

MIL - V - 5 5 2 5 C

21 OCTOBER 1959

 SUPERSEDING
 MIL-V-5525B(ASG)
 9 APRIL 1953

MILITARY SPECIFICATION

VALVES , AIRCRAFT POWER BRAKE

This specification has been approved by the Department of Defense and is mandatory for use by the Departments of the Army, the Navy, and the Air Force.

1. SCOPE

1.1 This specification covers power brake valves for use in aircraft hydraulic wheel brake subsystems up to a maximum rated pressure of 3,000 psi.

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:

SPECIFICATIONS

MILITARY

MIL-P-5514 - Packings; Installation and Gland Design, Hydraulic (General Specification for).

MIL-P-5517 - Plastic Parts in Aircraft Hydraulic Equipment; General Tests for.

MIL-H-5606 - Hydraulic Fluid, Petroleum Base, Aircraft and Ordnance.

MIL-H-8775 - Hydraulic System Components Aircraft, General Specification for.

. STANDARDS

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.

(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.)

3. REQUIREMENTS

3.1 Preproduction sample. Prior to beginning quantity production, preproduction samples shall be subjected to preproduction testing. The preproduction sample shall be produced by the same method and of the same material that will be used for quantity production of the item.

3.2 General. The requirements of Specification MIL-J-8775 apply as requirements of this specification with the exceptions and additions specified herein. When the two specifications conflict, this specification shall govern. Unless otherwise specified by the procuring activity, the brake valves shall not be used with any hydraulic fluid other than that conforming to the requirements of Specification MIL-H-5606.

FSC 1630

MIL-V-5525C

3.3 Travel, load, and pressure. Full plunger travel shall give maximum pressure at the brake port of the valve. The pressure versus travel curve shall be as shown on the applicable specification control drawing. The exact requirements of pressure, load, and travel shall be governed by the brake system requirements. The pressure application and release curves shall be smooth with a minimum indication of binding, sticking, or erratic action.

3.4 Performance. The power brake assemblies shall satisfy the performance tests specified in section 4 under paragraphs headed as follows:

- (a) Proof pressure (4.7.3)
- (b) Burst pressure (4.7.4)
- (c) Leakage (4.7.5)
- (d) Endurance (4.7.6)
- (e) Pressure compensation (4.7.7)
- (f) Immersion - (4.7.1.1)
- (g) Extreme temperature (4.7.8)
operation

3.5 Markings. All ports shall be clearly and permanently marked to facilitate identification.

4. QUALITY ASSURANCE PROVISIONS

4.1 Unless otherwise specified herein, the supplier is responsible for the performance of all inspection requirements prior to submission for Government inspection and acceptance. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. Inspection records of the examinations and tests shall be kept complete and available to the Government as specified in the contract or order.

4.2 General. The quality assurance provisions of Specification MIL-H-8775 shall apply as quality assurance provisions of this specification with the exceptions and additions specified herein. When the two specifications conflict, this specification shall govern.

4.3 Classification of tests. The inspection and testing of power brake valves shall be classified as follows:

- (a) Preproduction tests (see 4.4)
- (b) Acceptance tests (see 4.5)

4.4 Preproduction tests.

4.4.1 Sampling instructions. The preproduction test samples shall consist of two power brake valves of each size upon which approval is desired. One of the samples shall be assembled of parts to the adverse limits of the design within a 10 percent of the worst tolerances providing minimum clearance between moving parts. The other sample shall be assembled of parts to, the adverse limits of the design within ± 10 percent of the worst tolerances providing maximum clearance between moving parts. The samples shall be identified as required and forwarded to the activity responsible for testing. (See 6.2).

4.4.2 Tests. The preproduction tests of hydraulic power brake valves shall consist of all the tests of this specification as described under 4.7 "Test methods."

4.5 Acceptance tests. The acceptance tests shall consist of individual tests and sampling tests.

4.5.1 Individual tests. Each power brake valve shall be subjected to the following tests, as described under 4.7 "Test methods."

