

INCH-POUND

MIL-DTL-5515E  
 18 January 2011  
 SUPERSEDING  
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 14 March 1991

## DETAIL SPECIFICATION

## PUMP, HYDRAULIC, RAM, HAND DRIVEN

Inactive for new design after 4 April 1996.

This specification is approved for use by all Departments and Agencies of the Department of Defense.

## 1. SCOPE

1.1 Scope. This specification covers general requirements for hand-driven hydraulic ram pumps used on type I (-65 °F to +165 °F) aircraft hydraulic systems conforming to SAE-AS8775.

1.2 Classification. Pumps fabricated to this specification are classified as follows:

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

## 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 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 cited in the solicitation or contract.

## DEPARTMENT OF DEFENSE SPECIFICATIONS

AN6201	Pump - Hydraulic Hand
AN6248	Pump - Hydraulic Hand, Type 3000
MS21344	Fitting - Installation Flared Tube, Straight Threaded Connectors, Design Standard For
MIL-PRF-5606	Hydraulic Fluid, Petroleum Base; Aircraft, Missile, and Ordnance
MIL-PRF-83282	Hydraulic Fluid Fire Resistant, Synthetic Hydrocarbon Base, Metric NATO Code Number H-537
MIL-PRF-87257	Hydraulic Fluid, Fire Resistant; Low Temperature, Synthetic Hydrocarbon Base, Aircraft And Missile

(Copies of these documents are available online at <https://assist.daps.dla.mil/quicksearch/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

Comments, suggestions, or questions on this document should be addressed to: DLA Land and Maritime, Attn: VAI, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to [FluidFlow@dlamail](mailto:FluidFlow@dlamail). Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.daps.dla.mil>.

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2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

#### INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 17025 General Requirements for the Competence of Testing and Calibration Laboratories

(Copies of these documents are available online at <http://www.iso.ch> or from the International Organization for Standardization American National Standards Institute, 11 West 42<sup>nd</sup> Street, 13<sup>th</sup> Floor, New York, NY 10036.)

#### NCSL INTERNATIONAL

NCSL Z540.3 Requirements for the Calibration of Measuring and Test Equipment

(Copies of these documents are available online at <http://www.ncsli.org> or from NCSL International, 2995 Wilderness Place, Suite 107 Boulder, Colorado 80301-5404.)

#### SAE INTERNATIONAL

SAE-AS8775 Hydraulic System Components, Aircraft and Missiles, General Specification For

(Copies of these documents are available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), [www.sae.org](http://www.sae.org).)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document take precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between requirements of this specification and the specification sheets, the latter shall govern.

3.2 Qualification. Pumps furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.4, 6.3 and 6.3.1).

3.3 Materials. Materials shall be as specified in SAE-AS8775 and shall conform to all applicable specification sheets. When a definite material is not specified, a material shall be used which will enable the pump to meet the requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guarantee of acceptance of the finished product.

3.3.1 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials shall be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.4 General. The requirements of Type 1 (see 1.1) Hydraulic System and Hand Pump Standards listed herein apply as requirements of this specification.

3.4.1 Class. Pumps shall be of two classes.

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

3.4.1.2 Class 3000. A 3000 psi operating pressure and the requirements of AN6248 apply for this class of pump.

3.4.2 General specification. The requirements of SAE-AS8775 apply as requirements of this specification with the exceptions and additions called out herein. When the two specifications conflict, this specification shall govern.

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3.4.2.1 Exceptions. The exceptions to the requirement of SAE-AS8775 are as follows:

- a. Only Type I systems requirements apply to this specification.
- b. The temperature conditions for qualification testing do not apply to this specification.

3.4.2.2 Additional requirements. The design and construction requirements specified herein ([see 3.5](#)) are in addition to those requirements specified in SAE-AS8775.

### 3.5 Design and construction.

3.5.1 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.

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

### 3.6 Performance.

3.6.1 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 4.6.1](#)).

3.6.2 Priming. Pumps shall prime completely from a dry suction line in not more than 10 cycles of operation for class 1500 pumps and in not more than 15 cycles for class 3000 pumps, when tested in accordance with [4.6.2](#).

3.6.3 Ability to hold prime. The pumps shall hold prime for a minimum of 30 minutes and show no signs of external leakage from the pump or the suction line, when tested in accordance with [4.6.3](#).

