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MILITARY SPECIFICATION

RESERVOIRS, AIRCRAFT AND MISSILE, HYDRAULIC, SEPARATED TYPE

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

1. SCOPE

1.1 Scope. This specification covers the requirements of separated type hydraulic fluid reservoirs where pressure is generated in the fluid by means whereby no fluid surface is in contact with gas. For non-separated type reservoirs, see MIL-R-5520.

1.2 Classification. Hydraulic reservoirs shall be of the following types as specified (see 6.2b):

Type A - Fluid pressurized-self-pressurized through a differential area piston

Type B - Gas pressurized

Type C - Mechanically pressurized

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer, Naval Air Warfare Center Aircraft Division Lakehurst, Code SR3, Lakehurst, NJ 08733-5100, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 1650

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 6.2d).

SPECIFICATIONS

FEDERAL

PPP-B-585	-	Boxes, Wood Wirebound
PPP-B-591	-	Boxes, Shipping, Fiberboard, Wood-Cleated
PPP-B-601	-	Boxes, Wood, Cleated-Plywood
PPP-B-621	-	Boxes, Wood, Nailed, and Lock-Corner
PPP-B-636	-	Boxes, Shipping, Fiberboard

MILITARY

MIL-C-104	-	Crates, Wood, Lumber and Plywood, Sheathed Nailed, and Bolted
MIL-P-116	-	Preservation, Methods of
MIL-H-5440	-	Hydraulic Systems, Aircraft, Types I and II, Design and Installation Requirements For
MIL-H-5606	-	Hydraulic Fluid, Petroleum Base, Aircraft, Missile and Ordnance
MIL-H-8775	-	Hydraulic System Components, Aircraft and Missiles, General Specification For
MIL-V-8813	-	Valves, Aircraft, Hydraulic Pressure Relief, Type II Systems.
MIL-H-8891	-	Hydraulic Systems, Manned Flight Vehicles, Type III, Design, Installation and Data Requirements, General Specification For

MIL-L-10547	-	Liners, Case, and Sheet, Overwrap, Water Vaporproof or Waterproof, Flexible
MIL-H-25475	-	Hydraulic Systems, Missile, Design, Installation, Tests and Data Requirements, General Requirements For
MIL-H-83282	-	Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Aircraft

STANDARDS

MILITARY

MIL-STD-100	-	Engineering Drawing Practices
MIL-STD-129	-	Marking For Shipment And Storage
MIL-STD-130	-	Identification And Marking Of U.S. Military Property
MIL-STD-280	-	Definitions of Item Levels, Item Exchangeability, Models, And Related Terms
MIL-STD-810	-	Environmental Test Methods And Engineering Guide Lines
MIL-STD-889	-	Dissimilar Metals
MIL-STD-1523	-	Age Control Of Age - Sensitive Elastomeric Material
MS33649	-	Bosses, Fluid Connection - Internal Straight Thread

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from DoDSSP-Customer Service, Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

NAVY DEPARTMENT SPECIFICATION

SD8706	-	Data and Test, Engineering Contract Requirements For Aircraft Weapon Systems

(Copies of documents are available from the Navy Aviation Supply Office, Code 03443, Tabor Avenue, Philadelphia, PA 19120-5099.)

2.2 Non-Government publications. The following document forms a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the 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 6.2d).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D3951 - Packaging, Commercial

(Application of copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

AS 1933 - Age Controls For Hose Containing Age Sensitive Elastomeric Materials

(Application of copies should be addressed to the Society Of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.)

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

3. REQUIREMENTS

3.1 First article. When specified (see 6.4), a sample shall be subjected to first article inspection (see 4.3).

3.2 Selection of specifications and standards. Specifications and standards for necessary commodities and services not specified herein shall be selected with the approval of the contracting activity.

3.3 Materials. Materials shall conform to referenced specifications and shall be as specified herein and on MS standards or specification sheets. Materials which are not covered by the military specifications or which are not specifically described herein, shall be of the lightest weight and shall be compatible with hydraulic fluid. Materials that produce toxic or corrosive substances shall not be used.

3.3.1 Metal parts. All metal parts shall be of a corrosion resistant material or treated in a manner to render them resistant to corrosion.

3.3.1.1 Dissimilar metals. Unless protected against electrolytic corrosion, dissimilar metals shall not be used in intimate contact with each other. Dissimilar metals are defined in MIL-STD-889.

3.3.2 Protective treatment. When materials are used in the construction of the reservoirs that are subject to deterioration when exposed to environmental conditions likely to occur during service usage, they shall be protected against such deterioration in a manner that shall in no way prevent compliance with the performance requirements of this specification (see 3.5). Protective coatings which shall crack, chip, or scale during normal service life or under extreme environmental conditions shall not be used.

3.4 Design and construction. Hydraulic reservoirs furnished under this specification for aircraft use shall be in accordance with the requirements of this specification and the requirements of MIL-H-5440 for type I system temperature range from -65°F to +160°F (-54°C to +71°C) and type II system temperature range from -65°F to +275°F (-54°C to +135°C). For type III system, the requirements shall be in accordance with MIL-H-8891 temperature range from -65°F to +450°F (-54°C to +232°C) as applicable. Hydraulic reservoirs furnished under this specification for missile use shall be in accordance with the requirements of MIL-H-25475.