- (a) Examination of product (4.7.1)
- (b) Output pressure (4.7.2)
- (c) Leakage (4.7.5)
- (d) Proof pressure (4.7.3)
- (e) Output pressure and load (4.7.2.3)

4.5.2 Sampling tests. Sample brake valves shall be selected from each inspection lot in accordance with Standard MIL-STD-105 at inspection level II using an acceptable quality level (AQL) of 1.0 percent defective for the following tests described under 4.7 "Test methods":

Immersion	(4.7.1.1)
Burst pressure	(4.7.4)
Endurance	(4.7.6)
Pressure compensation	(4.7.7)
Extreme temperature operation	(4.7.8)
Packing, packaging and marking	(4.8)

4.5.3 Inspection lot. For purposes of inspection sampling, an inspection lot shall be all the brake valves manufactured under the same conditions and offered for inspection at one time.

4.5.4 Report of tests. A report in duplicate, showing the quantitative results for all the tests required by this specification, shall be submitted to the procuring activity.

4.5.5 Rejection and retest.

4.5.5.1 Preproduction test failure. The failure of any preproduction test unit subjected to the tests as the first unit of a new design shall be cause for rejection of the design represented. The acceptance of the remaining brake valves on a contract or purchase order shall be dependent upon approval of the test results on the preproduction sample required by 4.4.1 of this specification.

4.5.5.2 Acceptance test failure. Rejected lots may be resubmitted in accordance with paragraph titled "Resubmitted lots" of Standard MIL-STD-105. A resubmitted lot shall be inspected using tightened inspection. Before resubmitting, full particulars concerning previous rejection and the action taken to correct the defects found in the original shall be furnished the inspector. Units rejected after retest shall not be resubmitted without the specific approval of the procuring activity.

4.6 Test conditions.

4.6.1 Oil for testing. The oil used in conducting tests shall conform to Specification MIL-H-5606.

4.6.2 Temperature. Unless otherwise noted, all tests shall be conducted at a temperature

of approximately 21° C (70° F) and at oil temperatures of 21° to 43° C (70° to 110° F). The actual oil temperature shall be reported.

4.7 Test methods.

4.7.1 Examination of product. Each brake valve shall be carefully examined to determine conformance with the requirements for material, workmanship, and markings as specified herein, and conforming to the limiting dimensions indicated on the manufacturer's applicable drawings.

4.7.1.1 Immersion of plastic parts. Valves containing plastic parts shall be subjected to, and meet the test requirements of Specification MIL-P-5517. These tests shall be conducted prior to all other tests unless these tests are specifically waived by the procuring activity on the basis that the plastic material used has been previously qualified in similar usage.

