MILITARY SPECIFICATION

HYDRAULIC COMPONENTS, TYPE III, (-65° to +450° F),
GENERAL SPECIFICATION FOR

This specification has been approved by the Department of the Air Force and by the Bureau of Naval Weapons.

1. SCOPE

1.1 This specification covers general requirements common to hydraulic components used in type III hydraulic systems (-65° to +450°F) conforming to Specification MIL-H-8891. For types I and II components, see Specification MIL-H-8875.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids, form a part of this specification to the extent specified herein:

SPECIFICATIONS

Military

MIL-S-4040	Solenoid, Electrical, General Specification for
MIL-E-5272	Environmental Testing, Aeronautical and Associated Equipment, General Specification for
MIL-C-5541	Chemical Films for Aluminum and Aluminum Alloy's
MIL-I-6866	Inspecting Penetrant Method of
MIL-I-6868	Inspection Process, Magnetic Particle
MIL-P-6906	Plates, Information and Identification
MIL-S-7742	Screw Thresds, Stsndard, Optimum Selected Series: General Specification for
MIL-M-7969	Motors, Alternating Current, 400-Cycle, 115/200 Volt System, Aircraft, Class A and Class B, General Specification for
MIL-H-8446	Hydraulic Fluid, Nonpetroleum Base, Aircraft
MIL-F-8815	Filter and Filter Elements, Fluid Pressure, Hydraulic Line, 15 Micron Absolute, Type II Systems
MIL-H-8891	Hydraulic Systems, Manned Flight Vehicles, Type III, Design, Installation, and Data Requirements for
MIL-T-9107	Test Reports, Preparation of
MIL-F-25682	Filter and Filter Element, Fluid Pressure, Hydraulic, Absolute, 25 Micron, -65° to +450° and +600° F
MIL-D-70327	Drawings, Engineering and Associated Lists

STANDARDS

Military

MIL-STD-l0	Surface Roughness, waviness, and Lay
MIL-STD-l43	Specifications and Standards, Order of Precedence for the Selection of
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts
MS16153	Wrenches, Spanner, Pin Type, Hardened and Tempered Steel
MS20995	Wire, Lock
MS33540	Safety Wiring, General Practices for

Air Force-Navy Aeronautical

AN8505	Wrench, Thin Double End Open End

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

2.2 Other publications.- The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

Armed Forces Supply Support Center

Cataloging Handbook H6-1	Part 1 of General Item Identification Guides for Supply Cataloging Abbreviations and Symbols

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington 25, D.C.)

Society of Automotive Engineers (Aeronautical Recommended Practices)

ARP 24	Determination of Hydraulic Pressure Drop
ARP 243	Nomenclature, Aircraft Hydraulic and Pneumatic Systems

(Copies of SAE publications may be obtained from the Society of Automotive Engineers, Inc., 485 Lexington Avenue, New York 17, New York.)

3. REQUIREMENTS

3.1 Definitions.- For definitions of terms used in this spcification, see 6.3.

3.2 Detail specification. - In addition to this specification, a detail specification will be prepared for each caponent. Were the requirements for a component differ from those contained herein, they will be specified by the detail speification, which shall govern.

3.3 Materials shall conform to applicable specifications and shall be suitably processed. Materials which are not governed by applicable specifications may be used, provided it can be demonstrated that their use will result in a superior product.

3.3.1 Metals.- All metals shall be compatible with the fluid, temperature, service, and storage conditions to which the component will be exposed. The metals shall possess corrosion-resistant characteristias on internal and external surfaces or shall be protected by the use of permanent coatings to resist corrosion which may result from hydraulic fluid, dissimilar metal combinations, moisture, salt spray, and high-temperature deterioration, as applicable.

3.3.1.1 Stabilization.- For structural or dimensional stability, or both, a cold stabilization treatment is considered necessary operation in the fabrication of critical parts made from certain materials. Where such materials are used, the detail specification shall specify the materials and the processing required.

3.3.2 Plastic parts.- The use of plastic parts shall be subject to the approval of the procuring activity for the specific application involved.

3.3.3 Selection of materials.- Specifications and standards for all materials, parts, and Government certification and approval of processes and equipment, which are not specifically designated herein and which are necessary for the execution of this specification, shall be selected in accordance with Standard MIL-STD-143 or as specified in the contract or order, except as provided in 3.3.3.1.

3.3.3.1 Standard parts - Standard parts (MS, AN, or JAN) shall be used wherever they are suitable for the purpose, and shall be Identified on the drawings by their part-numbers. Commercial utility parts such as screws, bolts, nuts, and cotter pins may be used, provided they possess required properties and are replaceable by the standard parts (MS, AN, or JAN) without alteration, and provided the corresponding standard part numbers are referenced in the parts list and, if practicable, on the contractor's drawing. In the event there is no corresponding standard part in effect on date of invitation for bids, commercial parts may be used provided they conform to all requirements of this specification.

