

MIL-V-19067A (ASG)

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Superseding

MIL-V-19067(Aer)

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## MILITARY SPECIFICATION

VALVES, CHECK, CONTROLLABLE, HYDRAULIC, AIRCRAFT,  
TYPE II SYSTEMS

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

1.1 Scope. - This specification covers hydraulic controllable check valves for use in Type II aircraft hydraulic systems conforming to and as defined in Specification MIL-H-5440. The complete specification for these valves consists of Specification MIL-H-8775 which covers general requirements common to all aircraft hydraulic components, and this specification which includes additional requirements specifically applicable to such controllable check valves.

1.2 Classification. - Controllable check valves shall be furnished in accordance with the following standards, as specified (see 6.1):

Standard MS28764

Rotary-check valve

Standard MS28768

Plunger-type check valve

## 2. APPLICABLE DOCUMENTS

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

SPECIFICATIONSMilitary

MIL-H-5440

Hydraulic System: Design, Installation and  
Tests of Aircraft (General Specification  
for)

MIL-H-8775

Hydraulic System Components Aircraft, General  
Specification forSTANDARDSMilitary

MS28764

Valve, Check, Controllable, Rotary-Action,  
Hydraulic, 3,000 psi, Type II Systems

MS28768

Valve, Check, Controllable, Plunger-Type,  
Hydraulic, 3,000 psi, Type II System

FSC 1650

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(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 General - The requirements specified in Specification MIL-H-8775 are applicable as requirements of this specification. In the event the requirements of the general specification and this specification conflict, the requirements of this specification shall govern.

3.2 Qualification - The valves furnished under this specification shall be a product which has been tested and has passed the Qualification tests specified herein.

### 4. QUALITY ASSURANCE PROVISIONS

4.1 General - The qualification and acceptance provisions contained in section 4 of Specification MIL-H-8775 are applicable to, and form a part of this specification. Additional provisions shall be as specified herein.

#### 4.2 Test conditions-

4.2.1 Positioning - Unless otherwise specified, testing may be made with the valve axes in either of the following positions:

- (a) Horizontal
- (b) Vertical - (The force of gravity acting opposite to the checking action.)

4.3 Qualification tests - The Qualification tests described herein under "Qualification test methods" shall be performed on the applicable specimen by the manufacturer and the activity responsible for qualification, in the order as indicated in tables I and II, respectively. Tests may be supplemented with tests under actual service conditions at the option of the procuring activity.

4.3.1 Requalification - Qualification approval based on evaluation of handmade samples or models other than normal production samples shall be subject to requalification as directed by the procuring 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.

TABLE I  
Manufacturer's preliminary tests of Qualification samples

Tests required						
	On maximum clearance specimen			On minimum clearance specimen		
Order of tests	Test	Paragraph reference	Order of tests	Test	Paragraph reference	
1	Examination of product - Qualification	4.4.1	1	Examination of product - Qualification	4.4.1	
2	Fluid Immersion	4.4.2	2	Qualification test for leakage	4.4.5	
3	Proof pressure - Qualification	4.4.3	3	Proof pressure - Qualification	4.4.3	
4	Surge flow	4.4.4	4	Extreme temperature functioning	4.4.8	
5	Qualification test for leakage	4.4.5				
6	Operational	4.4.6				
7	Pressure drop	4.4.7				
8	Extreme temperature functioning	4.4.8				
9	Endurance cycling	4.4.9				
10	Control lever stops ruggedness	4.4.10				
11	Burst pressure	4.4.11				

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TABLE II  
Qualification tests

Tests required						
On maximum clearance specimen				On minimum clearance specimen		
Order of tests	Test	Paragraph reference	Order of tests	Test	Paragraph reference	
1	Examination of product - Qualification	4.4.1	1	Examination of product - Qualification	4.4.1	
2	Inspection and comparison of results with those conducted on minimum clearance specimen		2	Fluid Immersion	4.4.2	
			3	Proof pressure - Qualification	4.4.3	
			4	Surge flow	4.4.4	
			5	Qualification test for leakage	4.4.5	
			6	Operational	4.4.6	
			7	Pressure drop	4.4.7	
			8	Extreme temperature functioning	4.4.8	
			9	Endurance cycling	4.4.9	
			10	Control lever stops ruggedness	4.4.10	
			11	Burst pressure	4.4.11	

#### 4.4 Qualification test methods.-

4.4.1 Examination of product - Qualification .- The maximum and minimum clearance specimens shall each be carefully examined to determine the conformance with all the requirements of this specification and for any visible defects. The critical clearance dimensions shall be checked and recorded for comparison of results.