3.4.1 Reservoir capacity. Hydraulic reservoirs shall be designed to provide a minimum total available capacity equal to the sum of the following requirements, as applicable (see figure 1):

a. A sufficient amount of fluid to ensure that the hydraulic pump inlet pressurization and satisfactory circulation are maintained with the position of the separator corresponding to that fluid quantity.

b. A fluid volume equivalent to 100 percent of the possible net depletion caused by actuator volumetric changes which can occur in any ground operation or flight condition of a recirculating hydraulic system (see 6.5.1). Reference shall be from the normal reservoir filling attitude and position of the various hydraulic subsystems.

c. A fluid volume equivalent to 100 percent of the reservoir fluid volumetric change caused by charging all accumulators to system operating pressure from a completely discharged position, with no gas precharge in the largest single accumulator, and a minimum design gas precharge in all others in the system.

d. A fluid volume equivalent to 130 percent of the volumetric capacity of the largest quantity measuring type of hydraulic fuse in the system.

e. A fluid volume equivalent to the maximum thermal contraction which is expected to occur when the entire fluid content of a

recirculating system is exposed to a temperature decrease from 70°F down to -40°F (21°C to -40°C).

f. A fluid volume equivalent to not less than 5 percent of the entire system fluid volume, including the reservoir of a recirculating system in order to minimize the frequency of refilling. The differential volume between "full" and "refill" shall correspond to this leakage allowance.

g. A fluid volume equivalent to that resulting from the effects of fluid compression, line expansion, actuator expansion, and external seal deflection when the hydraulic system which the reservoir is serving is pressurized to normal operating pressures.

h. A fluid volume equivalent to system fluid thermal expansion, resulting from a temperature increase from 70°F (21°C) to maximum operating temperature.

3.4.1.1 Emergency reserve capacity. In those cases where an emergency reserve capacity of fluid is required, the minimum volume shall be equal to 125 percent of the fluid required for the emergency purposes. The volumetric capacity of those subsystems which can be operated other than hydraulic fluid shall not be considered, provided that no fluid is drawn from the reservoir during such operation. No allowances for return of fluid to the reservoir shall be made in determining emergency reserve capacity. The emergency reserve capacity shall be provided in a separate reservoir.

3.4.2 Filling and refill. The reservoir design shall be such that initial filling of the reservoir installed in vehicle, and any subsequent refilling or replenishment of the fluid, shall be accomplished only through the use of an external force device such as a hand pump or power pump. Unless otherwise specified in the contract such provision shall not be incorporated in the design of the reservoir. However, no provision shall be incorporated which permits the transfer of hydraulic fluid into the reservoir by gravity flow from an external container. The reservoir filling ports shall be so designed and installed at locations where it shall prevent the above procedure.

3.4.2.1 Fluid level indication. Indicators shall be incorporated in the reservoir design to automatically provide a continuous visual indication of reservoir fluid level. Temperature compensation for accurate fluid indication shall be included in the design. The fluid temperature compensation range shall be in accordance with the applicable type I, type II, and type III hydraulic systems. The indication shall be implemented either by alternate indication on a readout or by temperature sensing elements in the gaging mechanism. The use of a dip stick, or the necessity for the manipulation or movement of any of the component parts in order to obtain the reading shall not be acceptable.

