SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE STANDARD

SAE AS55151

Issued 2001-10

Pump, Hydraulic, Ram, Hand Driven

NOTICE

This document has been taken directly from U.S. Military Specification MIL-P-5515D, Notice 1 and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards. The initial release of this document is intended to replace MIL-P-5515D, Notice 1. Any part numbers established by the original specification remain unchanged.

The original Military Specification was adopted as an SAE standard under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of government specifications and standards. TSB rules provide for (a) the publication of portions of unrevised government specifications and standards without consensus voting at the SAE Committee level, and (b) the use of the existing government specification or standard format.

Under Department of Defense policies and procedures, any qualification requirements and associated qualified products lists are mandatory for DOD contracts. Any requirement relating to qualified products lists (QPL's) has not been adopted by SAE and is not part of this SAE technical document.

TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX: (724) 776-0790 SAE WEB ADDRESS: http://www.sae.org

1. SCOPE AND CLASSIFICATION:

1.1 Scope:

This specification covers hand driven, hydraulic ram pumps used on type I (-65° to +160°F) aircraft hydraulic systems.

1.2 Classification:

Pumps shall be of the following classes, as specified:

Class 1500	1,500 PSI operating pressure
Class 3000	3,000 PSI operating pressure

2. APPLICABLE DOCUMENTS:

2.1 Government documents:

2.1.1 Specifications, standards, and handbooks: The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

Military

MIL-P-116	Preservation, Methods Of
MIL-H-8775	Hydraulic System Components, Aircraft And Missiles, General Specification For
MIL-STD-129	Marking For Shipment And Storage
MIL-STD-970	Standards & Specifications, Order Of Preference For The Selection Of
MIL-STD-2073/1A	DOD Material Procedures For Development And Application Of Packing Requirement
MS21344	Fitting - Installation Of Flared Tube, Straight Threaded Connectors, Design Standard For
AN6201	Pump, Hydraulic Hand
AN6248	Pump, Hydraulic Hand, Type 3000

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Ave, Building #4, Section D, Philadelphia, PA. 19111-5094.)

2.2 Non-Government publications:

The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

American Society For Testing and Materials (ASTM)

ASTM D3951 Packaging, Commercial

(Application for copies should be addressed to: ASTM, 1916 Race St, Philadelphia, PA 19103.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence:

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

3. REQUIREMENTS:

3.1 General:

The requirements of Type I Hydraulic System and hand Pump Standards listed herein apply as requirements of this specification.

3.1.1 Class: Pumps shall be of two classes.

3.1.1.1 Class 1500: A 1500 psi operating pressure and the requirements of AN6201 apply for this class pump.

3.1.1.2 Class 3000: A 3000 psi operating pressure and the requirements of AN 6248 apply for this class pump.

3.2 Qualifications:

Pumps furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.4 and 6.3).

3.3 General specification:

The requirements of MIL-H-8775 apply as requirements of this specification with the exceptions and additions called out herein. When the two specifications conflict, this specification shall govern.

3.3.1 Exceptions: The exceptions to the requirement of MIL-H-8775 are:

a. Only Type I system requirements apply to this specification.

b. The temperature conditions for qualification testing do not apply to this specification.

3.3.2 Additions: The design and construction requirements specified herein are in addition to those requirements specified in MIL-H-8775.

3.4 Selection of specifications and standards:

Specifications and standards for necessary commodities and services not specified herein shall be selected in accordance with MIL-STD-970.

3.5 Materials:

Material shall conform to applicable section of MIL-H-8775.

3.6 Design and construction:

3.6.1 Clearance volume: The pump clearance volume, that is the cylinder volume not swept by the piston travel, shall be kept to a minimum and shall not exceed 20 percent of the total swept volume.

3.6.2 Displacement: The pumps shall be double-action and shall have an output differential not exceeding .50 cubic inch per stroke. The Class 1500 pumps shall have a displacement of 1.25 to 1.50 cubic inches per cycle. The class 3000 pumps shall have a minimum displacement of 0.7 cubic inches per cycle.