#### 3.6.4 Pressure.

3.6.4.1 Output pressure. Pumps shall be capable of delivering 85 percent of their displacement per cycle ([see 3.5.2](#)) at the required operating pressures ([see 3.4.1](#)), when tested in accordance with [4.6.4.1](#).

3.6.4.2 Proof pressures. Class 1500 and class 3000 pumps shall be capable of withstanding 2250 and 4500 psi proof pressures, respectively, when tested in accordance with [4.6.4.2](#).

3.6.4.3 Burst pressures. Class 1500 and class 3000 pumps shall be capable of withstanding 3750 and 7500 psi, respectively, when tested in accordance with [4.6.4.3](#).

3.6.5 Handle torque. Normal handle torque shall not exceed 1350 inch-pounds, when tested in accordance with [4.6.4.1.1](#). For pumps designed after 1 January 1977, the normal handle torque shall not exceed 1080 inch-pounds, when tested in accordance with [4.6.4.1.1](#).

#### 3.6.6 Cold operations.

3.6.6.1 Cold priming. Pumps shall be capable of priming completely at -65°F (-54°C) 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, when tested in accordance with [4.6.5.1](#).

3.6.6.2 Cold cycling. At -65°F (-54°C) ([see 4.6.5.2](#)) pump shall deliver 85 percent of its displacement per cycle at the required operating pressure ([see 3.4.1](#) and [3.6.4](#)), when tested in accordance with [4.6.5.2](#). During rapid warm-up there shall be no evidence of binding or other malfunction.

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### 3.6.7 Efficiency.

3.6.7.1 Volumetric. Output volume, shall not be less than 85 percent of their design displacement, unless otherwise specified herein, when tested in accordance with [4.6.6](#).

3.6.7.2 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 for full stroke at operating pressure when determined in accordance with [4.6.4.1.2](#).

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

- a. Without malfunctioning or failure.
- b. With 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 an average of 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 ([see 3.6.8.b](#)).
- d. At any time during specified test, output volume shall not be less than 75 percent of the pump displacement.

3.7 Identification of product. Unless otherwise specified, all pumps shall be stamped with manufacturer's name or trademark.

3.8 Workmanship. Pumps shall be free from cracks, laps, seams, burrs, longitudinal and spiral tool marks, or any other defects that may detrimentally affect their intended use ([see 4.5.2](#)).

## 4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection ([see 4.4](#)).
- b. Conformance inspection ([see 4.5](#)).

4.2 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection shall be established and maintained or identified by the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with ISO 17025 and NCSL Z540.3 as applicable.

4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in SAE-AS8775. Fluid and ambient temperatures shall be between 70°F (21°C) and 120°F (49°C), unless otherwise specified in each individual test method specified herein.

4.4 Qualification inspection. Qualification inspection shall be performed on units produced with equipment and procedures used in production.

4.4.1 Qualification test samples. Two test samples for each pressure class of the pump shall be tested in accordance with [4.4.2](#) and shall meet the requirements specified in [3.6](#).

4.4.2. Qualification inspection. Qualification inspection shall be as specified in [table I](#).

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TABLE I. Qualification inspection.

Examination or test	Requirement	Test method paragraph
Material	<a href="#">3.3</a>	<a href="#">4.5.2</a>
Workmanship	<a href="#">3.8</a>	<a href="#">4.5.2</a>
Physical dimensions	<a href="#">3.4.2</a>	<a href="#">4.5.2</a>
Design and construction	<a href="#">3.5</a>	<a href="#">4.5.2</a>
Clearance volume	<a href="#">3.5.1</a>	<a href="#">4.5.2</a>
Displacement	<a href="#">3.5.2</a>	<a href="#">4.5.2</a>
Markings and identification	<a href="#">3.7</a>	<a href="#">4.5.2</a>
Structural strength	<a href="#">3.6.1</a>	<a href="#">4.6.1</a>
Priming	<a href="#">3.6.2</a>	<a href="#">4.6.2</a>
Ability to hold prime	<a href="#">3.6.3</a>	<a href="#">4.6.3</a>
Output pressure	<a href="#">3.6.4.1</a>	<a href="#">4.6.4.1</a>
Handle torque	<a href="#">3.6.5</a>	<a href="#">4.6.4.1.1</a>
Mechanical efficiency	<a href="#">3.6.7.2</a>	<a href="#">4.6.4.1.2</a>
Proof pressure	<a href="#">3.6.4.2</a>	<a href="#">4.6.4.2</a>
Burst pressure	<a href="#">3.6.4.3</a>	<a href="#">4.6.4.3</a>
Cold priming	<a href="#">3.6.6.1</a>	<a href="#">4.6.5.1</a>
Cold cycling	<a href="#">3.6.6.2</a>	<a href="#">4.6.5.2</a>
Volumetric efficiency	<a href="#">3.6.7.1</a>	<a href="#">4.6.6</a>
Endurance	<a href="#">3.6.8</a>	<a href="#">4.6.7</a>