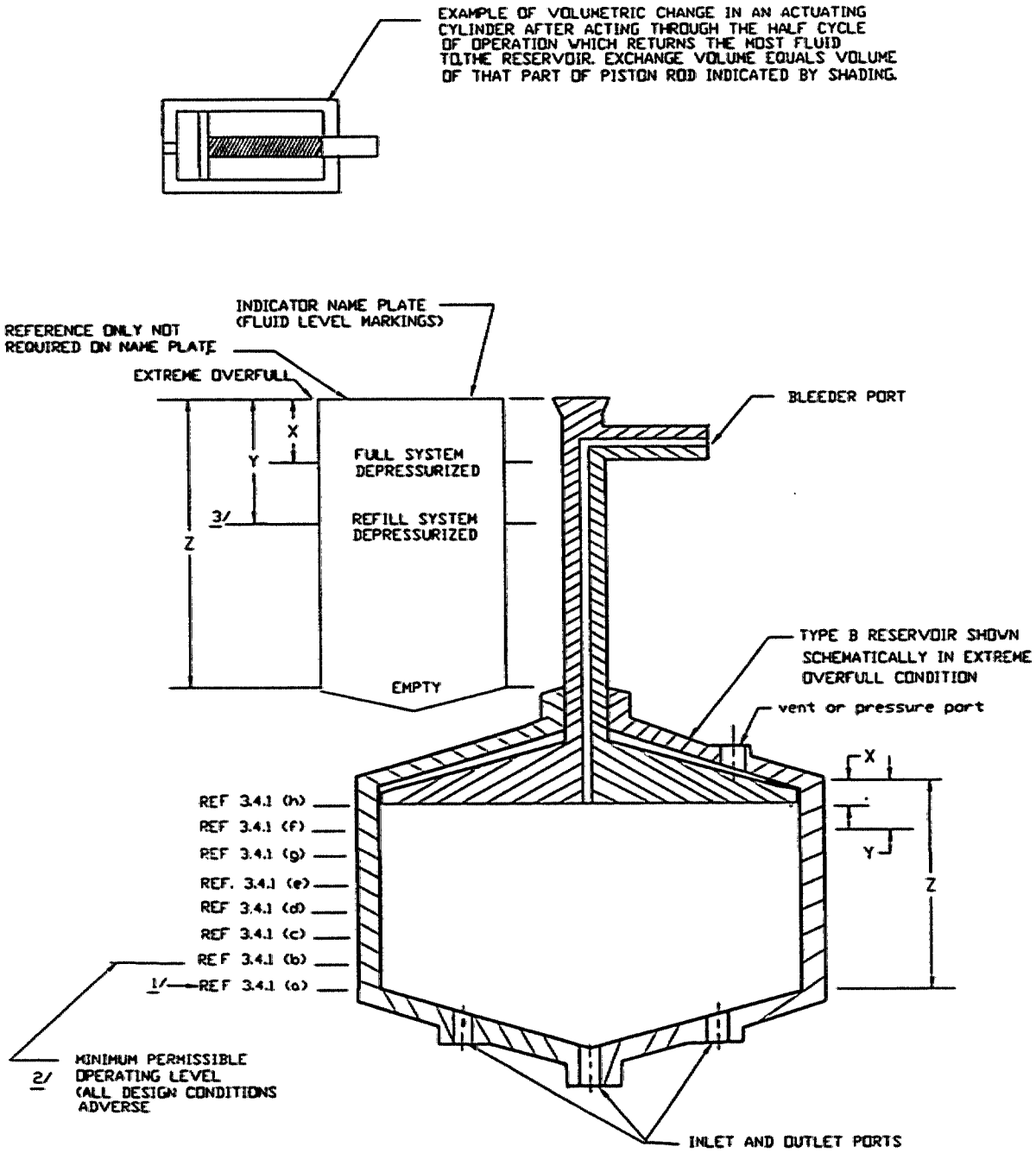

FIGURE 1. Reservoir capacity requirements.

NOTE to figure 1:

1/ Per 3.4.1 (a), some or all of this volume may be included in the end cavity containing residual oil as pictured depending upon the particular design situation.

2/ Actual service minimum operating level might be above this level depending upon the most adverse combination of actuation position available.

3/ Accumulator oil pressure shall be stated on this name plate if any accumulations are not automatically and rapidly depressurized when hydraulic pumps are stopped.

The indicating device shall have a fail-safe characteristic, so that failure of the indicating arrangement shall not malfunction the operation of the reservoir.

3.4.3 Draining. The reservoir shall contain provision for draining hydraulic fluid completely from the reservoir when the vehicle is at rest, without the necessity of disconnecting any tubing connections.

3.4.4 Bleeding. Reservoir design and installation shall be such that if entrained gas bubbles in the hydraulic fluid allowed to accumulate in any space in the reservoir, means shall be provided for removing entrapped air in a bleeding operation without any tubing disconnections. Also, provisions shall be provided in any recirculating system reservoir for either automatic or periodic manual removal of any hydraulic fluid from any cavities in the reservoir in which fluid is not present by design, such as the gas side of a gas-pressurized piston type reservoir.

3.4.5 Structural strength. Reservoirs shall have ample strength and rigidity to withstand 250 percent of the maximum wrench torques required for making any and all tubing connections without permanent deformation of the reservoir. The use of machining and weldments in place of forging and castings in the reservoir assemblies design shall require approval of the contracting activity.

3.4.6 Connections. All external fluid and gas connections to the reservoir as a separate unit, in aircraft usage, shall be made through internally threaded bosses conforming to MS33649 or other boss design acceptable to the contracting activity. Permanent fluid connections, such as welding and brazing, shall be made to the reservoir in missile applications provided that maintenance and replacement of the reservoir shall not be required in the design during the storage and operating life of the vehicle.

3.4.7 Pressure relief valve. Where a pressure relieving device is included as an integral part of the reservoir design, the relieving system shall be designed in accordance with the requirements of MIL-V-8813, as applicable. Consideration shall be given to the pressure effects generated by the acceleration imposed upon the bulk fluid in the reservoir during vehicle maneuvering.

3.4.8 Filters. Filtration shall not be provided as an integral part of the reservoir assembly without prior approval of the contracting activity. If an integral filter is used, the filter element shall be replaceable without disconnecting tubing.

3.4.9 Mounting. Design of the reservoir shall provide for mounting in the aircraft in such a manner that the reservoir shall be securely fastened in place with no weight carried by the fittings or fluid lines attached thereto. The mounting shall cause no abrasion of the reservoir or its fittings and shall not impose undue strain on the reservoir. The mounting shall provide for easy removal of the reservoir from the aircraft.

