MIL-V-5524B(ASG)
4 JUNE 1957

Superseding
MIL-V-5524A
17 March 1950
(See section 6.)

MILITARY SPECIFICATION

VALVES, CHECK, HYDRAULIC, AIRCRAFT, TYPE I SYSTEMS

This specification has been approved by the Department of the Air Force and by the Navy Bureau of Aeronautics.

1. SCOPE

1.1 Scope.- This specification covers the detail requirements for aircraft hydraulic check valves for use in type I systems (-65° to +160°F).

1.2 Classification.- Valves shall be of the following classes, styles, and sizes, as specified (see 6.3):

1.2.1 Classes.- Check valves shall be furnished in the classes specified in table I.

TABLE I

Pressure ratings

Class	Maximum rated hydraulic system pressure - psi
1500	1,500
3000	3,000

1.2.2 Styles.-

Style A - Flared tube valves in accordance with Drawing AN6207 or AN6249.
Style B - Flareless tube valve in accordance with Standard MS28890.
Style C - Internal port valve in accordance with Drawing AN6280.

1.2.3 Sizes.- Check valves shall be furnished in the sizes specified on the applicable AN drawings and MS standard specified in table II.

TABLE II

Drawings for check valves

Style	Class 1500	Class 3000
A	AN6207	AN6249
B	------	MS28890
C	------	AN6280

FSC 1650

2. APPLICABLE DOCUMENTS

2.1 The specifications, standard, and drawings, 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-O-5606	Oil; Hydraulic, Aircraft, Petroleum Base
MIL-O-6083	Oil; Preservative, Hydraulic Equipment
MIL-H-8775	Hydraulic System Components, Aircraft, General Specification for

STANDARDS

Military

MS28890	Valve, Hydraulic Check, 3,000 PSI. Flareless, Type I Systems

DRAWINGS

Air Force-Navy Aeronautical Standard Drawings

AN6207	Valve - 1500 PSI Hydraulic Check
AN6249	Valve - 3000 PSI Hydraulic Check
AN6280	Valve - 3000 PSI Hydraulic Check Internal Ports

(Copies of specifications and standards 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 Qualification.- The hydraulic check valves furnished under this specification shall be a product which has been tested and has passed the Qualification tests specified herein.

3.2 General.- The requirements of Specification MIL-H-8775 apply as requirements of this specification with the exceptions and additions specified herein.

3.2.1 In the event the requirements of the general specification and this specification conflict, the requirements of this specification shall govern.

3.3 Design and construction.- The design of the check valves shall be one that offers the least resistance to flow and the minimum possible weight consistent with the requirements of this specification.

3.3.1 The configuration, dimensions, and other details of design shall be as specified in the applicable AN drawings and MS standards specified in table II.

4. QUALITY ASSURANCE PROVISIONS

4.1 Classification of tests.- The inspection and testing of the hydraulic check valves shall be classified as follows:

(a) Qualification tests (see 4.3)
(b) Acceptance tests (see 4.4)

4.2 General.- The quality assurance provisions shall be in accordance with Specification MIL-H-8775 and as specified herein.

4.3 Qualification tests.- Qualification tests shall consist of all the tests of this specification, as described under 4.7, "Test methods," and in the order listed in tables III and IV.

TABLE III

Manufacturer's Qualification tests

Required on sample No. 1 (min)			Required on sample No. 2 (max)		
Order of test	Qualification test method		Order of test	Qualification test method	
	Description	Reference		Description	Reference
1	High- and low-temperature functioning	4.6.6	1	Examination of product	Specification MIL-H-8775
2	Examination of product	Specification MIL-H-8775	2	Immersion	Specification MIL-H-8775
3	Proof pressure	4.6.7	3	Leakage	4.6.2.2
4	Leakage	4.6.2.2	4	Surge flow	4.6.1
			5	Leakage	4.6.2.1
			6	Proof pressure	4.6.7
			7	Operation	4.6.3
			8	Pressure drop	4.6.4
			9	Endurance	4.6.5

TABLE IV

Services' Qualification tests

Required on sample No. 1 (min)			Required on sample No. 2 (max)		
Order of test	Qualification test method		Order of test	Qualification test method	
	Description	Reference		Description	Reference
1	Examination of product	Specification MIL-H-8775	1	Examination of product	Specification MIL-H-8775
2	Immersion	Specification MIL-H-8775	2	Proof pressure	4.6.7
3	Leakage	4.6.2.2	3	Leakage	4.6.2.2
4	Surge flow	4.6.1	4	Burst pressure	4.6.8
5	Leakage	4.6.2.1			
6	Proof pressure	4.6.7			
7	Operation	4.6.3			
8	Pressure drop	4.6.4			
9	Endurance	4.6.5			
10	High- and low-temperature functioning	4.6.6			
11	Burst pressure	4.6.8			