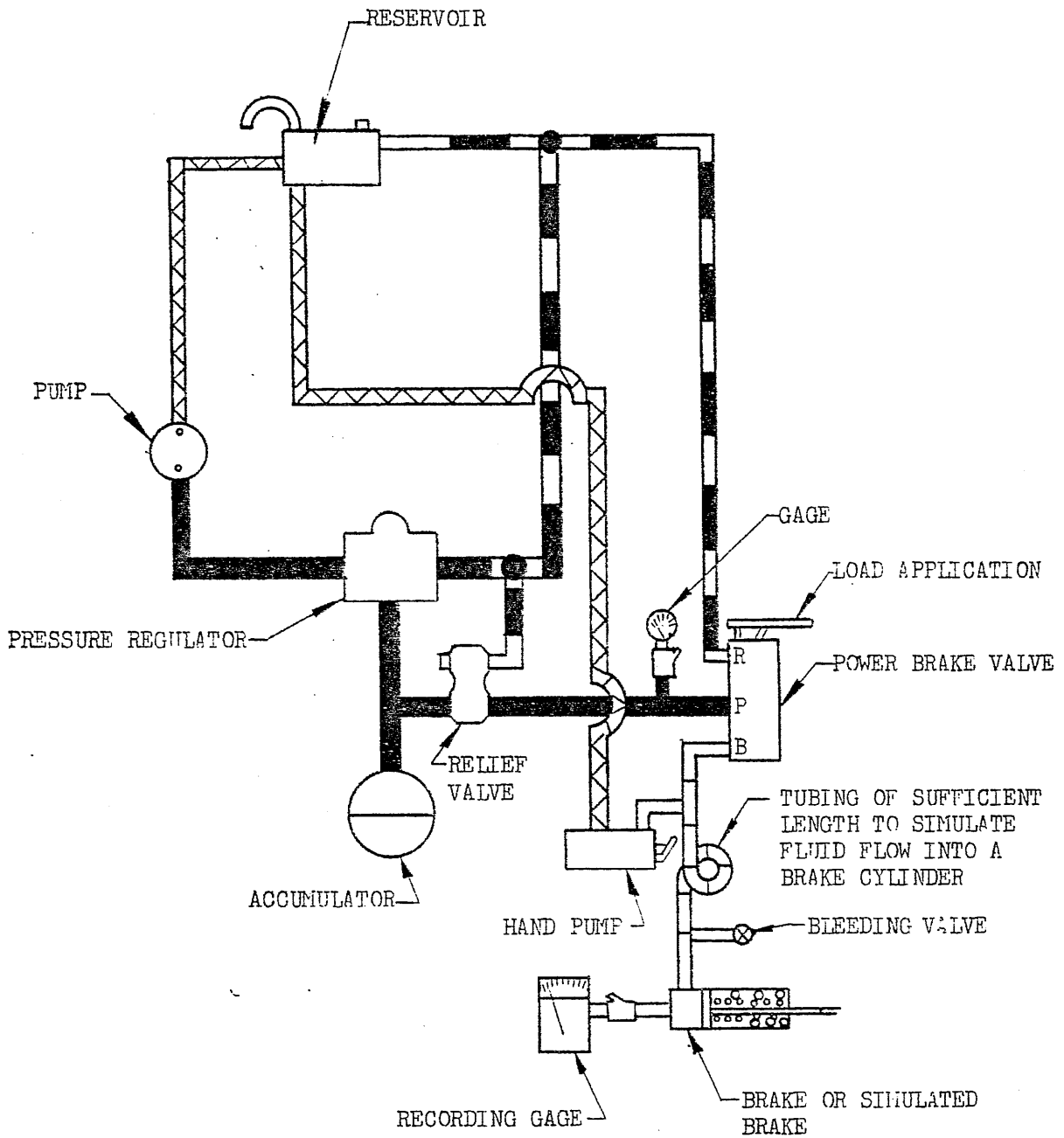
4.7.2 output pressure.

4.7.2.1 A typical output pressure and pressure range test set up is shown on figure 1. The test setup and procedure used in testing shall be described in detail, including details of the type of brake, or simulated brake, and its characteristics used in testing.

4.7.2.2 The following conditions shall apply for the above test:

- (a) The line between the brake valve and brake, or simulated brake, shall be the size and length of the system for which the valve is being tested.
- (b) The brake valve shall deliver to the brake or simulated brake, when maximum brake line pressure is applied, a quantity of fluid equal to the volume capacity of the brakes in the system for which the valve is being tested.
- (c) In the event that a brake is not used in this test, brake action should be simulated with a hydraulic cylinder in which hydraulic pressure

MIL-V-5525C



(IF AN ACTUAL BRAKE IS USED RATHER THAN A SIMULATED BRAKE, THE ACTUAL BRAKE SHALL BE SUPPORTED ON ARBOR CENTERED IN THE DRUM)