3.4.10 Marking of ports. The name plate and marking of ports of the reservoir shall be in accordance with MIL-H-8775 as applicable, except that the nameplate shall consist of the instruction plate specified herein.

3.4.11 Reservoir instruction plate. An identification and instruction plate shall be attached to either the reservoir itself or to the immediately adjacent vehicle structure near the fluid level indicating device, positioned so as to be easily readable. This plate shall contain simple and brief, but complete, instructions for servicing the reservoir.

a. Name and part number of the reservoir.
b. Specification number and color of fluid as applicable.
c. Reservoir fluid capacity at full level.
d. Full level indication references, two positions: system pressurized and depressurized.
e. Refill level indication references, two positions: system pressurized and depressurized.
f. Position of hydraulic devices and vehicle during filling procedure.
g. Depressurizing procedure reference.
h. Pressurization warning notice.

Additional full and refill levels under various conditions of system pressure, temperature, vehicle, attitude, accumulator precharge shall be added as required.

3.4.12 Age control. Age control for any synthetic rubber parts contained in the design or installation of the reservoir shall be in accordance with AS 1933 for flexible hoses or MIL-STD-1523 for all rubber parts other than hoses.

3.4.13 Reliability. Design and construction of the reservoir shall be such as to ensure the maximum reliability. Consideration shall be given to those factors which affect the reservoir reliability, including simplicity, number of parts, and degree of handling required by personnel. The design of all operating parts shall be analyzed for fail-safe characteristics.

3.4.14 Strength at elevated temperature. All pressurized reservoirs shall be capable of withstanding proof pressure at the maximum design temperature after exposure to elevated temperatures for a period specified in the manufacturer's drawing.

3.4.15 Corrosion resistance. All metals shall possess corrosion resistance characteristics or shall be protected by use of permanent coatings to resist corrosion which result from such conditions as dissimilar metal combinations, moisture, salt spray, and high temperature deterioration. Hydraulic fluid contacting interior surfaces of the reservoir shall not be considered a corrosion protection.

3.5 Performance.

3.5.1 Visual examination. The reservoir shall be inspected and examined before delivery to the Government and shall meet the requirements of visual examination test (see 4.6.1).

3.5.2 Proof pressure. Reservoirs shall be designed to withstand proof pressure as specified in the contract or as specified in the detail aircraft specification and shall be able to pass the proof pressure test (see 4.6.2).

3.5.3 Functional check. The reservoir, when tested as specified in 4.6.3, shall not have excessive fluid leakages at any dynamic seal or any external leakage and shall show no evidence of material failure.

3.5.4 Negative pressure. The reservoir, when tested as specified in 4.6.4, shall not allow air to enter into the reservoir and shall show no permanent deformation.

3.5.5 Capacity. The reservoir fluid capacity shall be as specified in the contract and shall meet the requirements as specified in 4.6.5.

3.5.6 Immersion. Reservoirs containing nonmetallic parts, when tested as specified in 4.6.6, shall not show any evidence of material failure.

3.5.7 Relief valve operation. Reservoirs with a pressure relieving device as an integral part of the design, shall meet the relief valve performance when tested as specified in 4.6.7.

3.5.8 Endurance. The reservoir, when tested as specified in 4.6.8, shall not show any evidence of mechanical or material failure.

3.5.9 Vibration. The reservoir, when tested as specified in 4.6.9, shall not show any evidence of mechanical or material failure.

3.5.10 Operating characteristics. With the hydraulic reservoir fluid at either full or refill level as specified in 4.6.10, the hydraulic fluid emerging from the reservoir outlet ports shall be free of froth or foam, and the flow of the hydraulic fluid supply from the pump shall be maintained for any condition of ground servicing or any expected flight attitude. All flight conditions, flight attitudes in all axes, temperature effects, vibration, and acceleration effects shall be considered in the design and construction of the reservoir. Fluid pressurization, fluid flow, and system indication where applicable, shall be maintained in operating condition under all circumstances. Foaming which occurs when the reservoir is tested in attitudes more severe than those for which it is required to operate, the foaming shall disappear and the flow of fluid supply from the hydraulic pump shall be visually clear after the reservoir is righted

(ground level attitude) within a length of time specified by the contracting activity or as specified in the performance requirements of a particular hydraulic system which the reservoir is design. Net pressurization of the hydraulic fluid, which is total fluid pressure at the pump supply outlet port, shall be maintained within the design operating upper and lower limits specified for a particular hydraulic power supply subsystem under any combination of adverse circumstances, including external influence, environment, and maximum internal thermal and tolerance conditions.

3.6. Identification of product. The reservoir shall be marked for identification by means of a durable name plate conforming to MIL-STD-130. The name plate shall be securely attached to the reservoir by use of welding or mechanical means. A metal name plate and metal fastener where use shall be protected from corrosion. Name plate which are attached by use of adhesion shall require approval of the contracting activity prior use. Name plate shall not be impression stamped after installation.

3.6.1 Marking. The reservoir shall be marked with the manufacturer's name or trademark, the material identification code and complete part number as specified in the MS standards, specification sheets or manufacturer's drawing approved by the contracting activity. Marking shall include the manufacturer's part number, commercial and Government entity (CAGE) code, capacity in gallons, military part number, and manufacture date.