3.4 Design and construction.-

3.4.1 Fluid.- The hydraulic fluid used shall be ML0-8200, or as approved by the procuring activity. If the maximum system fluid temperature does not exceed 400°F, the fluid used shall conform to Specification MIL-H-8446.

3.4.2 Temperature range.- The component shall be capable of full performance with the fluid at any temperature throughout the range of -20° F to +450° F and shall start to operate at a temperature of -65°F. The component shall operate satisfactorily within the range of ambient temperature of -65° to +630°F.

3.4.3 Altitude. - The altitude pressure range shall be sea level to 100,000 feet.

3.4.4 Pressures.-

3.4.4.1 Rated pressure.- The rated hydraulic pressure of the component shall be specified. in the detail specification.

3.4.4.2 Operating pressure.- The component shall be designed to insure satisfactory operation and life throughout the operating pressure range specified In the detail specification with 150-percent peak impulse pressures.

3.4.4.3 Proof and burst pressure .- The component shall be designed to withstand the proof and burst pressure requirements of the table titled "Operating pressures, psi" of Specification MIL-H-8891; or as specified in the detail specification within the fluid and ambient temperature range of -65°F to +450°F after being fatigned and temperature aged for a period equivalent to that experienced during the life of the component.

3.4.5 Surge pressures. - Components shall be designed so as to not induce surge pressures in excess of 135 percent of the maximum operating pressure specified in the detail specification, when tested in a system and under test conditions as specified in the detail specification.

3.4.6 Threads. - Except where necessary for functional or manufacturing purposes, only straight threads conforming to Unified Fine Thread Series, classes UNF-3A or UNF-3B of specification MIL-S-7742 shall be used. Pipe threads shall not be used.

3.4.7 Seals. - All static and dynamic seals shall be of metallic construction or equivalent. Elastomeric seals shall not be used.

3.3.8 safetying.- All threaded parts shall be securely locked or safetied by safety wiring or other approved methods. Safety wire shall be applied in accordance with the practice outlined in standard MS33540 and shall conform to Standard MS20995. Lockwashers and star washers shall not be used. Safety wire shall not be used for threaded parts required to maintain on accurate position or torque.

3.4.3 Function-adjustment screws. - Function-adjustment screws, if used, shall be so designed and construed as to maintain adjustment under all the required conditions of vibration, temperature, and operation. Friction-type locking devices shall be kept to a minimum. If friction type is used, the adjust - ment screws shall maintain their setting after adjusting through the full range 15 times and then vibration tested. It shall be possible to adjust and lock the adjustable screws with a standard wrench or screw driver.

3.4.9.1 Where practicable, it shall be possible to adjust under full system pressure with negligible loss of fluid. No adjustment screws shall be sealed unless necessary. The means for adjustment shall be either internal or protected from tampering by a cover or similar device. If the component is subject to multiple settings, the seal shall be externally visible and marked with its setting.

3.4.10 Retainer rings.- Retainer or snap rings shall not be used in hydraulic equipment in my location where failure of the ring (caused by hydraulic or mechanical loads) will allow blow-apart or jamming of the equipment. Neither shall retainer rings be used in locations where the buildup of clearances and manufacturing tolerances will allow destructive end-play contributing toward failure of seals, brinelling, or fatigue failure. For other applications, the retainer rings shall be capable of being installed and removed with standard pin-type pliers or other standard tools developed for use with the specified rings.

3.4.11 Drive screws and spring pins .- Drive screws and spring pins shall not be used in the assembly of components; however, drive screws may be used for attaching nameplates.

3.4.12 Directlionally critical components - Components which are subject to malfunction or failure owing to reverse installation shall make provision to render improper installation impossible. Line-mounted units shall also be marked with an arrow indicating direction of flow. Components which mount to structure shall be so designed that size or location of ports or mounting provisions are unsymmetrical.

3.4.13 Structural strength.- The equipment shall have sufficient strength to withstand all loads or combination of loads resulting from hydraulic pressure, temperature variations, actuation or operation, and installation wrench loads. Where a control lever, or other item, is integral in a component, the lever, mechanism, and stops shall be capeble of withstanding a limit torque of 50 radius (R) pound-inches if the control radius is less than 3 inches, 75R pound-inches for radii 3 to 6 inches, and 150R pound-inches for radii greater than 6 inches. Where a control lever is not integral in a component and the component incorporates stops, the stops shall be capable of withstanding a limit torque of 1,800 pound-inches.

3.4.14 Rated flow.- The component shall be designed to operate stably when operated from zero to 150 percent of rated flow in a test system and under operating conditions as specified in the detail specification.