4.4.2 Fluid immersion - All valves shall be immersed continuously in hydraulic fluid for a period of 72 hours at a fluid temperature of 275°F, prior to conducting the remainder of the Qualification tests specified herein. All internal parts Or the valve shall be in contact with the fluid during this immersion. After the 72-hour soak period, the valve shall remain in the fluid at normal room temperature until ready for test. It shall not be exposed to air internally for any appreciable length of time during the test.

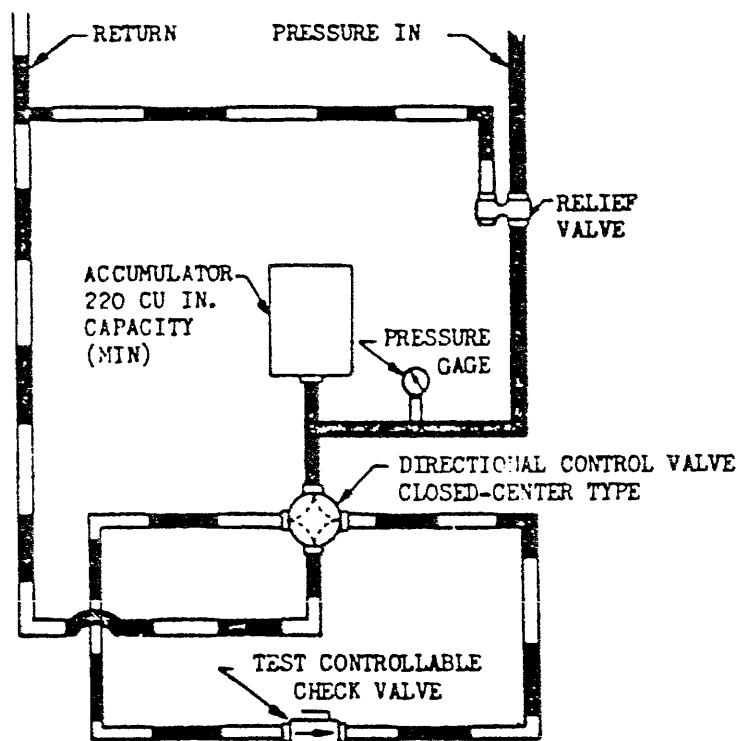
4.4.3 Proof pressure - Qualification - This test shall be performed at a temperature of 275°F. A proof pressure of 4,500 psi shall be applied in both the free- and reverse-flow directions at least two successive times in each direction and held for 2 minutes for each pressure application. For the reverse-flow direction, the poppet shall be unseated between applications of the proof pressure. There shall be no measurable external leakage, failure, or permanent set.

4.4.4 Surge flow - This test shall be performed within a temperature range of 70° to 120°F. A test setup similar to figure 1 shall be used, and the precharge pressure for the accumulator shall be stabilized at 1,000 psi. The hydraulic test pressure shall be 3,000 psi. The directional control valve shall be operated in the following sequence for 25 complete cycles. The following four-point sequence Shall total one 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 controllable check valve in the free-flow direction. The directional control valve handle shall be permitted to remain in this position until the hydraulic pressure drops to not more than the specified precharge in the accumulator.
- (c) The valve handle shall be returned to the neutral position to permit the buildup of the required rated hydraulic pressure.
- (d) The directional control valve handle shall be quickly actuated to permit reverse flow to the controllable 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.