3.6.2 Part numbering of interchangeable parts. All reservoirs having the same design activity CAGE code and part number shall be interchangeable as defined in MIL-STD-280. The item identification and part number requirements of MIL-STD-100 shall govern the design activity part numbers and changes thereto.

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 (see 6.3).

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 consist of the examinations and tests specified in table I.

4.3.1 First article samples. Unless otherwise specified in the contract, as soon as practicable after award of a contract or order, the manufacturer shall submit two hydraulic reservoir assemblies (see 6.4). The samples shall be representative of the design and construction, workmanship, integral components and materials to be used during production. The use of machining and weldments in place of forging and castings in the reservoir assemblies used for testing shall require approval of the acquiring activity before construction and shall be allowed only when substantiating data has been provided to demonstrate that differences in strength, fatigue properties, and other performance factors have been allowed for in the substitution (see 6.3). The first article samples shall be furnished to the Government as directed by the contracting officer (see 6.2f).

4.3.1.1 First article inspection report. Upon completion of the first article inspection, the activity or the company responsible for conducting the inspection program (see 6.2f) shall submit to the contracting officer the results of the inspection and test with recommendations (see 6.3).

4.3.1.2 Rejection. Failure of any reservoir assemblies to successfully comply with any of the requirements of the first article inspection (see 4.3) or quality conformance inspection (see 4.4) shall be cause for rejection of that reservoir design.

4.4 Quality conformance inspection. Quality conformance inspection shall consist of the following tests:

a. Examination of product (4.6.1)
b. Proof pressure (4.6.2)
c. Functional check (4.6.3)
d. Negative pressure (4.6.4)

4.5 Test conditions.

4.5.1 Fluid. Hydraulic test fluid shall be in accordance with MIL-H-5606, or MIL-H-83282, or other compatible test hydraulic fluid. Filtration shall be compatible with the operating requirements of a particular hydraulic system in which the reservoir shall be used.

4.5.2 Temperature. All temperatures referenced under 4.6 shall have a tolerance of ± 5°F (± 3°C). Room temperature referred to herein shall be 70°F to 110°F (21°C to 43°C). The minimum and maximum temperature range shall be in accordance with type I, type II, or type III applicable hydraulic systems.

TABLE I. First article inspection.

Item	Inspection	Requirement paragraphs	Test paragraphs
1	Visual examination	3.5.1	4.6.1
2	Proof pressure	3.5.2	4.6.2
3	Functional check	3.5.3	4.6.3
4	Negative pressure	3.5.4	4.6.4
5	Capacity	3.5.5	4.6.5
6	Immersion	3.5.6	4.6.6
7	Relief valve operation	3.5.7	4.6.7
8	Endurance	3.5.8	4.6.8
9	Vibration	3.5.9	4.6.9
10	Operating characteristics	3.5.10	4.6.10

4.5.3 Mounting. The vibration test shall be conducted with the reservoir assembly mounted in a framework of structure corresponding to the proposed installation in the vehicle. Consideration shall be given to shape, dimensions, material, strength, deflection characteristics, attitudes if applicable, and external loads which shall affect to the performance of the reservoir. This structural framework shall constitute the test cradle and shall be constructed in such a way as to be able to rotate in any of its major axes, as well as to be mounted on a vibration machine. All mounting provisions and tubing connections shall be identical to the vehicle installation. The cradle shall be capable of withstanding all environmental effects to which the test reservoir assemblies shall be exposed.

4.5.4 Pressure. All test pressures shall be in accordance with 4.6.2 and 4.6.4.

4.6 Test methods.

4.6.1 Visual examination. The reservoir shall be inspected to determine compliance to this specification and to applicable drawings with respect to interchangeability, dimensions, materials, and workmanship. Any defective parts found during the inspection shall be cause for rejection of the reservoir.

4.6.1.1 Packaging, packing, and marking. Packaging, packing, and marking shall be inspected in accordance with section 5.

4.6.2 Proof pressure.

4.6.2.1 For first article. With the hydraulic fluid storage portion of the reservoir vented to the atmosphere, the reservoir pressurization system shall be fluid pressurized (self pressurized) to 150 percent of its design operating pressure for type A, and gas pressurized to 200 percent of its design operating pressure for type B, for 5 minutes at the maximum elevated temperature for a particular hydraulic system tested. During the performance of the proof pressure test the reservoir assembly shall be measured before and after application of the proof pressure with an instrument which can be calibrated to 0.001 of an inch. During and following this test, there shall be no internal leakage or external leakage to form a drop nor permanent deformation of the reservoir. If any permanent deformation occurred, the proof pressure test shall be repeated on the same reservoir, and checked for further permanent deformation. Evidence of further permanent deformation after the second performance of the proof pressure test shall be cause for rejection of the reservoir design. This test is not applicable to Type C reservoir.