3.4.15 Pressure drop.- The component shall be so designed as to offer the minimum restriction to flow consistent with the other requirements of this specification and the applicable detail specifications.

3.4.16 Bleeding.- The configuration of components shall avoid cavities which cannot be purged of entrapped gas, or vented chamber which cannot be purged of entrapped water. Auxiliary bleed ports shall be provided when necessary.

3.4.17 Fluid connections. - The design of all ports shall be as specified in the detail specification and shill be subject to0 the approval of the procuring activity. All ports shall be clearly and permanently marked, using nomenclature in accordance with SAE publication ARP 243 and, where applicable, the direction of flow shall be indicated. Decalcomanias shall not be considered as permanent marking.

3.4.18 Plugs.- All plugs shall be specifically approved by the procuring activity.

3.4.19 Alignment.- All plungers, poppets, balls, and pistons shall be guided to prevent misalignment.

3.4.20 Mounting position - The component shall conform to the performance requirements specified herein and in the detail specification when mounted in any position.

3.4.21 Restrictor valves.- Only nonadjustable orifice restrictor valves shall be used in production aircraft.

3.4.22 Orifices.- All orifices smaller than 0.070 inch in diameter shall be protected by a filter element having a screened opening of 0.008 inch to 0.012 inch. Orifices and filter elements must be strong enough to absorb system design flow and pressure in either direction without rupture, excessive deformation, or loosening.

3.4.23 Electrical-hydraulic components.- Electrically controlled components shall be in accordance with the detail specification. This shall specify the following:

(a) Extreme of voltage, frequency, temperature, and pressure combinations.
(b) Manual override provisions if any.
c) Explosion-proof requirements.
d) Duty cycle.
e Vibration and shock requirements.
(f) Dielectric strength requirements.
(g) Maximum current.
(h) Any other requirements that are deemed necessary to insure integrity of the component for for its intended use.

3.4.24 Solnoid-operated, components. - Solenoids for operating hydraulic components shall be in accordance with Specification MIL-S-4040 and the following requirements:

(a) Environmental conditions: Solenoids shall be capable of continuous operation throughout the ambient temperature range specified.

(b) Solenoid construction: The solenoids shall be of compact design and of sufficiently rugged construction to withstand the mechanical shocks and stresses incident to their use in the air vehicle. Solenoids shall be designed for continuous duty and shall be provided with single-coil windings. Solenoids shall be totally enclosed in order to prevent moisture or hydraulic fluid from coming in contact with the electrical windings. The coil shall be firmly fixed in the frame to prevent ultimate failure of leads caused by vibration.

3.5 Interchangeability.- All replaceable parts or assemblies having the same manufacturer's or contractor's pert number shall be directly and completely interchangeable with each other with respect to installation and performance. Each assembly shall be designed to be replaceable with all other assemblies having the same part number without requiring the replacement of the other assemblies. Change in part numbers shell be governed by the drawing number requirements of Specification MIL-D-70327 and coordinated with the air vehicles contractor and procuring activity. Interchangeability requirments are not applicable to detail parts of permanent assemblies, such as welded assemblies, or matched detailed parts such as lapped components.

3.6 Lubricants. - When special lubricants are required, the lubricant used must be compatible with the hydraulic fluid and withstand the temperature and altitude ranges specified in the detail specification. The means of lubrication and the lubricant used shall be approved by the procuring activity. Lubrication shall be so accomplished that no disassembly for relubrication is necessary during endurance testing or normal service life.

3.7 Weight.- Weight shall be maintained as low as possible, consistent with the requirements of this specification. The weight of the assembled component shall not exceed that specified in the detail specification.

3.8 Envelope.- The external dimensions of the component shall be within the envelope dimensions shown on the detail specification. Mounting and port dimensions shall be within the tolerances specified. If no envelope is shown, the dimensions of the component shell conform to the manufacturer's drawings as approved for the component.

3.9 Finish.-

3.9.1 Surface roughness. - Surface roughness finishes, where required, shall be established and shall be specified on the manufacturers assembly drawings as outlined in Standard MIL-STD-10. The determination of surface finish shall be made with a profilometer, comparator brush analyser, or other suitable comparison equipment with an accuracy of ± 15 percent at the level being measured.

3.9.2 Coatings.- No finishes, paints, or color markings, other than those specified herein or otherwise authorized by the procuring activity shall be applied to the component, either externally or internally.

3.10 Physical defect inspection.- All magnetizable highly stressed parts shall be subjected to magnetic inspection in accordance with Specification MIL-I-6868. Aluminum or aluminum-alloy parts which have been treated with Specification MIL-C-5541 material shall be inspected after treatment by a process conforming to Specification MIL-I-6866. Where such inspection is necessary, it shall be stated on the manufacturer's drawings. Cracks or other injurious defects disclosed by the inspection shall be cause for rejection. Where Specification MIL-C-5541 material is used for touchup for parts which have been anodized, the above inspection process will not be required.