4.3.1 Requalification.- Qualification approval based on evaluation of handmade samples or models other than normal production samples will be subject to requalification as directed by the approving activity. The manufacturer shall furnish the activity responsible for qualification full particulars regarding changes in manufacturing processes, product design (including component parts thereof), and of resulting changes in performance. Results of tests conducted to prove the acceptability of such changes shall be

furnished. Submission of samples for evaluation shall be as directed by the activity responsible for qualification when such changes are made or when conformance of the product to requirements of this specification is questionable.

4.4 Acceptance tests.- Acceptance tests shall consist of Individual tests. Each check valve shall be subjected to the tests specified in table V and described under 4.7, "Test methods."

TABLE V

Individual tests

Order of test	Description	Reference
1	Examination of product	Specification MIL-H-8775
2	Proof pressure	4.7.7
3	Leakage	4.7.2.2

4.5 Test conditions.-

4.5.1 Test fluid.- The test fluid shall be continuously filtered during test in order to be free of all foreign matter (lint, dirt, metal particles, etc) over 10 microns in size.

4.5.1.1 For Qualification tests.- The hydraulic fluid for all Qualification tests shall conform to Specification MIL-O-5606.

4.5.1.2 For Acceptance tests.- The hydraulic fluid used for Acceptance tests shall conform to Specification MIL-O-5606 or MIL-O-6083.

4.5.2 Temperature.- Except where otherwise specified, the tests shall be conducted at a room temperature of 70° to 90°F and an oil temperature of 70° to 110°F.

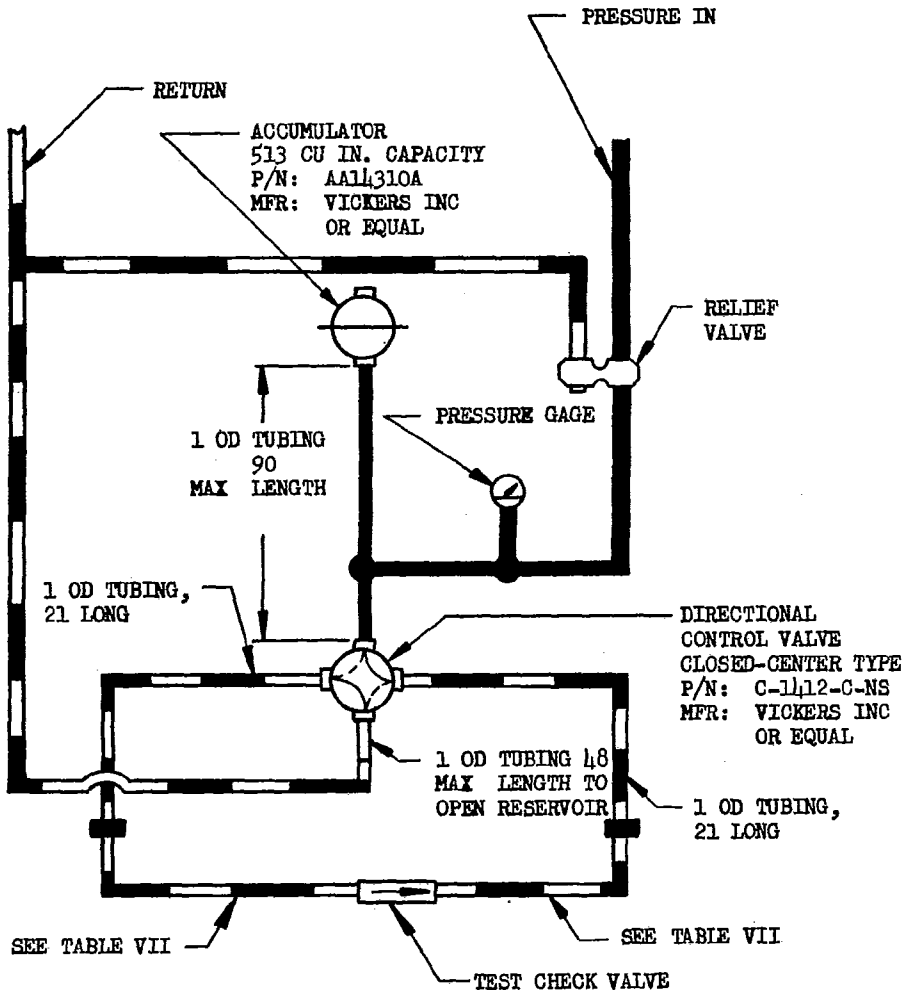
4.5.3 Position.- Unless otherwise specified, tests may be made with the valve axis in either of the following positions:

(a) Horizontal.
(b) Vertical - The inlet port shall be so positioned that the force of gravity will act with the valve checking action (i.e., direction of free flow is up).