FIGURE 1. Typical performance and pressure compensation test setup

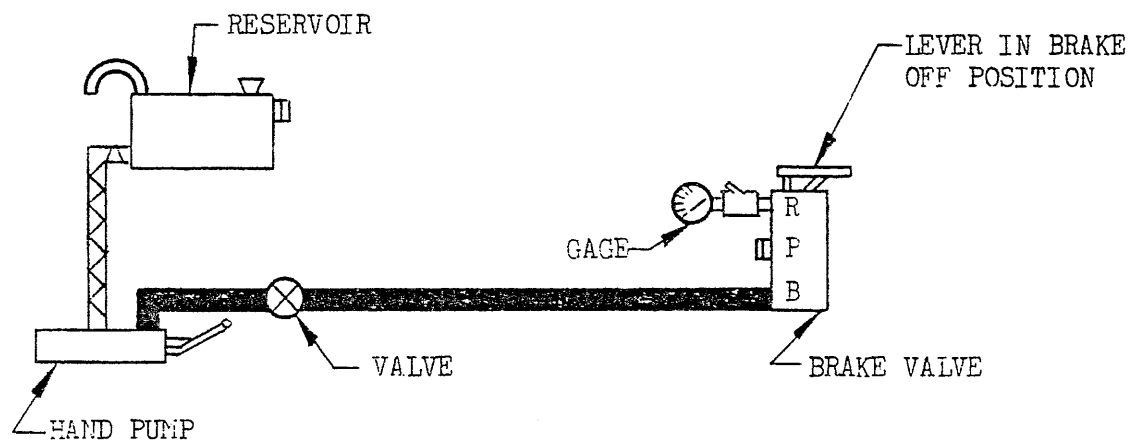


FIGURE 2. Brake port and reservoir port proof pressure test

acts against a spring-loaded piston. When fluid displacement specified herein has been reached, the piston will rest against a stop. The simulated brake shall have, as nearly as possible, the loadstroke characteristic of the brake used in the system for which the valve is being tested.

4.7.2.3 Output pressure and load. With the brake port connected to a pressure gage and 3,000 psi applied to the pressure port, the brake valve shall be actuated to obtain 100 percent of plunger travel or as specified in the applicable specification control drawing. Brake pressure and plunger load shall be within the limits specified for the valve on the desired performance curve or on the accepted performance of prototype units. With the brake part connected to return through a flowmeter and a metering valve, the valve shall be set in order that at maximum brake pressure rated flow occurs; then the lever shall be operated smoothly from maximum pressure to zero pressure and return several times. The flow shall follow the variation in lever position smoothly with maximum variations in smoothness not exceeding 10 percent.

4.7.3 Proof pressure. The power brake valve shall withstand a proof pressure of 4,500 psi applied at inlet port and shall withstand a proof pressure of 1.5 times the operating pres-

sure, as specified in 3.3, applied at the brake port and return port without external leakage or other malfunctioning. Typical proof pressure test setups are shown on figure 2. The specified test pressure shall be applied at the inlet port, brake port, and return port at least 2 successive times at each port and held for 2 minutes from the time full pressure is applied. There shall be no external leakage, permanent set, or failure of the valve assembly.

4.7.4 Burst pressure. The power brake valve shall not fail when subjected to a pressure of 7,500 psi applied at the inlet port with return and brake ports open. With the inlet and return ports plugged, 2.5 times the operating pressure shall be applied to the brake port. There shall be no rupture of the valve assembly or internal parts.

4.7.5 Leakage. When a single unit or one-half of a duplex unit is tested as specified below, the average leakage for the last 4 minutes of a 5-minute period shall not exceed that specified on applicable drawings. For this test, the valve shall be placed in such a position that the worst and most evident condition of leakage occurs.

4.7.5.1 With the valve in the brake-off position, leakage shall be measured at the brake port and return port with 3,000 psi applied the inlet port. The test setup should be in accordance with figure 3.

MIL-V-5525C

4.7.5.2 With the valve in full brake-on position, leakage shall be measured at the return port when outlet pressure at the brake port is maximum and 3,000 psi is held at the inlet port.

4.7.6 Endurance. System operating pressure shall be applied at the pressure port, and the brake valve shall deliver fluid at the rated output pressure throughout 10,000 full stroke cycles and 90,000 cycles at a load pressure corresponding to 60 percent of full load. A typical setup for this test is indicated in figure 4. The output pressure shall be checked at least once every 10,000 cycles. No components of the valve assembly shall be replaced during this test except packings which may be replaced after 50,000 cycles. No malfunctioning shall occur. At the completion of this test, the full stroke brake pressure shall not have changed in excess of ± 5 percent, and the internal leakage shall not exceed that permitted by the detail specification or drawing. The external leakage through sliding seals shall not exceed a rate of 1 drop per 50 cycles of operation.

4.7.7 Pressure compensation. The brake valve shall compensate for pressure changes at the brake port. At any brake pressure setting, the compensating range shall not exceed ± 5 percent, or as specified in the detail specification or drawing, of the maximum brake pressure initially attained at this setting.

