The drops shall be twice on the bottom and twice on any side other than the port side or handle side. Evidence

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of breakage or loose parts shall constitute failure of this test. Cracks, dents, or deformation of the tester case that do not effect tester operation, transporting the tester case lid or latch function will not be cause for rejection (see 3.5.4).

**4.6.4 Vibration.** Rigidly mount the tester on the vibration test apparatus. Subject the tester to simple harmonic vibration in each of three (3) perpendicular axes starting with the tester mounted bottom side down. The simple harmonic vibration shall consist of a uniform sweep of the frequency range of 5 to 55 to 5 Hz for one (1) minute plus or minus 3 seconds. The amplitude shall be 0.03 inch plus or minus .0015 inch (0.06 total excursion). The uniform sweep of the frequency range shall be applied for on (1) hour in each of the three (3) perpendicular axes. Nonconformance to paragraph 3.5.5 shall constitute failure of this test.

**4.6.5 Protective device test.** The tester shall be pressurized to not more than 115 percent of the rated pressure. The destructive protective device shall rupture at 115 percent of rated pressure, but not less than 105 percent of rated pressure. The destructive safety device shall be replaced without the use of special tools. Inability of the tester to meet the safety requirement shall constitute failure of this test.

**4.6.6 Protective finish test.** The surface of a sample part shall be used to conduct the paint test. The sample part shall be of identical material and have the same surface finish as the finished item. The sample part shall be painted at the same time as the production item using the same paint and the same painting process. The protective paint coating shall be not less than 2.0 mil (.002 inch.) in thickness.

**4.6.6.1 Paint removal.** Fiberglass tape shall be applied over two intersecting cuts in the paint which expose the base metal for a length of not less than 2 inches. Evidence of the paint sticking to the tape, upon removal of the tape, shall be cause for rejection.

**4.6.6.2 Surface hardness.** Press sharpened H and HB hardness wooden lead pencils vertically onto the surface of the painted sample part until the lead crushes or breaks. Evidence of indentation in the paint when using the HB pencil lead, or no evidence of indentation when using the H hardness pencil lead, shall be cause for rejection.

**4.7 Packaging inspection.** The items shall be inspected before and after packaging, to determine compliance with the preservation, packaging, packing, and marking requirements specified in Section 5 of this specification..

## 5. PACKAGING

**5.1 Preservation.** Preservation shall be level A or Level C as specified in the contract.

**5.1.1 Level A.** The tester, contained in the case with the inlet and outlet openings sealed as provided for, and the base lid closed, shall be placed in a close fitting weather resistant fiberboard box conforming to PPP-B-4636. Closure shall be in accordance with method IV of the appendix to the box specification.

**5.1.1.1 Hose assemblies.** The metal plugs shall be installed on the hose couplings. The hose shall be coiled to the minimum safe diameter and secured with cotton tape or twine.

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5.1.1.2 Repair parts. The preservation application criteria and applicable method(s) of preservation of MIL-P-196 shall be used to preserve repair parts.

5.1.1.3 Maintenance tools. Maintenance tools shall be preserved in accordance with the level A requirements of PPP-P-40.

5.1.1.4 Technical publications. Technical publications shall be packaged in waterproof, greaseproof barrier material and sealed. The package shall be protected against puncture and abrasion, and placed inside the case or taped securely to the outside of the case.

5.1.1.5 Consolidation. Repair parts, maintenance tools, and technical publications shall be consolidated in a close-fitting box conforming to PPP-B-636, W6c, style optional.

5.1.1.6 Level C. Level C preservation shall be in accordance with MIL-STD-1190.

5.2 Packing. Packing shall be level A, B, or Level C as specified in the contract.

5.2.1 Level A. Each complete tester, preserved as specified above, shall be packed in a close-fitting box conforming to PPP-B-601, overseas type, style optional. The hoses shall be stacked one on top of the other with the consolidated items placed in the center of the coil. The contents shall be secured within the box in a manner to prevent free movement. The box shall be closed and strapped in accordance with the appendix to the box specification.

5.2.2 Level B. Packing shall be as specified for level A, except the box shall be domestic type.

5.2.3 Level C. Level C packing shall be in accordance with MIL-STD-1190.

5.3 Marking. All marking shall be as in accordance with MIL-STD-129. Special marking shall be as required by the contract or purchase order. Bar code marking is required and shall be in accordance with MIL-STD-129.

## 6. NOTES

6.1 Intended use. The hydraulic tester is intended for use in testing flow, pressure, and temperatures of hydraulic systems in earthmoving, mobile, and other hydraulically actuated equipment.

### 6.2 Ordering date.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. First article, when required (see 3.1).
- c. Identification marking when required (see 3.8).

6.2.2 Contract data requirements. Required technical data such as operator's manuals, parts lists, and other instructions for operation and maintenance, as identified on a numbered DD Form 1664, should be specified on a DD Form 1423 incorporated in the contract.

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6.3 Safety and health determination. In order that equipment integrated into the user's operational environment will comply with OSHA limitation and control of noise levels, radiation electromagnetic emission, noxious vapors, heat, etc., as applicable, specific requirements concerning guarding the point(s) of operation, and other safety and health requirements should be specified by the user/requisitioner (see 6.2.1).

6.4 Subject term (key word) listing.

Back pressure  
Flow  
Hydraulic  
Pressure  
Temperature  
Tester

6.5 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodian:

Army - AL

Preparing activity:

Army - AL

Review activity:

Army - ME

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