4.4.5 Qualification test for leakage - This test shall be performed with the valve in the horizontal position. Unless otherwise specified, this test shall be conducted at a fluid temperature of 100°F. The valve shall be tested for internal leakage by applying the pressures listed in table III for a minimum period of 32 minutes each. The pressures shall be applied in the direction of reverse flow, and the valve poppet shall be unseated between pressure applications. The leakage measurement period shall be least 30 minutes in duration and shall begin 2 minutes after application of the required pressure. The internal leakage shall not exceed the amount stated in table III. There shall be no measurable external leakage during this test. This leakage test shall then be repeated with the pressures applied in the direction of free flow with the other port plugged.

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ALL TUBE OD'S SHALL BE AT LEAST ONE SIZE LARGER THAN THE CHECK VALVE TUBE SIZE. TUBE LENGTHS SHALL BE A MINIMUM. HOSE SHALL NOT BE USED.

FIGURE 1. Typical setup for Surge flow test

TABLE III

TLeakage

Pressure (psi)	Maximum internal leakage (cubic centimeters for 30 minutes)
5	1-1/2
1,000	No measurable amount
3,000	No measurable amount

4.4.6 Operational - Operational tests shall consist of Checking time and Cracking pressure. These tests shall be conducted within a temperature range of 70° to 120°F. When included as part of another test, the temperature specified in the paragraph describing such test shall apply.

4.4.6.1 Checking time - The valve poppet shall be mechanically actuated to its full-open position against a static-fluid head of 5 psi maximum; it should then be allowed to check before the static head of fluid decreases to 1 psi minimum. 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.

4.4.6.2 Cracking pressure - Gradually increasing pressure shall be applied in the free-flow direction beginning with zero pressure. Cracking pressure shall be observed and shall be not less than 2 psi or greater than 8 psi. Cracking pressure is defined as that pressure at which fluid is bypassed through the valve.

4.4.7 Pressure drop - This test shall be performed at a fluid temperature of 100°F. Pressure drop in both directions through the check 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 pressure drop through the valve shall not exceed the values specified in table IV. The test in the free-flow direction shall be made with the valve handle or plunger initially set at the closed position.

TABLE IV

Maximum pressure drop

Valve size	Tube size (in.)	Rated flow capacity minimum (gpm)	Pressure drop maximum (psi)
-4	1/4	1.2	25
-6	3/8	3.5	25
-8	1/2	6.0	25
-10	5/8	10.5	25
-12	3/4	16.0	25

#### 4.4.8 Extreme temperature functioning.-

4.4.8.1 Low temperature functioning - The valve snail be connected to a static head of 1 to 3 feet of hydraulic fluid in the reverse-flow direction. This arrangement shall be maintained at a temperature not warmer than -65°F for 4 hours. After this period, the valve poppet shall be actuated mechanically at least 10 times. After the tenth actuation, a Qualification test for leakage (4.4.5) shall be made at -65°F and the requirements therein shall be satisfied. After this leakage test, the Control force test specified herein under Acceptance (4.6.4), followed by the Operational tests (Cracking pressure and Checking time (4.4.6)) shall each be performed at -65°F, and the requirements therein shall be satisfied.

4.4.8.2 Rapid warmup - The low temperature arrangement shall be allowed to warm rapidly to a temperature of 27°F. While the temperature is being raised, sufficient mechanical actuation of the poppet and control movement shall be made at approximately 70°F differentials in ambient temperature to determine satisfactory operation throughout the temperature range. These check tests shall be made without waiting for the temperature of the entire unit to stabilize.

4.4.8.3 High temperature functioning - Except where otherwise indicated, the following tests shall be conducted at a temperature of 275°F. With a head of 1 to 3 feet of hydraulic fluid on the valve in the reverse-flow direction, the poppet shall be actuated mechanically at least 10 times. After the tenth actuation, the Qualification test for leakage (4.4.5) shall be conducted, and the requirements therein shall be satisfied. After this leakage test, the Control force test specified herein under Acceptance (4.6.4) followed by Operational tests (Cracking pressure and Checking time (4.4.6)) shall performed and the requirements therein shall be satisfied.