4.7.7.1 Pressure decrease. A typical test setup for compensation of pressure decrease is shown on figure 1. Pressure shall be maintained in the brake line at approximately 75 percent of the operating range under a system pressure of 3,000 psi. The bleeder valve shall then be opened to permit a flow of 2 cubic inches per minute to permit the pressure in the brake line to drop. The pressure in the brake line shall not fall below 85 percent of the original brake pressure before compensation is effected. The compensated pressure shall be within ± 15 percent of the original brake-line pressure.

4.7.7.2 Pressure increase. A typical test setup for compensation of pressure increase is shown on figure 1 and the testing procedure shall be the same as for pressure compensation during pressure decrease, except that an attempt shall be made to increase the pressure at the brake port to approximately 115 percent of the original brake pressure by means of the hand pump. The compensated pressure shall be within ± 15 percent of the original brake-line pressure.

4.7.8 Extreme temperature operation. These tests shall be conducted on the preproduction test sample valves having minimum clearance. These valves shall operate at any temperature from -54° to $+71^{\circ}$ C (-65° to $+160^{\circ}$ F) without sticking, binding, or other malfunctioning.

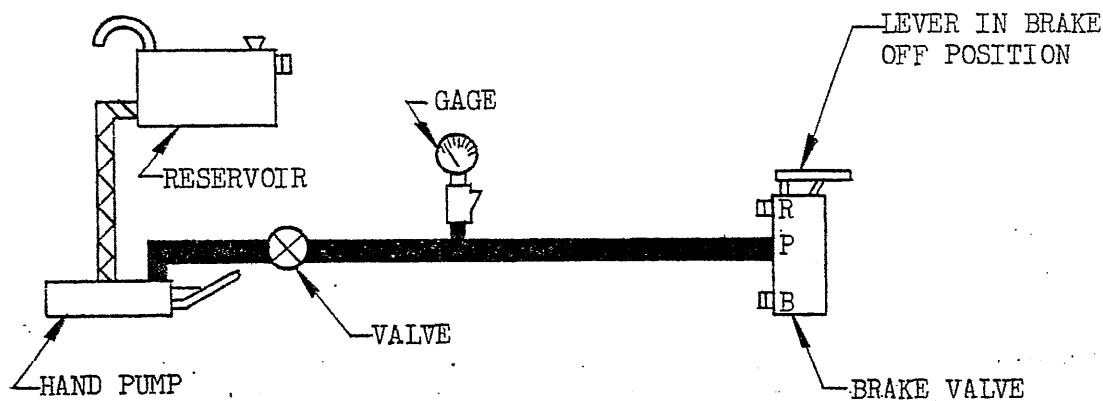


FIGURE 3. Pressure port proof and burst and leakage test

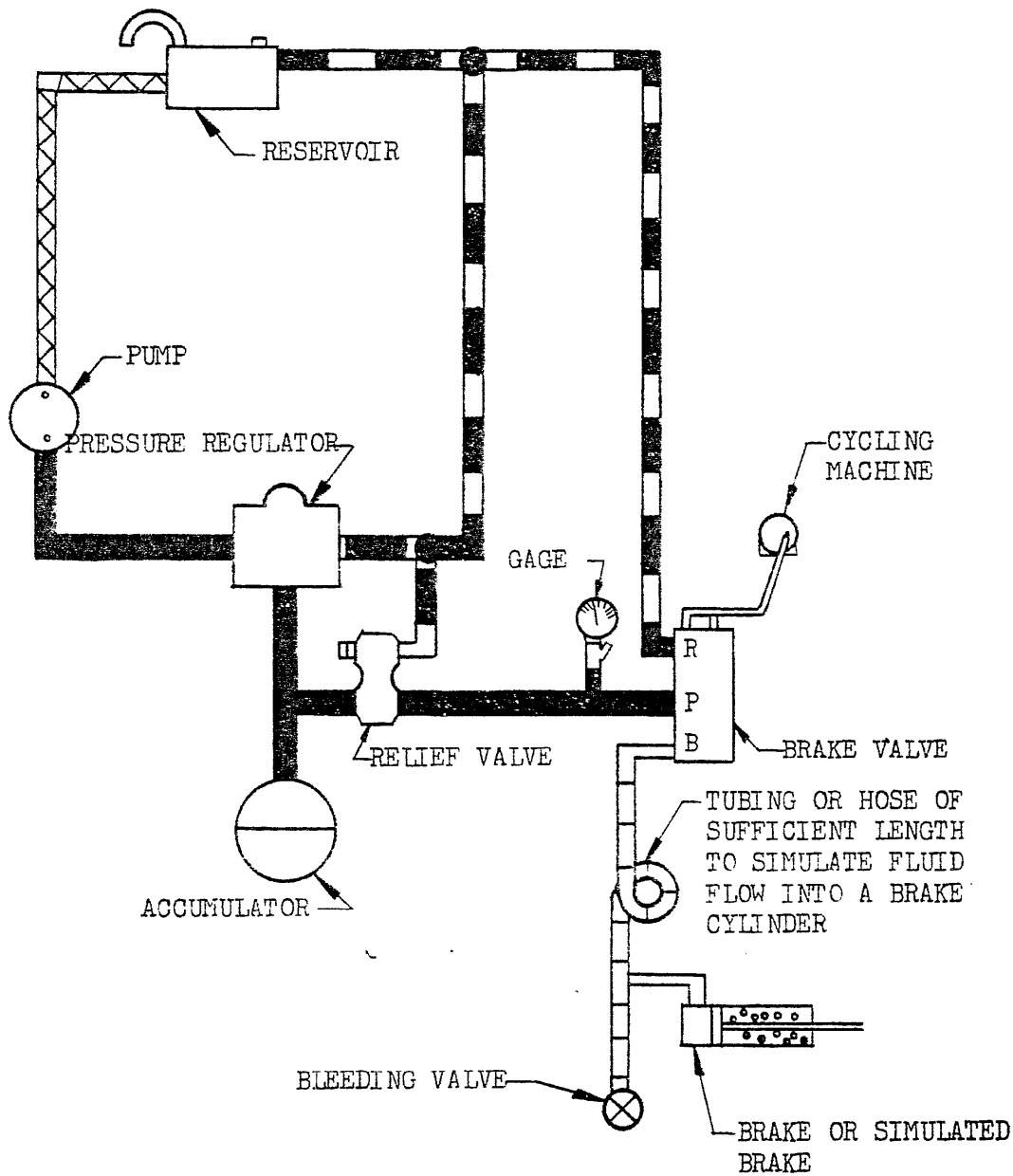


FIGURE 4. Typical setup for life test

MIL-V-5525C

tioning. In cases where brake valves will receive fluid or be subjected to an ambient temperature in excess of 71° C (160° F), they shall be required to operate at this high temperature without malfunction.