3.7 PERFORMANCE:

3.7.1 Structural strength: The structural strength of the pump parts, when installed in a normal manner, shall provide ample strength and rigidity to withstand, without failure, a normal handle torque; side torque; and wrench torques when tested in accordance with structural strength tests (see 4.4.6.1).

3.7.2 Priming: When tested in accordance with priming test (see 4.4.6.2), pumps shall prime completely from a dry suction line in not more that 10 cycles of operation for Class 1500 pumps and in not more than 15 cycles for Class 3000 pumps.

3.7.3 Ability to hold prime: When testing pumps in accordance with ability to hold prime test (see 4.4.6.3), there shall be no visible external leakage from the pump or suction tube.

3.7.4 Pressure:

3.7.4.1 Output pressure: When tested in accordance with output pressure test (see 4.4.6.4.1), pumps shall be capable of delivering 85 percent of their displacement per cycle at the required operating pressures.

3.7.4.2 Proof pressures: Class 1500 and Class 3000 shall be capable of withstanding 2250 and 4500 psi proof pressure, respectively.

3.7.4.3 Burst pressure: Class 1500 and Class 3000 shall be capable of withstanding 3750 psi and 7500 psi, respectively.

3.7.5 Handle Torque: Normal handle torque shall not exceed 1350 pound inches when tested in accordance with handle torque test (see 4.4.6.4.1.1) for the complete cycle. For pumps designed after 1 January 1977, the normal handle torque shall not exceed 1080 pound inches when tested in accordance with handle torque test (see 4.4.6.4.1.1) for the complete cycle.

3.7.6 Cold operation:

3.7.6.1 Cold priming: Pumps shall prime completely at -65°F (see 4.4.6.5.1) from a dry suction line in not more than 12 cycles of operation for the Class 1500 pumps and not more than 17 cycles for the Class 3000 pumps.

3.7.6.2 Cold cycling: At -65° (see 4.4.6.5.2) pumps shall deliver 85 percent of their displacement per cycle at the specified operating pressure. During rapid warm up there shall be no evidence of binding or other malfunction.

3.7.7 Efficiency:

3.7.7.1 Volumetric: Output volume, when tested in accordance with volumetric efficiency test (see 4.4.6.6) shall not be less than 85 percent of their design displacement unless otherwise specified herein.

3.7.7.2 Mechanical: The output load (output pressure in psi multiplied by area of pump piston in square inches) shall not be less than 80 percent of axial input load (see 4.4.6.4.1.2) for full stroke at operating pressure.

3.7.8 Endurance: The pumps shall withstand 70,000 cycles at specified conditions

a. Without malfunctioning or failure.

b. No external leakage except at running packings. This leakage, at no time during the test shall exceed two drops for 25 cycles nor shall the total leakage for the test exceed one drop per 25 cycles.

c. No bearings or other parts shall be replaced except running packings provided the original packings operate at least 40,000 cycles without excessive leakage.

3.7.8 (Continued):

d. At any time during specified test output volume shall not be less that 75 percent of the pump displacement. This output volume shall be reputable when tested in accordance with volumetric efficiency test (4.4.6.6).

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for inspection:

Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor 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 this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance: All items shall meet all requirements of sections 3 and 5. The inspection 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 ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.2 Classification of inspections:

The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.3).

b. Quality conformance inspection (see 4.4).

4.3 Inspection conditions:

Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in MIL-H-8775 shall apply except the temperature conditions. Unless otherwise specified in each individual test method herein, fluid and ambient temperatures shall be between 70 and 120°F.