3.11 Changes.- Changes affecting interchangeability, weight, performance, or function shall not be made in the assembly or detail parts of any component, without prior approval of the procuring activity.

3.12 Performance and reliability.- The component shall satisfy the quality assurance provisions of the detail specification and this specification. Compliance with the quality assurance provisions will be considered as providing an acceptable level of reliability.

3.13 Installation and maintenance.- Components shall be designed to facilitate maintenance and replacement. The design shall be such that special or unusual tools will not be required for normal maintenance and inspection of the component. If special tools are necessary, they shall be subject to the approval of the procuring activity. Cylindrical components shall be provided with flats or hex or spanner wrench openings for installation and disassembly and shall be dimensioned for use with MS16153 or AN3505 standard wrenches. It is preferred that the shaft and handle of a component be designed to make improper assembly impossible; in any case, index markes shall be incorporated to indicate the proper position.

3.13.1 Storage life.- The component shall be designed for a storage life compatible with the specific weapon system requirements and shall perform satisfactorily at any time during the storage period. Periodic inspection and exercising of the component, if required, shall be specified and accompanied by substantiating data.

3.14 Supplemental requirements and information -

3.14.1 Proposal requirements.- The contractor shall submit the following with the proposal:

(a) Drawings: A preliminary design data drawing prepared as specified in this specification.
(b) Electrical power (if applicable): A tabulation of electrical power requirements shall be provided and shall include the important electrical characteristics at the extreme environmental conditions.

(c) Development program: An outline of the proposed development testing of any unproven mechanisms, materials, and processes.
(d) Quality assurance program: An outline of the proposed preproduction and production testing.
(e) Ground support: A list of any recommended publications, spares, equipment, training, and technical service for maintenance, overhaul and testing.

3.14.2 Data.- The contractor shall submit the following data. Dates of submittal will be determined in subsequent negotiations.

(a) Progress reports: Periodic reports shoving the progress of the development program.
(h) Final versions: Finalized versions of the data under proposal requirements.
(c) Preproduction and production test reports: Formal reports on preproduction and production tests.
(d) Engineering drawings: Drawings prepared as specified in Specification MIL-D-70327.

3.14.3 Support.- The general areas of expected contractor support are listed below. Requirements will be determined in subsequent negotiations.

(a) Publications: All publications necessary for support of the component.
(b) Spares: Recommended storage period, overhaul, and spare parts provisioning.
(c) Training: Any special training required of service personnel.
(d) Technical service: Technical personnel required to support the component.
(e) Failure data: Record of failures in test and service.

3.14.4 Design Data drawing.- The design data drawing shall be furnished in duplicate in preliminary form (detail part numbers not required) with bid proposals . The finalized drawing shall be included in preproduction and production test reports and separate copies shall also be furnished concurrent with those reports. Each change shall be identified by a change letter in the same manner as for production drawings. It is required that any proposed changes in design be first incorporated on this drawing for evaluation by the air vehicle contract~r prior to incorporation on production drawings. This drawing shall have a drawing number and title and shall show the part number either in the title or adjacent to the title block. At the option of the manufacturer, this drawing may be combined with the production assembly drawing. Information contained on this drawing shall include the following, as applicable:

(a) Installation (outline) dimension, including mounting provisions.
(b) Cross section(s) of unit showing all detail part and subassemblies, sufficiently clear to show function of the unit and complete enough for assembly. All flow passages and openings in detail parts shall be shown. Each detail part shall be identified by name and part number.

(c) Material, protective finishes and processing of each detail part, including applicable specification (A suggested method is by use of code numbers and tabulation.)
(d) Ratings: Pressure, and temperature.
(e) Operating medium.
(f) Proof and burst pressures.
(g) Operating characteristics: Pressure drop, leakage, interflow or noninterflow, and operating limitations (quantitative).
(h) Operating forces and positions of mechanical cent.mls.
(i) Markings: Ports, positions, and special markings.
(j) Settings.
(k) Detents and stops.
(l) Locking and safetying devices.
(m) Seals, with details of all special configurations and justification for the use of special configuration.
(n) Electrical connectional, with sufficient detail to establish mating connections.
(o) Operating cycle: opening and closing times.
(p) Duty cycle.
(q) Protective closures for shipping and storage.
(r) Schematic diagram: Flow and electrical.