4.4.2.1 Failures. Any failure shall be cause for refusal to grant qualification approval.

4.4.3 Retention of qualification. To retain qualification, the contractor shall forward a report at 12-month intervals to the qualifying activity. The qualifying activity will establish the initial reporting date. The report shall consist of:

- a. A summary of the results of the sampling tests performed and completed during the 12-month period, including as a minimum the number of lots and the quantities that have passed and the number that have failed. The results of tests of all reworked sampling lots shall be identified and accounted for.
- b. A summary of the results of all periodic tests performed and completed during the 12-month period, including the number and mode of failures.

4.4.3.1 Nonconformance. If the summary of test results indicates nonconformance with specification requirements, and corrective action acceptable to the qualifying activity has not been taken, action may be taken to remove the failing product from the qualified products list.

4.4.3.2 Failure to submit test data report. Failure to submit the report within 30 days after the end of each 12-month period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the contractor shall immediately notify the qualifying activity at any time during the 12-month period that the inspection data indicate failure of the qualified product to meet the requirements of this specification. In the event that no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the item. If during two consecutive reporting periods there has been no production, the manufacturer may be required, at the discretion of the qualifying activity, to submit his qualified products to testing in accordance with the qualification inspection requirements ([see 4.4.2](#)).

4.4.3.3 Change to manufacturing process, materials or equipment. The manufacturer shall notify the qualifying activity, in writing, of any changes in the manufacturing process, materials, or equipment used to manufacture a QPL product. Subsequently, the qualifying activity will notify the manufacturer, in writing, if a full re-qualification, partial re-qualification, or no additional testing is required as a result of these changes.

#### 4.5 Conformance inspection.

4.5.1 Inspection of product for delivery. Each pump shall be subjected to and meet the requirements of the visual inspection ([4.5.2](#)) and pressure proof test ([see 4.6.4.2](#)) in [table I](#) for quality conformance inspection to determine conformance with this specification.

4.5.2 Visual inspection. A dimensional analysis and inspection of pump components shall be made to determine conformance with requirements of material, design, construction, and qualification samples as specified in SAE-AS8775 and this specification.

#### 4.6 Test methods.

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 high position, apply a 300 pound force to the handle 30 inches from the pivot. Repeat this test with the handle in the low position. Return the handle to within 5 degrees of the mid travel position and apply 160 pounds of 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 to 250 percent of the maximum torque value specified for fittings in MS21344.

4.6.2 Priming. The pump shall be mounted in the normal operating position with line (size as specified in the applicable standard) connecting the suction port to the hydraulic fluid supply. The fluid level shall not be less than 30 inches below the suction port, as specified on [figure 1](#). Operate pump at a rate of not less than 20 strokes per minute to determine the pumping cycles necessary to produce flow.