4.4.9 Endurance cycling - Controllable check valves shall be subjected to a total of 50,000 cycles of operation at a rate of  $35 \pm 5$  cpm. With a test setup similar to figure 2, the valve shall be subjected first to 30,000 cycles of automatic checking operation in the manner indicated in 4.4.9.1 and 4.4.9.2. Then with a test setup similar to figure 3, the same valve shall be subjected to 20,000 cycles of manual control operation in the manner indicated in 4.4.9.3 and 4.4.9.4. For automatic checking operation, each cycle shall consist of free flow through the valve at the rated pressure and flow capacity for the size, followed by an impulse in the reverse-flow direction of 150 percent  $\pm 5$  percent of rated pressure. Surge pressures in the free-flow direction during all 30,000 cycles of automatic checking operation shall be between 125 percent and 150 percent of the rated pressure. For manual control operation, each cycle shall consist of first opening and then closing the valve by means of the manual control, with the pressure source delivering rated flow and pressure in the reverse-flow direction. For manual control operation, surge pressure during the valve-closing portion of each of the 20,000 cycles shall be 150 percent  $\pm 5$  percent of the rated pressure. The rated flow capacity shall be as indicated in table IV.



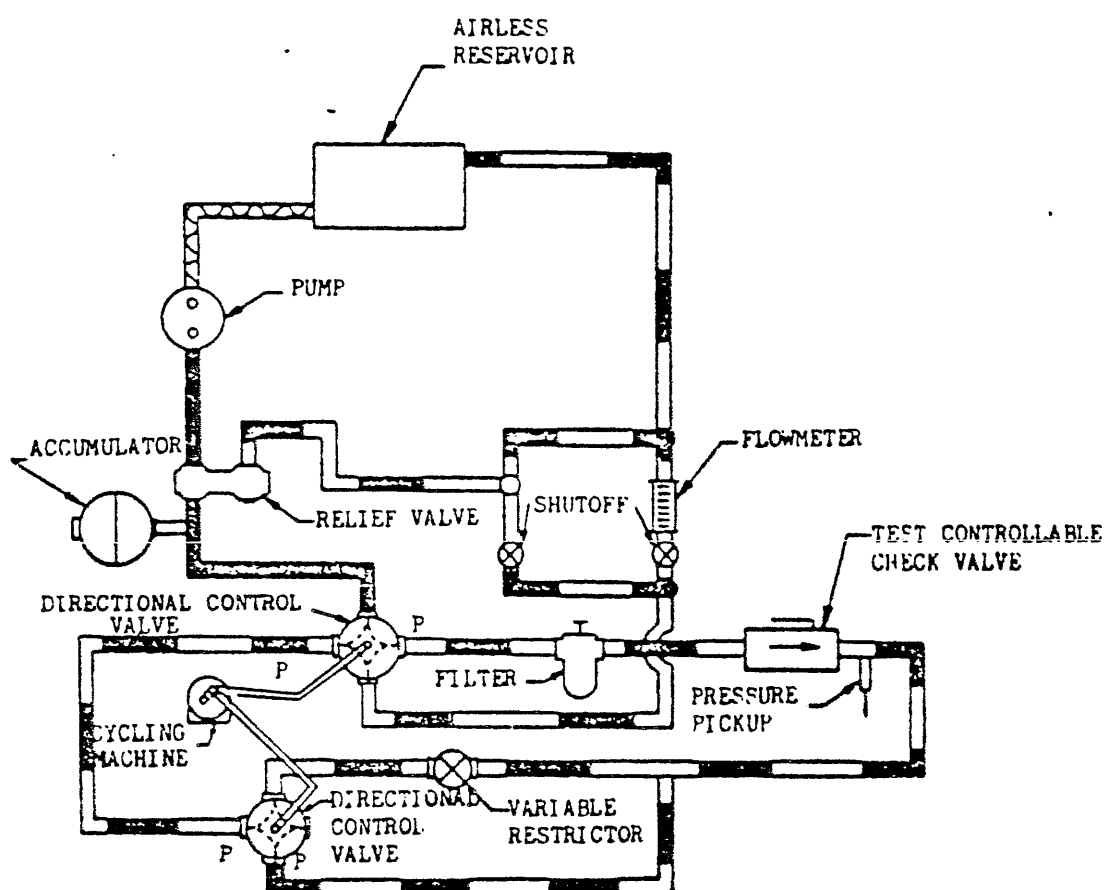


FIGURE 2. Typical setup for Endurance cycling test, automatic checking operation

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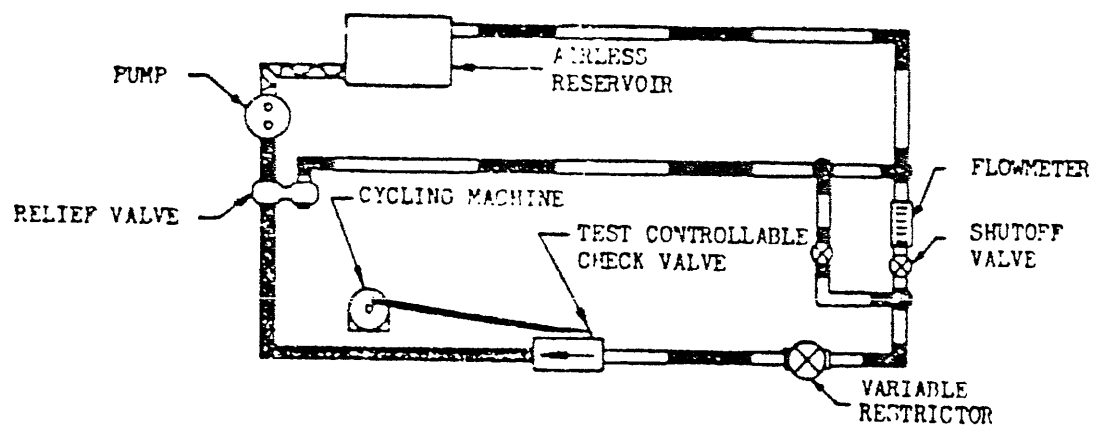


FIGURE 3. Typical setup for Endurance cycling test, manual control operation

4.4.9.1 High temperature cycling - automatic checking operation- The valve shall be subjected to 7,500 cycles of automatic checking operation at a temperature of 275°F. Upon completion of these 7,500 cycles, the valve shall be soaked at a temperature of 275°F for a period of 1 hour with rated pressure applied to the valve in the reverse-flow direction. The pressure shall then be relieved to approximately zero and the valve soaked for a period of 1 hour at a temperature of 275°F. The temperature shall then be reduced to a range of 70° to 120°F, and the Operational tests (Checking time and Cracking pressure (4.4.6)) shall be reconducted, and the requirement therein shall be satisfied. The temperature shall then be lowered to not warmer than 45°F, the Operational tests shall be conducted, and the requirements therein shall be satisfied.