4.6.2.2 For quality conformance.

4.6.2.2.1 Pressurizing device. The proof pressure test procedure for the quality conformance test shall be the same as that for the first article test, except that the application of pressure to both type A and type B reservoirs shall be 2 minutes at room temperature (see 4.5.2). During and following this test there shall be no internal or external leakage nor permanent deformation of the reservoir. Any internal or external leakage or permanent deformation after the second test shall be cause for rejection of the reservoir.

4.6.2.2.2 Fluid storage chamber. The fluid storage portion of the reservoir shall then be completely filled (pressurizing system vented to atmosphere) and 200 percent of its normal operating pressure shall be applied to both type A and type B reservoirs and maintained for 2 minutes at room temperature. During the performance of this test, there shall be no permanent deformation or internal or external leakage. Any internal or external leakage or permanent deformation of the reservoir after the second test shall be cause for rejection of the reservoir.

4.6.3 Functional check. With reservoir pressurization maintained by normal means (self pressurized or gas pressurized), cycle the fluid to the separator, either between full level position and minimum operating fluid level position or throughout the full sweep of the separator, 25 times at room temperature (at optional travel rate). There shall be no excessive fluid leakages at any dynamic seal and no external leakage. A slight wetting of the surface adjacent to any seal shall not be cause for rejection. With design pressure (or force) still maintained in the pressurizing device, fluid shall be alternately slowly bled from and supplied to the fluid storage portion of the reservoir at either operating extreme position of separator. Pressurization shall remain within the limits specified by the manufacturer and approved by the contracting activity, but shall not vary by more than $\pm$5 percent of the design value.

4.6.4 Negative pressure. Types A, B, and C reservoirs shall be subjected to a negative pressure test shown schematically in figure 2. Starting with the separator held at the extreme overfull position, evacuate the system to 11 psia (77 kPa). Close valve "A". Bubbling of air through water in flask shall cease (indicating essentially no influx of ambient air into reservoir fluid storage chamber). The above check shall be repeated, stopping separator at increments of travel by cracking and then closing valve "B", until it has traveled its full stroke. The reservoir shall show no permanent deformation.

4.6.5 Capacity. A test shall be conducted at a temperature of 70°F (21°C) to determine the following quantities within ± 1 percent:

a. Total fluid capacity of reservoir when pressurized and filled to full level and positioned in normal aircraft ground attitude.

b. Same as above, except filled to refill level.

c. Total fluid capacity of reservoir when pressurized and discharged of all available swept volume in normal aircraft ground attitude. The difference between (a) and (c) shall be considered maximum available fluid volume. The difference between (b) and (c) shall be considered design minimum available fluid volume.

d. Total quantity, if any, of residual fluid remaining in the reservoir when reservoir is in fully discharged position, in normal aircraft ground attitude.

e. Total fluid quantity, if any, available for emergency operation.

f. Total reservoir capacity, if any, for accepting fluid beyond the normal full condition.

4.6.6 Immersion. Reservoirs containing nonmetallic parts shall be subjected to an immersion test in accordance with the methods specified in MIL-H-8775 except use the corresponding temperature range specified for type I, type II, and type III hydraulic systems (see 3.4).

4.6.7 Relief valve operation. If a pressure relieving device is an integral part of the reservoir assembly, the valve element shall be tested in accordance with the applicable requirements of MIL-V-8813 except the pressure used for cracking, full flow, and reseat shall be as specified in the manufacturer's drawing, and the effects of maximum elevated design temperature of the reservoir assembly shall be used in the determining relief valve performance.

4.6.8 Endurance. In order to determine the endurance capability of the design, the test reservoir shall be subjected to the endurance test specified in MIL-H-8775 for type I and type II hydraulic systems. For type III system all the tests shall be repeated except conducted at 450°F (232°C). Any failure during the test shall be cause for rejection of the reservoir.