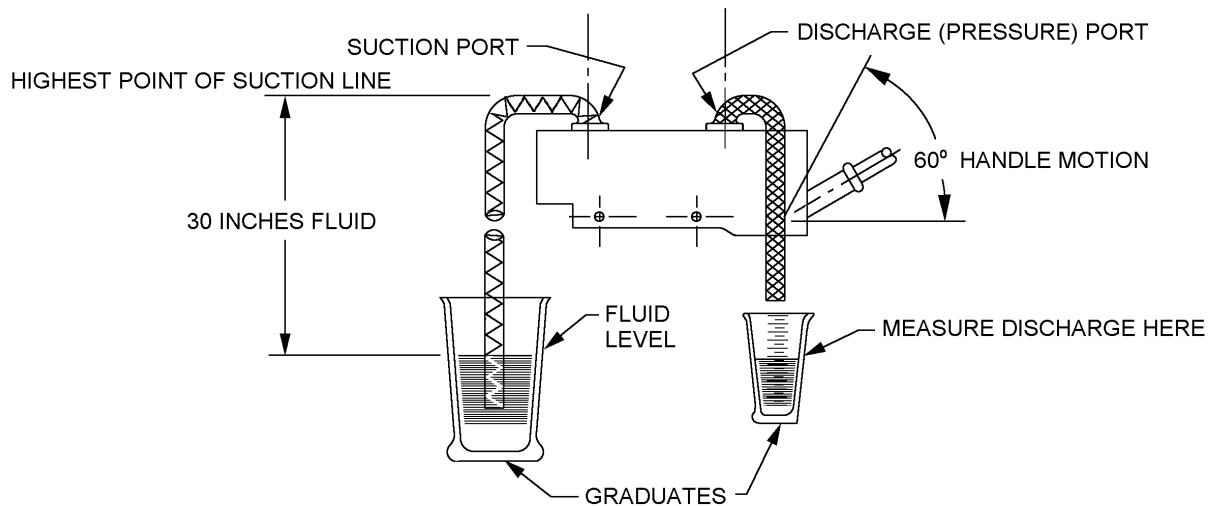


FIGURE 1. Hand pump priming and flow test set-up.

4.6.3 Ability to hold prime. Mount pump and tube as specified in priming test ([see 4.6.2](#)) and completely prime the pump, overflowing fluid through the pump discharge port to the atmosphere. After pumping is stopped and allowing not less than 30 minutes, determine leakage from the pump and suction line ([see 3.6.3](#)). Ambient and fluid temperatures shall not vary more than 2°F (-17°C) during this test.

#### 4.6.4 Pressure.

4.6.4.1 Output pressure. Connect pump to the fluid supply and a pressure regulator that is regulated to the required output pressure as specified on [figure 2](#). Operate pump to provide flow at this regulated pressure.

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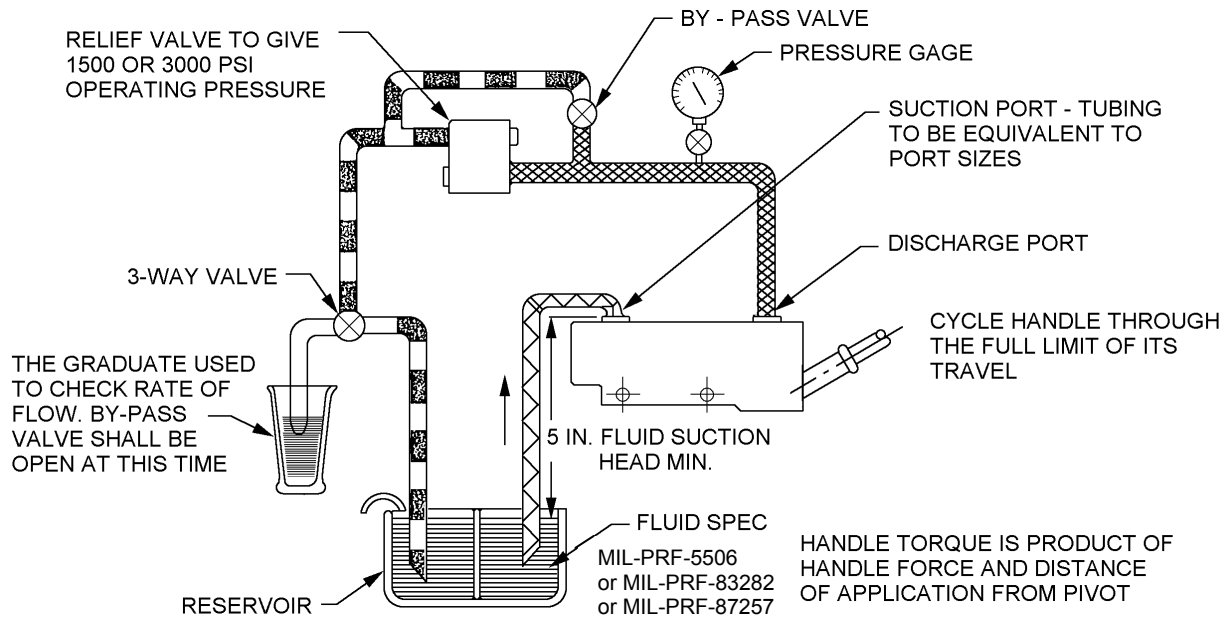


FIGURE 2. Hand pump cycling test set-up.