4.7.8.1 Low temperature operation. A typical setup for low temperature operation is indicated on figure 5. With the brake valve in the brake off position, the accumulator shall be charged to approximately 3,000 psi; however, the valve between the accumulator and the brake valve shall be so closed that 2 to 10 psi is applied to the brake valve. The system shall then be shred to stand for at least 24 hours at a temperature not higher than - 54° C (- 65° F) if the brake valve contains nonmetallic parts other than standard packing installed in accordance with Specification MIL-P-5514 or inert plastics. In the event that no nonmetallic materials, other than standard packing installed in accordance with Specification MIL-P-5514 or inert plastics are used, this time may be reduced to 4 hours.

During the soaking period, there shall be no external leakage, and internal leakage, as noted at the return port, shall not exceed that permitted by the detail specification or drawing. Pressure shall then be applied to the brake valve inlet port and allowed to remain on for at least 15 minutes. There shall be no evidence of external leakage, and internal leakage, as noted at the return Port, shall not exceed that specified in 4.7.5. At the end of this period, the brake valve shall be actuated to the full on position and allowed to remain thus for 1 hour. The force required for full brake application shall not exceed 110 percent of that required at normal temperature, and the pressure at the brake port shall be the full rated pressure of the valve tested. During this period, there shall be no external leakage, and internal leakage, as noted at the return port, shall not exceed that specified in 4.7.5. The brake valve shall then be returned to the "off" position and the brake port pressure shall be reduced to 0 psi.

4.7.8.2 Operation during fast warmup. Upon completion of the tests at - 54° C (-65° F),

the unit under test shall be removed from the cold chamber to outside room temperature and allowed to warm rapidly. When the external temperature reaches 4° C (40° F) sufficient actuations of the brake valve shall be made to prove that no binding exists in the unit throughout the fast warmup period. Leakage tests shall also be accomplished during this period, and leakage shall not exceed that permitted at -54° C (-65° F).