3.15 Identification of product. -

3.15.1 Nameplate.- Each component shall be permanently and clearly marked with the information specified in the detail specification. The markings shall be metal stamped directly on the component, or on a nameplate, in letters not less than 0.045 inch high. The nameplate shall conform to specification MIL-R-6906, except the 125°C (257° F) shall be replaced with 650°F. The nameplate shall have a nominal minimum thickness of 0.020 inch, except wraperound n~platis with crimped ends may be 0.012 inch. The nameplate shall be securely attached to each component by use of screws, rivets, drive screws, welding, wraparound, or other approved method. Adhesives of any type shall not be used. The markings shall not be attached to the mounting face. The nomenclature shall conform to Cataloging Handbook H6-1 or SAE publication ARP243.

3.16 Workmanship.- All details of workmanship shall be of sufficiently high quality to insure satisfactory operation and service life.

4. QUALITY ASSURANCE PROVISIONS

4.1 Inspection responsibility. - The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise Specified, the supplier may utilize his own or any other inspection facilities and services acceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government as specified in the contract or order. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of tests.- The tests, preproduction, production, and acceptance (see 6.3), shall be specified in the detail specification.

4.3 Sampling and tests.- The detail specification will specify the number of specimens to be used in testing, the applicable paragraphs under 4.7, and the order of combination in which the tests will be performed for each specimen.

4.4 Test reports, design changes, and approval data.-

4.4.1 Preproduction and production test reports. - The preproduction and production test reports shall be prepared essentially in accordance with Specification MIL-T-9107 and the requirements contained herein. Each report shall have an identifying number. A list of all detail parts of the component showing the current drawing change letter shall be included. The actual critical dimensions of each test sample and 3 mathematical analysis of the effect of temperature differentials and dissimilar materials at adverse tolerances shall be shown. A copy of the design data drawing shall be bound in the report. A photographic reduction of this drawing will be satisfactory provided it is legible. The reports shall be furnished in triplicate to the procuring activity. If the production test report is submitted prior to the delivery date of the preproduction report, the preproduction report is not required.

4.4.2 Subsequent design changes.- Production approval applies only to the design, materials, construction nominal dimensions, and nominal tolerances of the specimens tested, Such features shall be identified by the manufacturer's part number and drawing change letter suhrnf.tted in the test report. Any changes in any of these features may require new preproduction and production tests, at the option of the procuring activity. Such changes shall be made in conformance with Specification MIL-D-70327 and shall receive approval by the procuring activity prior to incorporation in production.

4.4.3 Production approval of similar units.- In the case of a series of devices which are intended to serve the same general function in a hydraulic system, approval of one device of the series may, at the discretion of the air vehicle contractor, be applied to any other device of the series if all the internal working parts are identical in every detail with the corresponding internal uorking parts of the approved device, and provided it conforms to the proof, burst pressure, and such operational requirements as may be designated by the air vehicle contractor. For example, approval of this type would apply to all devices which differ from previously approved devices only insofar as port size, port location, external body dimensions, and external body-configuration are concerned. This approval of similar devices is not automatic upon approval of one device in a series; it is the discretion of the air vehicle contractor.

4.5 Test failures.- If a test specimen or any of its parts fails to conform to this specification, the contractor shall advise the air vehicle contractor within 24 hours of the failure and of the planned corrective action. Individual tests may be continued, pending investigation of the failure. Final acceptance of components on hand or produced later will not be made until the cause of failure has been ascertained, the correction incorporated, and it is determined by further testing that the corrected component conforms to this specification. Where the investigation of a test failure indicates that defects exist in components already

accepted, the contractor shall advise the air vehicle contractor of these defects and shall be responsible for ascertaining and making the corrections to all parts whether delivered or in production. The air vehicle contractor shall coordinate major failures and resulting corrective action with the procuring activity .

4.6 Test conditions.-

4.6.1 Test fluid.- The test fluid shall be MIL-H-8200 unless otherwise specified in the detail specification.

4.6.2 Fluid temperature.- The fluid temperature shall be as specified for each individual test. Unless otherwise specified, the tolerance shall be ±5° F. If the fluid temperature is not specified, the temperature shall be 95° ±15° F. For components with appreciable heat-generating characteristics, such as relief valves, and solenoid-operated valves (except pumps), the outlet fluid temperature shall be as specified, and the inlet fluid temperature may be decreased a maximum of 25° F to compensate for this heat generation. The fluid temperature shall be measured as near as practicable to the component ports. During all soaking periods, the component shall be bled of air and inert gas and maintained full of fluid.

4.6.3 Filtration.- Unless otherwise specified in the detail specification, the test fluid shall be continuously filtered through a filter which conforms to Specification MIL-F-8815 or MIL-F-25682. The filter and element used shall be satisfactory for the temperature range encountered, and cleaned or changed regularly to avoid clogging. The degree of contamination by weight of fluid used shall be specified in the detail specification.