4.6 Test methods.-

4.6.1 Surge flow.- The setup for this test shall be as indicated in figure 1. The air precharge pressure for the accumulator and the hydraulic test pressure for each class of check valves shall be as given in table VI. The directional control valve shall be operated in the following sequence for 25 complete cycles. The following 4-point sequence shall total 1 complete cycle:

(a) The directional control valve handle shall be in a neutral position to permit the buildup of rated hydraulic pressure in the accumulator.
(b) The directional control valve handle shall be quickly actuated to permit flow through the check valve in the free-flow direction. The directional control valve handle shall be allowed to remain in this position until the hydraulic pressure drops to not more than the specified air precharge in the accumulator.



HOSE SHALL NOT BE USED

DIMENSIONS IN INCHES.

FIGURE 1. Setup used for Surge flow test

(c) The valve handle shall be returned to the neutral position to permit the buildup of the required hydraulic pressure.
(d) The directional control valve handle shall be quickly actuated to permit reverse flow to the check valve. The valve handle shall be allowed to remain in this position for at least 3 seconds and then moved to the original neutral position.

The test check valve shall be disassembled and visually inspected prior to the test and then upon completion of the test. Damage to spring, poppet, or any of the parts shall be cause for rejection. Upon completion of this test, the check valve shall be subjected to the Leakage test specified in 4.6.2.1, and the requirements thereof shall be satisfied.

TABLE VI

Surge flow test

Class	Maximum rated pressure hydraulic system (psi)	Accumulator air precharge pressure at room temperature (psi)	Accumulator hydraulic charge pressure
1500	1,500	600	1,500
3000	3,000	1,000	3,000

4.6.2 Leakage.-

4.6.2.1 Leakage (for qualification).- This test shall be performed with the valve held in the horizontal position and repeated with the valve held in the vertical position as specified in 4.5.3. The valves shall be tested for leakage by applying the pressures listed in table VIII for a period of 30 minutes after application of the required pressure. All pressures listed in table VIII shall be applied in the direction of reverse flow, and the valve poppet shall be unseated between pressure applications. The rates of internal leakage shall not exceed the amounts stated in table VIII. There shall be no external leakage, other than a slight wetting insufficient to form a drop, throughout the pressure range. In cases where the leakage results are marginal, the measurement period shall be extended to 1 hour.

4.6.2.2 Leakage (for acceptance).- These tests shall be performed with the valve held in the vertical position as specified under 4.5.3. Pressures of 5 psi and rated pressure shall be applied in the reverse-flow direction for 5 minutes each. The valve poppet shall be unseated between each pressure application. In each case the leakage measurement period shall consist of the last 3 minutes of the 5-minute period. The rate of internal leakage shall not exceed the amounts stated in table VIII. There shall be no external leakage, other than a slight wetting insufficient to form a drop, throughout the pressure range. In cases where the leakage results are marginal, the measurement period shall be extended to 30 minutes.

4.6.3 Operation.-

4.6.3.1 Checking time.- The valve shall be held in the vertical position defined under 4.5.3. The valve poppet shall be mechanically actuated to its full open position against a static head of fluid of 5 psi; it shall then be allowed to check before the static head of fluid decreases to 1 psi. The time between the release of the poppet and the cessation of fluid flow shall be the checking time and shall not exceed 1-1/2 seconds.

TABLE VII

Hydraulic line dimensions

Valve size	Tube OD (in.)	Tube length (in.)
-4	1/4	14
-5	5/16	15
-6	3/8	16-1/2
-8	1/2	19-1/2
-10	5/8	13-1/2
-12	3/4	23
-16	1	21

TABLE VIII

Leakage

Class	Pressure (psi)	Maximum leakage rate (drops per minute)
1500 and 3000	5	1
	1,000	None
	1,500	None
3000	3,000	None

4.6.3.2 Cracking pressure.- Gradually increasing pressure shall be applied at the valve inlet in the free-flow direction beginning with zero. Cracking pressure shall be observed and shall be not less than 2 psi nor greater than 8 psi. Cracking pressure is defined as the pressure at which the poppet is unseated allowing flow equal to or exceeding 2 cc per minute through the valve in the free-flow direction.