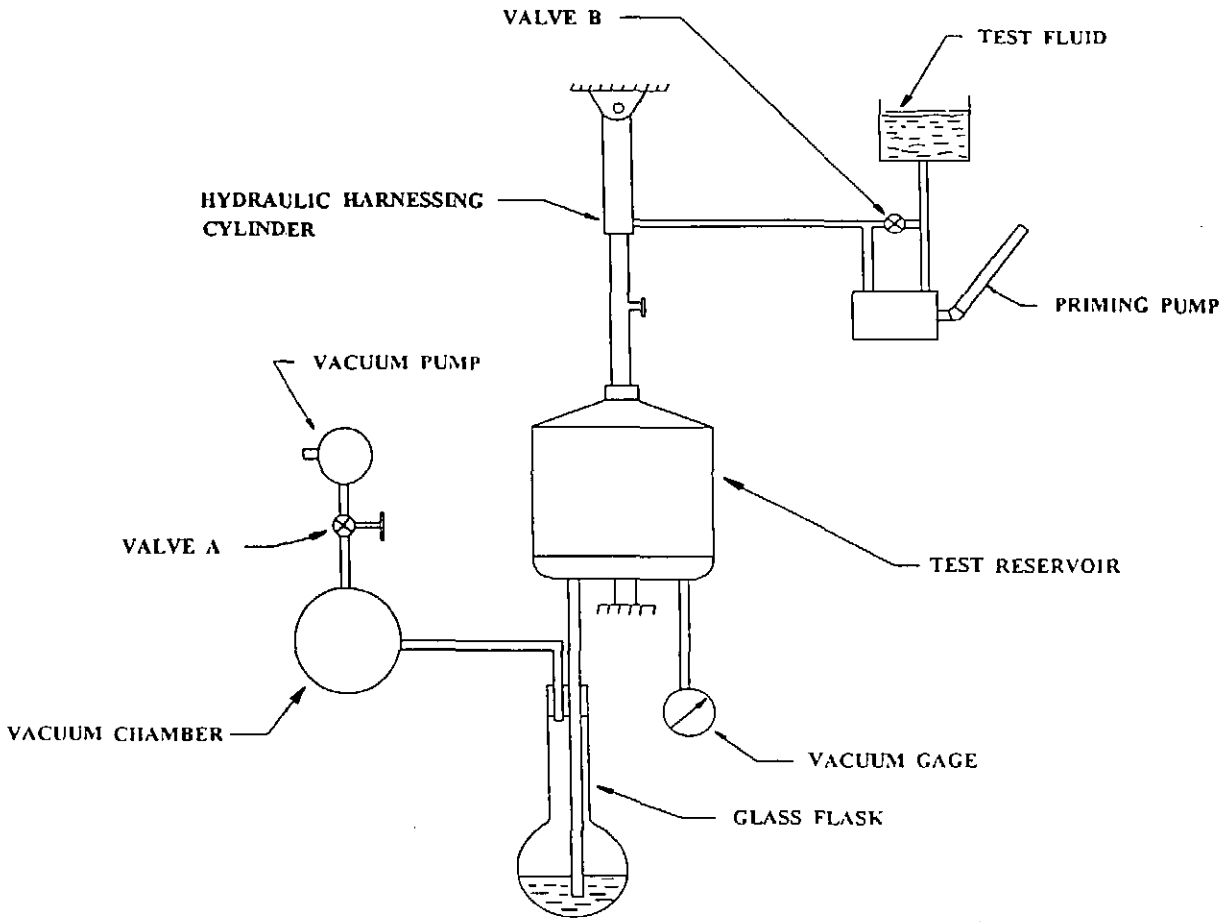

FIGURE 2. Negative pressure reverse air leakage test.

4.6.9 Vibration. In order to determine the capability of the design to vehicle vibration, the test reservoir shall be subjected to either of the following short-duty cycle or extented-duty cycle tests in accordance with the vehicle requirements. The test reservoir shall be filled up full with the hydraulic fluid, with pressurization applied, and the reservoir mounted in the test cradle described in 4.5.3. The reservoir assemblies with all tubing connections which are required to simulate in the aircraft installation, shall be placed on the vibration machine. Tests shall be conducted in accordance with 4.6.9.1 and 4.6.9.2.

4.6.9.1 Short-duty cycle. The vibration test shall be conducted in accordance with MIL-STD-810, procedure I, method 514.4. Pressurize the test reservoir for 30 minutes maximum. Operation of the reservoir during vibration is not required. At the conclusion of the test, the reservoir shall be inspected and there shall be no evidence of external leakage, distortion, or cracking. Evidence of external leakage or distortion or cracking shall be cause for rejection of the reservoir.

4.6.9.2 Extended-duty cycle. Repeat the vibration test procedure specified in 4.6.9.1 with pressurization more than 30 minutes. At the conclusion of the test, the reservoir shall be inspected for external leakage, distortion, or cracking. Any failure during or after the test shall be cause for rejection of the reservoir.

4.6.10 Operating characteristics. With the reservoir filled with the hydraulic fluid to the minimum service operating level and supplying fluid to the pump, apply and maintain reservoir pressurization by external means. The flow of the hydraulic fluid supply from the pump shall remain normal at maximum flow rate at normal system operating pressure as evidenced by the absence of pump "ripple", abnormal output pressure and flow fluctuations. Hydraulic pump supply characteristic at maximum design hydraulic flow shall be investigated for ground servicing, critical flight attitudes, and acceleration effects. If the reservoir is used in a system which has unbalanced cylinders, the fluid shall be cycled between the minimum operating level and the fluid level that corresponding to the return of at least the maximum cylinder exchange volume of fluid. Pump supply flow shall remain normal during the test. This test shall be conducted starting the reservoir fluid at (a) minimum operating temperature and then (b) maximum operating temperature. Gas bleeding capability of the reservoir, if applicable, shall be demonstrated.

4.7 Inspection of packaging. Except when commercial packaging is specified, the sampling and inspection of the preservation and interior package marking shall be in accordance with groups A and B quality conformance inspection requirements of MIL-P-116. The sampling and inspection of the packing for shipment and storage shall be in accordance with the quality assurance provisions of the applicable container specification shown in section 5. The inspection of marking, shipment, and storage shall be in accordance with MIL-STD-129. The inspection of commercial packaging shall be as specified in the contract.