4.6.4 Environmental conditions.- Unless otherwise specified in the detail specification, the ambient temperature tolerance shall be ±15° F. If environmental conditions are not specified or if "room conditions" are specified, the ambient temperature shall be 77° ±18° F, the barometric pressure shall be 28 ±4 inches of mercury, and the relative humidity shall not exceed 90 percent.

4.6.5 Test equipment.- Tests shall be conducted with a power-driven pump or a fluid power source. The test setup shall be such as to prevent air or moisture from coming in contact with the hydraulic fluid. The instruments used in measuring pressure, temperature, torque, and speeds shall be calibrated prior to starting the tests and shall be recalibrated throughout the tests as necessary.

4.6.6 Steady-state tests.- Steady-state tests are defined as tests conducted under selected steady-state conditions. Each test is usually conducted as an individual test, but in some cases may be combined, subject to the selected constant conditions. These tests do not include all the conditions to which the component will be subjected, but will be representative of those conditions and are intended to provide proof that the component will operate satisfactorily in service under these conditions.

4.6.7 Mission-profile tests. - Becauae of the advance in air vehicle per - formance with the accompanying complexity in requirements, purely steady steady-state condition tests will be insufficient to provide proof that the component will operate satisfactorily in service. In such cases, it will be necessary to con- duct tests simulating the sequence, magnitude, and duration of the conditions which the component is expected to encounter during the course of an actual air vehicle mission. Mission-profile tests may combine high and low temperature, rapid warmup, thermal shock, altitude, vibration, acceleration, shock, perform- ance, and endurance tests as one integrated test, as specified in the detail speci- fication.

4.7 Test methods. -

4.7.1 Examination of product. - When specified in the detail specification, the component shall be carefully examined to determine conformance with the requirements of the applicable specifications for weight, workmanship, marking, envelope, defects, and conformance of dimensions of detail parts to manufacturer's drawings. All critical dimensions of the specimen shall be recorded in the pre- production and production teat reports.

4.7.2 Performance verification tests. - The performance verification tests are preproduction and production tests as specified herein and shall be specified in the detail specification. They shall be conducted at room temperature prior to conducting other tests in order to estsblish initial performance. The same tests shall be repeated at the intervals and conditions specified in the prepro- duction and production tests and the results recorded and compared with the initial tests.

4.7.3 External leakage. - During the course of all the tests listed in this specifications external leakage, other than a slight wetting insufficient to form a drop through static seals, shall be cause for rejection. Where external dynamic seals are utilised, permissible leakage past such seals shall be no greater than specified in the detail specification.

4.7.4 Proof pressure. - When specified in the. detail specification the component shall be pressure tested at proof pressure. The proof pressure shall be applied while the component is stabilized at a fluid temperate Of 450° F and an ambient temperature from 450°F to 635°F. The rate-of-pressure rise shall not exceed 25,000 pounds per square inch (psi) per minute. A hand pump may be used if desired. The proof pressure shall be applied at least two successive times and held 2 minutes for each pressure application. The component shall be operated in its normal function between applications of the test pressure. There shall be no evidence of external leakage, other the a slight wetting insufficient to form a drop, or permanent set. Components which require varying test pressures in diff- erent elements may have these pressures applied either separately or simultaneously,

4.7.5 Internal leakage. - When specified in the detail specification, the component shall be tested for internal leakage. The internal leakage tests shall be performed with the component held in the position most conducive to leakage. The component shall be tested for leakage by applying 5 psi, 50 percent of working pressure, and working pressure for a period of 5 minutes each, unless otherwise specified in the detail specification. The leakage measurement period shall begin 2 minutes after the application of the required pressure, The component shall be

actuated between pressure applications. The rates of leakage shall not exceed those specified in the detail specification. During the first 2 minutes of each test, the leakage shall rapidly decrease from the flow condition to the rate in the final condition. The degree of contamination by weight of the fluid used shall be as specified in the detail specification.

4.7.6 Pressure drop.- When specified in the detail specification, the component shall be tested for pressure drop. The pressure drop test procedure shall conform to SAE publication ARP 24 and shall be performed at the flow specified in the detail specification. The pressure drop shall conform to requirements specified in the detail specification.

4.7.7 Dielectric strength.- When specified in the detail specification, the component shall be tested for dielectric strength. The test shall conform to Method 301 of Standard MIL-STD-202, except that the temperature shall be not less than 450° F or as specified in the detail specification.

4.7.8 Electrical power characteristics.- The electrical power characteristics shall be established and test conditions shall be outlined in the detail specification.

4.7.9 Clutch or brake slippage.- When specified in the detail specification, the component shall be tested for slippage of the clutch or brake of an electrically operated component. The test procedure shall conform to Specification MIL-M-7969.