4.6.4 Pressure drop.- Pressure drop through the valve shall be measured at a flow equal to the rated flow capacity. The fluid flow shall be accurately maintained. A manometer connected across the check valve may be used for accurate measurement of the pressure drop. The temperature of the oil shall be maintained at 100° ±5°F. The pressure drop through the valve shall not exceed the value specified in table IX.

TABLE IX

Pressure drop

Valve size	Tube size (inch)	Capacity (gpm)	Maximum pressure drop (psi)
-4	1/4	1.2	10
-5	5/16	2.3	18
-6	3/8	3.5	13
-8	1/2	6.0	10
-10	5/8	10.5	10
-12	3/4	16.0	10
-16	1	29.0	10

4.6.5 Endurance.- The valve shall be subjected to 50,000 cycles of operation at the rate of 30 to 100 cycles per minute. Each cycle shall consist of flow through the valve at the rated flow capacity for the size, followed by a reversal of the direction of the flow and application of the maximum rated pressure. During the first 45,000 cycles of this test, the peak pressure, which occurs during the pressure application portion of

each cycle, shall be 125 ±5 percent of the maximum rated pressure. A typical test setup for endurance cycling is indicated in figure 2. Leakage, as specified in 4.6.2.2, shall be checked upon completion of 22,500 cycles, and the requirements of that test shall be satisfied. Upon completion of 50,000, leakage and operation, as specified in 4.6.2.1 and 4.6.3, respectively, shall be checked, and the requirements of those tests shall be satisfied.

4.6.6 High- and low-temperature functioning.-

4.6.6.1 Low temperature.- The valve shall be connected to a static head of 1 to 3 feet of hydraulic oil in the reverse-flow direction. This arrangement shall be maintained at a temperature not warmer than -65°F for 72 hours if the valve contains nonmetallic parts other than static seals. If all parts of the valve except for static seals are metallic, this period may be reduced to 24 hours. After this period, the valve poppet shall be actuated mechanically at least 2 times. Leakage, as specified herein for Acceptance tests, and operation shall be checked at the end of the test, and the requirements of those tests (4.6.2.2 and 4.6.3, respectively) shall be satisfied.

4.6.6.2 Intermediate.- The test arrangement shall be warmed rapidly to a temperature of 160°F. While the temperature is being raised, sufficient mechanical actuations shall be made to determine satisfactory operation throughout the temperature range. These check tests shall be made without waiting for the temperature of the whole unit to stabilize.

4.6.6.3 High temperature.- The temperatures shall be maintained at 160°F for a length of time sufficient to allow all parts of the check valve to attain this temperature. With a head of 1 to 3 feet of hydraulic oil on the valve, in the reverse-flow direction, the poppet shall be actuated mechanically at least 2 times. Leakage, as specified herein for Acceptance tests, and operation shall be checked at the end of the test, and the requirements of those tests (4.6.2.2 and 4.6.3, respectively) shall be satisfied.

4.6.7 Proof pressure.- The proof pressure specified in table X shall be applied to the outlet port, with the inlet port open, at least 2 successive times and held 2 minutes for each pressure application. The poppet shall be unseated between applications of the test pressures. There shall be no evidence of leakage, failure, or permanent set.

TABLE X

Proof pressure

Class	Minimum proof pressure (psi)
1500	2,250
3000	4,500

4.6.8 Burst pressure.- Pressure shall be applied to the inlet port, with the output port plugged, at a maximum rate of 25,000 psi per minute until the burst pressures specified in table XI are obtained. The valve shall withstand this burst pressure for a period of 2 minutes. The valve shall not rupture under this pressure or leak externally. During the Qualification test, the pressure may be increased above that specified in order to secure data on actual burst pressures.