5. PACKAGING

5.1 Preservation. Preservation shall be level A or C (see 6.2g).

5.1.1 Level A. Reservoir shall be cleaned by process C-1 of MIL-P-116. Preservation shall be in accordance with MIL-P-116, Method III.

5.1.2 Level C. Preservation shall be in accordance with ASTM D3951.

5.2 Packing. Packing shall be level A or C (see 6.2g).

5.2.1 Level A. Reservoirs, preserved as specified in 5.1, shall be packed in overseas-type shipping containers conforming to PPP-B-621 (type overseas), or MIL-C-104. Exterior containers shall be of uniform shape and size, of minimum cube and tare consistent with identical quantities. The gross weight of each pack shall be limited to approximately 200 pounds. Strapping and closures shall be in accordance with the appendix of applicable container specification. Containers shall be provided with case liner conforming to MIL-L-10547 and sealed in accordance with the appendix.

5.2.2 Level C. The components shall be packed in domestic type exterior shipping containers conforming to PPP-B-591, PPP-B-621, domestic, PPP-B-585 class 1, or 2, PPP-B-636, or PPP-B-601 domestic. Exterior shipping containers shall be of minimum cube and tare consistent with the protection requirements. Exterior containers shall be of uniform shape and size and shall contain identical quantities. The gross weight of each pack shall be limited to 500 pounds. Strapping and closure shall be in accordance with the appendix of the applicable container specification. When fiberboard containers are used, the fiberboard shall conform to the special requirements table of PPP-B-636, as applicable.

5.3 Marking for shipments. Interior packages and exterior shipping containers shall be marked in accordance with MIL-STD-129. The identification shall be composed of the following information listed in the order shown:

National Stock No. (or other identification number as specified in the contract).
Specification No. MIL-R-8931
Specification Title. RESERVOIRS: AIRCRAFT AND MISSILE, HYDRAULIC, SEPARATED TYPE
Manufacturer's part no.
Name of manufacturer
Name of contractor (if different from the manufacturer)
Contract or order no.

6. NOTES

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

6.1 Intended use. These hydraulic reservoirs are intended for use in aircraft and missile hydraulic systems conforming to MIL-H-5440, MIL-H-25475, or MIL-H-8891 to store and provide pressurized hydraulic fluid to a pump.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number and date of this specification, including any amendments.

b. Type of reservoir (see 1.2).

c. Government part number and quantity.

d. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).

e. Whether first article inspection is waived (see 4.3.1).

f. Name and address of the first article inspection laboratory (see 4.3.1) and the name of the Government activity or the company responsible for conducting the first article inspection program (see 4.3.1.1).

g. Selection of applicable methods of preservation and packing (see 5.1 and 5.2).

h. Whether any special markings are required (see 5.3).

i. Items of data required (see 6.3).

6.3 Consideration of data requirements. The following Data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DID's) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/ provided and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DoD FAR Supplement 227.405-70 exempts the requirement for a DD Form 1423. For the department of the Navy, the Contract Data Requirements are shown in SD8706.

Reference Paragraph	DID Number	DID Title	Suggested Tailoring
4.3.1	DI-MISC-80761A	Test Schedule Report	Use contractor format
4.3.1.1	DI-NDTI-80809A	Test report	Use contractor format
4.1.1	DI-NDTI-80809A	Test report	10.2.7

The above DID's were those cleared as of the date of this specification. The current issue of DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

(Copies of the DoD Federal Acquisition Regulation Supplement and Forms are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-0001 and the DoDSSP - Customer Service, Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

6.4 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be a pre-production sample, a first article sample, a first production item, a sample selected from the first production items, a standard production item from the contractor's current inventory, and the number of items to be tested as specified in 4.3.1. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.5 Definitions. For purposes of this specification, the following definitions apply.

6.5.1 Recirculation reservoir. Recirculating reservoirs are those units where hydraulic fluid is returned to the reservoir for storage or further use after having been extracted to perform some function. Nonrecirculation reservoir are those units where no hydraulic fluid is returned to the reservoir after having once been discharged.

6.6 Nonseparated reservoirs. MIL-R-5520 covers the requirements for nonseparated type hydraulic reservoirs.

6.7 Subject term (key word) listing.

Fluid container
Fluid tank
Gas pressurized container
Mechanically pressurized container
Pressure tank
Storage tank

6.8 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.

Custodians:
Army - AV
Air Force - 99
Navy-AS

Reviewer activities:
Army - AV
Air Force - 71
DLA-CS

Preparing activity:
Navy - AS

(Project No. 1650-0507)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-R-8501A	2. DOCUMENT DATE (YYMMDD) 940121

3. DOCUMENT TITLE: RESERVOIR, AIRCRAFT AND MISSILE, HYDRAULIC, SEPARATED TYPE

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

b. NAME (Last, First, Middle, Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (if applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME COMMANDING OFFICER, NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION LAKEHURST SYSTEMS REQUIREMENTS DEPARTMENT	b. TELEPHONE (Include Area Code) (1) Commercial: (908) 323-7488 (2) AUTOVON: 624-7488
c. ADDRESS (Include Zip Code) CODE SR3 LAKEHURST, NJ 08733-5100	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340