4.7.10 Surge pressure.- When specified in the detail specification, the component shall be tested for pressure surges. The component shall be tested in a test setup simulating an actual application acceptable to the air vehicle contractor. The component shall be operated several times, using the rated flow specified in the detail specification. The induced pressure surges as shown on a hydrauloscope (or equivalent) shall not exceed 135 percent of the maximum specified operating pressure.

4.7.11 Low temperature.- When specified in the detail specification, the component shall be tested for operation at low temperature. The component shall be connected to a static head of 1 to 3 feet of the test fluid, and the ambient and fluid temperature shall be lowered to -65° F. After the component temperature has stabilized at -65° F, the component shall be functionally operated at least 10 times while continuing to maintain ambient and inlet-fluid temperatures of -65° F. The component shall operate. An increase in outlet-fluid temperature owing to operation is permitted. The above procedure shall be repeated with the temperature stabilized at -20° F. The component shall then be subject to and shall pass the tests specified in 4.7.2 while maintaining the ambient and inlet-fluid temperature at -20° F.

4.7.12 Intermediate temperature.- When Specified in the detail specification, the component shall be tested for operation with increasing temperatures. The component shall be stabilized at an ambient and fluid temperature of -65°F. The temperature shall then be increased to the maximum fluid and ambient temperatures specified in not less than 1/2 hour and not more than 2 hours. While

the temperatures are being raised, the component shall be subjected to and shall pass the tests specified for operation test at approximately 5 equal increments of temperature increase. These tests shall be made without waiting for the temperature of the entire component to stabilize.

4.7.13 Temperature shock.- When specified in the detail specification, the component shall be tested for operation while being subjected to a sudden application of high-temperature fluid. The test setup and test conditions to be used shall be as specified in the detail specification.

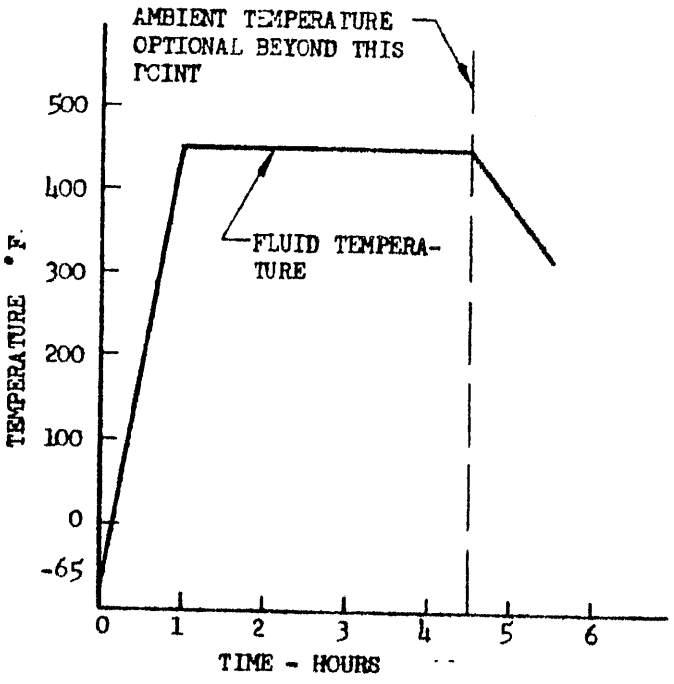
4.7.14 High temperature. - When specified in the detail specification, the component shall be tested for operation at high temperatures. With the component stabilized at the maximum fluid and ambient temperatures specified, the component shall be subjected to and shall pass the tests specified in 4.7.2 while maintaining the ambient and fluid temperatures.

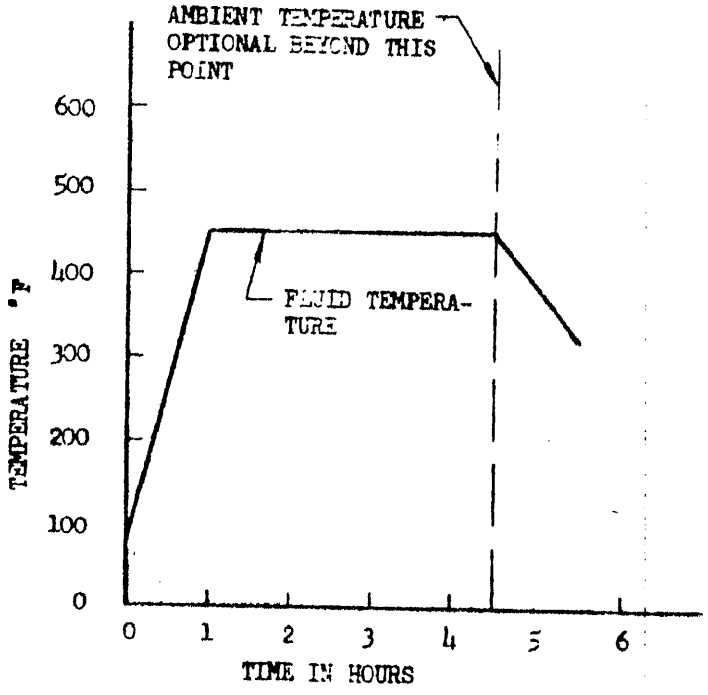
4.7.15 Endurance. - When specified in the detail specification, the component shall be tested for operational endurance under steady-state conditions. The component shall be subjected to the operating cycle, the number of operating cycles, schedule of cycles, cyclic rate, stroke, rate of flow, loads, altitudes, impulse peaks, leakage, and temperature specified in the detail specification. At the conclusion of the endurance test, the component shall be subjected to and shall pass the tests specified in 4.7.2. The component shall be disassembled and carefully inspected. Dimensions of all parts subject to wear and any evidence of impending failure of any part shall be recorded in the production test report.