4.4.9.2 Intermediate temperature cycling - automatic checking operation.- The valve shall then be subjected to 22,500 cycles of automatic checking operation at a temperature of 225°F. Upon completion of these 22,500 cycles, the High temperature functioning test (4.4.8.3) shall be conducted at a temperature of 225°F and the requirements therein shall be satisfied. The temperature of the test setup shall then be reduced to a range of 70° to 120°F and the fluid temperature stabilized at 100°F. The Qualification test for leakage (4.4.5) shall then be conducted and the requirements therein shall be satisfied.

4.4.9.3 High temperature cycling - manual control operation - The valve shall be subjected to 5,000 cycles of manual control operation at a temperature of 275°F. Upon completion of these 5,000 cycles, the valve shall be soaked at a temperature of 275°F for a period of 1 hour with rated pressure applied to the valve in the reverse-fbw direction. The pressure shall then be relieved to approximately zero and the valve soaked for a period of 1 hour at a temperature of 275°F. The temperature shall then be reduced to a range of 70° to 120°F, and Operational tests (Checking time and Cracking pressure(4.4.6)) shall be conducted and the requirements therein shall be satisfied. The temperature shall then be lowered to not warmer than -65°F, the Operational tests shall be conducted, and the requirements therein shall be satisfied.

4.4.9.4 Intermediate temperature cycling - manual control operation.- The valve shall then be subjected to 15,000 cycles of manual control operation at a temperature of 225°F. Upon completion of these 15,000 cycles, the High-temperature functioning test (4.4.8.3) shall be conducted at a temperature of 225°F, and the requirements therein shall be satisfied. The temperature of the test setup shall then be reduced to a range of 70°F to 120°F and the fluid temperature stabilized at 100°F. The Qualification test for leakage (4.4.5) shall then be conducted, and the requirements therein shall be satisfied.