4.4 Qualification inspections:

4.4.1 Qualification test samples: Test samples as specified in MIL-H-8775 shall apply for each class of pump.

4.4.2 Qualification inspection: Qualification inspection and testing shall be as specified in Table I.

TABLE I

Examination or Test	Test Method Paragraph	Samples to Be Inspected
Material	4.4.5	Min & Max
Workmanship	4.4.5	Min & Max
Physical Dimensions	4.4.5	Min & Max
Design and Construction	4.4.5	Min & Max
Clearance Volume	4.4.5	Min & Max
Displacement	4.4.5	Min & Max
Markings and Identification	4.4.5	Min & Max
Structural Strength	4.4.6.1	Max
Priming	4.4.6.2	Min & Max
Ability to Hold Prime	4.4.6.3	Max
Output Pressure	4.4.6.4.1	Max
Handle Torque	4.4.6.4.1.1	Max
Mechanical Efficiency	4.4.6.4.1.2	Max
Proof Pressure	4.4.6.4.2	Max
Burst Pressure	4.4.6.4.3	Max
Cold Priming	4.4.6.5.1	Min
Cold Cycling	4.4.6.5.2	Min
Volumetric Efficiency	4.4.6.6	Max
Endurance	4.4.6.7	Max

4.4.3 Quality conformance inspection: The visual inspection (4.4.5) and pressure proof test (4.4.6.4.2) of Table I shall apply for quality conformance inspection to determine conformance with this specification.

4.4.4 Sampling: Each pump shall be subjected to and meet the requirements of quality conformance inspections.

4.4.5 Inspection methods: A dimensional analysis and inspections of pump components shall be made to determine conformance with requirements of material, design and construction, and qualifications samples as specified in MIL-H-8775 and this specification.

4.4.6 Test methods:

4.4.6.1 Structural strength: Mount the pump securely by the mounting lugs to the test stand. With the fluid ports open and the handle in the forward position, apply a 300 lb force to the handle 30 inches from the pivot. Repeat this test with the handle in the aft position. Return the handle to within 5 degrees of mid travel position and apply 160 pounds force to 30 inches from the pivot perpendicular to the direction of travel. Repeat this test applying the load to the opposite side of the handle. Install fluid fittings and torque 250 percent of the maximum torque value specified for fittings in MS21344.

4.4.6.2 Priming: The pump shall be mounted in the normal operating position with tube (size as specified in the applicable standard) connecting the suction port to hydraulic fluid supply. The fluid level shall not be less than 30 inches below pump suction port as illustrated by Figure 1. Operate pump at a rate not less than 20 strokes per minute to determine the pumping cycles necessary to produce flow.

4.4.6.3 Ability to hold prime: Mount pump and suction tube as specified in priming test (see 4.4.6.2) and completely prime pump, overflowing through the pump discharge port to the atmosphere. After pumping is stopped and allowing not less than 30 minutes, determine leakage from pump or suction line. Ambient and fluid temperature shall not vary more than two degrees during this test.

4.4.6.4 Pressure:

4.4.6.4.1 Output pressure: Connect pump to fluid supply and a pressure regulator that is regulated to the required output pressure as illustrated by Figure 2. Operate pump to provide flow at this regulated pressure.

4.4.6.4.1.1 Handle torque: After operating pump to produce the required output pressure (see 4.4.6.4.1); increase flow by slowly applying loads at not greater than 30 inches from pivot point of a suitable pump handle to determine the necessary torque for entire stroke in both directions.

4.4.6.4.1.2 Mechanical efficiency: Using loads, determined in handle torque tests, and the mechanical advantage provided by the geometry of the linkages, determine the maximum axial input loads on pump piston for both stroke directions. Calculate mechanical efficiency for both stroke directions.

4.4.6.4.2 Proof pressure: Apply a load sufficient to produce the required proof pressure, at the end of a suitable handle for 5 minutes for each stroke direction.

4.4.6.4.3 Burst pressure: Apply required burst pressure with an external hydraulic power supply to all internal cavities of the pump that are subjected to operating pressure.