4.7.16 Mission-profile.- Unless otherwise specified in the detail specification, the component shall be tested for operational endurance under transient conditions. The mission-profile test shall consist of the endurance test (4.7.15) combined with a minimum of two test temperature cycles (figure 1, or as specified in the detail specification). Components that may exceed 450° F fluid temperature under certain adverse conditions shall be tested to the predicted temperature for the proportion of time expected at that temperature as specified in the detail specification.

4.7.17 Environmental. - Environmental tests, when specified in the detail specification, shall be conducted in accordance with appropriate sections of Specification MIL-E-5272, as specified in the detail specification.

4.7.18 Burst pressure. - When specified in the detail specification, the component. shall be pressure tested at burst pressure. The burst pressure specified in the detail specification shall be applied at room temperature. The rate-of-pressure rise shall not exceed 25,000 psi per minute. A hand pump may be used if desired. The pressure shall be held at least 2 minutes. The component shall not rupture under this pressure. Components which require different test pressures in different elements may have these pressures applied either separately or Simultaneously. When the materials used in the components are subject to strength deterioration owing to temperature or to time at temperature, the burst. pressure to be used slall be increased to produce a higher stress by the ratio of such a strength reduction. The burst pressure test may be run on a different sample than that used for the endurance test (4.7.15).





STABILIZE AT -65° F FLUID AND AMBIENT TEMPERATURE BEFORE STARTING THE CYCLE.

STABILIZE AT 90° ±20° F FLUID AND AMBIENT TEMPERATURE BEFORE STARTING THE CYCLE.

RATE OF TEMPERATURE RISE OR DECAY MAY VARY BUT MUST REACH THE EXTREME WITHIN THE TIME SHOWN. THE AMBIENT TEMPERATURE SHALL BE AS SPECIFIED IN THE PROCUREMENT SPECIFICATION. THE SPECIFIED MAXIMUM AMBIENT TEMPERATURE SHALL BE MAINTAINED AT A CONSTANT LEVEL DURING THE PERIOD OF MAXIMUM STABILIZED FLUID TEMPERATURE.

FIGURE 1A. First and last test temperature cycle

FIGURE 1B. Intermediate test temperature cycle

5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging, packing, and marking.- Preservation, packaging, packing, and marking shall be as specified in the detail specification.

6. NOTES

6.1 Intended use. - Aircraft hydraulic components covered by this specification are intended for use in type III hydraulic systems as specified by the applicable detail specification.

6.2 Ordering data.- Procurement documents should specify the following:

(a) Title, number, and date of this specification and of the detail specification relating to the component furnished.
(b) Applicable levels of packaging and packing as specified in the detail specification.

6.3 Definitions.-

6.3.1 Preproduction tests.- Preproduction tests are those tests performed prior to initiation of production to serve as a basis for preliminary design approval to proceed with production. Test specimens will approximate as nearly as practicable the intended production units in design configuration, material, processing, and production techniques.

6.3.2. Production tests.- Production tests are those tests performed on production units to confirm full compliance with the requirements of the detail specification. Test specimens will be taken at random form a production run, and may include modifications to the design as found necessary by the preproduction tests.

6.3.3 Acceptance tests.- Acceptance tests are those tests performed bn production components to assure the continuance of the quality of that component. The acceptance tests consist of individual tests and quality verification tests as follows.

6.3.3.1 Individual tests.- Individual tests are acceptance tests of each production unit conducted prior to installation in the air vehicle. The tests will be performed in accordance with the detail specification.

6.3.3.2 Quality verification.- Quality verification tests are acceptance tests on random production samples. The quality verification tests are more extensive than the individual tests. The tests will consist of any or all of the preproduction and production tests and will be selected by the air vehicle contractor. The tests will be adjusted to reflect the reliability history of the component. The frequency of the sampling will be at the discretion of the procuring activity.

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