4.4.10 Control lever stops ruggedness - A moment of 1,800 pound-inches torque shall be applied to the stop mechanical in each direction 10 times. At the completion of this test, the stop mechanism shall not have failed. Brinelling or normal wear shall not constitute failure.

4.4.11 Burst pressure - This test shall be performed at a temperature of 275°F. Any suitable fluid may be used for this test. Hydraulic pressure shall be applied in the free-flow direction with the outlet port plugged at a rate of approximately 25,000 psi per minute, until a burst pressure of 7,500 psi is obtained. The valve shall withstand this burst pressure for a period of 2 minutes without rupture of internal or external parts.

4.5 Acceptance tests.- Each valve to be furnished under contract shall be examined to determine conformance with the material and design requirements of this specification and shall be subjected to the following tests described under "Acceptance test methods":

- |     |                                     |         |
|-----|-------------------------------------|---------|
| (a) | Examination of product - Acceptance | (4.6.1) |
| (b) | Proof pressure - Acceptance         | (4.6.2) |
| (c) | Leakage - Acceptance                | (4.6.3) |
| (d) | Control force                       | (4.6.4) |

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4.6 Acceptance test method -

4.6.1 Examination of product - Acceptance - Each valve shall be carefully examined to determine conformance with the requirement of this specification, for design, construction, weight, workmanship, identification of product, conformance applicable drawings, and for any visible defects. The manufacturer's drawings and the manufacturer's applicable specifications which were submitted when qualification approval was granted, shall be used by the Inspector, as necessary, to determine that the product submitted for acceptance under contract is identical to the item as qualified.

4.6.2 Proof pressure - Acceptance - A proof pressure of 4,500 psi shall applied in both the free and free and reverse-flow directions at least two successive times in each direction and held 2 minutes for each pressure application. For the reverse-flow direction, the poppet shall be unseated between applications of the test pressure. There shall be no measurable external leakage, failure, or permanent set.

4.6.3 Leakage - Acceptance - This test shall be conducted at a fluid temperature of 100°F. The valve shall be tested for internal leakage by applying the pressures listed in table III in the reverse-flow direction for a minimum period of 5 minutes each. The poppet shall be unseated between pressure applications. For each pressure, the leakage measurement period shall consist of the last 3 minutes of the 5-minute period. At the 5-psi pressure, internal leakage shall not exceed three drops in the 3-minute period. No internal leakage is permitted at pressures of either 1,000 psi or 3,000 psi. There shall be no external leakage during this test.

4.6.4 Control force - The force or operating moment required to manually operate the valve control mechanism shall be measured with the rated pressure applied in the reverse-flow direction. The force or operating moment shall not exceed the values specified in table V.

TABLE V

Maximum manual operating torque

Part number	Force in pounds (max)	Operating moment in inch-pounds (max)
MS28768-4B	75	—
MS28768-6B	100	—
MS28768-8B	200	—
MS28768-10B	200	—
MS28764-4	—	45
MS28764-8	—	75
MS28764-12	—	90

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## 5. REPARATION FOR DELIVERY

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

5.2 Marking of shipments.- In addition to the marking of shipments identification specified in Specification MIL-H-8775, the following shall be added:

MS Part No.  
Manufacturer's Part No.

## 6. NOTES

6.1 General.- The notes contained in section 6 of Specification MIL-H-8775 form a part of this specification.

6.2 Intended use.- The valves covered by this specification are intended for use in aircraft type II hydraulic systems conforming to and as defined in Specification MIL-H-5440.

6.3 Ordering data.- Procurement documents should specify the MS Part No. of the valve desired. (See 1.2.)

6.4 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,

6.4.1 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. Request for information pertaining to qualification of products covered by this specification should be addressed to the Bureau of Aeronautics, Navy Department, Washington 25, D. C., the activity responsible for qualification, with a copy to the Commander, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio.

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:  
Navy - Bureau Of Aeronautics  
Air Force

Preparing activity:  
Navy - Bureau of Aeronautics