4.6.4.1.1 Handle torque. After operating the pump to produce the required output pressure (see 4.6.5.1), increase flow by slowly applying loads at not greater than 30 inches from pivot point of a suitable handle to determine the necessary torque for the entire stroke in both directions.

4.6.4.1.2 Mechanical efficiency. Using loads determined in handle torque tests (see 4.6.4.1.1), and the mechanical advantage provided by the geometry of the linkages, determine the maximum axial input loads on the pump piston for both stroke directions. Calculate mechanical efficiency for both stroke directions.

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.

4.6.4.3 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.

#### 4.6.5 Cold operation.

4.6.5.1 Cold priming. Cold soak an empty pump and test equipment as specified on figure 1 at not less than -65°F (-54°C) for not less than 72 hours. Test pump in accordance with priming testing (see 4.6.2), except at the cold soak temperature.

4.6.5.2 Cold cycling. Connect the above cold-soaked pump to a pressure regulator that is regulated to the required output pressure. The suction line may be changed to provide not less than 5 inches for the suction head. Operate the pump at not less than 20 cycles per minute through at least 25 complete cycles with the pump and fluid held at -55°F (-48°C) to -65°F (-54°C) to:

- a. Produce flow at required output pressure
- b. Determine output volume per cycle (see 3.6.7.1).

Cycle the pump at sufficient intervals to determine binding or other malfunctions due to differential expansion of mating parts during rapid warm-up to 120°F - 129°F (49°C - 54°C).

4.6.6 Volumetric efficiency. Mount the pump and associated test equipment as specified on figure 2. Operate the pump at not less than 55 cycles per minute. Determine output volume per cycle (see 3.6.7.1) for calculating volumetric efficiency.

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4.6.7 Endurance. Mount the pump and associated test equipment as specified on [figure 2](#). The suction shall be not less than 5 inches. Means shall be provided to open flow (0 psi output pressure) and regulate output within  $\pm 50$  psi of required operating pressure. Operate pump at 30 to 40 cycles per minute at not less than 95 percent of full stroke as follows:

- a. Operate pump for 10,000 cycles at required output pressure and determine leakage.
- b. Operate pump at open flow (0 psi output pressure) sufficiently to determine volume per cycle for calculating volumetric efficiency ([see 4.6.6](#)).
- c. Repeat a and b above until 70,000 cycles have accumulated.

## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order ([see 6.2](#)). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

## 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. This specification is being retained as a military detail specification because of the unique military requirements for use in aircraft type I hydraulic systems conforming to and as defined in SAE-AS8775.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Class and quantity of pumps to be acquired.
- c. Applicable specification sheet for Part or Identifying Number (PIN).
- d. Packaging requirements ([see 5.1](#).)

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL No. 5515, whether or not such products have actually been so listed by that date. The attention of contractors is called to these requirements; and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from DLA Land and Maritime, P.O. Box 3990, ATTN: DSCC-VQ, Columbus, Ohio 43218-3990 or emailed to [yqp.chief@dla.mil](mailto:yqp.chief@dla.mil). An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at <https://assist.daps.dla.mil>.

6.3.1 Requalification. If a pump design is modified in any way, the modified form must be subjected to and pass the same qualification tests as the original design.

6.4 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. As of the dating of this document, the U.S. Environmental Protection Agency (EPA) is focusing efforts on reducing 31 priority chemicals. The list of chemicals and additional information is available on their website <http://www.epa.gov/osw/hazard/wastemin/priority.htm>. Included in the EPA list of 31 priority chemicals are cadmium, lead, and mercury. Use of these materials should be minimized or eliminated unless needed to meet the requirements specified herein (see Section 3).

6.5 Subject term (key word) listing.

Aircraft  
Pressure class 1500, class 3000  
Type I system

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6.6 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue, due to the extent of the changes.

#### CONCLUDING MATERIAL

Custodians:

Army - AV  
Navy - AS  
Air Force - 99  
DLA - CC

Preparing activity:

DLA - CC

(Project 4320-2010-003)

Review activities:

Army - MI  
Air Force - 71

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <https://assist.daps.dla.mil>.