4.4.6.5 Cold operation:

4.4.6.5.1 Cold priming: Cold soak an empty pump and test equipment as illustrated by Figure 1 at not less than -65°F for not less than 72 hours. Test pump in accordance with priming test (see 4.4.6.2) except at cold soak temperature.

4.4.6.5.2 Cold cycling: Connect the above cold soaked pump to a pressure regulator that is regulated to the required output pressure. Suction tube may be changed to provide not less than 5 inches for the suction head. Operate pump at not less than 20 cycles per minute through at least 25 complete cycles with pump and fluid held at -55 to -65°F to:

a. Produce flow at output pressure.

b. Determine output volume per cycle.

Cycle pump at sufficient interval to determine binding or other malfunction due to differential expansion of mating parts, during rapid warmup to 120-129°F.

4.4.6.6 Volumetric efficiency: Mount pump and associated test equipment as illustrated by Figure 2. Operate pump at not less than 55 cycles per minute. Determine output volume per cycle for calculating volumetric efficiency.

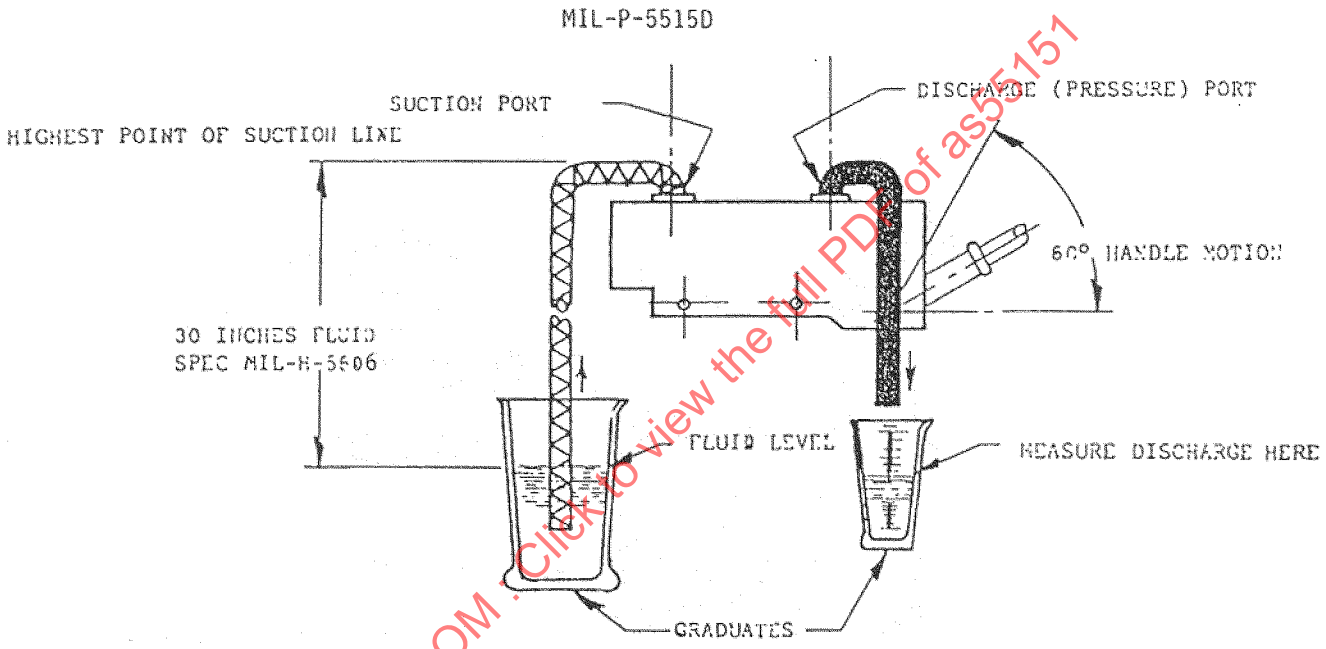

Figure 1. Hand pump priming and flow test set-up.