TABLE XI

Burst pressure

Class	Burst pressure (psi)
1500	3,750
3000	7,500

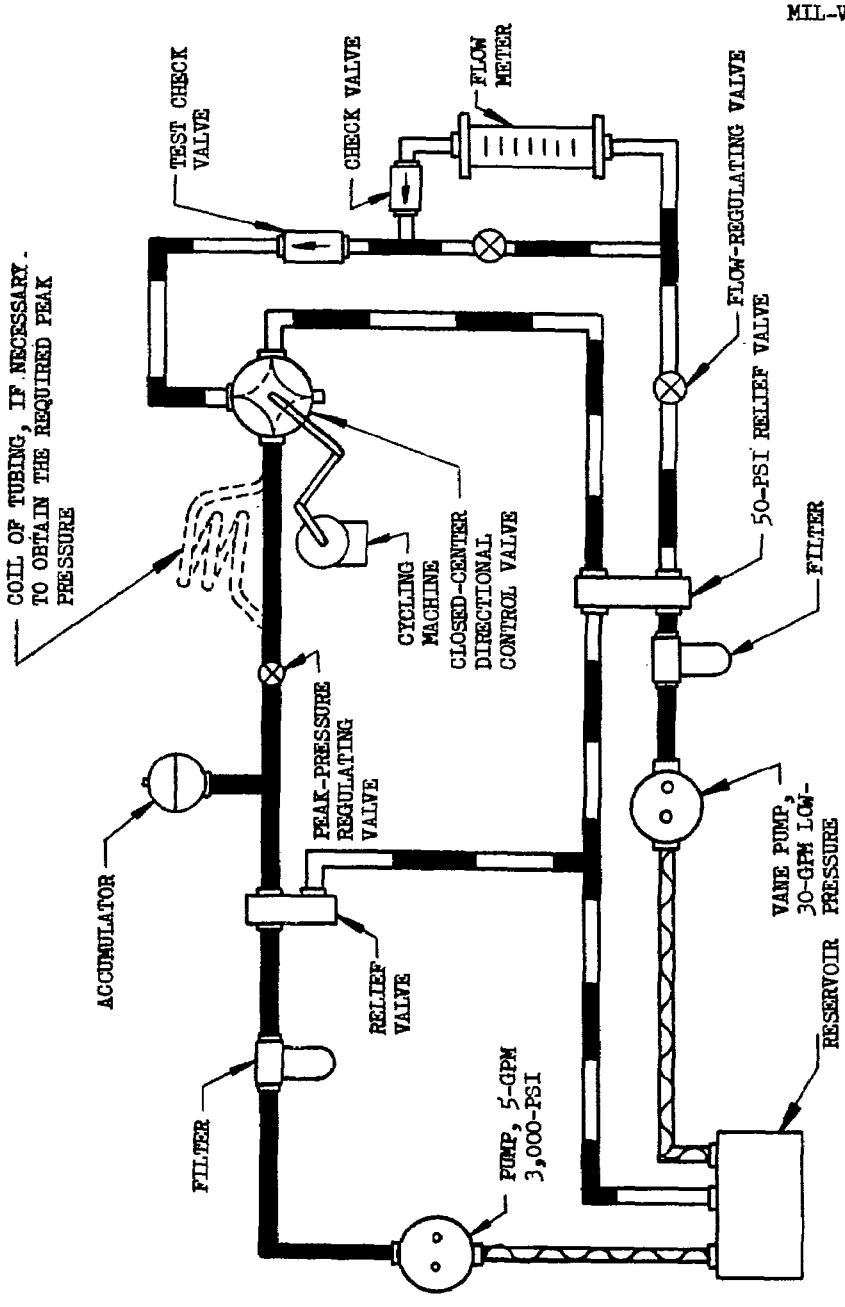


FIGURE 2. Typical setup for Endurance test

5. PREPARATION FOR DELIVERY

5.1 General.- The preparation for delivery requirements shall be in accordance with Specification MIL-H-8775.

6. NOTES

6.1 General.- In addition to the Notes specified herein, the Notes of Specification MIL-H-8775 are applicable to this specification.

6.2 Intended use.- The check valves covered by this specification are intended for use in aircraft hydraulic systems conforming to Specification MIL-H-5440, at operating pressures that do not exceed the values specified herein, with hydraulic fluid conforming to Specification MIL-O-5606. The function of the check valves is to allow free flow in one direction only, and prevent flow in the opposite direction.

6.3 Superseding data.- Valves covered by this specification were formerly procured under Specification AN-V-5, which specification was later renumbered by Cover Sheet MIL-V-5524.

6.4 It is understood that check valves supplied under contract will be identical in every respect to the sample tested and found satisfactory, and to the detail drawings thereof, except for changes previously approved by the Government. Any unapproved changes from the qualification sample or from the drawings will constitute a cause for rejection.

6.5 Provisions for qualification.- With respect to products requiring qualification, awards will be made only for such products as have, prior to the bid opening date, been tested and approved for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date.

6.5.1 The attention of suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government, tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Requests for information pertaining to qualification of products covered by this specification should be addressed to the Commander, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio, the activity responsible for qualification, with a copy to the Bureau of Aeronautics, Navy Department, Washington 25, D. C.

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.

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Preparing Activity:
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