4.7.8.3 High temperature operation. The brake valve shall be tested for binding, leakage, and other malfunctioning at a temperature of 71° C (160° F) or higher under the conditions specified in 4.7.8. This test may be run at the termination of the immersion period or any other convenient time so long as the assembly remains at the specified temperature long enough to insure that the entire unit, including the fluid, is at the elevated temperature. During this test, there shall be no evidence of binding or other malfunctioning. The leakage at 49° C (120° F) shall be not more than the leakage permitted at room temperature, and the leakage at temperature above 49° C (120° F shall be not more than twice that permitted at room temperature).

4.8 Packing, packaging, and marking. The inspector shall ascertain that the packing, packaging, and marking of the brake valves conform to the requirements of section 5.

5. PREPARATION FOR DELIVERY

5.1 The provisions contained in section 5 of Specification MIL-H-8775, as applicable, shall form a part of this specification.

6. NOTES

6.1 Intended use. The hydraulic power brake valves covered by this specification are intended for use in aircraft hydraulic brake systems as covered by Specifications MIL-H-5440 and MIL-B-8584.

6.2 Ordering data. Procurement documents should specify the following:

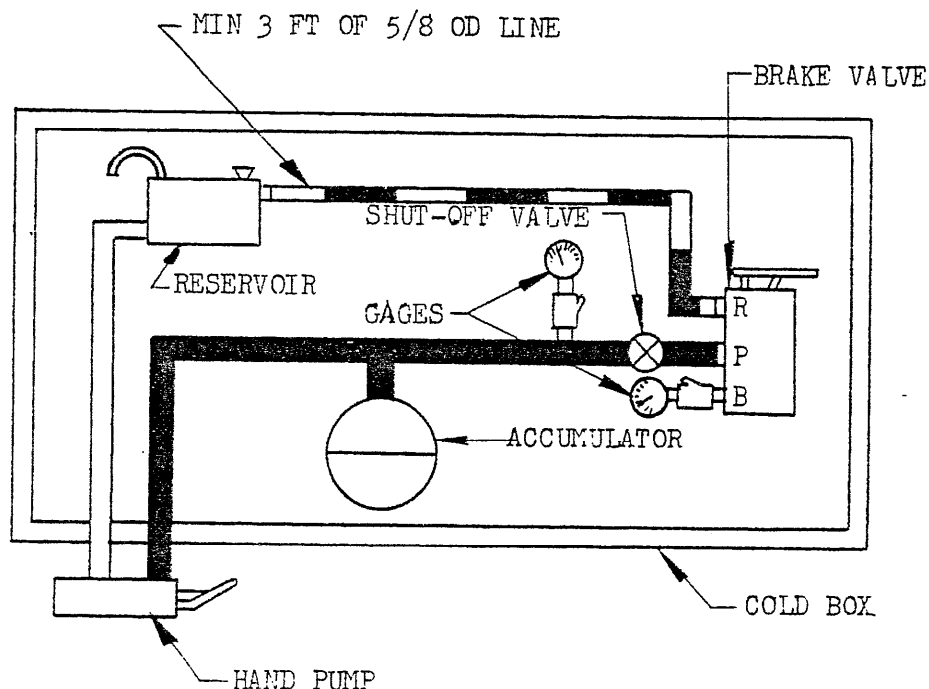


FIGURE 5. Typical setup for low temperature operation test

- (a) Title, number, and date of this specification.
- (b) Selection of applicable levels of packaging and packing,
- (c) Where the preproduction test samples should be sent, and instructions concerning the submittal of the test reports. (see 4.4.1).

6.3 Storage surveillance. Items preserved and packaged in accordance with level B requirements must be inspected to determine condition when not used within the time period indicated. Items not used within the time period specified must either be re-preserved or repackaged in accordance with level B requirements in this specification or with level A requirements if storage beyond an additional year is anticipated.

Notice. When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Custodians:

Army- Transportation Corps
Navy-Bureau of Aeronautics
Air Force

Preparing activity:

Navy Bureau of Aeronautics